Application Guidelines

Copeland™ Large Outdoor Refrigeration Units

OMTE-76D to OMTE-152D
OLE-49 & OLTE-82D

COPELAND

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About these guidelines

The purpose of these application guidelines is to provide guidance in the application of Copeland™ Large Outdoor Condensing Units (or LOCU refrigeration units). 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 units. The performance and reliability of the product may be impacted if the product is not used according to these guidelines or is misused.

These application guidelines cover stationary applications only. For mobile applications, contact Application Engineering as other considerations may apply.

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 LOCU refrigeration units are intended for installation in machines and systems in accordance with the following directives and regulations:

Machinery Directive MD 2006/42/EC	Supply of Machinery (Safety) Regulations 2008
Pressure Equipment Directive PED 2014/68/EU	Pressure Equipment (Safety) Regulations 2016
Low Voltage Directive LVD 2014/35/EU	Electrical Equipment (Safety) Regulations 2016
Electromagnetic Compatibility Directive EMC 2014/30/EU	Electromagnetic Compatibility Regulations 2016
Ecodesign Directive 2009/125/EC	Ecodesign for Energy-Related Products Regulations 2010

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 HVACR 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 of nitrogen, or when the compressor service valves are closed.
System breakdown! Personal injuries! Only approved refrigerants and refrigeration oils must be used.

WARNING
High shell 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. Lock and mark 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! Polyolester oil (POE) must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used at all times. POE 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! 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).

2 Product description

2.1 General information about Copeland™ LOCU refrigeration unit

Copeland has developed the LOCU refrigeration unit to meet the demands of the food retail and food service sectors. It is an air-cooled refrigeration unit that uses the latest Copeland patented scroll technology as the main driver and has electronic protection and diagnostics features built in the high-quality chassis. The combination of large condensers and low-speed fans allows for particularly quiet operation.

Figure 1: Front view of the Copeland LOCU refrigeration unit

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 condenser reduce the noise level and energy consumption significantly. This, combined with Copeland scroll technology, allows for high-efficiency operation.

For the rated cooling capacity, rated power input and rated COP value please refer to Copeland Select software at www.copeland.com/en-gb.

These guidelines meet the requirements of Regulation 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 "Condenser fins" and 5.5 "Routine leak testing"
- (vii) ➔ See chapters 2.10.4 "Main control & safety features" and 4.2 "Charging procedure"
- (viii) ➔ See chapter 7 "Dismantling & disposal"

2.3 Main product features and dimensions

Copeland OMTE, OLE & OLTE refrigeration units are released for multiple refrigerants. They are available in two cabinet sizes and are equipped with one or two fans. Depending on the compressors in use they are designed for medium-temperature or low-temperature refrigeration applications.

Refrigeration unit	Refrigerant	Displacement @ 100 % (m^3/h)	Cooling capacity* (kW)	Power supply
OMTE-76D	R404A, R407A, R407C, R407F, R448A, R449A R507A, R134a	28.7	16.65	3/N/PE~ 50 Hz 400/230 V TN-S
OMTE-90D		34.1	18.95	
OMTE-152D		57.6	33.90	
OLE-49	R404A, R448A, R449A, R507A	42.4	8.99	
OLTE-82D		70.7	13.50	

** Conditions with R448A: ambient temperature: 32 °C; evaporating temperature: -10 °C dew point for OMTE models and -35 °C dew point for OLE/OLTE models; suction temperature: 20 °C.*

Table 1: LOCU technical data

Unit	Outer dimensions length/width/height with closed cover (mm)	Net weight (kg)	Gross weight (kg)
OMTE-76D	1581 / 900 / 1069	345	383
OMTE-90D		348	386
OLE-49		314	352
OMTE-152D	2303 / 900 / 1150	508	566
OLTE-82D		511	569

Table 2: LOCU features

The figures hereafter shows the overall physical dimensions of the LOCU refrigeration units:

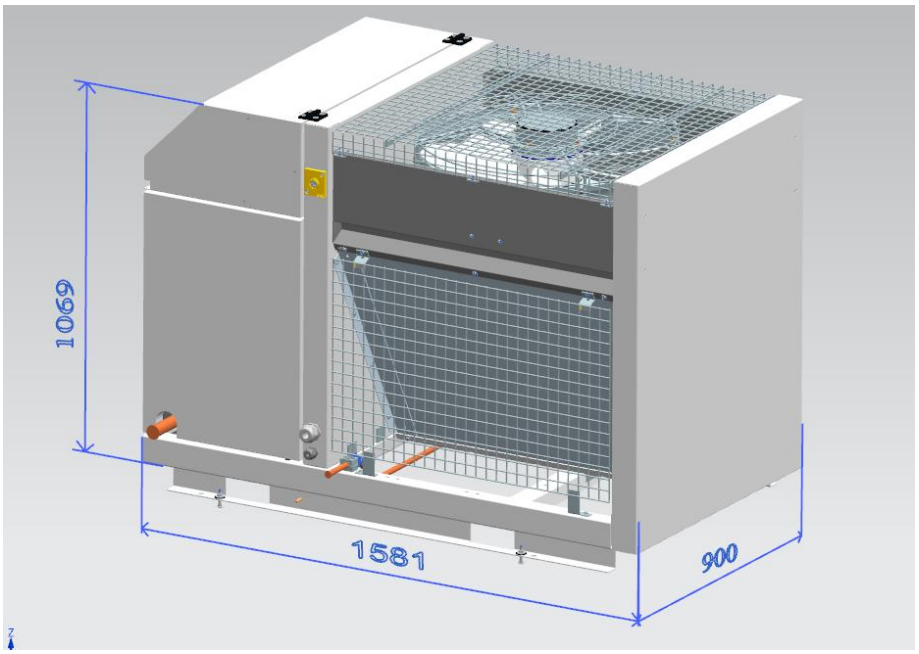


Figure 2: Outer dimensions of models OMTE-76D, OMTE-90D & OLE-49

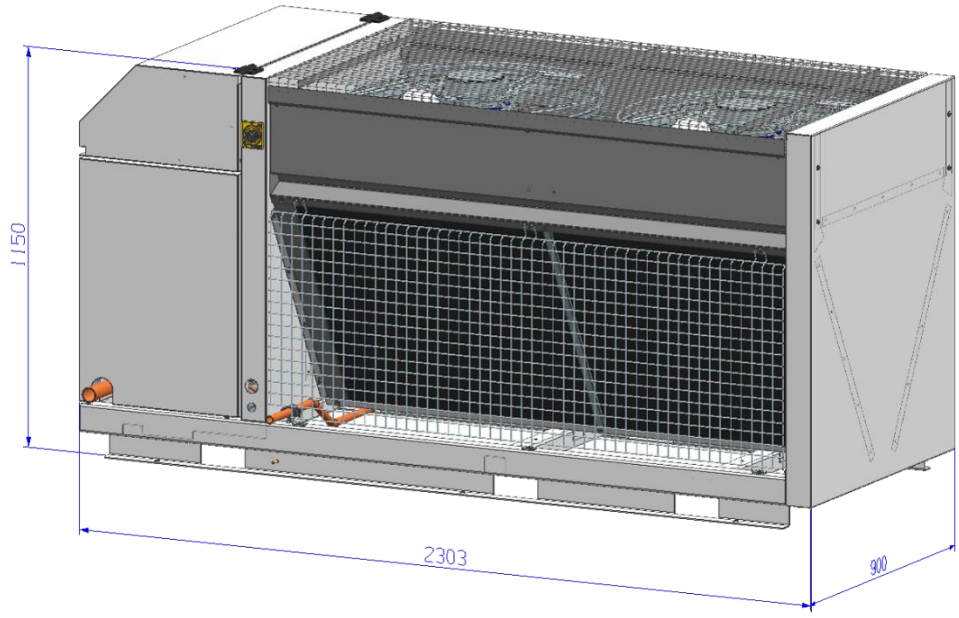


Figure 3: Outer dimensions of models OMTE-152D & OLTE-82D

2.4 Product nameplate

The refrigeration unit nameplate shows model designation and serial number, as well as locked rotor amps, maximum rated current, safety pressures and weight.

The compressor has its own nameplate with all electrical characteristics.

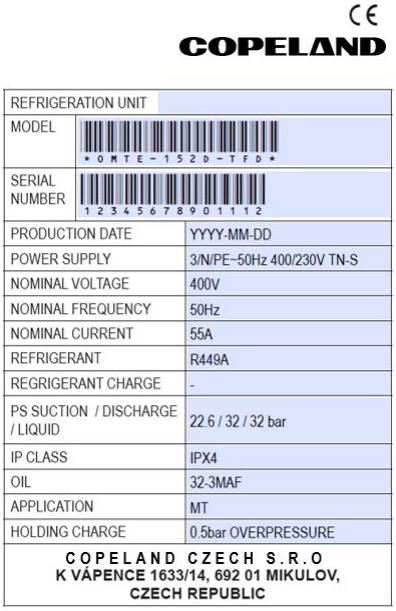


Figure 4: Nameplate LOCU units

2.5 Nomenclature

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

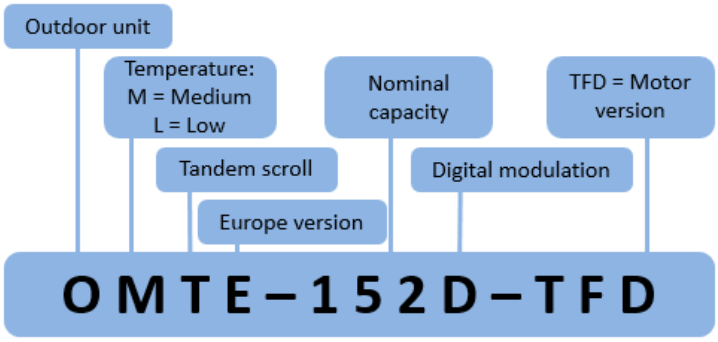


Figure 5: Nomenclature LOCU units

2.6 Application range

2.6.1 Qualified refrigerants and oils

Qualified refrigerants	**R404A, R407A, R407C, R407F, R448A, R449A, R507A, R134a**			**R404A, R448A, R449A, R507A**	
Qualified servicing oils	Emkarate RL 32 3MAF Mobil EAL Arctic 22CC			Emkarate RL 32 3MAF Mobil EAL Arctic 22CC	
Unit	OMTE-76D	OMTE-90D	OMTE-152D	OLTE-82D	OLE-49
Oil charge single compressor	3.37	3.37	3.37	3.37	3.37
Pre-charge oil separator	3.8				N/A
Total oil charge	10.54				3.37

Table 3: Qualified refrigerants and oils & oil charge in litres

***NOTE:* OMTE & OLTE units are equipped with an oil separator. The separator is pre-charged with 3.8 litres of oil.**

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 viscosity decrease of the oil. Additional measures in system design might help to avoid unacceptable lubrication conditions.

For application envelopes, please refer to the compressor application envelopes which can be found in Copeland Select software, available at www.copeland.com/en-gb.

LOCU refrigeration units can be used at ambient temperatures down to -15 °C. The application envelopes of the units must be respected under all operating conditions. For lower ambient temperatures please contact your local Application Engineering representative.

2.6.3 PED category

The PED category is assigned according to the Pressure Equipment Directive PED 2014/68/EU. Requirements apply to the relevant pressure levels in the refrigeration unit if a defined limit value of pressure relative to the environment and relevant internal free volume is exceeded.

The calculation of the PED category is based on the fluid group (group 1: flammable or group 2: non-flammable) and on the vessel size. A differentiation must be made between the high- and low-pressure sides. The highest of the calculation results is considered to determine the PED category.

LOCU refrigeration units are operated with A1 refrigerants (fluid group 2).

Refrigeration unit range	Refrigerant	Fluid group	PED class
OMTE-76D, OMTE-90D & OMTE-152D	R404A, R407A, R407C, R407F, R448A, R449A, R507A, R134a	2	2
OLE-49 & OLTE-82D	R404A, R448A, R449A, R507A	2	2

Table 4: PED category based on refrigerant used

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 units covered in these guidelines are available in the following BOM versions:

BOM	Family	Introduction date	Controller concept	Oil separator
501	OMTE-76D & OMTE-90D	07/2019	XCM25D (Emerson - Dixell)	Yes
	OMTE-152D & OLTE-82D	01/2019		Yes
	OLE-49	12/2020		No
502	OMTE-76D & OMTE-90D	07/2019		Yes
	OMTE-152D	01/2019		Yes
600	OMTE-76D & OMTE-90D	11/2022		Yes
	OMTE-152D & OLTE-82D	11/2022		Yes
	OLE-49	11/2022		No

Table 5: BOM variations

2.8 P&I diagrams

2.8.1 OMTE-76D & OMTE-90D models

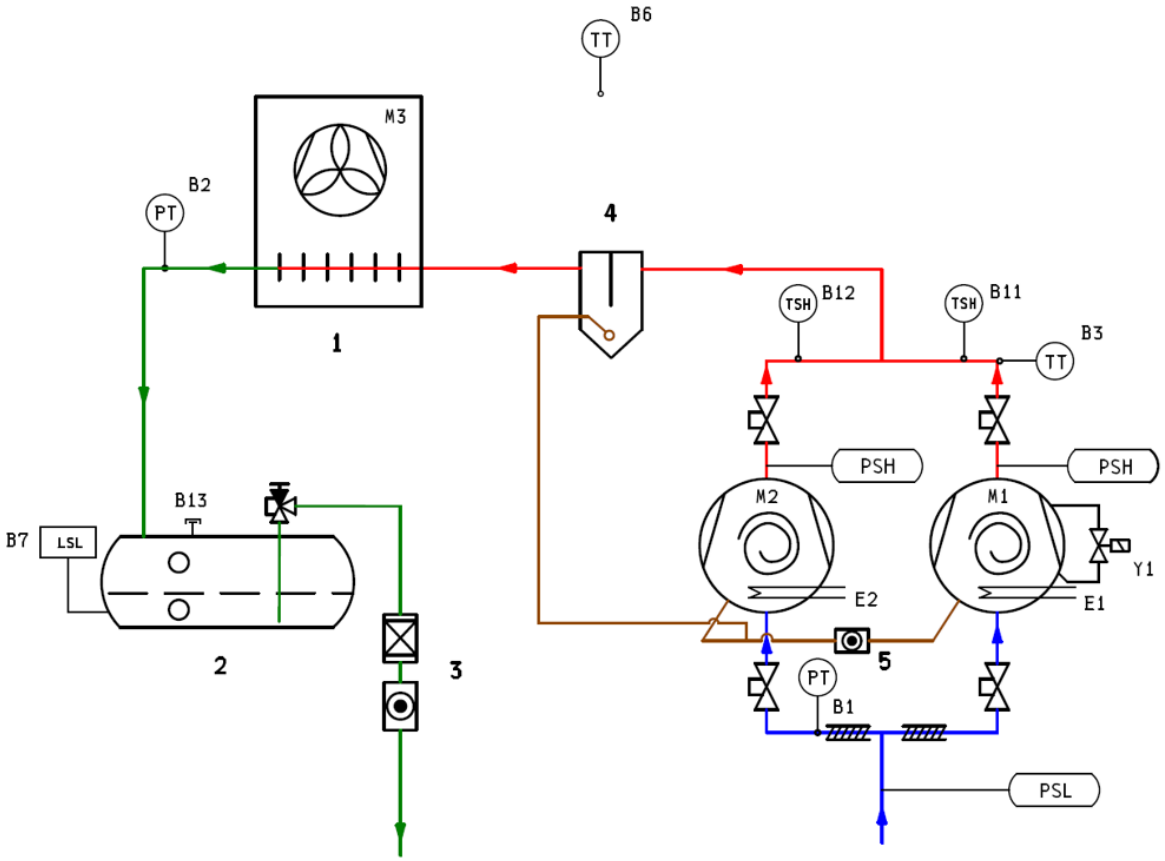


Figure 6: P&I diagram for OMTE-76D & OMTE-90D models

Position	Description	Comments
B1	P1 Suction pressure transducer (AI1)	PPR15
B2	P2 Condensing pressure transducer (AI2)	PPR30
B3	DLT Discharge line temperature sensor (AI3)	NTC 86K
B6	Ambient temperature sensor (AI6)	NTC 10K
B7	Liquid receiver with liquid level watch	LW4-L120 Alco Controls
B11	TT >> DLT Discharge line thermostat 130 °C compressor 1	
B12	TT >> DLT Discharge line thermostat 130 °C compressor 2	
B13	Connection for pressure relief valve	½" NPT
PSL	Mechanical low-pressure switch PS1	PS1-A3A Alco Controls
PSH	High-pressure cut-out device	PS3-W6S Alco Controls
E1	Crankcase heater compressor 1	
E2	Crankcase heater compressor 2	
M1	High-efficiency digital scroll compressor (ZBD*)	Compressor 1
M2	High-efficiency standard scroll compressor (ZB*)	Compressor 2
M3	High-efficiency EC fan	FN071-ZIQ
Y1	Digital control solenoid valve	
1	Condenser	
2	Liquid receiver	
3	Filter-dryer & sight glass combination	Alco Controls
4	Oil separator	
5	Oil equalization line sight glass	Alco Controls

