INSTALLATION AND OPERATING 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:

B-Cab:	Battery Cabinet
BESS:	Battery Energy Storage System
BMS:	Battery Management System
C-Cab:	Conversion cabinet
C-Cab Master:	First cabinet of 2 paralleled cabinets
C-Cab Extension:	Cabinet in parallel with C-Cab Master
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-C05 system).

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.
- Possible to install 2 units in parallel per system to reach 550 kVA.

B-Cab

- Lithium-ion battery.
- LFP technology.
- 203 kWh nameplate / rack.
- Liquid cooling thermal management.
- Fire Safety System including fire detection and suppression (smoke detector and heat sensor, aerosol canister, dry pipe and deflagration panel).
- Possible to install up to 6 units in parallel per system to reach 1218 kWh nameplate / rack.

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! 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! 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 should be provided by the installer, except for fuse F1 on the AC side between the contactor and the disconnector, which is already installed.
	Before carrying out any operations read this user manual and its safety instructions carefully, in order to work under safe conditions. Keep this manual safe for future reference.
	If the Battery Energy System (BES) is not supplied by SOCOMEC, overcurrent protection for the BES is to be provided by the installer.
	DANGER! Failure to observe safety standards could result in fatal accidents or serious injury, and damage equipment or the environment.
	CAUTION! 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! 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! Only use accessories recommended or sold by the manufacturer.
	CAUTION! 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 fused voltage supplies can be connected to the unit: 1. DC line – supply from the batteries or other DC sources 2. AC line – supply to/from the grid and/or loads 3. AC line – auxiliary voltage supply (3 phases) 4. AC line – auxiliary voltage supply (1 phase) 5. AC line – auxiliary voltage supply from internal UPS (1 phase)
	DANGER! RISK OF ELECTRIC SHOCK! 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 «11.2. System power off», page 112 for details.
	CAUTION! Before cleaning, performing maintenance work or connecting appliances to the C-Cab, switch it off and disconnect all power sources.
	DANGER! Live device! RISK OF ELECTRIC SHOCK! - Carry out the following steps before C-Cab maintenance: - Disconnect the batteries - Disconnect the AC power supplies - Disconnect the DC disconnection switches (Q2) - Disconnect the AC disconnection switches (Q1 and Q3) - Switch off the UPS - Make sure the system cannot be restarted - Make sure the power supply (AC and DC voltages) has been disconnected
	DANGER! RISK OF ELECTRIC SHOCK! After disconnecting all power sources wait approx. 5 minutes for the complete discharge of the unit. Please note that the BESS batteries and UPS batteries remain dangerous.
	CAUTION! RISK OF BURNS! During operation the casing of the heaters located in the bottom of the machine can reach high temperatures. Do not touch the surfaces!
	CAUTION! The tightening torque for DC and AC terminals must be in accordance with the indication of the present manual and controlled periodically.
	CAUTION! 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! The unit must operate within the ambient temperature range specified. Refer to relevant sections of this manual for limits and additional notes. 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 (167°F) or 90°C (194°F) wire, either copper or aluminum; refer to “Electrical installation” chapter for further details about the suggested AWG size.
	**NOTICE** 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 must be used for calculation of the design currents used in the relevant sections of NEC Article 690 and 705.
	WARNING! 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 For supplemental power control system: “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! 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! Not for residential use.
	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; TUV certificate: CU 72405524 0001
	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!
I	The switch is ON
O	The switch is OFF
	Waiting time before operating
	Protective earth terminal.
	Authorised personnel only.
	No smoking.
	Read the user instructions carefully. Read the user manual before performing any operations.

Symbols	Description
	Wear protective gloves.
	Wear safety shoes.
	Wear protective goggles.
	In the event of contact with the eyes, wash immediately with plenty of water and call a doctor. 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. Do not connect the C-Cab to batteries that are not approved; this may cause serious damage to the equipment. 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. For any further information, contact Socomec.

2.3. Important risks associated with BESS

2.3.1. Hazardous Voltage

Hazardous Voltage

- High AC voltages at PCS input.
- High DC voltages, 760 VDC at PCS output, 760 VDC at Battery output terminals

Consequence

- Electric shock or Electrocution, Fire, Explosion

Avoidance

- Access should be restricted and only granted to individuals who are both qualified and authorized.
- The guards and barriers for the equipment should always be kept in their designated positions.
- The Personal Protective Equipment (PPE) used should be suitable for both the task at hand and the equipment being used.

2.3.2. Arc Flash Fault

An arc fault is a dangerous electrical problem that occurs when electrical current unintentionally flows through an unintended path, creating an electric arc. This arc generates high levels of heat, which can easily ignite surrounding materials, such as insulation, and could result in an electrical fire.

Arc Fault

- An arc fault occurs when there is a breakdown in insulation or an unintended contact between high-voltage conductors. This causes an electrical discharge to travel through the air gap between the conductors.

Consequence

- Arc fault creates an electrical explosion.
- An arc fault creates intense light and heat referred to as arc flash, that is produced during an electrical explosion.
- Pressure wave caused by the tremendous temperatures of the arc flash is known as arc blast.

Avoidance

- Access should be restricted and only granted to individuals who are both qualified and authorized.
- Restricted access.
- The guards and barriers for the equipment should always be kept in their designated positions.
- The Personal Protective Equipment (PPE) used should be suitable for both the task at hand and the equipment being used.

2.3.3. Arc Flash Hazard Boundary

The Arc Flash Hazard Boundary is a safety guideline used in electrical systems. It establishes the closest safe distance that one can be from conductors or circuit parts that are energized and could potentially cause an arc flash. This boundary is a key part of electrical safety protocols, as it helps to pinpoint areas that could be dangerous and ensures that workers are informed about these risks. This means that this boundary is designed to keep people at a safe distance from any parts of the system where an arc flash could occur, thereby reducing the risk of electrical accidents.

The boundary is calculated based on the incident energy that could be released during an arc flash, measured in calories per square centimeter (Cal/cm^2). The higher the incident energy, the greater the potential for injury and the larger the arc flash boundary see Figure 1.

The National Fire Protection Association (NFPA) recommends defining three boundaries to minimize risk of electrical injuries:

Arc Flash Boundary: This is the furthest boundary from the exposed equipment. It's the distance where a worker without appropriate Personal Protective Equipment (PPE) would receive second-degree burns. It's calculated to 1.2 calories/cm^2 of incident energy.

Limited Approach Boundary: This is the boundary closer to the energized equipment. Within this boundary, it is still possible to be exposed to a shock hazard. Appropriate PPE should be worn by qualified workers in this space.

Restricted Boundary: This is the area closest to the live, exposed equipment. In order to pass this boundary, you must be a qualified worker with the proper training and PPE.

These boundaries are crucial for ensuring safety when working with or around energized electrical equipment.

See Figure 1 for a pictorial view of the arc flash boundaries.

	WARNING! Reduce the risks, do not work on live equipment or live parts.

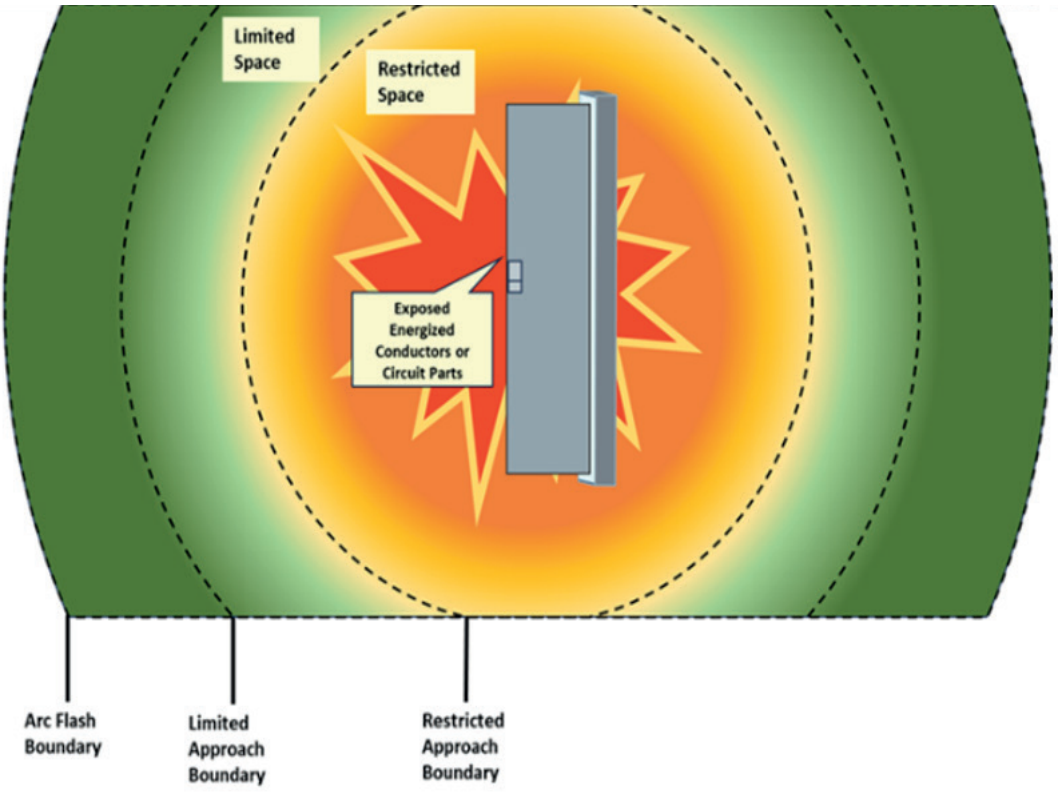


Figure 01. Arc Flash Hazard Boundary

2.3.4. Arc Flash

The diagram above Figure 1 illustrates the arc flash hazard boundary. This boundary indicates the potential for high energy development in the event of a fault. It's crucial to adhere to safety protocols when operating around electrical equipment. This includes turning off and applying a lockout to all power sources before working on the equipment.

Without the correct Personal Protective Equipment (PPE), you should not cross the restricted approach boundary. According to the National Fire Protection Association (NFPA) 70E standard, the arc flash boundary is estimated based on the incident energy level that could cause second-degree burns to personnel. The hazard boundary is then defined based on this estimation.

2.3.4.1. C-Cab AC Power Arc Flash

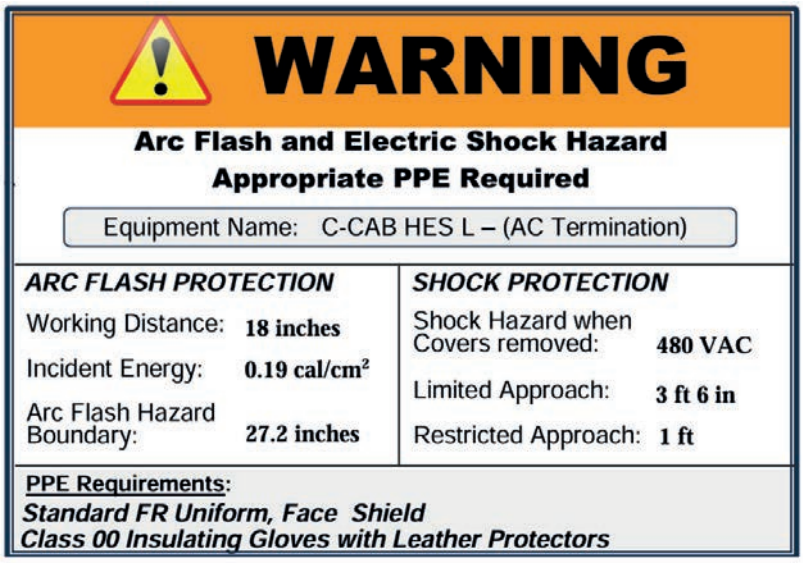


Figure 02. C-Cab AC Power Arc Flash Warningy

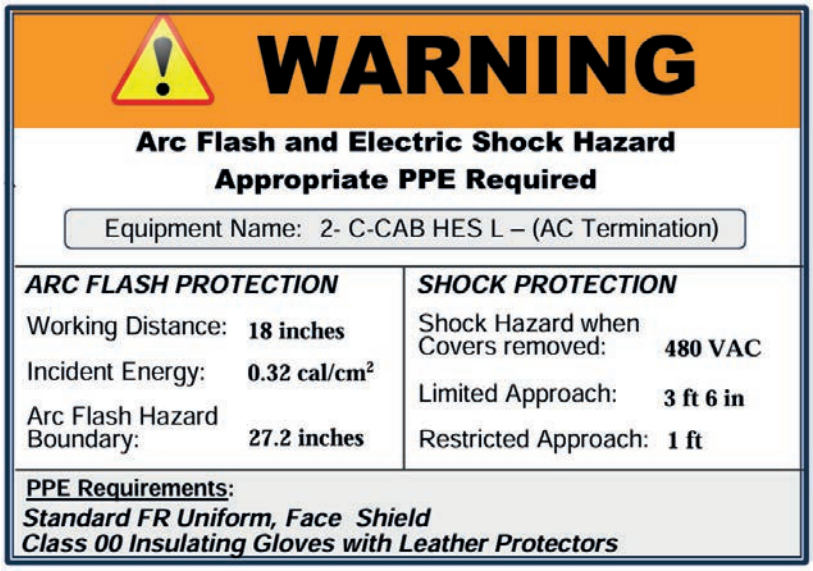


Figure 03. Paralleled C-Cabs AC Power Arc Flash Warning

	WARNING! Arc Flash Only authorized, adequately trained Energy Storage personnel with proper Personal Protective Equipment (PPE) should access the system. Do not open or remove protective guards unless you are a qualified person. Reduce the risks, **do not work** on live equipment or live parts.

2.3.4.2. DC Power Arc Flash & B-Cabs Grouping

The amount of incident energy produced by a DC arc flash is directly influenced by the number of battery cabinets, or B-Cabs, integrated into the system. As the number of B-Cabs increases, so does the potential for a more intense arc flash. This relationship is crucial in understanding the safety measures needed when configuring the system.

The provided table illustrates this relationship in detail. It quantifies the arc flash energy associated with various quantities of connected B-Cabs, offering a clear view of how system configuration impacts arc flash intensity. By studying this table, one can make informed decisions about system configuration and safety protocols to minimize the risk and impact of DC arc flash incidents.

Table 1 - DC Arc Flash & B-Cabs

Number of B-Cabs	Arc Flash incident Energy [Cal/cm^2]	Arc Flash Protection Boundary [mm/inch]	PPE Category Recommended
1	0,6	218.5/8.6	1
2	1,21	308/12.16	1
3	1,81	378.4/14.9	1
4	2,41	437/17.2	1
5	3,01	489/19.23	1
6	3,62	535.2/21.1	1

Ensure that you are equipped with the appropriate level of protective gear suitable for the task at hand. This includes not only physical protection but also mental preparedness. Thoroughly plan the task, anticipate all possible scenarios, and be prepared to respond effectively.

It's crucial to avoid working on a system while it's live or operational. This is a fundamental safety rule to prevent exposure to dangerous levels of energy. However, in situations where working on a live system is unavoidable, extra caution is necessary, especially when in close proximity to live components. In such cases, the energy exposure can surpass the listed arc flash boundary, posing a significant risk.

Understanding these guidelines and adhering to them can significantly reduce the risk.

Do not work on a live system.

Without the correct Personal Protective Equipment (PPE), you should not cross the restricted approach boundary. According to the National Fire Protection Association (NFPA) 70E standard, the arc flash boundary is estimated based on the incident energy level that could cause second-degree burns to personnel. The hazard boundary is then defined based on this estimation.

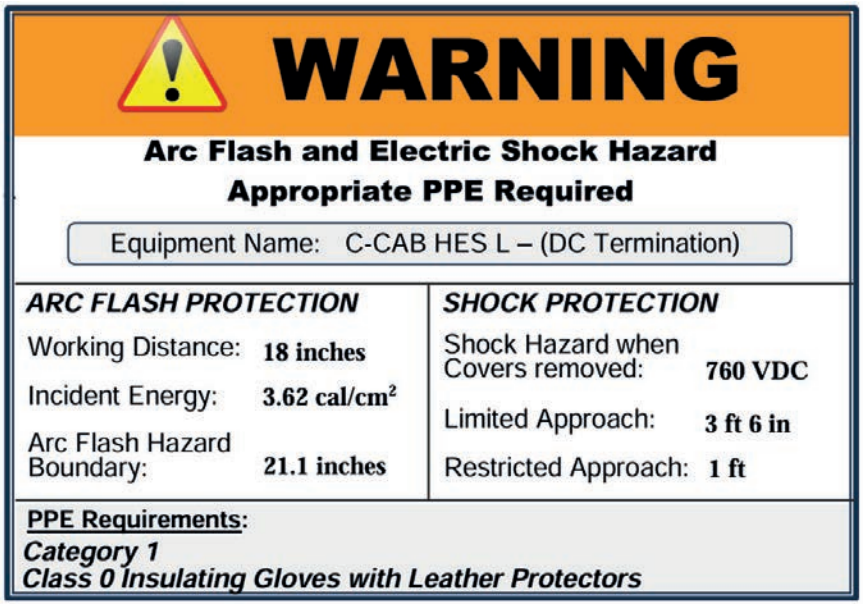


Figure 04. C-Cab DC Power Arc Flash Warning

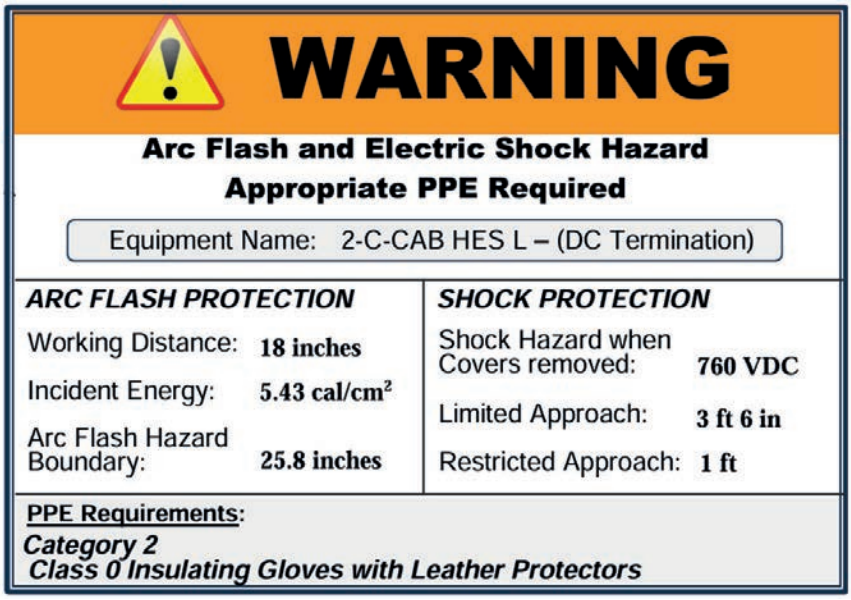


Figure 05. Paralleled C-CABs DC Power Arc Flash Warning

	WARNING! Arc Flash Only authorized, adequately trained Energy Storage personnel with proper Personal Protective Equipment (PPE) should access the system. Do not open or remove protective guards unless you are a qualified person. Reduce the risks, **do not work** on live equipment or live parts.

2.3.5. Personal Protective Equipment (PPE)

The individual carrying out a task is accountable for that task. If any tasks are being performed that are deemed prohibitive, at the very least, Personal Protective Equipment (PPE) of Category 1 should be utilized. For any task that needs to be done, the authorized personnel should conduct a risk assessment and choose the suitable level of PPE required.

PPE CATEGORY 1	PPE CATEGORY 2	PPE CATEGORY 3	PPE CATEGORY 4
Minimum Arc Rating of 4 cal/cm²	Minimum Arc Rating of 8 cal/cm²	Minimum Arc Rating of 25 cal/cm²	Minimum Arc Rating of 40 cal/cm²
Arc Rated Clothing: • AR long-sleeve shirt and pants, or AR coverall • AR face shield, or AR flash suit hood • AR jacket, parka, rainwear, or hard hat liner (as needed)	**Arc Rated Clothing:** • AR long-sleeve shirt and pants, or AR coverall • AR flash suit hood, or AR face shield and AR balaclava • AR jacket, parka, rainwear, or hard hat liner (as needed)	**Arc Rated Clothing:** • As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants • AR flash suit hood • AR gloves • AR jacket, parka, rainwear, or hard hat liner (as needed)	**Arc Rated Clothing:** • As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants • AR flash suit hood • AR gloves • AR jacket, parka, rainwear, or hard hat liner (as needed)
			
Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Heavy-duty leather gloves • Leather footwear (as needed)	**Protective Equipment:** • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Heavy-duty leather gloves • Leather footwear	**Protective Equipment:** • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Leather footwear	**Protective Equipment:** • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Leather footwear

Figure 06. PPE Categories and Protection Ratings

2.4. 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.

	Note that the battery self-discharges even if the system is not operating or if the battery itself is not connected. Therefore, it is important to monitor the voltage (which reflects the state of charge) of the battery when disconnecting it and to carefully follow the discharge process. Once the discharge reaches a value that is too low (2.8V), the battery cannot be reconnected without a complex and specific intervention.

2.5. 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: From the web interface, the user has the possibility to reset the alarms and to change the configuration of the local EMS. SUNSYS HES L control is carried out in Modbus TCP. Therefore it is highly recommended to limit the hosts allowed to access the system. These access restrictions can be implemented by: - 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. - When commissioning the energy storage system, Socomec technicians configure it to limit access in accordance with the information provided by the customer.

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 as an alternative to a generator in the event of a grid failure, power quality anomalies, or during life safety and emergency load case.

The SUNSYS HES L system comprises two cabinets, namely, a converter cabinet for AC/DC bidirectional conversion (referred to as C-Cab L) and the battery cabinet (B-Cab L). 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.

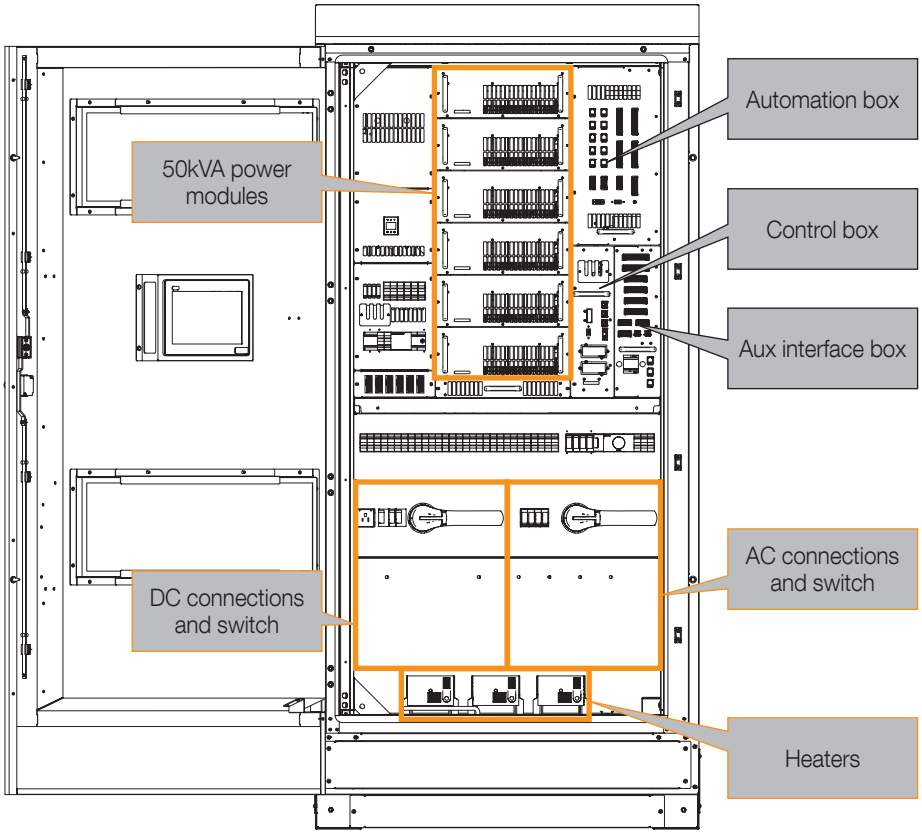


Figure 07. SUNSYS C-Cab L composition

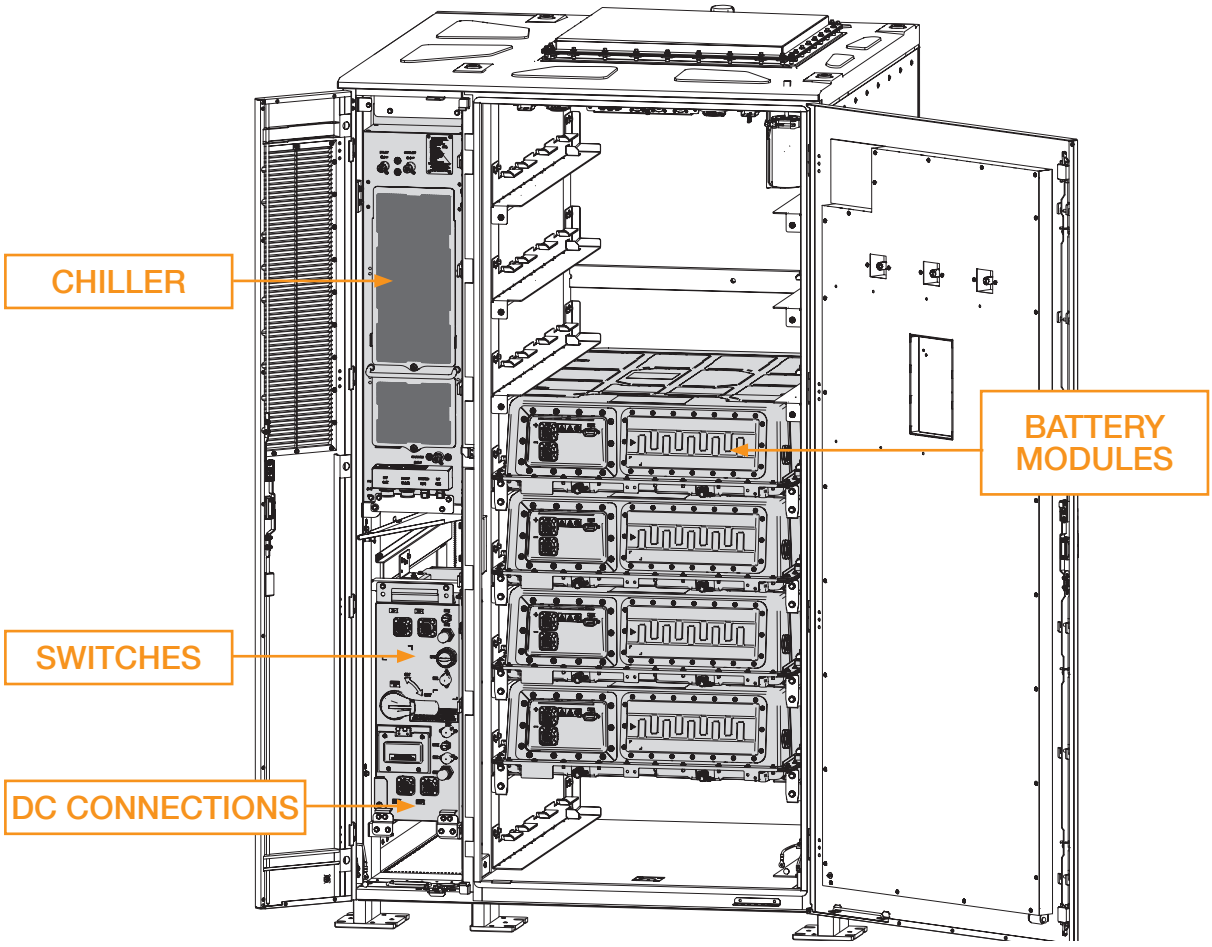


Figure 08. SUNSYS B-Cab L composition

3.2. Models

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

C-Cab L available power sizes:

Frame 1: one SUNSYS C-Cab L Master from 50kVA to 300kVA, modulo 50kVA

Frame 2: one SUNSYS C-Cab L Master + one SUNSYS C-Cab L extension, from 350kVA to 550kVA, modulo 50kVA

Figure 09. SUNSYS C-Cab L Master from 50kVA to 300kVA, modulo 50kVA

Figure 10. SUNSYS C-Cab L Master + one SUNSYS C-Cab L extension, from 350kVA to 550kVA, 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: 203 kWh 4 modules

Figure 11. View of the B-Cab

The batteries can not be padlocked, they are locked using 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 components that can be installed inside the unit.

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

ID	Item	C-Cab	C-Cab Extension	Description
1	PC tablet	Yes	No	Support plate for a computer
2	Parallel board	Yes	Yes	"Parallel board" to parallelize Master and Extension C-Cabs
3	Auxiliary supply SPD	Yes	Yes	SPD for auxiliary power supply Required if the Overvoltage Category of the supply line is OCV>II
4	SPD DC	Yes	Yes	SPD for additional protection of the DC input line.
5	UPS	Yes	Yes	UPS for auxiliary line For protection of the auxiliary supply line during service interruptions
6	RCD	Yes	Yes	Residual Current Detector
7	ETH switch	Yes	Yes	Ethernet switch
8	Router	Yes	No	CheckPoint 1570R Ethernet router
9	Wireless 4G modem	Yes	No	Wireless 4G-modem + spare Antenna (Sierra Wireless) 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	No	PMS package (PLC, I/O, relays, commons)
11	Digiware package for PMS	Yes	No	Digiware meters for the PMS (Gateway, U-30, I-35 + probes) to be installed in the C-Cab Master and Digiware meters for the PMS (I-35 + probes) to be installed in the C-Cab Extension
12	Diris AUX power supply measurement	Yes	Yes	Diris B-30 device for AUX power supply measurement
13	Internal HMI for Automation	Option	Yes	Schneider 10" display for the Automation package
14	Data logger	Yes	No	Socomec H-80 Industrial PC
15	Battery control package	Yes	No	CATL battery control devices (MBMU + ETH box)

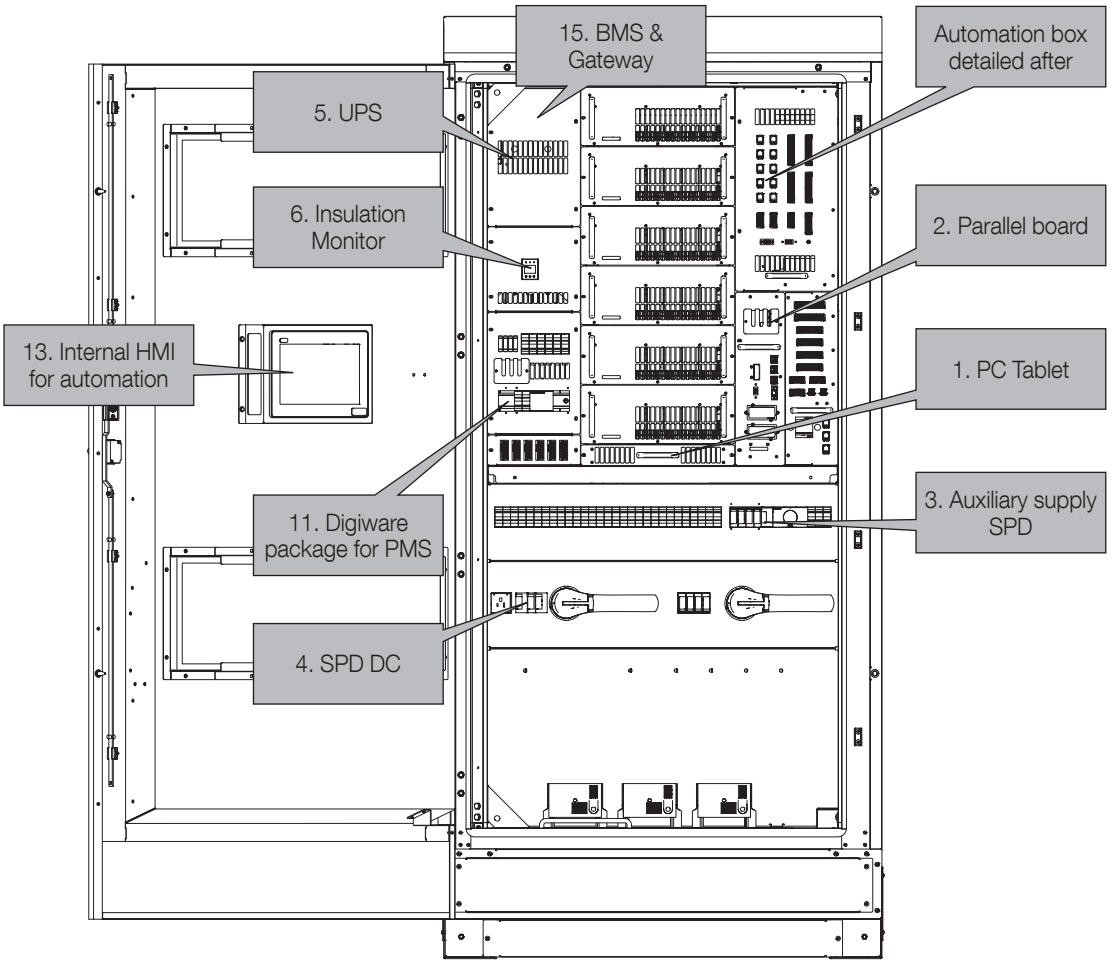


Figure 12. View of the dedicated components inside the C-Cab

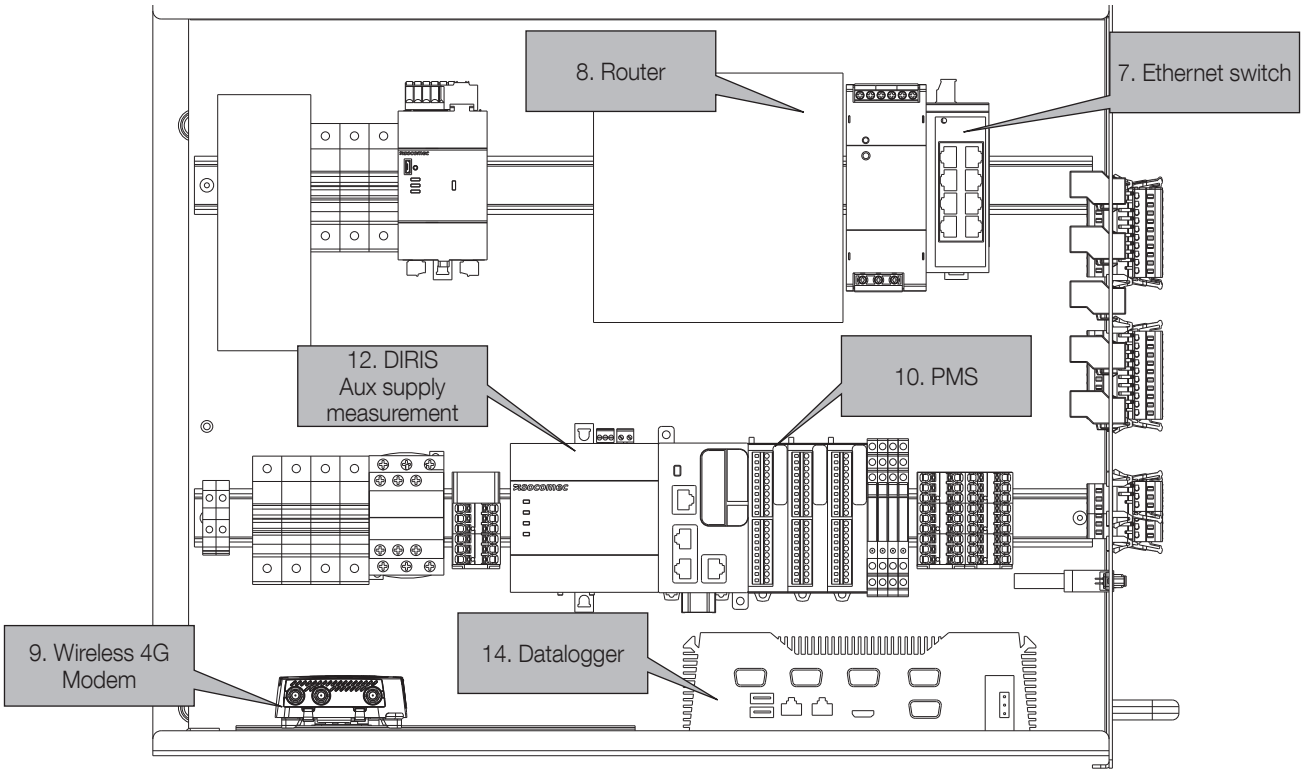
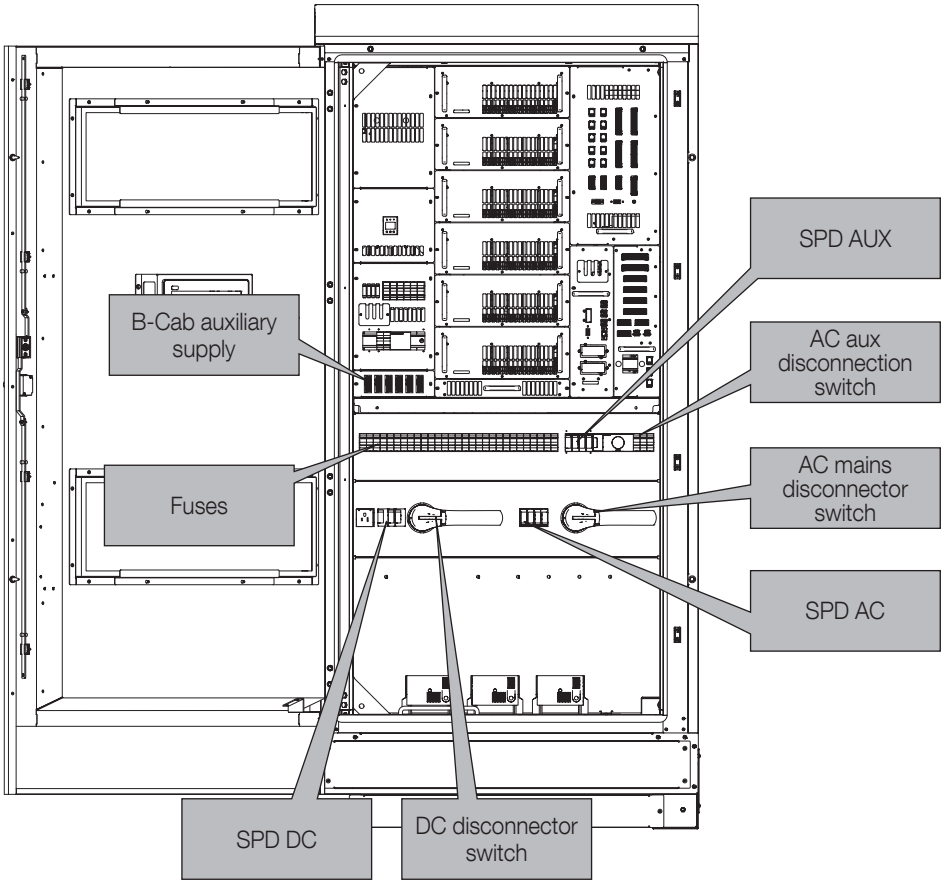


Figure 13. Detailed view of the Automation box

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.



