USER MANUAL

EN

Energy Storage System

# SUNSYS HES L


UL

socomec
Innovative Power Solutions

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# 1. INTRODUCTION

## 1.1. Glossary

For the purpose of this document, the following abbreviations are used:

| | |
|---|---|
| BESS: | Battery Energy Storage System |
| BMS: | Battery Management System |
| C-Cab: | Conversion cabinet (SUNSYS C-Cab L) |
| DER: | Distributed Energy Resources |
| EMC: | Electro Magnetic Compatibility |
| EMS: | Energy Management System |
| ESS: | Energy Storage System |
| HMI: | Human Machine Interface |
| IM: | Islanding Mode |
| IoT: | Internet of Things (internet-connected devices) |
| PCS: | Power Conversion System |
| PE: | Protective Earth |
| PMS: | Power Management System |
| RCD: | Residual current device |
| SOC: | State of Charge |
| SOH: | State of Health |
| SPD: | Surge Protection Device |
| THDI: | Total Harmonic Distortion of Current |
| THDV: | Total Harmonic Distortion of Voltage |

## 1.2. Concerned products

The present manual covers the SUNSYS HES L range.

SUNSYS HES L System is composed of an assembly of 2 types of cabinets:

**C-Cab**

- Bidirectional power converter
- 50 to 300 kVA / cabinet. Based on 50kVA power modules.
- Automation functions
- AC/DC distribution and protection
- Battery management system
- IoT connected cabinet

**B-Cab**

- Lithium-ion battery
- LFP technology
- 186 kWh nameplate / rack - 176 kWh useable / rack
- Liquid cooling thermal management
- Integrated fire safety detection and extinguishing system included
- Possible to put up to 6 units in parallel per system to reach 1116 kWh nameplate / 1056 kWh useable

**SUNSYS HES L Configurations**

SUNSYS HES L system is available with different combinations of power and energy.

# 2. IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS– This manual contains important instructions for SUNSYS HES L systems (see “Concerned products”) that shall be followed during installation and maintenance of the storage inverter.

A potential **Shock and Injury Hazard** exists when working on or around electrical systems which could lead to serious injury or even death. Only qualified competent personnel who have been trained in and are familiar with the **Risk of Electric Shock** and **Plasma Arc Flash Hazards** may perform installation and maintenance on electrical systems. It is the sole **responsibility of the personnel** doing the work to be fully cognizant of all necessary safety regulations and procedures and **be familiar with the installation instructions detailed in this manual**.

| | |
|---|---|
|  | CAUTION!<br>Any work carried out on the equipment must be performed by skilled, qualified technicians. |
|  | The input and output circuits are isolated from the enclosure; the system grounding, when required by Sections 690.41, 690.42, and 690.43 of the National Electric Code, ANSI/NFPA 70, is the responsibility of the installer |
|  | The wiring methods in accordance with the National Electrical Code, ANSI/NFPA 70 and Canadian Electric Code (CEC) are to be used. All national standards applicable to batteries must be observed. |
|  | CAUTION!<br>Each power supply line must be provided with overcurrent protection according to the indication contained in the present manual. |
|  | This inverter complies with Part 15 of the FCC Rules Operation so it may not cause harmful interference and must accept any interference received, including interference that may cause undesired operation. |
|  | Overcurrent protection for the AC circuit is to be provided by the installer. |
|  | Before carrying out any operations read this user manual and its safety instructions carefully, in order to work under safe conditions. |
|  | If the Battery Energy System (BES) is not supplied by SOCOMEC, overcurrent protection for the BES is to be provided by the installer. |
|  | CAUTION!<br>Before carrying out any operations on the unit read the installation and operating manual carefully. Keep this manual safe for future reference. |
|  | DANGER!<br>Failure to observe safety standards could result in fatal accidents or serious injury, and damage equipment or the environment. |
|  | CAUTION!<br>If the unit is found to be damaged externally or internally, or any of the accessories are damaged or missing, contact SOCOMEC. Do not operate the unit if it has suffered a violent mechanical shock of any kind. |
|  | CAUTION!<br>Install the unit in accordance with the minimum distances from near walls in order to guarantee sufficient ventilation and access to handling devices (see Environmental requirements chapter). |
|  | CAUTION!<br>Only use accessories recommended or sold by the manufacturer. |
|  | CAUTION!<br>When the equipment is transferred from a cold to a warm place wait before operating the unit to avoid condensation. |

| | |
|---|---|
|  | DANGER! LIVE DEVICE! RISK OF ELECTRIC SHOCK: Up to five separately fused voltage supplies can be connected to the unit:<br>1. DC line – supply from the batteries or other DC sources<br>2. AC line – supply to/from the grid and/or loads<br>3. AC line – auxiliary voltage supply (3 phases)<br>4. AC line – auxiliary voltage supply (1 phase)<br>5. AC line – auxiliary voltage supply from internal UPS (1 phase) |
|  | DANGER! RISK OF ELECTRIC SHOCK!<br>If the C-Cab is provided with internal UPS, switch off the UPS before maintenance. The input switches do not switch off the power coming from internal UPS. See the dedicated chapter for details. |
|  | CAUTION!<br>Before cleaning, performing maintenance work or connecting appliances to the unit, switch the unit off and disconnect all power sources. |
|  | DANGER! Live device! RISK OF ELECTRIC SHOCK!<br>- Carry out the following steps before C-Cab maintenance:<br>- Disconnect the batteries<br>- Disconnect the AC power supplies<br>- Disconnect the DC disconnection switches (Q2)<br>- Disconnect the AC disconnection switches (Q1 and Q3)<br>- Switch off the UPS<br>- Make sure the system cannot be restarted<br>- Make sure the power supply (AC and DC voltages) has been disconnected |
|  | DANGER! RISK OF ELECTRIC SHOCK!<br>After disconnecting all power sources wait approx. 5 minutes for the complete discharge of the unit. |
|  | CAUTION! RISK OF BURNS!<br>During operation the casing of the heaters located in the bottom of the machine can reach high temperatures. Do not touch the surfaces! |
|  | CAUTION!<br>The tightening torque for DC and AC terminals must be in accordance with the indication of the present manual. |
|  | CAUTION!<br>Any use other than the specified purpose will be considered improper. The manufacturer/supplier shall not be held responsible for damage resulting from this. Risk and responsibility lie with the system manager. |
|  | WARNING!<br>The unit must operate within the ambient temperature range specified. Refer to relevant sections of this manual for limits and additional notes.<br>The unit is not intended to operate at ambient temperatures higher than 50°C (122°F) or lower than -20°C (-4°F). |
|  | Use 75°C or 90°C wire, either copper or aluminum; refer to “Electrical installation” chapter for further details about the suggested AWG size. |
|  | NOTICE<br>The maximum operating currents in controlled busbars or conductors are limited by the settings of the power control system (PCS) and may be lower than the sum of the currents of the connected controlled power sources. The settings of the PCS controlled currents may be used for calculation of the design currents used in the relevant sections of NEC Article 690 and 705. |
|  | WARNING!<br>Only qualified personnel shall be permitted to set or change the setting of the maximum operating current of the PCS. The maximum PCS operating current setting shall not exceed the busbar rating or conductor ampacity of any PCS controlled busbar or conductor. |
|  | NOTICE<br>For supplemental power control system:<br>“This system is equipped with a power control system. All power control systems controlled busbars or conductors shall be protected with suitably rated overcurrent devices appropriately sized for the busbar rating or conductor ampacity”. |
|  | WARNING<br>Configuration of power control settings system or changes to settings shall be made by qualified personnel only. Incorrect configuration or setting of the C-Cab may result in unsafe conditions. |

**⚠ WARNING!**

**California proposition 65 warning:**

Product range: Energy storage system

This product can expose you to chemicals including lithium ions, Styrene and glycol which are known to the State of California to cause cancer and birth defects or reproductive harm. For more information go to:

http://www.p65warnings.ca.gov

## 2.1. Symbols Used on the equipment labels and plates

The words "CAUTION", "WARNING" or "DANGER" are used in accordance to the meaning defined by UL1741 standard.

| Symbols | Description |
|---|---|
|  | UL1741; CSA-C22.2 No.107.1-16; MET file E113907 |
|  | General warning – Important safety information. |
|  | Risk of Electric Shock and/or ARC Flash Hazard: Life threatening voltages may be present with the risk of ARC Flash in the event of an inadvertent short circuit. |
|  | Risk of explosion! Avoid short circuits! |
|  | The switch is ON |
|  | The switch is OFF |
|  | Waiting time before operating: 5 min |
|  | Protective earth terminal. |
|  | Authorised personnel only. |
|  | No smoking. |
|  | Read the user instructions carefully.<br>Read the user manual before performing any operations. |
|  | Wear protective gloves. |
|  | Wear safety shoes. |
|  | Wear protective goggles. |

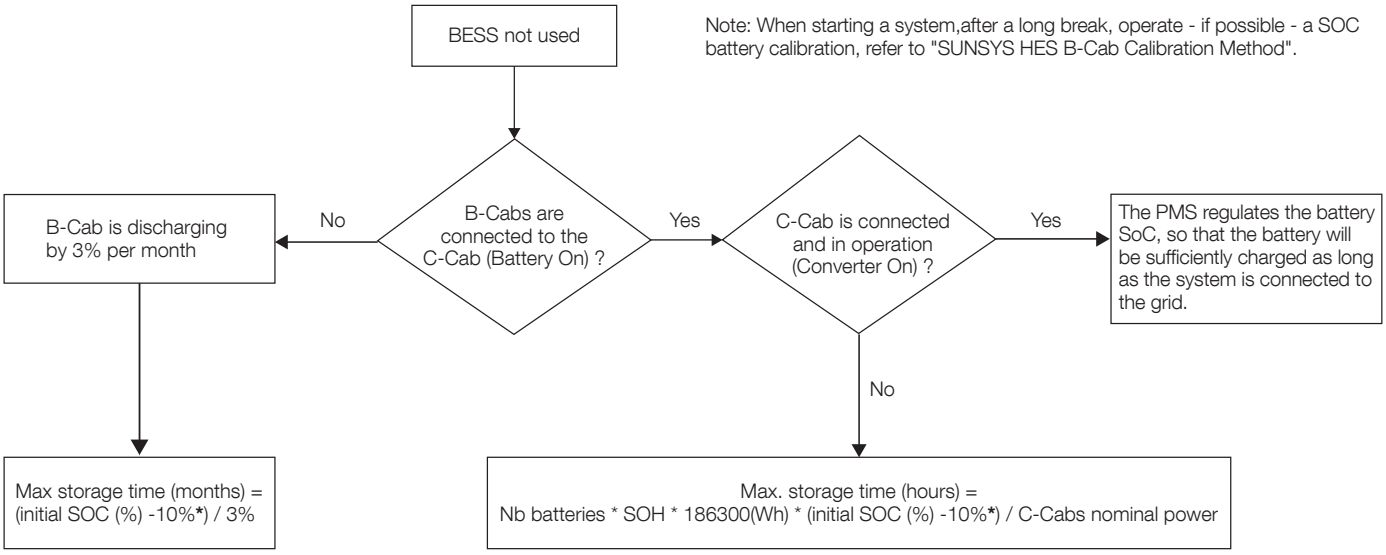
| Symbols | Description |
|---|---|
|  | In the event of contact with the eyes, wash immediately with plenty of water and call a doctor.<br>Call a doctor immediately in the event of accidents or illness. |
|  | Do not dispose of in normal waste stream (symbol waste electrical and electronic equipment). |

## 2.2. Important safety instructions for batteries

| | |
|---|---|
|  | Warning! a battery can present a risk of electrical shock and burn from high short-circuit current. Observe proper precautions. |
|  | When replacing batteries use only batteries approved by Socomec.<br>Do not connect the C-Cab to batteries that are not approved; this may cause serious damage to the equipment.<br>For any further information, contact Socomec. |
|  | Proper disposal of batteries is required. Refer to your local codes for disposal requirements. |
|  | The battery installation must be done in accordance with the storage battery rules of the Canadian Electrical Code, Part I. |
|  | The characteristics of the batteries must be compatible with the ratings of the C-Cab.<br>For any further information, contact Socomec. |

## 2.3. Limits to use of this equipment

| | |
|---|---|
|  | This equipment is rated for permanent connection to an electrical low voltage power supply according to the ratings reported in the present manual. |
|  | Devices and connections to the ancillary inputs and outputs (other than to external power) have specific limits with regard to voltages and isolation requirement; refer to relevant sections of this manual for limits and additional note. |
|  | Any use other than the specified purpose will be considered improper. The manufacturer/supplier shall not be held responsible for damage resulting from this. Risk and responsibility lie with the system manager. |
|  | Utility interconnection may require approval from the authority having jurisdiction in the local area. |




**(*) 10% is the limit for the very low SoC**

Note that the battery is self-discharging even if the system is not operating, or even if the battery itself is not connecting. So be careful as to monitor the state of charge of the battery when disconnecting it and carefully follow the discharge.
Once the discharge has reached a value that is too low; the battery cannot be reconnected unless operating a complex and specific intervention. The figure hereunder gives more information about the discharging rate.

## 2.4. Cybersecurity recommendations and best practices

Like any device connected to an Ethernet network, SUNSYS HES L system must be protected against any risk of cyber-attack or loss/destruction of data.

SUNSYS HES L provides cybersecurity features to prevent these attacks and help users implement and ensure the most robust IT protection possible. The following paragraphs set out some recommendations. Check that they are part of your company's security policy:

- Awareness of security policy: Users of SUNSYS HES L must be made aware of appropriate IT security practices (information and compliance with company security policy, management of authentication procedures, reliability of passwords, online session management, phishing risks, etc…) and be duly trained.
- Network security: The architecture of the computer system must make it possible to preserve resources, by segmenting the network according to the degree of sensitivity and by using different protection devices (firewall, demilitarized zone, VLAN, network antivirus, etc...).

Contribution of SUNSYS HES L to cybersecurity:
Interfaces must be accessed using secure versions of standard communication protocols:
- FTPS: secure data export
- HTTPS: secure browsing on the web server

- Device security: Security depends on the network environment, but also on user behavior. In terms of environment, it is strongly recommended to apply basic protection measures (filtering of authorized stations by MAC address, opening of service ports, choice of authorized applications, etc...). Greater caution should be exercised when handling mobile media (external hard drive, USB key, wireless communication equipment, etc...). Finally, the energy storage system must be protected by controlling and limiting physical access to cabinets that house electronic equipment.

- Data security: Data security covers several aspects, in particular the confidentiality, integrity, authenticity and availability of data. Particular care should be taken with regard to data security and archiving procedures on backup devices, both internal and external to the company.

Contribution of SUNSYS HES L energy storage system to cybersecurity:
It is possible to export data, such as energy indexes, load curves and historical measurements, manually or automatically, for backup purposes.
Confidentiality is guaranteed by AES 256-bit encryption (AES 256) for personal data. This means that it would take $2^{256}$ combinations to decipher the encryption key.

- Access and authentication management: Managing access to resources and data is an essential aspect of the IT systems security policy. Each user must have an account and access rights corresponding to their profile.

| | |
|---|---|
|  | SUNSYS HES L access:<br>From the web interface, the user has the possibility to reset the alarms and to change the configuration of the local EMS.<br>SUNSYS HES L control is carried out in Modbus TCP.<br>Therefore it is highly recommended to limit the hosts allowed to access the system.<br><br>These access restrictions can be implemented by:<br>- The implementation of firewall rules at the level of the client Ethernet network by limiting the IP addresses or MAC addresses to access the Web interface of the storage system.<br>- When commissioning the energy storage system, Socomec technicians configure it to limit access in accordance with the information provided by the customer. |

| | |
|---|---|
|  | Installation recommendation:<br>For stability and performance reasons, the connection between the PMS and the PMS extension must not be connected to other networks.<br>In the same way, the connection between the storage system and the CRE card must not be connected to other networks. |

# 3. OVERVIEW

The information in this manual is provided to aid in the installation, operation, and maintenance of the SUNSYS HES L energy storage system. Please read, understand and follow the procedures given to ensure trouble-free installation and operation.

## 3.1. General description

The SUNSYS HES L is a fully integrated AC connected energy storage system that supports a host of applications such as firming renewable production, stabilizing the electrical grid, controlling energy flow, optimizing asset operation and creating new revenue which provides greater control, efficiency and reliability across the electric grid. Another important function of the system is to provide backup power in the event of a grid failure or during power quality anomalies, therefore the system is able to operate in Island Mode.

The SUNSYS HES L system comprises two major cabinets namely, a converter for DC to AC conversion (referred to as C-Cab) and the Battery cabinets (B-Cabs). The unit has been designed to operate natively outdoors, potentially making installation simpler and not burdening the facility cooling and ventilation systems. This unique capability is facilitated by utilizing liquid cooling loops for the batteries which minimizes the cabinet flow through air volume, facilitating internal environmental control using filtered normal environmental air. The battery requires tighter temperature control for life and performance, consequently the battery cabinets utilize an active chiller to control the temperature within closely controlled limits to maximize battery life and performance. For the C-Cab proper air filtering and ventilation system is used in order to keep internal ambient under controlled conditions. Active cabinet heating is also employed for low temperatures and humidity condensation control.

The internal power flow between the modules of the system is controlled by a Power Management System (PMS), which is integrated inside the C-Cab.

The SUNSYS C-Cab L, shown in Figure 1, comprises the conversion modules of 50kVA each with their control, an automation box that can contain the PMS and IoT devices, a DC part with protection and connection and an AC part with protection and connection.

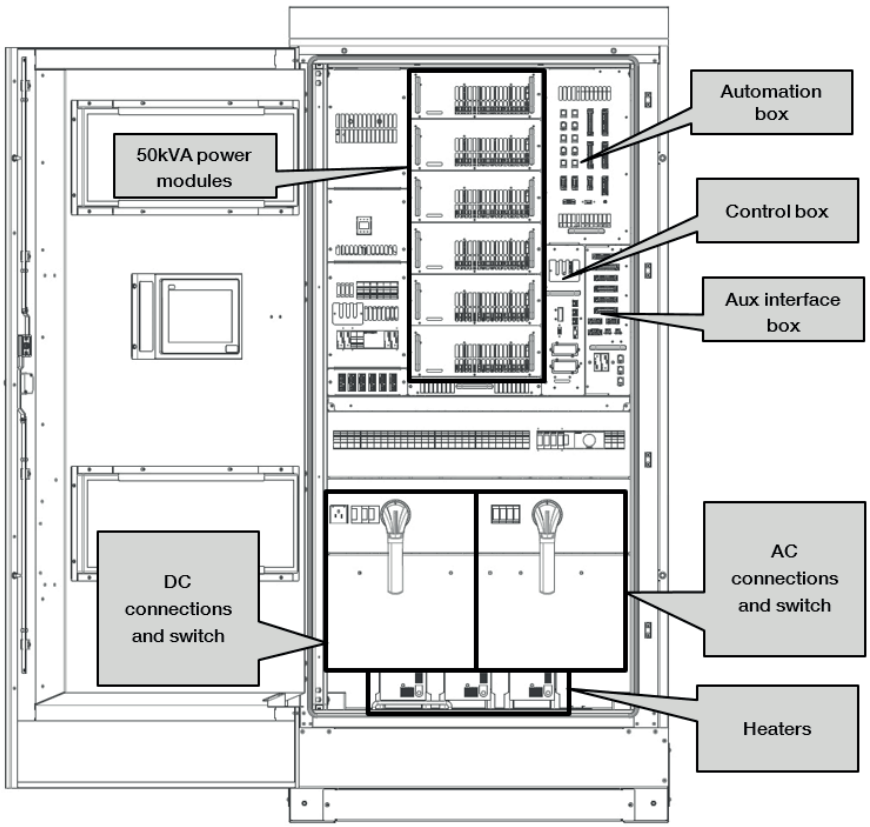



Figure 01. SUNSYS C-Cab L composition

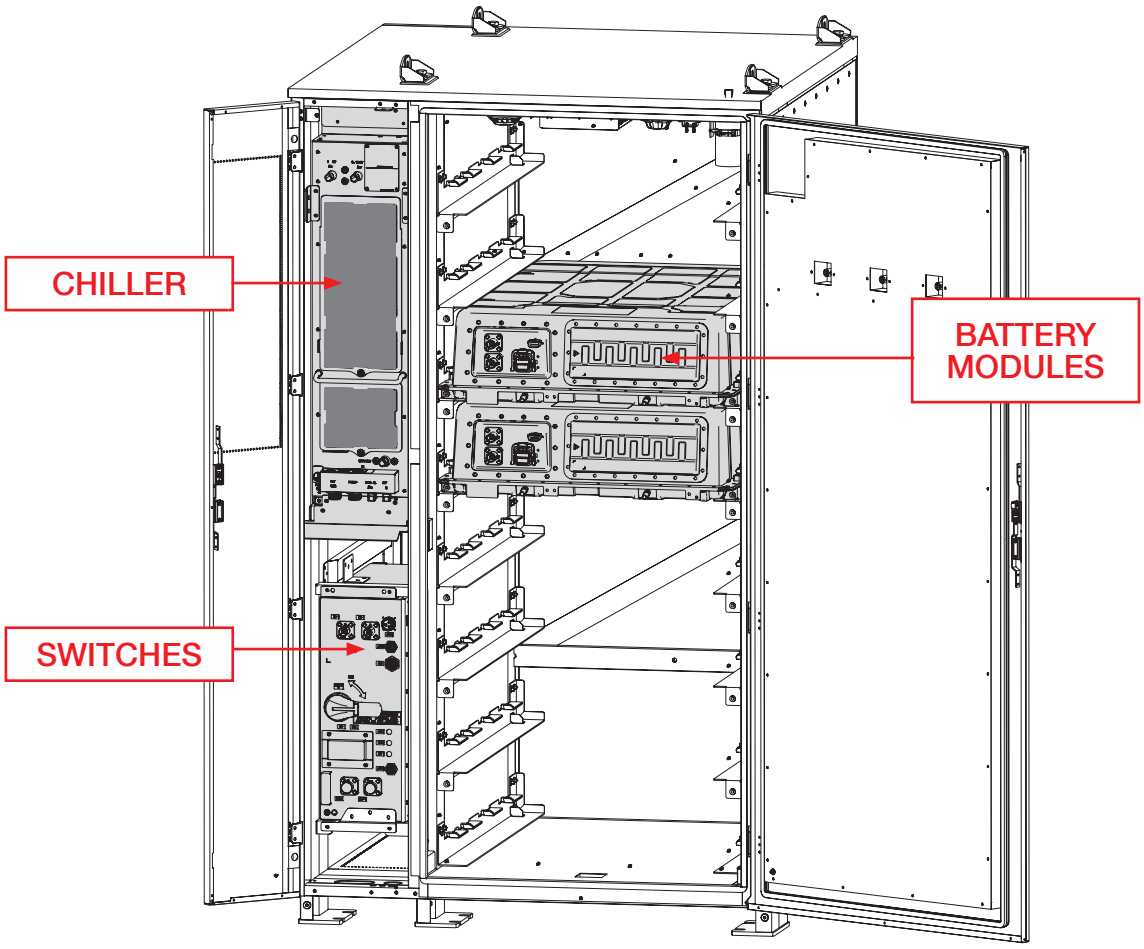



Figure 02. SUNSYS B-Cab L composition

## 3.2. Models

The C-Cab is composed of the 480Vac cabinet (SUN-HES-L-480) integrating an auto-transformer, operational at 60Hz, with up to 6 modules (SUN-HES-MOD50) 50kVA each installed.


Figure 03. SUNSYS C-Cab L Master from 50kVA to 300kVA, modulo 50kVA

For the specific as shipped unit configuration please refer to the nameplate included with each unit or contact Socomec for support with reference to the nameplate serial number. Units may be additionally supplied with configurations and options as defined by the customer at time of order.

The cabinet can be padlocked using a <10mm diameter padlock - not provided by Socomec.

**B-Cab Frame: 186kWh 4 modules**


Figure 04. View of the B-Cab

The batteries can not be padlocked, they are locked by the use of a key.

## 3.3. List of dedicated components

Each C-Cab can have different options installed, allowing a very high flexibility of setup to satisfy the user's requirements.

In the table below are listed all the optional components that can be installed inside the unit.

The items having spare parts available can also be installed outside of the factory, while the other items can only be installed in the factory.

Only options provided by Socomec can be installed inside the unit.

| ID | Item | | C-Cab | Description |
|---|---|---|---|---|
| 1 | PC tablet | | Yes | Support plate for a computer |
| 2 | Auxiliary supply SPD | | Yes | SPD for auxiliary power supply<br>Required if the Overvoltage Category of the supply line is OCV>II |
| 3 | SPD DC | | Yes | SPD for additional protection of the DC input line. |
| 4 | UPS | | Yes | UPS for auxiliary line<br>For protection of the auxiliary supply line during service interruptions |
| 5 | Insulation monitor | RCD | Yes | Residual Current Detector |
| 6 | Neutral contactor | | Yes | Contactor to manage the Neutral wire connection/disconnection |
| 7 | ETH switch | | Yes | Ethernet switch |
| 8 | Router | | Yes | CheckPoint 1570R Ethernet router |
| 9 | Wireless 4G modem | | Yes | Wireless 4G-modem + spare Antenna (Sierra Wireless)<br>The antenna is delivered as spare-part w/ the C-Cab, i.e., not mounted on the roof top in the factory |
| 10 | PMS (Power management System) | | Yes | PMS package (PLC, I/O, relays, commons) |
| 11 | Digiware package for PMS | | Yes | Digiware meters for the PMS (Gateway, U-30, I-35 + probes) |
| 12 | Diris AUX power supply measurement | | Yes | Diris B-30 device for AUX power supply measurement |
| 13 | Internal HMI for Automation | | Option | Schneider 10" display for the Automation package |
| 14 | Data logger | | Yes | Socomec H-80 Industrial PC |
| 15 | Battery control package | | Yes | CATL battery control devices (MBMU + ETH box) |
| 16 | EMS | | Option | KARBON 300 computer, Energy Management System (ETB CPU) |

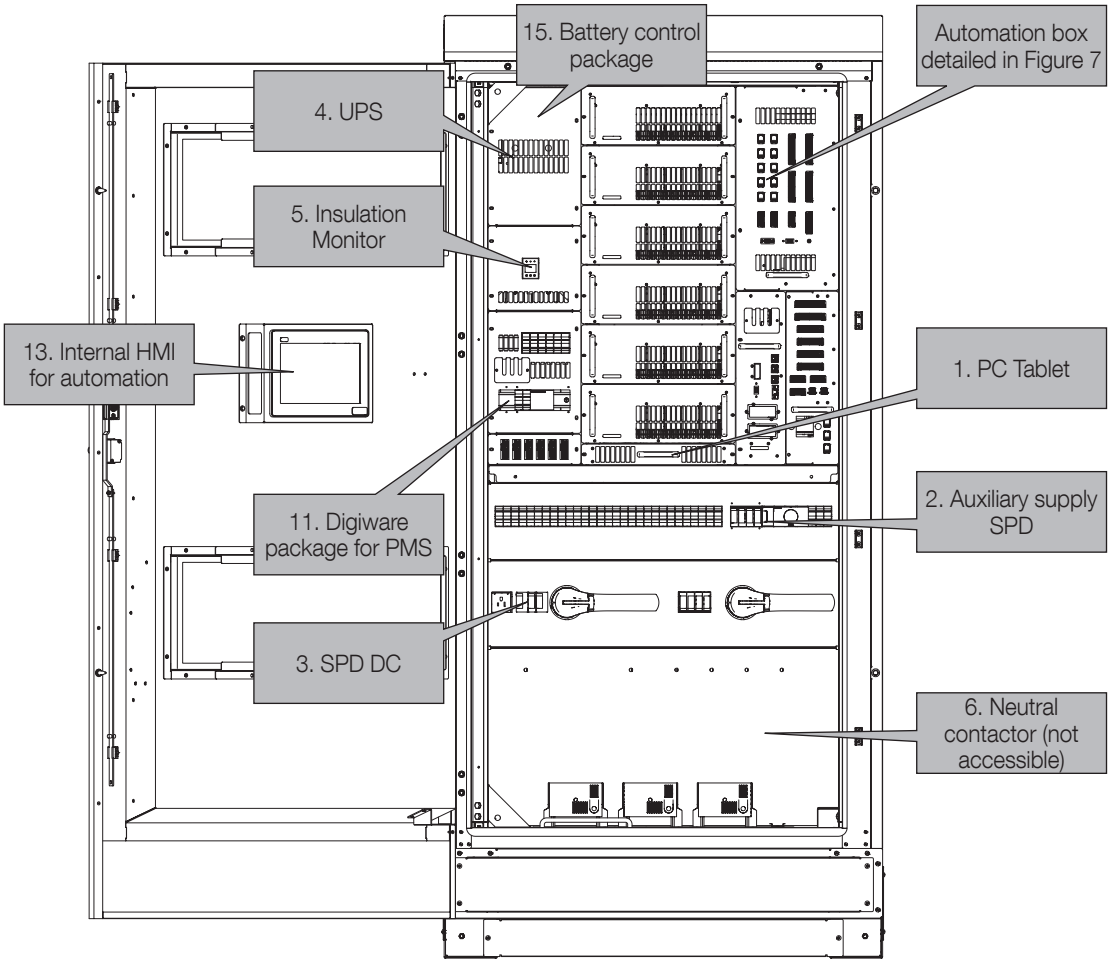



Figure 05. View of the dedicated components inside the C-Cab

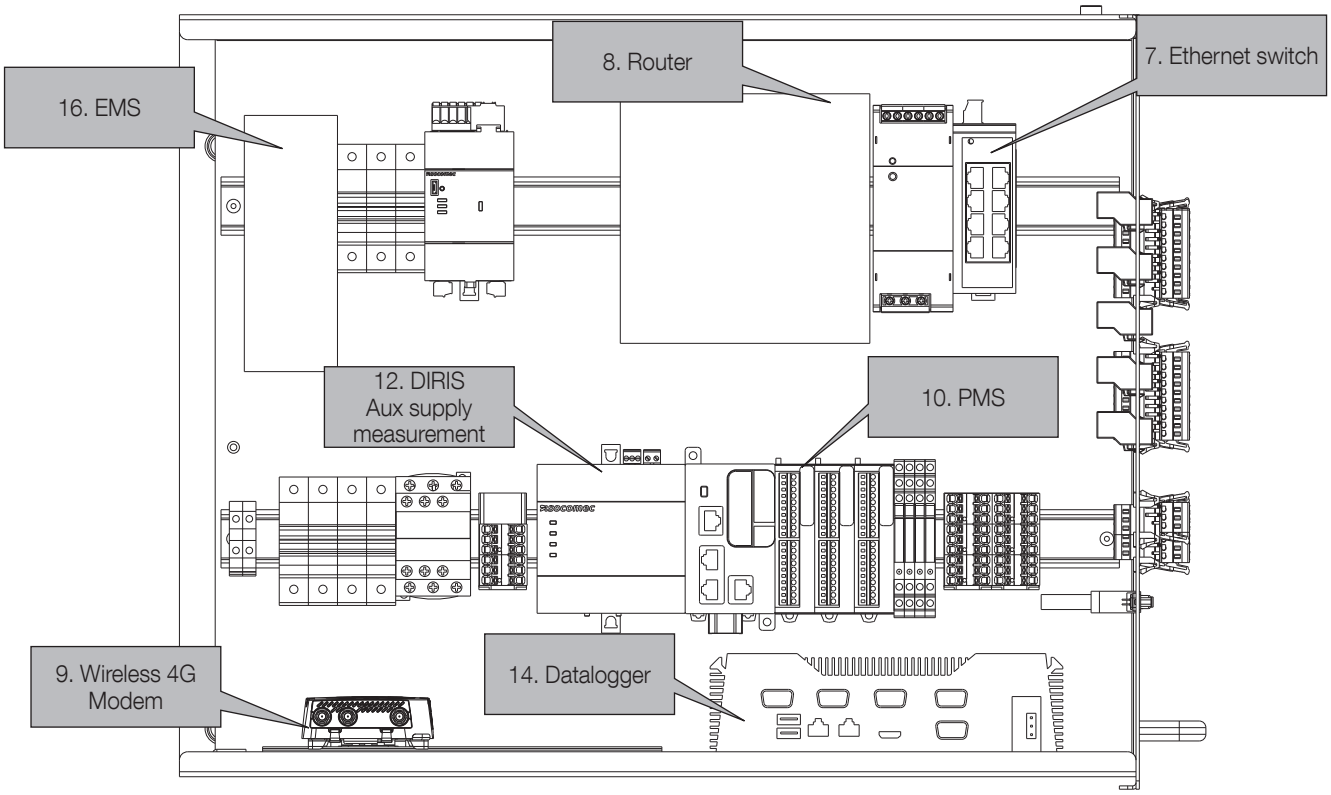



Figure 06. Detailed view of the Automation box

## 3.4. Devices with frontal access

When the C-Cab's door is open, it is possible to access to all the devices and ports available on the front of the machine. These devices are described in the figures below.

Some of them are optional and may not be present, as explained in the "List of options" section.

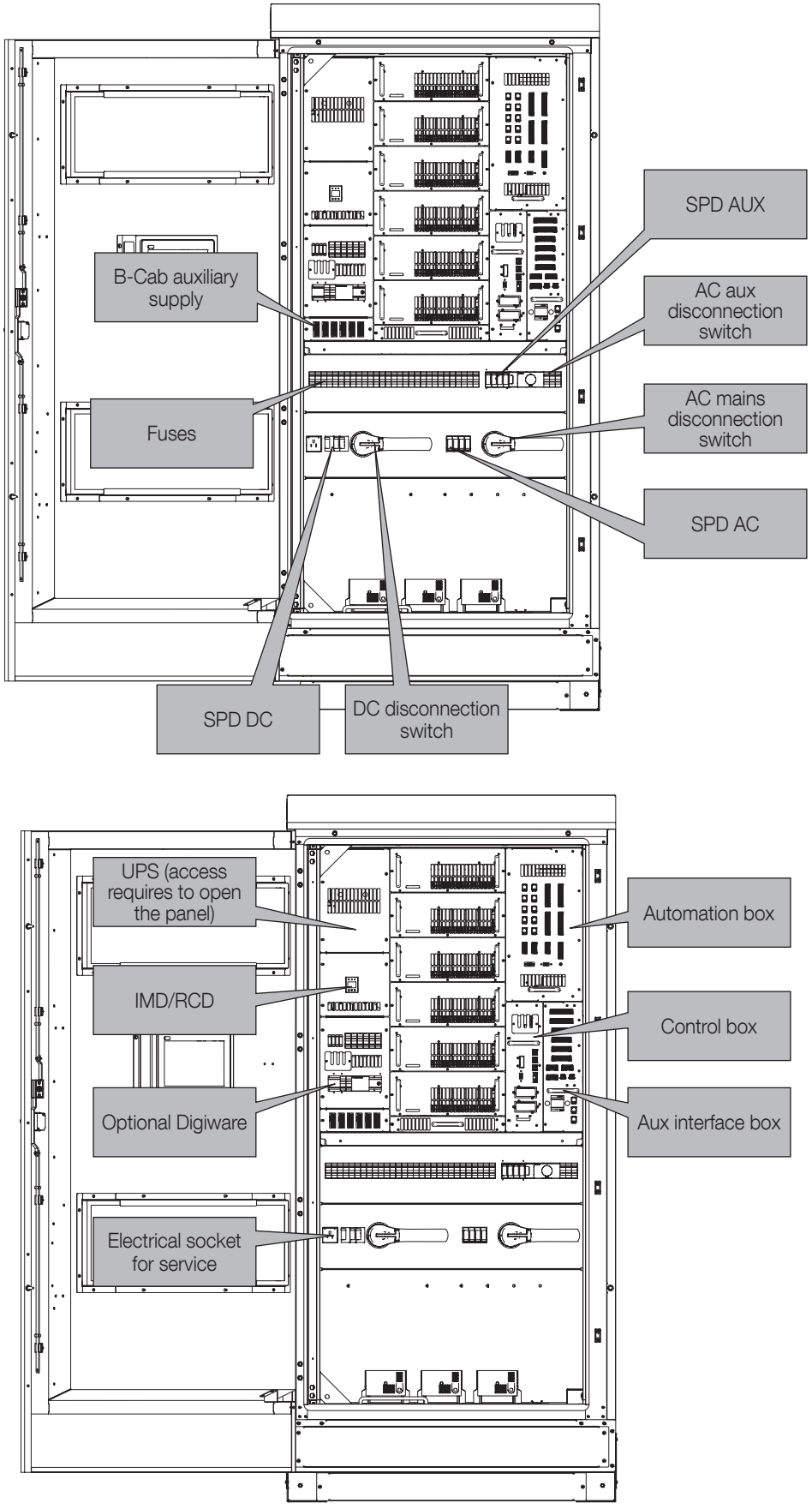



Figure 07. View of the devices accessible from the front of the C-Cab

## 3.5. Topology

The SUNSYS C-Cab L has been designed to operate autonomously thanks to the PMS (with compatible batteries) or from the external commands of a device called Energy Management System (EMS) which is not a part of this manual. The EMS is provided by a third party and has full control over the Energy Storage System (ESS), our privileged partner for this offer is ETB and when you choose its offer the EMS is integrated in our C-Cab.

