

LiFePO₄ - 51.2NESP55 Battery System

Installation Manual



Q/NDC 09.11005-2020 V4.5
June 2021

Read this manual carefully before starting the installation of the battery system.

Retain these instructions for reference.

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Table 11-1 History of Version Upgrade

Version	Date	Change
V 1.0	25/09/2020	First edition
V1.1	08/10/2020	Updates on HMI, Tools, BMS Configuration
V3.0	03/10/2021	Updates to Cabinet, BMS, and Wiring
V4.0	05/26/2021	Added Rack Lifting Instructions
V4.3	08/17/2021	Updated lifting instruction, rack images, and other instructions
V4.4	09/15/2021	Updated torque spec and added CLB mounting instructions
V4.5	09/24/2021	Updated P/Ns, torque specs

Contents

1.	Scope.....	8
2.	Definitions.....	8
3.	Acronyms and Abbreviations.....	9
3.1	Introduction	9
3.2	Features	9
3.3	Specifications	10
3.4	Components.....	10
4.2	BMS	14
4.3	Grounding Wires	18
4.4	Accessories.....	19
5.	Preparation Requirement	20
5.1	Required Personnel.....	20
5.2	PPEs and Tools.....	20
5.3	Documentation	22
5.4	Inspections	22
6.	General Guidelines.....	22
6.1	Installation Steps.....	22
6.3	Cabinet Positioning	25
6.4	Installation Configurations.....	27
7	Busbar Connection.....	28
9	Communication Cable Connection	36
9.1	Control Box and Module	36
9.2	Control Box and BAMS.....	39
9.3	Multiple Rack	42
10	Power Cable Connection.....	44
10.1	Input Connection	44
10.2	Dry Contact and E-Stop	44
11	BMS Configuration.....	45
11.1	BMS Architectures.....	45
12	Rack Lifting Instructions.....	46
12.1	Lifting Instructions	46

Important Safety Instructions

Please read and follow these instructions!

The following precautions are intended to ensure your safety, extend the service life of your product, and prevent property damage. Before installing this product, be sure to read all safety instructions in this document for proper installation.

The system location shall address and minimize personnel exposure to electrical hazards. All electrical work shall be done in accordance with latest local electrical, building, fire and other codes, standards, regulations or utility requirements as applicable to the installation, by qualified service personnel who has been appropriately trained and authorized in accordance with the related instructions and appropriate practices.

NESP Series is a high-voltage LFP lithium battery system. When dealing with the battery system, it is important to follow all safety recommendations.

The following warnings, safety instructions and notes are given as safety measures for the user as well as measures to prevent damage to the product or parts of the connected machines. Warnings, safety notes, and notes that are generally valid when working with the NESP battery system are summarized.

Safety Precautions

The following precautions provide general safety guidelines that should be followed when working with or near the High Voltage Lithium Battery System. Complete safety parameters and procedures are site-specific and should be developed by the customer for the installation site.

Review and refer to all safety warnings and cautions in this manual before installation.

Only authorized, adequately trained technical operators should be able to access the system. Consult local codes and applicable rules and regulations to determine permit requirements. If required, mark enclosures appropriately before beginning work.



Qualified Personnel

The personnel must be thoroughly familiar with all the warnings and installation procedures described in the installation instructions!

Only qualified personnel with valid proof or certificate of electrical knowledge with code requirements, safety standards, and experienced in the type work may work on electrical circuits and equipment.

Only qualified personnel who are familiar with the batteries and safety precautions should perform installation or maintenance of the battery.

Only authorized, trained technicians should perform annual preventive maintenance. Do not allow unauthorized personnel to contact the batteries.



Safe Electrical Work

All live electrical work requires a live work permit, qualified, trained personnel, following proper Lockout/Tag out procedures prior to beginning electrical work.



Safe Battery Handling

Please be aware that a battery presents a risk of electrical shock including high short-circuit current. Follow all safety precautions while operating the batteries.

Do not smoke or use fire near batteries!

Do not use organic solvent to wash batteries!

Do not dispose of the batteries in a fire.

Do not dismantle batteries, it contains electrolyte which is a hazardous material that can harm the skin and eyes!

Do not put tools or any metal parts on the top of the batteries!

Remove watches, rings, and other metallic accessories!

Use only insulated tools with minimum rating of 1000V to avoid accidental short circuits!

Disconnect charging through opening of disconnect. Ensure load is Open before connecting or disconnecting terminals!

Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment!

Keep 0.5m away from heat sources or any places may occur sparks (such as breakers, fuse box, etc.)!

Avoid direct sunlight on the battery rack, exposure to water or rain or high humidity!

Batteries must be handled, transported, and recycled or discarded in accordance with federal, state, and local regulations!



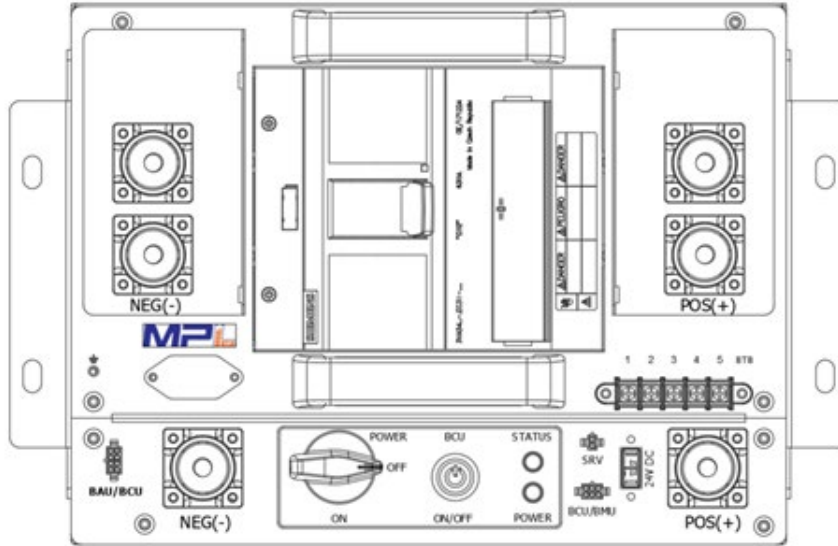
Installation Precautions

Before installation and Inspection, all required personal protection equipment (PPE) for supervising and installation shall be in place.

Before installation, the installation personnel should fully understand the installation procedures outlined in the manual.

All power cables shall be considered energized unless proper measures have been taken to de-energize.

Before installation, be sure to cut off the UPS power and make sure the battery Control Box is switched off by turning main power switch to off position on each string. Press BCU OFF first then turn the switch to OFF position. Both Status and Power lights will be OFF.



All battery racks must be grounded.










The tightening torque for the Busbar is 25Nm using a M10 hex head screws. The BMS and cabinet disconnect control box power connections torque is 25Nm using M10 hex head screws.

Before electrical commissioning, ensure the following connections are properly torqued.

- Busbar connection between modules
- Control Box Power Terminals
- Ground Terminals
- Mounting Screws for Modules

Personnel in contact with the battery system should be aware of the following hazards. Please pay attention to the following safety cautionary markings and warning signs during installation.

Warning Signs Table

 Danger	 High Voltage Shock Hazard	 Arc Flash Hazard	 Read the manual
 Warning	 Fire Hazard	 Pinch Point	 



1. Scope

This manual stipulates system specifications and detailed steps during installation of Narada NESP high-voltage lithium battery system.

2. Definitions

- 2.1 Cell:** The basic unit of lithium iron phosphate battery consisting of positive, negative electrodes and electrolyte, with rated voltage of 3.2V and rated capacity of 55Ah.
- 2.2 Module:** The 51.2NESP55 module with rated voltage of 51.2V and rated capacity of 55Ah, is composed of 55 Ah cells.
- 2.3 Rack:** Several modules and control boxes are connected in series through electrical connectors, delivers voltage up to 512V (10 Pcs of 51.2NESP55 modules) in rated voltage and 55 Ah in rated capacity.
- 2.4 Cabinet:** The rack enclosure that contains the battery system components (Modules and Control box).
- 2.5 Control box:** The control box provides isolation and protection for single rack (multiple battery modules). It integrates the BCU, High voltage management unit, circuit breakers, main contactors, pre-charge resistors, fuses, current sensors and switching power supply.
- 2.6 BMS:** Battery Management System, is a collection of electronic devices used to monitor, evaluate, and protect battery operating parameters. It consists of BMU, BCU, Control box, BAMS, HMI and other components. It has 3 levels that control, and monitor information related to operational status, battery cells, battery racks, and battery system units, such as battery voltage, current, temperature, and protection, etc., evaluating and calculating the state of charge (SOC) and state of health (SOH).
- 2.7 BMU:** Battery Management Unit, the first rank of BMS (Module BMS). It is responsible for cell voltage and temperature acquisition, balancing management, real-time cell monitoring and upward communication.
- 2.8 BCU:** Battery Cluster Management Unit, the second rank of BMS (Rack BMS). It is responsible for the current collection of the battery string. It integrates multiple CAN communication circuits and multiple wet and dry contacts. It is responsible for communicating with the managed BMUs, collecting information, alarms and protecting in case of overvoltage/ undervoltage/ overcurrent /short circuit /over temperature of the battery string. The information is sent to the next level BAMS, enabling the BAMS to

resolve the problems of the lower-level system (BMU and battery) to ensure safe, reliable, and efficient operation of the battery management system.

2.9 BAMS: Battery Administration Management System, the third level of BMS (System BMS), composed of Battery Administration Management Unit (BAU) and HMI.

2.10 BAU: Battery Administration Management Unit.

2.11 HMI: Human Machine Interface, enabling data reading and parameter setting.

3. Acronyms and Abbreviations

The following acronyms and abbreviations are used in this manual.

Abbreviations	Full Name
BMS	Battery Management System
BMU	Battery Management Unit (Module level)
BCU	Battery Cluster Management Unit (String level)
BAMS	Battery Administration Management System (BAU and HMI)
BAU	Battery Administration Management Unit (System level)
HMI	Human Machine Interface
PPE	Personal Protection Equipment
EHS	Environmental Health and Safety
LFP	Lithium iron phosphate
BAT	Battery
SOC	State of Charge
SOH	State of Health

Product Description

3.1 Introduction

3.1.1 NESP Series 55Ah battery system is a high-voltage high power lithium (LFP) system which is primarily used in emergency power supply, and data center applications. Both the lithium-ion (LFP) batteries and the BMS use a standard modular design.

3.2 Features

3.2.1 **Modular design:** The battery module and BMS designed to have uniform standard modular design. Flexible configuration allows for different quantities of battery modules in series providing multiple battery voltage options to match your UPS. Modular design makes the system easy to assemble, maintain and install.

3.2.2 **High safety:** The grouping structure, ventilation and thermal management design ensures the temperature consistency of each cell in each battery module during operation. Redundant protection system ensures the unit safety.

3.2.3 **Long-life design:** Long-life and high-quality cells are automatically selected during production, thus the consistency of the cells in grouping is ensured. The combination of passive and active balancing of the battery modules ensures the consistency of each cell during system operation, leading to extended battery life and improved system safety and reliability.

3.2.4 **Smart BMS:** System data is collected and managed in a systematic manner, through data interaction between BMS and monitoring system, enabling rapid response. The BMS ensures the battery is always running properly through real time monitoring, automatically balancing, automatically scanning protection and power data requests.

3.3 Specifications

	NLHP51255B		MPLHP-5125528	
	Module		System	
Rated Voltage / Capacity	V / Ah	51.2 / 55	Configuration	160S1P
Weight	Kg/lbs	35 / 77	Modules /String	10
Charge / Discharge Current (Max)	A	55 / 425	Nominal Voltage(V)	512
Charge / End Voltage	V	57.6 / 43.2	Module (Ah)	55
Discharge Voltage	V	43.2	Charge Voltage(V)	584
Module Dimensions	Width, mm/in	392 / 15.5	Cutoff Voltage(V)	448
	Depth, mm/in	435 / 17.2	Max Discharge (A)	425
	Height, mm/in	165 / 6.5		
Recommended Temperature Range	Charge	0°C to 55°C	Rack Width(mm/in)	500 / 19.7
	Discharge	-20°C to 55°C	Rack Depth(mm/in)	710 / 28.0
	Storage	0°C to 40°C	Rack Height(mm/in) with CLB	2295 / 90.4
	Operating	15°C to 35°C	System Weight (kg/lbs.)	540 / 1188

Fig 3-1 51.2NESP55 Rack Specifications

3.4 Components

3.4.1 The major components of NESP rack are:








- 3.4.1.1 Battery Module
- 3.4.1.2 Control Box
- 3.4.1.3 Cabinet
- 3.4.1.4 Conduit Landing Box (to be installed on site).
- 3.4.1.5 BMS – Based on a 3-level architecture and is composed of
 - 3.4.1.5.1 BMU - Preinstalled in Battery Module
 - 3.4.1.5.2 BCU - Preinstalled in the Control Box
 - 3.4.1.5.3 HMI - Preinstalled in cabinet
 - 3.4.1.5.4 BAU – Preinstalled in cabinet

Table 3-1 Location of BMS Components

Unit Level	Unit Name	Location	Function
Level 1, Module Level	BMU	In Battery Module	Monitor cell information;
Level 2, Rack Level	BCU	In Control Box	Data collection, analysis, and decision; Rack Level Protection; Communication with BAMS;

Level 3, System Level	BAU+HMI	On Cabinet door	Communication with BCU and UPS, etc.
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Table 3-2 Main Components of NESP Rack

No.	Components	Description	Appearance
1	Batteries	High Rate LFP Battery Modules	
2	Connectors	Copper Bus Bars	
3	BMS	BMU 1P16S	
		Control box	
		HMI	
		BAU	
4	Cabinet	Cabinet for battery and BMS	

