

NBi 180 POWER CABINET

**HARDWARE AND
INSTALLATION MANUAL**



NBi 180 POWER CABINET

EV CHARGING SOLUTIONS

Hardware and Installation Manual

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NBI180HW02CI Rev. C

ABOUT THIS MANUAL

PURPOSE

This manual contains important instructions for the installation, configuration and use of the power cabinet **NBi 180** which manages the power transformation and main control for the charge. From now on, this manual refers to **NBi 180** with the term “equipment” or “power cabinet”.

Please notice the **NBi 180** range includes the power cabinets NBi 60 / NBi 90 / NBi 120 / NBi 150 / NBi 180.

The power cabinet must be connected to any of the Power Electronics' Dispensers. Please consult the specific documentation of all the equipment included in the project.

Power Electronics reserves the right to modify product features.

TARGET AUDIENCE

This manual is intended for qualified customers who will install, configure and operate **NBi 180** power cabinets.

Only qualified technical personnel validated by Power Electronics may install and start up the equipment.

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REVISIONS CONTROL

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01 / 12 / 2021	A	First edition.
23 / 09 / 2022	B	Introduction. Technical characteristics. Preparation for installing the equipment. Cable access and connections. Communications. LOTO procedure. Misprints corrections.
02 / 12 / 2022	C	Safety instructions. Dimensions and weight. Cable access and connections. Interface. Maintenance. Misprints corrections.

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The equipment and technical documentation are periodically updated. Power Electronics reserves the right to modify all or part of the contents of this manual without previous notice. To consult the most updated information on this product, you may access our website www.power-electronics.com, where the latest version of this manual can be downloaded. The reproduction or distribution of the present manual is strictly forbidden unless express authorization from Power Electronics.

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ACRONYMS

The terms commonly used in the documentation of Power Electronics' products are listed in the table below.

Please notice this is a general series of terms and it encompasses all our product divisions (industrial, solar, storage, and electric mobility), thus, some of the following expressions may not apply to this particular manual.

ACRONYM	MEANING
AASS	Auxiliary Services
AC	Alternating Current
AI	Analogue Input
AO	Analogue Output
BESS	Battery Energy Storage System
BMS	Battery Manager Solution
CCID	Charge circuit interrupting device
CCL	Charge Current Limit.
CCS	Combined charging system – charging and communications protocol following the standard IEC 61851-23 Annex CC
CHAdEMO	Charging and communications protocol following the standard IEC 61851-23 Annex AA
CPU	Central Processing Unit
DC	Direct Current
DCL	Discharge Current Limit
DI	Digital Input
DSP	Digital Signal Processor
DO	Digital Output
EV	Electric Vehicle
FPGA	Programmable device (Field-Programmable Gate Array)
FRU	Field Replaceable Unit
GFDI	Ground Fault Detector Interrupter
GPRS	General Packet Radio Services, a data transmission system
HVAC	Heating, Ventilation, and Air Conditioning
IGBT	Insulated Gate Bipolar Transistor
IMI	Insulation monitoring device
IT	Grid system where the power supply is kept isolated and the electrical equipment system is grounded.
LOTO	Lock Out – Tag Out
MCB	Miniature Circuit Breaker
MPCS	Multi Power Conversion System
MID	Measuring Instrument Directive
MV	Medium Voltage. This term is used to refer to high voltage in general
PE	Ground connection
PI	Proportional and Integral
POI	Point Of Interconnection
PPE	Personal Protection Equipment

ACRONYM	MEANING
PV	Photovoltaic energy
RCD	Residual Current Device
RCM	Residual Current Monitor
RFID	Radio Frequency Identification
SOC	State Of Charge – referred to battery
SOH	State Of Health – referred to battery. It compares the actual state of the battery to its initial conditions. It is measured in percentage
STO	Safe Torque Off
TN	Grid system where the power supply is grounded, and the electrical equipment system is brought to the same ground through the neutral connector.
TT	Grid system where both the power supply and the electrical devices are connected to the ground via separate connections
UPS	Uninterruptible Power Supply
VSD / VFD	Variable Speed Drive, Variable Frequency Drive. Both terms are used

SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.

In this manual, safety messages are classified as follows:



WARNING

Identifies potentially hazardous situations where dangerous voltage may be present, which if not avoided, could result in minor personal injury, serious injury or death.

Be extremely careful and follow the instructions to avoid the risk of electrical shocks.



CAUTION

Identifies potentially hazardous situations, which if not avoided, could result in product damage, or minor or moderate personal injury.

Read the message and follow the instructions carefully.



NOTICE

Identifies important measures to take in order to prevent damage equipment and warranty lost, as well as encouraging good use and environmental practices.

Other symbols used in this manual for safety messages are the following:



Hot surface. Be careful and follow the instructions to avoid burns and personal injuries.



Risk of fire. Be careful and follow the instructions to prevent causing an unintentional fire.



Caution, risk of electric shock. Energy storage timed discharge. Wait for the indicated time to avoid electrical hazards.

SAFETY INSTRUCTIONS

IMPORTANT!

SAVE THIS INSTRUCTIONS

Read carefully all documentation before handling the equipment and pay special attention to safety recommendations to maximize the performance of this product and ensure its safe use and installation.

This document covers the most important and frequent potential causes of damage to equipment or personnel. It is the responsibility of the installer to follow the instructions provided in this manual, follow good electrical practices and identify all warnings and recommendations before starting up and operating the power cabinet and the electric vehicle chargers.



WARNING

FIRST CONSIDERATIONS

The operations detailed in this manual can only be performed by qualified personnel.

The condition of qualified personnel referred to in this manual shall be at least the condition that meets the standards, regulations and safety laws applied to the installation and operation of this equipment.

Read and retain the *Hardware and Installation Manual* for future reference.

Before assembling the equipment, read all instructions, caution signs and other sections of this manual. Failure to follow these warnings can result in severe electrical shock or death. Pay attention at all times to prevent possible accidents.

In addition to the recommendations in this manual, **local and site-specific safety procedures should be observed.** Additionally, local and national electrical regulations must be followed to avoid personal injury and/or equipment damage.

The electric vehicle charging system may cause an ELECTRICAL DISCHARGE if the instructions indicated on this manual are not followed.

Make sure the equipment is completely disconnected from the power supply and grounded before handling or servicing. Otherwise, there is a risk of electric shock. To avoid electrical hazards, disconnect the input supply, ground the equipment, remove control voltages before performing any tasks, and ensure that busbars are completely discharged. Warning and safety labels must be properly affixed to terminals, cabinets and control panels in accordance with local regulations.

When working on electrical installations, always remember to apply the FIVE GOLDEN RULES:

1. Visible shutdown of all live sources.
2. Mechanical locking of all cutting elements.
3. Verify the absence of voltage by using the appropriate tools for the voltage of the installation.
4. Ground and short-circuit all possible voltage sources.
5. Delimit and mark the work area.

Do not modify the equipment. In case of doing so, Power Electronics will not assume any liability, and the product warranty will be voided.



WARNING



The housing must be properly closed, otherwise it may not adequately protect people or property from any abnormal situation inside the equipment.

Always follow the instructions in the manual to move and position the equipment. The weight of this equipment can cause injuries, serious injuries and even death if not handled correctly.

The output airflow can reach high temperatures that could harm people exposed to it.

Electric shock danger. The steps to isolate the equipment must be carefully followed before performing any task or opening any cover of the equipment. Avoid inappropriate actions that may cause electric shock.

Always wear the appropriate personal protective equipment (PPE) for each task and work in electrical areas with dry hands. Otherwise, you may get an electric shock.

Do not use cables with damaged insulation. Do not subject cables to abrasion, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

Do not supply power to a damaged equipment or with missing parts, even if the installation is complete. Otherwise, you may get an electric shock.

In the event that the equipment stops due to a loss of power, do not do any work on it. The auto-restart function may be enabled and you may receive an electric shock.



The equipment has capacitors. Wait until the capacitors have discharged before performing any maintenance task.

USE

Do not use this equipment for purposes other than the electric vehicle charging with the modes provided for this product and defined in this manual.

Do not disconnect or connect any terminals while the equipment is running. Otherwise, you may get an electric shock and the equipment may be damaged.

Do not use this product if its enclosure or electric vehicle connector(s) (on both the equipment and vehicle sides) are broken, cracked or otherwise damaged. Otherwise, you may get an electric shock.

CONNECTION TO EARTH

Prevention of electric shock:

- The equipment chassis must be properly grounded to prevent a possible electrical shock if a leakage current flows through the enclosure. Disconnect all power supplies before proceeding with maintenance operations inside the equipment.
- Only connect the grounding device to the equipment's grounding plate. Do not use the enclosure or chassis screws for grounding.
- The protective earth wire must be connected first and last disconnected.

**CAUTION**

Install the equipment, on a solid, level surface in a location where there is no risk of explosion, flooding, or impact damage. Follow the recommendations on how to build the foundation of this manual. Otherwise, there is a risk of malfunction and even permanent damage.

Never clean the surfaces or the inside of the equipment with abrasive liquids, solvents or cleaning products that could damage it. Water should not be applied under excessive pressure.



Disconnect the input power in case the equipment gets damaged.
Otherwise, it could result in a secondary accident or a fire.

Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the equipment. Otherwise, a fire or an accident could occur.



After the input power is applied or removed, the equipment will remain hot for a few minutes. Touching internal hot parts could result in skin burns.

EN

IMPORTANT RECOMMENDATIONS FOR CHARGING ELECTRIC VEHICLES:**CAUTION**

Follow at all times the charging process described by the electric vehicle manufacturer.

This device should be monitored when used near children.

Do not handle the vehicle or equipment during the loading process (washing of the vehicle, intervention in the vehicle engine compartment, handling of the loading post, etc.).

Do not modify or interfere with the electrical installation while charging the vehicle.
Failure to do so could result in electric shock.

Do not charge the vehicle in the event of water, signs of corrosion or foreign matter on the charger cable connector or vehicle charging socket. Otherwise, there is a risk of fire and electric shock.

Do not attempt to touch the terminals of the charging station connector cable or the vehicle charger socket, nor insert objects into them. Failure to do so could result in electric shock.

Do not attempt to disassemble, repair, alter or modify the charging connector or any part of the charger. The connector is not a user-serviceable device. Contact Power Electronics.

Always be careful with the charger's cable and connector: treat it carefully, do not crush it, immerse it in water, pull it out, or hit it, etc.

Follow the directions given by the vehicle manufacturer regarding the suitability of charging the vehicle when you or the vehicle are exposed to intense rain, heavy electrical storm or other severe weather.

PERSONAL PROTECTIVE EQUIPMENT (PPE from now on) REQUIRED

The use of PPE in accordance with standards is required to repair and maintain the equipment. Follow applicable instructions at the installation site to comply with national and local regulations.

In the case of tasks with voltage present, it is mandatory to use an Electric Arc Safety Kit (gloves, clothing and face protection).

A detailed example of the PPE used is shown below. The customer must specify in his safety instructions (hazard statement and work procedure) which PPE is required and when and how they should be used according to his electric arc studies, the characteristics of the site, the chargers, the installation and the country.





Power Electronics assumes no liability for damage resulting from improper use of the equipment or failure to comply with local or national regulations.

Always follow local regulations / NEC Health & Safety standards.




The following table shows an example of commonly used PPE:

ITEM	DESCRIPTION
Safety glasses	Eye protection according EN 166.
Electric gloves	Gloves with mechanical, dielectric and against arc flash. Class according to voltage. EN 60903; ASTM D120 specifications and NFPA 70E standards.
Safety footwear	S3 class complying with BS EN ISO 20345.
Insulation carpet	Isolation carpet according to IEC 61111 Class according to voltage.
Safety kit arc flash	Arc flash personal protective equipment kit (including arc flash protective face shield & hard hat), fire resistant 40 cal/cm ² .
Padlock set	Padlock and auxiliary elements set to lock out dangerous equipment.
HI-VIS vest	Fr VIS vest 9 cal/cm ² .
MV stool	Medium Voltage insulation stool.
Rescue pole	Insulated body rescue pole.

PPE FOR INSTALLATION

			
Mechanical gloves	Safety boots	Safety helmet	Safety glasses

Additional PPE for commissioning and maintenance tasks

			
Safety clothes according to NFPA-70E and safety labels			

The following table shows **the protection class type**, depending on the working voltage.

ELECTRICAL INSULATED GLOVES

Class	AC (V _{AC})	DC (V _{DC})
00	500	750
0	1000	1500
1	7500	11250
2	17000	25500
3	26500	39750
4	36000	54000

ELECTRICAL SAFETY MATTING

Class	AC (V _{AC})	DC (V _{DC})
0	1000	1500
1	7500	11250
2	17000	25500
3	26500	39750
4	36000	54000



NOTICE

PPE should be checked according to the manufacturer's instructions.

The electrical gloves must have thermal, electric and mechanical protection. Some models of gloves have the three kinds of protection, so it is not necessary to combine them with more gloves.

If the gloves only have dielectric protection, it is mandatory to use under fireproof gloves and over gloves cover.

EN



NOTICE

RECEPTION

- Electric vehicle chargers are supplied after passing strict performance tests and are carefully packed for shipment.
- In case of damage to the unit during transportation, notify the shipping agency and Power Electronics (International +34 96 136 136 65 57, USA + 1-415-874-3668) or your nearest agent within 24 hours of receipt of the merchandise.

RECYCLING

Packaging equipment must be recycled. Separate all different materials (plastic, paper, cardboard, wood...) and place them in the corresponding containers. Ensure waste collection is properly managed with a Non-Hazardous Waste Agent.



To guarantee health and natural environmental sources protection, the European Union has adopted the WEEE directive concerning discarded electric and electronic equipment (SEEA).

Waste of electrical and electronic equipment (WEEE) must be collected selectively for proper environmental management.

Our products contain electronic cards, capacitors and other electronic devices that should be separated when they are no longer functional. These WEEEs should be managed accordingly with a Hazardous Waste Agent.

Power Electronics promotes good environmental practices and recommends that all its products sold outside of the European Union, once they reach the end of their life, are separated and the WEEE managed according to the particular country applicable legislation (especially: electronic cards, capacitors and other electronic devices).

If you have any questions about the electric and electronic equipment waste, please contact Power Electronics.