Table 6: Legend of the P&I diagram for OMTE-76D & OMTE-90D models

2.8.2 OMTE-152D models

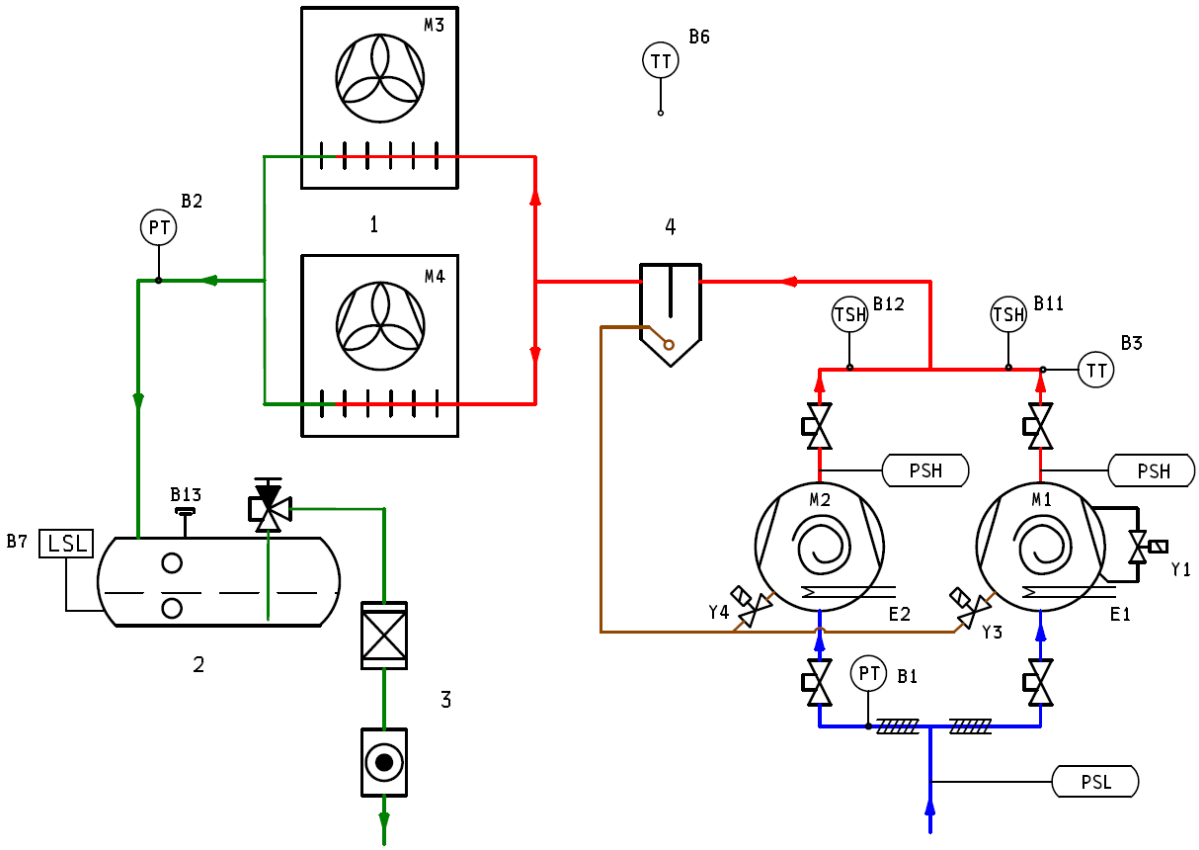


Figure 7: P&I diagram for OMTE-152D models

Position	Description	Comments
B1	P1 Suction pressure transducer (AI1)	PPR15
B2	P2 Condensing pressure transducer (AI2)	PPR30
B3	DLT Discharge line temperature sensor (AI3)	NTC 86K
B6	Ambient temperature sensor (AI6)	NTC 10K
B7	Liquid receiver with liquid level watch	LW4-L120 Alco Controls
B11	TT >> DLT Discharge line thermostat 130 °C compressor 1	
B12	TT >> DLT Discharge line thermostat 130 °C compressor 2	
B13	Connection for pressure relief valve	½" NPT
PSL	Mechanical low-pressure switch PS1	PS1-A3A Alco Controls
PSH	High-pressure cut-out device compressor 1	PS3-W6S Alco Controls
PSH	High-pressure cut-out device compressor 2	PS3-W6S Alco Controls
E1	Crankcase heater compressor 1	
E2	Crankcase heater compressor 2	
M1	High-efficiency digital scroll compressor (ZBD*)	Compressor 1
M2	High-efficiency standard scroll compressor (ZB*)	Compressor 2
M3	High-efficiency EC fan	FN071-ZIQ
M4	High-efficiency EC fan	FN071-ZIQ
Y1	Digital control solenoid valve	
Y3	TraxOil active oil management device compressor 1	OM3-CCE
Y4	TraxOil active oil management device compressor 2	OM3-CCE
1	Condenser	
2	Liquid receiver	
3	Filter-dryer & sight glass combination	Alco Controls
4	Oil separator	

Table 7: Legend of the P&I diagram for OMTE-152D models

2.8.3 OLE-49 models

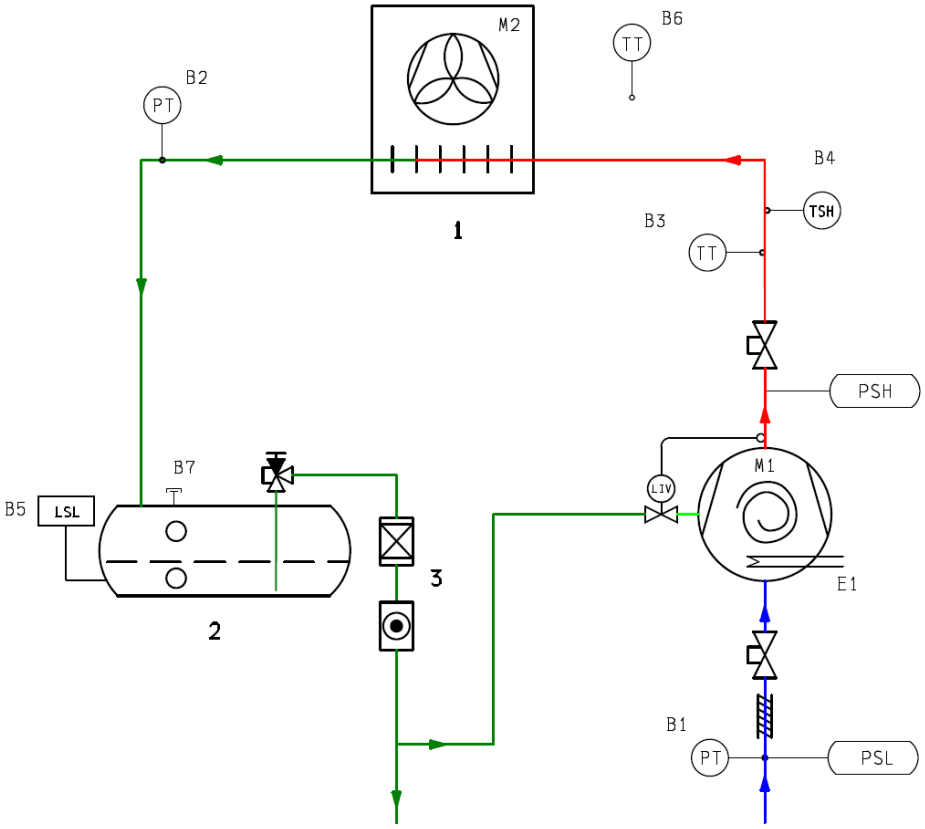


Figure 8: P&I Diagram OLE-49 models

Position	Description	Comments
B1	P1 Suction pressure transducer (AI1)	PPR15
B2	P2 Condensing pressure transducer (AI2)	PPR30
B3	DLT Discharge line temperature sensor (AI3)	NTC 86K
B4	TT >> DLT Discharge line thermostat 130 °C	
B5	Liquid receiver with liquid level watch	LW4-L120 Alco Controls
B6	Ambient temperature sensor (AI6)	NTC 10K
B7	Connection for pressure relief valve	½" NPT
PSL	Mechanical low-pressure switch PS1	PS1-A3A Alco Controls
PSH	High-pressure cut-out device	PS3-N15 Alco Controls
E1	Crankcase heater	
LIV	Liquid injection valve	Alco Controls
M1	High-efficiency scroll compressor (ZF*)	
M2	High-efficiency condenser EC fan	FN071-ZIQ
1	Condenser	
2	Liquid receiver	
3	Filter-dryer & sight glass combination	Alco Controls

Table 8: Legend of the P&I diagram for OLE-49 models

2.8.4 OLTE-82D units

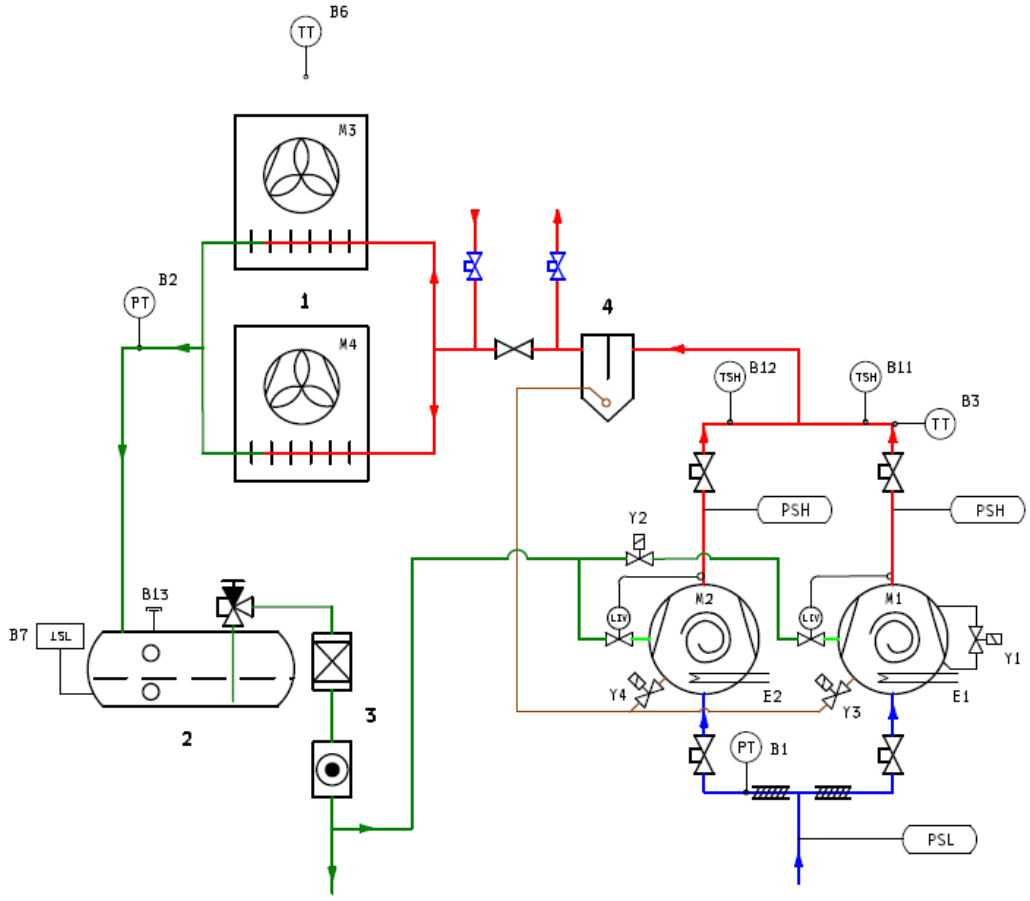


Figure 9: P&I diagram for OLTE-82D models

Position	Description	Comments
B1	P1 Suction pressure transducer (AI1)	PPR15
B2	P2 Condensing pressure transducer (AI2)	PPR30
B3	DLT Discharge line temperature sensor (AI3)	NTC 86K
B6	Ambient temperature sensor (AI6)	NTC 10K
B7	Liquid receiver with liquid level watch	LW4-L120 Alco Controls
B11	TT >> DLT Discharge line thermostat 130 °C compressor 1	
B12	TT >> DLT Discharge line thermostat 130 °C compressor 2	
B13	Connection for pressure relief valve	½" NPT
PSL	Mechanical low-pressure switch PS1	PS1-A3A Alco Controls
PSH	High-pressure cut-out device compressor	PS3-W6S Alco Controls
E1	Crankcase heater compressor 1	
E2	Crankcase heater compressor 2	
M1	High-efficiency digital scroll compressor (ZFD*)	Compressor 1
M2	High-efficiency standard scroll compressor (ZF*)	Compressor 2
M3	High-efficiency EC fan	FN071-ZIQ
M4	High-efficiency EC fan	FN071-ZIQ
Y1	Digital control solenoid valve	
Y2	Solenoid valve used for liquid injection	
Y3	TraxOil active oil management device compressor 1	OM3-CCE
Y4	TraxOil active oil management device compressor 2	OM3-CCE
1	Condenser	
2	Liquid receiver	
3	Filter-dryer & sight glass combination	Alco Controls
4	Oil separator	

Table 9: Legend of the P&I diagram for OLTE-82D models

2.9 Main components description

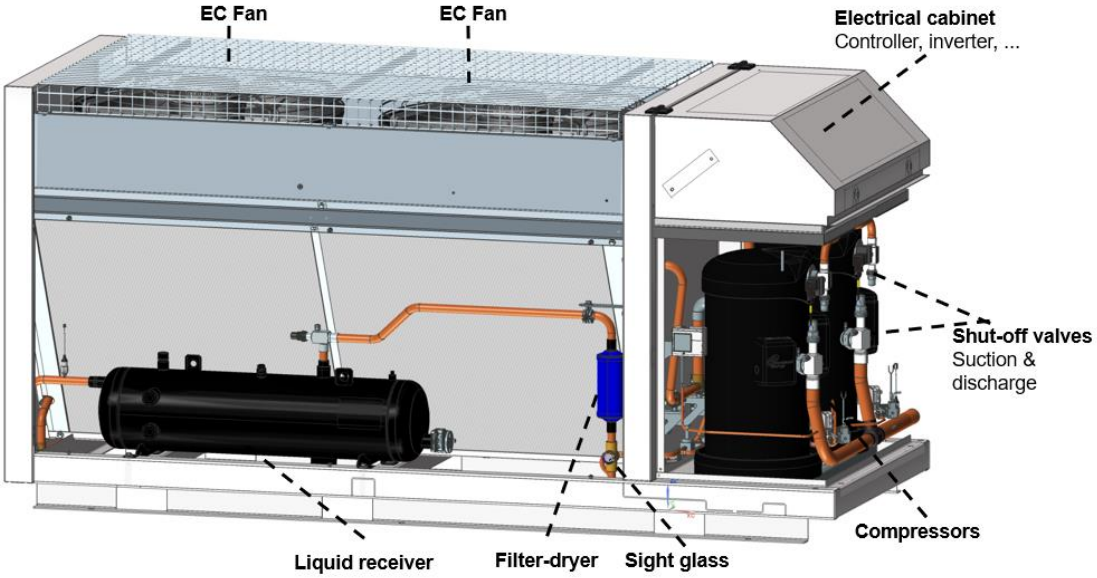


Figure 10: Main components of LOCU units

2.9.1 Bill of material 501 – General description

The standard bill of material for OMTE, OLE & OLTE units is 501. In general, these units have an air-cooled condenser with 1 or 2 EC fans for condensing temperature control.