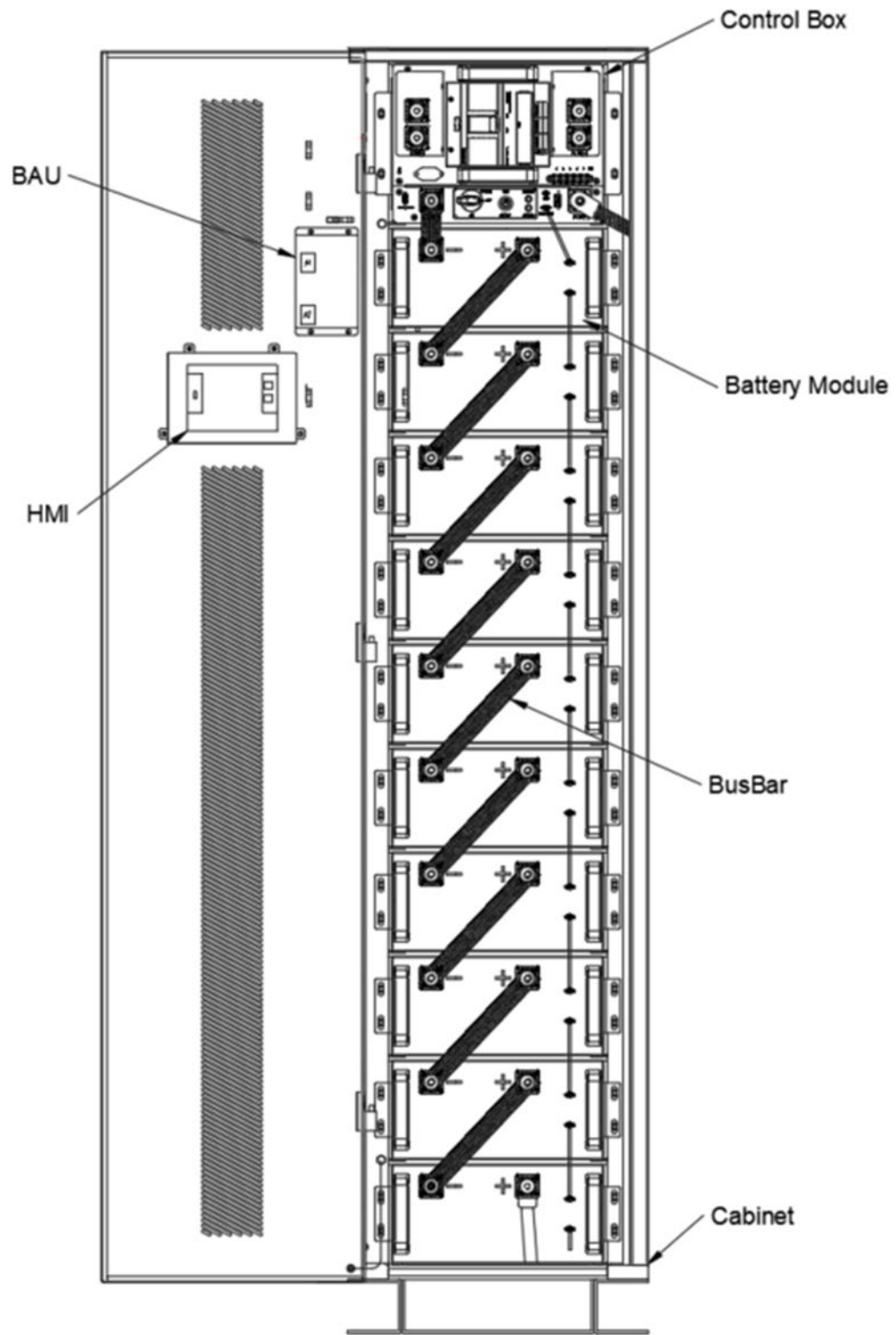


Fig 3-2 Major Components of 5C Rack

4. Cabinet

4.1 Cabinet

4.1.1 The Cabinet houses modules Control Box and integrated BAMS assembly. It facilitates grounding the installed components.

4.1.2 For the Rack composed of 10 pcs of 51.2NESP55 modules (Model #5125528), the specification is as below:

Weight: 540KG

Dimension with CLB (LxWxH): 500mm x 710mm x 2295 mm

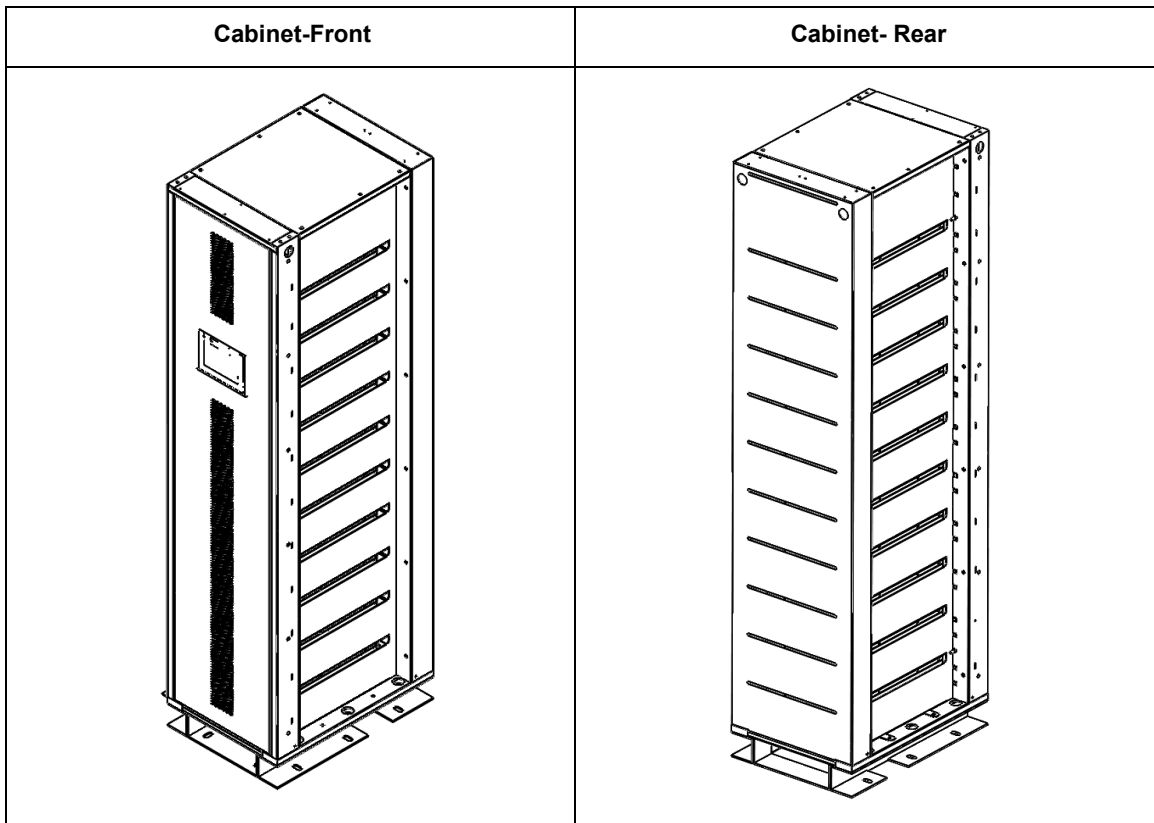


Fig 4-1 Front and Rear Views of the Standard 10-Module Rack

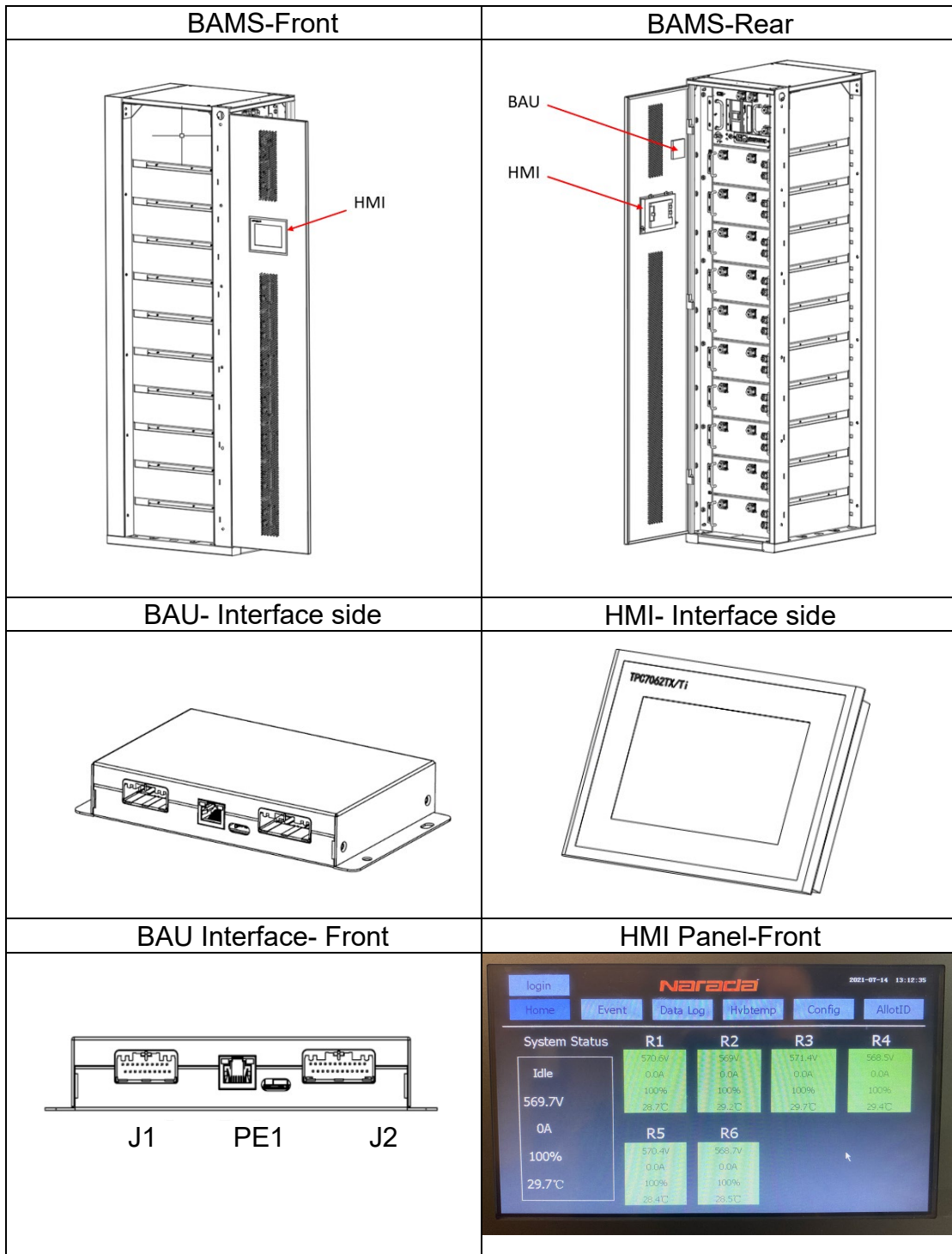
4.2 BMS

4.2.1 For the Rack composed of 10 pcs of 51.2NESP55 modules (Model #5125528), the specification is as below

Table 4-1 Specifications of BMS Components

Unit Level	Unit Name	Specifications
Module Level	BMU	<ul style="list-style-type: none"> • Battery type: High Rate LFP • Voltage detection range: 0.5-5.0V • Voltage acquisition of cells in strings: 16 • Voltage sampling accuracy: 0.1% or $\leq 5\text{mV}$ • Temperature sampling accuracy: $\pm 2^\circ\text{C}$ • Balance type: Passive balance • Balance current: $\leq 2.5\text{A}$ • Communication interface: CAN2.0 • Supply voltage: 20-28Vdc (typical 24Vdc)
Rack Level	BCU	<ul style="list-style-type: none"> • Max BMU number: 10 • Current sampling accuracy: $\pm(1\%\text{FS} + 1\%\text{RD})$ • Voltage sampling interval: 100ms • Communication interface: RS 485*0, CAN*3 • Supply voltage: 20-28Vdc (typical 24Vdc) • High voltage detection: 0-900 Vdc, Accuracy: 0.5% • Insulation resistance detection: 100K-5MΩ, Accuracy $\leq 10\%$
System Level	BAMS	<ul style="list-style-type: none"> • Communication interface: RS 485*3, CAN*2, Ethernet*1 • Supply voltage: 20-28Vdc (typical 24Vdc)

4.2.2 The Locations and interface of BAU and HMI are shown below



- 4.2.2.1 There are three Ports in the BAU, namely J1 as Power and Communication Port, PE1 as Ethernet Communication Port and J2 as Communication Port.
- 4.2.2.2 BAU has a total of 4 dry contact interfaces, four outputs, and one inputs. The four outputs are on pins 1&2, 11&12, 13&14, 15&16 of the J1 interface. One input is on pin 3 of the J1 interface.
- 4.2.2.3 When the BMS system is in a normal operating state, the BAU dry contact outputs are closed. For alarm or failure status, the dry contact is open. The dry contacts can be connected to < 60VDC.

Table 4-3 J1 Power and Communication Port

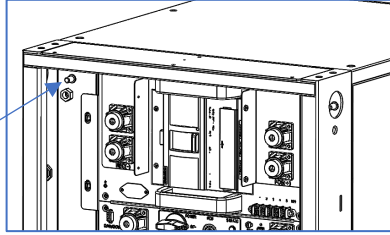
Item	Part Name	Description
J1 Connector	PWR+	Power Supply + (12/24V typ.)
	PWR-	Power Supply - (12/24V typ.)
	GPIO	Digital input signal
	NC	No connect
	Contactor1(2/3/4)_1 Contactor1(2/3/4)_2	4 pairs of dry contactors
	HSD1, HSD2, HSD3, HSD4	Power output (24VDC, 1A)
Pin No.	Pin Name	Function
10	PWR+	Power supply+
9	HSD_OUT1	High side switch 1 channel output positive
8	HSD_OUT2	High side switch 2 channel output positive
7	HSD_OUT3	High side switch 3 channel output positive
6	HSD_OUT4	High side switch 4 channel output positive
5	DB_RLY3-	High side switch 3 channel negative
4	DB_RLY4-	High side switch 4 channel negative
3	GPIO/ACC	Power supply enable
2	Cot1_1	Dry contact 1, no polarity
1	Cot1_2	
20	PWR-	Power supply-
19	DB_RLY1-	High-side switch 1 channel negative or negative supply
18	DB_RLY2-	High-side switch 2 channel negative or negative supply
17	EARTH	Ground
16	Cot4_2	Dry contact 4, no polarity
15	Cot4_1	
14	Cot3_2	Dry contact 3, no polarity
13	Cot3_1	
12	Cot2_2	Dry contact 2, no polarity
11	Cot2_1	
A6	GND	

Table 4-4 J2 Communication Port

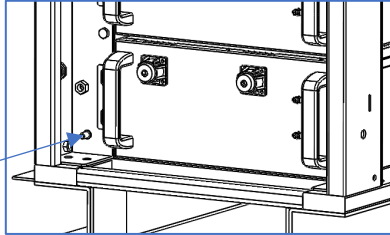
Item	Part Name	Description
J2 Connector	CAN1(2) H CAN1(2) L	CAN interface for communication
	485A1(2,3) 485B1(2,3)	5 pairs of RS485 communication
	CAN1(2,3) G 485G1(2,3)	Interface for shield of communication cables(reserved)
Pin No.	Pin Name	Function
12	CAN1H	CAN communication interface with shielding
11	CAN1G	
10	CAN1L	
9	NC	Undefined, suspended
8	RS484G1	RS485 communication interface with shielding
7	RS485A1	
6	RS484G2	
5	RS485B3	
4	RS484G3	
3		
2		
1		
24	CAN2G	CAN communication interface with shielding
23	CAN2H	
22	CAN2L	
21	NC	Undefined, suspended
20	NC	
19	RS485B1	RS485 communication interface
18	RS485B2	
17	RS485A2	
16	RS485A3	
15		
14		
13		