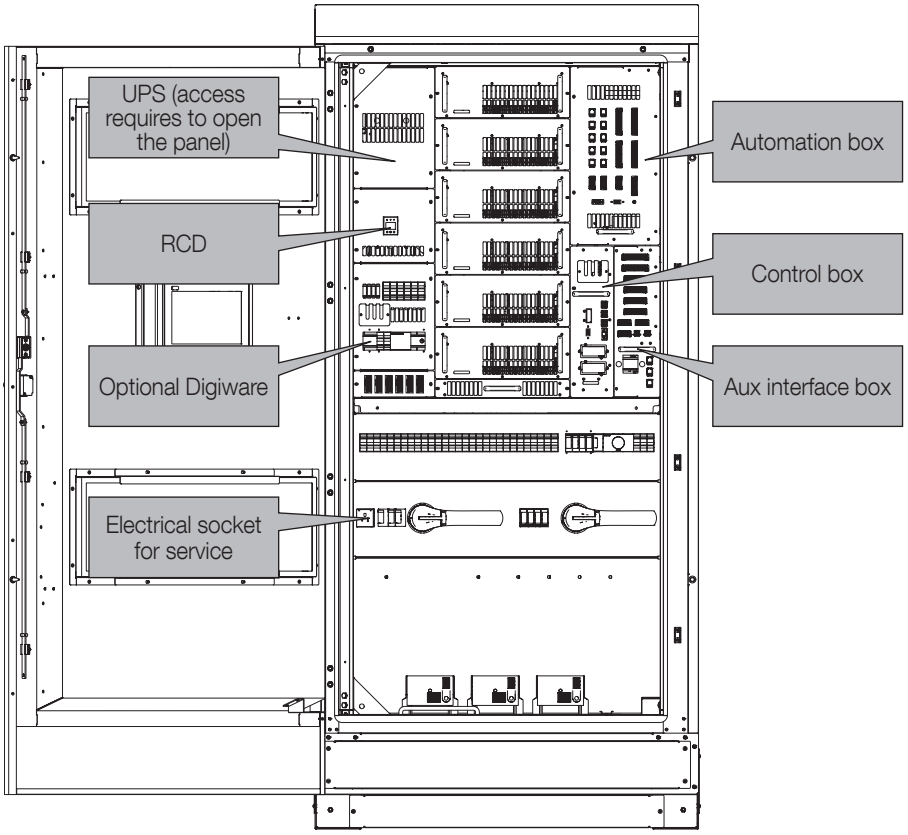


Figure 14. View of the devices accessible from the front of the C-Cab

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).

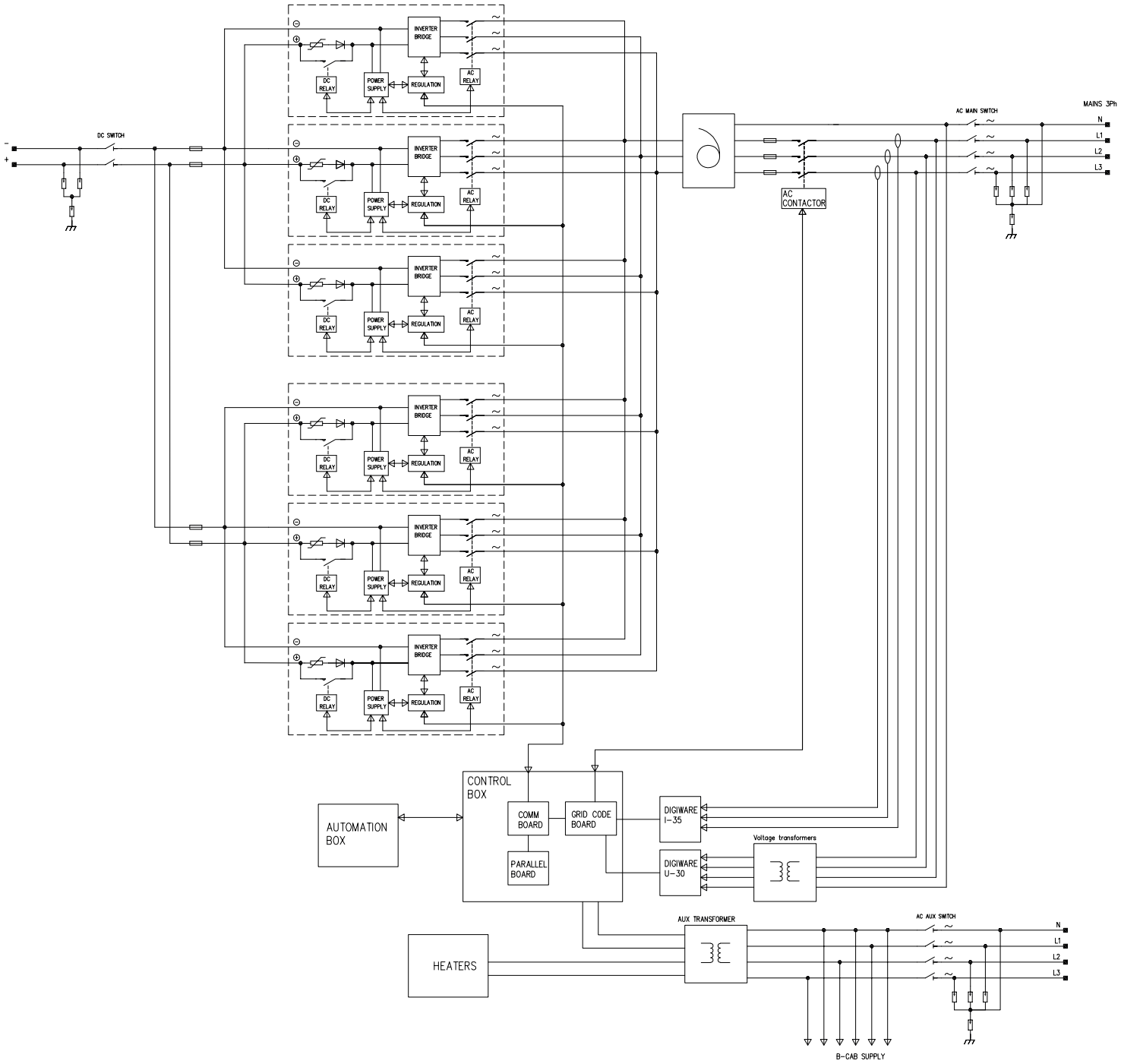


Figure 15. Example of C-Cab layout with autotransformer and options installed

3.6. Modes of operation

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

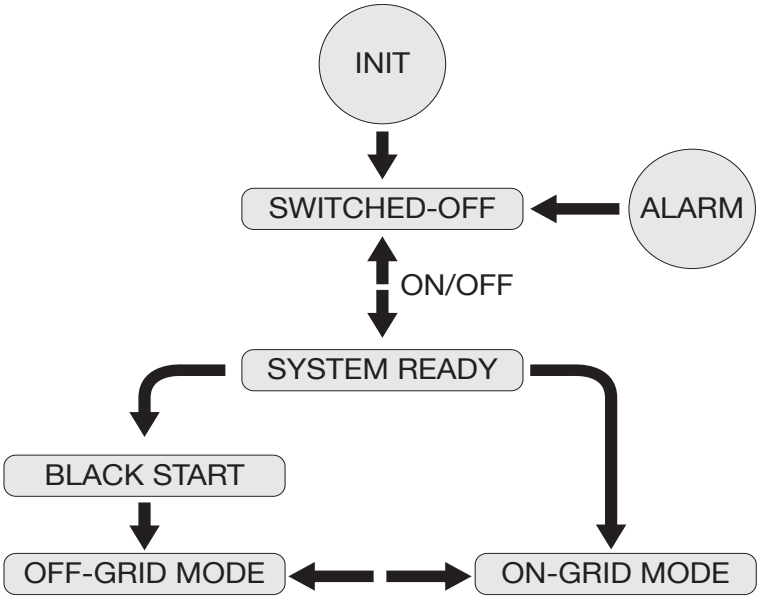


Figure 16. Modes of operation of SUNSYS HES L

3.6.1. On-Grid Mode

SUNSYS HES L is a Grid Follower, meaning output voltage and frequency are imposed by the grid. The C-Cab operates according to active and reactive power set-points, provided by PMS HMI/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 BESS may import active power from Area EPS while charging and may export active power to the Area EPS while discharging.
- **Import Only Mode**: The BESS 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 BESS 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 BESS 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 installation requirements.

SUNSYS HES L is UL3141 OOI (Outline of Investigation) tested with compliance which is the replacement of the UL1741 PCS CRD

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 accurately. The Off-Grid Mode is also called grid-forming mode.

For specific 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 Synchronization card

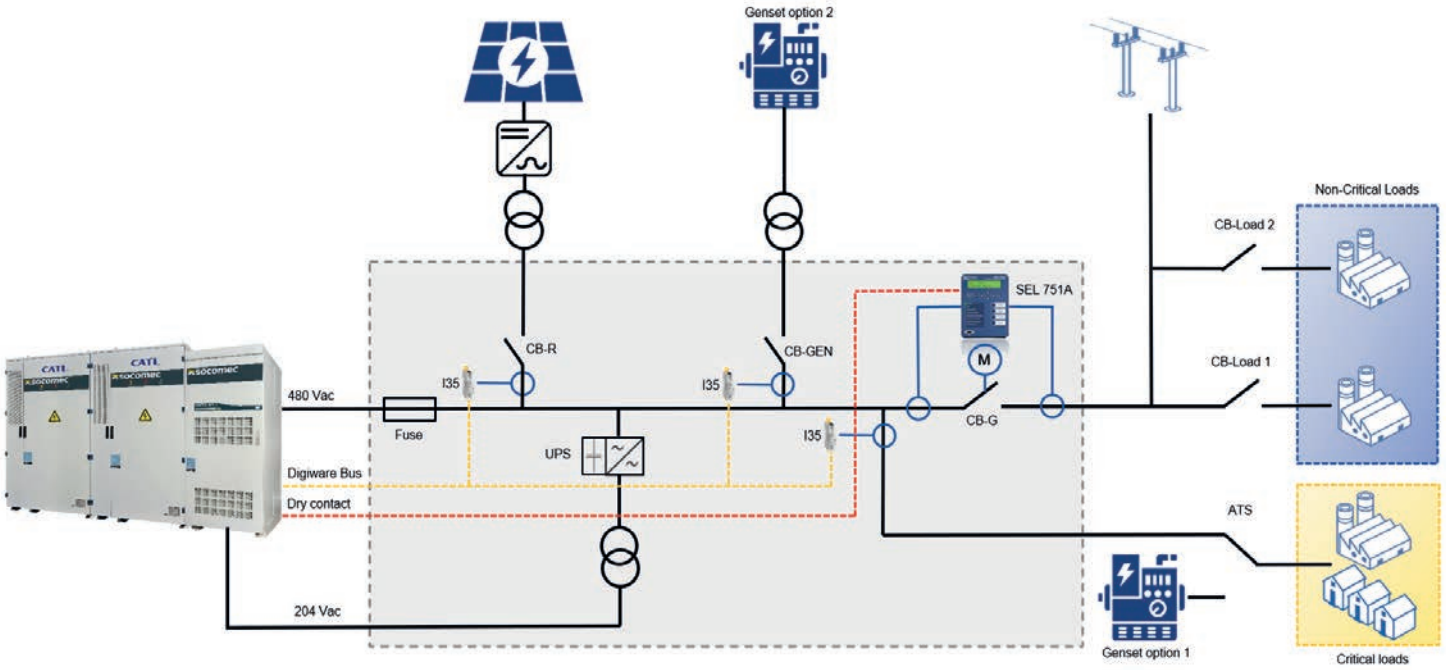


Figure 17. Architecture of the installation in case of operation with Islanding

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

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

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

3.7. Environmental controls

The system is designed for the IP55 , NEMA 3R & C3 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.

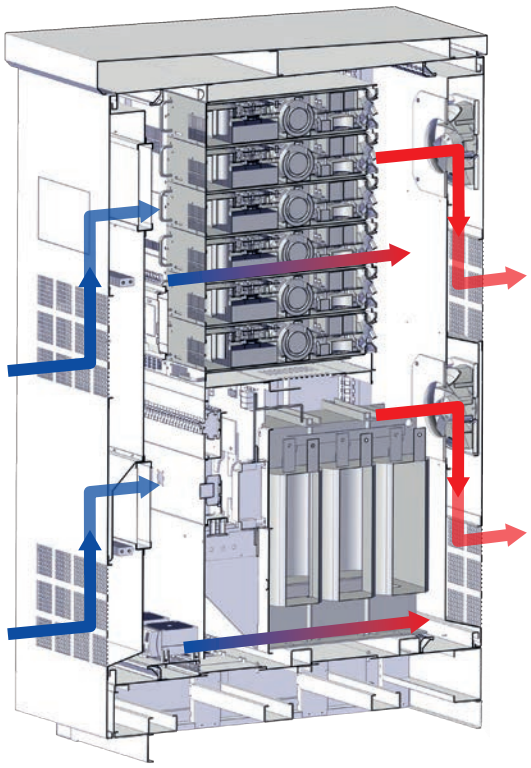


Figure 18. Air flows inside the SUNSYS C-Cab L

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)

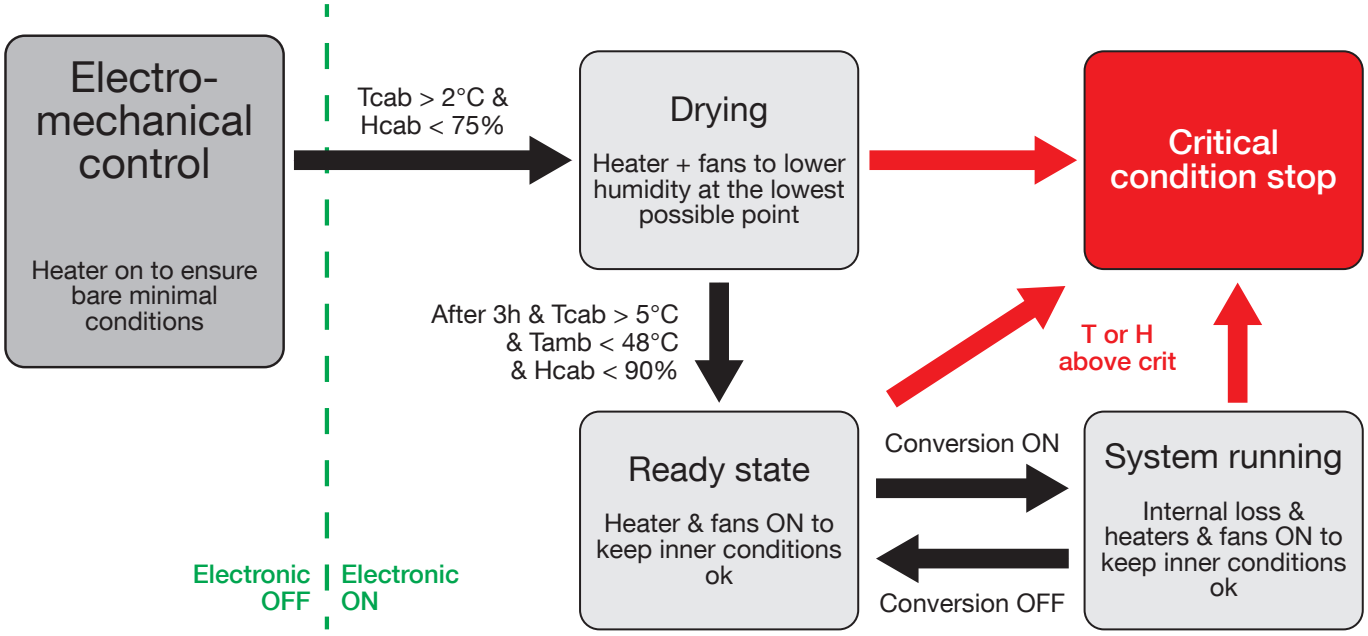


Figure 19. Environmental logic diagram

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 Pre-commissioning period.

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 Power Management System (PMS) acts as the controller for the converter and the batteries and its basic interface within the system is illustrated in the following diagram. The PMS derives its operational intelligence to operate the system based on the following:

- Modbus TCP / SunSpec communication to the converter for control 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 data, internal connection.

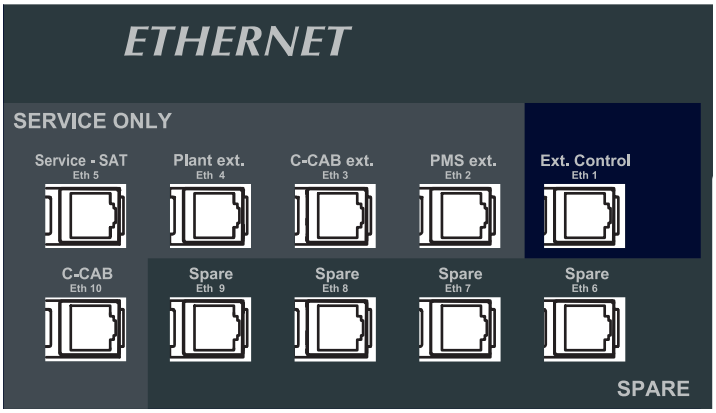


Figure 20. Ethernet connection ports

The PMS enables services like peak shaving, self-consumption, power back-up, genset, photovoltaic, and load management. However, it's important to note that the PMS does not connect with energy markets for dynamic electricity pricing, nor does it provide forecasting capabilities for local production and consumption using machine learning.

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

To ensure optimal conditions during the transport, the system must be transported 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 (-4°F) and +60°C (140°F).

A forklift shall do the unloading of the container.

4.2. Inspection

The cabinets are 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 21. B-Cab aux supply connectors

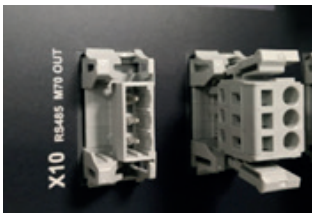


Figure 22. Other plug-in connectors

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.

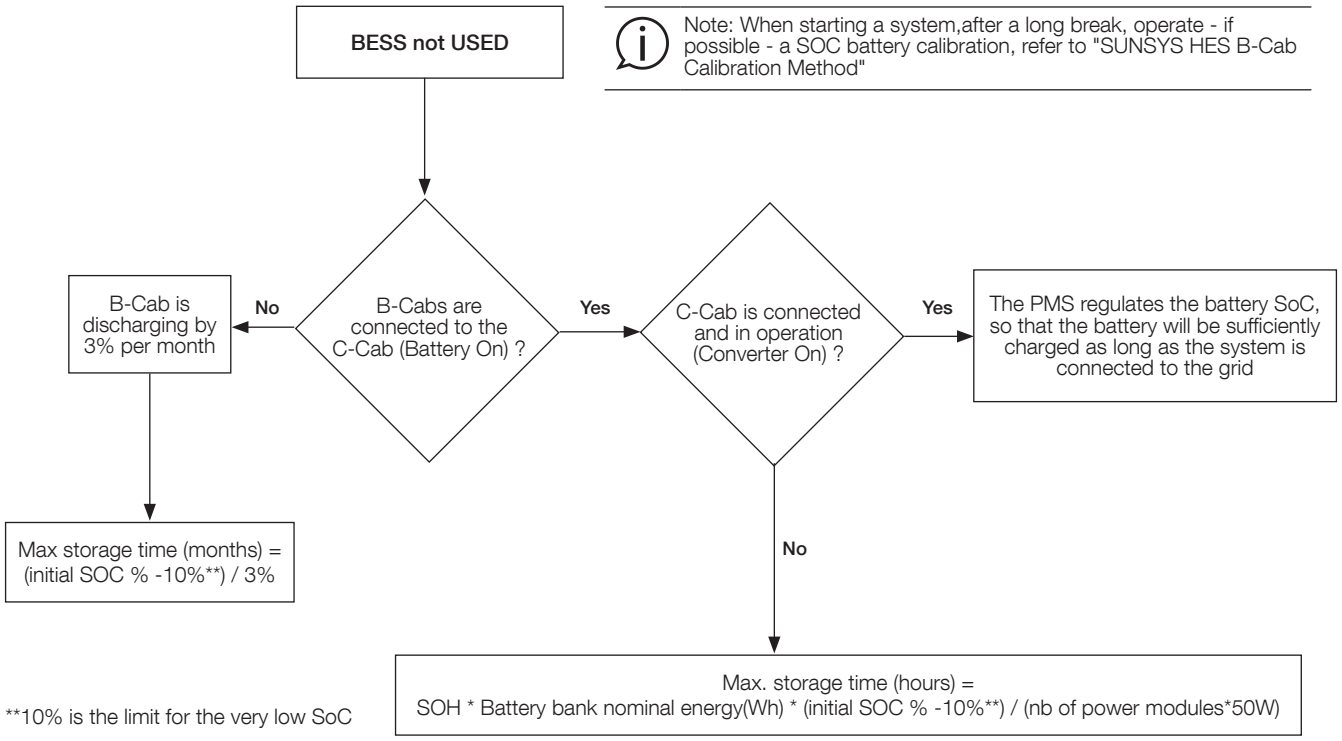
4.3. Storage

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 (68°F +/-37.4°F) with a daily average storage temperature ≤25°C (77°F) 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 exceeding 1 month, please contact Socomec.

If the system hasn't been started up, whether it's already installed at your site or stored in our warehouse (once the title transfer has been completed). The battery's SoC (State of Charge) is required to be tested every 3 months by one of our field engineers to determine if a charge is required to maintain a correct SoC.

4.3.1. Battery storage time



	Note that the battery self-discharges even if the system is not operating or if the battery itself is not connected. Therefore, it is important to monitor the voltage (which reflects the state of charge) of the battery when disconnecting it and to carefully follow the discharge process. Once the discharge reaches a value that is too low (2.8V), the battery cannot be reconnected without a complex and specific intervention.

4.3.2. Long time storage and system repositioning

If after the commissioning the machine must be stored again for a period that exceeds 3 weeks, we need to ensure that the storing condition are acceptable. The idea being to protect the system against aging due to low temperature and high humidity, if the auxiliaries are still present the situation is not a storage.

Note: to perform this procedure you need a long-time storage kit that can be purchased through your Socomec support team.

Step 1 : do a full charge then a full discharge and recharge the battery to 30% SoC

Step 2 : shut down the system completely and open all the switches in the system (AC-DC and AUX in every C-Cab and 1 DC switch in every B-Cab)

Step 3 : place the packs of dessicant (hygroscopic substance used as a drying agent) close to the heater at the bottom of the C-Cab

Step 4 : place the sticker present in the kit on all the air inlet of the C-Cab

Note: once the battery is stored without power supply it will deplete energy at a rate of 3% per month.

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.

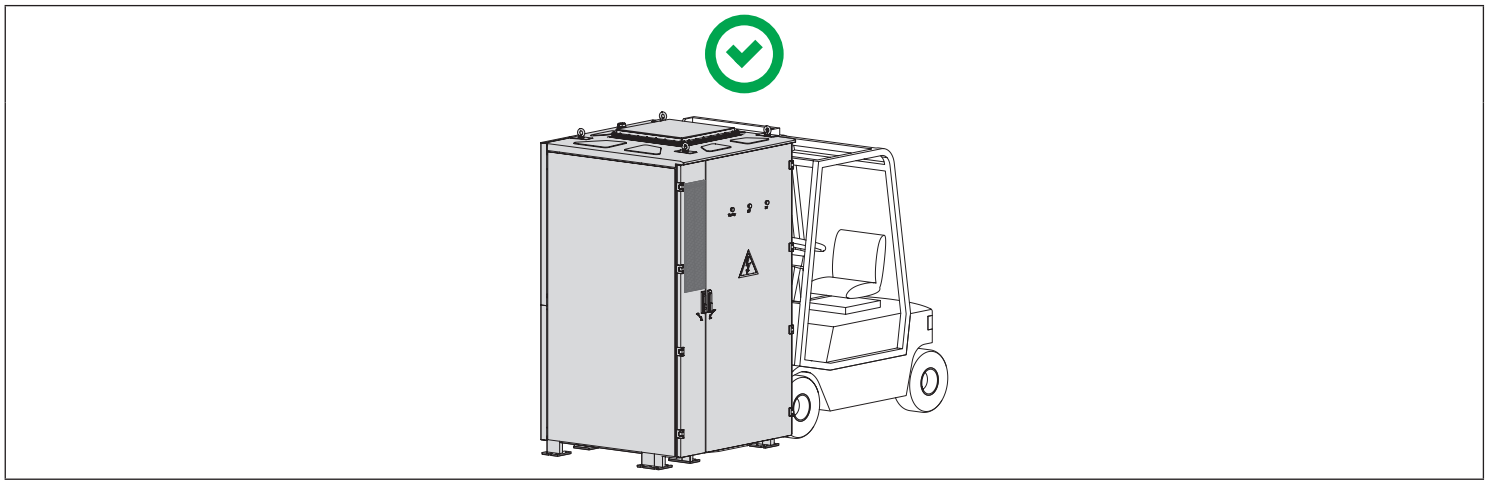
C-Cab and B-Cab are shipped individually mounted on individual pallets.

If you need to transport through a building the minimum opening, with the roof installed, must be 1050mm x 2170mm (41.3 x 85.4in) for the C-Cab and 1350mm x 2330mm (53.1 x 91.7in) 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).

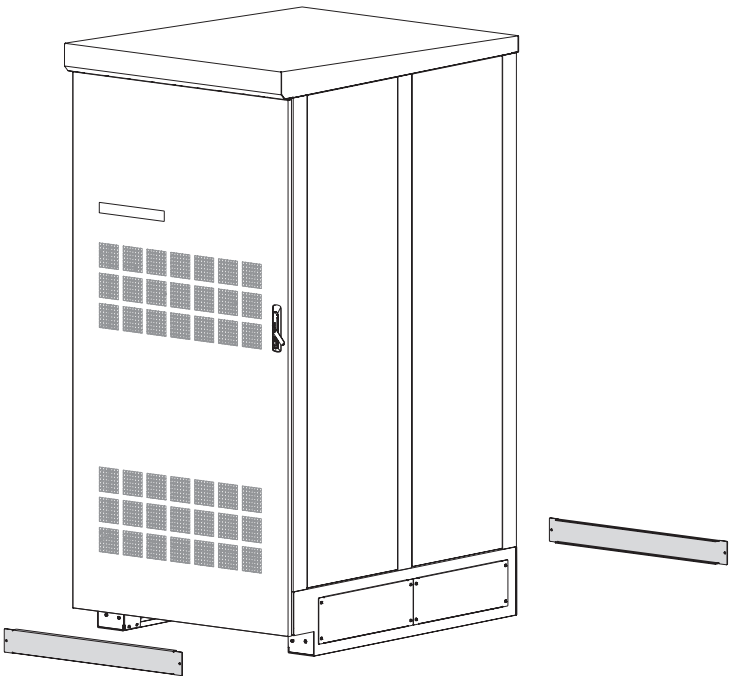


Figure 23. Panels to remove from the C-Cab

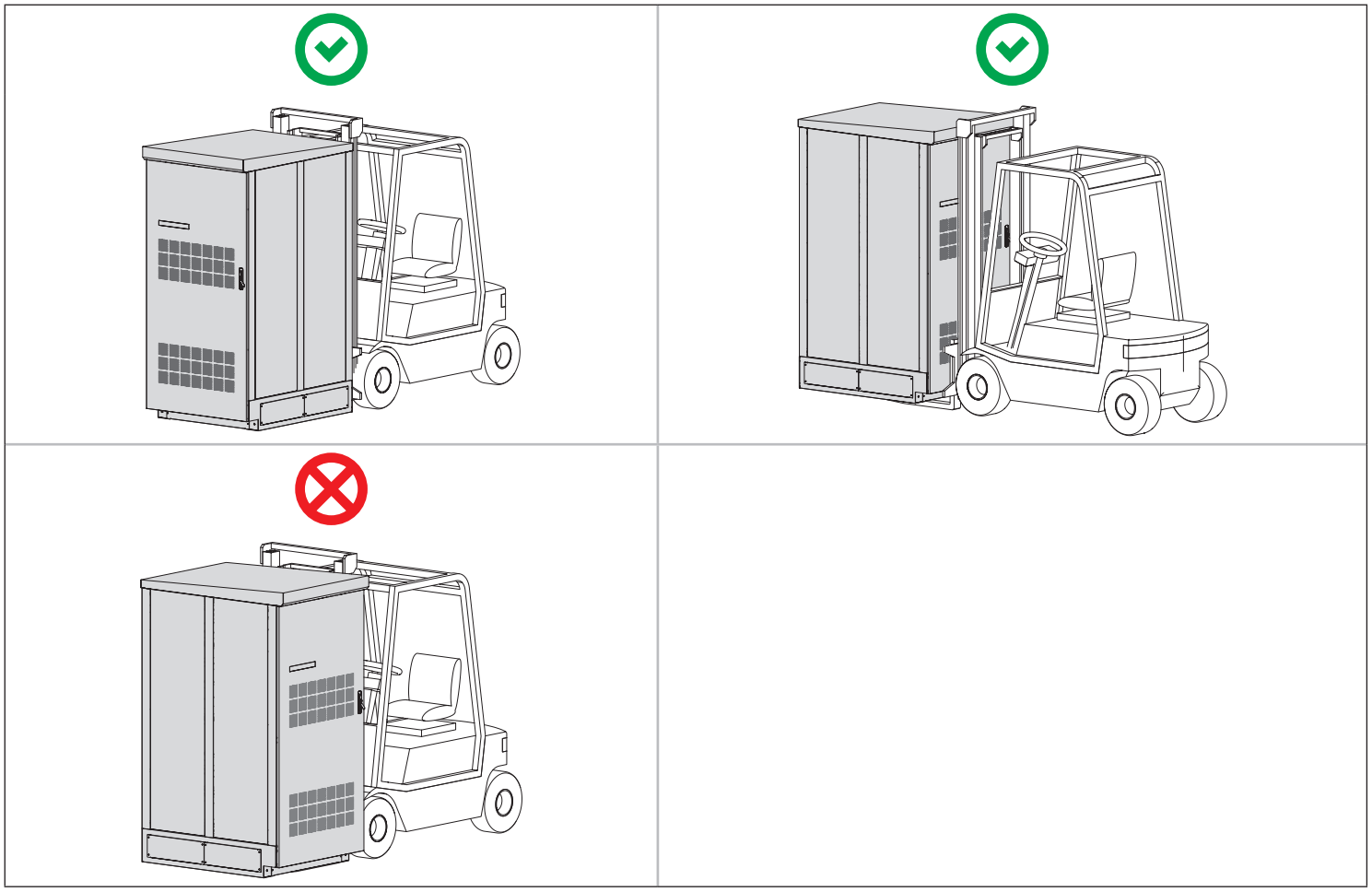


Figure 24. Handling of the unit using pallet truck with 1.30m (4.3ft) long forks

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

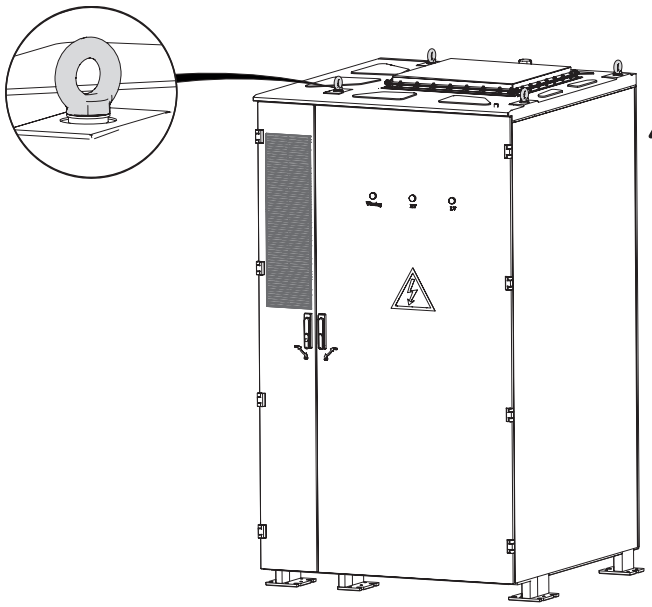
4.6. Overhead lifting

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.

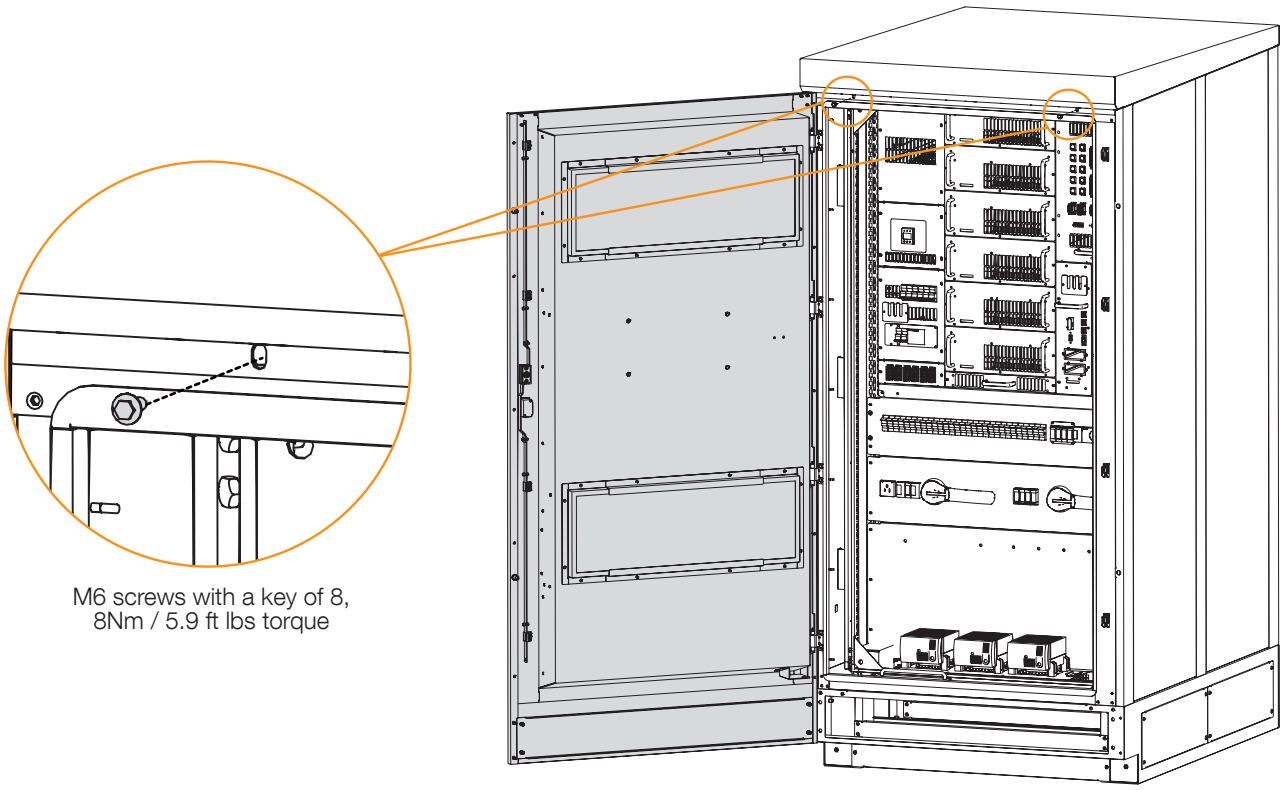
The radius of the hole on the lifting lug is 11mm / 0.43in.



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

Figure 25. 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 26. 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):

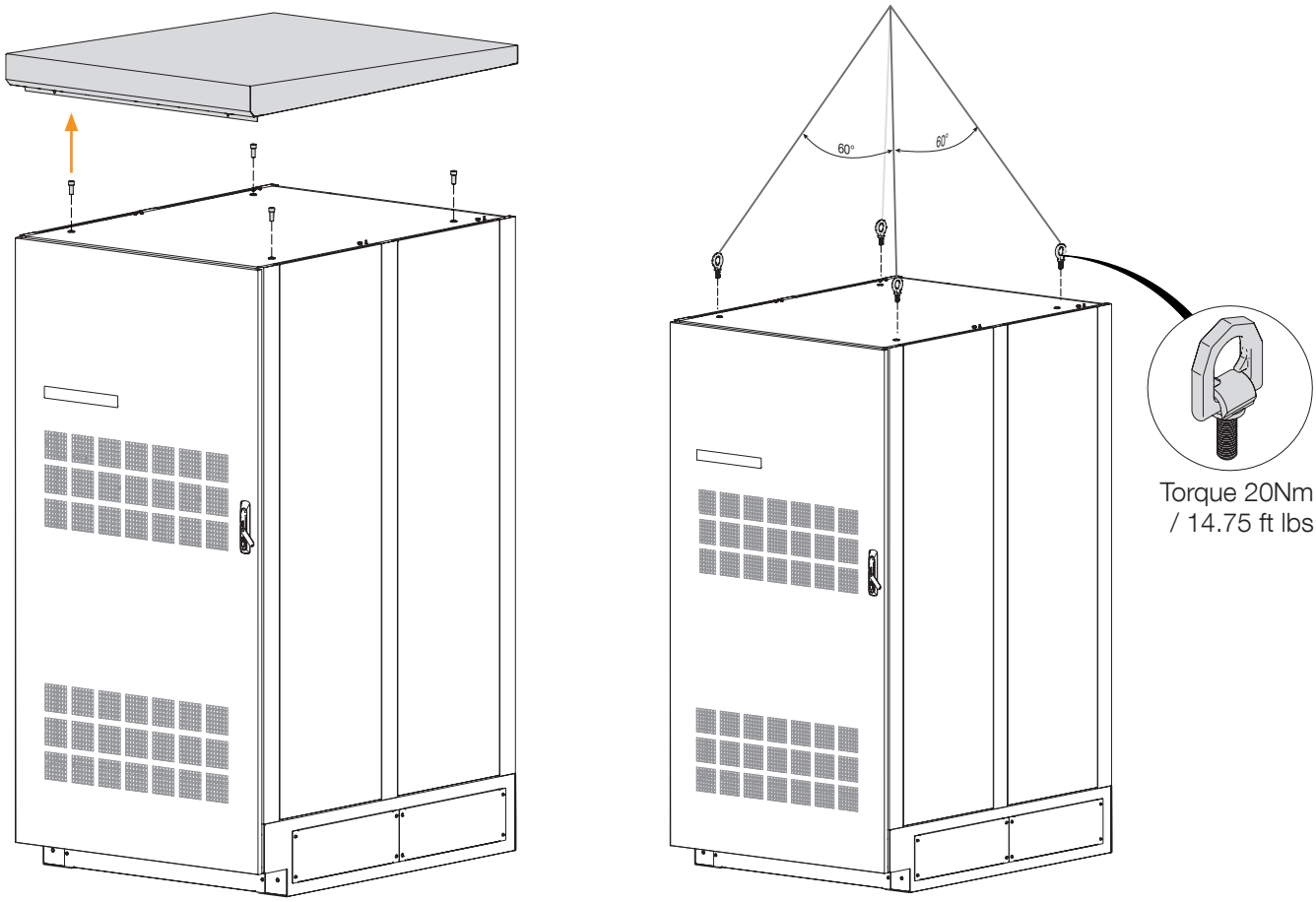


Figure 27. Lifting lugs on top of the C-Cab

- 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.