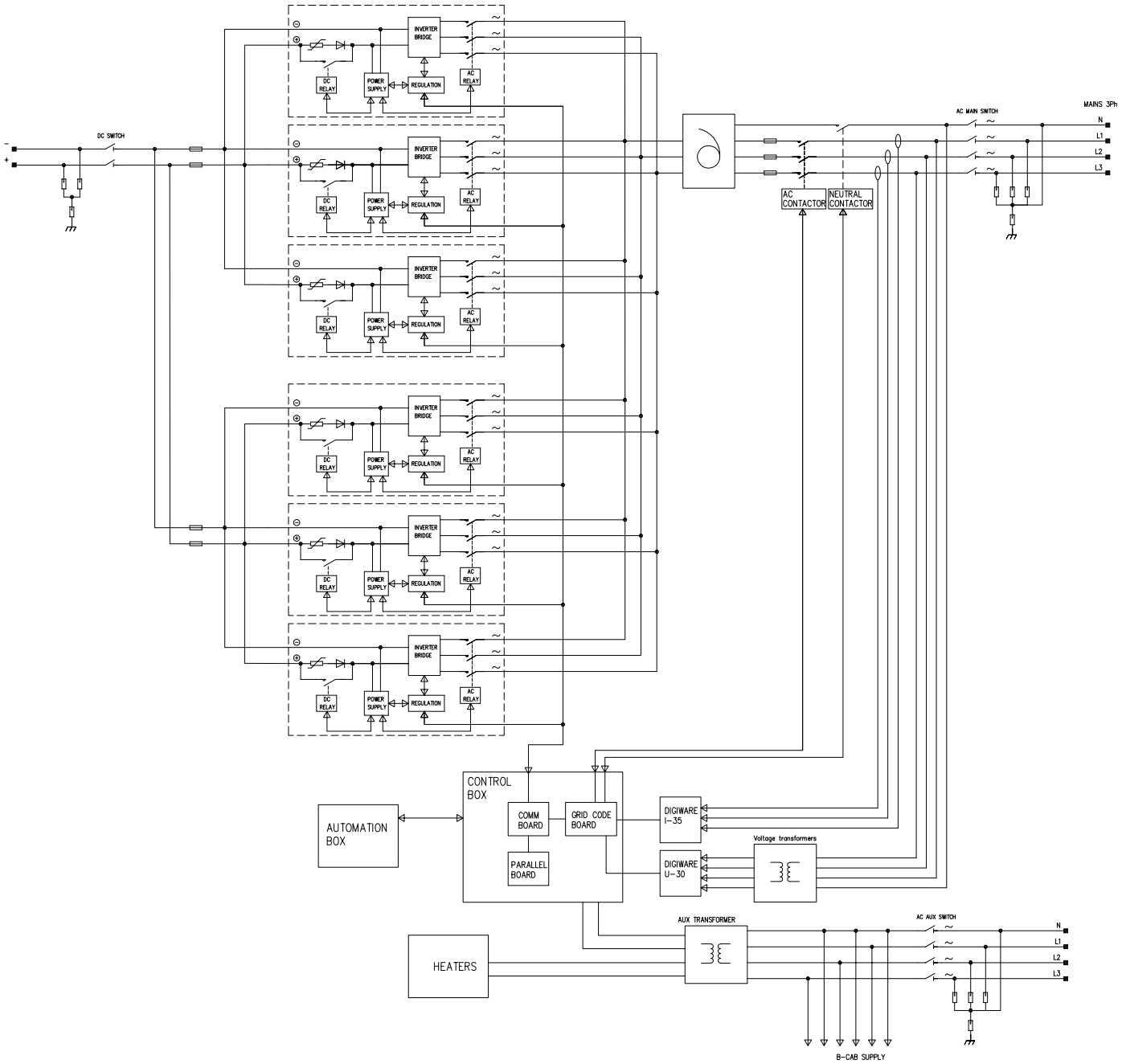



Figure 08. Example of C-Cab layout with autotransformer and options installed

## 3.6. Modes of operation

The system is designed to operate in the following modes of operation:

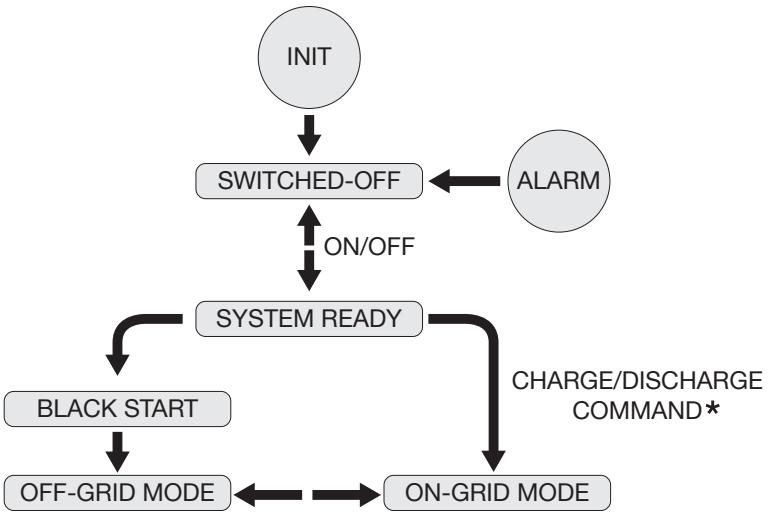



Figure 09. Modes of operation of SUNSYS HES L

*After the battery is fully charged (maximum allowed SOC) or discharged (minimum allowed SOC), the ESS returns into its standby mode.

### 3.6.1. On Grid Mode

SUNSYS HES L is a Grid Follower, meaning output voltage and frequency are imposed by the mains. The C-Cab operates according to active and reactive power set-points, provided by PMS/EMS, to exchange active and reactive power with the mains, both in injection and absorption.

When operating in On-Grid, the C-Cab is a grid-tied AC current generator controlled as a Current Source Inverter. AC current exchanged with the mains is controlled by an inner current control loop, driven by P and Q set-points.

During this Operation Mode all the criteria defined in the Grid Codes are met, from the point of view of both Interface Protection Requirements and Grid Support Functionalities.

When operating in On-Grid Mode, it provides Grid Support functionalities being properly a grid support utility interactive device as defined by UL1741 SB 3rd rev. September 28, 2021.

The converter has also been designed to UL1741 CRD (March 2019, Power Controls Systems) with four modes of operations being possible:

- **Unrestricted Mode**: The ESS may import active power from Area EPS while charging and may export active power to the Area EPS while discharging.
- **Import Only Mode**: The ESS may import active power from the Area EPS for charging purposes but shall not export active power from the ESS to the Area EPS.
- **Export Only Mode:** The ESS may export active power to the Area EPS during discharing but shall not import active power from the Area EPS for ESS charging purposes.
- **No Exchange Mode:** The ESS shall not exchange active power with the Area EPS for charging or discharging purposes

Refer to the document «SUNSYS HES L Instruction Guide UL1741 PCS function» to get more details about the operation.

### 3.6.2. Off-Grid Mode

SUNSYS HES L is a Grid Former, meaning output voltage and frequency are imposed by C-Cab itself.

In this operating mode the C-Cab is controlled as a Voltage Source Inverter. Active power and reactive power exchanged with the bus depend on loads and generators connected to AC bus (Microgrid).

The C-Cab is disconnected from the grid and it autonomously manages the microgrid parameters such as voltage, frequency and phase accurately. The Off-Grid Mode is also called grid-forming mode.

For specific Seamless Islanding operation, it is necessary to add a cabinet, in addition to the C-Cab, that includes:

- **A protective relay*** at PCC (Point of Common Coupling) connected on the C-CAB (Ethernet and dry contact) and use for :
  - Grid reconnection : Synchronism Check
  - Unintentional islanding Detection with ROCOF (81R), Fast ROCOF (81 RF) and Vector Shift (78) capabilities
- **A motorized Breaker**** with additional relay (Mx) with the capabilities to perform an opening in below than 50ms
- **Additional measurement***** connected to the C-CAB for load and other sources (Renewable, Genset, …
- **Synchro Compact Core** – CRE Technology card

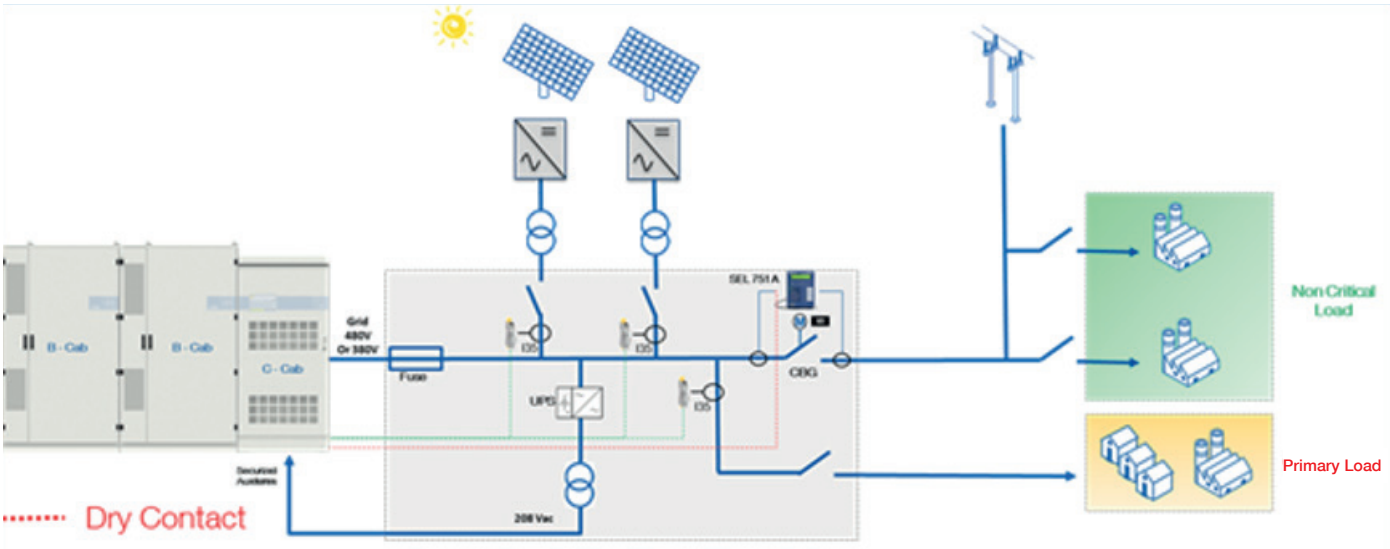



Figure 10. Architecture of the installation in case of operation with Islanding

* Protective relay recommended by Socomec: **Schweitzer engineering laboratories with SEL 751**

** Motorized breaker recommended by Socomec: **Schneider with Mx relay**

*** Additional measurement: **Socomec Digiware Mandatory**

Note: to get more details about the embedded functionalities of the system, please refer to the document «Functions available through the PMS».

## 3.7. Environmental controls

The system is designed for the IP55 & NEMA 3R enclosure requirements for the operation in an outdoor environment at the specified temperature ranges and up to 100% humidity non-condensing.

However, the converter and batteries have different environmental control strategies described as follows:

The C-Cab environmental control is maintained by a combination of forced air cooling with filters and heaters. Additionally, the cabinet has double skin which prevents entry of water, maintaining IP degree.

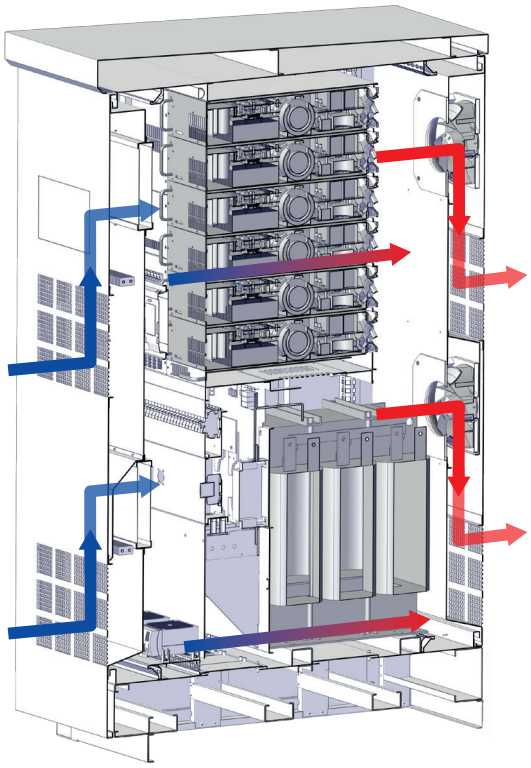


Figure 11. Air flows inside the SUNSYS C-Cab L

The environment control is divided in different sub logic that acts at different level and that can be either controlled by software logic or electro-mechanical actuators.

The deepest level of logic is the one managed directly by module. Each converter has its own fan and set the rotation speed according to the level of load and certain components temperature.

On top of that there is a logic controlling the temperature and the humidity inside the cabinet, in order to avoid damages to its electronic components.

This logic is called the environmental logic and it controls the 3 small heaters on the front side of the machine and the two extracting fans on the back. According to the cabinet temperature, the ambient temperature and the humidity measures, this logics will apply the minimum level of heating and ventilation to protect the machine from any potential damage due to environmental conditions.

This logic is running all the time and is divided into 3 main sequences. The first one takes part before the electronic is energized. In this phase a **thermostat and a hygrostat are activating the heaters** and prevent from the electronic power supply until **the temperature reaches +2°C (+35.6 °F) and the humidity goes below 75%**.

Then, the software reactivates the heater and the fans in order to fully dry the machine. **This drying is needed to avoid any condensation** that might result from storing conditions or temperature and humidity variation. **This sequence lasts for at least 3 hours and is operated every time the machine is completely de-energized and restarts**. Please note that if the system restarts within 20 minutes after the UPS stopped, the 3h drying will be skipped. If it restarts between 20 minutes and 2 hours it will be skipped if the environmental conditions are within certain criteria (for more detail please contact Socomec). After the 3 initial hours, if the cabinet temperature is higher than +5°C (41 °F), the ambient temperature lower than +48°C (118.4 °F) and cabinet humidity  lower than 90% the machine goes in ready mode, the DC source can be connected and the system starts. If one of these condition is not met, the system will continue the drying logic until they are all met.

Once the drying has been completed the machine is safe and we enter the working phase of the operation.

Finally we can consider an additional state consisting in **critical alarm state that will stop the machine** and that is activated at any time in the process if one of the following conditions is reached:

- the cabinet temperature reaches +53°C / 127.4 °F
- the cabinet temperature goes below -1°C / 30.2 °F
- the ambient temperature goes below -22°C / -7.6 °F
- the ambient temperature goes over 51°C / 123.8 °F
- the cabinet humidity reaches 93%. (note if ambient humidity goes above 95% it generates a warning but it does not stop the machine)

The batteries have a more tightly controlled environment which affords better battery performance and longer life. Components of the B-Cab environment control include an autonomously controlled HVAC system using an air to liquid cooling loop (not shown in the figure below)

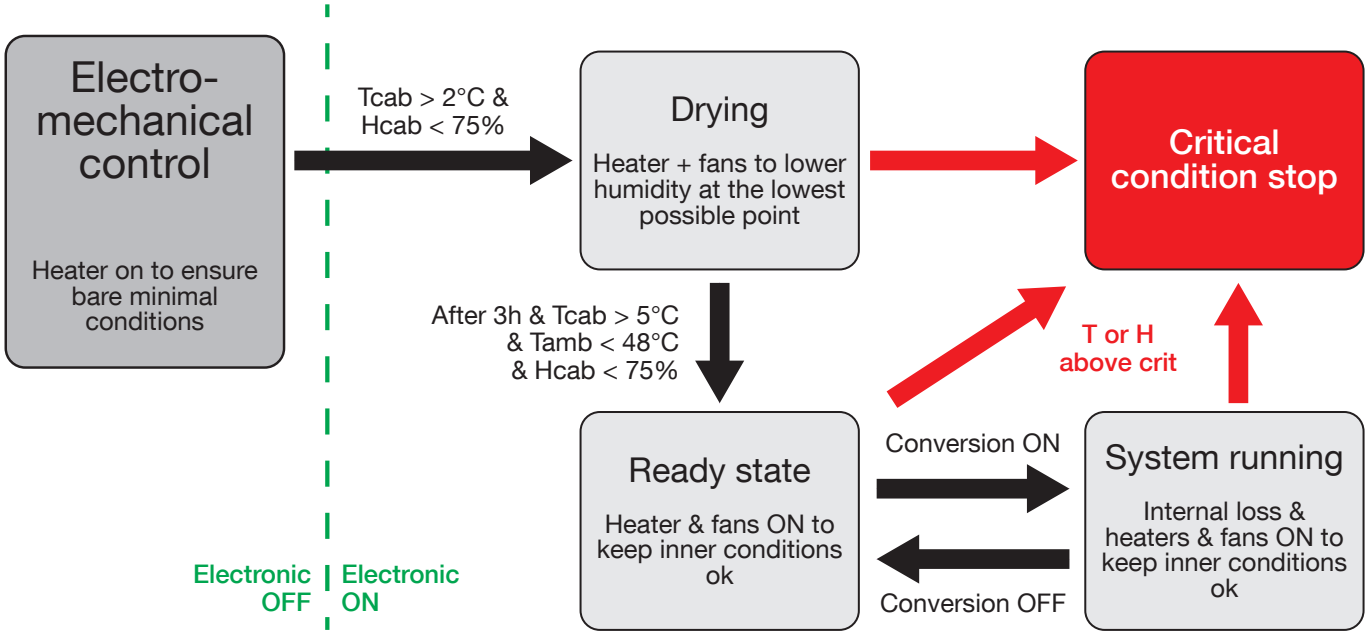



Figure 12. Environmental logic diagram

## 3.8. System communication

### 3.8.1. Communication with external EMS

The energy exchange (charge/ discharge) of the system can be managed by an Energy Management System (EMS) that performs remote operations.

This EMS will communicate with the PMS using the Modbus TCP / SunSpec protocol.

The connection is realized with an Ethernet RJ45 cable. The C-Cab IP address will be defined during commissioning.

Socomec is member of the SunSpec organization.

The SunSpec specifications are available on the SunSpec site https://sunspec.org/.

#### Supported models

| Model | Label | Description |
|---|---|---|
| 1 | Common | All SunSpec compliant devices must include this as the first model |
| 701 | DER AC Measurement | DER AC measurement model. |
| 702 | DER Capacity | DER capacity model. |
| 703 | Enter Service | Enter service model. |
| 704 | DER AC Controls | DER AC controls model. |
| 705 | DER Volt-Var | DER Volt-Var model. |
| 706 | DER Volt-Watt | DER Volt-Watt model. |
| 713 | DER Storage Capacity | DER storage capacity. |
| 715 | DER Ctl | DER Control |
| 802 | Battery Base Model | Battery Base Model |
| 803 | Li-ion Battery Bank Model | Lithium Ion Battery Model |

The communication is checked by writing a heartbeat value in the 715 model, it must change every second.

To control the DER, we use the models 715 for ON/OFF controls.

The DER set points are defined by the model 704. To control the battery, we use the model 802.

Reading the model 701 it will give you access to the states, alarms and measurements.

#### Start sequence

| Model | Offset | Name | Value | Action | Description |
|---|---|---|---|---|---|
| 715 | 7 | AlarmReset | 1 | | Reset the alarm |
| 715 | 7 | AlarmReset | 0 | | After a delay of 1 second |
| 802 | 50 | SetOp | 1 | CONNECT | Connect the battery, you have to wait the precharge before starting the PCS |
| 715 | 8 | OpCtl | 1 | START | Start the PCS |
| 704 | 22 | WSetEna | 1 | ENABLED | Enable the active power control |
| 704 | 23 | WSetMod | 1 | WATTS | Not a percentage but a value (can be another value) |
| 704 | 24 | WSet | active power value | | Active power set point |
| 704 | 35 | VarSetEna | 1 | ENABLED | Enable the reactive power control |
| 704 | 36 | VarSetMod | 4 | VARS | Not a percentage but a value (this setting can have another value) |
| 704 | 37 | VarSetPri | 0 | ACTIVE | This setting can have another value |
| 704 | 38 | VarSet | reactive power value | | Reactive power set point |

#### Stop sequence

| | | | | | |
|---|---|---|---|---|---|
| 715 | 8 | OpCtl | 0 | STOP | Stop the PCS |
| 802 | 50 | SetOp | 2 | DISCONNECT | Disconnect the battery, you have to wait 5 minutes before switching it on again |

### 3.8.2. The PMS

The PMS acts as the controller for the converter and the batteries and its basic interface within the system is illustrated in the following single line control diagram. The PMS derives its operational intelligence to operate the system based on the following:

- Modbus TCP / SunSpec communication to the converter for control & operational data, connection through Eth10.
- Modbus TCP communication  to external power meter for voltage, current and power measurement - internal connection.
- Modbus TCP / SunSpec communication with the EMS for remote control, connection through Eth1.
- Modbus TCP communication to batteries for control & operational data, internal connection.

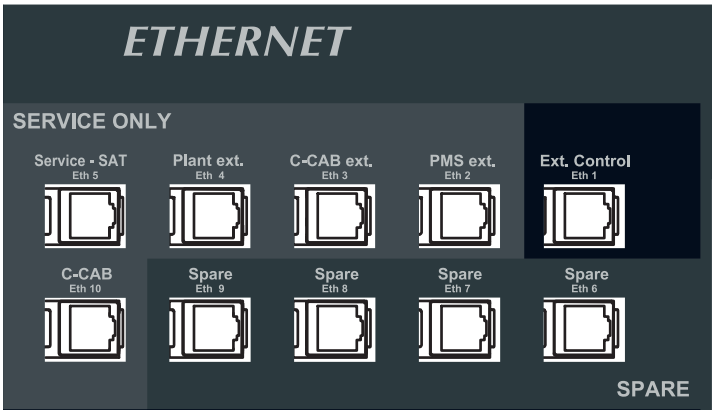



Figure 13. Ethernet connection ports

# 4. TRANSPORT, STORAGE & HANDLING

The instructions provided here are intended as a guide to the transportation, storage and handling of the unit.
For further support, please contact Socomec.

## 4.1. Transport

Note: customers have the responsibility of the transportation of all the parts from our sites to the final installation site. SOCOMEC declines all responsibility on any damage caused during the transport.
The choice of the type of transport is the responsibility of the customer, but needs to follow our requirements below and shall be decided in accordance with transport laws of the country crossed during the travel.

To ensure optimal conditions during the transport, you must transport the system in a High Cube container: equipment rigging, packing, etc.

**Note that for transport, the batteries have to travel respecting the following requirement: Transport for hazardous material.**

The transport and storage temperature must be between -20°C and +60°C.

A forklift shall do the unloading of the container.

## 4.2. Inspection

The unit is shipped on a wooden pallet. Power modules are shipped separately.

Upon receipt of the equipment, immediately inspect for damage that may have occurred during transit. Any damage claims are to be filed with the carrier and reported to Socomec expeditiously with serial number information and carrier details.

Check also that the content is complete.

The following items are shipped with the C-Cab:

1. Removable connectors mounted on each available port; there are 2 types of connectors.


Figure 14. B-Cab aux supply connectors

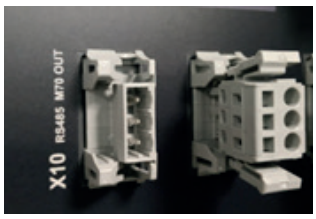



Figure 15. Other plug-in connectors

The number may vary according to the options installed; verify that all the connectors on the front panels are covered with their removable counterparts.

2. Tamper proof allen key for rear panel opening, provided in a dedicated bag.

The following items are shipped with the installation kits:

1. MSD

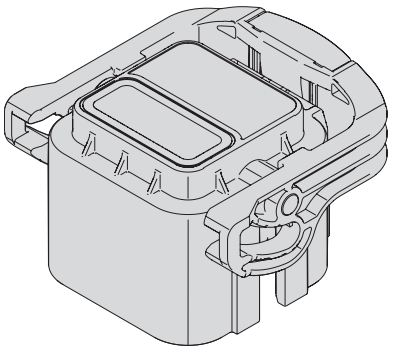


Figure 16. MSD

4 pieces per B-Cab of MSD are delivered and their installation must be conducted by Socomec team after the fixation of the cables and not before commissioning.

## 4.3. Storage

Store the cabinets in a dry and clean location protected from the elements and ensure that the ventilation openings remain covered to prevent the entry of moisture or dust. No harmful gases, flammable or explosive products and corrosive chemicals are allowed in the battery warehouse. The recommended storage temperature is about 20°C +/- 3°C with a daily average storage temperature ≤25°C to preserve the life of the battery and limit its self-discharge, though the allowed range of temperature is -20°C (-4°F) to +60°C (+140°F).

For storage duration exceding 1 month, please contact Socomec.

## 4.4. Handling and Moving

**WARNING!**
The packaging guarantees the stability of the unit during shipping and physical transfer.
The unit must remain in a vertical position during all shipping and handling operations.
Ensure that the floor is strong enough to support the weight of the unit.
Carry the packaged unit as close as possible to the installation site.

**WARNING!**
Move the unit using a fork lift truck taking the utmost caution at all times.
At least two people must handle the unit. The people MUST take position at the sides of the cabinet with respect to the direction of movement.
Do not move the unit by putting pressure on the front door nor back plate.
When moving the unit on even slightly sloping surfaces, use the locking equipment and braking devices to ensure that the unit does not fall over.

**WARNING!**
Provide vertical support while moving the unit due to its height and relatively high centre of gravity; move slowly with care to avoid tipping.

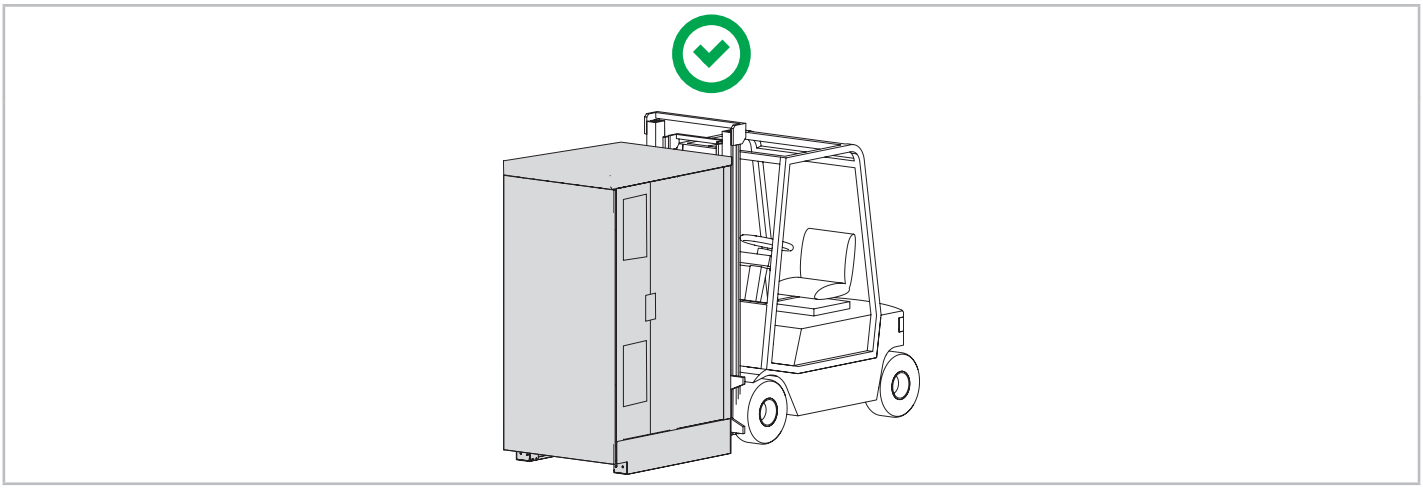
C-Cab and B-Cab are shipped individually mounted on individual pallets.

If you need to transport through a building the minimum opening, with the roof installed, must be 1050mm x 2170mm for the C-Cab and  1350mm x 2330mm for the B-Cab.

## 4.5. Forklift or Pallet truck handling

- **B-Cab**

Handling of the B-Cab needs to be done from the side of the cabinet, as shown on the figure below.



1. The forklift arm needs to be protected to avoid dirt pollution on the fork arm, or the forklift scrapes the bottom of the cabinet.
2. Before the forklift fork arm reaches into the bottom of the cabinet, make sure the height of the fork arm is lower than the bottom of the cabinet to avoid collision with the cabinet.
3. After the forklift fork arm reaches into the bottom of the cabinet , make sure that the fork arm are visible on the other side of the cabinet.
4. Forklift transport process should be maintained at a uniform speed.
5. Pay attention to the electric cabinet when transferring forklift truck.
6. Forklift model selection should consider the total weight of rack.

- **C-Cab**

Prior to use the forklift with the C-Cab remove the front and rear panels (as shown below).

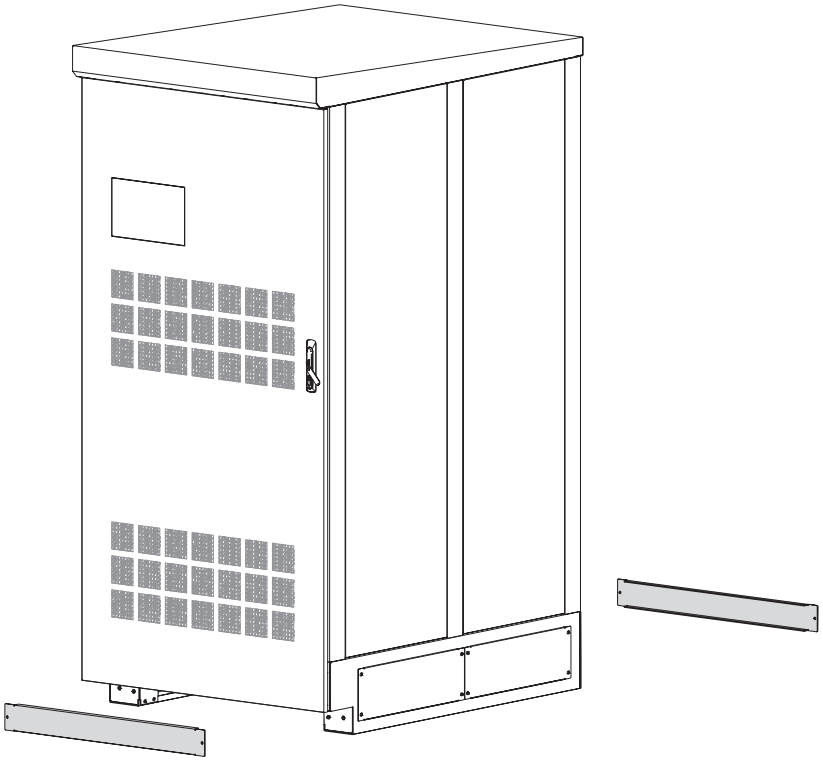


Figure 17. Panels to remove from the C-Cab

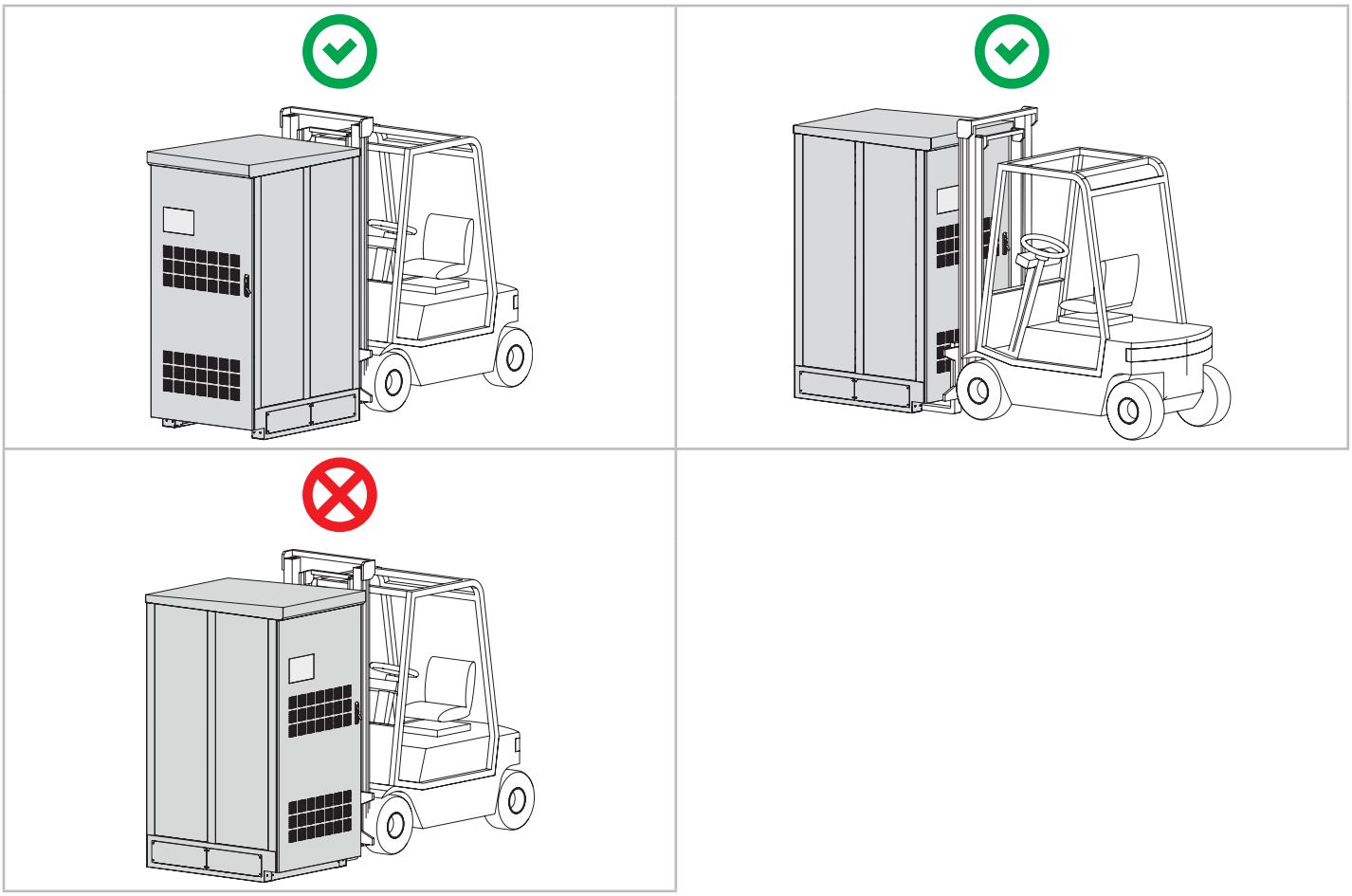


Figure 18. Handling of the unit using pallet truck with 1.30m long forks

(screen shall be at the back, if not possible it can be at the front, but then take care of the screen)

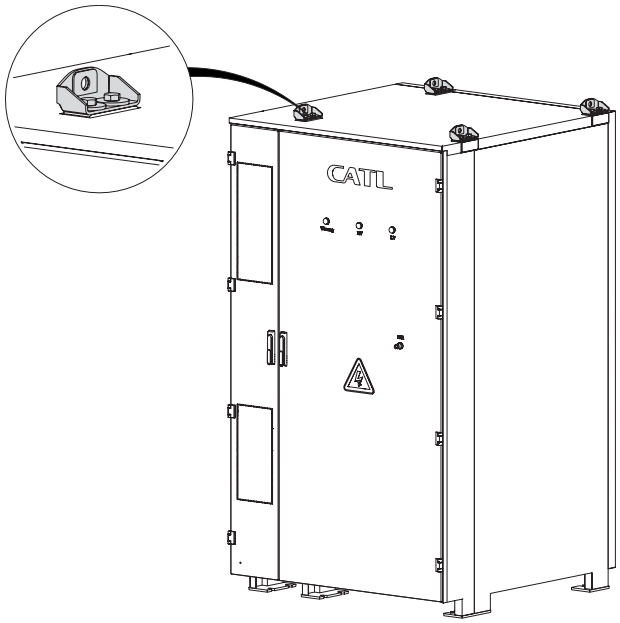
## 4.6. Overhead lifting

If a crane is available on site, it is possible to handle the unit from above.

- **B-Cab**

4 lifting lugs are on the top of the unit.

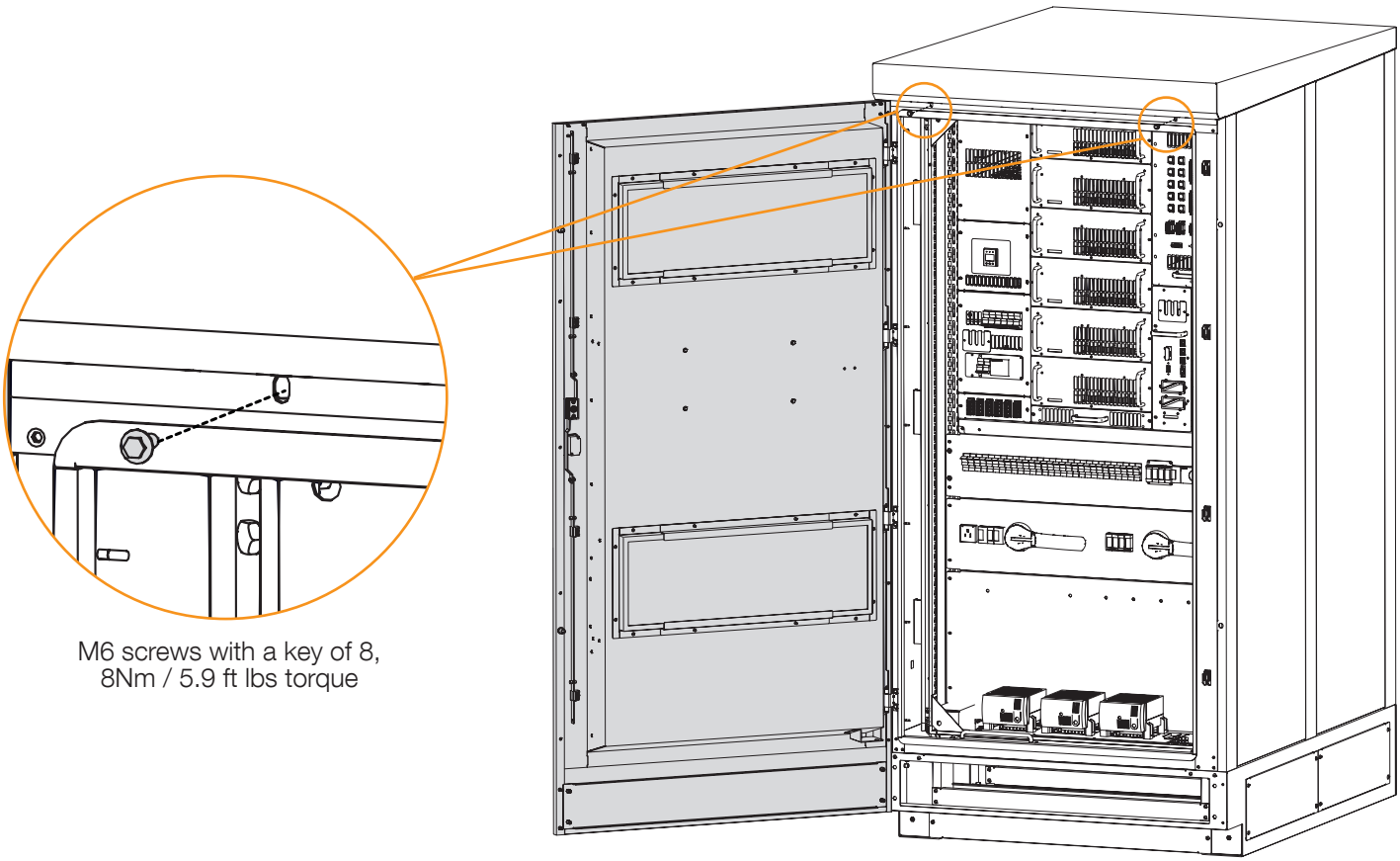
The radius of the hole on the lifting lug is 11mm / 0.43in.