4.3 Grounding Wires

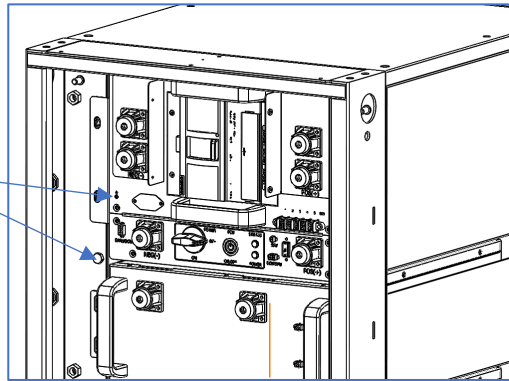
System grounding location (Top)



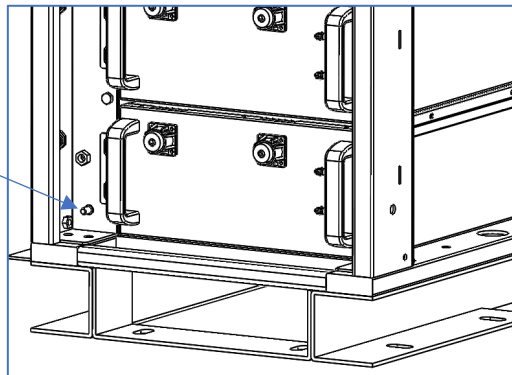
System grounding location (Bottom)



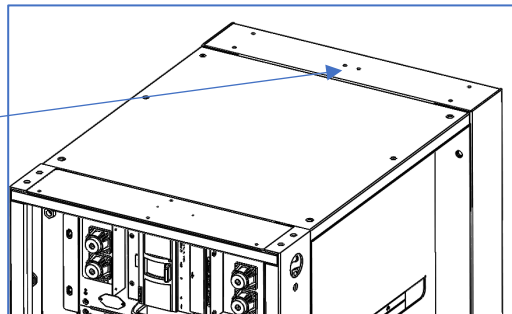
Control Box grounding location



Door grounding location



System grounding location Optional (M6)



- 4.3.1 Grounding the system is required to reduce and eliminate electrical noise in the system and prevent shock hazards.
- The control box should be grounded to the rack frame using the supplied green/yellow cable
 - The door should be grounded to the rack frame using the supplied green/yellow coiled cable
 - The rack should be grounded to a site/system ground with customer supplied cable
- 4.3.2 Grounding connections and requirements will vary based on specific project and system configurations. All grounding methods should comply with NEC Article 250.
- 4.3.3 Ground wire should be #6 AWG with M6 terminals.

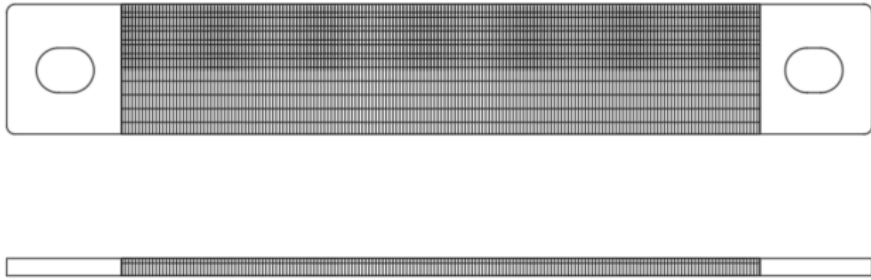
Table 4-5 Rack Fastener Hardware

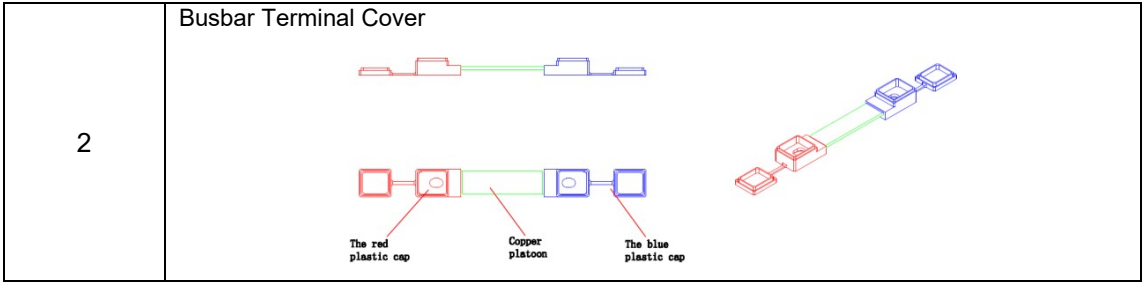
Fastener Location	Size	Hardness	Thread Pitch	Material
Wire Fasteners	M8*14L	HRC32 Grade 8.8	1.25mm (0.05 in)	SS304
Rack Floor Anchors	Refer to local seismic req)			
Multi Rack Fasteners	M10*25L (Side)	HRC32 Grade 8.8	1.5 mm (0.06 in)	SS304

4.4 Accessories

- 4.4.1 Bus bars are supplied for connecting the modules together in series to form a full string connected to the Control Box.

Table 4-1 Specifications of Accessories

Types	Descriptions of Accessories
1	<p>Copper bus bar for connecting modules vertically within a cabinet Part Number BB-4030263-M10</p> 



5. Preparation Requirement
5.1 Required Personnel

- 5.1.1 All personnel performing installation activities shall be trained and experienced with the Narada High Rate LFP Battery system. Individuals shall meet all the training prerequisites and must have completed the system training. Required Personnel include:
- 5.1.2 Trained service personnel to perform any installation work that falls within owner’s scope of effort as identified in this document.
- 5.1.3 Trained owner representative to perform any installation work that falls within owner’s scope of effort as identified in this document.










5.2 PPEs and Tools


	WARNING
	<ul style="list-style-type: none"> ▪ Do not wear watches, rings, jewelry, or any other metal objects. ▪ Wear helmet before entering construction site to protect your head. ▪ Wear electrically insulated gloves and safety shoes. ▪ Use properly insulated tools to prevent accidental electric shock or short circuits! ▪ Wear FR clothing.

Service Engineer should prepare the needed items such as Personal Protection Equipment (PPEs) and Tools before the operation and installation starts. Service Engineer must check condition of PPE and verify it is suitable prior to performing any installation activities.

Recommended tools and equipment are shown in the following table. Verify that all equipment is calibrated via approved calibration procedures, and that the calibration is not expired.

Table 5-1 Recommended Tools and Instruments

No.	Items	Appearance
1	Insulated Phillips Screwdriver	
2	Utility Knife	
3	Insulated Torque Wrench	
4	Insulated Sockets (10 mm, 13mm, 18mm and 19mm)	
5	Insulated Extension for Socket	
6	Level	
7	1000V Digital Multimeter	
8	Insulated wrench & box wrenches	
9	Measuring tape	

10	Conductance, Battery Tester	
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5.3 Documentation

5.3.1 Before installation, all related documents such as Contracts, Technical Agreement, Shipping List, Installation Drawing shall be collected and confirmed they are of the final version. Technical service personnel should make sure all required preparation in place before installation.

5.4 Inspections

5.4.1 Installation personnel should make a record after unpacking according to the checking list. After unpacking, all items should be inspected. If any defects are found during the inspection, contact technical customer service to address the problem.


6. General Guidelines

6.1 Installation Steps

Table 6-1 Installation Steps of Rack with 10 Modules

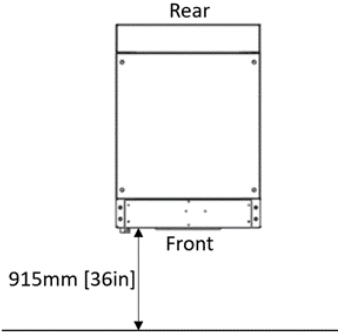
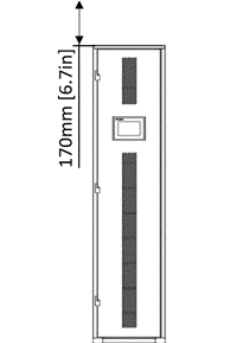
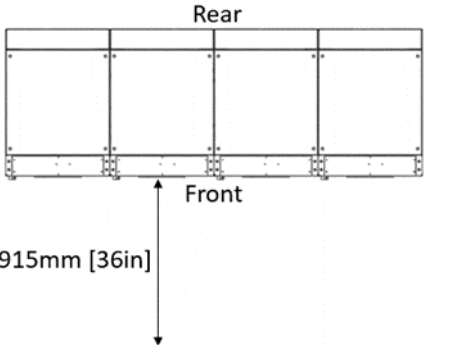
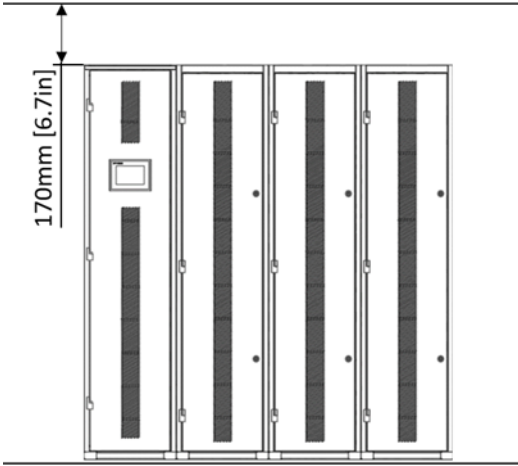
No.	Step	
1	Unpacking	
2	Inspection	
3	Cabinet Positioning	
4	Rack Installation	Busbar
		Communication Cables
		Power and Control Cables
		BMS Configuration

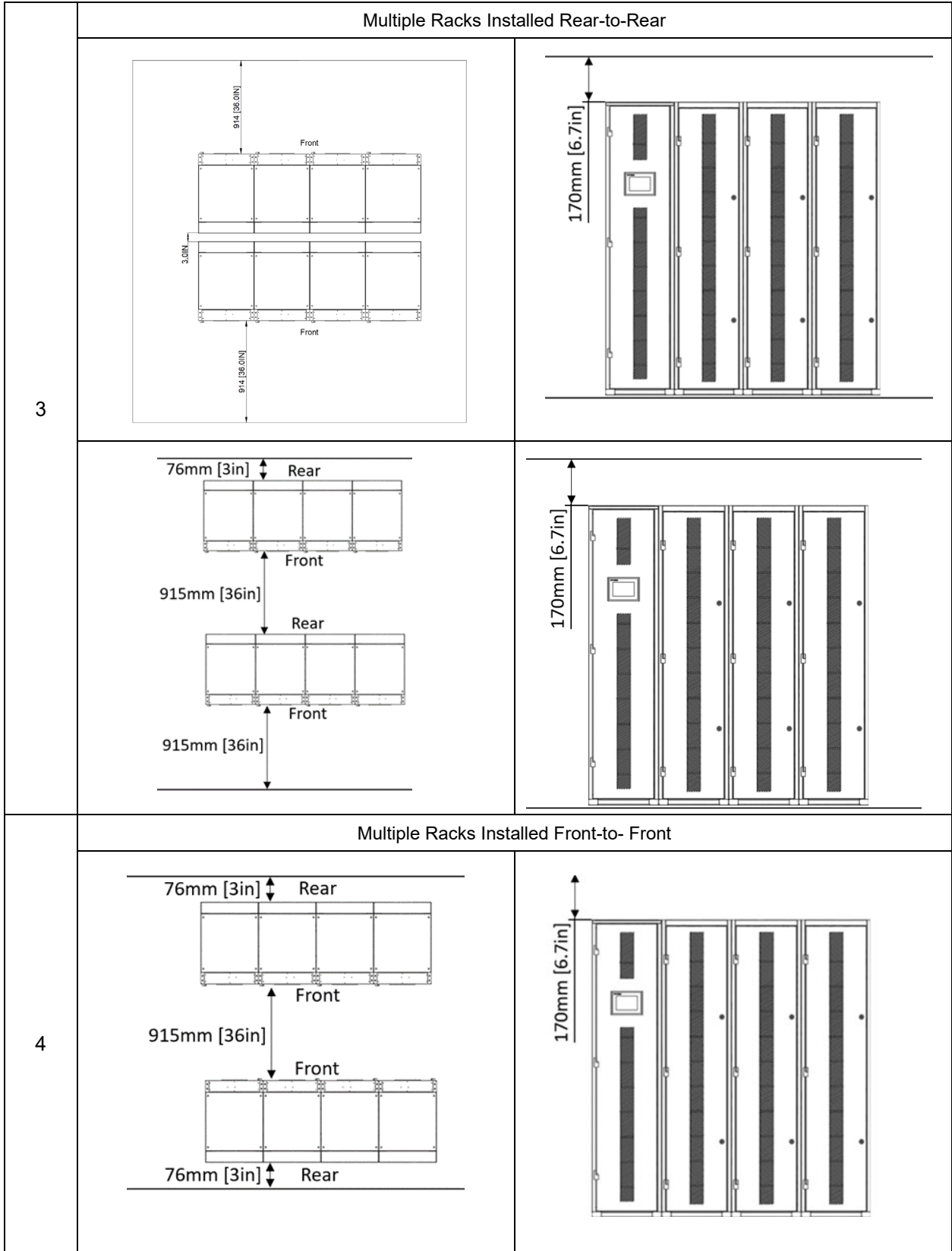
6.2 Clearance Distance

	WARNING
	<ul style="list-style-type: none"> ▪ Lift the rack from the front when using a forklift. Please see Section 11 for lifting instructions. ▪ Use lock washers on all anchoring bolts. ▪ Be sure rack is installed plumb and level. ▪ Do not distort the rack by installing on a non-level or non-flat surface. ▪ Distorting the rack will cause problems connecting racks together and opening/closing the doors. ▪ Adhere to the clearance distances as required.

6.2.1 The clearance distances should be kept according to the figures shown below for the purpose of proper ventilation and cooling of the battery, and for the ease of installation and maintenance. There should be a minimum of 3" of space on the back side of the rack for proper ventilation.