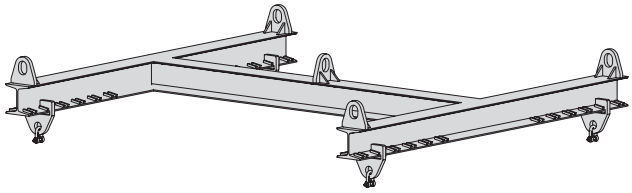


Figure 28. Vertical load spreader

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:
  - 152mm (6in) deep – for SDS* 0.8g;
  - 254mm (10in) deep – for SDS* 1.6g;
  - 254mm (10in) deep – for SDS* 2.5g;
  - 508mm (20in) around the equipment.
- be a non-combustible surface as required by UL1741, NFPA 855, IFC and CFC, 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, NFPA 855, IFC and CFC.

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

Dimensions in/mm

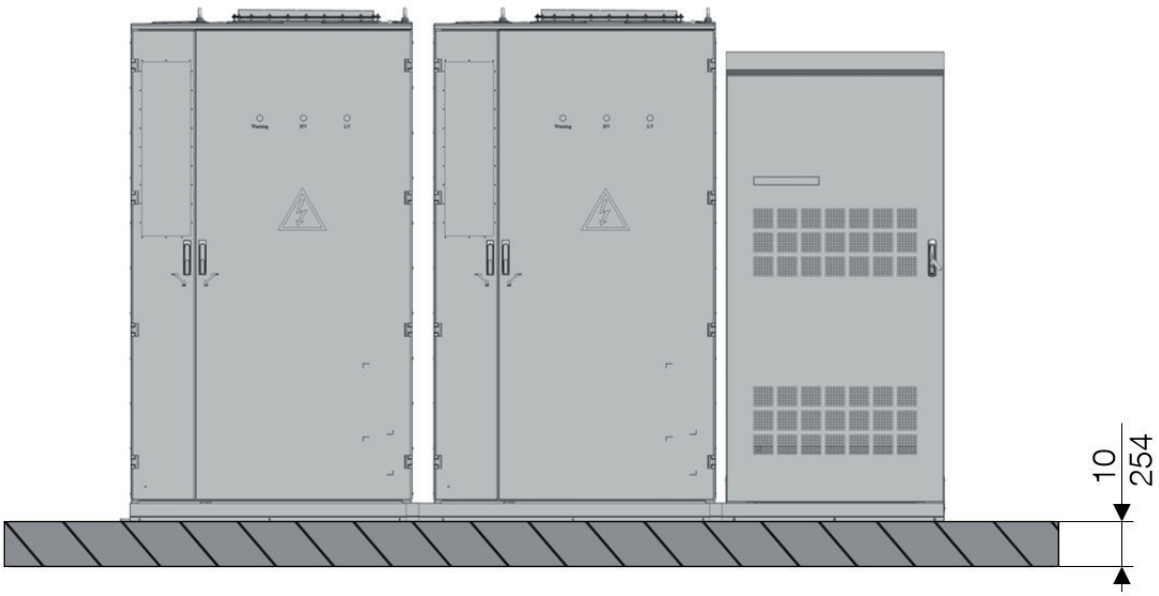


Figure 29. Concrete depth – SDS 2.5

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

- 76.2mm (3.25in) for both C-Cab and B-Cab for SDS 1.5g
- 76.2mm (3.25in) for the C-Cab and 152.4mm (6.5in) for the B-Cab for SDS 2.5g

And the bolts used must sustain the following characteristics:

SDS	Cabinet	Bolt diameter		Embedment lenght		Load			
						Tension		Shear	
		in	mm	in	mm	kip	N	kip	N
0.8g	C-Cab	1/2	12.7	2	50.8	0.6	2669	1	4448
	B-Cab	5/8	15.9	2.5	63.5	0.9	4003	1.4	6228
1.6g	C-Cab	1/2	12.7	2.75	69.9	1.6	7117	1.9	8452
	B-Cab	5/8	15.9	4	101.6	2.4	10676	2.8	12455
2.5g	C-Cab	1/2	12.7	6	152.4	2.8	12455	3	13345
	B-Cab	5/8	15.9	8.5	215.9	4.1	18238	4.4	19572

Dimensions *in*/mm

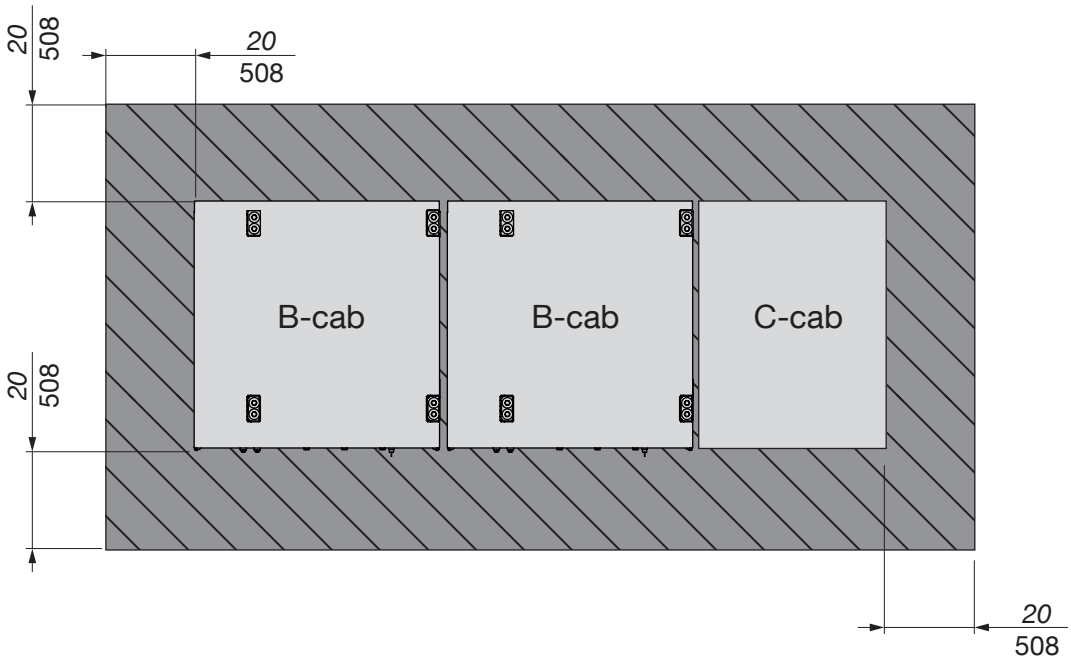


Figure 30. Concrete space around the equipment

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 requirements/recommendations).
Integration check	
1.	Battery and converter are installed in a perfectly levelled ground concrete floor. 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 48). 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. Check the well mounting of the antenna of the Modem in the roof of the C-Cabinet or other localization. Please provide a photo. 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.	Make sure the sensor is accessible to the service teams.
2.	Make sure there is a Digiware current sensor on the load for the CRD function.
Installation environment 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-Cabs.
5.	Check ground connection on the C-Cab.
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-Cab.
4.	Please provide a photo of the Auxiliaries Cable connection of the C-Cab.
5.	Please provide a photo of the DC and auxiliaries Cable connection of the B-Cabs.
6.	For Islanding. Check all connection with devices required by SOCOMEC.
Internet Connection (if no Modem 4G option)	
1.	Check the ethernet connection wiring from your site to the C-Cab.
Sensors	
1.	Check the connection of the Load sensor for CRD function to the C-cab.

5.2.3. IoT prerequisite

IP addresses for communication			
1.	The connection needed has to be characterized as follows: minimum flow = 1600kbits/s (3.5G) 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 BESS 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 BESS or provide DHCP server. If a static IP address is used, please provide a subnet mask and a default gateway.		
Different access			
Functionality	Protocol	Inbound / Outbount	Destinations
Remote access	IKE phases 1 et 2 (UDP port 500)	In/Out	remote-access-ess.socomec.com
	L2TP (UDP port 1701)	In/Out	remote-access-ess.socomec.com
	NAT-Traversal (UDP port 4500)	In/Out	remote-access-ess.socomec.com
	Probing link (UDP port 259)	In/Out	remote-access-ess.socomec.com
	SSH (TCP port 22)	In/Out	smbrelaylb-1.smbrelay.checkpoint.com
	HTTPS (TCP port 443)	In/Out	smbrelaylb-1.smbrelay.checkpoint.com
Update of security policy (firewall and network config)	FW1-ICP-service (vpn cert fetch) (TCP port 18264)	In/Out	security-policy-ess.socomec.com
	Logs (TCP port 257)	In/Out	security-policy-ess.socomec.com
	CPD SIC + policy install (TCP port 18191)	In/Out	security-policy-ess.socomec.com
	CDP_amon (TCP port 18192)	In/Out	security-policy-ess.socomec.com
Datalogging (battery warranty)	HTTPS (TCP port 443)	Out	https://storage.iot.socomec.com
	HTTPS (TCP port 443)	In/Out	ca.iot.socomec.com No stream re-encryptions https (no proxy)
	HTTP (TCP port 80)	Out	ctldl.windowsupdate.com
Meter and system data logging	HTTPS (TCP port 443)	Out	activate.iot.socomec.com 94.125.109.122
	HTTPS (TCP port 443)	Out	streams-mqtt.iot.socomec.com 94.125.105.191 94.125.105.192 94.125.105.193
	MQTTs (TCP port 8883)	Out	streams-mqtt.iot.socomec.com 94.125.105.191 94.125.105.192 94.125.105.193
Network (by default, can be changed on customer demand)	DNS (TCP/UDP port 53)	Out	1.1.1.1 8.8.8.8 9.9.9.9
	NTP (UDP port 123)	Out	0.pool.ntp.org 1.pool.ntp.org

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 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. Use appropriate personal protective equipment (PPE) and follow safe electrical work practices when working in close proximity to live electrical circuits. Ensure all covers and doors are in a closed condition prior to applying power.
	DANGER OF TIPPING IF NOT PROPERLY HANDLED Provide vertical support while moving the unit due to its height and relatively high center of gravity; move slowly with care to avoid tipping. Ensure that lifting devices evenly distribute the load over the base or lifting eyes if used. 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 chapter «7. Positioning», page 51 for requirements and instructions for cable gutter installation.
- The recommended layout for battery cabinets is single connections i.e., cabinets connected in line or back-to-back connection.
- When Division of the State Architect (DSA) approval is required, layout may vary, please refer to chapter «8. Connecting kit installation», page 58 & to the DSA anchorage study (contact us).
- 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 in a C3 environment within 500m (1640ft) 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 chapter «6.2. Clearance distances», page 48 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.

The system shall be installed in accordance with local electrical, building, fire, and other codes or utility requirements as applicable to the installation and equipment, by qualified service personnel in accordance with the installation instructions and appropriate practices.

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.

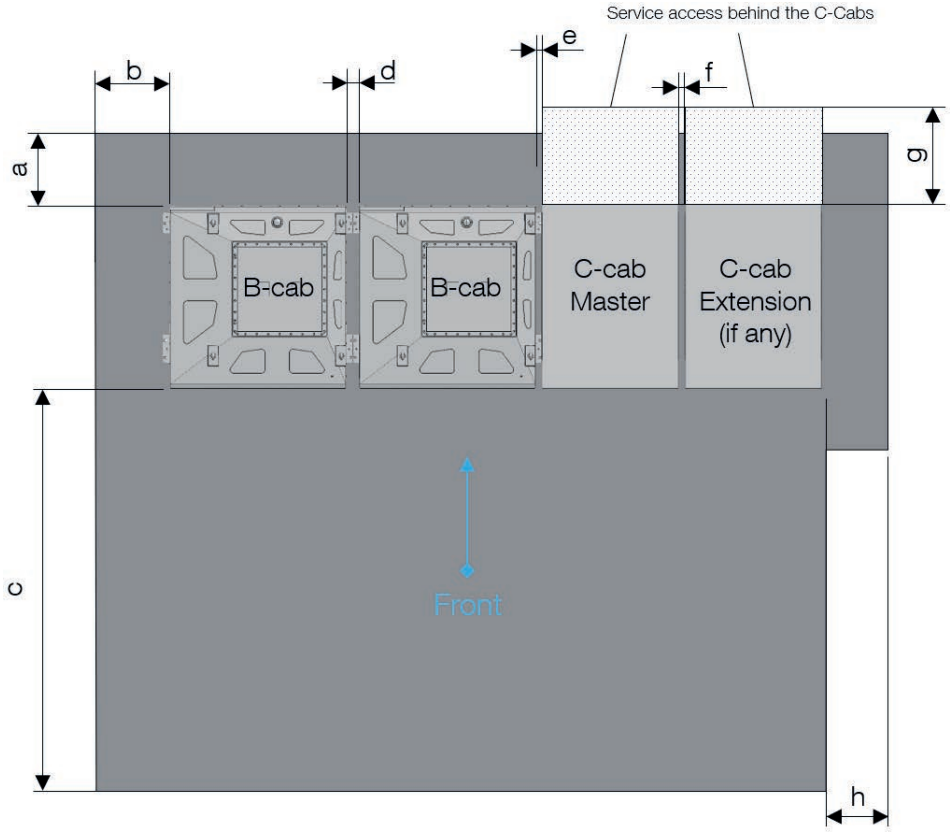


Figure 31. Clearance distances

Minimum clearance distances							
B-Cab rear clearance (a)	B-Cab side clearance (b)	B-Cab front clearance (c)	B-Cab to B-Cab clearance (d)	B-Cab to C-Cab clearance (e)	C-Cab to C-Cab clearance (f)	C-Cab rear clearance (g)	C-Cab side clearance (h)
500 mm / 20 in*	500 mm / 20.0 in	3,000 mm / 118.1 in	100 mm / 3.93 in**	50.8 mm / 2.0 in***	50.8 mm / 2.0 in***	700 mm / 27.6 in****	500 mm / 20.0 in

* 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.

** To enable the installation of the cable gutter please leave 100mm +/-6mm (3.94in +/-0.24in)

*** To enable the installation of the cable gutter please leave 50.8mm +/-6mm (3.94in +/-0.24in)

**** 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.

A minimum clearance distance of 65 cm / 25.6 in must be maintained above the SUNSYS HES L B-CAB. This space is essential to ensure the proper functioning of the deflagration panel located on top of the battery cabinets, allowing for safe and effective operation.

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

WARNING!
The clearances shown here are the minimum technical requirements. In some cases, regional standards might require higher clearances. Check local standards and apply them if they are more demanding.

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 (-4°F / +113°F) without derating +45°C / +50°C (+113°F / +122°F) with derating	
Relative Humidity (non-condensing)	4-100 %	
Max. altitude above sea level	1000 m without derating	
Max. snow load	< 250 kg/m² (51.2 psf)	
Solar Radiation *	< 1090 W/m²	IEC 60721
Saline environment **	> 500m from sea (Class C3)	ISO 9223
Polluted environment (dust)	Pollution degree 3 4S13	IEC 60664-1 IEC 60721-3-4:2019

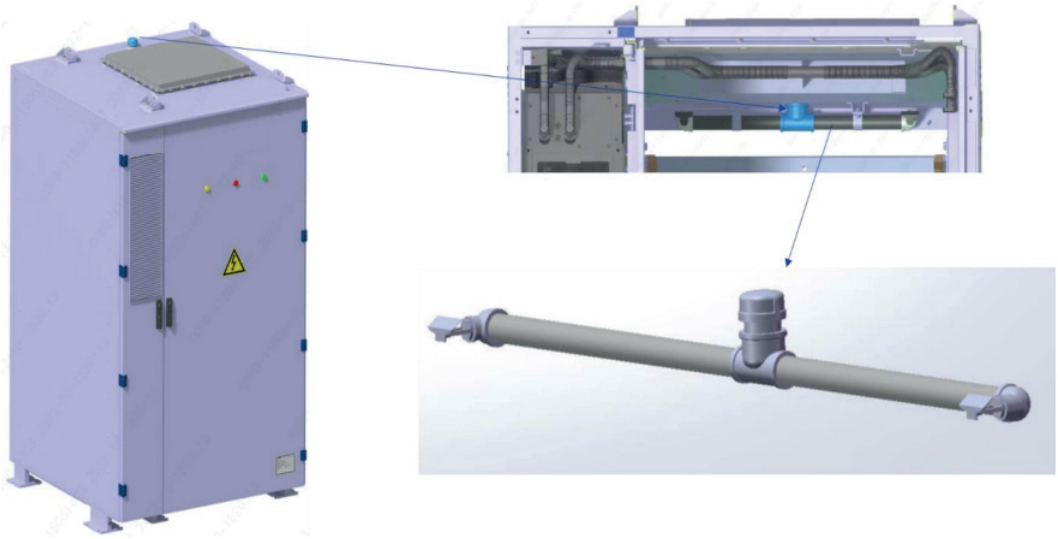
*According to the standard IEC 60721, SUNSYS HES L is designed to solar radiation up to 1090W/m². Above this level, a protection cover shall be installed on the cabinet to reduce solar radiation exposition.
**SUNSYS HES L is designed to be installed in a non-salt air site without any corrosion risk.

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

6.4. Dry Pipe Installation

The water fire protection system is designed to cool the battery pack by spraying water, thereby preventing the spread of fire. This system can supply water through either external water pipes or preset pipes. Typically, the pipe is a dry pipe, meaning it remains empty until activated.

In the event of a fire in the electric cabinet, it is necessary to manually open the water pipe control valve to activate the system. Please note that Socomec does not provide control valves or external piping.



7. POSITIONING

There are two standard 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.

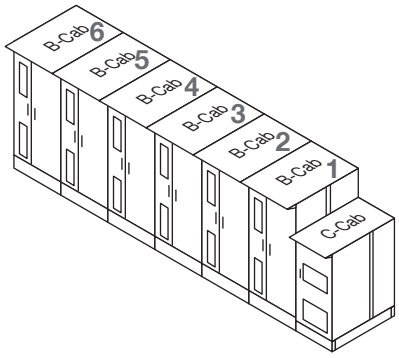


Figure 32. In line installation

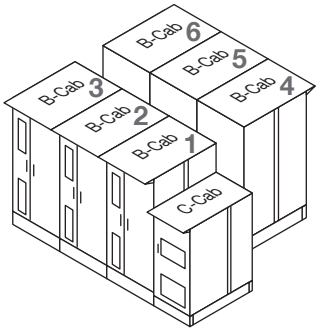


Figure 33. Back-to-back installation

Socomec provides a specific type of installation to comply with the Division of the State Architect (DSA) structural, fire and life safety seismic requirements for BESS:

- In line with 3m (10ft) spacing between 2 sets of 2 B-Cabs L.

See installations below:

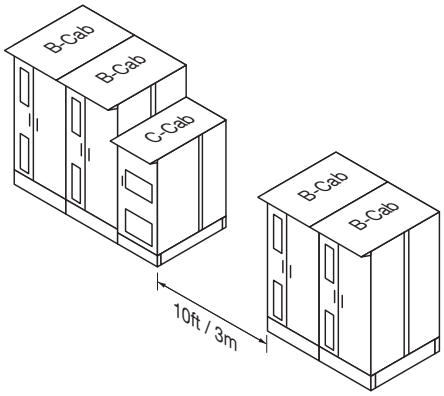


Figure 34. In line with 3m (10ft) spacing DSA installation

- Other layouts, such as back-to-front or front-to-front, can be developed upon request, subject to additional cost and development time.

For these 4 types of installations C-Cabs L and B-Cabs L 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.

WARNING!
These DSA designs have been established with the support of American recognized experts to provide a guide as accurate as possible. This guide provide some indications and recommendations, but it cannot overtake specific requirements coming from the Authority Having Jurisdiction. As standards are subject to change, it is the sole responsibility of the reader to verify compliance with the standards in force.

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):

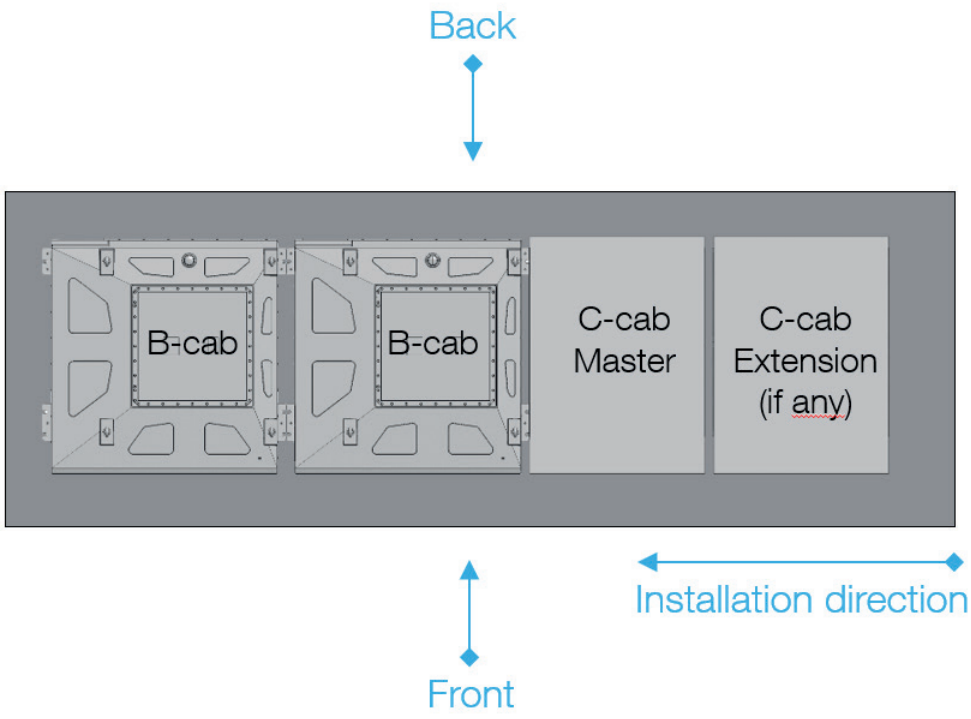


Figure 35. Cabinets order

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.

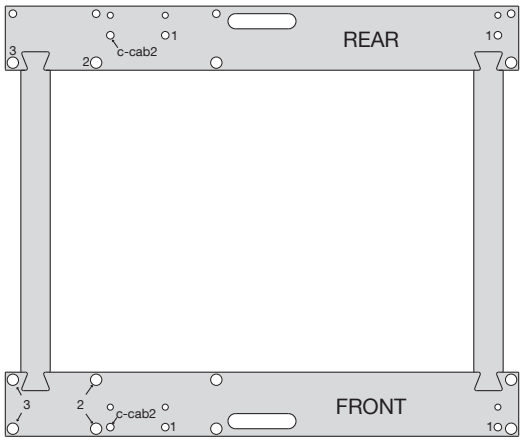


Figure 36. Top view of the drilling template mounted

7.2.1. Installation with only 1 C-Cab (no extension)

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

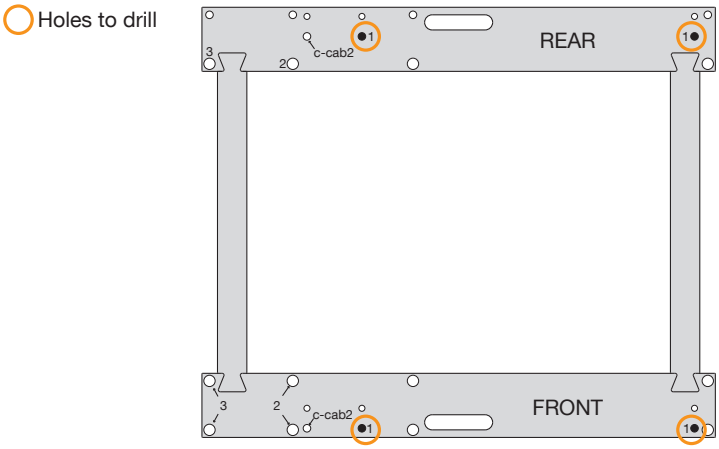


Figure 37. Holes to drill for 1 C-Cab installation

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

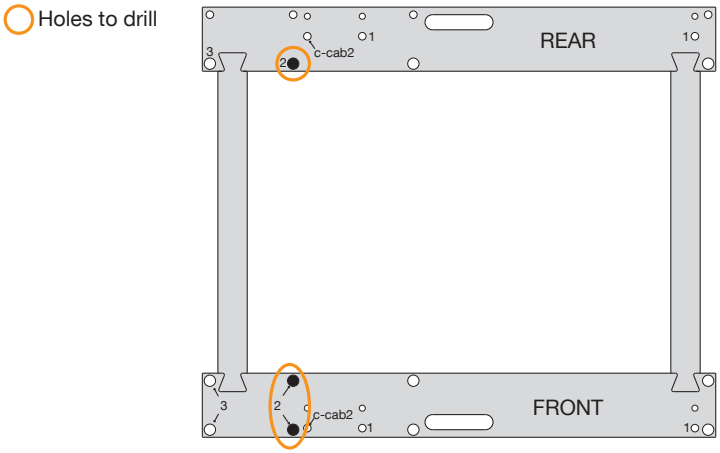


Figure 38. Holes to prepare B-Cab installation next to the C-Cab

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.

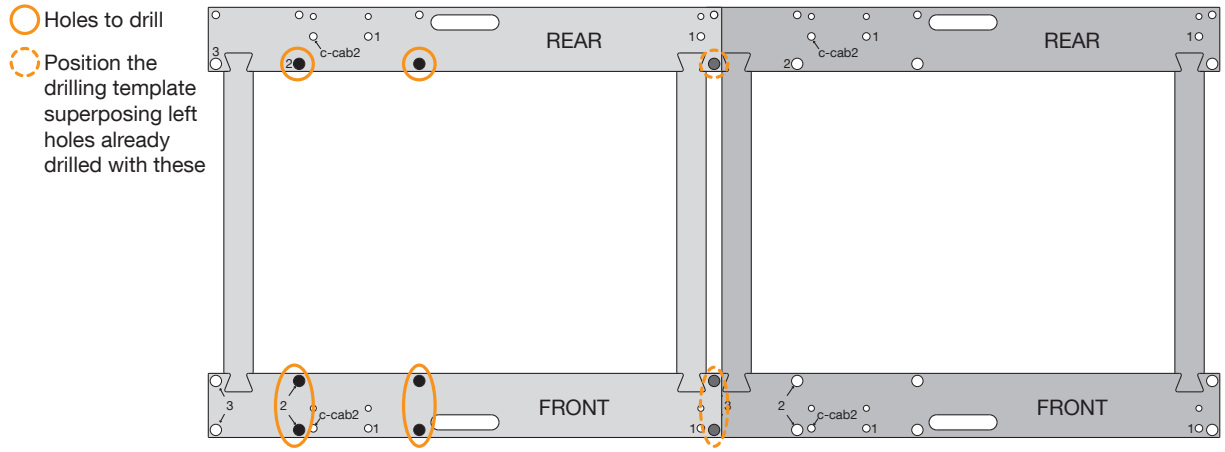


Figure 39. Holes to drill for the B-Cab installation

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.

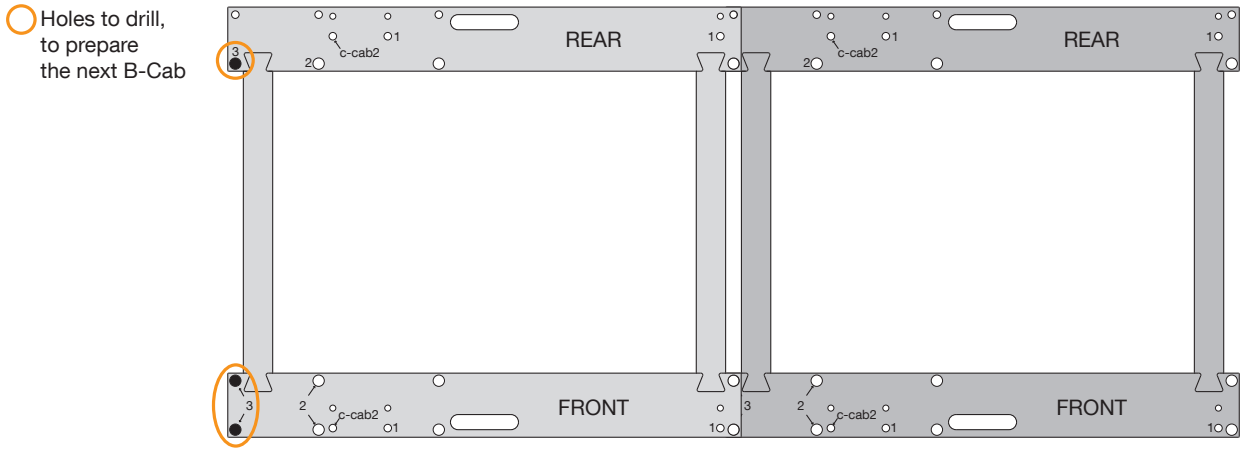


Figure 40. Holes to drill to prepare next B-cab installation

Note: contact Socomec for back-to-back or DSA's in line and back-to-back front installations drilling.

7.4. Installation with more than 1 C-Cab (one Master and one Extension)

Start from the cabinet on the right, position the drilling template of the C-Cab and mark the 6 holes – 4x note “1” and 2x note “c-cab2” - as shown below.

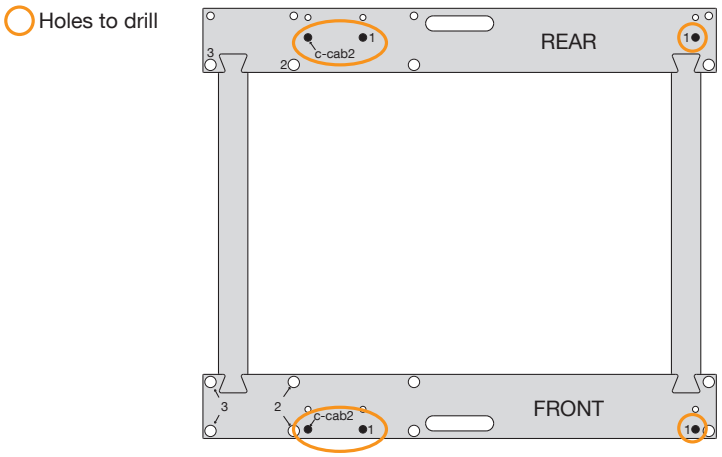


Figure 41. Holes to drill for 1 C-Cab + 1 C-Cab ext. installation

Then put the drilling plate as shown below, overlapping 2 holes – note “1” - that you already marked and mark 2 note “1” additional ones:

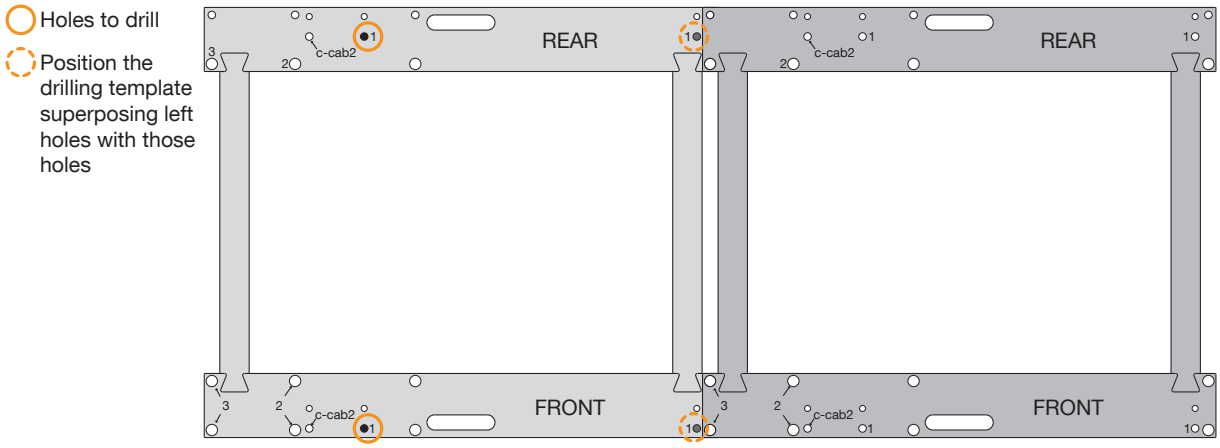


Figure 42. Holes to drill for the C-Cab installation

Then prepare the next C-Cab installation if applicable (go back to Figure 35) or the B-Cab installation by marking 3 more holes -note “2”, as shown below.

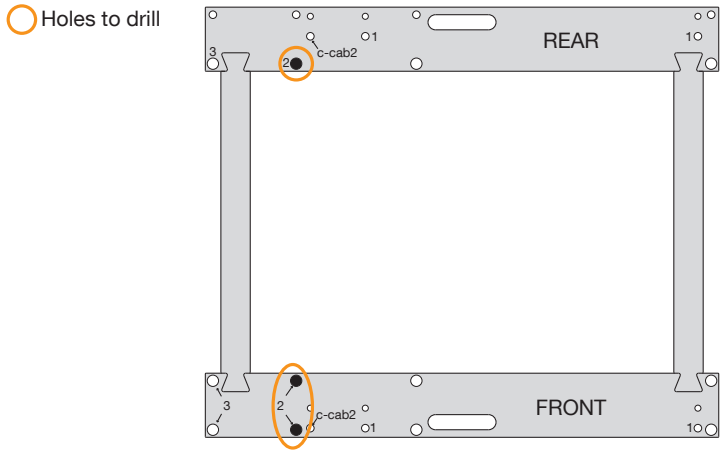


Figure 43. Holes to prepare B-Cab installation next to the C-Cab.

7.5. Drilling

Drill all the holes marked:

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

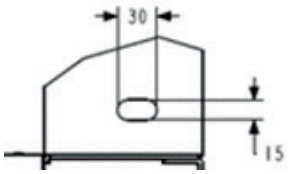
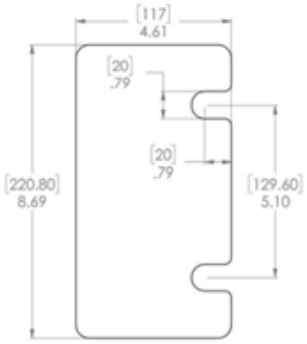
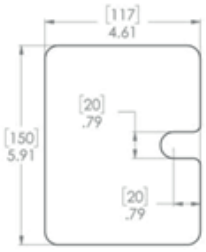
7.6. Putting cabinets in place

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 (40ft-lbs) torque, put the side panels back, with a 81Nm (60ft-lbs) 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	 	M16 / 5/8 inch	81 Nm / 60 ft-lb

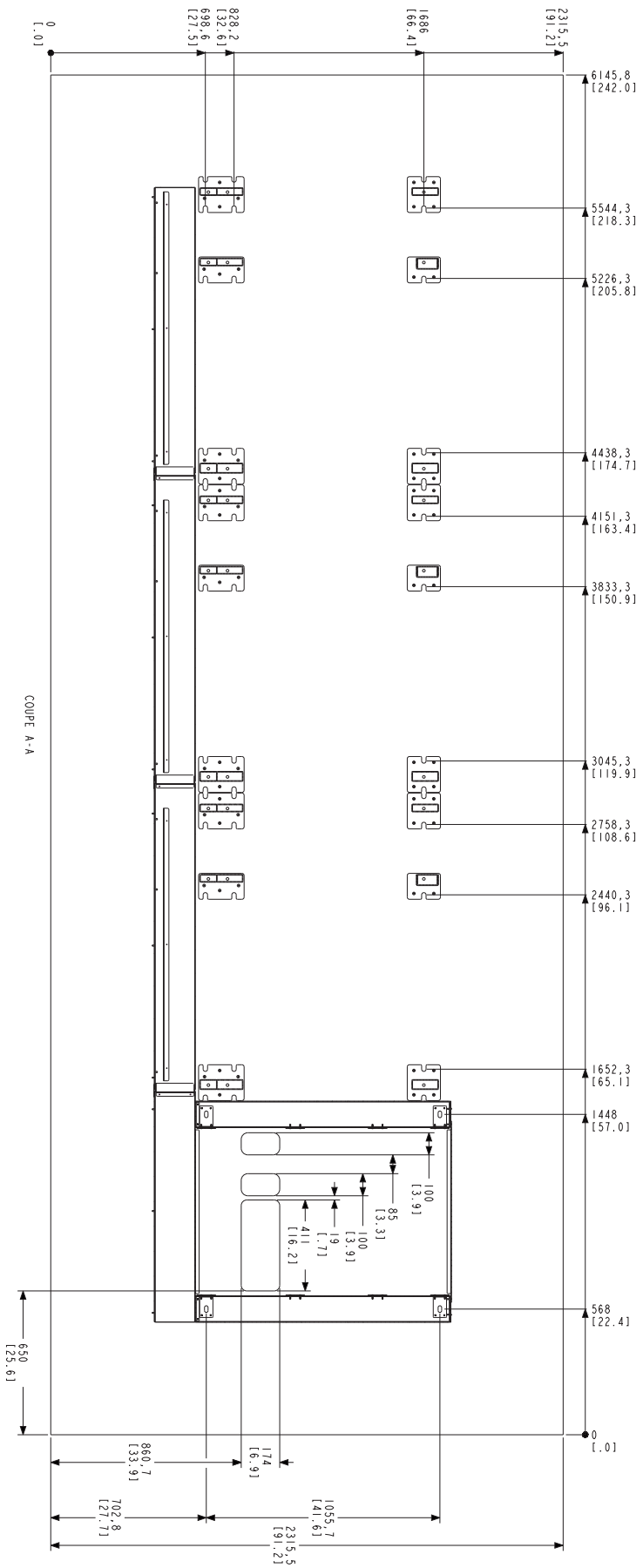
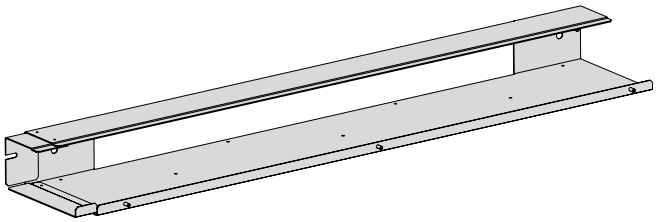
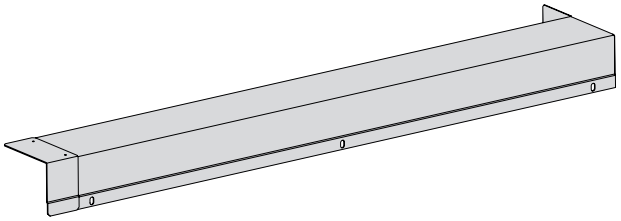
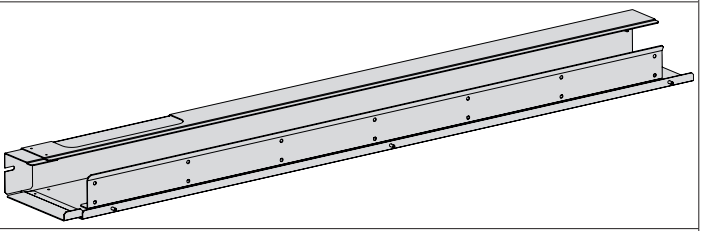
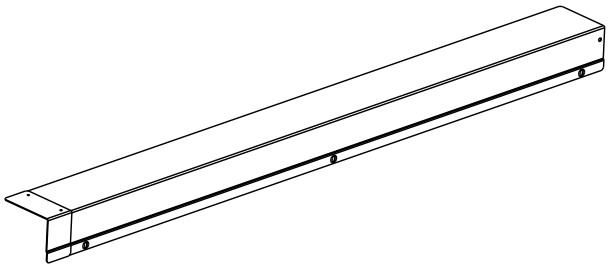
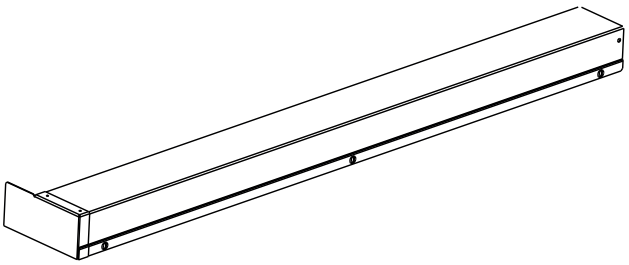
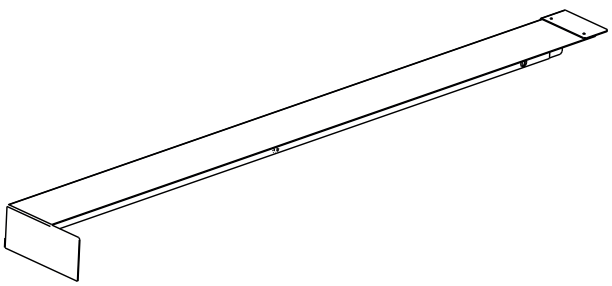
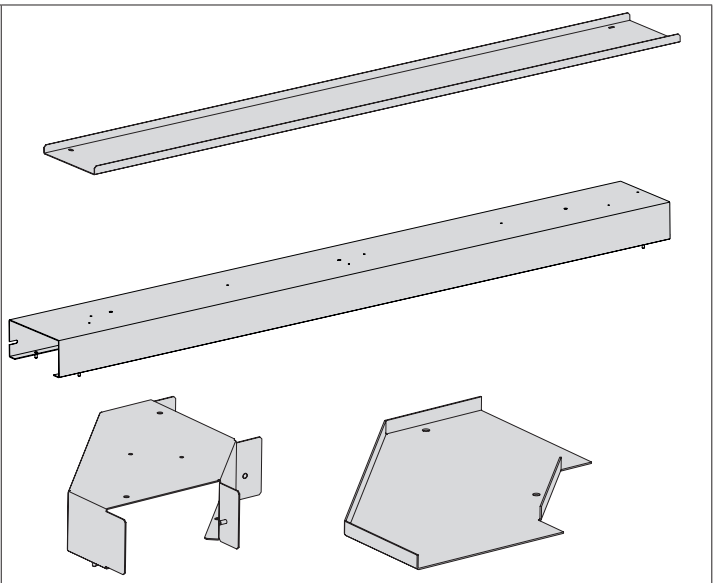
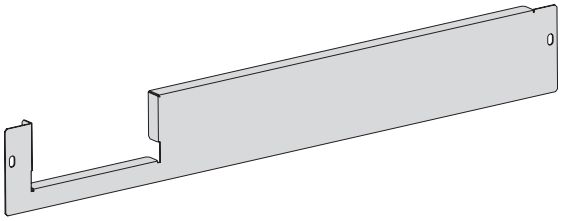
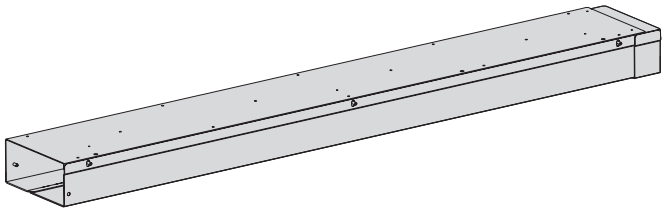
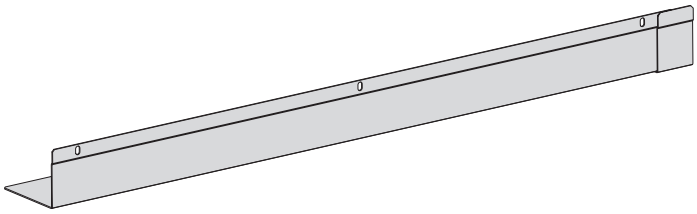