For OMTE and OLTE units, a Tandem set of 2 scroll compressors (ZB** for OMTE, ZF** for OLTE) provides the required cooling capacity. One of the compressors is always a digital scroll, which allows modulation to very low part-load conditions.

The compressors in OLE and OLTE units have LIV technology inside.

All compressors are equipped with a high-efficiency sound shell for best sound performance.

An oil management system with a combined oil separator (including the reservoir) and oil injection devices secure sufficient compressor oil levels. Unit models OMTE-76D and OMTE-90D have only the oil separator with oil return into the suction line.

An electronic controller XCM25D will handle suction pressure regulation, fan speed control in standard and heat recovery conditions, as well as system safety. Main safety features provided by the controller: compressor oil level control (only for OMTE-152D), discharge temperature protection, voltage sensing, refrigerant charge level control and high- and low-pressure safety.

2.9.2 Bill of material 502 – General description

The BOM 502 version is only available for OMTE units. This version is prearranged for heat recovery (HR). Mechanically the unit has connections for external piping in the discharge line. An additional ball valve between the 2 connection ports allows the manual activation of the heat recovery functionality.

For heat recovery activation the controller settings have to be adjusted. The controller hardware remains the same as in the standard unit.

All other features and equipment are the same as in version 501.

***NOTE:* Please refer to section 2.16 "Heat recovery mode – Optional" for more details.**

2.9.3 Bill of material 600 – General description

The BOM 600 version includes a power meter. This version is available for all OMTE, OLTE and OLE units described in these application guidelines.

2.9.4 Compressor

Unit	Standard scroll compressor	Digital scroll compressor
OMTE-76D-TFD	ZB38KCE-TFD-551	ZBD38KCE-TFD-551
OMTE-90D-TFD	ZB45KCE-TFD-551	ZBD45KCE-TFD-551
OMTE-152D-TFD	ZB76K5E-TFD-567	ZBD76K5E-TFD-567
OLE-49-TFD	ZF49K5E-TFD	
OLTE-82D-TFD	ZF41K5E-TFD-567	ZFD41K5E-TFD-567

Table 10: Compressor model overview

2.9.5 Electrical cabinet

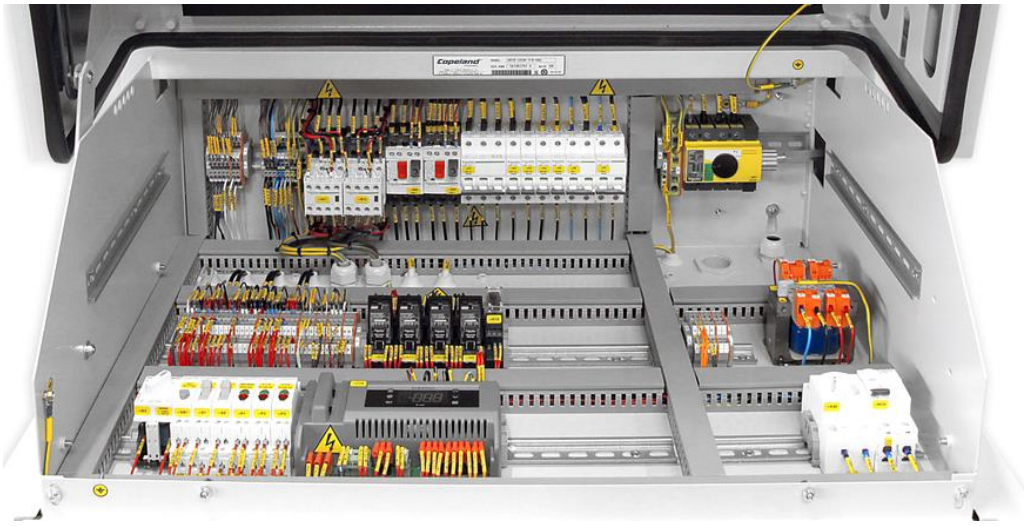


Figure 11: Electrical cabinet

2.9.6 Condenser fans

The condensers of the LOCU refrigeration units are equipped with electronically-commutated (EC) external rotor motor with integrated EC controller:

- Integrated motor contactor, active temperature management.
- Interference emissions EN 61000-6-3.
- Interference immunity EN 61000-6-2.
- Protection rating IP20, IP54.
- Satisfies IE4 (IEC60034-31) efficiency class.
- Extremely energy-efficient thanks to EC technology.
- Compact, modular design.
- Straightforward installation and commissioning.
- Flexible customer interface, easy to expand.

The fan type on LOCU units is FN071-ZIQ.DG.V7P3.

2.9.7 Housing

Copeland LOCU refrigeration units have the following housing features:

- Redesigned electrical box, accessible via a hinged cover with two positions (45° & 90°).
- Easy and service-friendly access to compressor compartment.
- Easy and service-friendly access to liquid receiver/filter-dryer/sight glass area.
- Easy cleaning of condenser section.

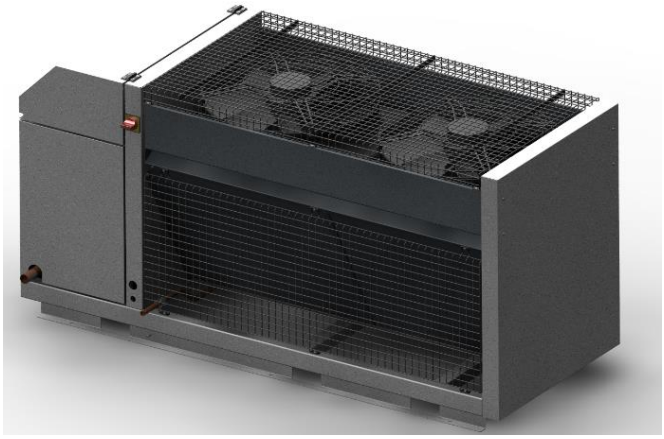


Figure 12: LOCU unit housing

The housing is designed to withstand a 300-hour salt spray test according to ASTM B-117, ASTM D-1654 and ČSN EN ISO 9227. This means that the external panels and frame comply with the requirements of a category C3 (medium) environment according to standard ISO 12944-2.

2.10 XCM25D Electronic controller – Features

The XCM25D controller is designed to be a powerful, flexible controller for use in multiple applications. It has been developed for condensing units and allows the adjustment of all relevant parameters by the user.

2.10.1 Description

WARNING
Electrical pins under voltage! Electrical shock hazard! There are unused fast-on pins (C1 & DO2) on the XCM25D which could be under voltage. They are covered by insulated fast-on flags in the factory. Handle carefully when removing insulating flags during service on site.

The controller is designed for usage in an outdoor refrigeration unit. It is rated to be used for the following environment:

- Outdoor controller ambient temperature for controller operation: -40 to +60 °C
- Ambient temperature for storage: -40 to +80 °C
- Maximum humidity: 90 % at 48 °C (non-condensing)
- Board power: 24 V AC +15 % / -20 %
- Voltage sensing capabilities: three phase 200-240, 380-460, 575 V AC ± 10 %

The units of measure are selectable. The factory default unit is bar (always considered relative) for pressure and °C for temperature.

Figure 13: XCM25D Electronic controller

2.10.2 Functionality

The controller allows for easy commissioning by the technician with the factory settings at the highest program level. It also offers the possibility to make substantial changes to the system optimization in further programming levels. Advanced functionality can also be activated.

The following functions are covered by the controller:

- refrigeration unit control, including tandem management;
- condenser fan control;
- voltage and current sensing (compressor protection);
- digital compressor control;
- Modbus/Canbus communication.

NOTE: **The XCM25D controller includes all the functions necessary for the control of the LOCU unit. For additional functionalities please contact your local Application Engineering representative at Copeland.**

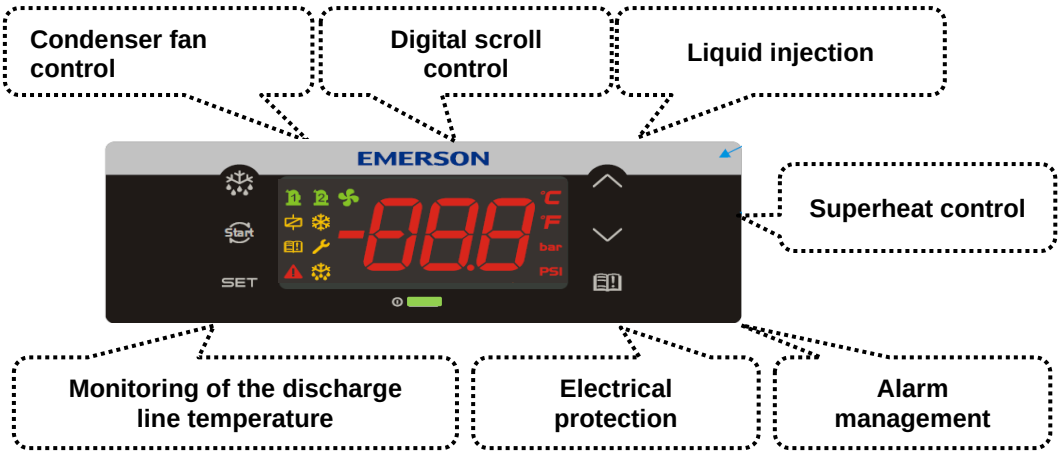


Figure 14: XCM25D controller functionality overview

2.10.3 Modbus Communication

The XCM25D controller can communicate via Modbus (RS-485) connection to provide all running data. Additional commands can also be activated through Modbus connection. The Modbus map is available on request from the Application Engineering department at Copeland.

A pre-configured X-Web Supervisor device is also available and allows easy handling and connectivity with the XCM25D controller.

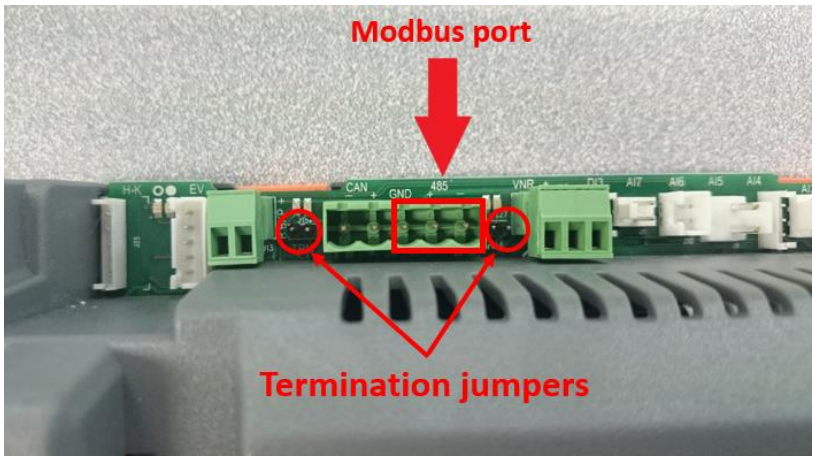


Figure 15: Modbus port and termination jumpers

***NOTE:* If the XCM25D controller is connected in chain the termination jumpers must be removed.**

2.10.4 Main control & safety features

Suction pressure control: Each unit is equipped with a suction pressure transmitter. The XCM25D controls the suction pressure by evaluating the input signal of the pressure transmitter. The suction pressure regulation for LOCU units must be defined by the setpoint (**C16**) and proportional band (**C17**). The signal of the suction pressure transmitter is also used for additional functionalities.

Condensing pressure control: Each unit is equipped with a high-pressure transmitter. The XCM25D controls the condensing pressure by regulating the fan speed corresponding to the ambient temperature. The unit controller regulates the condensing pressure with a constant temperature difference to the ambient ("floating HP"; factory setting **E66** = 8 K).

Different control options are available. Parameter **E38** allows to choose "floating HP" (factory setting) or control of condensing temperature inside compressor envelope. In this mode, the compressor can run different minimum condensing temperatures based on the suction pressure of the compressor. This is the most energy-efficient way to minimize the condensing temperature as much as possible. However it also means that the fan is running at full speed more often than in floating HP mode.

Automatic liquid injection on OLE & OLTE models: A mechanical injection valve (LIV) allows liquid refrigerant to be injected into the scroll set of the compressor to reduce discharge temperatures generated when the unit operates at increasing compression ratios. There is a bulb on each compressor top cap connected to the injection valve which allows individual regulation for each

compressor. On digital models a solenoid valve (normally closed NC) is energized in parallel to the digital modulation solenoid valve to avoid injection during part-load conditions. The discharge line protection is achieved with discharge line thermostats (B11 & B12; Klixon), installed directly on the discharge pipe.

Compressor phase reversal: Ensures that the compressors keep running in one direction only (clockwise = right rotation) – necessary for a compliant scroll compressor to compress and pump refrigerant. Reset is automatic once the phase rotation is correct for the compressor.

Motor current overload protection: The motor current overload protection is achieved by adjustable motor circuit breakers Q02 & Q03.

Fixed high-pressure switch: This is a non-adjustable protection device designed to prevent the compressor from operating outside of its safe high-pressure range. Reset is automatic.

- OMTE units: 28.8 bar cut-out / 24 bar cut-in.
- OLE units: 28.8 bar cut-out / 24 bar cut-in.
- OLTE units: 28.8 bar cut-out / 24 bar cut-in.

The high-pressure cut-out device is in the same safety chain as the discharge line thermostat. The alarm provided by the XCM25D does not indicate if it is high pressure or high discharge temperature alarm.