Table 6-2 Rack Installation Clearance Distances

Types	Clearance Distance	
1	Single Rack	
		
2	Multiple Racks	
		

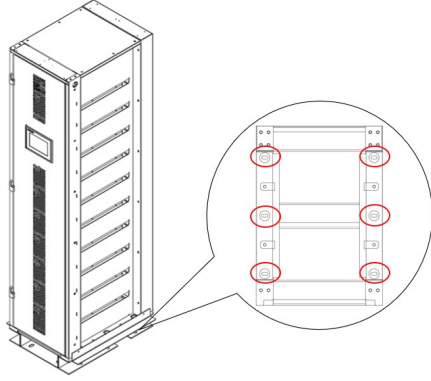
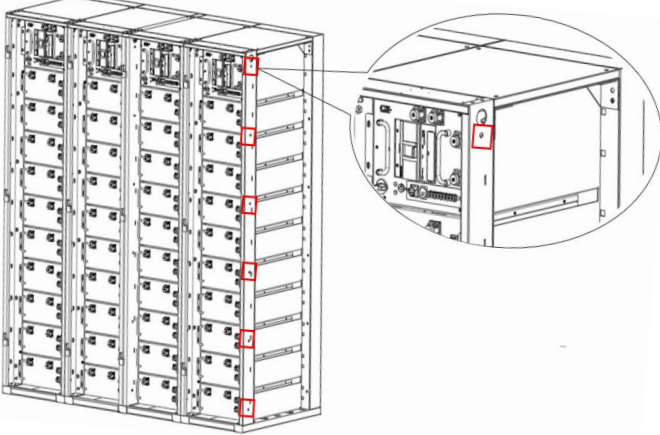


6.3 Cabinet Positioning

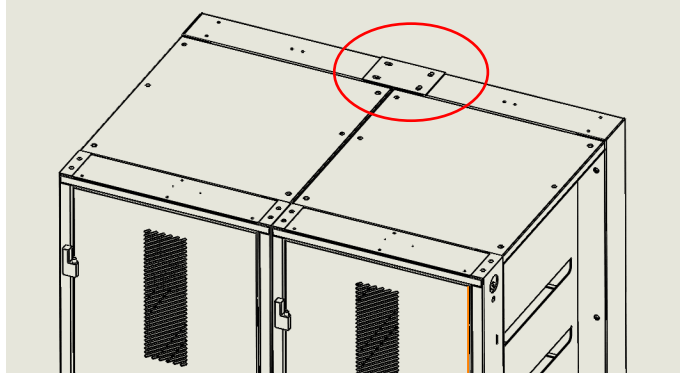
6.3.1 After the cabinet is unpacked and transported to its installation location, (Please see Section 11 for lifting instructions) confirm the pre-drilled holes in the bottom and sides are aligned for positioning and mounting.

6.3.2 The cabinet positioning steps are as follows.

Table 6-3 The Steps for Cabinet Positioning

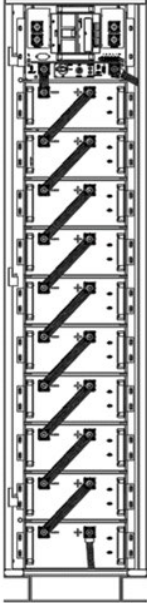
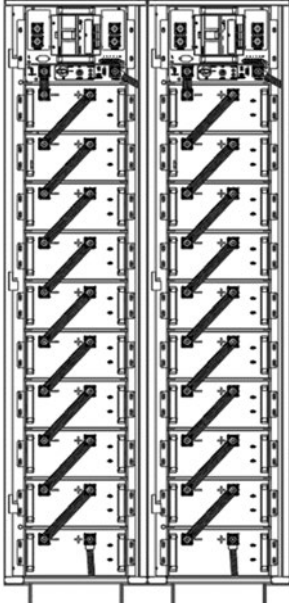
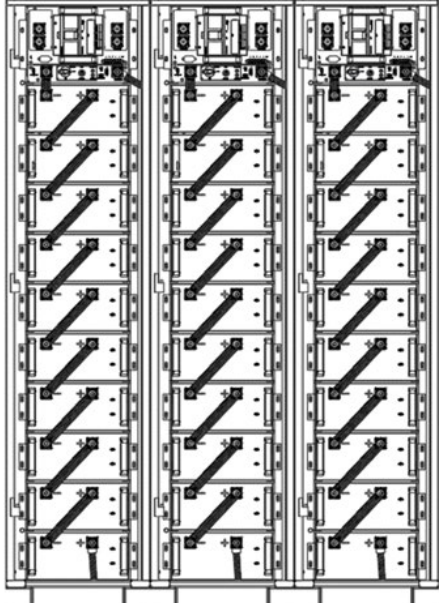
Steps	Inspection items
1	<p data-bbox="386 814 695 842">Mount cabinet to the floor.</p>  <p>The diagram shows a single server cabinet standing upright. A circular callout provides a magnified view of the bottom and side panels, highlighting several pre-drilled holes with red circles. These holes are arranged in a grid pattern, indicating where the cabinet will be secured to the floor.</p>
2	<p data-bbox="386 1276 1149 1304">Connect adjacent racks together using screws, nuts, washers.</p>  <p>The diagram shows two server cabinets side-by-side. Red boxes highlight the connection points on the side panels of both cabinets. A circular callout provides a magnified view of these connection points, showing the internal structure and the specific locations where screws, nuts, and washers should be used to join the cabinets together.</p>

Connect the adjacent racks together on the top of the cabinet using connecting plate and M6 screws.




6.4 Installation Configurations

Table 6-4 Layout of Different Configuration

1-5125528	2-5125528	3-5125528
<p style="text-align: center;">1 Rack</p> 	<p style="text-align: center;">2 Racks</p> 	<p style="text-align: center;">3 Racks</p> 

7 Busbar Connection

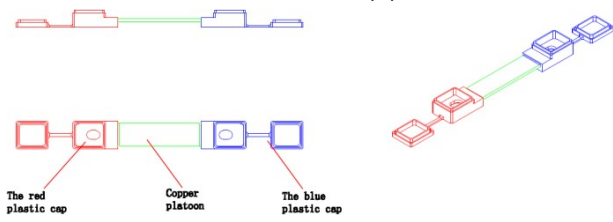
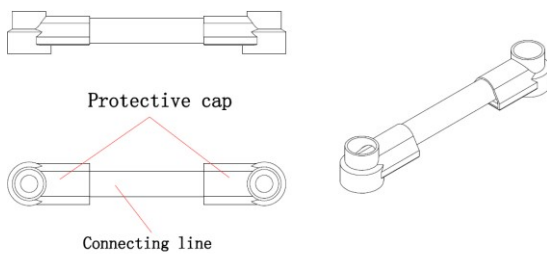
	WARNING
	<ul style="list-style-type: none"> ▪ Exercise extreme caution to prevent short circuits between the positive and negative terminal of a single battery module. ▪ Exercise extreme caution to prevent positive and negative terminals from contacting anything other than their intended mounting points. ▪ Only remove module terminal covers when installing bus bars. ▪ Immediately re-install module terminal covers when bus bar installation is complete for each module. ▪ Ensure control box disconnect is in the OFF position.

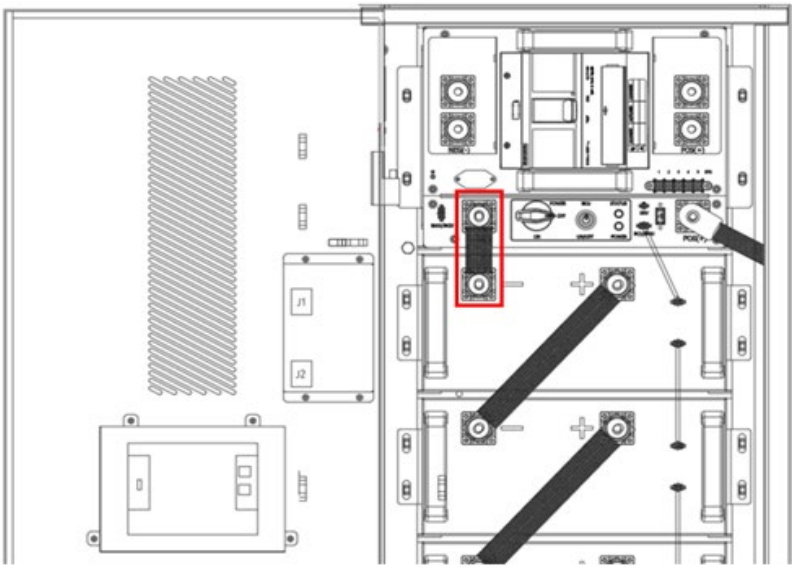
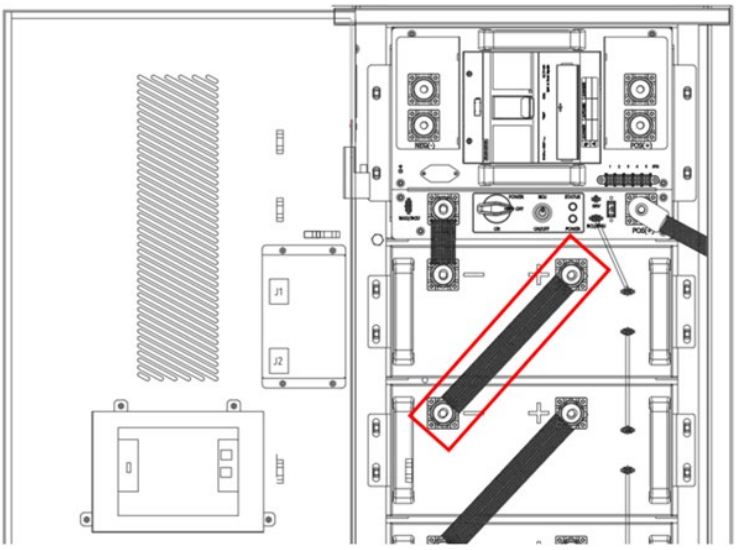
7.1 After all the modules and control box have been installed and secured, connect the bus bars to the battery modules.

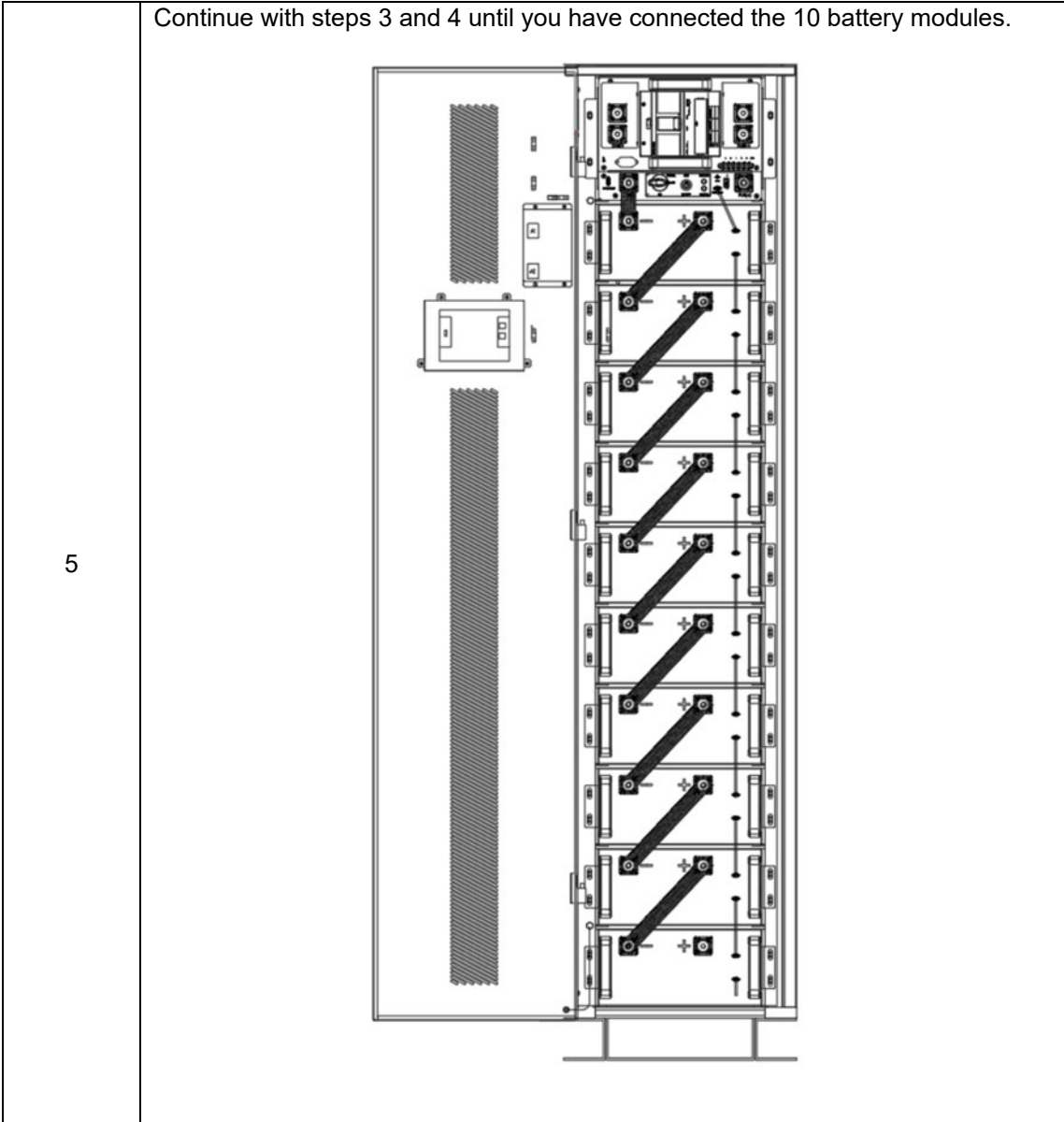
7.2 Tightening torque specification.