NOTICE

CYBERSECURITY DISCLAIMER

This product is designed to be connected to and to communicate information and data via a network interface. Access to the system is restricted to those employees who legitimately need it for reasons of maintenance and/or updating of the system.

It is the customer's sole responsibility for providing and continuously ensuring a secure connection between the product and customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Power Electronics and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

TORQUE AND SCREW SIZING

The following table shows, broadly speaking, the recommended torque for both mechanical and electrical connections, applicable to all cabinets ^[1, 2]:

SCREW SIZE		RECOMMENDED TORQUE			
METRIC (mm)	ENGLISH (in.)	DIN (Nm)		ASTM (ft*lb)	
		6,9 QUALITY ^[a]	8,8 QUALITY ^[a]	A449 TYPE 1 ^[a]	A325 TYPE 1 ^[a]
M3	1/8	1	1,3	-	-
M4	5/32	2,5	3		
M5	3/16	4	6		
M6	1/4	5	8	4	-
M8	5/16	20	20	9	
M10	7/16	40	40	25	
M12	1/2	60	60	38	
M14	9/16	100	120	54	-
M16	5/8	150	210	75	99 – 120

[a] For other qualities, follow the screw's manufacturer guidelines.



CAUTION

For all screwing that holds a **particular component** such as a bus, contactor, etc. it will be necessary to **apply the tightening torque indicated by the manufacturer** of the same component.

Screwing should be tightened correctly only when necessary, i.e. when the factory marks are not in place. For small screws that do not have marks, the good electrical praxis will determine if it is loose.

¹ Power Electronics recommends the use of **Zinc Steel quality 8.8 bolts for internal connections** in general, DC and earth connections included.

² Power Electronics recommends the use of **A2-70 stainless bolts for external connections** in general, AC connections included.

1. INTRODUCTION

1

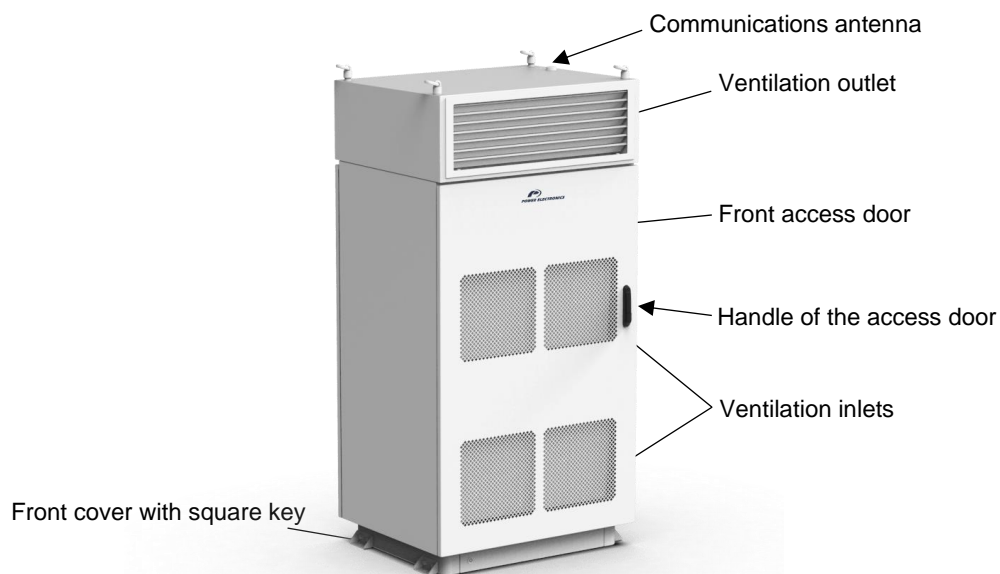
The Power Electronics' **NBi 180 power cabinet** is a robust and modular high power EV charger designed with a flexible architecture to be able to fit at any location. The charging solution consists of a power cabinet with low voltage input, which can supply energy to Dispensers and pantographs.

With a power range from 60 kW to 180 kW, and the possibility of parallel connection of the power units¹, it can be easily power-scalable to follow EV market growth over time. NBi 180 is the best solution for EV fleet management and to maximize the revenue generation. It can charge simultaneously up to three vehicles and up to four sequentially (DC charge).

With an extended full power voltage range², NBi 180 is a future-proofing solution able to support both standard and HV battery packs, with voltage ranges between 150 Vdc and 1000 Vdc, working between 300 Vdc and 1000 Vdc at maximum power.

By making use of smart user-friendly features, such as Smart Fleet Management and Smart Power Balance, and its small footprint, NBi 180 is the best solution for sites that require the combination of flexibility, high power and innovation.

The following image shows the equipment's main parts:



Note: To open the access door, turn the handle 90° clockwise. Likewise, to close the access door, turn the handle 90° counterclockwise.

¹ If the project includes more than one power cabinet, consult Power Electronics.

² Please notice the NBi 180 range includes the power cabinets NBi 60 / NBi 90 / NBi 120 / NBi 150 / NBi 180.

Advanced charge functionalities

Smart Fleet Management (optional)

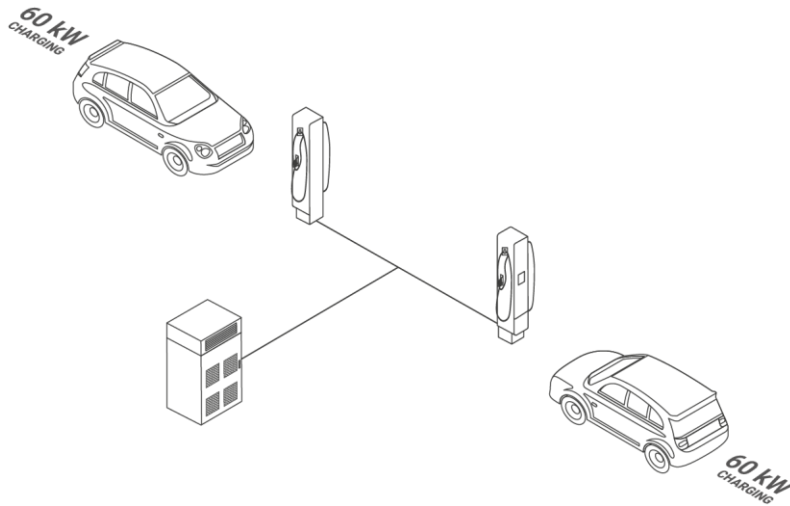
This functionality has been designed to minimize the initial investment and operation costs.

It is able to balance the power based on the number of charging posts in use. Therefore, the total power required to supply the total energy gets substantially reduced, representing a cost reduction in the electrical facility infrastructure and a cost saving due to a minor power contracted. Besides, the hardware and the back-office communication is optimized.

Smart power balance technology (optional)

The power cabinet allows the optimization of the use of the charging point and dynamic balancing of the power depending on the vehicle to be charged.

Configuration example: NBi 120 with two charging Dispensers of 120 kW.



EN



NOTICE

The Smart Fleet Management is an optional functionality, it must be ordered by the customer for each specific project.

The Smart power balance is an optional functionality, it must be ordered by the customer for each specific project.

Sequential charge (optional)

Daisy chain is an optional configuration designed for sequential charge. It consists in the serial connection of the industrial posts, connected to the same DC output of the NB station or power cabinet. The operating principle of this configuration is to supply all the energy to the first post until the end of the charge, and then supply the energy to the second post and so on. Daisy chain can also be used for auxiliary services connection.

One of the most interesting advantages of using this configuration is that it reduces the amount of cable required, thus contributing to a cost reduction.

Refer to the documentation of the project to obtain more information about the connections between the post and the station.

Open door detection

Door contact switches are used in order to recognize if the front access door of the power cabinet is open. If it is detected that the door is open, ongoing charging sessions will be immediately stopped.



WARNING

The power cabinet door must be correctly locked after installation, service or repair operations.

Power retrofit (optional)

The power retrofit uses modular technology. It allows the NBi 180 power cabinet to be easily power-scalable adding power modules to support EV fleets growth or to follow the increase in EV market size over time.



NOTICE

The power retrofit is an optional functionality, it must be ordered by the customer for each specific project.

It is the customer's responsibility to consider the cable cross-sections for the maximum power to be installed in the future.

Regulatory framework

The **NBi 180 power cabinet** is a device that is connected to the AC low-voltage network and provides a DC power supply at a variable voltage of 150 V to 1000 V¹ for charging electric vehicles.

Its certification as a product in accordance with current Spanish and UL legislation is carried out through the evaluation, where applicable, of compliance with the following standards:

- **IEC 61851** - Conductive charging system for electric vehicles
 - Part 1: General requirements.
 - Part 23: DC charging station for electric vehicles.
 - Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging.
- **IEC 61000** - Electromagnetic compatibility (EMC)
 - Part 6-2: Generic standards. Immunity standard for industrial environments.
 - Part 6-3: Generic standards. Emission standard for residential, commercial and light industrial environments.
- **UL 2202**: Electric Vehicle (EV) Charging System Equipment.
- **IEC 61851-21-2:2021** - Electric vehicle conductive charging system.
- **NEC - Article 625**: Electric Vehicle Charging Systems.
- **FCC part 15 - class A**: Unintentional radiators - Industrial application.

¹ CHAdeMO up to 500 V.

2. TECHNICAL CHARACTERISTICS

2

Depending on the regulation to be followed, the equipment will fulfill different technical characteristics.

NBi 180 Power Cabinet – IEC

REFERENCE		NBi0600 H NBi060S H	NBi0900H NBi090SH	NBi1200 H NBi120S H	NBi1500 H NBi150S H	NBi1800 H NBi180S H
DC OUTPUT	Maximum power [kW]	60	90	120	150	180
	Voltage range [V]	150 – 1000 ^[1]				
	Maximum simultaneous charging points	1	2	2	3	3
	Maximum sequential charging points	4				
AC INPUT FOR DC OUTPUT	Power [kVA]	63	95	126	158	189
	Voltage [V]	400 (3ph + N + PE) ± 10 %				
	Power factor	> 0.99				
	Frequency [Hz]	50 / 60				
	Efficiency	95 %				
	Protections	Surge arrester Type 2 (optional)				
		DC charge: MCB + RCD Type A (optional)				
	Others	Smart Fleet Management (optional)				
		Smart Power Balance (optional)				
	Enclosure / foot color	White (RAL 9016) / Grey (RAL 7016)				
	Customization ^[2]	Enclosure / Foot				
	Degree of protection	NEMA 3R IP54 IK10 (IK08 for ventilation grilles)				
	Operating temperature range	From -30°C to 50°C				
	Relative humidity	From 4% to 95%				
Maximum altitude (above sea level)	Without derating: 2000 m. Max: 3000 m					
Communications	Ethernet (10/100) + Wi-Fi					
	Cellular data: 4G, 3G, GSM					
Charge protocols	Autocharge, ISO 15118, CHAdeMO 1.1, IEC 61851, OCPP 1.6J, DIN 70121					
Dimensions (WxDxH) [mm]	1000 x 800 x 2000					
Regulation	IEC 61851-1, IEC 61851-23, IEC 61851-24, IEC 61851-21-2					

Notes:

Power Electronics is not responsible for the power cabinet's input power connection, nor its installation.

[1] 150 - 500 Vdc for CHAdeMO. Maximum power from 300 V.

[2] Consult Power Electronics for more information.

EN

NBi 180 Power Cabinet – UL

REFERENCE		Nbi0600U Nbi060SU	Nbi0900U Nbi090SU	Nbi1200U Nbi120SU	Nbi150 0U Nbi150 SU	NB 1800U Nbi180SU
DC OUTPUT	Maximum power [kW]	60	90	120	150	180
	Voltage range [V]	150 – 1000 ^[1]				
	Maximum simultaneous charging points	1	2	2	3	3
	Maximum sequential charging points	4				
AC INPUT FOR DC OUTPUT	Power [kVA]	63	95	126	158	189
	Voltage [V]	480 (3ph + N + PE) ± 10 %				
	Power factor	> 0.99				
	Frequency [Hz]	60				
	Efficiency	95 %				
	Protections	Surge arrester Type 2 (optional)				
		DC charge: MCB + RCD Type A (optional)				
	Others	Smart Fleet Management (optional)				
		Smart Power Balance (optional)				
	Enclosure / foot color	White (RAL 9016) / Grey (RAL 7016)				
	Customization ^[2]	(optional)				
	Degree of protection	NEMA 3R IP54 IK10 (IK08 for ventilation grilles)				
	Operating temperature range	From -22°F to 122°F				
	Relative humidity	From 4% to 95%				
	Maximum altitude (above sea level)	Without derating: 6561 ft. Max: 9842 ft				
Communications	Ethernet (10/100) + Wi-Fi					
	Cellular data: 4G, 3G, GSM					
Charge protocols	Autocharge, ISO 15118, CHAdeMO 1.1, IEC 61851, OCPP 1.6J, DIN 70121					
Dimensions (WxDxH) [ft]	3.28 x 2.63 x 6.56					
Regulation	UL 2202, NEC 625, FCC Part 15 Class A					

Notes:

Power Electronics is not responsible for the power cabinet's input power connection, nor its installation.

[1] 150 - 500 Vdc for CHAdeMO. Maximum power from 300 V.

