USER MANUAL

EN

Energy Storage System

SUNSYS HES XXL

IEC

socomec
Innovative Power Solutions

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1. INTRODUCTION

1.1. Glossary

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

BESS:	Battery Energy Storage System
BMS:	Battery Management System
C-Cab:	Conversion cabinet (SUNSYS C-Cab XXL)
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 XXL range.

SUNSYS HES XXL System is composed of an assembly of 4 types of cabinets:

C-Cab

- Bidirectional power converter
- 1.5 MVA / cabinet
- Hybrid liquid / air cooling system
- AC/DC distribution and protection

B-Cab

- Lithium-ion battery
- LFP technology
- 372 kWh nameplate / rack - 352 kWh useable / rack
- Liquid cooling thermal management
- Integrated fire safety detection and extinguishing system included
- Possible to put up to 14 units in parallel per C-Cab to reach 5.2 MWh nameplate / 4.9 MWh useable

M-Cab

- Battery management system
- ESS control cabinet
- Devices for remote management
- Auxiliaries power supply
- PLC for automation functions (or connection to an external EMS)
- Battery data logging

DC-Cab (option)

- DC distribution panel enabling the connection of 9 to 16 B-Cabs on 1 C-Cab

SUNSYS HES XXL Configurations

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

1.3. Revision history

Rev A – October 2023

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**.
Failure to follow safety instructions can result in damage to equipment, injury or death.

	DANGER! LIVE DEVICE! RISK OF ELECTRIC SHOCK: Basic electrical precautions must be followed by all personnel when working on electrical systems. Equipment damage, injury or death can occur as a result of failure to follow these instructions or by installation done by unqualified personnel.
	CAUTION! Any work carried out on the equipment must be performed by skilled, qualified technicians.
	CAUTION! Each power supply line must be provided with overcurrent protection according to the indication contained in the present manual.
	Before performing any installation or maintenance work: 1. Clearly identify the location of the work. 2. Ensure that all sources of power have been disconnected. 3. The C-Cab contains capacitors which require several minutes to discharge after removing power. Verify that system and component voltages are at or near 0V by measuring with a voltmeter. 4. All electrical installations must comply with the electrical standards applicable on-site.
	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 is not supplied by SOCOMEC, overcurrent protection for the battery has 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! The tightening torque for DC and AC terminals must be in accordance with the indication of the present manual.
	WARNING! The unit must operate within the ambient temperature range specified. Refer to relevant sections of this manual for limits and additional notes.
	NOTICE A hipot test has been performed at the factory and is not permitted to be performed in the field by the user.

	CAUTION! The inverter has air vents. Debris should not be allowed to fall into the venting, including metallic chips from drilling, weld splatter, etc. as it may result in damage to the C-Cab. Covering the vents is a good practice if there is a chance of debris falling. The covers MUST be removed prior to operation to provide adequate ventilation.

2.1. Symbols Used on the equipment labels and plates

The words "CAUTION", "WARNING" or "DANGER" are used for cautionary marking.

Symbols	Description
	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.
	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 characteristics of the batteries must be compatible with the ratings of the C-Cab. For any further information, contact Socomec.

2.3. Limits to use of this equipment

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

3. OVERVIEW

The information in this manual is provided to aid in the installation, operation, and maintenance of the SUNSYS HES XXL 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 XXL is a fully integrated AC connected energy storage system that supports a host of applications such as firming renewable production, stabilizing the electrical grid, controlling energy flow, optimizing asset operation and creating new revenue which provides greater control, efficiency and reliability across the electric grid. Another important function of the system is to provide backup power in the event of a grid failure or during power quality anomalies; therefore we are supplying the Island Mode version of the system.

The SUNSYS HES XXL system comprises three major cabinets namely, a converter for DC to AC conversion (referred to as C-Cab, Figure 01 page 11) , the Battery cabinets (B-Cabs, Figure 02 page 12) and the Master cabinet (M-Cab, Figure 03 page 12). The units have 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 power electronic is water cooled in order to protect circuit boards and power electronics in a sealed compartment which is also insulated and heated to protect against condensation. Other equipment's are air cooled through a salt-fog arresting E12 HEPA filter. For the M-Cab proper air filtering and HVAC 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 is controlled by a Power Management System (PMS), which is integrated inside the M-Cab.

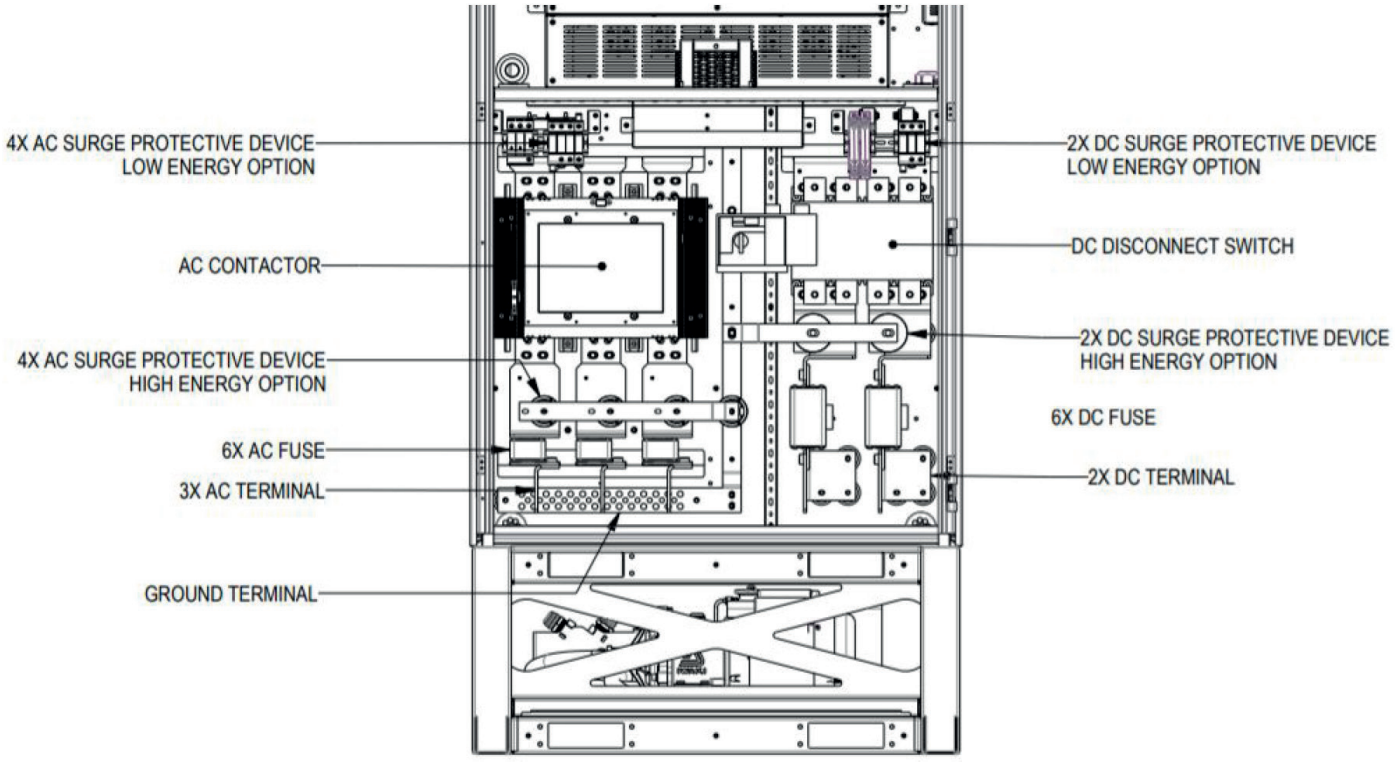


Figure 01. SUNSYS C-Cab XXL composition

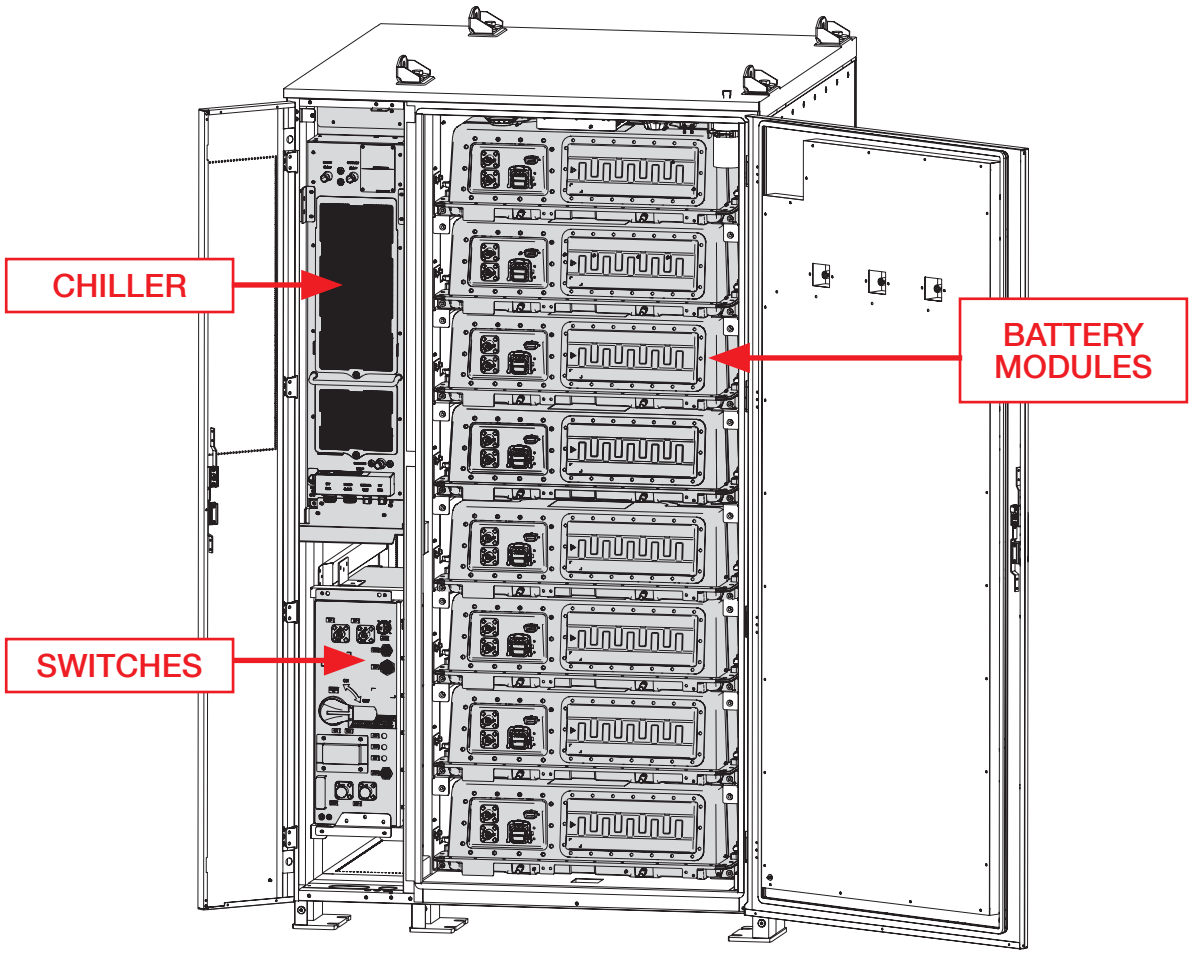


Figure 02. SUNSYS B-Cab XXL composition

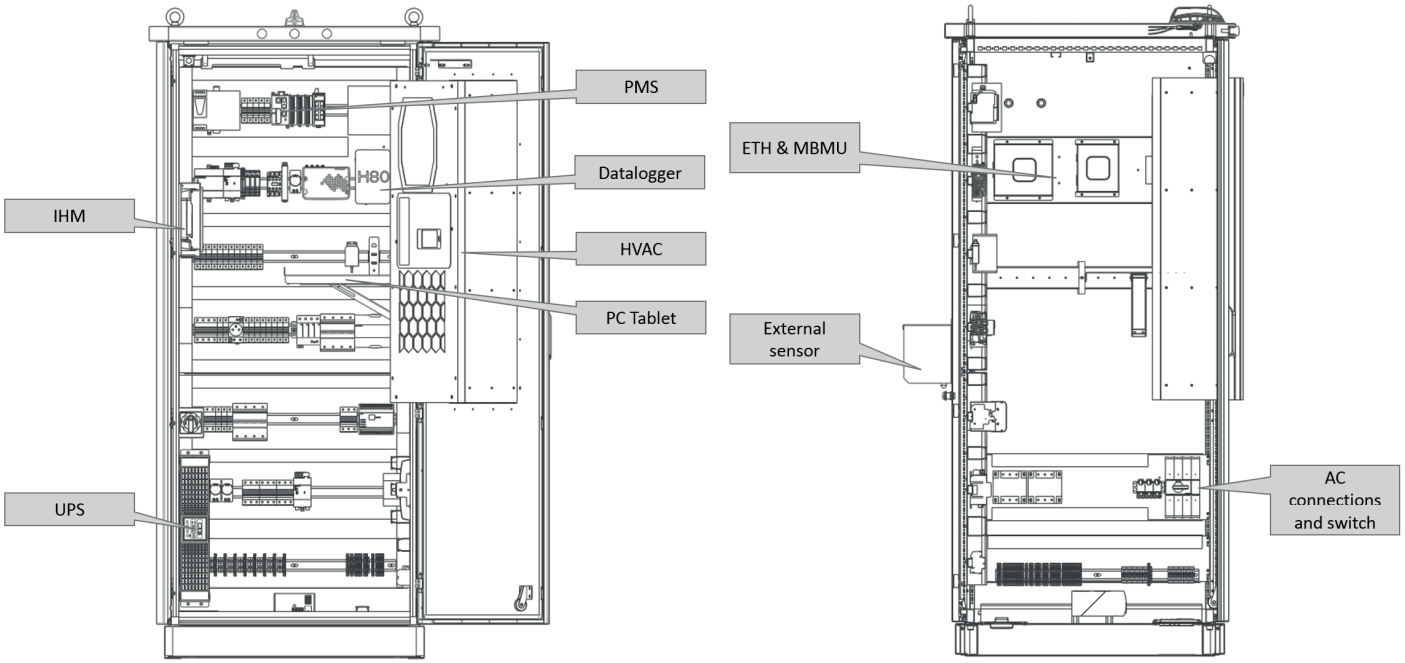


Figure 03. SUNSYS M-CAB XXL composition

3.2. List of C-Cab options

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

In the table below are listed all the optional components that can be installed inside the unit, installation has to be done at the factory before the delivery.

Item	Description
Input for external UPS	Requires a 208-250 VAC UPS provided by the customer
UPS operation	Remote sense board for UPS operation
AC precharge	AC precharge
Statcom	Reactive power compensation for installation: - without batteries - with batteries
System paralleling	C-Cabs AC paralleling on a common bus and B-Cabs DC paralleling on a common bus C-Cabs AC paralleling on a common bus and B-Cabs DC inputs are independent"
Increased reactive power	Increased VAR capabilities
AC busbar	AC busbar for the connection of up to 4 C-Cabs with C2 or C5 coating
Auxiliary contacts for fuses	- DC fuses - AC fuses"
Surge protection device	- High energy AC SPD - High energy DC SPD
Coating	C5M degree of protection
Low temperature	Package for arctic -40°C temperature
Ground Fault Detection	- Ground fault detector - Ground fault fuse

3.3. Topology

The figure below shows a typical high-level drawing of the C-Cab.

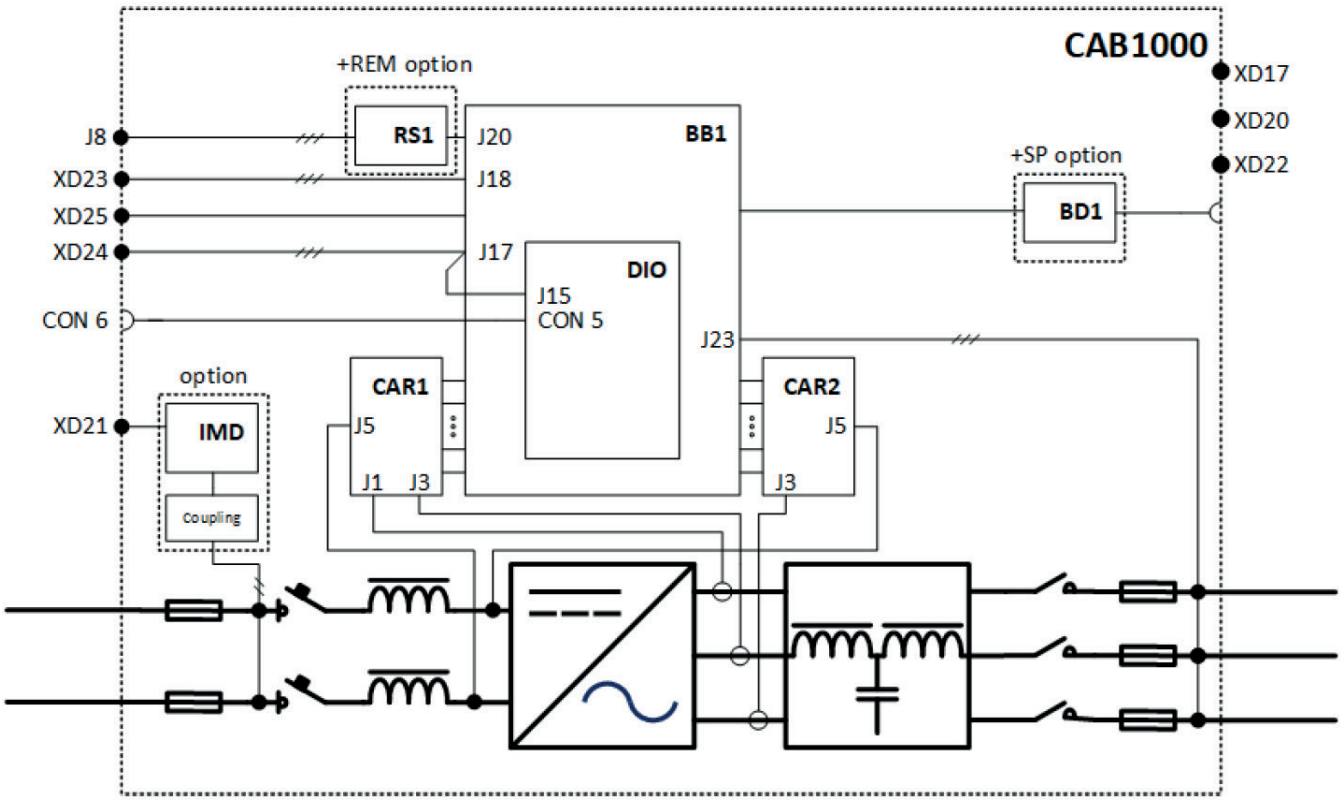


Figure 04. Example of C-Cab layout with autotransformer and options installed

3.4. Modes of operation

Control power must be applied to the unit as soon as possible after commissioning and must remain present for the life of the product in order to prevent condensation from occurring internally. If control power is removed, condensation may form on critical internal components and could compromise the inverter's performance and warranty.The system is designed to operate in the following modes of operation:

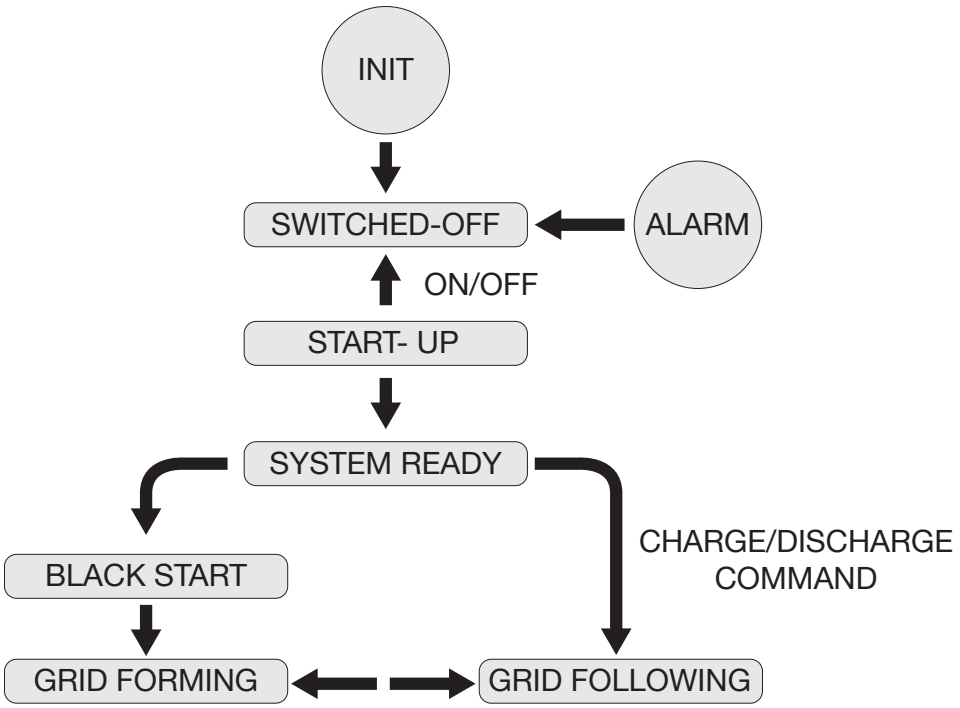


Figure 05. Modes of operation of SUNSYS HES XXL

3.4.1. Start-up

As standard the C-Cab supports DC Precharges, which are the typical method used for BESS. It will automatically execute this precharge as part of its normal startup sequence. The internal DC capacitors are charges from the DC source as part of the startup sequence.

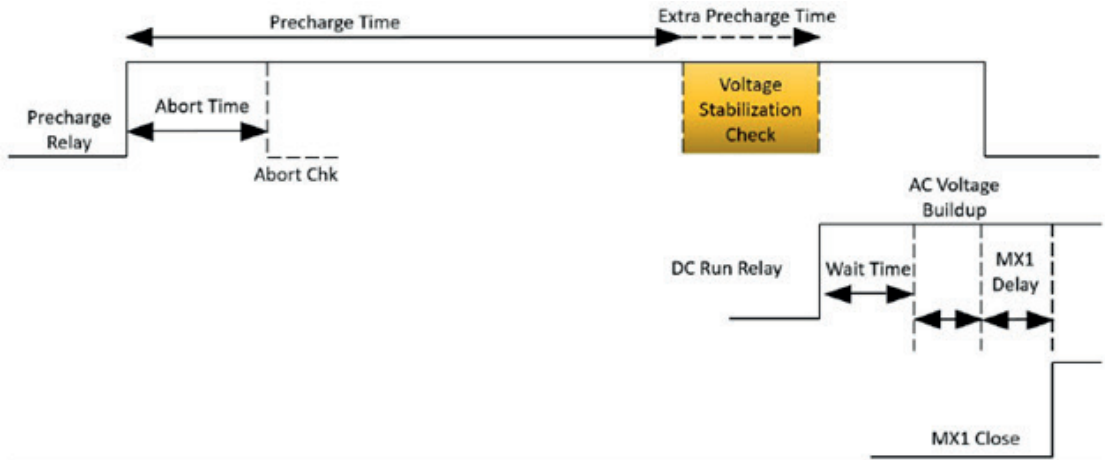


Figure 06. DC Precharge sequence

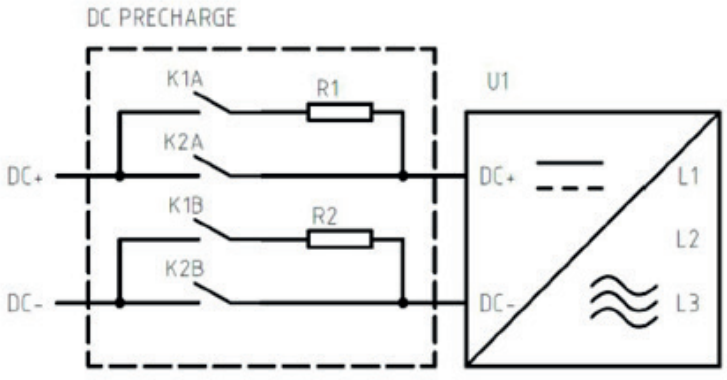


Figure 07. DC Precharge circuit

Note: the precharge parameters must be configured for the DC precharge within the C-Cab (through the communications interface).

The precharge procedure is the following:

- Precharge contactor (typically designated as K1) closes.
- C-Cab observes the DC voltage ramp rate to ensure precharge is successfully operating. If ramp rate is insufficient, the C-Cab will abort the precharge sequence and indicate a faulted state.
- Once the C-Cab DC voltage has stabilized, the main DC contactor (K2) will close and the precharge contactor will open, completing the precharge sequence.