Screw size	Location	Torque
M6	Module Mounting	9 N-m
M6	Option Ground (top of cabinet)	9 N-m
M8	Ground wires	12 N-m
M10	Cabinet to Cabinet	18 N-m
M10	Busbars, Input/Output terminals	25 N-m

Table 7-1 The Steps for Busbar Connection

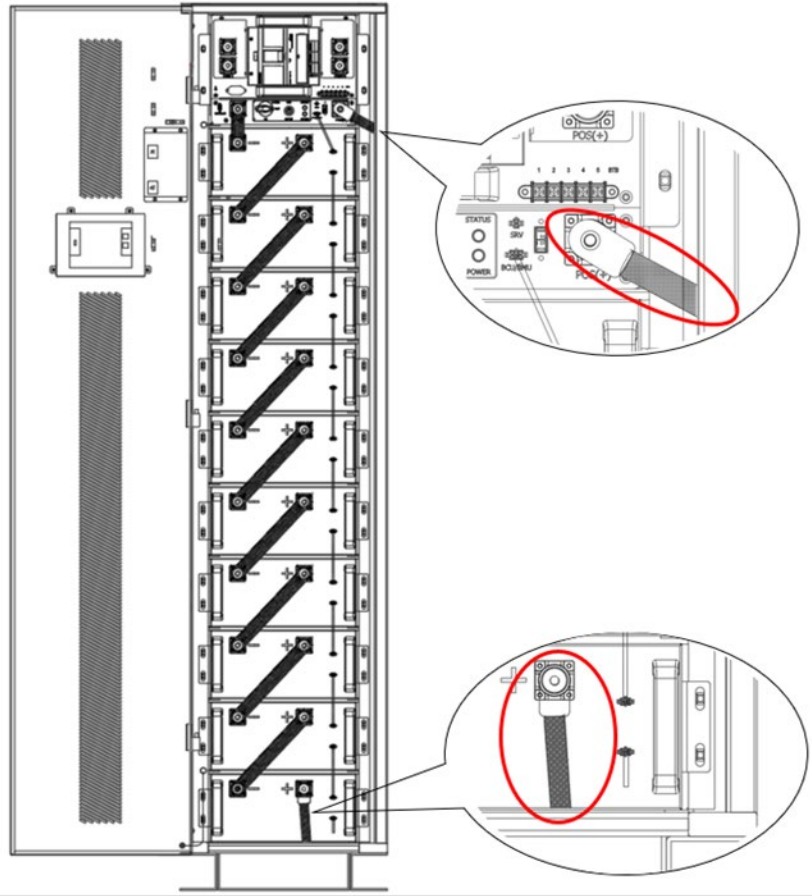
Steps	Busbar Connection
1	<p>Upper and lower joint copper terminal Matching silicone cap (one red, one blue) total of nine (6)</p> 
2	<p>The connecting line of control box positive pole and negative pole connecting line (Brass terminal protective cap)</p>  <p>1: Red protective cap at both ends of positive pole; 2: Blue protective cap at both ends of negative pole</p>

<p>3</p>	<p>Control Box Input - and Module #1 Neg terminal is connected using an M10</p> 
<p>4</p>	<p>Connect Battery Module #1 Pos and Module #2 Neg using Copper busbar and an M10 screw. Then close the terminal cover.</p> 



6

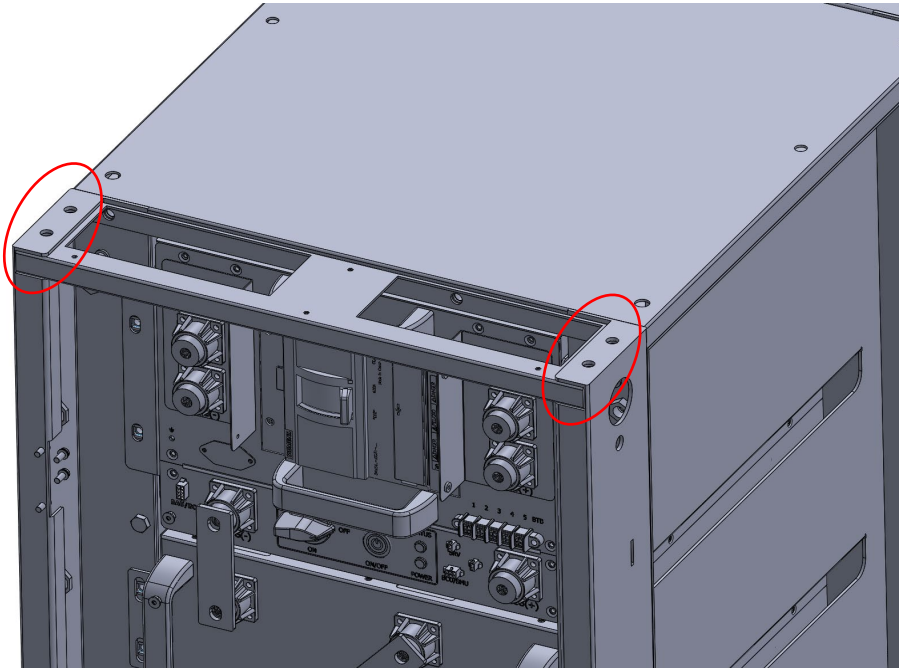
Control Box Input + and Module #10 Pos terminal are connected using an M10 screw.



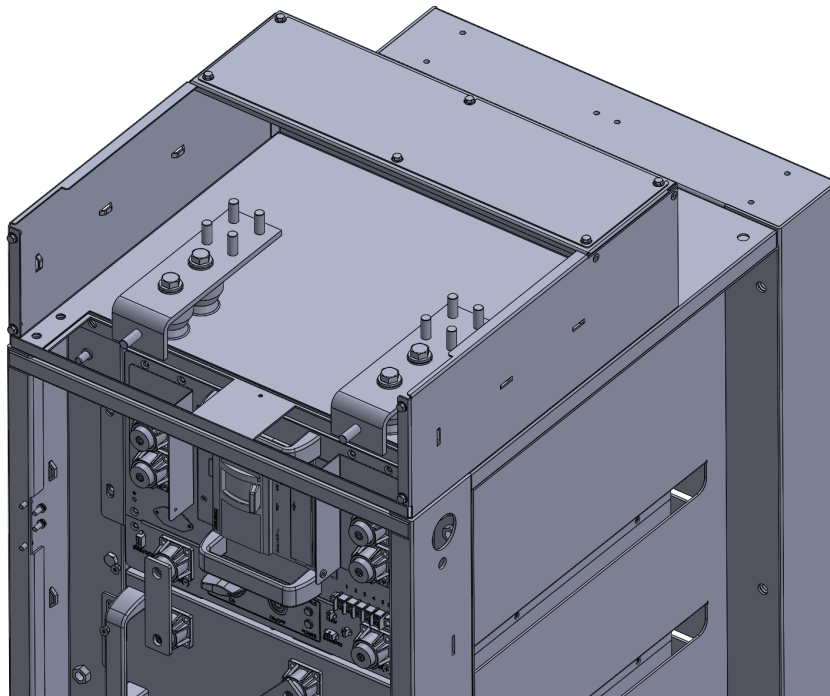
8 Conduit Landing Box installation

It is recommended to install all conduit landing boxes after all the racks have been set in place, tied together, and anchored to the floor

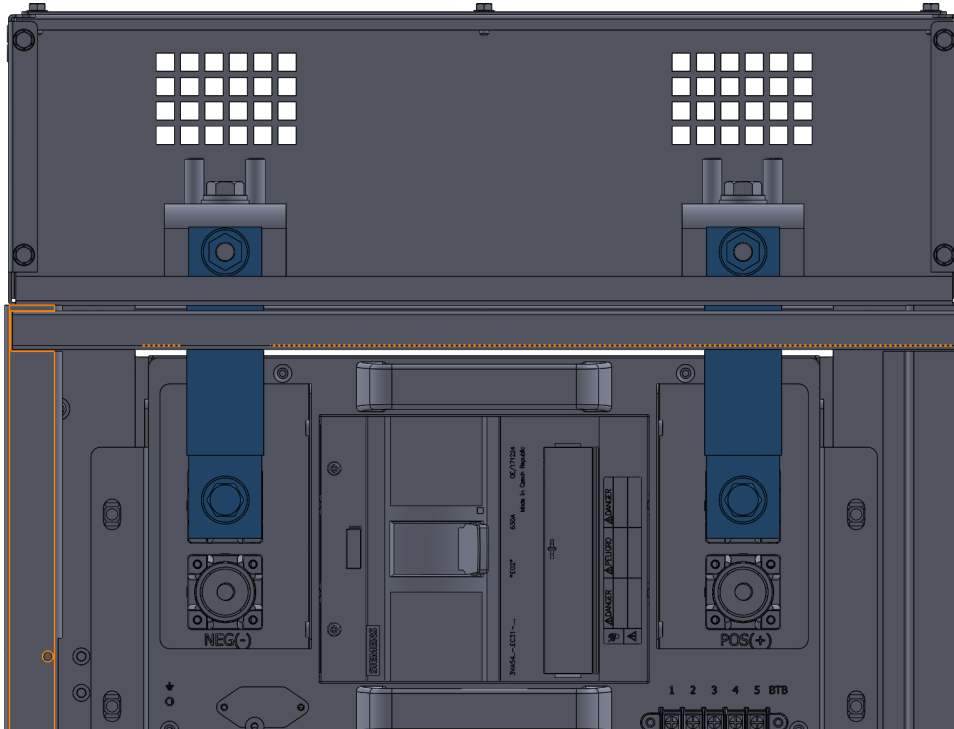
- 8.1 Remove 4 M8 bolts from the top of the rack. Set the bolts aside, they will be used secure the CLB to the top of the cabinet.



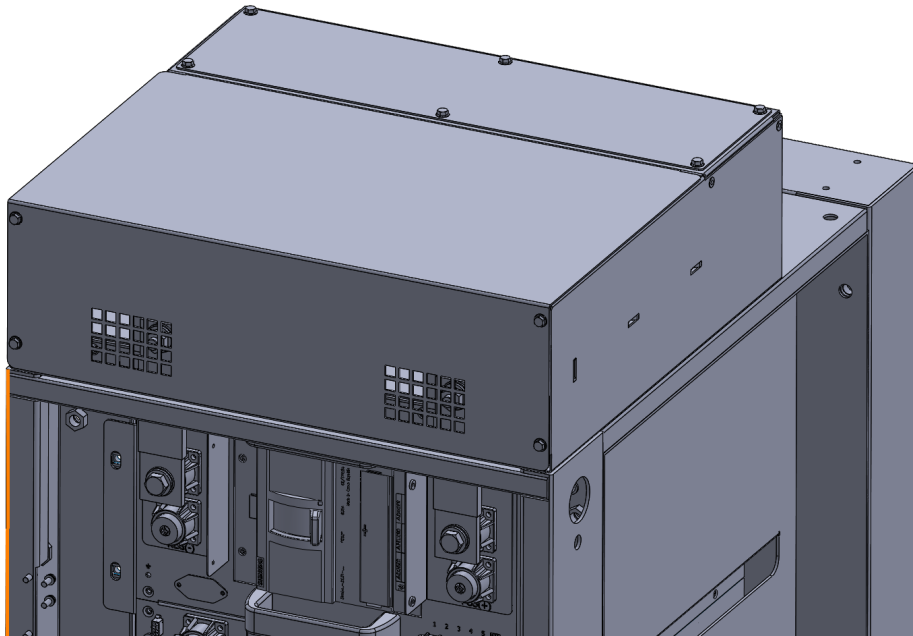
- 8.2 Remove the front cover from the CLB and Place the box on top of the cabinet and ensure the mounting holes are aligned.



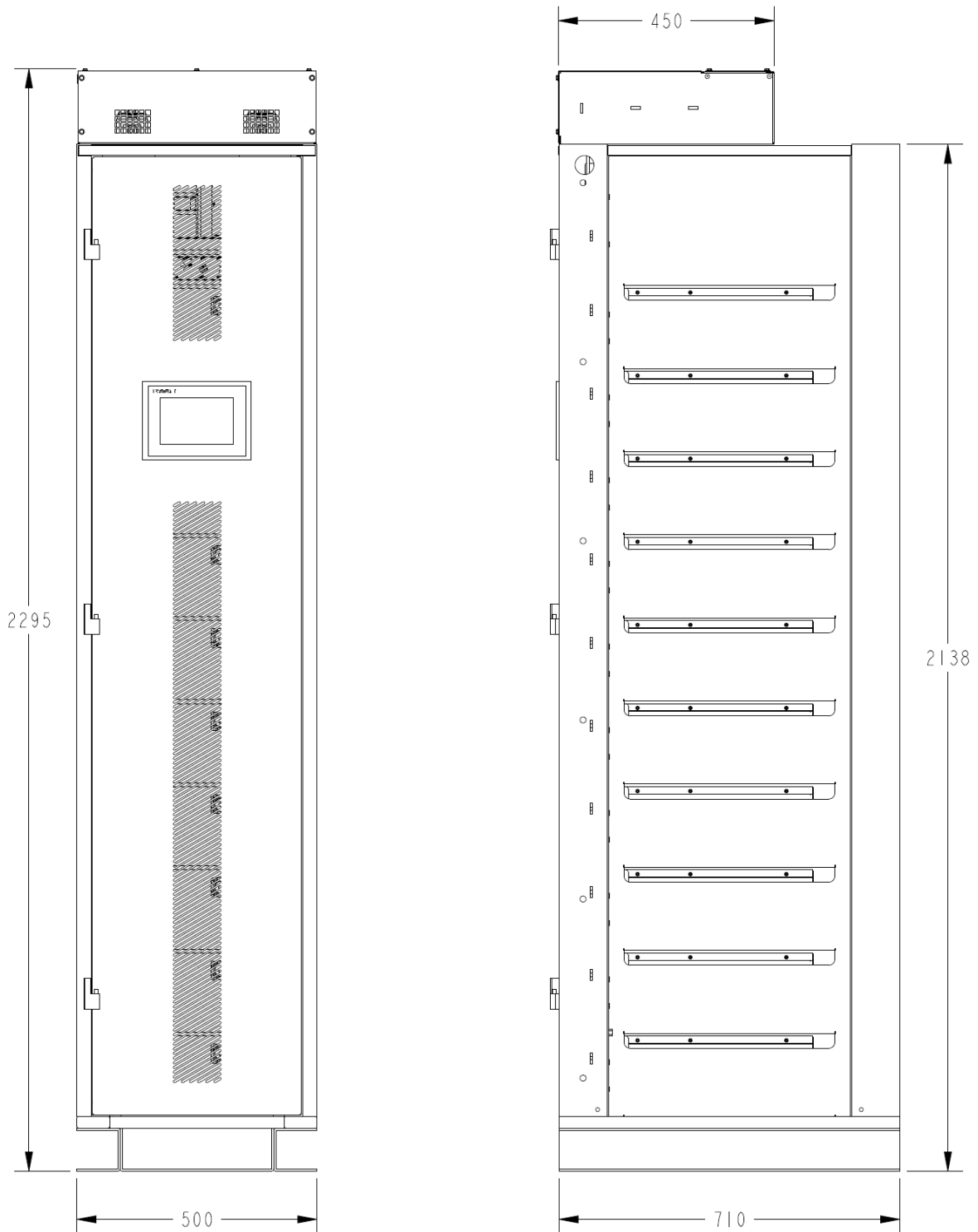
- 8.3 Secure the box to the top hat using 4x M8 bolts that were removed from the cabinet.
- 8.4 Connect the busbars to the control box output terminals using provided hardware. Tighten the Bolts and Nuts to 25Nm torque.



- 8.5 After the power output terminals have been connected to the busbars reinstall the cover.




8.6 Fully assembled rack dimensions



9 Communication Cable Connection

9.1 Control Box and Module

	WARNING
	<ul style="list-style-type: none"> ▪ Use the proper signal cables as specified by the specifications below. ▪ Do not insert both ends of the signal cable into the same Battery Module.

