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INSTALLATION GUIDE

HVC-PD Depot E-Bus Charger Installation Guide for NAM products

Version 2.0



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Version control

Version	Date	Remarks
0.1	07-06-2019	Released for review
1.0	26-08-2019	Commercial release
1.1	07-07-2020	Add description to connect DC- OVP Sensing wire in ACM. Changes made according to Mantis issue 12192. Distance sensor is removed form Charge Pole
2.0	03-02-2021	Added picture of RFID; Distinction between 150kW to 450kW cable connections; Added schematics for different ratings; Mounting instructions; Junction box pictures and visuals; Cable interface through junction box Commercial release for BAA compliant model

Table of Contents

1. Introduction	8
1.1. Preface	8
1.2. Intended document users	8
1.3. Signs	8
1.4. Safety regulations	9
1.4.1. Owner responsibilities	9
1.4.2. Tilting and handling	10
1.4.3. Electric hazards	11
1.4.4. Installation safety	11
1.5. Environment and disposal of waste	12
1.6. Cyber Security Disclaimer	12
1.7. Contact information	13
2. Description of the product	14
2.1. Overview of the system	14
2.1.1. Standard HVC-PD 150 kW E-Bus Charger system	14
2.1.2. Standard HVC-PD 300 kW E-Bus Charger system	14
2.1.3. Standard HVC-PD 450 kW E-Bus Charger system	15
2.1.4. Power Cabinet	15
2.1.5. ACM Enclosure kit	16
2.1.5.1. ACS Control Module	17
2.1.5.2. Junction Box	18
2.1.6. Panto Down Bracket Assembly	19
2.1.6.1. Panto Down Junction Box	19
2.1.6.2. Pantograph	19
2.2. Accessories	19
2.2.1. Foundation for Power Cabinet	19
2.2.2. Wall-mounting brackets for safe wall fixing	21
2.2.3. Communication glass fiber cable	21
2.2.4. Emergency unit	22
2.2.5. Charger state indicator light (beacon)	23
2.2.6. WiFi antenna	24
2.2.7. RFID unit	24
3. Preparation	26
3.1. Project planning	26
3.2. Grid connection	27
3.3. Internet access	27
3.4. Location	27
3.5. Geometry of infrastructure	28
3.5.1. Required space for the Power Cabinet	28
3.5.2. Placement of multiple cabinets	29
3.5.3. Required space for the ACM Enclosure kit	30
3.6. Pantograph position in relation to the bus	30
3.6.1. Pantograph position in relation to the drive direction of the bus	31
3.6.2. Pivoting of the collector head around the pantograph axis (Z-axis)	31
3.6.3. Maximum allowed slope of the pantograph in Z-axis	32
3.6.4. Pantograph position in X-axis (height relative to TOR)	32
3.6.5. Pantograph position in Y-axis in relation with the bus	33
3.6.6. Maximum slope of the road in X-axis	36
3.7. WiFi antenna position in relation to the bus	37
3.8. RFID reader within the PD bracket	38

3.9. Electrical engineering	38
3.9.1. Electrical installation	38
3.10. Civil installation	39
3.11. Lightning protection	40
4. Construction	42
4.1. Construct foundation of the Power Cabinet	42
4.1.1. Options	42
4.1.2. Workflow with concrete foundation	43
4.1.3. Workflow with metal frame foundation	45
4.1.4. Workflow mounting Power Cabinet direct on a floor (footprint)	46
4.2. Mounting preparation of the ACS Control Module Enclosure	47
4.2.1. Preparation	47
4.2.2. Workflow for wall mounting	47
4.3. Cabling	49
4.3.1. Charge system configurations	49
4.3.2. AC power cable	50
4.3.3. Cables between the Power Cabinets and the ACS Control Module	50
4.3.4. Cables between the Power Cabinets	51
4.3.5. Cables between the ACS Control Module and the Panto Down Junction Box	51
4.3.6. Grounding of the Charge system	51
4.3.7. Cable specification list	53
4.4. Internet connection	54
5. Placement and Connection	55
5.1. About placement and connection	55
5.2. Route the cables	55
5.3. Unpack Power Cabinet	56
5.3.1. Before unpacking	56
5.3.2. Remove packaging	57
5.4. Move Power Cabinet to position	57
5.4.1. Move cabinet with a hoist	58
5.4.2. Move cabinet with a forklift truck	59
5.5. Install Power Cabinet onto the foundation	60
5.5.1. Connect Power Cabinet to foundation	60
5.5.2. Open the door of the Power Cabinet	62
5.5.3. Move the sliding plate of the guidance plates of the cabinet	63
5.5.4. Route cables through guidance plates	63
5.5.5. Move sliding plates of the guidance plates of the cabinet	64
5.5.6. Install border covers of the Power Cabinet	65
5.5.7. Install border covers of metal frame foundation	65
5.5.8. Install front cover plate on foundation	66
5.6. Connect AC power cable and PE wires Power Cabinets	67
5.6.1. Remove the protection covers	67
5.6.2. Connect the PE wire of the AC power cable	68
5.6.3. Connect the AC power cable	69
5.6.4. Install the protection covers	70
5.6.5. Install lightning protection (optional)	71
5.6.6. Connect the PE wire to the Charge Pole	72
5.6.7. Connect the PE wire between the Power Cabinets	73
5.7. Connect the DC power cables Power Cabinets	73
5.7.1. Remove the protection cover	74
5.7.2. Connect the DC power cables	74
5.7.3. Install the protection cover	75
5.8. Connect AC utility power, Interlock and CAN cables Power Cabinet	75

5.8.1.	Route the cables to the terminal blocks	75
5.8.2.	Connect the AC utility power cable	76
5.8.3.	Connect the Interlock cable for the HVC 150 kW system	77
5.8.4.	Upgrade the Interlock connection to the HVC 300 kW system	78
5.8.5.	Upgrade the Interlock connection to the HVC 450 kW system	80
5.8.6.	Connect the CAN cable	82
5.9.	Connect the communication cable Power Cabinet	85
5.9.1.	Route the cable to the terminal blocks	85
5.9.2.	Connect the communication fiber cables	85
5.10.	Close the door of the Power Cabinet	86
5.11.	Installation of the Pantograph with Junction Box	87
5.11.1.	Before unpacking	87
5.11.2.	Move the Pantograph to position	87
5.11.3.	Mounting the Pantograph Bracket	89
5.12.	Connect cables to Panto Down Junction Box	91
5.12.1.	Connect the PE wire to the Panto Down Junction Box.	93
5.12.2.	Connect the ACS PE and CP/PE wire to the Panto Down Junction Box	94
5.12.3.	Connect DC cables to Panto Down Junction Box	94
5.12.4.	Connect ACS control cable to Panto Down Junction Box	95
5.12.5.	Connect ACS heater cable to Panto Down Junction Box	96
5.12.6.	Connect RFID cables to Panto Down Junction Box	96
5.12.7.	Connect Beacon cables to Panto Down Junction Box	97
5.12.8.	Connect Wifi cables to Panto Down Junction Box	98
5.13.	Unpack the ACS Control Module Enclosure Kit	98
5.13.1.	Before unpacking	98
5.13.2.	Remove packaging	98
5.14.	Install ACS Control Module Enclosure kit onto wall	100
5.14.1.	Using the wall-mounting brackets (only for ACM Enclosure)	101
5.15.	Connect remaining PE wires to central PE-rail in the ACM Enclosure	102
5.15.1.	Existing PE connections on the PE rail	102
5.15.2.	Connect the PE wire from the Panto Down Junction Box	103
5.15.3.	Connect the PE wire of the Power Cabinet	103
5.15.4.	Install lighting protection (optional)	104
5.16.	Connect cables into the ACS Control Module Enclosure	105
5.16.1.	Gland layout of the ACS Control Module – 450-600kW models only	105
5.16.2.	Connect the DC+ power in- and output cables	108
5.16.3.	Connect the DC- power in- and output cables in Junction Box	110
5.16.4.	Connect the AC utility power cable from Power Cabinet	112
5.16.5.	Connect the communication cable from the Power Cabinet	112
5.16.6.	Connect the WiFi cable	114
5.16.7.	Connect the RFID cables	114
5.16.8.	Connect the other cables to the ACS Control Module	116
5.17.	Close the door of the ACS Control Module	118
5.18.	Mounting the emergency unit	118
6.	Commissioning	119
6.1.	Commissioning preparation	119
6.2.	Customer Acceptance Form (CAF)	120
7.	Service and Maintenance	121
7.1.	About Service and Maintenance	121
7.2.	Cleaning of the cabinet	121
8.	Technical Specification	123
8.1.	Electrical specification complete 150 kW system	123

8.2. Electrical specification complete 300 kW system	123
8.3. Electrical specification complete 450 kW system	124
8.4. Mechanical data	124
8.5. Environment	125
8.6. Certifications	125
9. Appendix	126
A Dimensions Power Cabinet	127
B Dimensions ACS Control Module	129
C Dimensions Junction Box	130
D Dimensions Pantograph	131
E Dimensions	132
F Dimensions Metal Foundation Power Cabinet	136
G Power Cabinet – Outline with Foundation	137
H Connection diagram	138
I Ground overview of the system	141
J WEEE disposal – 2012-19/EU	142

Glossary

AC

Alternating Current.

ACM

ACS Control Module

ACS

Automatic Control System. In this charger system the pantograph.

CAF

Customer Acceptance Form.

Contractor

Entity hired by the owner / site operator to do engineering, civil and electrical installation work.

DC

Direct Current.

Grid provider

Company responsible for the transportation and distribution of electricity.

HMI

Human Machine Interface; the screen on the charger.

HVC

Heavy Vehicle Charger.

Power Cabinet

Intermediate unit that provides 150 kW of DC power to the Charge control set. Gets its power from a power distribution board.

Interlock

The Interlock is an isolated current loop and is a feature that makes the state of two mechanisms or functions mutually dependent.

LAN

A computer network that interconnects computers systems within a limited area.

NOC

ABB Network Operating Centre; remotely checks the correct functioning of the charger.

OPP Charge

Is a trade name of fast charging method for electric vehicles.

Owner

The legal owner of the charger.

Pantograph

The mechanical contact linkage of the charger through which the DC charge power is electrical transported to the electrical vehicle.

PD

Panto Down. A charge system where the pantograph is mounted external from the vehicle.

PE

Protective Earth.

PPE

Personal Protective Equipment. Equipment such as safety shoes, helmet, glasses, gloves.

RCD

Residual-Current Device.

RFID

Radio-Frequency IDentification. RFID is a communication technology by means of radio waves to transfer data over a very short distance between a reader and an electronic tag or card.

Site operator

The entity is responsible for the day to day control of the charger. The site operator can be the owner, but not necessarily.

TOR

Top of Road

User

The owner of an electric vehicle, who uses the Charge Station to charge that vehicle.

WiFi

A technology that allows electronic devices to connect to a wireless LAN (WLAN) network.

1. Introduction

1.1. Preface

This guide describes the physical installation of the HVC-PD Depot E-Bus Charger at its location.

The HVC-PD Depot E-Bus Charger is a DC fast charger system for hybrid or electrical buses that can be used within bus depots which is based on the CCS Charging standard. It is not permitted to use the HVC-PD Depot E-Bus Charger to charge any other equipment, or to use the HVC-PD Depot E-Bus Charger for any other purposes.

The HVC-PD Depot E-Bus Charger uses high-amperage electric currents. Therefore the installation must be planned carefully, and must be done by certified personnel only (according to local standards¹).

Before installing the HVC-PD Depot E-Bus Charger, read this Installation Guide carefully and attentively. Follow the instructions in this Installation Guide. ABB is not responsible for any damage that has been caused by not or incorrectly following and executing the instruction described in this manual.




1.2. Intended document users

This document is intended to be used by:






- Customers who purchased a HVC-PD Depot E-Bus Charger, or are in the process of ordering and want to know in more detail how it has to be installed.
- Contractors who are responsible for site preparation and/or installation of the HVC-PD Depot E-Bus Charger.

1.3. Signs

The following signs are used on the equipment and in this manual:

	DANGER
	Hazardous voltage Identifies a hazard that could result in severe injury or death through electrocution.
	WARNING
	Various Identifies a hazard that could result in severe injury or death.
	WARNING
	Rotating parts Identifies a hazard that could result in injury due to the presence of rotating or moving parts.

¹ Local regulations shall take precedence if they list different installation requirements than prescribed in this Installation Manual.

	<p style="text-align: center;">WARNING</p> <p>Pinch Hazard Identifies a hazard that could result in injuries in which some body parts are pinched or crushed.</p>
	<p style="text-align: center;">WARNING</p> <p>Fall Hazard Identifies a hazard that could result in injury due unsafe work at height.</p>
	<p style="text-align: center;">CAUTION</p> <p>Various Identifies a hazard that could result in damage to the machine, other equipment, and/or environmental pollution.</p>
	<p style="text-align: center;">CAUTION</p> <p>Environmental damage Identifies a special indication as well as biddings and prohibitions to avoid damages in the environment. This sign refers to present national regulation according the environment.</p>
	<p style="text-align: center;">NOTICE</p> <p>Contains remarks, suggestions or advice.</p>

1.4. Safety regulations




1.4.1. Owner responsibilities

The owner and site operator are required:

- To operate the charge system with the protective devices installed and to make sure all protective devices are correctly installed after carrying out installation or maintenance.
- To write an emergency plan that instructs people what to do in case of emergency.
- To prepare the site where the charge system will be installed, according to the requirements described in this guide.
- To make sure that there is enough space around the charger to carry out maintenance work.
- To appoint a person responsible for the safe operation of the charge system and for the coordination of all work.
- All work must be carried out from qualified personnel. All qualified personnel must estimate their required work, estimate potential risks, and plan accordingly. They must have experience and enough knowledge over: safety regulations and labor medical regulations, accident prevention regulations, guideline and approved safety regulations, and special instruction concerning occurrence of danger (especially remaining risk) possible dangers.

- You are not allowed to modify the charge system without the permission of ABB. The owner is cautioned that changes or modifications not expressly approved by ABB could void the owner’s authority to operate the equipment and ABB’s warranty policy.
- Neither ABB nor its affiliates shall be liable to the purchaser of this product or third parties for damages, losses, costs or expenses incurred by purchaser or third parties as a result of: an accident, misuse or abuse of this product or unauthorized modifications, repairs or alterations to this product, or failure to strictly comply ABB operating and maintenance instructions.

1.4.2. Tilting and handling

	<p style="text-align: center;">CAUTION</p> <p>Heavy equipment Handling instructions:</p> <ol style="list-style-type: none"> 1. Use crane or forklift truck when lifting or moving the Power Cabinet and or Pantograph. 2. Do not drop parts of the HVC-PD E-Bus Charger. 3. Do not exceed a tilting of 30° for the Power Cabinet. 4. Read and follow the ABB <i>Guidance on the requirements for safe operation of mobile cranes</i> (ML-03, 9Akk104941D0113).
	<p style="text-align: center;">WARNING</p> <p>Personal safety (PPE) Always wear a safety helmet, safety gloves and safety shoes when you do the lifting and tilting work.</p>
	<p style="text-align: center;">WARNING</p> <p>Make sure that personnel cannot be crushed or become trapped during lifting and tilting work.</p>

Lifting activities

It is a legal requirement that all activities involving lifting equipment are planned and that they are conducted under effective supervision and managed based on the risk, complexity of the activity and the work environment (EU directive 2009/104/EEG, appendix II, chapter 3.2.5).


It is of great importance, regardless of location, that any lifting activity is performed safely, and this activity is:

- Carried out within the framework of an effective management system;
- Properly planned;
- Assessed for risks
- Supervised
- Performed by skilled personnel and with the appropriate means.





All lifting activities must be performed under the ABB *Guidance on the requirements for safe operation of mobile cranes* (ML-03, 9Akk104941D0113).



When applying this Standard, local laws and regulations must be taken into account at all times. In the event of conflicts, local laws and regulations prevail over this Standard.

1.4.3. Electric hazards


	DANGER
	<p>Hazardous voltage The HVC-PD E-Bus Charger conductors under hazardous electrical voltages. The grid terminals on the internal DIN rail may carry hazardous voltages, even if all circuit breakers are switched off.</p>

1.4.4. Installation safety

	WARNING
	<p>Personal safety (PPE) Always wear a safety helmet, safety gloves and safety shoes when you do the lifting and tilting work.</p>
	WARNING
	<p>Visually examine the package for damage. See section <i>Before unpacking</i> on Page 56 and section <i>Before unpacking</i> on Page 98. If there is damage, do not install the system.</p>
	DANGER
	<p>Hazardous voltage</p> <p>Instructions:</p> <ol style="list-style-type: none"> 1. Always switch off the external group switch and the main switch in the cabinet, before performing any installation, disassembly, repair or replacement of components. 2. Do a voltage check and make sure that the electrical power is disconnected from the system. 3. Only ABB certified technicians are permitted to commission the HVC-PD E-Bus Charger. 4. When the system is in an open or dangerous condition, do not allow unqualified persons to go near it. Instruct and warn people about the potential harmful high voltages. 5. The installation and maintenance personnel must supply their own lighting equipment, since the HVC-PD E-Bus Charger has no lights inside the cabinet. 6. Always connect the Protective Earth (PE) first, before connecting the neutral (N) and Phase (P) wiring. 7. Correctly lock the door after installation or service operations.
	WARNING
	<p>Make sure that there is a minimum free space of 1000 mm in front of the door of the Power Cabinet. The minimum space is necessary to allow service personnel to quickly move away from the Power Cabinet if there is an emergency when the door is open.</p>

	WARNING
	<p>Make sure that there is a minimum free space of 1000 mm in front of the door of the ACS Control Module. The minimum space is necessary to allow service personnel to quickly move away from the Depot Charge Box if there is an emergency when the door is open.</p>
	CAUTION
	<p>Warranty Installation and commissioning work must be carried out by certified personnel. The warranty will be void if any work carried out by non-certified personnel.</p>

1.5. Environment and disposal of waste

	CAUTION
	<p>Always observe the local rules and regulations with respect to processing (non-reusable) parts of the HVC-PD E-Bus Charger.</p>

1.6. Cyber Security Disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is customer's sole responsibility to provide and continuously ensure 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 anti-virus 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.

ABB Ltd 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.

1.7. Contact information

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ABB EV Infrastructure

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2629 JG Delft
The Netherlands

Telephone +31 88 440 46 00

E-mail info.evi@nl.abb.com

2. Description of the product

2.1. Overview of the system



Example of a complete installation

- A Low voltage power distribution cabinet of the owner
- B Power Cabinet – 150 kW (HVC 150)
- C ACM 150-450kW Enclosure kit
- D Pantograph
- D Cables between Power Cabinet and HVC-PD kit
- E Electric hybrid and/or full electric Bus
- F Bus stop space for charging

The HVC-PD E-Bus Charger consists of multiple components and it may require additional parts depending on the project and location of installation which dictates whether these parts are needed.

ABB offers standard delivery system configurations with a DC charge power of 150, 300 or 450 kW. Additional needed components can be ordered separately and are not part of the standard delivery. See section *Accessories* on Page 19.

2.1.1. Standard HVC-PD 150 kW E-Bus Charger system

The following parts are provided for this system configuration:

- 1x HVC 150 Power Cabinet (ABB6AGC063474)
- 1x HVC-PD ACM 150-450kW kit Enclosure (2CEB489803R1002) including:
 - 1x ACS Control Module (ACM) (3P289940000A)
 - 1x Grounding rail
- 1x Pantograph Junction Box (2CEB489803R0070)
- 1x Pantograph (ACS) (FB206.11)

2.1.2. Standard HVC-PD 300 kW E-Bus Charger system

The following parts are provided for this system configuration:


- 1x HVC 150 Power Cabinet (ABB6AGC063474)
- 1x HVC-PD ACM 150-450kW kit Enclosure (2CEB489803R1002) including:

- 1x ACS Control Module (ACM) (3P289940000A)
- 1x Grounding rail
- 1x Pantograph Junction Box (2CEB489803R0070)
- 1x Pantograph (ACS) (FB206.11)

2.1.3. Standard HVC-PD 450 kW E-Bus Charger system

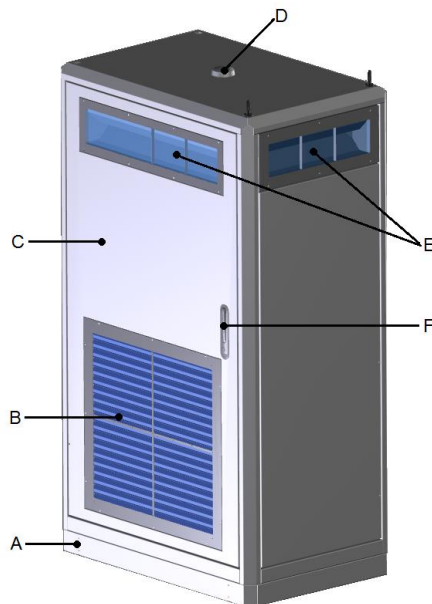
The following parts are provided for this system configuration:

- 1x HVC 150 Power Cabinet (ABB6AGC063474)
- 1x HVC-PD ACM 150-450kW Enclosure kit (2CEB489803R1002) including:
 - 1x ACS Control Module (ACM) (3P289940000A)
 - 1x Junction Box
 - 1x Grounding rail
- 1x Pantograph Junction Box (2CEB489803R0070)
- 1x Pantograph (ACS) (FB206.11)

NOTICE	
	<p>The cables between the Power Cabinet(s) and HVC-PD kit ACM 150-450kW is not part of the order. See section <i>Cabling</i> on Page 49 for selecting the right cable type needed between the Power Cabinet(s) and Charge kit.</p>

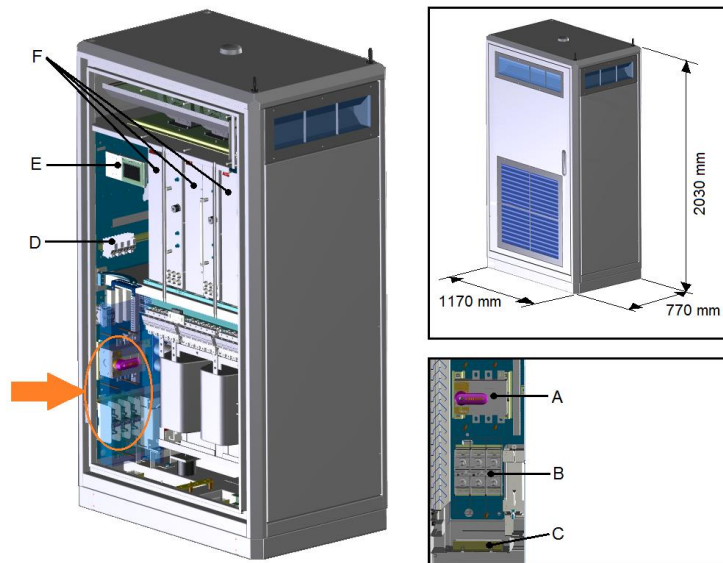
2.1.4. Power Cabinet

Outside view of the HVC 150 Power Cabinet



- | | | | |
|---|------------|---|---|
| A | Base cover | D | 3G Antenna |
| B | Air outlet | E | Air inlets (also on the left and back side) |
| C | Door | F | Door handle / lock |

Inside view of the HVC 150 Power Cabinet



- A Main switch
- B AC Power connection
- C Guidance plate of the cables
- D Data/communication connection

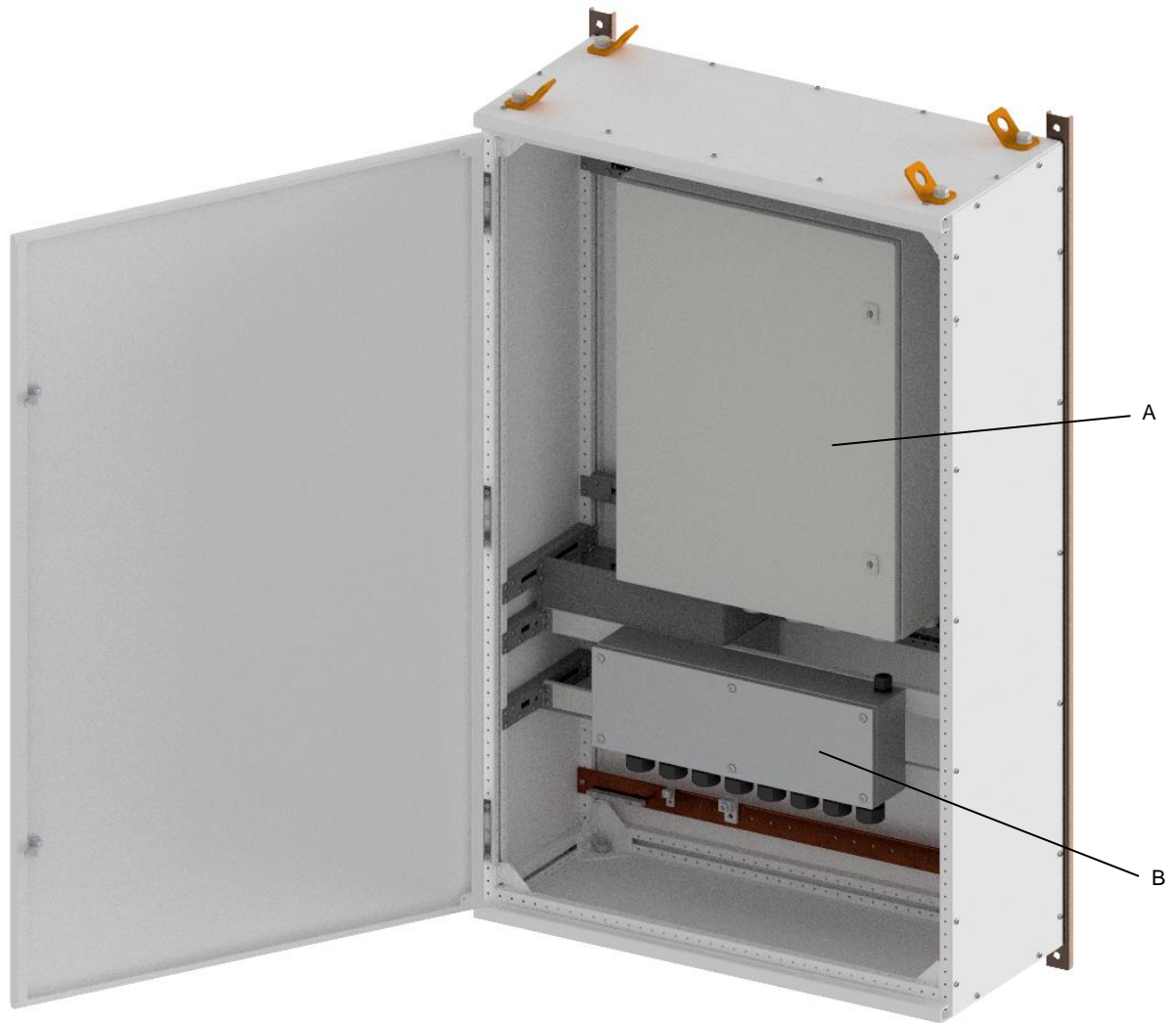
- E Display
- F Power Modules

2.1.5. ACM Enclosure kit

Outside view of ACM Enclosure kit

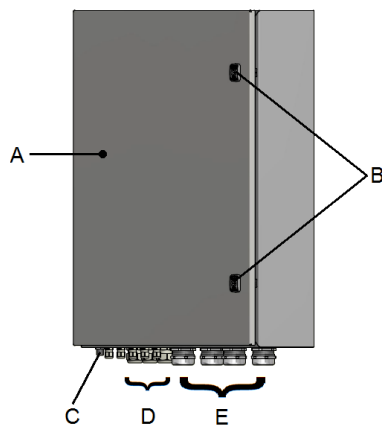


Inside view of ACM Enclosure kit



- A ACS Control Module
- B Junction Box

2.1.5.1. ACS Control Module
Outside view of the ACS Control Module



- A Door

- B Locks
- C WiFi coax connector
- D In- and outputs for cables from Power Cabinet and to pantograph
- E In- and outputs DC power cables

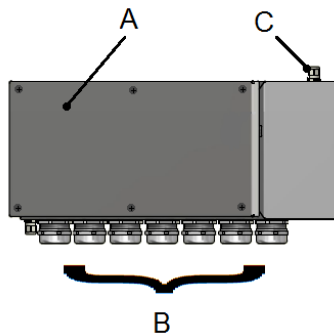
Inside view of the ACS Control Module



- A Communication connection
- B Connection block
- C Protection cover for DC contactors

2.1.5.2. Junction Box

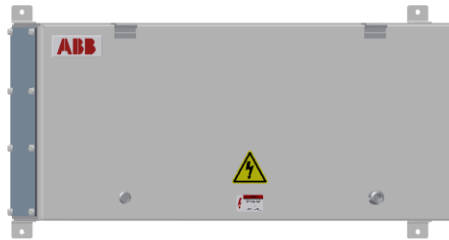
Outside view Junction Box



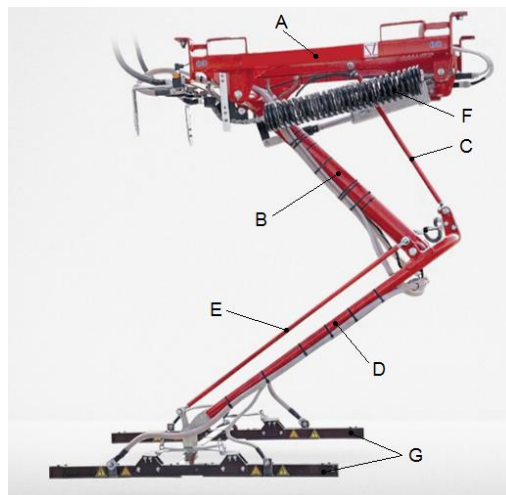
- A Cover
- B In- and outputs DC power cables
- C Output DC- OVP sensing cable (cable is included, length is 750 mm)

2.1.6. Panto Down Bracket Assembly

2.1.6.1. Panto Down Junction Box



2.1.6.2. Pantograph



- A Base frame
- B Lower arm
- C Lower guide rod
- D Upper arm
- E Collector head guidance
- F Tension spring
- G Collector head

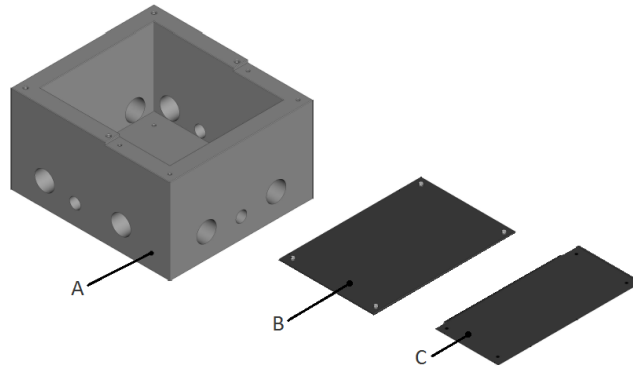
2.2. Accessories

The following parts can be ordered at the time of the initial order or afterwards. Contact ABB Sales department (see *Contact information* on Page 13 for contact details).

2.2.1. Foundation for Power Cabinet

Concrete foundation

The concrete foundation can be used to install the Power Cabinet on soil.

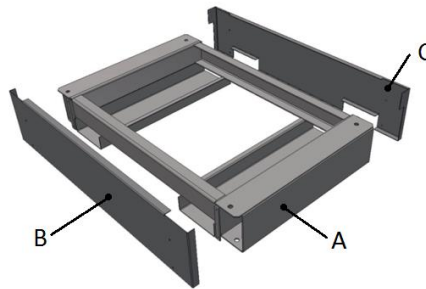


- A Foundation
- B Top cover plate
- C Front cover plate

Amount	Part number	Description
1	ABB6AGC069029	HxC power cabinet foundation & front cover plate
1	ABB6AGC067780	HxC power cabinet foundation top cover plate

Metal frame foundation

The metal frame foundation can be used to install the Power Cabinet on a solid surface.



- A Foundation
- B Front border cover
- C Rear border cover

Amount	Part number	Description
1	4EPY420133R1	HxC power cabinet metal foundation

2.2.2. Wall-mounting brackets for safe wall fixing



The ACM Enclosure kit can be mounted at the installation site without any need for installation of brackets.

2.2.3. Communication glass fiber cable

The CAN and Ethernet communication between the Power Cabinet and Charge control set is done via a glass fiber cable. This glass fiber cable must be prefabricated and can be ordered separately.

Cable length must be defined by the contractor performing installation during site survey.