Adjustable high-pressure limitation: The unit controller provides the possibility to stop the unit at a critical discharge pressure which is lower than the cut-out value of the fixed high-pressure switch. The high-pressure alarm value can be adjusted with parameter **E58**.

Discharge temperature protection: Each unit is equipped with discharge line thermostats (DLT). The DLT's are in the same safety chain as the high-pressure cut-out switches and have a common alarm. Each compressor has its own safety chain. In addition, there is a discharge line sensor installed on the discharge pipe of the digital compressor. The controller is using the signal from this sensor for control purposes as well as safety functions.

Adjustable low-pressure alarm: The unit controller features an adjustable low-pressure alarm managed by the suction pressure sensor. The factory setting of this alarm is the lowest permitted pressure of the refrigerant with the lowest pressure-vapour properties. If needed the user can modify this value as per the required application.

- OMTE units: 0.8 bar rel
- OLE units: 0.3 bar rel
- OLTE units: 0.3 bar rel

Adjustable low-pressure switch PS1: In case of controller breakdown, the low-pressure switch is used for emergency operation (pre-wired rescue mode components). It must be adjusted based on running conditions and possible special requirements. The compressor envelopes published in Select must always be respected. Further information can be found in **section 2.15 "Rescue mode (emergency mode)"**.

In standard operation mode the low-pressure switch will work for both compressors as a protection device.

Each **crankcase heater** is connected directly to the controller. The crankcase heater will be energized when the ambient sensor is below a given value (10 °C) and the compressor has been off for a period of 5 minutes. The minimum off time does not apply at initial power up.

Liquid line assembly: Composed of a filter dryer and a sight glass/moisture indicator.

2.11 XCM25D Electronic controller – Programming

CAUTION
Low refrigerant charge! Compressor damage! Never energize the unit/controller without minimum refrigerant system charge. There is a risk of malfunction of the controller in deep vacuum operation which can cause compressor damage.

2.11.1 Programming the local display

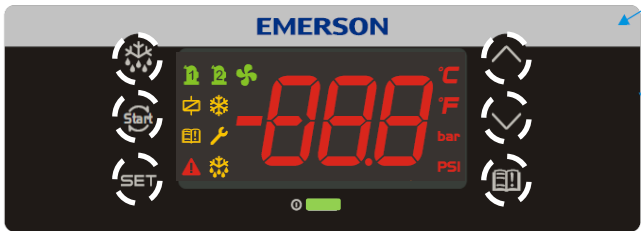


Figure 16: Local display

LED	Mode	Function
	On	Compressor 1 enabled
	Flashing	Anti-short cycle delay enabled
	On	Condensing fans enabled
	On	Display in bar
	Flashing	Programming mode
	On	Display in PSI
	Flashing	Programming mode
	On	When browsing the service menu
	Flashing	In fast access menu
	On	When browsing the alarm menu
	Flashing	A new alarm occurred
	On	An alarm is occurring
	On	Digital unloader solenoid On

Table 11: LED functions description

NOTE: **By default, the local display will show the value of the suction pressure during operation. This can be changed by choosing another value for parameter B03 (Remote Display visualization).**

Setting for B03	Value shown on the display	Comments
0	**P1 value = Suction pressure**	
1	P2 value = Condensing pressure	
2	P3 value = Discharge line temperature	
3	*P4 value = nu*	*Not used*
4	*P5 value = nu*	*Not used*
5	P6 value = Ambient temperature	
6	P7 value = Rescue mode	
7	PEr value = Probe error	
8	Aou value = Analog output	

Table 12: Display visualisation

2.11.2 Remote display CCM60

This device allows for remote monitoring and control of the XCM25D controller via cable. The CCM60 has the same interface as the XCM25D controller therefore the commands and symbols are identical. The remote display shall be mounted on a vertical panel, in a 29 x 71 mm hole, and secured using the special bracket supplied – see **Figure 17**.

The temperature range allowed for correct operation is 0 to +60 °C.

Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. Allow for air to circulate through the cooling holes.

When front-mounted the remote display is IP65 rated.

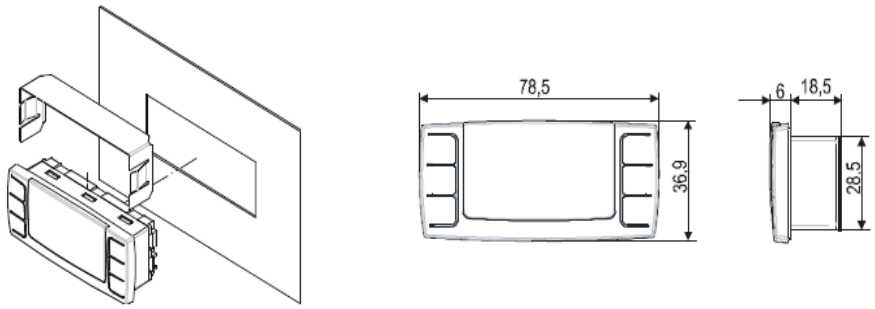


Figure 17: Remote display front panel mounting

The remote display is a proprietary bus of communication for Dixell HMI (x-rep, CCM60) interfaces. There are two connection terminals on the back of the remote display (+ and -).

***NOTE*: Copeland recommends using a shielded cable twisted pair 2 x 0.5 mm².**

The device must be connected to the VNR-terminal on the unit controller according to the polarity. **Figure 18** shows the VNR terminal on the unit controller.

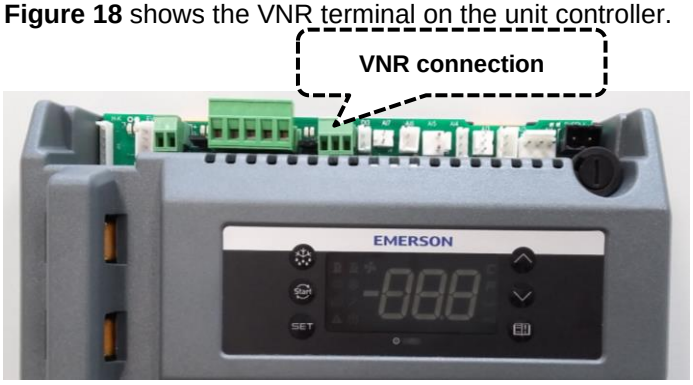


Figure 18: VNR connection for the remote display

Before connecting cables make sure the power supply complies with the hardware requirements. Separate the terminal cables from the power supply cables, the outputs and the power connections.

2.11.3 Single commands

SET	Press the **SET** key to display the target setpoint. In programming mode, this allows to select a parameter or to confirm an operation.
Start	Press the **RESET** key and hold for 5 seconds to reset any lockouts if the current state of the controller allows for it to be reset.
∧	**(UP)** To view the fast access menu. In programming mode, this browses the parameter codes or increases the displayed value.
∨	**(DOWN)** In programming mode, this browses the parameter codes or decreases the displayed value.
	(SERVICE) To enter the service and alarm menu.

Table 13: Single commands

2.11.4 Double commands – Entering programming level 1 "Pr1"

	Press simultaneously for about 3 seconds to lock (**PoF**) or unlock (**Pon**) the keyboard.
	Press simultaneously to leave the programming mode or menu. On submenus **rtC** and **EEV** this combination allows to go back to the previous level.
	Press simultaneously for about 3 seconds to access the first level of programming mode.

Table 14: Double commands

The device provides 2 programming levels:

- **Pr1** with direct access
- **Pr2** protected with a password (intended for experts)

2.11.5 How to program the parameters (Pr1 and Pr2)

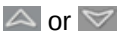
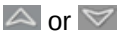
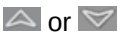
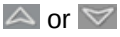
Access pre-program level		Press and hold simultaneously for about 3 seconds to access the pre-programming level. The message **rtC** (real time clock) is displayed.
Access program level		Use the **UP** and **DOWN** keys to move to the **Par** label.
Access Pr1		Press the **SET** key to enter programming level 1. The first parameter **C01** or **C07** appears.
Select item		Select a parameter or submenu using the arrows.
Show value		Press the **SET** key.
Modify		Use the arrows to modify the value.
Confirm and store		Press the **SET** key: the value will blink for 3 seconds, then the display will show the next parameter.
EXIT		Press simultaneously to exit the programming mode or wait for 30 seconds (MTO) without pressing any key.

Table 15: Programming level 1 parameters

When entering the programming level for the first time the display will show the **rtC** (real time clock) label.

- Press  to access parameters N01/02/03/04/05 to adjust time & date. For further details, see **section 2.13 "Parameters level 1 – Required settings"**.
- Press  to change from the **rtC** label to the **Par** label, in order to access the programming level 1.
- Press  : the parameters of programming level 1 can be changed.

2.11.6 Entering programming level 2 "Pr2"

To enter the Pr2 programming menu:

- Press  simultaneously for 3 seconds. The first parameter label will be displayed.
- Press  till the **T18** label is displayed, then press the  key.
- The blinking **PaS** label will be displayed; wait for a few seconds.
- The display will show "**0 - -**" with blinking 0: insert the password [**321**] using the  and  keys and confirming with the  key.

2.11.7 Fast access menu

The fast access menu contains the list of probes and some values that are automatically evaluated by the board such as the superheat and the percentage of valve opening.

"nP" or **"noP"** stands for "Probe not present" or "Value not evaluated". **"Err"** means "Value out of range" or "Probe damaged, not connected or incorrectly configured".

Entering the fast access menu		Press and release the **UP** arrow. In case of inactivity the menu remains displayed for 3 minutes. The values that will be displayed depend on the configuration of the board.
Use the  or  arrow to select an entry, then press  to see the value or to go on with another value.	▪ P1P: Pressure value of the P1 probe (suction pressure) ▪ P2t: Temperature value of the P2 probe (not valid) ▪ P2P: Pressure value of the P2 probe (discharge pressure) ▪ P3t: Temperature value of the P3 probe (discharge line temperature) ▪ *P4t: Temperature value of the P4 probe = not available* ▪ *P5t: Temperature value of the P5 probe = not available* ▪ P6t: Temperature value of the P6 probe (ambient temperature) ▪ P7t: Temperature value of the P7 probe (free) ▪ *SH: Value of superheat. nA = not available* ▪ *oPP: Percentage of step valve opening = not available* ▪ LInJ: Status of the liquid line solenoid ("On" – "Off"). This information is available only if one relay is set as "Liquid Line Solenoid". ▪ SEtd: Value of the dynamic setpoint (condenser fan SET). This information is available only if the dynamic setpoint function is enabled. ▪ AOO: Percentage of the analogue output (0-10 V or TRIAC PWM Mod.). This information is available only if the 0-10 V or TRIAC PWM Mod. is enabled. ▪ dStO: Percentage of the PWM output driving the valve of the digital scroll compressor ▪ L°t: Minimum room temperature ▪ H°t: Maximum room temperature ▪ HM: Menu ▪ tU1: Voltage reading V1 ▪ tU2: Voltage reading V2 ▪ tU3: Voltage reading V3 ▪ tA1: Current reading I1 ▪ tA2: Current reading I2	
Exit		Press simultaneously or wait for the timeout of about 60 seconds

Table 16: Fast access menu

2.12 Controller keyboard

2.12.1 How to lock the keyboard

Keep the  and  keys pressed simultaneously for more than 3 seconds. The **"PoF"** message will be displayed and the keyboard will be locked. At this point it is only possible to see the setpoint or the maximum or minimum temperatures stored. If a key is pressed for more than 3 seconds, the **"PoF"** message will be displayed.

2.12.2 How to unlock the keyboard

Keep the  and  keys pressed simultaneously for more than 3 seconds, till the **"Pon"** message is displayed.

2.13 Parameters level 1 – Required settings

The XCM25D is preconfigured to reduce the required settings on job-site to a minimum. In most cases it will not be necessary to enter programming level 2 **"Pr2"**. **Table 17** gives an overview of the parameters available in programming level 1 **"Pr1"**.

Code	Description	Range	Factory settings		
			OMTE	OLE	OLTE
C01	Compressor cut-in pressure setpoint	C02 to C04	N/A	1.0	N/A
C02	Compressor cut-out pressure setpoint	C03 to C01	N/A	0.5	N/A
C07	Refrigerant selection for regulation	R404A (0) - R507A (1) R134A (2) - R407C (4) R407A (5) - R407F (6) R448A (7) - R449A (8)	8-R449A		
C16	Digital compressor setpoint	C03 to C04	2.6	N/A	1.0
C17	Proportional band for compressor regulation	0.1 to 9.9 bar*; 0.1 to 99.9 PSI; 0.1 to 25.5 °C	2.0	N/A	1.0
C21	Cycle time for digital compressor	10 to 40 sec	20	N/A	20
C26	Time with digital compressor at maximum capacity before starting another compressor	0 to 255 sec	30	N/A	30
C27	Time with digital compressor at minimum capacity before stopping another compressor	0 to 255 sec	0	N/A	0
D04	Minimum time between two starts (same compressor)	0 to 15 min	4	4	4
D29	Low pressure alarm value	0 to 15 bar	0.5	0	0
E66	Delta temperature condenser floating setpoint	0.0 to 25.5 °C	8	8	8
T18	Access to Pr2 level	(0÷999)	3 2 1		

* *Pressure values are always relative*

Table 17: Parameters in programming level Pr1

***NOTE*: The cycle time of the digital compressor (C21) must not be reduced below 20 seconds.**

***NOTE*: The full list of parameters in programming level "Pr2" can be found in Technical Information TI_Unit_LOCU_01_EN "Copeland™ LOCU refrigeration units – XCM25D Controller Parameter List".**

2.14 Digital operation

A digital unit is able to operate in a part-load mode. Part-load operation is achieved by loading and unloading of the digital scroll compressor for certain periods of time (time cycles). The cycle of time can be chosen between 10 and 30 seconds. Example: if the time cycle is 20 seconds at 50 % of capacity request, the compressor will run for 10 seconds loaded and 10 seconds unloaded. For proper commissioning of the digital unit the diagram in **Figure 19** must be considered.

The regulation starts when the suction pressure (**AI1**) increases and reaches the value (C16-C17/2+(C17*C24)/100). Within the adjustment range (C16-C17/2 ~ C16+C17/2) the digital scroll compressor is activated in PWM mode according to the value of the control variable.

When the pressure is higher than (C16+C17/2) then the TRIAC output is at maximum capacity. When the pressure is lower than (C16+C17/2) but higher than (C16-C17/2) the digital compressor modulates the capacity according to the proportional band. If the pressure is lower than (C16-C17/2) the digital compressor switches off.