The specifications of communication cables to connect control box to battery modules is included in the following table.

Table 8-1 The Specification of Communication Cable Between BCU and BMU


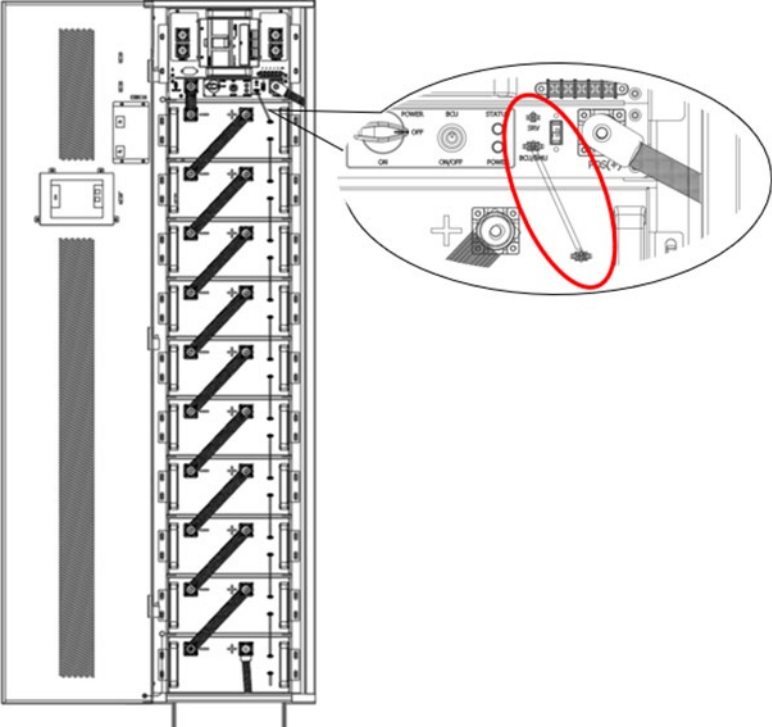
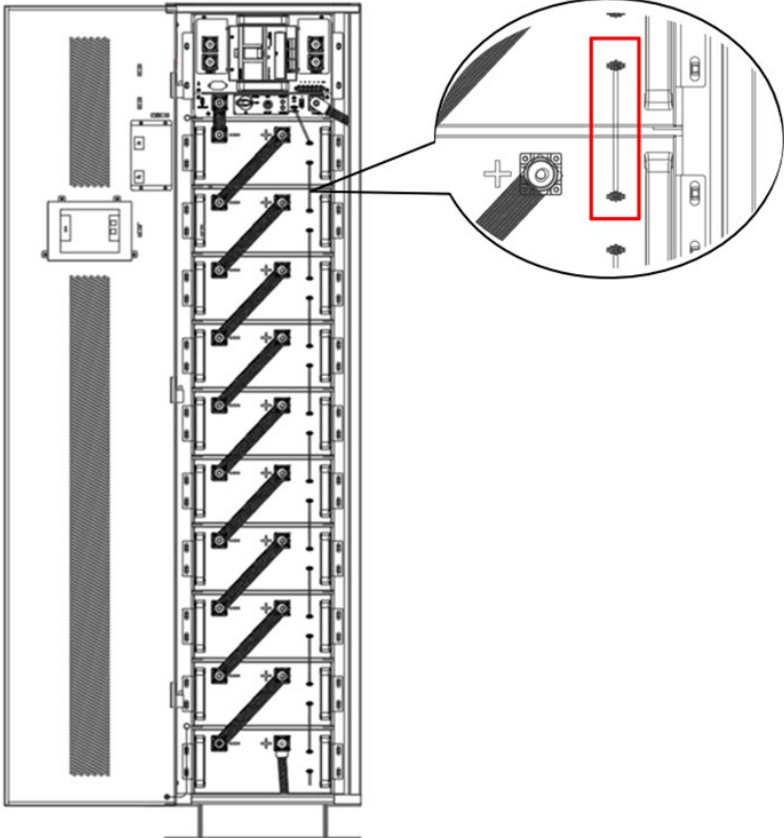
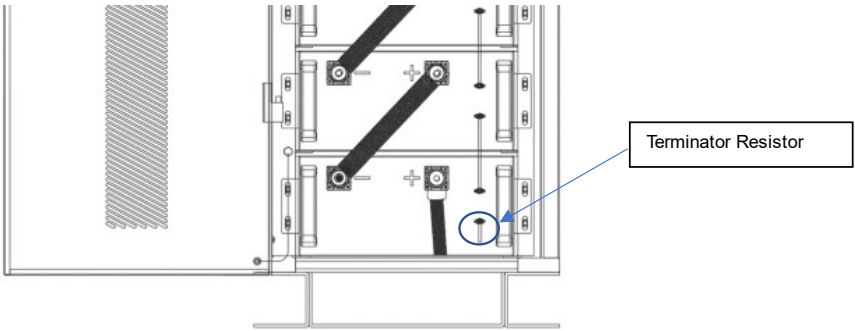

Types	Communication Cable										
BCU & BMU	<p>One side connects to Control Box “BMU COM” port and the other goes to Module #1 top COM port.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">B</td> <td style="text-align: center;">C</td> <td style="text-align: center;">D</td> <td style="text-align: center;">E</td> </tr> <tr> <td style="text-align: center;">PWR+</td> <td style="text-align: center;">PWR-</td> <td style="text-align: center;">CANH</td> <td style="text-align: center;">CANL</td> <td style="text-align: center;">ADR</td> </tr> </table>	A	B	C	D	E	PWR+	PWR-	CANH	CANL	ADR
A	B	C	D	E							
PWR+	PWR-	CANH	CANL	ADR							
BMU & BMU	<p>Same as above cable, only difference is the length. We have 9 identical cables as below per rack.</p> 										

Table 8-2 The Steps for Communication Connection Between Control Box and Module

Steps	Communication Connection Between Control Box and Module
1	<p>Connect the signal cable between the BMU COM port of Control Box and Module #1 top COM port</p> 

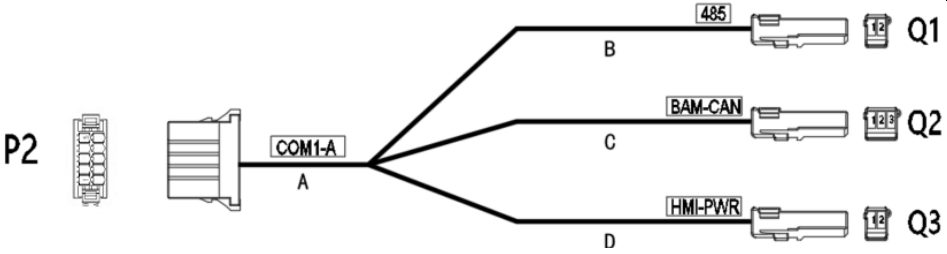
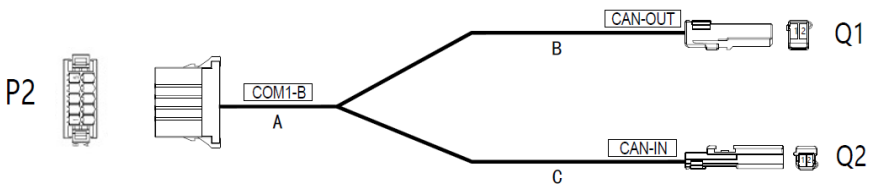
<p>2</p>	<p>Connect the signal cable from Module #1 Into Module #2 Out and proceed down until all Com cables are installed between Modules</p> <p><i>Note: After the Connector is inserted the locking collar must be rotated clockwise to lock the connector in place.</i></p> 
<p>3</p>	<p>Connect Terminator resistor to the comm of module 10</p> 

9.2 Control Box and BAMS

	WARNING
	<ul style="list-style-type: none"> Use the proper signal cables as specified by the specifications below.

The specifications of signal cables to connect control box to BAMS is included in the following table.

Table 8-3 The Specification of Signal Cable Between BCU and BAMS

BMS	Communication Cable														
Rack 1 BCU & BAU & HMI	 <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Pin ID of the P1</th> </tr> </thead> <tbody> <tr> <td>P2-B2</td> <td>24V+</td> </tr> <tr> <td>P2-A2</td> <td>24V-</td> </tr> <tr> <td>P2-A4</td> <td>BAU_CANH</td> </tr> <tr> <td>P2-B4</td> <td>BAU_CANL</td> </tr> <tr> <td>P2-A3</td> <td>485A</td> </tr> <tr> <td>P2-B3</td> <td>485B</td> </tr> </tbody> </table>	Pin ID of the P1		P2-B2	24V+	P2-A2	24V-	P2-A4	BAU_CANH	P2-B4	BAU_CANL	P2-A3	485A	P2-B3	485B
Pin ID of the P1															
P2-B2	24V+														
P2-A2	24V-														
P2-A4	BAU_CANH														
P2-B4	BAU_CANL														
P2-A3	485A														
P2-B3	485B														
BCU & BCU															

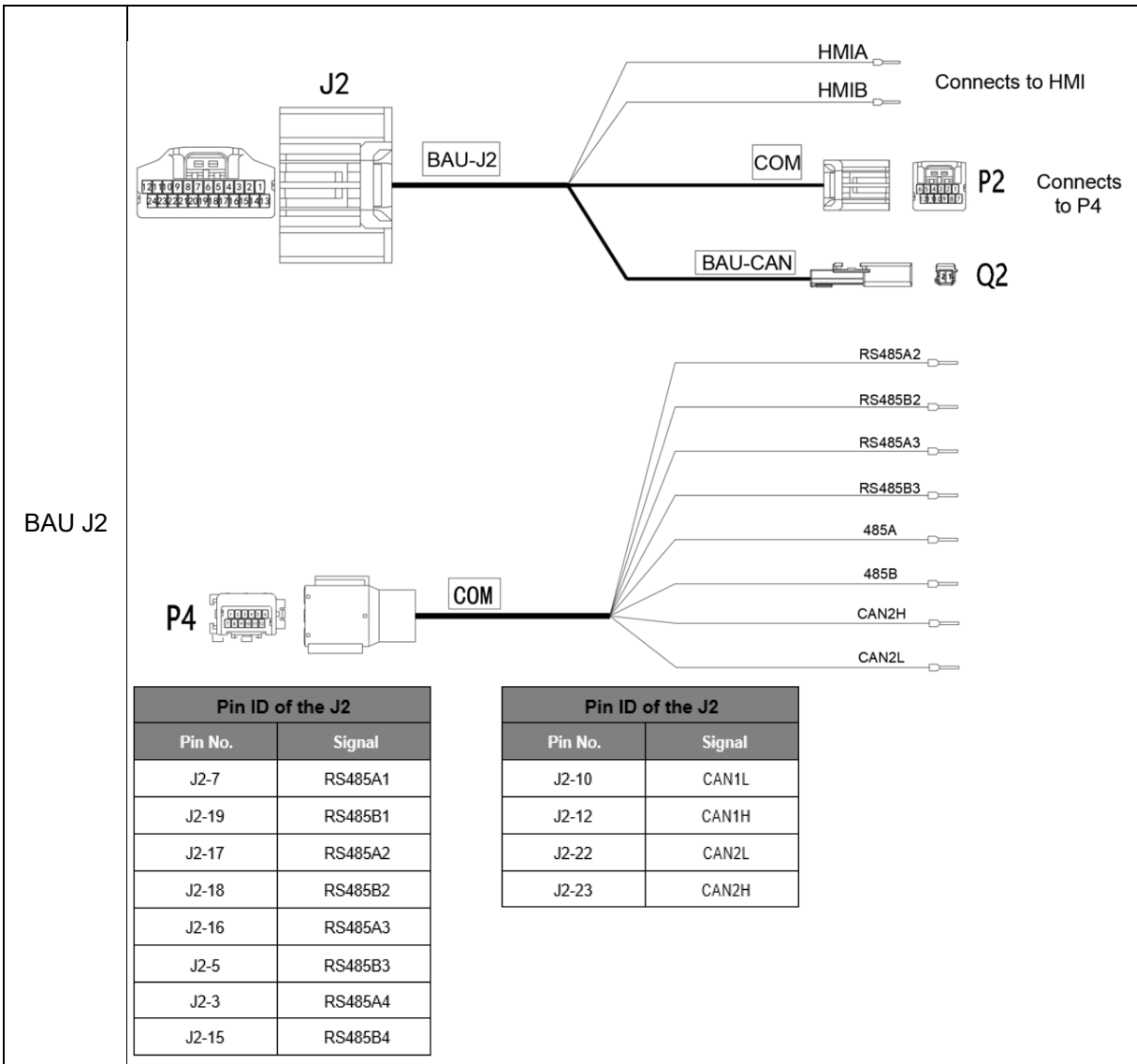
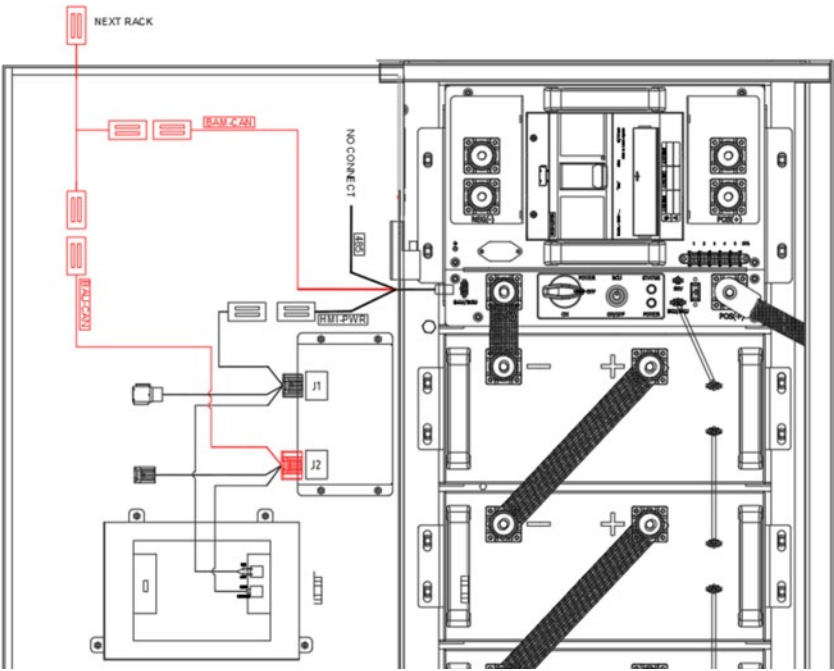
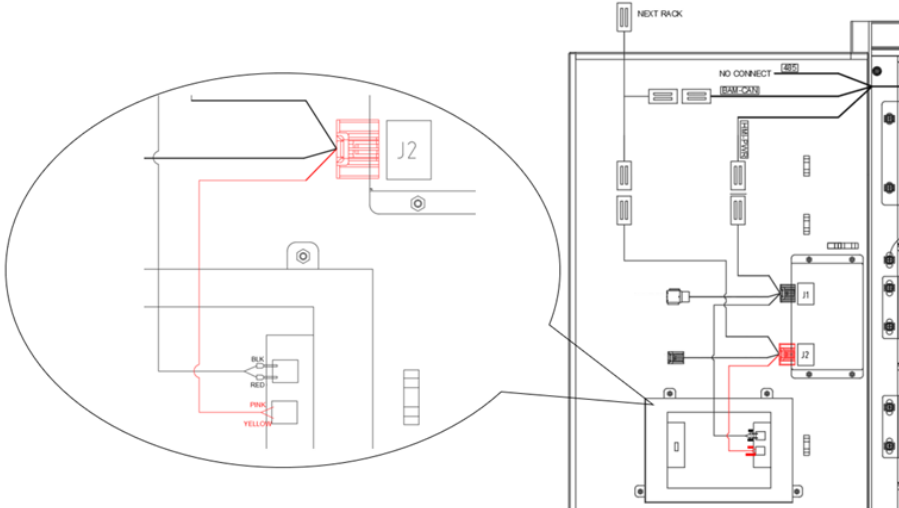