Amount	Part number	Description
1	OM3, prefabricated	OM3, PCF or fiberglass (multimode, 850 nm) optic cable with 8 fibers (4 for spare), with B-FCO(ST®) connectors

2.2.4. Emergency unit



Amount	Part number	Description
1	1SFA619550R1051	CE4T-10R-02 Emergency stop button (ABB)
1	1SFA619811R1000	CEP1-0 Enclosure (ABB)

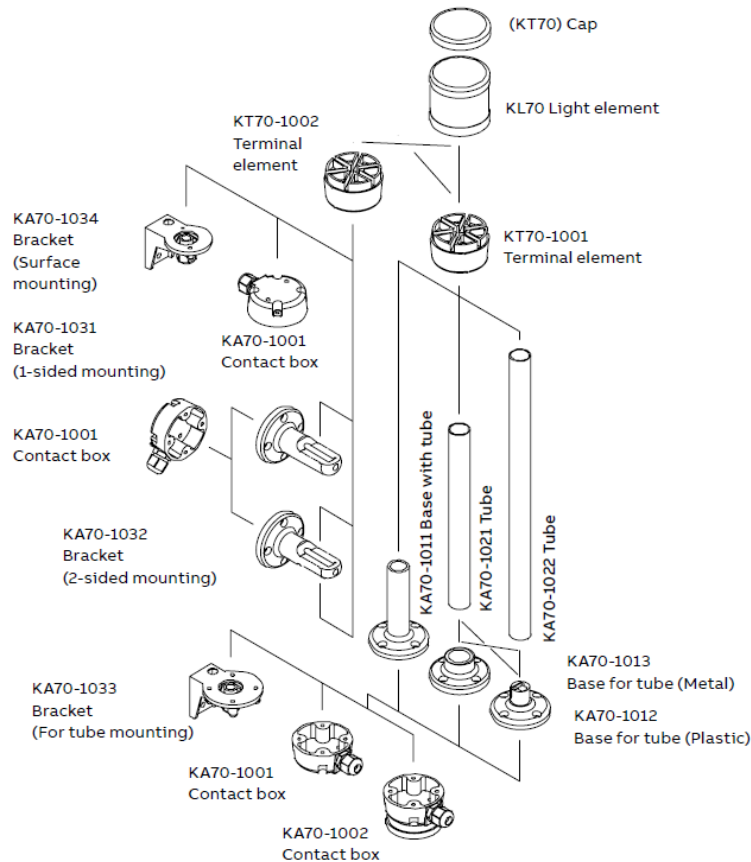
2.2.5. Charger state indicator light (beacon)

Beacon displays the status of the charging system.



Amount	Part number	Description
1	1SFA616070R3051	Red permanent light element with integrated LED, KL70-305R (ABB)
1	1SFA616070R3052	Green permanent light element with integrated LED, KL70-305G (ABB)
1	1SFA616070R3054	Blue permanent light element with integrated LED, KL70-305L (ABB)

There are different possibilities to mount the beacon. Depending on the installation situation, the right bracket can be ordered for mounting the beacon, see picture and table below.



Description	Type	Order code
Terminal elements		
For tube mounting, including cap	KT70-1001	1SFA616075R1001
For bracket or base, including cap	KT70-1002	1SFA616075R1002
Special parts		
Contact box		
Cable exit at side	KA70-1001	1SFA616077R1001
Magnetic base	KA70-1002	1SFA616077R1002
Base with tube		
D=25 mm L=110 mm	KA70-1011	1SFA616077R1011
Base for tube		
D=25 mm, plastic	KA70-1012	1SFA616077R1012
D=25 mm, metal	KA70-1013	1SFA616077R1013
Tube, anodized aluminum		
D=25 mm L=250 mm	KA70-1021	1SFA616077R1021
D=25 mm L=400 mm	KA70-1022	1SFA616077R1022
D=25 mm L=800 mm	KA70-1023	1SFA616077R1023
Bracket		
1-sided mounting, max. 5 elements	KA70-1031	1SFA616077R1031
2-sided mounting, max. 10 elements	KA70-1032	1SFA616077R1032
For tube mounting	KA70-1033	1SFA616077R1033
For surface mounting	KA70-1034	1SFA616077R1034

2.2.6. WiFi antenna

The WiFi antenna is an essential part of the HVC-PD E-Bus Charger system. This takes care of the communication between the charger and the bus.



Amount	Part number	Description
1	1356.17.0008	SPOT-L Linear polarized directional high-gain Wi-Fi-Antenna (Huber+Suhner)

2.2.7. RFID unit

Needed when multiple Pantographs are installed close to each other (distance between each other is less than 12 m).



Amount	Part number	Description
1	RFU 630-131xx (*)	RFID RFU63x (Sick)
1	SSL-2J04-G20ME (part 6036158)	RFID Ethernet cable 20 m (male connector, M12, 4-pin, straight, D-coded / male connector, RJ45, 8-pin, straight) (Sick)
1	2070427	RFID Power cable 10 m (female connector, M12, 17-pin, straight, A-coded) (Sick)

(*) The RFID unit is available for the following regions:

xx

00 = Europe / Saudi Arabia / South Africa

01 = USA / Canada / Mexico

02 = Australia

03 = India

04 = Brazil

05 = China

06 = Japan

08 = Russia / Belarus

10 = Korea

11 = New Zealand

12 = Indonesia

13 = Taiwan

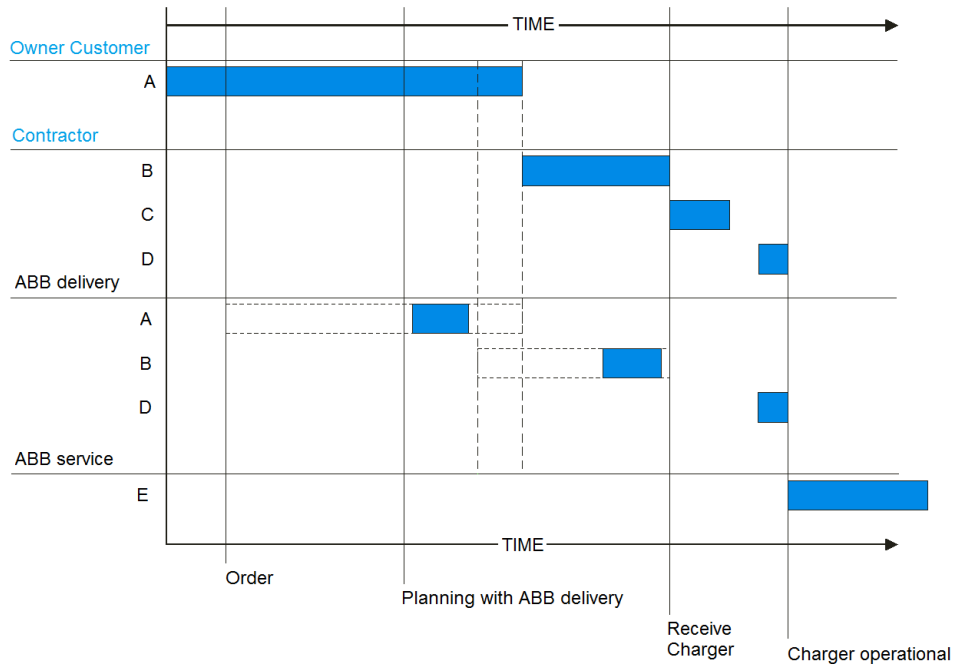
15 = Morocco

3. Preparation

Before beginning the final installation, a number of steps should be taken. This chapter describes the preparations that must be performed before the installation.

3.1. Project planning

Careful project planning is necessary before a HVC-PD Depot E-Bus Charger is purchased and put into operation. The different phases of the full project plan are shown in the figure below:



A. Preparation

The owner / site operator has ordered a HVC-PD Depot E-Bus Charger. In this phase all preparation work must be done before the contractor can do the civil and electrical works.

B. Construction

The contractor does all civil and electrical works. See *Construction* on Page 42

C. Placement and Connection

The location is mechanically and electrically ready to receive the HVC-PD Depot E-Bus Charger. See *About placement and connection* on Page 55.

D. Commissioning

The delivery department will bring the HVC-PD Depot E-Bus Charger into operation. See *Commissioning preparation* on Page 119.

E. Service and Maintenance

The HVC-PD Depot E-Bus Charger is in operation. There are various options for service and maintenance. See *About Service and Maintenance* on Page 121.

3.2. Grid connection

The HVC Power Cabinet requires high current (400 V AC 265 A) connections. A normal domestic or small business power connection is not sufficient.

The HVC 150 Power Cabinet can be connected directly to the electrical grid or to an existing customer low voltage power distribution cabinet. In both cases a 265 A (for the HVC 150), 400 V AC, 50 Hz, 3P+PE connection to the Power Cabinet is necessary that meets the following requirements:

- Fuse (gG type) 3 x 315 A AC or 3 phase 285 A circuit breaker.
- Main switch.
- PE connected to the main PE rail.
- The components used in the HVC 150 are suited for a short circuit capacity of 25 kA.
- A TN-C earthing system. Possibly an extra 0.9 Ω earth electrode is required, consult the grid owner.
- EMC filter is required to meet EMC conducted emission class B: Schaffner type FN 3359HV-400-99. When EMC conducted emission class A is required there is no filter required.
- Specifications of the following parts must be determined by your electrical engineer. They depend on local laws, safety and electrical regulations:
 - Adjustable RCD in the range of 30 mA up to 300 mA. The Power Cabinet has an integrated 300 mA RCD (Type A) for the power section.
 - Class 1 Surge Protection Device (SPD).

Measure, check and report the position of the cables between the power distribution board and the Power Cabinet and the cables between the Power Cabinet and the ACS Control Module.

Contact your electricity retailer and/or grid owner if a grid upgrade is required. Ask about the work that is needed to upgrade the connection to meet the requirements described in section *Electrical installation* on Page 38.

3.3. Internet access

The HVC-PD Depot E-Bus Charger requires a connection to the internet. This connection is used for serviceability, remote access by ABB Service department.

There are two options for the internet connection:

- Wireless, which requires coverage to a 3G network at the location. This is the preferred connection. A 3G modem with active SIM card is included with the HVC-PD Depot E-Bus Charger (a customer SIM card is not required).
- Ethernet (RJ45). If there is no 3G signal available, a wired internet connection must be available at the location. For this option, contact ABB Sales department (see *Contact information* on Page 13 for contact details).

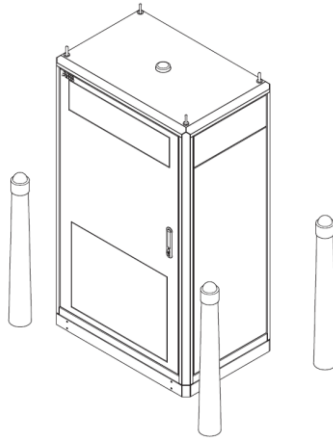
3.4. Location

The location of the HVC-PD Depot E-Bus Charger must meet the following requirements:

- The height is not more than 2000 m above sea level.
- The HVC-PD Depot E-Bus Charger must not be immersed in water, or any other fluid.
- The operational temperature of the HVC-PD Depot E-Bus Charger is between -35 and 45 °C.
 - For locations where the Power Cabinet will be exposed to direct sunlight and high ambient temperatures for most of the day, it is recommended to install

protection from direct sunlight. Otherwise the temperature inside the cabinet might exceed the maximum temperature.

- Do not install or use the HVC-PD Depot E-Bus Charger in areas where there is an explosion hazard. You must provide information about the HVC-PD Depot E-Bus Charger to the fire brigade.
- The protection rating of the housing of the Power Cabinet is IP54 and the ACS Control Module/Junction Box is IP65 and designed for outdoor use.
- The maximum cable length between Power Cabinet and ACS Control Module/Junction Box is 150 m. Take this into account when physically placing the Power Cabinet in relation to the ACS Control Module/Junction Box.
- The maximum cable length between ACS Control Module and Pantograph is 20 m. Take this into account when physically placing the ACM Enclosure kit in relation to the pantograph.
- It is recommended to provide good lighting around the charge system to increase safety.
- Design and arrange the location around the HVC-PD Depot E-Bus Charger in a way that prevents the Depot Charge Box and the Power Cabinet from being hit by vehicles. For example, there can be installed bollards (see picture below) around the Power Cabinet.




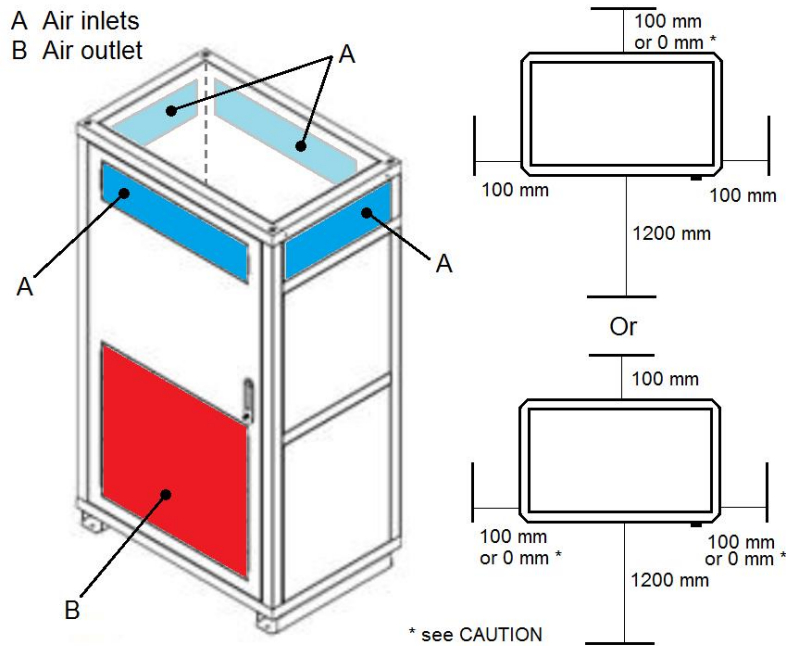
3.5. Geometry of infrastructure

3.5.1. Required space for the Power Cabinet

A single HVC 150 Power Cabinet requires a minimum floor space of 1170 x 2070 mm (W x D) or 1370 x 1970 mm (W x D). This space is calculated as follows:

- A cabinet footprint of 1170 x 770 mm.
- The following free space around the cabinet:
 - 100 mm at the rear side or 0 mm at the rear side when both left and right side have a minimum free space of 100 mm.
 - 100 mm or 0 mm at the left side, if another Power Cabinet is placed next to it.
 - 100 mm or 0 mm at the right side, if another Power Cabinet is placed next to it.
 - 1200 mm at the front side in order to open the front door. If the cabinet is placed inside a room, consider extra free space in front of the open door (escape way for service people).

CAUTION	
	<p>The cabinet needs at least the opening area of the front and rear side with a minimum free distance of 100 mm. This means that cabinets can stand in a row with one or both side entries blocked (distance on left/right side is 0 mm).</p> <p>It is also possible that the cabinet can stand back to back (distance on the rear side is 0 mm). In this case both side entries must have a minimum free distance of 100 mm. If this is not the case, then the air supply is not sufficient.</p>



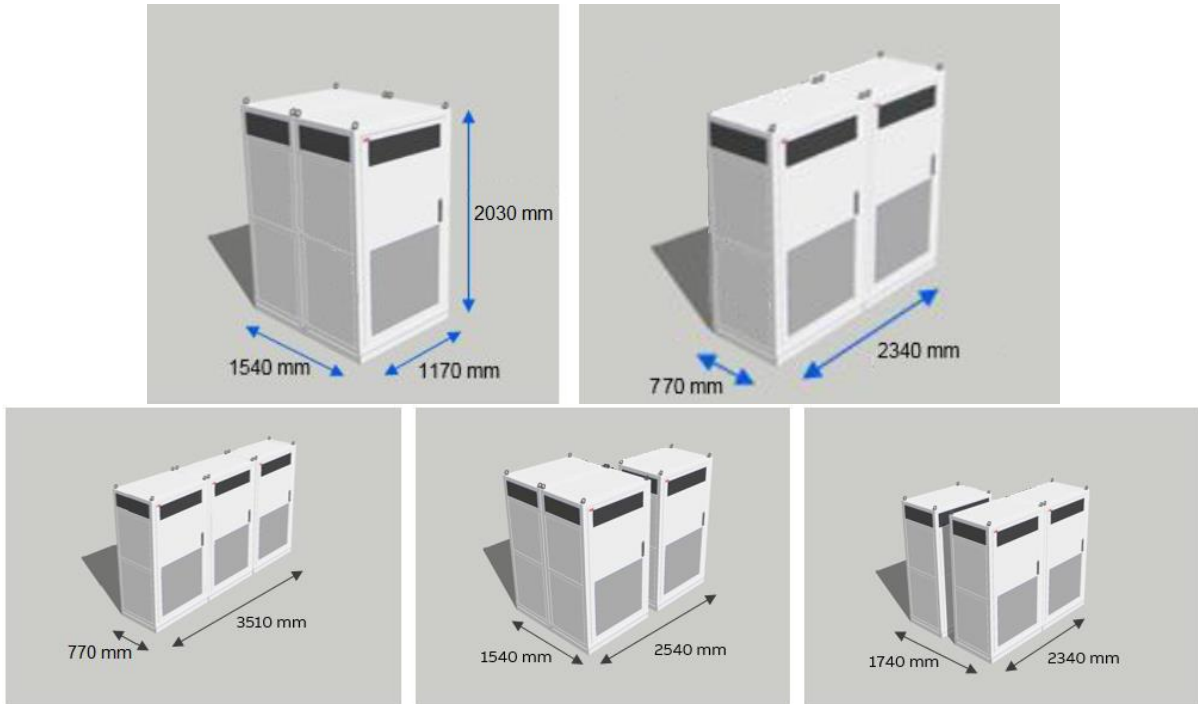
The HVC 150 has air inlets (A) on all sides and air outlet (B) on the front to control the temperature inside the cabinet. Do not install any objects near these air inlets and outlets (see also Caution above). If necessary, take precautions to prevent snow, sand or dust from blocking the inlets and outlets.

Specifications for inside installation of the Power Cabinet

- Airflow required for one cabinet = 1450 m³/h.
- Maximum allowed pressure drop = 300 pA. If the pressure drop of the room is higher than 300 pA an extra fan should be placed. Contact ABB Sales department (see *Contact information* on Page 13 for contact details).

3.5.2. Placement of multiple cabinets

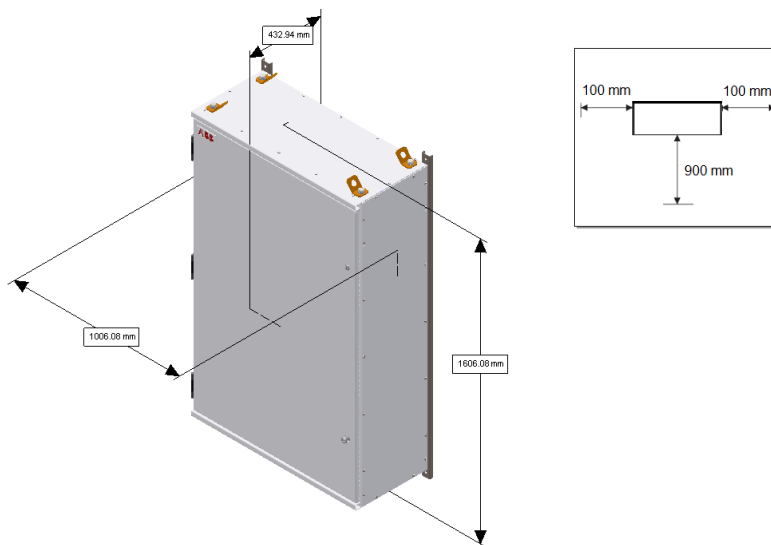
There two possible configurations for the placement of multiple HVC 150 systems, see picture below.



3.5.3. Required space for the ACM Enclosure kit

The ACS Control Module and Junction Box come within the ACM Enclosure kit. The following requirements must be taken into account when determining the location of the ACM Enclosure kit:

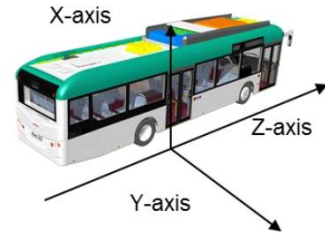
- The following minimum free space:
 - 100 mm at the left and right side.
 - 900 mm at the front side to open the door.
- It is recommended that the ACS Control Module be placed at working height (approximately 1094 mm).




3.6. Pantograph position in relation to the bus

It is important that the pantograph has the good position in relation with the bus, so that the pantograph's collector head can make physical contact with the interface rails on the bus roof. In general, the bus has a certain freedom degree to position under the pantograph:

- Z-axis = 560 (± 280) mm → longitudinal axis;
- Y-axis = 500 (± 250) mm → transversal axis;
- X-axis = 1150 mm → vertical axis;
- When the road is horizontal and the top of road (TOR) is flat (no wear);
- Compensation of angles: X-axis ≤ 3.5°, Z-axis ≤ 2.5°.

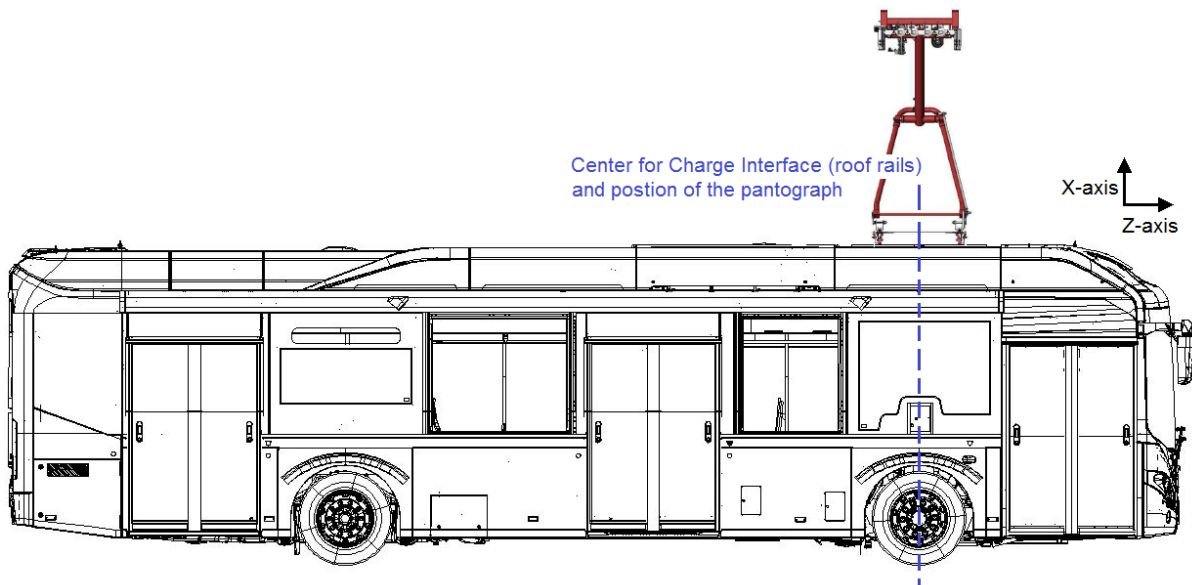


NOTICE	
	<p>ABB can help with the calculation of the position of the Pantograph. Contact ABB Sales department (see <i>Contact information</i> on Page 13 for contact details).</p>

3.6.1. Pantograph position in relation to the drive direction of the bus

Note: the following example is with respect to a bus which has the contact rails directly above the front wheelbase.

The front wheelbase is exactly below the power charge connection rails on the roof of the bus. So the center of the pantograph in Z-axis should be in line with the center of the front wheel of the bus.



3.6.2. Pivoting of the collector head around the pantograph axis (Z-axis)

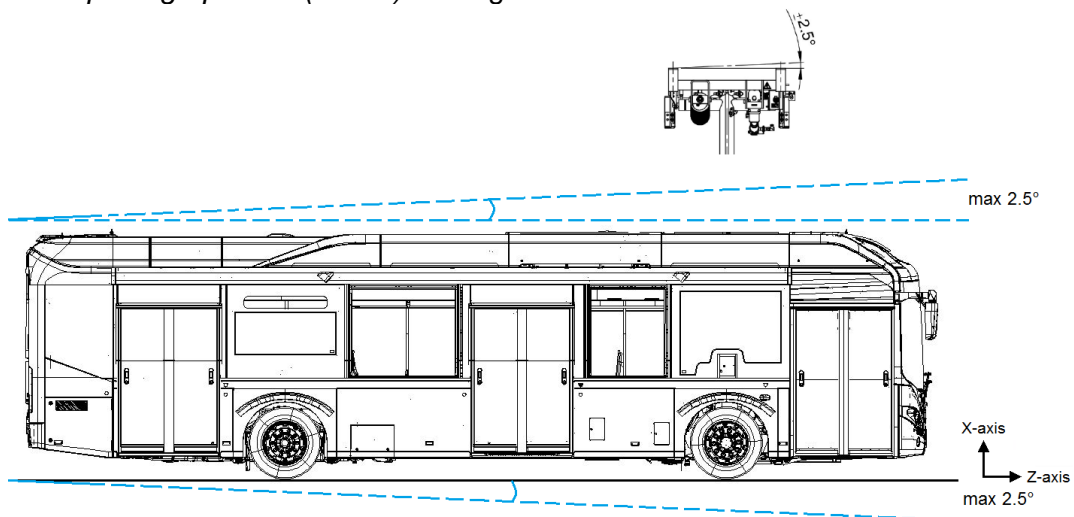
The collector head of the pantograph can compensate for inclination about the Z-axis to a minor extent tolerance.

When the collector head gets in contact with the contact rails on the bus roof an inclination of the bus roof of ±1.5° is allowed.



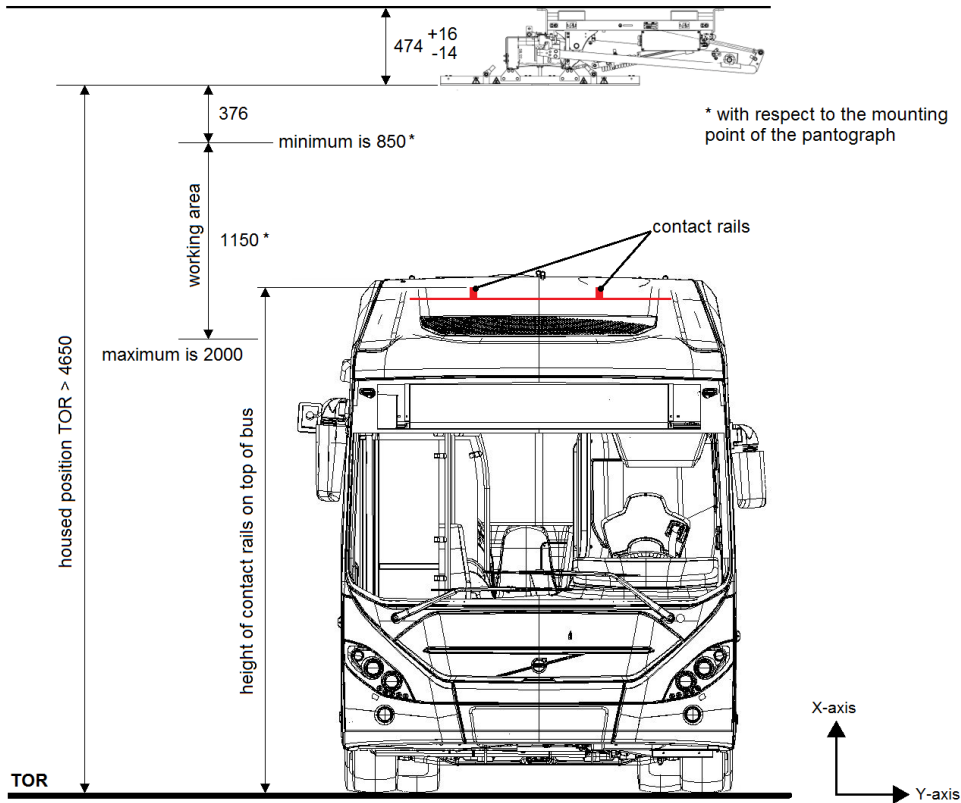
3.6.3. Maximum allowed slope of the pantograph in Z-axis

The maximum inclination of the pantograph in Z-axis is 2.5° . This allows to compensate a slope of the floor space of the bus (road gradient), see section *Pivoting of the collector head around the pantograph axis (Z-axis)* on Page 31.



3.6.4. Pantograph position in X-axis (height relative to TOR)

How high the pantograph should be placed depends, among other things, on the height of the contact rails that are placed on the roof of the bus. The picture below shows the working area of the pantograph.

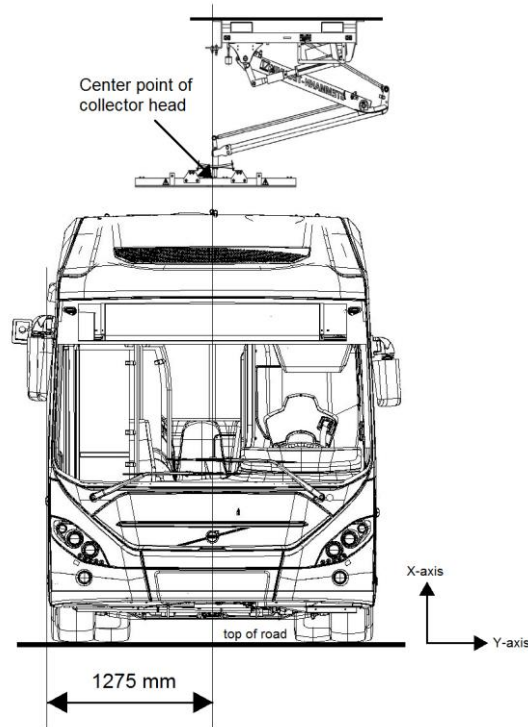


The working area in which the pantograph has the right force to make contact force with the contact rails is 1150 mm; the upper working position is 850 mm and the lower working position is 2000 mm measured from the mounting point of the pantograph (see picture above). This means that the contact rails must be in the working area of the pantograph. So the height of the contact rails on the roof of the bus relative to the TOR and the working area of the pantograph determines how high the pantograph can be placed with respect to TOR. Bear in mind that the pantograph is sufficiently high when in housed position that no other vehicles can hit the pantograph.

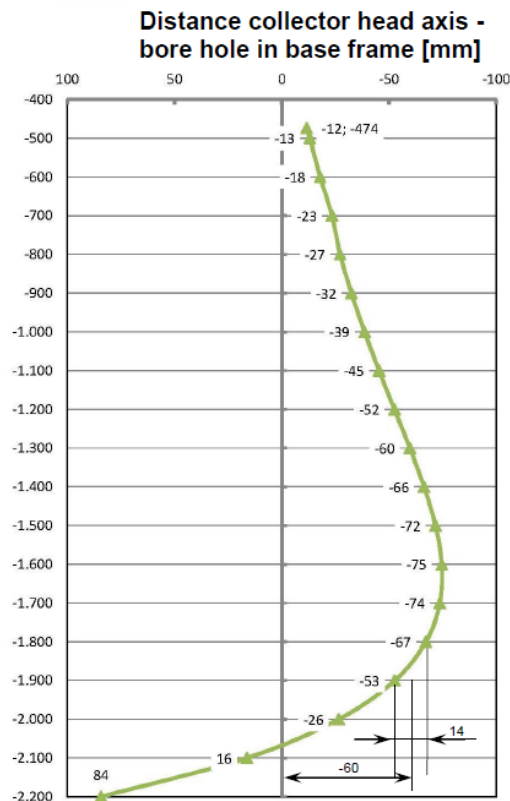
3.6.5. Pantograph position in Y-axis in relation with the bus

The picture below shows the correct position of the pantograph with respect to the position of the bus; the center of the pantograph's collector head must be aligned with the center line of the bus in Y-axis. Be aware this is in case the road is flat and doesn't have an angle in the sideways direction of the bus, else the minimum and maximum distance need to be re-calculated.

The maximum deviation in Y-Axis may be ± 250 mm with respect to the center line of the bus.



The picture below shows the curve the collector head of the pantograph make when lowering down. The -474 mm is the start position of the collector head measured from the mounting point of the pantograph. This S-curve must be taken into account when determining the correct position of the pantograph in the Y-Axis.



S-curve of the collector head during lowering into different working heights

Due to the S-curve of the pantograph offsets result for the working area in Y-Axis of -75mm to +84mm.