**Warning: The tilt angle should be smaller than 5° during hoisting.**

Figure 19. Lifting lug on the top of the rack

- **C-Cab**
  - Open the door and remove the front screws:



M6 screws with a key of 8, 8Nm / 5.9 ft lbs torque

Figure 20. C-Cabs front top screws

- Remove the roof and replace the 4 screws by M12 lifting rings, we recommend you to use double swivel rings (not supplied):

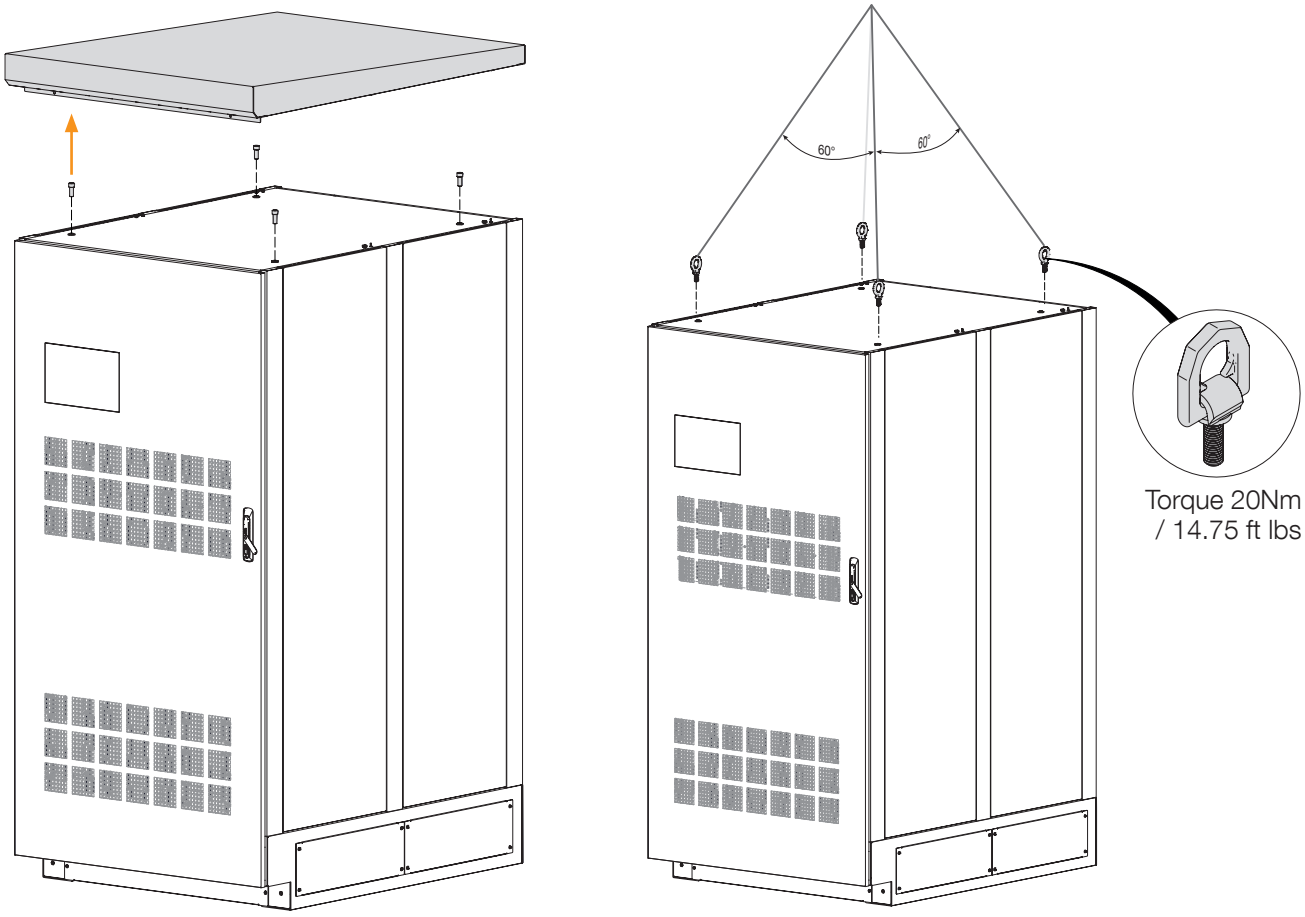



Figure 21. Lifting lugs on top of the C-Cab

- Should you not use double swivel rings but basic ones; you will need to use a vertical load spreader, not supplied (as illustrated below) for handling.

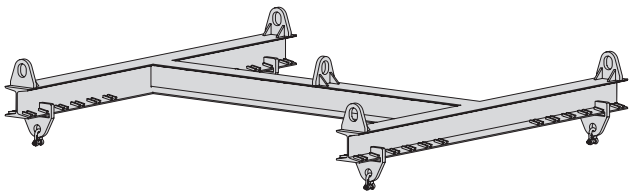


Figure 22. Vertical load spreader

**CAUTION!**
While lifting it is important to ensure even vertical load, distribution on all the lifting eyes and slowly lift and move into a prepared location while observing standard safety protocols. Do not use slings or straps without spreaders to lift the units from above.
No tilting is permitted. The unit cannot be laid.

# 5. PREPARATION

## 5.1. Civil and foundation requirements

SUNSYS HES L must be installed on a concrete pad that must be designed complying with National, State and local codes, standards and regulation defined by AHJ. It should also:

- be of a suitable size, minimum:
  - 150mm deep – for SDS* (Numeric seismic design value 0.2s) 1.5g;
  - 203mm deep – for SDS* 2.5g;
  - 508mm around the equipment.
- be a non-combustible surface as required by UL1741 chapter 5.8.2, non-corrosive and non-conductive;
- support the weight of the units and guarantee their stability, it shall be of a minimum capacity of 3000psi or 20.68MPa,
- respect a solid and perfectly levelled ground, in order to ensure the correct drainage of the water and avoid its stagnation
- respect the flatness / unevenness values in respect to DIN 18202: table 3, line 4.

Anchorage study including a seismic analysis can be provided for reference.

To carry out the foundation calculations, it is necessary to take into account the loads that influence the ambient conditions, as per the country regulations.

The floor must be a non-combustible surface as required by UL1741 chapter 5.8.2.

*0.4 SDS - Design Spectral Response at Short Periods - (FMEA) is equivalent to aN (PS92).

Dimensions *in*/mm

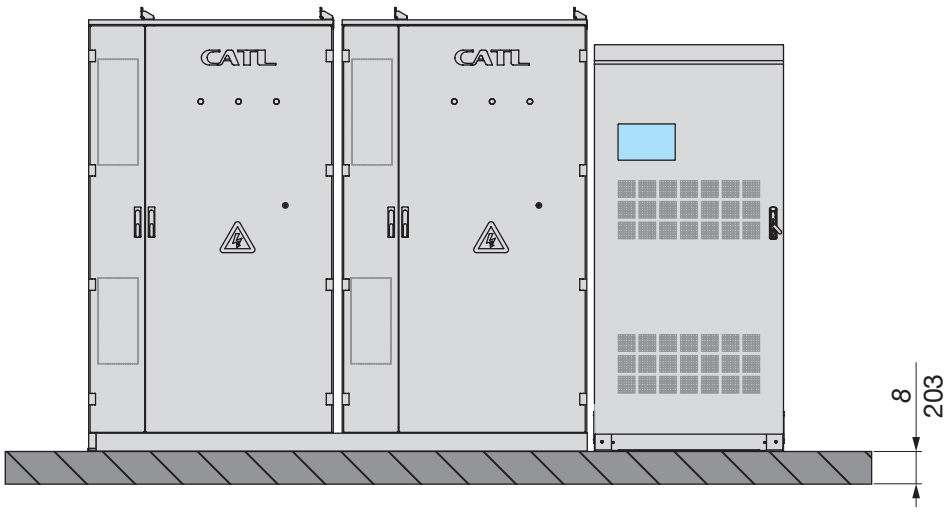



Figure 23. Concrete depth – SDS 2.5

The holes for the bolts must be of the following embedment length:

- 3.25in for both C6Cab and B-Cab for SDS 1.5g
- 3.25in for the C-Cab and 6.5in for the B-Cab for SDS 2.5g

And the bolts used must sustain the following characteristics:

| SDS | Cabinet | Bolt diameter | Load | |
|---|---|---|---|---|
| | | | Tension | Shear |
| 2.5g | C-Cab | 0.5inch | 2282 lbs (10151 N) | 1118 lbs (4973 N) |
| | B-Cab | 0.625inch | 2954 lbs (13140 N) | 2911 lbs (12494 N) |
| 1.5g | C-Cab | 0.5inch | 1210 lbs (5382 N) | 671 lbs (2985 N) |
| | B-Cab | 0.625inch | 1525 lbs (6784 N) | 1747 lbs (7771 N) |

Dimensions *in*/mm

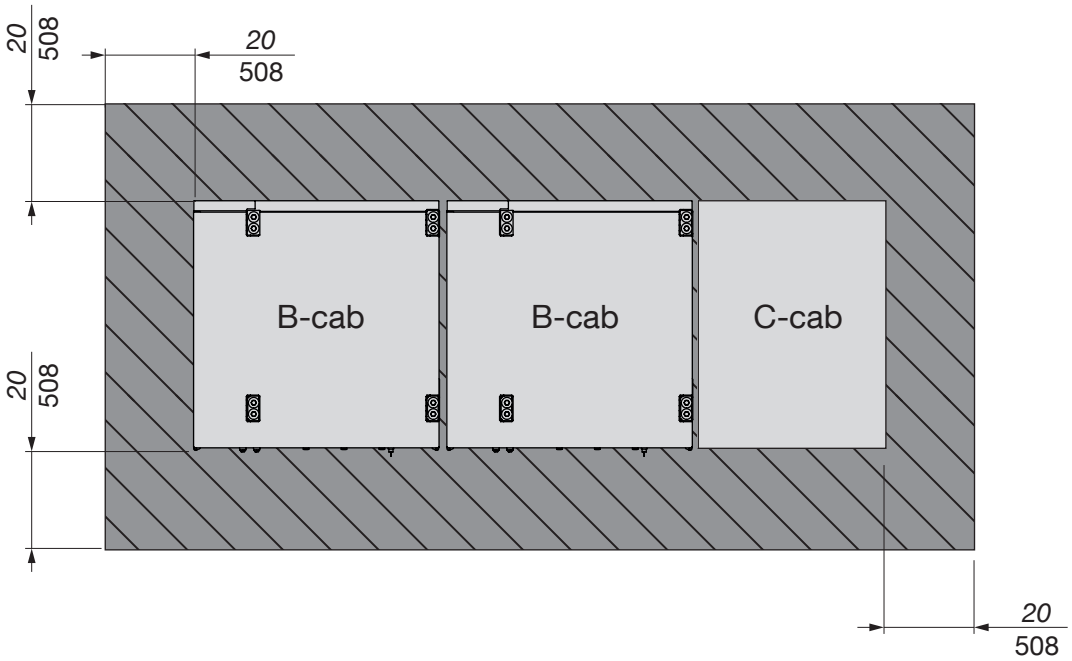



Figure 24. Concrete space around the equipment

## 5.2. Commissioning prerequisite

### 5.2.1. Integration prerequisite

| | |
|---|---|
| **General** | |
| 1. | Check the exact match of component product number and rating with your order. |
| 2. | Battery energy storage system includes a user manual (system description, operating and safety instructions, maintenance requirements, safe battery handling equirements/recommendations). |
| **Integration check** | |
| 1. | Battery and converter are installed in a perfectlly levelled ground concrete floor.<br>Please provide a photo of the concrete floor with a spirit level to validate that there is no inclination. |
| 2. | The distance area around the system is at minimum as required by SOCOMEC (please find distance required at chapter "»6.2. Clearance distances», page 40). When using the cable trays supplied by Socomec, please make sure to respect the specified distances, therefore use the drilling template delivered. |
| 3. | Please provide a photo of the all installation (overview - front side). |
| 4. | Please provide a photo of the all installation (overview - back side). |
| 5. | "If Modem 4G option.<br>Check the well mounting of the antenna of the Modem in the roof of the C-Cabinet or other localisation.<br>Please provide a photo.<br>If it's in another localisation, please provide a plan." |
| 6. | Verify the attachment of all unit to the concrete floor. |
| 7. | Verify the attachment of all cable gutters. |
| **Sensors** | |
| 1. | Presence of a Digiware sensor for current on the Load for CRD function. |
| 2. | Make sure the sensor is accessible to the service team. |
| **Installation Environement inspection and setting check** | |
| 1. | The area around the system is accessible. |
| 2. | The area is secured : no civil work, stable floor, ... |

### 5.2.2. Connection prerequisite

| | |
|---|---|
| **Grounding** | |
| 1. | Any conductive battery racks, cases or trays must be connected to an equipment grounding conductor. |
| 2. | Equipment grounding conductor is properly identified as either bare, green, or green with continuous yellow stripe(s) |
| 4. | Check the ground interconnection of all the B-Cabinets. |
| 5. | Check ground connection on the C-Cabinet. |
| **Interconnection / Electrical cable visual inspection** | |
| 1. | For all the system verify the connection (power and communication) of each cable is in accordance with the cable book, the single line diagram and the installation manual provided by SOCOMEC. |
| 2. | Check the Emergency Stop loop connection. |
| 3. | Please provide a photo of the AC Cable connection of the C-Cabinet. |
| 4. | Please provide a photo of the Auxiliaries Cable connection of the C-Cabinet. |
| 5. | Please provide a photo of the DC and auxiliaries Cable connection of the B-Cabinet. |
| 6. | For Islanding.<br>Check all connection with devices required by SOCOMEC. |
| **Sensors** | |
| 1. | Check the connection of the Load sensor for CRD function to the C-cabinet. |
| **Internet Connection (if no Modem 4G option)** | |
| 1. | Check the ethernet connection wiring from your site to the C-Cabinet. |

### 5.2.3. IoT prerequisite

| IP addresses for communication | |
|---|---|
| 1. | The connection needed has to be characterized as follows:<br>minimum flow = 1600kbits/s (3.5G)<br>latency to Socomec server = 1500ms |
| 2. | Please provide an IP address to communicate with the PMS (Power Management System). |
| 3. | Please provide an IP address to communicate with the Digiware gateway (Measurement Central device). |
| 4. | Please provide the IP address range where the ESS system should be accessible. |
| 5. | Please, do not connect the ESS system in the IP range 192.168.20.0/24 or higher (ie 192.168.0.0/16). |
| 6. | Please provide an IP address to communicate with the HMI. |
| 7. | Please provide an IP address for the gateway with the ESS. |
| **Network access (if no Modem 4G option)** | |
| 1. | Please provide the network IP address range where the ESS system will be connected. |
| 2. | Please provide NTP server access or give local NTP server IP address. |
| 3. | Please provide DNS server access or give local DNS server IP address. |
| 4. | Please provide an IP address for the gateway with the ESS or provide DHCP server. If a static IP address is used, please provide a subnet mask and a default gateway. |
| **Different access** | |
| 1. | Please make sure to open the following accesses for remote access:<br>TCP port 500 => 194.169.203.21<br>TCP port 1701 => 194.169.203.21<br>TCP port 4500 => 194.169.203.21<br>TCP port 259 => 194.169.203.21 |
| 2. | Please make sure to open the following accesses to update the firewall:<br>TCP port 18264 => 194.169.203.20<br>TCP port 257 => 194.169.203.20<br>TCP port 18191 => 194.169.203.20<br>TCP port 18192 => 194.169.203.20 |
| 3. | Please make sure to open the following accesses to send battery warranty data<br>HTTPS (TCP port 443) => https://storage.iot.socomec.com/api/v1 |
| 4. | Please make sure to open the following accesses to send system data:<br>HTTPS (TCP port 443) => activate.iot.socomec.com<br>94.125.109.122<br><br>HTTPS (TCP port 443) => streams-api.iot.socomec.com<br>94.125.105.191, 94.125.105.192, 94.125.105.193<br><br>MQTTS (TCP port 8883) => streams-mqtt.iot.socomec.com<br>94.125.105.191, 94.125.105.192, 94.125.105.193 |

# 6. SYSTEM INSTALLATION

The instructions provided here are intended as a guide to the installation of the unit. For further support, please contact Socomec.

| | |
|---|---|
|  | HAZARD OF ELECTRIC SHOCK OR ARC FLASH<br>This equipment is to be installed and maintained only by qualified personnel. Before working on this equipment ensure that all power is off and locked out following safe lock-out procedures.<br>Use appropriate personal protective equipment (PPE) and follow safe electrical work practices when working in close proximity to live electrical circuits.<br>Ensure all covers and doors are in a closed condition prior to applying power. |
|  | DANGER OF TIPPING IF NOT PROPERLY HANDLED<br>Provide vertical support while moving the unit due to its height and relatively high center of gravity; move slowly with care to avoid tipping.<br>Ensure that lifting devices evenly distribute the load over the base or lifting eyes if used.<br>Before carrying out any operations, ensure the C-Cab is secured at the feet. |

## 6.1. Installation guidelines and considerations

The unit is to be installed in accordance with the prevailing local and National Electric Codes such as **National Electric Code (NEC) in the USA or Canadian Electric Code in Canada**, which governs the requirements for electrical installation. These requirements may include, but is not limited to:

- Input upstream overcurrent protection will be required by code specified by the engineer of record for the site for the protection of the input power cabling even though the unit has integrated overcurrent protection.
- Appropriately rated feeder and load conductors
- Grounding: Chassis Safety Grounding of the enclosure is mandatory (Electric Code requirements); # 2/0 or 70mm² minimum recommended
- AC connections:
  - Cable entry: Bottom. Refer to outline drawing.
  - Method of routing: Conduit.
- Battery cabinet interconnections:
  - Cable entry: Bottom
  - Method of routing: Use provided cable gutter and cables
    Note: the unit is not prepared to use conduit connections. If required, contact factory for support.
  - Refer to section "»7. Positioning», page 42 for requirements and instructions for cable gutter installation.
- The recommended layout for battery cabinets is in line or back-to-back connection.
- Torque all connections using tables below as a guide (or per specific manufacturer instructions).

The following additional points must be considered in choosing a location:

- Location: The unit cannot be installed within 2 km outdoors from the sea.
- Ventilation Clearance: Inlet filters are located at the front of the units and exhaust at the rear of the units.
  Refer to section "»6.2. Clearance distances», page 40 for further details.
- Battery clearance: limitation to specific installations at the rear of the units. Refer to chapter «6.2. Clearance distances», for further details.

## 6.2. Clearance distances

To ensure enough space for ventilation and allow the access for any intervention, the following clearance distances shall be respected in addition to any other local laws.

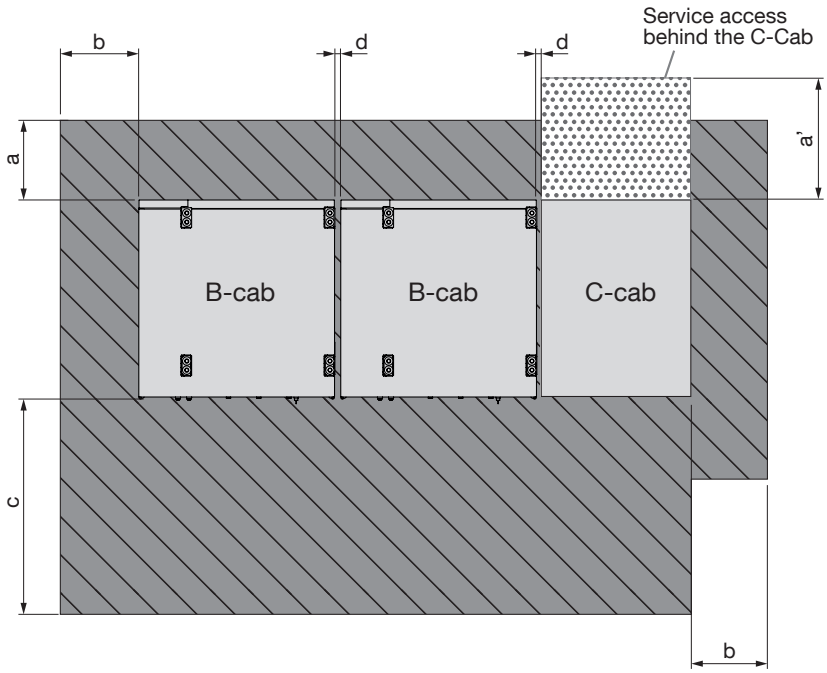



Figure 25. Clearance distances

| | Distance a<br>rear clearance | Distance a'<br>rear clearance | Distance b<br>side clearance | Distance c<br>front access | Distance d<br>between 2 units |
|---|---|---|---|---|---|
| **Minimum clearance distance** | Min. for the access<br>500 mm / 20 in*<br>Min. for the airflow<br>100 mm / 4 in | 700mm / 27.6 in** | 500 mm / 20in | 1500 mm / 59.1in | 25,4 mm / 1in<br>To enable the installation of the cable gutter please leave 25.4 +/6mm / 1+/-0.04in. |

*500mm / 20in is the minimum of space needed to operate. In case of removable back fence this fence can be installed at 100mm / 4in, enough for the ventilation, and once removed, we should have again the requested space to operate.
**700mm / 27.6in is the minimum of space needed to operate. In case of removable back fence this fence can be installed at 500mm / 20in, enough for the ventilation, and once removed, we should have again the requested space to operate.

**WARNING!**
System shall be separated by a minimum 3m/10ft from the following exposures:

- (1) Lot lines
- (2) Public ways
- (3) Buildings
- (4) Stored combustible materials
- (5) Hazardous materials
- (6) High-piled stock
- (7) Other exposure hazards not associated with electrical grid infrastructure.

Contact factory in case of specific need

## 6.3. Environmental conditions

SUNSYS HES L has been designed to be installed in the following environmental conditions.

| External Operating Condition | | |
|---|---|---|
| Temperature range | -20°C / +45°C without derating<br>+45°C / +50°C with derating | |
| Relative Humidity (non-condensing) | 4-100 % | |
| Max. altitude above sea level | 1000 m without derating | |
| Max. snow load | < 250 kg/m² | |
| Solar Radiation * | < 1090 W/m² | IEC 60721 |
| Saline environment ** | > 2km from sea (Class C3) | ISO 9223 |
| Polluted environment (dust) | Pollution degree 3<br>4S13 | IEC 60664-1<br>IEC 60721-3-4:2019 |

*According to the standard IEC 60721, SUNSYS HES L is designed to solar radiation up to 1090W/m². Above this level, a protection cover shall be installed on the cabinet to reduce solar radiation exposition.

**SUNSYS HES L is designed to be installed in a non-salt air site without any corrosion risk. If the implantation is less than 2km from the sea, please contact SOCOMEC for a specific version.

Please contact SOCOMEC to discuss a specific integration possibility for harsher environments.

# 7. POSITIONING

There are two types of installation possible: in line (side-to-side) and back-to-back. Concerning the back-to-back installations, only the B-Cabs are back-to-back, there is free space behind the other cabinets. You must respect the correct layout to ensure cable connections are sufficient.

You will find two examples of these installations below:

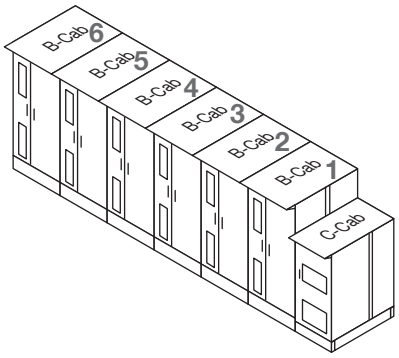



Figure 26. In line installation

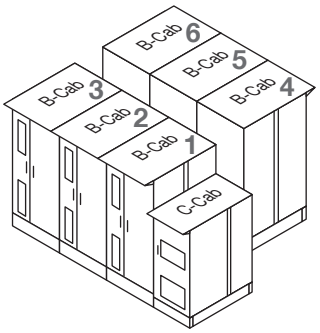



Figure 27. Back-to-back installation

The C-Cab and B-cab anchoring holes in the floor of the concrete base must be pre-drilled using the template provided and the mechanic anchoring installed before putting the cabinet in place.

Positioning of all cabinets is critical to ensure proper installation with the cable troughs from each battery cabinet.

Refer to the template provided to prepare the mounting location and install the cabinets into the designated place.

Drilling templates along with outline drawing dimensions will define the location of the cabinets. The drilling templates provided are an overlapping modular set, you will need to attach the 4 parts of the template together before starting.

Follow the procedure described below to prepare the mounting location as detailed in the template.

## 7.1. Cabinets order

From top view, the cabinets always have to be positioned as follows: the C-CAB on the right side and the B-CAB on the left side – from front face of the products. Installation must be started from the cabinet on the right (view below):

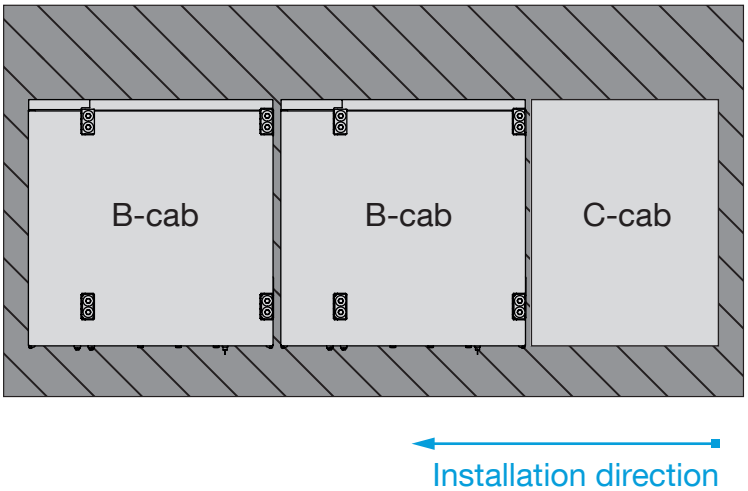



Figure 28. Cabinets order

**WARNING!**
The batteries have always to be installed on the left of the C-Cab, as shown above.

## 7.2. Marking of the C-Cab

Pay attention to the mounting direction of the top and bottom template. The numbers must be legible upright.

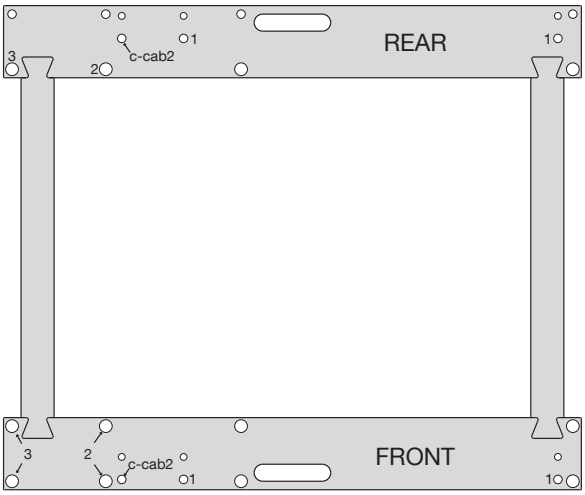



Figure 29. Top view of the drilling template mounted

Mark the 4 holes shown below – note “1”.

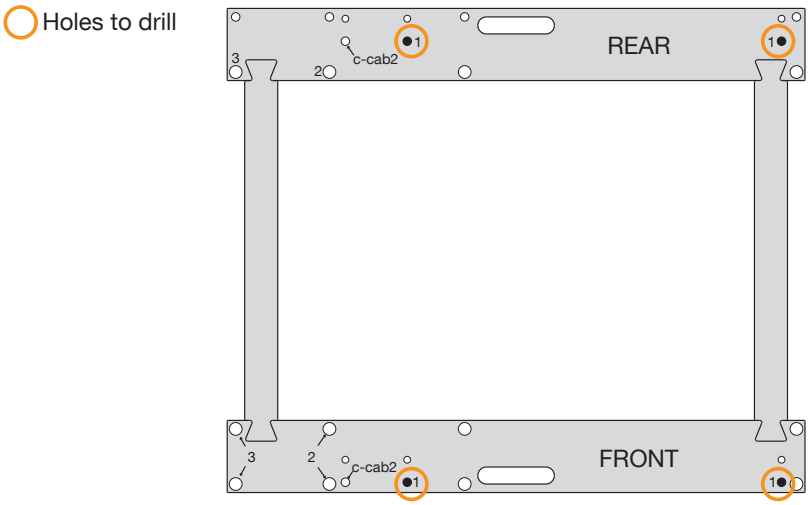



Figure 30. Holes to drill for 1 C-Cab installation

Then prepare the B-Cab installation by marking 3 more holes -note “2”, as shown below.

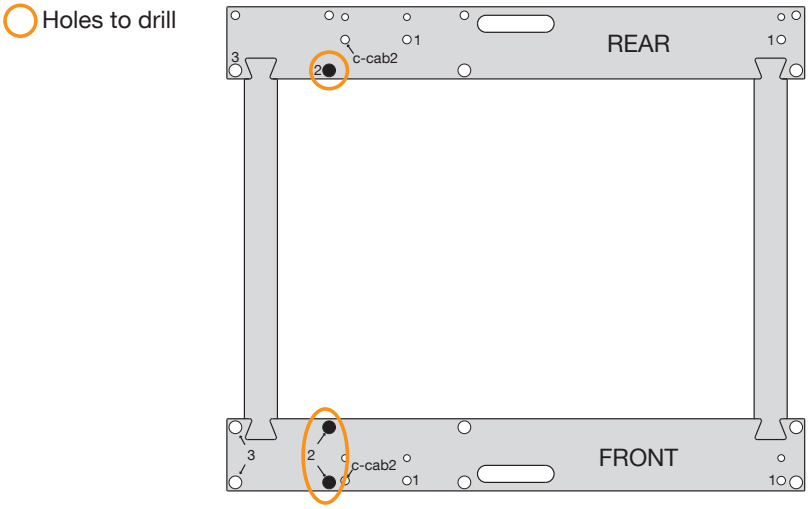



Figure 31. Holes to prepare B-Cab installation next to the C-Cab

## 7.3. Marking of the B-Cab

Move the drilling template kit and install it overlapping the 3 holes already drilled – note"2" - as shown below.

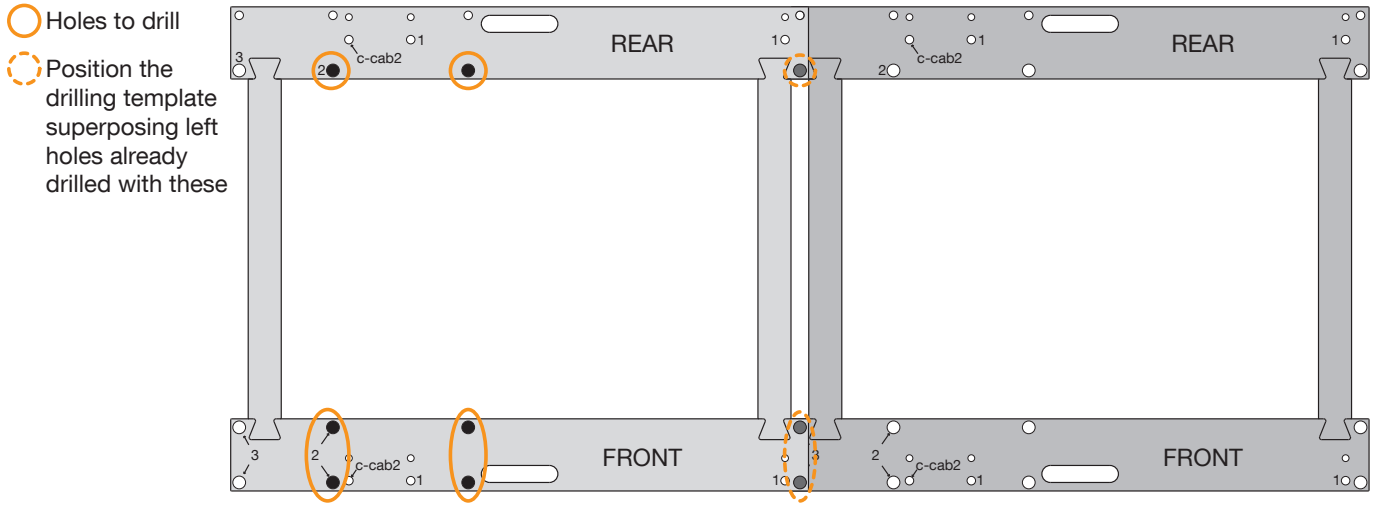



Figure 32. Holes to drill for the B-Cab installation

If the battery is not the last one to be installed on the left side, you need to directly prepare the holes for the next battery, by marking 3 more holes –note "3" – as shown below, and then go back to previous step.

If it is the last one, the marking is over.

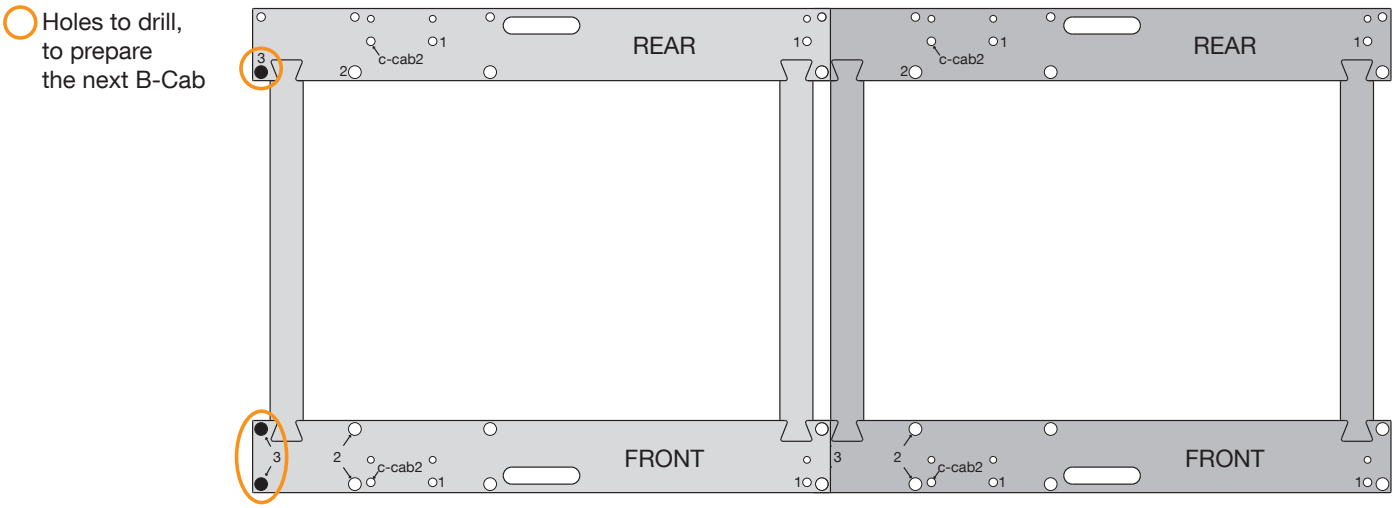



Figure 33. Holes to drill to prepare next B-cab installation

Note: contact Socomec for back-to-back drilling.

## 7.4. Drilling

Drill all the holes marked:

- Dia M12 / ½ inch for the C-Cab
- Dia M16 / 5/8 inch for the B-Cab

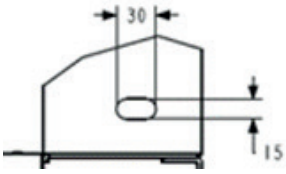
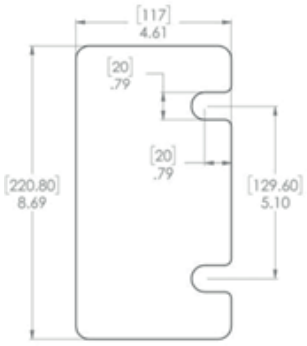
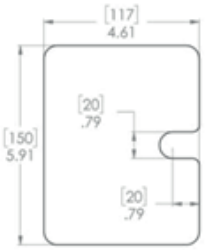
## 7.5. Putting cabinets in place

Before installing on the floor, level the floor using provided shims. Maximum allowed deviations must be in the following range: 0.06in for vertical direction, plus/minus 0.25in for horizontal direction (left to right), and plus/minus 0.25in for horizontal direction (front to back).

Note: It is important for the unit to be leveled to ensure proper installation with the cable troughs from each battery cabinet.