Table 8-4 The Steps for Communication Connection Between Control Box and BAMS

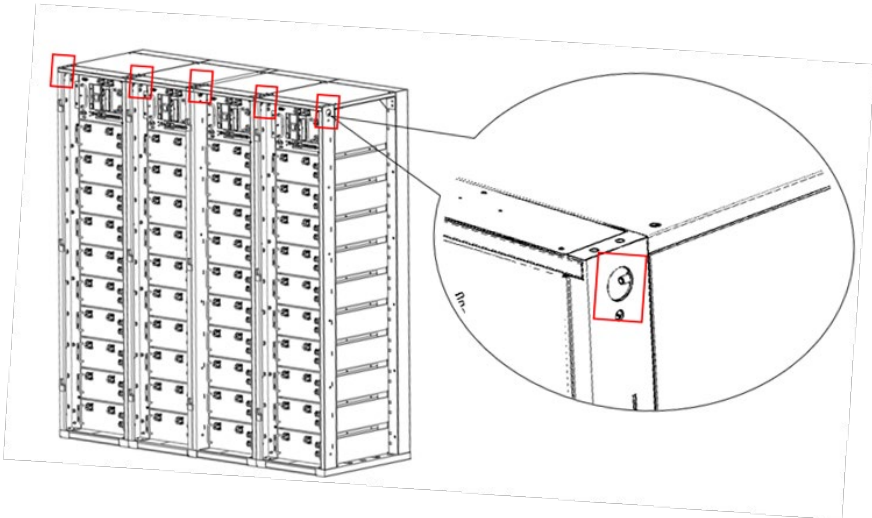
Steps	Communication Connection Between Control Box and BAMS
1	<p>Connect the COM1 cable's "BAM-CAN" labeled branch wire to a Y shaped connector (not needed for a single rack system). Then, connect it to J2 connector's "BAU-CAN" labeled branch wire.</p> 
2	<p>Connect the signal cable from the BAU J2 to HMI. Note that these are not "keyed" connectors. Pink connects to top and yellow connects to bottom.</p> 

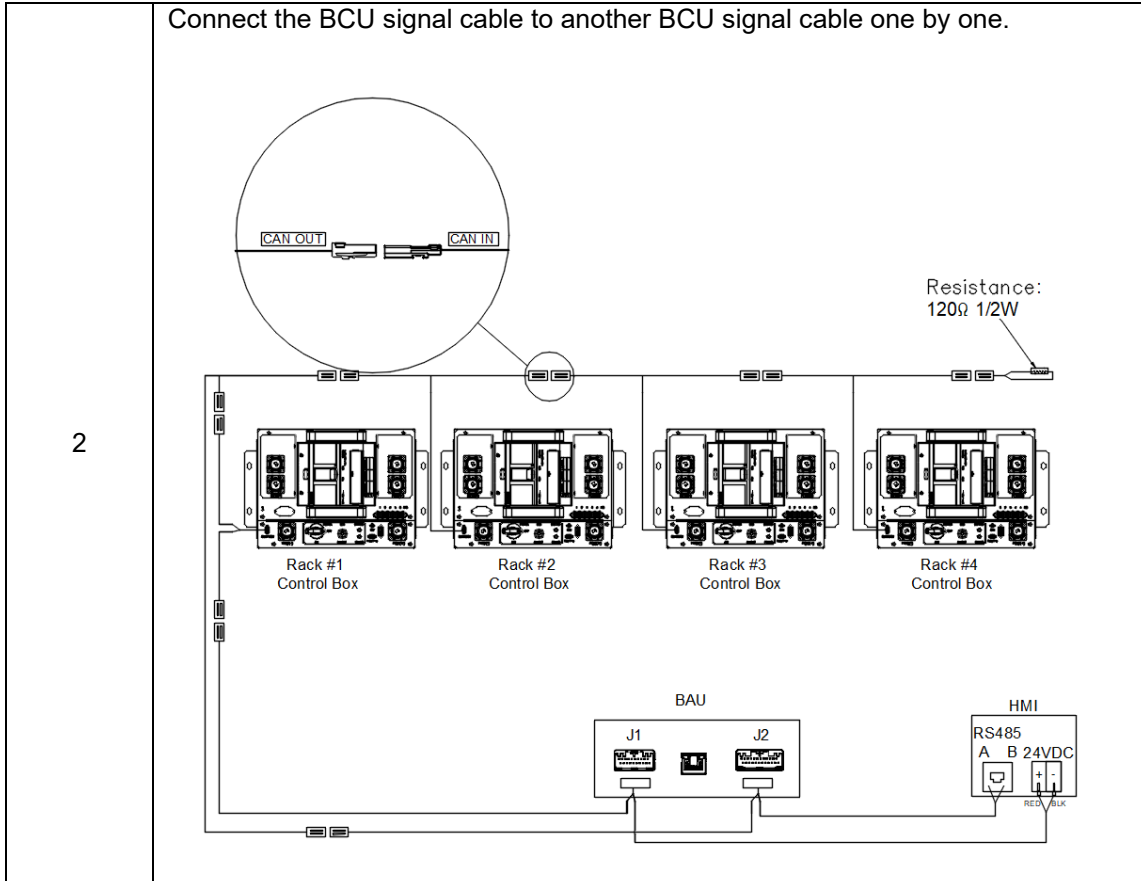
9.3 Multiple Rack

	WARNING
	<ul style="list-style-type: none"> Use the proper signal cables as specified by the specifications below.

The specifications of signal cables to connect control box to another control box is included in the following table.


Table 8-6 The Steps for Communication Connection Between Multiple Control Boxes

Steps	Communication Connection Between Multiple Control Boxes
1	<p>For multi-rack systems, signal lines are connected between the control boxes of each rack. The cable passes through the opening at the top of the side column of the cabinet.</p> 



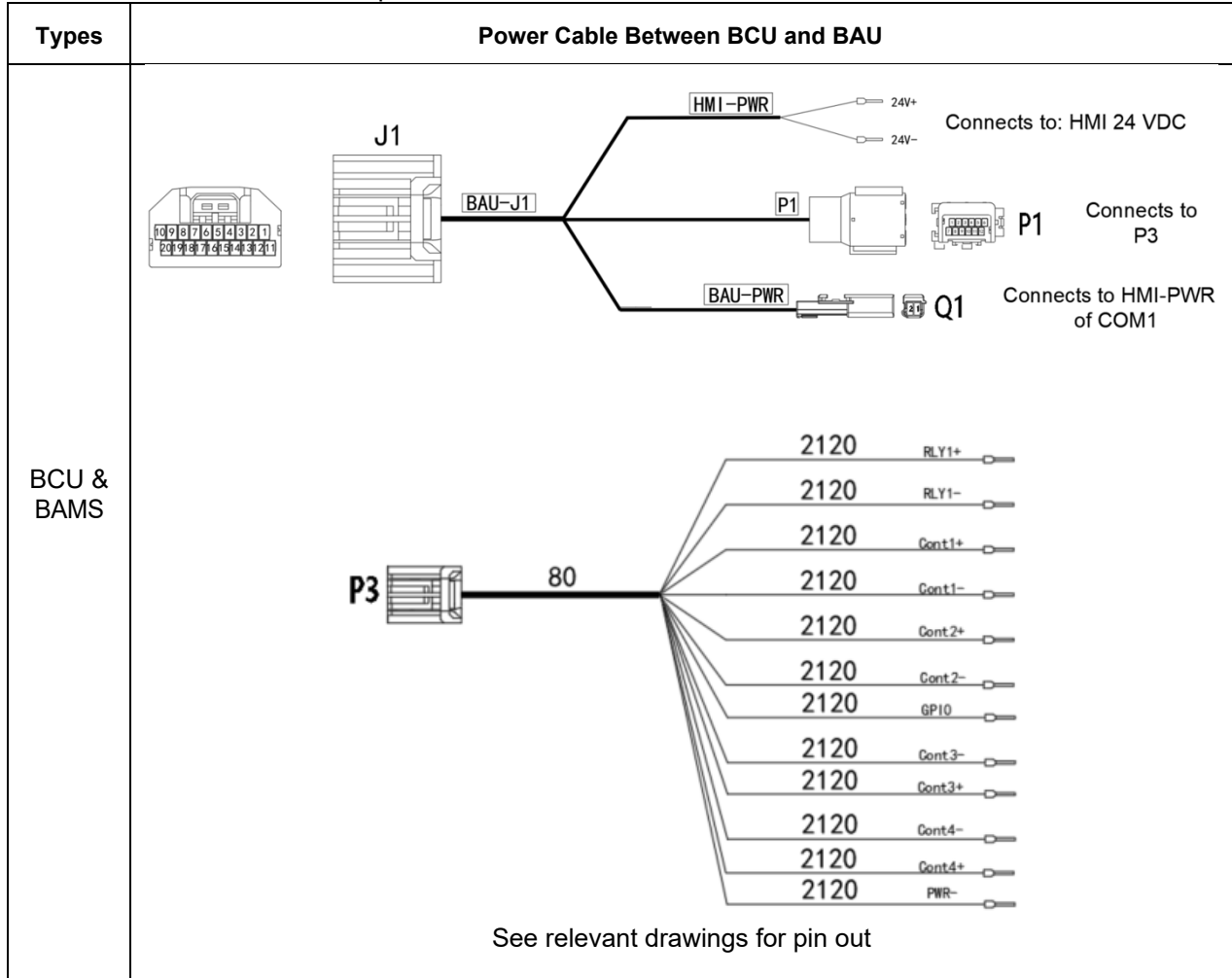
10 Power Cable Connection

10.1 Input Connection

	WARNING
	<ul style="list-style-type: none"> Use the proper power cables as specified by the specifications below.

The specifications of power cables to connect control box to BAMS is included in the following table.

Table 9-1 The Specification of Power Cable Between BCU and BAU



10.2 Dry Contact and E-Stop

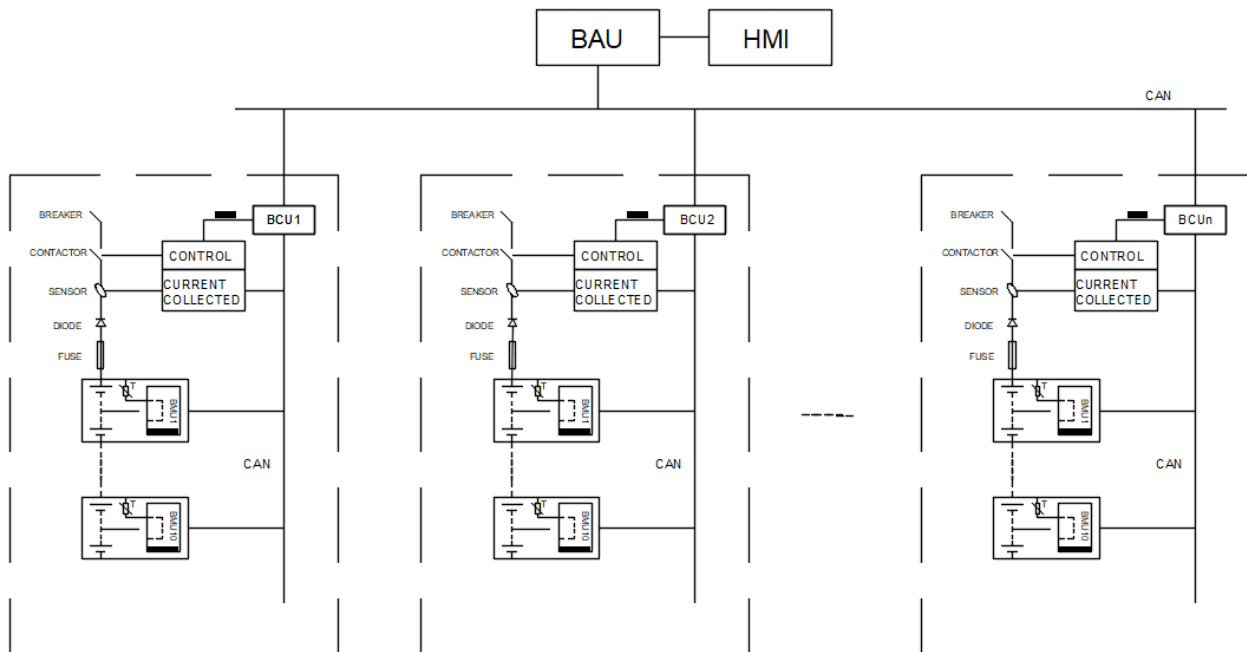
E-Stop feature can be utilized by USP or external device to turn battery power off to the system. GPIO and PWR- of P3 cable above can be shortened to clear alarm for testing purposes.

11 BMS Configuration

11.1 BMS Architectures

BAUs do not communicate with each other and should be treated as an independent sub-system. BAUs can be identified by different IP address. Sample architectures are shown below.