Figure 44. Example of a footprint view of 1C-Cab + 3 B-Cabs

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 (last C-Cab on the right)	
Item 3	B-Cab connection kit – back part	
Item 4	B-Cab connection kit – cover part	
Item 5	B-Cab connection kit – left cover part	
Item 6	B-Cab connection kit – right cover part (for back-to-back installations and DSA in line installations)	

Item 7	Straight + angle bottom parts and covers for back batteries (for back-to-back installations)	
Item 8	Back plate for C-Cab for back-to-back installations	
item 9	DSA In line connection kit - Straight (back and covers) parts for DSA In line B-Cabs installation.	
item 10	C-Cab connection kit – middle cover	

8.2. Mounting details - Part 1

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

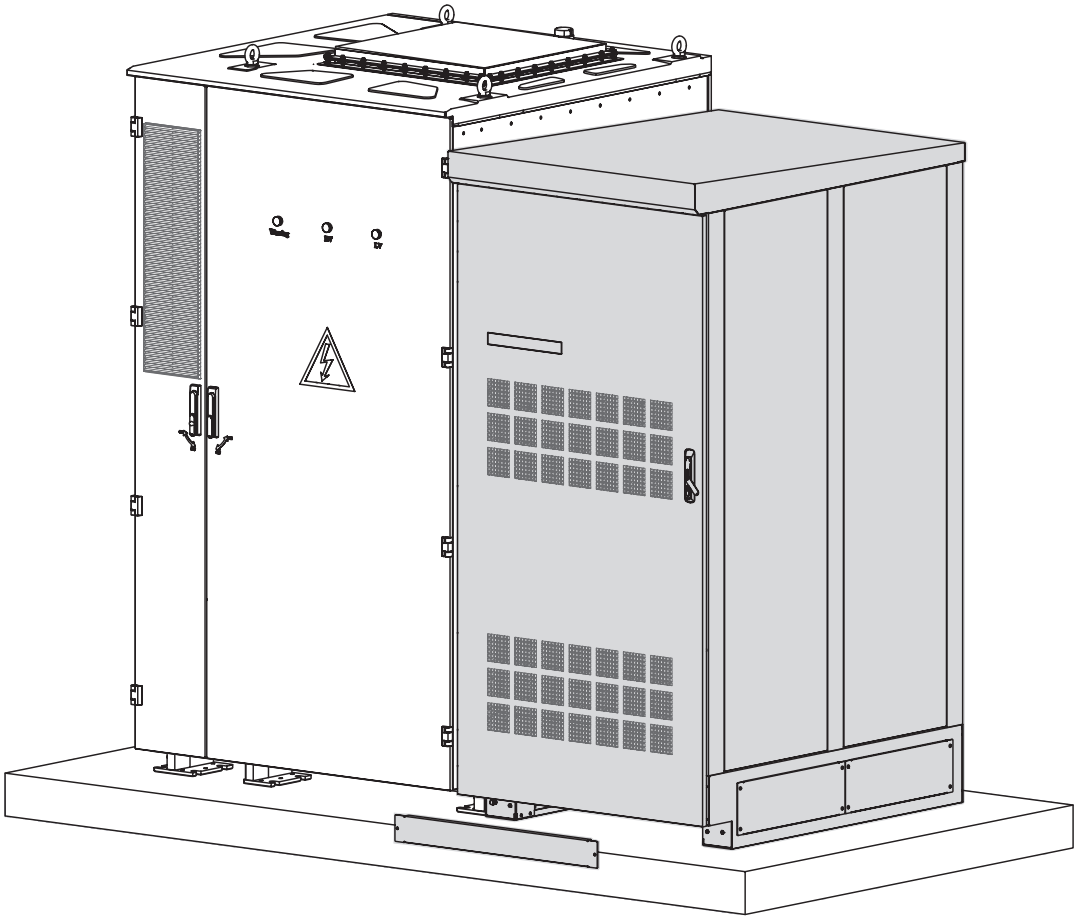


Figure 45. C-Cab front panel removal

Step 2: Place the C-Cab connection kit – back part, item 1, under the cabinet. 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.

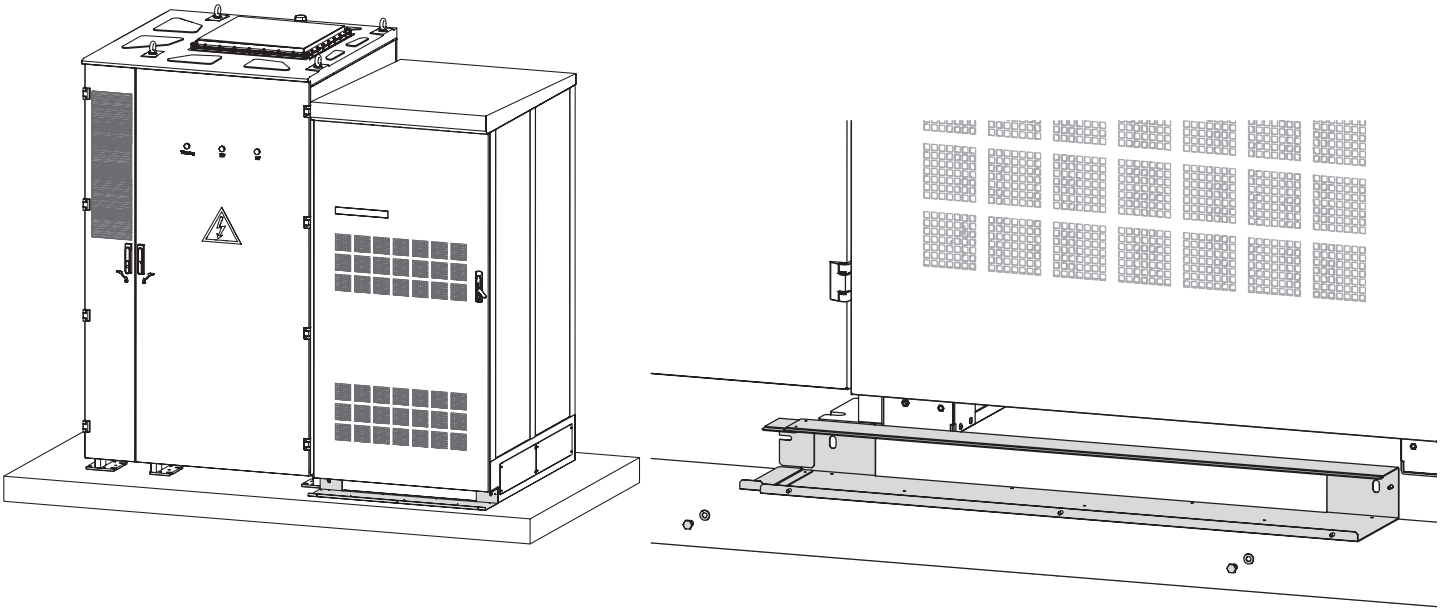


Figure 46. Installation of the back part of the C-Cab connection kit

In case of back-to-back installation, as shown on the picture below, you need some specific parts,item 6, item 9 and item 10 of the table.

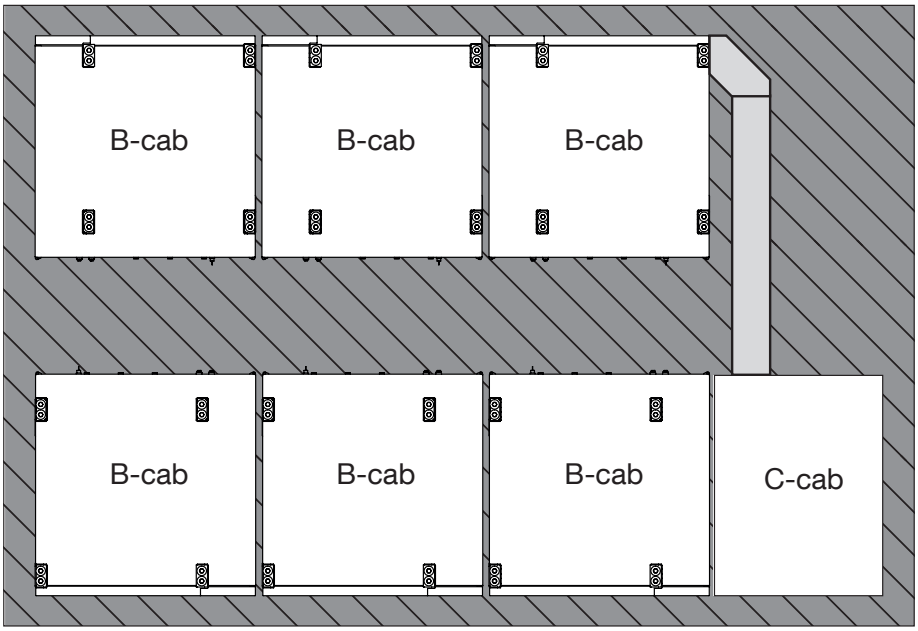


Figure 47. Specific connection parts for back-to-back installations

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

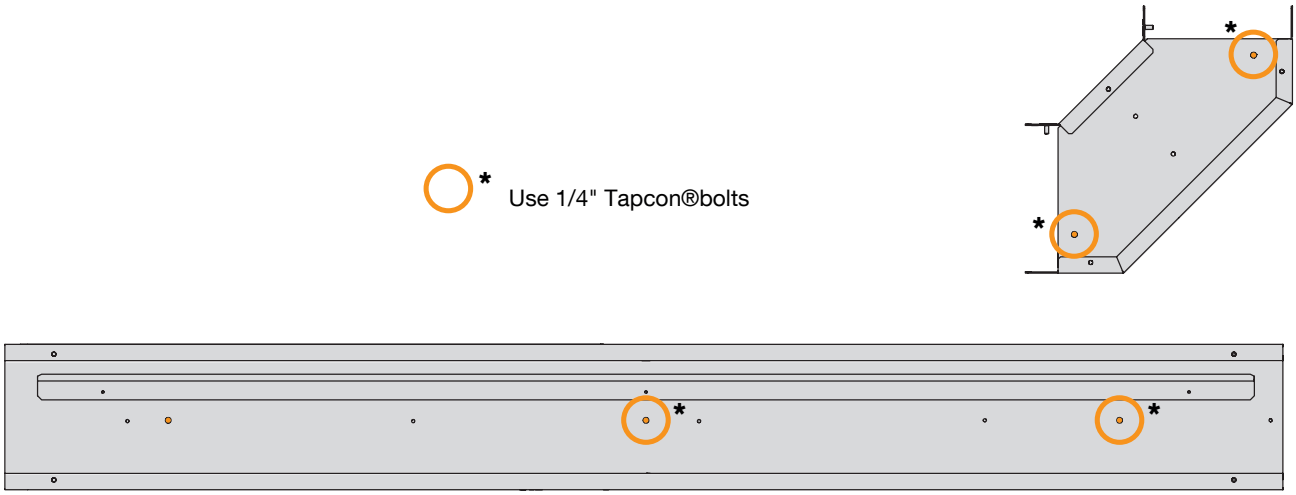


Figure 48. Details of the parts for back-to-back installations

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 8.

In case of DSA's specific In line installation, as shown on the schema below, you will need specific parts item 6, item7, item 10 of the table from chapter «8.1. List of parts», page 58.

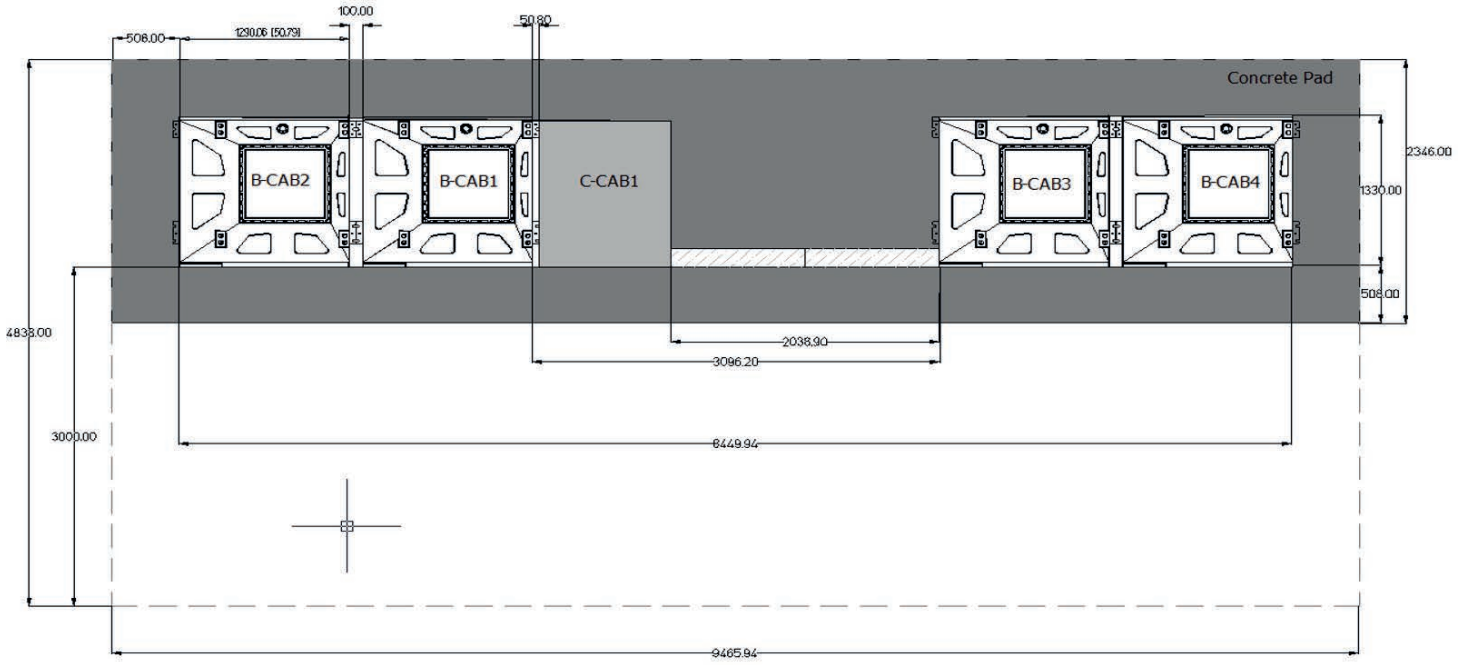


Figure 49. Specific connection parts for In line DSA installation

In case of the addition a C-Cab Extension to a C-Cab L Master, you will need specific parts item 11 of the table from chapter «8.1. List of parts», page 58.

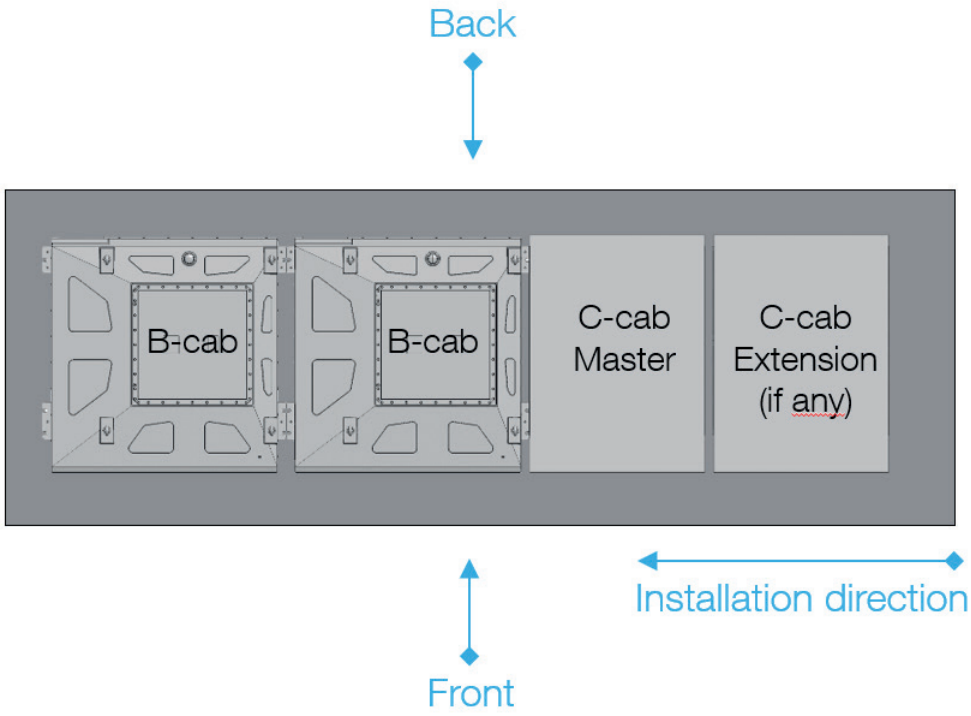


Figure 50. Specific connection parts for C-Cab extension installation

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.

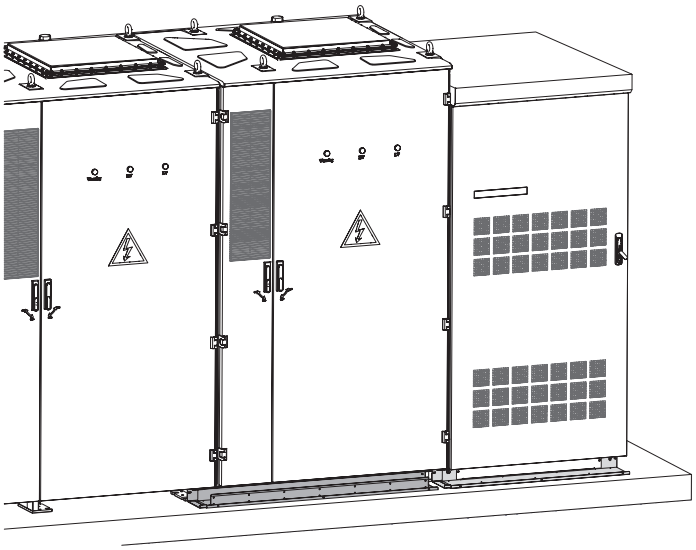


Figure 51. Installation of the B-Cab back part connection kit

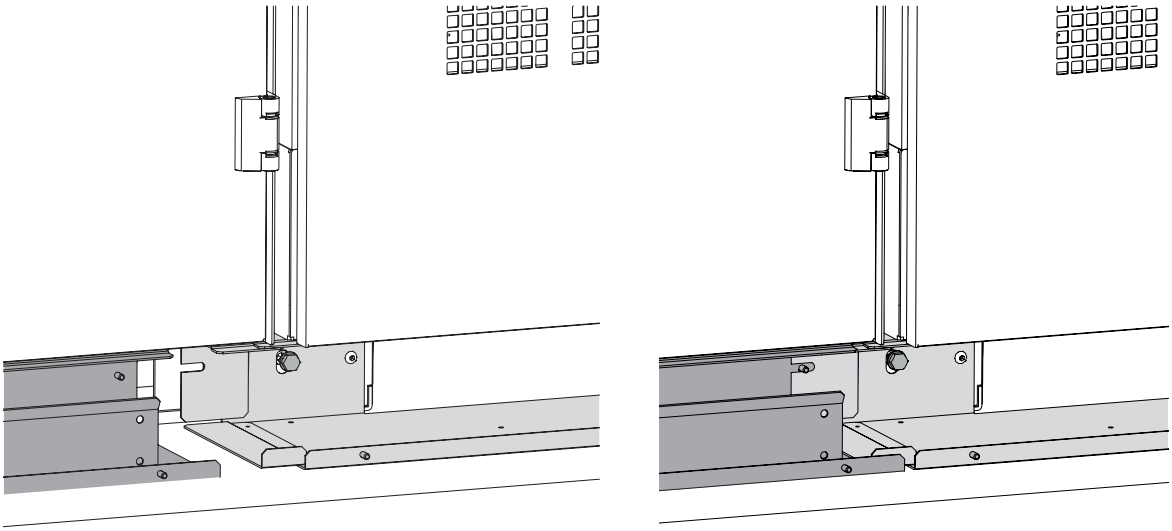


Figure 52. Connection of C-Cab and B-Cab parts

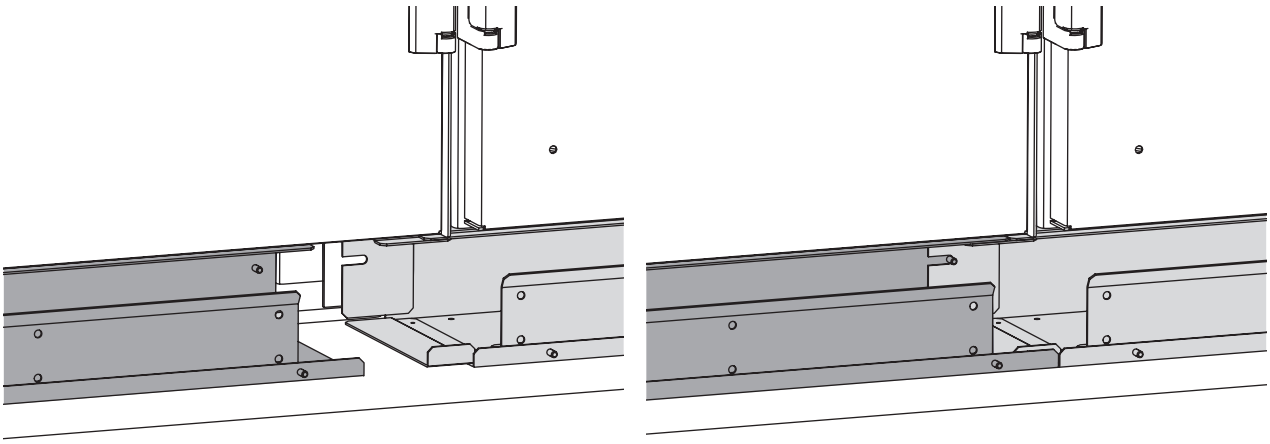


Figure 53. Connection of two B-Cab parts

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.

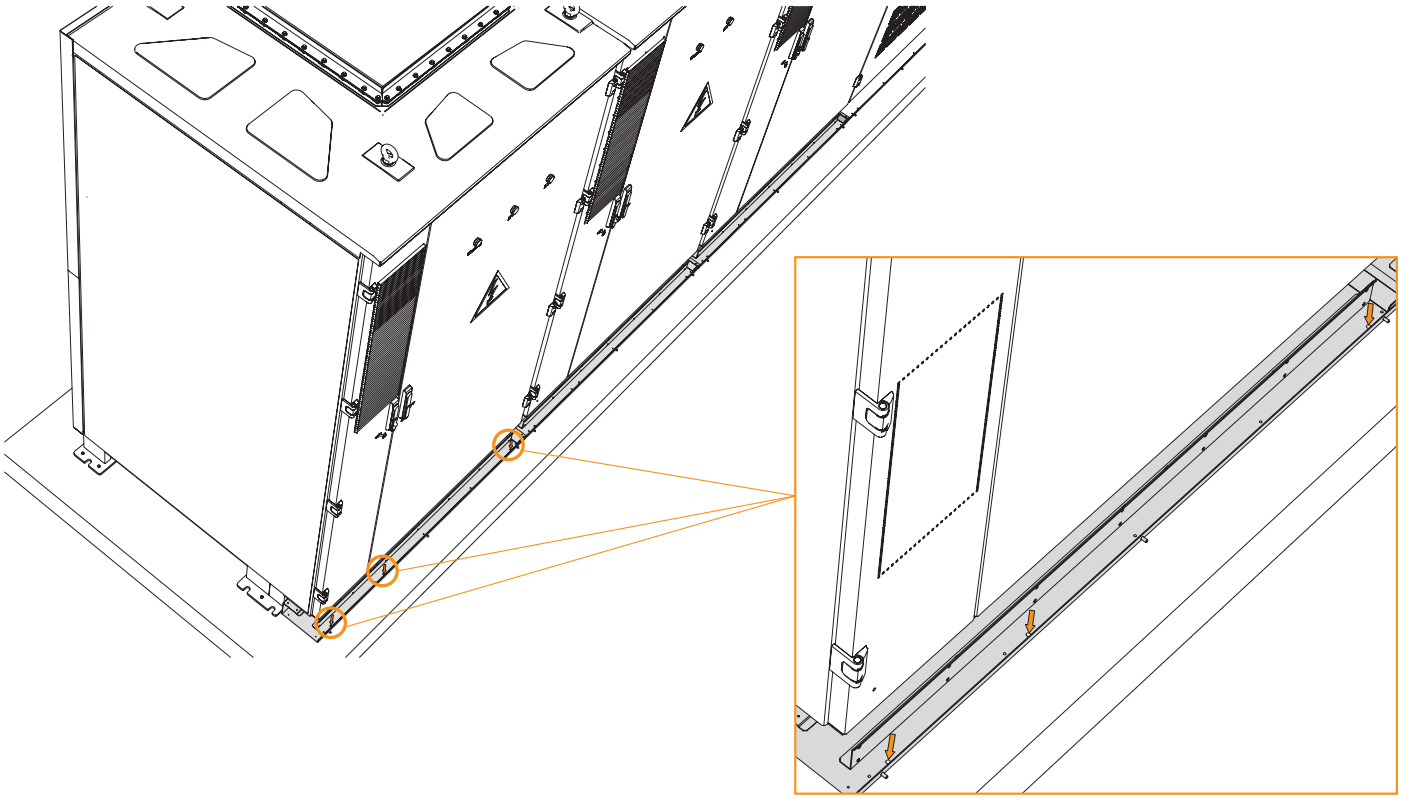


Figure 54. Cable connection kits locking

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

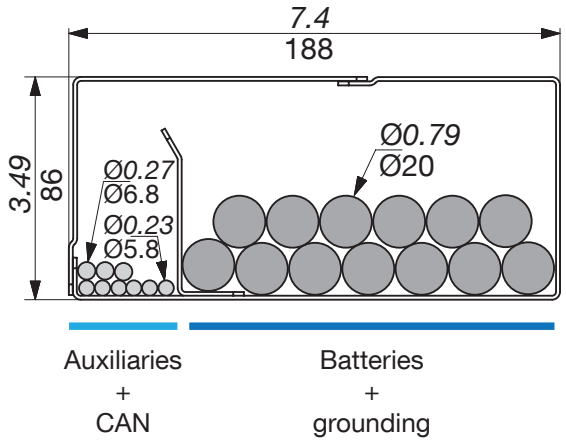


Figure 55. Cables organization inside the cable gutter

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	276	312	372
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 (in-lbs)	Wire Size	Torque (in-lbs)	Wire Size	Torque (in-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 QS1 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. Before proceeding to wiring, ensure that the isolation switch QS1 and the breakers QF1 & QF2 in the battery cabinets are in OPEN (OFF) position as illustrated after.

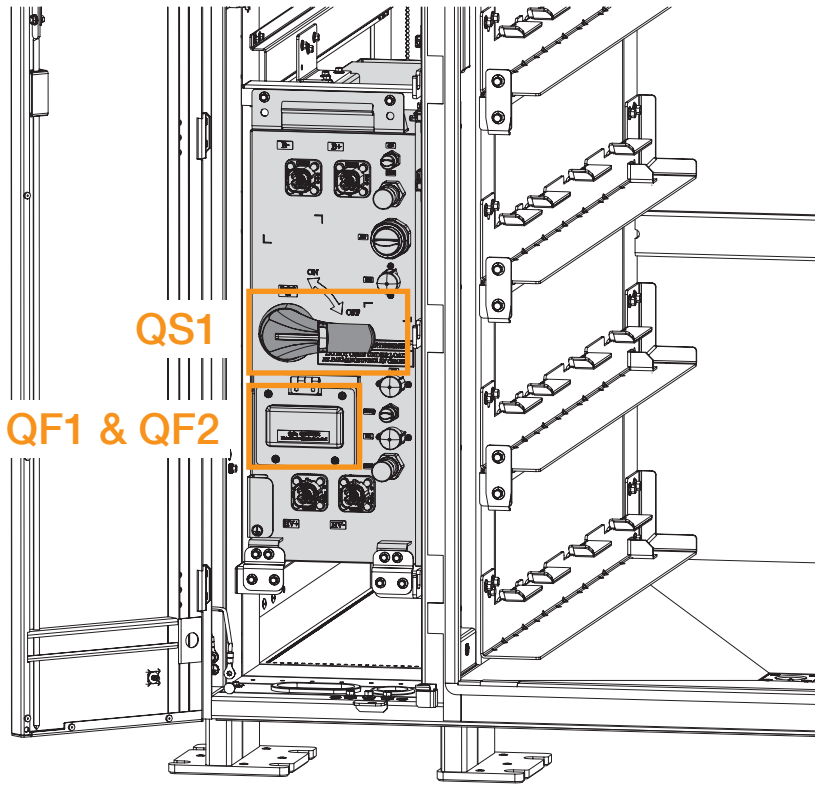


Figure 56. Location of isolation switch QS and breakers QF1 & QF2

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 89
- Cable bridge for B30 option between X9 and X10 - check check chapter «8.4.4.3. Connections of automation box», page 89
- Cable bridge for Auxiliary power supply between X107 and X108 - check chapter « AC aux from user's UPS
- 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 87

8.4.1. Battery Cabinet Interconnections

	**DANGER!** 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!** 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.

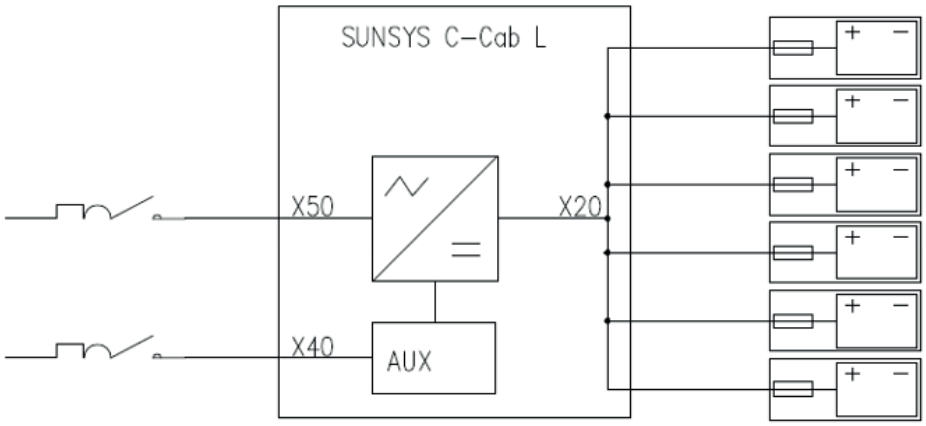
Description	Terminal ID	Max number of cables for each pole	Max cable section	Tightening torque	Termination type	Type of cable
DC connection	X20	6	95 mm2 3/0 AWG	70Nm / 52ft-lb	N°3 holes each bar (Ø13 mm)	>90°C copper wire
AC connection	X50	2	185 mm2 350 MCM			
		3	150 mm2 300 MCM			
		4	95 mm2 3/0 AWG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

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

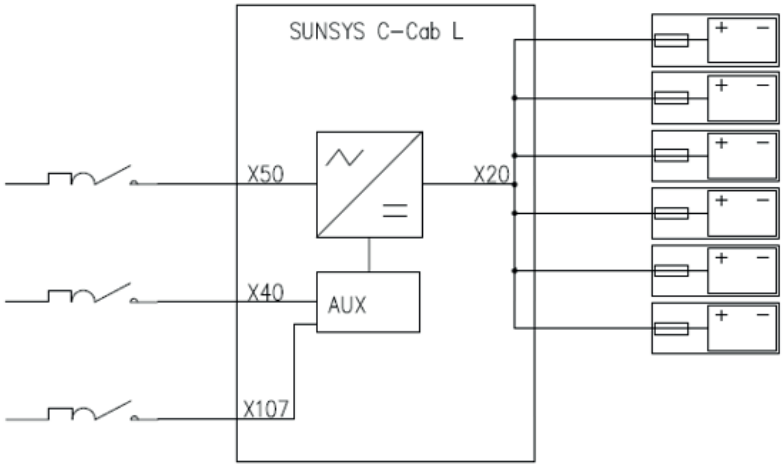
The tables below show the connection features and the size of the protection devices recommended for correct installation. See the schematics for an overview of the possible configurations.

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

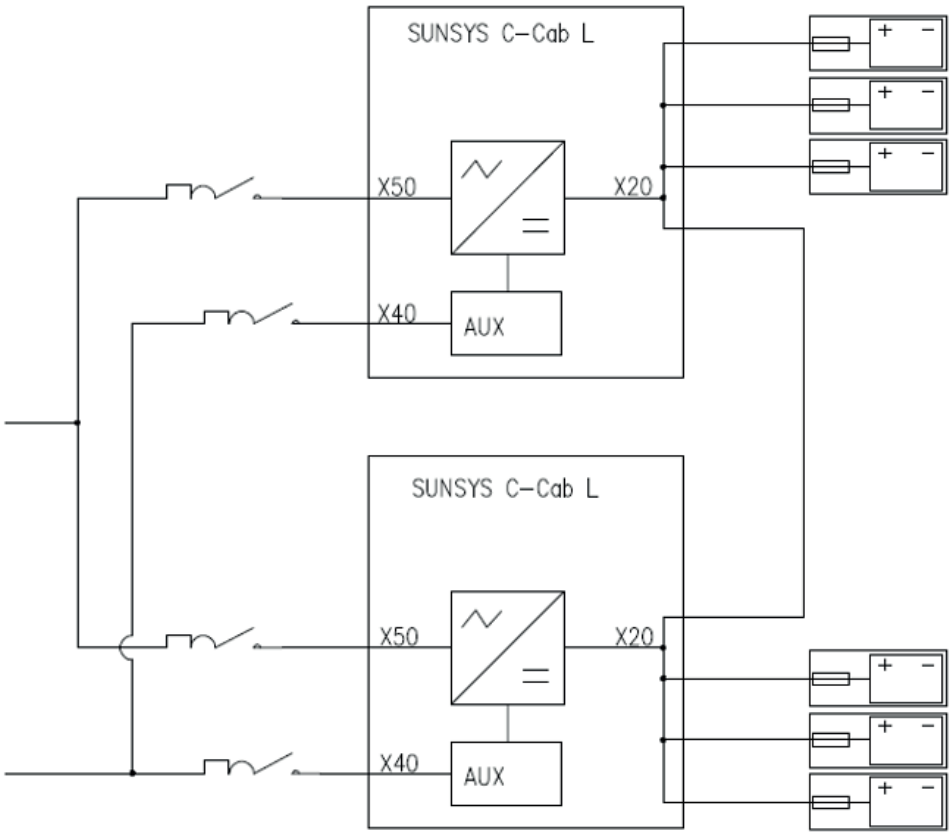
Protection of single C-Cab



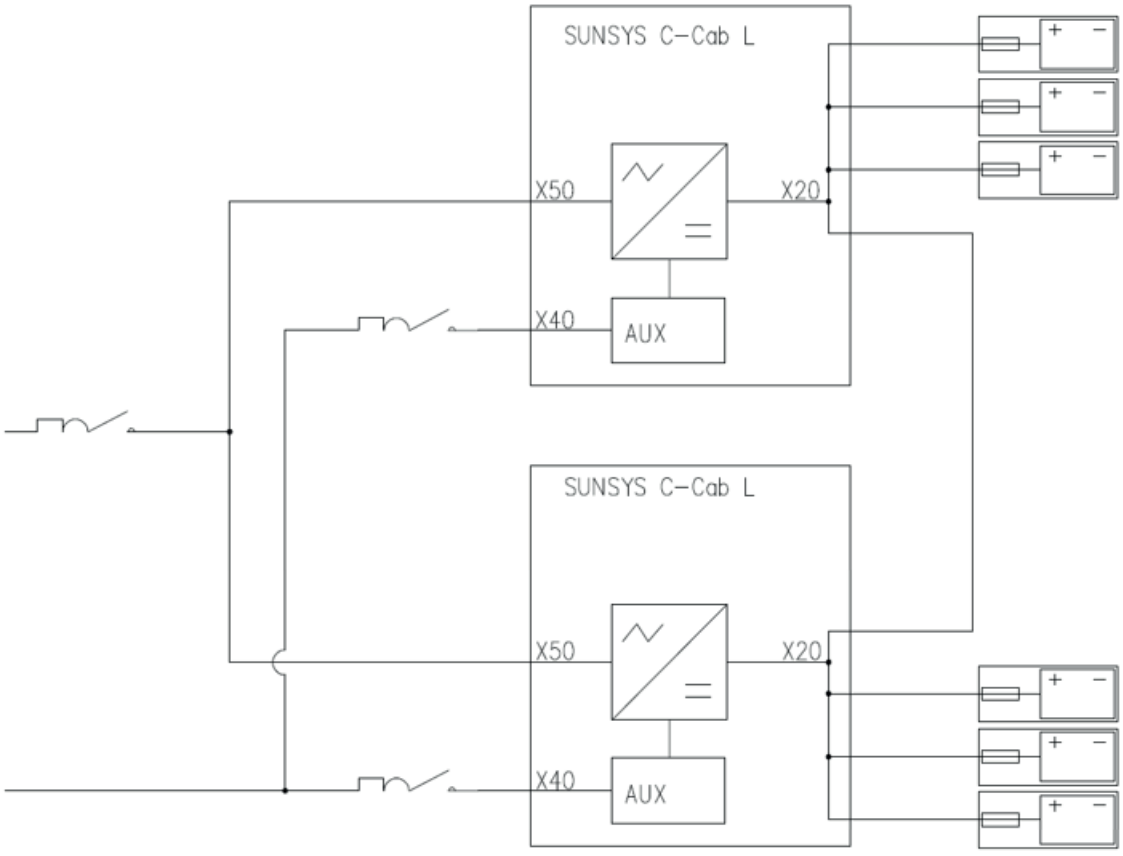
Protection of single C-Cab with external line on X107 (see «8.4.4. Communication and signal connections», page 87)



Protection of 2 C-Cabs with 2 separated AC protections (suggested)



Protection of 2 C-Cabs with common AC protection (allowed)



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	80 A	D	0.5 A Type “B”	50 kA
		100 kVA	150 A	D		
		150 kVA	225 A	D		
		200 kVA	300 A	D		
		250 kVA	400 A	C		
		300 kVA	450 A	C		
N°2 C-Cabs in parallel	480 V 3 ph+N 60Hz	350 kVA	600 A	C		
		400 kVA	600 A	C		
		450 kVA	700 A	C		
		500 kVA	800 A	C		
		550 kVA	1000 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		

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	12 A	D	50kA	10kA
	1	40 A	C		
	2	63 A			
	3	63 A			
	4	80 A			
	5	100 A			
	6	100 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**
88÷132 V 1 ph+N 50/60 Hz	8 A	C

8.4.2.1. Power cables connection

	WARNING! 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.