On the AC side:

- If grid **voltage is present** and the C-Cab enters a 'grid following' mode , the C-Cab will "spool up" the LCL filter in sync with the grid (matched phase angle and magnitude). Once in sync, the main AC contactor (MX1) closes and the C-Cab connects to the grid with little to no transient inrush. The C-Cab is now online in a 'grid following' mode.
- If grid **voltage is NOT present** and the C-Cab enters 'grid forming' mode , once the precharge sequence is completed, the C-Cab will first close its AC contactor (MX1), and then ramp up its output voltage to its commanded setpoint. The C-Cab is now online in a 'grid forming' mode.

3.4.2. Grid Following Mode

SUNSYS HES XXL is a Grid Follower, meaning output voltage and frequency are imposed by the mains that needs to be present for the operation of the system. The C-Cab operates:

- according to active and reactive power set-points to exchange active and reactive power with the mains, both in injection and absorption
- according to real and reactive current 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

3.4.3. Grid Forming Mode

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

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

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

3.5. Environmental controls

The system is designed for the IP54 & NEMA 3R enclosure requirements for the operation in an outdoor environment at the specified temperature ranges and up to 95% humidity non-condensing.

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

The C-Cab environmental control is really based on separated compartments, as shown on the drawing below. The power electronics is water cooled while the rest is air cooled and is able to operate with relative humidity going from 5 to 100% non-condensing. A salt fog kit can be made available in case of installations close to the sea.

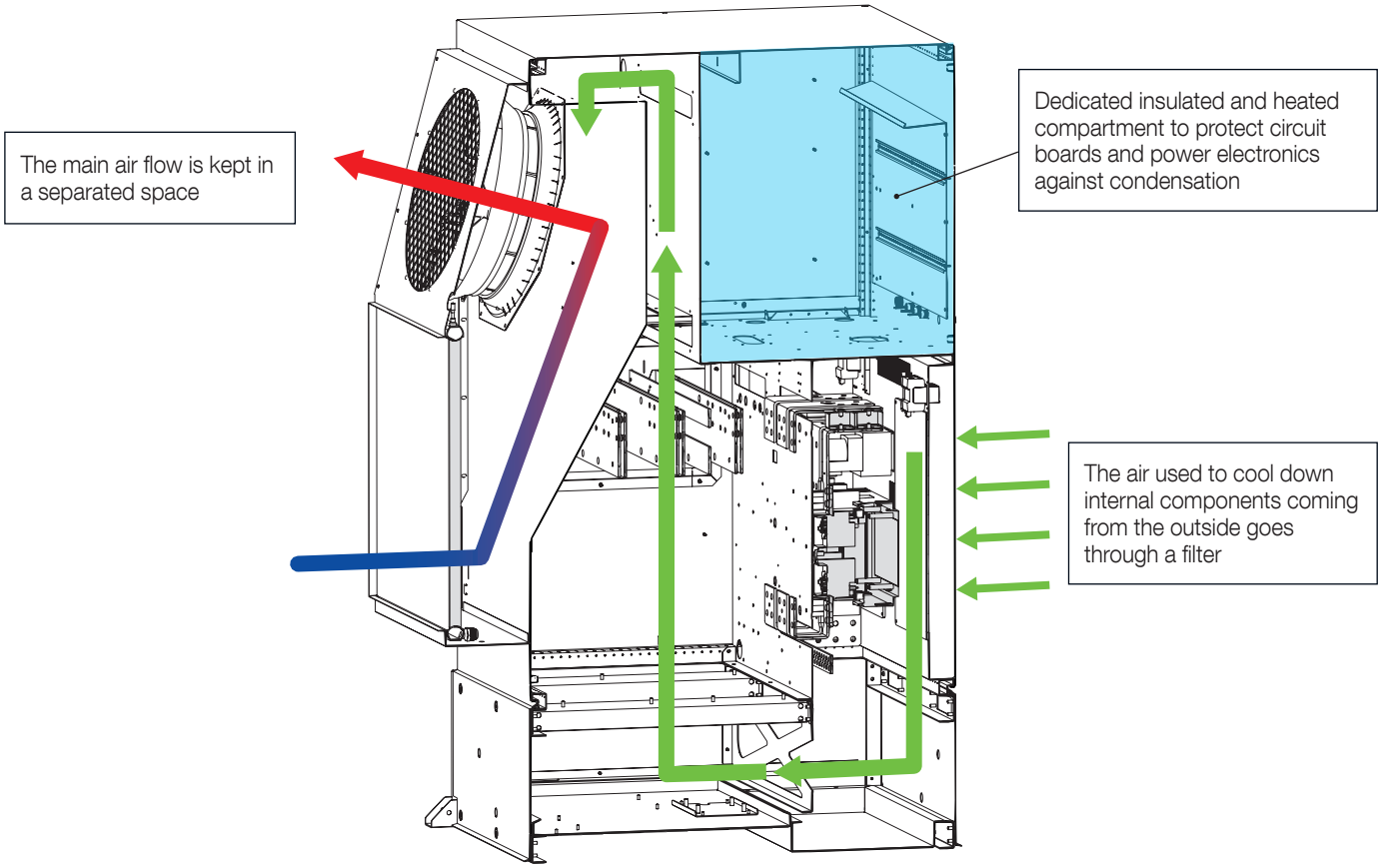


Figure 08. Air flows inside the SUNSYS C-Cab XXL

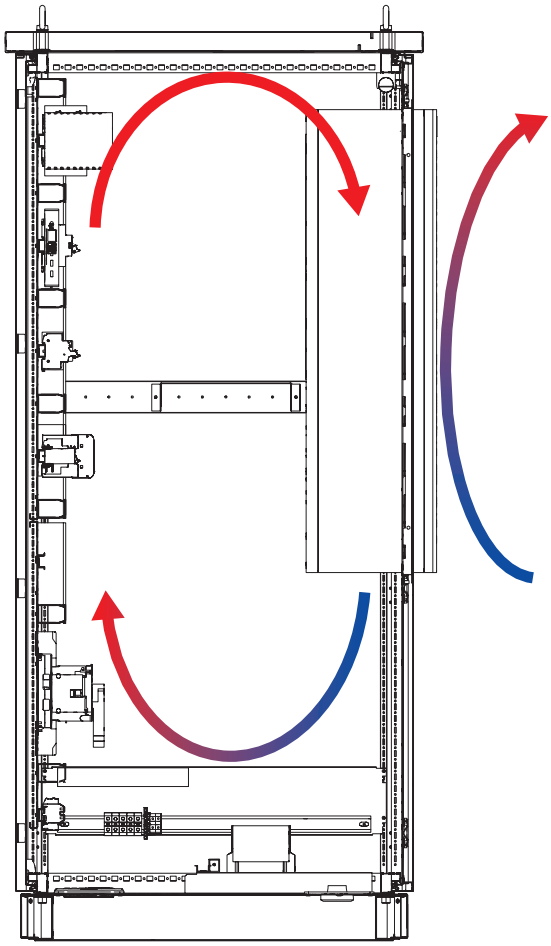
The batteries have a more tightly controlled environment which affords better battery performance and longer life.

Components of the B-Cab environment control include an autonomously controlled HVAC system using an air to liquid cooling loop.

The M-Cab, on its side, is designed for IP55 with relative humidity up to 95% non-condensing. The thermal regulation is a cloosed loop system, cooling being managed by a HVAC and heating by thermal resistances.

Starting requirements:

- Temperature between 0°C and 45°C
- Humidity between 0 and 70% (non-condensing)



3.6. System communication

3.6.1. 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 pilot the PMS using the Modbus TCP / SunSpec protocol.

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

Socomec is member of the SunSpec organization.

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

Supported models

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

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

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

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

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

Start sequence

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

3.6.2. The PMS

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

- X29.2 - Modbus TCP communication to external power meter for voltage, current and power measurement.
- X29.1 - Modbus TCP / SunSpec communication with the EMS for remote control.
- X29.3 - Socomec use only.

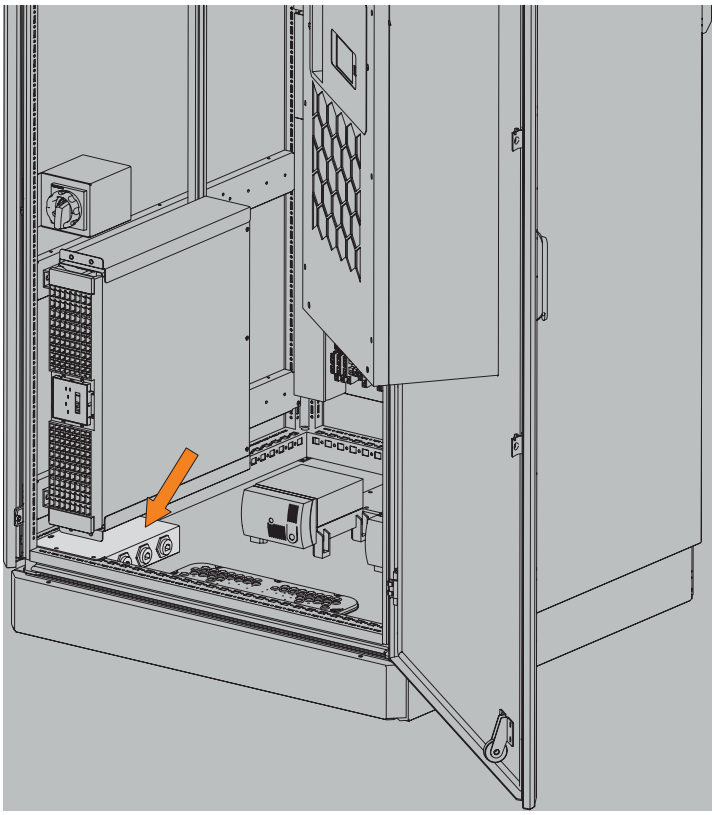


Figure 09. Ethernet connection ports

4. TRANSPORT, STORAGE & HANDLING

The instructions provided here are intended as a guide to the transportation, storage and handling of the unit. For full dimensional and connection details, please refer to the outline drawings and electrical schematics provided with the unit. For further support, please contact Socomec.

4.1. Transport

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

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

Note that for transport, the batteries have to travel in a separated container, for security reasons. This container has to respect the following requirement: Transport for hazardous material.

The transport and storage temperature must be between -25°C and +55°C.

A forklift shall do the unloading of the container.

4.2. Inspection

The units are shipped on a wooden pallet.

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 and includes the user manual.

In the event of equipment damages, please submit an RMA to EPC Power with appropriate pictures of damages equipment.

The following items are shipped with the C-Cab units:

MSD

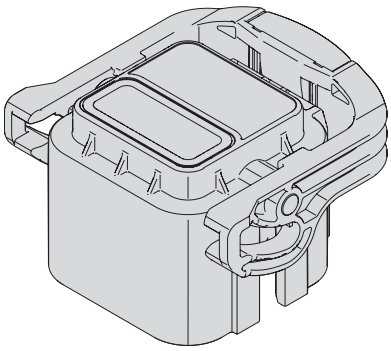


Figure 10. MSD

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

Some cables can be included in the installation kit as an option
- 1 cable JXH1 for every B-CAB
- 1 cable JX3 for every B-CAB
- 1 cable JX2 for the number of B-CAB minus 1
- 1 cable polarity + from the last B-CAB to C-CAB
- 1 cable polarity - from the last B-CAB to C-CAB

4.3. Storage

Store the cabinets in a dry and clean location protected from the elements, free from risk of damage 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.

Make sure the cabinets are protected against animals/rodents, all packaging remain intact until installation and doors and panels remain in place and closed.

The recommended storage temperature is about 20°C +/- 3°C with a daily average storage temperature ≤25°C to preserve the life of the battery and limit its self-discharge, though the allowed range of temperature is -25°C to +55°C.

The design of the C-CAB is such that it is necessary to supply AUX power to the inverter within 2 weeks of shipment. During this period, the system must be stored in the following conditions:

1. A safe place free from risk of damage.
2. Protected against animals/rodents
3. All packaging to remain intact until installation
4. Doors and panels to remain in place and closed

If storage will extend beyond the recommended 2 week period, please contact Socomec.

4.4. Handling and Moving

WARNING!
The packaging guarantees the stability of the units during shipping and physical transfer.
The units 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 units.
Carry the packaged units as close as possible to the installation site.

WARNING!
Move the unit using a fork lift truck taking the utmost caution at all times, use lifting eyes and straps when appropriate.
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.

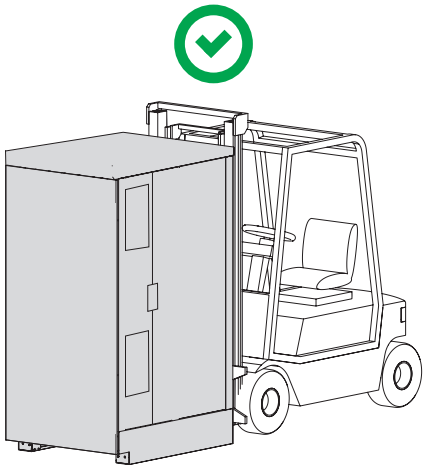
C-Cab and B-Cab are shipped individually mounted on individual pallets.

4.5. Forklift or Pallet truck handling

- **B-Cab**

The forklift arm needs to be protected to avoid dirt pollution on the fork arm, or the forklift scrapes the bottom of the cabinet.

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



- **M-Cab**

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

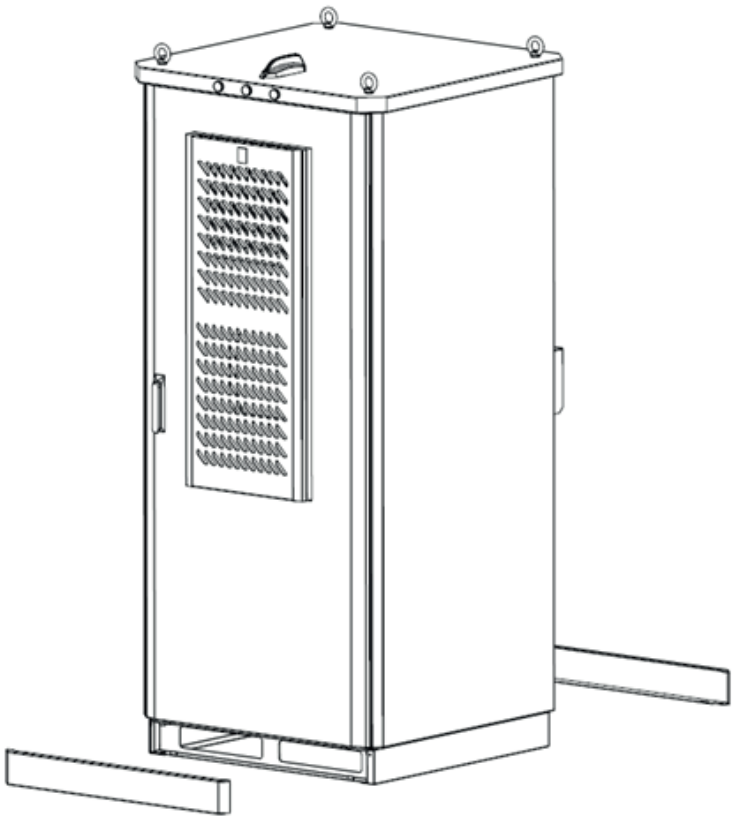


Figure 11. Panels to remove from the M-Cab

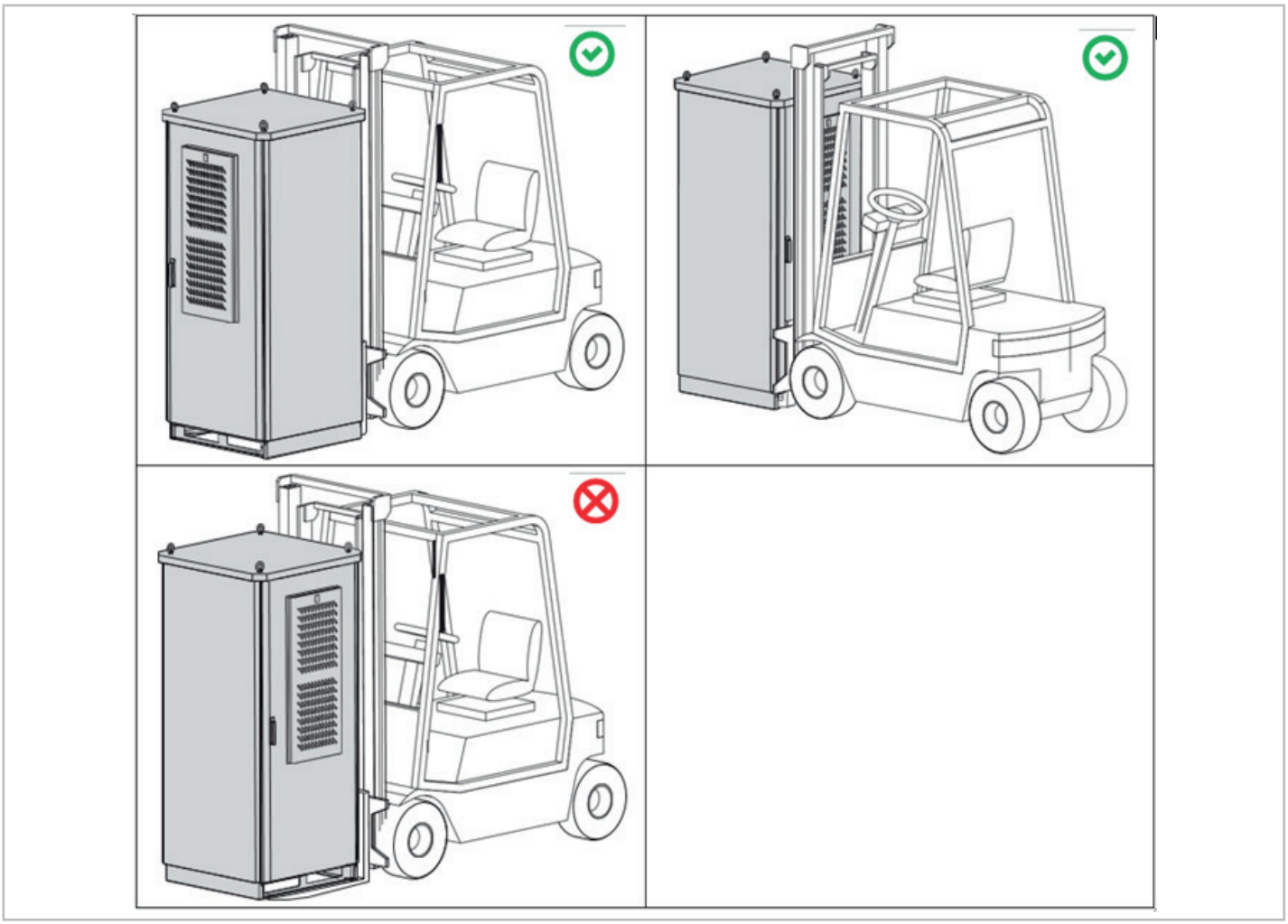


Figure 12. Handling of the unit using pallet truck with 1.30m long forks

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

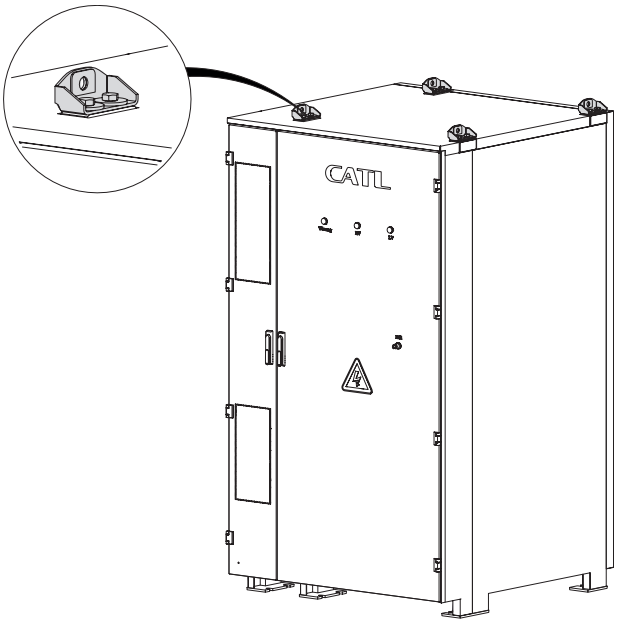
4.6. Overhead lifting

A crane or hoist is mandatory on site for the C-Cab, it can also be used for the other units.

- **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 title angle should be smaller than 5° during hoisting.

Figure 13. Lifting lug on the top of the rack

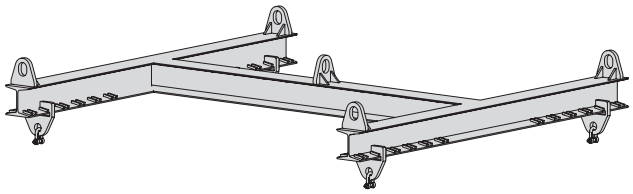
- **C-Cab**

The center of gravity is located as follows:

	Front Left [kg (lbs)]	Front Right [kg (lbs)]	Front Right [kg (lbs)]	Front Right [kg (lbs)]	Total [kg (lbs)]	CoG from Front [mm (in)]	CoG from Front [mm (in)]
Inverter Only	259 (572)	347 (765)	421 (928)	312 (689)	1340 (2954)	707 (28)	348 (14)
Inverter & Crate	373 (822)	397 (875)	448 (988)	327 (722)	1545 (3407)	643 (25)	348 (14)

When transporting and moving the C-Cab it is recommended to keep the packing in place as long as possible to protect from damage. Do not allow the inverter to tip over; always set the inverter on a level surface.

CAUTION!
Overhead lift is the preferred method of lifting the C-Cab. Therefore install 4 separate lift lines, one to each eyebolt. Use a combination of spreader bars, lift the C-Cab ensuring only a vertical force on each eyebolt. Side loading can damage the lift points. Inspect eyebolt and cabinet after lift to ensure no damage and weather integrity remains intact.



Example of a vertical spreader

4 rings are on top of the unit. The rings are Ø29mm / Ø1.14

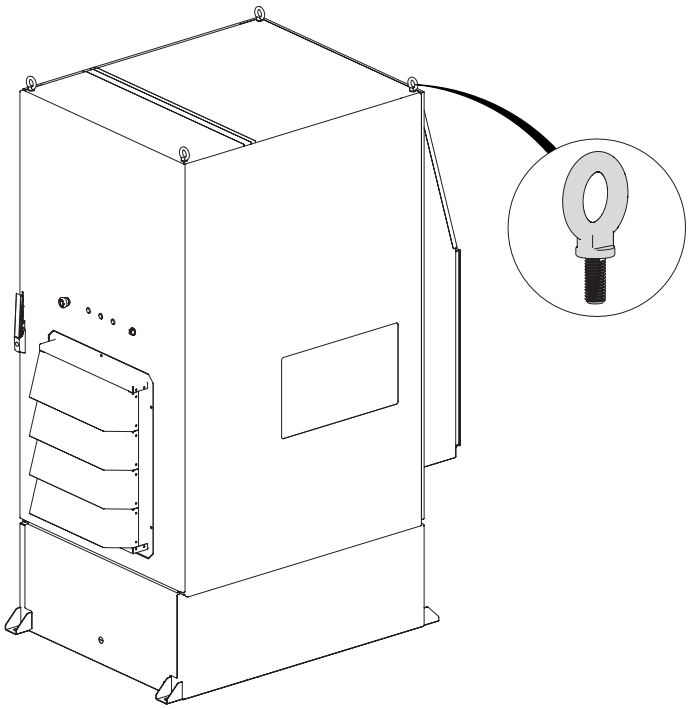


Figure 14. Lifting lugs on top of the C-Cab

M-Cab

4 lifting lugs are on the top of the unit. The rings are Ø30mm / Ø1.18.

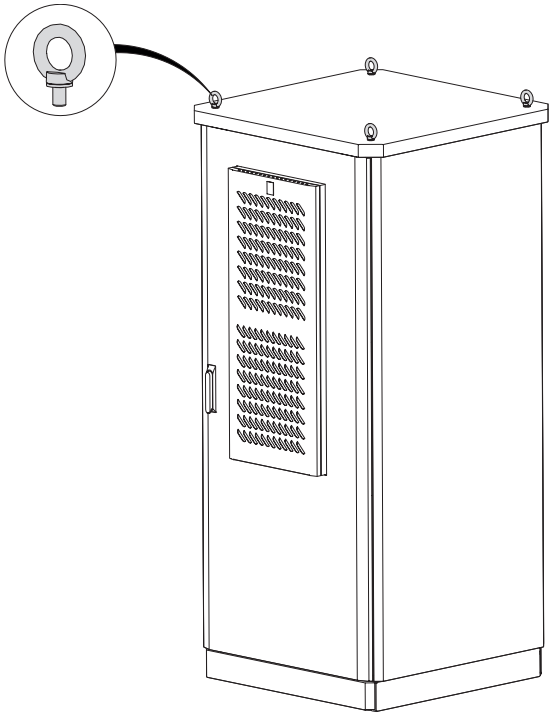


Figure 15. Lifting lugs on top of the M-Cab

CAUTION!
While lifting it is important to ensure even vertical load, distribution on all eyebolts 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 units cannot be laid.
After lift is completed, inspect eyebolts and cabinets to ensure weather integrity remains intact.