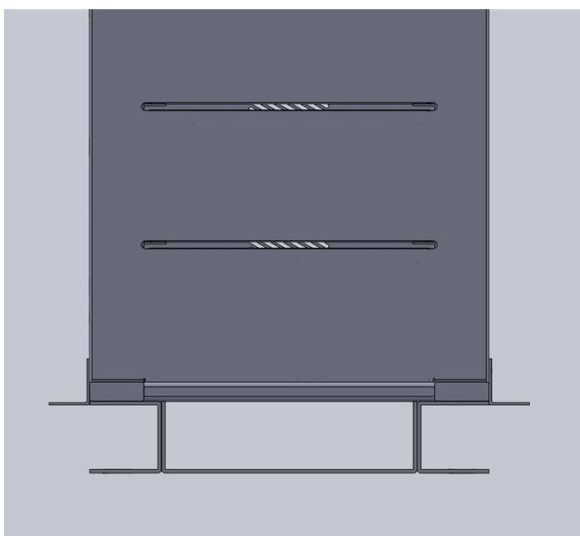
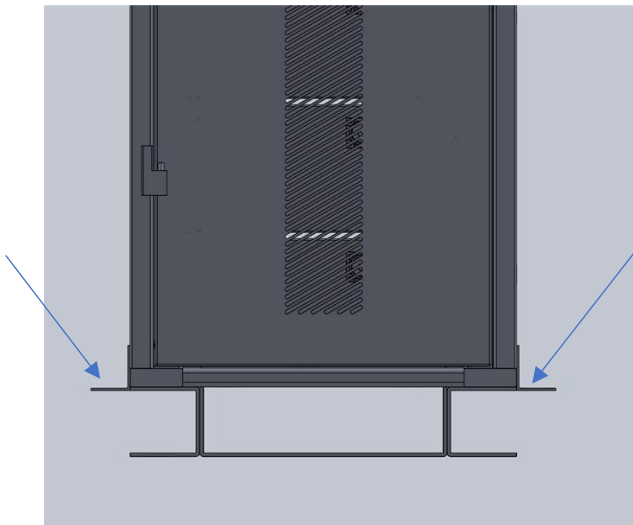
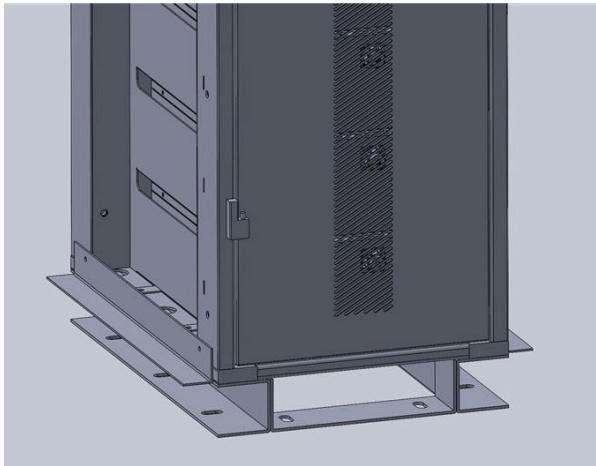
Fig 10-1 System with a single BAU



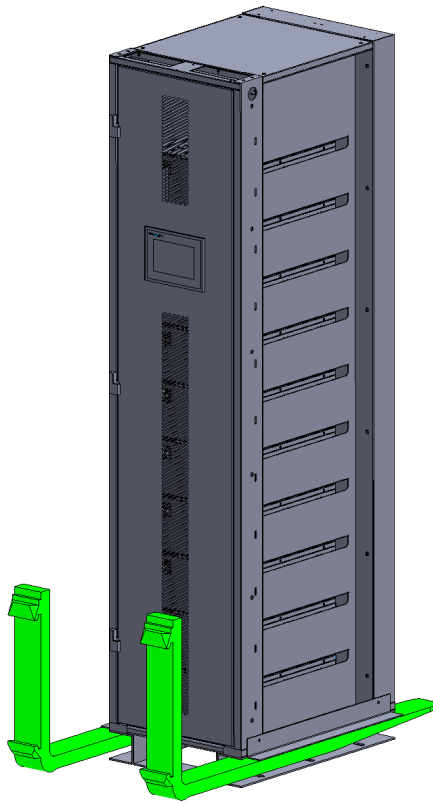
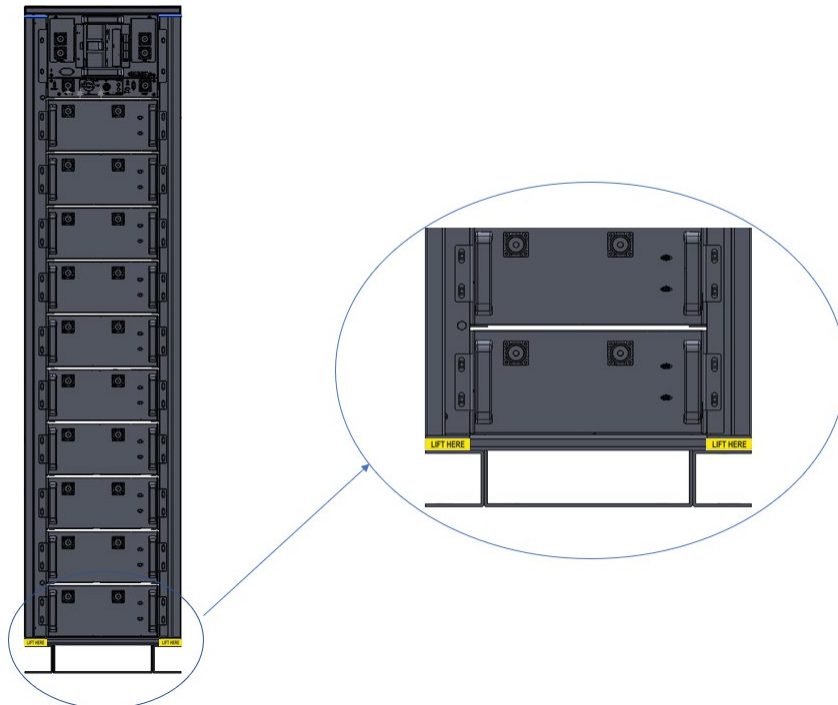
12 Rack Lifting Instructions

12.1 Lifting Instructions

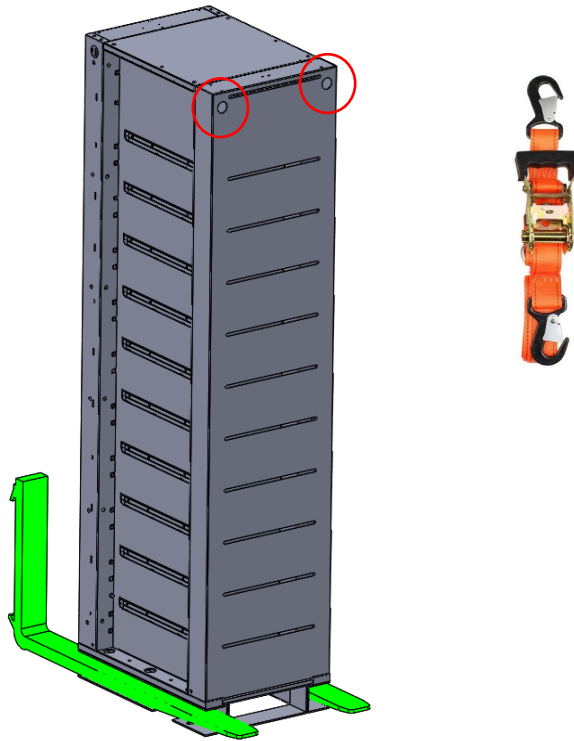
12.1.1 Install angle brackets on the left-side and right-side bottom. (If not already installed)



- 12.1.2 Insert forklift under the verticals. There are stickers at lifting points.
- 12.1.3 Forklift inside width shall be about 350mm (13.8 in)
- 12.1.4 21-in wide pallet jacks shall work

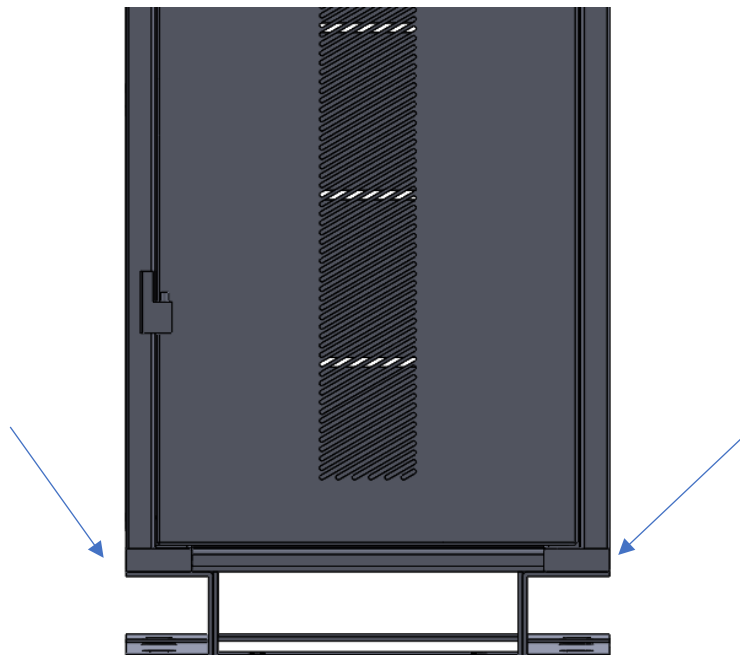


12.1.5 To ensure stability of the rack during transportation it is recommended that the top of the rack is strapped to the frame of the forklift using a ratchet strap. Below image shows the locations where the strap can be attached.

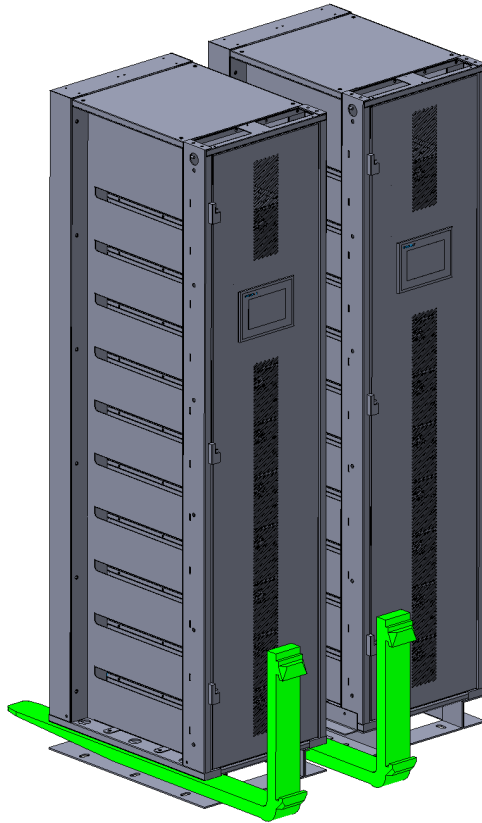


12.1.6 Position the first rack in place.

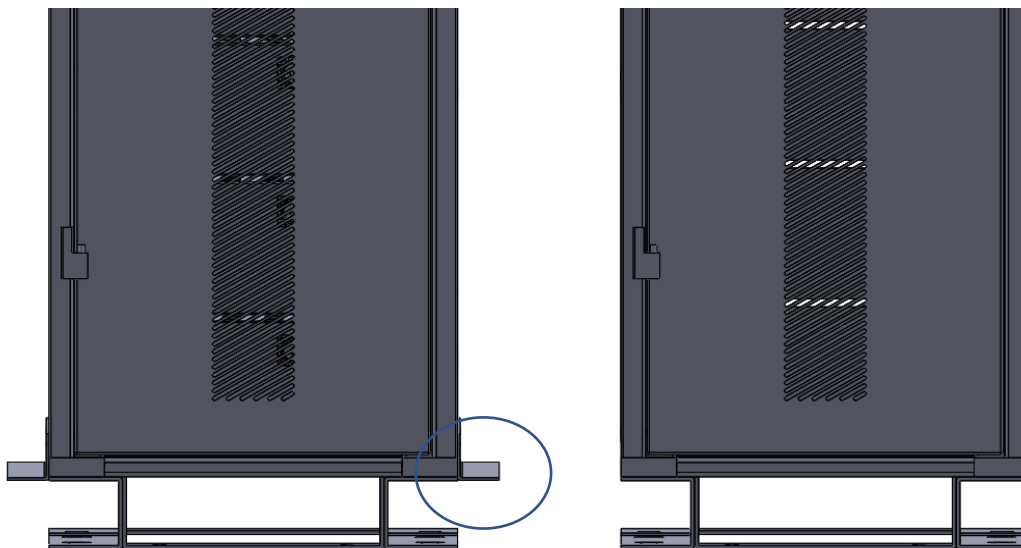
12.1.7 Remove the angle brackets from both sides.



- 12.1.8 Secure the rack with the anchoring bolts to the floor
- 12.1.9 Place the second rack beside the first one that is already in place. Leave about 8-10" in between to be able to remove angle brackets,

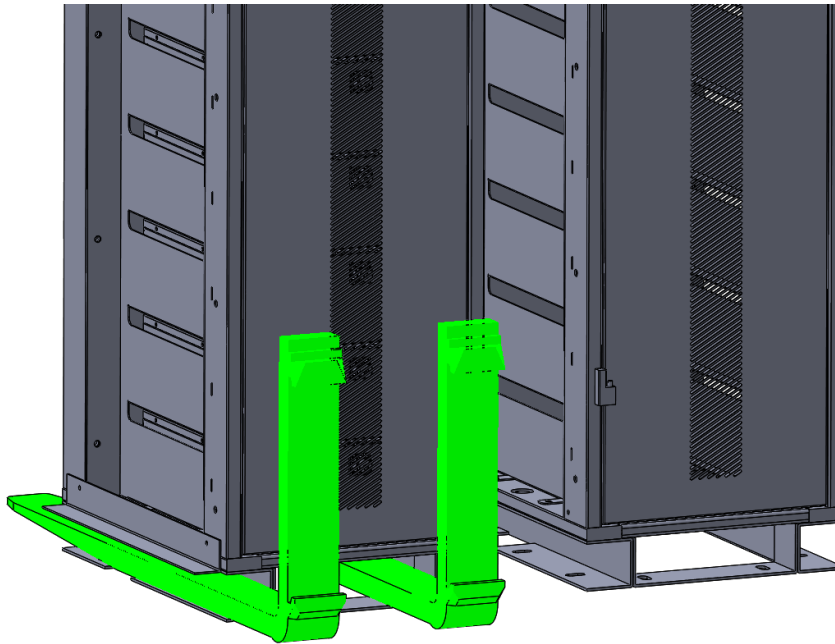


- 12.1.10 Uninstall right-side angle bracket from the 2nd rack



12.1.11 Reposition the forks so that they are about 220mm (8.5 inch) apart

12.1.12 Slowly insert forks, one through the middle and the second one to the left side of the rack.



6.1.1 Slightly lift the rack and reposition it adjacent to the one already in place.

6.1.2 Remove the angle bracket on the left side of the second rack and anchor it to the floor

6.1.3 Anchor 2nd rack to the floor





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