Due to the S-curve the height of the bus has to be taken into account when positioning the pantograph above the road so that the vehicle can be positioned at the low accuracy of ± 250 mm in Y-Axis always. Otherwise the tolerance for the positioning of the vehicle more strictly:

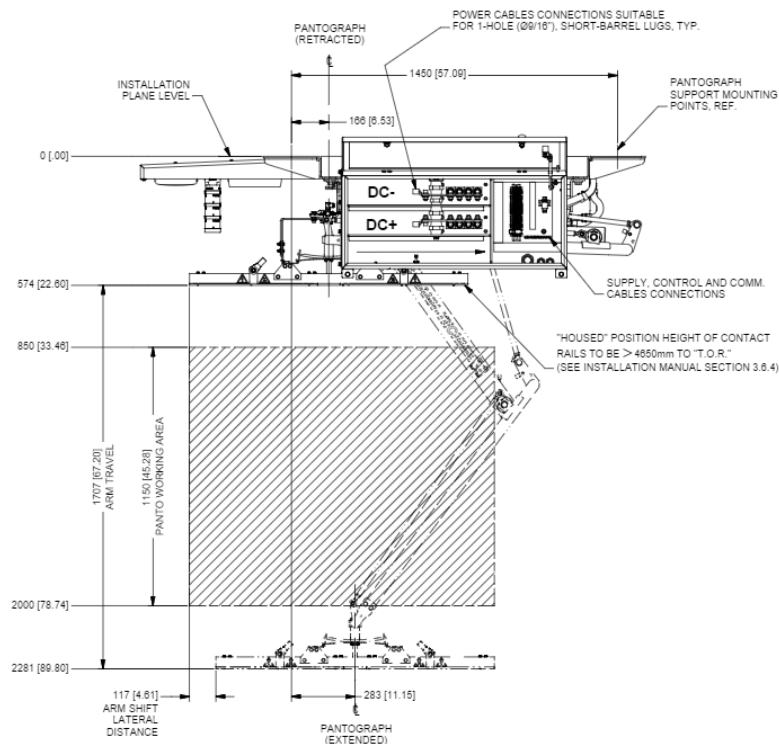
Example²:

The pantograph works between the working height of -1800 mm and -1900 mm, according to TOR = 3340 mm and TOR = 3240 mm. The position tolerance of the pantograph in Y-Axis is ± 250 mm.

The S-curve shows for the working height -1800 mm a Y-Axis of the collector head center of -67mm and for the working height of -1900 mm a Y-Axis of the collector head center of -53 mm related to the 0-line, which passes through the center of the front bore hole of the pantograph.

The difference in Y-Axis is thus 14 mm ($| -67 | - | -53 | = 14$). The collector head center will shift to the relevant working heights to -60mm in Y-direction.

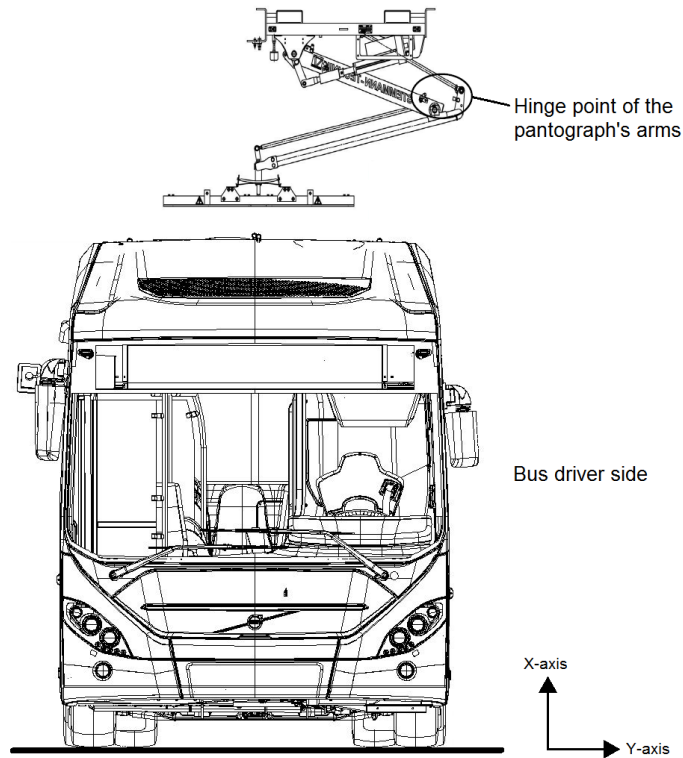
The Y position of the collector head center lays in relation to the center of the front bore hole of the pantograph at -60 mm ($-53 - 14/2 = -60$) and will vary by ± 7 mm. This results in a working area in Y-Axis of ± 183mm ($250 - 60 - 7 = 183$).



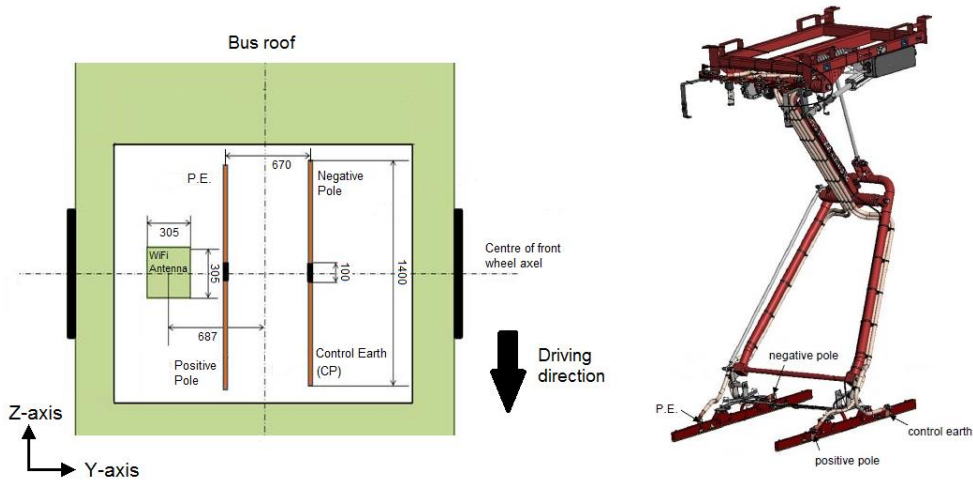
Shifting of the collector head center due to the S-curve

The hinge point of the pantograph’s arms is, in most cases, located on the right side of the bus (seen from the front of the bus), shown in the figure that follows:

² Reference: taken from “Single Arm Pantograph”, document Stemann-Technik 0Fb206.03

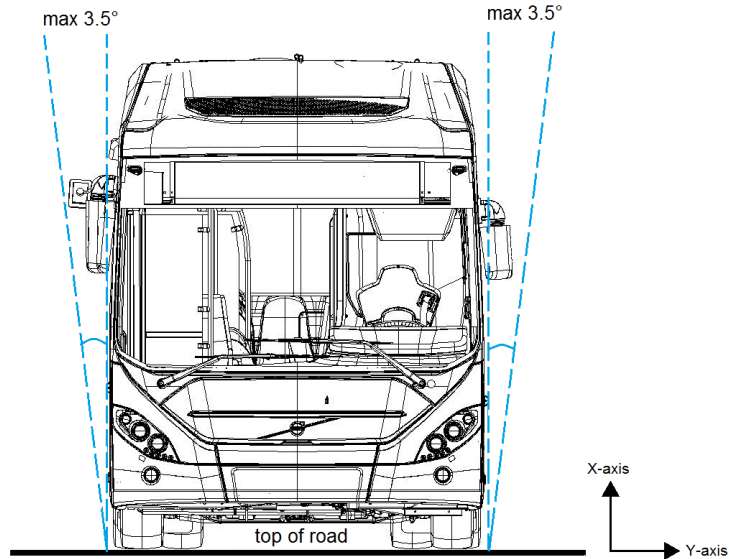


In this case the pantograph's collector head make the right electrical contact with the contact rails on the roof of the bus, see picture below.



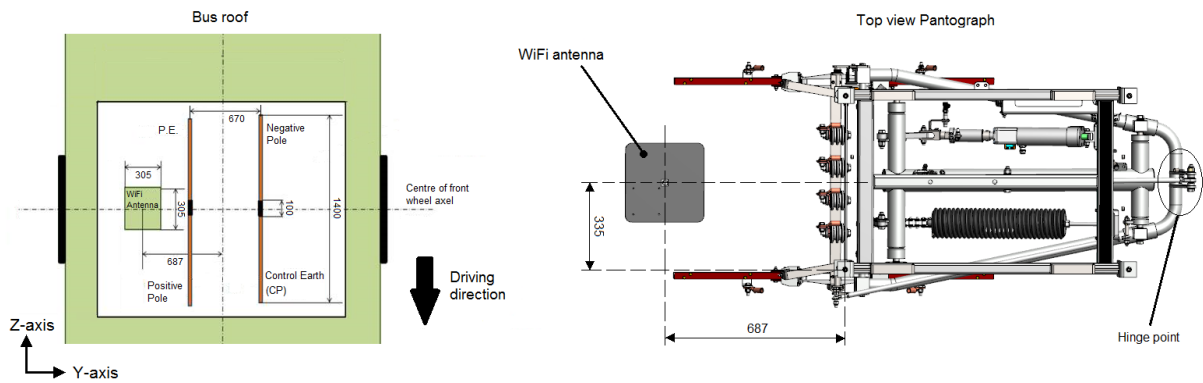
3.6.6. Maximum slope of the road in X-axis

The maximum slope of the road sideways direction is 3.5° , **including** the kneeling of the bus. This will shift the top of the bus 200 mm (assuming a height of 3280 mm from the bus) relative to the center of the bus. So the displacement caused by the road angle should be taken into account calculating the position of the Pantograph in X-axis with respect to the bus.

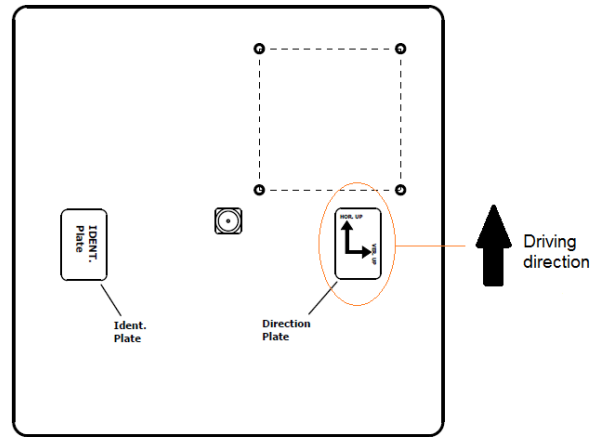


3.7. WiFi antenna position in relation to the bus

The WiFi antenna is an essential part of the HVC-PD E-Bus Charger system. This takes care of the communication between the charger and the bus. To establish good communication, the WiFi antenna must be located above the WiFi receiver/transmitter on the bus during the charge session. The picture below shows the location of the WiFi receiver/transmitter on the bus and the position of the WiFi antenna with respect to the pantograph.



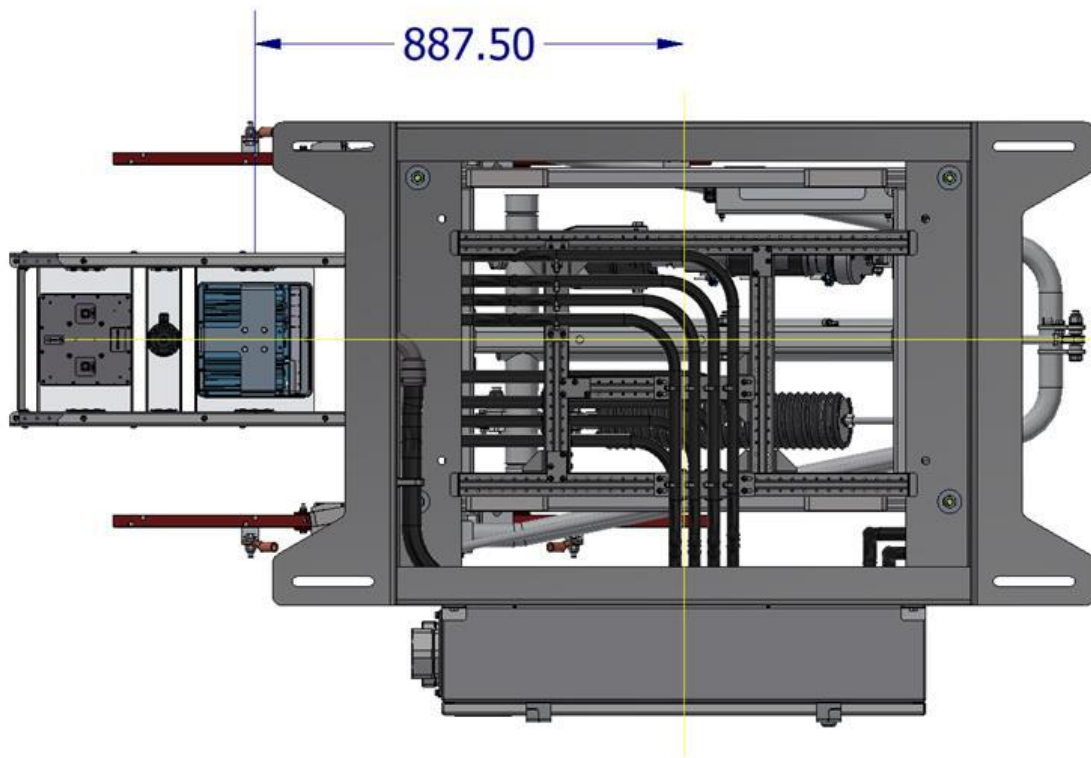
The WiFi antenna can be used in linear vertical or horizontal polarised direction. In the HVC-PD E-Bus Charger system, the WiFi antenna is oriented according to the indicated sign on its back plane "Hor.Up", in the drive direction of the bus. See picture below.



Top view WiFi antenna

3.8. RFID reader within the PD bracket

Should an RFID reader be necessary for your application, as described in Section 2.2.8, it's location in the PD bracket will be as per this picture:



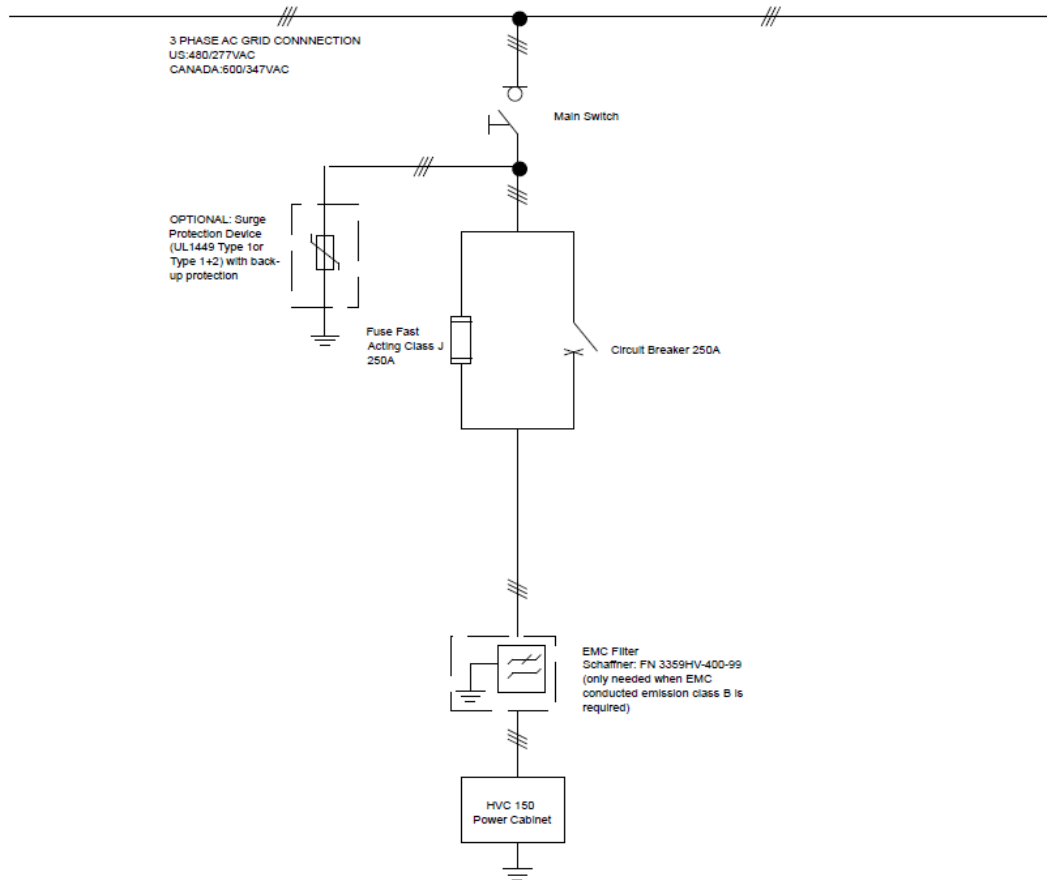
Contact your local ABB technical representative for support with the RFID pairing.

3.9. Electrical engineering

3.9.1. Electrical installation


The electrical installation must be completed according to the local safety and electrical regulations and laws. See section *Grid connection* on Page 27 for the requirements of the electrical connection. A one-line diagram for the electrical grid connection for the Power Cabinet is shown in the figure that follows. The diameter of the electrical conductor (maximum

cross section is 240 mm²) in the AC power cable depends on the length and method of installation. This must be determined by your contractor.



The activities of installing cable conduits (for underground), ducts or trays for the supply of cables between the different parts of the HVC-PD Depot E-Bus Charger, are entirely dependent of the location, and may differ per location. For this reason, the installation of those cable conduits, ducts or trays are out of scope for this Installation Guide. It is the responsibility of the contractor to setup a routing plan for the cable conduits, ducts or trays for the installation on location.


3.10. Civil installation

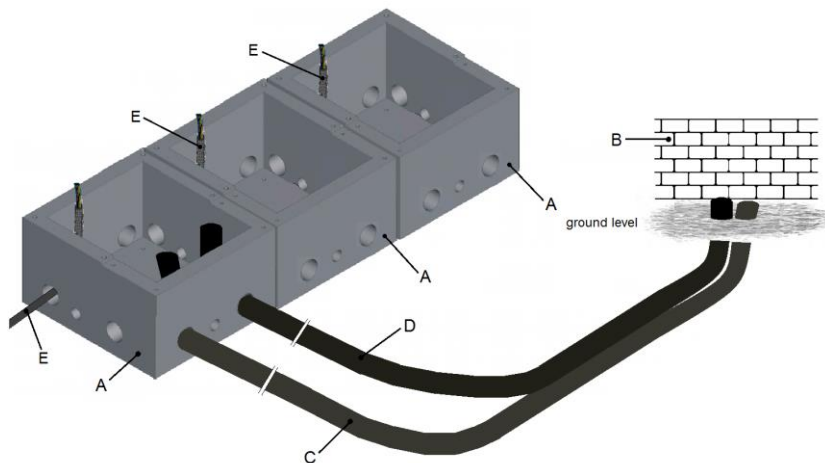
NOTICE	
	<p>The instruction described in this section assumes that the cables between the Power Cabinet and the ACS Control Module are placed into the ground.</p> <p>Depending on the location, for example the HVC-PD Depot E-Bus Charger is installed inside, the cables can be installed above the ground. In this case there is needed cable ducts or trays to protect the cables. Check with your local contractor what the installation options are because this is not described in this Installation Guide.</p>

DC power cables, AC utility power cable, PE wire and data cables must be routed between the Power Cabinet and the Charge control set. Therefore two (flexible) cable conduits with an outer diameter of 160 mm must be installed between the foundation of one of the Power Cabinets and the position where the ACS Control Module is mounted.

The DC power cables must be installed in separate cable conduit with respect to the AC utility power cable, PE wire and data cables. The maximum length of the cables between the Power Cabinet and the ACS Control Module is 150 m. Both conduits must be at least 600 mm deep in the ground and must be in one-piece.


The AC power cable from the distribution board can also be installed in a cable conduit (is not mandatory).

	NOTICE
	<p>It is recommended to place an extra flexible cable conduit with an outer diameter of 40 mm in the cable conduit intended for the AC utility power cable, PE wire and data cables. This extra cable conduit is meant for the glass fiber cable.</p>



Example of civil installation when ACS Control Module is mounted on a wall (450 kW Charge system)

- A Foundation of Power Cabinet
- B Wall on which the ACS Control Module and Junction Box will be mounted
- C Flexible conduit for DC power cables
- D Flexible conduit for AC auxiliary power, PE wire and data cables
- E AC power cable for Power Cabinet

	NOTICE
	<p>Document the location of all the cables in the ground between the Power Cabinet and the ACS Control Module. The routing of the cables can be found easily in the future, for example, prevent damage by excavation work.</p>

3.11. Lightning protection

One electrode (ground rod) of maximum 10 Ω must be placed into the earth near the foundation of the Power Cabinet. In some cases, also additional grounding is required at the

ACM Control Module side. This is dependent on the local regulations and should be determined by the contractor.

If the grid is TT based, consult the grid owner. It is possible that an extra 0,9 Ω electrode will be required. This requirement must be determined by the contractor.

Consult a local specialist for the options of lightning protection. The charge system has to be within the protection angle of the lightning distraction. This requirement must be determined by the owner and a local specialist (according to NEN-EN-IEC 62305).

The implementation of the lightning protection depends on the local laws, safety and electrical regulations. This requirement must be determined by the contractor and owner of the site / HVC-PD Depot E-Bus Charger.

4. Construction

The construction phase includes all work required to prepare the location and make it ready for the placement and connection of the HVC-PD Depot E-Bus Charger. The construction phase can start when:

- All engineering work is done.
- All permits are granted.
- The grid connection is available.



4.1. Construct foundation of the Power Cabinet

4.1.1. Options

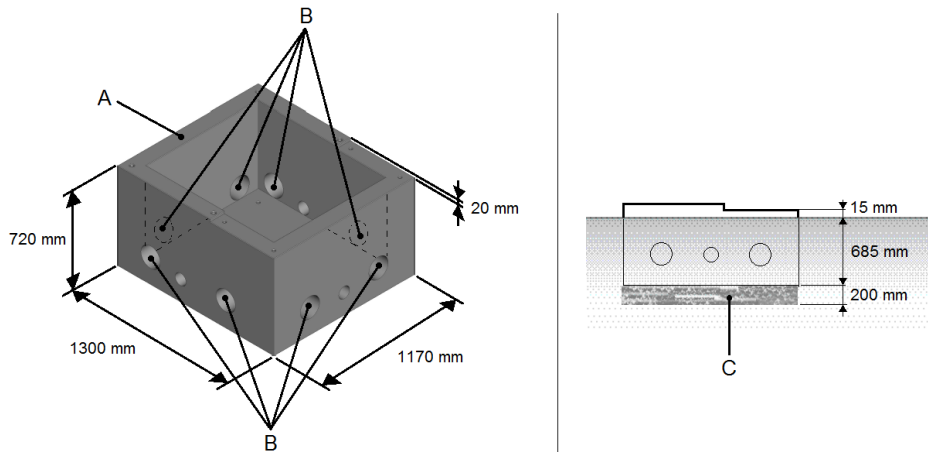
Use the correct foundation for the type of surface that the Power Cabinet will be installed on:



- **Soil**
Use a concrete foundation to get a firm fixation on soil.
A concrete foundation can be ordered separately. See section *Accessories* on Page 19. For detail drawings see Appendix D *Dimensions concrete foundation Power Cabinet*.
- **Solid floor**
 1. Use a metal frame foundation to guide the cables from the cabinet to the cable duct. This foundation can be ordered separately. See section *Accessories* on Page 19. For detail drawings see Appendix E *Dimensions metal frame foundation Power Cabinet*.
 2. The Power Cabinet is installed directly on a solid floor, through which the floor is accessible from below (related to the feed through of the cables). For detail drawings see Appendix A *Dimensions Power Cabinet*.

The cables must be embedded in the ground within cable conduits. See section *Cabling* on Page 49 and section *Civil installation* on Page 39.


	NOTICE
	<p>It is advised to install traction wires into the conduits to install the electrical cabling afterwards.</p>
	NOTICE
	<p>Be aware of the bending radius of the AC power input cables when using the metal frame foundation. This metal frame foundation has a height of 180 mm.</p>

4.1.2. Workflow with concrete foundation




	<p style="text-align: center;">WARNING</p> <p>Make sure that personnel cannot be crushed or become trapped while moving the foundation. Be aware that the weight of the concrete foundation is about 1300 kg.</p>
	<p style="text-align: center;">CAUTION</p> <p>Before you lower the foundation, remove sharp edges of the cable holes (B) in the foundation to protect the cables.</p>

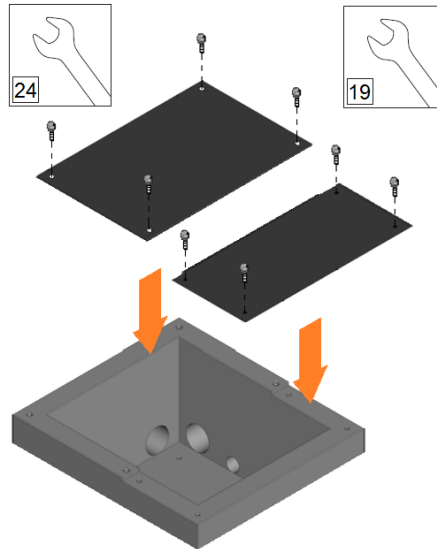
1. Make a hole in the ground with at least a minimum depth of 885 mm, shown in the figure above.
2. Fill the hole with (minimum) 200 mm lean concrete (C), see figure above.
3. Make sure that the conduits are routed to one of the indicated positions (B). The conduits must come out of the foundation with a length of about 250 mm.
4. Make sure that the AC power cable is routed to one of the indicated positions (B).
5. Lower the foundation (A) into the hole.
6. Make sure that the front top surface of the foundation is at least 15 mm above ground level (see figure above).
7. Make sure that the top surface of the foundation is leveled.
8. Route the conduits through one of the eight holes (B).

	<p style="text-align: center;">NOTICE</p> <p>Make sure that the end of the cable conduits are 300 to 500 mm above the top of the foundation.</p>
---	---


9. The conduits must be installed with a curve inside the foundation in order to prevent water from entering the conduits and seal the space between the conduits and all open holes.
10. Route the AC power cable through one of the eight holes (B). Make sure that a cable length of 1000 mm is available above the surface of the foundation for internal routing in the cabinet.

	NOTICE
	<p>This extra cable length is required to connect the AC power cable with the connectors in the Power Cabinet without problems.</p>

11. Place both cover plates on the appropriate place on the foundation.

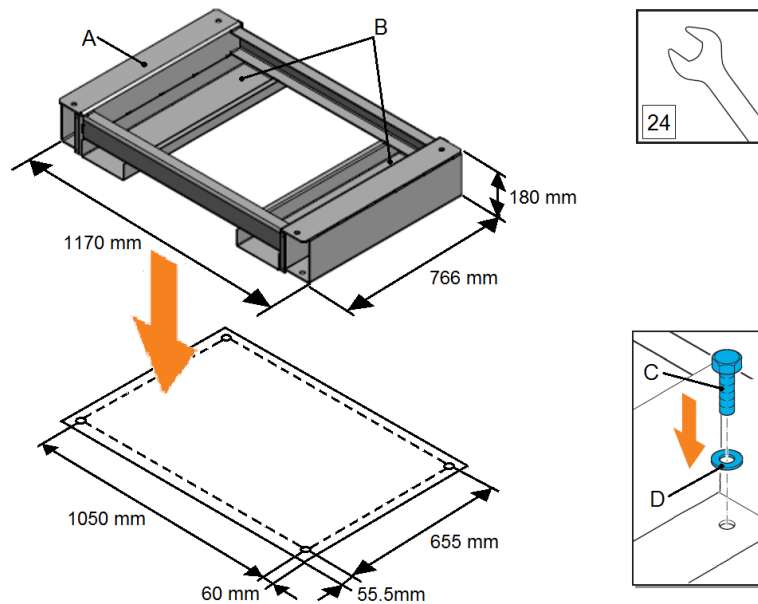


12. Secure the top cover plate with M16 bolts (4x) and the front cover plate with M12 bolts (4x).


	WARNING
	<p>These cover plates are required to prevent people from falling into the foundation.</p>

13. Fill the open space in the ground around the foundation and the channels for the conduits with filling material (e.g. sand). Filling material is packed 2 – 3 times with a packing machine until the desired ground level is obtained. Avoid having filling material inside the foundation.


4.1.3. Workflow with metal frame foundation



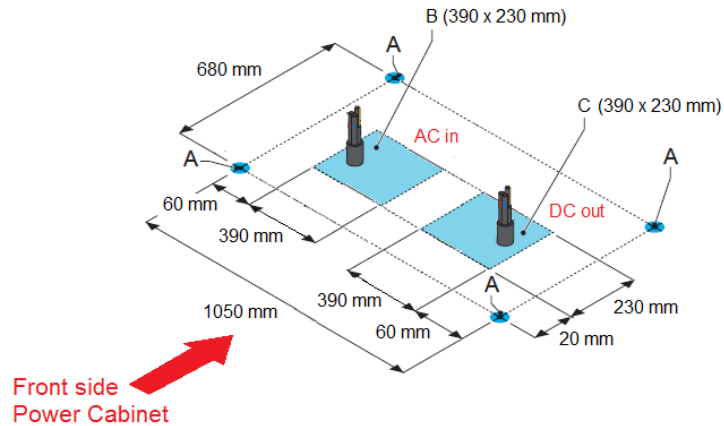
1. Place the frame (A) in the desired position and mark the position of the holes for drilling.

	NOTICE
	<p>The hole distance of 655mm on either side of the metal frame foundation is not equal to the hole distance (680 mm) from the HVC 150(S) cabinet. See also the mechanical drawing in Appendix G <i>Dimensions Metal Foundation Power Cabinet</i> on page 136.</p>

2. Remove the frame.
3. Drill and tap holes at the marked positions. The holes must be suitable for bolt size M16.
4. Route the cables tray through one of the cable openings (B).
5. Align the frame (A) with the tapped holes.
6. Insert the bolts (C) fitted with the washers (D) into the holes (4x).
7. Tighten the bolts.
8. Route the AC power cable through the left cable opening (B). Make sure that a cable length of 1000 mm is available above the floor for internal routing in the cabinet.

	NOTICE
	<p>This extra cable length is required to connect the AC power cable with the connectors in the Power Cabinet without problems.</p>

4.1.4. Workflow mounting Power Cabinet direct on a floor (footprint)



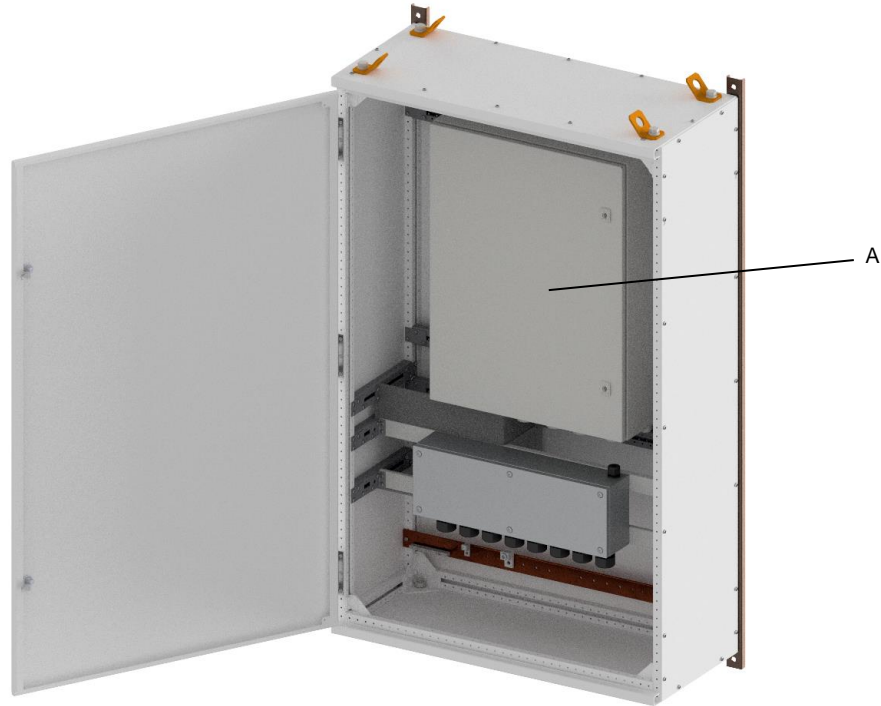
1. Drill and tap holes in the floor at the indicated positions (A). The holes must be suitable for bolt size M16.
2. Make rectangular holes on the indicated positions (B) and (C). For detail drawings bottom view of Power Cabinet see Appendix A *Dimensions Power Cabinet*.
3. Make sure that the AC power cable and other cables comes out of the floor within the marked area (B).
4. Make sure that the DC power cables come out of the floor within the marked areas (C).
5. For the AC and DC power cable, make sure that a cable length of 1 m is available above the floor for internal routing in the cabinet.
6. For the other cables, make sure that a cable length of 3 m is available above the floor for internal routing in the cabinet.