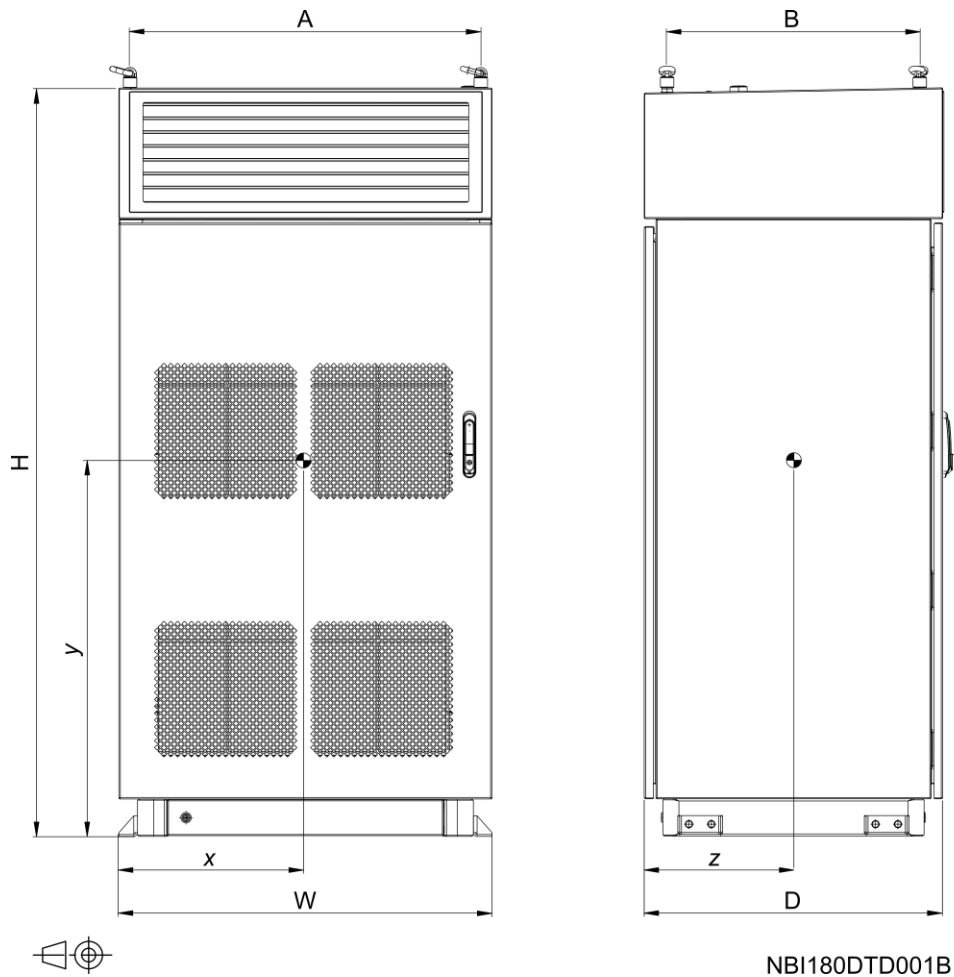
[2] Consult Power Electronics for more information.

3. DIMENSIONS AND WEIGHT

3

The dimensions, gravity center and the weight of the **NBi 180 power cabinet** are detailed in this section.

The front and left view, from left to right, are shown below:



NBi180DTD001B

	GENERAL DIMENSIONS					CENTER OF GRAVITY		
	W	H	D	A	B	x	y	z
mm	1000	2000	800	940	677	495	1005	401
in.	39.37	78.76	31.5	37	26.65	19.49	39.57	15.79

The approximate weight for the NBi 180 power cabinet is 400 kg (63 st)¹.

¹ For other equipment of the NBi 180 range, consult Power Electronics.

4. HANDLING AND TRANSPORTATION

4



CAUTION

Read carefully the following transportation and installation instructions.

Failure to follow transportation and installation instructions could result in damage to the equipment or injury to people.

Reception

The equipment is delivered perfectly packed and checked. Upon receipt, inspect the equipment. In the event of damage to the equipment, notify the logistics agent and Power Electronics 902 40 20 70, (International +34 96 136 65 57), or your nearest agent within 24 hours of receipt. Verify that the goods received correspond to the delivery note, models and serial numbers.

Standard storage

Whenever possible, the equipment should be unloaded at its place of installation and operation.

If it is necessary to store the equipment, it must be kept in its original packaging and the following rules must be followed to keep it in proper condition:

- Store the equipment in a place protected against harmful elements such as animal entries, excess moisture (inside and outside the equipment), thermal radiation, direct solar radiation, contact with chemicals, corrosive gases, etc.
- Store the equipment on a flat, level surface. Never rest the equipment on wooden beams.
- Store equipment away from passageways where it may be damaged.
- Keep the covers on during storage.
- Keep the equipment packed until the time of installation.
- The temperature in the storage location must be between -40°C y +60°C and the relative humidity at <95% without condensation.



NOTICE

Standard storage is defined as the expected time period from the time the equipment arrives at its location until its commissioning occurs. It is assumed that this period is less than 6 months. This period is variable according to the weather conditions of the site.

Customer is responsible of deciding if the equipment are installed within the standard period or otherwise, the installation date is to be defined. In this case, customer must take the appropriate measures.

Extended storage

If the equipment is stored for an extended period of time before installation for an undefined date, new considerations should be taken, in addition to the recommendations in the previous section "[Standard storage](#)":

- The equipment shall be protected under cover, by means of an external protector or by the method adapted to the local conditions which prevents condensation and humidity inside the equipment.
- Draining bags shall be included inside the equipment to prevent moisture from damaging electronic components. These shall be replaced when storage conditions require it.
- A clearance shall be left around the equipment so that inspections can be undertaken.
- Periodic inspections should be performed when possible. Proper internal cleanness must also be checked.



WARNING

Tasks shown above are standard and **they are not applicable to all weather conditions**. In those plants where customer considers extreme weather conditions, these requisites should be adjusted for each particular case, as well as the maximum storage time for these conditions.

Unpacking

During the unpacking, remove carefully the packaging (do not use sharp tools). After removing the packaging, check the material inside. If you receive replacement parts with the product, please separate and store them in a safe place. They should not be exposed to vibrations, falls or moisture.



NOTICE

Waste disposal is customer's responsibility and it is **not within Power Electronics' scope**.

Handling and transportation

CAUTION

Follow the handling and transportation requirements described here. Any other method of transport or handling could damage the unit or void the warranty.

During handling and transport, the goods must not be exposed to moisture, overturned, inverted, inclined or impacted.

The elevation angle should be less than 90°.

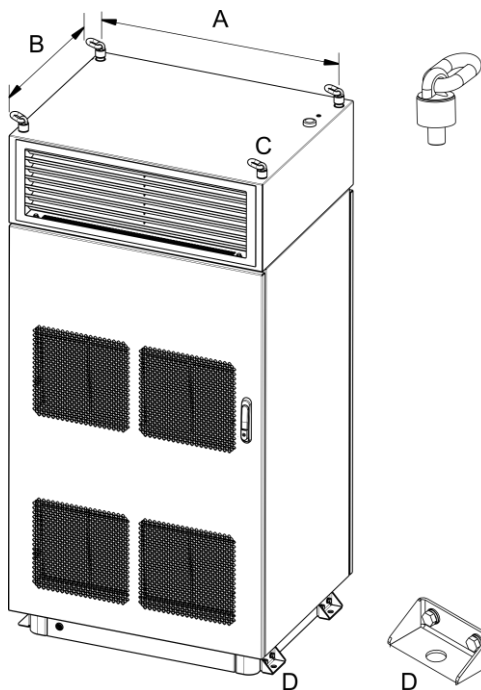
Avoid sudden movements and jerking during lifting. Stop the load just before placing it on the ground and then lower the equipment slowly to avoid knocks. Otherwise, the equipment may get damaged.

The equipment has a lifting tool with hoist rings located at the upper part of the tool. To lift them, slings must be attached to each ring. Also, the slings must be firmly attached to the crane.

The equipment is packed assembled vertically, in a cardboard box and fixed on a pallet base with screws at four steel brackets. Externally the box is strapped and shrink-wrapped.

The equipment is ready to be handled by forklift truck and be transported by truck or container. Keep in mind the load distribution and center of gravity.

For handling, the equipment has four lifting rings at the top. The image below shows the location of the four lifting points.



NBI180DTG002B

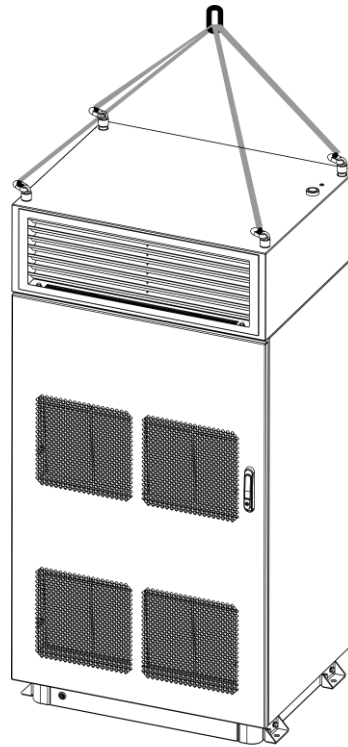
GENERAL DIMENSIONS

	A	B
mm	940	677
in.	37	26.65

REF	DESCRIPTION
C	Lifting ring
D	Steel bracket for base fixation

Be aware of all caution and warning messages before lifting the equipment.

To lift the equipment, a sling or a chain must be attached to each ring and securely fastened to the crane. The following image shows an example of lifting the equipment with slings:



NBi180DTG003B



NOTICE

If the methods described here cannot be applied, please contact Power Electronics.

It is the customer's responsibility to ensure unhindered access of vehicles to the final site or location, taking into account their movement and handling at the unloading site.

It is important to keep the equipment in the packaging and place it as close as possible to the final location for installation.

Ensure that loading / lifting equipment has a greater capacity than the weight of the equipment plus the auxiliary elements and the loading / lifting task is carried out in a way that ensures the stability of the equipment.

5. PREPARATION FOR INSTALLING THE EQUIPMENT

5

Site recommendations

When deciding the location of the equipment and planning its installation, it is recommended to follow a series of guidelines derived from its characteristics.



CAUTION

To guarantee proper electrical installation, it is very important to comply with the bend radius of the cable. The customer must ensure the cables enter the equipment perpendicularly and the spacing between them is appropriate.

Avoid corrosive environments that may affect the equipment's proper functioning.



NOTICE

The instructions given in this section must not replace in any way the mandatory regulations of the country in which the equipment will be installed.

Prior to installation, a geotechnical study of the terrain where the equipment will be installed must be carried out to determine its characteristics and to decide the most suitable type of foundation.

It is the customer's responsibility to design and build concrete foundations with the necessary piping and ground network in accordance with the applicable regulatory requirements.

Proper installation is absolutely necessary and it is not within the scope of the manufacturer's responsibility.

Soil

The soil should have the following characteristics:

- The soil must be dry, compacted, stable and homogeneous.
- The land will be gravel, ballast or pebbles.
- Do not install on floodplains, neither in places where objects can fall on.
- The land should be provided with a drainage system, especially in locations with high water tables and / or heavy rainfall.
- It is recommended that the ground should not exceed the level of the foundation.
- Maximum permissible ground pressure of 150 kN/m².
- Soil compaction degree of 98%.
- Maximum land unevenness of 0.25%.
- It must not be a direct place of passage so that the load cables do not interrupt the movement of pedestrians or traffic.

Base site

Power Electronics recommends making a concrete foundation slab to support the equipment. The support surface for the equipment must be perfectly level. **The client is responsible for the correct dimensioning and construction of the foundation in accordance with current regulations.** The foundation must meet the following characteristics:

- It is recommended to install a layer of cleaning concrete between the ground and the foundation.
- The sizing should be appropriate for the weight of the equipment and the characteristics of the soil.
- It must be thick enough to support the equipment.
- It must have trenches wide enough to ensure proper wiring passage.
- It is advisable to leave the slab at the same level as the ground to facilitate maintenance works.
- If the slab is above ground level, the maximum height allowed is 200 mm (7.87 in.).



NOTICE

The client is responsible for building a solid concrete base perfectly leveled and elevated with respect to the user's floor height.

The equipment is not designed for mobile installations. In case of installing the equipment over a mobile platform, the warranty may be voided.

For further information on this kind of applications, please contact Power Electronics.

In case of specification of variable actions such as snow, wind or earthquake, the slab must comply with the following requirements, **not being excluded those indicated by the specific regulations of the country of installation:**

- Ability to withstand compression forces of 25 N/mm².
- Steel reinforcement capable of withstanding tensile forces of 500 N/mm².
- Taking into account severe wind conditions (60 m/s), the reinforcement should be dimensioned as follows:
 - The longitudinal side of the reinforcement must be able to withstand forces of up to 80 kN.
 - The transverse side of the reinforcement must be able to withstand forces of up to 10 kN.

Note that the thickness of the slab must be determined from the results of the geotechnical study.

See anchor recommendations at the "[Anchoring of the equipment](#)" section.

Minimum working distances



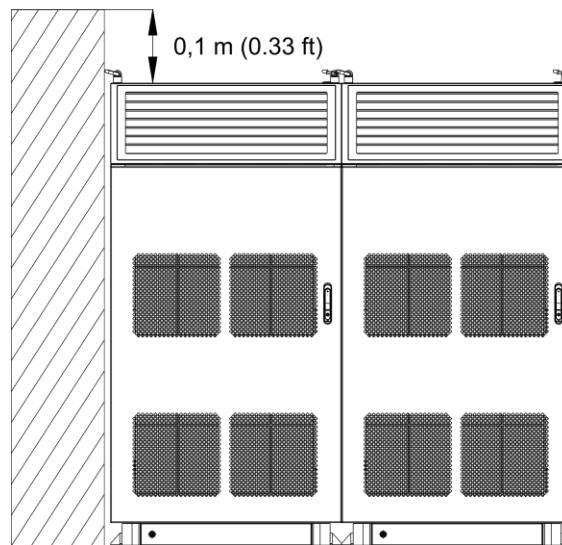
CAUTION

When installing the equipment, keep the minimum safety distances. Be aware of all the minimum insulation requirements established by the applicable electrical code, as well as the thermal, safety and accessibility requirements. The safety distances given in this section must not replace in any way the mandatory regulations of the country in which the equipment will be installed.

Power cabinets can be mounted back to back, against a wall or side by side. For proper inspection and ventilation, as well as correct handling, it is important to leave the following clearance distances:

Side to side distance: The equipment does not require any side to side space.

Top side space: The equipment requires 0,1 m (0.33 ft) top side space.



NB180DTD005A

Front side distance: The equipment requires 2 m (6.56 ft) free front space to access it, operate and open the door properly.

Rear side distance: The equipment does not require any rear space, as it does not include any door, access or ventilation grill.

Please notice that, besides the recommended clearance distances indicated above, the maximum distance between the power cabinet and the Dispenser must also be taken into account. For more information, please refer to "[Communications](#)" section.