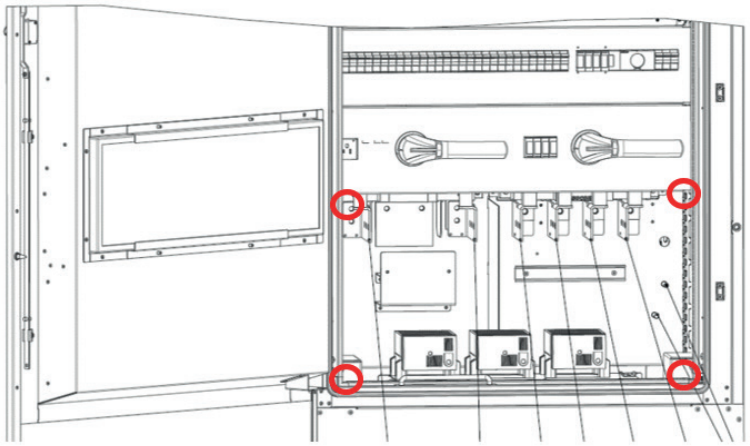


Figure 57. Screws of the plastic panel

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:

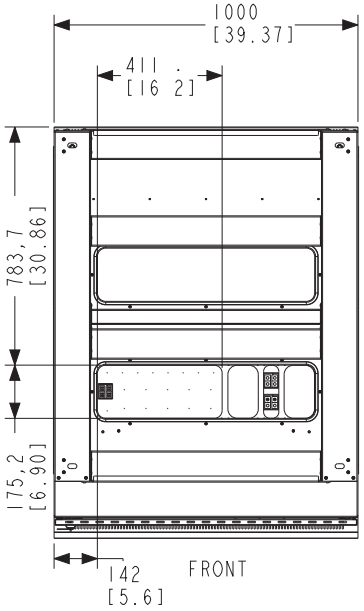


Figure 58. C-Cab bottom view

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.

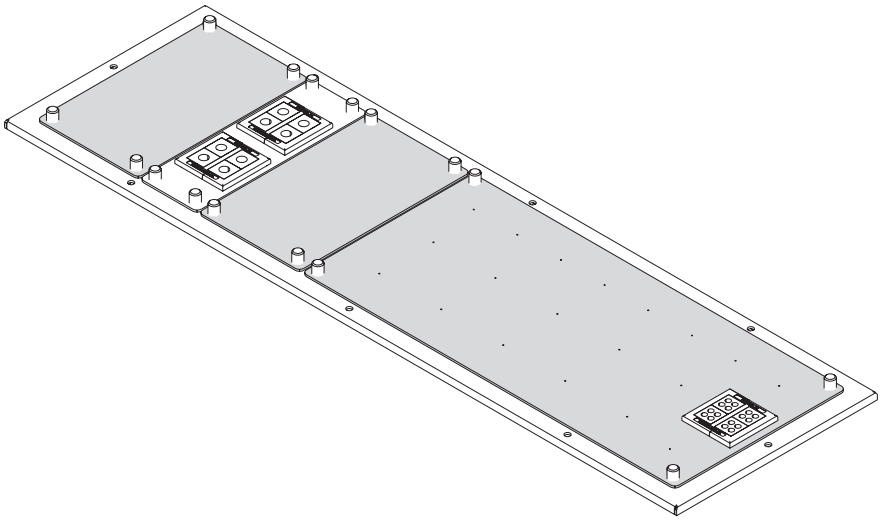
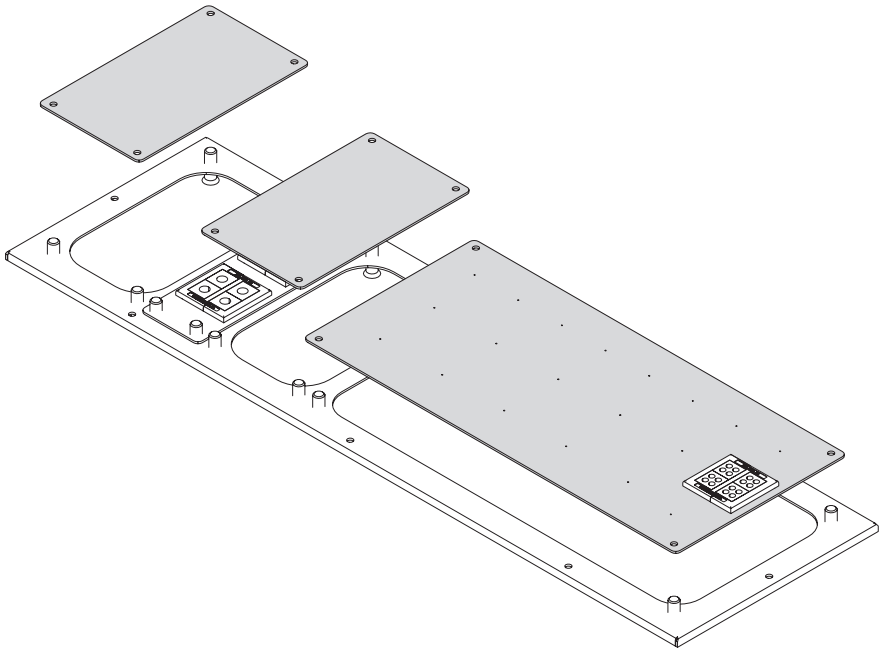


Figure 59. Cable glands plates

To install the power cables, follow the procedure below:

1) Remove the 3 plates from the bottom, as shown on the below view from above



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

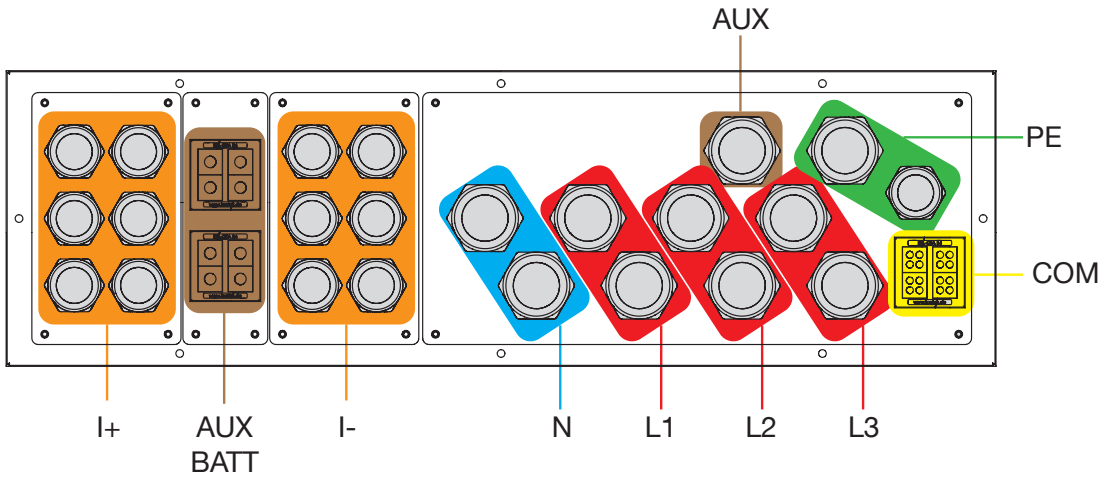
4) Put the plates back in place and fix them to the baseplate

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 its 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:



In case of systems above 300kVA, so meaning made of 2 C-Cabs, the AC connection needs to come from the grid to both C-Cabs (each one with one connection, see chapter 8.5.2). In this case additionnal metering devices are required, please contact Socomec team to help you determine what is requested.

8.4.3. AC, DC and ground connection

Power AC, DC and Ground terminals

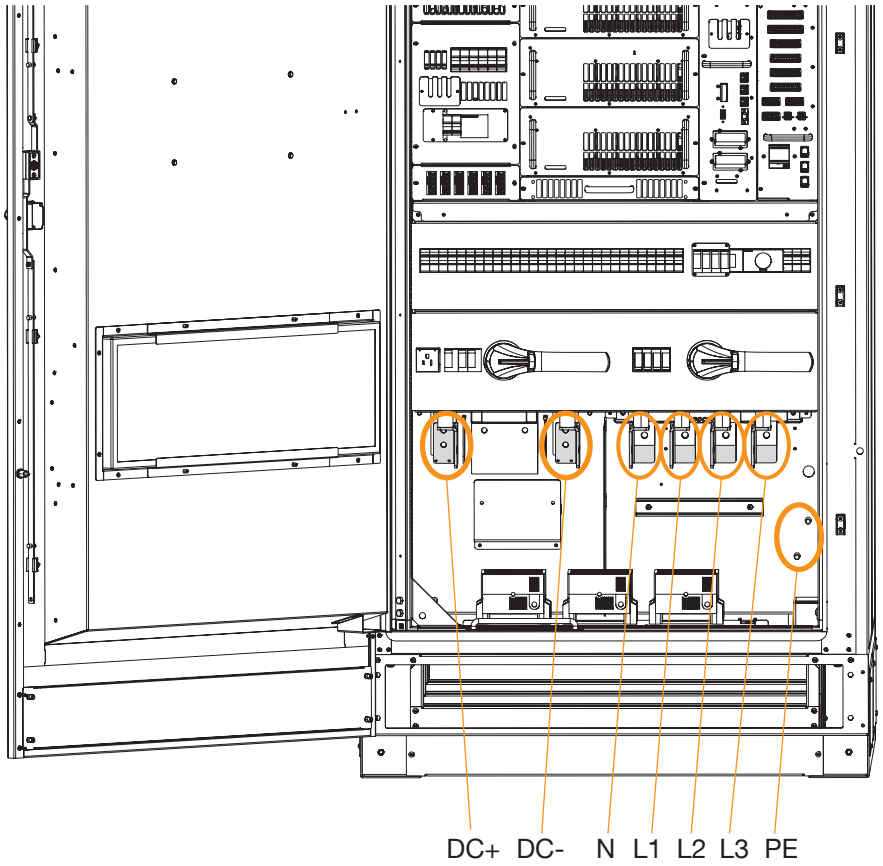


Figure 60. Power and ground connections

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!** 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.
⚠	**CAUTION!** 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: “DANGER — HIGH VOLTAGE” Or “DANGER 860V”
⚠	**CAUTION!** 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.

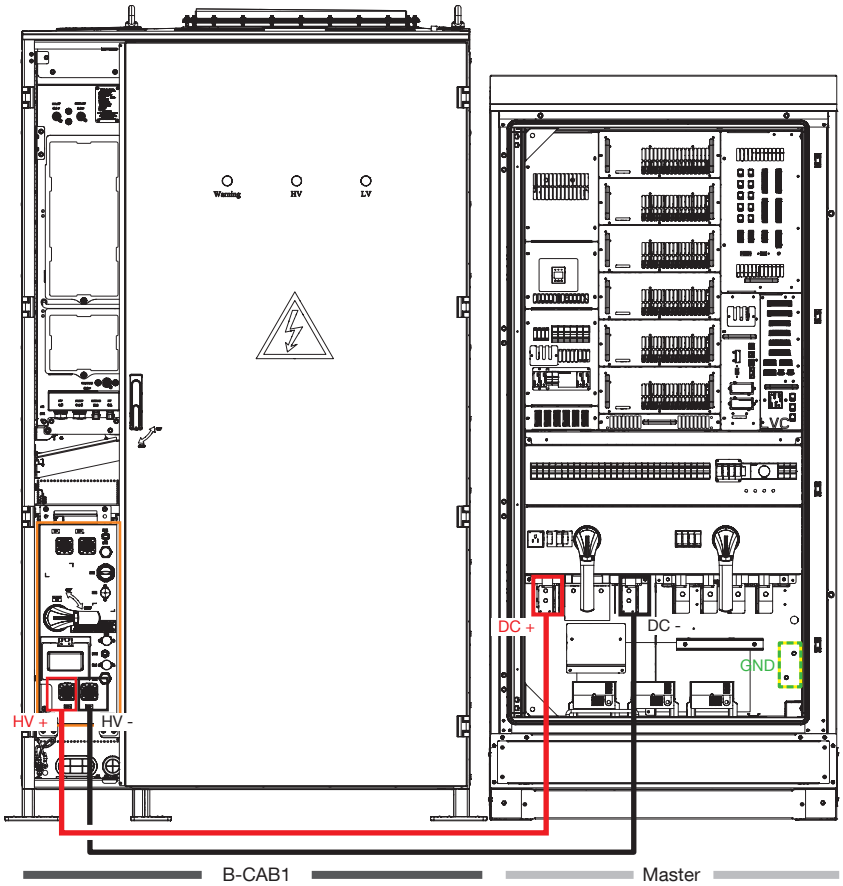
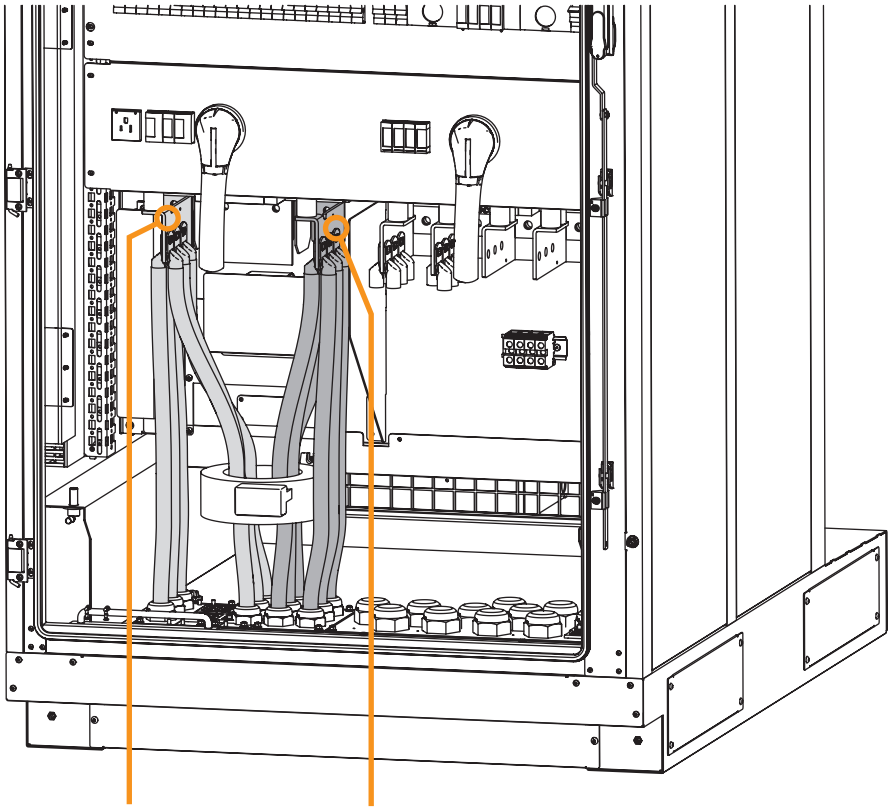


Figure 61. DC Power connections

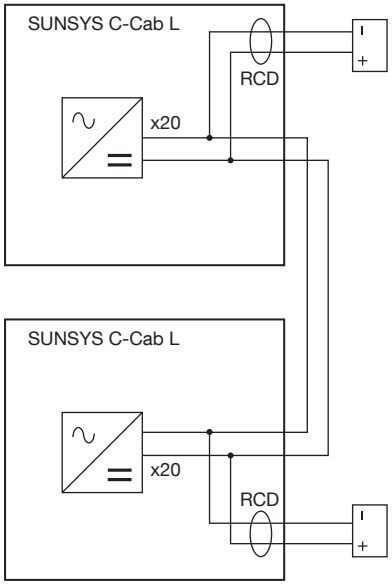
8.4.3.2. RCD positioning for systems composed of 2 C-Cabs (1 Master and 1 Extension)

If the system is composed of 2 C-Cabs in parallel, one master and one extension, the RCD will be installed in the bottom part of each cabinet, below the copper bar connections.

The cables that are connected to the battery (both positive and negative poles) shall pass through the RCD current transformer, while the cables connected to the other C-Cab shall pass outside the current transformer. This allows to detect a fault on the battery in order to protect the battery itself.



Extension (or master) C-Cab Battery

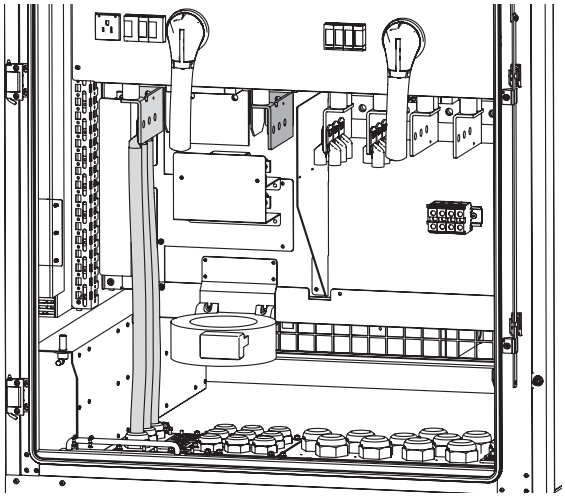


In order to allow an easier installation of the cables, start fixing the cables from the left to the right.

Take care that the cables do not press too hard against the plastic of the component.

Pay attention not to damage the cable connected to the RCD component during the installation.

- Connect and fix the first parallel cables on the left (up to 3 cables):



8.4.3.3. 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 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.

The ground connection cross-section must be at least equal to the half of one phase cross-section.

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

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.

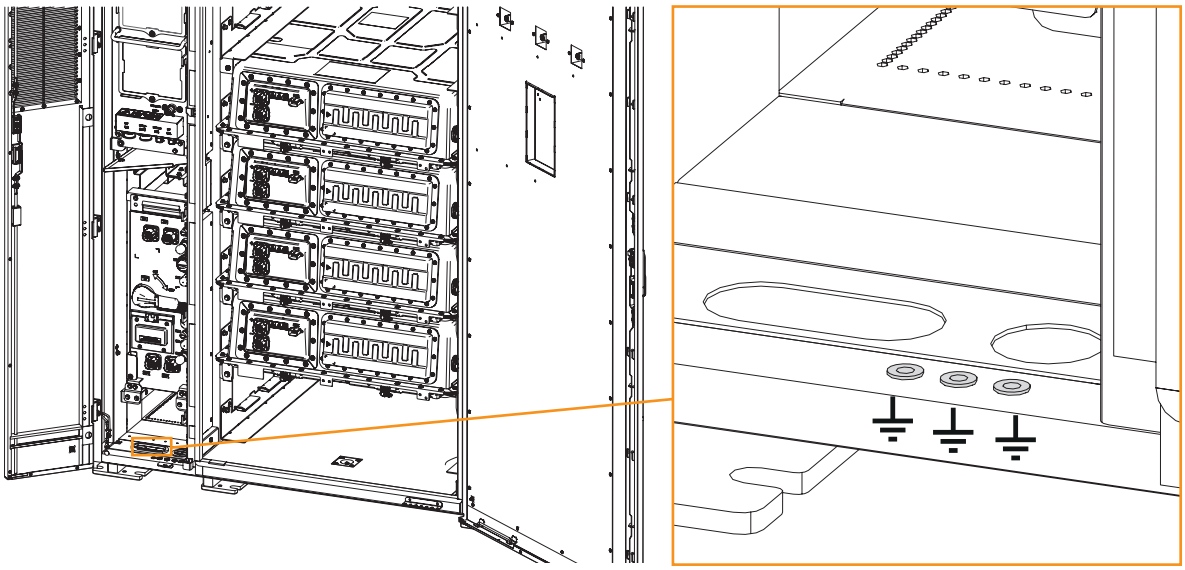


Figure 62. Battery cabinet ground terminal

8.4.3.4. Auxiliary power connection

Auxiliary terminals

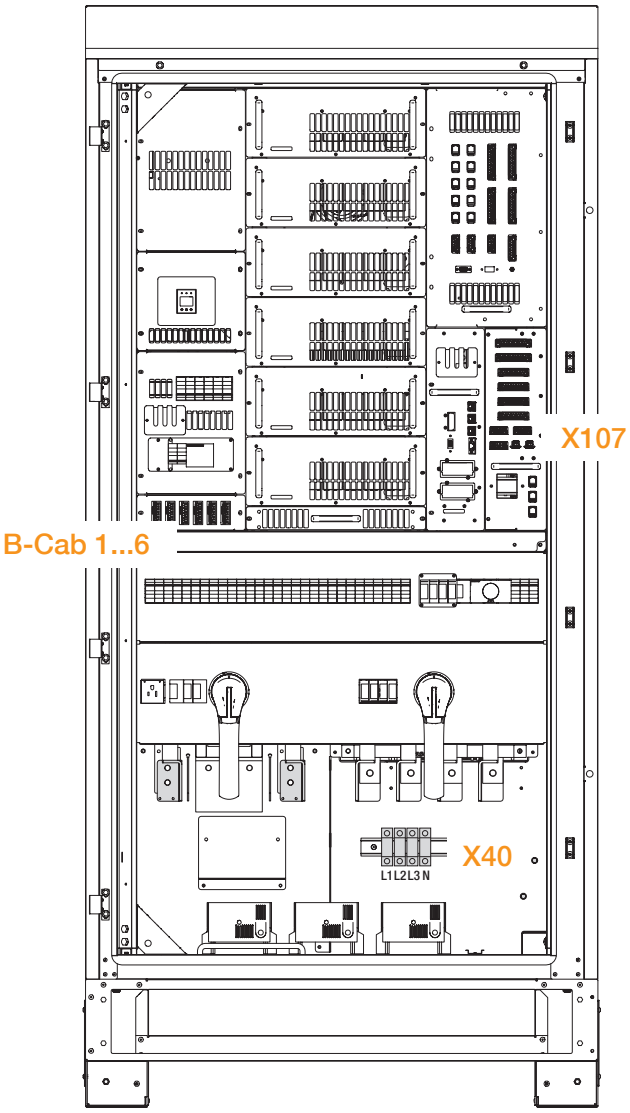


Figure 63. Location of the auxiliary connections in the C-Cab

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**	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.

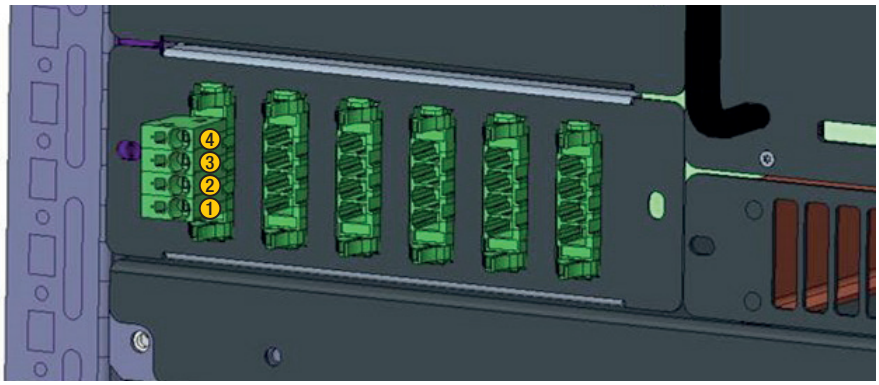


Figure 64. C-Cab connector for B-Cabs aux power supply

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 « 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

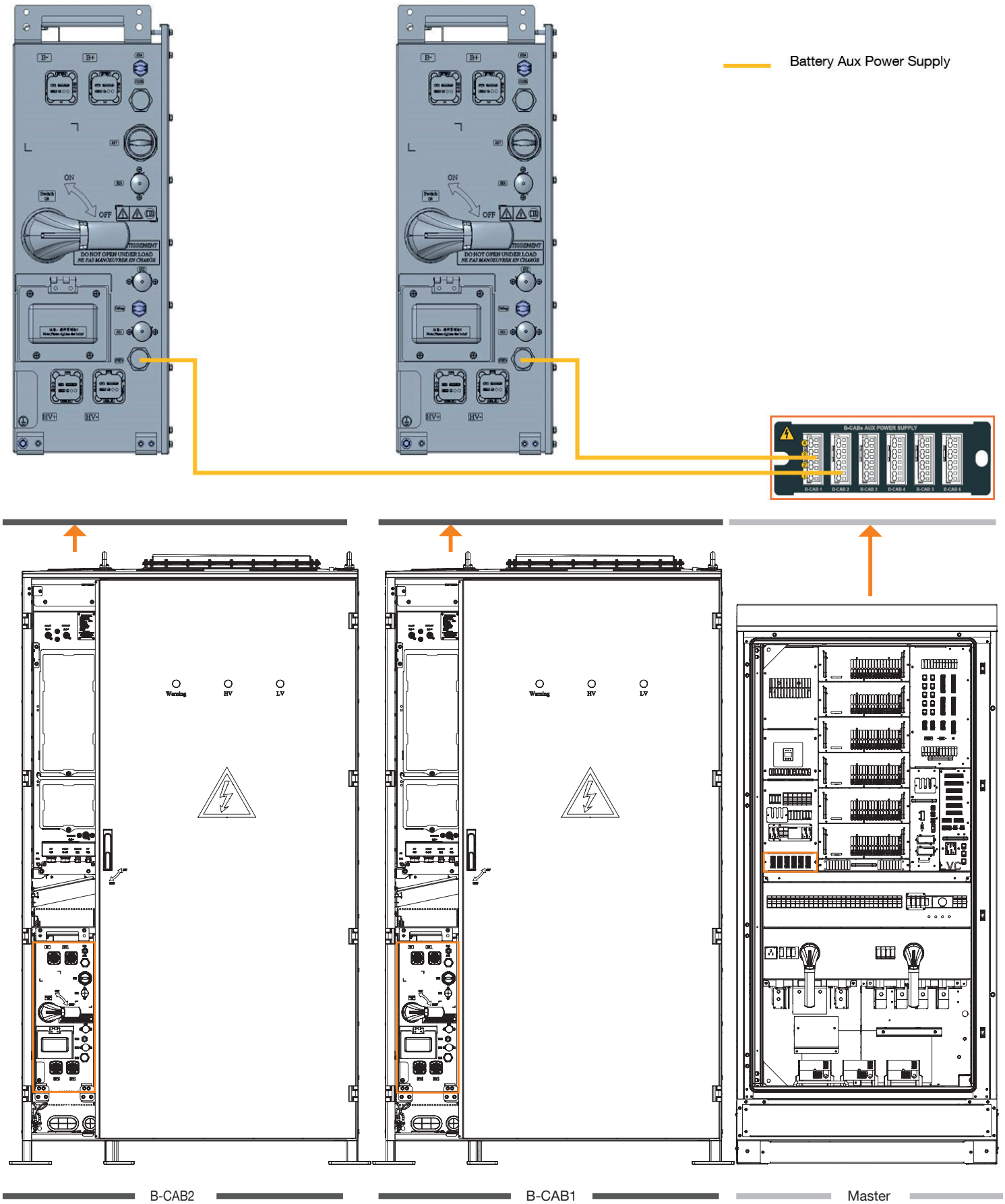


Figure 65. Connection of the B-Cabs aux power supply from the C-Cab

AC aux from user's UPS

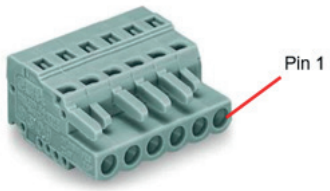
The X107 terminal is used to supply the control circuit of the C-Cab.

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 88÷132 V 1 ph+N 50/60 Hz
	2	N	
	3	⏚	
X108	1	L	Internal UPS output 120 V 60 Hz
	2	N	
X109	1	L	Not used
	2	N	

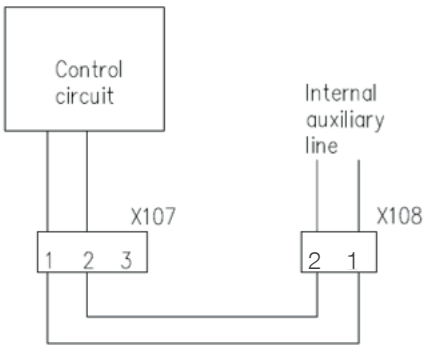
The pin 1 is the one indicated in the figure below:



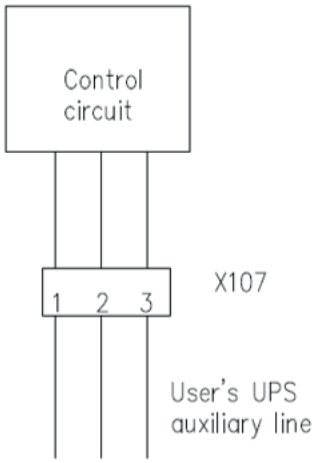
For connection of plug-in connectors use cables in the following range:

1.5mm^2÷2.5mm^2 / 16÷12 AWG

Standard configuration



Aux from user's UPS configuration

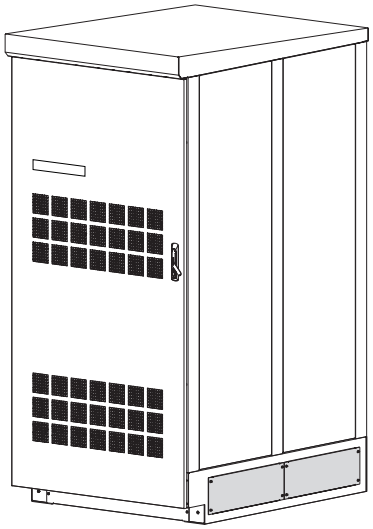


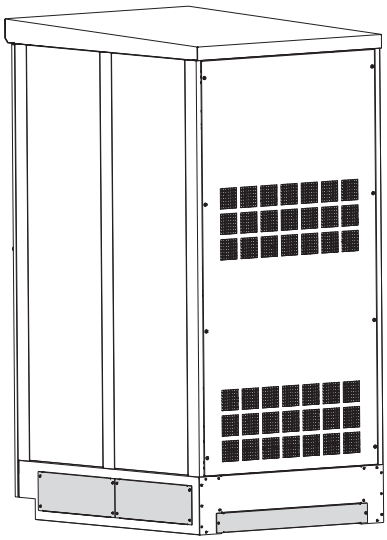
8.4.3.5. AC Power connections

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

1. Recommended path:

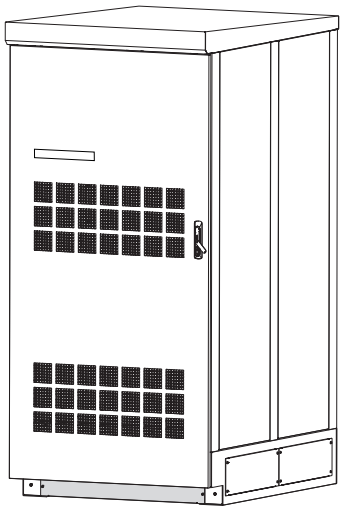
Use one of the indicated removable plates, either on the side or at the back of the cabinet:





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!** 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 72. Therefore it is mandatory to pass the cables through this gland plate.

	**WARNING!** 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 66, there is enough space inside the C-Cab to connect up to 2*185mm² /2*350MCM on each pole. The lugs needed are M12.

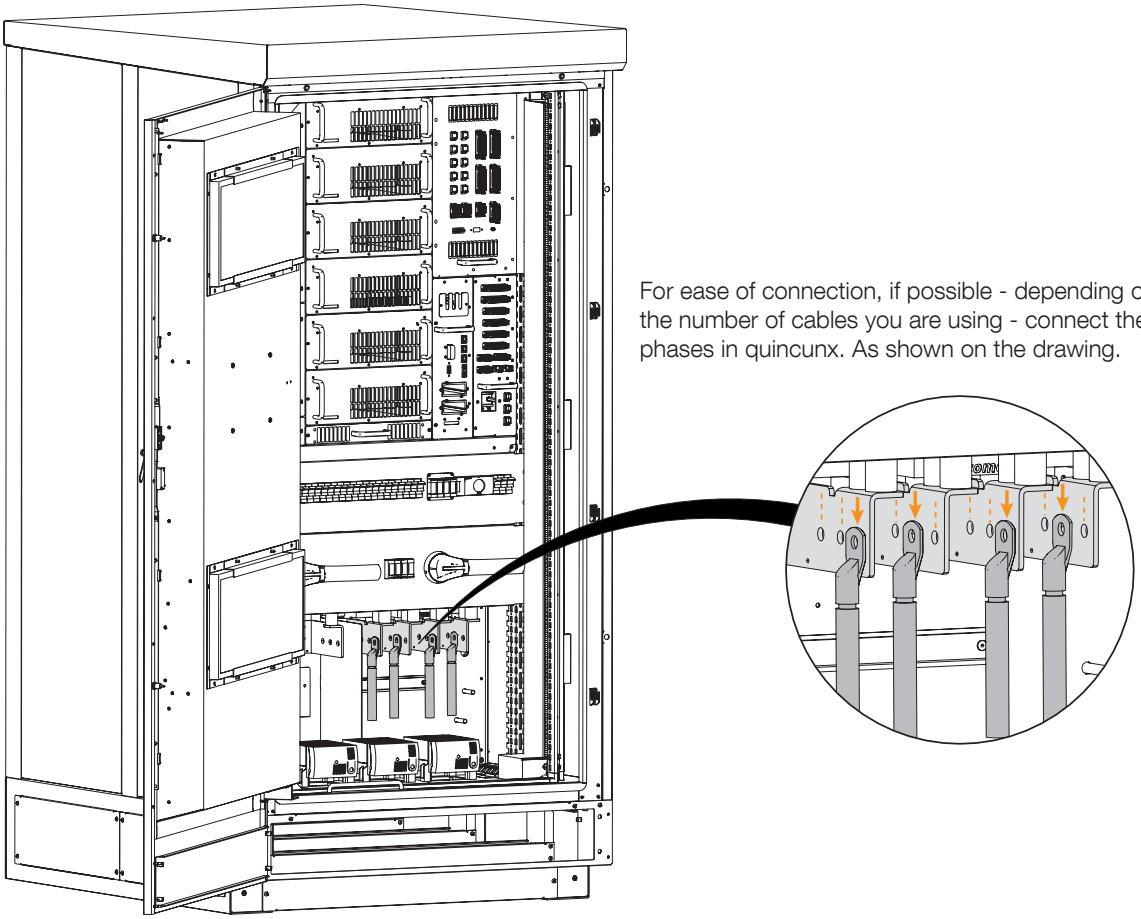


Figure 66. AC power connections positioning

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

Note: the C-Cab is compatible with TN-C, TN-S, TT and IT electrical supply systems

8.4.4. Communication and signal connections

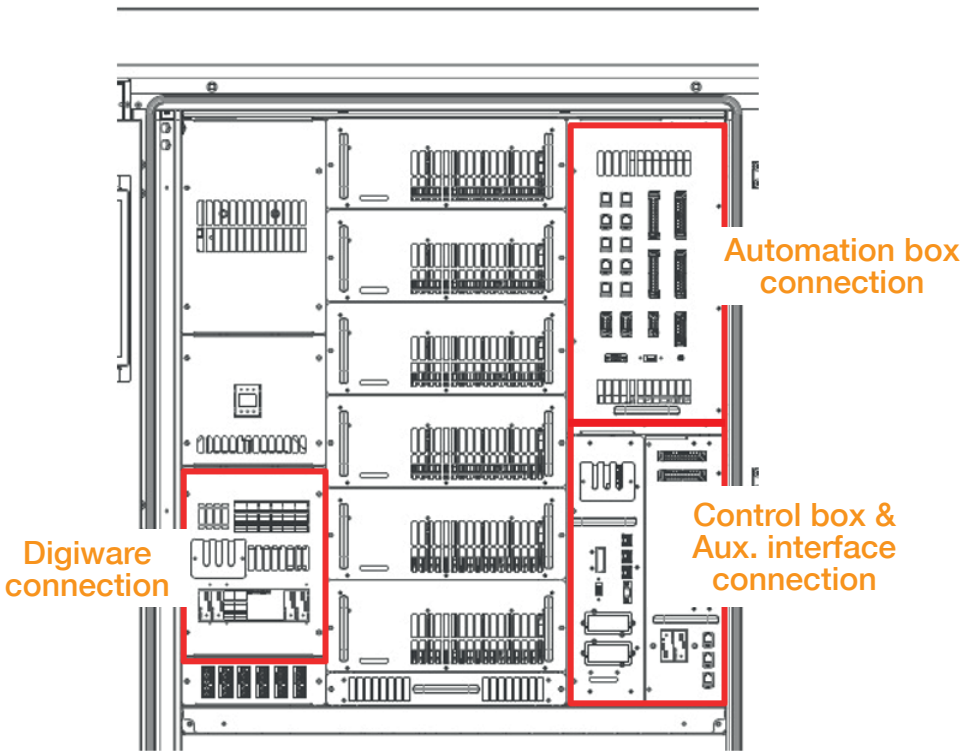


Figure 67. Location of the communication and signal connections in the C-Cab

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 on 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	Communication with Automation Box
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. The signal cables connected must be maintained with a proper SELV insulation. Before using signals of this connector please contact your Socomec service team.