	NOTICE
	<p>This extra cable length is required to connect the cables with the connectors in the Power Cabinet without problems.</p>
	NOTICE
	<p>To prevent dust from entering the tapped holes, it is recommended that you cover them until you are ready to do the placement.</p>

4.2. Mounting preparation of the ACS Control Module Enclosure

4.2.1. Preparation

Refer to general layout drawing 2CEB260002E0002.pdf for the finer details of this equipment.




A ACS Control Module

- **Wall mounting**
The ACM Enclosure kit should be mounted on a solid wall.

4.2.2. Workflow for wall mounting

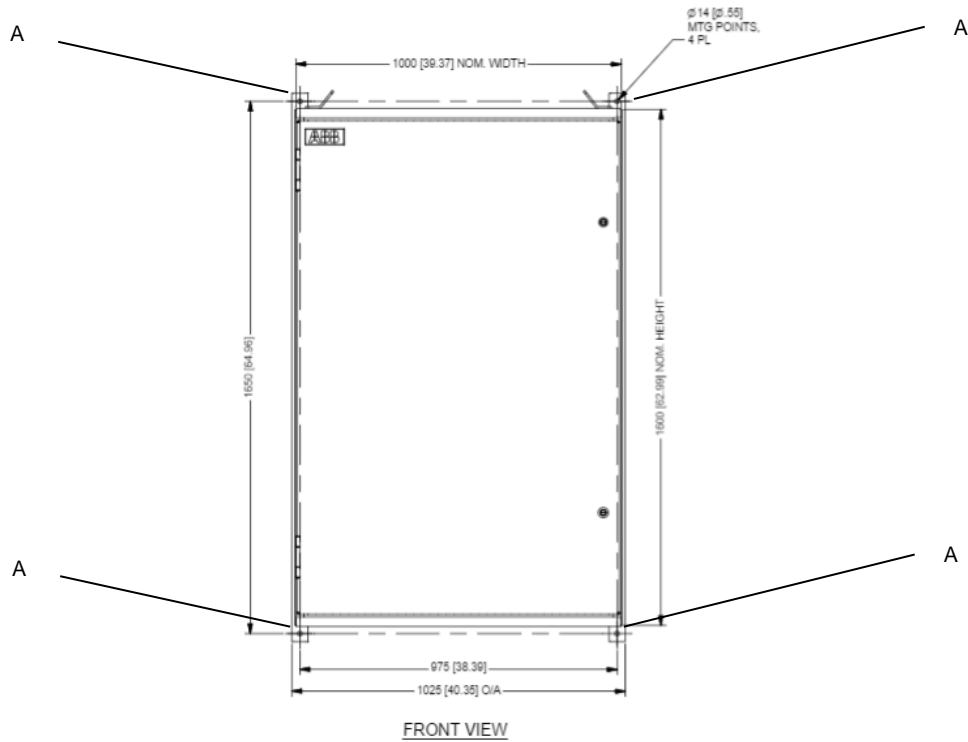
Preconditions:

- Parts: 4x wall plugs (Ø12 mm, L = 50 mm).
- Tools: mark tools, level tool, drilling machine, drill bit (Ø12 mm).


NOTICE	
	<p>For a correct operation of the ACS Control Module, it is important that the cabinet is mounted properly levelled.</p>

To mount the ACM Enclosure on a wall:

1. Use the 4 mounting points as referenced.



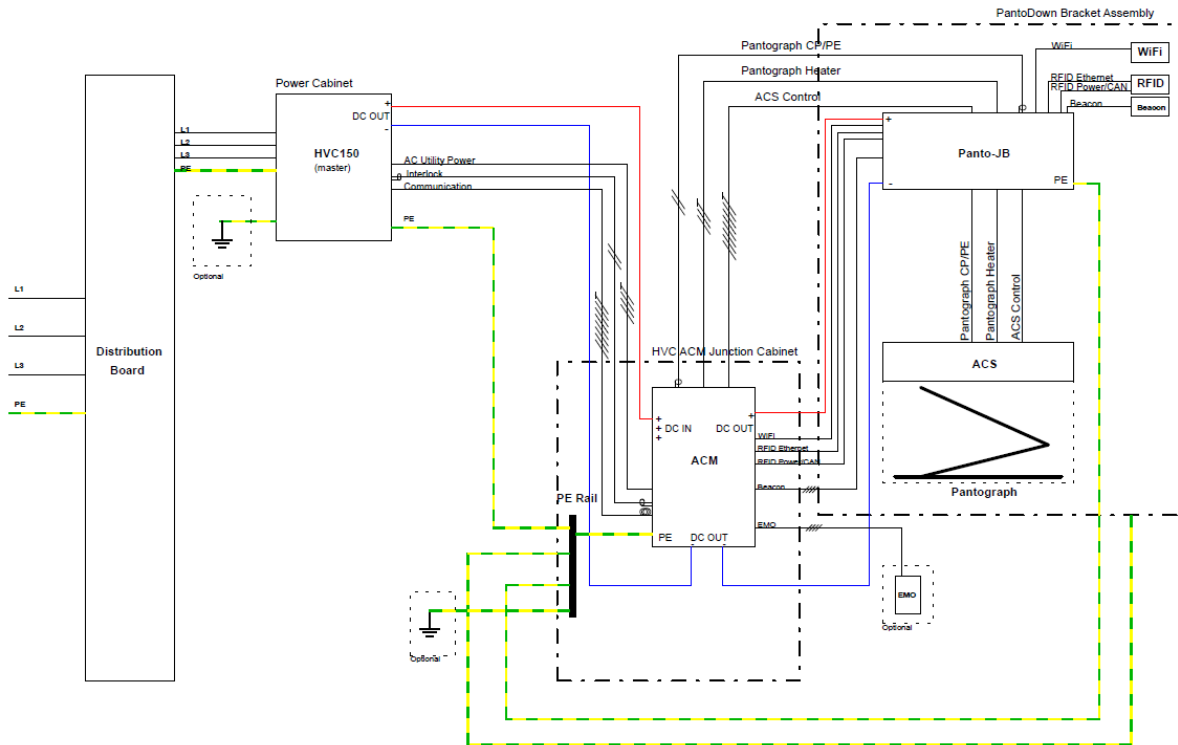
2. Drill holes in the wall at the indicated positions (A) of one of the chosen mounting options (see pictures above). For any material, the mounting surfaces must be suitable for M12 bolts.
3. In case of a concrete or stony wall, insert wall-plugs (4x) into the holes.

NOTICE	
	<p>The activities of installing cable ducts, for the supply of cables for the ACS Control Module, are entirely dependent of the location, and may differ per location. Due to this reason, the installation of those cable ducts is out of the scope of this Installation Guide.</p> <p>It is the responsibility of the contractor to setup a routing plan for the cable ducts and installing this cable ducts on location.</p>

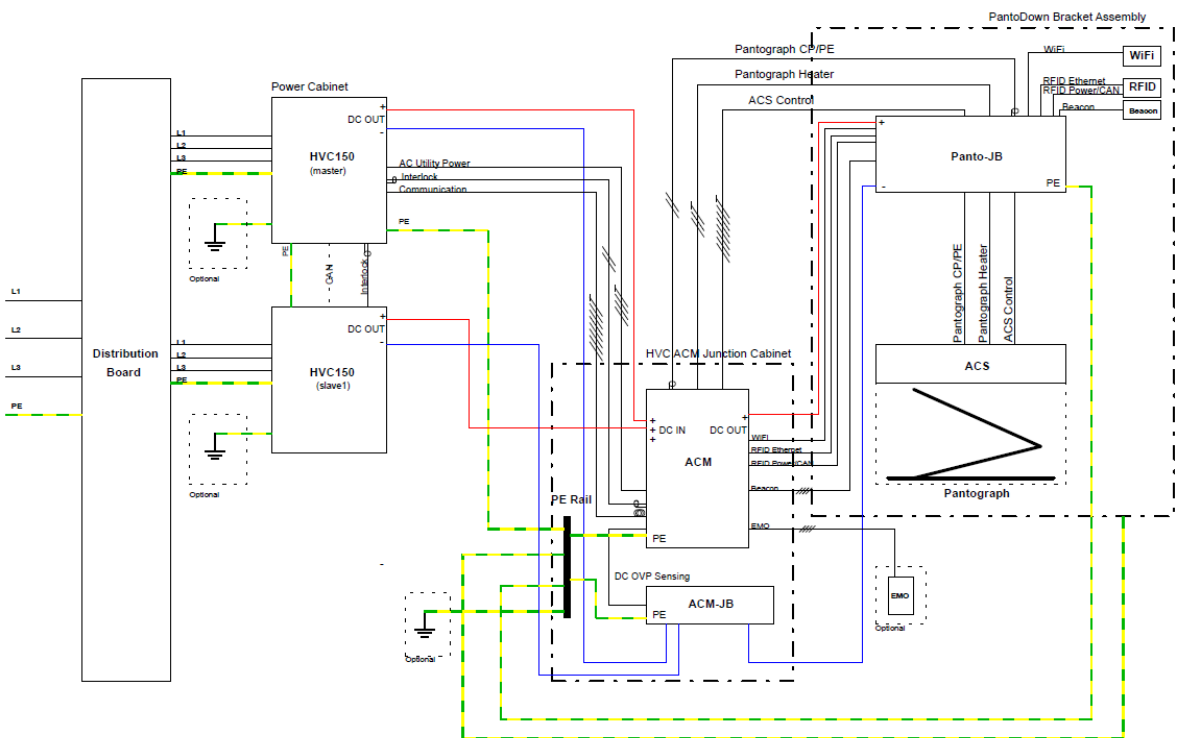
4.3. Cabling

4.3.1. Charge system configurations

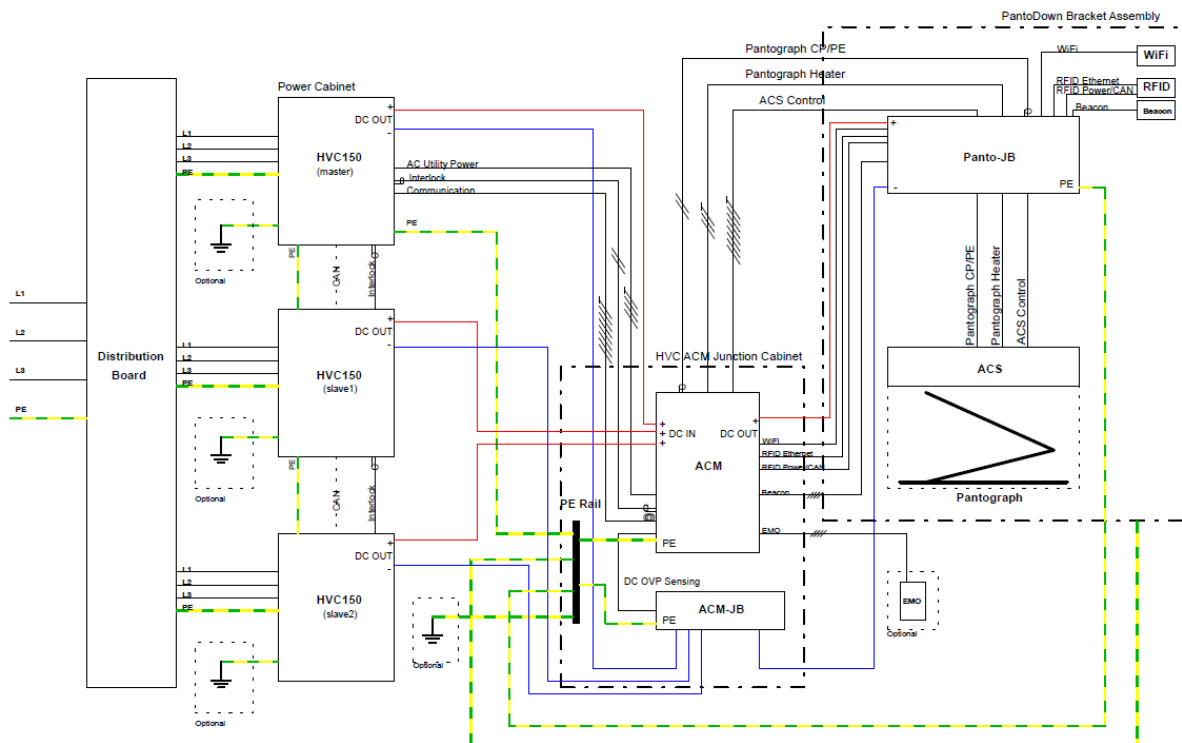
Overview electrical connections of an HVC-PD 150 kW charge system



Overview electrical connections of an HVC-PD 300 kW charge system



Overview electrical connections of an HVC-PD 450 kW charge system



Separated electrical diagrams for the different HVC-PD Charge systems are available:

- 2CEB260001E0016, Electrical diagram HVC-PD 150 kW Depot E-Bus Charger,
- TBD, Electrical diagram HVC-PD 300 kW Depot E-Bus Charger,
- 2CEB260001E0008, Electrical diagram HVC-PD 450 kW Depot E-Bus Charger.

Contact ABB Sales department (see *Contact information* on Page 13 for contact details) to request the electrical diagrams.

4.3.2. AC power cable

For Power Cabinet:


- Cable type: 3P+PE (optional shielded).
- The cable shielding (if present) must be attached to the PE Rail at both ends of the cable.
- The cross section of the cable conductor must be determined by your contractor.
- The maximum cross section is 240 mm².
- The PE conductor of the power cable must have the same cross section as the phase conductors.

4.3.3. Cables between the Power Cabinets and the ACS Control Module

The following cables are not in the scope of supply of ABB.

- 2x, 4x or 6x DC power cables (depending on system configuration),
- 1x PE cable,
- 1x AC utility power cable,

- 1x Interlock cable,
- 4x communication cables; 8x glass fiber (4 fibers are required, 4 are for spare).
 - The 8x glass fiber cable is a special cable that should be sourced locally.

	NOTICE
	For detailed information about type of glass fiber cable which are needed, see <i>Communication glass fiber cable</i> on Page 21.


Use local regulations and datasheet of the manufacturer to determine the cable cross section for the DC power cables. Recommended minimum cable cross section is 185 mm² (with a reinforced isolation > 5400 V DC) for a distance until 150 m.

4.3.4. Cables between the Power Cabinets

The following cables are not in the scope of supply of ABB.

- 1x PE cable;
- 1x Interlock cable;
- 1x CAN cable.

4.3.5. Cables between the ACS Control Module and the Panto Down Junction Box

	NOTICE
	The maximum length of the cables between the ACS Control Module and the Pantograph is 20 m. Take this into account when physically placing the ACS Control Module in relation to the pantograph.

The following cables are not in the scope of supply of ABB.

- 2x, 4x or 6x DC power cables (depending on system configuration),
- 1x Pantograph CP/PE cable,
- 1x Pantograph heater cable,
- 1x ACS control cable,
- 2x PE (connected to central PE-rail).

4.3.6. Grounding of the Charge system

- PE must be connected to each of the Power Cabinets, the ACM Enclosure, the Panto Down Junction Box and the Pantograph by 35 mm² cable as described in the IEC 61851-23.
- Grounding scheme is dependent on layout of specific installation site and contracted electrical company should define detailed design of grounding installation. Local legal requirements must be followed.
- Use a central PE connection point (for example a 100 A PE- or earth-rail with minimum of six M8 bolt connections) for all of the PE wires, see section *Charge system configurations* on Page 49.
- For requirements for the lightning protection, see section *Lightning protection* on Page 40.



NOTICE

For the overview of the grounding of the system, see Appendix G *Ground overview of the system* on Page 141.

4.3.7. Cable specification list

Tables below provides general specifications for the needed cables. Use these tables to select cables, taking into account local installation conditions, cable length, cable temperature rating, losses and local regulations.

AC and DC power cables

Functional description	DC Power cable	PE cable	AC utility power cable	ACS heater cable
Number of cores	1	1	4	3
Cross section	185 – 300 mm ²	35 mm ²	2.5 mm ²	2.5 mm ²
Min – Max external diameter to fit through gland	19 – 28 mm	13 – 21 mm	5 – 10 mm	5 – 10 mm
Shielding	No	No	No	No
Conductor	Tinned copper or aluminum conductor, fine wire stranded acc. to VDE 0295 cl.5/IEC Cl.5	Fine strand copper wire acc. to VDE 0295 Cl. 5/ IEC 60228 Cl. 5	Bare copper, fine wired, bunch stranded acc. to VDE 0295 Cl.5/IEC Cl.5	Fine strand copper wire
Insulation	Special rubber or PVC (outdoor use, UV-protected, oil resistant)	Special PVC (outdoor use, UV-protected, oil resistant)	Special PVC (outdoor use, UV-protected, oil resistant)	PVC or other material that can be used outdoor and are UV-protected
Nominal Voltage Uo/U	600/1000 Vac 900/1500 Vdc	450/750 Vac	450/750 Vac	600/1000 Vac
Test Voltage	6 kV	4 kV	4 kV	2 kV
Ambient Temperature range	-40°C to 80°C, permissible conductor operating temperature +90°C	-40°C to 70°C	-40°C to 80°C	-40°C to 80°C
Core identification		gn/ye	Color Acc. to IEC 60446	Numbering

Data cables

Functional description	Interlock cable	CAN cable
Number of (twisted) pairs	2 x 2	1 x 2
Cross section	0.75 – 2.5 mm ²	0.5 – 0.75 mm ²
Min – Max external diameter to fit through gland	13 – 21 mm	<i>inapplicable</i>
Shielding	Yes (tinned copper braid)	Yes (tinned copper braid)
Conductor	Fine strand copper wire	Fine strand copper wire
Insulation	PVC or other material that can be used outdoor and are UV-protected	PVC or other material that can be used outdoor and are UV-protected
Characteristic impedance	120 Ω ± 10%	120 Ω ± 10%
Frequency range		
Test Voltage	1.5 kV	1.5 kV
Ambient Temperature range	-40°C to 70°C	-40°C to 70°C
Core identification	Acc. to DIN 47100	Acc. to DIN 47100
Remarks		

Control cables

Functional description	DC- OVP Sensing cable	ASC control cable	ACS CP/PE cable	EMO cable
Number of cores	1	8	2	4
Twisted pair	No	No	No	No
Cross section	10 mm ²	2.5 mm ²	1.5 mm ²	0.5 – 0.75 mm ²
Min – Max external diameter to fit through gland	13 – 21 mm	13 – 21 mm	5 – 10 mm	5 – 10 mm
Shielding	No	No	Yes (tinned copper braid)	No
Conductor	Bare copper, fine wired, bunch stranded acc. to VDE 0295 Cl.5/IEC Cl.5	Fine strand copper wire	Fine strand copper wire	Fine strand copper wire
Insulation	Special rubber or PVC (outdoor use, UV-protected, oil resistant)	PVC or other material that can be used outdoor and are UV-protected	PVC or other material that can be used outdoor and are UV-protected	PVC or other material that can be used outdoor and are UV-protected
Test Voltage	6 kV	2 kV	2 kV – 4 kV	2 kV – 4 kV
Nominal Voltage U _o /U	1.8/3 kVac	600/1000 Vac	300/500 Vac or 450/750 Vac	300/500 Vac or 450/750 Vac
Ambient Temperature range	-40°C to 80°C	-40°C to 80°C	-40°C to 80°C	-40°C to 80°C
Core identification		Numbering	Numbering	Numbering or color

- Important: when the cables are routed below ground, use cables that are suitable for underground installation, submerged in conduit.
- All cables must have an isolation that are self-extinguishing and flame retardant according to DIN VDE 0482-332-1-2, DIN EN 60332-1-2, IEC 60332-1-2.
- All cables must be corresponding to the VDE, CE and EAC Low Voltage Directive and must meet the RoHS compliance.
- The identity and/or function of the cable must be marked on every 2000 mm of the cable and on both ends.

4.4. Internet connection

In most cases, the integrated 3G modem is used for wireless internet access. A customer SIM card is not required. If there is no 3G signal available, a standard wired internet connection is required. For this option, contact ABB Sales department (see *Contact information* on Page 13 for contact details).


5. Placement and Connection

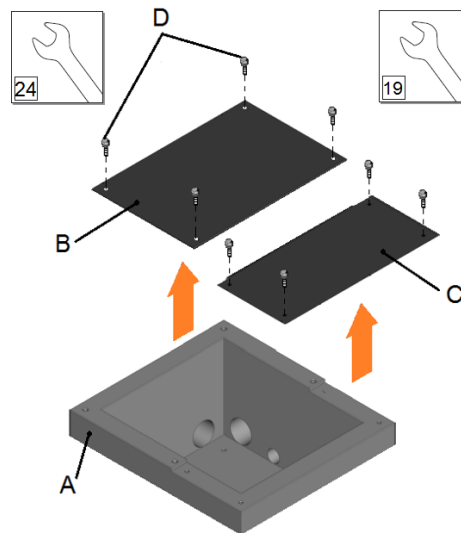
5.1. About placement and connection

When the construction phase is finished, the HVC-PD Depot E-Bus Charger can be installed and connected.


5.2. Route the cables

1. Unpack the cables. See *Cabling* on Page 49 for details which cables must be used.


NOTICE	
	<p>Step 2 and 3 are only applicable when the Power Cabinet is placed on a concrete foundation. The top cover plate is not needed any more after the cabinet is placed on the foundation.</p>



2. Remove the top cover plate (B) and the front cover plate (C) from the foundation (A) by loosen the bolts (D).
3. Put the front cover plate (C) and its bolts (D) in a safe location as it will be installed again later on.
4. Route the DC power cables through the cable conduit, duct or tray.
5. Route the AC utility power, PE wire and Interlock cable through the other cable conduit, duct or tray.
6. Route the communication glass fiber cable through the extra 40 mm cable conduit when using underground conduits.



CAUTION	
	<p>To prevent damage to the glass fiber optic cable, a minimum of two persons is required to route the glass fiber cable through the conduit. One person for pulling, the other person to guide the glass fiber cable. Ensure that the glass fiber cable is carefully rolled out before it is pulled through the conduit, and do not use large traction forces, this can damage the glass fiber cable.</p>

7. For the DC power cables, make sure that a cable length of 1000 mm is available above the surface for internal routing in the cabinet.
8. For the other cables, make sure that a cable length of 3000 mm is available above the surface for internal routing in the cabinet.

	NOTICE
	This extra cable length is required to connect the cables with the connectors in the Power Cabinet without problems.

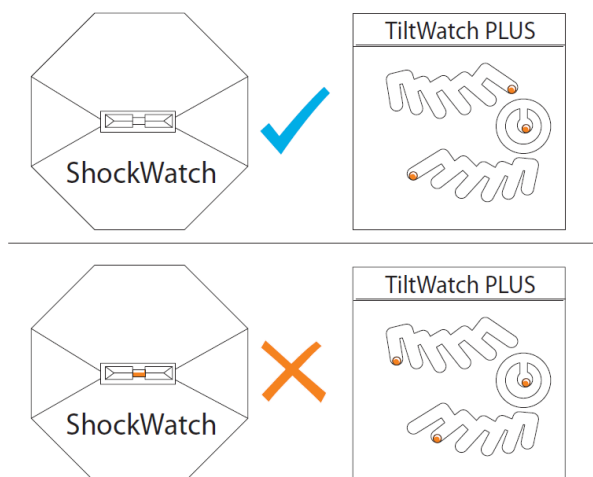
5.3. Unpack Power Cabinet

5.3.1. Before unpacking

	NOTICE
	<p>Unloading Power Cabinet The delivery truck only unloads the pallet carrying the Power Cabinet. The delivery truck will not move the Power Cabinet to its final location. The placement of the Power Cabinet to its final location is the responsibility of the contractor. Upon request it is possible to order a truck with a crane.</p>
	CAUTION
	Do not pollute the environment with plastic and cardboard packing. Dispose of these materials according to the applicable local regulations as well as environment-friendly protocols.

Preconditions:

- All construction work is completed.
- The product is delivered by a transport company at the confirmed date of delivery.

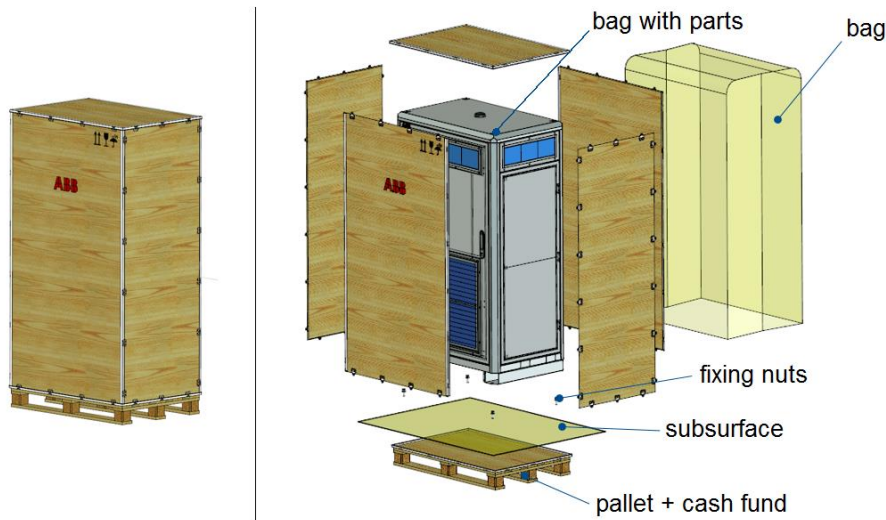


1. Make sure that the Power Cabinet has not been shaken or tilted over 30°.

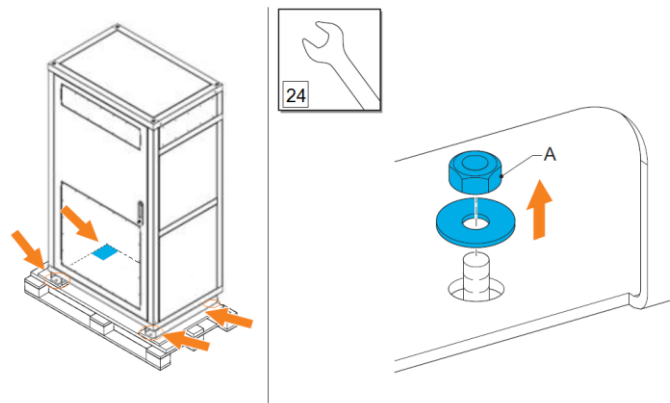
5.3.2. Remove packaging

Preconditions

- Tools: spanner (size 24).



1. Remove the packaging material from the Power Cabinet.
2. Remove the bag which contain the keys, cover caps and mounting material that are attached with tape on one of the lifting eyebolt at the top of the cabinet.
3. Keep this bag with parts in a safe place.



4. Remove the nuts (A) at the four corners.





5.4. Move Power Cabinet to position

There are two options to move the Power Cabinet from the delivery truck to the location.

- Use a hoist to lift the cabinet from the top. See *Move cabinet with a hoist* on Page 58.
- Use a forklift truck to lift the cabinet from the bottom. See *Move cabinet with a forklift truck* on Page 59.

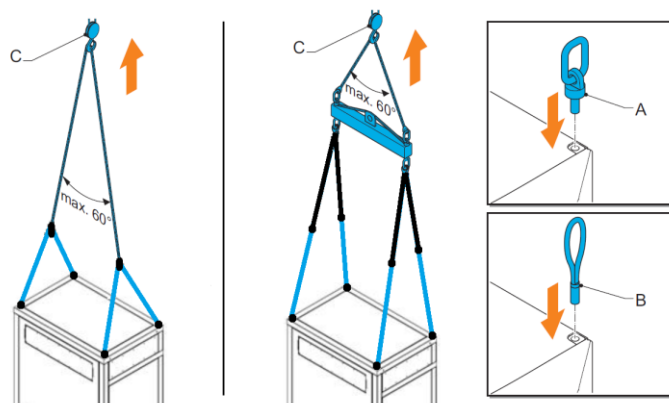
Preconditions:

- All packaging material is removed from the Power Cabinet.
- The two cover plates are removed from the foundation.
- The tapped holes of the foundation are free from dust. If necessary, clean the holes with a vacuum cleaner. Use a thread tap to make sure that the bolts will go in smoothly.

	<p style="text-align: center;">DANGER</p> <p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>
	<p style="text-align: center;">WARNING</p> <p>Make sure that personnel cannot be crushed or become trapped while moving the Power Cabinet.</p>
	<p style="text-align: center;">CAUTION</p> <p>Warranty Damage due to moving the Power Cabinet to its position is not covered by the warranty.</p>
	<p style="text-align: center;">CAUTION</p> <p>Do not use a compressor to clean the Power Cabinet. Use a vacuum cleaner.</p>

1. Use one of the two options to move the Power Cabinet to the foundation.
2. When the Power Cabinet is about 500 mm above its location, continue the installation procedure with *Install Power Cabinet onto the foundation* on Page 60.

5.4.1. Move cabinet with a hoist




- A Swivel eye bolts (standard delivered with the cabinet)
- B Lifting loops
- C Hoisting equipment

Preconditions:

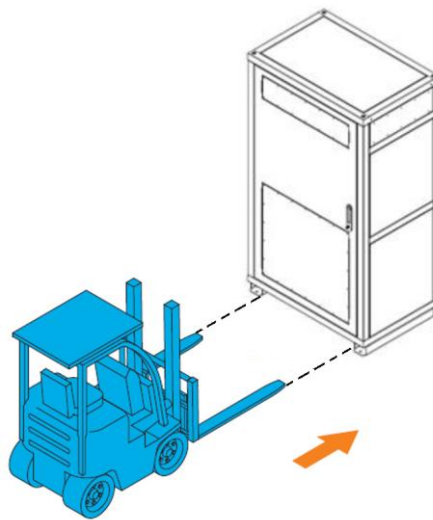
- A minimum of two persons is required: one person to operate the hoisting equipment, the other person to guide the Power Cabinet to its location.
- Use M16 swivel eye bolts (A) or M16 bolts with lifting loops (B).

1. Insert the bolts (A) or (B) into the holes at the opposite corners of the cabinet, if not placed upon delivery.
2. Tighten the bolts.
3. Connect the hoisting equipment (C).

	CAUTION
	Keep the hoisting angle below 60°.


4. Move the Power Cabinet to the foundation.

5.4.2. Move cabinet with a forklift truck



Preconditions:

- A minimum of two persons is required: one person to operate the forklift truck, the other person to guide the Power Cabinet to its location.
1. Place wooden slats with a thickness of about 10 to 15 mm and a width equal to the width of the fork of the forklift truck on both forks.
 2. Move the forks of the forklift truck next the gaps at the rear of the Power Cabinet.
 3. Move the Power Cabinet to the foundation.



	NOTICE
	The use of the fork slides is mandatory. The distance between the outer side of the forks need to be 930 mm, lifting the cabinet outside the fork slides is NOT allowed and will damage the cabinet.

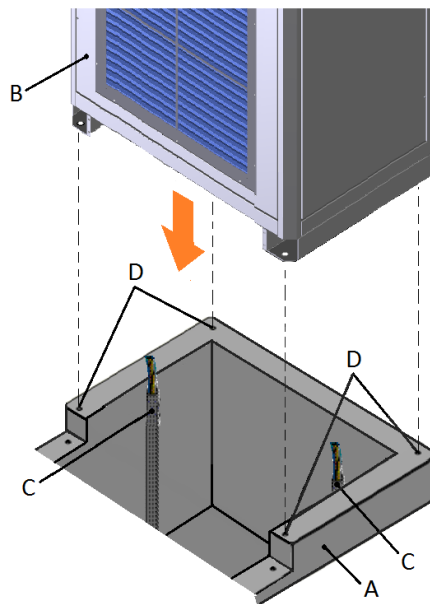
5.5. Install Power Cabinet onto the foundation

5.5.1. Connect Power Cabinet to foundation

Preconditions:

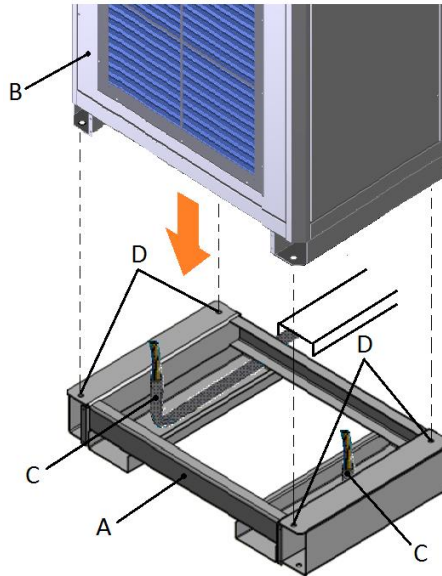
- Tools: spanner (size 24).
- Cover caps (4x) that were removed from the Power Cabinet (bag with parts).
- The Power Cabinet is about 500 mm above its location.