5. PREPARATION

5.1. General recommendations

As SUNSYS HES XXL system is designed to be installed outdoor, it must be protected against various environmental risks. Therefore, we advise you to (non-exhaustive list):

- Avoid installation in places subject to natural hazards (water flooding, forest fire, exposure to strong winds, etc.)
- Avoid installation near trees and other potential sources of pollution
- Prevent the risk of vandalism or surrounding accidents thanks to appropriate devices: fences, bollards, steps, etc.
- Avoid the presence of water in cable trays and ducts
- Avoid the entry of small animals (mice, rat, snake...) into the cabinets via the cable trays and ducts

A safe environment for SUNSYS HES XXL must be guaranteed for the lifetime of the system.

5.2. Civil and foundation requirements

In accordance with local laws and regulations, the site selection requirements are as follows:

- The installation position of the node cannot be in a low-lying area, and the site level is higher than the highest historical water level in the area.
- The soil condition is good and the ground is solid. No bad geological conditions such as rubber soil and soft soil layer are allowed. The ground that is easy to accumulate water and sink should be avoided.
- nvest in a well-ventilated place
- Keep away from strong vibration, noise sources, and electromagnetic interference areas. Try to avoid places with existing underground facilities.
- Keep away from places that produce dust, fume, harmful gases, and produce or store corrosive, flammable, and explosive materials. The distance from the airport, landfill, river bank, shore or dam should not be less than 500m.
- Keep at least 50m away from residential areas to avoid noise pollution.
- Choose an open location and ensure that there are no obstacles from the surrounding area.
- The actual clearance should comply with the local standards and regulations and consider the maintenance feasibility.
- For back-to-back arrangement of the B-Cabs, the minimum clearance between the back side of rack and the enclosure is 100mm(0.5C), 500mm(1C), and the minimum clearance between the front side of rack and the enclosure is 2000mm, the clearance here refers to the road width. (For installation and maintenance)

Foundation Requirement

Before installing the B-Cabs, build the foundation and trench on the selected ground. The requirements for foundation construction are as follows:

The size of foundation meets the requirements of rack installation and bearing capacity of 3.7 tons. The units should be installed on a level surface, not exceeding 0.25% (≤±4mm/2m) adhering to the anchoring information, and relevant clearance and conduit entry requirements. Fasten the cabinets to the ground using appropriate hardware based on site conditions.

Dimensions *in*/mm

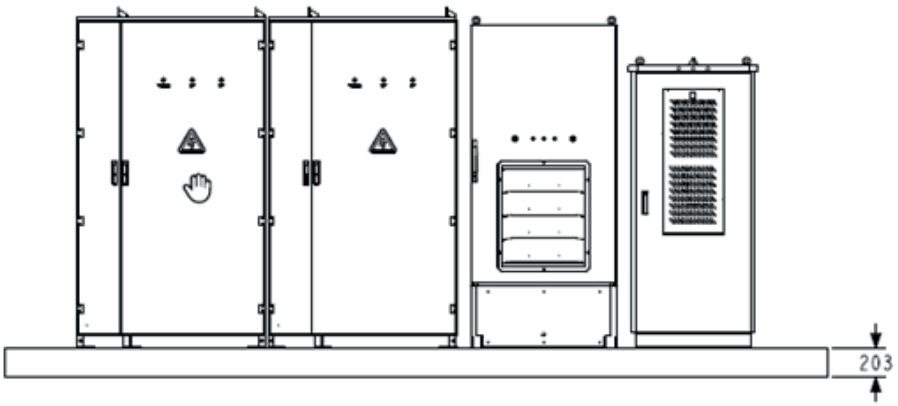


Figure 16. Concrete depth – SDS 2.5

Dimensions *in*/mm

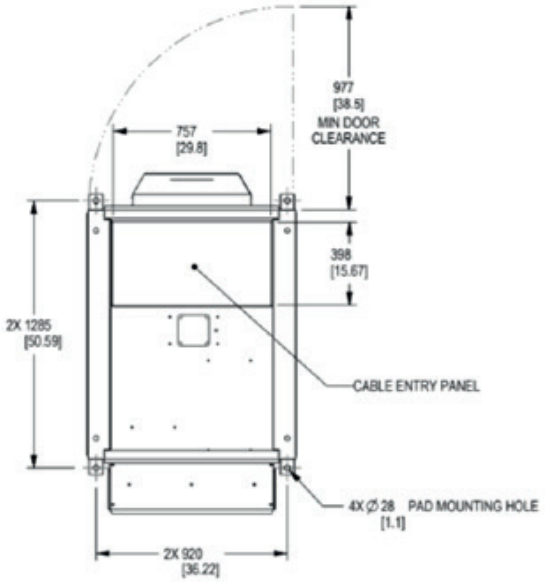


Figure 17. Anchor foot dimensions

Dimensions *in*/mm

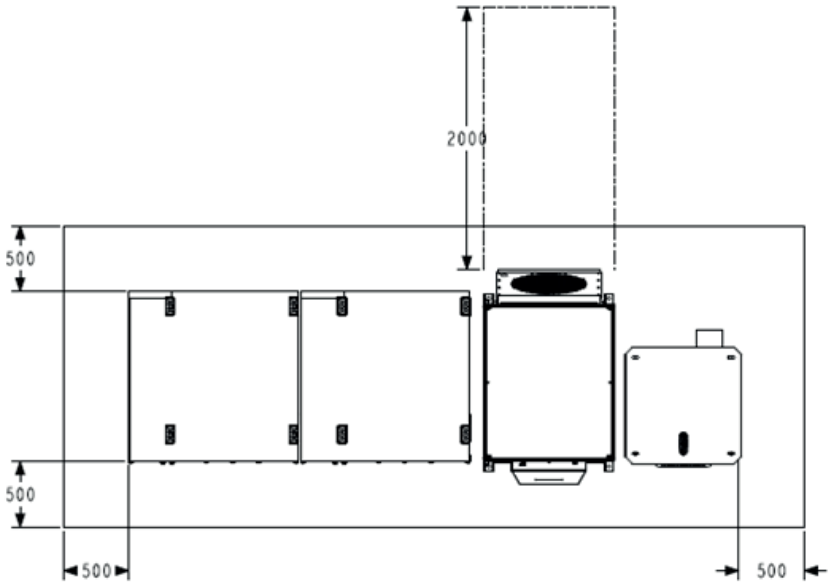


Figure 18. Concrete space around the equipment

5.3. Commissioning prerequisite

5.3.1. 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.
Integration check	
1.	Battery and converter are installed in a perfectlly 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 in chapter «Clearance distances», page 31).
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.	Verify the attachment of all cabinets to the concrete floor.
Installation Environement inspection and setting check	
1.	The area around the system is accessible.
2.	The area is secured : no civil work, stable floor, ...

5.3.2. 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).
3.	Check the ground interconnection of all the B-Cabs.
4.	Check ground connection on the C-Cabs and M-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 single line diagram and the user manual provided by SOCOMEC.
2.	Check the Emergency Stop loop connection (if installed). And if not shunt it.
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 M-Cab.
5.	Please provide a photo of the DC and auxiliaries Cable connection of the B-Cab.
6.	Phase Rotation of the AC connection and Auxiliaries connection have to be clock wise. Please check this is the case.
7.	For islanding. Check all connections with devices required by SOCOMEC linked to the Resiliency package (PMS extension, SEL relay, CRE card...)
Internet Connection (if no Modem 4G option)	
1.	Check the ethernet connection wiring from your site to the C-Cab.

5.3.3. IoT prerequisite

IP addresses for communication	
1.	Please provide an IP address to communicate with the PMS (Power Management System).
2.	Please provide an IP address to communicate with the M70 (Measurement Central device).
3.	Please provide the IP address range where the ESS system should be accessible (communication with the router of the ESS).
4.	Please, do not connect the ESS system in the IP range 192.168.20.0/24 or higher (ie 192.168.0.0/16).
5.	Please provide an IP address to communicate with the HMI, if present.
Network access	
1.	Please provide the network IP address range where the ESS system will be connected.
2.	Please give the NTP server (1 and 2) IP address (optional if the customer doens't want to open a NTP access).
3.	Please provide an IP address for the gateway with the ESS or provide DHCP server. If a static IP address is used, please provide a subnet mask and a default gateway.
4.	Please provide DNS server (1, 2 and 3) IP address - optional
Different access	
1.	Please make sure to open the following accesses: TCP port 257 TCP port 18191 TCP port 18192 TCP port 18264 UDP port 4500 UDP port 500 UDP port 1701 UDP port 259 MQTT port 8883 (TCP) to mqtt.iotagora.net NTP UDP port 123 HTTP port 80 to https://activate.iot.socomec.com HTTP port 80 to https://api.iotagora.net HTTPS port 443 TCP port 443 to https://storage.iot.socomec.com/api/v1 SNTP to time.windows.com DNS to 8.8.8.8, 1.1.1.1 and 208.67.222.222

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.

SUNSYS HES XXL is an outdoor system, if installed inside a building or container, please contact Socomec.

6.1. Installation guidelines and considerations

The system is to be installed in accordance with the prevailing local and National Electric Codes which governs the requirements for electrical installation. These requirements may include, but is not limited to:

- The system is intended to be installed on a flat surface.
- 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.
- Minimum access front aisle clearance: (typically 48” or 122 cm, refer to codes)
- Appropriately rated feeder and load conductors
- Grounding:
  - Always install a converter chassis grounding with a conductor of sufficient cross section (refer to chapter 8.2.4.2 Grounding). Input and output circuits are isolated from the enclosure.
  - When servicing the system groundings may be used and they must be removed prior to energizing the equipment.
- AC connections:
  - Cable entry: Bottom.
  - Method of routing: Conduit or throat in case of C-Cab installed in parallel.
- Battery cabinet interconnections:
  - Cable entry: Bottom
  - Method of routing: Conduit
- The recommended layout for battery cabinets is single row connections i.e. cabinets connected in line or back-to-back.
- Torque all connections

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

- Location: The unit cannot be installed within 2 km outdoors from the sea.
- Clearance: Refer to chapter "»6.2. Clearance distances», page 31 for further details

6.2. Clearance distances

6.2.1. Ventilation clearance

There are two intake vents and an exhaust fan on the back of the C-Cab to circulate air. In the final installation, the vents may not be covered or obstructed and must have at least 2 meters clearance in the rear of the C-Cab, in both the vertical and horizontal direction to allow for air flow.

6.2.2. Maintenance clearance

At minimum, the doors should be free to open fully unimpeded. In addition, the rear provides access to the cooling unit and it should be possible to remove it.

For the B-Cab especially, a free space is required in the front of the cabinet in order to enable the mounting and dismounting of battery racks with a forklift or manual stacker.

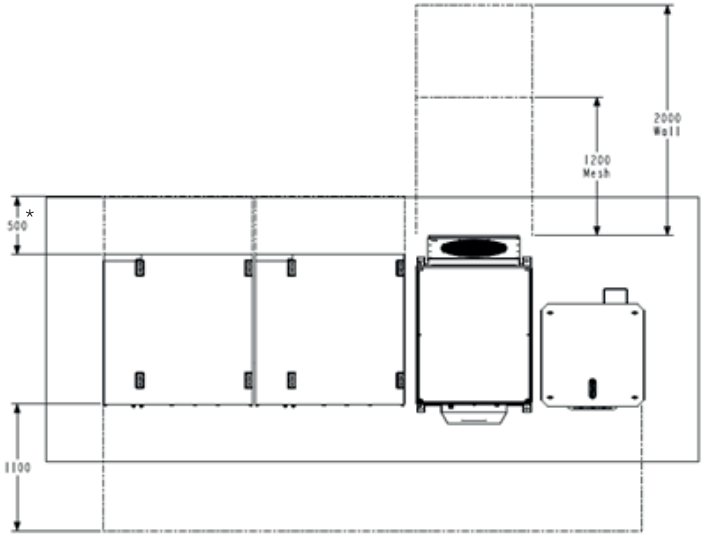


Figure 19. Clearance distances

*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.

6.2.3. Installation with several C-Cabs

Follow the spacing below when locating units next to each other.

Dimensions mm/[in]

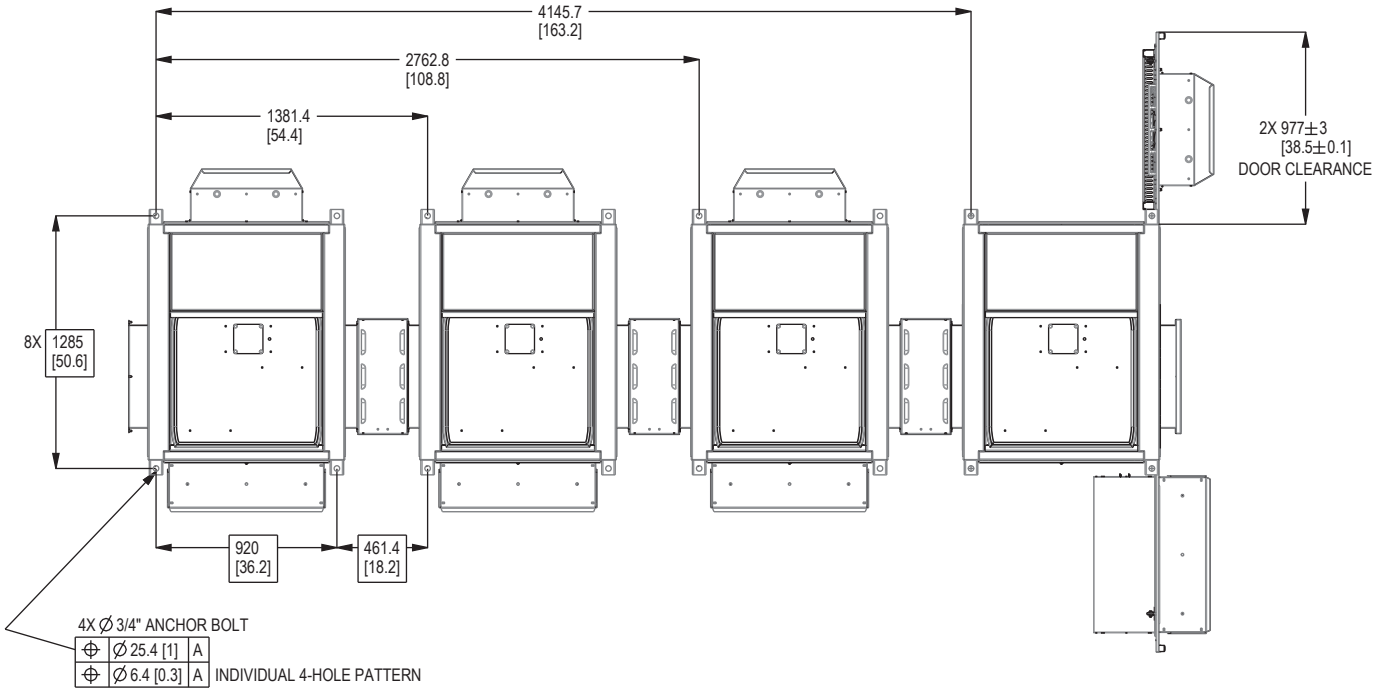


Figure 20. Unit to unit clearance (view from bottom)

	System shall be separated by a minimum 3m/10ft from the following exposures 1. Lot lines 2. Public ways 3. Buildings 4. Stored combustible materials 5. Hazardous materials 6. High-piled stock 7. Other exposure hazards not associated with electrical grid infrastructure. Contact factory in case of specific need.

6.3. Environmental conditions

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

External Operating Condition	
Temperature range	-20°C / +40°C without derating; +55°C with derating
Relative Humidity (non-condensing)	5-95%
Max. altitude above sea level	1000 m without derating 1% derating per 100 m up to 3000 m

6.3.1. Snow, Ice, and Cleaning Operations

This chapter aims at providing information on managing both snow and ice, as well as the associated cleaning operations for SUNSYS HES XXL. Winter conditions can present unique challenges for the system, requiring specific measures to ensure its proper operation and safety.

6.3.1.1. Snow and Ice

Impact of Snow and Ice

Both snow and ice can have several impacts on SUNSYS HES XXL, including:

- Reduced ventilation efficiency due to blocked air inlets.
- Increased risk of structural damage from the weight of snow and ice on components and structures.
- Difficult access to components for maintenance operations.

Monitoring Snow and Ice

It is essential to regularly monitor weather conditions and the accumulation of snow and ice around the system.

Use appropriate meteorological instruments to detect changes.

6.3.1.2. Cleaning Operations in Case of Snow and Ice

Safety Precautions

Before starting cleaning operations in the presence of snow and ice, follow these safety precautions:

- Power off all electrical cabinets of the system.
- Ensure that personnel performing cleaning are properly trained and equipped to work in winter conditions.

Snow and Ice Removal

When dealing with snowy or icy conditions, follow these steps for cleaning:

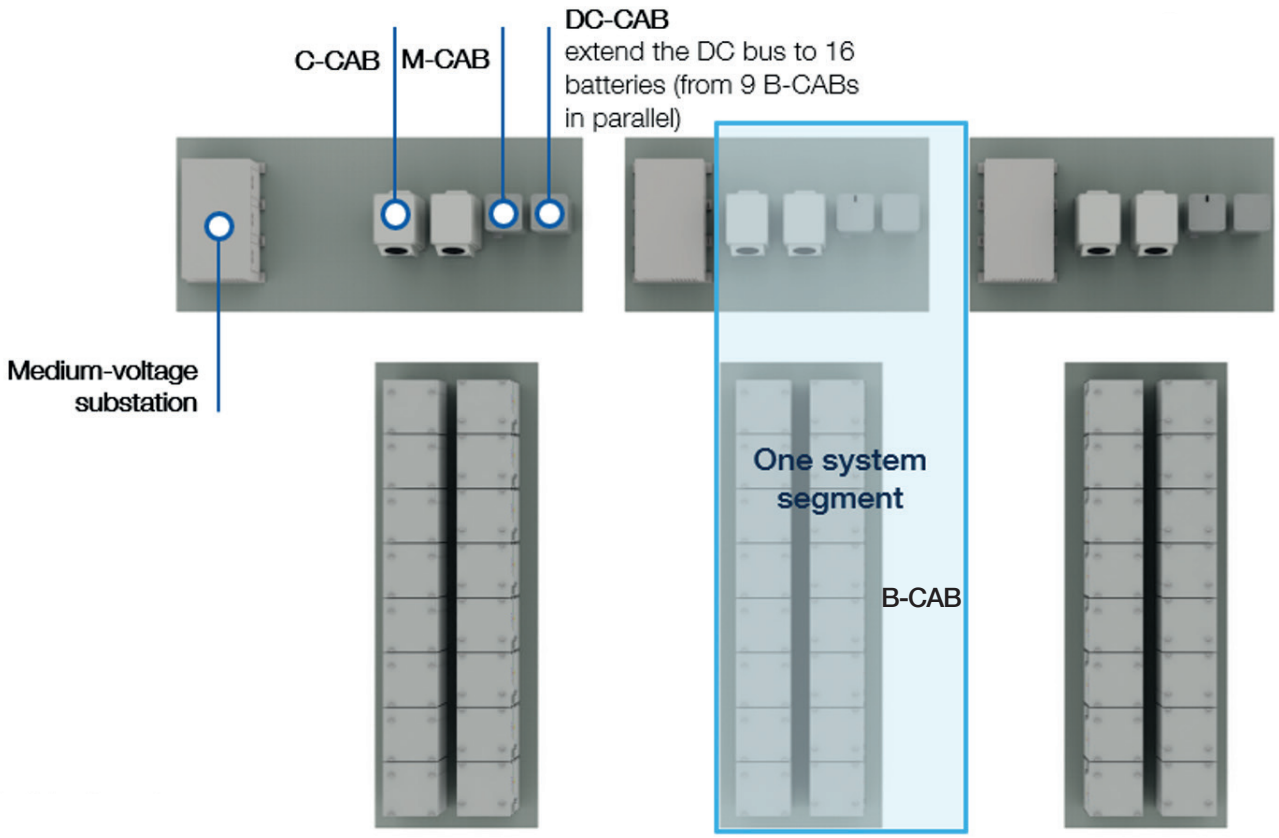
1. Power off the system according to the appropriate procedure.
2. Gently remove snow and ice from electrical cabinets, components, and structures using suitable tools, avoiding damage.
3. Ensure that ventilation air inlets are clear to maintain adequate airflow.
4. Check hinges, opening mechanisms, and door seals for any snow or ice that may impede their operation.
5. Remove snow to allow front and rear (if applicable) doors to open.

Ice Prevention

In addition to cleaning operations, consider methods to prevent ice formation, such as applying antifreeze.

7. POSITIONING

There are two types of battery installation possible: in line (side-to-side) and back-to-back, the view below shows a mix of the installations.



Consider conduit entry points and ventilation spacing requirements when placing the C-Cab. The M-Cab and B-cab anchoring holes in the floor of the concrete base must be pre-drilled using the template provided and the mechanic anchoring installed before putting the cabinet in place.

The C-Cab can be drilled in place.

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

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

7.1. Recommended cabinets order

The cabinets always have to be positioned as follows: the M-CAB, then C-Cab, then B-Cabs – starting from right or left is let at the customer discretion.

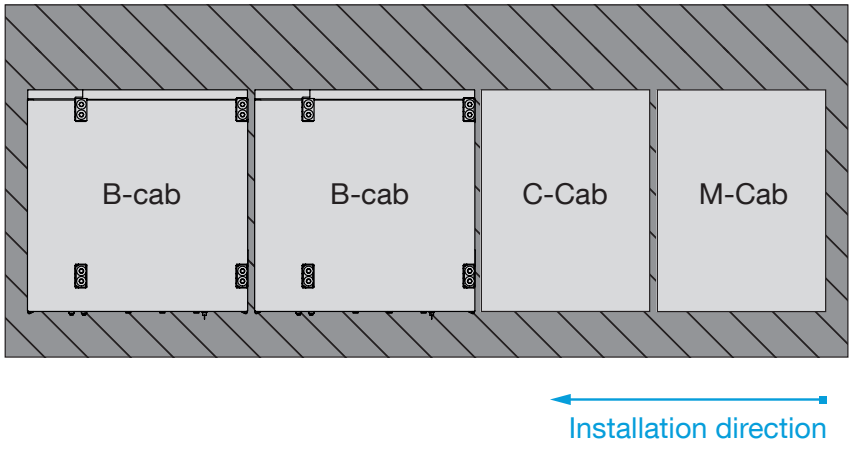


Figure 21. Cabinets order

7.2. Marking of the M-Cab

Take the drilling template provided and install it as shown below.

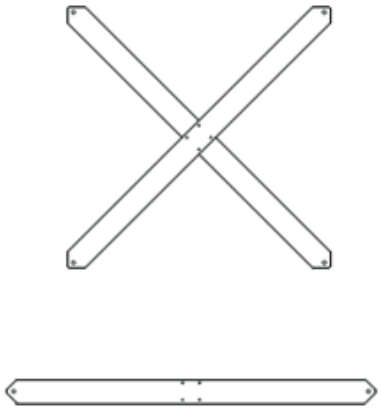


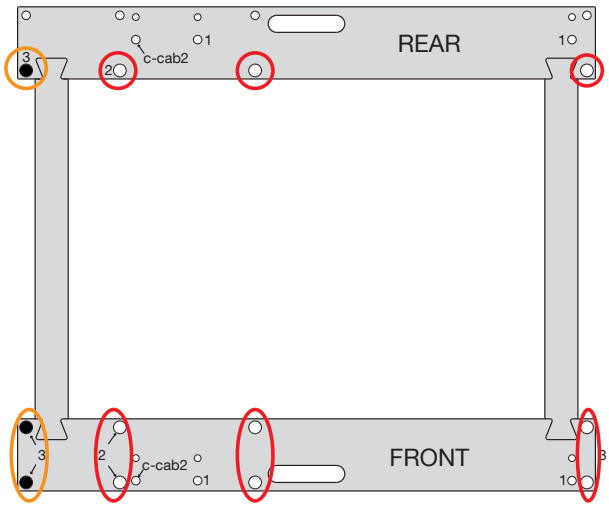
Figure 22. Top view of the drilling template mounted

7.3. Marking of the C-Cab

The C-Cab doesn't need any marking as it has a drill in place solution, nevertheless, make sur you keep enough space on the floor to install it between the M-Cab and the B-Cab. To make sure you can still open the doors, keep a minimum distance of 100mm between the C-Cab and the B-Cab, when the batteries are installed on the left and 260mm minimum when installed on the right.