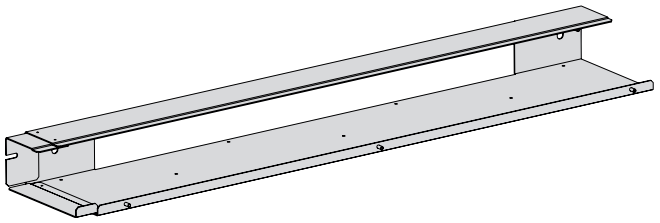
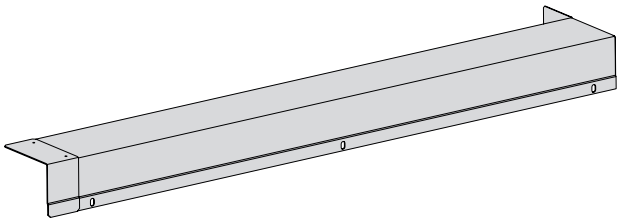
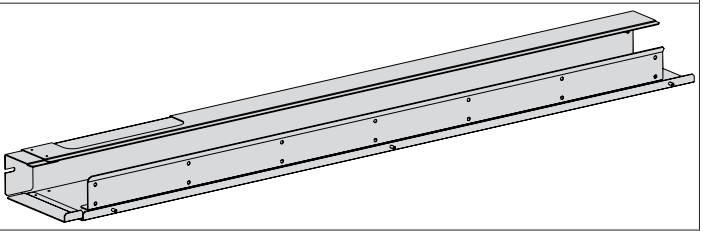
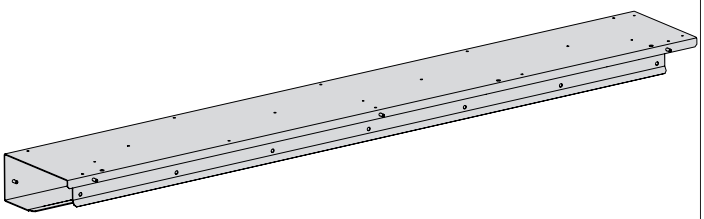
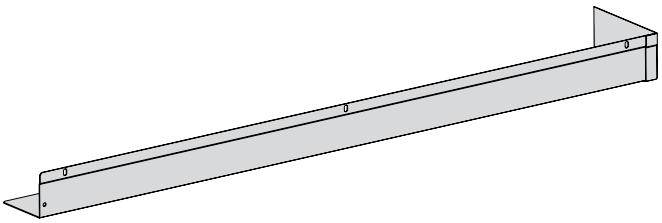
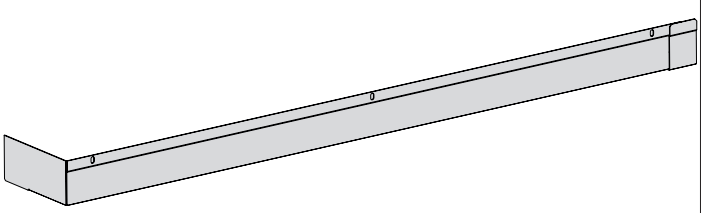
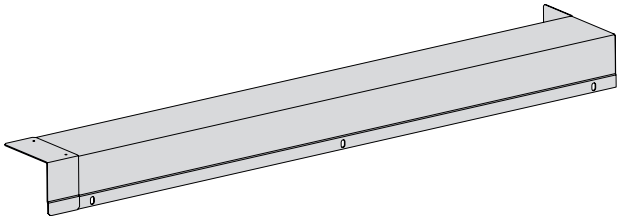
Put the cabinets in place, starting with the C-Cab on the right, and make sure to remove the side panels to have access to the bolts.

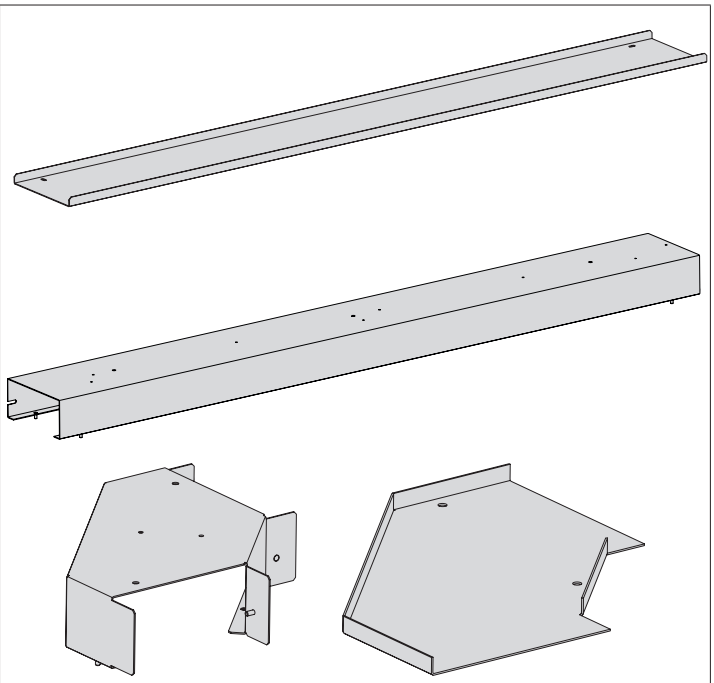
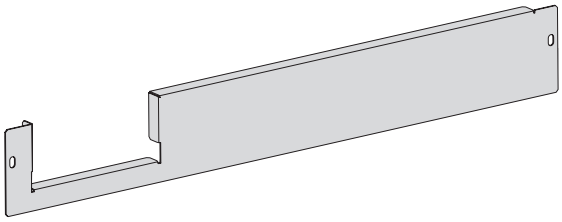
Once fixed with a 54Nm torque, put the side panels back, with a 8N.m torque. Then put the B-Cabs in place.

| Cabinet | Fixing holes | Recommended screws size | Tightening torque |
|---|---|---|---|
| C-Cab |  | M12 / ½ inch | 54 Nm/40 ft-lb |
| B-Cab |  <br>  | M16 / 5/8 inch | 81 Nm / 60 ft-lb |

# 8. CONNECTING KIT INSTALLATION

## 8.1. List of parts

| | | |
|---|---|---|
| Item 1 | C-Cab connection kit – back part |  |
| Item 2 | C-Cab connection kit – cover part |  |
| Item 3 | B-Cab connection kit – middle and right back part |  |
| Item 4 | B-Cab connection kit – cover part |  |
| Item 5 | B-Cab connection kit – left back part |  |
| Item 6 | B-Cab connection kit – left cover part |  |
| Item 7 | B-Cab connection kit – right cover part |  |

| | | |
|---|---|---|
| Item 8 | Straight + angle bottom parts and covers for back batteries |  |
| Item 9 | Back plate for C-Cab for back-to-back installations |  |

## 8.2. Mounting details - To be continued

Once all cabinets are installed, shimmed (if necessary) and bolted to the concrete pad, you can install the connecting kit.

**Step 1:** Remove the front panel of the base of the C-CAB

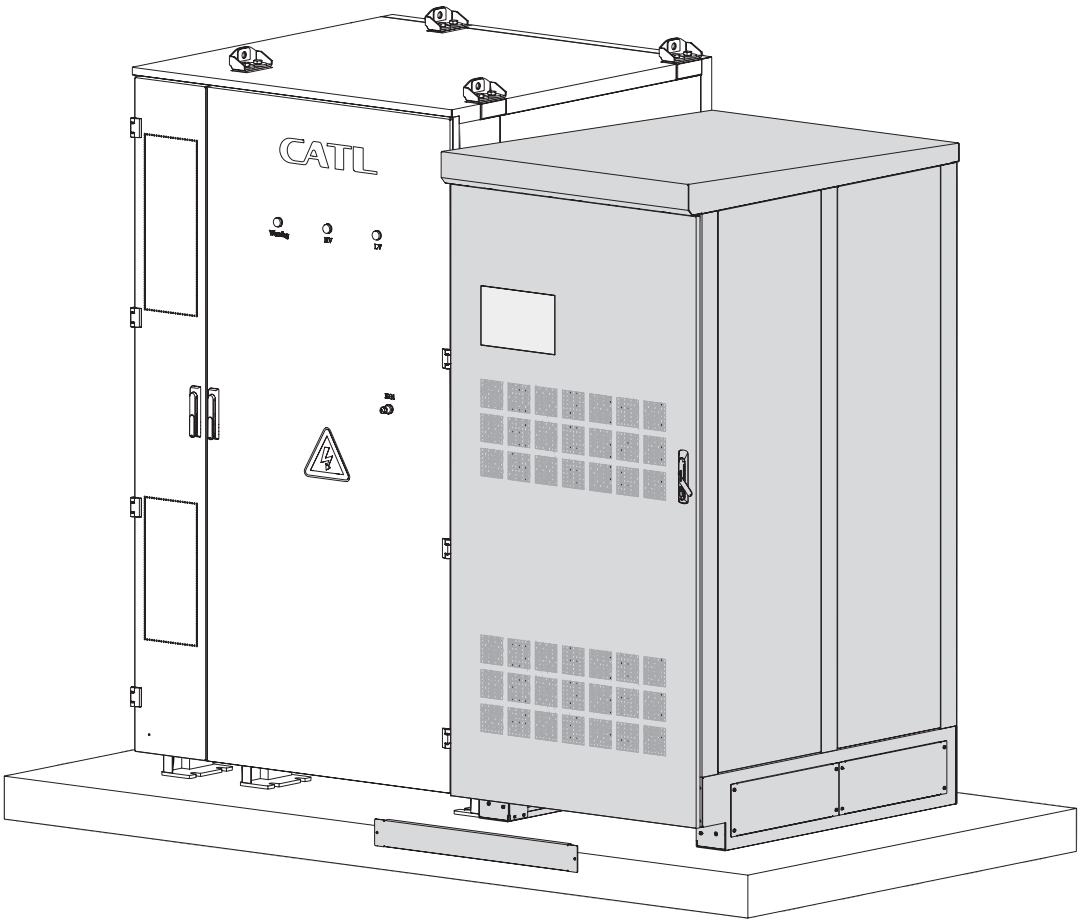



Figure 34. C-Cab front panel removal

**Step 2:** Place the C-Cab connection kit – back part, item 1, under the C-Cab. Put it on top of the shims or directly on the concrete pad, whichever applies, and screw it on the cabinet with two screws M8, as shown below, with a torque of 15.2Nm.

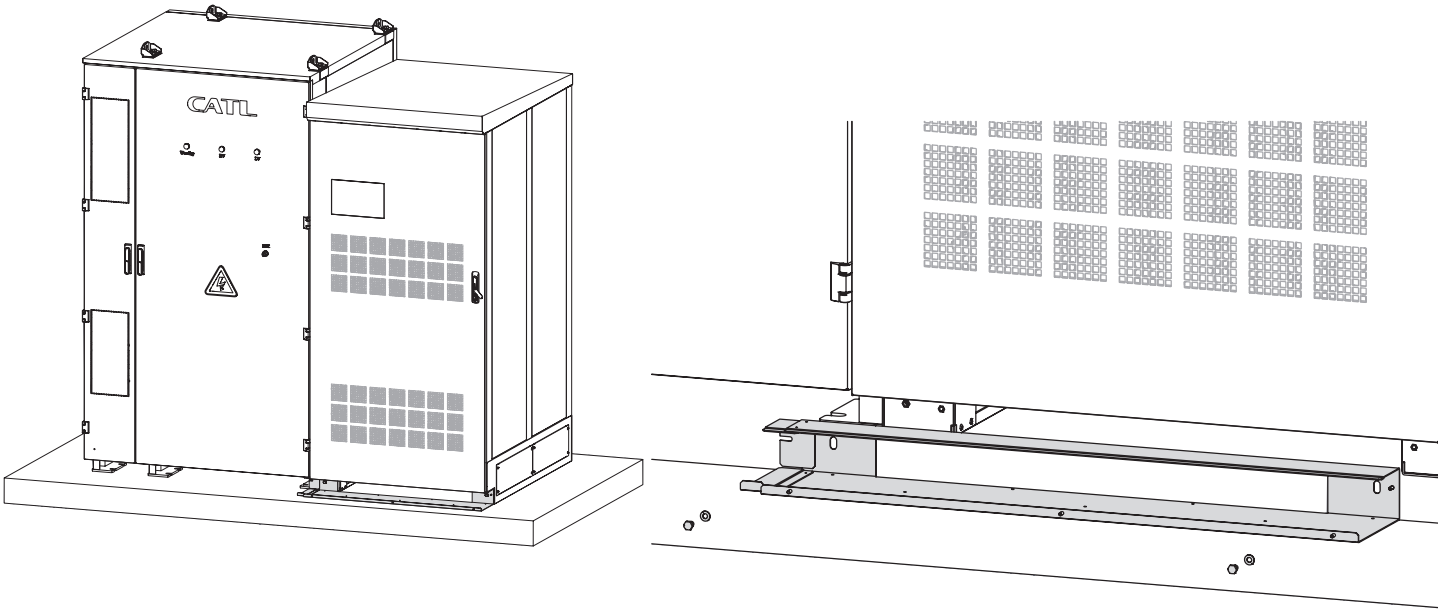



Figure 35. Installation of the back part of the C-Cab connection kit

In case of back-to-back installation, as shown on the picture below, you need some specific parts, item 8 of the table.

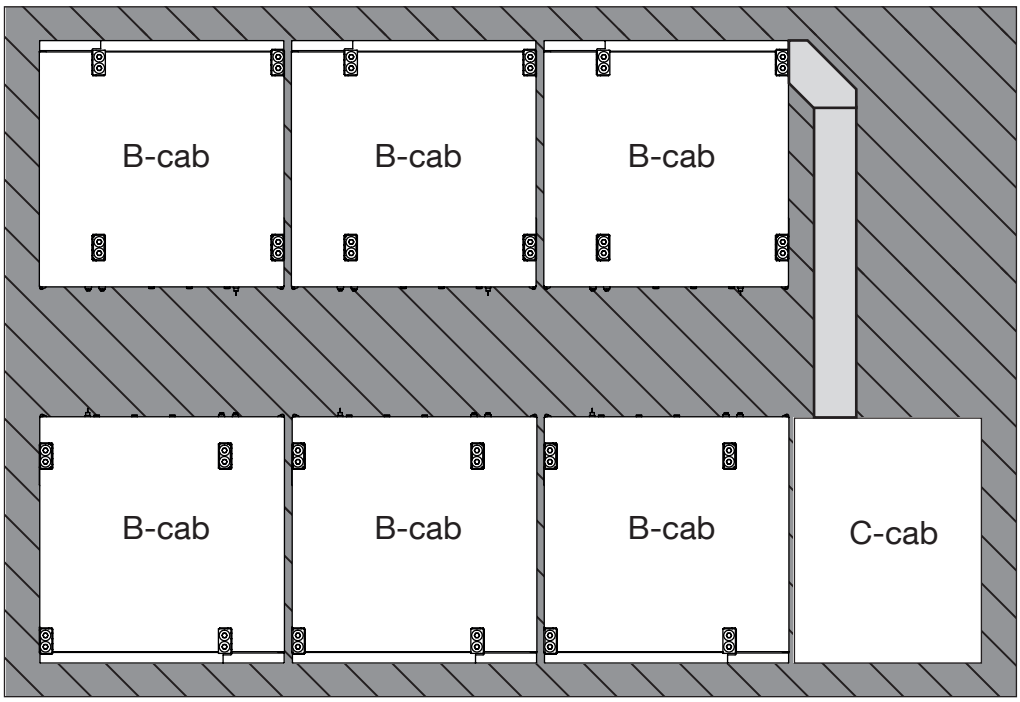



Figure 36. Specific connection parts for back-to-back installations

This connection is composed of 4 parts. Fix them on the floor using ¼" Tapcon®bolts.

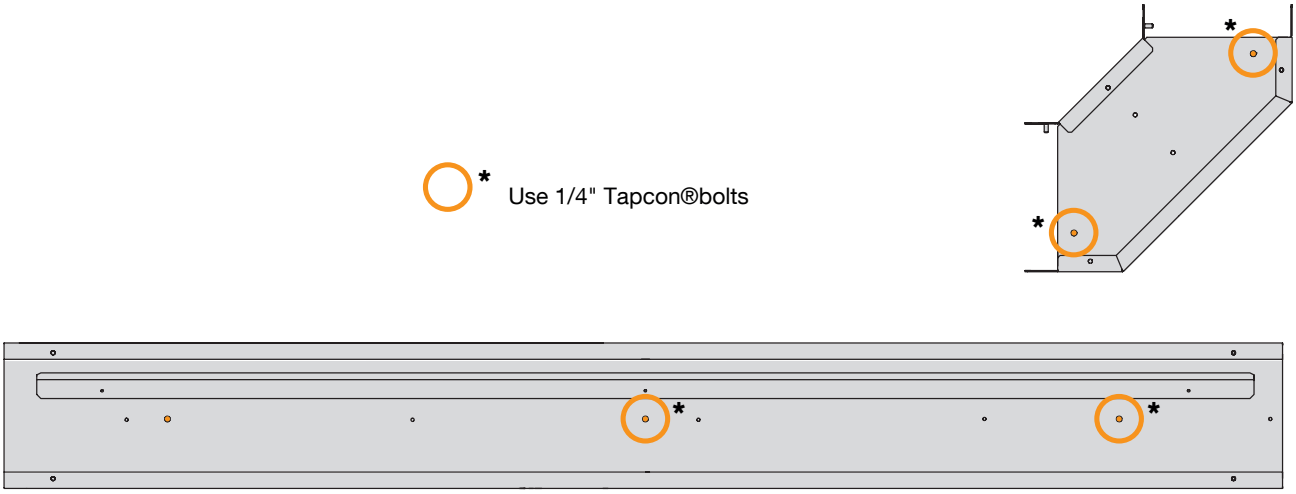



Figure 37. Details of the parts for back-to-back installations

Start with the straight bottom part, then add the angle bottom part.

The C-Cab will also be closed on the bottom using a specific plate: item 9.

**Step 3:** Place the B-Cab connection kit – back part, item 3, under every B-Cab. Put it on top of the shims or directly on the concrete pad, whichever applies, and screw every notch with stud M5, with a torque of 6Nm.

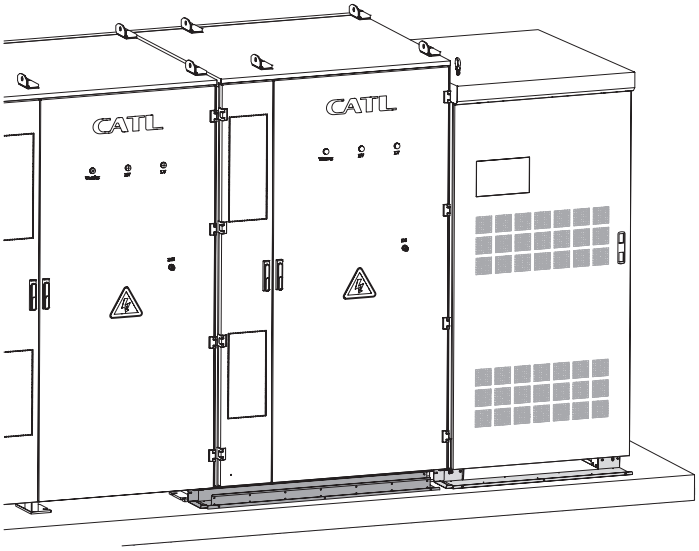



Figure 38. Installation of the B-Cab back part connection kit

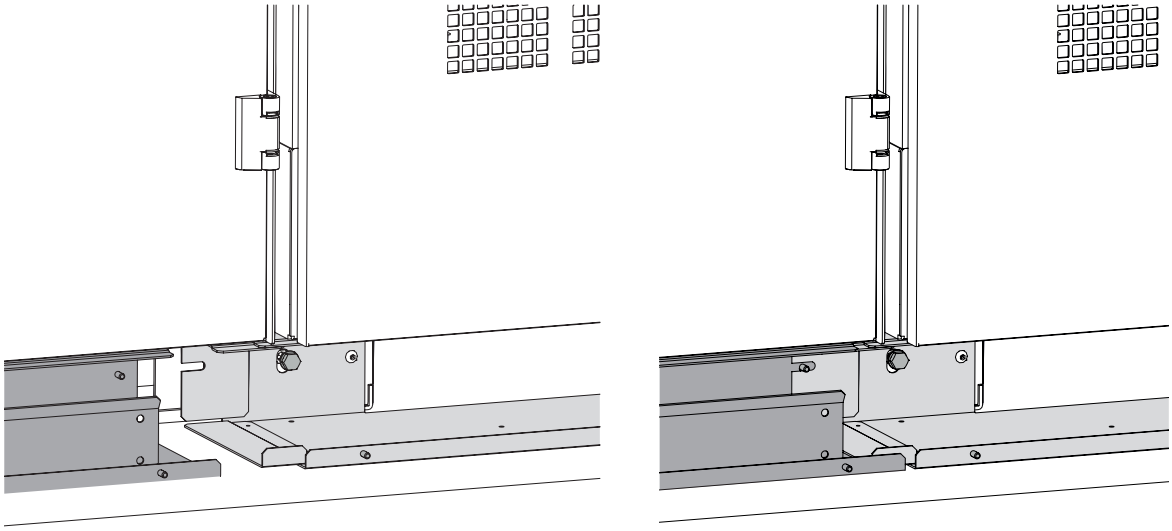


Figure 39. Connection of C-Cab and B-Cab parts

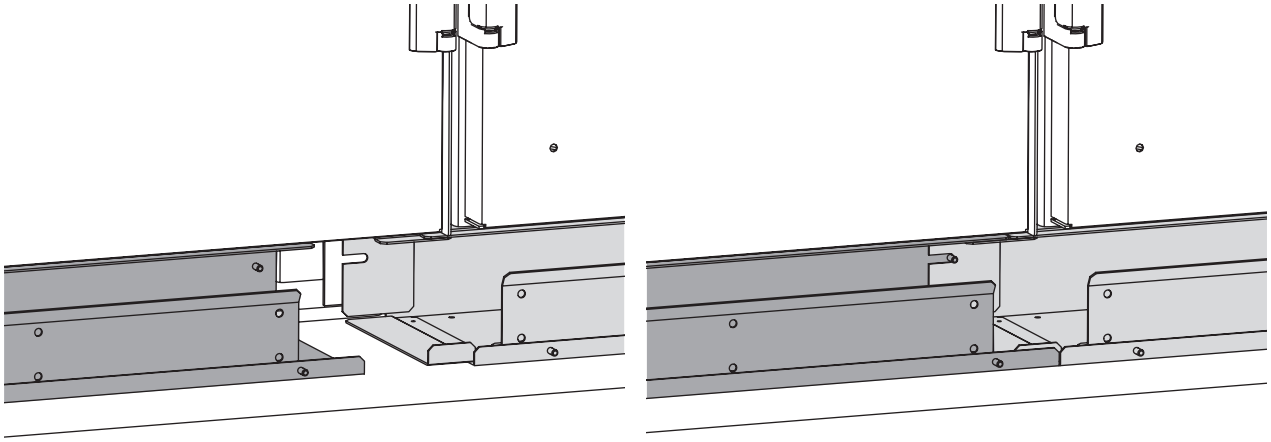


Figure 40. Connection of two B-Cab parts

Note: For the last B-cab of the front row, use item 5, left back part, instead of item 3.

**Step 4:** Lock in place all cable connection kits by using ¼" Tapcon® bolts to secure them into the concrete floor in the 3 locations - through the shims (if they are present). Refer to Tapcon® for proper pilot hole sizes.

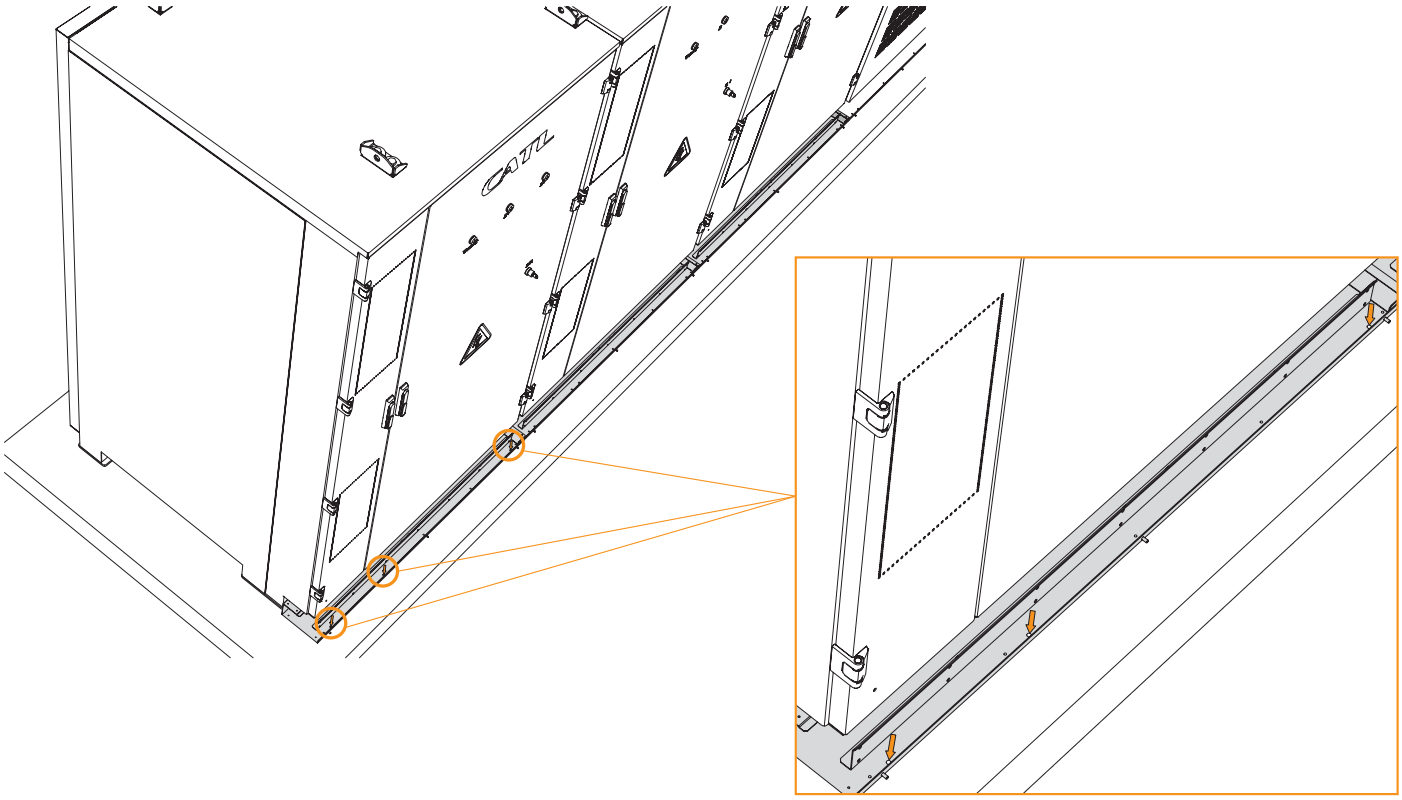


Figure 41. Cable connection kits locking

**Step 5:** Proceed with the wiring of the DC cables, the internal Ethernet communication and the battery communication cables and chiller and auxiliaries power supply cables. All these cables are supplied with the system.

Start from the C-Cab and connect the batteries from the nearest to the furthest. The details of the electrical connections will be found in the Electrical installation chapter.

Dimensions *in*/mm

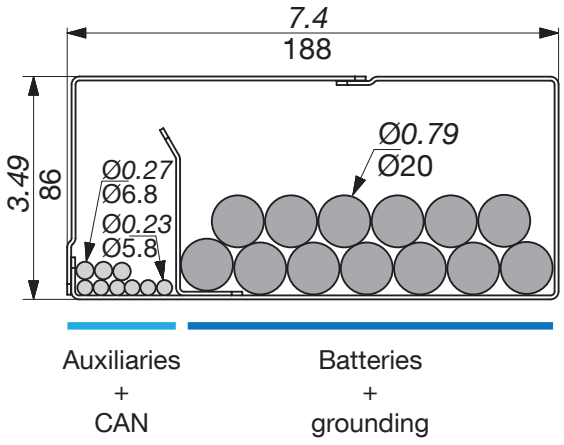



Figure 42. Cables organization inside the cable gutter

## 8.3. Torque Reference Table

Refer to the following tables for guidance on recommended torques for mechanical fittings, electrical terminals and mechanical lugs.

### 8.3.1. Recommended Torques for metric (dry zinc plated) bolted class 8.8 fasteners

| Bolt Nominal dia. (mm) | Pitch | Clamp load (lbs.) | Torque (ft-lbs.) |
|---|---|---|---|
| 4 | 0.7 | 858 | 1.9 |
| 5 | 0.8 | 1387 | 3.9 |
| 6 | 1 | 1968 | 6.6 |
| 7 | 1 | 2822 | 11.0 |
| 8 | 1.25 | 3580 | 16.0 |
| 10 | 1.5 | 5671 | 31.6 |
| 12 | 1.75 | 8240 | 55.1 |
| 14 | 2 | 11289 | 88.1 |
| 16 | 2 | 15320 | 137 |
| 18 | 2.5 | 18822 | 189 |
| 20 | 2.5 | 23938 | 267 |

### 8.3.2. Recommended Torques for imperial (dry zinc plated) bolted class 5 fasteners

| Bolt Nominal dia. (in.) | Threads per inch | Tensile stress area (sq. in.) | Clamp load (lbs.) | Torque (in-lbs.) | | |
|---|---|---|---|---|---|---|
| | | | | K=0.15 | K=0.17 | K=0.20 |
| 1/4 | 20 | 0.0318 | 2029 | 76 | 86 | 101 |
| 5/16 | 18 | 0.0524 | 3342 | 157 | 178 | 209 |
| 3/8 | 16 | 0.0775 | 4940 | 23 ft-lbs. | 26 ft-lbs. | 31 ft-lbs. |
| 7/16 | 14 | 0.1063 | 6777 | 37 | 42 | 49 |
| 1/2 | 13 | 0.1419 | 9046 | 57 | 64 | 75 |
| 9/16 | 12 | 0.1819 | 11599 | 82 | 92 | 109 |
| 5/8 | 11 | 0.2260 | 14408 | 113 | 128 | 150 |
| 3/4 | 10 | 0.3345 | 21322 | 200 | 227 | 267 |

### 8.3.3. Recommended Torques for electrical mechanical lugs

| Wire Size | Torque Inch/lbs. | Wire Size | Torque Inch/lbs. | Wire Size | Torque Inch/lbs. |
|---|---|---|---|---|---|
| 14 | 75 | 6 | 110 | 2/0 | 180 |
| 12 | 75 | 4 | 110 | 3/0 | 250 |
| 10 | 75 | 2 | 150 | 4/0 | 250 |
| 12 | 75 | 1 | 150 | 250/350 mcm | 325 |
| 8 | 75 | 1/0 | 180 | 500 mcm | 375 |

## 8.4. Electrical installation

**FOR YOUR SAFETY:** IT IS IMPERATIVE THAT **ALL SOURCES OF POWER (AC & DC) ARE PROVEN DISCONNECTED** BEFORE ANY WORK ON OR PHYSICAL CONTACT TO ELECTRICAL CIRCUITS IS ATTEMPTED.

**DO NOT ASSUME** BUT **CHECK** ACROSS THE LINES AND TO GROUND WITH A RELIABLE VOLTMETER AND ENSURE THAT THE SOURCE **DISCONNECTION DEVICES** ARE SECURELY **LOCKED OUT**.

**THE MANUAL SWITCH DISCONNECT IN EACH BATTERY** CABINET SHOULD BE IN THE **OFF POSITION**.

**LOCK OUT AND TAG OUT PROCEDURES** SHOULD BE FOLLOWED WHEN SERVICING THE EQUIPMENT.

Each battery cabinet is provided with an isolation switch QS to cut off the output of the batteries and breakers QF1 & QF2 (behind the cover) to cut off supply to chiller and controls of battery system. These switch & breakers are accessible from the control box located at left-hand side of each B-Cab. Additionally, each battery modules in the cabinet are provided with a Manual Switch Disconnect (MSD) for safety. Before proceeding to wiring, ensure that the isolation switch QS and the breakers QF1 & QF2 in the battery cabinets are in OPEN (OFF) position as illustrated after.

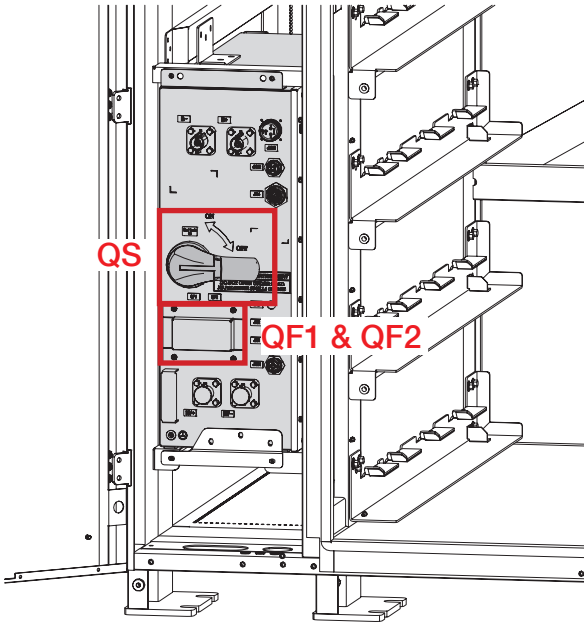



Figure 43. Location of isolation switch QS and breakers QF1 & QF2

The following pieces are already present in the C-Cab:

- Termination resistance for RS485 bus (X8 connector) - check chapter "»8.4.4.3. Connections of automation box», page 72
- Cable bridge for B30 option between X9 and X10 - check check chapter "»8.4.4.3. Connections of automation box», page 72
- Cable bridge for Auxiliary power supply between X107 and X108 - check chapter "»8.4.3.3. Auxiliary power connection», page 64
- Cable between X3 (Automation Box) and X106 (Aux Interface Box)
- Ethernet cable between Eth10 (Automation Box) and Eth3 (Control Box) - check chapter "»8.4.4. Communication and signal connections», page 70

## 8.4.1. Battery Cabinet Interconnections

| | |
|---|---|
|  | **DANGER!**<br>Risk of electrical shock including high short-circuit current as batteries are a source of electrical energy. Use only insulated tools around the modules and batteries and carefully avoid shorting the battery terminals or connections. |
|  | **CAUTION!**<br>Inadvertent short circuits are the major cause of failures for batteries. Risks associated with shorting as well as other hazardous conditions can be mitigated by carefully following the listed guidelines below. |

**Handling Precautions and Guidelines**

- Wear appropriate Personal Protective Equipment (PPE) with due attention to eye protection in addition to insulated gloves.
- Remove all metallic objects from the person (e.g., Watches, jewelry, etc.) that could potentially contact the live battery terminals.
- All tools used around the battery assembly should be insulated or covered with, a non-conductive material.

The batteries require interconnections for DC power, auxiliary power, communication, and ground. The cables are provided for each connection and are labelled for ease of identification as they are of different lengths for each battery cabinet connections. Battery interconnections can be installed using the factory provided cable gutter.

## 8.4.2. Converter Cabinet Interconnections

On the following table there is an overview of the power connections of the C-Cab, including AC mains, DC connection, AC aux and the ground connection.

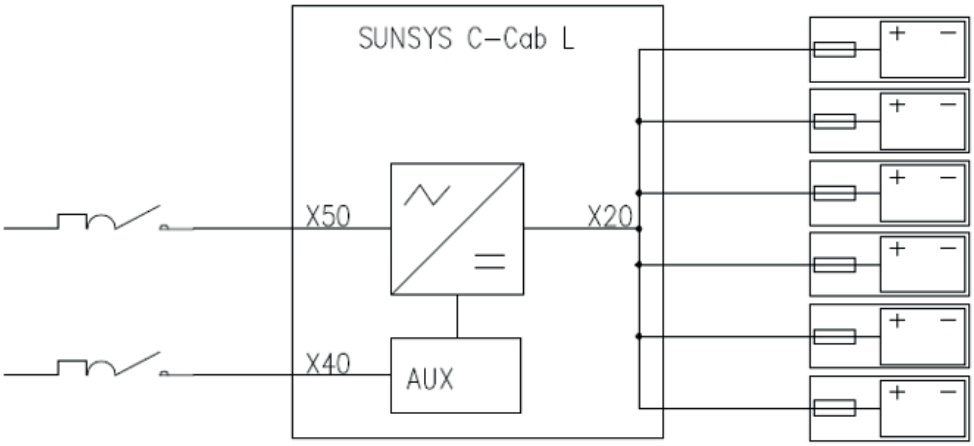
| Description | Terminal ID | Max number of cables for each pole | Max cable section | Tightening torque | Termination type | Type of cable |
|---|---|---|---|---|---|---|
| DC connection | X20 | 6 | 95 mm2<br>3/0 AWG | 70Nm / 52ft-lb | N°3 holes each bar (Ø13 mm) | >90°C copper wire |
| AC connection | X50 | 2 | 185 mm2<br>350 MCM | | | |
| | | 3 | 150 mm2<br>300 MCM | | | |
| | | 4 | 95 mm2<br>3/0 AWG | | | |
| Ground | ⏚ | 1 | 185 mm2<br>350 MCM | 40Nm / 29.5 ft-lb | N°2 screws M10 (Ø10 mm) | |
| | | 2 | 95 mm2<br>3/0 AWG | | | |
| AC auxiliary connection | X40 | 1 | 35 mm2<br>2 AWG | 2.5Nm / 1.8ft-lb | Screw-in terminal block | |
| AC optional auxiliary connection | X107 | 1 | 2.5 mm2<br>14 AWG | N/A | Push-in terminal block | |
| CATL B-Cab power supply (voltage output) | B-CAB 1<br>:<br>:<br>B-CAB 6 | 1 | 4 mm2<br>12 AWG | | | |

The electrical distribution panel must have a sectioning and protection system installed for each of the power inputs previously listed.

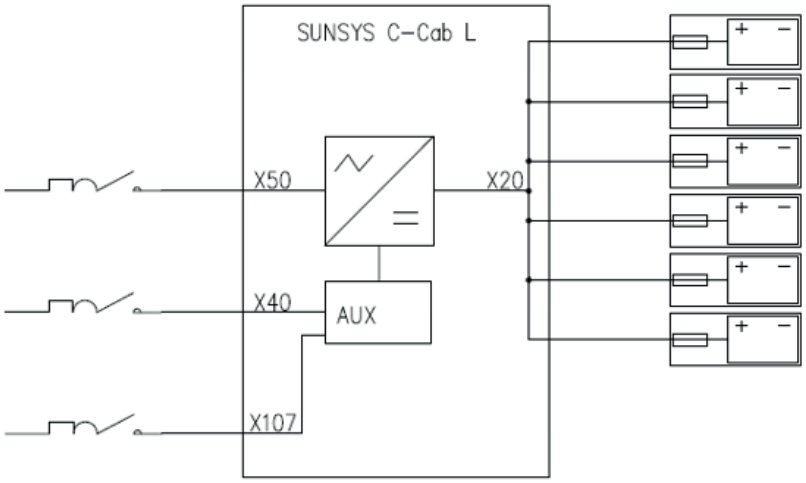
The tables below show the connection features and the size of the protection devices recommended for correct installation. See the schematics for an overview of the possible configurations.

In the “Power cables connection” section is described the position of each connection point and the safe procedure to connect the cables.

**Protection of single C-Cab**




**Protection of single C-Cab with external line on X107 (see "»8.4.4. Communication and signal connections», page 70)**




The installation and system must comply with the National Electric Code (NFPA 70) and all local regulations.