	<p style="text-align: center;">DANGER</p> <p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>
	<p style="text-align: center;">WARNING</p> <p>Make sure that personnel cannot be crushed or become trapped while moving the Power Cabinet.</p>



Placement on concrete foundation

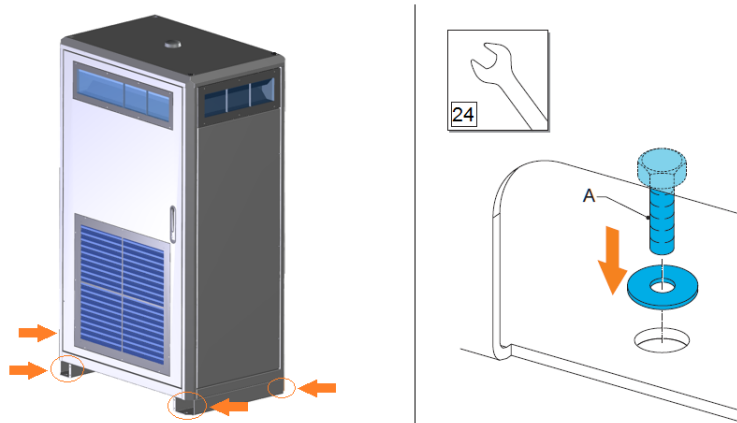
- A Foundation
- B Power Cabinet
- C Cables
- D Tapped holes




Placement on metal frame foundation

- A Foundation
- B Power Cabinet
- C Cables
- D Tapped holes

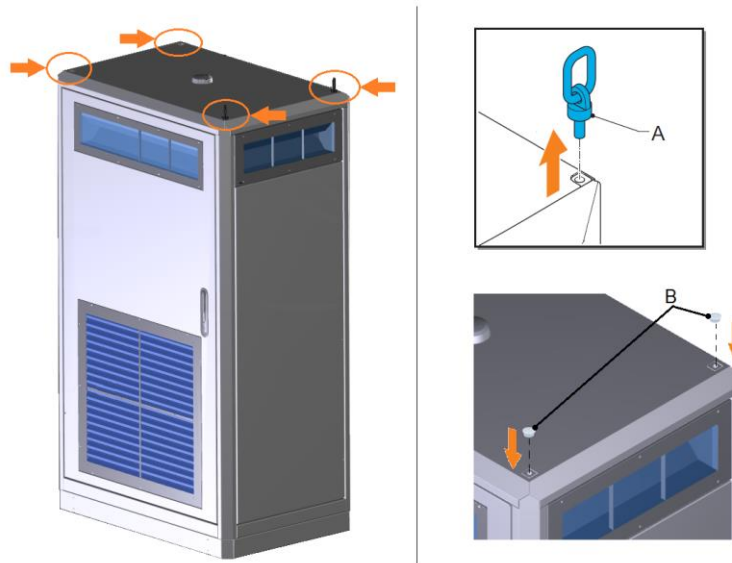
1. Carefully lower the Power Cabinet (B) onto the foundation (A).
2. Make sure that you do not trap the cables (C).
3. Make sure that the cabinet is aligned with the tapped holes (D).



4. Insert the M16 bolts (A) fitted with the washers into the holes in the corners (4x).

NOTICE	
	<p>A minimum of three M16 bolts are need to applied to securely mount the Power Cabinet onto the foundation. In case of placing two Power Cabinets next to each other and (100 mm distance) against the wall, then one Power Cabinet can be secured by three M16 bolts on to the foundation.</p>

5. Tighten the bolts.

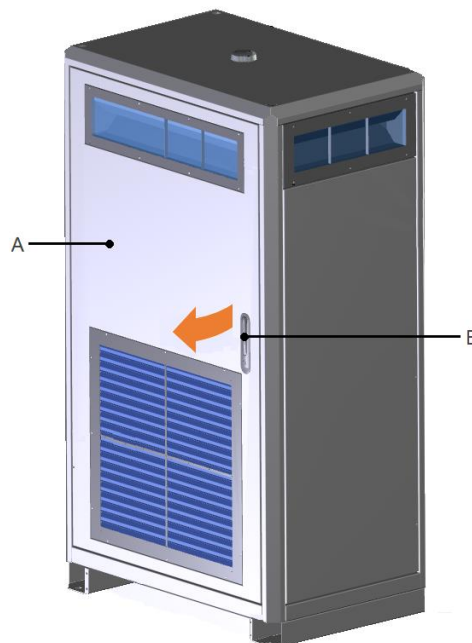


6. Remove the swivel eye bolts or lifting loops (A).
7. Place the cover caps (B) in the holes (4x).

5.5.2. Open the door of the Power Cabinet

Preconditions:

- Key that were removed from the Power Cabinet (bag with parts).

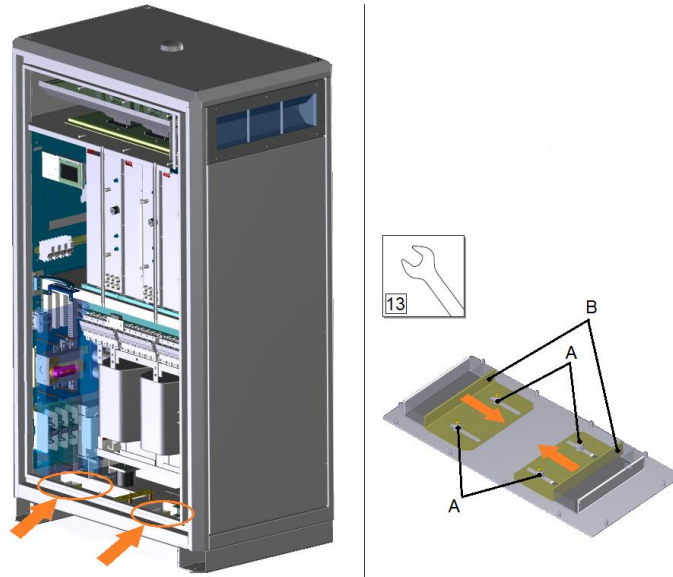


1. Unlock the handle (B)
2. Use the handle (B) to open the door (A).

5.5.3. Move the sliding plate of the guidance plates of the cabinet

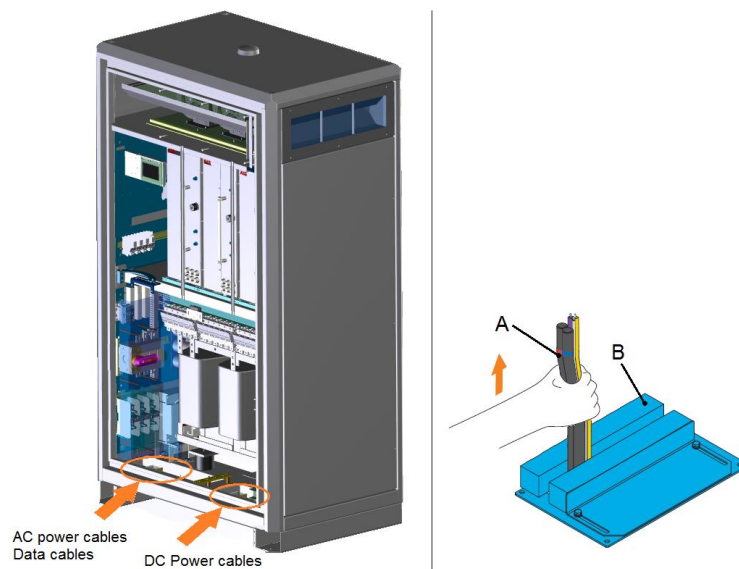
Preconditions:

- Tools: spanner (size 13).



1. Loosen the bolts (A).
2. Move the sliding plate (B) of the 2 guidance plates.

5.5.4. Route cables through guidance plates



1. Route the cables (A) through the right guidance plates (B).
2. Make sure that there is sufficient cable length to reach the connectors at the top of the cabinet.

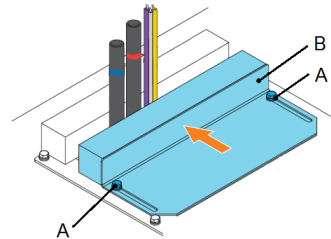
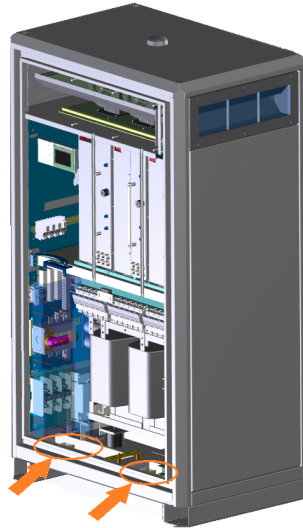
**NOTICE**

A length of 3000 mm is required, because the connection of the cables with the connectors in the Power Cabinet is at the middle of the cabinet.

5.5.5. Move sliding plates of the guidance plates of the cabinet

Preconditions:

- Tools: spanner (size 13).

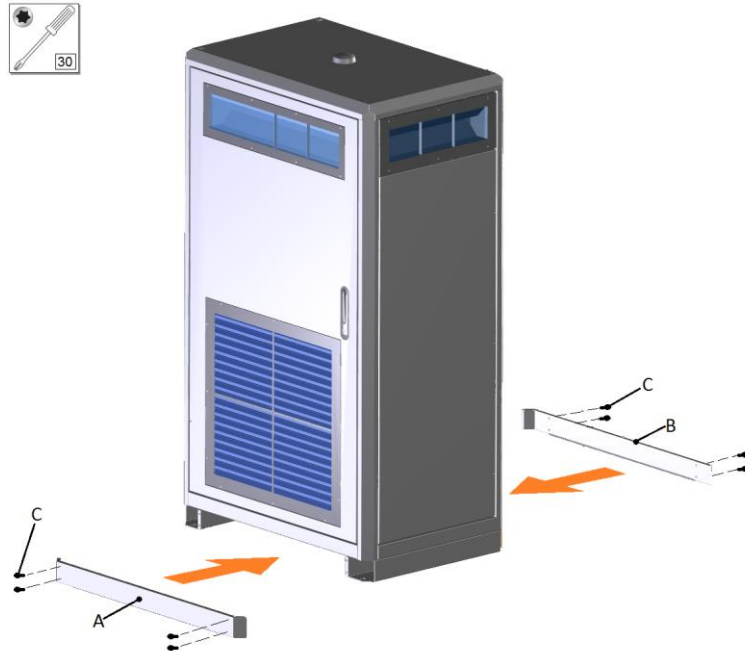


1. Move the sliding plates (B).
2. Tighten the bolts (A).

5.5.6. Install border covers of the Power Cabinet


Preconditions:

- Tools: torx screwdriver (size 2163TX-T30).
- M5 bolts (8x) that were removed from the Power Cabinet (bag with parts).



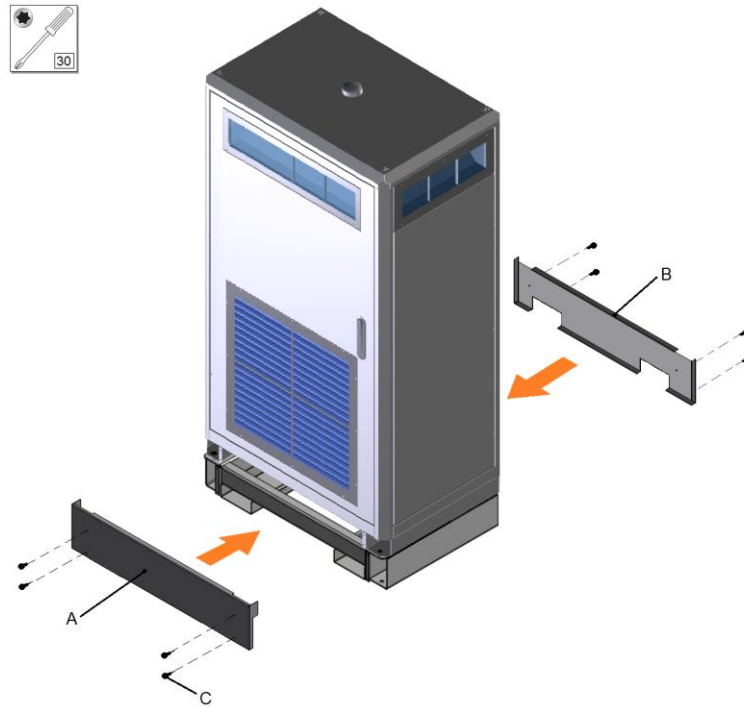
1. Put the front cover (A) against the bottom front of the Power Cabinet by aligning the four bolts at the back side of the front cover (A) with the holes in the bottom front.
2. Put the rear cover (B) against the rear front of the Power Cabinet.
3. Insert the M5 bolts (C) into the holes (8x).
4. Tighten the bolts.

5.5.7. Install border covers of metal frame foundation

NOTICE	
	<p>Only applicable when the Power Cabinet is placed on a metal frame foundation. The supplied front and rear cover on the Power Cabinet are not used in this case.</p>


Preconditions:

- Tools: torx screwdriver (size 2163TX-T30).



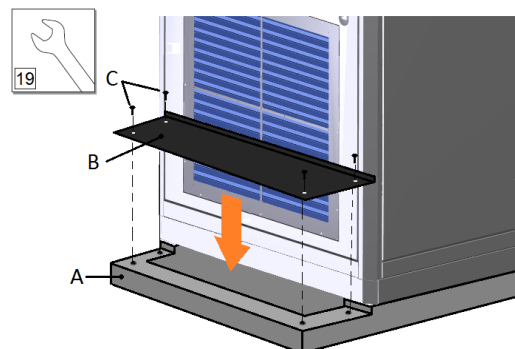
1. Put the front border cover (A) against the bottom front of the Power Cabinet.
2. Put the rear border cover (B) against the rear front of the Power Cabinet.
3. Insert the M5 bolts (C) into the holes (8x).
4. Tighten the bolts.

5.5.8. Install front cover plate on foundation

NOTICE	
	<p>Only applicable when the Power Cabinet is placed on a concrete foundation.</p>

Preconditions:

- Tools: spanner (size 19)



1. Place the front cover plate (B) on the foundation (A).
2. Make sure that the front cover plate (B) is aligned with the tapped holes within the foundation.

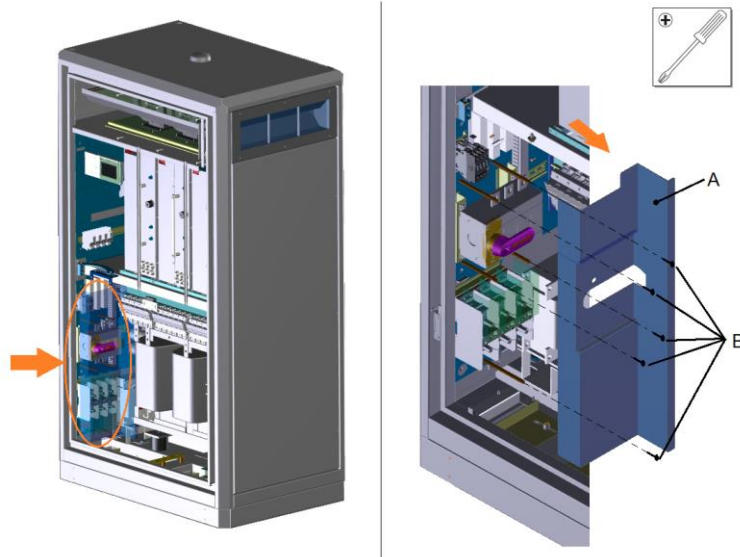
3. Insert the M12 bolts (C) into the holes (4x).
4. Tighten the bolts.

5.6. Connect AC power cable and PE wires Power Cabinets

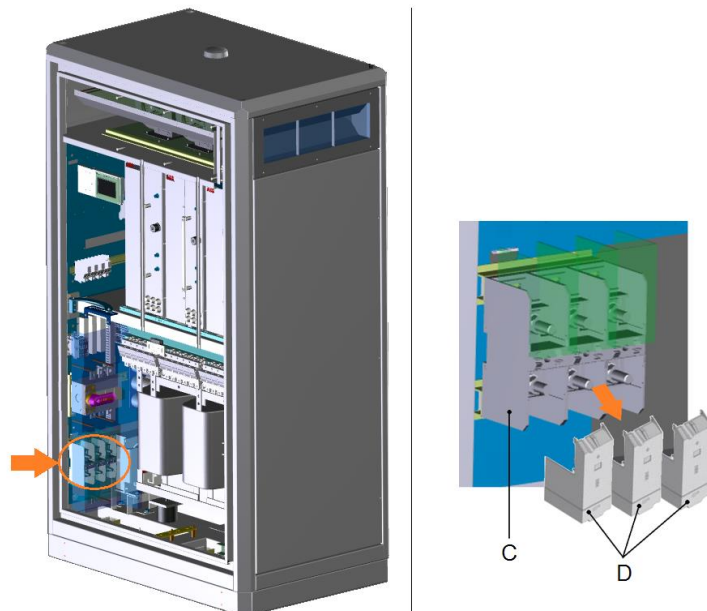
5.6.1. Remove the protection covers

Preconditions:

- Tools: cross-head screwdriver



1. Remove the protection plate (A) by loosening the screws (B).
2. Put the protection plate and screws in a safe location as it will be installed again later on.




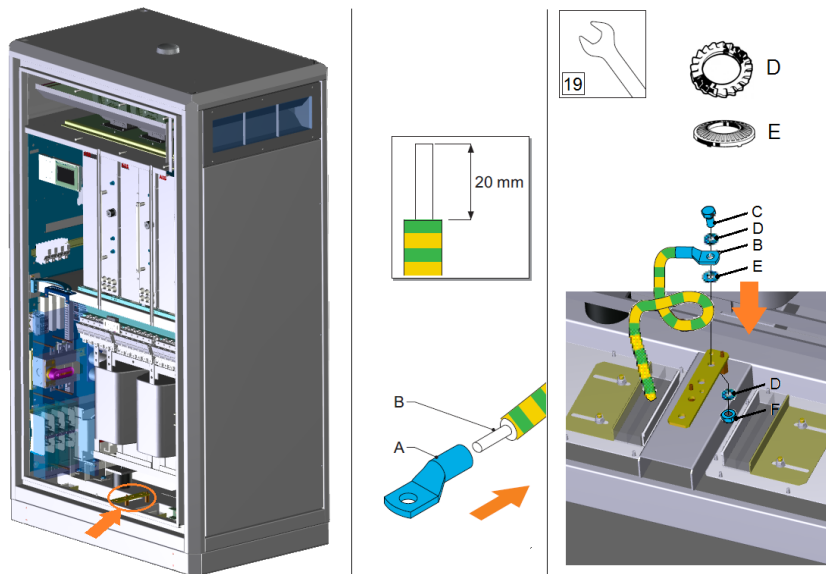
3. Remove the 3 protection covers (D) from the connector blocks (C).
4. Put the protection covers in a safe location as it will be installed again later on.

5.6.2. Connect the PE wire of the AC power cable


Preconditions:

- Parts (per cabinet): tubular cable lug (1x).
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque wrench (size 19).

	DANGER
<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>	



1. Make a loop in the PE wire.


	NOTICE
<p>For safety, it is recommended to make a loop in the PE wire so it is longer than the phase wires. This loop makes sure that the PE wire is not the first wire that is disconnected if the Power Cabinet is moved by a collision.</p>	

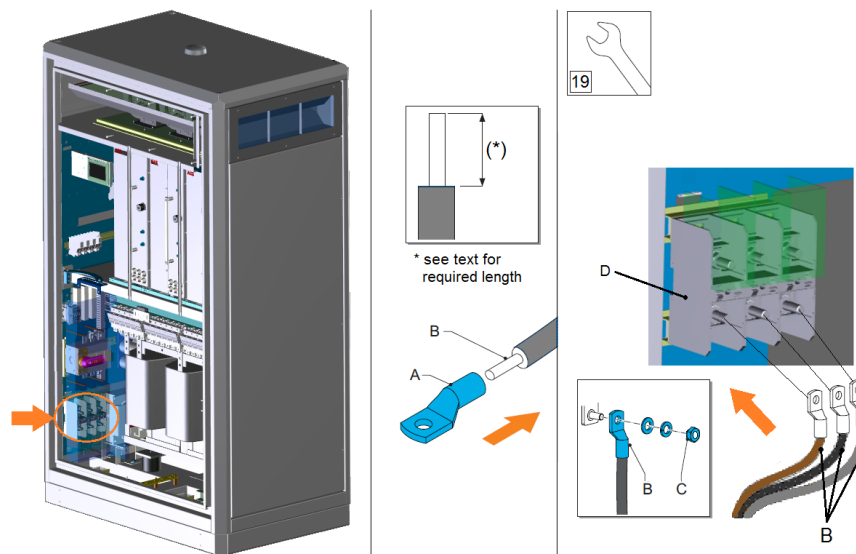
2. Cut the PE wire of the AC power cable to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose.
3. Strip 20 mm of the insulation from the end of the PE wire.
4. Attach a wire end ring (A) to the end of the PE wire (B).
5. Remove the M12 bolt, nut and washers from the PE rail.
6. Fit the bolt (C) with toothed washer (D), the PE wire (B) and the contact washer (E).
7. Insert the bolt fitted with the PE wire into the PE rail.
8. Screw from the bottom of the PE rail a toothed washer (D) and a nut (F) on the bolt (C)
9. Tighten the bolt/nut connection with a tightening torque of 30 N·m.

5.6.3. Connect the AC power cable

Preconditions:

- Parts (per cabinet): tubular cable lug (3x).
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque wrench (size 19).

	DANGER
	<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>

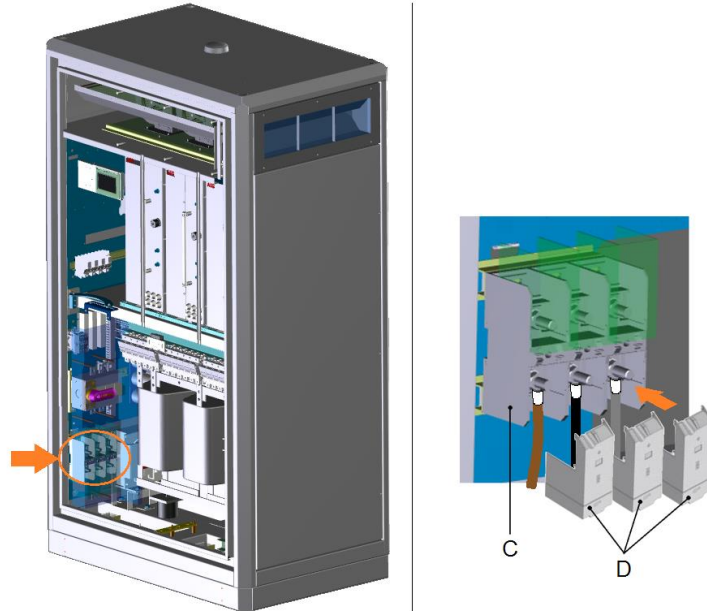


1. Cut the wires of the AC power cable to the correct lengths to reach the connectors. Do not make the wire routing too tight, or too loose.
2. Strip the insulation on the required length specified by the used lug from the end of the wire (B).
3. Attach cable lugs (A) at the end of the wires.
4. Remove the nuts and washers (C) from the bolts (M12) of connector block (D).
5. Insert the 3 wires (B) with the nuts and washers onto the bolts of connector block (D).
 - From left to right:
 - L1 (brown),
 - L2 (black),
 - L3 (grey or black).
6. Tighten the nuts (C) with a tightening torque of 30 N·m.

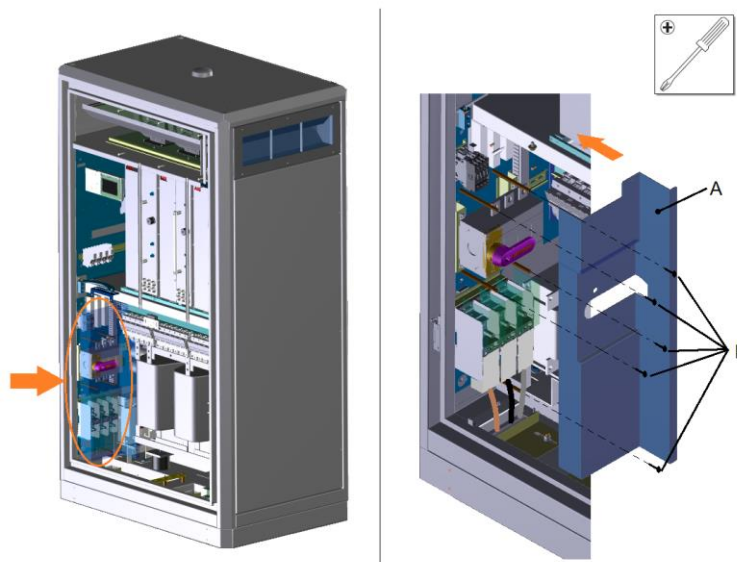
5.6.4. Install the protection covers

Preconditions:


- Tools: cross-head screwdriver



1. Take the 3 protection covers that was removed in *Remove the protection covers* on Page 67.
2. Place the protection covers (D) back on the connector blocks (C).



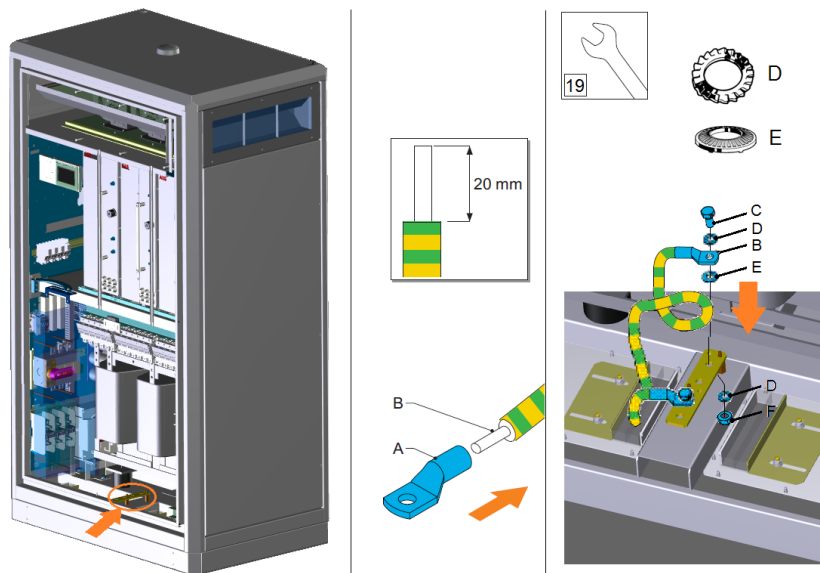
3. Take the protection plate and the screws that were removed in *Remove the protection covers* on Page 67.
4. Place the protection plate (A) back over the main switch and connector blocks and secure the plate by the screws (B).

WARNING	
	<p>Leave the main switch switched off. The Power Cabinet is not ready for use yet. If there is no appointment for commissioning yet, contact the ABB Delivery department to make an appointment for commissioning. See Error! Reference source not found. on Page Error! Bookmark not defined. for contact details.</p>

5.6.5. Install lightning protection (optional)

Preconditions:

- Parts (per cabinet): 50/M12 tubular cable lug (1x).
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque wrench (size 19).



1. Cut the wire of the lightning protection cable to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose.
2. Strip 20 mm of the insulation from the end of the wire.
3. Attach a wire end ring (A) to the end of the lightning protection wire (B).
4. Remove the M12 bolt, nut and washers from the PE rail.
5. Fit the bolt (C) with toothed washer (D), the lightning protection wire (B) and the contact washer (E).
6. Insert the bolt fitted with washers and the lightning protection wire into the PE rail.
7. Screw from the bottom of the PE rail a toothed washer (D) and a nut (F) on the bolt (C)
8. Tighten the bolt/nut connection with a tightening torque of 30 N·m.

5.6.6. Connect the PE wire to the Charge Pole

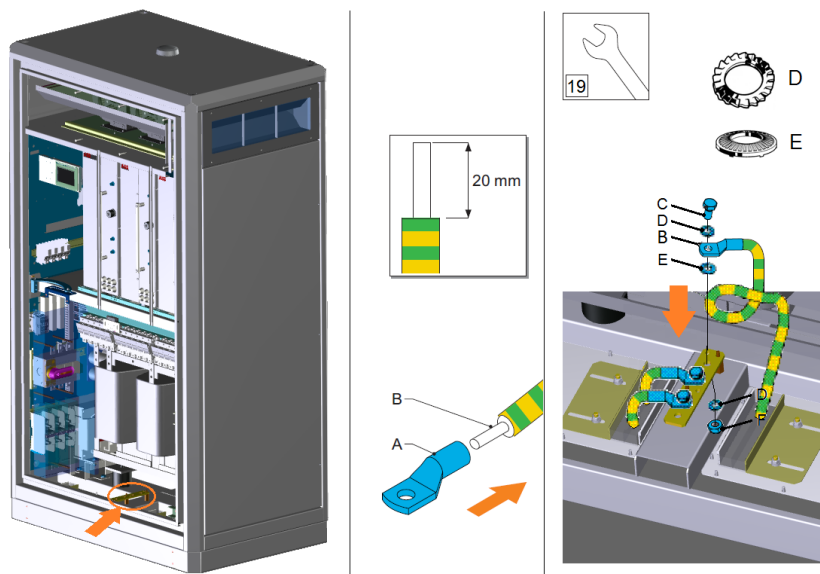


NOTICE

The PE wire to the Charge Pole is only connected within the HVC 150 Power Cabinet, see for more details section *Cabling* on Page 49.

Preconditions:

- Parts (per cabinet): 35/M12 tubular cable lug (1x).
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque wrench (size 19).

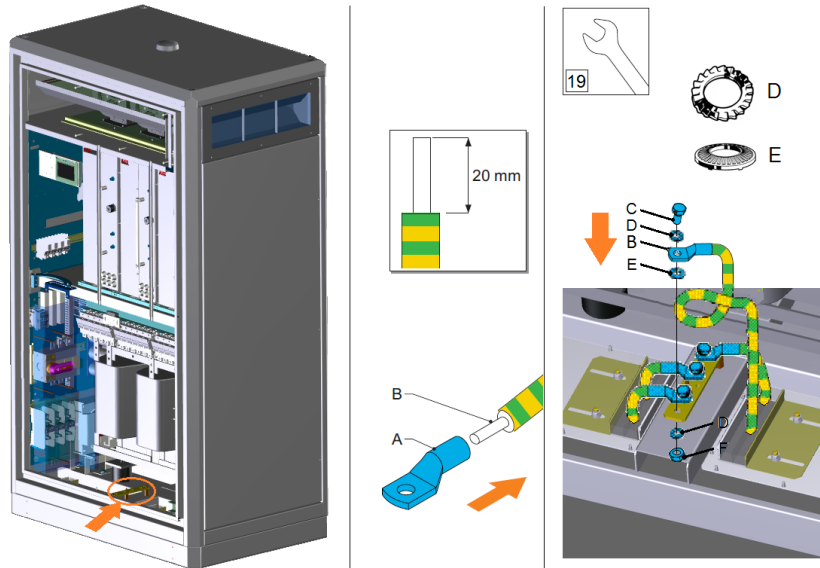


1. Cut the PE wire of the power cable to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose.
2. Strip 20 mm of the insulation from the end of the PE wire.
3. Attach a wire end ring (A) to the end of the PE wire (B).
4. Remove the M12 bolt, nut and washers from the PE rail.
5. Fit the bolt (C) with toothed washer (D), the PE wire (B) and the contact washer (E).
6. Insert the bolt fitted with the PE wire into the PE rail.
7. Screw from the bottom of the PE rail a toothed washer (D) and a nut (F) on the bolt (C)
8. Tighten the bolt/nut connection with a tightening torque of 30 N·m.

5.6.7. Connect the PE wire between the Power Cabinets

Preconditions:

- Parts (per cabinet): 35/M12 tubular cable lug (1x).
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque wrench (size 19).




Both PE wire connection must be made between the HVC 150 and the first HVC 150S and between both HVC 150S, see also section *Cabling* on Page 49:

1. Cut the PE wire of the power cable to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose.
2. Strip 20 mm of the insulation from the end of the PE wire.
3. Attach a wire end ring (A) to the end of the PE wire (B).
4. Remove the M12 bolt, nut and washers from the PE rail.
5. Fit the bolt (C) with toothed washer (D), the PE wire (B) and the contact washer (E).
6. Insert the bolt fitted with the PE wire into the PE rail.
7. Screw from the bottom of the PE rail a toothed washer (D) and a nut (F) on the bolt (C)
8. Tighten the bolt/nut connection with a tightening torque of 30 N·m.