7.4. Marking of the B-Cab

Place the drilling template on the floor next to the C-Cab, keeping the distance mentioned before, and drill the 12 holes marked on the view below.



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

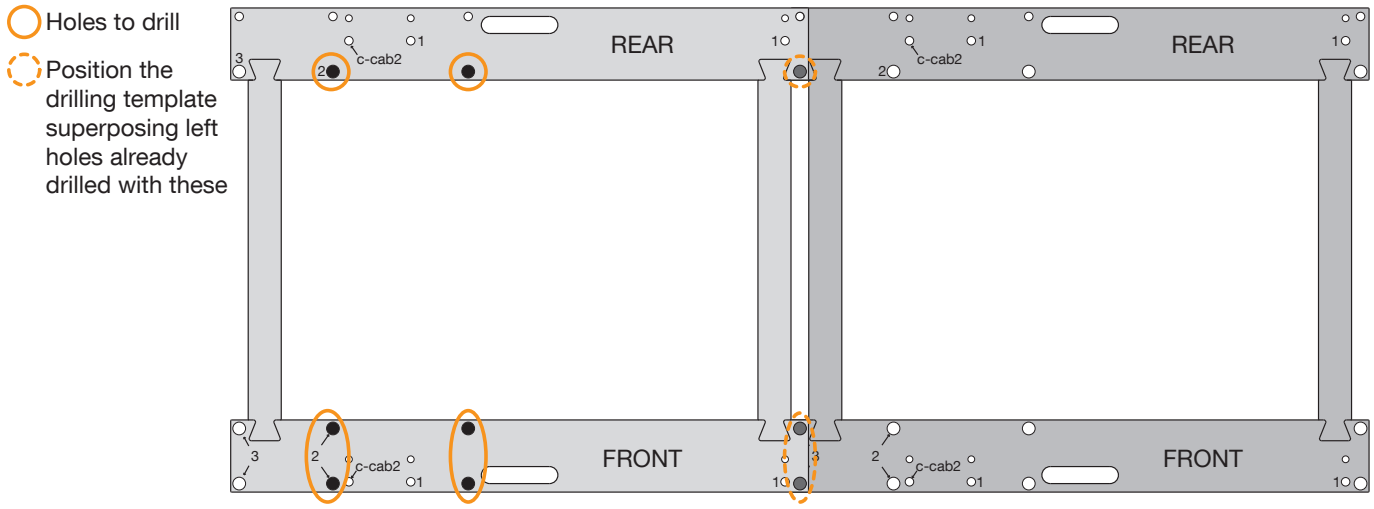


Figure 23. Holes to drill for the B-Cab installation

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.

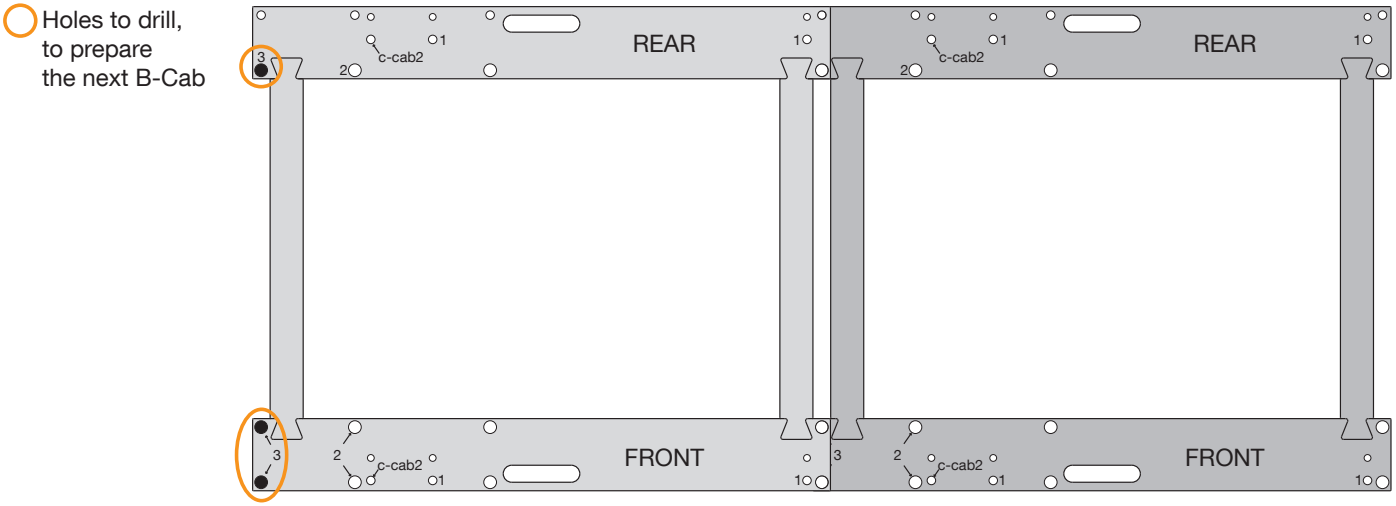


Figure 24. Holes to drill to prepare next B-cab installation

7.5. Drilling

Drill all the holes marked and use anchor rods:

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

7.6. Putting cabinets in place

Before installing on the floor, level the floor using shims. Maximum allowed deviations must be in the following range: 2mm / 0.06in for vertical direction, plus/minus 7mm / 0.25in for horizontal direction (left to right), and plus/minus 7mm / 0.25in for horizontal direction (front to back).

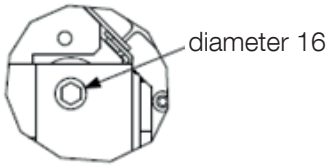
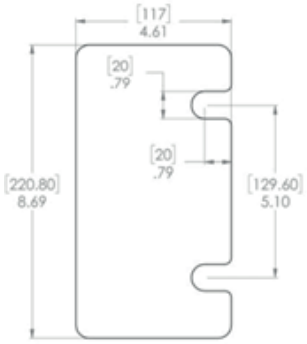
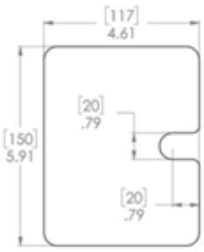
Put the cabinets in place, starting with the C-Cab on the right, therefore follow the below steps:

1. Remove the front and rear access panels.
2. Remove the front ventilation hood (if applicable).
3. Remove the conduit entry floor panel.
4. Position the C-Cab.
5. If a throat connection is being used, complete section “Throat connection” prior to moving to next step.
6. Fasten the C-Cab to the ground using the 4 pre-installed ¾” anchor bolts in each of the four pad mounting holes.
7. Measure the position of the bottom entry metal conduits and cut holes in the bottom conduit entry plate (provided) slightly larger than conduits. For the AC cables the phases should be balanced going through each conduit.
8. Install floor panel, and seal entry points, leaving no gaps between the floor panel and conduits.
9. Reinstall the access panels and ventilation hood.
10. Check the entire surface of the C-Cab for defects in the paint. Fill any defects in the paint. Any damage to the paint must be repaired once installation is complete, to prevent corrosion.
11. Make sure that both front and rear doors are fully closed.

Then put the M-Cab and finally the B-Cabs in place.

Notes on sealing the conduit:

1. Once the conduit entry floor panel is reinstalled the conduit must be sealed around its outer surface to prevent moisture, dust, air and debris from entering the cabinet.
2. Once the power lines are installed and are in their final position any excess space in the conduit must be sealed with an expansion foam or sealant to prevent moisture, dust, air and debris from entering through the conduit. Ensure that the chemistry of the foam/sealant used to seal the interior of the conduit is compatible with insulation used in the power cables and that the maximum expected temperature of the cables does not exceed that of the degradation temperature of the foam/sealant. Improper sealing could compromise the enclosure.

Cabinet	Fixing holes	Recommended screws size	Tightening torque
C-Cab		M16 / 0,625 inch	80 Nm / lbs
M –Cab		M12 / 0,5 inch	40 Nm / lbs
B-Cab	 	M16 / 0,625 inch	80 Nm / lbs

8. CONNECTIONS

8.1. Power and control cables

When routing the cables please follow the good installation practices. Pay attention to following items to avoid any EMI or inductive heating issues with the installation:

- Install the DC power cables, AC power cables and control and communication cables in different route
- If using cable trays (or other conducting materials) make sure that the trays are electrically bonded
- Control and communication cables should be installed at least 500 mm (20 in) away from the power cables.
- If the control cables cross the power cables this should be in 90° angle to the power cables.
- If using single phase cables, route all phases and same amount of each phase (R, S and T) at same route. Especially when going through conductive surfaces or installed on the conducting surface.

8.2. Electrical installation

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

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

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

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

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

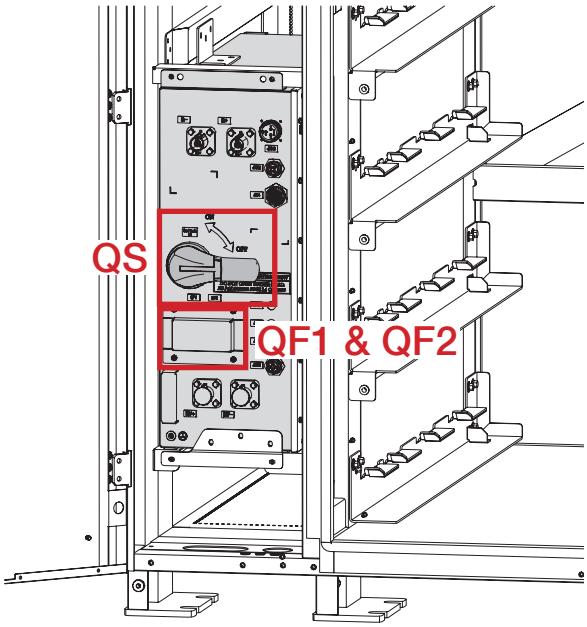
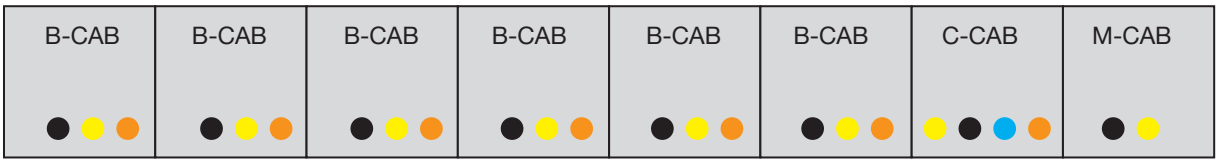


Figure 25. Location of isolation switch QS and breakers QF1 & QF2

8.2.1. Electrical interconnections

Below is an overall view of the system with the positioning of the ducts according to the classification of the signals used for the interconnection of the system.



- Duct for battery auxillaries Power AC - 230 / 400V
- Duct for 24V + communication
- Duct for main Power AC - 690V
- Duct for Power DC

8.2.2. 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.

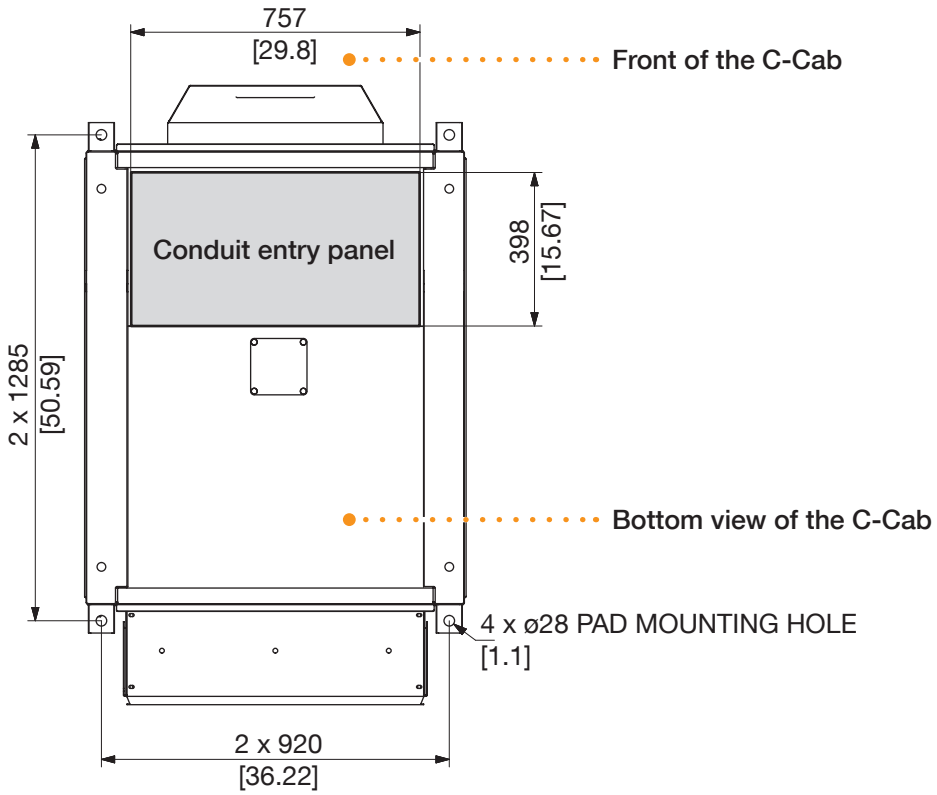
Handling Precautions and Guidelines

- 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.

8.2.3. Power cables connection

Cable conduit entry point mm [inch]



Conduit entry points must be cut through the conduit entry floor panel on the base of the inverter for all power connections made from the ground. Ensure the conduit entry panel is removed prior to installing the cabinet. Failure to do so may result in the panel being damaged. This panel will be reinstalled later and is part of the integrity of the enclosure

⚠	**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

Connections to the C-Cab made in the field must comply with applicable standards. The C-Cab uses L1/L2/L3 to identify phases. L1/L2/L3 is equivalent to R/S/T or U/V/W. The phases may be connected in any order; the C-Cab will self-detect the phase rotation when in grid following mode.

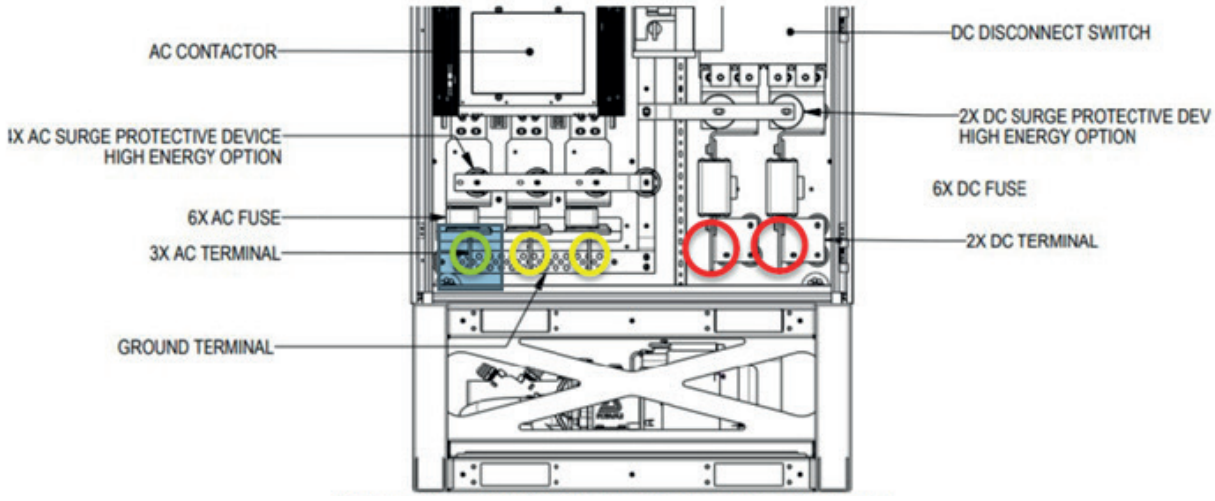


Figure 26. C-Cab Power connection overview

Dimensions in mm [in]

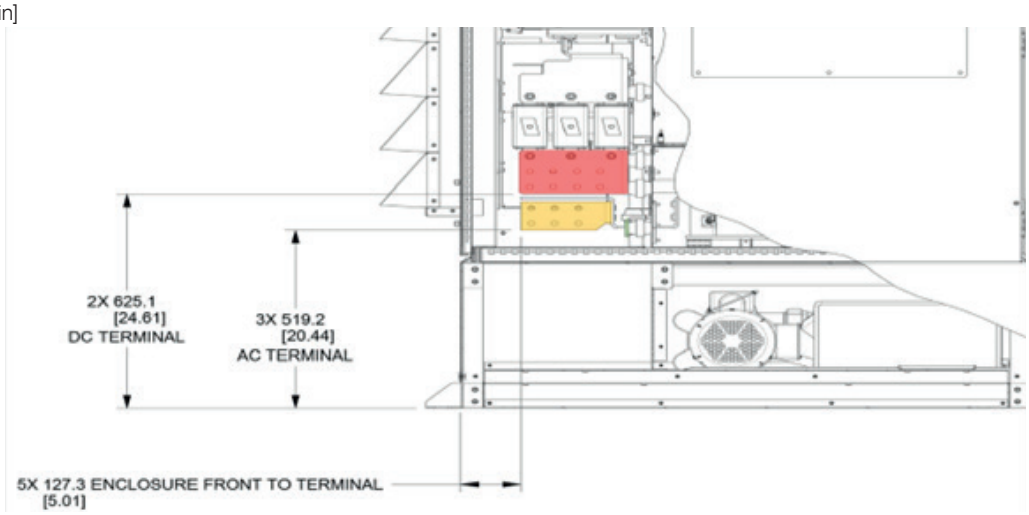
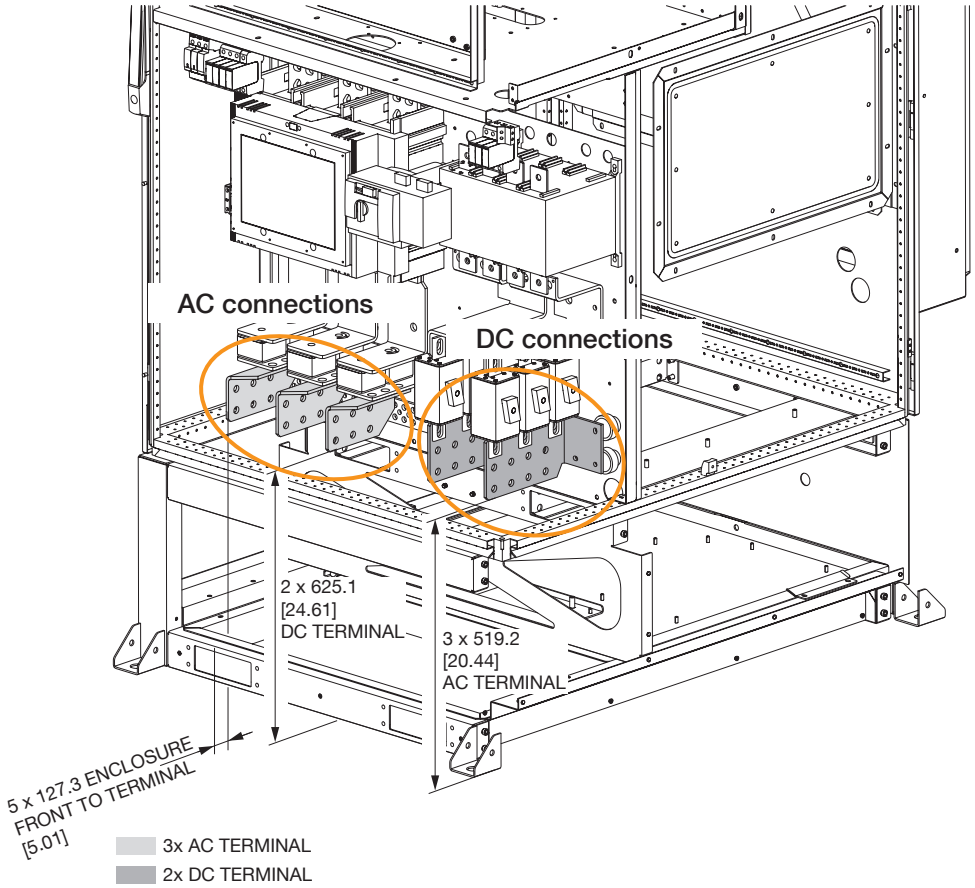


Figure 27. DC and AC terminal dimensions to floor

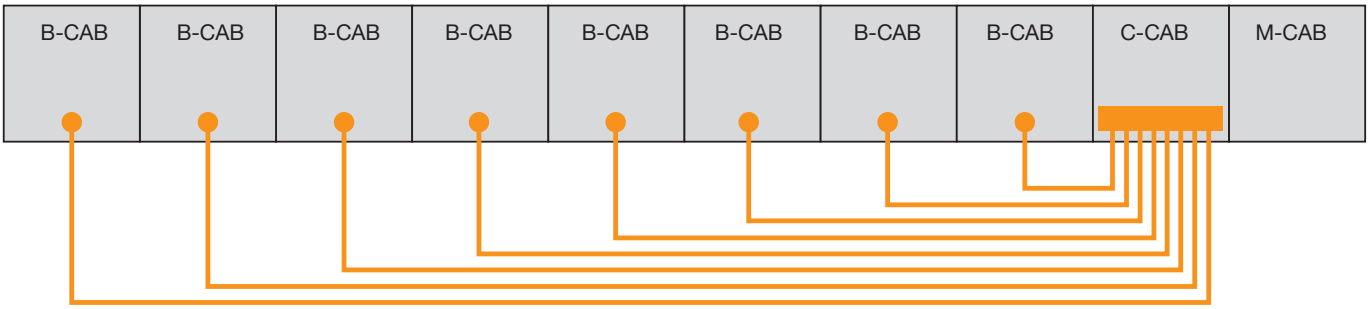
8.2.4. AC, DC and ground connection



AC connections (detailed in chapter «8.2.5. AC Power connections», page 47).
DC connections (detailed in chapter «8.2.4.1. DC Power Connections», page 43).

Figure 28. C-Cab DC and AC connections

8.2.4.1. DC Power Connections



Dimensions in mm [in]

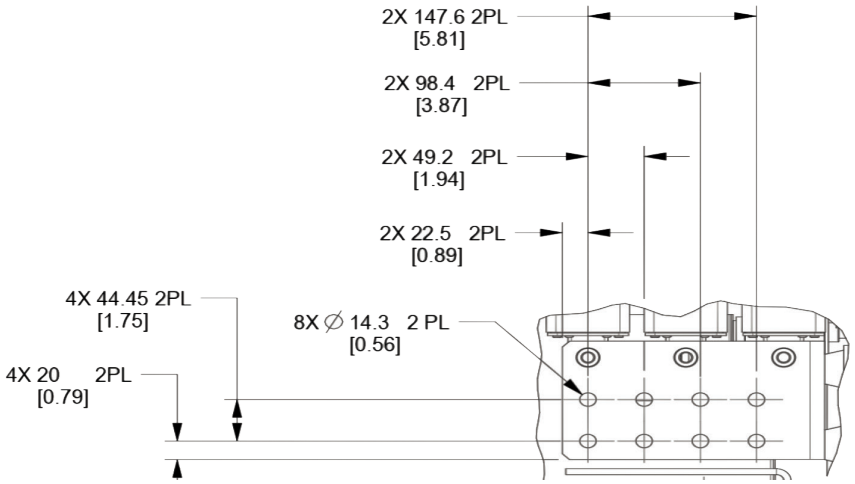


Figure 29. C-Cab DC Busbar termination detail

Description	Nb of terminals	Max. nb of cables per terminal	Max. cable section	Tightening torque
DC connection	2 (1+ and 1-)	8 (1per B-Cab)	95mm²	56.5Nm

A - For the first B-Cab

1. Open both cabinet doors and remove the dead front from the termination compartment.
2. Identify the cable for positive power connection.
3. 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.
4. 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.
5. 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.

6. 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.

7. Connect to the positive terminal and bolt using the provided hardware and torque.
8. Identify the cable for negative power connection.
9. 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.
10. 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.

11. 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.

12. 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.

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

B - 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.