The electrical distribution panel must have a sectioning and protection system installed for input and auxiliary mains.

| Size of AC input protection | | | | | | |
|---|---|---|---|---|---|---|
| Type of system | Rated AC voltage | System power | Overcurrent protection rated current | | | Maximum short circuit current |
| | | | Size | Circuit breaker type | RCD* (Residual Current Device) | |
| | | | Vout 480V | Vout 480V | | |
| Single C-Cab | 480 V 3 ph+N 60Hz | 50 kVA | 90 A | D | 0.5 A Type “B” | 50 kA |
| | | 100 kVA | 180 A | D | | |
| | | 150 kVA | 270 A | D | | |
| | | 200 kVA | 360 A | D | | |
| | | 250 kVA | 450 A | C | | |
| | | 300 kVA | 540 A | C | | |
| N°2 C-Cabs in parallel | 480 V 3 ph+N 60Hz | 350 kVA | 630 A | D | | |
| | | 400 kVA | 720 A | D | | |
| | | 450 kVA | 810 A | D | | |
| | | 500 kVA | 900 A | C | | |
| | | 550 kVA | 990 A | C | | |
| | | 600 kVA | 1080 A | C | | |

*AC side RCD is not allowed for TN-C systems and not mandatory for TN-S systems.

| Size of DC input protection – if you are not using our provided cabling kits | | | | | |
|---|---|---|---|---|---|
| Type of system | DC Voltage range | System power | Overcurrent protection rated current | Maximum short circuit current | Maximum let-through energy |
| Single C-Cab | 570 V ÷ 860 V | 50 kVA | 100 A | 100 kA | 1.4 $MA^2s$ |
| | | 100 kVA | 200 A | | |
| | | 150 kVA | 300 A | | |
| | | 200 kVA | 400 A | | |
| | | 250 kVA | 500 A | | |
| | | 300 kVA | 600 A | | |
| N°2 C-Cabs in parallel | 570 V ÷ 860 V | 350 kVA | 700 A | | |
| | | 400 kVA | 800 A | | |
| | | 450 kVA | 900 A | | |
| | | 500 kVA | 1000 A | | |
| | | 550 kVA | 1100 A | | |
| | | 600 kVA | 1200 A | | |

| Size of AC auxiliary input protection | | | | | |
|---|---|---|---|---|---|
| Auxiliary rated voltage | Number of B-Cabs | Overcurrent protection rated current | Circuit breaker type | Maximum prospective short circuit current | Maximum peak let through(1) |
| 208 V 3 ph 60Hz | 0 | 25 A | D | 50kA | 10kA |
| | 1 | 40 A | C | | |
| | 2 | 63 A | | | |
| | 3 | 63 A | | | |
| | 4 | 80 A | | | |
| | 5 | 80 A | | | |
| | 6 | 80 A | | | |

(1) Refer to protection device characteristic for the peak let-through value

| Optional “Control auxiliary port” Connector X107 Size of protection | | |
|---|---|---|
| Auxiliary rated voltage | Required overcurrent protection | Circuit breaker type |
| 100÷250 V 1 ph+N 50/60 Hz | 8 A | C |

### 8.4.2.1. Power cables connection

| | |
|---|---|
| ⚠ | **WARNING!**<br>Cable glands must not be removed during the normal function of the product; use only the cable glands provided with the C-Cab for the installation. |
| ⚠ | Make sure that all the glands are in place and that no hole remains uncovered after the installation of cables |

In order to access the terminals for the connection of cables, unscrew the 4 screws at the corners and remove the plastic panel protecting the connection area in front of the terminals.

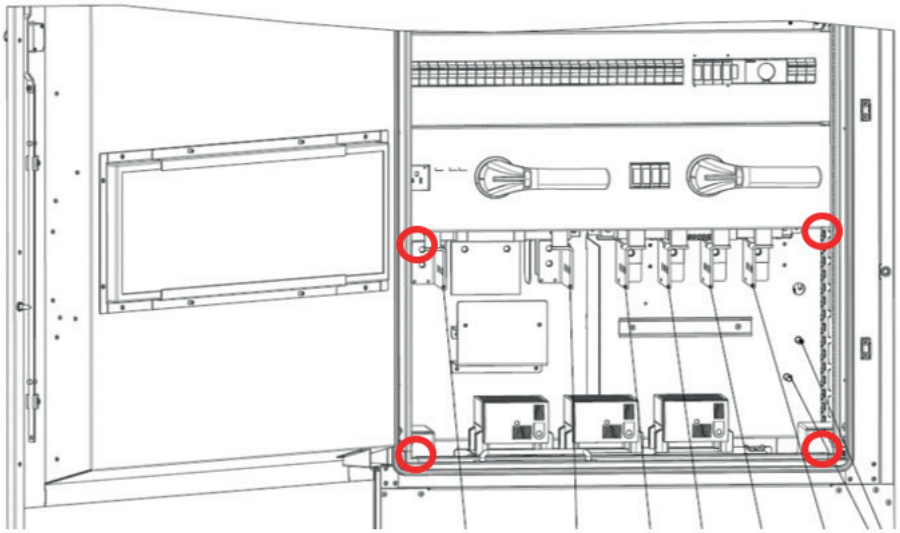
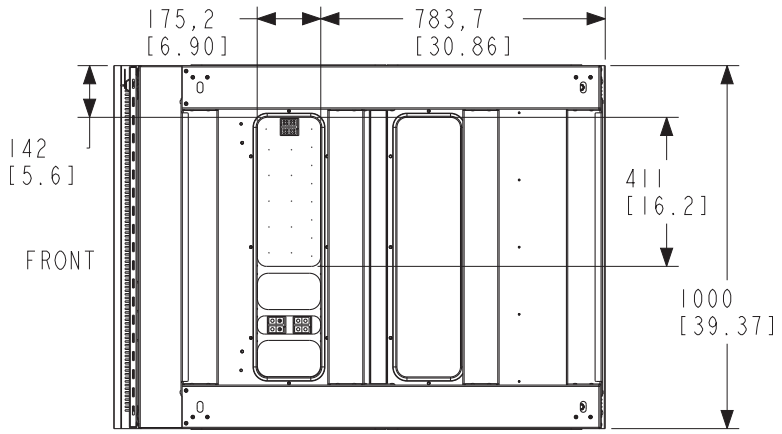


Figure 44. Screws of the plastic panel

The bottom part of the machine is provided with 4 metal plates that are used for the passage of cables. This part is located inside the C-Cab as shown on the below figure:




In order to grant the IP55 protection of the cabinet, the cables have to be installed following the instructions in the present manual.

3 cable glands are provided for the passage of small cables; the cable glands for power cables are not installed by default and it is necessary to drill the plates with the required number of holes according the layout of the installation.

Note: ensure that the cabling is not under excessive stress and not pressing any sharp edge or adjacent terminal; adjust and strap/lace in place as required.

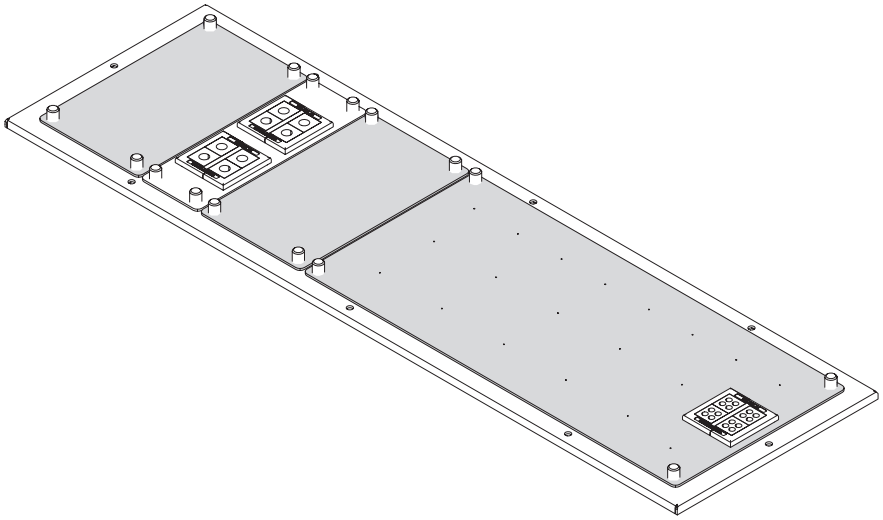
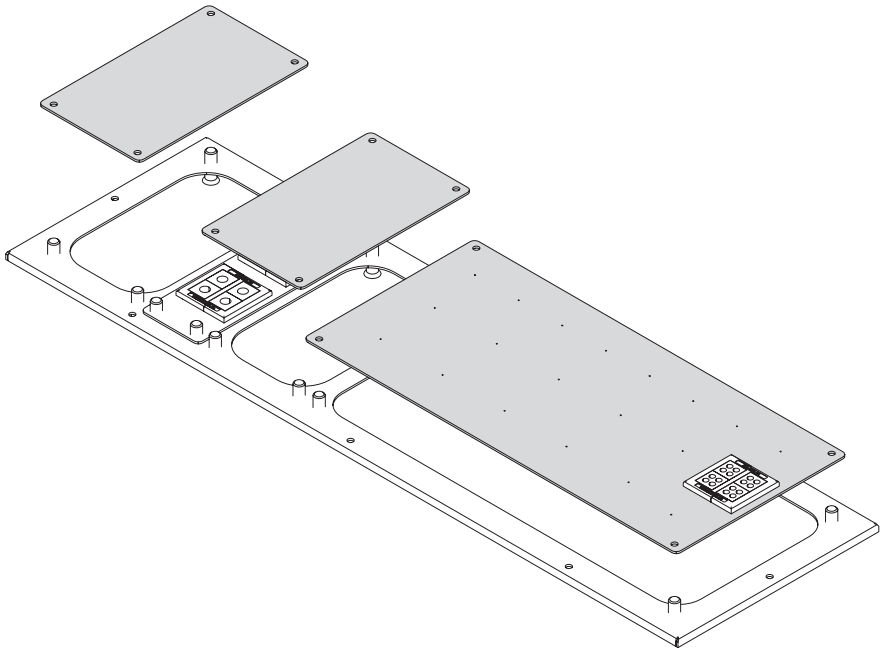


Figure 45. Cable glands plates

To install the power cables, follow the procedure below:

1) Remove the 3 plates from the bottom



2) Drill the holes on the plates. See the layout suggested later on this chapter.

3) Insert the Nema 3R/IP55 glands (not delivered) in the holes

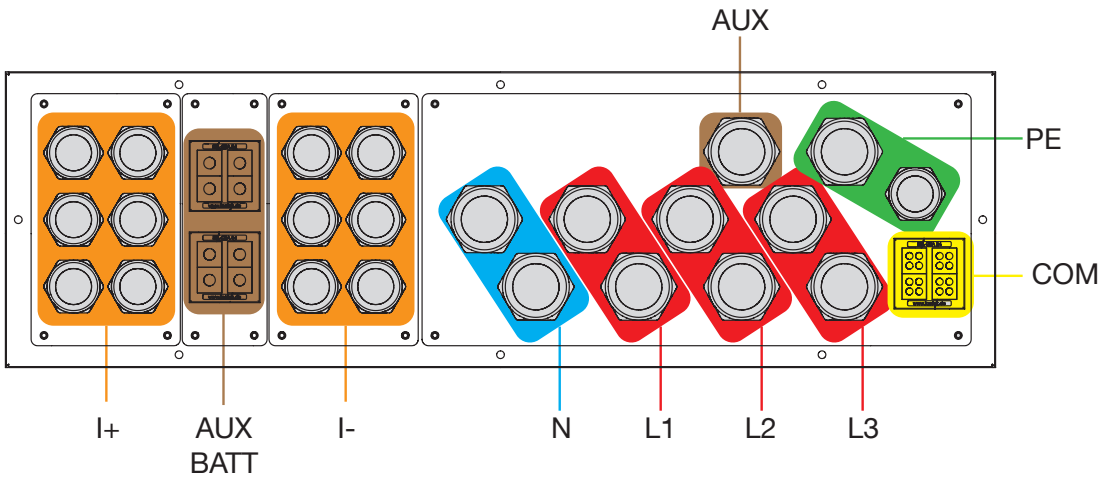
4) Put the plates back in place and fix them to the baseplate

5) Start to fix the cables
For each cable, follow this procedure:
A) insert the cable inside the cable gland
B) fix the cable to the power terminal
C) fix the gland with the proper torque
Apply this procedure starting from the rear row of cables and proceeding to the front.

6) After the connection of all the cables (described in the present chapter), re-close the plastic panel with his 4 screws.

7) Make sure that all the cable glands are in place and properly fixed in order to grant the IP55 protection of the system.

Suggested layouts for cable glands positioning:



## 8.4.3. AC, DC and ground connection

### Power AC, DC and Ground terminals

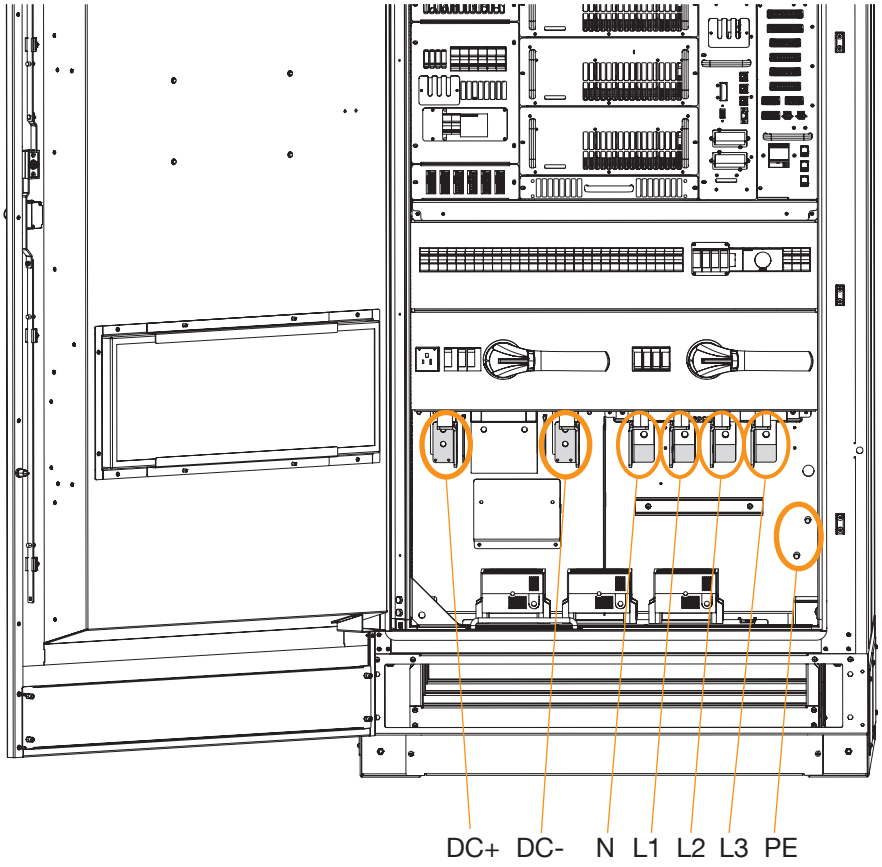



Figure 46. Power and ground connections

| Terminal block | Terminals | Description |
|---|---|---|
| X50 | L1 L2 L3 N | Connection terminals for the main AC network |
| X20 | DC+ DC- | DC connection terminals for the batteries |
| ⏚ | PE | Connection terminal for the protective earth wire |

| | |
|---|---|
| ⚠ | **CAUTION!**<br>Failure to observe grounding procedures may lead to the risk of electrical shock, or the risk of fire if a ground fault occurs.<br>Remember to connect the ground at the marked point ⏚.<br><br>Ground connections must be in compliance with local regulations and applicable standards. |
| ⚠ | **CAUTION!**<br>For compliance with CSA 107.1-16, the installer shall mark the C-Cab with the following wording or equivalent, located on or adjacent to the DC wiring compartment:<br>“DANGER — HIGH VOLTAGE” Or “DANGER 860V” |
| ⚠ | **CAUTION!**<br>The AC output circuits are isolated from the enclosure and the AC system grounding, when required by the Canadian Electrical Code, Part I, is to be done in the installation. |

### 8.4.3.1. DC Power Connections

**1 - For the first B-Cab**

a. Open both cabinet doors and remove the dead front from the termination compartment.

b. Identify the cable for positive power connection.

c. Lay the cable on the ground in front of the cable gutter with the orange connector at the B-Cab and other end trailing over to the termination compartment.

d. For the B-Cab, route the cable end with the orange connector through the bottom hole in the gutter and the B-Cab access hole.

e. Plug in the connector to HV+ terminal by completely pushing into the receptacle while pressing the secondary lock (red) inwards to secure the connection. Ensure the connection if fully locked in place by pulling on it.

Note: the HV connector is not installed correctly if the secondary lock cannot be pushed in.

f. For the termination compartment, route the other end of the cable up from the gutter opening into the bottom of the termination compartment while laying the cable into the rear of the gutter.

Note: ensure the cable is laid straight without any excessive slack.

g. Connect to the positive terminal and bolt using the provided hardware and torque.

h. Identify the cable for negative power connection.

i. Lay the cable on the ground in front of the cable gutter with the black connector at the B-Cab and other end trailing over to the termination compartment

j. For the B-Cab, route the cable end with the black connector through the bottom hole in the gutter and the B-Cab access hole.

k. Plug in the connector to HV- terminal by completely pushing into the receptacle while pressing the secondary lock (red) inwards to secure the connection. Ensure the connection if fully locked in place by pulling on it.

Note: the HV connector is not installed correctly if the secondary lock cannot be pushed in.

l. For the termination compartment, route the other end of the cable up from the gutter opening into the bottom of the termination compartment while laying the cable into the rear of the gutter.

Note: ensure the cable is laid straight without any excessive slack.

m. Connect to the negative terminal and bolt using the provided hardware and torque.

2 - In like manner, repeat the above procedure for each battery cabinet using the appropriate table to identify the cable sets for each cabinet cable run.

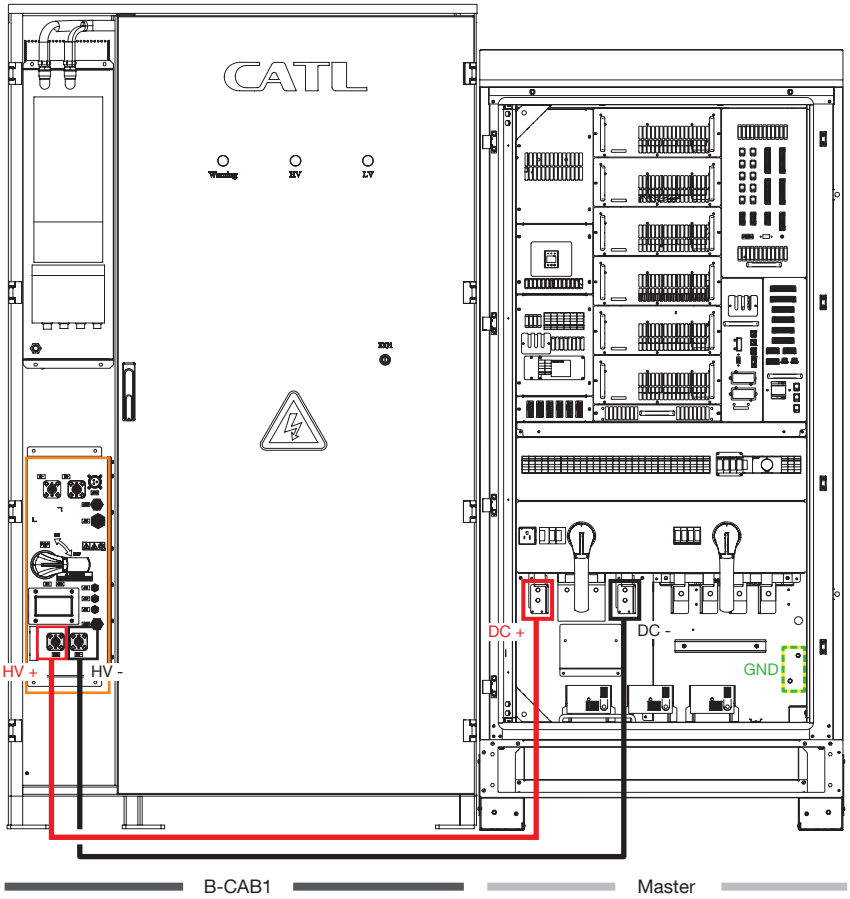



Figure 47. DC Power connections

### 8.4.3.2. Grounding

**CAUTION!**
Failure to observe grounding procedures may lead to the risk of electrical shock, or the risk of fire if a ground fault occurs.
Remember to connect the ground at the marked point ⏚.

Ground connections must be in compliance with local regulations and applicable standards.

The AC output circuits are isolated from the enclosure and the AC system grounding, when required by the Canadian Electrical Code, Part I, is to be done in the installation.

Grounding is used for equipment and personnel safety. The SUNSYS HES L is designed to operate with 4-wire grounded sources and is compatible with solidly grounded or resistance grounded systems, specific option depending on your requirement. All input and output power feeds must include an equipment grounding means as required by the local codes.

The equipment ground conductors should be sized based on the upstream overcurrent protection per code and connected to the sole Ground Terminal.

A ground connector with cross section at least equal to half of main conductor size is recommended.

The following instructions describe the method of routing ground cables from each B-Cab to the termination compartment, these are supplied by Socomec. In the instructions below, B-Cabs are referred relative to their position from the C-Cab.

**WARNING!**
Ensure that there is no power applied to the unit
Ensure the isolation switch QS and the breakers QF1 & QF2 in each battery cabinet are in OPEN position
Ensure all MSD covers in each battery cabinet are not installed

1. Check with a reliable voltage indicating device that both DC and AC terminals in battery and termination compartments have close to zero potential.
2. For the first B-Cab,
    a. Lay the cable on the ground in front of the cable gutter between the B-Cab and the termination compartment.
    b. For the B-Cab, route one end of the cable through the bottom hole in the gutter and the B-Cab access hole.
    c. Connect to the ground terminal and bolt using the provided hardware and torque.
    d. For the termination compartment, route the other end of the cable up from the gutter opening into the bottom of the termination compartment while laying the cable into the rear of the gutter.

Note: ensure the cable is laid straight without any excessive slack.

    e.Connect to the ground terminal and bolt using the provided hardware and torque.
3. Then, connect the ground from B-Cab 1 and B-Cab 2, then B-Cab 2 to B-Cab 3… in a daisy chained manner.

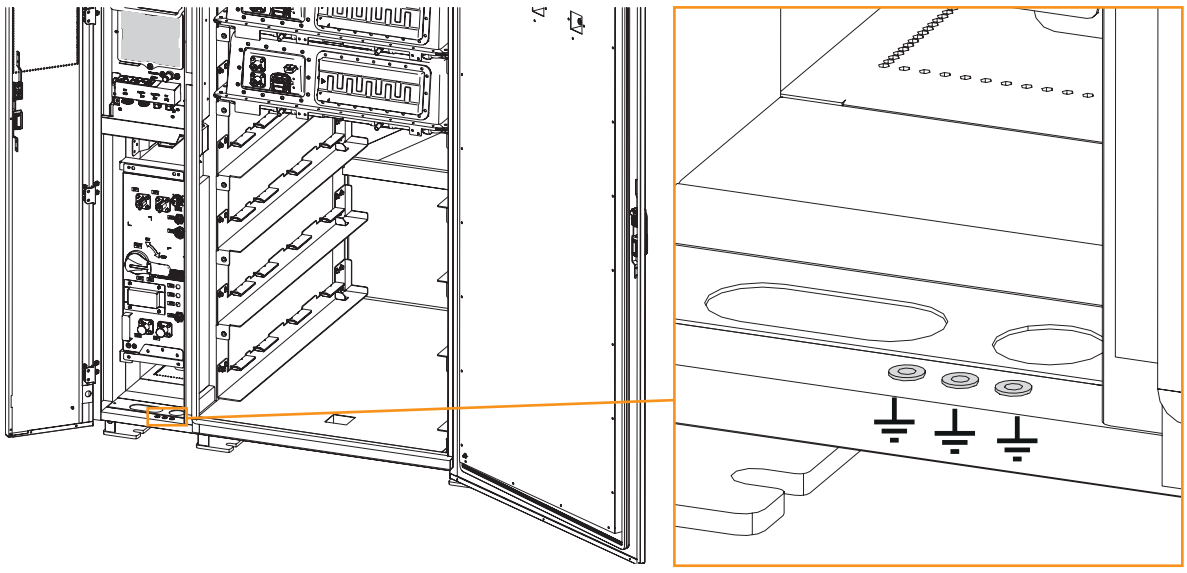


Figure 48. Battery cabinet ground terminal

### 8.4.3.3. Auxiliary power connection

#### Auxiliary terminals

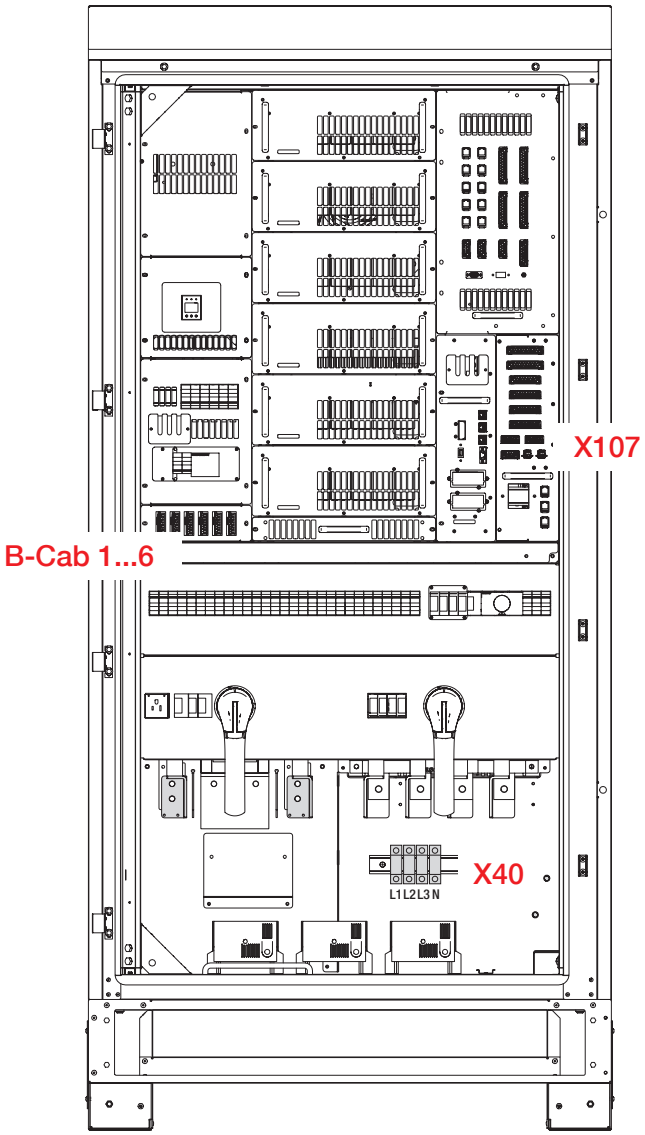



Figure 49. Location of the auxiliary connections in the C-Cab

| Terminal block | Terminals | Description |
|---|---|---|
| X40 | L1 L2 L3 N | AC auxiliary connection |
| X107 | **See AC aux from user's UPS - below** | AC optional auxiliary connection |
| B-CAB 1 ÷ B-CAB 6 | **See B-Cabs aux power supply - below** | CATL B-Cab power supply (voltage output) |

#### AC aux connection

Fix the wires L1, L2, L3 to the connection terminals (208 Vac Ph-Ph, 60 Hz).The neutral wire is not connected.

The maximum possible size of the cables is AWG 1 or 42.4mm².

For information, for 6 B-cabs the minimum size is AWG 2 or 33.6mm².

Note: the L1, L2 and L3 wires shall be connected respecting a **clockwise phase rotation**, i.e. L1 anticipates L2 and L2 anticipates L3.Some utilities may adopt a counterclockwise phase rotation as standard, so the names or colors indicated on the cables may not match the names indicated on the C-Cab AC bars.
Verify the actual phase rotation before connecting the AC cables.

**WARNING!**
Auxiliary supply should not be directly connected on AC power connection. Voltage tolerance and overvoltage category must be considered carefully.

### B-Cabs aux power supply

The SUNSYS C-Cab L is provided with 6 connectors that can supply the auxiliary power to the B-Cabs.

Each connector has two lines that provide power to the HVAC system and to the electronic of a single B-Cab. Do not connect more than 1 B-Cab per connector.

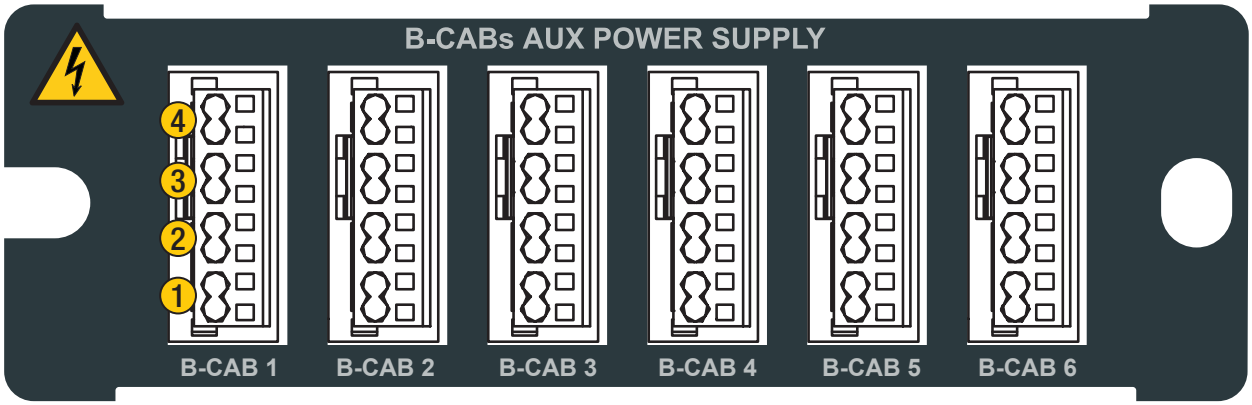



Figure 50. C-Cab connector for B-Cabs aux power supply

| Pin | Function |
|---|---|
| 1 | HVAC supply |
| 2 | |
| 3 | Aux supply |
| 4 | |

Shall you have only a master C-Cab or a master + extension C-Cab, all the connections will come from the master C-Cab.

| From C-Cab Master<br>« B-Cab Aux power supply connectors » | To (B-Cab) |
|---|---|
| B-CAB 1 | JXH1 of B-Cab 1 |
| B-CAB 2 | JXH1 of B-Cab 2 |
| B-CAB 3 | JXH1 of B-Cab 3 |
| B-CAB 4 | JXH1 of B-Cab 4 |
| B-CAB 5 | JXH1 of B-Cab 5 |
| B-CAB 6 | JXH1 of B-Cab 6 |

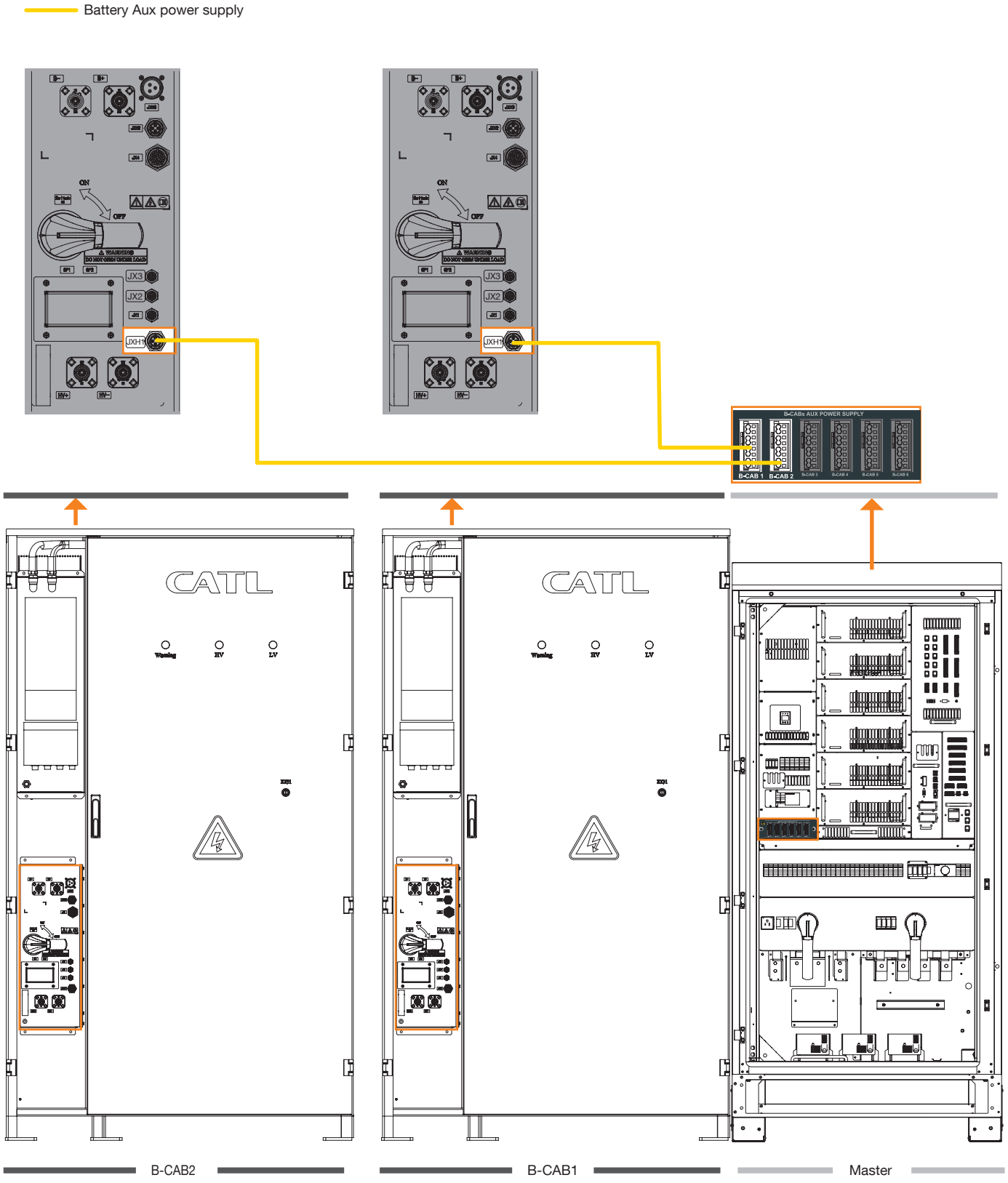



Figure 51. Connection of the B-Cabs aux power supply from the C-Cab

### AC aux from user's UPS

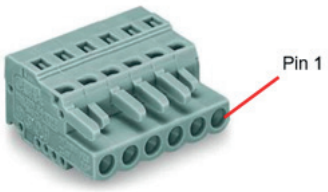
The X107 terminal is used to supply the control circuit of the C-Cab.

X108 is the output of the internal UPS. It is possible to supply the control circuits with a separated line using the X107 input.

Note: none of the configurations addressed in this chapter replace the power supply connection to the X40 terminals previously described, which is always required and necessary.

| Connector | Pin | Function | Description |
|---|---|---|---|
| X107 | 1 | L | AC optional auxiliary voltage<br>88÷132 V 1 ph+N 50/60 Hz |
| | 2 | N | |
| | 3 | ⏚ | |
| X108 | 1 | L | Internal UPS output<br>120 V 60 Hz |
| | 2 | N | |
| X109 | 1 | L | Not used |
| | 2 | N | |

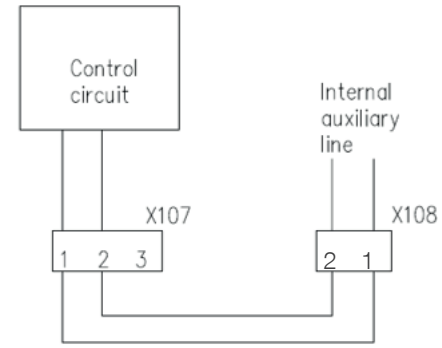
The pin 1 is the one indicated in the figure below:



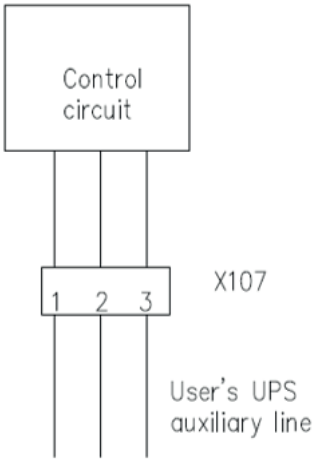

For connection of plug-in connectors use cables in the following range:

1.5mm$^2$÷2.5mm$^2$ / 16÷12 AWG

**Standard configuration**




**Aux from user's UPS configuration**

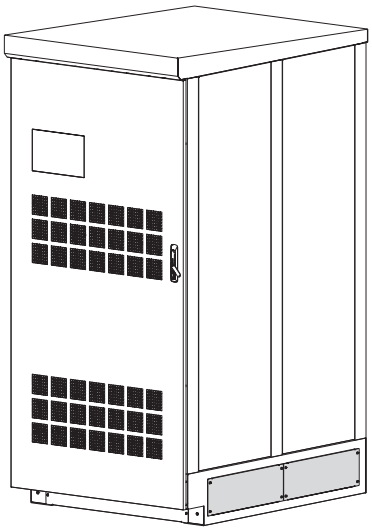


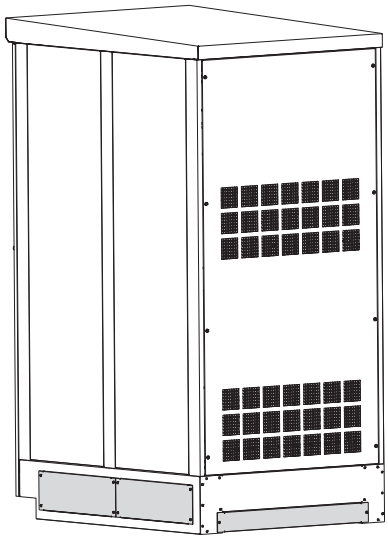
### 8.4.3.4. AC Power connections

To get the AC cables inside the C-Cab please follow the below information.