Connector ID	Connector type	Pin number	Function
X106	8 pin plug-in connector	Pin 1-3	Internal use
		Pin 2-4	Internal use
		Pin 5-6	Internal use
		Pin 7-8	**Output** - Contactor feedback This output provides the position of the internal mains AC contactor. It is an optocoupler transistor output. Contactor position / Output state Open / 0 Close / 1 Maximum current: 10mA Pin 7: emitter, to be connected to negative pole of a voltage source Pin 8: collector, to be collected to positive pole of a voltage source

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

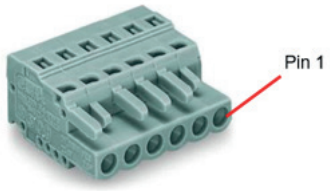
The Automation Box may contain different optional components as listed in the “List of Options” section.

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	Fire Safety System	
		3-4	External emergency stop (EPO)	
		5-6	CB-B open position report	
		7-8	CBG opening order report	
		9-10	Emergency stop report	
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”	

W



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

1.5mm^2÷2.5mm^2 / 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.

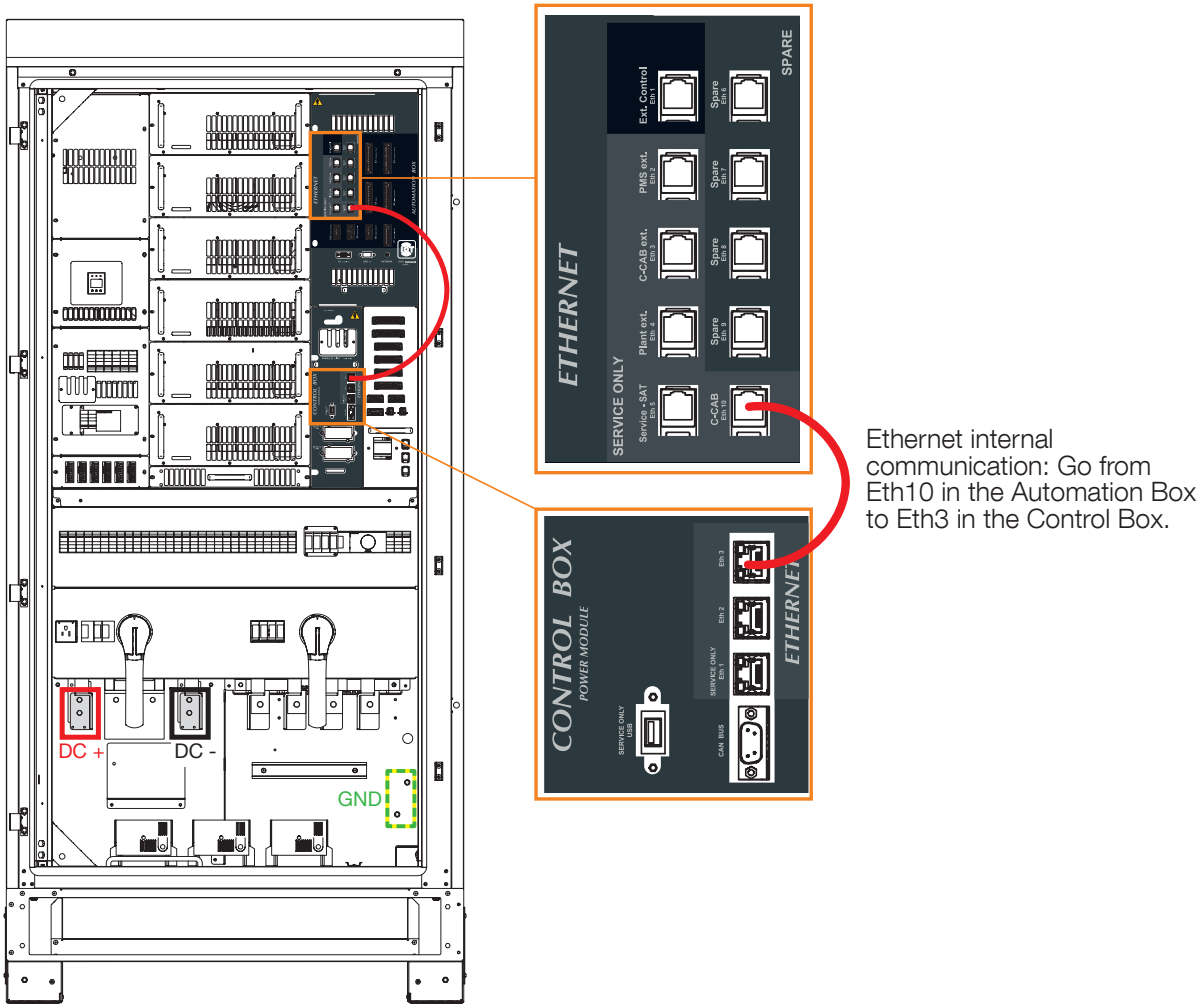


Figure 68. Connection of the communication with the control box

X2: Battery communication

The communication interconnections between the cabinets are configured in a daisy chain pattern. The cable must go from X2 inside the C-Cab to JX1 of the first B-Cab. If there is more than one B-Cab, the cable will then go out of B-Cab1 through JX2 and enter B-Cab2 through JX1, and so on. When you reach the last B-Cab, JX2 is connected to the terminal resistor connector.

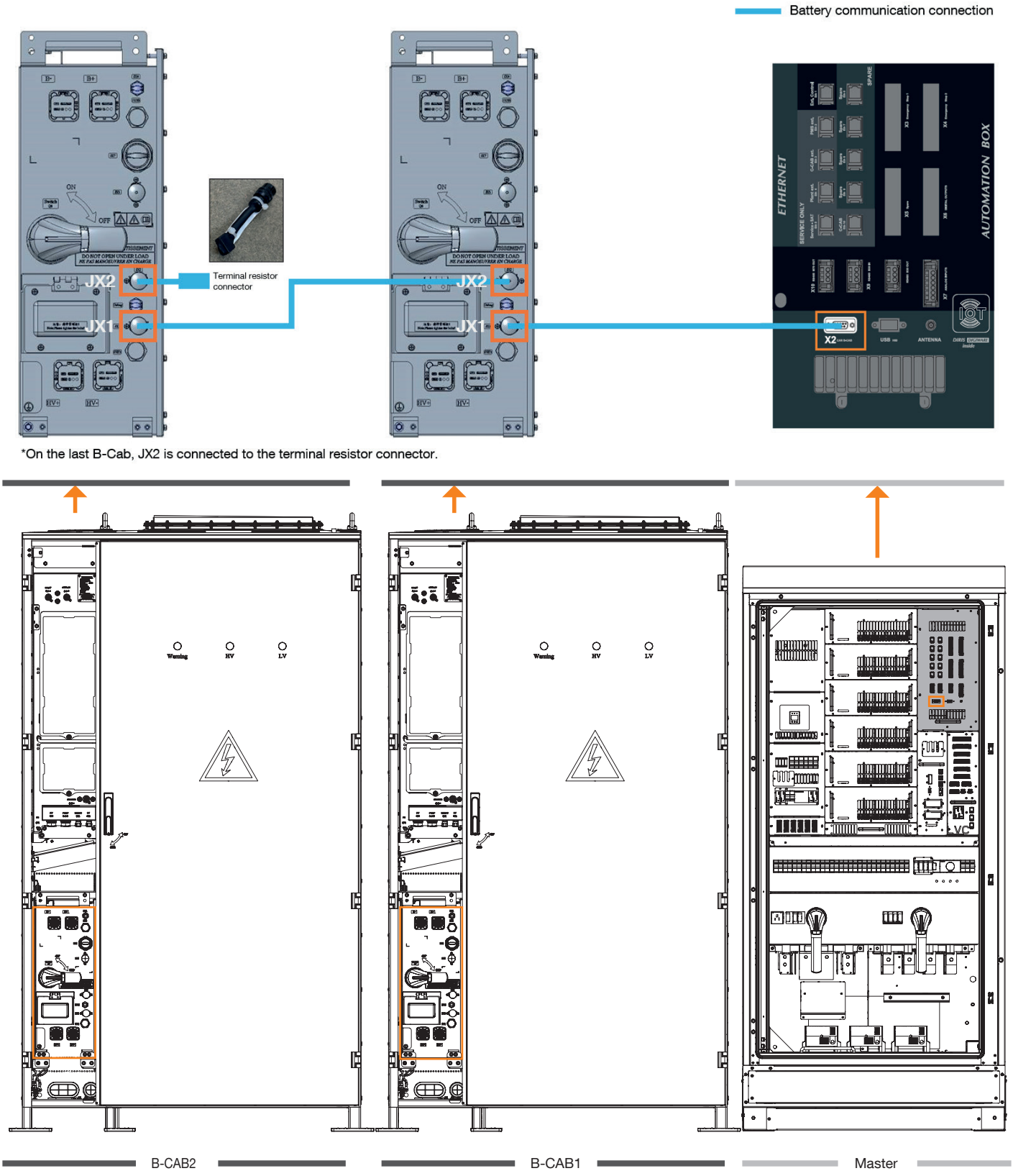


Figure 69. Connection of the communication between B-Cabs and C-Cab

X3-X4: Emergency stop input pin 3-4 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.

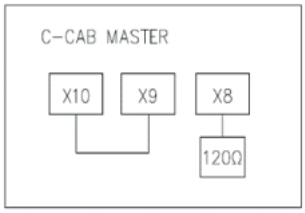
These inputs directly control the “Emergency stop outputs”.

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).

X8-X9-X10:

RS485 bus used for the communication with Diris Digiware M70 and Diris B30 devices. The cable between X9 and X10 is pre-installed. X8 is either connected to a 120Ω termination resistor when it’s the latest cabinet or to a C-Cab-extension if present.



Connection to automation Digiware

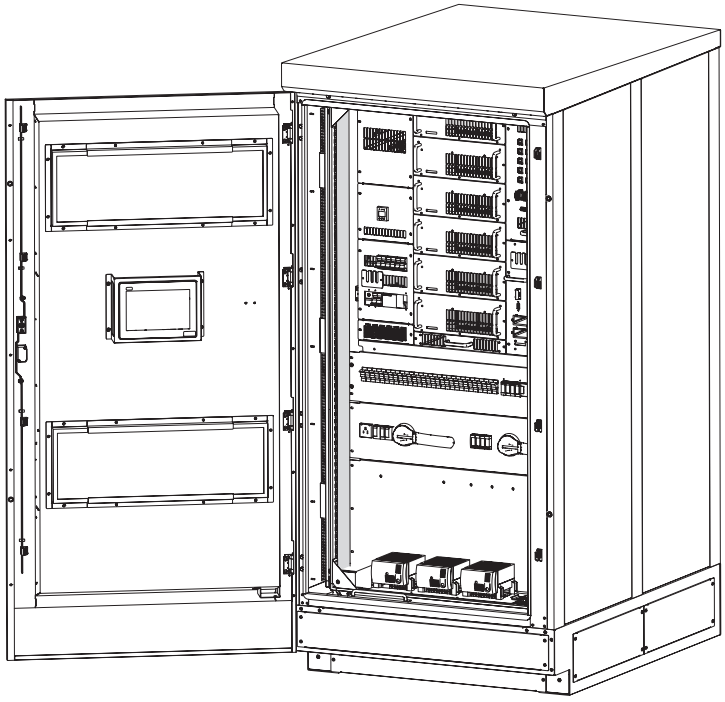
The two Diris Digiware modules are located in the left panel.

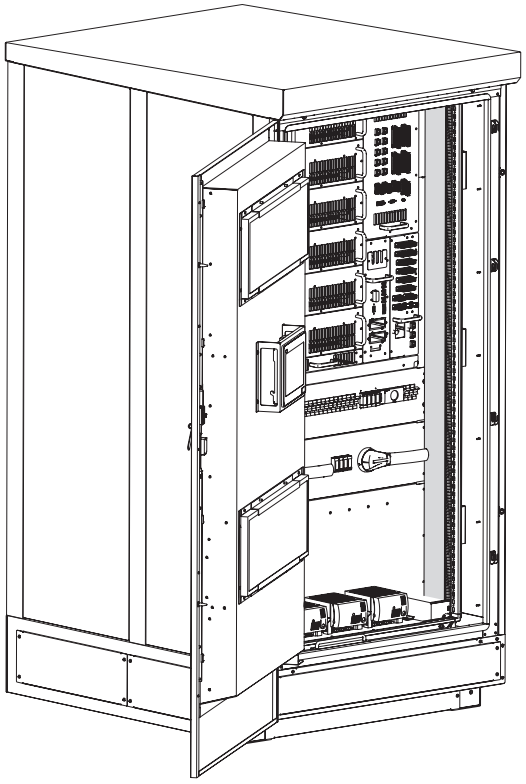
It is possible to connect other external Digiware current modules; this operation must be performed only by trained/authorized personal.

8.4.5. Connection path

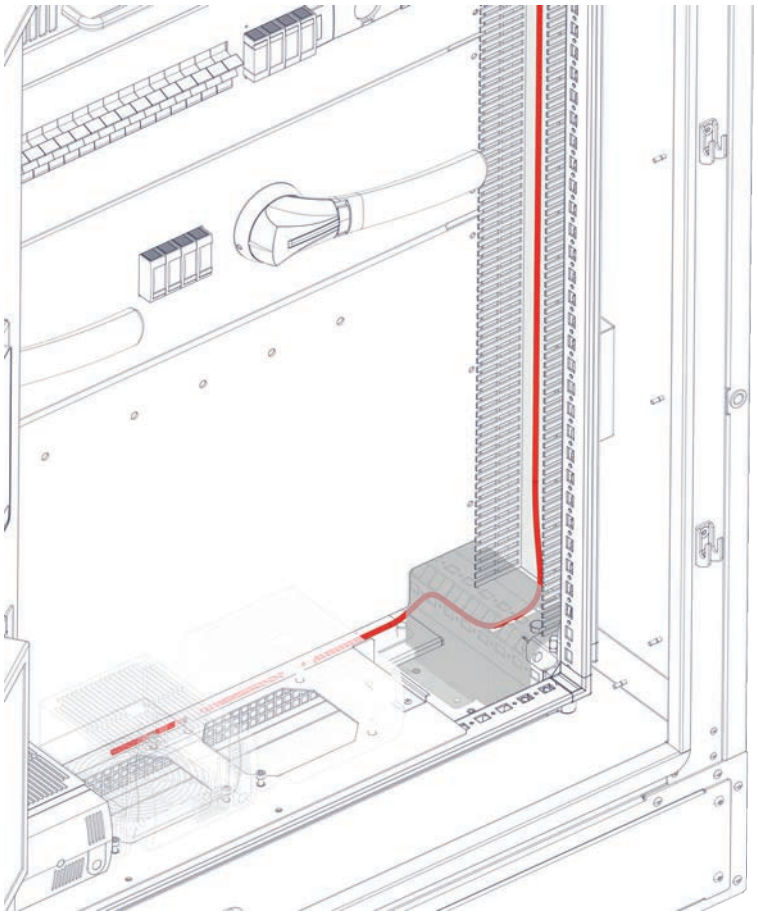
The Ethernet cables need to go through the cable duct on the side wall of the machine, as per the following procedure:

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. Parallel connection

To increase the power of the system up to 2 C-Cabs (1 Master and 1 Extension) can be connected in parallel without using an additional external coupling cabinet.

8.5.1. DC Power Connection

When the system is composed of 2 C-Cabs (one Master and one Extension), it is mandatory to connect half of the B-Cabs to the C-Cab Master and the other half to the C-Cab Extension.

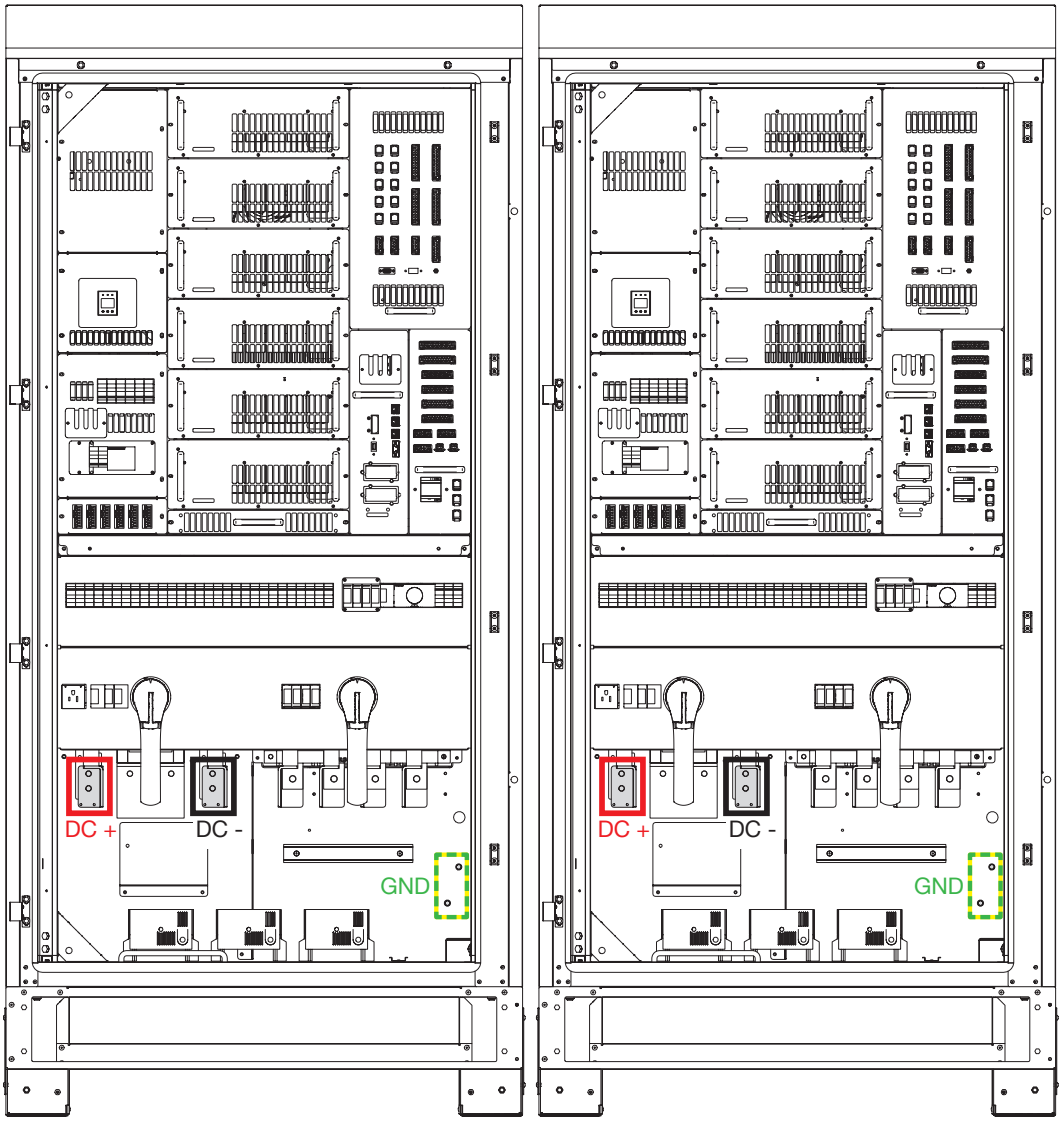


Figure 70. B-Cabs connection distribution

8.5.2. AC Power Connection

In this configuration, the connections of the parallel are made on the copper bars of the X50 terminals.

Each C-Cab shall be connected to the AC mains with a dedicated line, as indicated in chapter «8.4.2. Converter Cabinet Interconnections», page 68.

The cables from the user's plant shall be sized according to the total power of the system (C-Cab Master power + C-Cab Extension power).

All phases must be divided and connected on all C-Cabs.

Note: a digiware connection kit also has to be added,please refer to the documentation "Installation Manual Kit Digiware SUNSYS HES L"

Note: the C-Cab is compatible with TN-C, TN-S, TT and IT electrical supply systems.

8.5.3. Communication Connection

1) An RJ45 cable connects the Parallel board of C-Cab Master with the Parallel board of C-Cab Extension.

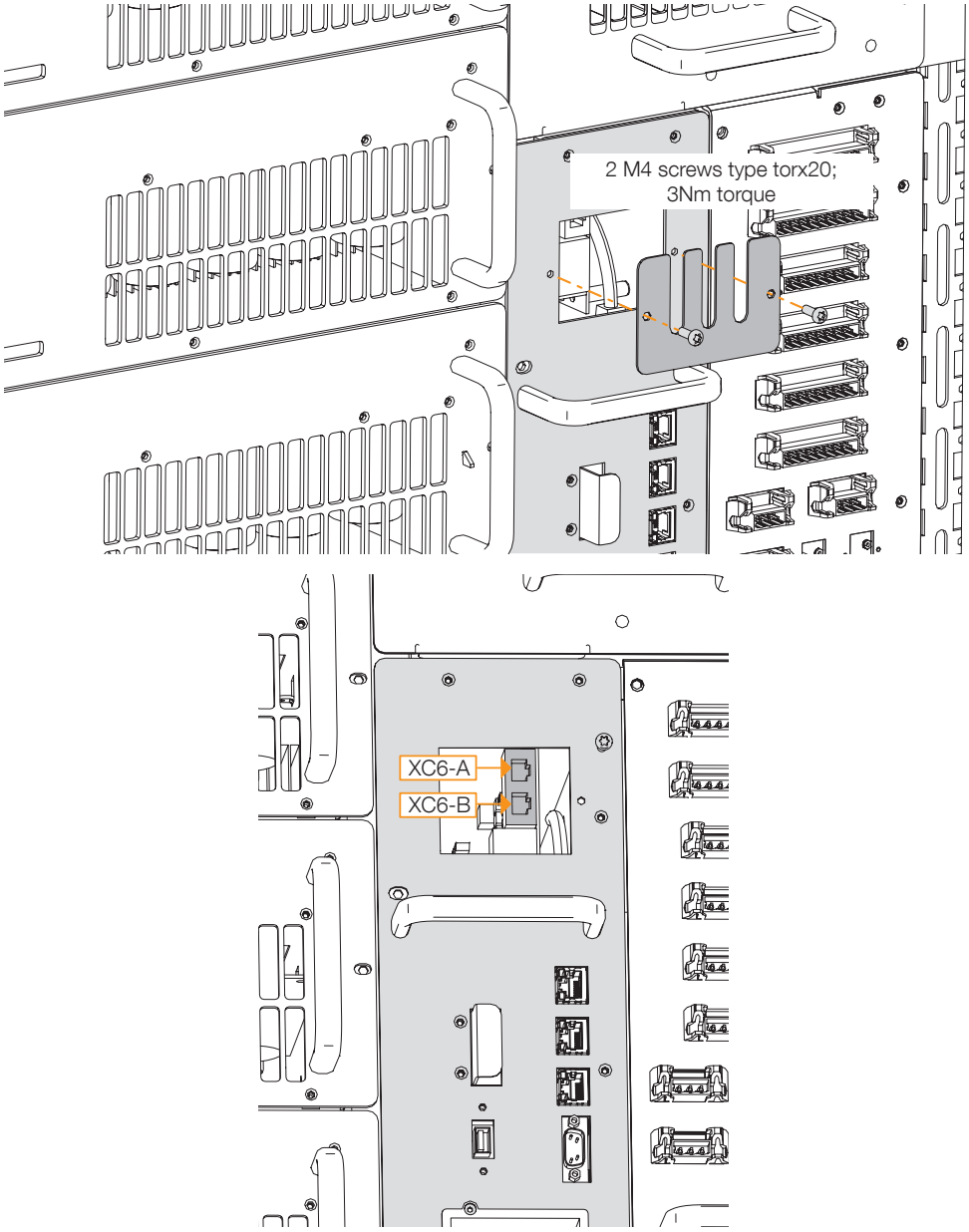


Figure 71. Location of the RJ cables for C-Cabs Master-Extension paralleling

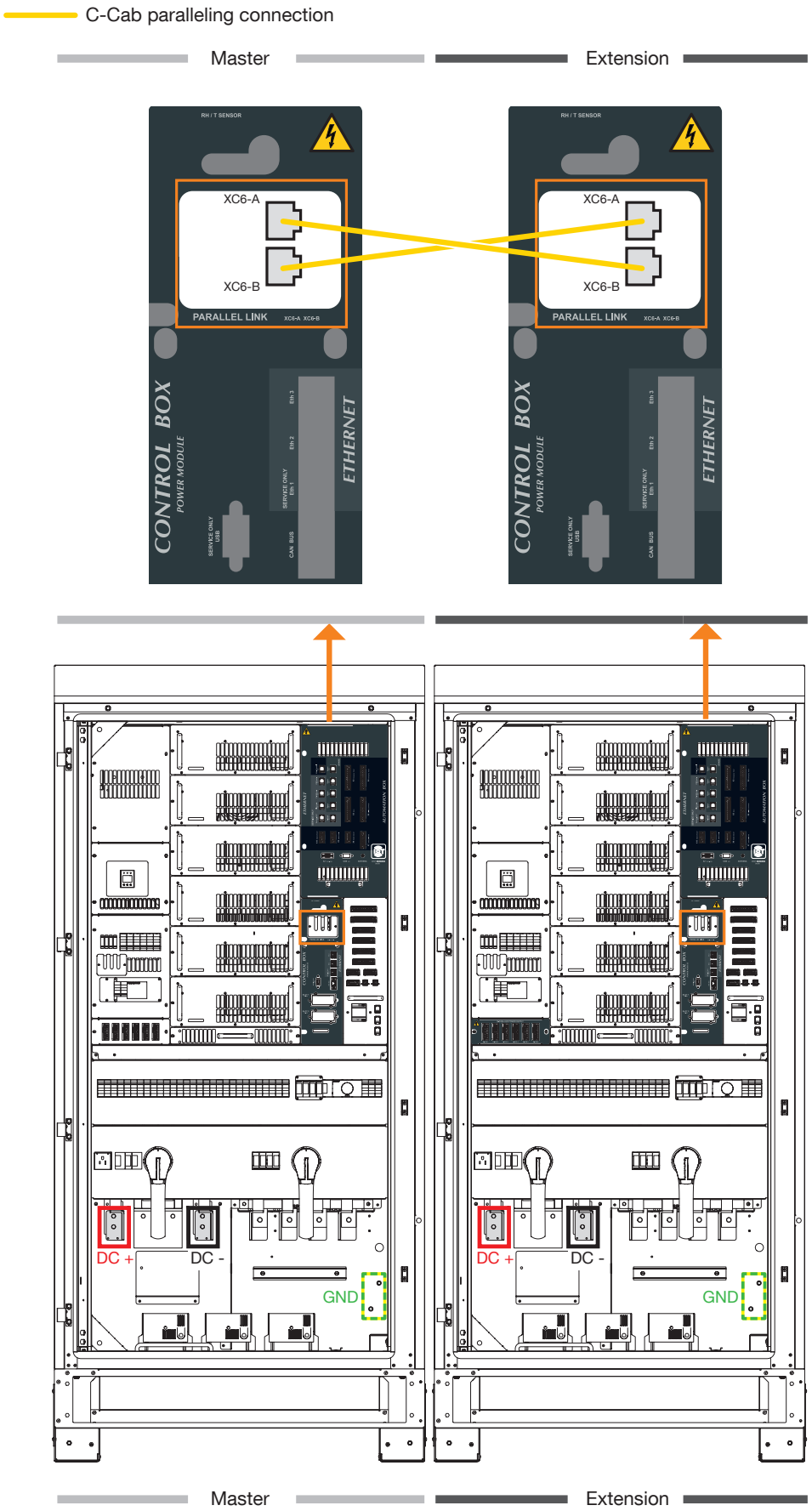


Figure 72. Connection of the communication for the paralleling

2) Control box connection: port Eth10 from the master is connected to the Eth 3 of the master Control Box (pre-built in factory), then a cable goes from Eth2 of the master Control Box to Eth3 of the extension Control Box.

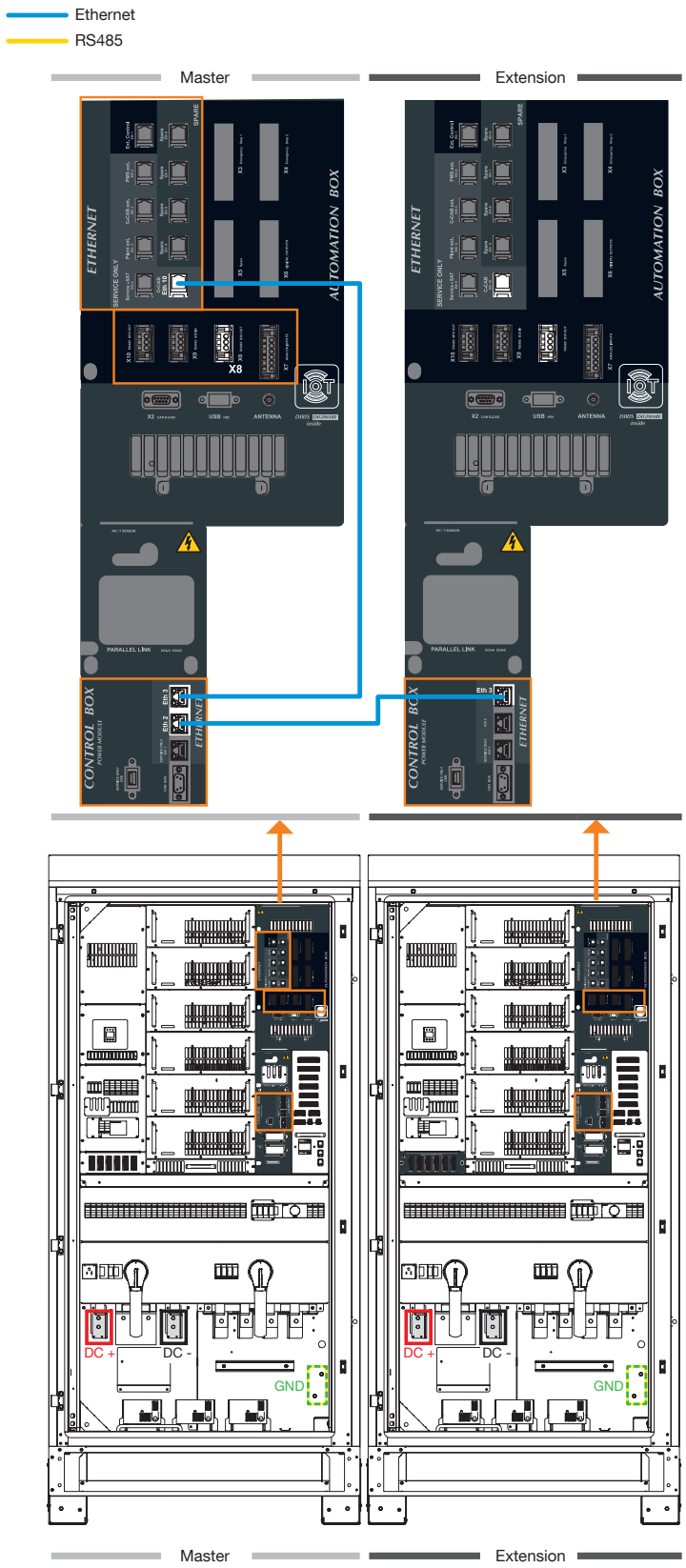


Figure 73. Connection of the communication for the Digiware package

3) EPO: up to 6 Emergency Power Off outputs are available in the Automation Box of C-Cab Master.

The C-Cab Extension can be connected to the EPO input of the Aux Interface box (connector X106).

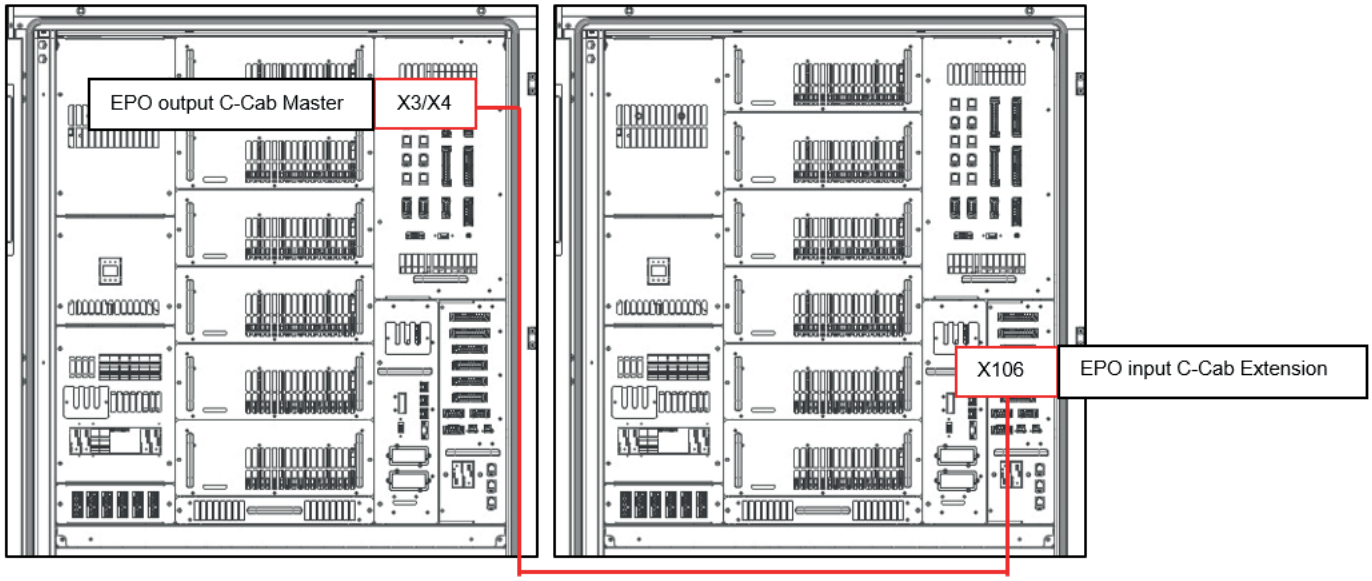


Figure 74. Location of the Emergency Power Off connections

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.	qty	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 F8B	2	10x38 CC	2A	AC 230V	Fan Extractor
F9	1	10x38 CC	1A	AC 230V	PCS Opt. Digiware
F10	3	10x38 CC	25A	AC 208V	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 F18B	2	10x38 CC	10A	AC 230V	Door Heaters
F19	1	10x38 CC	12A	AC 230V	Heaters 2kW
F21A F21B F21C	6	10x38 CC	2A	AC 230V	B-CAB 1-4 B-CAB 2-5 B-CAB 3-6
F22	1	10x38 CC	8A	AC 230V	UPS Input
F23	1	10x38 CC	2A	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:

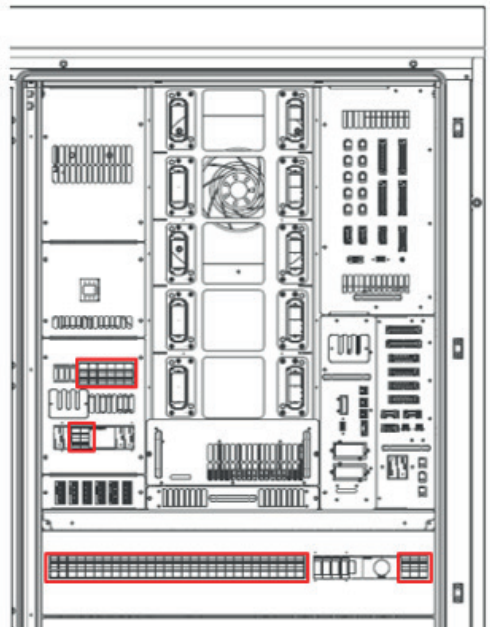


Figure 75. Location of the fuses inside the C-Cab

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. 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 (0.75in)

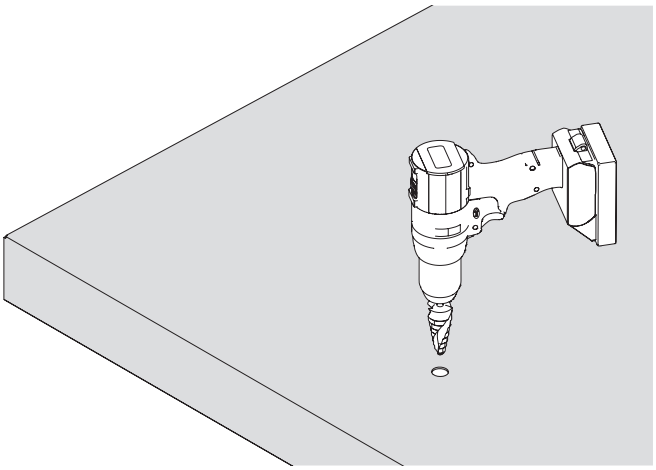


Figure 76. Hole drilling in the roof

Step 3: Install the antenna and glue it by removing the sticker, pass the cable on the right side at 310mm (12.2in) from the end.