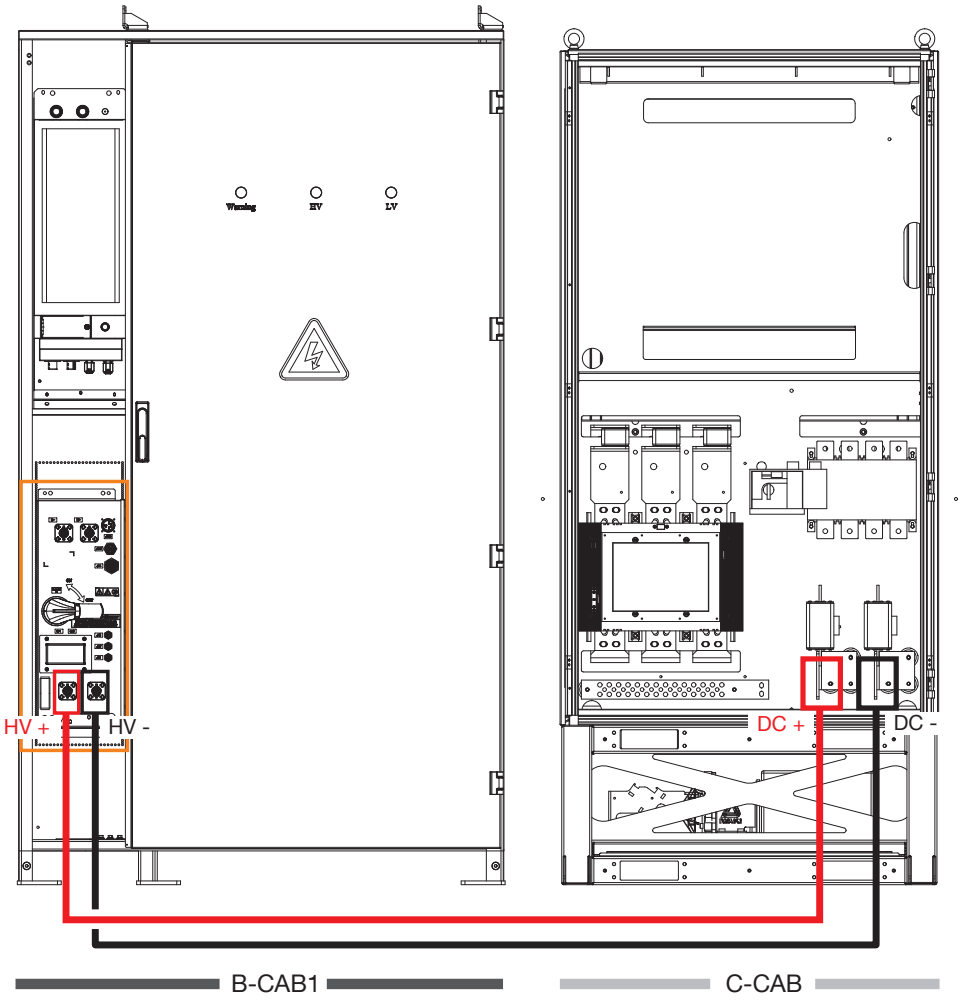


Figure 30. DC Power connections

8.2.4.2. Grounding

The C-Cab grounding conductor must be connected to the grounded bus bar behind the dead front of the cabinet as shown in Figure 26, page 41. Hole size and spacing is shown below.

Dimensions in mm

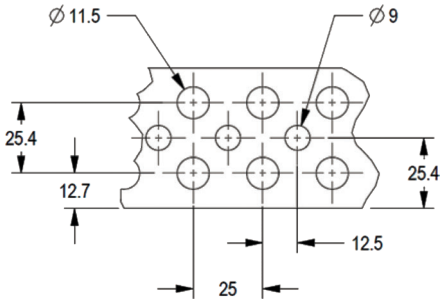


Figure 31. C-Cab Grounding Terminal Detail

The C-Cab grounding conductor must be sized per the governing standard for your application, typically according to IEC standard ½ of the cross-section of the main phase conductor

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

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

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

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

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

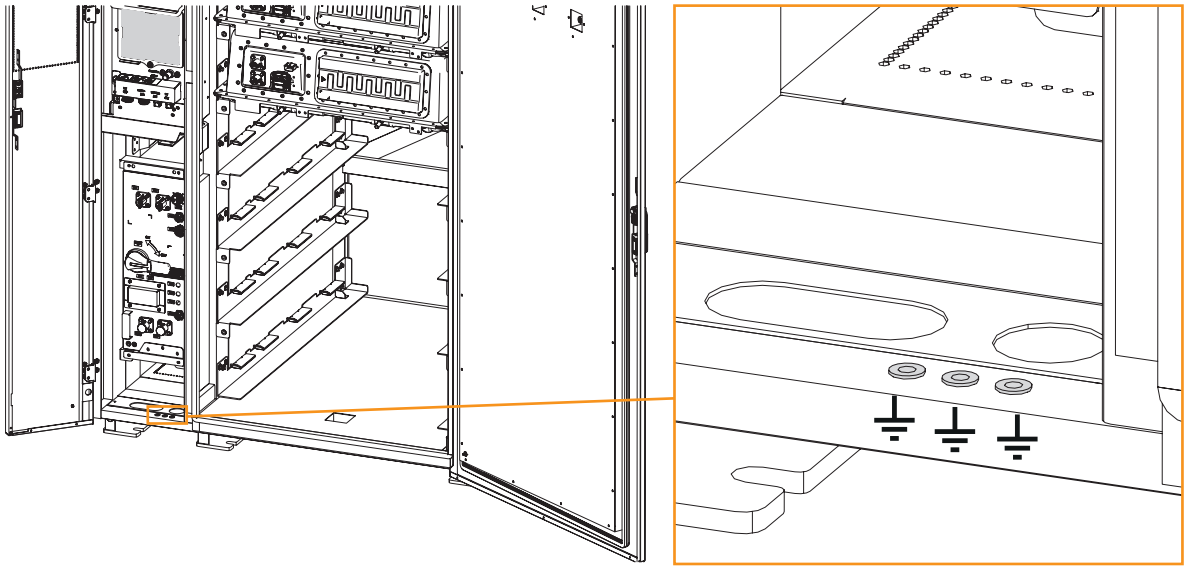


Figure 32. Battery cabinet ground terminal

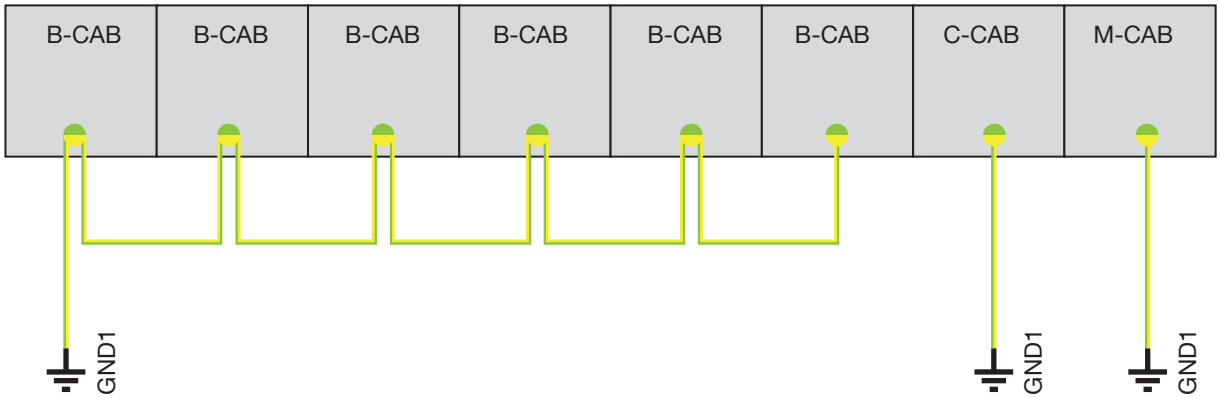


Figure 33. Ground connections

To guarantee an optimal use of the whole system, especially in terms of electromagnetic field, the M-CAB, the C-CAB and the group of B-Cabs require their own individual ground connection by a unique ground cable for each.

The B-Cab ground cable can be connected to any B-Cabs as long as those cabinets are connected between each other.

8.2.5. AC Power connections

8.2.5.1. C-Cab

The C-Cab is supplied by a 3x690Vac(Max) network:

Dimensions in mm [in]

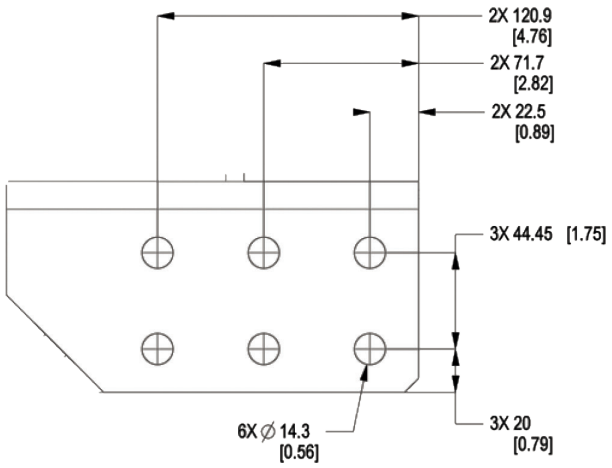
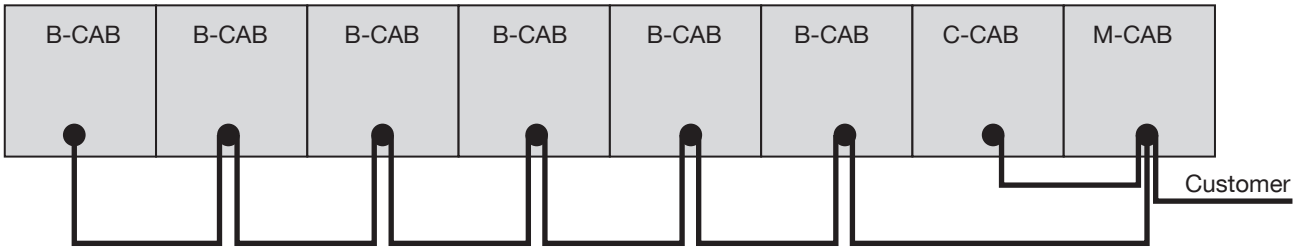


Figure 34. C-Cab Grounding Terminal Detail

Description	Nb of terminals	Max. nb of cables per terminal	Max. cable section	Tightening torque
AC connection	3	6	300mm²	113Nm

8.2.5.2. Auxiliary power connection



All control and auxiliary wiring connections are located on the lower DIN rail mounted on the inside of the front door of the C-Cab. Wires are routed through the wire duct and zip tied to avoid contact with busbars or other electrical equipment. Do not zip tie any wires to the outermost frame face, highlighted in red above. This will hinder the dead front from being re-installed.

The system integrator will need to cut a small hole in the rubber wire gland to pass lines from the clean compartment into the area below. This can be accomplished by creating an “X” shaped incision with a razor blade or similar.

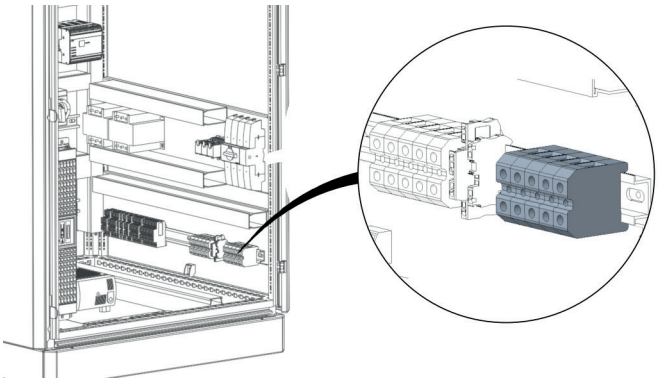
Auxiliary power wire should be of the appropriate gauge to handle 15 A of continuous current, as defined by applicable standards.

8.2.6. Auxiliaries power supply

M-Cab Aux Power Supply

The M-Cab auxiliairies are supplied by a 3x400Vac+N network, from external connections according to the below cable book:

Description	Nb of terminals	Max. nb of cables per terminal	Max. cable section	Tightening torque
AC connection - XAUX	5 (L1, L2, L3, N, PE)	6	35mm^2	2.8Nm



C-Cab Aux Power Supply

Not all connections are required in some applications. Read the descriptions to determine which functions are relevant to your system.

Installer is responsible for connecting auxiliary power through the input circuit breaker mounted on the DIN rail. The auxiliary power input provides power for:

- Controls
- Cooling fan
- Coolant pump
- Heaters for condensation mitigation

The red jumpers in the terminal strips are used to jumper terminal strips together. These should not be removed.

The control power circuit breaker and the cooling power circuit breaker may be either a 2-pole or 3-pole breaker.

In black start application the auxiliary power input needs to be divided into UPS and non-UPS sections to reduce the UPS power requirement.

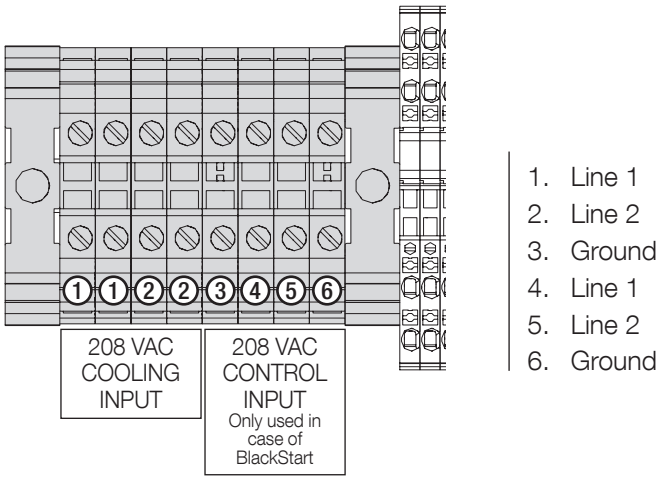
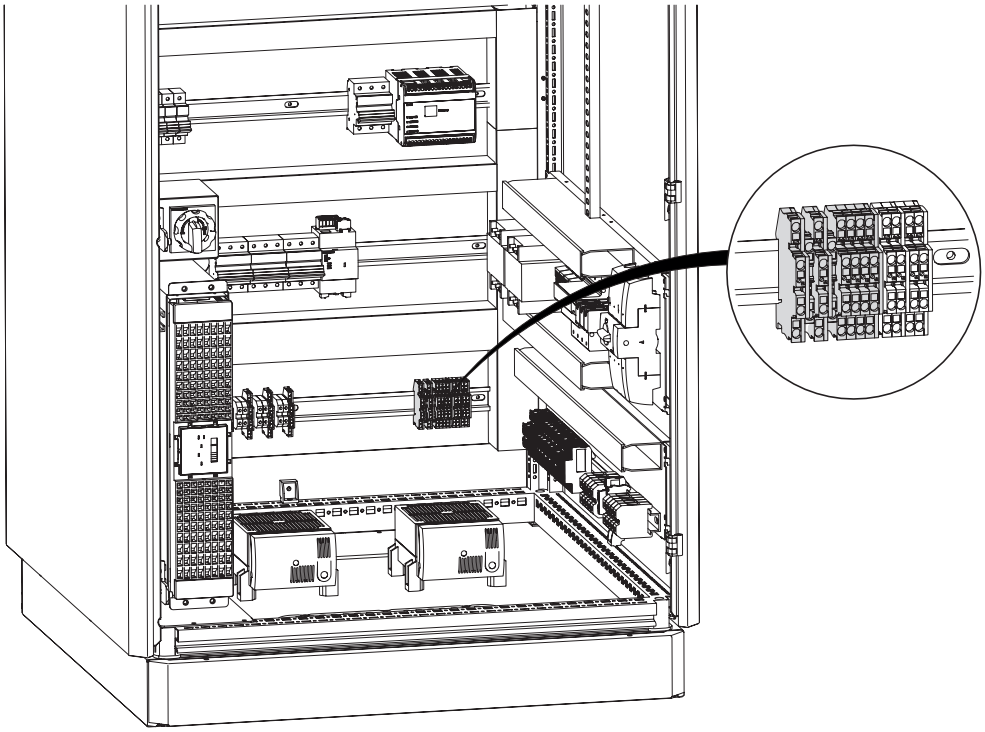


Figure 35. Auxiliaries power supply terminal

The C-Cab auxiliaries are supplied from the M-Cab, according to the below cable book:

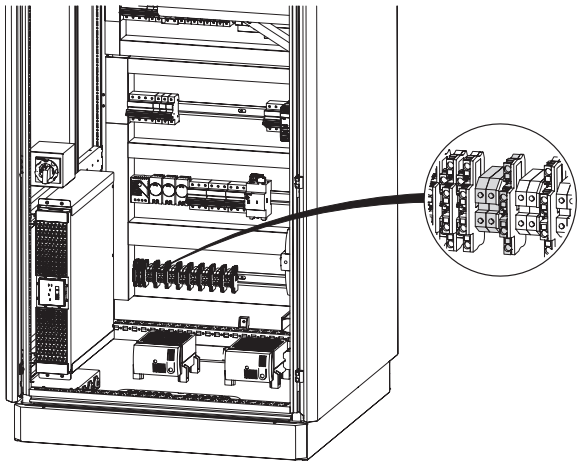
Departure	Arrival	Cable section	Power requirement (continuous /Peak)
X1S1.1 - M-Cab	XD17.1 - C-Cab	2,5mm^2	5kVA / 1.6kVA
X1S1.2 - M-Cab	XD17.2 - C-Cab	2,5mm^2	5kVA / 1.6kVA
X1S1.3 - M-Cab	XD17.4 - C-Cab	2,5mm^2	3kVA / 0.8kVA
X1S1.4 - M-Cab	XD17.5 - C-Cab	2,5mm^2	3kVA / 0.8kVA

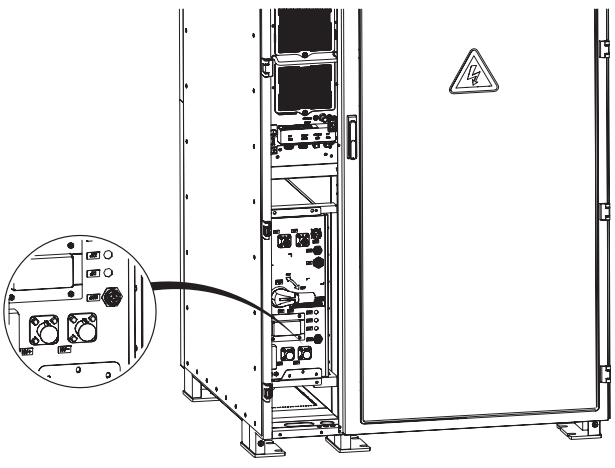


B-Cabs aux power supply

The B-Cab auxiliaries (Chiller and control) are supplied from the M-Cab, according to the below cable book:

Departure	Arrival	Cable section	Power requirement
X1B1.1 - M-Cab	JXH1.D - B-Cab 1	2.5mm²	Chiller power 4.3kW
X1B1.2 - M-Cab	JXH1.C - B-Cab 1		
X1B1.3 - M-Cab	JXH1.B - B-Cab 1	2.5mm²	Control power 60W
X1B1.4 - M-Cab	JXH1.A - B-Cab 1		
X1B2.1 - M-Cab	JXH1.D - B-Cab 2	2.5mm²	Chiller power 4.3kW
X1B2.2 - M-Cab	JXH1.C - B-Cab 2		
X1B2.3 - M-Cab	JXH1.B - B-Cab 2	2.5mm²	Control power 60W
X1B2.4 - M-Cab	JXH1.A - B-Cab 2		
X1B3.1 - M-Cab	JXH1.D - B-Cab 3	2.5mm²	Chiller power 4.3kW
X1B3.2 - M-Cab	JXH1.C - B-Cab 3		
X1B3.3 - M-Cab	JXH1.B - B-Cab 3	2.5mm²	Control power 60W
X1B3.4 - M-Cab	JXH1.A - B-Cab 3		
X1B4.1 - M-Cab	JXH1.D - B-Cab 4	2.5mm²	Chiller power 4.3kW
X1B4.2 - M-Cab	JXH1.C - B-Cab 4		
X1B4.3 - M-Cab	JXH1.B - B-Cab 4	2.5mm²	Control power 60W
X1B4.4 - M-Cab	JXH1.A - B-Cab 4		
X1B5.1 - M-Cab	JXH1.D - B-Cab 5	2.5mm²	Chiller power 4.3kW
X1B5.2 - M-Cab	JXH1.C - B-Cab 5		
X1B5.3 - M-Cab	JXH1.B - B-Cab 5	2.5mm²	Control power 60W
X1B5.4 - M-Cab	JXH1.A - B-Cab 5		
X1B6.1 - M-Cab	JXH1.D - B-Cab 6	2.5mm²	Chiller power 4.3kW
X1B6.2 - M-Cab	JXH1.C - B-Cab 6		
X1B6.3 - M-Cab	JXH1.B - B-Cab 6	2.5mm²	Control power 60W
X1B6.4 - M-Cab	JXH1.A - B-Cab 6		
X1B7.1 - M-Cab	JXH1.D - B-Cab 7	2.5mm²	Chiller power 4.3kW
X1B7.2 - M-Cab	JXH1.C - B-Cab 7		
X1B7.3 - M-Cab	JXH1.B - B-Cab 7	2.5mm²	Control power 60W
X1B7.4 - M-Cab	JXH1.A - B-Cab 7		
X1B8.1 - M-Cab	JXH1.D - B-Cab 8	2.5mm²	Chiller power 4.3kW
X1B8.2 - M-Cab	JXH1.C - B-Cab 8		
X1B8.3 - M-Cab	JXH1.B - B-Cab 8	2.5mm²	Control power 60W
X1B8.4 - M-Cab	JXH1.A - B-Cab 8		





Size of AC auxiliary input protection:

Auxiliary rated voltage	C-rate	Number of B-CAB	Overcurrent protection rated current
400V 3PH+N 50Hz	0.5 C	1	40A
		2	40A
		3	40A
		4	50A
		5	50A
		6	50A
		7	50A
		8	63A
	1	1	40A
		2	40A
		3	40A
		4	63A
		5	63A
		6	63A
		7	63A
		8	80A

8.3. Loss of Auxiliary Power

8.3.1. 1. Introduction

Auxiliaries play a crucial role in powering battery thermal management, the inverter, control cabinet, and cloud data transmission. The loss of auxiliary power, especially in extreme weather conditions, can lead to accelerated system degradation.

Therefore, it is vital to restore this power supply within 7 days in the event of a failure.

8.3.2. 2. Impact of Loss of Auxiliary Power

The loss of auxiliary power can have severe consequences on SUNSYS HES XXL, including:

- **Battery thermal management:** Without auxiliary power, battery may be compromised, leading to overheating or inadequate cooling of the batteries, reducing their lifespan.
- **Cloud communication disruption:** The loss of power can prevent the transmission of data to the cloud, affecting remote monitoring, performance tracking battery warranty, and preventive system maintenance.

8.3.3. Procedures for Restoring Auxiliary Power

8.3.3.1. Diagnosing Loss of Auxiliary Power

In the event of auxiliary power loss, follow these steps to diagnose the issue:

1. Check the status of indicator lights or system monitoring for any anomalies.
2. Verify the main power supply to the system to ensure it is functioning correctly.

8.3.3.2. Restoration Procedures

If the loss of auxiliary power is confirmed, follow these steps to quickly restore power:

1. Identify the source of the outage, whether it's a failure of the auxiliary power source itself or a wiring issue.
2. In case of auxiliary power source failure, replace it.
3. If the issue is related to wiring, perform necessary repairs while adhering to electrical safety standards.
4. Ensure the auxiliaries are functioning correctly before restoring the main electrical power to the system.

8.3.3.3. Preventive Maintenance

To minimize the risk of auxiliary power loss, perform regular preventive maintenance on auxiliary components and monitor alarms or fault notifications.

8.3.4. Restart Procedures

8.3.4.1. Safety Precautions

Before restarting the system, adhere to these safety precautions:

- Ensure all personnel involved in the restart are trained and knowledgeable about the system's operation and safety procedures.
- Verify that the cause of the auxiliary power blackout has been identified and resolved.
- Make sure that the main power supply of the system is in good working condition and has been properly tested.

8.3.4.2. Sequential Restart

Follow these sequential steps to restart the system after an auxiliary power blackout:

1. **Auxiliary Power Connection:** Ensure that the auxiliary power supply is reconnected and operational. It is crucial to keep the auxiliary power connected for a minimum of 24 hours before proceeding to the next step. This extended duration allows for proper system initialization and stabilization.
2. **System Check:** Conduct a thorough inspection of the system's components, including batteries, inverters, control cabinets, and monitoring equipment. Ensure that no damage has occurred during the blackout period.
3. **Main Power Reconnection:** Only after the 24-hour period of auxiliary power connection and successful system checks should you proceed to reconnect the main power supply.
4. **System Initialization:** After the main power is restored, allow the system to initialize and stabilize. This may take some time, and it's essential to be patient during this process.
5. **Performance Verification:** Verify that the system is operating within normal parameters and that all functions are performing as expected.

8.3.5. Control interface

All control interfaces of the C-Cab are located on the rear panel on the front door. The terminal interface block is shown in below.