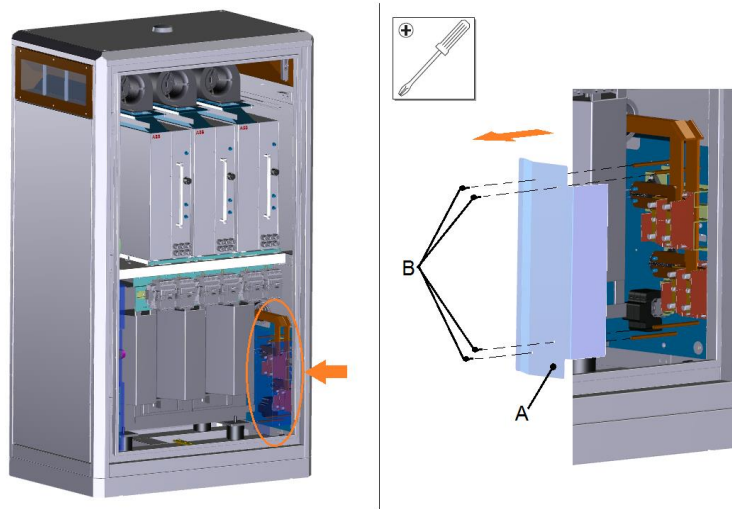
5.7. Connect the DC power cables Power Cabinets

Preconditions:

- Parts (per cabinet): 185/M12 tubular cable lug (2x), heat-shrink red 2:1 Ø 25.4 mm, heat-shrink black 2:1 Ø 25.4 mm.
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque wrench (size 19), cross-head screwdriver.

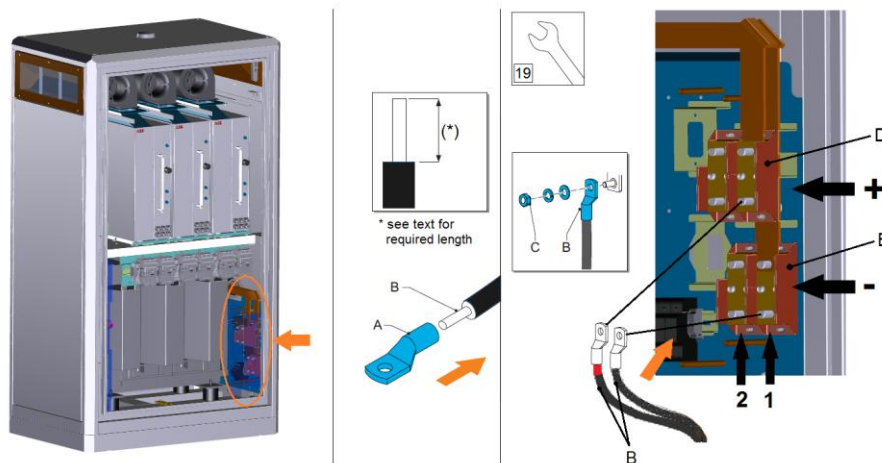
	DANGER
	<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>

5.7.1. Remove the protection cover



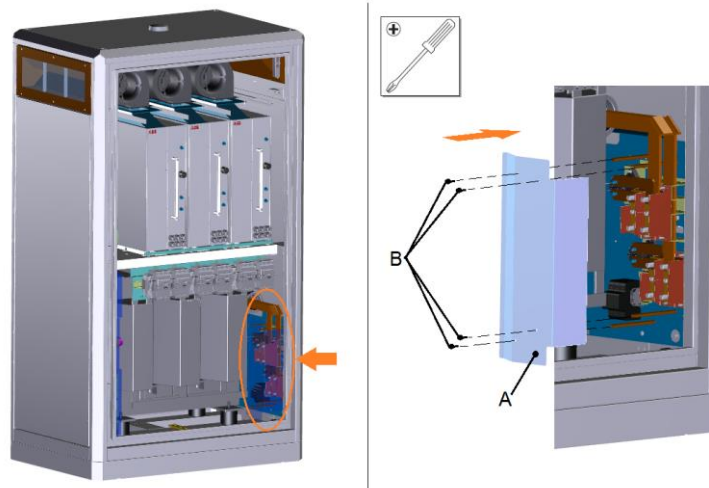
1. Remove the protection plate (A) by loosening the screws (B) (4x).
2. Put the protection plate and screws in a safe location as it will be installed again later on.

5.7.2. Connect the DC power cables



1. Cut the wires of the DC power cable to the correct lengths to reach the connectors. Do not make the wire routing too tight, or too loose.
2. Place 80 mm long heat-shrink (red on DC+ and black on DC- power cables).
3. Strip the insulation on the required length specified by the used lug from the end of the wire (B).
4. Attach cable lug (A) at the end of the wires and use the heat-shrink to cover the crimp connection.
5. Remove the nuts and washers (C) from the bolts (M12) of connector block (D) and (E).
6. Insert the DC+ wire (marked by red heat-shrink) with the nuts and washers onto the bolts of pin 1 of the connector block (D).
7. Insert the DC- wire with the nuts and washers onto the bolts of pin 1 of the connector block (E).
8. Tighten the nuts (C) with a tightening torque of 30 N·m.

5.7.3. Install the protection cover




1. Take the protection plate that was removed in *Remove the protection cover* on Page 74.
2. Place the protection plate (A) back over the DC connector blocks and secure the plate by the screws (B) (4x).

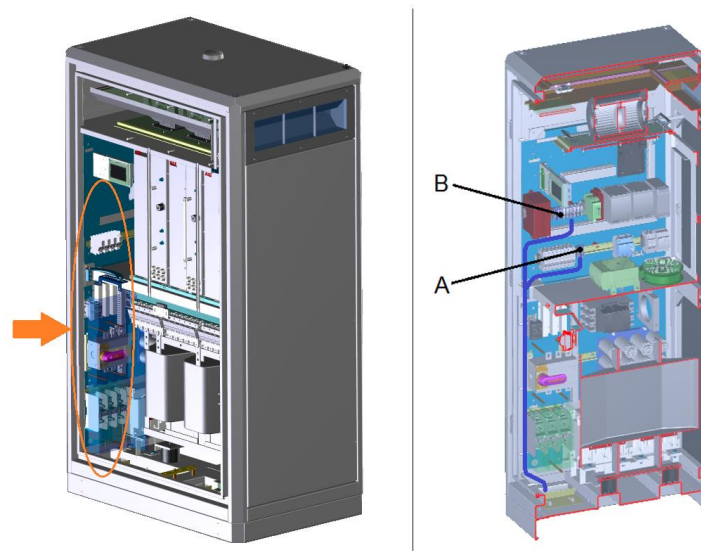
5.8. Connect AC utility power, Interlock and CAN cables Power Cabinet

Preconditions:

- Parts: 0.5 x 8 ferrule, 1.5 x 8 ferrule, 2.5 x 8 ferrule.
- Tools: wire cutter, wire stripper, screwdriver, ferrules, crimp pliers.

	DANGER
<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>	


5.8.1. Route the cables to the terminal blocks

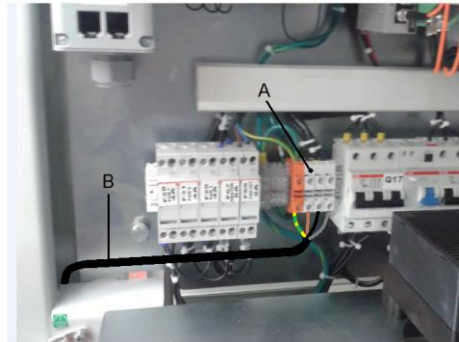
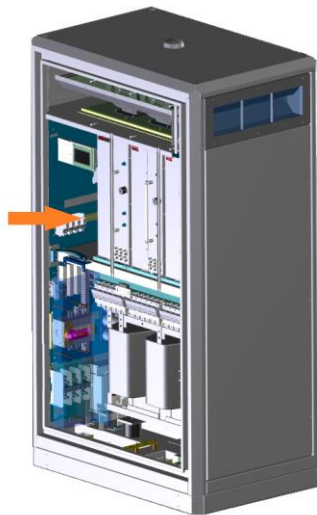


Preferred cable route

1. Route the AC utility cable to the terminal block (A). Refer to the figure for the preferred cable route inside the cabinet (only within the HVC 150).
2. Route the Interlock cable(s) to the terminal block (B). Refer to the figure for the preferred cable route inside the cabinet.
3. Route the CAN cable to the terminal block (B). Refer to the figure for the preferred cable route inside the cabinet.

5.8.2. Connect the AC utility power cable

	NOTICE
<p>The AC utility power cable for the ACS Control Module is only connected within the HVC 150 Power Cabinet, see for more details section <i>Cabling</i> on Page 49.</p>	



- A Terminal block
- B AC utility power cable

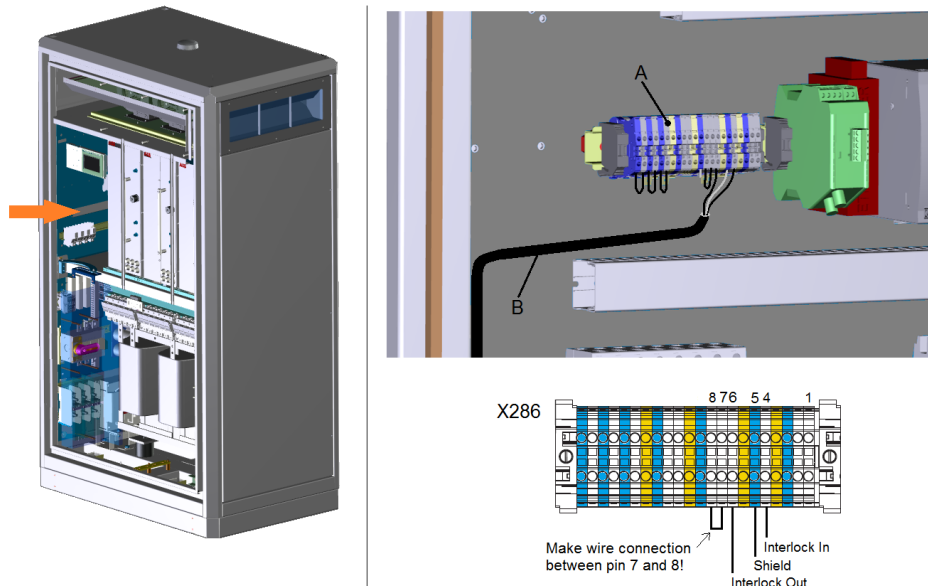
1. Move the cable towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of the wires.
3. Crimp a ferrule onto the end of the wire.
4. Loosen the connector screws.
5. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire color
PE	X341-1	Green/yellow
L1	X341-2	Brown
L2	X341-3	Black
L3	X341-4	Gray

6. Tighten the connector screws with a tightening torque of 1.3 N·m.

5.8.3. Connect the Interlock cable for the HVC 150 kW system

Interlock cable connection in the master HVC 150:



- A Terminal block
- B Interlock cable from/to ACS Control Module (ACM)

1. Move the cable towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of **only the White and Brown wire!**
3. Crimp a ferrule onto the end of the White and Brown wire.
4. Ensure that the unused wires, the Green and Yellow wire, are protected so that they cannot touch metal parts.
5. Make a wire connection between pin X286-7 and X286-8.
6. Loosen the connector screws.
7. Insert the wires into the connectors, see table below:

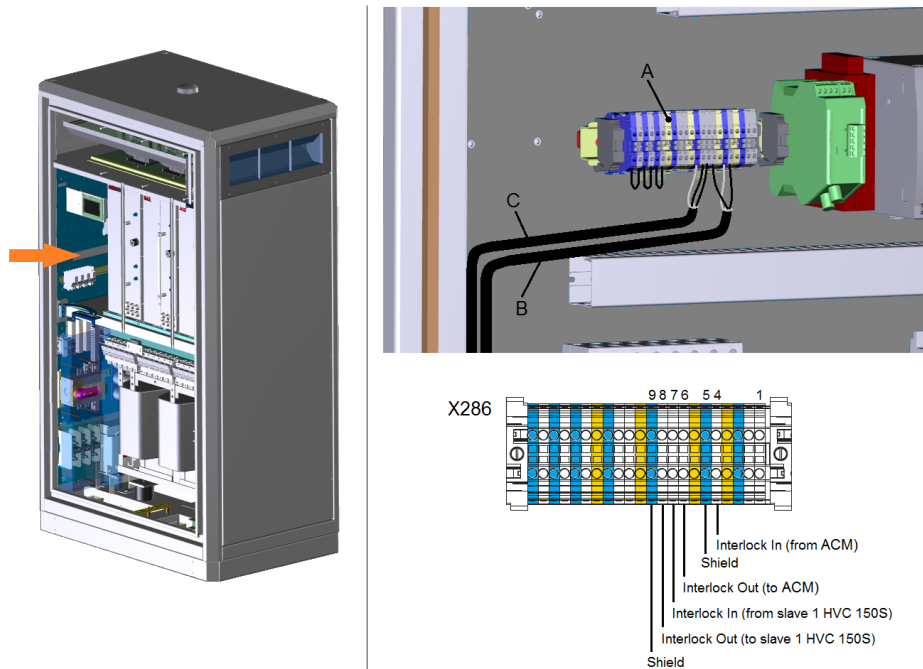
Functional description	Connector	Wire number
Interlock In	X286-4	Brown
Interlock Out	X286-6	White
Interlock GND	X286-5	Shield
Interlock loop	X286-7	Black
Interlock loop	X286-8	Black

See also Appendix H *Signal connection diagram*.

8. Tighten the connector screws with a tightening torque of 1.3 N·m.

5.8.4. Upgrade the Interlock connection to the HVC 300 kW system

Interlock cable connection in the master HVC 150:



- A Terminal block
- B Interlock cable from/to ACS Control Module (ACM)
- C Interlock cable from/to slave 1 HVC 150S

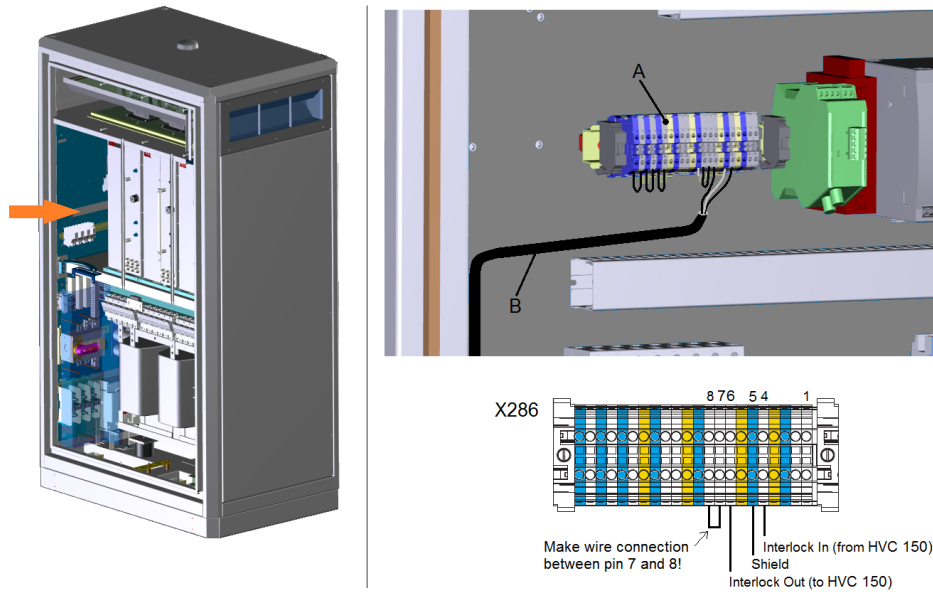
1. Move the cables towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of **only the White and Brown wire!**
3. Crimp a ferrule onto the end of the White and Brown wire.
4. Ensure that the unused wires, the Green and Yellow wire, are protected so that they cannot touch metal parts.
5. Loosen the connector screws.
6. Remove the wire connection between pin X286-7 and X286-8, if present.
7. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire number
Interlock In (ACM)	X286-4	Brown
Interlock Out (ACM)	X286-6	White
Interlock GND (ACM)	X286-5	Shield
Interlock In (slave 1 HVC 150S)	X286-7	White
Interlock Out (slave 1 HVC 150S)	X286-8	Brown
Interlock GND (slave 1 HVC 150S)	X286-9	Shield

See also Appendix H *Signal connection diagram*.

8. Tighten the connector screws with a tightening torque of 1.3 N·m.

Interlock cable connection in **slave 1 HVC 150S**:



- A Terminal block
- B Interlock cable from/to master HVC 150

1. Move the cables towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of **only the White and Brown wire!**
3. Crimp a ferrule onto the end of the White and Brown wire.
4. Ensure that the unused wires, the Green and Yellow wire, are protected so that they cannot touch metal parts.
5. Make a wire connection between pin X286-7 and X286-8.
6. Loosen the connector screws.
7. Insert the wires into the connectors, see table below:

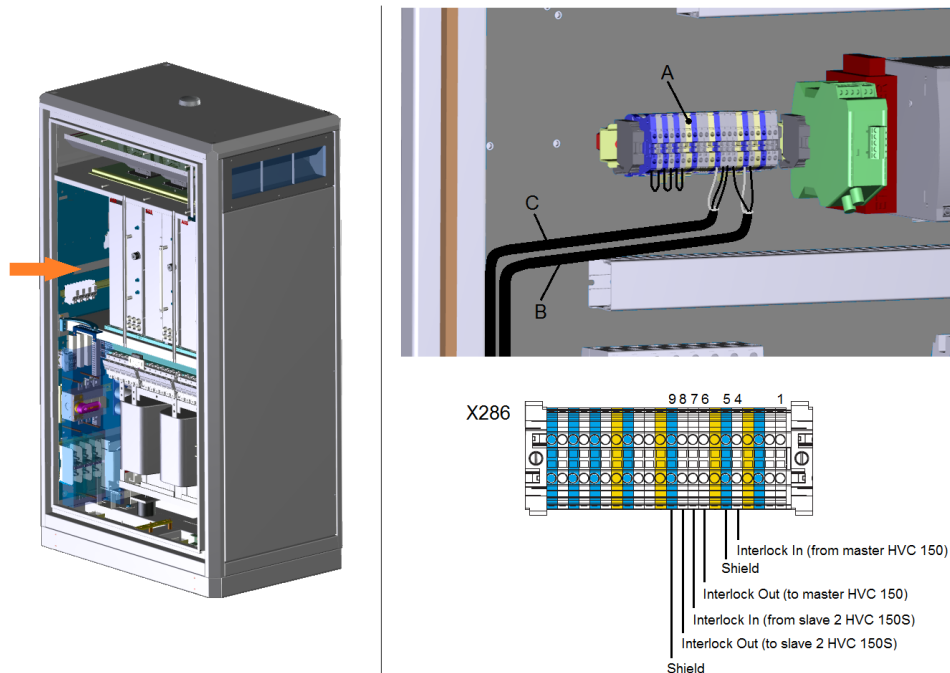
Functional description	Connector	Wire number
Interlock In (master HVC 150)	X286-4	Brown
Interlock Out (master HVC 150)	X286-6	White
Interlock GND (master HVC 150)	X286-5	Shield
Interlock loop	X286-7	Black
Interlock loop	X286-8	Black

See also Appendix H *Signal connection diagram*.

8. Tighten the connector screws with a tightening torque of 1.3 N·m.

5.8.5. Upgrade the Interlock connection to the HVC 450 kW system

Interlock cable connection in **slave 1 HVC 150S**:



- A Terminal block
- B Interlock cable from/to master HVC 150
- C Interlock cable from/to slave 2 HVC 150S

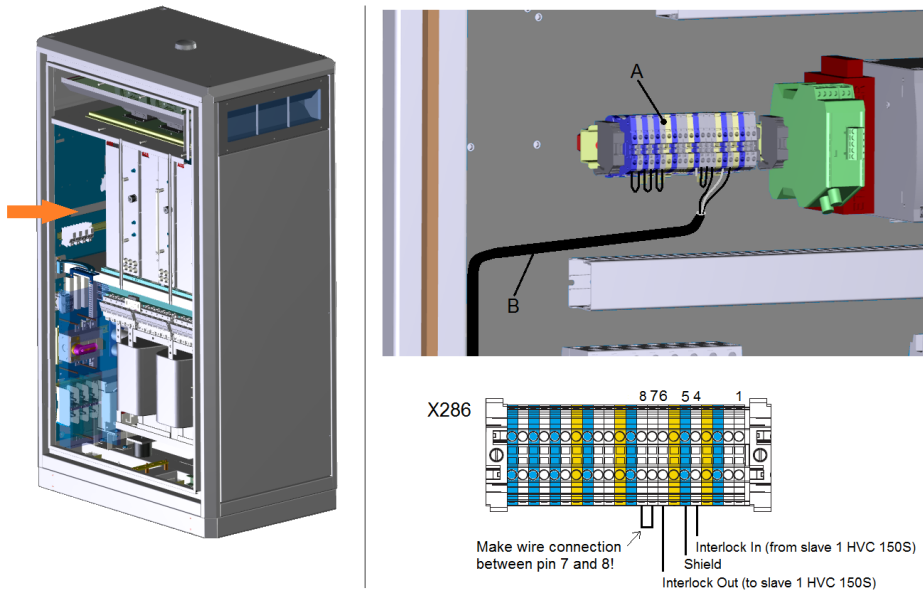
1. Move the cables towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of **only the White and Brown wire!**
3. Crimp a ferrule onto the end of the White and Brown wire.
4. Ensure that the unused wires, the Green and Yellow wire, are protected so that they cannot touch metal parts.
5. Loosen the connector screws.
6. Remove the wire connection between pin X286-7 and X286-8, if present.
7. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire number
Interlock In (master HVC 150)	X286-4	Brown
Interlock Out (master HVC 150)	X286-6	White
Interlock GND (master HVC 150)	X286-5	Shield
Interlock In (slave 2 HVC 150S)	X286-7	White
Interlock Out (slave 2 HVC 150S)	X286-8	Brown
Interlock GND (slave 2 HVC 150S)	X286-9	Shield

See also Appendix H *Signal connection diagram*.

8. Tighten the connector screws with a tightening torque of 1.3 N·m.

Interlock cable connection in **slave 2 HVC 150S**:



- A Terminal block
- B Interlock cable from/to slave 1 HVC 150S


1. Move the cables towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of **only the White and Brown wire!**
3. Crimp a ferrule onto the end of the White and Brown wire.
4. Ensure that the unused wires, the Green and Yellow wire, are protected so that they cannot touch metal parts.
5. Make a wire connection between pin X286-7 and X286-8.
6. Loosen the connector screws.
7. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire number
Interlock In (slave 1 HVC 150S)	X286-4	Brown
Interlock Out (slave 1 HVC 150S)	X286-6	White
Interlock GND (slave 1 HVC 150S)	X286-5	Shield
Interlock loop	X286-7	Black
Interlock loop	X286-8	Black

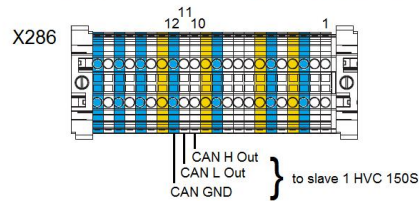
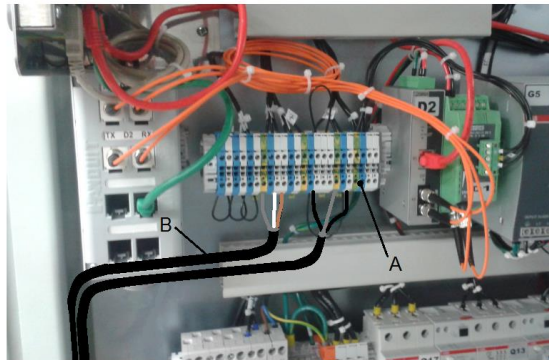
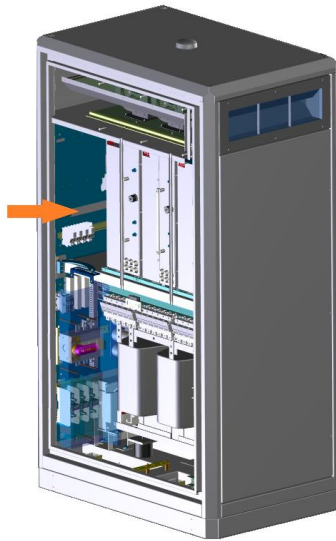
See also Appendix H *Signal connection diagram*.

8. Tighten the connector screws with a tightening torque of 1.3 N·m.

5.8.6. Connect the CAN cable

	NOTICE
<p>The CAN cable connection is only needed for the HVC 300 kW and 450 kW E-Bus Charger, see for more details section <i>Cabling</i> on Page 49.</p>	

CAN cable connection in **slave 2 HVC 150S** (in case of a HVC 450 kW system):



- A Terminal block
- B CAN cable to slave 1 HVC 150S

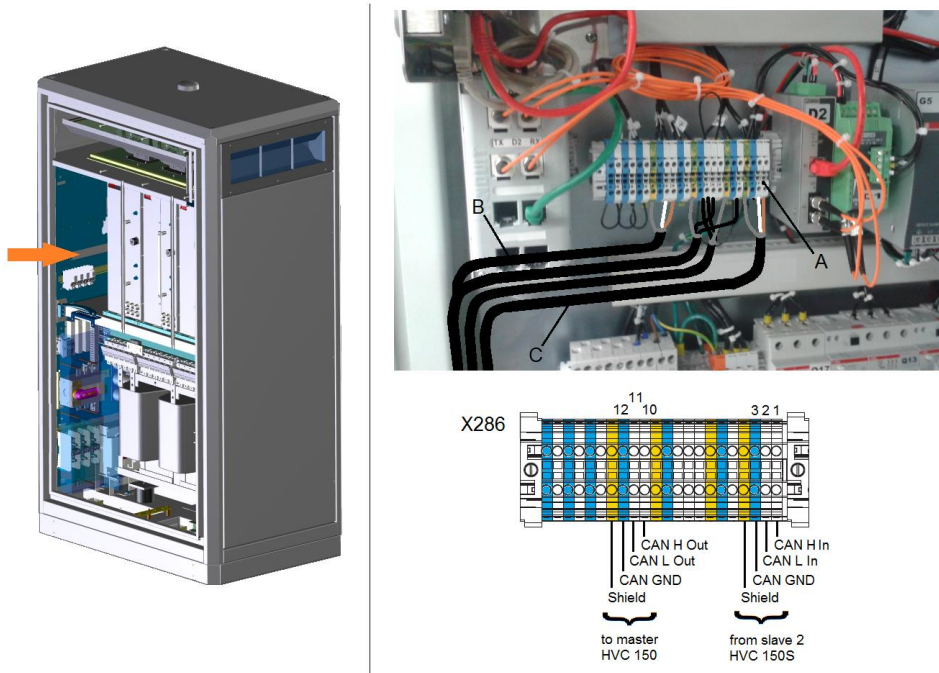
1. Move the cable towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of the wires.
3. Crimp a ferrule onto the end of the wire.
4. Loosen the connector screws.
5. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire color
CAN H Out	X286-10	Brown
CAN L Out	X286-11	White
CAN GND	X286-12 or Shield Can Out	Shield

See also Appendix H *Signal connection diagram*.

6. Tighten the connector screws with a tightening torque of 1.3 N·m.

CAN cable connection in **slave 1 HVC 150S**:



- A Terminal block
- B CAN cable to master HVC 150
- C CAN cable from slave 2 HVC 150S (in case of a HVC 450 kW system)

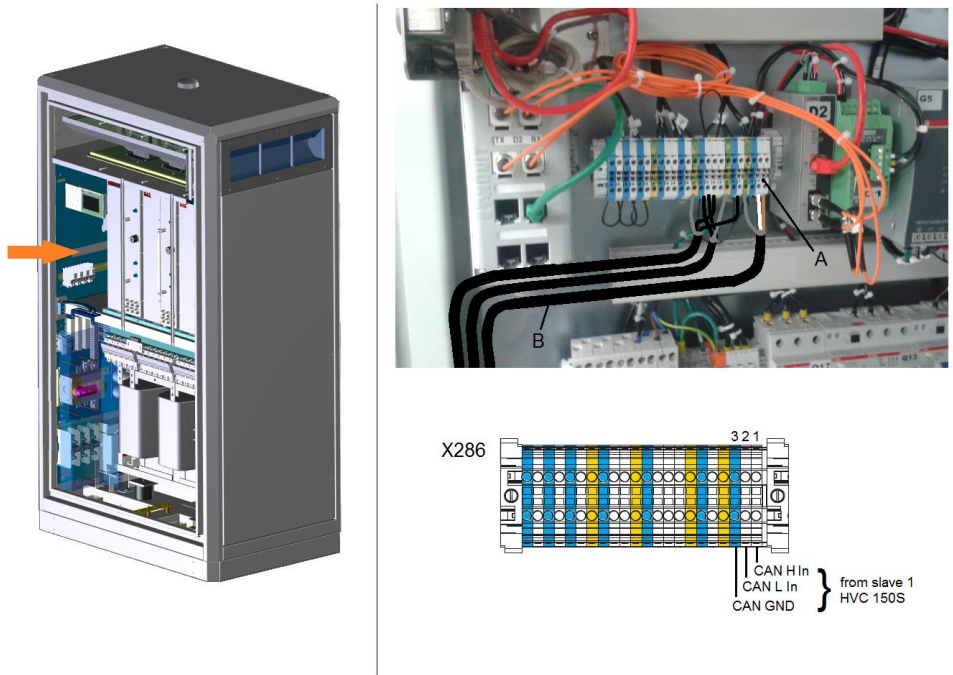
1. Move the cable towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of the wires.
3. Crimp a ferrule onto the end of the wire.
4. Loosen the connector screws.
5. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire color
CAN H In (to master HVC 150)	X286-1	Brown
CAN L In (to master HVC 150)	X286-2	White
CAN GND (to master HVC 150)	X286-3 or Shield Can In	Shield
CAN H Out (from slave 2 HVC 150S)	X286-10	Brown
CAN L Out (from slave 2 HVC 150S)	X286-11	White
CAN GND (from slave 2 HVC 150S)	X286-12 or Shield Can Out	Shield

See also Appendix H *Signal connection diagram*.

6. Tighten the connector screws with a tightening torque of 1.3 N·m.

CAN cable connection in **master HVC 150**:



- A Terminal block
- B CAN cable from slave 1 HVC 150S

1. Move the cable towards the terminal block (A).
2. Strip 11 mm of the insulation from the ends of the wires.
3. Crimp a ferrule onto the end of the wire.
4. Loosen the connector screws.
5. Insert the wires into the connectors, see table below:

Functional description	Connector	Wire color
CAN H In	X286-1	Brown
CAN L Out	X286-2	White
CAN GND	X286-3 or Shield Can In	Shield

See also Appendix H *Signal connection diagram*.

6. Tighten the connector screws with a tightening torque of 1.3 N·m.

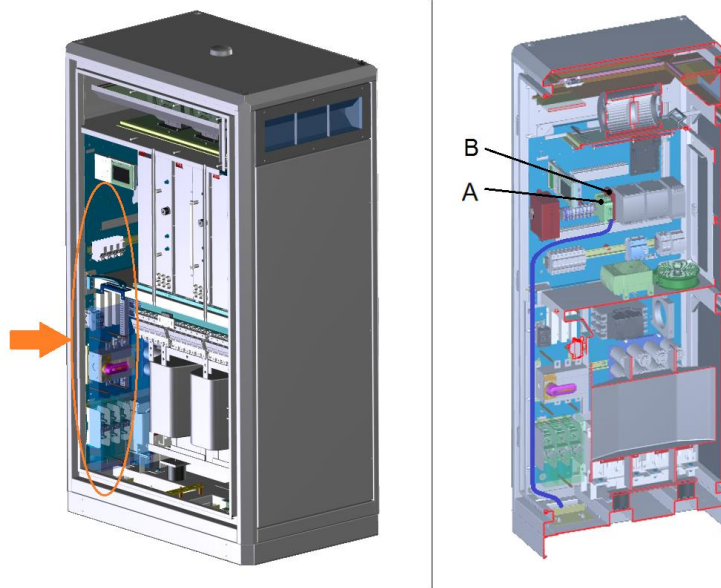
5.9. Connect the communication cable Power Cabinet



NOTICE

The communication fiber cables to the ACS Control Module are only connected within the master HVC 150 Power Cabinet, see for more details section *Cabling* on Page 49.