**1. Recommended path:**

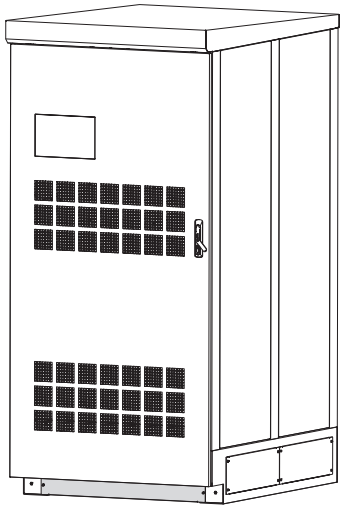
Use one of the indicated removable plates, either on the side or at the back of the cabinet:





**2. Alternative path:**

If those plates are not accessible, or cables are too big to enter you can also cut through the plate indicated in the next drawing.



| | |
|---|---|
| | **WARNING!**<br>For both of the paths it is not required to add any accessory guaranteeing a protection index greater than or equal to 55, this will be guaranteed by the Cable gland plate, refer to chapter "»8.4.2.1. Power cables connection», page 57. Therefore it is mandatory to pass the cables through this gland plate. |

| | |
|---|---|
| | **WARNING!**<br>It is forbidden to enter the cables from any other part of the cabinet, indeed you will break the IP rating by cutting the double skin parts. |

Concerning the AC connection, refer to Figure 50, there is enough space inside the C-Cab to connect up to 2*185mm² /2*350MCM on each pole. The lugs needed are M12.

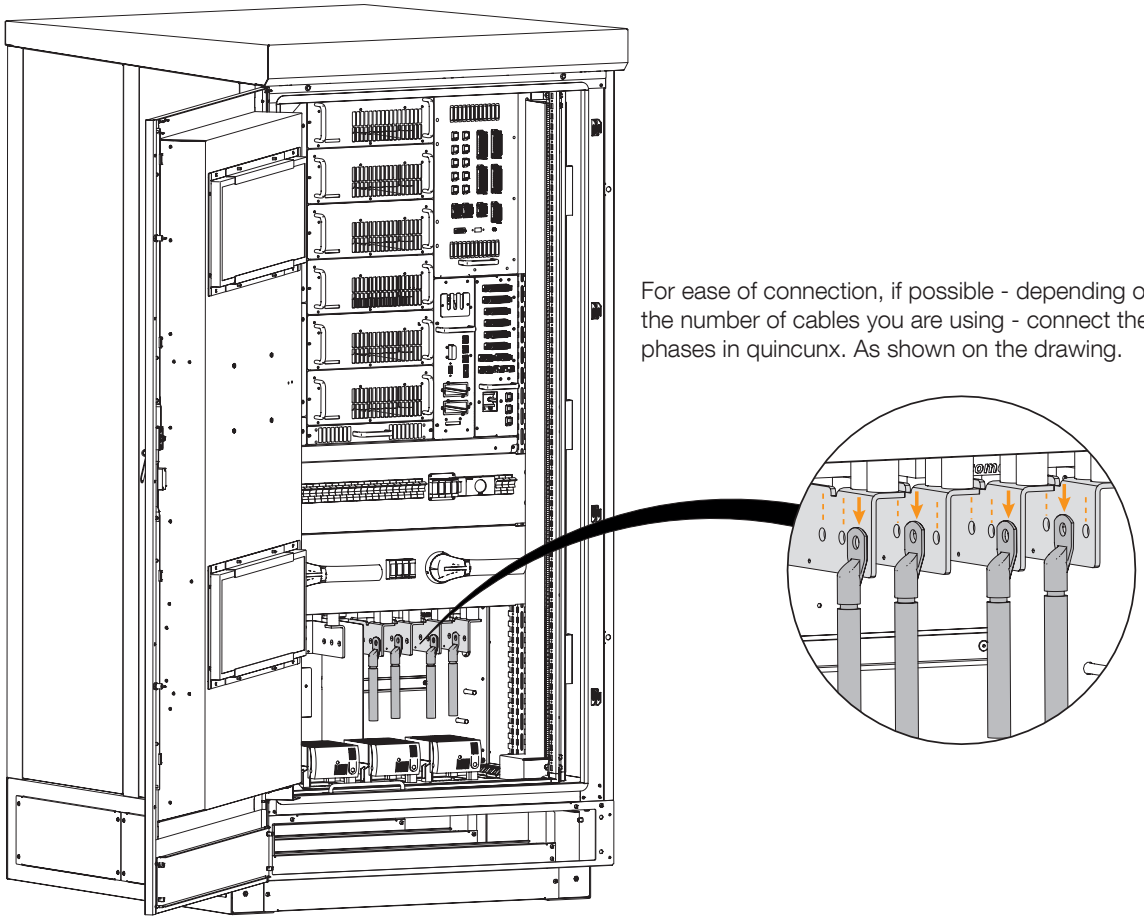



Figure 52. AC power connections positioning

Note: the L1, L2 and L3 wires shall be connected respecting a **clockwise phase rotation**, i.e. L1 anticipates L2 and L2 anticipates L3.Some utilities may adopt a counterclockwise phase rotation as standard, so the names or colors indicated on the cables may not match the names indicated on the C-Cab AC bars.
Verify the actual phase rotation before connecting the AC cables.

| AC Power Neutral connection | | | |
|---|---|---|---|
| Type of connection | Pure on-grid | Pure off-grid | Mixed on-grid/off-grid |
| Neutral connection | Not required | Required with 4 wires load | Required with 4 wires load |

## 8.4.4. Communication and signal connections

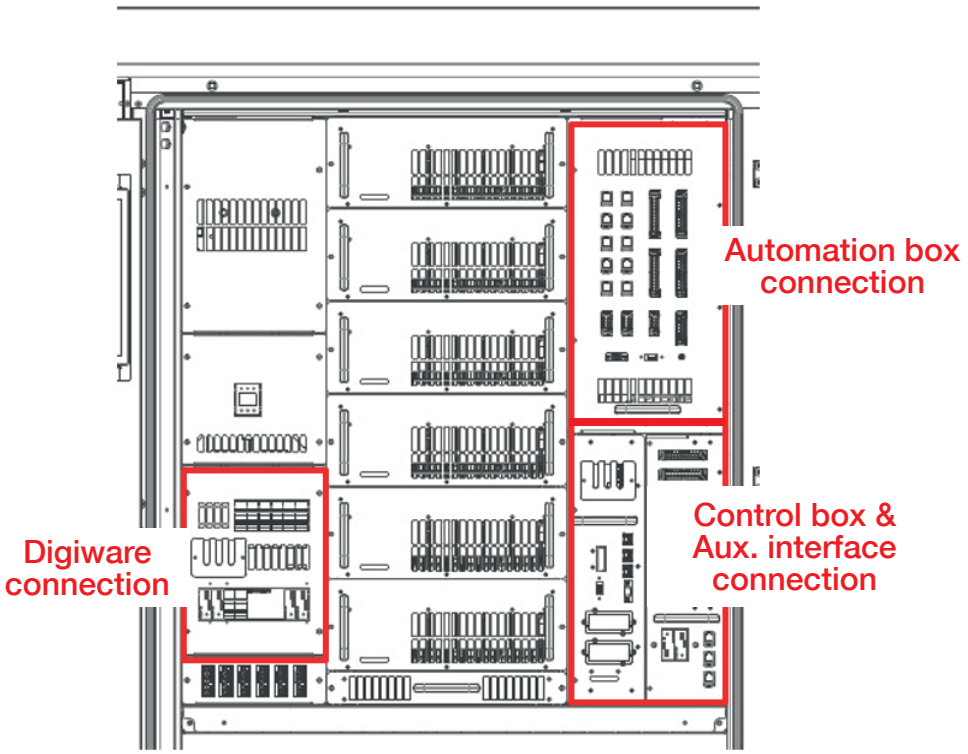



Figure 53. Location of the communication and signal connections in the C-Cab

Several communications and I/O ports are located on the side of the power modules.

All the connections are described in the present chapter.

Note that not all the devices described may be present, depending from the options installed (see “List of options”).

### 8.4.4.1. Control Box Connections

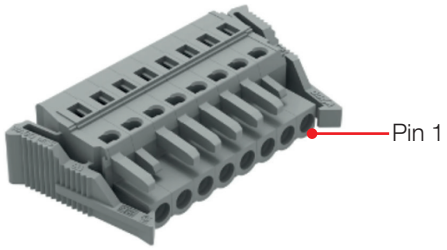
| Connector ID | Connector type | Function |
|---|---|---|
| ETH 1 | Service only | |
| ETH 2 | RJ45 | Dedicated to user-defined functions |
| ETH 3 | RJ45 | Dedicated to user-defined functions |
| CAN BUS | DB-9 | Reserved |
| USB | Service only | |
| SLOT 1 | ADC+SL card | Not used |
| SLOT 2 | ADC+SL card | Not used |

### 8.4.4.2. Aux. interface box connection

X106 connector provides the Inputs and Output having the function reported in the table below.

| | |
|---|---|
|  | The connections to X106 are SELV voltage.<br>The signal cables connected must be maintained with a proper SELV insulation.<br>Before using signals of this connector please contact your Socomec service team. |

<table>
<tr><th>Connector ID</th><th>Connector type</th><th>Pin number</th><th>Function</th></tr>
<tr><td rowspan="4">X106</td><td rowspan="4">8 pin plug-in connector</td><td>Pin 1-4</td><td>Input - Contactor forced open<br>This input forces the open procedure of the C-Cab internal contactor in order to stop energy exchanges between the C-cab and the grid.<br>It has to be connected to a normally open dry-contact.<br><br><table><tr><td>Input state</td><td>Action</td></tr><tr><td>Open</td><td>None</td></tr><tr><td>Close</td><td>Contactor forced open</td></tr></table></td></tr>
<tr><td>Pin 2-3</td><td>Input - PO (Power Off)<br>This input is used to switch off the power of the SUNSYS HES L system using an external emergency power off button.<br>It has to be connected to a normally close dry-contact. As standard, the system is delivered with a shunt between those pins.<br><br><table><tr><td>Input state</td><td>Action</td></tr><tr><td>Open</td><td>Power off</td></tr><tr><td>Close</td><td>None</td></tr></table></td></tr>
<tr><td>Pin 5-6</td><td>Internal use</td></tr>
<tr><td>Pin 7-8</td><td>Output - Contactor feedback<br>This output provides the position of the internal mains AC contactor.<br>It is an optocoupler transistor output.<br><br><table><tr><td>Contactor position</td><td>Output state</td></tr><tr><td>Open</td><td>0</td></tr><tr><td>Close</td><td>1</td></tr></table><br>Maximum current: 10mA<br>Pin 7: emitter<br>Pin 8: collector</td></tr>
</table>




For connection of plug-in connectors use cables in the following range:

1.5mm$^2$÷2.5mm$^2$ / 16÷12 AWG

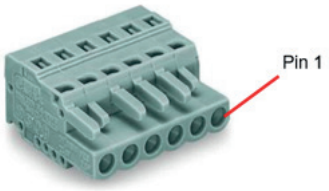
### 8.4.4.3. Connections of automation box

The Automation Box may contain different optional components as listed in the “List of Options” section.

Below there is a list of the connectors present in the front of the Automation Box.

Refer to Socomec for additional details about the functions supported by the installed options.

| Connector ID | Connector type | Pin number | Function | |
|---|---|---|---|---|
| Eth 1 | RJ45 | | External control | |
| Eth 2 | RJ45 | | PMS external | |
| Eth 3 | RJ45 | | C-CAB external | |
| Eth 4 | RJ45 | | Plant external | |
| Eth 5 | RJ45 | | Service – SAT | |
| Eth 6 – Eth 9 | RJ45 | | Free | |
| Eth 10 | RJ45 | | Communication with Control Box | |
| X2 | DB-9 | | CAN for B-CAB | |
| X3 | 10 pin plug-in connector | 1-2 | Emergency stop input 1 | |
| | | 3-4 | Emergency stop input 2 | |
| | | 5-6 | Internal use | |
| | | 7-8 | Internal use | |
| | | 9-10 | Internal use | |
| X4 | 10 pin plug-in connector | 1-2 | Emergency stop output | |
| | | 3-4 | Emergency stop output | |
| | | 5-6 | Emergency stop output | |
| | | 7-8 | Emergency stop output | |
| | | 9-10 | Emergency stop output | |
| X5 | 10 pin plug-in connector | 1-2 | Input IX1.1 – reserved for PMS functionalities | |
| | | 3-4 | Input IX1.2 – reserved for PMS functionalities | |
| | | 5-6 | Input IX1.3 – reserved for PMS functionalities | |
| | | 7-8 | Input IX1.4 – reserved for PMS functionalities | |
| | | 9-10 | Input IX1.5 – reserved for PMS functionalities | |
| X6 | 10 pin plug-in connector | 1-2 | Output QX1.0 – reserved for FSS (Battery Fire Safety System alarm report) functionalities | |
| | | 3-4 | Output QX1.1 – reserved for PMS functionalities | |
| | | 5-6 | Output QX1.2 – reserved for PMS functionalities | |
| | | 7-8 | Output QX1.3 – reserved for PMS functionalities | |
| | | 9-10 | Output QX1.4 – reserved for PMS functionalities | |
| X7 | 6 pin plug-in connector | 1 - 6 | Reserved | |
| X8 | 3 pin plug-in connector | 1 | + | Reserved for Digiware gateway and B30 auxiliaries - Socomec only |
| | | 2 | - | |
| | | 3 | Shield | |
| X9 | 3 pin plug-in connector | 1 | + | |
| | | 2 | - | |
| | | 3 | Shield | |
| X10 | 3 pin plug-in connector | 1 | + | |
| | | 2 | - | |
| | | | Shield | |
| USB | USB | | USB port for datalogger - Service only | |
| Antenna | Proprietary device | | Connection of antenna for “Wireless 4G modem” | |




For connection of plug-in connectors use cables in the following range:

1.5mm²÷2.5mm² / 16÷12 AWG

### Eth 10: C-Cab

In the C-Cab master, this port is connected to Eth 3 of Control Box; this cable is pre-installed.

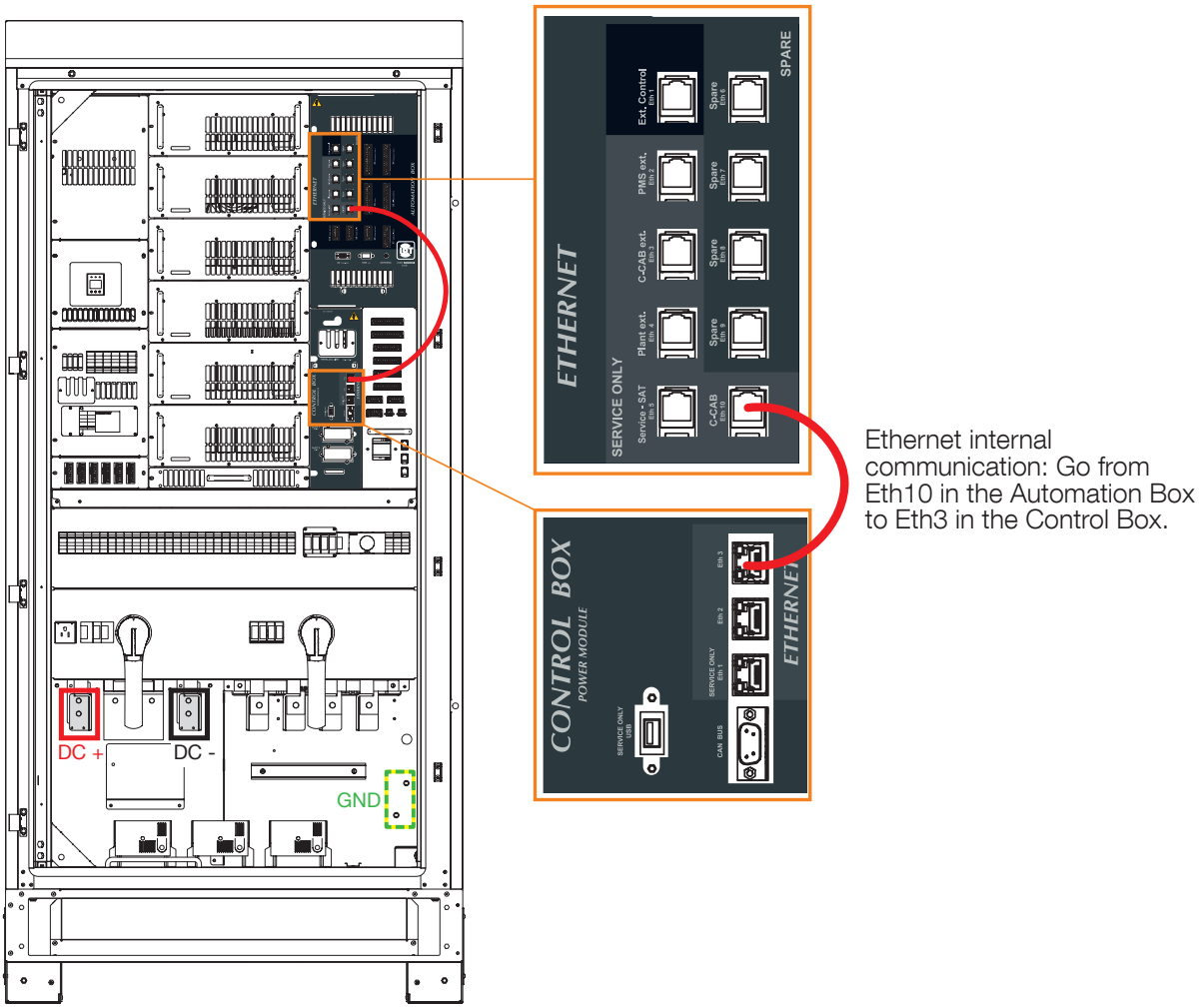



Figure 54. Connection of the communication with the control box

### X2: Battery communication

The communication interconnections between the cabinets are done in a daisy chain pattern. The cable must go from X2 inside the C-Cab to JX3 of the first B-Cab.  Shall there be more than 1 B-Cab, the cable will then go out of B-Cab1 through JX2 and enter B-Cab2 through JX3 and so on. When you reach the last B-Cab, JX2 is connected to the terminal resistor connector.

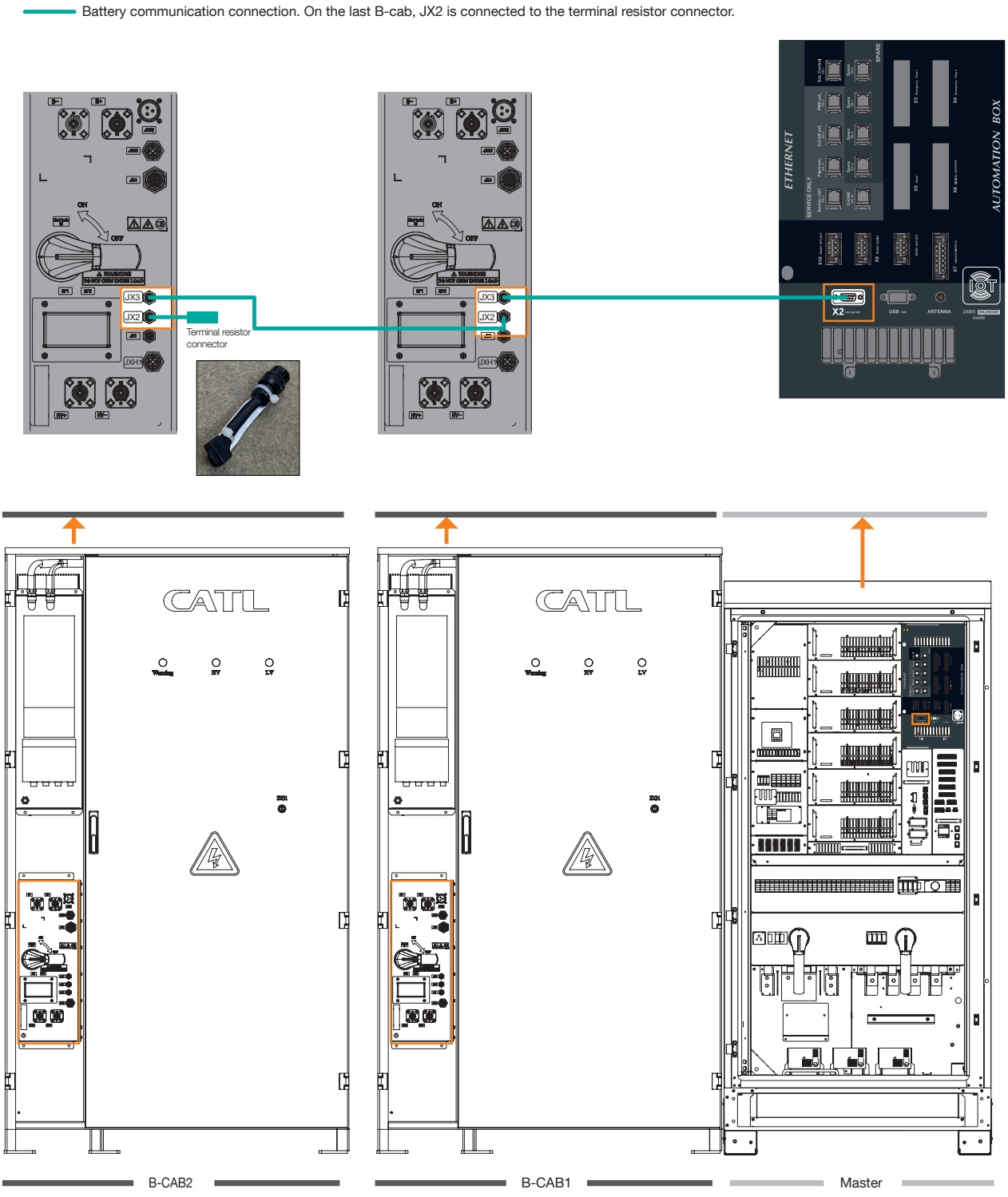



Figure 55. Connection of the communication between B-Cabs and C-Cab

### X3-X4: Emergency stop input 1÷2 and Emergency stop output

These inputs are used to switch off the power of the C-Cab using an external emergency push button. Emergency stop inputs shall be connected to a normally close dry contact.

If one of the input is not used, it must be short circuited.

These inputs directly control the “Emergency stop outputs”.

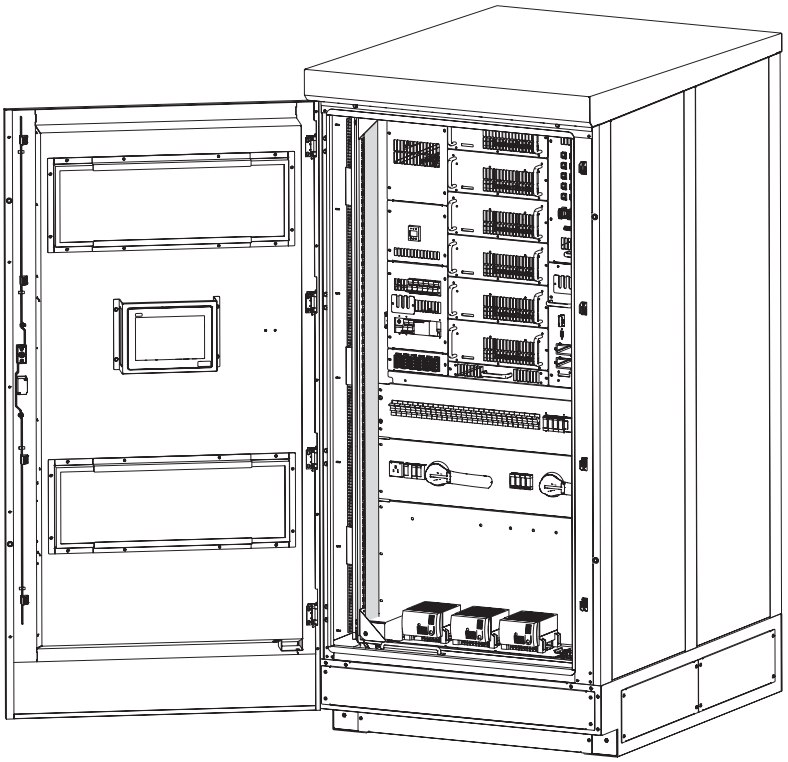
| Emergency stop input state | Emergency stop output state |
|---|---|
| Opened | Opened |
| Closed | Closed |

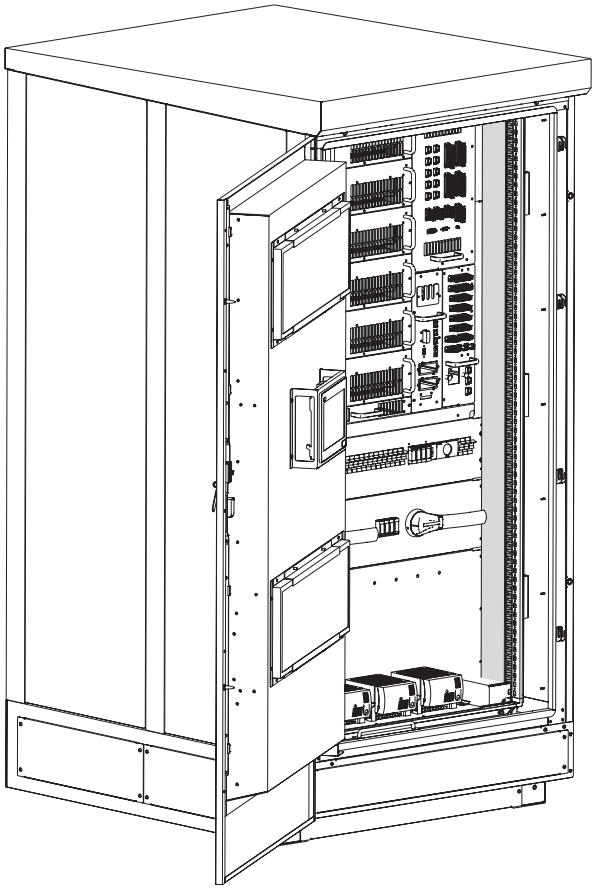
The outputs can be used to switch off the power of the C-Cab and of other C-Cabs in parallel to the first one. Each output shall be connected to the EPO input of the Aux interface box (see “Connections to Aux interface box).

### 8.4.5. Connection path

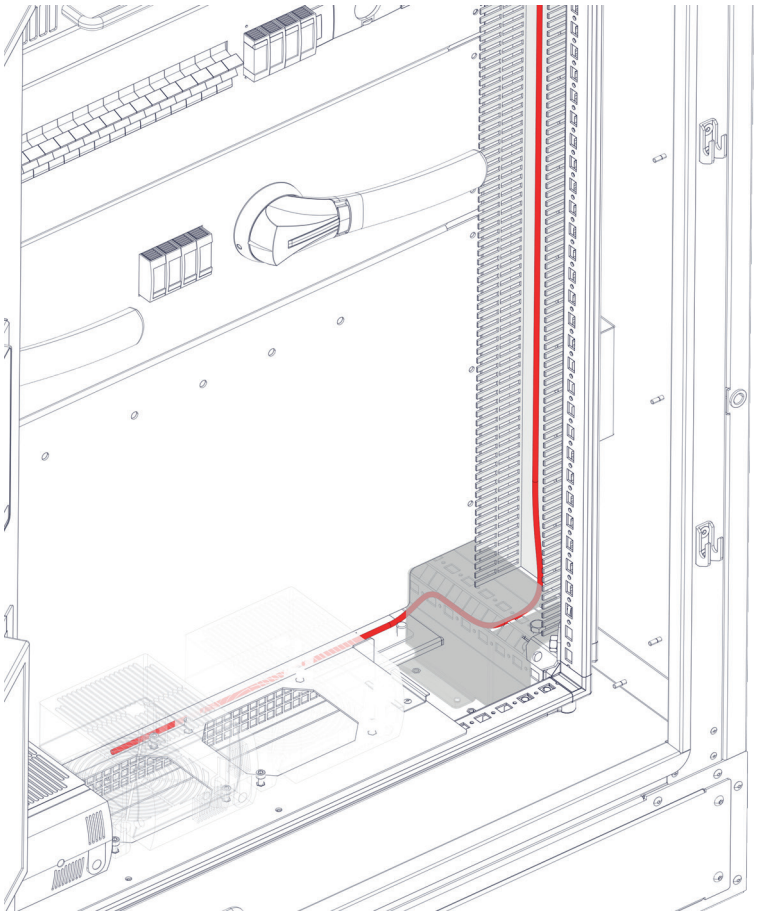
The Ethernet cables need to go through the cable duct on the side wall of the machine, as per the following procedure:

1) Remove the cable duct cover on both sides





2) Pass the cables inside the cable duct
3) The cables shall pass under the metal covers in the lower corners
4) Put the cover back in place, covering all the cables inside the duct



## 8.5. Metering package for CRD

Refer to the document «SUNSYS HES L Instruction Guide UL1741 PCS function» to get more details about the operation.

## 8.6. List of fuses

CAUTION!
When replacing fuses, only use fuses of type and size indicated in the present manual.

The accessible fuses used in the unit are listed in the table below, some fuses may not be present if the related optional component is not installed in the unit (see **List of dedicated components** for more details about optional parts).

| Fuse id. | q.ty | Fuse type | | | Function |
|---|---|---|---|---|---|
| F3 | 1 | 10x38 CC | 5A | AC 230V | RCD |
| F6 | 2 | 10x38 CC | 2A | 1000V DC | U-Adapter |
| F7 | 1 | 10x38 CC | 6A | AC 230V | Heater 1kW |
| F8A<br>F8B | 2 | 10x38 CC | 2A | AC 230V | Fan Extractor |
| F9 | 1 | 10x38 CC | 1A | AC 230V | PCS Opt. Digiware |
| F10 | 3 | 10x38 CC | 15A | AC 230V | AUX Mains |
| F11 | 1 | 10x38 CC | 2A | AC 230V | Grid Contactor Coil |
| F12 | 1 | 10x38 CC | 1A | AC 230V | Control Box power supply |
| F17 | 1 | 10x38 CC | 5A | AC 230V | Service Socket |
| F18A<br>F18B | 2 | 10x38 CC | 10A | AC 230V | Door Heaters |
| F19 | 1 | 10x38 CC | 12A | AC 230V | Heaters 2kW |
| F20A<br>…<br>F20F | 12 | 10x38 CC | 25A | AC 230V | B-CAB 1<br>…<br>B-CAB 6 |
| F21A<br>F21B<br>F21C | 6 | 10x38 CC | 1A | AC 230V | B-CAB 1-4<br>B-CAB 2-5<br>B-CAB 3-6 |
| F22 | 1 | 10x38 CC | 8A | AC 230V | UPS Input |
| F23 | 1 | 10x38 CC | 6A | AC 230V | Automation box |
| F24 | 1 | 10x38 CC | 8A | AC 230V | Aux 217V output - not used |
| F25 | 1 | 10x38 CC | 1A | AC 230V | Heaters control relays |
| F26 | 1 | 10x38 CC | 1A | AC 230V | Hygrostat + Thermostat |

The fuses are located in the areas indicated below:

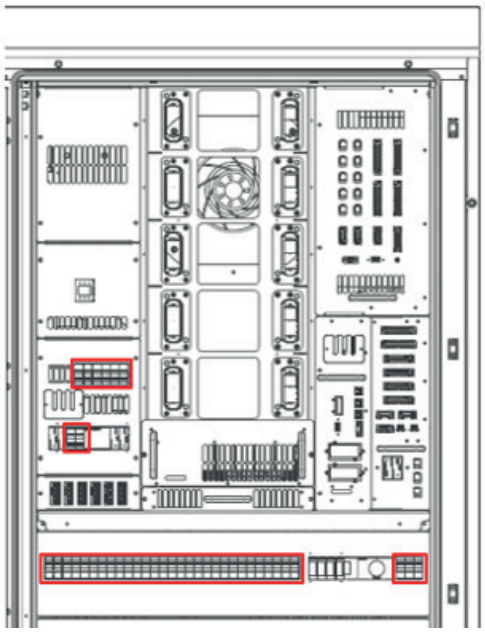


Figure 56. Location of the fuses inside the C-Cab

These fuses can only be accessed by Socomec trained personal.

Apart from the listed fuses, there are fuses to protecting the AC mains and the DC line; only trained personal from Socomec is authorized to replace these fuses.

The “SPD DC” are protected with a couple of fuses located under the DC input bars.

Only trained personal from Socomec is authorized to replace these fuses.

## 8.7. Installation of MSD

Installation of Manual Switch Disconnector (MSD) shall be conducted by Socomec only after the installation of DC power and control cabling in all B-Cabs. Do not do it before Commissioning.

## 8.8. 4G Antenna Installation

**Step 1: Remove the roof of the C-Cab, refer to Figures 21 and 22.**

**Step 2: Drill a hole in the front part of the roof - 19mm / 3/4in.**

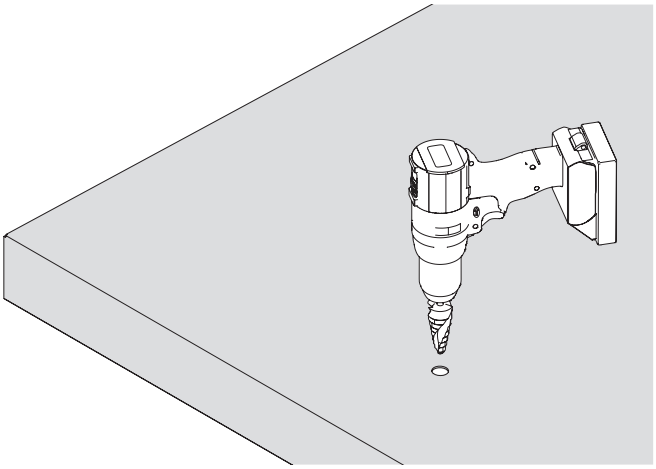


Figure 57. Hole drilling in the roof

**Step 3: Install the antenna and glue it by removing the sticker, pass the cable on the right side at 310mm from the end.**

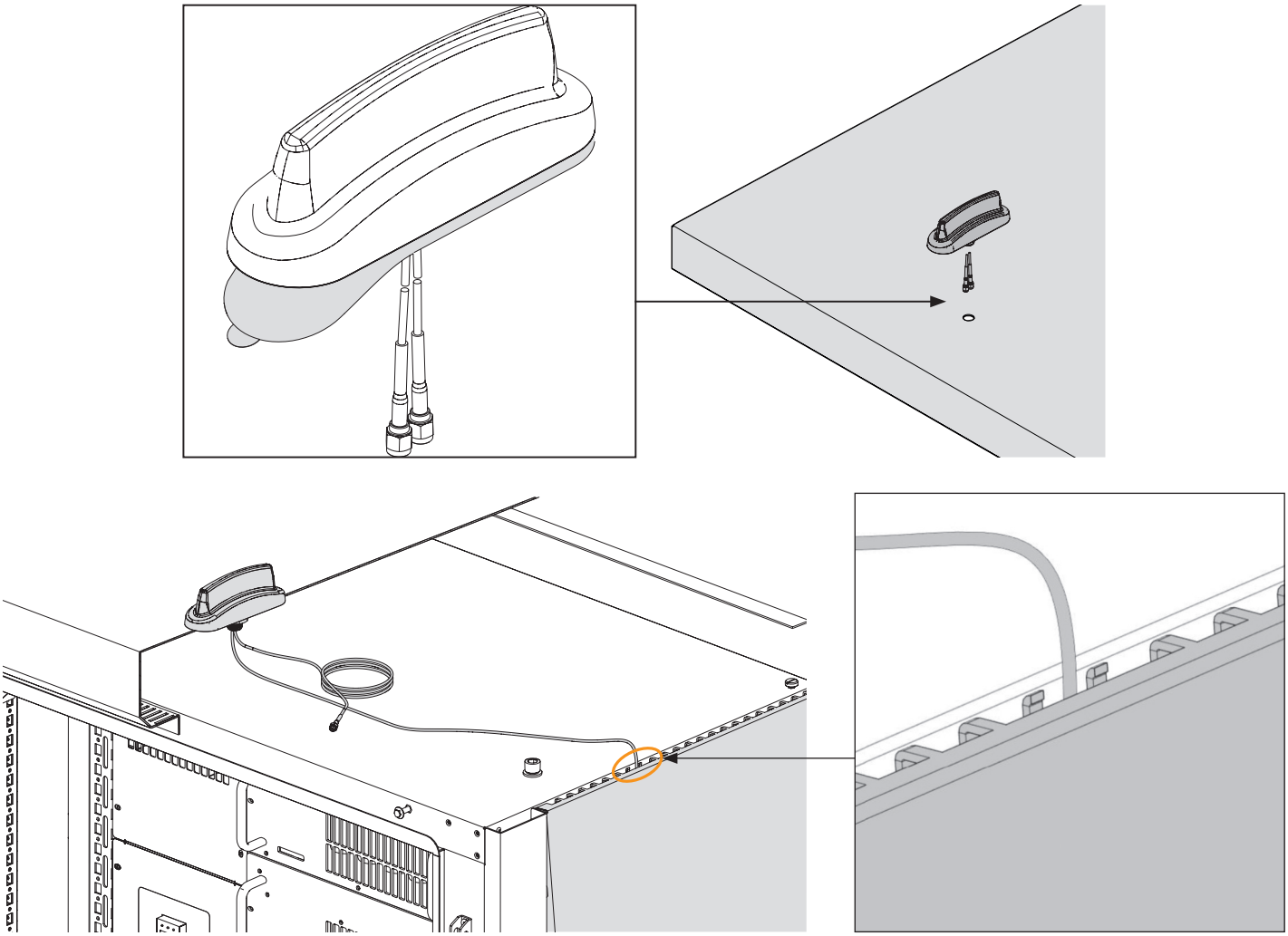


Figure 58. Antenna installation on the C-Cab

Step 4: Reinstall the cover by passing the cable inside the top hole.