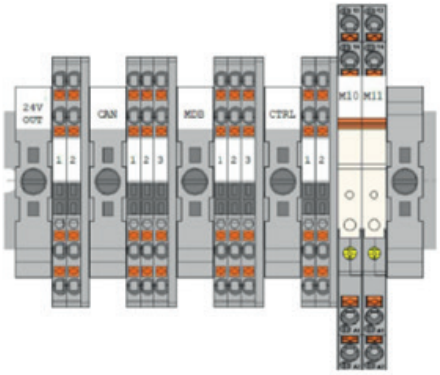


Figure 36. Control interface terminal

Emergency stop

The system includes a hardware loop that may be optionally used to initiate a hardware-only shutdown independant of the communication interface.

Departure	Arrival	Cable section
X1S1.1 - M-Cab	XD17.1 - C-Cab	2.5mm² shielded
X1S1.2 - M-Cab	XD17.2 - C-Cab	

When piloted by the customer through a push-button, it shall be connected as follows:

Departure	Arrival	Cable section
X4.1 - M-Cab	Emergency stop push button input	2 x 0.5mm² shielded
X4.2 - M-Cab		
X4.4 - M-Cab	Emergency stop output	2 x 0.5mm² shielded
X4.2 - M-Cab		

Use a small screwdriver or similar tool to open terminal block clamps when installing wires as shown in the image below.

Figure 37. Opening terminal block clamp

Wires should be terminated by ferrules before inserting into terminal blocks. If ferrules cannot be used, any other termination method specified by manufacturer's instructions is acceptable. Use strain relief methods for conductors terminating on the DIN rail.

Size of system control input protection (non-depending on B-CAB number or C-rate):

Auxiliary rated voltage	Overcurrent protection rated current
230V P+N 50Hz	2A
24VDC	10A

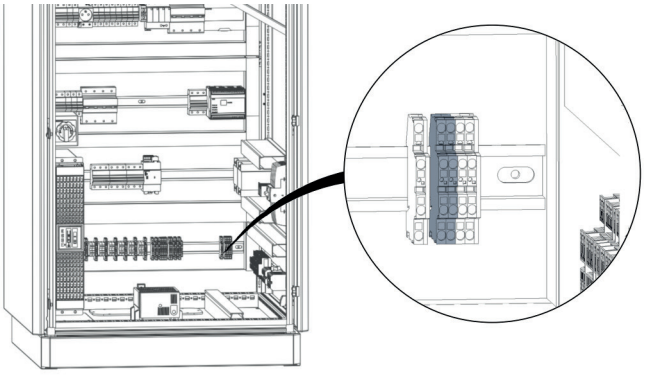
X2: Battery communication

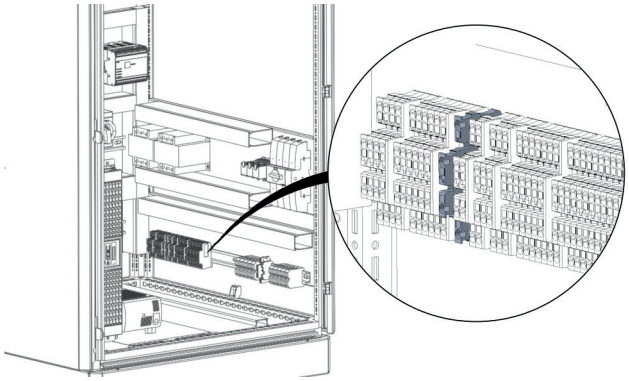
On the B-Cab side the CAN communication and the FSS power supply, are as shown in the below cable book:

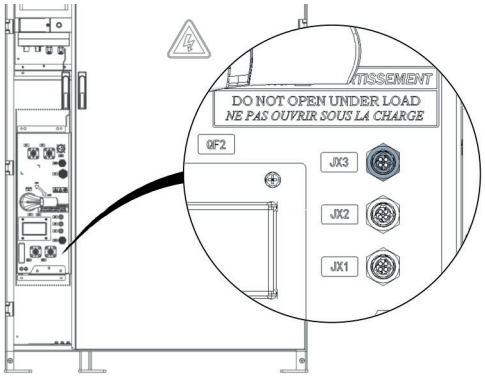
Departure	Arrival	Cable section
XCAN.1 - M-Cab	JX3.A - B-Cab 1	4x2x0.5mm² shielded
XCAN.2 - M-Cab	JX3.B - B-Cab 1	
X2B1.1 - M-Cab	JX3.D - B-Cab 1	
X2B1.2 - M-Cab	JX3.C - B-Cab 1	
X2B1.3 - M-Cab	JX3.F - B-Cab 1	
X2B1.4 - M-Cab	JX3.E - B-Cab 1	
X2B1.5 - M-Cab	JX3.H - B-Cab 1	
X2B1.6 - M-Cab	JX3.G - B-Cab 1	
JX2.A - B-Cab 1	JX3.A - B-Cab 2	4x2x0.5mm² shielded
JX2.B - B-Cab 1	JX3.B - B-Cab 2	
JX2.C - B-Cab 1	JX3.C - B-Cab 2	
JX2.D - B-Cab 1	JX3.D - B-Cab 2	
JX2.E - B-Cab 1	JX3.E - B-Cab 2	
JX2.F - B-Cab 1	JX3.F - B-Cab 2	
JX2.G - B-Cab 1	JX3.G - B-Cab 2	
JX2.H - B-Cab 1	JX3.H - B-Cab 2	
JX2.A - B-Cab 2	JX3.A - B-Cab 3	4x2x0.5mm² shielded
JX2.B - B-Cab 2	JX3.B - B-Cab 3	
JX2.C - B-Cab 2	JX3.C - B-Cab 3	
JX2.D - B-Cab 2	JX3.D - B-Cab 3	
JX2.E - B-Cab 2	JX3.E - B-Cab 3	
JX2.F - B-Cab 2	JX3.F - B-Cab 3	
JX2.G - B-Cab 2	JX3.G - B-Cab 3	
JX2.H - B-Cab 2	JX3.H - B-Cab 3	
JX2.A - B-Cab 3	JX3.A - B-Cab 4	4x2x0.5mm² shielded
JX2.B - B-Cab 3	JX3.B - B-Cab 4	
JX2.C - B-Cab 3	JX3.C - B-Cab 4	
JX2.D - B-Cab 3	JX3.D - B-Cab 4	
JX2.E - B-Cab 3	JX3.E - B-Cab 4	
JX2.F - B-Cab 3	JX3.F - B-Cab 4	
JX2.G - B-Cab 3	JX3.G - B-Cab 4	
JX2.H - B-Cab 3	JX3.H - B-Cab 4	

Departure	Arrival	Cable section
JX2.A - B-Cab 4	JX3.A - B-Cab 5	4x2x0.5mm² shielded
JX2.B - B-Cab 4	JX3.B - B-Cab 5	
JX2.C - B-Cab 4	JX3.C - B-Cab 5	
JX2.D - B-Cab 4	JX3.D - B-Cab 5	
JX2.E - B-Cab 4	JX3.E - B-Cab 5	
JX2.F - B-Cab 4	JX3.F - B-Cab 5	
JX2.G - B-Cab 4	JX3.G - B-Cab 5	
JX2.H - B-Cab 4	JX3.H - B-Cab 5	
JX2.A - B-Cab 5	JX3.A - B-Cab 6	4x2x0.5mm² shielded
JX2.B - B-Cab 5	JX3.B - B-Cab 6	
JX2.C - B-Cab 5	JX3.C - B-Cab 6	
JX2.D - B-Cab 5	JX3.D - B-Cab 6	
JX2.E - B-Cab 5	JX3.E - B-Cab 6	
JX2.F - B-Cab 5	JX3.F - B-Cab 6	
JX2.G - B-Cab 5	JX3.G - B-Cab 6	
JX2.H - B-Cab 5	JX3.H - B-Cab 6	
JX2.A - B-Cab 6	JX3.A - B-Cab 7	4x2x0.5mm² shielded
JX2.B - B-Cab 6	JX3.B - B-Cab 7	
JX2.C - B-Cab 6	JX3.C - B-Cab 7	
JX2.D - B-Cab 6	JX3.D - B-Cab 7	
JX2.E - B-Cab 6	JX3.E - B-Cab 7	
JX2.F - B-Cab 6	JX3.F - B-Cab 7	
JX2.G - B-Cab 6	JX3.G - B-Cab 7	
JX2.H - B-Cab 6	JX3.H - B-Cab 7	
JX2.A - B-Cab 7	JX3.A - B-Cab 8	4x2x0.5mm² shielded
JX2.B - B-Cab 7	JX3.B - B-Cab 8	
JX2.C - B-Cab 7	JX3.C - B-Cab 8	
JX2.D - B-Cab 7	JX3.D - B-Cab 8	
JX2.E - B-Cab 7	JX3.E - B-Cab 8	
JX2.F - B-Cab 7	JX3.F - B-Cab 8	
JX2.G - B-Cab 7	JX3.G - B-Cab 8	
JX2.H - B-Cab 7	JX3.H - B-Cab 8	

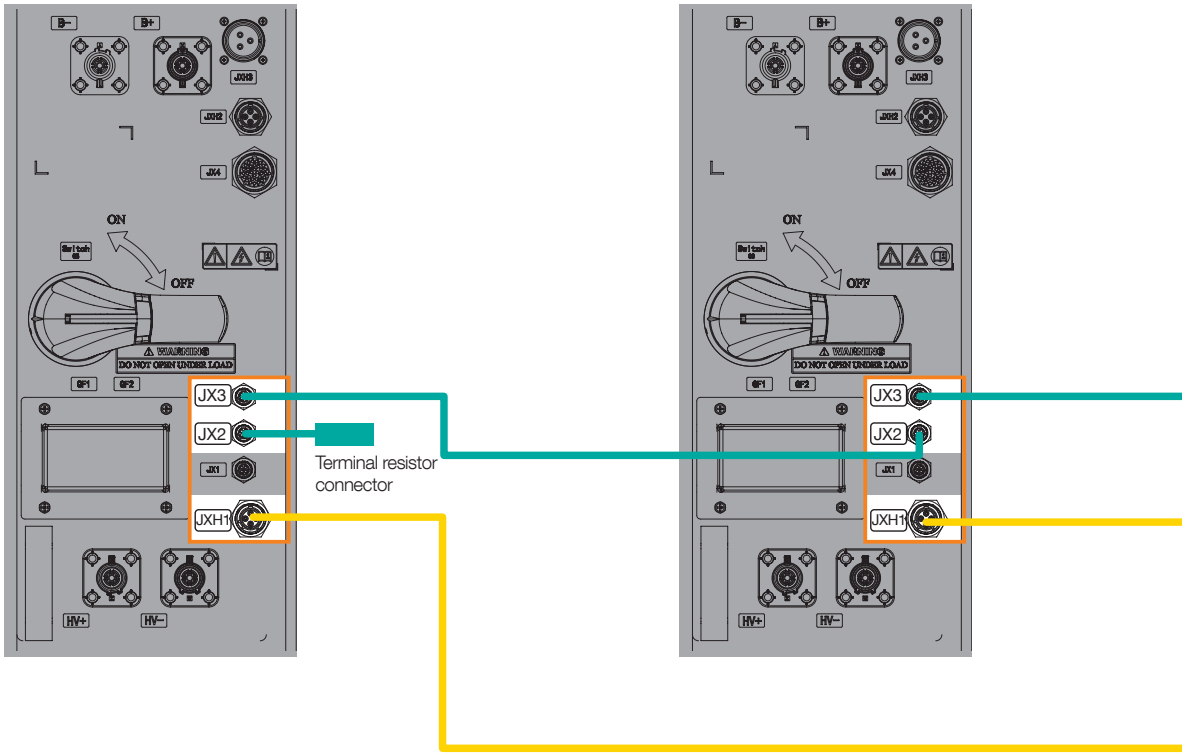
M-CAB Xcan to BCAB1 JX3






DO NOT OPEN UNDER LOAD
NE PAS OUVRIR SOUS LA CHARGE
QF2
JX3
JX2
JX1

Then BCAB to BCAB JX2 to JX3



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

8.4. SUNSYS HES XXL measures for the PMS

8.4.1. Current sensing

3 current probes are provided inside the M-Cab, ready to be connected.

The current probes are meant to measure the current on the 3 phases (L1, L2, L3) of the C-Cab AC-Side (690Vac).

The probes are “Rogowski” type and therefore can be opened and installed once the AC power cables are connected.

To connect the probes, follow the procedure below:

- open the probe by releasing the locking system.
- pass the probe around the AC power cables; each probe shall embrace all the cables of the associated phase (please check the M-Cab schematics):
  TC15.1 ➜ phase L1
  TC15.2 ➜ phase L2
  TC15.3 ➜ phase L3
  the arrow on the side of the sensor has to point toward the grid side (i.e. it goes from the inside to the outside of the cabinet).

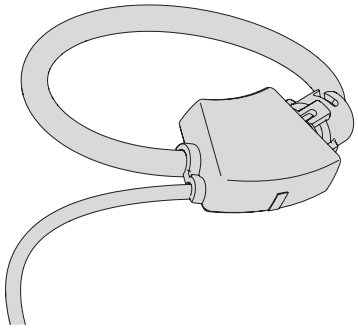


Figure 38. Rogowski probe

- close the probe with the locking system, then make sure that the probe is properly closed and that all the cables of each phase are inside the loop.

8.4.2. Voltage Sensing

The voltage at the point of connection of the SUNSYS HES XXL AC-Side is taken from the C-Cab AC busbars and goes to the M-Cab as shown below:

Departure	Arrival	Cable section
L1 - C-Cab	X1S1.5 - M-Cab	1,5mm^2
L2 - C-Cab	X1S1.6 - M-Cab	1,5mm^2
L3 - C-Cab	X1S1.7 - M-Cab	1,5mm^2

8.4.3. IMD sensing

The IMD sensing of the SUNSYS HES XXL AC-Side is taken from the C-Cab AC busbars and goes to the M-Cab as shown below:

Departure	Arrival	Cable section
L1 - C-Cab	X1S1.9 - M-Cab	1,5mm^2
L2 - C-Cab	X1S1.10 - M-Cab	1,5mm^2
L3 - C-Cab	X1S1.11 - M-Cab	1,5mm^2

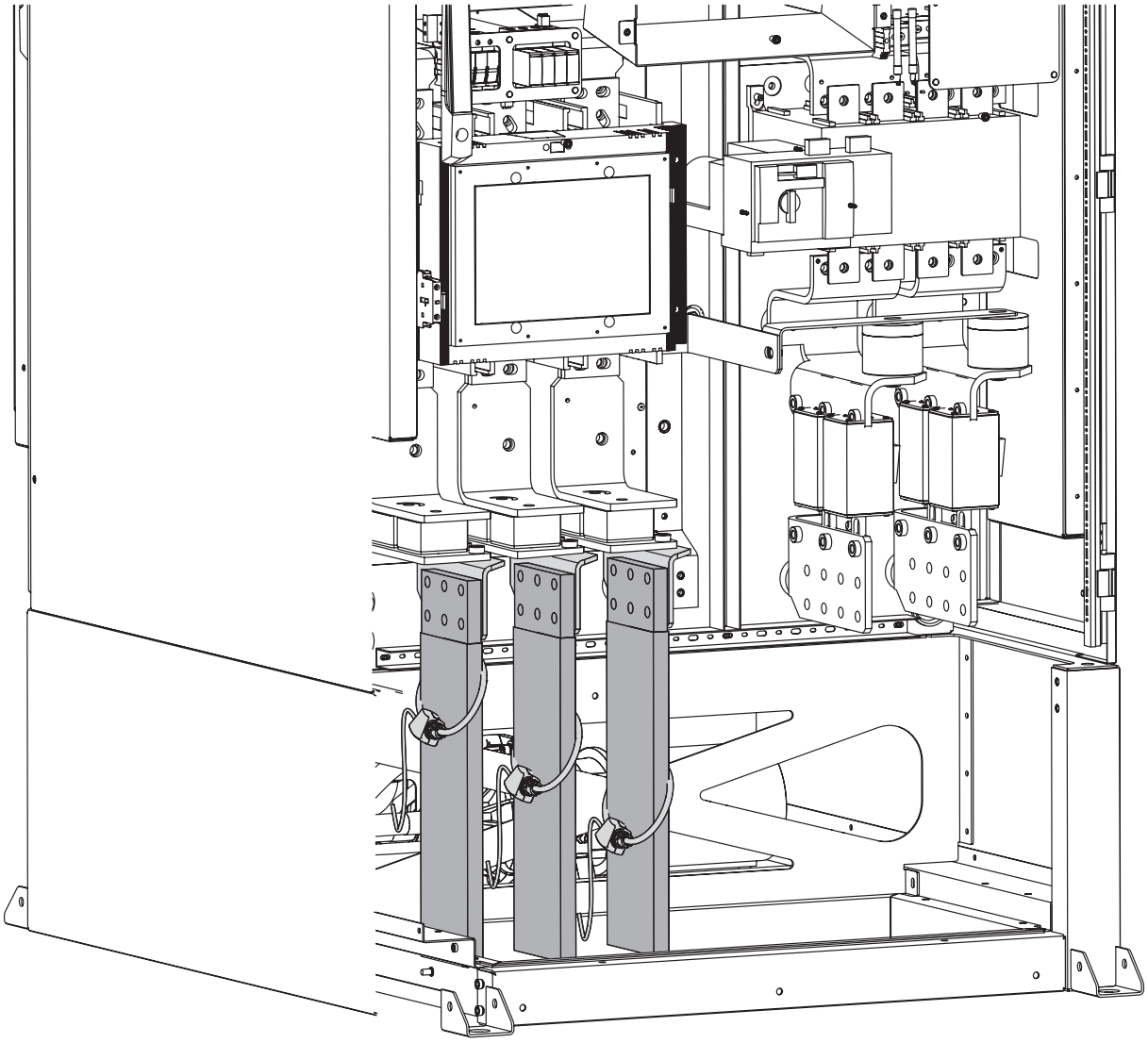


Figure 39. Connection of the probes and voltage sensor

8.5. Parallel connection

8.5.1. Throat Connections

When the system has two to four C-Cabs in parallel, AC connections between them may be made using the AC throat kit. The connections must comply with applicable standards.

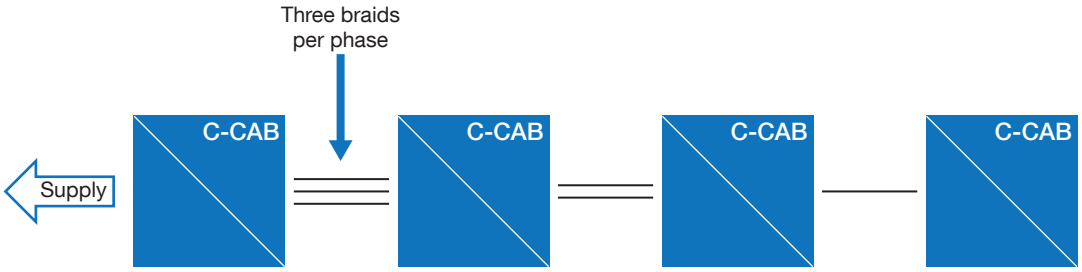


Figure 40. Four throat connected C-CAB's, number of braids required per phase

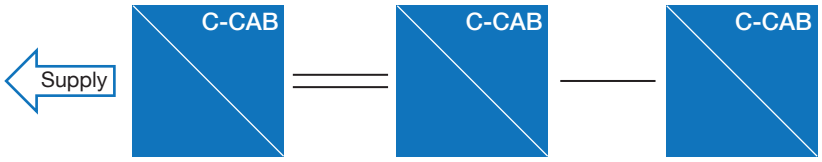


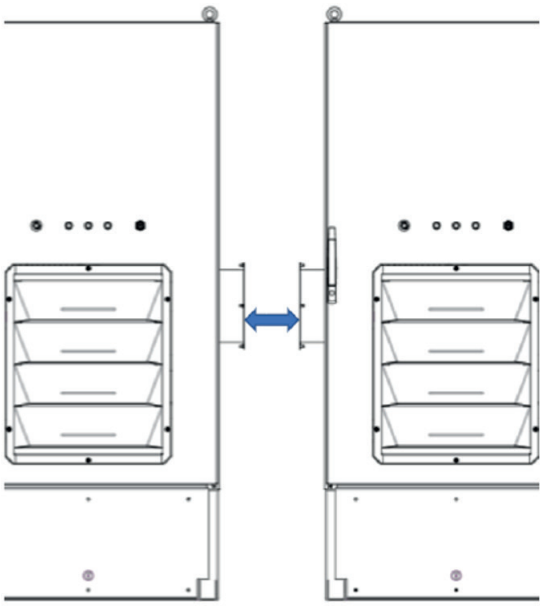
Figure 41. Three throat connected C-CAB's, number of braids required per phase

8.5.1.1. Throat installation

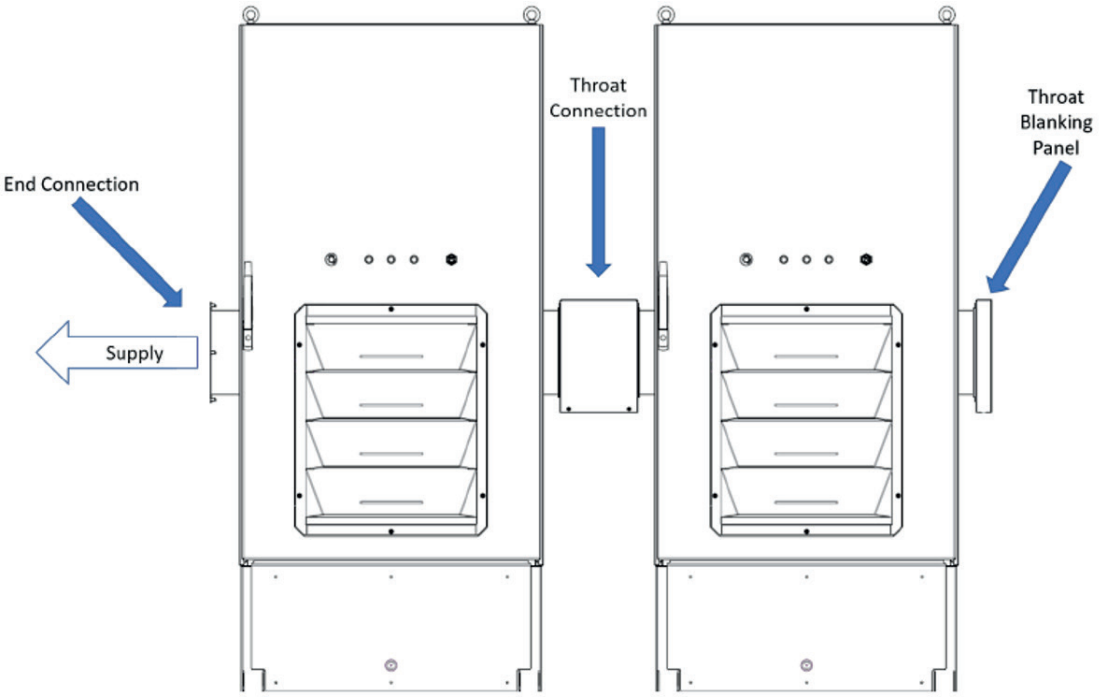
There must be a minimum **clearance of 20mm** between all line, neutral and ground conductors and their securing hardware. Failure to meet this specification will result in failure of equipment.

The distance between the throat flange faces must be between **161 mm and 196 mm** to utilize the braid connections and the throat cover box.

The braids cannot be forced to bulge when fastened in place.