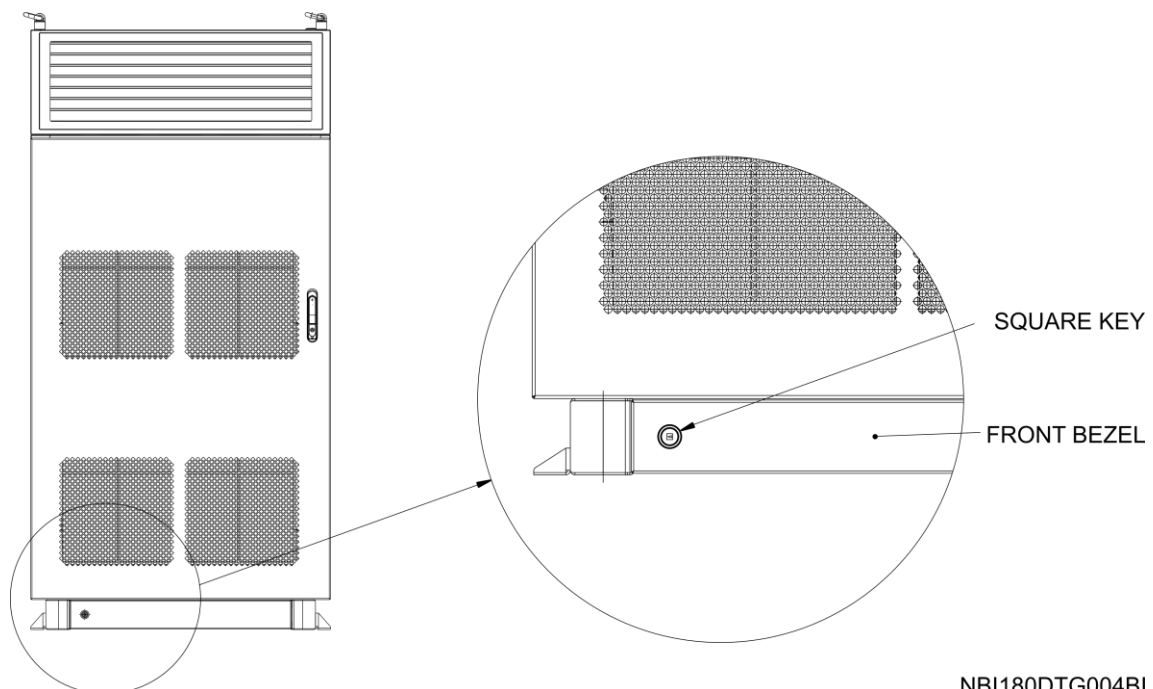
Anchoring of the equipment

NOTICE

It is the customer's responsibility to dimension correctly equipment anchoring to the foundation, guaranteeing stability towards horizontal actions.

The equipment must be anchored to a solid and leveled surface (slab), see slab recommendations at the "[Base site](#)" section.

To anchor the equipment, customer must access the lower part. For this, the front and rear bezel must be removed by using a square key.



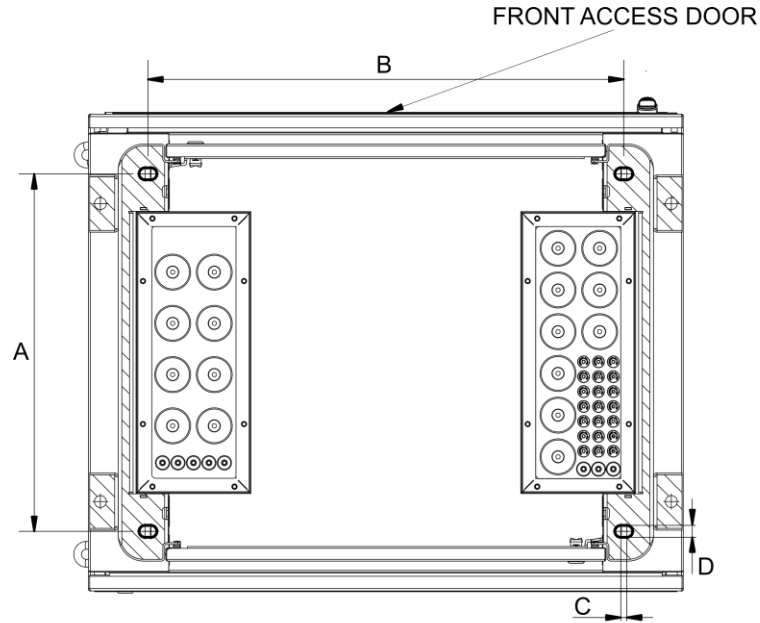
The equipment has two anchoring options, depending on the mounting needs. The location and diameter of the equipment's anchoring holes for each option are described below.

For both options, it is recommended to use M16 (5/8") A4-70 stainless screws for high load solicitations, being accepted both expansive anchor bolts and chemical. Please, secure them applying the recommended torque for mechanical connections.

EN

Option 1

Equipment anchoring using the **four internal holes**, with the following dimensions (bottom-up view).



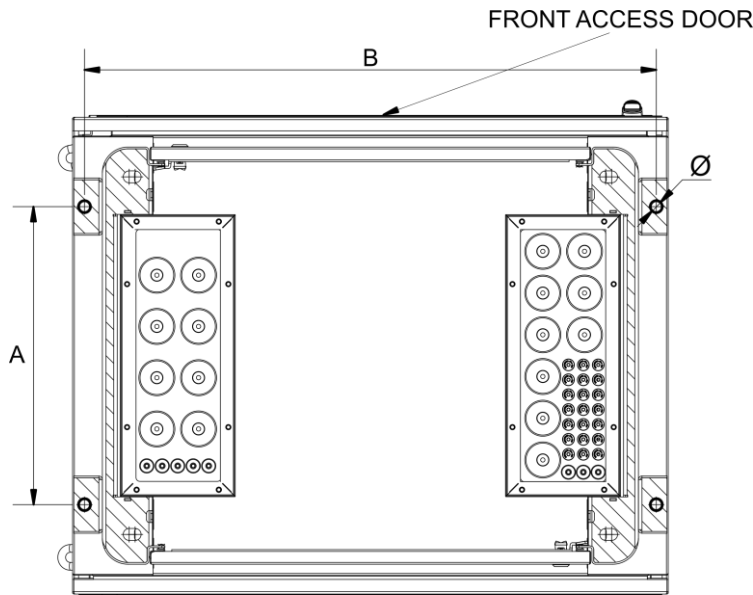
NBI180DTD003BI

ANCHORING DIMENSIONS – OPTION 1

	A	B	C	D
mm	600	800	10	20
in.	23.62	31.5	0.39	0.79

Option 2

Equipment anchoring using the **four external holes**, with the following dimensions (bottom-up view).



NBI180DTD004BI

ANCHORING DIMENSIONS – OPTION 2

	A	B	Ø
mm	500	960	20
in.	19.69	37.8	0.79

Ventilation system



CAUTION

Special care must be taken to ensure that there are no external elements near the air inlets and outlets that prevent proper ventilation of the equipment.

The power cabinet has a forced air ventilation system. There are four air inlets located in the middle and bottom of the door and one outlet at the top.

**EN**

6. CABLE ACCESS AND CONNECTIONS

6



WARNING

Before opening any door, the equipment must be completely isolated, without any tension. Make sure to follow the insulation guidelines and all safety instructions indicated in the "[Safety instructions](#)" section. Please use all the indicated PPE.

Otherwise, you may get an electric shock.

During the connection, you must ensure the proper cable installation in the terminals of the equipment so that there are no voltage parts accessible in this wiring and the polarity is respected.



CAUTION

To guarantee proper electrical installation, it is very important to comply with the bend radius of the cable. The customer must ensure that the trenches are deep enough and consistent with the section "[Site recommendations](#)".



NOTICE

Refer to the recommended tightening torque for mechanical and electrical connections in the "[Torque and screw sizing](#)" section.

Power Electronics is not responsible for damages resulting from an incorrect connection.

The dimensioning of the input and output power cables of the charging point must be checked by a qualified electrician. The customer is responsible for the correct sizing and execution of the corresponding connections in accordance with the regulatory requirements applicable in the country of installation.

The customer is responsible for choosing and installing the communication cables between the different power cabinets of the project and the Dispenser.

The customer is responsible for the correct sizing and execution of the corresponding ground networks in accordance with the regulatory requirements applicable in the country of installation.

Power, ground, auxiliary and communication cables are not included within Power Electronics' scope.

MATERIAL WITHIN CUSTOMER'S RESPONSIBILITY:

The following cables and elements are not provided by Power Electronics, they are customer's responsibility.

- AC input power cables and terminal lugs (as applicable).
- Ground input cable and terminal lug to site local ground system (as applicable).
- +/- DC power cables and terminal lugs to each Dispenser or pantograph (as applicable).
- Ground cables and terminal lugs to each Dispenser or pantograph (as applicable).
- MV switchgear wiring terminals (as applicable).
- Auxiliary power supply cable to each Dispenser or pantograph (as applicable).
- Control optical fiber to each Dispenser or pantograph (as applicable).
- Ethernet cable (CAT5e or CAT6) with RJ45 terminals to each power cabinet and Dispenser (as applicable).

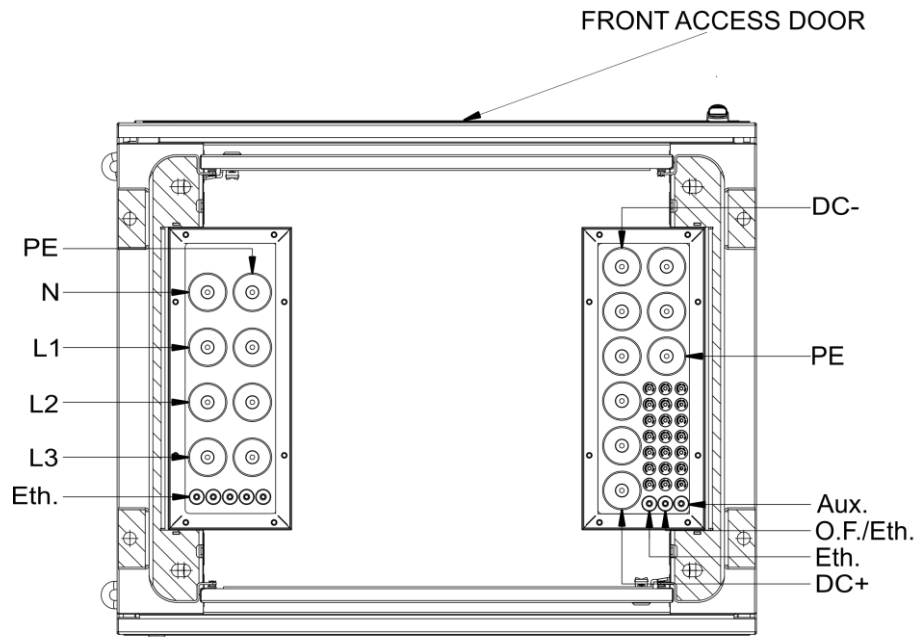
Several factors can influence the choice of cable, including the distance between the distribution board and the power cabinet, the maximum input current and the installation mode.

Access

The power and communication cables can enter through the bottom part of the equipment.

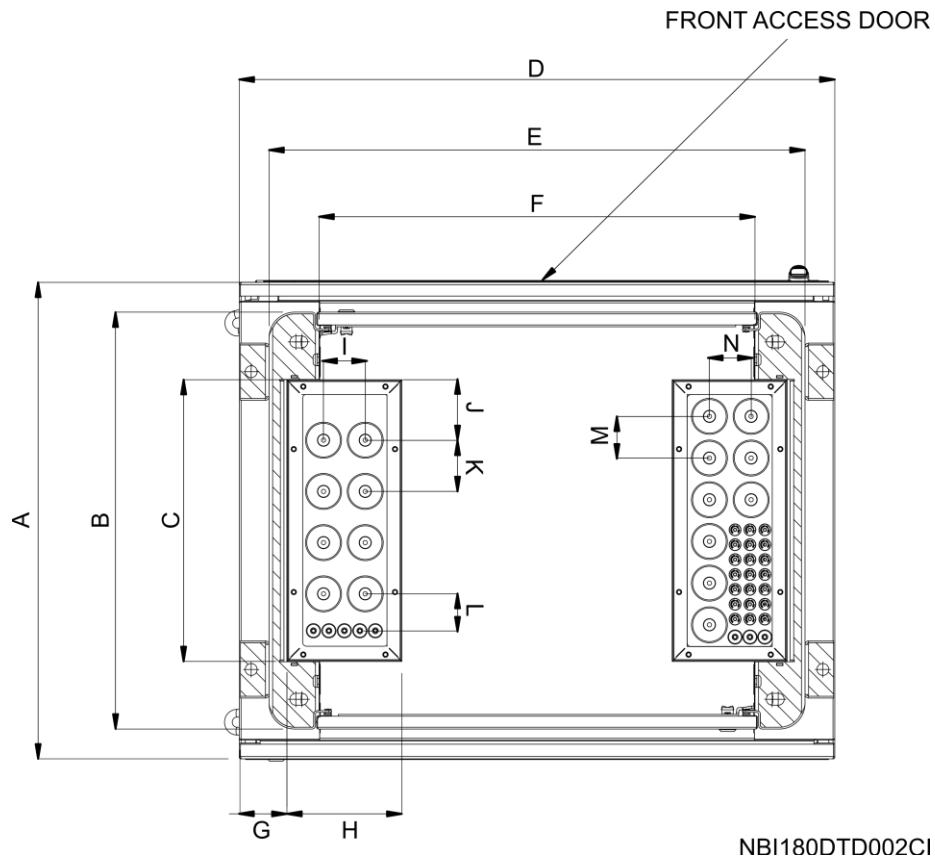
To access the lower part, remove the front and rear bezel, see "[Anchoring of the equipment](#)".