5.9.1. Route the cable to the terminal blocks



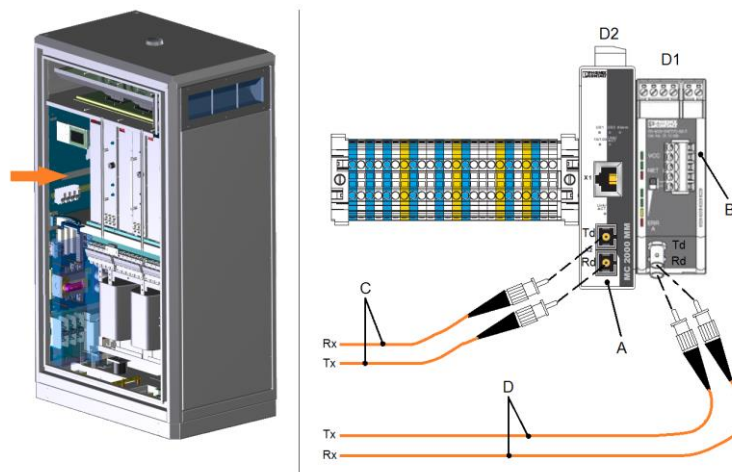
Preferred cable route

1. Route the communication fiber cable to module D1 (B) and D2 (A). Refer to the figure for the preferred cable route inside the cabinet (only within the HVC 150).


5.9.2. Connect the communication fiber cables

Preconditions:


- Tools: tak-ty or ty-raps



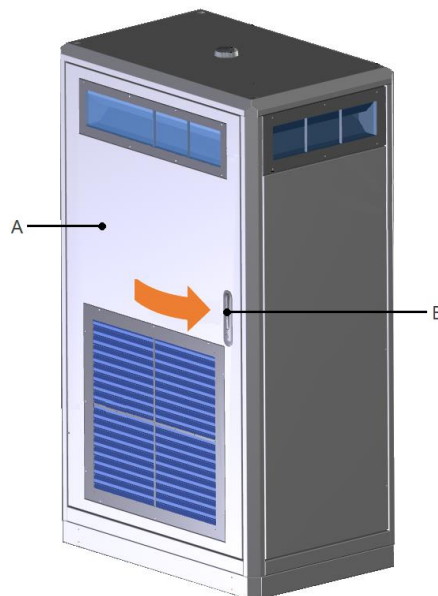
1. Remove the protection covers from the optical connectors.
2. Connect the two Ethernet fiber cables (C) onto the module D2 (A):
 - Rx with Td D2;
 - Tx with Rd D2.
3. Connect the two CAN bus fiber cables (D) onto module D1 (B):
 - Rx with Td D1;
 - Tx with Rd D1.

	NOTICE
<p>Four fiber cables are not connected. Those fiber cables are meant for spare.</p>	

4. Bind the cables together and secure the loops loosely with a piece of tak-ty or ty-rap.

	CAUTION
<p>Make the loop bend radius of the fiber cables not smaller than 64 mm, otherwise the core of the fiber cable may break.</p>	

5.10. Close the door of the Power Cabinet



Preconditions:



- Key that were removed from the Power Cabinet

1. Close the door (A).
2. Lock the handle (B).

5.11. Installation of the Pantograph with Junction Box

5.11.1. Before unpacking

The Pantograph will be delivered within a wooden box.

	NOTICE
	<p>Unloading Pantograph The delivery truck only unloads the pallet carrying the Pantograph. The delivery truck will not move the Pantograph to its final location. The placement of the Pantograph to its final location is the responsibility of the contractor. Upon request it is possible to order a truck with a crane.</p>
	CAUTION
	<p>Do not pollute the environment with plastic and cardboard packing. Dispose of these materials according to the applicable local regulations as well as environment-friendly protocols.</p>

Preconditions:



- All construction work is completed.
- The product is delivered by a transport company at the confirmed date of delivery.
- Crane or forklift truck to lift the pantograph. The load is about 180 kg.
- Boom lift to install the pantograph to the ceiling or construction and connect the cables onto the pantograph. Required height about 6 meter.





1. Check both boxes for damages.

5.11.2. Move the Pantograph to position

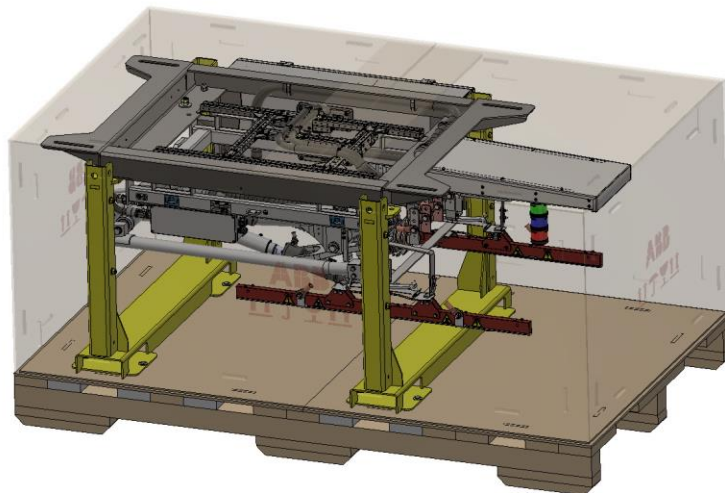
Preconditions:

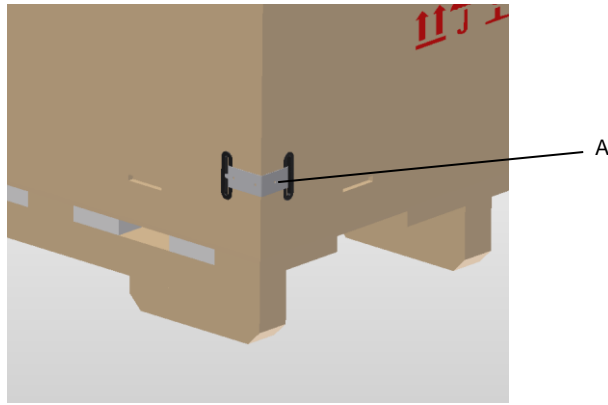
- The box with the pantograph is unloaded from the delivery truck.
- The area for installation, where the mounted pantograph shall be installed, is prepared. This means that the place where the pantograph shall be installed is clean and that the construction on which the pantograph mount shall be installed is ready.
- The work must be carried out by at least two persons.
- Tools: cross-head screwdriver, spanner (size 24).

	DANGER
	<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>
	WARNING
	<p>Make sure that personnel cannot be crushed or get stuck while moving the parts of the pantograph.</p>

	<p style="text-align: center;">WARNING</p> <p>Before mounting the pantograph affix a rope or cable to the crossbar of the upper arm and to the base frame so that the pantograph cannot lower unexpectedly out of housed position.</p>
	<p style="text-align: center;">WARNING</p> <p>Make sure that personnel cannot be falling from the platform when working at height.</p>
	<p style="text-align: center;">CAUTION</p> <p>Warranty Damage due to moving the pantograph to its position is not covered by the warranty.</p>
	<p style="text-align: center;">NOTICE</p> <p>The pantograph must be mounted on a plane surface. The frame must not be distorted.</p>

1. Move the wooden crate with the pantograph underneath the installation location (make sure the hinge points in the right direction, see section *Pantograph position in Y-axis in relation with the bus* on Page 33).






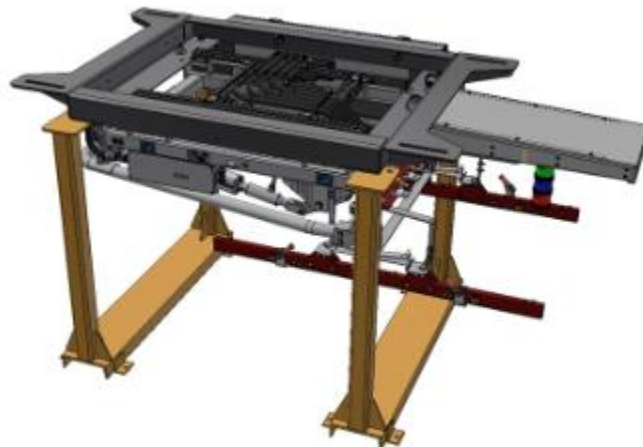
2. Remove the snaps (A) to disassemble.

5.11.3. Mounting the Pantograph Bracket

Preconditions:

- The work must be carried out by at least two persons.
- Parts: M16 Class 10.9 bolt (4x), M16 washer (4x), M16 spring washer (4x).
- Tools: boom lift, spanner (size 24), torque-wrench (size 24).

	WARNING
	<p>Make sure that personnel cannot be falling from the platform when working at height.</p>



There are two options to mount the Pantograph Bracket to your desired installation position:

1. Using a forklift to pick-up the Bracket from under the yellow support stools
2. Using a crane to pick-up the Bracket from above by attaching onto pre-placed eyebolts

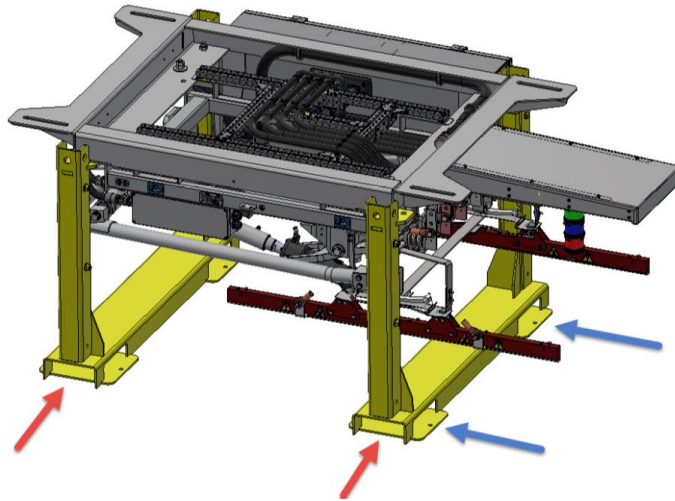
How to mount the pantograph assembly depends on the construction onsite, your available equipment, and may differ per location.

	NOTICE
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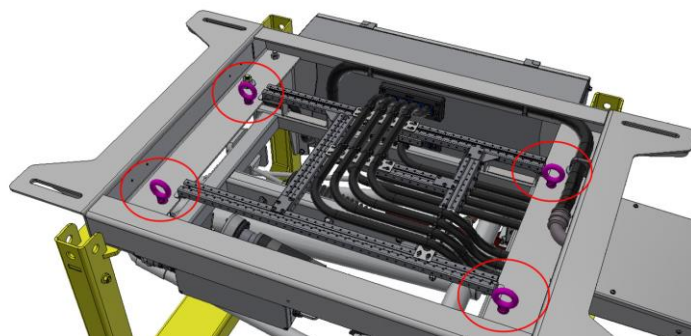
When lifting up the Pantograph by using a forklift truck, remove inside of the wooden box.
For lifting with crane only, use textile belts, so that the paint will not be damaged.

Mounting using a forklift





1. Ensure you are working with a forklift capable of lifting up to 1000lbs of weight. Place the forklift blades within the yellow metal support stool as listed above.
2. Proceed to lift the pantograph bracket upwards to the desired installed position. When lifting the Pantograph, ensure that the slots in the Bracket are aligned with the appropriate bore holes of the construction on which the Bracket will be mounted.
3. Refer to our general layout drawing for the finer details of the bracket's slots. The 4 mounting slots are made to receive M16 screws to be installed into the ceiling.
4. Fix the base frame (B) with M16 bolts, washers and spring washers (4x) (provided by the customer).
5. Tighten the bolts with a tightening torque of 110 N·m.
6. Check that the Pantograph's base frame is planar and bear on without tension.

Mounting using a crane



1. Ensure you are working with a crane capable of lifting up to 1000lbs of weight. Place the hoist where your lifting eyes are located as per the above picture.



2. Proceed to lift the pantograph bracket upwards to the desired installed position. When lifting the Pantograph, ensure that the slots in the Bracket are aligned with the appropriate bore holes of the construction on which the Bracket will be mounted.
3. Remove the yellow metal stools from under the installation.
4. Refer to our general layout drawing for the finer details of the bracket's slots. The 4 mounting slots are made to receive M16 screws to be installed into the ceiling.
5. Fix the base frame (B) with M16 bolts, washers and spring washers (4x) (provided by the customer).
6. Tighten the bolts with a tightening torque of 110 N·m.
7. Check that the Pantograph's base frame is planar and bear on without tension.
8. Remove the hoist and pre-installed lifting eyes from the equipment itself.


	NOTICE	
<p>The bolted fastenings have to be marked after fixing with required tightening torque with a suitable marker pin.</p>		

5.12. Connect cables to the Panto Down Junction Box

Preconditions:

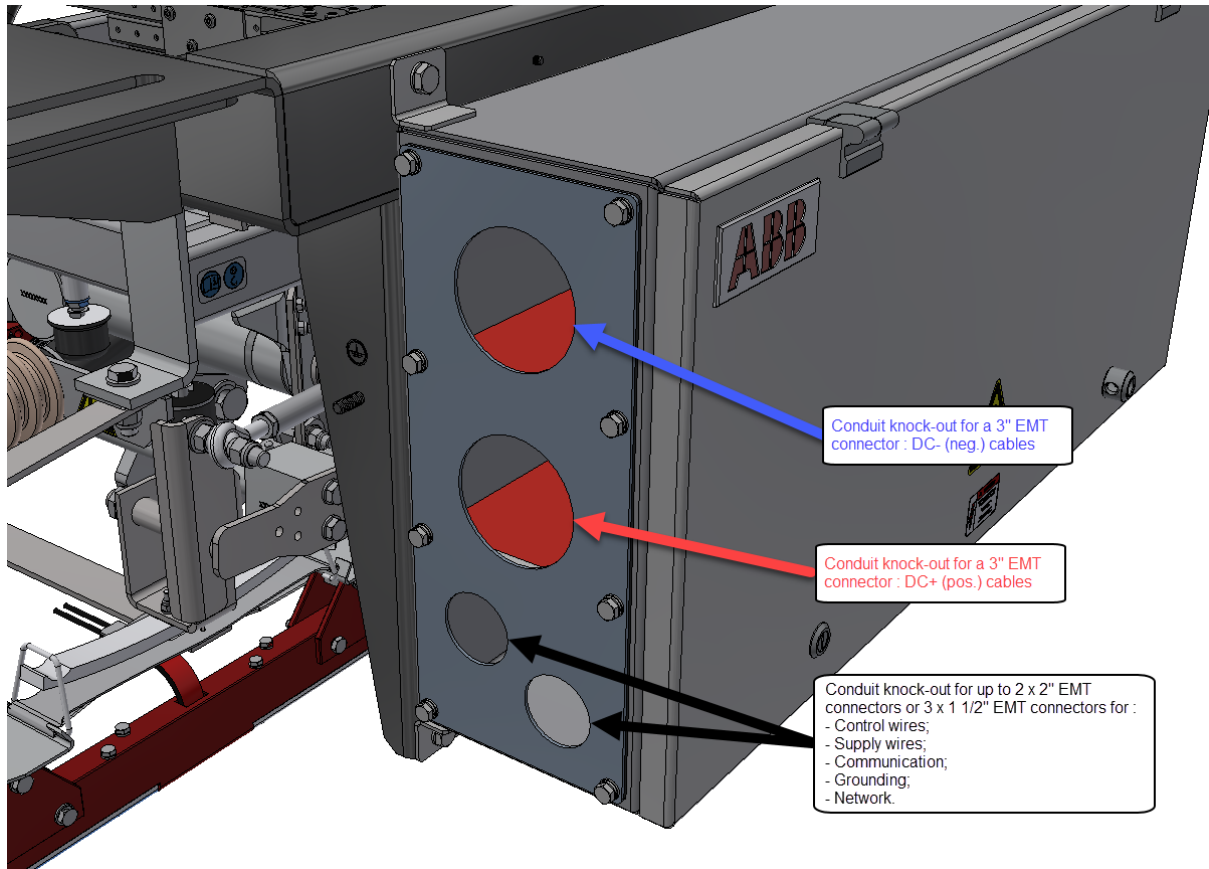
- The Pantograph, the WiFi communication unit and RFID unit (optional) are placed.
- The work must be carried out by at least two persons.
- Tools: boom lift.

	DANGER
<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>	
	WARNING
<p>Make sure that personnel cannot be falling from the platform when working at height.</p>	

	CAUTION
<p>Do not pollute the environment with plastic and cardboard packing. Dispose of these materials according to the applicable local regulations as well as environment-friendly protocols.</p>	

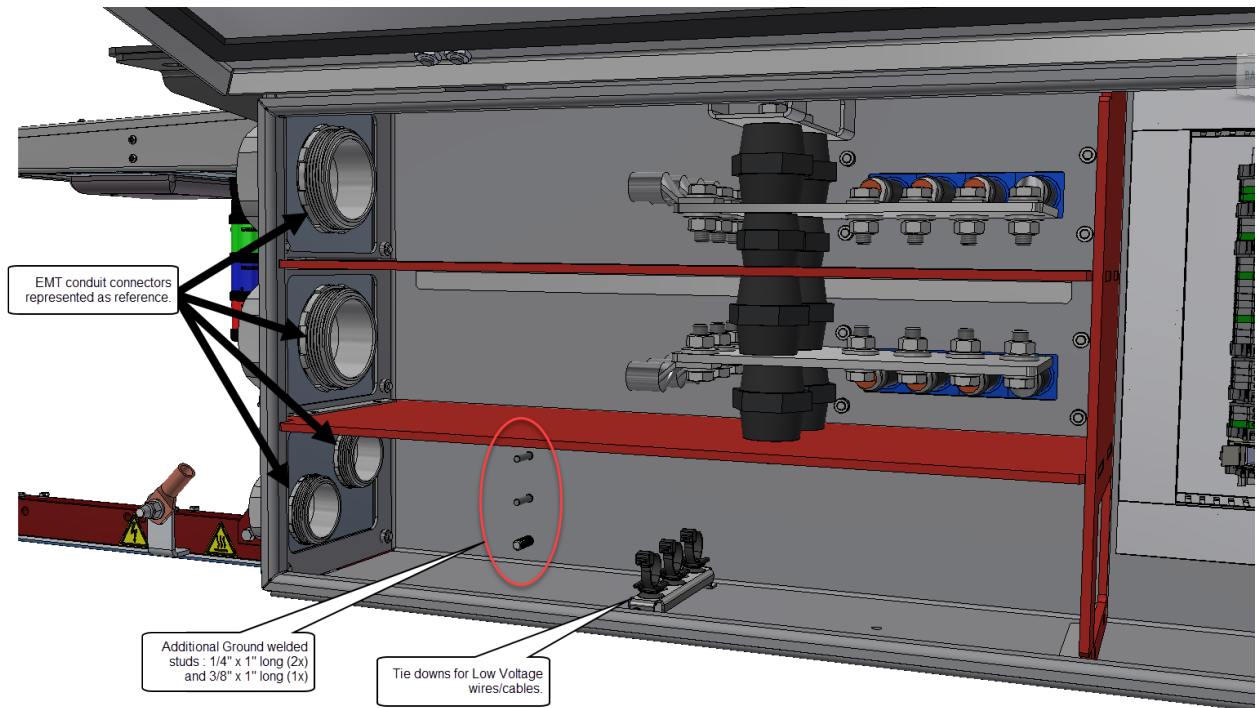
All wires and cables from ACM Enclosure to be terminated into the Pantograph Junction Box should be routed using EMT conduits and connectors.

DC power cable conduits enter the upper section of the Pantograph Junction Box whereas the control, supply, ground, communications and network cables/wires are to be entered at the bottom of the box, as shown below :



The Pantograph Junction Box comes with a blank removable side gland plate for conduit knock-outs to be punched on-site. Shown above are suggested locations and sizes required for proper routing of all wires and cables to the final connection points into the Junction Box.

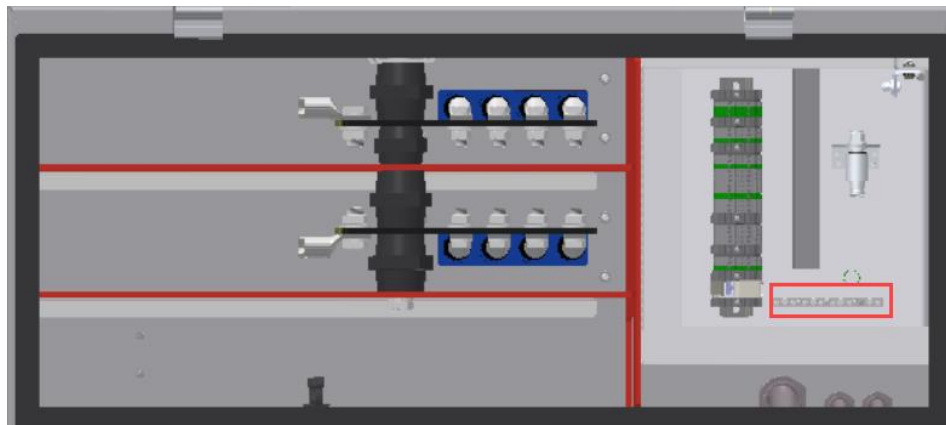
Shown below is a view of internal features of the Pantograph Junction Box.



5.12.1. Connect the PE wire to the Panto Down Junction Box.

Preconditions:

- Parts: 2AWG ferrules(X1)
- Tools: wire cutter, wire stripper, crimp pliers, flat screwdriver

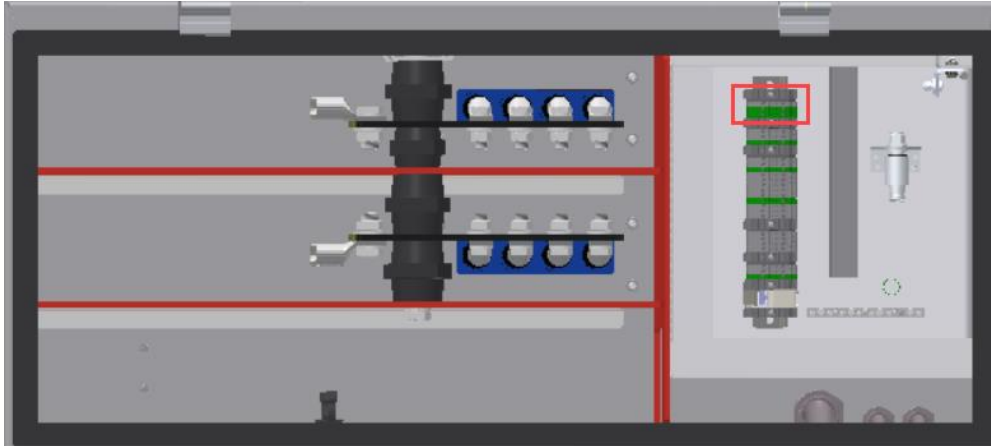


1. Cut the PE wire to the correct length to reach the PE connection (highlighted) on the Panto Down Junction Box. Do not make the wire routing too tight, or too loose.
Terminal: - **X9: GND_ACM**
2. Strip 20 mm of the insulation from the end of the wire.
3. Attach the ferrule to the end of the CP and PE wire.
4. Connect the wire on the above indicated terminal position.

5.12.2. Connect the ACS PE and CP/PE wire to the Panto Down Junction Box

Preconditions:

- Parts: 16AWG ferrules(X2)
- Tools: wire cutter, wire stripper, crimp pliers, flat screwdriver

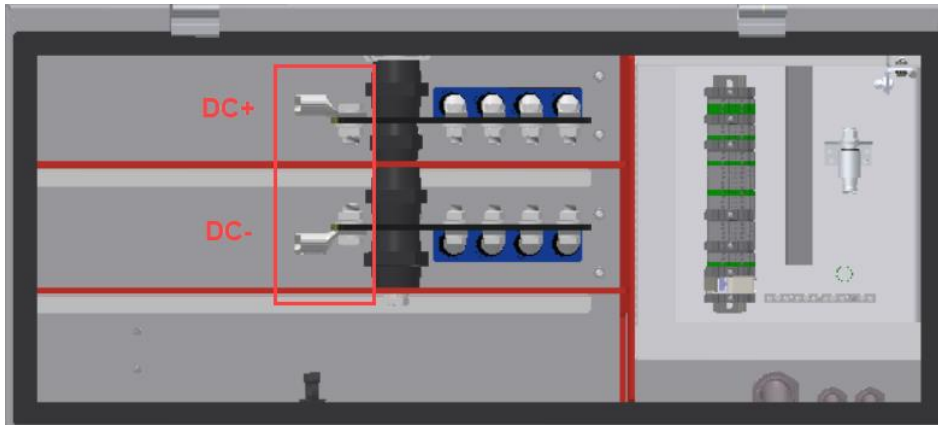


1. Cut the CP/PE cable to the correct length to reach the appropriate connection points on the Panto Down Junction Box. Do not make the wire routing too tight, or too loose.
Terminal: **-X3:1,2**
2. Strip 300 mm insulation from the cable.
3. Cut off the shielding.
4. Place a 40 mm long heat-shrink and a label "CP/PE" at the end of the cable.
5. Strip 11 mm of the insulation from both the ends of the wires.
6. Crimp the ferrules onto the end of the wires.
7. Connect the wires on the above specified terminal as per wiring documentation.

5.12.3. Connect DC cables to Panto Down Junction Box

Preconditions:

- Parts: 185/M12 (373MCM) tubular cable lug (2x, 4x or 6x), M12 x 40 Class 8.8 bolt (2x, 4x or 6x), M12 washer (4x, 8x or 12x), M12 spring washer (2x, 4x or 6x), M12 nut (2x, 4x or 6x), heat-shrink black 2:1 Ø 25.4 mm, heat-shrink red 2:1 Ø 25.4 mm.
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 19), torque-wrench (size 19).



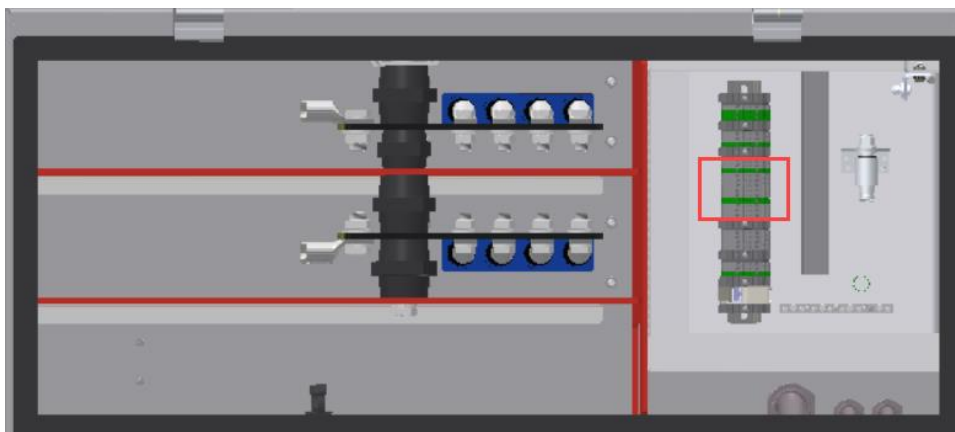
1. Cut the wires of the DC power cable to the correct lengths to reach the DC+ and DC- connection points on the Junction box. Do not make the wire routing too tight, or too loose.
2. Place 80 mm long heat-shrink (black on DC- and red on DC+ cables).
3. Strip the insulation on the required length specified by the used lug from the end of the wire.
4. Attach cable lug at the end of the wires and use the heat-shrink to cover the crimp connection.
5. Fit the M12 bolts with washers and the DC+ cable.
6. Insert the bolt fitted with the DC+ cable(s) into the DC+ connector.
7. Screw from the other side of the DC+ connector, the DC+ wire(s) (if needed), washer(s), spring washer(s) and nut(s) on the bolt(s).
8. Repeat the same steps for the DC- cables.
9. Tighten the bolt/nut connections with a tightening torque of 78 N·m.

Note: The number of DC+ and DC- cables depend on the power rating of the product. 150kW: 1xDC+ and 1xDC-, 300kW: 2xDC+ and 2xDC-, 450kW: 3xDC+ and 3xDC-.

5.12.4. Connect ACS control cable to Panto Down Junction Box

Preconditions:

- Parts: 14AWG ferrule (x8)
- Tools: wire cutter, wire stripper, crimp pliers.



1. Cut the ACS control cable to the correct lengths to reach the terminal (highlighted). Do not make the wire routing too tight, or too loose
2. Strip 5 mm of the insulation from the ends of the wires and insert ferrules.
3. Connect the wires between the ACM and the Terminal **X5** on the Panto Down Junction Box as per the table below:

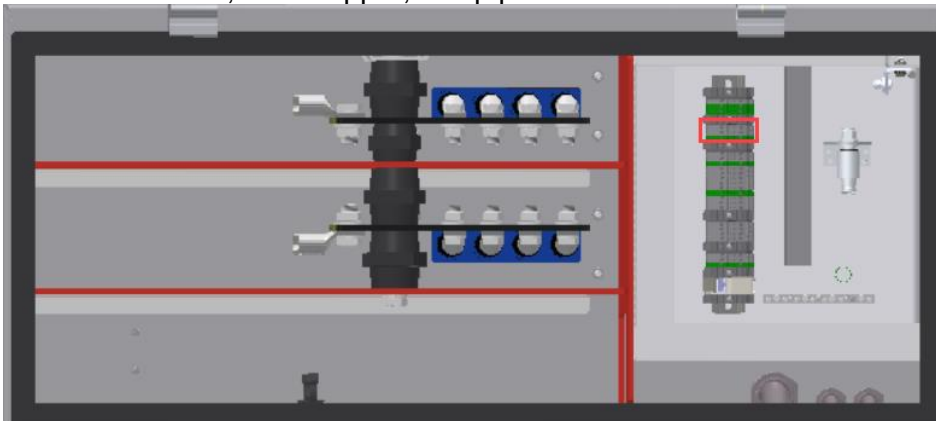
Functional description	ACM Terminal	Wire number	Terminal on X5 (PANTOJB)
ACS +24V	X3-1	1	1
ACS -24V	X3-2	2	2
PE	X3-3	8	3
ACS Extend/Retract Out	X4-5	3	4
ACS Supply/Retract Out	X4-7	4	6
ACS Retracted In	X4-8	5	7
ACS GND_B	X4-10	6	9
ACS Extended In	X4-11	7	10

4. Make sure to use green/yellow wire for the PE connection on terminal **-X5:3**

5.12.5. Connect ACS heater cable to Panto Down Junction Box

Preconditions:

- Parts: 14AWG ferrules(x3)
- Tools: wire cutter, wire stripper, crimp pliers.

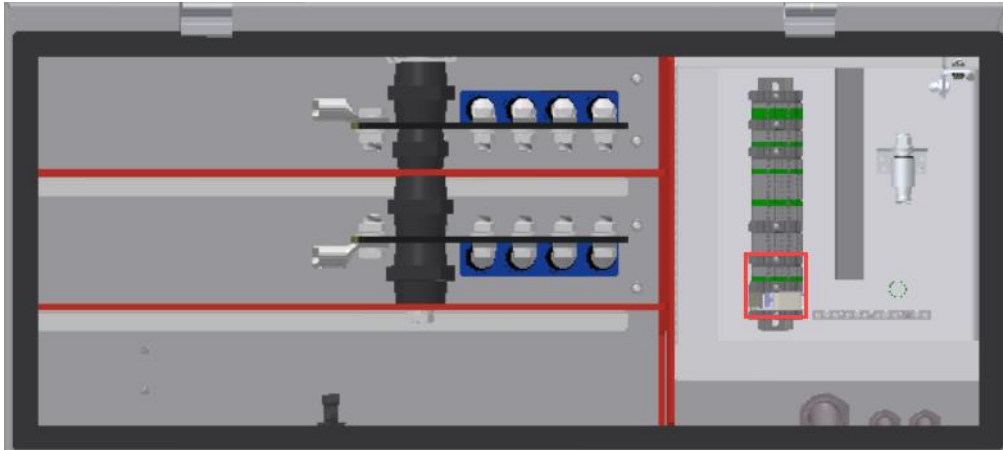


1. Cut the ACS heater cable to the correct lengths to reach the connector (A). Do not make the wire routing too tight, or too loose.
Terminal: **-X4: 1,2,3**
2. Strip 5 mm of the insulation from the ends of the wires and terminate with ferrules.
3. Connect the wire onto the above specified terminal as per wiring documentation

5.12.6. Connect RFID cables to Panto Down Junction Box

Preconditions:

- Parts: 16AWG ferrules(x2)
- Tools: wire cutter, wire stripper, crimp pliers.