Throat and end connections are difined as shown below:

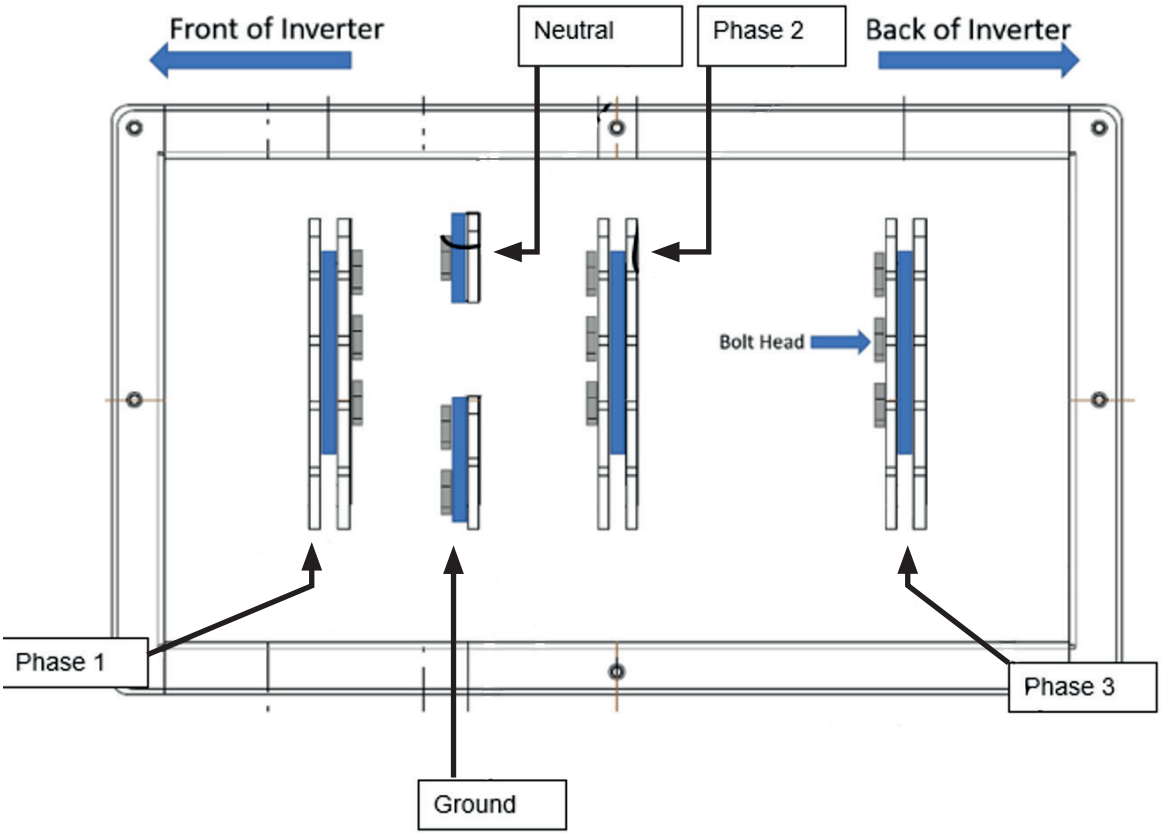


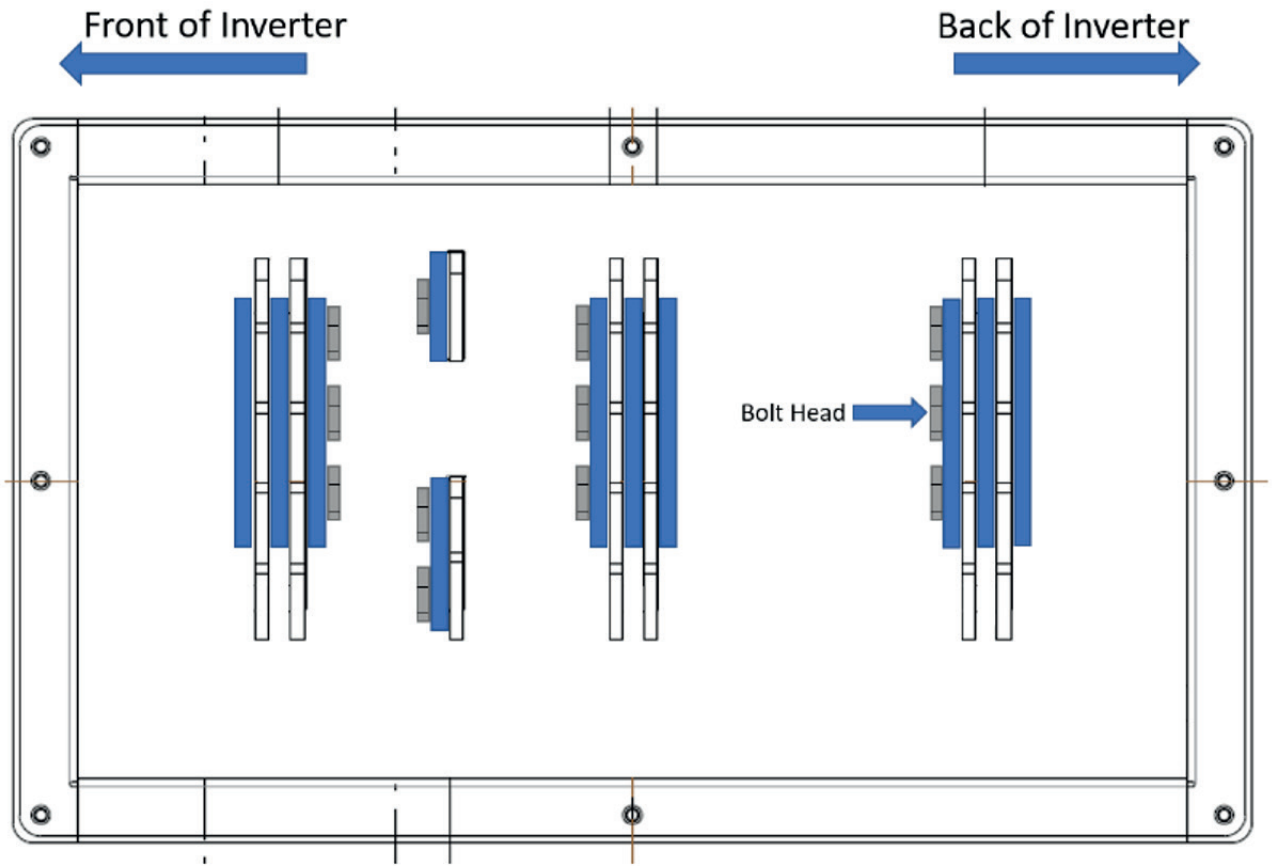
The positions of the braids (left/right/middle) on their respective busbars is important, and differs based on the number of braids being used in the throat.

For the braids used on the phase busbars, the three braid holes may occupy any of the five busbar slots, however when more than one braid is stacked on a busbar they must share the same three slots.

The ground and neutral braids should always be fastened on the front side of their respective busbars.

All braids should be centered between their phase busbar pair as shown below:




Front of Inverter
Back of Inverter
Bolt Head

8.5.1.2. Bolt installation

The hardware should be tightened to 50 Nm.

Installing the hardware for the braids on the phase busbars beforeinstalling the braids on the ground and neutral busbars is recommended.

The phase 1 bolt heads should be facing the back side of the inverter, giving maximum clearance of the ground and neutral busbars. The phase 2, phase 3, ground and neutral bolt heads should be facing the front side of the inverter, giving maximum clearance of the ground and neutral busbars.

The fasteners used for lines 1, 2 and 3 are M12 x 65mm bolts. Each bolt requires two M12 fender washers and two M12 belleville washers, as shown below.

Bellevilles have a cup shape when uncompressed and it is critical that this cup is facing the joint when installed (facing away from the bolt head or nut, depending on which side it is installed on).

There must be a fender washer between each belleville and the surface being clamped (except for the case of the ground and neutral busbars).

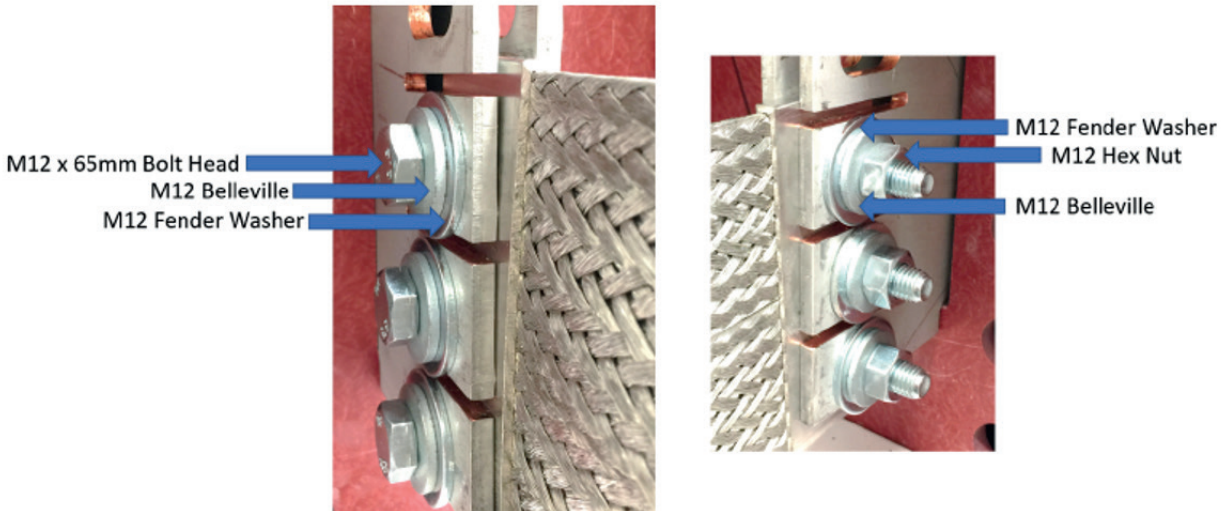


Figure 42. Hardware stackup for lines 1, 2 and 3

The fasteners used for the ground and neutral conductors are M12 x 40mm bolts. Each **requires two M12 belleville washers and one M12 fender washer, as shown below**:

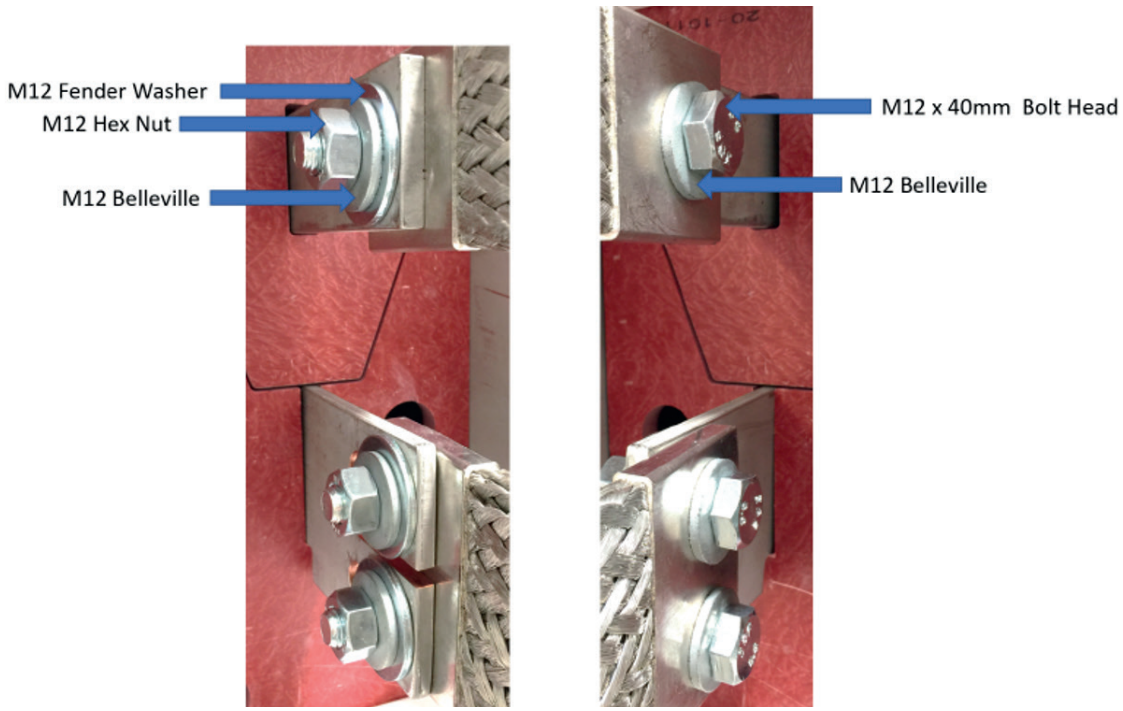


Figure 43. Hardware stackup for ground and neutral

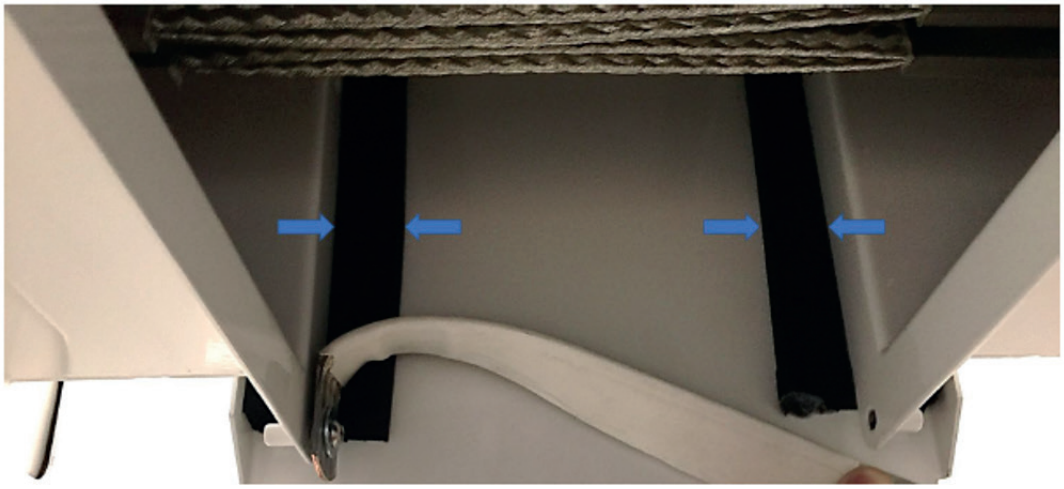
8.5.1.3. Throat cover installation

Please follow the procedure below when installing the throat cover.

1. Fasten one end of the ground strap to the bottom, right-most threaded hole on either throat flange (choose the right hand side based on the direction you're facing) using the ground strap hardware included with the throat kit.
    a. Ensure the hardware is stacked as shown in the photo below.
    b. Stackup sequence: M6 x 16 bolt, fender washer, ground strap, fender washer, paint piercing washer
    c. Tighten the bolt to 5 Nm
    d. Once fastened, the strap must be in the vertical orientation, shown below.

2. Remove the paper covering the pre-greased surfaces on the top and bottom part of the throat cover. Reapply No-Ox-ID "A Special" to the exposed metallic surface on the **throat cover box top and bottom pieces**.

3. Slide the top portion of the throat cover box over the throat flanges
    a. Orient the box such that the greased corner is directly opposite the corner of the flange that the ground strap is fastened to.
    b. Ensure that there is an even amount of foam showing on the inside of the left and right sides of the throat cover box as shown below.



4. Position the bottom piece of the throat cover between the walls of the upper piece with the exposed metal areas of both pieces located at the same corner.
    a. The foam is challenging to compress by hand, use the clamp to squeeze the top and bottom pieces together (be sure not to scratch the metal when clamping) to align the holes on the top and bottom pieces of the throat cover.
    b. The free end of the ground strap should be positioned between the greased corners of the top and bottom pieces of the throat cover box, and the fastener must pass through the ground strap hole when installed.
    c. Install the four M6 x 16mm screws with flat and split lock washers at all four corners of the throat box cover.
        i. Hardware stackup sequence: screw head, split lock washer, flat washer
        ii. Torque fasteners to 5 Nm
    d. The ground braid MUST span across the width of the throat cover when fastened to the throat cover, from the inside the view should be the same as that shown below:

8.5.1.4. Throat blanking panels installation

These panels are used to cover the unused throat flange of the last C-Cab in a line of throat connected inverters.
All throat connected C-Cabs are shipped with their throat blanking panels installed which must be removed prior to inverter installation

1. Use the T-27 Torx bit to remove all of the unneeded blanking plates.
2. For each C-Cab that requires a blanking panel, remove two of the lower fasteners and replace the split lock washer with one of the provided M6 paint piercing washers.

If a blanking panel is removed and needs to be reinstalled, follow the instructions below:

1. Ensure that the glastic panel is installed between the blanking panel and the throat flange.
2. The foam gasket on the glastic piece must face towards the throat flange and the longest strip of the foam gasket must be on the top side of the glastic when installed.
3. The (ledge, overhang thing) must be on the top side of the throat flange and hook over the protrusions on the backside of the flange face.
4. Use five stainless steel M6 x 16mm screws with split lock and flat washers to fasten the panel to the throat flange, leaving two bottom holes open.
5. Use two stainless steel M6 x 16mm screws with a paint piercing washer in the last holes, this acts as a ground for the panel.
6. Tighten all fasteners to 5 Nm

8.5.2. C-Cab paralleling

8.5.2.1. Soft paralleling

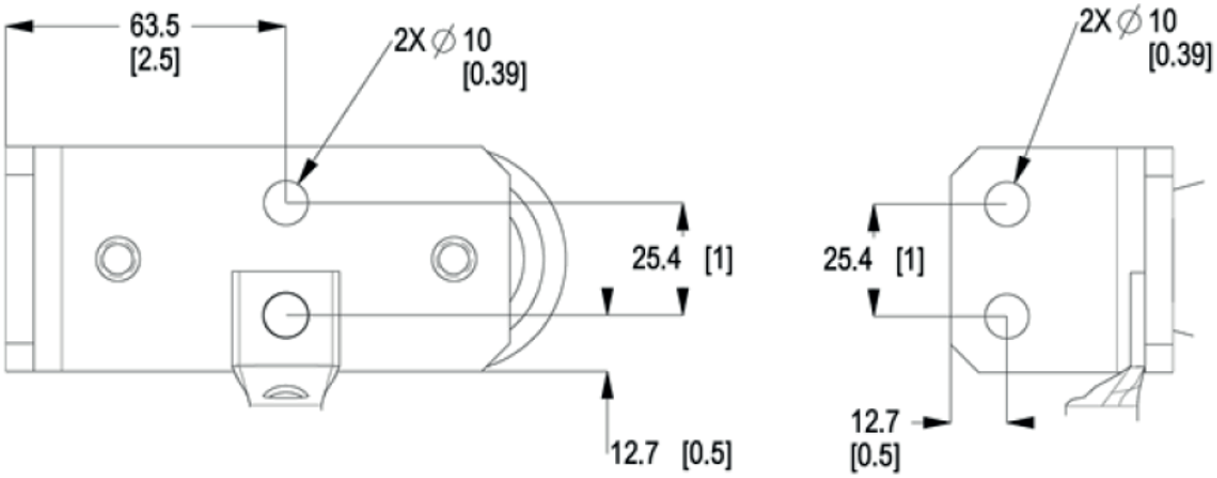
In case of C-Cabs that are AC-connected but not DC connected, the DC midpoint of the soft parallel capacitors must be connected.

When the C-Cabs are connected through throats, the connection between DC midpoints is directly provided by the throat and no additional connections is needed.

When the C-Cabs are connected without throats an additional cable must be connected between the midpoint of each inverter.

This cable should be sized for 200 amps.

Please find the location of the midpoint on the drawing below.



8.5.2.2. Hard paralleling

In case of C-Cabs that are AC and DC- connected, the DC midpoint needs to be connected together.

When the C-Cabs are connected through throats, the connection between DC midpoints is directly provided by the throat and no additional connection is needed.

When the C-Cabs are connected without throats an additional cable must be connected between the midpoint of each inverter.

This cable should be sized for 200 amps. Termination location is next to the ground bar.

8.6. List of fuses

CAUTION!
When replacing fuses, continued protection against risk of fire, only use fuses of type and size indicated in the present manual.

The accessible fuses used in the C-Cab and M-Cab are listed in the table below:

Label	Poles	Function	Rating	Type	Size	Cabinet
FU15.1	3P	TRANSFO 690/100	0,5A	gG	RM32	M-Cab
FU15.2	3P	DIRIS B-30 ESS	0,5A	gG	RM32	M-Cab
FU15.3	3P	IMD	2A	gG	RM32	M-Cab
FU16.1	3P+N	DIRIS B-30 AUX.	0,5A	gG	RM32	M-Cab
FU16.2	3P+N	SPD	20A	gG	RMS50	M-Cab
FU16.3	1P+N	THERMAL MGT (heating resistors)	10A	gG	RM32	M-Cab
FU16.4	1P+N	THERMAL MGT (initial conditions, high temperature, door contact)	0,5A	gG	RM32	M-Cab
FU18.1	1P+N	BATT1 CHILLER	20A	aM	RM32	M-Cab
FU18.2	1P+N	BATT2 CHILLER	20A	aM	RM32	M-Cab
FU18.3	1P+N	BATT3 CHILLER	20A	aM	RM32	M-Cab
FU18.4	1P+N	BATT4 CHILLER	20A	aM	RM32	M-Cab
FU18.5	1P+N	BATT5 CHILLER	20A	aM	RM32	M-Cab
FU18.6	1P+N	BATT6 CHILLER	20A	aM	RM32	M-Cab
FU18.7	1P+N	BATT7 CHILLER	20A	aM	RM32	M-Cab
FU18.8	1P+N	BATT8 CHILLER	20A	aM	RM32	M-Cab
FU19.1	1P+N	CAB1000 N°1 AUX.	8A	aM	RM32	M-Cab
FU19.2	3P+N	HVAC	2A	aM	RM32	M-Cab
FU19.3	P+N	UPS NETYS	16A	aM	RM32	M-Cab
FU19.4	1P+N	CONSOLE SOCKET	4A	gG	RM32	M-Cab
FU19.5	1P+N	CABINET LIGHT	1A	gG	RM32	M-Cab
FU19.6	3P+N	DC CAB AUX.	50A	aM	RM50	M-Cab
FU21.1	1P+N	CONTROL BOX N°1	4A	gG	RM32	M-Cab
FU21.2	1P+N	CONTROL BOX N°2	4A	gG	RM32	M-Cab
FU21.3	1P+N	CONTROL BOX N°3	4A	gG	RM32	M-Cab
FU21.4	1P+N	CONTROL BOX N°4	4A	gG	RM32	M-Cab
FU21.5	1P+N	CONTROL BOX N°5	4A	gG	RM32	M-Cab
FU21.6	1P+N	CONTROL BOX N°6	4A	gG	RM32	M-Cab
FU21.7	1P+N	CONTROL BOX N°7	4A	gG	RM32	M-Cab
FU21.8	1P+N	CONTROL BOX N°8	4A	gG	RM32	M-Cab
FU22.1	1P+N	CAB1000 N°1 AUX. SECURED	4A	aM	RM32	M-Cab
FU22.2	1P+N	DC CAB AUX.	8A	gG	RM32	M-Cab
FU22.3	1P+N	230VAC/24VDC POWER SUPPLY	4A	gG	RM32	M-Cab
FU22.4	1P+N	DIRIS B-30 ESS + AUX.	0,5A	gG	RM32	M-Cab
FU22.6	1P+N	DATALOGGER	0,5A	gG	RM32	M-Cab
FU26.1	P+N	24VDC GENERAL PROTECTION	10A	gG	RM32	M-Cab
FU27.1	1P	24VDC IMD + CONTROL	1A	gG	RM32	M-Cab
FU27.2	1P	24VDC PMS + ETH	4A	gG	RM32	M-Cab
FU27.3	1P	24VDC HMI + DIRIS M-70	2A	gG	RM32	M-Cab
FU27.4	1P	24VDC ETH BOX + MBMU	1A	gG	RM32	M-Cab
FU27.5	1P+N	24VDC BATT FSS	2A	gG	RM32	M-Cab
	3P	AC Side	11A	Fast acting	RM32	C-Cab
	2P	DC Side	30A	gPV	10x85mm	C-Cab

These fuses can only be accessed by Socomec trained personal.

8.7. Installation of MSD

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

9. COOLANT FILLING

WARNING!
This coolant tank contains a heating element. If power is applied to the unit prior to filling the tank, the heating element may be damaged.

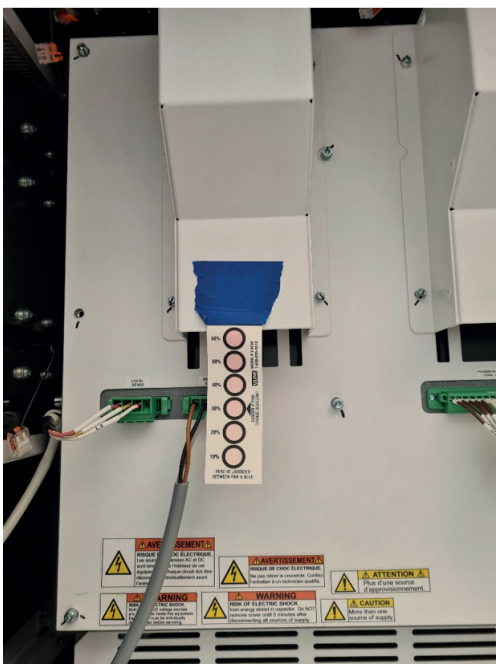
10. COMMISSIONING

Hot Commissioning shall be done only by Socomec trained personal.

A maximum period of 2 weeks of storage is recommended between cold commissioning and hot commissioning. Shall this be extended, please contact Socomec

Contact Socomec for further details.

Note: Before commissioning you shall check the label sticked inside the C-Cab. This is showing the level of humidity. In case this is equal to or above 30% the cabinet needs to be dried before the commissioning.