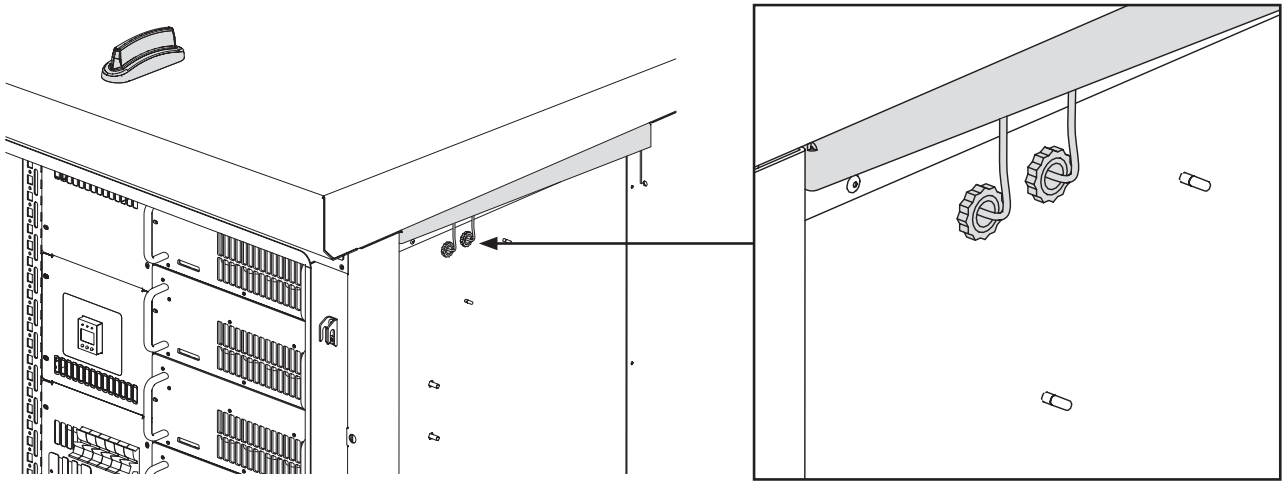


Figure 59. Cable direction from antenna to inside the C-Cab

Step 5: Connect the cables to the antenna input of the automation box : the cable marked Cellular to the connector Antenna and the cable marked Diversity to the connector Diversity.

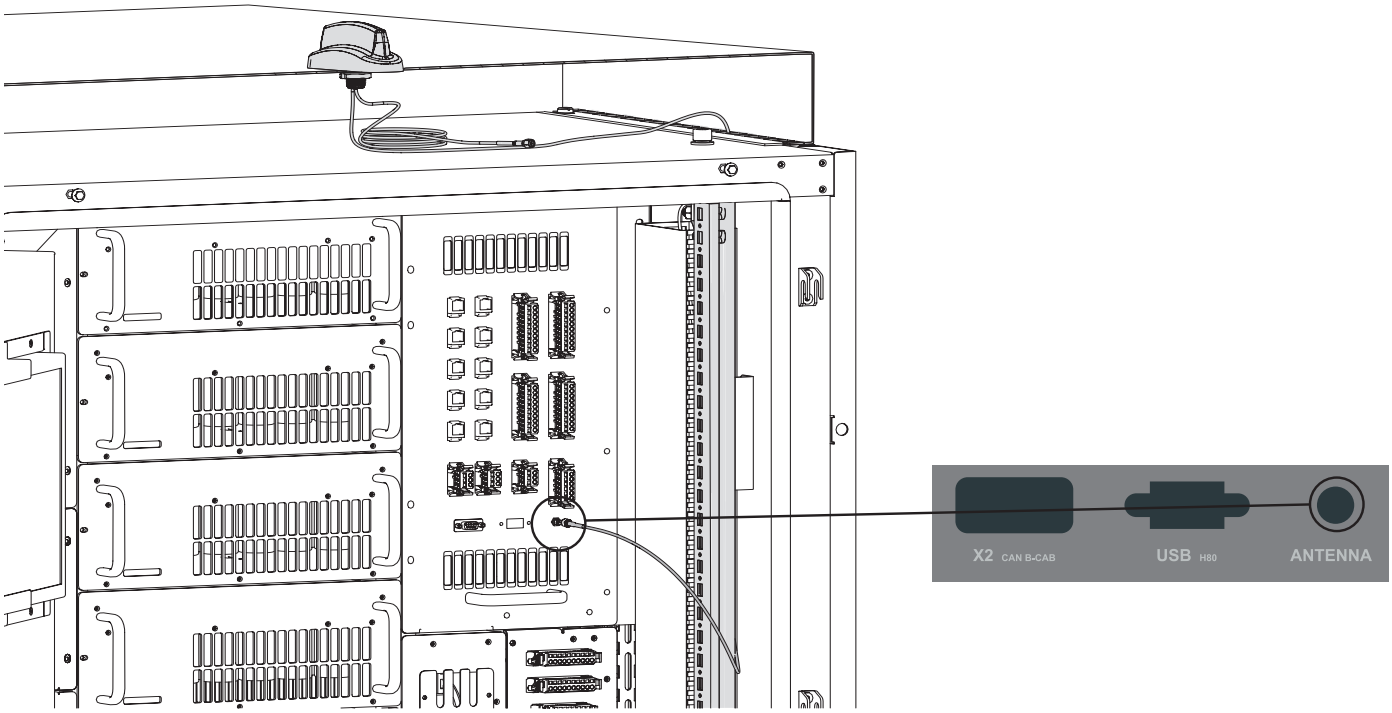



Figure 60. Connection of the antenna cable inside the C-Cab

## 8.9. Mounting details - end

At the end of the cabling you can proceed with the end of the installation, meaning the closure of the Cable gutters.

**Step 7:** Snap the B-cab connection kits covers starting from left to right and screw them with M5 nuts, torque 6Nm.

Use item 6, left cover part, for the battery at the left end – front line -, item 7, right cover part for the battery at the right end – back line - and item 4, cover part, for other batteries.

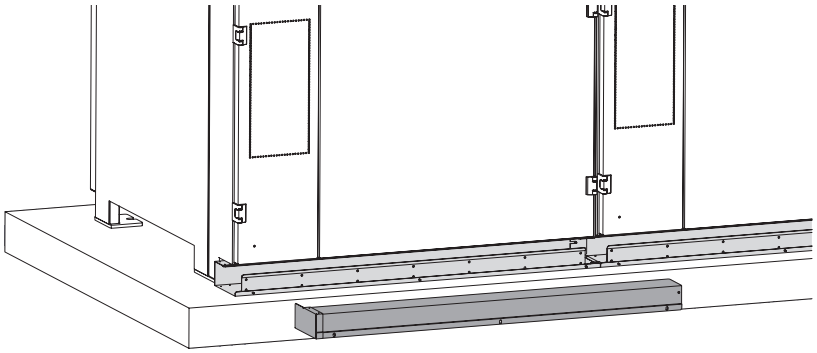
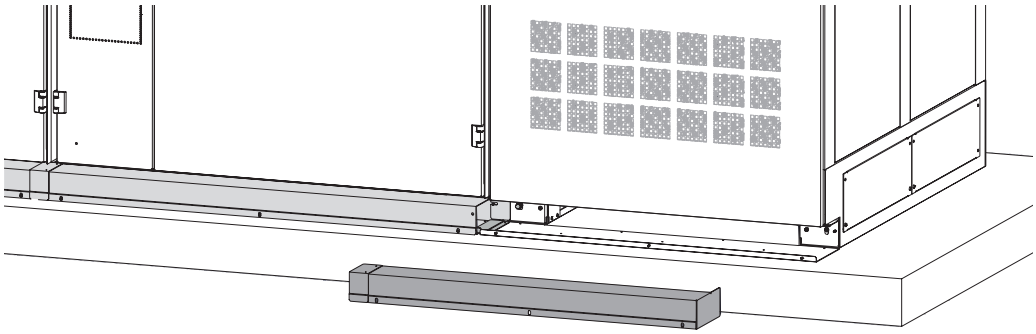


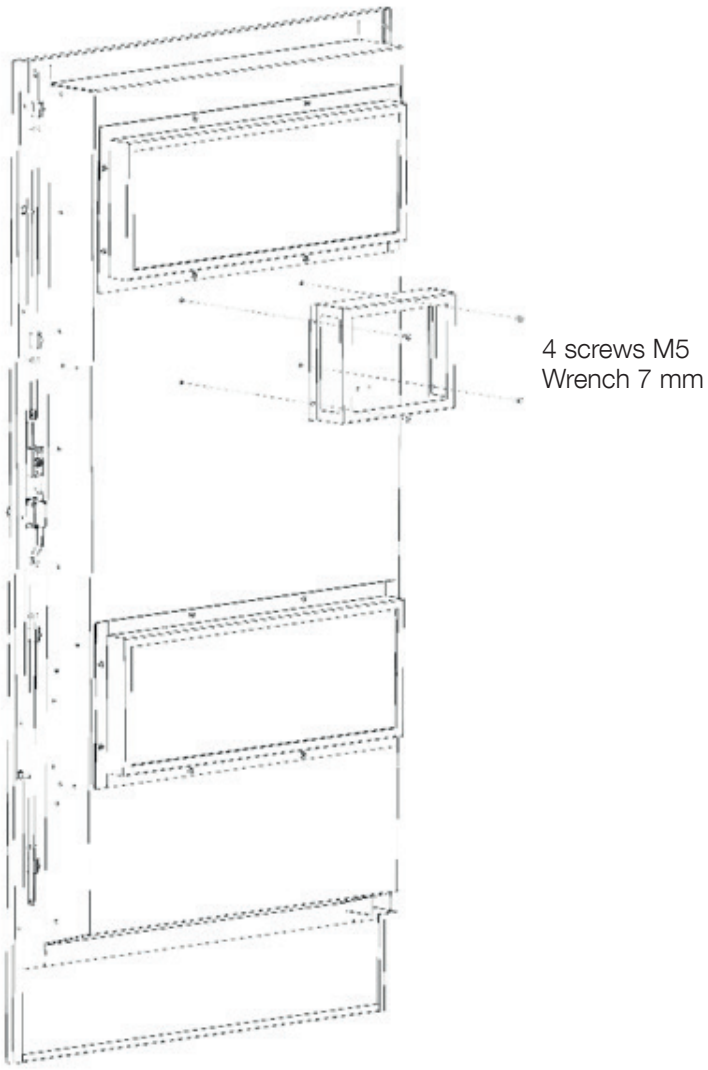
Figure 61. Screwing of the covers

**Step 8:** Finish with the C-Cab connection kit cover, item 2, using M5 nuts, torque 6Nm.

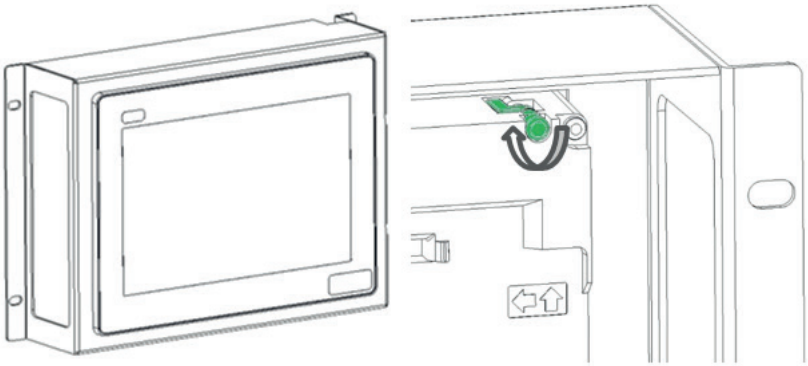


## 8.10. HMI installation

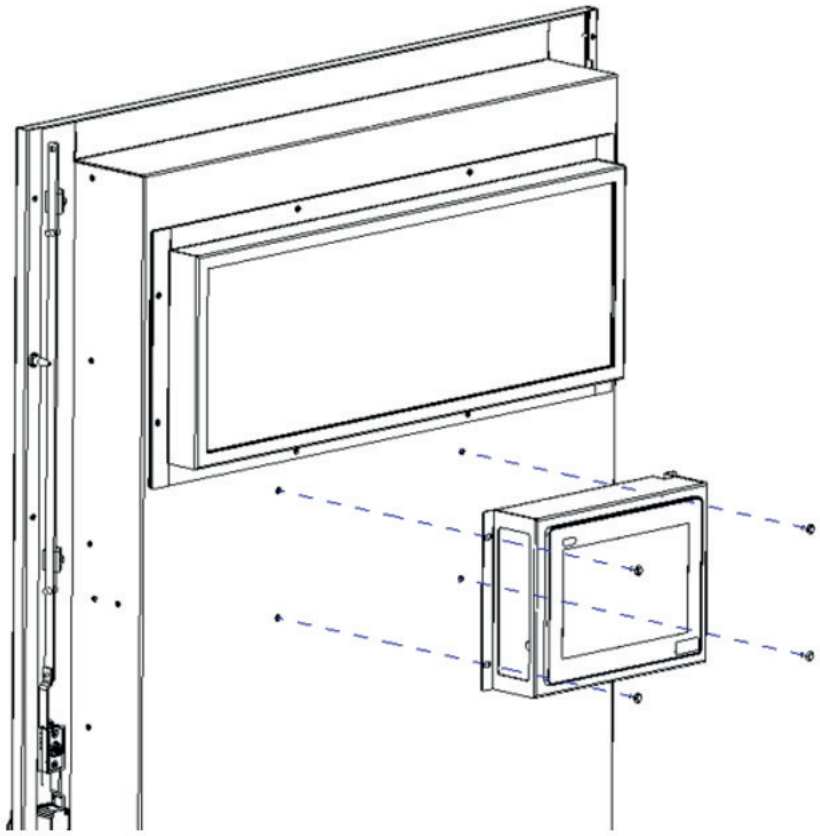
1. Unmount the support of the HMI from the door



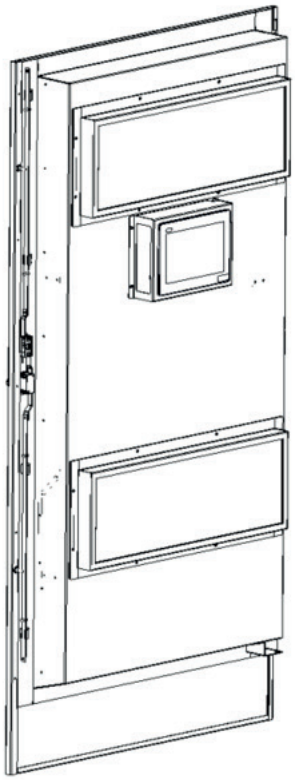

2. Mount the HMI on the support



3. Mount the support with the HMI back on the door



4. Wire the HMI with the existing cables



# 9. COMMISSIONING

To reduce the risk of dust/humidity infiltration prior to MHC commissioning, four stickers are covering the openings on the front and rear doors. These stickers shall not be removed prior to the commissioning.

Commissioning shall be done only by Socomec trained personal, for the C-Cab configuration the “Xpertsoft” software is required.

Contact Socomec for further details.

Note: For the CRD function:

Parameters ➜ “CRD Param.”➜ PMS-PAR019

# 10. HMI PRESENTATION

The status ledbar on the front of the C-Cab replicates the ledbar on the Control Box, indicating the status of the machine and the system.


Figure 62. View of the External HMI of the C-Cab

| Status bar | |
|---|---|
| Green | The system is working and turned on, no alarm and no warning present |
| Blinking green/yellow | The system is on and a warning is present |
| Yellow | The system is turned off and a warning is present |
| Red | Alarm present and the system is off |
| Nothing | System is off, with no alarms nor warnings |

The LEDs on the batteries have the following functions:

| LEDs | |
|---|---|
| WARNING | A warning or alarm is present on the battery |
| RUN | The battery is in operation |
| READY | Battery auxiliaries are powered on |

# 11. PRODUCT START AND STOP

**WHEN WORKING IN CLOSE PROXIMITY TO LIVE INSTALLATIONS**
Follow all safety requirements defined in NFPA 70E or CSA Z462 which includes, but not limited to, the use of protective equipment (PPE: clothing, insulated gloves, safety goggles, etc.). It is further recommended that all metal jewellery (i.e., wristbands, watch chains, rings, bracelets, necklaces, body jewellery, piercings, etc.) shall not be worn when working on electrical installation.

The procedures detailed in this section are intended as a guide to both a normal power up of the unit from a non-operating state and for an initial power up.

The equipment doors must be opened to access the breakers and switches; this is a normal operating situation. Always ensure that the dead fronts are secured in place before applying power.

**WARNING!** Operate the system with all dead fronts in place; open dead front panels expose the operator to high arc flash energy risks.

WARNING! Do not open the battery roght door when the system is operating.
In this case, the battery will disconnect but the others will continue operating, thus leading to a possible unbalance between them and difficulties to reconnect the disconnected battery.

## 11.1. System power on

1. Check the switch QS is in the ON position in each B-Cab, refer to Figure 43.
2. Switch on the auxiliary power:

Switch on Q3 by turning the handle in position 1

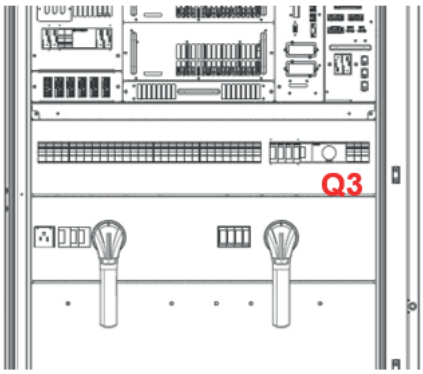



Figure 63. Location of the switch Q3 in the C-Cab

3. Switch on the UPS:

Remove the top-left panel by removing the four screws

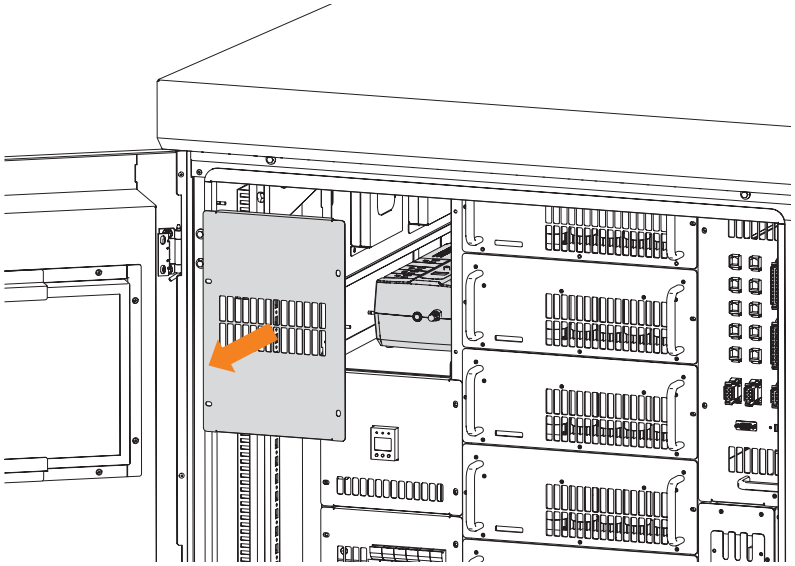


Figure 64. Location of the UPS in the C-Cab

Press and hold the button on the top of UPS for a few seconds, until device beeps

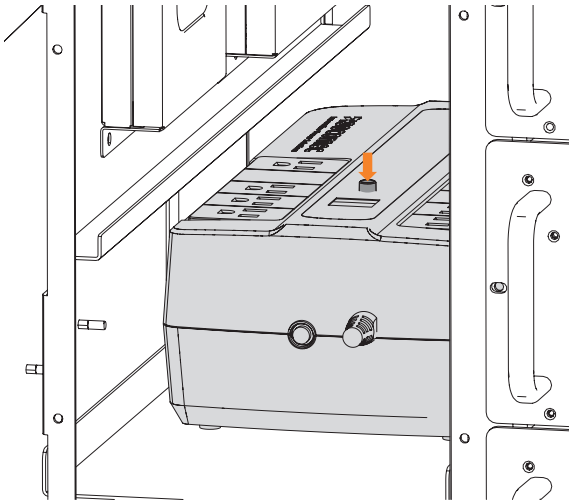


Figure 65. Location of the power button of the UPS

Close the top-left panel using the four screws previously removed

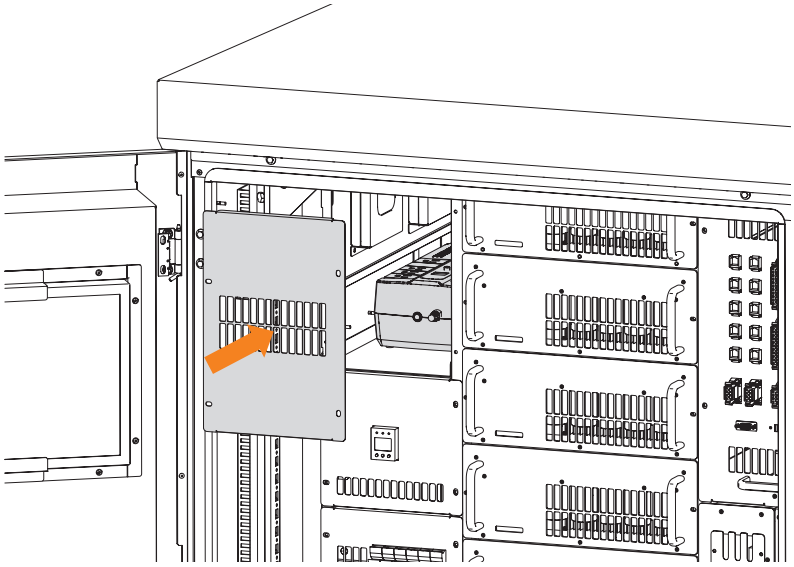


Figure 66. Reinstallation of the panel

If an external supply line (see AC aux from user's UPS.) is connected to the X107 connector, this power line has to be switched on

4. Switch on AC and DC:

Switch on Q1 (mains AC and Q2 (DC bus)) by turning the handles in position 1

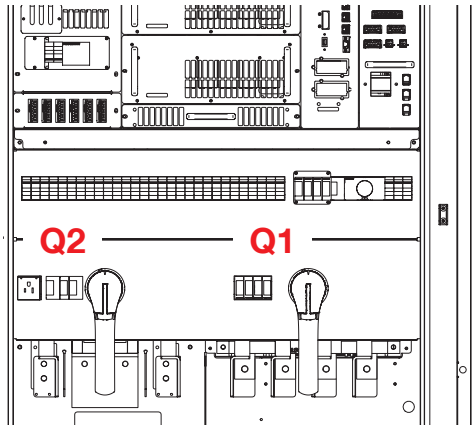



Figure 67. Location of the AC and DC switches (Q1 and Q2) in the C-Cab

Check that there are no active alarms present. The system is ready.

## 11.2. System power off

A. Remote System Power Off
EMS sends the power off command to PMS.

B. Manual System Power Off (if required)

In order to manually switch off the system, follow the procedure below.

With this procedure, the load will be disconnected.

For any service requiring access to the internal components of the unit, it is necessary to power off and complete the internal isolation before the dead fronts are removed. To complete full isolation and make the unit safe for service, please wait for 5 minutes after complete power off of the unit before accessing internal components and open the control switches and breakers.

Ensure the system is in standby mode (no active dis/charge)

1. Switch off AC and DC:

Switch off Q2 (DC bus) and Q1 (mains AC) by turning the handles in position 0,refer to Figure 66.

2. Switch off the UPS:

Remove the top-left panel by removing the four screws, refer to Figure 64.

Press and hold the button on the top of UPS for a few seconds, until device beeps and the output of the UPS is switched off, refer to Figure 65.

Close the top-left panel using the four screws previously removed, refer to Figure 66.

If an external supply line (see AC aux. from user's UPS) is connected to the X107 connector, this power line must be disconnected

3. Switch off the auxiliary power:

Switch off Q3 by turning the handle in position 0, refer to Figure 63

4. Open the isolation switch QS and QF1 & QF2 in all B-Cabs, refer to Figure 43.

The unit is now isolated for service and the appropriate dead-fronts may be unscrewed and removed; however, it is very important that all accessible terminals be proven to be electrically dead before any work is attempted in the unit.

## 11.3. RCD setup

When installed, the RCD options are configured with predefined settings.

During the commissioning trained and qualified service personnel may modify the predefined settings with others, depending on the plant configuration (number of C-Cabs, B-Cabs, etc.).

No setup is required from user.

# 12. POWER MODULE INSTALLATION

| | |
|---|---|
| | **WARNING!**<br>RISK OF TIPPING OVER: before carrying out any operations, ensure the C-Cab is secured at the feet. |
| | **WARNING!**<br>RISK OF TIPPING OVER: the modules must be inserted from the bottom upwards and removed from the top downwards to ensure the unit remains stable. |
| | **WARNING!**<br>The modules have to be moved individually. Never handle more than one module. |
| | Weight of the module: 22.5kg |

Procedure:

Remove the front panels unscrewing their lateral screws

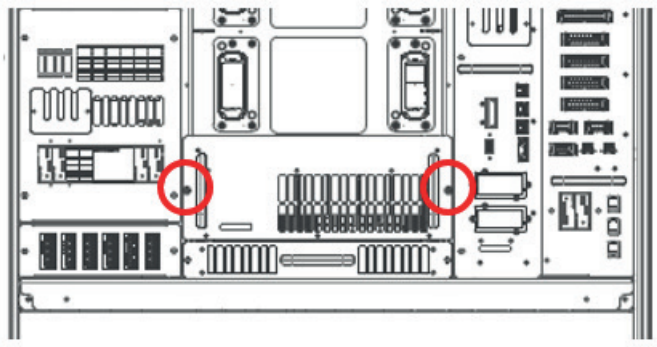


Figure 68. Power module screws location

Insert the module completely, starting from the lower one

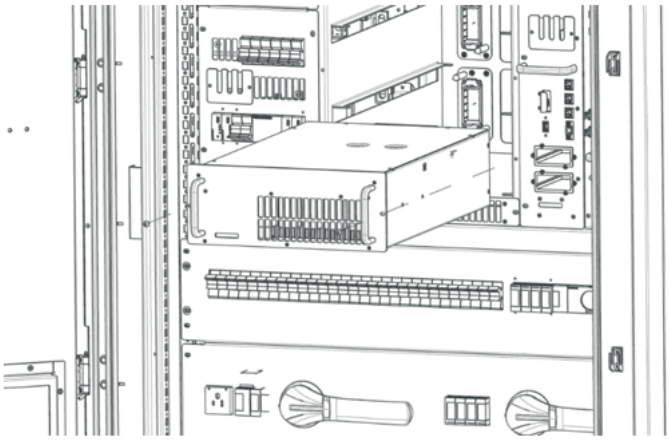


Figure 69. Insertion of the power module

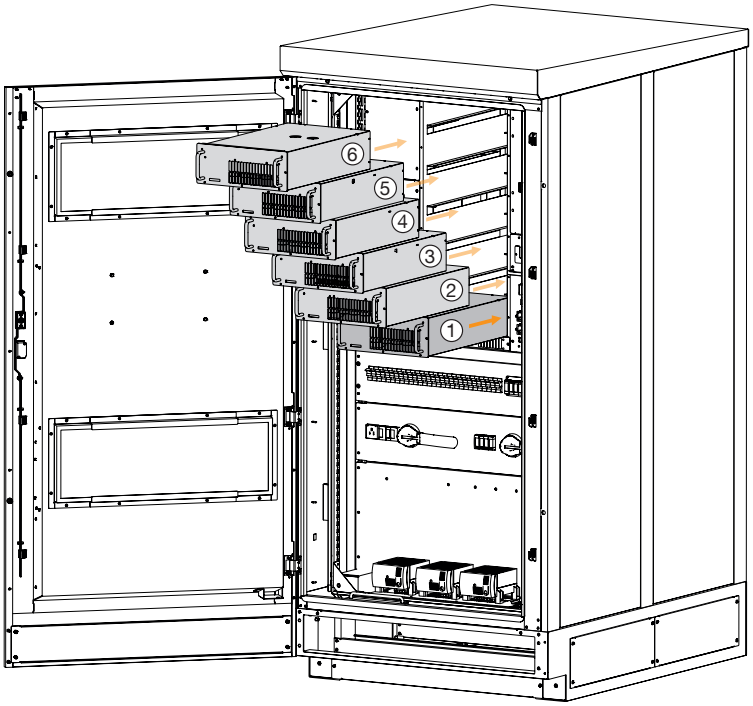



Figure 70. Order of insertion of the modules

Tighten the screws at 5.5 Nm / 3.7 ft-lbs to secure the module

# 13. MAINTENANCE

| | |
|---|---|
|  | **CAUTION!**<br>Lethal voltages exist inside the unit during normal, maintenance and service operations.<br>Disconnect and lock-out all power sources before working inside the unit.<br>**For your safety, it is imperative that you check, and do not assume, that all accessible terminals (not just those being contacted) are proven electrically dead (no potential between all connections or to ground).** |
|  | **CAUTION!**<br>Before carrying out any operations on the unit read the “Important Safety Instructions” chapter carefully. |
|  | **CAUTION!**<br>SUNSYS specific maintenance should be performed only by Socomec trained and qualified service personnel.<br>SUNSYS routine maintenance should be performed only by personnel trained and qualified, as per local regulations. |

The SUNSYS HES L will require periodic attention and maintenance in order to ensure trouble-free operation. Maintenance will be considered in the following phases:

1. Timely Inspection and Corrective Actions: Driven by automated alarms and warnings
2. Preventative Maintenance:
    a. Routine Visits: Yearly inspections with follow up corrective actions if required and maintenance of specific components
    b. Specific visits: regular maintenance of specific components at specified periodic intervals
3. End of life refresh maintenance

Before performing any maintenance activity, the system must be switched off and isolated following the procedure described in Manual System Power Off Chapter.

## 13.1. Timely inspections and corrective actions

Timely inspections and associated corrective actions are to be driven by any system generated alarms and warnings. The potential alarms and warnings are listed in the Troubleshooting part of this manual.

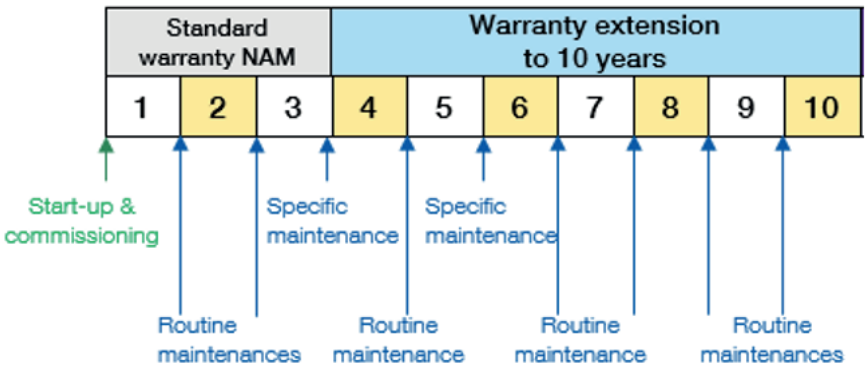
Note: The service provider is responsible for managing the timely service of the unit based on the alerts and alarms delivered from the SUNSYS HES L.

## 13.2. Preventive maintenance

Maintenance requires accurate functionality checks of the various electronic and mechanical parts and, if necessary, the replacement of parts subject to wear and tear (filters, fans and capacitors). It is recommended (even mandatory in case of warranty extensions) to carry out annual preventative maintenance, in order to keep the equipment at the maximum level of efficiency and to avoid the installation being out of service with possible damage/risks. Maintenance consists of parts replacement as well as functionality checks on:

- Electronic and mechanical parts
- Dust removal
- Software updating (only possible by Socomecs’ teams)
- Environmental checks

The following table, shows which are the routine maintenance visits, which are the specific maintenance visits, and when these visits must be performed. Depending on the level of maintenance contract chosen, the routine maintenance visits can be performed by customer and under customer's responsibility (requiring that the customer is qualified to perform such work in the local jurisdiction. Socomec requires the customer to provide a maintenance report to Socomec after each routine maintenance operation). The specific maintenance visits must always be performed by Socomec or an authorized third party.




The following inspections should be performed at the recommended intervals given in the table below:

**Table of Preventative Maintenance**

| Schedule | Inspections/Procedure |
|---|---|
| Monthly | • Operate a SOC battery calibration, refer to "SUNSYS HES B-Cab Calibration Method". |
| Yearly * | • Check and keep the site clear around the unit removing any foreign material that could block the intake grills.<br>• Check all the ventilation grills are free from dirt and debris.<br>• Check all the C-Cab filters for any dirt and debris accumulation; clean, wash or replace as required following the instructions below; the replacement must be done at least once per year.<br>• Check the SPD functionality in the C-Cab following guides and procedures (See details below). If defective, must be replaced.<br>• Clean the pollen from the cabinet if needed during the pollen season to prevent the mesh from being blocked.<br>• If there are fluid leaks, or other indication that fluid levels in B-Cabs are low, then 'Topping up the cooling system' may be required (This is to be done by Socomec or third party service team only).<br>• To ensure the free circulation of air in the B-Cab, clean the system regularly as required. Especially for dusty application scenarios, it is important to clean the air inlet and outlet of the fans. Check and clean the drain on the floor drain when necessary, using a vacuum cleaner (usage of air-compressor is forbidden).<br>• Check in all the B-Cabs for the operation of the temperature and smoke sensors as indicated by the red LED flashing every few seconds.<br>• Clean the dust on the B-Cabs condensers.<br>• Inspect signs of external corrosion and use a suitable paint to mitigate the spread of rust. Check for any wire distortions or colour change. Contact Socomec for additional details. |
| *Note: The optimal inspection frequency will depend on the operating environment; the minimum recommended inspection frequency is yearly for clean dry locations, but it is also recommended that there should be monthly inspections for the first quarter to establish an optimal inspection frequency for the specific site. More frequent inspections may be required for adverse environmental conditions (e.g., Dust, airborne contaminants, chemical fumes, etc.). | |
| During maintenance visits at the end of years 3, 5 and 7 | • Replace the UPS that is inside the SUNSYS C-Cab L. |
| Every five years<br>(by Socomec or trained service technician only)<br><br>Note: The system is completely powered off for this inspection | • Check for signs of discoloration on all electrical power terminals which is indicative of overheating, if so clean and re-torque terminals.<br>• Re-torque all connections including the AC & DC power connections.<br>• Inspect signs of corrosion and use appropriate paint to mitigate the spread of rust wherever observed.<br><br>B-Cab:<br>• Drain the coolant following the procedure and replace with fresh automotive grade antifreeze (50% Glycol).<br>• Replace the desiccant in the condenser.<br><br>C-Cab:<br>• Replace the UPS that is inside the SUNSYS C-Cab L.<br>• Replace the fans (modules and cabinets).<br>• Replace the extractor.<br>• Replace the Humidity/Temperature PCB.<br>• Replace the hygrostat.<br>• Replace the DC capacitors PCB.<br>• Replace the AC capacitors PCB.<br>• Replace the 230Vac/24V DC Power Supply inside Automation Box. |

| Schedule | Inspections/Procedure |
|---|---|
| Every 10 years (not included in the maintenance contract)<br>(by trained service technician only)<br><br>Note: The system is completely powered off for this inspection | • The fire protection system in the B-Cabs requires replacement of the aerosol container.<br>• Replace the internal converter cabinet fan (recommended).<br>• Replace the CPU inside Automation Box.<br>• Replace I/O and Analog cards inside Automation Box.<br>• Replace the DIRIS.<br>• Replace all SPDs.<br>• Replace DC & AC capacitors PCB inside power modules.<br>• Replace the varistors PCB (EMI filter board).<br>• Replace the control module power supply.<br>• Replace the RCD. |

## 13.3. Detailed instructions – C-Cab

### 13.3.1. Air filters

Air filters are used to filter the inlet air and grant the IP55 degree; they must be inspected for dirt accumulation as required. The optimal inspection frequency will depend on the operating environment.

Air filters are located in the front door:

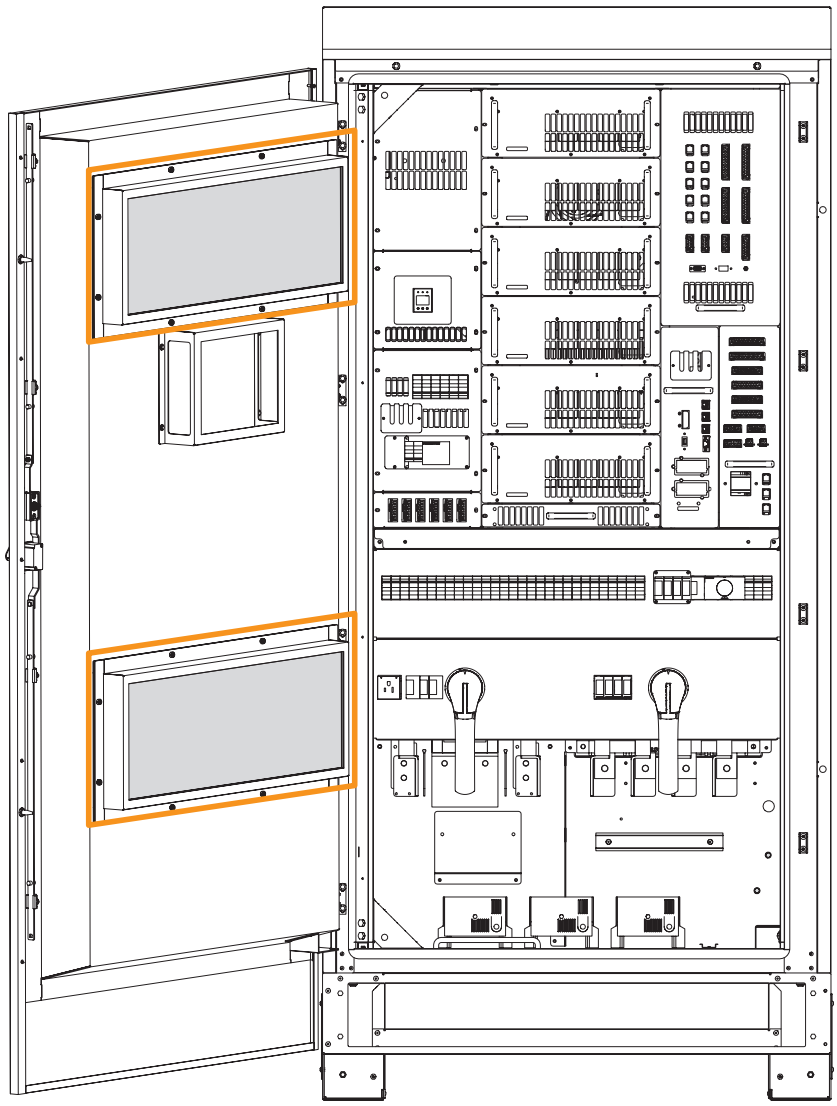


Figure 71. Location of the C-Cab air filters

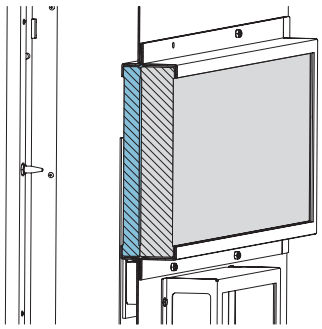


Figure 72. Details of the air filters

Each filter is made of a washable stainless steel filter (blue one in the figure) coupled with a sponge cloth filter (grey one in the figure).