The power and communication cables enter and exit through the lower part of the power cabinet by using the space shown in the following figure (bottom-up view):



NBi180DTG001CI

Access dimensions are detailed in the following figure (bottom-up view):

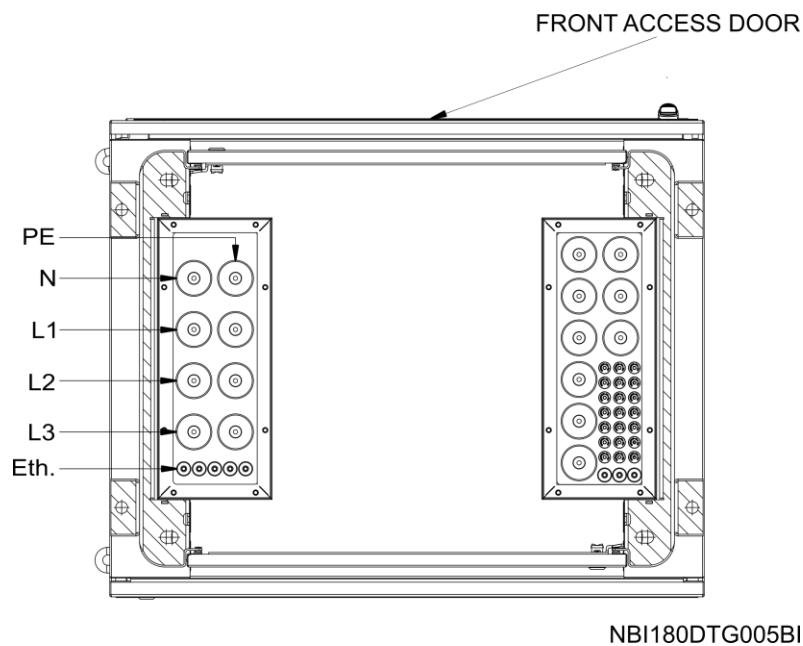


BOTTOM DIMENSIONS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
mm	800	700	473	1000	900	732	80	193	70	101,5	86	62	70	70
in.	31.5	27.56	18.62	39.37	35.43	28.82	3.15	7.6	2.76	4	3.39	2.44	2.76	2.76

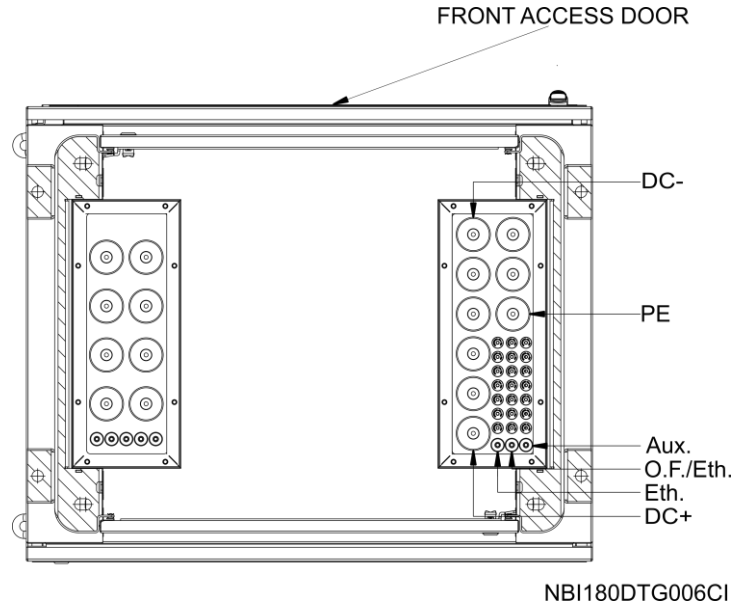
Cable access plate

The following image shows the standard cable entry plate. Only the amount of cable glands needed for the project must be used. See the following figure (bottom-up view):



Cable output plate

The cable output plate allows power connections to be made to another equipment, to a charging post or to a pantograph. See also section [Parallel connection of power cabinets](#). These connections are: Power (DC+, DC-), ground, optical fiber and Ethernet communications. See the following figure (bottom-up view):



Note: Use only the amount of cable glands needed for the project.

NOTICE

For the entry of the power cables of the equipment, an additional vertical wiring space below the cable gland plate may be required to allow the correct alignment of the cables. It is recommended to construct a small vault or pit in the foundation under the gland plates. This construction should not interfere with the anchoring of the charger.

Connections

This section details the input and output connections that must be performed in the equipment.

There are several factors that can influence the choice of cable, including the distance between the distribution board and the Dispenser, the maximum input current and the installation mode.

NOTICE

The dimensioning of the cables must be checked by a qualified electrician. The customer is responsible for the correct sizing and execution of the corresponding connections in accordance with the regulatory requirements applicable in the country of installation.

To guarantee proper insulation, it is very important the cable diameter is within the tolerable range of the cable gland.

The power cables and RJ45 connector must be inserted into the equipment without crimping the terminal, or they will not be able to pass correctly through all the expected spaces. Forcing them could affect the sealing of the equipment.

The cable terminals can be either single / standard or double / long crimp barrel length depending on the requirements of the project. The installer must consider the bending radius of the input power connections when performing the crimping.

The AC connection is composed of three phases, ground wire and the neutral wire. The DC power connection exit from power cabinet to Dispenser is composed of DC+/DC- and ground wire. Both, the power supply input / output and the communication connections input / output will be introduced through one of the accesses and will pass through their corresponding space in the internal cable entry plate to reach the connection panel.

AC input power connections

Cable size:

The tables below show the input rated current for IEC / UL, as well as the recommended cable size for the equipment. Installer must dimension the wiring taking into consideration the minimum and maximum diameter, as well as the particularities of the project:

	INPUT RATED CURRENT UL	INPUT RATED CURRENT IEC
NBi060	79	94
NBi090	117	140
NBi120	155	186
NBi150	194	232
NBi180	232	278

INPUT POWER SUPPLY (L1, L2, L3)

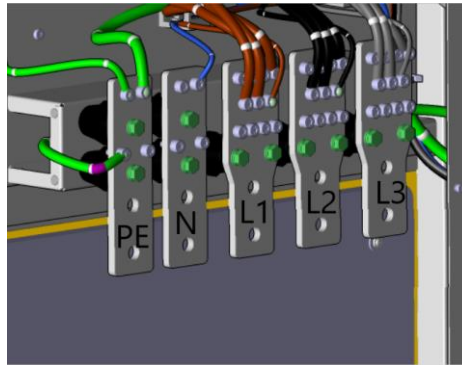
	RECOMMENDED SECTION	CABLE GLAND	MINIMUM DIAMETER	MAXIMUM DIAMETER
NBi060	70 mm ² (2/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi090	95 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi120	120 mm ² (4/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi150	150 mm ² (250 kcmil)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi180	2x120 mm ² (2x4/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)

GROUND AND NEUTRAL (PE, N)

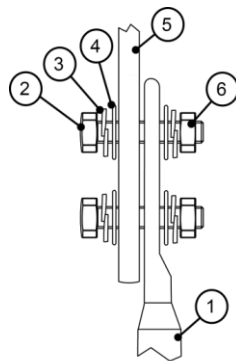
	RECOMMENDED SECTION	CABLE GLAND	MINIMUM DIAMETER	MAXIMUM DIAMETER
NBi060	50 mm ² (1 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi090	50 mm ² (1 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi120	70 mm ² (2/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi150	95 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi180	120 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)

EN

Connections:



The following figure shows the correct connection:



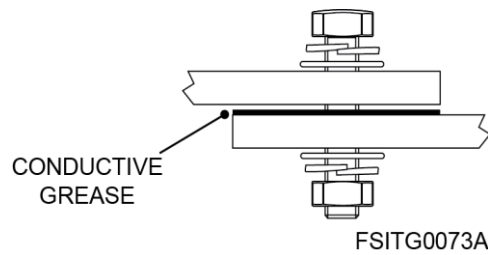
FSITG0053B

REF.	ELEMENT
1	Terminal lug
2	M12 (1/2") bolt
3	Spring washer
4	Fender washer
5	Plate
6	M12 (1/2") nut

Note: If the terminal is a single-hole terminal, it is recommended to connect it to the upper hole in the busbar, so that the contact area is maximized.

The ground plate is made of tin plated aluminum. The following recommendations must be taken into account for the correct ground connection:

- Before connecting the cable, clean the contact surfaces with a clean cloth and ethanol cleaner. Once cleaned, apply conductive grease.
- It is recommended to use Ø11 mm (7/16") copper, aluminum or copper-clad aluminum terminal lugs with a maximum width of 45 mm (1-3/4").
- Use M10 (7/16") bolts and nuts and apply the recommended torque according to the quality (See "[Torque and screw sizing](#)").
- Use a spring washer and a fender washer between the nuts or bolts head and the busbar or terminal lug.



DC output power connections

Exit from power cabinet to charging posts or pantographs.

Cable size:

The tables below show the output rated current for IEC, as well as the recommended cable size for the power cabinet to charging posts or pantographs. Installer must dimension the wiring taking into consideration the minimum and maximum diameter, as well as the particularities of the project:

OUTPUT RATED CURRENT IEC

NBi060	200
NBi090	300
NBi120	400
NBi150	500
NBi180	600

OUTPUT POWER SUPPLY (DC+/DC-)

	RECOMMENDED SECTION	CABLE GLAND	MINIMUM DIAMETER	MAXIMUM DIAMETER
NBi060	150 mm ² (300MCM)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi090	150 mm ² (300MCM)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi120	150 mm ² (300MCM)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi150	150 mm ² (300MCM)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi180	150 mm ² (300MCM)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)

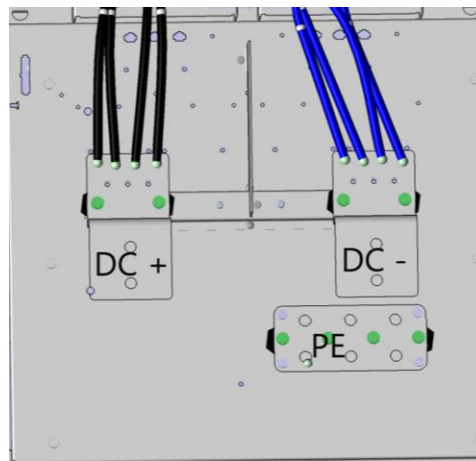
GROUND (PE)

	RECOMMENDED SECTION	CABLE GLAND	MINIMUM DIAMETER	MAXIMUM DIAMETER
NBi060	70 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi090	70 mm ² (2/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi120	70 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi150	70 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)
NBi180	70 mm ² (3/0 AWG)	M50 (2")	27 mm (1.06 in.)	35 mm (1.38 in.)

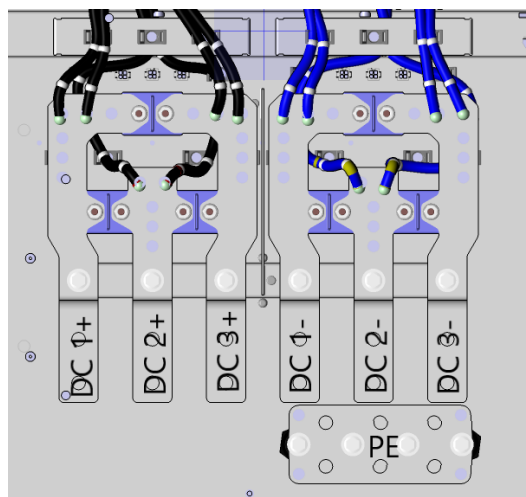
Connections:

The DC output power connections (DC+/DC-, PE) are directly connected to the Nema 2-hole lug, as shown in the following images.

DC connection when there is one charging posts or pantograph connected:



DC connection when there is more than one charging posts or pantograph connected:



EN

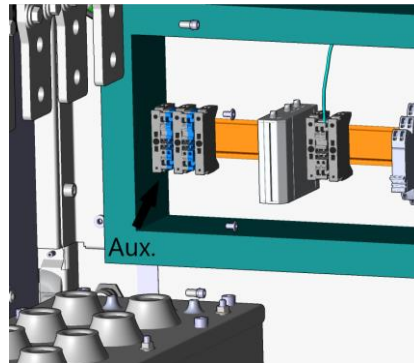
AC output auxiliary connection

Exit from power cabinet to Dispenser.

Recommended cable size: 2 x 2.5 mm² / 2 x 14 AWG.

Maximum cable diameter: 7 – 10 mm² (cable gland M16).

Connection:



Communications connection

Output connections from power cabinet to other power cabinets and towards the Dispenser can be either Ethernet + optical fiber or optical fiber.

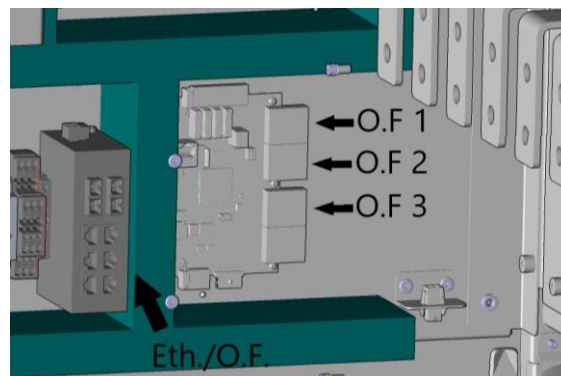
Optical fiber (GOF): For power control communications.

- **Recommended cable size:** duplex multi-mode OM3 (50/125 micron) 2 x SC Connectors.
- **Maximum cable diameter:** 4 – 8 mm² (cable gland M12).

Ethernet or optical fiber (GOF): For high level communications protocols. By default, it is done through Ethernet, but it is possible to change it to optical fiber¹.

- **Recommended cable size:** Ethernet CAT 5E UTP - RJ45 Connection Switch. Or, if the customer requested this option, optical fiber (GOF) duplex multi-mode OM3 (50/125 micron) 2 x SC Connectors - optional.
- **Maximum cable diameter:** 4 – 7 mm² (cable gland M12).

Connections: The following image represents the place where Ethernet switch is installed. Location may vary according to the project.

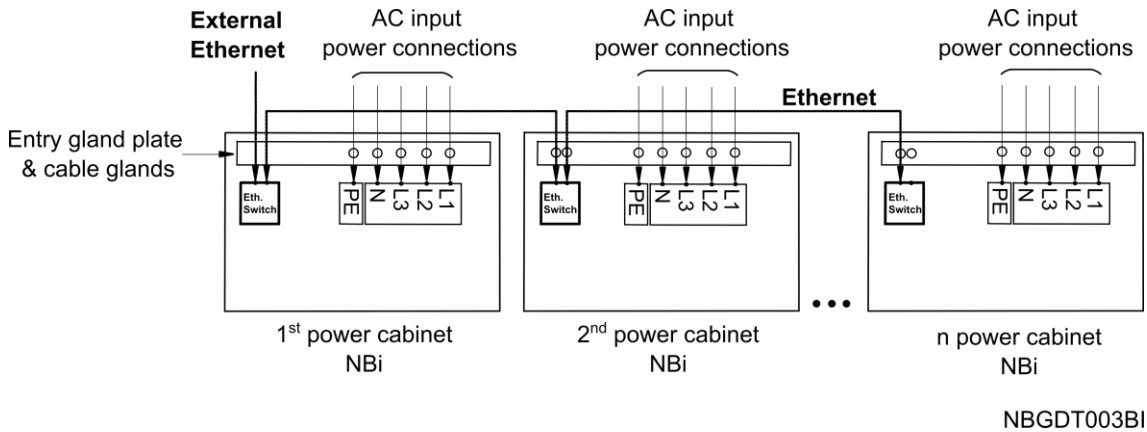


In the power cabinet, the customer must carry out the communications connection. The equipment includes an Ethernet entry connection for internet connection and continuous monitoring by OCPP1.6

¹ Upon request. Please contact Power Electronics in case of requiring this option.

requirements. The connection can be made on any free port of the internal Ethernet switch with a RJ45 connector, entering the cable through the corresponding cable gland entry.