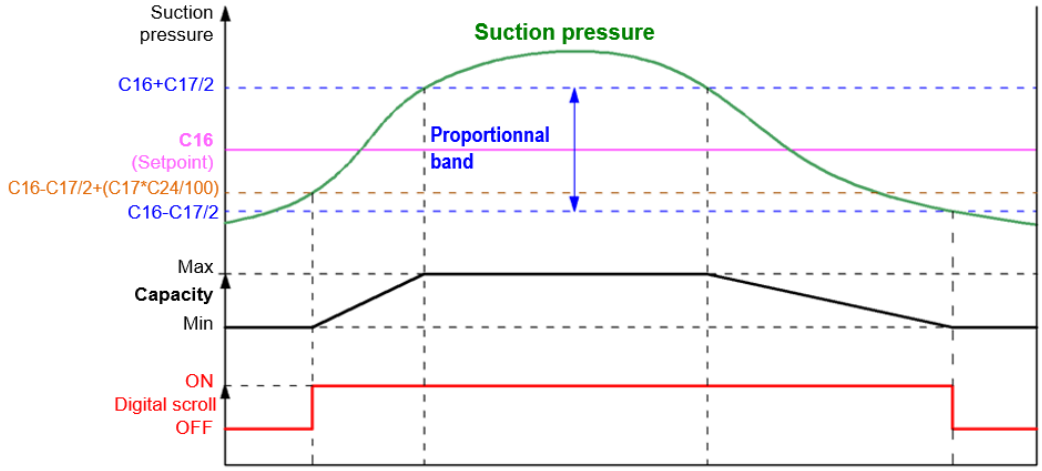


Figure 19: Digital operation

***NOTE:* When the digital valve on the compressor is discharged the compressor is loaded.**

***NOTE*: At start-up the valve is energized for C20 start-up time, ie, time interval with the digital valve energized before regulation starts. It ranges from 0 to 10 seconds (factory setting = 5 seconds).**

2.15 Rescue mode (emergency mode)

In case of controller malfunction, the unit provides an emergency operation mode. The controller will be completely bypassed and the system will continue to run based on low-pressure switch (**B10**) cycling. The functionality of the high-pressure protection devices (**B21 & B22**) remains active for safety.

***NOTE:* The low-pressure switch B10 in standard configuration is used as a safety device. When activating the emergency running mode the cut-in and cut-out setpoints must be adjusted according to the application requirements. Error message E58 is displayed when the emergency mode is activated.**

2.15.1 Functionality

The emergency mode can be activated by means of the "rescue mode" switch **S3**.

There are 2 circuit breakers (S1 [Compressor 1 ENABLE or STOP] and S2 [Compressor 2 ENABLE or STOP]) to activate the compressors (the digital compressor will perform as the fixed-speed compressor [= 100 % capacity]). In emergency mode, the system operator must decide if one or two compressors should be activated to provide sufficient cooling capacity. Switching off one of the two compressors with S1 or S2 will divide the cooling capacity by half. A time delay can be adjusted using relay K42 to avoid compressor cycling in rescue mode (factory setting = 10 minutes). If two compressors are activated in rescue mode (S11 & S12) both compressors will always run in parallel. Also, the time delay is always applied to both compressors in parallel.

Figure 20: Rescue mode – Control panel front and bottom views

Compressor control is achieved by low-pressure switch **B10**. In standard operation mode, the **B10** low-pressure cut-out switch is used as a safety device. In rescue operation mode, the settings must be adapted to installation requirements. The time delay for the compressor starts as soon the cut-in value of **B10** is reached. After time delay the active compressor (or both) will run with 100 % cooling capacity until low-pressure cut-out value **B10** is reached then the compressor(s) will stop.

The fans are automatically activated with the rescue mode switch. The EC fans are programmed to run at maximum speed during emergency mode by help of input **D1** on the EC fan.

There is no need for any adjustments on the fans in this operation mode.

***NOTE*: The SB1 button (test button) allows to by-pass the low-pressure device B10. It might be useful under certain system conditions to manually let the compressors run. Only qualified and trained technicians should activate the compressors manually. Keep system pressures and temperatures within acceptable limits.**

Three LEDs (P1/P2/P3) show the status during rescue mode:

- P1 green = Cooling demand, compressors run according to S1 & S2 activation
- P1 red = Indicates that the system is in emergency mode
- P2 green = Compressor 1 discharge temp, oil level & overload status "OK"
- P2 red = Compressor 1 >> High-pressure cut-out
- P3 green = Compressor 2 discharge temp, oil level & overload status "OK"
- P3 red = Compressor 2 >> High-pressure cut-out

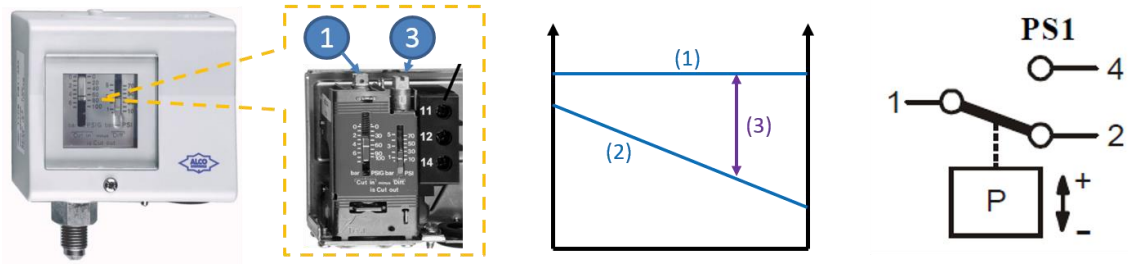
2.15.2 PS1 – Setpoint adjustment of low-pressure switch in rescue mode

A pressure limiter is installed for low-pressure protection. This device is designed according to EN 12263. It has an automatic reset.

In emergency mode, PS1 takes over the control of the suction pressure regulation. It should be adjusted on a case-by-case basis per application requirements. The factory settings of the low-pressure limiter are defined for safety purposes, not for emergency operating conditions.

Upper setpoint (1)	-0.5 … 7 bar
Differential setpoint (3)	0.5 … 5
Lowest setpoint	-0.9 bar
Factory setting	3.5 - 4.5 bar
Leakage reset pressure	24 bar
Connection port	Solder 6 mm

Table 18



1. Upper setpoint range spindle
2. Lower setpoint
3. Differential spindle = variable

Figure 21

- PS1 pressure switches come with individually adjustable differentials.
- Use a flat screwdriver or a ¼" refrigeration (square) wrench to adjust setpoints.
- Adjust upper setpoint (1) using the range spindle (1).
- Adjust lower setpoint (2) by turning the differential spindle (3).

2.15.3 Fan operation in rescue mode

Depending on ambient conditions it might be sufficient to have one fan running during emergency operation. Fan 1 (motor M3, fuse **F6**) is the leading fan in rescue mode.

If low ambient conditions require only one fan running, the second fan (motor M4, fuse **F7**) must be switched off (by switching off fuse **F7**). Switching off the leading fan M3 with fuse **F6** will also deactivate the second fan M4.

2.16 Heat recovery mode – Optional

OMTE units can be ordered with special BOM 502 for simple heat recovery integration. A unit in this special version is mechanically pre-arranged with piping connections for an additional heat exchanger for desuperheating.

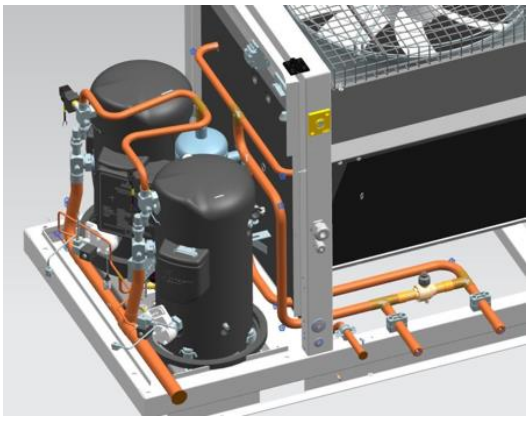


Figure 22: Piping arrangement for heat recovery

The heat recovery feature is active by default. A digital input signal must be provided on terminals X11.51 & X11.52 (probe 5, A15 = Heat recovery active) in case of heating demand.

As soon as the digital input DI5 gets a demand signal, the setpoint for the condensing temperature switches from "standard operating mode" to "heat recovery mode". The required condensing temperature can be defined by parameter **E67** (Heat recovery condensing fan setpoint).

It is recommended to use 2 additional shut-off valves (ball valves) in the lines to the external heat exchanger. This allows independent unit operation without heat recovery in case of issues on the heat exchanger – see **Figure 23** below.

The control of the water cycle must be done by a third-party controller. This controller must provide the digital input signal to the XCM25D controller.

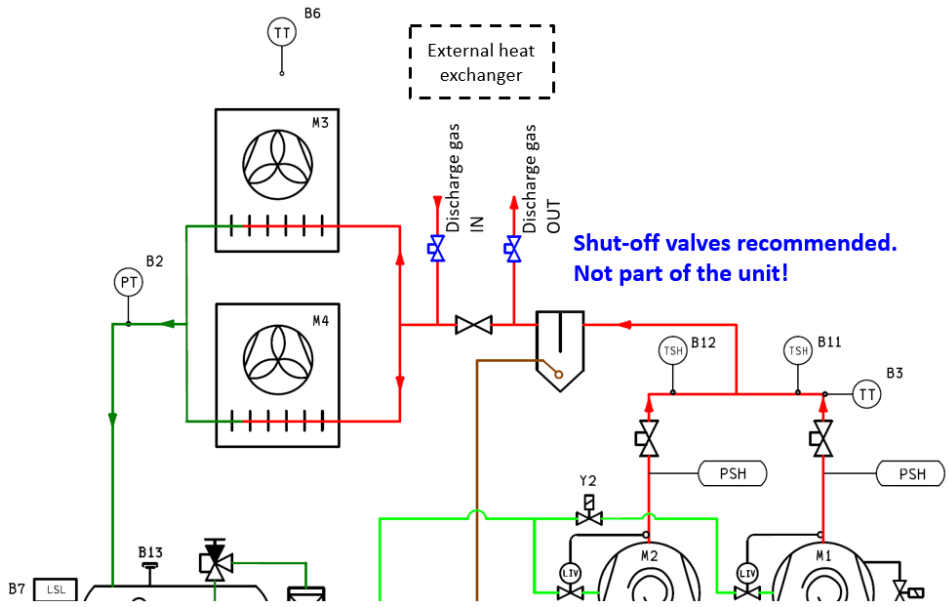


Figure 23: Heat recovery implementation

2.17 Pumpdown

CAUTION
System pressure below atmospheric pressure! Compressor damage!
Never operate the system below atmospheric pressure. There is a risk of malfunction of the controller in deep vacuum operation which can cause compressor damage.

Pumpdown functionality is not provided by the XCM25D controller for the LOCU refrigeration units covered in these guidelines.

2.18 Reset to factory settings – Emerson "Hot Key"

2.18.1 How to save factory settings or user settings

There is no way to reset the XCM25D controller to factory settings other than with additional equipment. Copeland recommends using the Emerson "Hot Key" (not part of the standard delivery) to save the factory settings at initial power up. The same hot key can also be used to save user settings.

By means of a special programming software (Emerson Wizmate) and corresponding hardware (Emerson Prog-Tool), the user can:

- pre-program hot keys;
- copy hot keys;
- change parameter levels;
- compare parameter lists.

For further information please visit our website at www.copeland.com/en-gb or contact your local Application Engineering representative.

2.18.2 Applicable hot key for LOCU units with XCM25D controller

The Emerson "Hot Key" **DK00000300** can be used for uploading and downloading of parameter lists. Copeland ident number 3226456.

Figure 24: Emerson "Hot Key"

2.18.3 Location of the "Hot Key" plug connection on the XCM25D controller

The "Hot Key" plug connection is located on the upper left corner of the XCM25D.

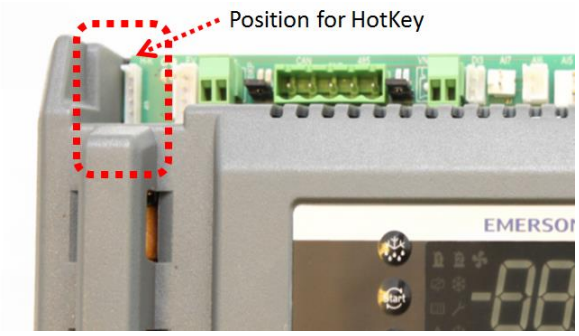


Figure 25: Location of "Hot Key" plug connection

2.18.4 How to program a "Hot Key" from the controller (upload)

- Program the controller with the front keypad.
- When the controller is on, insert the "Hot Key" and press the **UP** key; the **"uPL"** message appears followed a by a flashing "**End**" label.
- Press the **SET** key: the "**End**" label will stop flashing.
- Turn the controller off, remove the "Hot Key" then turn it on again.

***NOTE:* The "Err" message appears in case of a failed programming operation. In this case press the UP key again to restart the upload or remove the "Hot Key" to abort the operation.**

2.18.5 How to program the controller using an Emerson "Hot Key" (download)

- Turn the controller off.
- Insert a pre-programmed "Hot Key" into the 5-pin receptacle and turn the controller on.
- The parameter list of the hot key will be automatically downloaded into the controller memory. The "**doL**" message will blink followed a by a flashing "**End**" label.
- After 10 seconds the controller will restart working with the new parameters.
- Remove the "Hot Key".

***NOTE:* The message "Err" is displayed in case of a failed programming operation. In this case turn the unit off, then on again to restart the download, or remove the "Hot Key" to abort the operation.**

2.19 Troubleshooting – Alarm history

The controller records the total number of alarm activations (max 50) in the alarm menu – see **Appendix 2**.

Action	Key or display	Notes
Enter menu		Push and release the **ALR** key.
Waiting for action	**SEC**	The menu to change the section will be entered. The alarm list section is active.
Enter section list		Press **SET** to confirm. The following list will be available to select the proper network function.
Select active alarm code from list	 or 	Scroll the list of active alarms by alarm number (letter + number, A01-A50). Press  to see the alarm name or code. Press to see the next active alarm.
Exit menu		Press  simultaneously or wait for about 10 seconds without pressing any key.

Table 19: How to check the alarm list

2.20 Compressor motor protection

The electronic controller protects the compressor motor against the following:

- phase loss;
- incorrect phase rotation;
- voltage imbalance.

2.21 System pressure protection

2.21.1 High-pressure safety switch

A non-adjustable high-pressure switch protects the system against excessive high pressure. The device will open in the event of an abnormally high discharge pressure (above 28.8 bar).

- The unit will stop then restart automatically after a 5-minute delay and after the unit pressure has decreased to 24 bar.

2.21.2 Low-pressure safety switch

In a way similar to the high-pressure sensor, the electronic controller registers the switching action of the adjustable low-pressure switch, which will open in the event of an abnormally low suction pressure.

- The unit will stop then restart automatically after a 3-minute delay **(D28)** and when the unit reaches the cut-in pressure level.

The unit is always equipped with a suction pressure transmitter which also takes care for protection against vacuum operation. In rare instances of controller breakdown, the low-pressure switch would allow the unit to run in emergency mode – see **section 2.15 "Rescue mode (emergency mode)"**.

2.22 Other inputs of the XCM25D controller

2.22.1 Heat recovery mode

The electronic controller provides a digital input (**DI5**) to activate the heat recovery mode. There are prewired terminals X11.51 & X11.52 available to connect the demand signal. The wiring between the controller and above-mentioned terminals is factory-assembled. For more details please refer to **section 2.16 "Heat recovery mode – Optional"**.

2.22.2 Ambient temperature sensor

An ambient temperature sensor supplied by Copeland is connected to the electronic controller. This temperature sensor has several functionalities like emergency mode control, lower fan speed limitation and crankcase heater control.

2.22.3 Refrigerant level control – Leak detection device

The liquid receiver is equipped with an external liquid level watch LW4-L120 from Alco Controls. This device provides a digital signal to the XCM25D system controller in case of low charging level inside the receiver. As a result, system leakage can be detected and communicated at a very early stage.