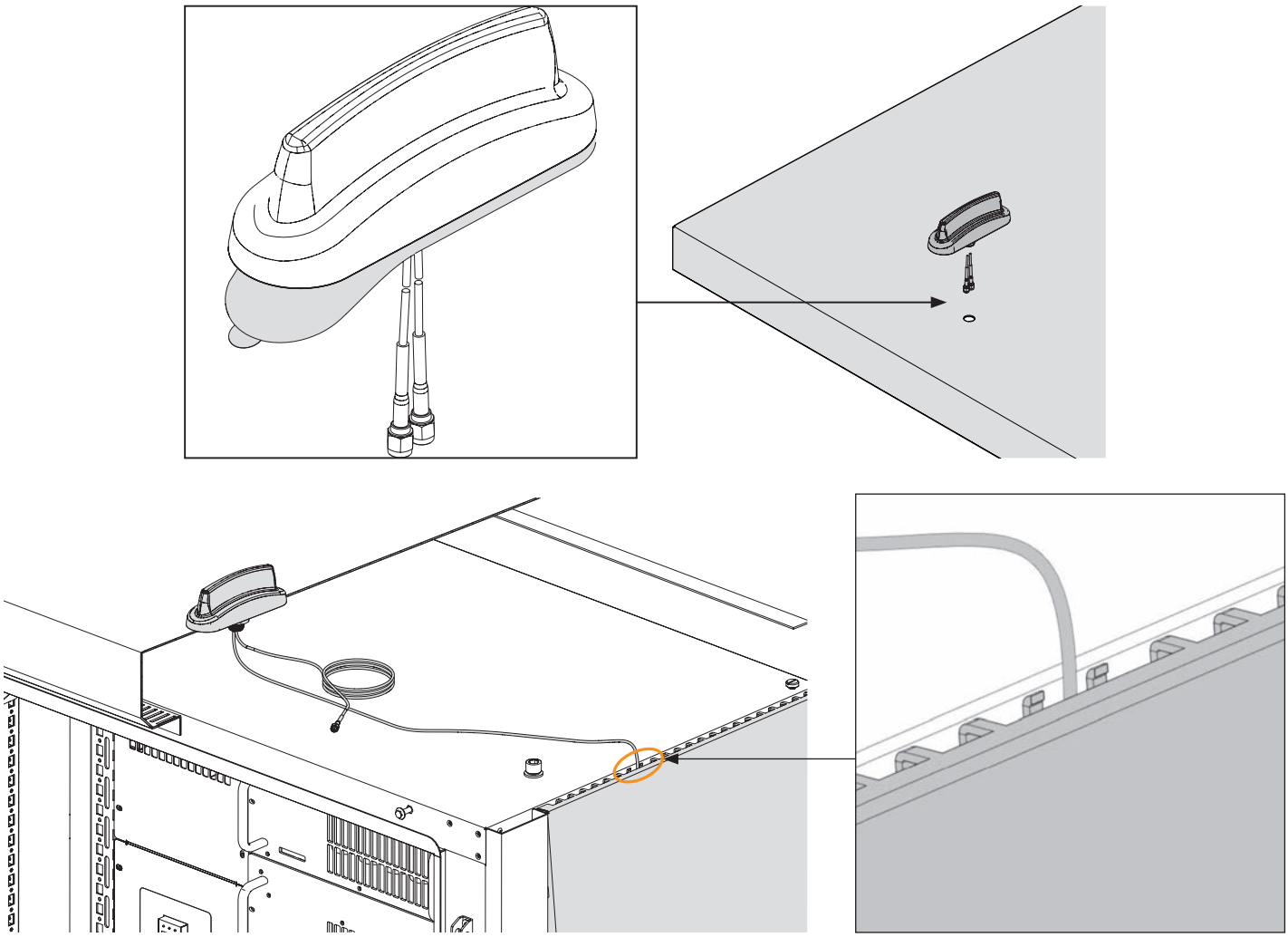


Figure 77. Antenna installation on the C-Cab

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

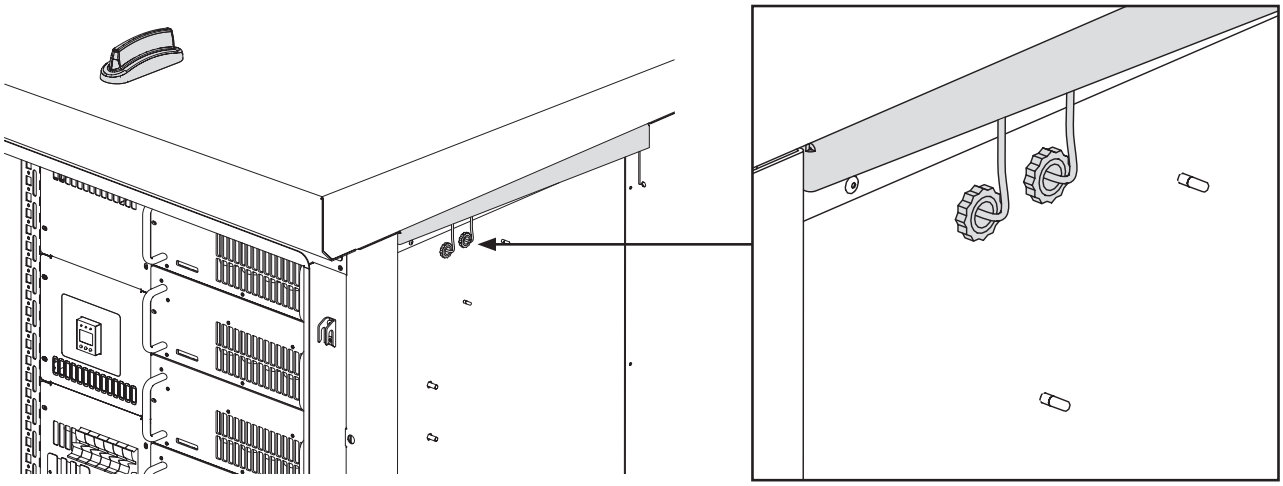


Figure 78. Cable direction from antenna to inside the C-Cab

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.

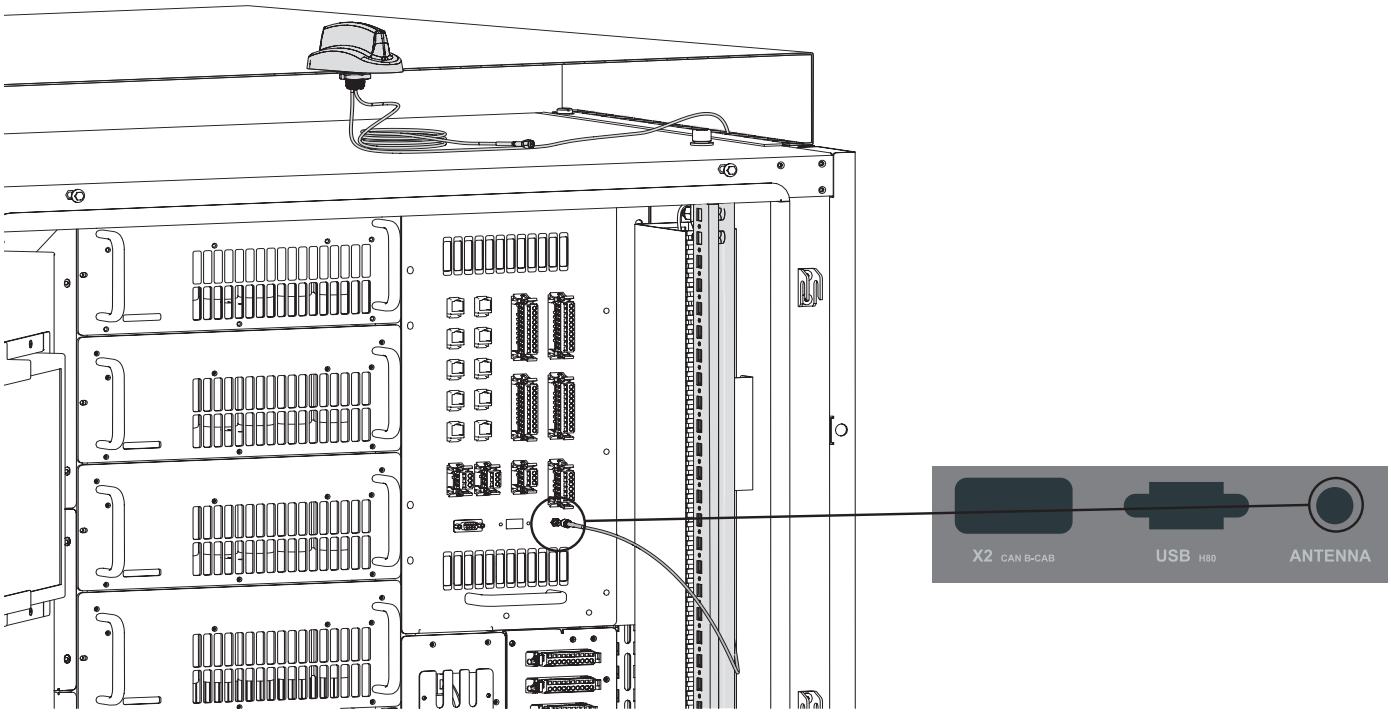


Figure 79. Connection of the antenna cable inside the C-Cab

8.8. Mounting details - Part 2

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 (4.4 ft-lbs).

Use item 5, left cover part, for the battery at the left end – front line -, item 6, right cover part for the battery at the right end – back line - and item 4, cover part, for other batteries.

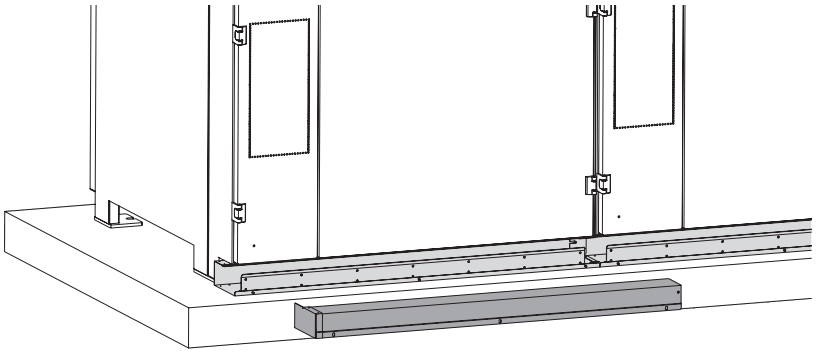
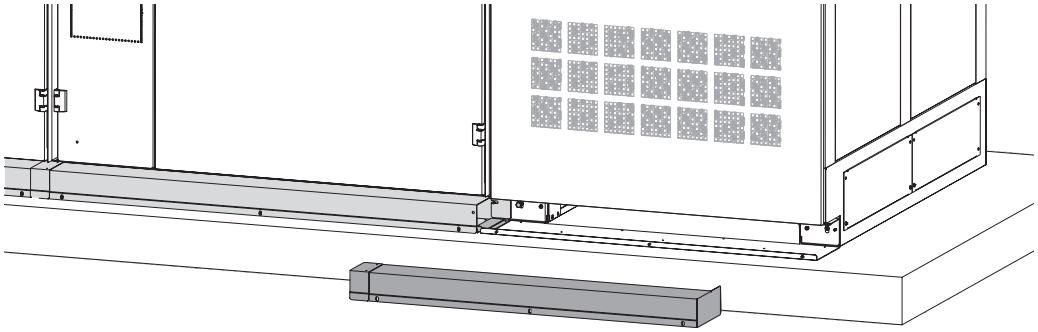


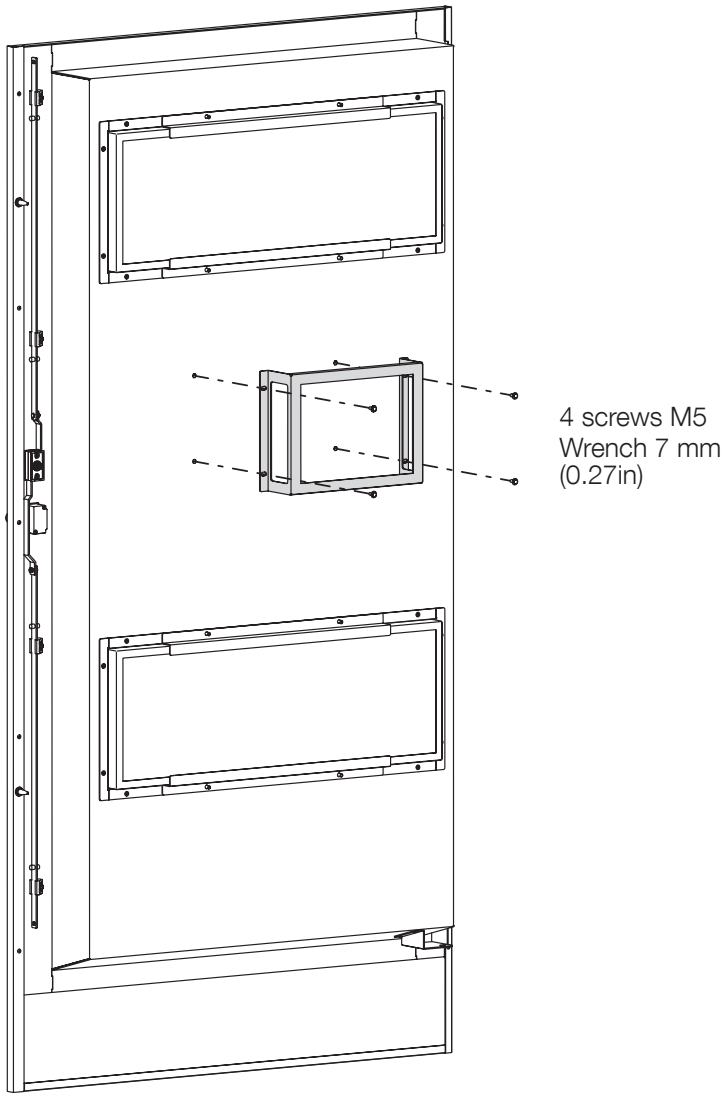
Figure 80. Screwing of the covers

Step 8: Finish with the C-Cab connection kit cover, item 2, using M5 nuts, torque 6Nm (4.4 ft-lbs).

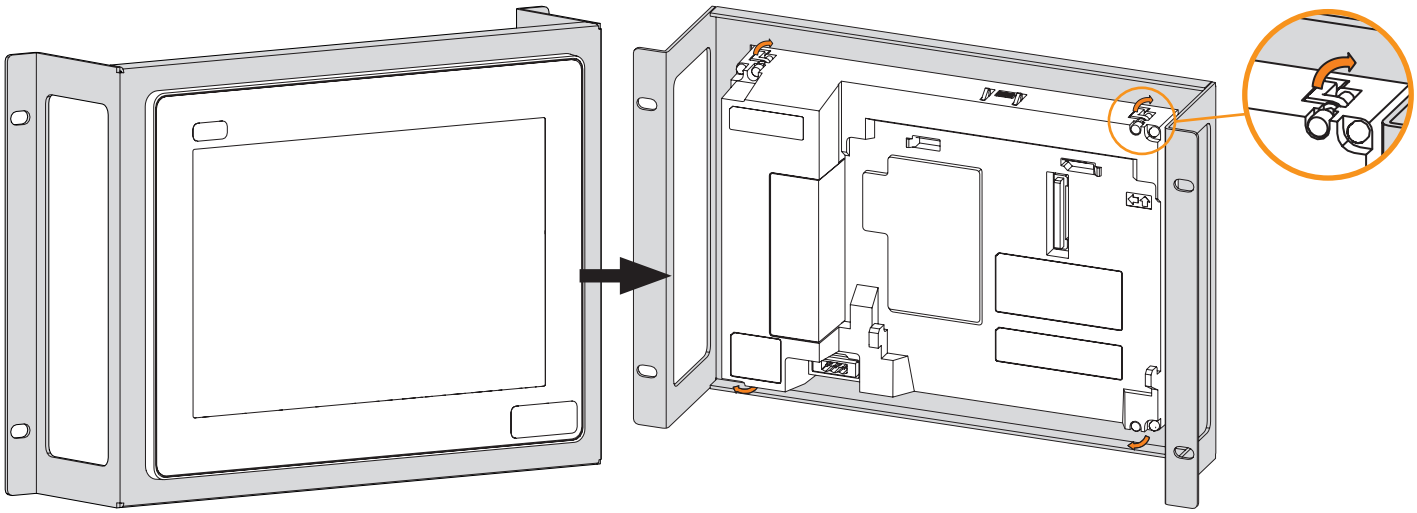


8.9. HMI installation

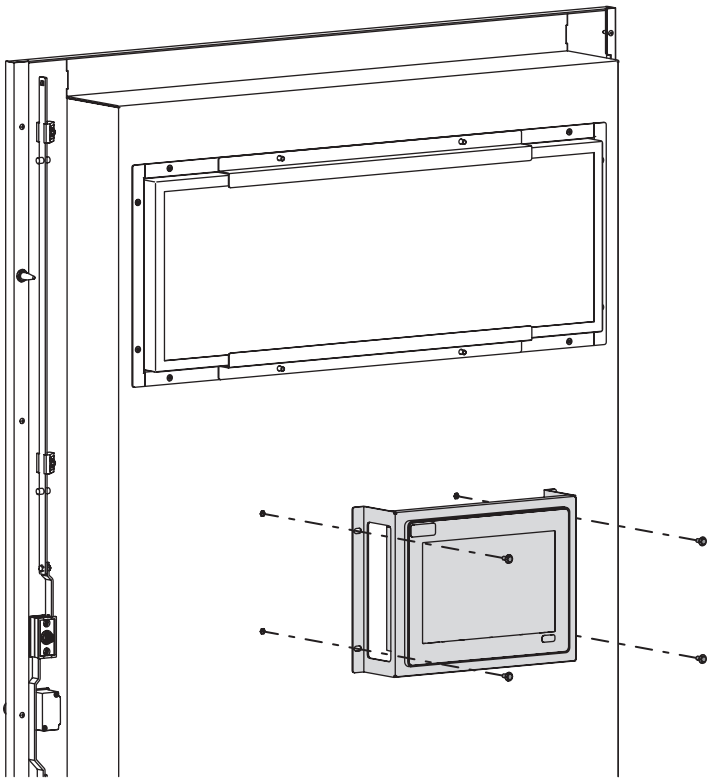
1. Unmount the support of the HMI from the door



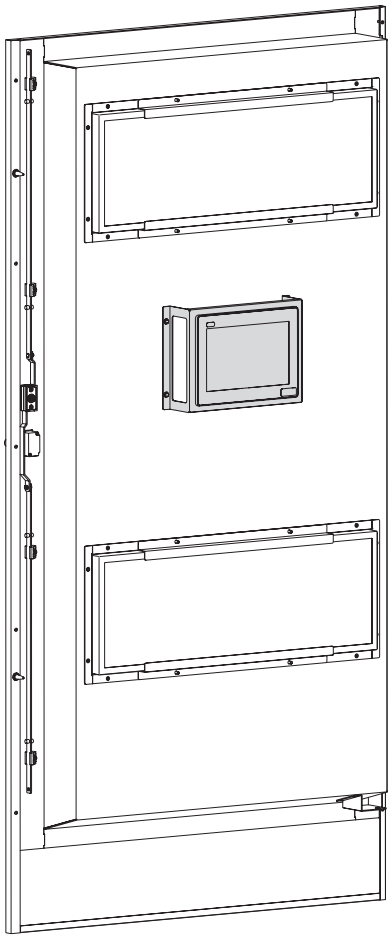
2. Mount the HMI on the support



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



4. Wire the HMI with the existing cables



8.10. UL 9540 - EWCS connection

The requirements reported in this chapter are necessary to be compliant with UL9540 if the global energy of the system is higher than 500kWh.

To satisfy UL9540 18.2 requirement regarding External Warning Communication System (EWCS), Sunsys HES-L auxiliary must be supplied from an external UPS (not provided with this product).

EWCS is a system that gives notification of potential safety issues with the ESS. This system must be available for 5h regardless of battery source availability.

The minimum requirements for external UPS are reported in the table below:

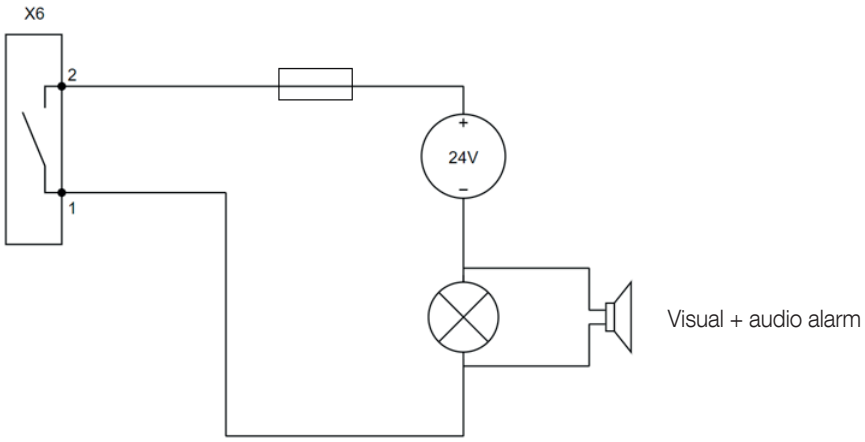
UPS requirements for UL9540 compliance	
Min power	500W
Min apparent power	750VA
Min backup time	5h
Rated voltage	120V (1Phase+Neutral)
Voltage range	88÷132V
Frequency	50/60Hz

This UPS shall be connected to X107 input as specified in chapter “8.4.2. Converter Cabinet Interconnections”.
This line shall be protected with an 8A class CC fuse or equivalent.

The EWCS provides alarm through an output of the internal PMS.
This output shall trigger an external warning signal such as a warning light and audio alarm (not provided with this product).
Visual alarms shall be in accordance with UL 1638, and audio alarms shall be in accordance with UL 464/ULC 525.

The maximum sound level for audio alarms shall not exceed 110 dBA at the minimum hearing distance. For outdoor installations, visible alarms installed on the ESS, shall be located no less than 203.2 cm (80 in) nor more than 243.8 cm (96 in) above the ground.

The EWCS alarm signal is available at connector X6 at pin 1 and 2 (see chapter «8.4.4.3. Connections of automation box», page 89).
This is a dry contact output; below is an example of the circuit that can be connected to the output:



Dry contact specifications	
Max current	6A
Maximum switching voltage	277V

9. COMMISSIONING

To reduce the risk of dust/humidity infiltration prior to SUNSYS HES L 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. EXTERNAL STATUS LEDBAR

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.

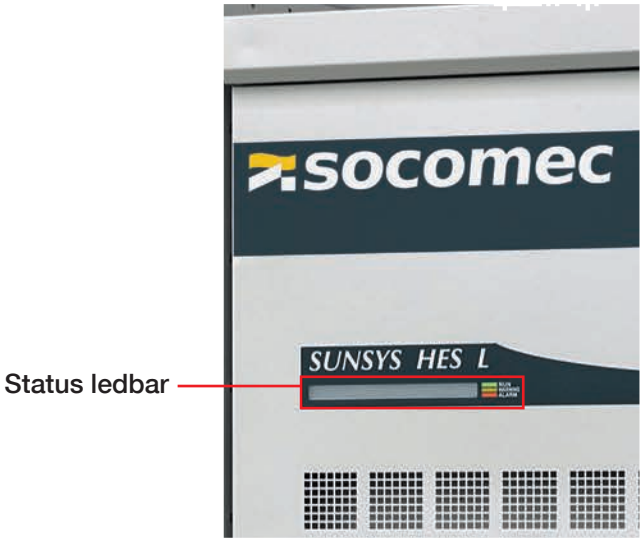


Figure 81. View of the External HMI of the C-Cab

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 jewelery (i.e., wristbands, watch chains, rings, bracelets, necklaces, body jewelery, 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 right 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 60.
2. Switch on the auxiliary power:

Switch on Q3 by turning the handle in position 1

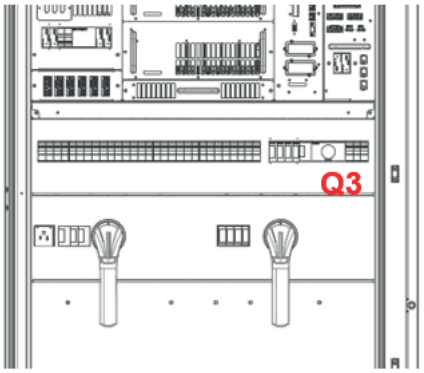


Figure 82. Location of the switch Q3 in the C-Cab

3. Switch on the UPS:

Remove the top-left panel by removing the four screws

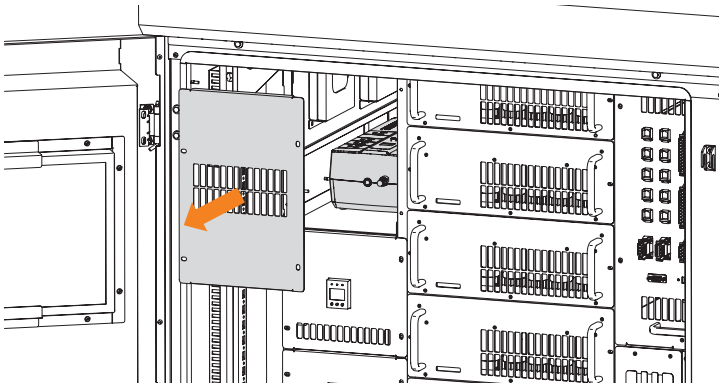


Figure 83. Location of the UPS in the C-Cab

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

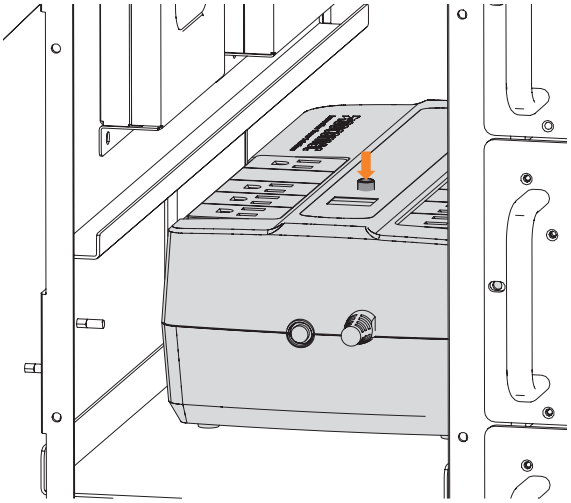


Figure 84. Location of the power button of the UPS

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

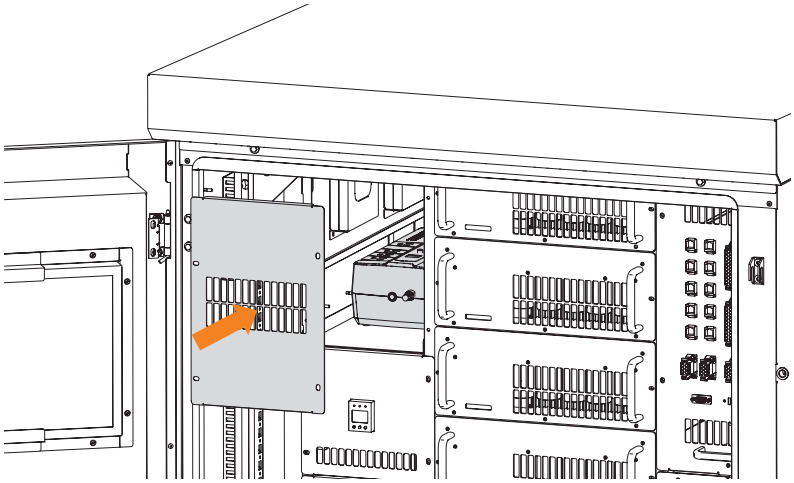


Figure 85. Reinstallation of the panel

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

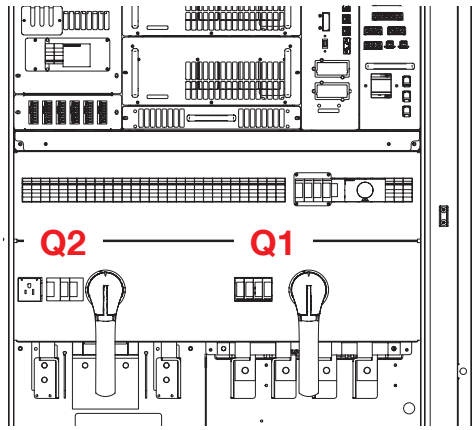


Figure 86. Location of the AC and DC switches (Q1 and Q2) in the C-Cab

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 86.

2. Switch off the UPS:

Remove the top-left panel by removing the four screws, refer to Figure 83.

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 84.

Close the top-left panel using the four screws previously removed, refer to Figure 85.

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 82

4. Open the isolation switch QS and QF1 & QF2 in all B-Cabs, refer to Figure 60.

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! RISK OF TIPPING OVER: before carrying out any operations, ensure the C-Cab is secured at the feet.
	WARNING! The modules have to be moved individually. Never handle more than one module.
	Weight of the module: 22.5kg (49.6lbs)

Procedure:

Remove the front panels unscrewing their lateral screws

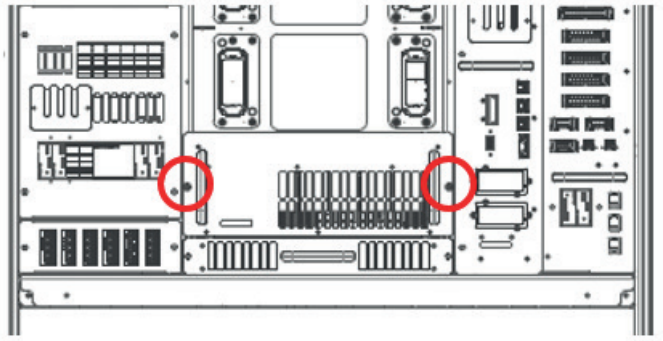


Figure 87. Power module screws location

Insert the module completely, following the order of «Figure 89. Order of insertion of the modules», page 114

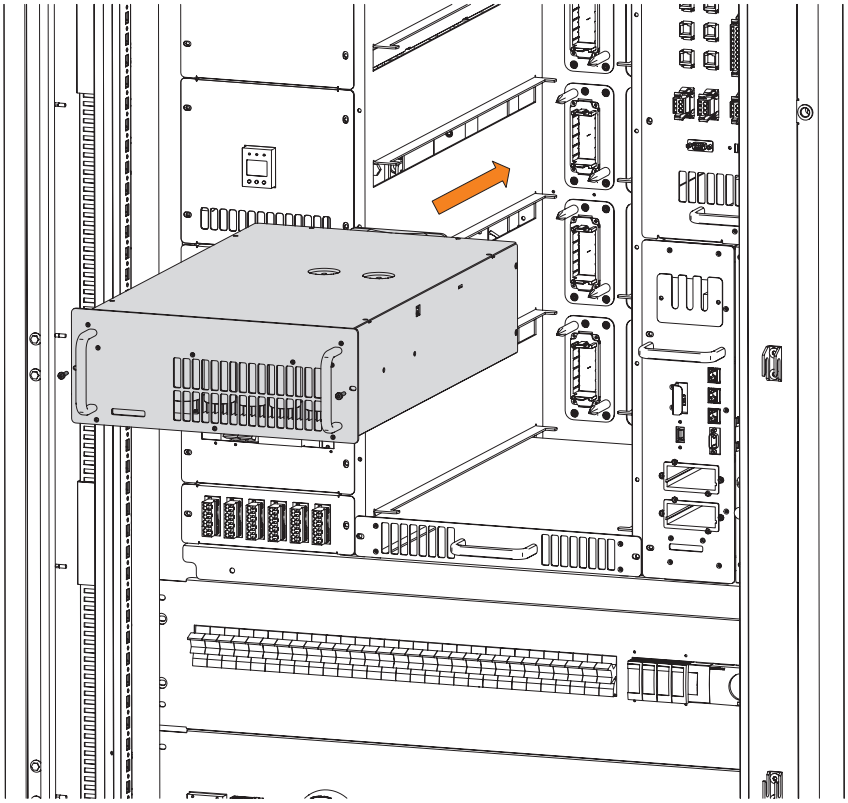


Figure 88. Insertion of the power module

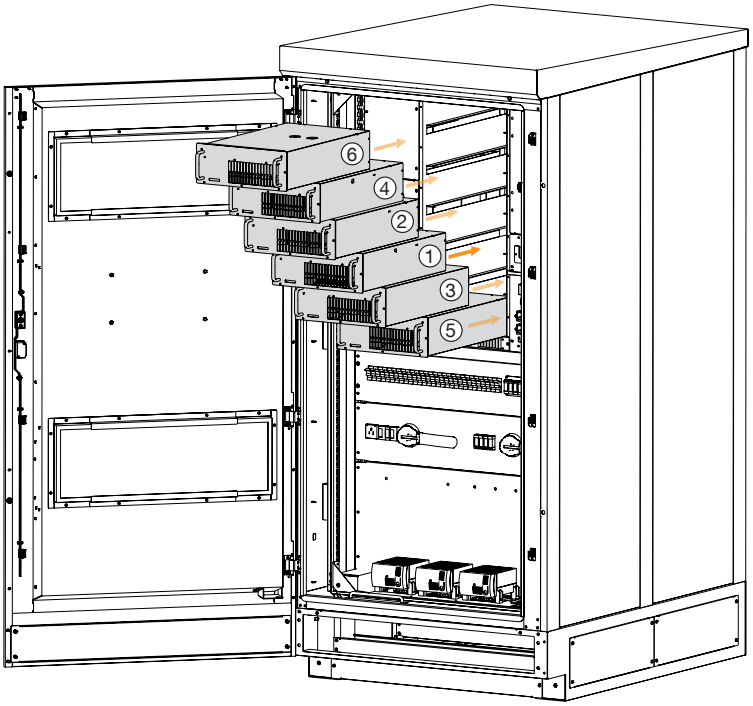


Figure 89. Order of insertion of the modules

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

13. MAINTENANCE

	**CAUTION!** Lethal voltages exist inside the unit during normal, maintenance and service operations. Disconnect and lock-out all power sources before working inside the unit. **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!** Before carrying out any operations on the unit read the “Important Safety Instructions” chapter carefully.
	**CAUTION!** SUNSYS specific maintenance should be performed only by Socomec trained and qualified service personnel. 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

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.

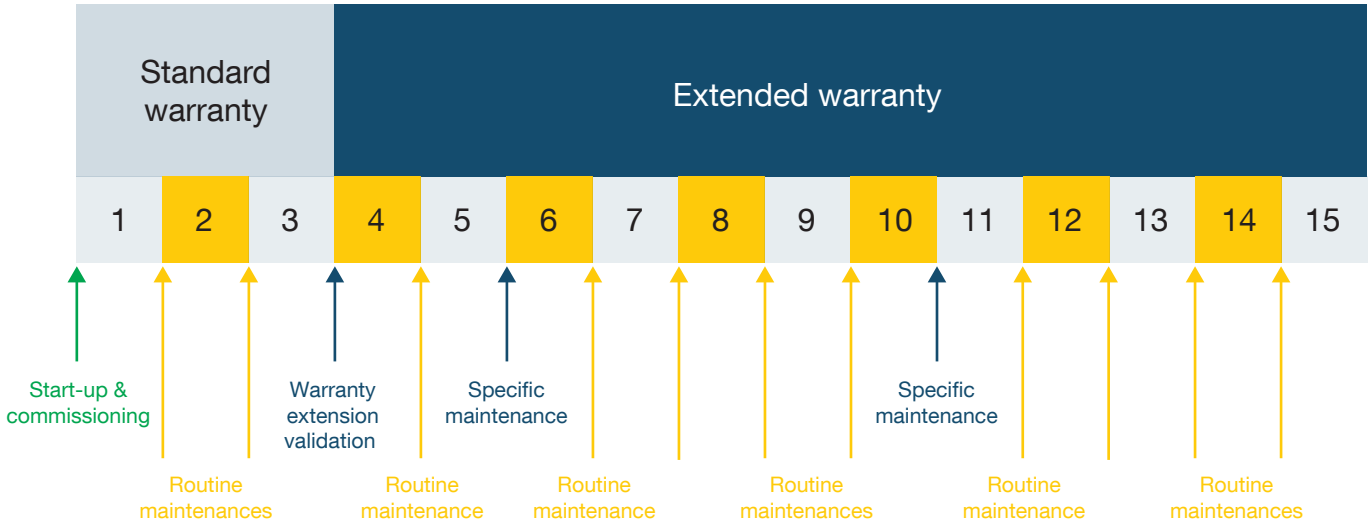
Note: The service provider is responsible for managing the timely service of the unit based on the alerts and alarms delivered from the SUNSYS HES L.

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 "OPM_22_121977-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. • Check all the ventilation grills are free from dirt and debris. • 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. • Check the SPD functionality in the C-Cab following guides and procedures (See details below). If defective, must be replaced. • Clean the pollen from the cabinet if needed during the pollen season to prevent the mesh from being blocked. • 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). • 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). • 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. • Clean the dust on the B-Cabs condensers. • 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.

Schedule	Inspections/Procedure
Every five years (by Socomec or trained service technician only) 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. • Re-torque all connections including the AC & DC power connections. • Inspect signs of corrosion and use appropriate paint to mitigate the spread of rust wherever observed. B-Cab: • Drain the coolant following the procedure and replace with fresh automotive grade antifreeze (50% Glycol). • Replace the desiccant in the condenser. C-Cab: • Replace the UPS that is inside the SUNSYS C-Cab L. • Replace the fans (modules and cabinets). • Replace the extractor. • Replace the Humidity/Temperature PCB. • Replace the hygrostat. • Replace the DC capacitors PCB. • Replace the AC capacitors PCB. • Replace the 230Vac/24V DC Power Supply inside Automation Box.
Every 10 years (by Socomec or trained service technician only) Note: The system is completely powered off for this inspection	• The fire protection system in the B-Cabs requires replacement of the aerosol container. • Replace the internal converter cabinet fan (recommended). • Replace the CPU inside Automation Box. • Replace I/O and Analog cards inside Automation Box. • Replace the DIRIS. • Replace all SPDs. • Replace DC & AC capacitors PCB inside power modules. • Replace the varistors PCB (EMI filter board). • Replace the control module power supply. • 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:

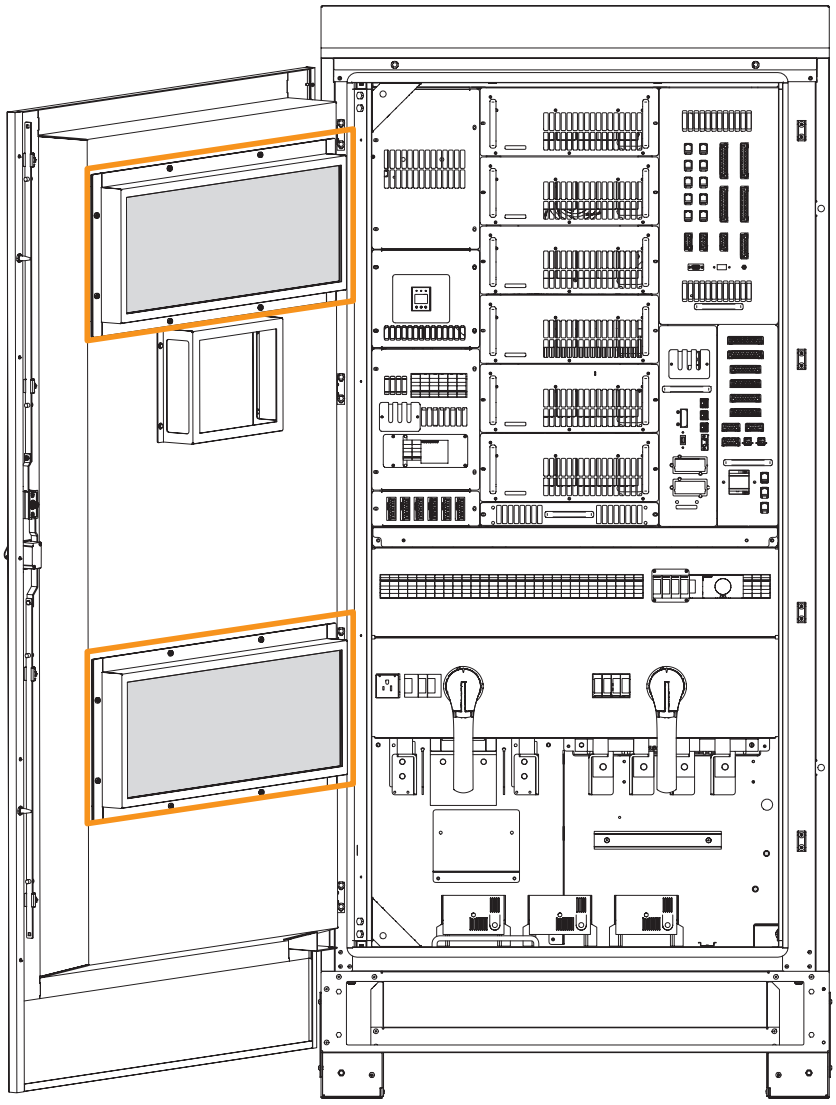


Figure 90. Location of the C-Cab air filters

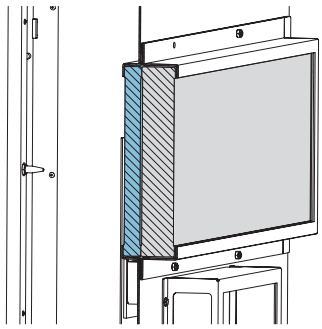


Figure 91. Details of the air filters

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:

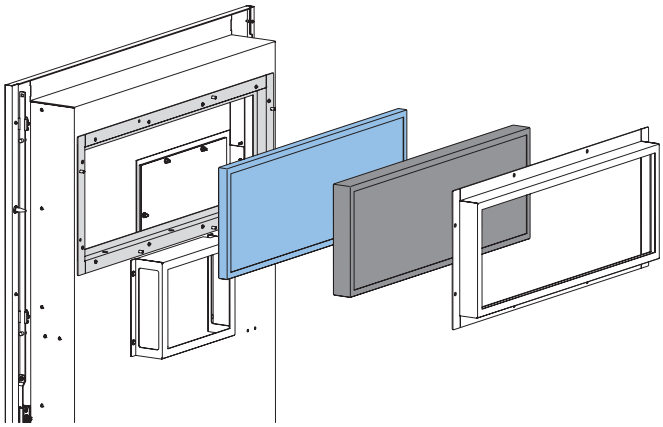


Figure 92. Installation of the air filter

- 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 Figure 83, Figure 84 and Figure 85.