The stainless steel filter can be washed in a solution of detergent and hot water or cleaned with compressed air.

Do not wash the sponge cloth filter, this one needs to be replaced at least once per year

To remove the filters, follow the procedure detailed below:

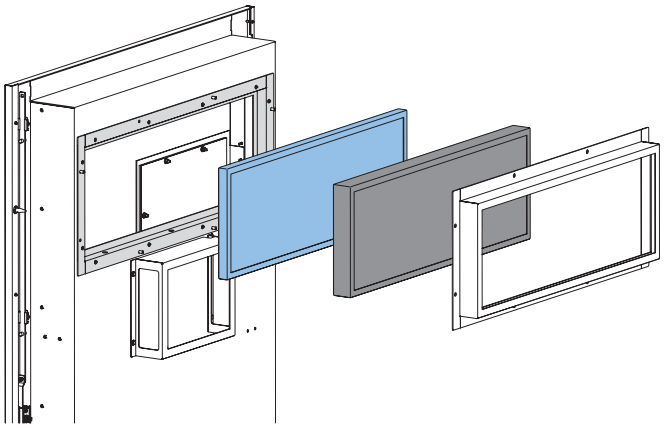


Figure 73. Installation of the air filter

- Open the door to full extent.
- Remove the screws on the frames around the filter and remove the frame.
- Pull out the filter.
- Inspect the sponge cloth filter; if found to be exceptionally dirty, it should be discarded and replaced.
- Place the new sponge cloth filter, or the cleaned stainless filter, inside the frame.

The sponge cloth filter (grey one in the figure) has to be installed with the directional arrow pointing toward the inside of the cabinet.

- Fix the frame with the screws; be careful not to remove the gasket.

### 13.3.2. UPS

Remove the metal sheet cover, stop it by pushing for 5s the button located on top of the UPS, then unplug the UPS and plug in the new one. Then start the new one by pushing the button located on top of the UPS for 5s.
Put the cover back in place, refer to Figure 6468, 69 and 70.

### 13.3.3. SPD

The C-Cab is normally equipped with an SPD on AC mains and SPDs on DC input and AC aux input

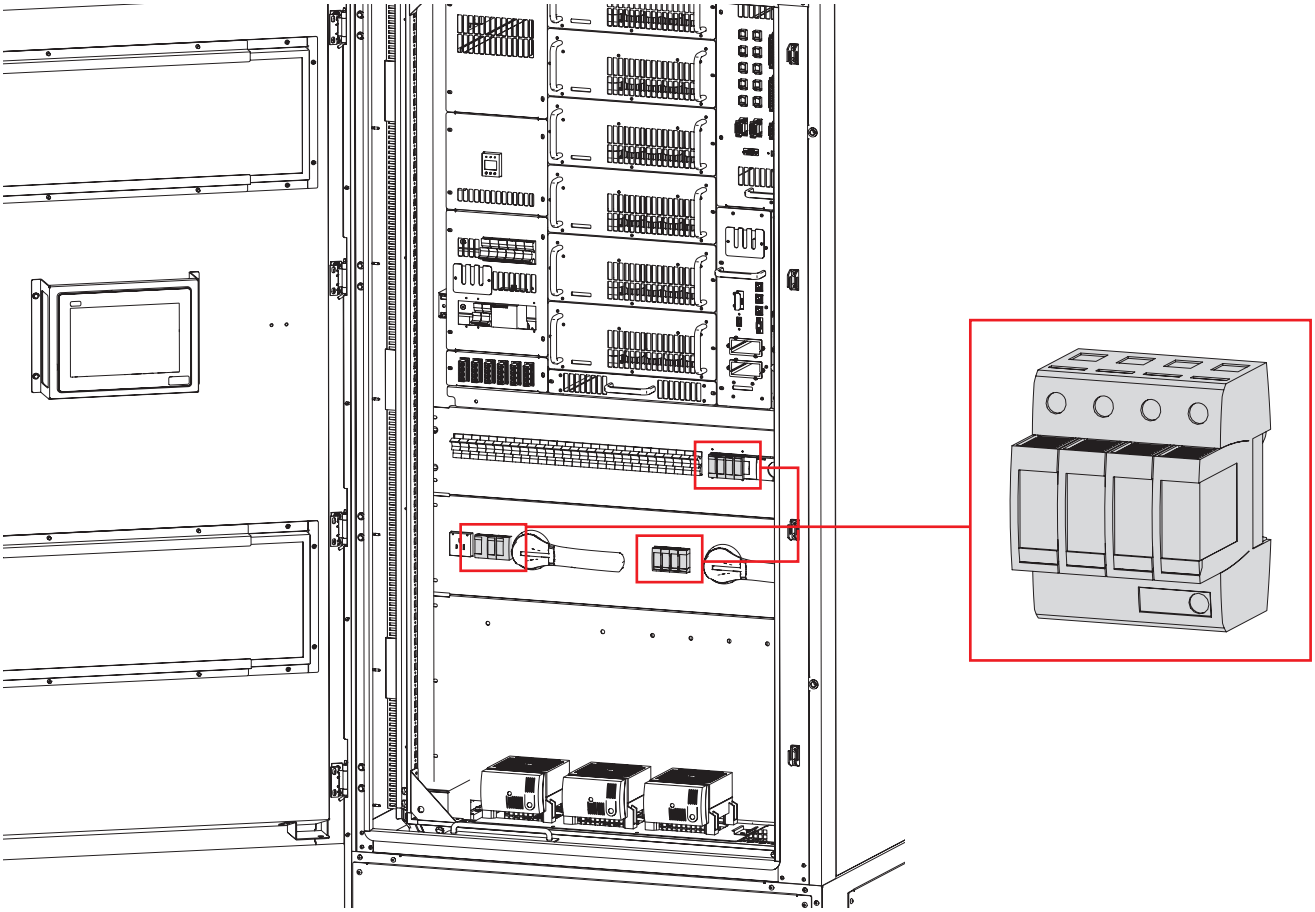


Figure 74. Location of the SPDs inside the C-Cab

Each SPD has a fault indicator; when the indicator turns red, the SPD has tripped and its module has to be replaced.

## 13.4. Detailed instructions – B-Cab

### 13.4.1. Battery unit

**DANGER!**
**Batteries present an inherent risk of electrical shock. Contact with any part of the battery circuit battery can result in electrical shock.**
**Batteries are supplied in a charged condition and are capable of extremely high short circuit currents. Take care to avoid short-circuiting any terminals; use only appropriately insulated tools.**
**Warning: Risk of fire, explosion, or burns. Do not disassemble, heat above 60ºC, or incinerate. Avoid any short circuit. Avoid any Metallic parts around the battery, do not place tools or items on top of the battery.**

The following additional precautions must be observed when working on batteries:

1. Remove watches, rings, or other metal objects from your person.
2. Use insulated tools only.
3. Wear insulated gloves and electrically insulated boots.
4. Do not lay tools or metal parts on top of batteries.
5. Ensure that the battery disconnect switch is open prior to installing or maintaining the battery.
6. Do not use any type of oil, solvent, detergent, petroleum-based solvent or ammonia solution to clean the battery containers or lids. These materials will cause permanent damage to the battery container and lid and will invalidate the warranty.

Follow the suggested maintenance schedule required for batteries as described in section "»13.2. Preventive maintenance», page 90. For servicing of battery modules from the cabinet, contact Socomec.

**WARNING!**
**Check to ensure environmental safety, system safety, no alarm, no fault before performing maintenance operations.**
**After the battery maintenance of ESS is completed, you can notify our after-sales engineer to perform data analysis for free.**

The battery needs to be calibrated once a month to reset the SoC level.

Please refer to the document «Calibration Procedure» to get the process.

### 13.4.2. Coolant

The location of independent fluid cooling loop in the B-Cab is shown in the figure below:

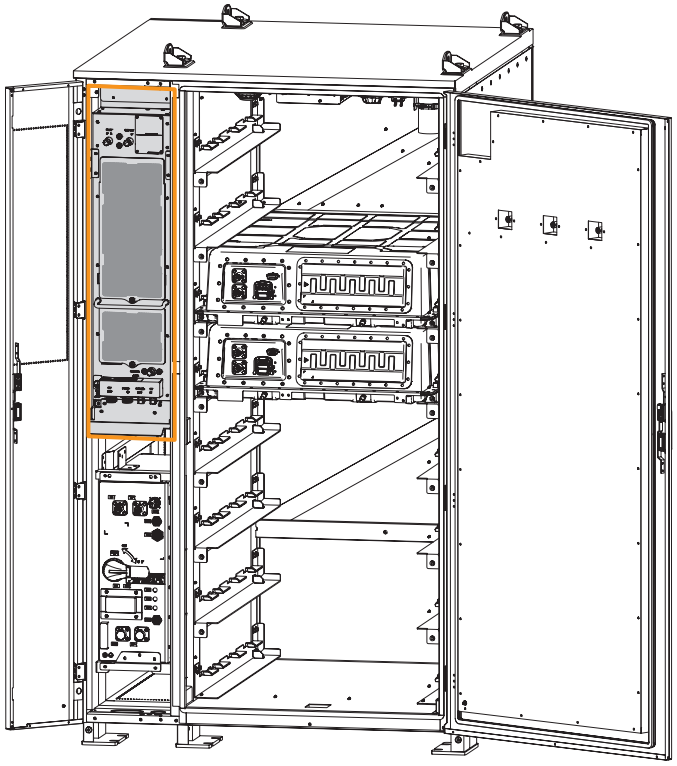


Figure 75. Location of chiller on B-Cab

Checking fluid levels

The fluid levels for batteries should be inspected and verified for the recommended levels by examining the logs of the unit. A hydrostatic level sensor is used in the system to alert when the coolant level is low. If the liquid pressure goes below the set level (< 0.8), an alarm will be prompted, and the coolant should be filled for the recommended level. In this situation, please contact your Socomec service team.

| | |
|---|---|
|  | **CAUTION!**<br>**This procedure should be performed only by a trained and qualified service personnel and should be carried out only when the system is de-energized at the input power source.** |

### 13.4.3. Battery disposal and recycling

| | |
|---|---|
|  | **CAUTION!**<br>**Ensure the batteries are fully discharged before attempting for disposal** |

To dispose of the batteries, they must be fully discharged and packaged and transported in accordance with prevailing transportation rules and regulations and disposed of in compliance with local and national laws by a licensed or certified lithium-ion battery recycler. For further assistance, contact Powersmiths or Socomec.

## 13.5. Capacity measurements of the Battery System

Refer to the "Capacity Measurement Method" document.

# 14. TROUBLESHOOTING

The alarm messages offer immediate diagnosis of any faults, malfunctions or breakdowns in the batteries. The following events are indicated:

- Warning: doesn't cause the unit stop. This can be reset automatically.
- Alarm: cause the unit stop. These alarm conditions require a manual reset.
  Alarm and warnings are divided into two categories:
- System Alarms/Warnings: these alarms/warnings relate to external parts of the unit (mains power network, output line, ambient temperature…). Corrective actions are activated by the user (system installer or operator) or by the Service team.
- Unit Alarms/Warnings: these alarms/warnings relate to parts of the unit. Corrective actions are carried out by the Support Service

# 15. GRID SUPPORT UTILITY INVERTER

NOTE!
Changes to the threshold parameters listed below can lead to changes regarding conformity with the standard and must be approved by the on-site electric utility company and/or the appropriate authority.

The system is certified UL 1741 SA and SB 3rd.

The system complies with the:

- IEEE 1547-2018 normal operating performance Category B;
- IEEE 1547-2018 abnormal operating performance Category III.

## 15.1. Voltage and frequency trip settings

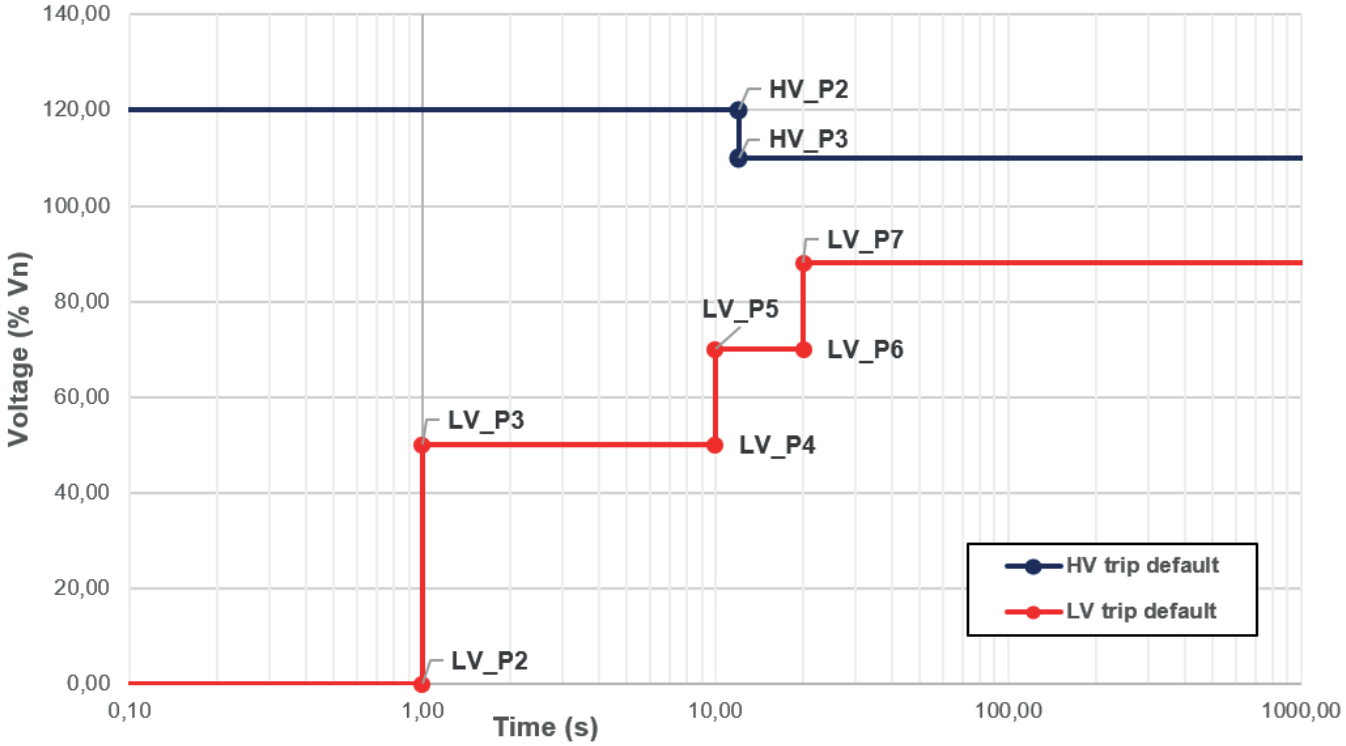
This section describes the voltage and frequency trip default settings and how to map from IEEE 1547-2018 trip settings to SunSpec information models. The complete set of available SunSpec models is present in 5.3.1.

SunSpec uses curves to specify the trip settings, each segment in a curve is represented by two points. Even though the information in the curve may be able to be represented with less points in some circumstances, all the points are specified to provide a uniform method of representing all curves derived from the IEEE 1547-2018 threshold settings.

**Voltage Trip settings**
The voltage default trip settings are specified in the table X.x.x.

| IEEE 1547-2018 - Abnormal operating performance Category III | | |
|---|---|---|
| **Points** | **Voltage (% of nominal voltage)** | **time (s)** |
| **Under-Voltage default trip curve** | | |
| LV_P1 | 0,00 | 0,00 |
| LV_P2 | 0,00 | 1,00 |
| LV_P3 | 50,00 | 1,00 |
| LV_P4 | 50,00 | 10,00 |
| LV_P5 | 70,00 | 10,00 |
| LV_P6 | 70,00 | 20,00 |
| LV_P7 | 88,00 | 20,00 |
| **Over-Voltage default trip curve** | | |
| HV_P1 | 120,00 | 0,00 |
| HV_P2 | 120,00 | 12,00 |
| HV_P3 | 110,00 | 12,00 |

The settings above describe the following voltage trip curves.




This voltage trip curves comply with the trip times as per IEEE 1547-2018 and IEEE 1547a-2020.

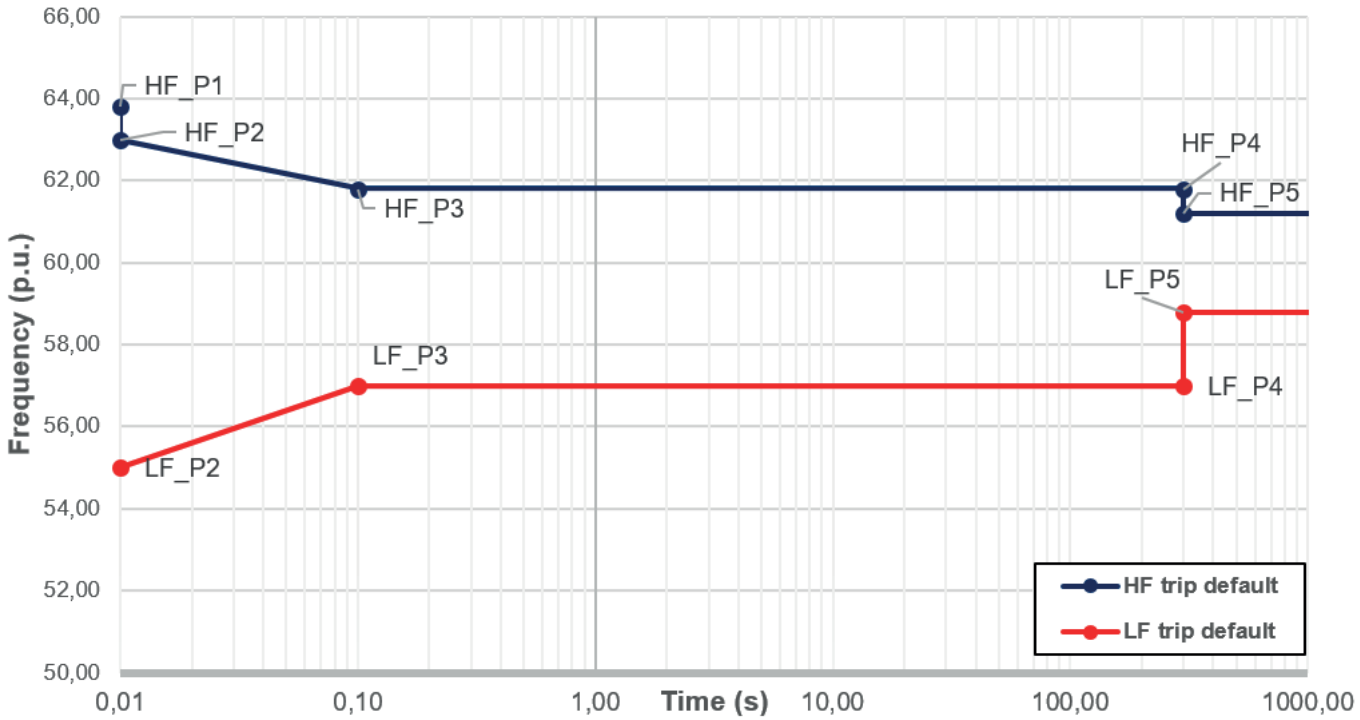
The IEEE 1547-2018 and IEEE 1547a-2020 define the ranges of adjustability ( in brackets {…}) , provided in table X.x.x.

| IEEE 1547-2018 – Abnormal operating performance Category III | | |
|---|---|---|
| **Threshold** | **Voltage (% of nominal voltage)** | **Clearing time (s)** |
| OV2 | 120 {fixed} | 0.16 {fixed} |
| OV1 | 110 {110 ÷ 120} | 13.0 {1.0 ÷ 13.0} |
| UV1 | 88 {0.0 ÷ 0.88} | 21.0 {2.0 ÷ 50.0} |
| UV2 | 50 {0.0 ÷ 0.50} | 2.0 {0.16 ÷ 21.0} |

### Frequency Trip settings

The frequency default trip settings are specified in the table X.x.x

| IEEE 1547-2018 - Abnormal operating performance Category III | | |
|---|---|---|
| **Points** | **Frequency ( Hz )** | **time (s)** |
| **Under-Frequency default trip curve** | | |
| LF_P1 | 55,00 | 0,00 |
| LF_P2 | 55,00 | 0,01 |
| LF_P3 | 57,00 | 0,10 |
| LF_P4 | 57,00 | 299,00 |
| LF_P5 | 58,80 | 299,00 |
| **Over-Frequency default trip curve** | | |
| HF_P1 | 63,80 | 0,01 |
| HF_P2 | 63,00 | 0,01 |
| HF_P3 | 61,80 | 0,10 |
| HF_P4 | 61,80 | 299,00 |
| HF_P5 | 61,20 | 299,00 |




This frequency trip curves comply with the trip times as per IEEE 1547-2018 and IEEE 1547a-2020.

The IEEE 1547-2018 and IEEE 1547a-2020 define the ranges of adjustability ( in brackets {…}) , provided in table X.x.x..

| IEEE 1547-2018 - Abnormal operating performance Category III | | |
|---|---|---|
| **Threshold** | **Frequency (Hz)** | **Clearing time (s)** |
| OF2 | 62.0 {61.8 ÷ 66.0} | 0.16 {0.16 ÷ 1000.0} |
| OF1 | 61.2 {61.0 ÷ 66.0} | 300.0 {180.0 ÷ 1000.0} |
| UF1 | 58.5 {50.0 ÷ 0.59} | 300.0 {180.0 ÷ 1000.0} |
| UF2 | 56.5 {50.0 ÷ 0.57} | 0.16 {0.16 ÷ 1000.0} |

In addition to the default settings as per IEEE 1547-2018 and IEEE 1547a-2020 Category III, the system can be configured to be compliant with the following predefined requirements, as well:

y.y.y. AVAILABLE DEFAULT CONFIGURATIONS

| |
|---|
| IEEE 1547-2018 abnormal operating performance Category I |
| IEEE 1547-2018 abnormal operating performance Category II |
| CA Rule21 PG&E - SRD UL1741SA-2020 |
| CA Rule21 SCE - SRD UL1741SA-2020 |
| CA Rule21 SDG&E - SRD UL1741SA-2020 |
| HECO Rule14 – SRD IEEE 1547.1-2020 V2.0 |

Settings can be accessed and programmed via SunSpec protocol – DER series models as described in the Tab. X.x.x..

x.x.x. VOLTAGE AND FREQUENCY RIDE-THROUGH AND TRIP SETTINGS SUNSPEC MODELS

| Function | SunSpec reference model |
|---|---|
| Low voltage trip settings | 707 |
| High voltage trip settings | 708 |
| Low frequency trip settings | 709 |
| High frequency trip settings | 710 |

Installers are responsible for setting parameters according to the prescriptions defined in the local utility SRD(s) (Source Requirement Document) depending on the jurisdiction.

Contact SOCOMEC After-Sales Service for further information or other specific settings.

## 15.2. Grid support functions

The system is equipped with the advanced grid support functionality defined in UL 1741 Supplement SA and Supplement SB 3rd Edition and IEEE 1547-2018, listed in the Tab. X.x.x..

The table also includes the default enable/disable status of each function as defined in IEEE 1547-2018 and the means by which the programmable function settings can be accessed and programmed.

The two means available for accessing the functions parameters are the SunSpec protocol – DER Series models and Socomec maintenance tool.

x.x.x. GRID SUPPORT FUNCTIONS

| Scope/Function | Default state IEEE 1547-20181 | SunSpec reference model |
|---|---|---|
| Capability to limit active power | Disabled | 704 |
| Constant power factor mode | Disabled | 704 |
| Voltage-reactive power mode | Disabled | 705 |
| Active power-reactive power mode | Disabled | 712 |
| Constant reactive power mode (Q set) | Disabled | 704 |
| Voltage-active power mode | Enabled | 706 |
| Frequency droop | Enabled | 711 |

1 – Default enable/disable state may change according to the local utility requirements (SRD).

The complete set of available SunSpec models is present in 5.3.1.

## 15.3. Manufacturer’s stated accuracy

The manufacturer’s stated accuracy for voltage, frequency, active power, reactive power and time is available in Tab. x.x.x..

x.x.x. MANUFACTURER’S STATED ACCURACY

| | |
|---|---|
| Voltage | 1%Vn |
| Frequency | 10mHz |
| Active power | 1% Pn |
| Reactive power | 2% Qn |
| Cease to energize time accuracy | 2 cycles (33ms) |
| Trip time accuracy | <100ms |

# 16. RECYCLING INFO

Do not dispose of electrical appliances with normal waste, use separate collection facilities.

Follow local council waste regulations for proper disposal arrangements to reduce the environmental impact of waste electrical and electronic equipment or contact your local government for information regarding the collection arrangements available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging health and wellbeing. Depleted batteries are considered as toxic waste. When battery replacement becomes necessary, only give rundown batteries to certified and licensed waste disposal companies. In accordance with local legislation, it is prohibited to dispose of batteries together with other industrial waste or household refuse.

The crossed-out trash bin symbol is placed on this product to encourage users to recycle components and units whenever possible. Please be environmentally responsible and recycle this product through your recycling facility at the end of its lifetime.

For any questions regarding the disposal of the product, contact local distributors or retailers.

# 17. TECHNICAL DATA

## 17.1. Dimensions and weights

- **C-Cab**

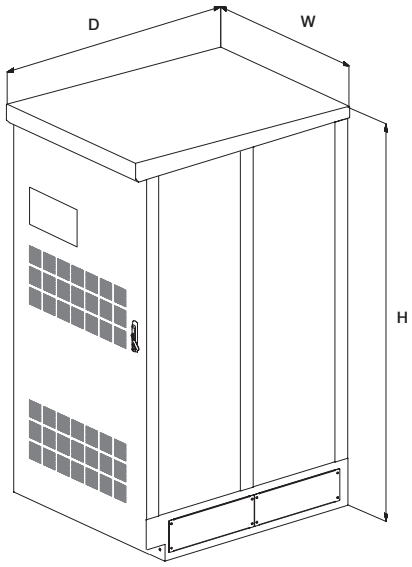



Figure 76. C-Cab dimensions

| | 50 kVA | 100 kVA | 150 kVA | 200 kVA | 250 kVA | 300kVA |
|---|---|---|---|---|---|---|
| Width x Depth x Height | 1000 x 1300 x 2160 mm / 39.4 x 51.2 x 85 inches | | | | | |
| Width x Depth x Height (with packaging) | 1100 x 1400 x 2500 mm / 43.3 x 55.1 x 98.4 inches | | | | | |
| Module weight | 22.5 kg / 49.6 lbs | | | | | |
| Cabinet weight | 972,5 kg<br>2143 lbs | 995 kg<br>2194 lbs | 1017,5 kg<br>2243 lbs | 1040 kg<br>2293 lbs | 1062,5 kg<br>2342 lbs | 1085 kg<br>2392 lbs |

- **B-Cab**

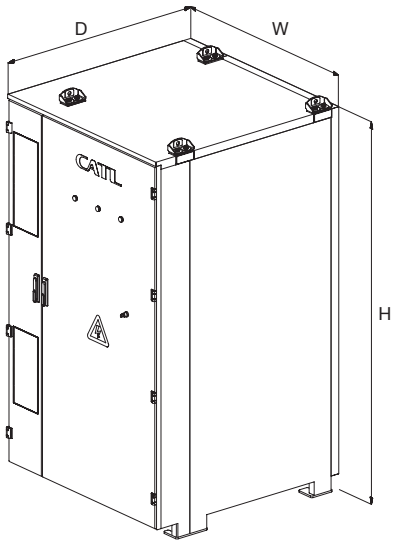



Figure 77. B-Cab dimensions

| | 186 kWh |
|---|---|
| Width x Depth x Height | 1300 x 1300 x 2280 mm / 51.2 x 51.2 x 89.8 inches |
| Width x Depth x Height (with packaging) | 1350 x 1350 x 2480 mm / 53.1 x 53.1 x 97.6 inches |
| Weight | 2180 kg / 4806 lbs |
| Weight (with packaging) | 2230 kg / 4916 lbs |

The batteries are delivered with the modules already mounted.

## 17.2. SUN-HES-L-480

| | **SUN-HES-L-480** (Cabinet) + 1÷6 x **SUN-HES-MOD50** (Power modules) | | | | | |
|---|---|---|---|---|---|---|
| Parameters | 50 kW | 100 kW | 150 kW | 200 kW | 250 kW | 300 kW |
| **DC Section** | | | | | | |
| Range of DC operating voltage | 570÷860 Vdc | | | | | |
| Number of power modules | 1 | 2 | 3 | 4 | 5 | 6 |
| Maximum discharging current | 87 A | 174 A | 261 A | 348 A | 435 A | 522 A |
| Maximum charging current | 82 A | 165 A | 248 A | 330 A | 413 A | 495 A |
| **Battery Section** | | | | | | |
| Li-Ion, Lead acid, Vanadium Redox, SuperCap, LIC, Electronic DC source, Generic Battery. | Supported in combination with PMS.<br>Multi-battery compliancy through SunSpec protocol.<br>Please contact Socomec for specific compatibility evaluation. | | | | | |
| **AC Section** | | | | | | |
| Nominal voltage (Un) | 480 Vac (3ph + N) | | | | | |
| Operating voltage range | 480 Vac +/- 20% (3ph + N) | | | | | |
| Rated frequency (Fn) | 60 Hz | | | | | |
| Operating frequency range | 55 to 65 Hz | | | | | |
| Maximum continuous Active Power | 50 kW | 100 kW | 150 kW | 200 kW | 250 kW | 300 kW |
| Maximum continuous Apparent Power | 50 kVA | 100 kVA | 150 kVA | 200 kVA | 250 kVA | 300 kVA |
| Max continuous unbalanced load (difference between max phase load and min phase load) | 16.7 kW | 33.3 kW | 50 kW | 50 kW | 50 kW | 50 kW |
| On-Grid overload | 110 % - 60 minutes<br>(Ambient temperature dependent) | | | | | |
| Off-grid overload (symmetrical or asymmetrical) | 110 % - 60 minutes, 125 % - 20 minutes, 150 % - 60 seconds<br>(Ambient temperature dependent) | | | | | |
| Rated current | 60 A | 120 A | 180 A | 241 A | 301 A | 361 A |
| Maximum temporary current (overload) | 90 A | 180 A | 271 A | 361 A | 451 A | 541 A |
| Off-grid short-circuit current symmetrical fault | 125 A<br>50 ms | 250 A<br>50 ms | 375 A<br>50 ms | 500 A<br>50 ms | 625 A<br>50 ms | 750 A<br>50 ms |
| Off-grid short-circuit current asymmetrical fault (Phase to Neutral) | 185 A<br>50 ms | 370 A<br>50 ms | 555 A<br>50 ms | 740 A<br>50 ms | 925 A<br>50 ms | 1110 A<br>50 ms |
| Response time | <50ms, from 0 to 90% P/Q | | | | | |
| Output power factor rating | -1.00 to +1.00 | | | | | |
| THDI On-grid mode | < 3% | | | | | |
| THDv Off-grid mode | <1.5 % | | | | | |
| Topology | DC/AC single conversion | | | | | |
| **Parallel operation** | | | | | | |
| On-grid mode | With other SUNSYS C-Cab units (power extension) or any kind of third-party generator (voltage or current type) | | | | | |
| Off-grid mode | With other SUNSYS C-Cab units (power extension) | | | | | |
| | With generic current/power generators | | | | | |
| | Not operated in parallel with other isochronous voltage generators | | | | | |
| **Other features** | | | | | | |
| Islanding detection | Yes | | | | | |
| Black start mode | Yes, capable of supplying the micro-grid from power cut conditions | | | | | |
| Scheduled On-grid to Off-grid mode transition | Yes, seamless transition without power supply break, with additional Socomec equipment. Please contact Socomec for further information | | | | | |
| Unscheduled On-grid to Off-grid mode transition | Yes, with additional Socomec equipment. Please contact Socomec for further information | | | | | |
| Synchronization of the micro-grid with the grid to perform Off-grid to On-grid mode transition | Yes, with additional Socomec equipment. Please contact Socomec for further information | | | | | |
| Integrated Power Management System services | Peak shaving, energy shifting, self-consumption, fuel saving and others on demand. | | | | | |

| | | **SUN-HES-L-480** (Cabinet) + 1÷6 x **SUN-HES-MOD50** (Power modules) | | | | | |
|---|---|---|---|---|---|---|---|
| Parameters | | 50 kW | 100 kW | 150 kW | 200 kW | 250 kW | 300 kW |
| External communication | | SunSpec Ethernet Modbus TCP protocol.<br>Alarm & warning status configurable dry contacts.<br>Unit status light.<br>Emergency power-off connection.<br>Ready to connect to third-party supervision system (EMS, SCADA…). | | | | | |
| **Efficiency** | | | | | | | |
| Max efficiency | Disch. | 96.8 % | 97.6 % | 97.8 % | 97.9 % | 97.9 % | 97.9 % |
| | Charg. | 96.6 % | 97.4 % | 97.6 % | 97.7 % | 97.7 % | 97.7 % |
| Typical efficiency | Disch. | 96.4 % | 97.2 % | 97.4 % | 97.5 % | 97.5 % | 97.5 % |
| | Charg. | 96.1 % | 97.0 % | 97.2 % | 97.3 % | 97.3 % | 97.3 % |
| **Main Auxiliary Voltage** | | | | | | | |
| Rated voltage | | 208 V 3ph (187÷229 V) | | | | | |
| Rated frequency | | 60 Hz (55÷65 Hz) | | | | | |
| **Main Auxiliary consumption** | | | | | | | |
| Max PCS control circuits consumption | | 76 W / 110 VA | | | | | |
| Consumption during operation (W/o heating) | | 450 W / 1130 VA | | | | | |
| Consumption on standby (W/o heating) | | 150 W / 850 VA | | | | | |
| Max PCS heating consumption (extreme climatic conditions) | | 3.0 kW | | | | | |
| PCS auxiliary rated current (w/o battery racks) | | 11 A | | | | | |
| Max CATL battery control circuits consumption | | 216 W /516 VA (No. 6 racks) | | | | | |
| Max CATL battery heating/cooling consumption (extreme climatic conditions) | | 3.0 kW per rack (Max. No. 6 racks) | | | | | |
| PCS auxiliary rated current (with battery racks) | | 25 A (1 B-Cab) / 36 A (2&3 B-cabs) / 50 A (4 B-Cabs) / 62 A (5&6 B-Cabs) | | | | | |

| | |
|---|---|
| **General data** | |
| Operating ambient temperature | -20 °C to +45 °C<br>+45 °C to +50 °C with power derating |
| Storage temperature | -20 °C to +60 °C |
| Relative humidity | 4 % to 100 % non-condensing |
| Cooling/heating system | Air forced, smart cooling/heating |
| Acoustic noise at 1 m | 64.8 dB |
| Altitude | Max 1000 m, >1000 m as per IEC 62040-3 |
| Pollution class in accordance with UL 840 and IEC 60664-1 | Pollution class 3 |
| Over Voltage Category (OVC) in accordance with UL 840 and IEC 60664-1 (AC terminals) | OVC IV |
| Enclosure rating | NEMA 3R / IP55 |
| Environmental category | Outdoor |
| **Dimensions and Weight** | |
| Dimensions (L x D x H) | 1000 x 1354 x 2150 mm |
| Weight (without modules) | Max. 990 kg |
| Power module weight | 22.5 kg |

| Certifications | |
|---|---|
| Safety | UL 1741 3rd Edition revision September 20, 2021<br>STANDARD FOR SAFETY Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources |
| | CSA C22.2 No. 107.1-16<br>Power conversion equipment |
| | ANSI/CAN/UL 9540:2020<br>STANDARD FOR SAFETY Energy Storage Systems and Equipment |
| EMC | FCC Part 15, Subpart A/B - Class A<br>Radio frequency devices: measurement of disturbance voltage. |
| Grid Code | IEEE 1547-2018, IEEE 1547a-2020<br>IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces |
| | IEEE 1547.1-2020<br>IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces |
| | UL 1741 3rd Edition Supplement SA (September 28, 2021)<br>Grid support utility interactive equipment |
| | UL 1741 3rd Edition Supplement SB (September 28, 2021)<br>Grid support utility interactive inverters and converters based upon IEEE 1547-2018 and IEEE 1547.1-2020 |
| | California RULE 21<br>Generating Facility Interconnections<br>(PG&E - May 31, 2018, SCE - April 8, 2021, SDG&E - May 19, 2021) |
| | HECO Rule 14H Service Connections and Facilities on Customer's Premises using the range of adjustments defined in SRD-UL1741 SA V1.1<br>Hawaiian Electric IEEE 1547.1-2020 SRD V2.0 |
| Software | UL 1998<br>Standard for Software in Programmable Components |
| Other standards | UL 1741 CRD dated March 8th, 2019<br>Power Control of Distributed Energy Resources<br>Available ESS Operating Modes: Unrestricted Mode, Export Only Mode, Import Only Mode, No Exchange Mode |
| | EN 60068-2-30:2015<br>Environmental testing<br>Part 2: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) |

### Additional data for CSA compliance

| SUN-HES-L-480 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Maximum current unbalance according CSA22.2 107.1-16 | | 0.11% | | | | | |
| Short circuit current according CSA22.2 107.1-16 | Initial phase-phase | 112 A | 224 A | 336 A | 448 A | 560 A | 672 A |
| | Initial three-phase | 125 A | 250 A | 375 A | 500 A | 625 A | 750 A |
| | Peak phase-phase | 151 A | 302 A | 453 A | 604 A | 755 A | 906 A |
| | Peak three-phase | 149 A | 298 A | 447 A | 596 A | 745 A | 894 A |
| | Breaking phase-phase | 113 A | 226 A | 339 A | 452 A | 565 A | 678 A |
| | Breaking three-phase | 125 A | 250 A | 375 A | 500 A | 625 A | 750 A |

# 18. UL9540A

The SUNSYS B-Cab L was tested according to UL 9540A - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, 4th edition.

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