If the project includes more than one power cabinet and the customer requires control of the different power cabinets, the customer will have to make the Ethernet connections between the different power cabinets, as described in the following image:



Next, the connections to be made when three equipment are connected in parallel are shown below.

Parallel connection of power cabinets

Power Electronics power cabinets can be connected in parallel to provide a common power output to a charging post or to a pantograph.

Parallel communication connections between power cabinets are made with CAN bus cables and open door signal. The cables required to make the connections are:

CAN Bus:

- **Recommended cable size:** cable twisted pair 1x 2 x 0.34 mm² with ferrule terminal.
- **Maximum cable diameter:** 4 – 8 mm² (cable gland M12).

Open door signal:

- **Recommended cable size:** 1 x 2 x 1 mm² with ferrule terminal.
- **Maximum cable diameter:** 4 – 8 mm² (cable gland M12).

Next, it is detailed the diagrams for connecting two and three equipment in parallel, the location of the terminals of the communication connections and their cable glands.



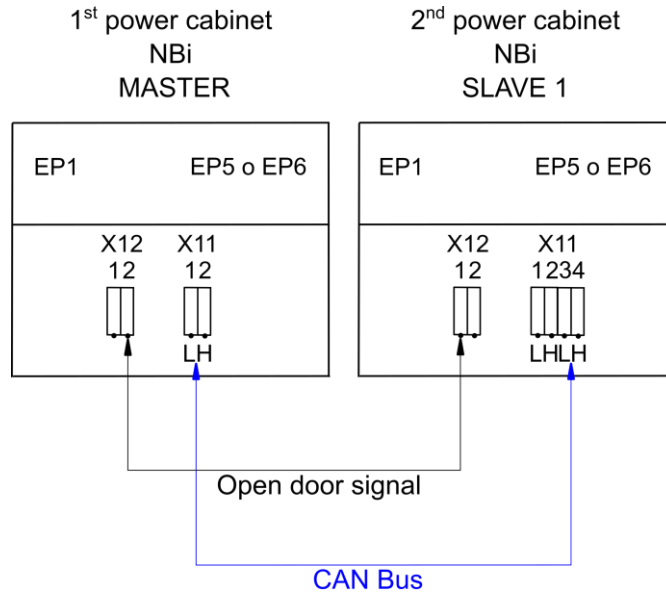
NOTICE

Consult Power Electronics for more information on power connections in parallel equipment.

Open door signal is a functionality currently under development.

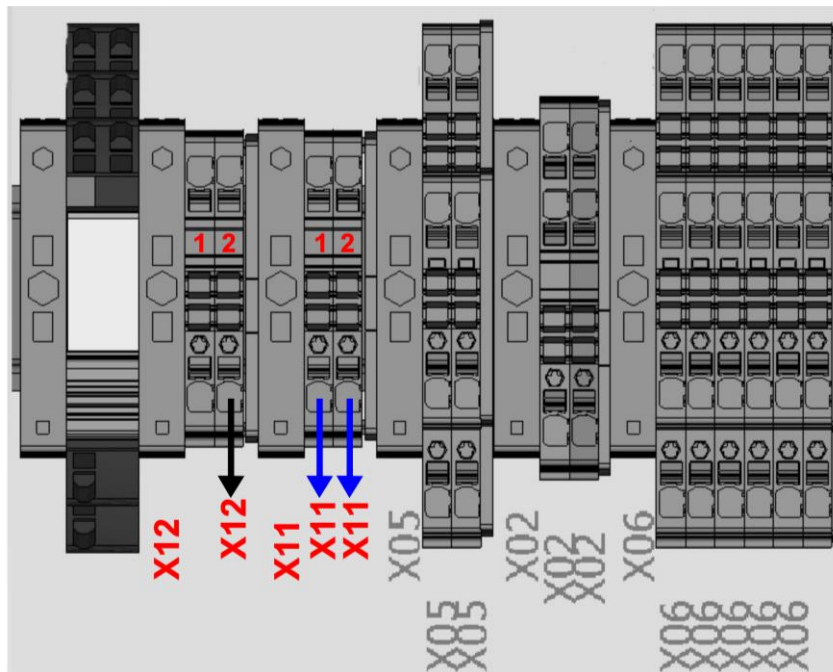
Connection of two power cabinets in parallel:

The following picture shows in detail CAN bus cable connections and open door signal. The connections on the terminals depend on if the power cabinet is master or slave. The open door signal connections are connected to terminals X12 and the CAN bus connections are connected to terminals X11. The location of these terminals is on the bottom of the unit, next to the Ethernet switch.

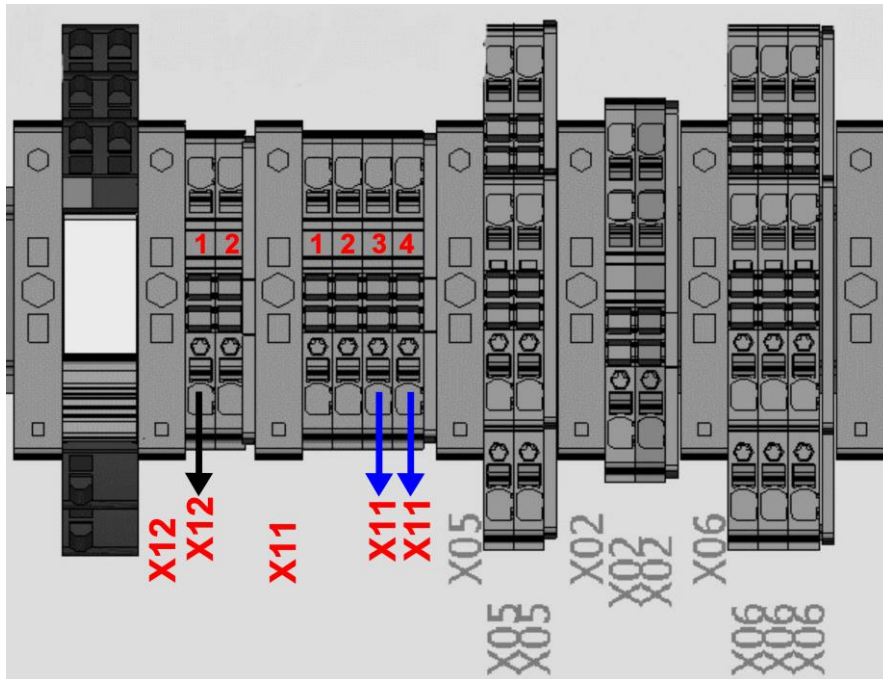


NBGMT007AI

The following picture shows in detail the terminals of the CAN bus connections and the open door signal on master power cabinets:



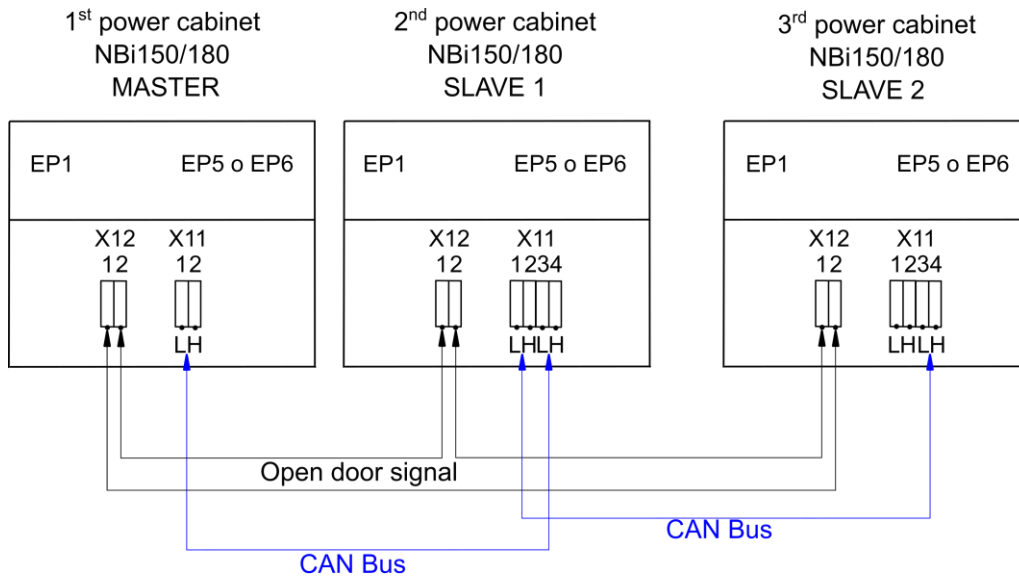
The following picture shows in detail the terminals of the CAN bus connections and the open door signal on the slave power cabinets:



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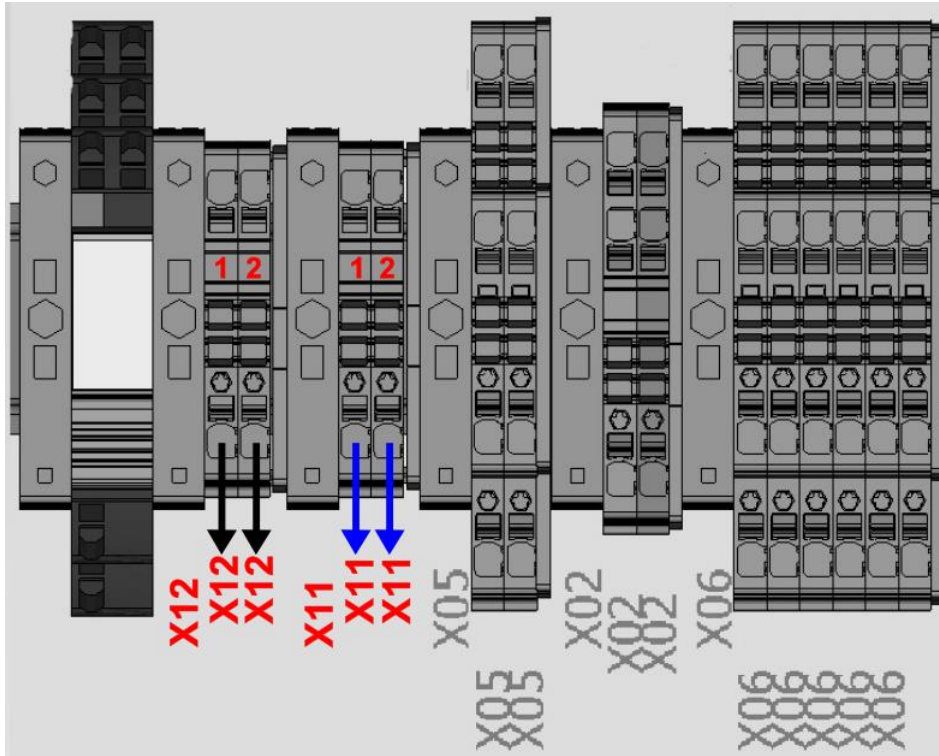
Connection of three power cabinets in parallel:

The detailed schematic of the CAN bus cable connections and the open door signal is as follows.

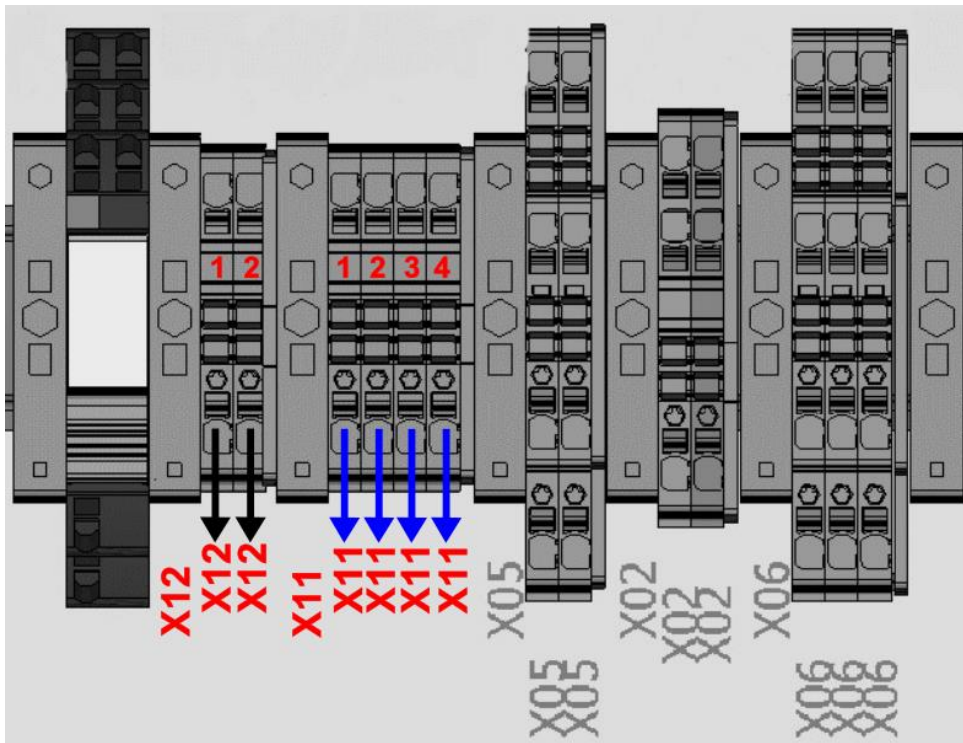


NBGDT007AI

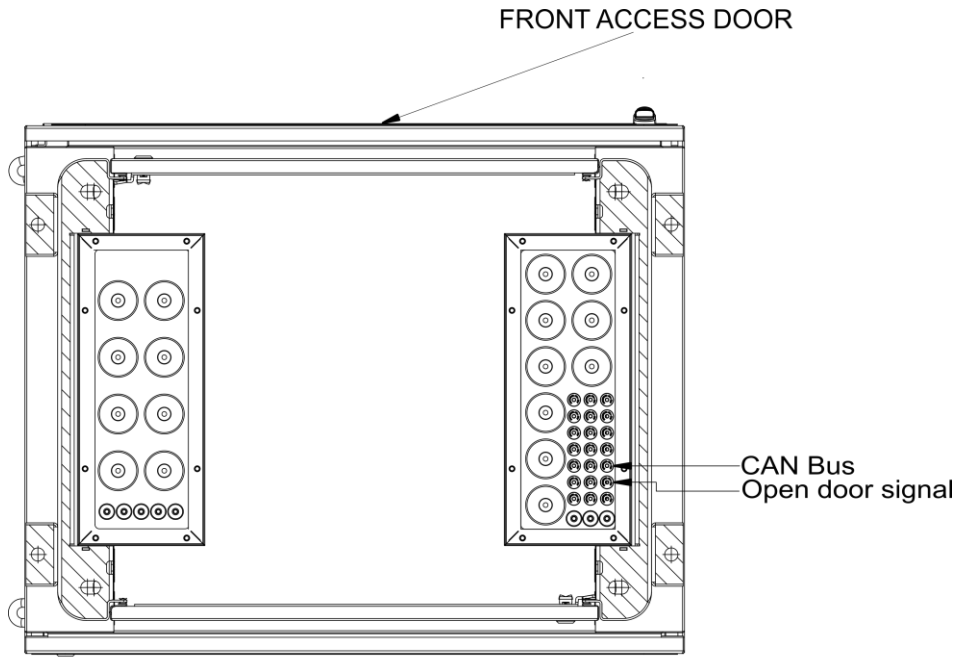
The following picture shows in detail the terminals of the CAN bus connections and the open door signal on master power cabinets:



The following picture shows in detail the terminals of the CAN bus connections and the open door signal on the slave power cabinets:



Communication cables pass through the corresponding cable glands:



NBi180DTG007CI

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7.PROTECTIONS



The power cabinet is equipped with multiple hardware protections. This section describes the different protections available to the equipment.

Insulation monitoring

The power cabinet has an insulation monitor to detect possible insulation faults in DC charge.

Overvoltage protection

The equipment can include as optional an AC overvoltage protection, surge arrester type II, located in the main control cabinet. This product does not require the addition of a backup fuse.

OVERVOLTAGE PROTECTION	Nominal voltage (U _n)	Discharge capacity (I _n)
IEC – Type II	400 V _{AC}	20 kA
UL – Type II	480 V _{AC}	20 kA

Overcurrent and short circuit protection

The equipment includes other protections for each charge line with following characteristics:

	Type	Nominal current (I _n)	Nominal voltage (U _n)	Breaking capacity (kA)
DC charge line 30 kW	3-phases	63 A	480 V _{AC}	6 kA
Auxiliaries	2P	10 A	480 V _{AC}	10 kA

Overtemperature protection

The equipment includes NTC probes and a thermal sensor in the inductive elements; it also includes hygrothermostatic sensors integrated in the electronics.

Residual current protections (optional)

The equipment includes the following optional: an RCBO in the auxiliary protections and a dimmable residual current device to prevent electric shock.

	Type	Operational limit	Nominal current (I _n)	Breaking capacity (kA)
RCBO	Curve C	30 mA	10 A	6 kA
RCD	A	30 mA	-	-

8.INTERFACE

8

Controls

The electric vehicle user interacts with the Dispenser directly, no control interaction with the power cabinet is required.

LED indicators

The equipment does not include any special external LED indicator. Internally, the power stages have three LEDs:



LED INDICATOR	NORMAL STATE	ABNORMAL STATE
FAULT (red)	Off	On Flash
ALM (yellow)	Off	On Flash
RUN (green)	On	Off Flash

The normal status of the "ALM" LED is "Off". When the charger is in stand-by (no vehicle charging) the LED will flash until vehicle charging begins. At this point, the LED will no longer be illuminated and will switch to the "Off" state.

If the "ALM" LED is fix or flashing, this indicates an abnormal state.

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9. COMMUNICATIONS

9

The equipment requires several communications to work and to interact with the charging Dispenser or customers.

Each one has its own aim and purpose, described in this section.

Refer to "[Communication connections](#)" section for further information about connections to enable these communications.



WARNING

Before opening any door, the equipment must be completely isolated, without any voltage. Make sure to follow the insulation guidelines and all safety instructions indicated in the "[Safety instructions](#)" section. Please use all the indicated PPE.

Otherwise, you may get an electric shock.

Ethernet communication

The equipment requires an Ethernet entry connection for OCPP1.6 communications and internet connection.

There is an Ethernet connection for communication with the main control board of the different power cabinets and towards the Dispenser.

Moreover, there is an Ethernet connection to monitor and configure the parameters through the Power Electronics' applications, commonly used by the back office. This use is mainly focused on maintenance and commissioning.

Power Electronics recommends using CAT5e or higher, copper cable and RJ45 connector for these connections.

Optical fiber communication

The equipment requires, for power regulation, an optical fiber communication between the protocols and FPGA boards from the power cabinet to each Dispenser.

Besides, it can include, as optional, the optical fiber connection to replace the Ethernet communication with the main control board of the Dispenser. This optional communication method allows locating the Dispenser farther than with Ethernet connection.

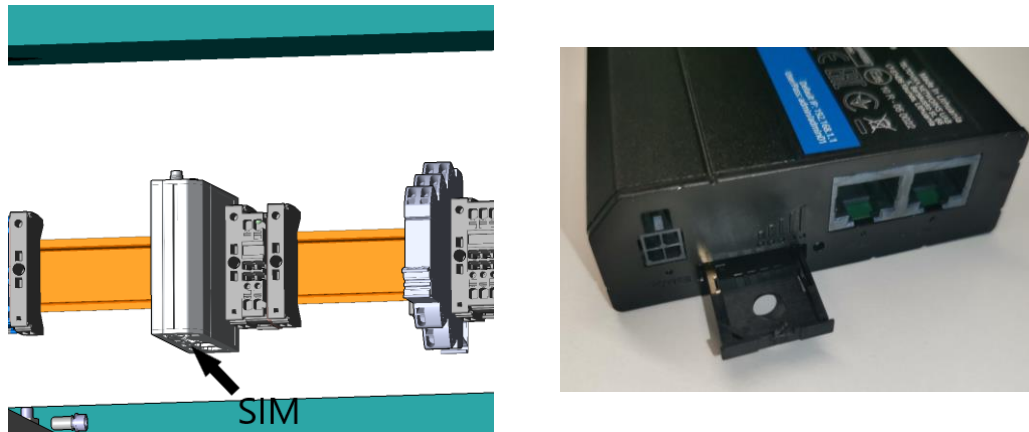
Power Electronics recommends a maximum distance between the power cabinet and the Dispenser of 80 m (262.46 ft) with Ethernet communication and 150 m (492.13 ft) with optional fiber optic communication.

Wi-Fi communication

The equipment is equipped with a Wi-Fi router to facilitate user access to the equipment. This connection requires that the device and the user are connected to the same Wi-Fi network. Once configured, the user can start a charging session through the mobile application.

3G / 4G communication

Communication via 3G / 4G through the communications antenna is included for internet access. In this case, insert a SIM card into the commercial router installed in the power cabinet:



NOTICE

Once the SIM has been inserted, it must be configured, and then the system must be reset.

EN

10. LOTO PROCEDURE

10

The aim of the lockout / tagout or LOTO procedure is to protect the user towards unintended reconnections and to avoid risks associated with the control of energy sources.

This involves isolating, locking and tagging the dangerous energy sources to avoid accidents / incidents mainly derived from dangerous movements, unexpected energizations or stored energy discharges.

Appropriate devices must be used, possible residual energies must be eliminated and, finally, the absence of energies must be verified.



NOTICE

LOCKOUT / TAGOUT (LOTO)

Lockout / tagout standards establish procedures to protect personnel from hazardous energy sources on equipment during service and maintenance.

Lockout / tagout disables equipment from producing hazardous amounts of electrical energy, allowing service and maintenance personnel to safely perform their jobs. Employees must be trained to understand and follow the hazardous energy control procedures.

Use only lockout / tagout devices authorized for particular equipment.

Lockout / tagout devices must be durable, standardized and individual.

PPE is required according to standards while executing LOTO actions. Refer to section "[Safety instructions](#)" for further information and recommendations.

CAUTION

The shutdown of the equipment must only be carried out by personnel qualified. Read these instructions and all safety recommendations carefully. Otherwise, the equipment could get damaged and personnel get seriously injured.

The instructions in this manual do not replace local or national regulations. It is the user's responsibility to comply with all safety standards that apply at the installation site.

Equipment statuses

Before working with the equipment, it is convenient to define two possible statuses.

POWER CABINET STATUSES	
STATUS 1	<ul style="list-style-type: none"> • Equipment running (no action required from safe stop). • Proper state for carrying the Power test.
	Check points for absence of voltage: No measuring in Status 1.
STATUS 2	<ul style="list-style-type: none"> • The equipment is completely stopped, isolated, discharged and locked. • Follow the complete process from “Loto actions” subsection. Make sure there is no independent auxiliary supply coming from outside the power cabinet. • Proper state for carrying out the Dead test.
	Check points for absence of voltage: Follow the complete process.

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CAUTION

The absence of voltage must be verified once an equipment has been isolated, with the necessary means and PPE.

In addition, the specific diagrams of the installation should be reviewed.

Even the multimeters have scheduled revisions, it is convenient always to check the multimeter is working fine before taking any measure, especially to prove dead. This might be damaged and show false values. Use a commercial proving unit to check it.

Use appropriate equipment for DC power measures.

It is responsibility of the technical personnel to have their tools calibrated and in good conditions.

Always wear the PPE according to electric risk and to the current H&S regulations.

LOTO actions

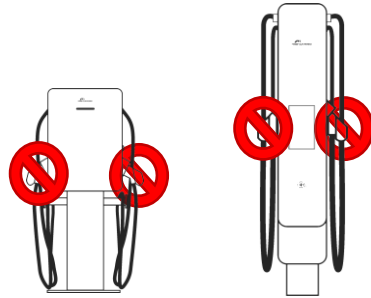
This section shows the LOTO actions that must be carried out, as part of the safety actions, every time the equipment is started or stopped.

It is responsibility of the customer to carry out maneuvers at the low voltage facility network and on the Dispenser to guarantee a safe scenario for maintenance and operation routines inside the power cabinet and Dispenser.

Follow the indications on "[Commissioning](#)" or "[Safe stop](#)" sections before applying any LOTO action.

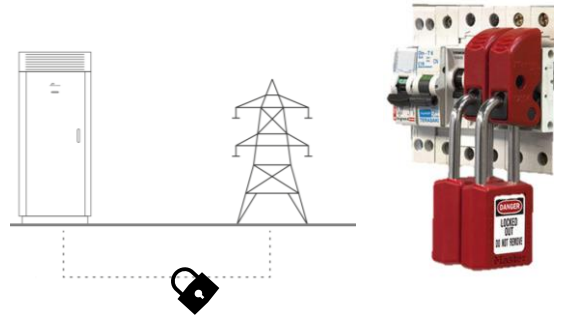
Disconnect all charging processes following the safe stop instructions or wait until all charging sessions are finished.

Then, limit the access to the Dispenser, so no one can start a new charging process.



Disconnect and lock with padlocks all LV facility network connections to eliminate power completely before the power cabinet input.

The customer is the one who disconnects and locks the LV supply connections, all keys must be stored in a locked box and Power Electronics will keep one of the opening keys.



Once the equipment is stopped, wait until the different storage buses are discharged (4 or 5 minutes).



Deactivate all circuit breakers (the image is from a NBi 120).

Although the supply to the circuit breakers was removed, this step confirms and locks it, then reconnection is not possible until the LOTO actions are removed.

Follow the "[Check points for absence of voltage](#)".



After all these actions, status 2 is reached on the power cabinet.



CAUTION

Auxiliary supply must be disconnected last and connected first when possible.



Electric shock hazard. Auxiliary supply power layout is a characteristic of each plant and may vary from one to other installation. Check the latest electrical schematics of the plant and make sure no voltage is present by confirming with a multimeter.



Electric shock hazard. Wait until all capacitors of the equipment are discharged under 30 V. Check it with a multimeter.

Before any maintenance operation, **verify that the equipment is completely stopped** before maneuvering any cutting element. This applies to elements with load-breaking capacity (circuit breakers and switches) as well as those with no capacity (disconnectors). **Under no circumstances** any of these components must be **manually** operated when the equipment is energized.

Remove LOTO actions

Follow the LOTO actions and procedure in the inverse order.

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Check points for absence of voltage

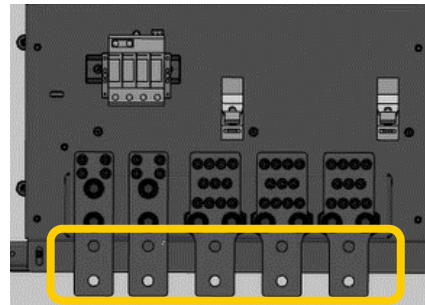
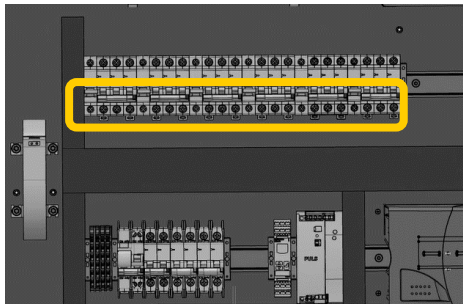
Follow this procedure as last LOTO actions to reach status 2 in the equipment.

CHECK POINTS FOR ABSENCE OF VOLTAGE

1. Wear the appropriate PPE based on the electrical arc studies of the plant and the risk assessment carried out by the customer.
2. Ensure the correct operation of the multimeter.
3. Once the equipment is stopped, wait until the different storage buses are discharged (4 or 5 minutes).
4. Check that power stage LEDs are NOT illuminated.



5. Check that there is no voltage in the circuit breakers AC input. Then, remove polycarbonate to be able to measure voltage in the AC input plates.