The LW4-L120 device is connected to the digital input **DI3** (terminals X1.65/66/67).

2.22.4 Fan failure – Fan feedback

Thanks to the introduction of EC fan technology the XCM25D system controller gets feedback from the fans about their condition. In case of failure the digital input **DI7** (terminals X1.55/56/57) is activated and a fan alarm is generated.

2.23 Alarm output (DO5) of the XCM25D controller

The digital output **DO5** is pre-configured as an alarm contact. The relay (max. 5 A, 250 V AC) is activated in case of alarms and lockouts. Warnings will be shown only on the controller display.

This setting can be adjusted using parameter **S01**.

3 Installation

WARNING
High-pressure! Injury to skin and eyes possible! Be careful when opening connections on a pressurized item.

IMPORTANT
The installation location must be selected in accordance with local workplace safety regulations.

Copeland LOCU refrigeration units are delivered with a holding charge of neutral gas.

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

The unit must be installed in such a way that the air flow is not restricted.

A clogged condenser will increase the condensing temperature, thus reduce the cooling capacity, and lead to a high-pressure switch tripping. Clean the condenser fins on a regular basis.

3.1 Refrigeration unit handling

3.1.1 Transport and storage

WARNING
Risk of collapse! Personal injuries! Move units only with appropriate mechanical or handling equipment according to weight. Keep in the upright position. Respect stacking loads according to **Figure 26**. 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 26: Maximum stacking loads for transport and storage

3.1.2 Weights

Unit	Net weight (kg)	Gross weight (kg)
OMTE-76D	345	383
OMTE-90D	348	386
OMTE-152D	508	566
OLE-49	314	352
OLTE-82D	511	569

Table 20: Weights

3.1.3 Lifting

WARNING
Heavy equipment handling! Personal injuries! Never stay in the surrounding area when the unit is lifted. Use only adequate tools and fastening devices to secure the unit during transport and lifting.

CAUTION
Incorrect handling! Unit damage! Never use slings for transport or lifting as they would squeeze the unit.

Always lift the unit by points marked with yellow arrows on pictures below.

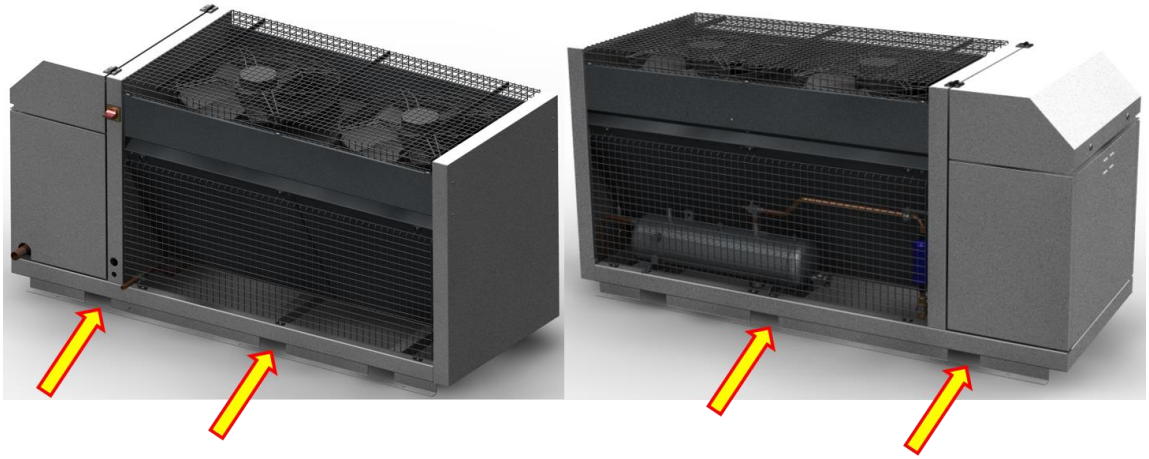


Figure 27: Lifting points in LOCU

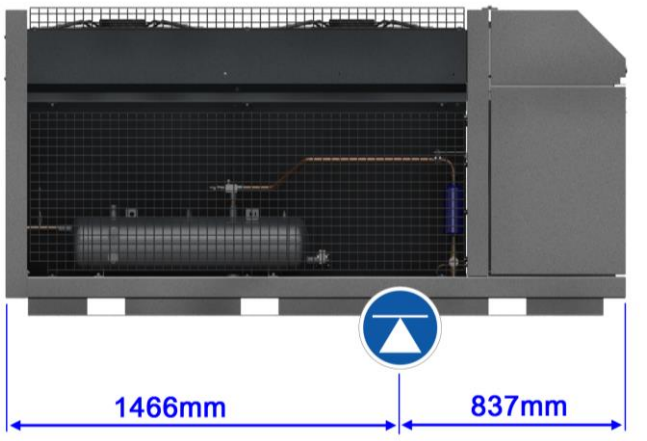


Figure 28: Centre of gravity

3.2 Refrigeration piping connections

3.2.1 Refrigeration piping installation

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, 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 (at the service valves) are in fact the correct size to run your interconnecting refrigeration pipes. The service valve sizes have been selected for convenience of installation and in some cases (larger units) these may be considered too small. However, for the very short pipe run within our units these service connection sizes are adequate. All interconnecting piping should be sized to satisfy the duty required.

The piping should be sized to ensure optimum performance and good oil return. The sizing must also consider the full capacity range through which this unit will need to operate.

Pipe runs should be kept as short as possible, using the minimum number of directional changes. Use large radius bends and avoid trapping of oil and refrigerant. This is particularly important for the suction line. The suction line should ideally slope gently towards the unit. Recommended slope is

1/200 to 1/250. Upper and lower oil traps, double risers and reduced pipe diameters may be required for suction lines where long vertical risers cannot be avoided.

All pipes should be adequately supported to prevent sagging which can create oil traps. The recommended pipe clamp support distance is shown in **Table 21** below:

Tube size	Max distance between 2 clamp supports
1/2" (12.7 mm)	1.20 m
5/8" (16.0 mm)	1.50 m
7/8" (22.0 mm)	1.85 m
1 1/8" (28.5 mm)	2.20 m

Table 21: Maximum distance between 2 clamp supports

***NOTE:* It is strongly recommended to insulate both the suction and liquid interconnecting piping between the OLTE unit and the evaporator.**

3.2.2 Connection sizes

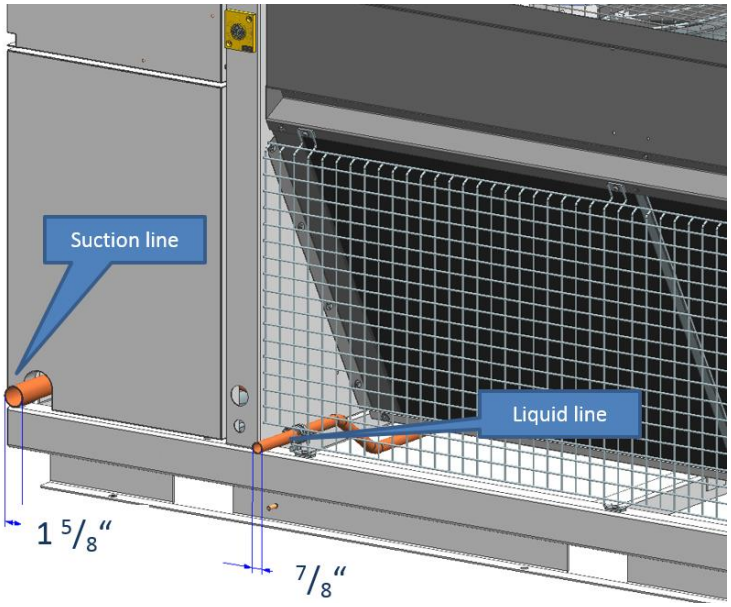


Figure 29: Connection ports on suction & liquid lines

Unit	Suction inlet	Liquid outlet
OMTE-76D & OMTE-90D	1 3/8" (34.925 mm)	5/8" (15.875 mm)
OLE-49	1 3/8" (34.925 mm)	1/2" (12.7 mm)
OMTE-152D & OLTE-82D	1 5/8" (41.275 mm)	7/8" (22.23 mm)

Table 22: Suction & liquid line diameters

3.2.3 Brazing recommendations

WARNING
High temperature! Burning! Proceed with caution when brazing system components. Do not touch the compressor until it has cooled down. Ensure that other materials in the area of the compressor do not come into contact with it.

CAUTION
High temperature! Risk of component damage! Always use a wet cloth when brazing the suction tube. Pay special attention to the pressure transmitter on the suction pipe: it needs to be cooled down during brazing to avoid any damage to the component.

CAUTION
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, thermal expansion valves, and accumulator oil return holes.
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.

- Remove the discharge connection cap.
- Remove the suction connection cap.
- Open both valves mid-way. Care should be taken to avoid the holding charge releasing too quickly.
- Be sure tube fitting inner surface and tube outer surface are clean prior to assembly.
- Both tubes are extended from the refrigeration unit housing, therefore Copeland recommends isolating the housing by using a wet cloth on the copper tubing.
- Recommended brazing materials: a copper/phosphorous or copper/phosphorous/silver alloy rod should be used for joining copper to copper whereas to join dissimilar or ferric metals a silver alloy rod either flux coated or with a separate flux would be used.
- Use a double-tipped torch.

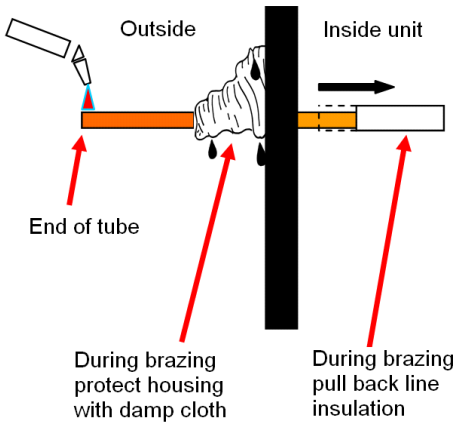


Figure 30: Brazing – Sectional view

3.2.4 Brazing procedure

Refer to **Figure 31** and procedure below for the brazing of the tubes:

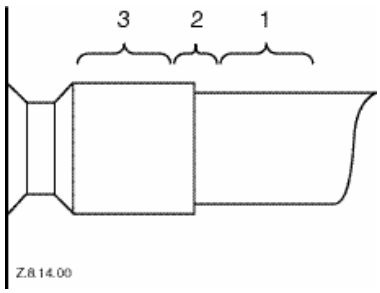


Figure 31: Suction tube brazing areas

- Fit the copper tube into the unit tube.
- Heat area 1. As the tube approaches brazing temperature,
- Heat area 2 until braze temperature is attained. It is necessary to heat the tube evenly. Move the torch up and down and rotating around the tube.
- Add braze material to the joint while moving the torch around the joint to flow braze material around the circumference.
- Then heat area 3. This will draw the brazing material down into the joint.

***NOTE:* The time spent heating area 3 should be minimal. As with any brazed joint, overheating may be detrimental to the final result.**

***NOTE:* Due to the different thermal properties of steel and copper, brazing procedures may have to be changed from those commonly used.**

To disconnect:

- Heat joint areas 2 and 3 slowly and uniformly until solder softens and tube can be pulled out of the fitting.

To reconnect:

- See procedure above.

3.3 Electrical connection

WARNING
Conductor cables! Electrical shock hazard! Shut off power supply before undertaking any task on electrical equipment.

3.3.1 Power supply connections

WARNING
Electrical pins under voltage! Electrical shock hazard! There are unused fast-on pins **(C1 & DO2)** on the XCM25D which could be under voltage. They are covered by insulated fast-on flags in the factory. Handle carefully when removing insulating flags during service on site.

The electrical connection of the refrigeration unit to the power supply must be made by qualified technicians in compliance with valid electrical standards, eg, DIN EN 60204-1. Additionally, the voltage drop and line temperatures must be considered for cable selection.

Copeland LOCU refrigeration units are designed for 380-420 V / 3 Ph / 50 Hz power supply. A voltage tolerance of ± 10 % is acceptable.

The main switch and the circuit breaker must be switched off before opening the front panel.

Before commissioning, ensure that the neutral "N" and ground protection "PE" wires are connected to the main switch.

3.3.2 Maximum operating currents for cable selection

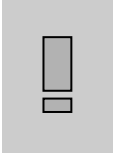
Unit model	Locked rotor (A)	Rated current (A)
OMTE-76D-TFD-501	64 + 65.5	28
OMTE-90D-TFD-501	2 x 74	30
OMTE-152D-TFD-501	2 x 118	55
OLE-49-TFD-501	139	27
OLTE-82D-TFD-501	2 x 118	66

Table 23: Locked rotor and rated current

3.3.3 Electrical protection standard (protection class)

- Units: IPX4.
- Scroll compressors: IP21 according to IEC 34.
- Fan: IP44 according to IEC 34.
- Solenoid valve coils: IP65 according to DIN 43650.

3.4 Location & fixings



IMPORTANT
Dust and dirt contamination! Unit life reduction! The unit should always be installed in a location that ensures clean air flow. External fouling of the condenser fins also 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 32** – see dimensions in blue colour. Both service access and air flow have been considered in making these recommendations.

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 of unit quantities and available space and it

is not the intention of this manual to go over these. However, in general terms, air by-pass around each condenser 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.

Another factor to consider in finding a good installation site is the direction of the prevailing wind. For example, if the air leaving the condenser faces the prevailing wind, the air flow through the condenser 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.

The corrosivity category of the installation location shall be considered as well. For further information please refer to **section 2.9.7 "Housing"**.

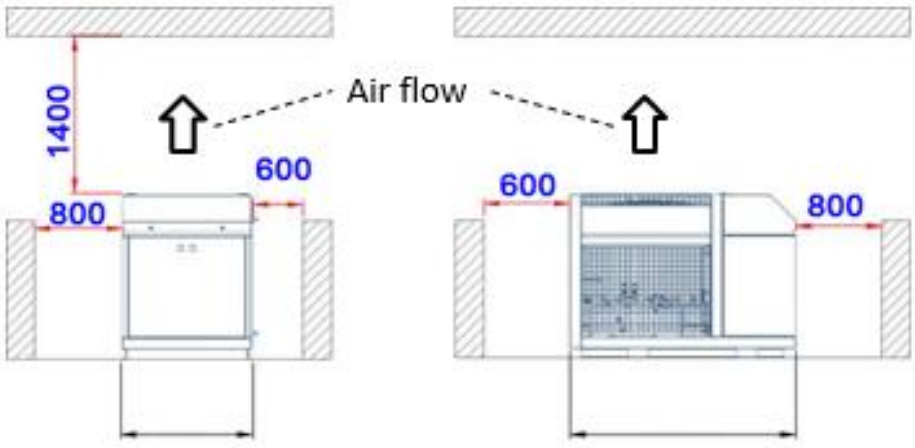


Figure 32: Fixing dimensions and distances in mm

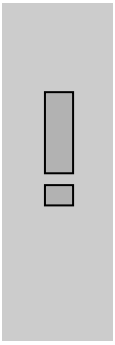
4 Start-up & operation

WARNING
Diesel effect! System explosion! The mixture of air and oil at high temperature can lead to an explosion. Avoid operating with air.