11. HMI PRESENTATION

The LEDs on the M-Cab have the following functions:

M-Cab LEDs	
Green	The system is working and turned on, no alarm present
Yellow	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 B-Cabs have the following functions:

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

12. PRODUCT OPERATION

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

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

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

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

12.1. Normal system power on

① Check the switch QS is in the ON position in each B-Cab, refer to Figure 25.

② Switch on the auxiliary power:

Switch on Q16.1

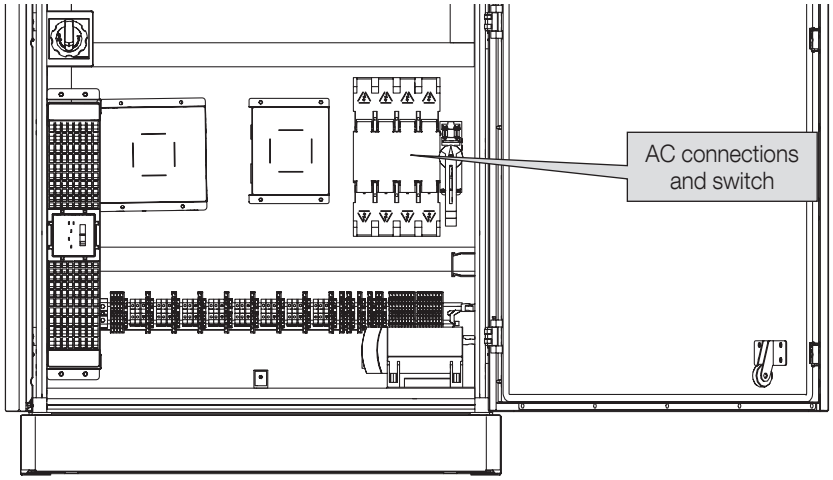


Figure 44. Location of the switch Q16.1 in the M-Cab

③ Switch on the UPS, using Q20.1:

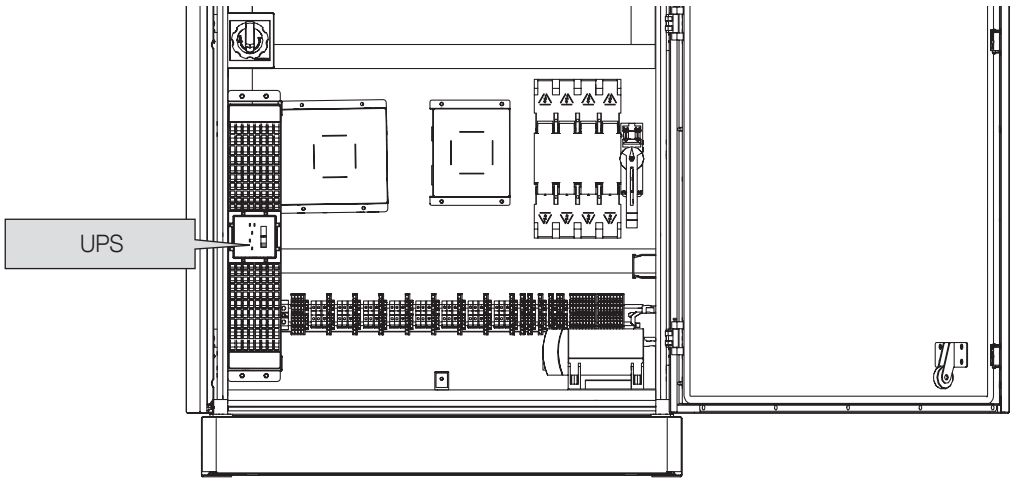


Figure 45. Location of the UPS in the M-Cab

If the UPS does not start automatically, it is necessary to turn it ON by pressing the start button

Not: as long as the UPS is not manually turned OFF, it will remain operational as soon as it is supplied with power, even after loss of the main source.

If climate conditions are not respected (temperature, humidity inside C-Cab out of range), the system will launch a drying process after being powered ON. This step can only be done while every cabinets doors are closed and cannot be skipped.

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

12.2. 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 the UPS:

To completely turn OFF the system, it is necessary to disconnect the UPS to avoid it from supplying auxiliaries if there is any loss of main source.

To do so, the recommended way is to switch OFF the UPS using Q20.1 (doing so without turning it down before, the UPS will automatically start once it gets powered again).

Otherwise you may switch OFF the UPS (but note that UPS will require to be turned ON after being powered next time the system is started).

② Switch off the auxiliary power:

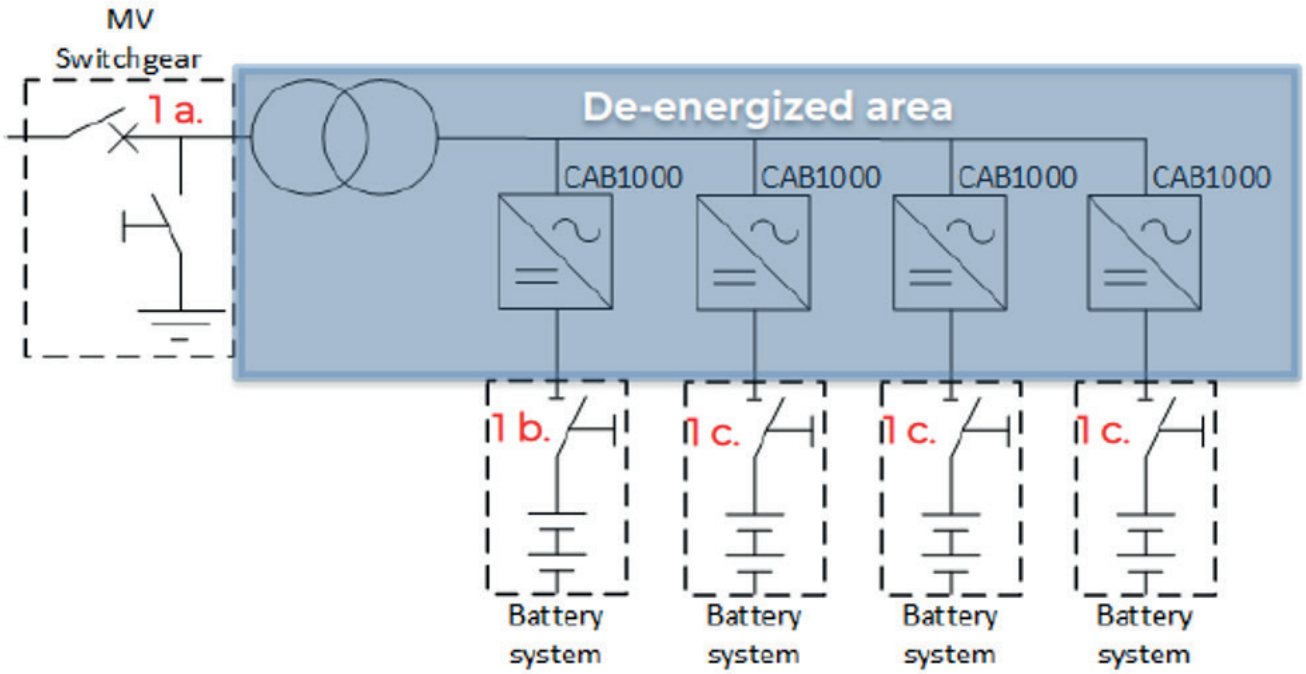
Disconnect auxiliaries by switching OFF Q16.1.

③ Open the isolation switch QS and QF1 & QF2 in all B-Cabs, refer to Figure 25 page 39.

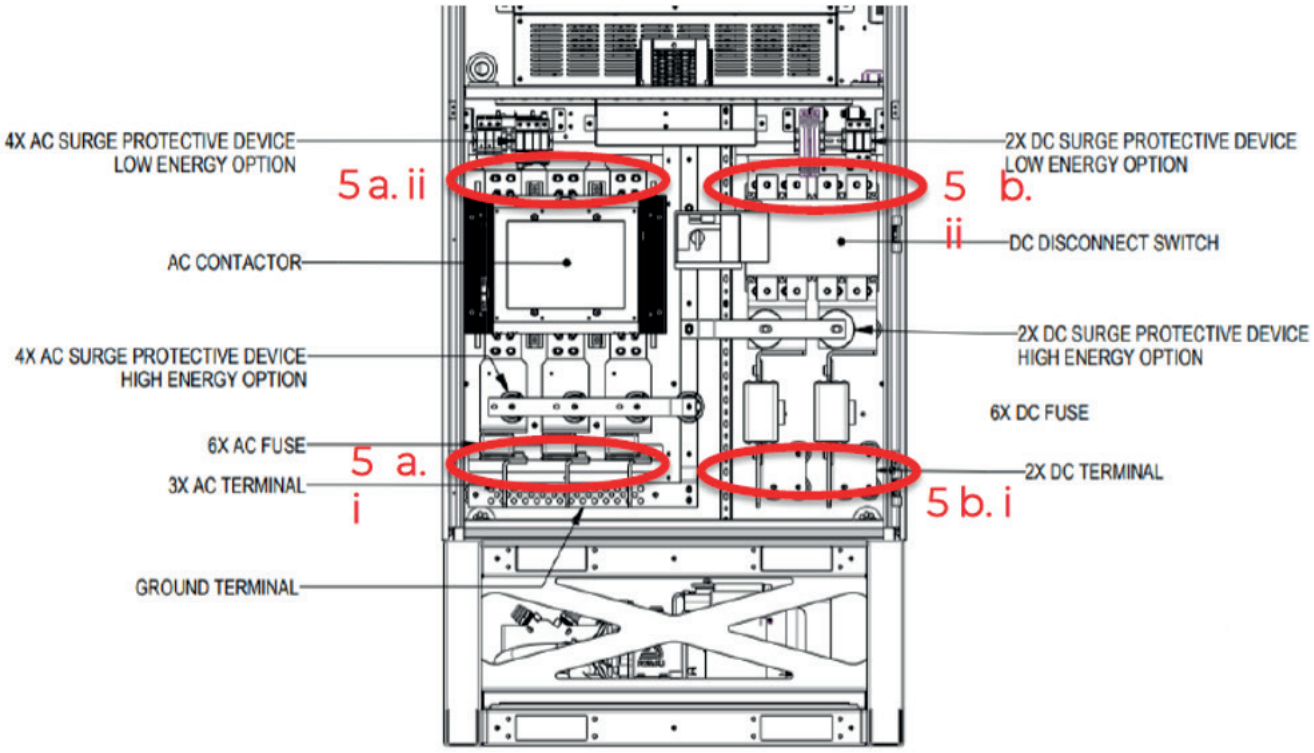
The unit is now isolated for service and the appropriate dead-fronts may be unscrewed and removed; however, it is very important that all accessible terminals be proven to be electrically dead before any work is attempted in the unit.

After powering down and before working on the inverter:

1. Disconnect or turn off and lock out all sources of power such as Main AC (1 a), Main DC (1 b), Power sources to all inverters in parallel (1 c) and auxiliary power (optional).



2. Ensure that power cannot be re-applied while working on the equipment by following proper lockout procedures for all power sources.
3. Wait for at least 5 minutes (or as indicated by the C-Cab label) after disconnecting power to the C-Cab to allow capacitors stored energy to discharge.
4. Remove the dead front panel.
5. Measure voltages and ensure that they are below ~5 volts by using a 1500V by using a Digital Multimeter. The following list is only a minimum set of measurements suggested.
    a. Suggested AC measurements – using the digital multimeter in AC and DC measurement modes
        i. On the incoming side of the AC contactor; from L1-L2; L2-L3; L3-L1; L1-N; L2-N; L3-N
        ii. On the converter side of the AC contactor; from L1-L2; L2-L3; L3-L1; L1-N; L2-N; L3-N
    b. Suggested DC measurements – using the digital multimeter in AC and DC measurement modes
        i. On the incoming side of the DC contactor; from +/-; +/N; -/N
        ii. On the converter side of the DC contactor; from +/-; +/N; -/N



6. Install safety grouding as appropriate.

12.3. Operations

C-Cab can charge and discharge the batteries at a power level that can be specified by the operator.

- Charging mode

  In the Charging mode, the power modules convert the grid AC power into DC power and charges the battery. The charging profile is managed by the SUNSYS C-Cab L according to the battery needs.

  After the battery is fully charged (top of the SOC range or the maximum voltage), the ESS returns into its standby mode.

- Discharging mode

  The power modules reverse their operation (compared to the charging mode) and convert the DC power to AC one. The ESS stays in this mode until it receives a command to charge or go to standby mode or until the battery reaches its low end (minimum allowed SOC).

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

- Reactive power

  C-Cab can control the power factor and reactive power percentage by feeding the reactive power.

- Stable output voltage and frequency

  C-Cab can stabilise the output voltage and frequency by controlling the reactive power and active power in the on-grid applications.

12.4. IMD setup

The IMD present in the M-Cab is 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.

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.
3. End of life refresh maintenance.

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

13.1. Timely inspections and corrective actions

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

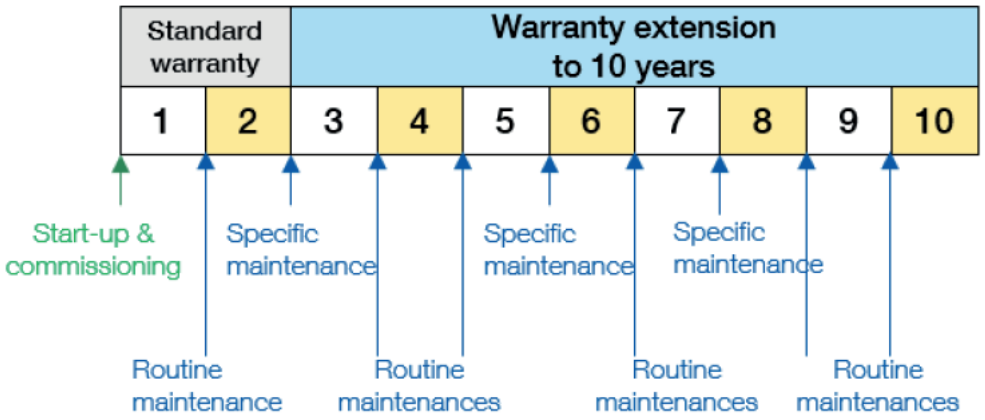
Note: the service provider is responsible for managing the timely service of the unit based on the alerts and alarms delivered from the SUNSYS HES XXL.

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.



Please refer to the dedicated «Preventive Maintenance» document for more information about operations that need to be performed.

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

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

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

13.2.1. 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 Socomec.

14. TROUBLESHOOTING

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

- Warning: abnormal condition that doesn't cause the unit stop. This can be reset automatically.
- Alarm: serious alarm conditions that 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. 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.

16. TECHNICAL DATA

16.1. Dimensions and weights

16.1.1. B-Cab

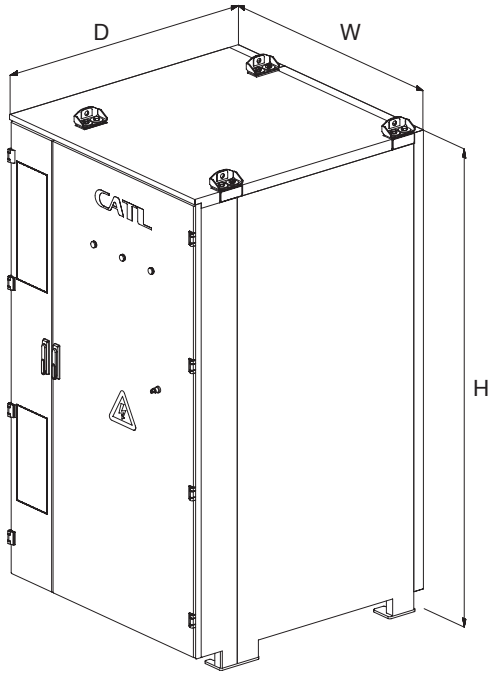


Figure 46. B-Cab dimensions

Width x Depth x Height	1300 x 1300 x 2280 mm / 51.2 x 51.2 x 89.8 inches
Width x Depth x Height (with packaging)	1350 x 1350 x 2480 mm / 53.1 x 53.1 x 97.6 inches
Weight	3550 kg / 7826 lbs
Weight (with packaging)	3600 kg / 7937 lbs

16.1.2. C-Cab

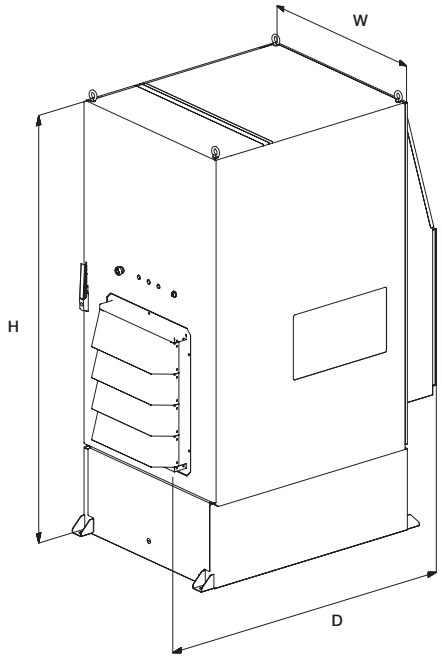


Figure 47. C-Cab dimensions

Width x Depth x Height	1009 x 1634 x 2281 mm / 39.7 x 64.3 x 89.8 inches
Width x Depth x Height (with packaging)	1422 x 1829 x 2490 mm / 56 x 72 x 98 inches
Weight (with no options installed)	1340 kg / 2954 lbs
Weight (with packaging)	1545 kg / 3407 lbs

16.1.3. M-Cab

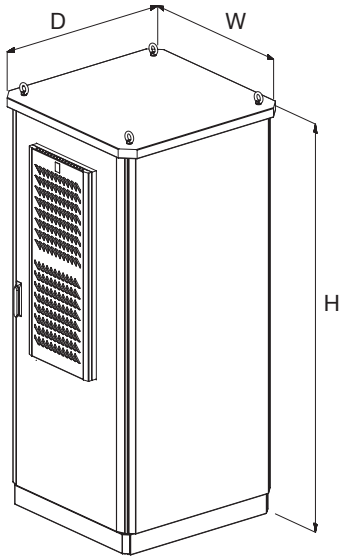


Figure 48. C-Cab dimensions

Width x Depth x Height	894 x 1046 x 2001 mm / 35.2 x 41.2 x 78.8 inches
Width x Depth x Height (with packaging)	1100 x 975 x 2200 mm / 43.3 x 38.4 x 86.6 inches
Weight	250 kg / 551 lbs
Weight (with packaging)	300 kg / 661 lbs

16.2. SUNSYS HES XXL

DC data					
Maximum DC voltage range	720 - 1500V	900 - 1500V	945 - 1500V	990 - 1500V	1035 - 1500V
DC voltage range at nominal power	761 - 1200V	951 - 1500V	999 - 1500V	1046 - 1500V	1094 - 1500V
Minimum recommanded DC voltage	1,65 x nominal AC voltage				
Maximum DC deviation voltage between parallel units	150VDC				
Maximum DC current	1400A				
Maximum DC fault current allowed	180 kA (with internal DC fuses per input)				
Number and section of DC cables inputs	8 B-CAB max, 2x95mm² per B-CAB				
DC disconnection	Motorized disconnect				
DC fuses in C-CAB	3x 750A, 210kAIc (20kA SC min)				
DC surge protection (SPD) in C-CAB	Type 1 heavy duty				

DC data					
Operating voltage range	480VAC - 690VAC				
Nominal voltage (3 ph)	480VAC	600VAC	630VAC	660VAC	690VAC
Maximum AC active Power export/import capacity @40°C and cos phi = 1	1043kW	1304kW	1369kW	1435kW	1500kW
Nomial current (export/import)	1255A				
Maximum short circuit current from AC source	100kA (throated version) | 180kA (non-throated version)				
Number and section of AC cables inputs	6x300mm² per phases and neutral				
Rated frequency	50Hz / 60Hz				
Export power overload capacity @40°C, starting from 66% full load	120% for 3 seconds to 116% for 5 minutes				
Power factor (reactive power capacity)	0,8 - 1 leading/lagging				
Harmonic distortion THD	UL1741 / IEEE, <2% TDDi at rated power per IEEE 519 <3% according to VDE-AR-N 4110/4120				
Efficiency @690V	98,8% peak | 98,4% CEC | 98,5% Euro				
AC disconnection	Contactor				
AC fuses in C-CAB	2x 1000A, 200kAIc (24kA SC min)				
AC surge protection (SPD) in C-CAB	Type 2 (optionally type 1 heavy duty)				
Safety features	F-stop, AC/DC overvoltage, AC timed overvoltage, inst & timed overcurrent, overtemperature (both instantaneous and time-overload), condensation, etc.				
Ground fault detection (optional)	IMD				

Parallele operation	
On-grid mode	With other HES XXL C-CAB units or any kind of third party generator (voltage or current type)
Off-grid mode	With other HES XXL C-CAB units | With generic current/power generators | Not operated in parallel with other isochronous voltage generators

Control and auxiliaries	
Control interface	CAN, Modbus TCP/IP
Command latency	1ms (CAN) |3ms (Modbus TPC/IP)
Respond time (to accomplish a full power step)	2ms adjustable longer via parameters
Auxiliaries voltage	208V at 60Hz | 240V at 50Hz
Self-consumption per C-CAB	2400W Abs. max | 1500W Typ. 100% load | 1200W 50% load, standby
Max B-Cab control circuits consumption	366W
Max B-Cab heating/cooling consumption (extreme climatic conditions)	3.0kW for 0.5C (per rack) | 4.3kW for 1C (per rack)

Other features	
On-Off grid transition (optional)	Yes, UPS mode available
Black start capability (optional)	Yes, capable of supplying the micro-grid from power cut conditions
Grid tied control modes	Voltage mode | PQ (power) | DQ (current) | cos phi (pf) | STATCOM
Grid support functions	Active /Reactive control | Volt/VAR | Hz/Watt | L/HVRT & L/HFRT | Inertia | ramp rate, etc.
Islanded control modes	V&f | droop control | VSG | Ok to parallel with other sources
Island overload avoidance	Active inruch limiting for starting large loads
Scheduled On-grid to Off-grid mode transition	Yes, seamless transition without power supply break, with additional Socomec equipment. Please contact Socomec for further information
Unscheduled On-grid to Off-grid mode transition	Yes, with additional Socomec equipment. Please contact Socomec for further information
Synchronization of the micro-grid with the grid to perform Off-grid to On-grid mode transition	Yes, with additional Socomec equipment. Please contact Socomec for further information
Integrated Power Managment System services	Peak shaving, energy shifting, self-consumption, fuel saving and others on demand.
External communication	SunSpec Ethernet Modbus TCP protocol. Alarm & warning status configurable dry contacts. Unit status light. Emergency power-off connection. Ready to connect to third-party supervision system (EMS, SCADA…).

Environmental	
Ambient temperature (operation)	-20°C to 60°C -25°C (option) to 60°C
Ambient temperature (storage)	-30°C to 55°C
Relative humidity	5% to 100% non condensing
Protection degree	Outdoor IP54 / NEMA 3R. Salt fog kit available for coastal sites (C5 option)
Maximum altitude	3000m (consult Socomec for higher elevation)
Altitude derating current	10% per 1000m above 1000m elevation
Temperature derating	1,7% per degree °C from 40 to 55°C
Airborne noise	<75dBA at 3m
Seismic	ICCC-ES AC 156 Sds @ 1,35 G
Environmental category	Outdoor classe C3 (C5 available in option)

Cabinet data	
C-CAB dimensions	1000 x 1636 x 2281 mm (W x D x H)
C-CAB weight	1370 kg | 3020 lbs
Mounting	Pad moun | skid mount
Cooling	Hybrid liquid + air temperature controlled
B-CAB dimensions	1300 x 1300 x 2280 mm (W x D x H)
B-CAB weight	2180 kg | 4806 lbs

Certifications	
Safety	EN IEC 62909-1:2018 Bi-directional grid-connected power converters –Part 1: General requirements
Safety	EN 62477-1:2012/A1:2017 Safety requirements for power electronic converter systems and equipment - Part 1: General
Safety	UL 1741 | C22.2 No. 107.1-16
EMC	EN 61000-6-2:2019 Generic standards –Immunity for industrial environments
EMC	EN 61000-6-4:2007; EN 61000-6-4/A1:2011 Generic standards - Emission standard for industrial environments
EMC	ETSI EN 301 489-1 (V.2.2.0):2017 Electromagnetic Compatibility (EMC) standard for radio equipment and services Part 1: Common technical requirements
EMC	ETSI EN 301 489-52 (V.1.1.2):2020 Electromagnetic Compatibility (EMC) standard for radio equipment and services Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment
EMC	FCC Part 15 subpart B | EN 55011 | CISPR 32 ; CISPR 11 | IEEE C37.90.2
Grid code	Grid code compatibility is continuously being upgraded. Please contact SOCOMEC for current grid code compatibility.
Other standards	EN 60068-2-30:2015 Environmental testing Part 2: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)

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