6. There will be no voltage in the equipment.

CAUTION

The absence of voltage must be verified once an equipment has been isolated, with the necessary means and PPE.

In addition, the equipment specific diagrams of the installation should be reviewed.

Even the multimeters have scheduled revisions, it is convenient always to check the multimeter is working fine before taking any measure, especially to prove dead. This might be damaged and show false values. Use a commercial proving unit to check it.

Use appropriate equipment for DC power measures.

It is responsibility of the technical personnel to have their tools calibrated and in good conditions.

Always wear the PPE according to electric risk and to the current H&S regulations.

11. COMMISSIONING

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CAUTION

Commissioning may only be carried out by personnel authorized by Power Electronics. Read these instructions and all safety recommendations carefully. Failure to do so could result in damage to the equipment and serious injury to personnel.

Make sure that no voltage is present at the power terminals. Make sure that no voltage source can be unexpectedly connected.

The instructions in this manual do not replace local or national regulations. It is the responsibility of the user to comply with all applicable safety standards at the installation site.

The following steps describe the process for starting up the power cabinet and turn it on for the first time. Please, also consult the *Hardware and Installation Manual* that corresponds to the Dispensers included on the project.

Visual inspection: unpackage the equipment and ensure that all components are in good condition and have not suffered any damage in transit.



Disconnect the external power supply before starting with the installation. Open the door of the device and ensure internal protections are deactivated. Block, delimit and signal the work area following the "[LOTO procedure](#)" section.



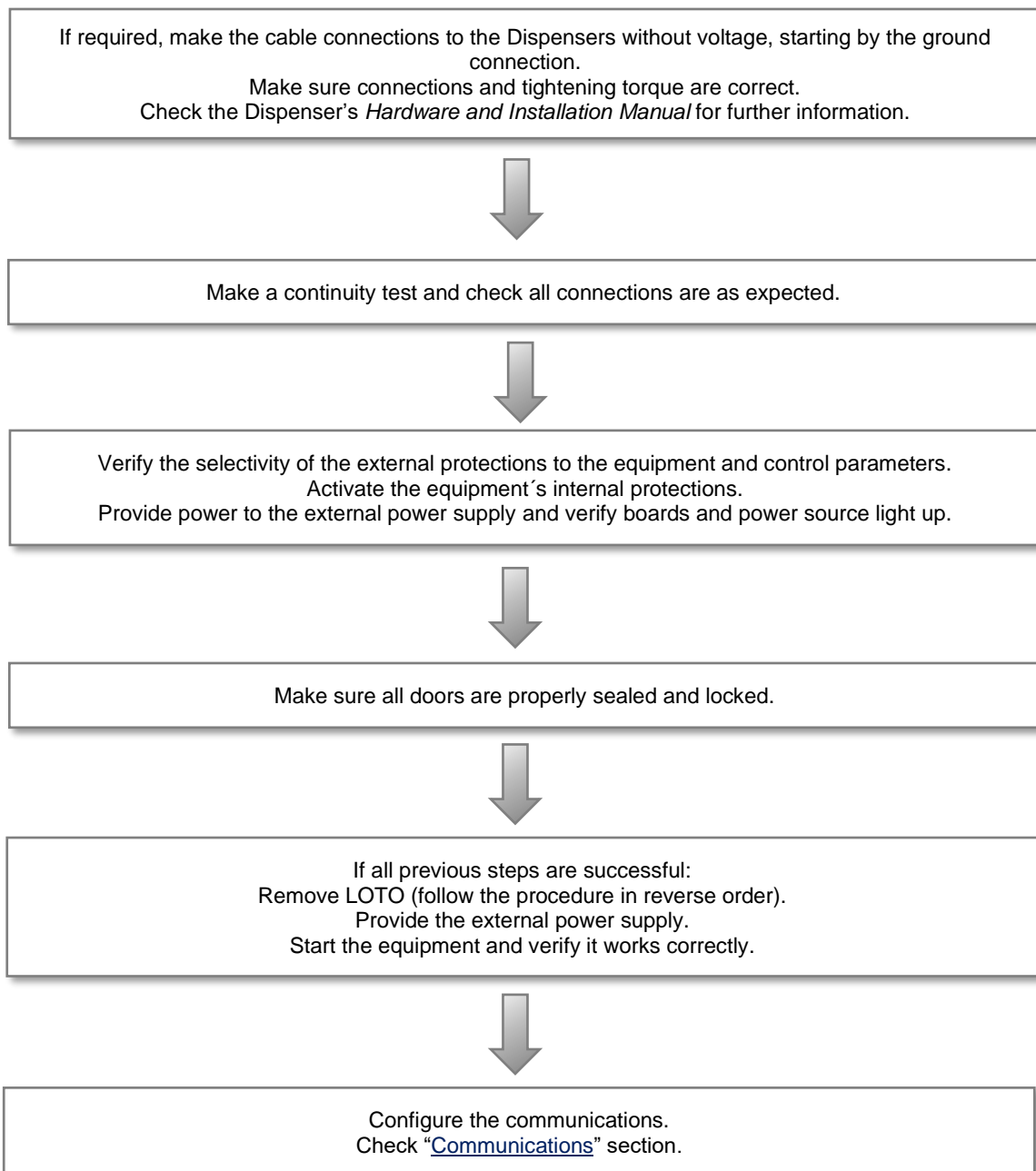
Perform the anchoring of the equipment at its final destination following the instructions according to the chosen type of fixation (option 1 or option 2). Check "[Anchoring of the equipment](#)" section.



Make the cable access and connections without voltage, starting by the ground connection. Make sure connections and tightening torque are correct. Check "[Torque and screw sizing](#)" and "[Cable access and connections](#)" sections.



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12. SAFE STOP

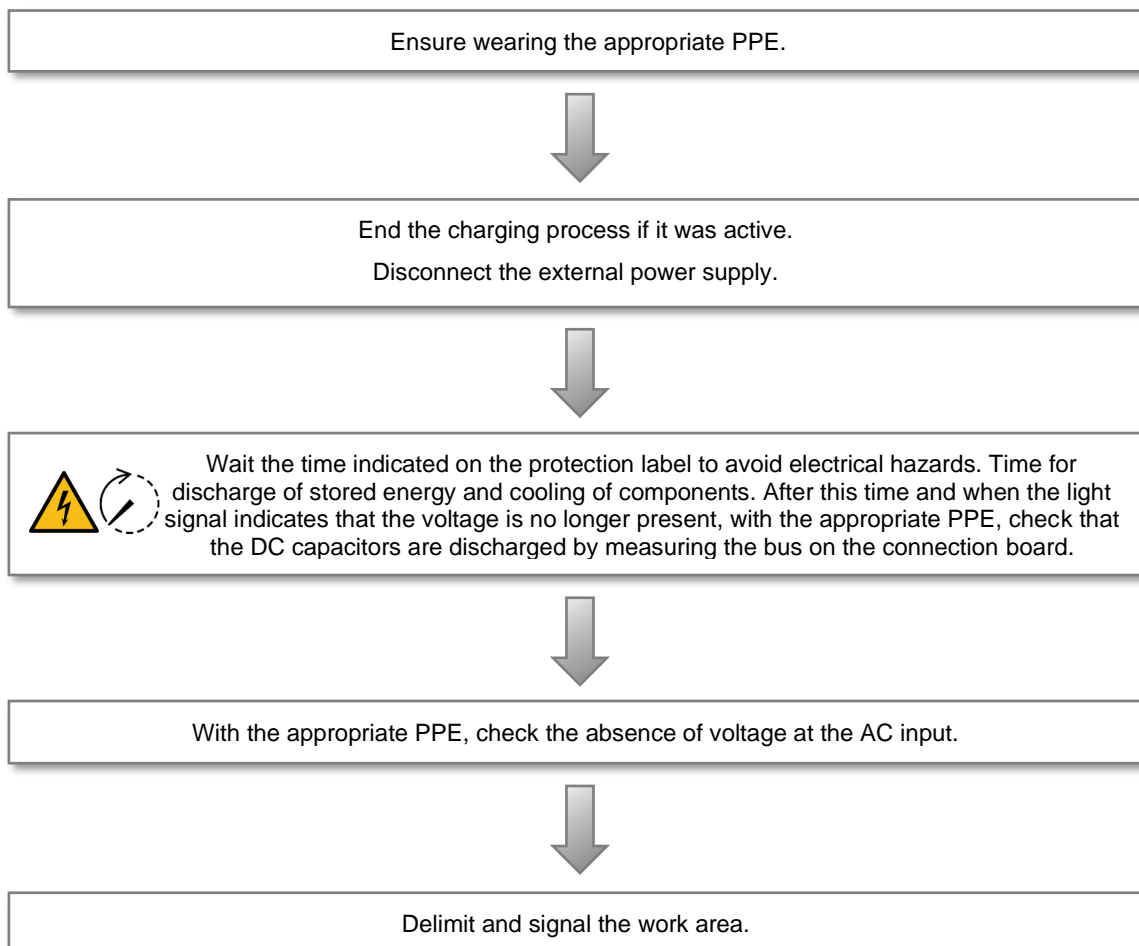
12

CAUTION

The shutdown of the equipment must only be carried out by personnel qualified. Read these instructions and all safety recommendations carefully. Otherwise, the equipment could get damaged and seriously injured personnel.

The instructions in this manual do not replace local or national regulations. It is the user's responsibility to comply with all safety standards that apply at the installation site.

The following steps describe the process to follow for disconnecting the power cabinet. Please, also consult the *Hardware and Installation Manual* that corresponds to the Dispensers included on the project.

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13. MAINTENANCE

13

The power cabinet has been developed based on a revolutionary design concept that simplifies significantly the tasks and reduces preventive and corrective maintenance times. Nonetheless, there are some actions and revisions required.

Equipment statuses

Before detailing the maintenance procedure, it is convenient to define two possible statuses to carry out the maintenance tasks.

Status 1: Proper state for carrying the **Power test. Equipment with voltage and operating.**

Status 2: Proper state for carrying the **Dead test. Equipment with no voltage, stopped, uncharged, isolated and blocked.**



CAUTION

Maintenance tasks must only be performed by qualified personnel and approved by Power Electronics. Otherwise, the equipment may get damaged and personnel could suffer severe injuries.

Use the necessary PPE according to the electrical risk and the Health and Safety regulations



WARNING

Before opening any door, be sure to follow insulation guidelines and all safety instructions. Failure to do so may result in electric shock.

Make sure to follow the insulation guidelines and all safety instructions before opening any door or handling the equipment internally. Otherwise, you may get an electric shock.

To carry out maintenance tasks or any activity inside the equipment, the user must verify that there is no voltage present in the equipment, as well as carry out the procedure of a [safe stop](#). Always apply the [five golden rules](#) to ensure that there are no dangerous tensions.

In addition to the recommendations given in this manual, local safety procedures and those specific to the installation site must be taken into account. Also, local and national electrical regulations must be followed to avoid personal injury and / or damage to the equipment.

Failure to comply with safety instructions and electrical codes may void the warranty.

Checklist

The list of tasks detailed below **should be carried out annually**. The duration of each task is an estimate.

MAINTENANCE		TIME
GLOBAL OPERATION TIME		1h and 35 min.

POWER TEST (STATUS 1)		TIME (MIN)	OK
1	Environmental conditions – visual check.	5	
2	Enclosure state – visual check.	5	
3	Make sure the equipment is accessed remotely - connection to the PC, if it exists.	5	
4	Ventilation system and absence of vibrations - visual and auditory check.	5	
5	Operation of the differential switch – visual and manual check.	5	

The following tasks must be performed with the equipment completely off (no voltage at all, stopped, uncharged and isolated):

DEAD TEST (STATUS 2)		TIME (MIN)	OK
1	Internal cleaning.	15	
2	Filters – visual check and replacement.	15	
3	Doors condition.	10	
4	Cables and conductors – visual and manual check.	10	
5	External and internal tightening torques – manual check.	10	
6	Control circuit and protections – manual check.	10	

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Power test (status 1)

Note: Please, also consult the documentation for all the other equipment included in the project (Dispenser, pantograph).

1. Environmental conditions

Verify that the equipment environment complies with the specifications. Verify that the humidity is adequate.



CAUTION

This task should be carried out annually. However, it should be done more frequently if climate conditions require so. **This also affects tasks 1 and 2 of the dead revision (state 2).**

Also, in installations with a high level of contamination, it may be necessary to carry out this task more frequently. The review criteria are the following:

- Whenever pruning, mowing, grazing or similar tasks are carried out in the vicinity of the equipment, which may produce the presence of plant or animal debris suspended in the air.
 - When, due to human activities, climatic or biological reasons, the presence of solid remains in the air susceptible to accumulate on the filters is detected in the area. In this case, it will be enough to inspect the equipment that due to their location have been more exposed, and if dirt is detected in them, the inspection will be generalized to the rest of the equipment at the plant.
-

2. Enclosure state

Check the enclosure is in good general state and no traces of corrosion or impacts are present. Check the equipment anchoring.

3. Remote access

Verify that the equipment can be accessed remotely. If it exists, verify the connection with a PC.

4. Ventilation system and absence of vibrations

Verify that there are no abnormal noises or oscillations in the ventilation system.

Dead test (status 2)

1. Internal cleaning

Check that the equipment does not show signs of dust, moisture, oxidation or presence of animals. If dust is found in the control electronics, use a specific vacuum cleaner for electronic boards. Otherwise, the electronic components may get damaged.

2. Filters

Visual inspection of air filters. Use a set of screwdrivers to access the filters and take them off. Check that they are clean and unobstructed. Clean them if they are dirty. It is not necessary to replace the air filters unless they show signs of saturation.

3. Doors condition

Check that each door closes correctly, seals and closures are in good conditions. Check hinges, gaskets, closures and doors.

4. Cables and conductors

Visual inspection of cables and terminals. Check the cables are in good condition and sealed. Check that the connectors and terminals are correctly inserted and there are no visual signs of overheating.

5. External and internal tightening torques

Check the accessible connections of the Low Voltage circuit and **retighten correctly only if necessary**. To do so, check that all tightening marks are in place. In the case of small screws that do not have marks, good electrical practice will determine if a screw is loose.

Pay special attention to the input connections of the equipment, check the torque and **retighten**.

6. Control circuit and protections

Check if overvoltage protectors are operational.

Visually check the fuses to guarantee they are not blown.

Check the good condition of the control cards, as well as its connections.



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