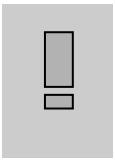
Before commissioning, ensure that all valves on the refrigeration unit are fully opened. Only qualified personal and certified companies are allowed to carry out installation, commissioning, service and maintenance work.

4.1 Evacuation

CAUTION
Inadequate refrigerant charge! Compressor damage! Never energize the unit/controller without minimum refrigerant system charge. There is a risk of malfunction of the controller in deep vacuum operation which can cause compressor damage.



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 ensure successful evacuation in the whole piping system.

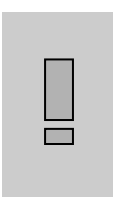
Before the installation is put into commission, it has to be evacuated with a vacuum pump. The installation should be evacuated down to an absolute pressure of 0.3 mbar. Proper evacuation reduces residual moisture to 50 ppm. During the initial procedure, suction and discharge shut-off valves on the compressor remain closed. The installation of adequately sized access valves at the furthest point from the compressor on the suction and liquid lines is advisable. The 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.

The highest demands are placed on the leak-proof design of the installation and on the leak testing methods – please refer to EN 378.

4.2 Charging procedure

4.2.1 Refrigerant charging procedure

CAUTION
Service valve closed! Compressor damage! Do not charge the unit with vapour (gas). The suction service valve must never be fully closed when the compressor is running. This would cause compressor damage in the same manner as explained above. This valve is provided for ease of connection and for the fitting of service gauges without removing the unit panel.



IMPORTANT
Inadequate charge! Overheating! The scroll compressor design requires the system to be charged 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 to cool not only the motor but also the scrolls. Temperature builds up very quickly in the scrolls if this is not done.

IMPORTANT
Refrigerant leakage! Contamination of surroundings! In case of leakage the surrounding area can be contaminated with a mixture of oil and refrigerant.
Periodically check the system for leakage.
Before charging or re-charging, the system must be leak- and pressure-tested with appropriate purging gas.

Ensure that the refrigerant system is grounded prior to charging with refrigerant.

Pre-charging must be done with liquid refrigerant through the service valve on the liquid line. It is advisable to pre-fill the suction side with a partial charge to avoid vacuum operation. Further charging can be done by carefully filling refrigerant through the suction line while simultaneously checking the sight glass.

Extreme care shall be taken not to overfill the system with refrigerant. The system manufacturer/installer must respect the charge limitations according to valid standards, such as but not limited to EN 378.

***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.**

4.2.2 Charging level in liquid receiver

The liquid receiver is equipped with 2 sight glasses, one at approximately 30 % charging quantity and one at 80 %. The level watch device sends an alarm to the system controller at 20 % charging quantity.

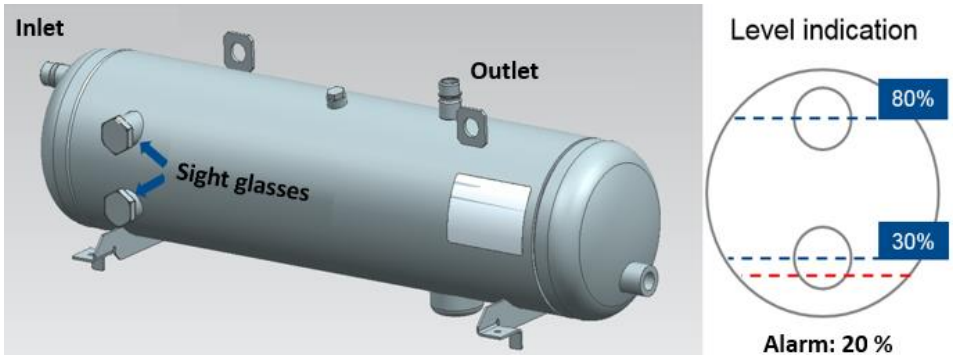


Figure 33: Charging level in liquid receiver

4.2.3 Oil charging procedure

Copeland LOCU refrigeration units are pre-charged with oil. After commissioning, the oil level should be checked and topped up if necessary.

As mentioned in **section 2.6.1 "Qualified refrigerants and oils"**, Copeland recommends charging with one of the following oil types:

- Emkarate RL 32 3MAF
- Mobil EAL Arctic 22 CC

Charging on a system in operation can be done through the Schraeder valve located on the suction shut-off valve.

For an empty system the service connection port on the oil reservoir outlet can be used – see **Figure 34** below.

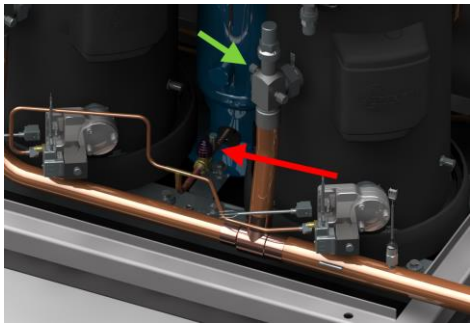


Figure 34: Oil charging service ports

The compressors in OMTE-152D and OLTE-82D units are equipped with an OM3 TraxOil oil management device from Alco Controls. The compressors will be switched off in case of insufficient oil level. The TraxOil will inject an adequate quantity of oil if required. It is important to have a sufficient quantity of oil in the system to ensure proper functionality of the oil management system.

***NOTE:* OMTE & OLTE units are equipped with an oil separator. This separator is pre-charged with 3.8 litres of oil. The oil level in the oil separator sight glass should always be up to top end.**

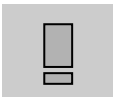
4.3 Rotation direction of scroll compressors

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. Three-phase compressors are protected against wrong rotation field by the unit controller.

4.4 Maximum compressor cycle

Maximum permitted starts per hour: 10. The factory setting of the XCM25D system controller takes into account the maximum permitted starts and stops of the compressor and also controls the running time and minimal downtime. It is recommended to change these settings only in exceptional cases.

4.5 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 opened.
- Set the essential parameters of the electronic controller in the programming level 1 (refrigerant type, compressor cut-out/cut-in settings, condensing fan setpoint….) according to the required application.
- Carry out visual inspection.
- Check fan rotation before starting compressors and turn fans on manually.
- Perform control tests to ensure all controls operate correctly, including any manual backup system (if applied).
- 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.
  - ✓ Cores fitted in filter dryers.
  - ✓ 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 compressors and to add oil if necessary to ensure a sufficient oil level (halfway up the sight glass).
- The following should also be checked:
  - ✓ Phase rotation of scroll compressors.
  - ✓ Fan rotation.
  - ✓ Refrigerant level.
  - ✓ Oil level in oil reservoir.
  - ✓ Expansion valve superheat.

***NOTE:* Before first compressor start in OMTE and OLTE units, the oil level in the non-digital compressor can be higher than halfway up the sight glass. This is normal and does not entail any risk for the unit. The oil level should be at standard level after first compressor start.**

4.6 Pressure fluctuations in case of digital unit

Digital scroll compressors are capable of capacity modulation. A normally closed (de-energized) solenoid valve is a key component for achieving modulation. When the solenoid valve is energized, the two scroll elements move apart axially into the unloaded state. In this state, the compressor motor continues running, but there is no compression. Within scroll modulation the suction and the discharge pressure could fluctuate. During the unloaded state, the discharge pressure will decrease and the suction pressure will increase. This normal pressure fluctuation has no observable effect on the reliability of the compressor or system components. However, the installation and setting of pressure controls should take this into account.

5 Maintenance & repair

WARNING
Conductor cables! Electrical shock hazard! Follow the lockout/tag out procedure and the national regulations before undertaking any maintenance or service work on the system.
Screwed electrical connections must be used in all applications. Refer to original equipment wiring diagrams. Electrical connections must be made by qualified electrical personnel.

5.1 Opening the unit housing

As part of standard servicing and maintenance it may be necessary to open the unit housing and covers. The unit allows easy access to all main components:

5.1.1 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 locks located on both sides of the electrical cabinet and lift the cover.

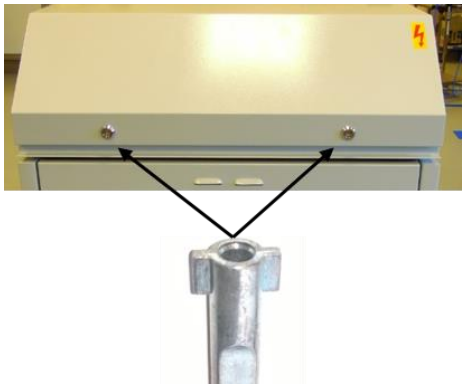


Figure 35: Position of the locks

5.1.2 To open the compressor chamber

- Unscrew the two screws located on the top of the compressor chamber cover, unplug the green/yellow grounding cable by pulling, then lift the cover.

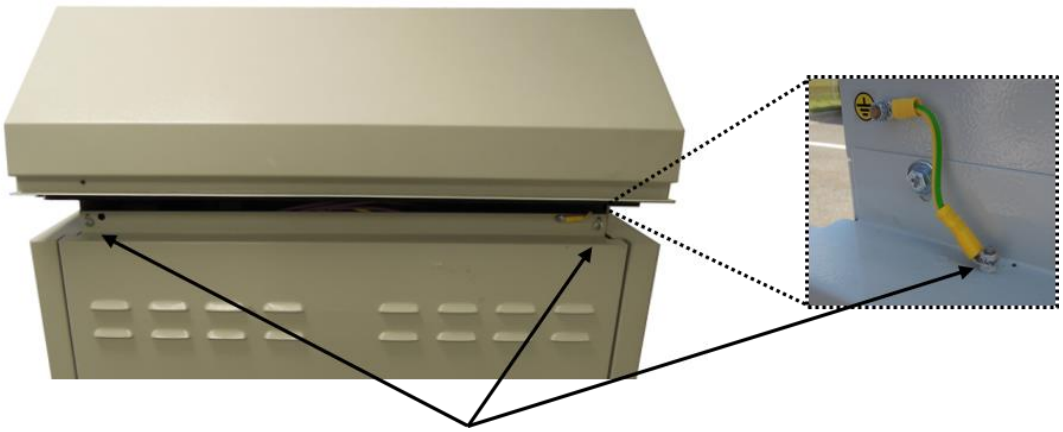


Figure 36: Opening the compressor chamber

5.1.3 To remove the fan safety grid

WARNING
Uncovered rotating parts! Personal injuries! Always de-energize the unit before removing the condenser 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 six screws securing the grid and lift it off.

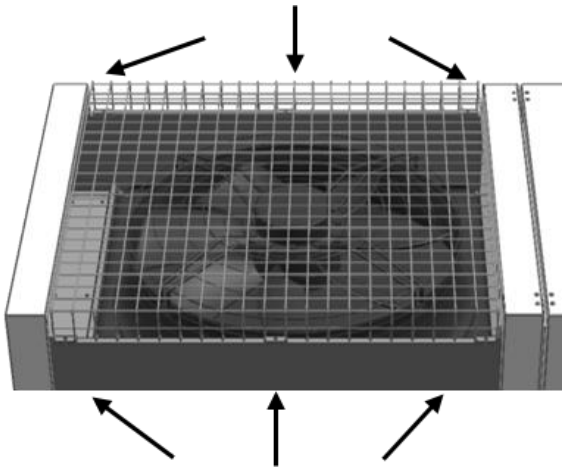


Figure 37: Opening the fan safety grid

5.1.4 To access the inner parts of the condenser

- The side panel can be removed only when the unit is turned off.
- To remove the side panel, unscrew the three screws located below the condenser first, then unscrew all the remaining screws and remove the cover by lifting it off.

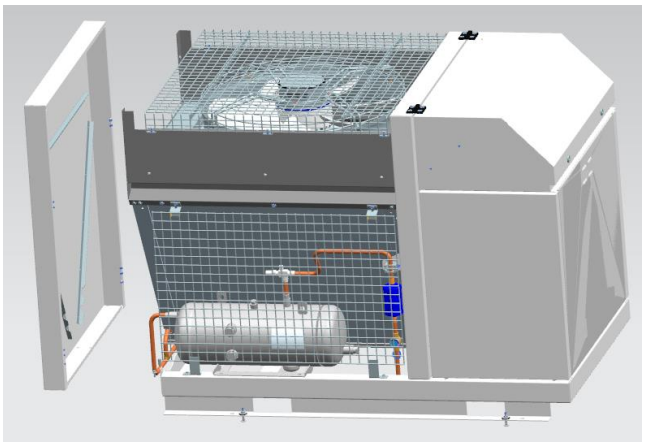


Figure 38: Accessing the inner parts of the unit

5.2 Replacing a compressor

CAUTION
Inadequate lubrication! Bearing destruction! Exchange the accumulator after replacing a compressor with a burned-out motor. The accumulator oil return orifice or screen may be plugged with debris or may become plugged. This will result in starvation of oil to the new compressor and a second failure.

In the case of a motor burnout, most contaminated oil will be removed with the compressor. The rest of the oil is cleaned using suction and liquid line filter driers. A 100 % activated alumina suction line filter drier is recommended but must be removed after 72 hours. **It is highly recommended to replace the suction accumulator, if the system contains one.** This is because the accumulator oil return orifice or screen may be plugged with debris or may become plugged shortly after a compressor failure. This will result in starvation of oil to the replacement compressor and a second failure. 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.

- De-energize the refrigeration unit before any intervention.
- 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.**

5.3 Electrical terminations

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

All refrigeration units will generate some degree of vibration. Copeland LOCU refrigeration units are no exception. Over time, due to the slight vibrations and to temperature fluctuations within the unit housing, electrical terminations may 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.

In all cases, if metal covers (with grounding connections) have been removed for maintenance, all grounding connections have to be reconnected before unit operation when the covers are put back in place.

5.4 Condenser fins

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

Condenser fins become dirty over time as ambient air is induced to the condenser. 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 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 provided the unit is installed level, 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 Routine leak testing

CAUTION
Leaking system! System breakdown! It is recommended to periodically re-torque all pipe and fixing connections to the original settings after the system has been put into operation.

All joints inside the system should be leak-tested as part of a regular maintenance schedule. The checking frequency is described in standard EN 378-4, Annex D. Copeland recommends checking the system tightness at least every 6 months.

Torque settings of system valves and adaptors with Rotalock connections might decrease significantly after some time in operation. Recurring temperature changes, vibration and other influencing parameters can lead to expansion and contraction of the metal material and a relaxation of the gaskets. It is recommended to periodically retorque the Rotalock connections to the original settings.

However, pipe plugs with sealant applied at the factory are not to be retorqued, as this would break the seal and create a leak path in the cured sealant.

	Torque (Nm)
Rotalock 1/2" x 5/8"	Brazed connection
Rotalock 5/8" x 5/8"	Brazed connection
Rotalock 7/8" x 7/8"	Brazed connection
Rotalock B.5/8", R.1"-14NS	35
Rotalock B.7/8", R.1 1/4"	45
Rotalock B.1 3/8", R.1 3/4"	70

Table 24: Torques of Rotalock connections

***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.**

5.6 Condenser fans & motors

A yearly inspection of these items is recommended. Fastenings can become loose; bearings may wear 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.

6 Certification & approval

- Copeland LOCU 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 LOCU refrigeration units comply with the Electromagnetic Compatibility Directive EMC 2014/30/EU. The compliance is verified through harmonized standards:
  - EN 55014-1: Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus, Part 1: Emission.
  - EN 55014-2: Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus, Part 2: Immunity – Product family standard.
  - 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 61000-3-11: 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.
  - EN 61000-6-3: Electromagnetic compatibility (EMC) Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments.
- The LOCU 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 LOCU 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 accordance with national legislation and regulations.**

Dispose of compressor(s) and/or unit in accordance with national legislation and regulations.