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

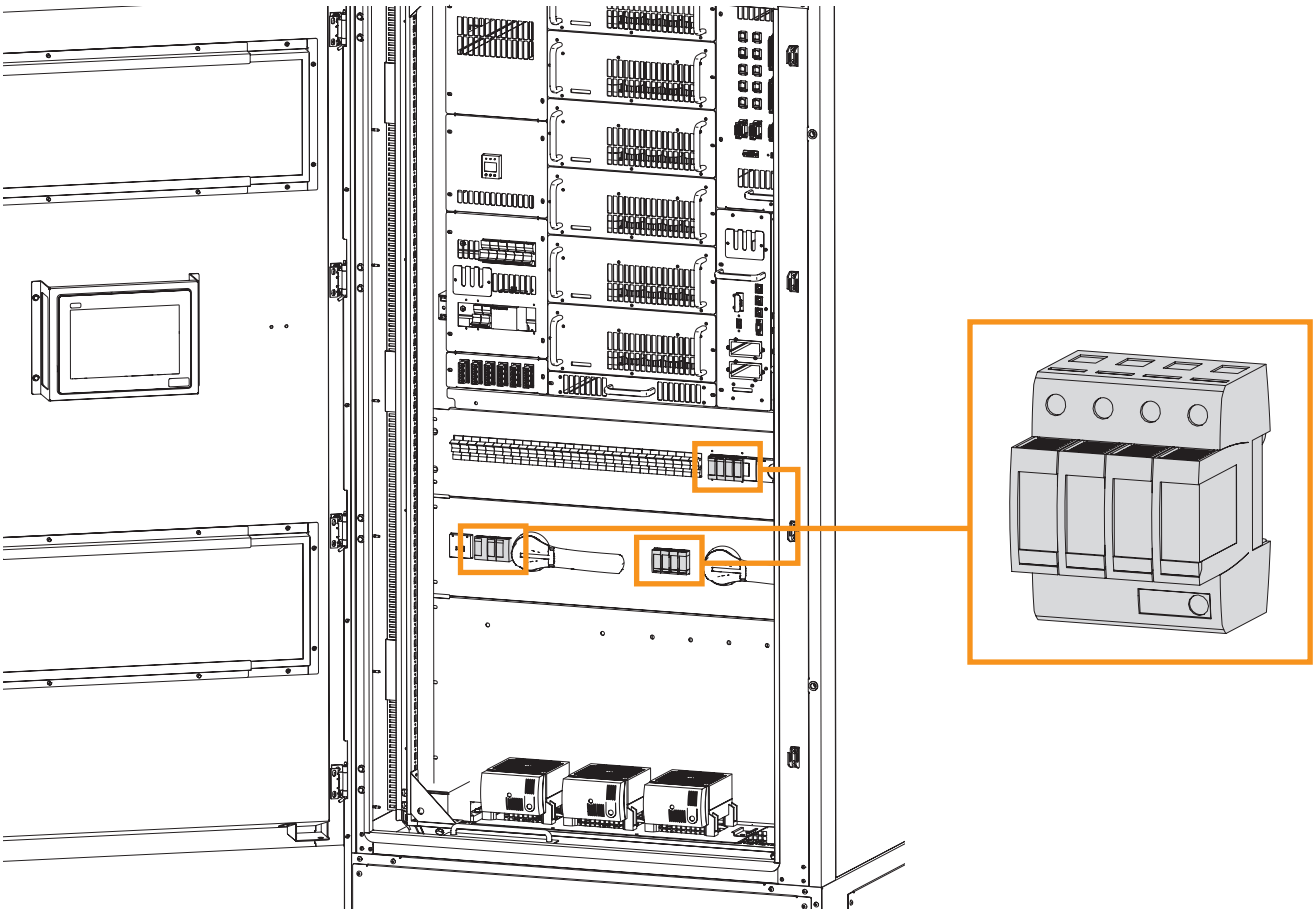


Figure 93. Location of the SPDs inside the C-Cab

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 (140°F), 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 115. 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.

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

Please refer to the document»OPM_22_121977-SUNSYS_HES_B-CAB-Calibration_Method» to get the procedure.

13.4.2. Coolant

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

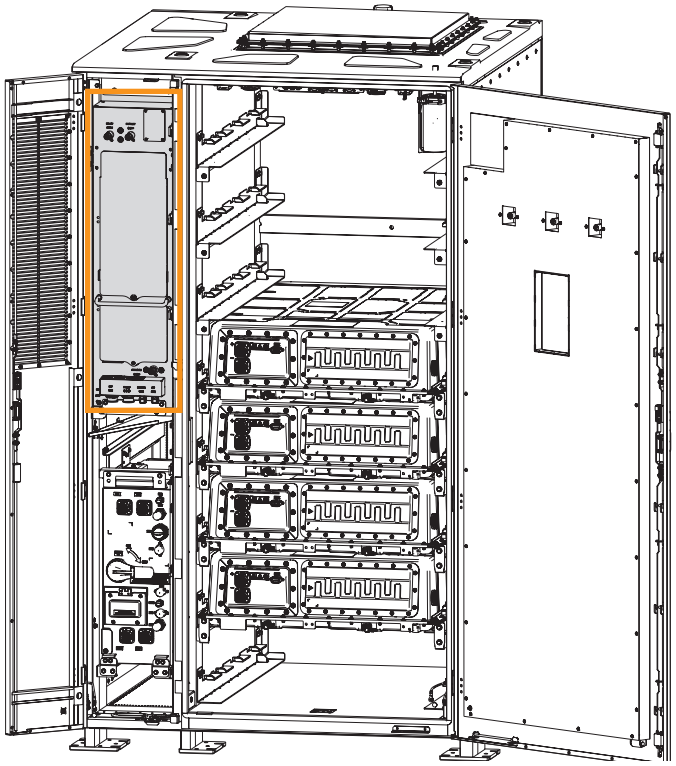


Figure 94. Location of chiller on B-Cab

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!** **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!** **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 «OPM_22_121978-SUNSYS_HES_B-CAB-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 qualified as a «GRID SUPPORT UTILITY INTERACTIVE INVERTER" and complies with the advanced grid interconnection requirements specified in UL 1741 Supplement SA and Supplement SB 3rd Edition based upon IEEE 1547-2018, IEEE 1547a-2020 and IEEE 1547.1-2020.

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 default voltage and frequency trip settings and how to map from IEEE 1547-2018 trip settings to SunSpec information models. The complete set of available SunSpec models can be found in 5.3.1.

SunSpec uses curves to specify the trip settings, each segment in a curve is represented by two points. Although the information in the curve can be represented with fewer points in some circumstances, all the points are specified to provide a consistent method of representing all curves derived from the IEEE 1547-2018 threshold settings

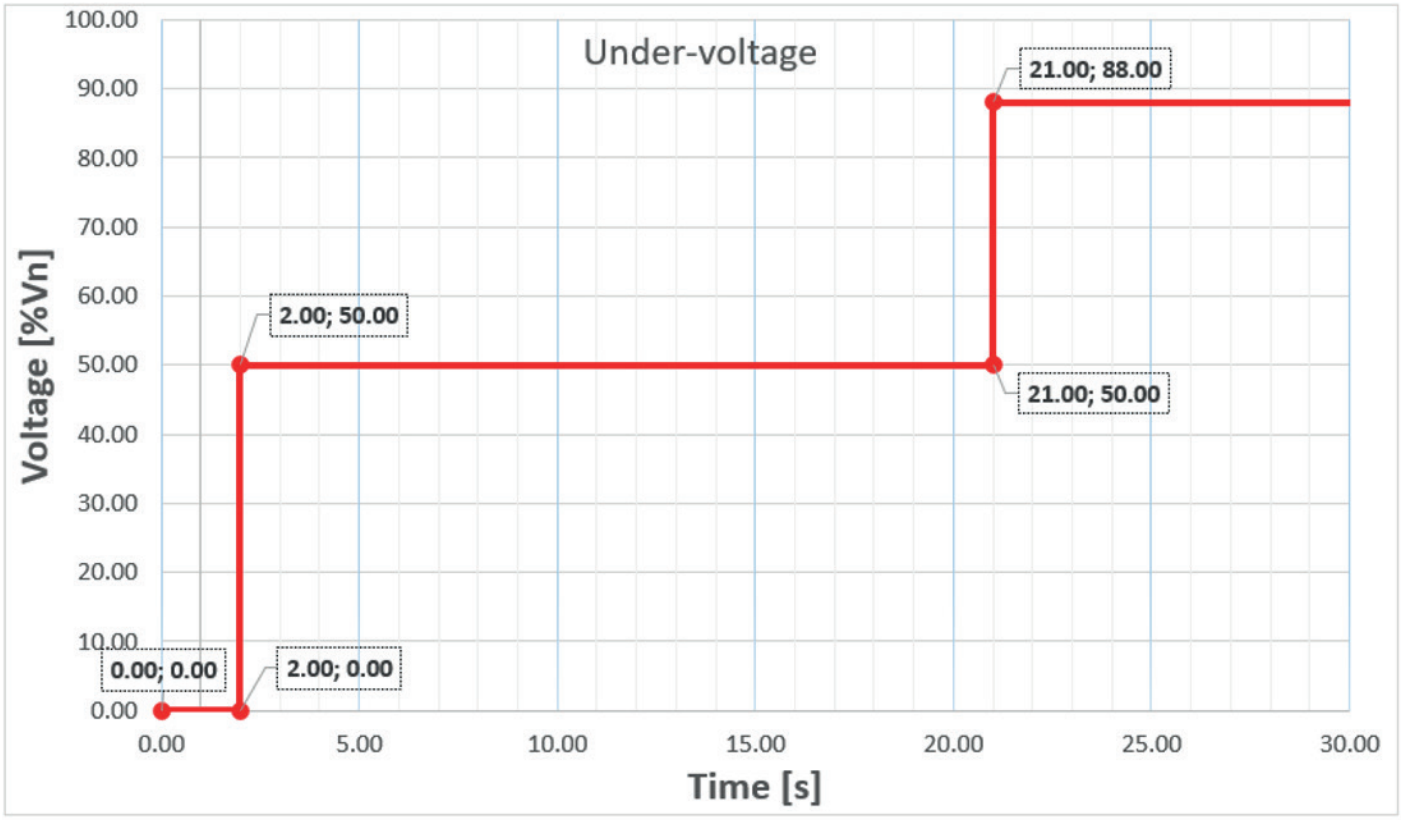
Voltage Trip settings

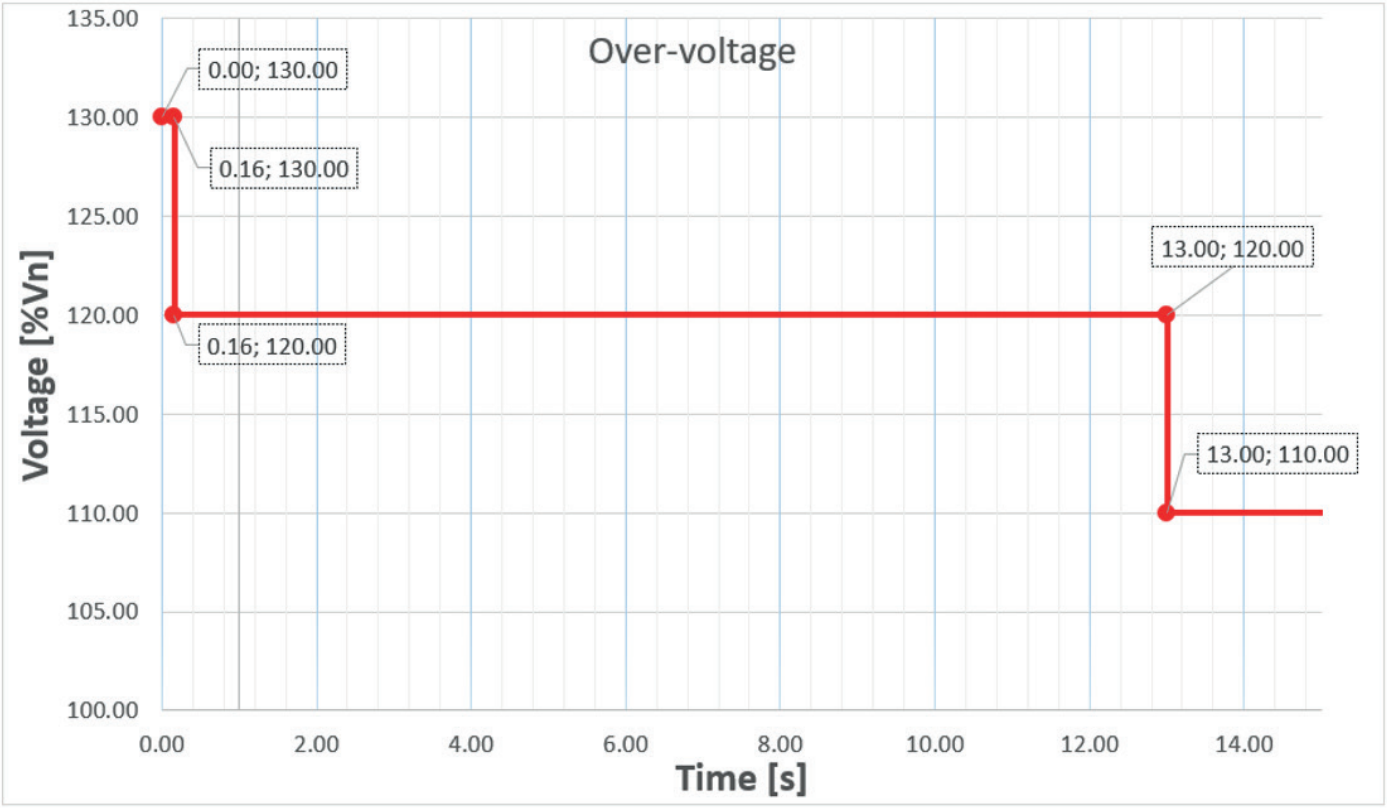
The default voltage trip settings are specified in the following table.

SUNSYS C-CAB L DEFAULT VOLTAGE TRIP SETTINGS

IEEE 1547-2018 - abnormal operating performance Category III		
Points	**Voltage (% of nominal voltage)**	**time (s)**
Under-Voltage default trip curve		
UV_P1	0.00	0,00
UV_P2	0,00	2.00
UV_P3	50,00	2.00
UV_P4	50,00	21.00
UV_P5	88.00	21.00
Over-Voltage default trip curve		
OV_P1	130.00	0,00
OV_P2	130.00	0.16
OV_P4	120.00	0.16
OV_P5	120.00	13.00
OV_P6	110.00	13.00

The settings above describe the following under and over-voltage trip curves.





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

IEEE 1547a-2020 defines the ranges of adjustability for the trip thresholds and the clearing times (in brackets {…}); they are provided in the following table.

ABNORMAL VOLTAGE TRIP SETTINGS

IEEE 1547a-2020 – 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}

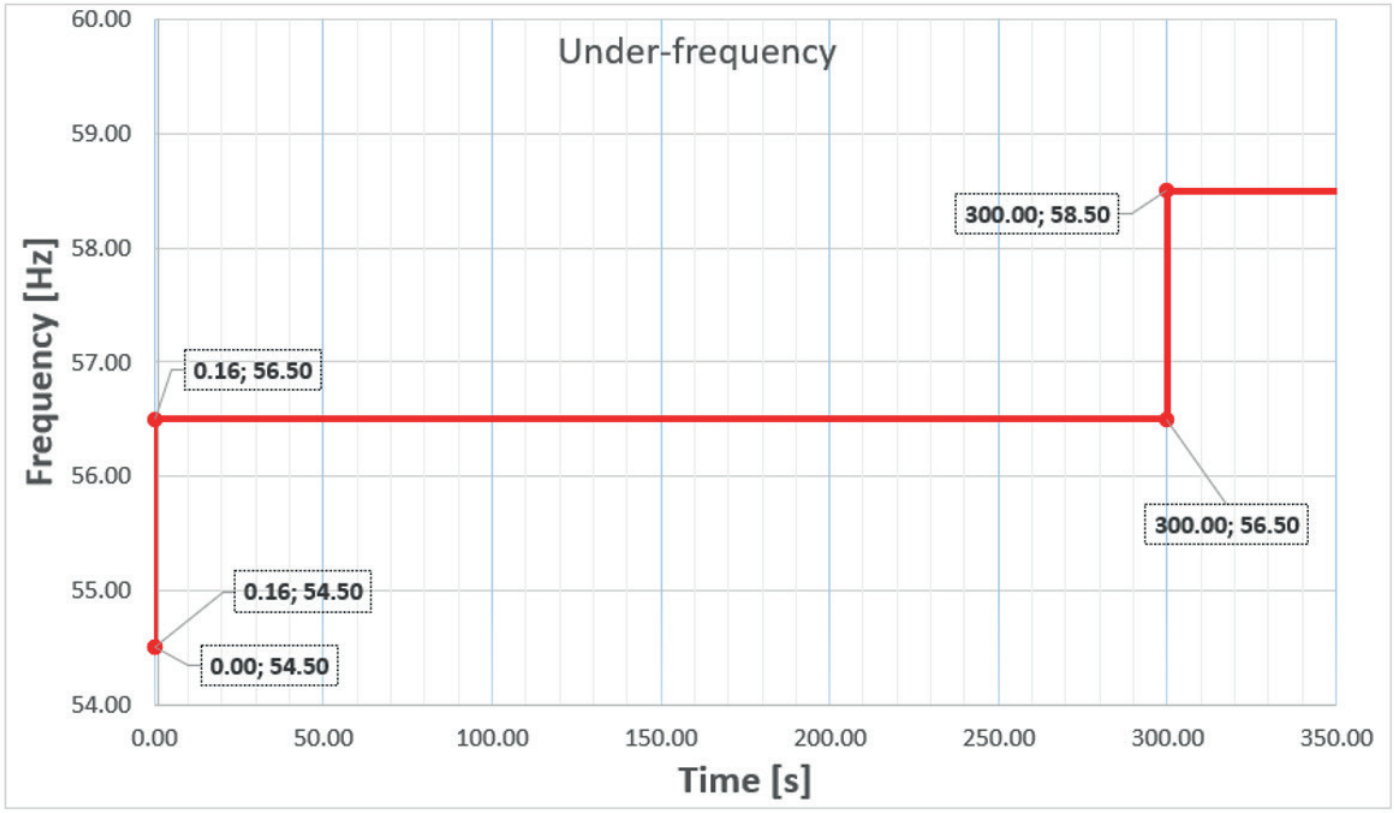
Frequency Trip settings

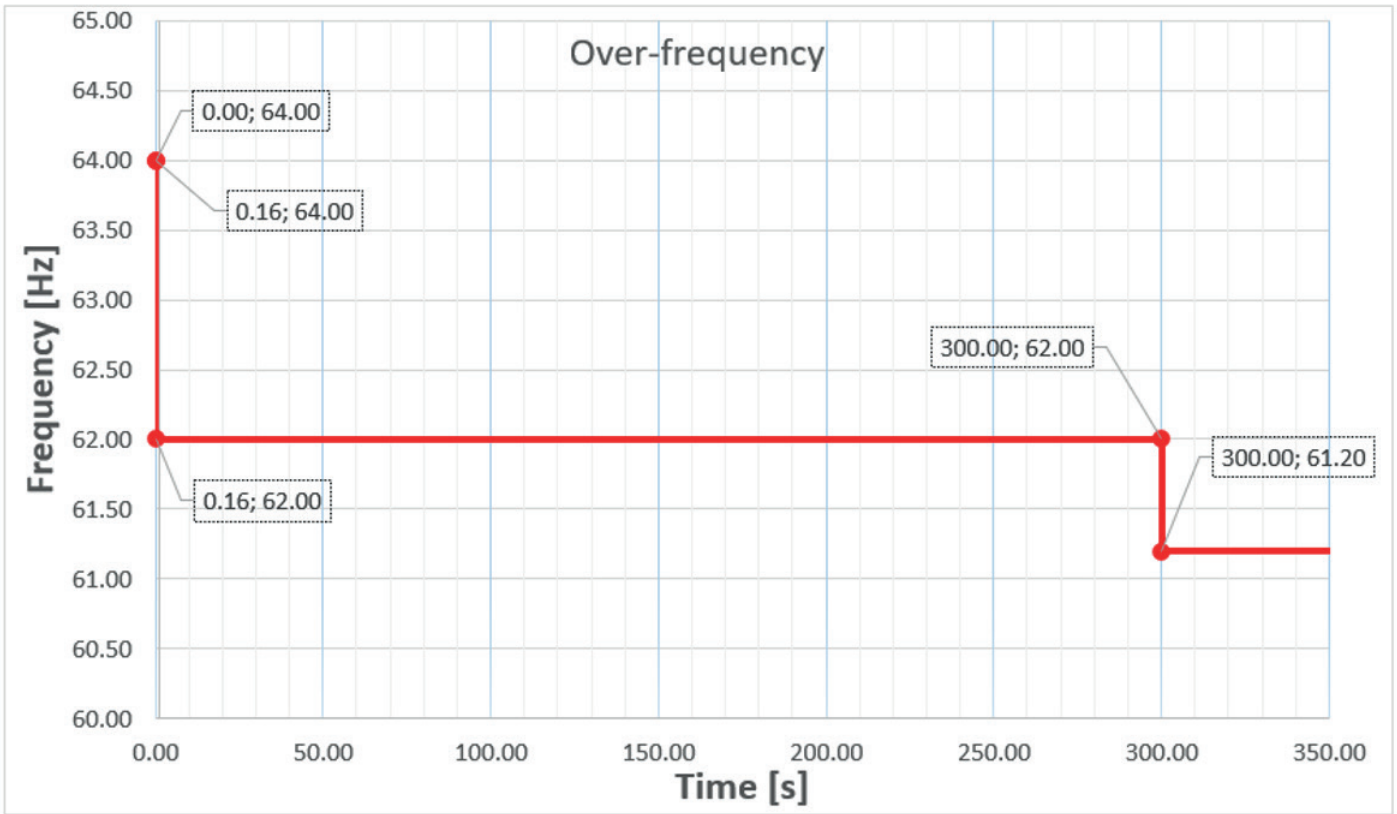
The default frequency trip settings are specified in the following table.

SUNSYS C-CAB L DEFAULT FREQUENCY TRIP SETTINGS

IEEE 1547-2018 - Abnormal operating performance Category III		
Points	**Frequency (Hz)**	**time (s)**
Under-Frequency default trip curve		
UF_P1	54.50	0.00
UF_P2	54.50	0.16
UF_P3	56.50	0.16
UF_P4	56.50	300.00
UF_P5	58.50	300.00
Over-Frequency default trip curve		
HF_P1	64.00	0.00
HF_P2	64.00	0.16
HF_P3	62.00	0.16
HF_P4	62.00	300.00
HF_P5	61.20	300.00

The settings above describe the following under and over-frequency trip curves.





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

IEEE 1547-2018 defines the ranges of adjustability for the trip thresholds and the clearing times (in brackets {…}); they are provided in the following table.

DEFAULT ABNORMAL FREQUENCY TRIP SETTINGS

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:

AVAILABLE DEFAULT CONFIGURATIONS

IEEE 1547-2018 abnormal operating performance Category I
IEEE 1547-2018 abnormal operating performance Category II
CA Rule21 PG&E - SRD UL1741SB-2021
CA Rule21 SCE - SRD UL1741SB-2021
CA Rule21 SDG&E - SRD UL1741SB-2021
New England – IEEE 1547-2018 URP – ISO New England

Settings can be accessed and programmed via SunSpec protocol – DER series models as described in the following table.

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

The installer is responsible for setting the trip parameters according to the specifications defined in the local utility SRD(s) (Source Requirement Documents) depending on the jurisdiction.

For further information or specific settings, please contact SOCOMEC After-Sales Service.

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 following table.

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 the Socomec maintenance tool.

GRID SUPPORT FUNCTIONS

Scope/Function	Default state IEEE 1547-2018[1]	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 chapter «3.8.1. Communication with external EMS», page 34.

15.3. Manufacturer's stated accuracy

The manufacturer's stated accuracy for voltage, frequency, active power, reactive power and time is available in the following table.

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**

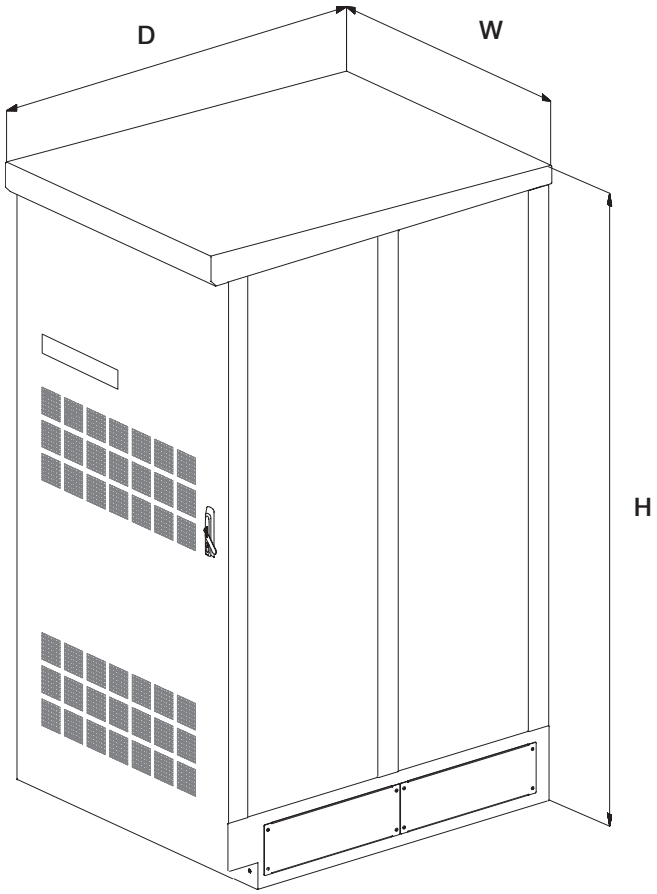


Figure 95. C-Cab dimensions

Dimensions and Weight

Parameters	50 kW	100 kW	150 kW	200 kW	250 kW	300 kW	350 kW	400 kW	450 kW	500 kW	550 kW
Dimensions (W x D x H)	1000 x 1300 x 2160mm (39.4 x 51.2 x 85 in)						2051 x 1300 x 2160mm (80.7 x 51.2 x 85 in)				
Dimensions with packaging (W x D x H)	1100 x 1450 x 2309 mm / 43.3 x 57.1 x 90.9 inches per C-Cab										
Weight (without modules)	950 kg (2094 lbs) per C-Cab										
Power module weight	22.5 kg (49.6 lbs)										
Weight	973 kg	995 kg	1018 kg	1040 kg	1063 kg	1085 kg	2058 kg	2080 kg	2103 kg	2125 kg	2125 kg
	2144 lbs	2194 lbs	2244 lbs	2293 lbs	2343 lbs	2392 lbs	4537 lbs	4586 lbs	4636 lbs	4686 lbs	4686 lbs

- **wB-Cab**

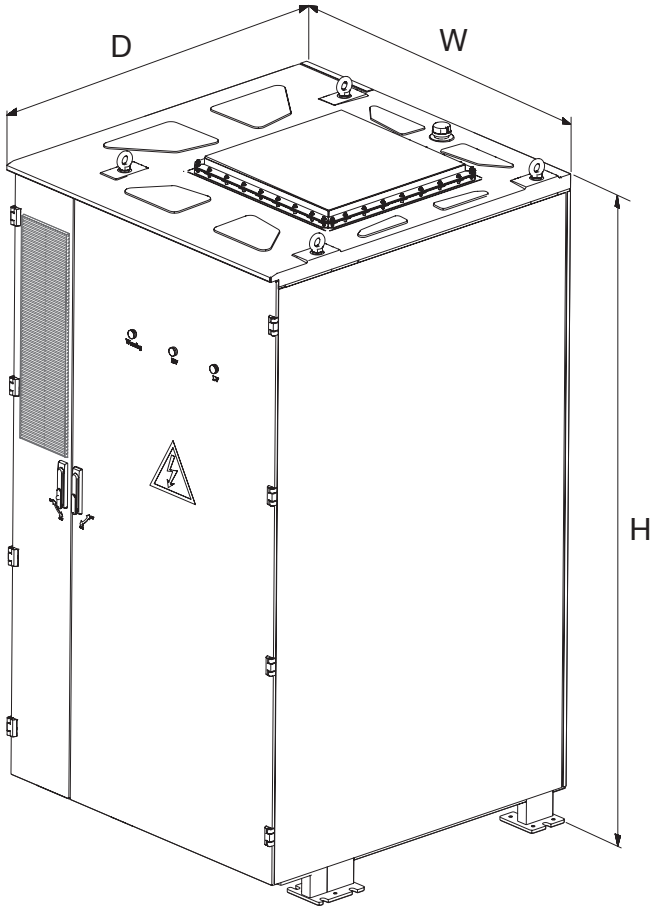


Figure 96. B-Cab dimensions

	203 kWh
Width x Depth x Height	1,390 x 1,344 x 2,348 mm / 54.7 x 52.9 x 92.4 inches
Width x Depth x Height (with packaging)	1450 x 1500 x 2500 mm / 57.1 x 59.1 x 98.4 inches
Weight	2 370 kg / 5225 lbs
Weight (with packaging)	2470 kg / 5445 lbs

The batteries are delivered with the modules already mounted.

17.2. SUN-HES-L-480

	SUN-HES-L-480 (C-Cab L Master cabinet) + 1÷6 x **SUN-HES-MOD50** (Power modules)						**SUN-HES-L-480** (C-Cab L Extension cabinet) + 7÷11 x **SUN-HES-MOD50** (Power modules)				
Parameters	50kW	100kW	150kW	200 kW	250kW	300 kW	350 kW	400 kW	450 kW	500 kW	550 kW
DC Section											
Range of DC operating voltage	570÷860 Vdc										
Number of power modules	1	2	3	4	5	6	7	8	9	10	11
Maximum discharging current	87 A	174 A	261 A	348 A	435 A	522 A	609 A	696 A	783 A	870 A	957 A
Maximum charging current	82 A	165 A	248 A	330 A	413 A	495 A	578 A	660 A	743 A	825 A	908 A
Battery Section											
Li-Ion, Lead acid, Vanadium Redox, SuperCap, LIC, Electronic DC source, Generic Battery.	Supported in combination with PMS. Multi-battery compliancy through SunSpec protocol. Please contact Socomec for specific compatibility evaluation.										
Maximum available fault current	100 kA										
AC Section											
Nominal voltage (Un)	480 Vac										
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	350 kW	400 kW	450 kW	500 kW	550 kW
Maximum continuous Apparent Power	50 kVA	100 kVA	150 kVA	200 kVA	250 kVA	300 kVA	350 kVA	400 kVA	450 kVA	500 kVA	550 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	50 kW	50 kW	50 kW	50 kW	50 kW
On-Grid overload	110 % - 60 minutes (Ambient temperature dependent)										
Off-grid overload (symmetrical or asymmetrical)	110 % - 60 minutes, 125 % - 20 minutes, 150 % - 60 seconds (Ambient temperature dependent)										
Rated current	60 A	120 A	180 A	241 A	301 A	361 A	421 A	481 A	541 A	602 A	662 A
Maximum temporary current (overload)	90 A	180 A	271 A	361 A	451 A	541 A	631 A	721 A	811 A	902 A	992 A
Off-grid short-circuit current symmetrical fault	125 A	250 A	375 A	500 A	625 A	750 A	875 A	1000 A	1125 A	1250 A	1375 A
	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms
Off-grid short-circuit current asymmetrical fault (Phase to Neutral)	185 A	370 A	555 A	740 A	925 A	1110 A	1295 A	1480 A	1665 A	1850 A	2035 A
	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	50 ms	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 L units (power extension) or any kind of third-party generator (voltage or current type)										
Off-grid mode	With other SUNSYS C-Cab L 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										

		SUN-HES-L-480 (C-Cab L Master cabinet) + 1÷6 x **SUN-HES-MOD50** (Power modules)						**SUN-HES-L-480** (C-Cab L Extension cabinet) + 7÷11 x **SUN-HES-MOD50** (Power modules)				
Parameters		50kW	100kW	150kW	200 kW	250kW	300 kW	350 kW	400 kW	450 kW	500 kW	550 kW
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.										
Efficiency												
Max efficiency	Disch.	96.8 %	97.6 %	97.8 %	97.9 %	97.9 %	97.9 %	96.8 %	97.6 %	97.8 %	97.9 %	97.9 %
	Charg.	96.6 %	97.4 %	97.6 %	97.7 %	97.7 %	97.7 %	96.6 %	97.4 %	97.6 %	97.7 %	97.7 %
Typical efficiency	Disch.	96.4 %	97.2 %	97.4 %	97.5 %	97.5 %	97.5 %	96.4 %	97.2 %	97.4 %	97.5 %	97.5 %
	Charg.	96.1 %	97.0 %	97.2 %	97.3 %	97.3 %	97.3 %	96.1 %	97.0 %	97.2 %	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						152 W / 220 VA				
Consumption during operation (W/o heating)		450 W / 1130 VA						900 W / 2260 VA				
Consumption on standby (W/o heating)		150 W / 850 VA						300 W / 1700 VA				
Max PCS heating consumption (extreme climatic conditions)		3.0 kW						6.0 kW				
PCS auxiliary rated current (w/o battery racks)		11,0 A						22,0 A				
Max CATL battery control circuits consumption		216 W /516 VA (No. 6 racks)										
Max CATL battery heating/cooling consumption (extreme climatic conditions)		4.8 kW per rack (Max. No. 6 racks)										
PCS auxiliary rated current (with battery racks)		34 A (1 B-Cab L) / 51 A (2 & 3 B-Cabs L) / 57 A (4 B-Cabs L) / 91 A (5 & 6 B-Cabs L)						35 A (1 B-Cab L) / 62 A (2 & 3 B-Cabs L) / 68 A (4 B-Cabs L) / 102 A (5 & 6 B-Cabs L)				

General data	
Operating ambient temperature	-20°C to +45°C (-4°F to +113°F) +45 °C to +50 °C (+113°F to +122°F) with power derating
Storage temperature	-20 °C to +60 °C (-4°F to 140°F)
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

Certifications	
Safety	UL 1741 3rd Edition revision September 20, 2021 STANDARD FOR SAFETY Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
	CSA C22.2 No. 107.1-16 Power conversion equipment
	ANSI/CAN/UL 9540:2020 STANDARD FOR SAFETY Energy Storage Systems and Equipment
EMC	FCC Part 15, Subpart A/B - Class A Radio frequency devices: measurement of disturbance voltage.
Grid Code	IEEE 1547-2018, IEEE 1547a-2020 IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
	IEEE 1547.1-2020 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) Grid support utility interactive equipment
	UL 1741 3rd Edition Supplement SB (September 28, 2021) Grid support utility interactive inverters and converters based upon IEEE 1547-2018 and IEEE 1547.1-2020
	California RULE 21 Generating Facility Interconnections
	ISO-NE New England Utility Required Profile of settings from IEEE 1547-2018 (as amended by IEEE 1547a-2020)
Software	UL 1998 Standard for Software in Programmable Components
Other standards	UL 1741 CRD dated March 8th, 2019 Power Control of Distributed Energy Resources Available ESS Operating Modes: Unrestricted Mode, Export Only Mode, Import Only Mode, No Exchange Mode
	EN 60068-2-30:2015 Environmental testing Part 2: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)

Additional data for CSA compliance

		SUN-HES-L-480 (C-Cab L Master cabinet)					
		+ 1÷6 x **SUN-HES-MOD50** (Power modules)					
Parameters		50 kW	100 kW	150 kW	200 kW	250 kW	300 kW
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

		SUN-HES-L-480 (C-Cab L Extension cabinet)				
		+ 7÷11 x **SUN-HES-MOD50** (Power modules)				
Parameters		350 kW	400 kW	450 kW	500 kW	550 kW
Maximum current unbalance according CSA22.2 107.1-16		0,11%				
Short circuit current according CSA22.2 107.1-16	Initial phase-phase	784 A	896 A	1008 A	1120 A	1232 A
	Initial three-phase	875 A	1000 A	1125 A	1250 A	1375 A
	Peak phase-phase	1057 A	1208 A	1359 A	1510 A	1661 A
	Peak three-phase	1043 A	1192 A	1341 A	1490 A	1639 A
	Breaking phase-phase	791 A	904 A	1017 A	1130 A	1243 A
	Breaking three-phase	875 A	1000 A	1125 A	1250 A	1375 A

Surge withstand performance requirements have been validated using the testing standard, test types and levels in the following table, as defined by IEEE 1547.1-2020.

SURGE WITHSTAND PERFORMANCE TEST RESULTS

AC power ports					
Standard	**Test**	**Description**	**Injection**	**Coupling**	**Test level [kV]**
IEEE C62.41.2	Surge immunity test	AC input (AUX)	Direct (CDN)	CM	±6
		AC input (AUX)	Direct (CDN)	DM	±6
		AC output (grid)	Direct coupling with 10Ω + 9µF	CM	±6
		AC output (grid)	Direct coupling with 18µF	DM	±6
	Ring wave immunity test	AC input (AUX)	Direct (CDN)	CM	±6
		AC input (AUX)	Direct (CDN)	DM	±6
		AC output (grid)	Direct (CDN)	CM	±6
		AC output (grid)	Direct (CDN)	DM	±6
Communication, signal and control ports					
Standard	**Test**	**Description**	**Injection**	**Coupling**	**Test level [kV]**
IEEE C37.90.1	Electrical fast transient/ burst immunity test	Signal port (RS-485)	Capacitive clamp	-	±4
		Signal port (EPO)	Capacitive clamp	-	±4
		Signal port (CAN)	Capacitive clamp	-	±4
		Comm. Port (Ethernet)	Capacitive clamp	-	±4
	Oscillatory Dump Wave Immunity test	Signal port (RS-485)	Capacitive clamp	-	±2.5
		Signal port (EPO)	Capacitive clamp	-	±2.5
		Signal port (CAN)	Capacitive clamp	-	±2.5
		Comm. Port (Ethernet)	Capacitive clamp	-	±2.5

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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