Appendix 1: Parameter list level 1 (Pr1)

Parameter	Description	Range	Factory settings		
			OMTE	OLE	OLTE
C01	Compressor cut-in pressure setpoint	C02 to C04	N/A	1.0	N/A
C02	Compressor cut-out pressure setpoint	C03 to C01	N/A	0.5	N/A
C07	Refrigerant selection for regulation	R404A(0-404) - R507(1-507) - R134A(2-134) - R407C(4-07C) - R407A(5-07A) - R407F(6-07F) - R448A(48A) - R449A(8-49A)	8-R449A		
C16	Digital compressor setpoint	C03 to C04	2.6	N/A	1.0
C17	Proportional band for compressor regulation	0.1 to 9.9 bar; 0.1 to 99.9 PSI; 0.1 to 25.5 °C	2.0	N/A	1.0
C21	Cycle time for digital compressor	10 to 40 sec	20	N/A	20
C26	Time with digital compressor at maximum capacity before starting another compressor	0 to 255 sec	30	N/A	30
C27	Time with digital compressor at minimum capacity before stopping another compressor	0 to 255 sec	0	N/A	0
D04	Minimum time between two starts (same compressor)	0 to 15 min	4	4	4
D29	Low-pressure alarm value	0 to 15 bar	0.5	0.0	0.0
E66	Delta temperature condenser floating setpoint	0.0 to 25.5 °C	8.0	8.0	8.0
N01	Current minute	0 to 59	-	-	-
N02	Current hour	0 to 23	-	-	-
N03	Day of month	1 to 31	-	-	-
N04	Month	1 to 12	-	-	-
N05	Year	0 to 99	-	-	-
T18	Access to Pr2 level	(0÷999)	3 2 1		

Table 25: Parameters level 1

Appendix 2: Alarm menu

Code	Description	Cause	Action	Reset
E01	AI1 error (Probe 1 / Suction pressure transducer failure alarm)	Probe failure or out of range	Only in digital unit - Compressor is activated according to C23, and compressor on & off time according to D02 & D03	Automatically as soon as the probe restarts working
E02	AI2 error (Probe 2 / Discharge pressure transducer failure alarm)	Probe failure or out of range	The fans speed control is disabled	Automatically as soon as the probe restarts working
E03	AI3 error (Probe 3 / Discharge line temperature sensor failure alarm)	Probe failure or out of range	Discharge temperature control is disabled	Automatically as soon as the probe restarts working
E04	AI4 error (Probe 4 / PHE vapour inlet temperature sensor failure alarm)	Probe failure or out of range	PHE superheat control is disabled	Automatically as soon as the probe restarts working
E05	AI5 error (Probe 5 / PHE vapour outlet temperature sensor failure alarm)	Probe failure or out of range	PHE superheat control is disabled	Automatically as soon as the probe restarts working
E06	AI6 error (Probe 6 / Ambient temperature sensor failure alarm)	Probe failure or out of range	The functions related to Probe 6 (ambient sensor) are disabled	Automatically as soon as the probe restarts working
E07	*AI7 error*	*Not used*		
E08	Battery error	The internal back-up battery is not working properly	Disable the clock function to restart the unit	No reset required
E09	Current sensor 1 error	Probe out of range	The functions related to current sensor are disabled	Automatically as soon as the probe restarts working
E10	Current sensor 2 error	Probe out of range	The functions related to current sensor are disabled	Automatically as soon as the probe restarts working
E11	Voltage sensor 1 error	Probe out of range	The functions related to voltage sensor are disabled	Automatically as soon as the probe restarts working
E12	Voltage sensor 2 error	Probe out of range	The functions related to voltage sensor are disabled	Automatically: as soon as the probe restarts working
E13	Voltage sensor 3 error	Probe out of range	The functions related to voltage sensor are disabled	Automatically as soon as the probe restarts working
E14-E19	*Reserved*			
E20	Lost phase error	Power supply phase loss (3-phase units)	The compressor will trip	Automatically as soon as lost phase is recovered and H08 delay time-out

Code	Description	Cause	Action	Reset
L20	Lost phase lockout	Power supply phase loss happened H12 times within one hour (3-phase units)	The compressor will lock out	Hold "start" button for 5 sec or manual power off and on
L21	Phase sequence lockout	Incorrect phase sequence (3-phase units)	The compressor will lock out	Manual power off and on
E22	Phase imbalance	One phase voltage lower than H18 percentage of 3 phases average voltage (3-phase units)	The compressor is activated according to H19	Automatically as soon as voltage is recovered and H16 setting delay time-out
L22	Phase imbalance lockout	One phase voltage lower than H18 percentage of 3 phases average voltage (3-phase units)	The compressor is activated according to H19 = 1: OFF the unit	Manual reset: voltage recover and H16 setting delay time-out
E23	Overcurrent compressor # 1	Electrical current higher than H09 setting	The compressor will trip	Automatically: H08 delay time-out
L23	Overcurrent lockout compressor # 1	Overcurrent happened H11 times within one hour	The compressor will lock out (if H11 equal to 0, no compressor lockout)	Hold "start" button for 5 sec or manual power off and on (if H11 equal to 0, compressor starts automatically after H08 delay time-out)
E24	*Open run circuit error*	*Not used*		
L24	*Open run circuit lockout*	*Not used*		
E25	*Open start circuit error*	*Not used*		
L25	*Open start circuit lockout*	*Not used*		
E26	Undervoltage alarm	Voltage lower than H13 setting for H15 seconds	The compressor will trip	Automatically as soon as voltage is back within acceptable range and H16 delay time-out
L26	Undervoltage lockout	Undervoltage happened H17 times within one hour	The compressor will lock out (if H17 equal to 0, no compressor lockout)	Hold "start" button for 5 sec or manual power off and on (if H17 equal to 0, compressor starts automatically when voltage is back within acceptable range and H16 delay time-out)
E27	Overvoltage alarm	Voltage higher than H14 setting for H15 seconds	The compressor will trip	Automatically as soon as voltage is back within acceptable range and H16 delay time-out

Code	Description	Cause	Action	Reset
L27	Overvoltage lockout	Overvoltage happened H17 times within one hour	The compressor will lock out (if H17 equal to 0, no compressor lockout)	Hold "start" button for 5 sec or manual power off and on (if H17 equal to 0, compressor automatically start when voltage is back within acceptable range and H16 delay time-out)
E28	No current detected on compressor # 1		Alarm	Automatically as soon as electrical current detected
L29	Frequency error	Detection of wrong frequency	The compressor will trip and lockout	Manual power on and power off
E30	Main power lost	Controller power supply lost	Warning signal only	Restore power supply
E31	Overcurrent compressor # 2	Electrical current higher than H09 setting	The compressor will trip	Automatically: H08 delay time-out
L31	Overcurrent lockout compressor # 2	Overcurrent happened H11 times within one hour	The compressor will lock out (if H11 equal to 0, no compressor lockout)	Hold "start" button for 5 sec or manual power off and on (if H11 equal to 0, compressor starts automatically after H08 delay time-out)
E32	No current detected on compressor # 2		Alarm	Automatically as soon as electrical current detected
E33-E39	*Reserved*			
E40	High-pressure switch	High-pressure switch open	The compressor will trip	Automatically as soon as high-pressure switch closed and D14 delay time-out
L40	High-pressure switch lockout	High-pressure switch open error happened D15 times within one hour	The compressor will lock out (if D15 equal to 0, no compressor lockout)	Hold "start" button for 5 sec or manual power off and on (if D15 equal to 0, compressor starts automatically when high-pressure switch closed and D14 delay time-out)
E41	Low-pressure switch	Low-pressure switch open	The compressor will trip	Automatically as soon as low-pressure switch closed and D28 delay time-out
E43	Low-pressure alarm	Digital compressor main configuration: suction pressure is lower than D29 for D12 seconds	Warning signal only	Suction pressure exceeds parameter D29 or cut-out value
E44	Discharge line temperature alarm compressor # 1	Discharge line temperature higher than D22 for D24 seconds	The compressor will trip	Automatically as soon as discharge line temperature lower than D23 setting and D25 delay time-out

Code	Description	Cause	Action	Reset
L44	Discharge line temperature lockout compressor # 1	Discharge line temperature overheat happened D26 times within one hour	The compressor will lock out (if D26 equal to 0, no compressor lockout)	Hold "start" button for 5 sec or manual power off and on (if D26 equal to 0, compressor starts automatically when discharge line temperature lower than D23 setting and D25 delay time-out)
E45	High condenser pressure alarm	Condenser pressure higher than E58 for E59 minutes	The compressor is activated according to E60	Automatically as soon as condenser pressure lower than E61
E46	High condenser temperature alarm	Condenser temperature higher than E58 for E59 minutes	The compressor is activated according to E60	Automatically as soon as condenser temperature lower than E61
E47	*EXV fully open (only when EVI is applied)*	*Not used*		
E48	*Refrigerant shortage*	*Not used*		
E49	*Pumpdown alarm*	*Not used*		
E50	High-side floodback alarm	Discharge temperature too low. The differential temperature between discharge and mid-coil is lower than H21 for accumulated H22 minutes in H23 minutes	Warning signal only	Automatically as soon as differential temperature between discharge and mid-coil is larger than H21 for H24 minutes
E51	Cold-start alarm	Discharge line temperature is higher than parameter D31 setting or suction pressure is lower than parameter D32 setting	Used for digital compressor: during alarm time, the digital compressor output is 50 %	Automatically as soon as condenser probe temperature is higher than C13

Code	Description	Cause	Action	Reset
L51	Cold-start lockout alarm	Number of cold-start alarms due to suction pressure exceeds parameter D34 setting or number of cold start alarms due to discharge line temperature exceeds parameter D33 setting	Digital compressor turns off and is locked out	Hold "start" button for 5 sec or manual power off and on
E52	Liquid watch	Digital input for liquid receiver level open	Warning signal only	Check the gas charge; check for leaks
E53	Digital compressor down	Safety chain of digital compressor open and digital compressor active	Warning signal only	Check compressor protection
E54	Fixed compressor down	Safety chain of fixed compressor open and compressor active	Warning signal only	Check compressor protection
E55	Fan failure	Fan alarm contact open	Warning signal only	Check fans protection
E58	Rescue mode	Rescue mode activated via switch S3	Warning signal only	After controller replacement, turn switch 3 to normal position (1)
E60	*Max pressure alarm of superheating*	*Not used*		
E61	*Min pressure alarm of superheating*	*Not used*		
E62	*High superheating alarm*	*Not used*		
E63	*Low superheating alarm*	*Not used*		
E64	*High room temperature alarm*	*Not used*		
E65	*Low room temperature alarm*	*Not used*		
E66	*Open door alarm*	*Not used*		
E80	rtC warning, date error	HW problem in the board	Disable the rtC or change the board	0
E81	rtC warning, communication error	HW problem in the board	Disable the rtC or change the board	0

Code	Description	Cause	Action	Reset
E82	Probe configuration error	Different probes (P3, P4, P5, P6, P7) have the same configuration. For example, A13 = Ambient temp (NTC 10 K), A15 = Ambient temp (NTC 10 K)	Correct the configuration	Board must be reset
E83	DI configuration error	Different digital inputs DI (DI1, DI2, DI3) have the same configuration. For example, R04 = Door switch, R07 = Door switch	Correct the configuration	Board must be reset
E84	Compressor configuration error	Case 0: digital compressor relay is configured, no digital solenoid configuration; Case 1: digital compressor relay is configured, no digital solenoid configuration; Case 2: no digital compressor relay configuration, digital solenoid is configured; Case 3: C05 = 3, digital compressor relay and digital solenoid are configured	Correct the configuration	Board must be reset
E85	*Injection probe configuration error*	*Not used*		
E86	EEPROM R/W error (manual)	HW problem in the board	Change the board	
E87	Fan failure	Fan alarm contact (digital input DI7) open F6(F7)	Check reason for fan alarm contact opening (mechanical issue, electrical issue)	Automatically: as soon the alarm contact closes again

Table 26: Alarm code overview

Appendix 3: Temperature / resistance curve for B7 Sensor (customer option)

R25 = 10 kΩ B25/85 = 3435 K

Temp. (°C)	Resistance (kΩ)	Temp. (°C)	Resistance (kΩ)	Temp. (°C)	Resistance (kΩ)	Temp. (°C)	Resistance (kΩ)	Temp. (°C)	Resistance (kΩ)	Temp. (°C)	Resistance (kΩ)
-50	329.2	-21	71.07	8	19.48	37	6.468	66	2.512	95	1.108
-49	310.7	-20	67.74	9	18.70	38	6.246	67	2.437	96	1.080
-48	293.3	-19	64.54	10	17.96	39	6.033	68	2.365	97	1.052
-47	277.0	-18	61.52	11	17.24	40	5.829	69	2.296	98	1.025
-46	261.3	-17	58.65	12	16.55	41	5.630	70	2.229	99	0.999
-45	247.5	-16	55.95	13	15.90	42	5.439	71	2.163	100	0.974
-44	234.1	-15	53.39	14	15.28	43	5.256	72	2.101	101	0.949
-43	221.6	-14	50.95	15	14.68	44	5.080	73	2.040	102	0.925
-42	209.8	-13	48.66	16	14.12	45	4.912	74	1.981	103	0.902
-41	198.7	-12	46.48	17	13.57	46	7.749	75	1.924	104	0.879
-40	188.4	-11	44.44	18	13.06	47	4.594	76	1.870	105	0.858
-39	178.3	-10	42.45	19	12.56	48	4.444	77	1.817	106	0.836
-38	168.9	-9	40.56	20	12.09	49	4.300	78	1.766	107	0.816
-37	160.1	-8	38.76	21	11.63	50	4.161	79	1.716	108	0.796
-36	151.8	-7	37.05	22	11.20	51	4.026	80	1.669	109	0.777
-35	144.0	-6	35.43	23	10.78	52	3.897	81	1.622	110	0.758
-34	136.6	-5	33.89	24	10.38	53	3.772	82	1.577	111	0.740
-33	129.7	-4	32.43	25	10.00	54	3.652	83	1.534	112	0.722
-32	123.2	-3	31.04	26	9.632	55	3.537	84	1.492	113	0.705
-31	117.1	-2	29.72	27	9.281	56	3.426	85	1.451	114	0.688
-30	111.3	-1	28.47	28	8.944	57	3.319	86	1.412	115	0.672
-29	105.7	0	27.28	29	8.622	58	3.216	87	1.374	116	0.656
-28	100.4	1	26.13	30	8.313	59	3.116	88	1.337	117	0.641
-27	95.47	2	25.03	31	8.015	60	3.021	89	1.301	118	0.626
-26	90.80	3	23.99	32	7.725	61	2.928	90	1.266	119	0.611
-25	86.39	4	22.99	33	7.455	62	2.838	91	1.233	120	0.597
-24	82.22	5	22.05	34	7.192	63	2.752	92	1.200		
-23	78.29	6	21.15	35	6.941	64	2.669	93	1.169		
-22	74.58	7	20.30	36	6.699	65	2.589	94	1.138		

Table 27: B7 AI7 optional sensor >> Temperature / resistance curve

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