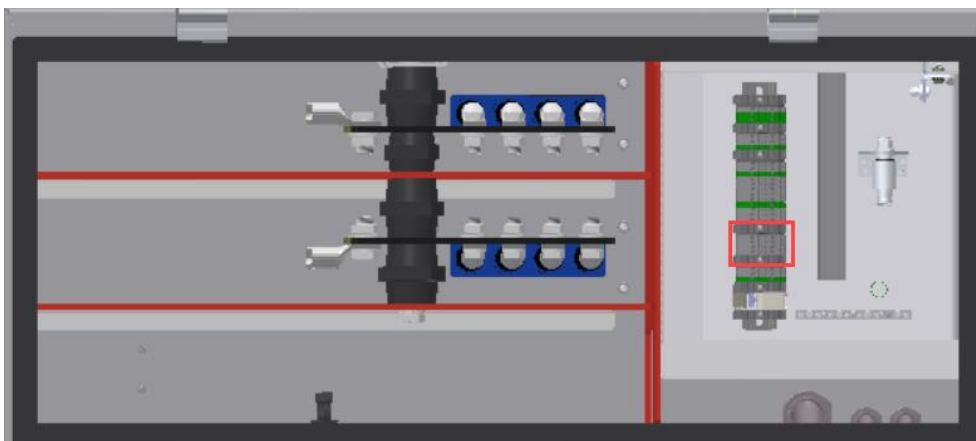
1. Cut the RFID power cable to the correct lengths to reach the connector (highlighted). Do not make the wire routing too tight, or too loose.
Terminal: **-X7: 1,2,3,4**
2. Strip 5 mm of the insulation from the ends of the wires and terminate with ferrules.
3. Connect the wire onto the above specified terminal as per wiring documentation
4. Connect the control cable to terminal -X7:4

Functional description	ACM Terminal	Wire number	Terminal on X5 (PANTOJB)
GND	X4-32	1-blue	1
Supply Voltage	X4-31	2-brown	2
Shield	shield	shield	3
Control cable	U10-X2	Cat5e	4

5.12.7. Connect Beacon cables to Panto Down Junction Box

Preconditions:

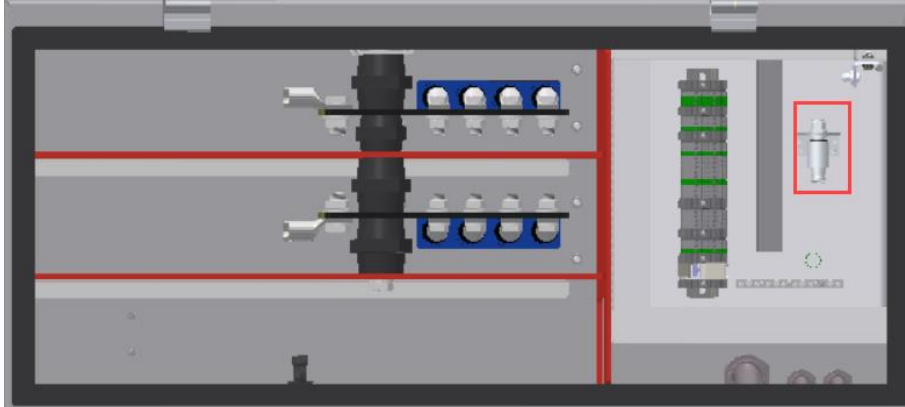
- Parts: 16AWG ferrules(x4)
- Tools: wire cutter, wire stripper, crimp pliers.



1. Cut the Beacon cable to the correct lengths to reach the connector (highlighted). Do not make the wire routing too tight, or too loose.
Terminal: **-X6: 1,2,3,4**
2. Strip 5 mm of the insulation from the ends of the wires and terminate with ferrules.

3. Connect the wire onto the above specified terminal as per wiring documentation


5.12.8. Connect Wifi cables to Panto Down Junction Box



1. Connect the Wifi coaxial cable on the connector indicated above. Terminal: **-X8**

5.13. Unpack the ACS Control Module Enclosure Kit

5.13.1. Before unpacking

	CAUTION
	<p>Do not pollute the environment with plastic and cardboard packing. Dispose of these materials according to the applicable local regulations as well as environment-friendly protocols.</p>

Preconditions:



- All construction work is completed.
- The product is delivered by a transport company at the confirmed date of delivery.

1. Check box for damage.

5.13.2. Remove packaging

Preconditions:

- The installation work must be carried out by at least two persons.





	WARNING
	<p>Make sure that personnel cannot be crushed or become trapped while moving the ACS Control Module out of the box.</p>
	CAUTION
	<p>Warranty Damage due to moving the ACS Control Module and Junction Box out of the box is not covered by the warranty.</p>

1. Unpack the ACS Control Module Enclosure kit.
2. Remove the bag which contain the keys. The bag is attached with tape on the door of the ACS Control Module.
3. Lift the ACS Control Module Enclosure kit out of the box
4. Place ACS Control Module Enclosure kit on the ground with its top facing up.

5.14. Install the ACS Control Module Enclosure kit onto a wall

Preconditions:

- All packaging material is removed from the ACS Control Module Enclosure.
- A minimum of two persons is required.
- Tools: key, spanner (size 13), torque wrench (size 13), cross-head screwdriver.

	<p style="text-align: center;">WARNING</p> <p>Make sure that personnel cannot be crushed or become trapped while moving the ACS Control Module.</p>
	<p style="text-align: center;">CAUTION</p> <p>Warranty Damage due to moving the ACS Control Module and Junction Box to its position is not covered by the warranty.</p>
	<p style="text-align: center;">CAUTION</p> <p>Do not use a compressor to clean the ACS Control Module. Use a vacuum cleaner.</p>
	<p style="text-align: center;">CAUTION</p> <p>Attach the ACM Enclosure kit to a solid wall or support structure that can support the weight of the ACS Control Module Enclosure kit (= 193 kg). Also the mounting points within the wall or support structure must withstand at least 3 to 4 times the weight of the ACM Enclosure kit.</p>

5.14.1. Using the wall-mounting brackets (only for ACM Enclosure)

The ACM Enclosure can be easily mounted by using the wall-mounting brackets, see *Wall-mounting brackets for safe wall fixing* on Page 21.

1. Carefully place the ACM Enclosure against the wall.
2. Make sure that the ACM Enclosure is aligned with the drilled holes in the wall.
3. Insert the M12 wood-wire-bolts into the holes of the wall-mounting brackets. See the details on the table below for torque specifications.


METRIC	Imperial equivalent	N*M	KGF*CM	LBS*PI.	LBS*PO.
M5	10-32	5	51	3.7	44
M6	1/4	9	92	6.6	80
M8	5/16	20	200	15	177
M10	3/8	40	400	29.5	354
M12	1/2	72	735	53	637
M16	5/8	180	1835	132.8	1593
M20	3/4	350	3569	258.1	3098

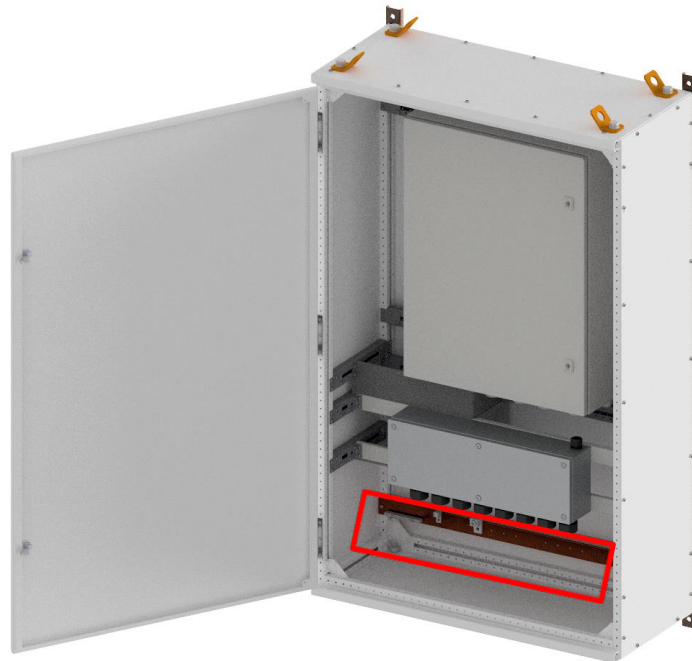
Table 1 - Torque for plain steel bolts grade 8.8 used for bus bar connections

5.15. Connect remaining PE wires to central PE-rail in the ACM Enclosure

Preconditions:

- Parts: cable lug (as per wire being connected)
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size 13)

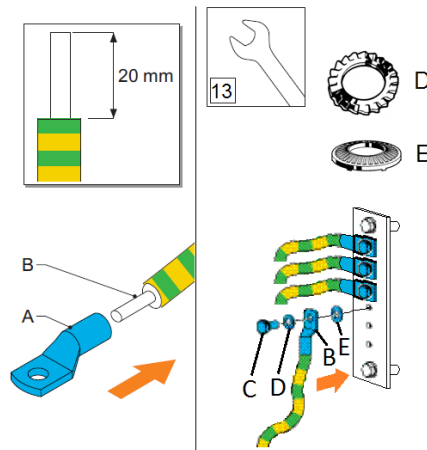
	DANGER
	Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.



5.15.1. Existing PE connections on the PE rail

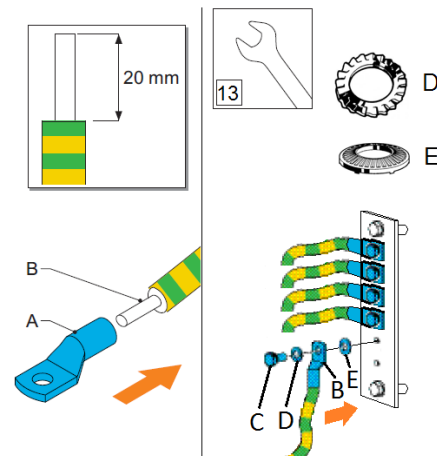
1. Connection from ACS control module
2. Connection from DC- Junction Box

5.15.2. Connect the PE wire from the Panto Down Junction Box



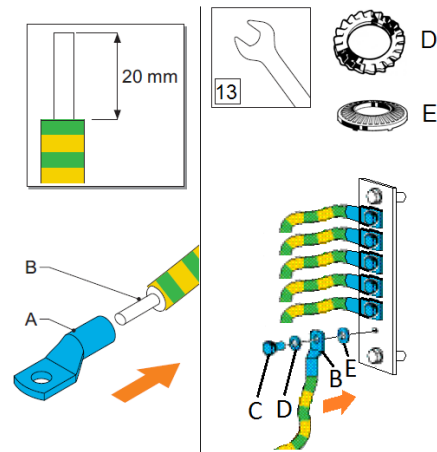
1. Cut the PE wire to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose. This is the PE wire connected at terminal -X9:GND_ACM
2. Strip 20 mm of the insulation from the end of the wire.
3. Attach a wire end ring (A) to the end of the PE wire (B).
4. Remove the M8 bolt and washers from the PE rail.
5. Fit the bolt (C) with toothed washer (D), the PE wire (B) and the contact washer (E).
6. Insert the bolt fitted with the PE wire into the PE rail.
7. Tighten the bolt with a tightening torque of 15 N·m.

5.15.3. Connect the PE wire of the Power Cabinet




1. Cut the PE wire to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose.
2. Strip 20 mm of the insulation from the end of the wire.
3. Attach a wire end ring (A) to the end of the PE wire (B).
4. Remove the M8 bolt and washers from the PE rail.
5. Fit the bolt (C) with toothed washer (D), the PE wire (B) and the contact washer (E).
6. Insert the bolt fitted with the PE wire into the PE rail.
7. Tighten the bolt with a tightening torque of 15 N·m.

5.15.4. Install lighting protection (optional)

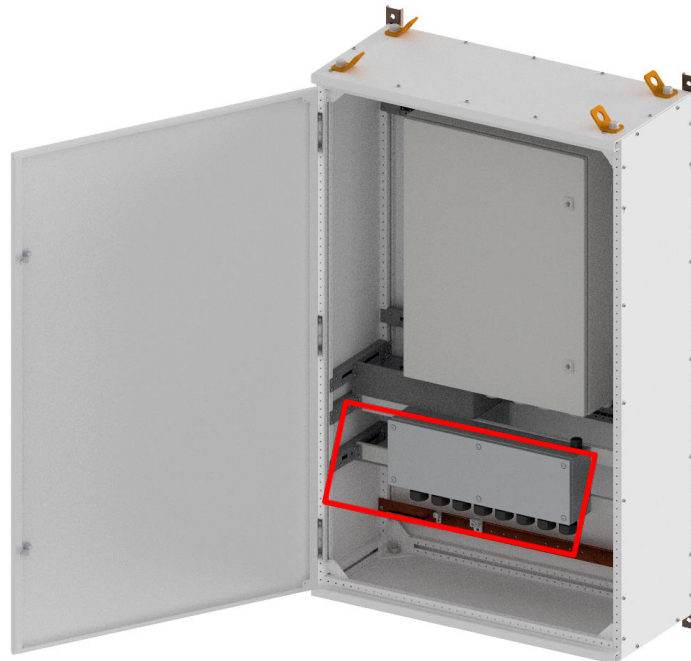


1. Cut the wire of the lighting protection cable to the correct length to reach the PE rail. Do not make the wire routing too tight, or too loose.
2. Strip 20 mm of the insulation from the end of the wire.
3. Attach a wire end ring (A) to the end of the lighting protection wire (B).
4. Remove the M8 bolt and washers from the lighting protection rail.
5. Fit the bolt (C) with toothed washer (C), the lighting protection wire (B) and contact washer (E).
6. Insert the bolt fitted with the lighting protection wire into the lighting protection connection.
7. Tighten the bolt with a tightening torque of 15 N·m.

5.16. Connect cables into the ACS Control Module Enclosure

	DANGER
	<p>Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>

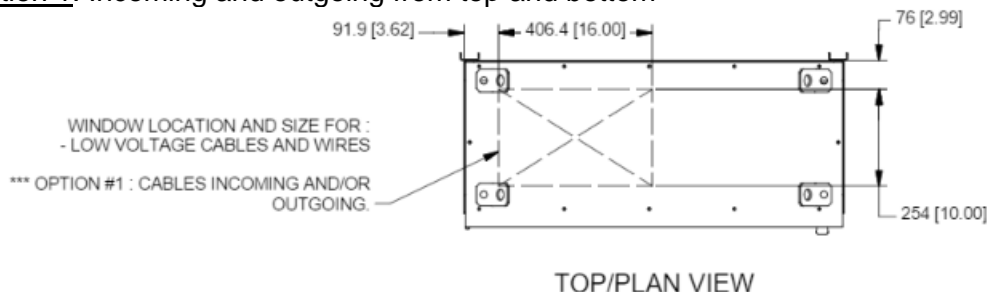
5.16.1. Gland layout of the ACS Control Module – 450-600kW models only

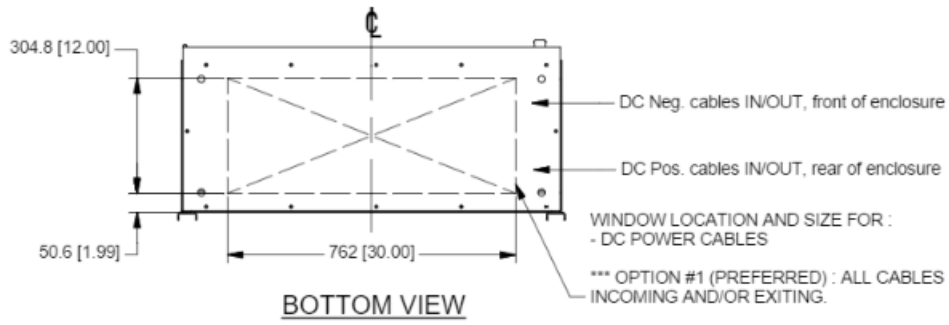


Note : Image shown above includes a DC Junction Box only found on 450kW/600kW model - for lower power ratings, connections are made directly Automatic Control Module (both DC +/-)

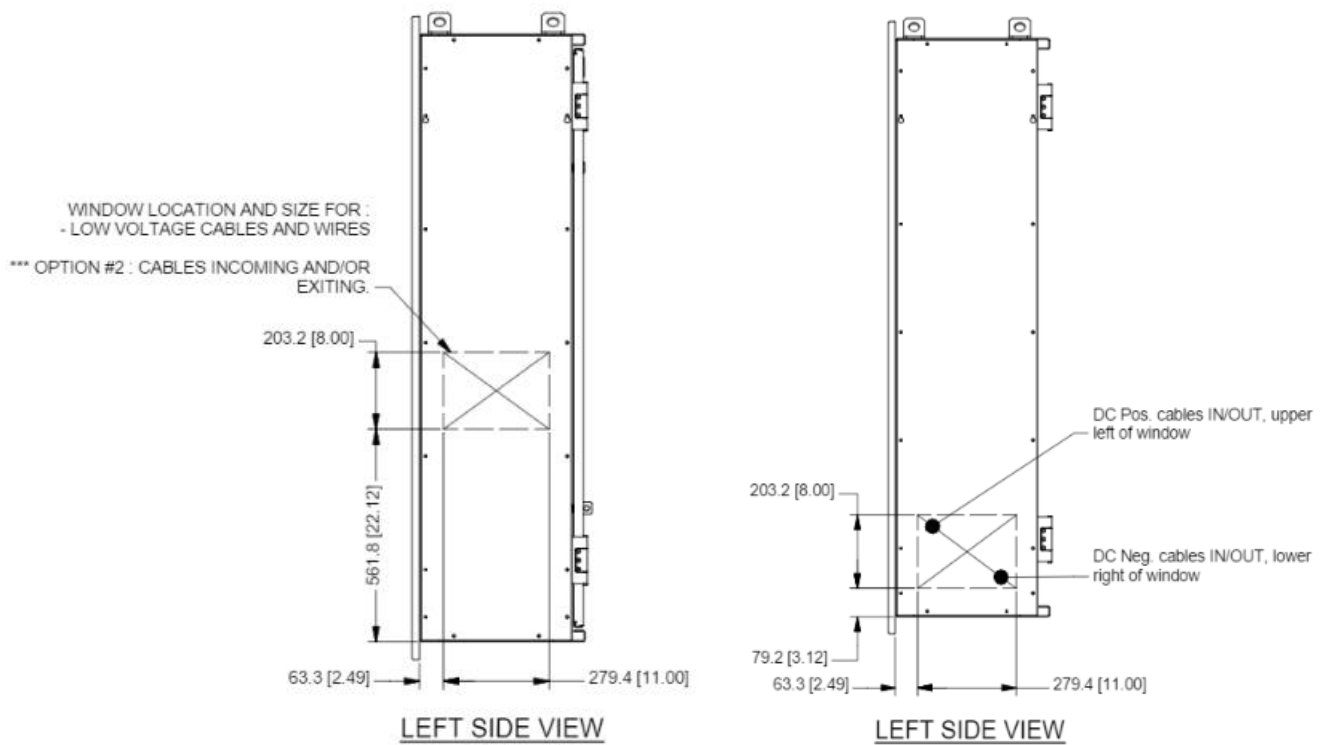
To enable cable connection inside the ACM Enclosure, the following conduit zones are available for cable entry/exit

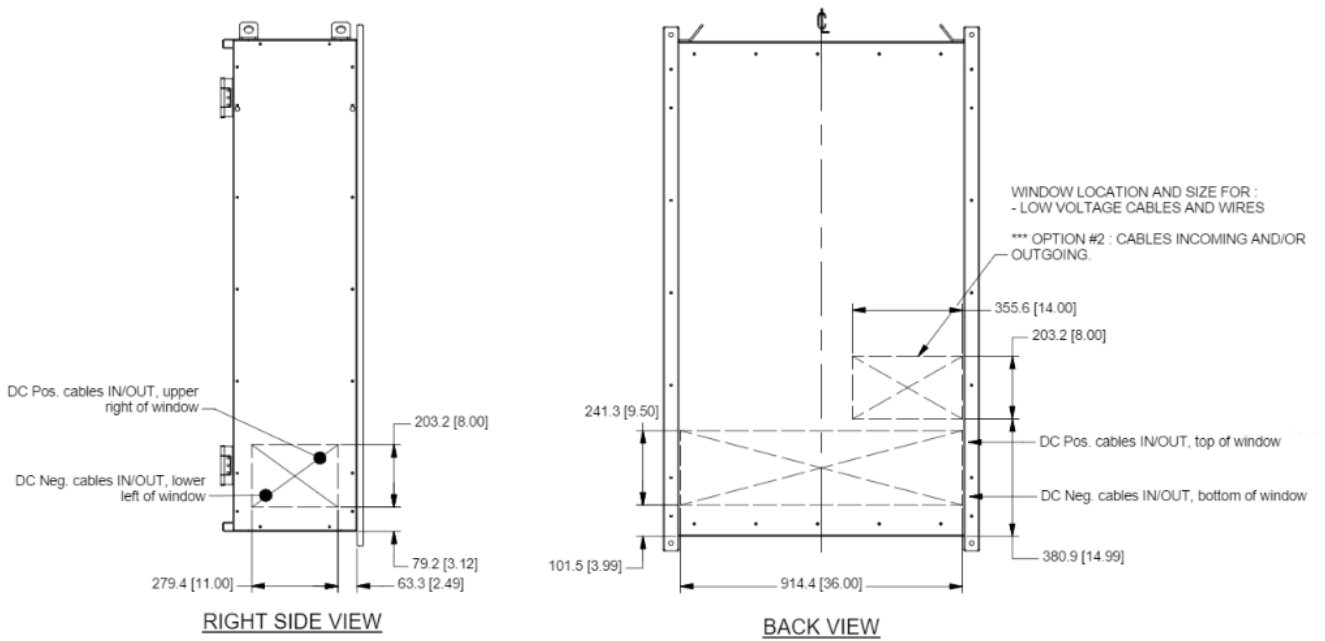
Option 1: Incoming and outgoing from top and bottom



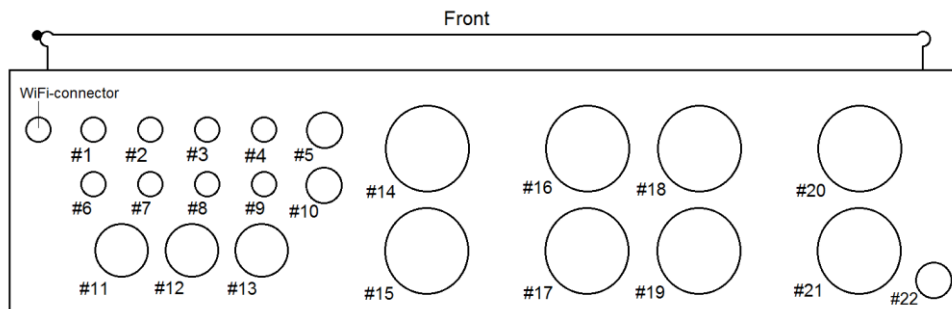


Option 2: Incoming and outgoing from the sides and back





The gland layout on the bottom of the ACS control module is shown below:




Gland #	Clamping range ØF	Cable	150-300 kW	450-600 kW
1	5 – 10 mm	AC utility power	✓	✓
2	5 – 10 mm	Pantograph heater	✓	✓
3	5 – 10 mm	Interlock	✓	✓
4	5 – 10 mm	Pantograph CP/PE	✓	✓
5	10 -17 mm	RFID Ethernet	✓	✓
6	5 – 10 mm	EMO switch	✓	✓
7	5 – 10 mm	Beacon	✓	✓
8	5 – 10 mm	Distance sensor	✓	✓
9	5 – 10 mm	Temperature sensor	✓	✓
10	10 -17 mm	RFID Power cable	✓	✓
11	13 – 21 mm	Communication (fibers)	✓	✓
12	13 – 21 mm	ACS Control	✓	✓
13	13 – 21 mm	PE	✓	✓
14	27 – 35 mm	DC+ In (from HVC 150, master)	✓	✓
15	27 – 35 mm	DC+ In (from HVC 150S, slave 1)	✓	✓
16	27 – 35 mm	DC+ Out (to pantoJB)	✓	✓
17	27 – 35 mm	DC+ Out (to pantoJB)	✓	✓

18	27 – 35 mm	DC+ Out (to pantoJB)	✓
19	27 – 35 mm	<i>Not used</i>	
20	27 – 35 mm	DC+ In (from HVC 150S, slave 2)	✓

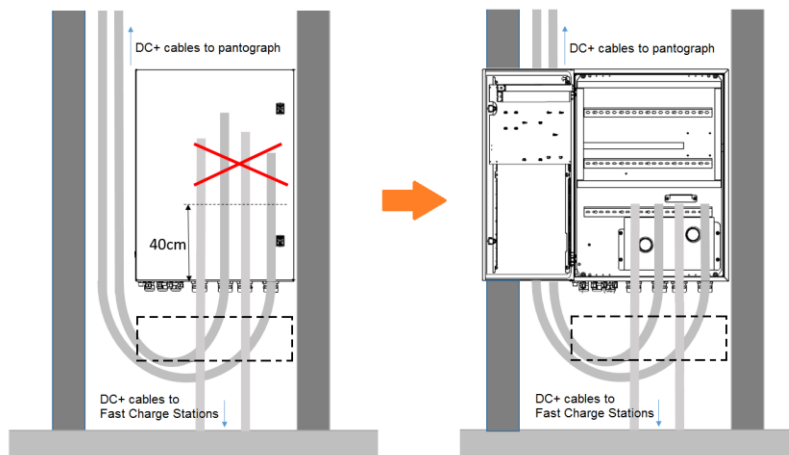
5.16.2. Connect the DC+ power in- and output cables

Preconditions:

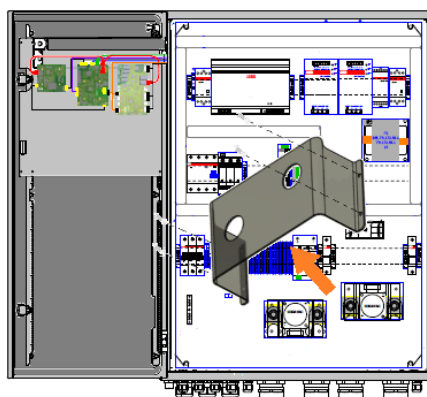
- Parts: 185/M12 tubular cable lug (2x, 4x or 6x³), heat-shrink red 2:1 Ø 25.4 mm.
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size13 and 18), torque wrench (size 13 and 18).

	NOTICE
<p>Ensure that the DC cables during mounting do not hit the PCBAs on the door of the ACS Control Module. When these cables hit the PCBAs, the PCBAs can be damaged. It is advised to protect the PCBAs during mounting of the DC cables.</p>	

To prevent damage of the PCBAs in the ACS Control Module:

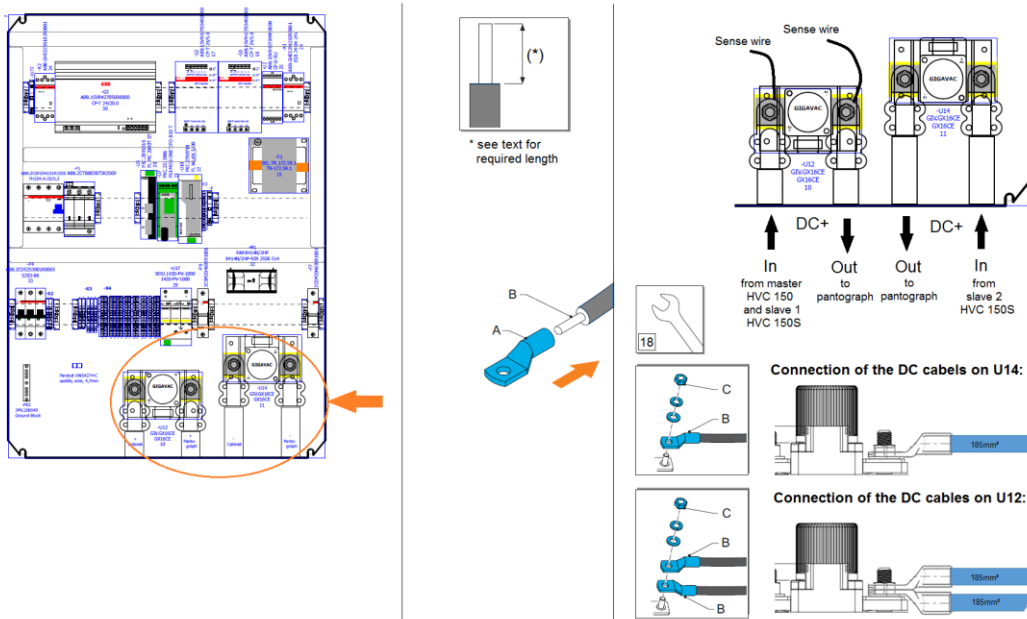


1. Cut the DC cables at 400 mm from the bottom side of the ACS Control Module.
2. Open the door of the ACS Control Module and check the required length.




³ Depends on the charger system configuration, see section *Charge system configurations* on Page 45.

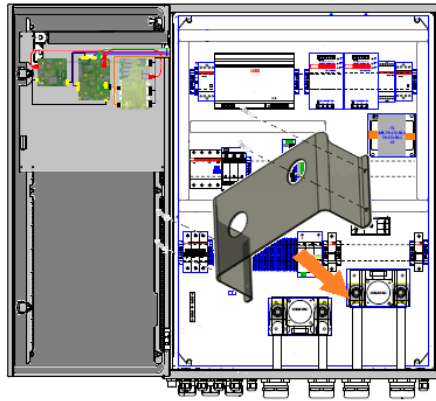
3. Remove the DC contactor's protection cover.



4. Loosen and remove the cable gland's (#14 - #18 and #20, depending on the system configuration see also *Charge system configurations* on Page 49) nuts, including the cover caps inside the gland, for the DC+ power cables.
5. Slide the cable gland's nuts over the DC+ power cables.
6. Insert the DC+ power cables into the right cable gland (#14 - #18 and #20, see picture above and section *Gland layout of the ACS Control Module* on Page 105).
7. Place 80 mm long heat-shrink (red on DC+ power cables).
8. Strip the insulation on the required length specified by the used lug from the end of the wire (B).
9. Attach cable lug (A) at the end of the wires and use the heat-shrink to cover the crimp connection.
10. Remove the nuts and washers (C) from the bolts of the DC contactor connectors.
11. **If present:** remove the sense wires from the bolts of the DC contactor connectors.
12. Insert the wires (B) onto the correct bolts of the DC contactor connectors, see picture above for the correct connection.
13. Insert the sense wires back onto the bolts of the DC contactor connectors.

	NOTICE
	<p>Make sure that the sense wires are placed back on the DC contactor connectors. If this is not the case, then the system will not function.</p>

14. Tighten the nuts (C) with a tightening torque of 30 N·m.



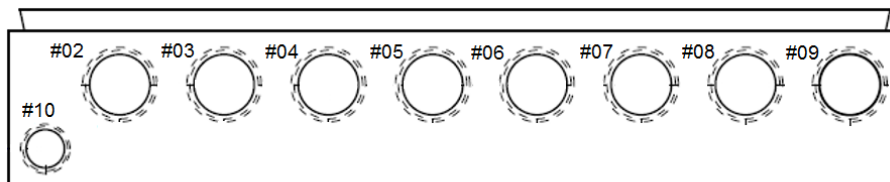
15. Place the protection cover back on the DC contactors.
16. Hand tighten the screws of the protection cover.
17. Tighten the cable gland's nut to secure the DC power cables.

5.16.3. Connect the DC- power in- and output cables in Junction Box

Preconditions:

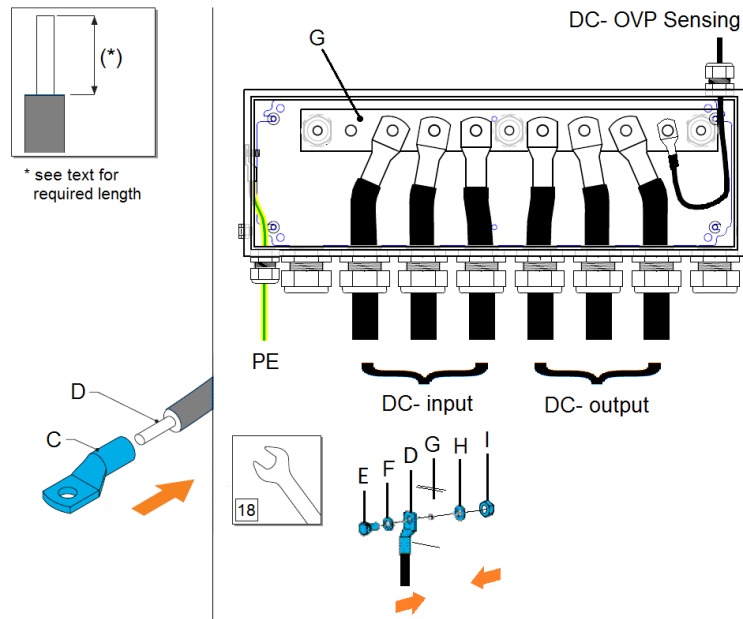
- Parts: 185/M12 tubular cable lug (2x, 4x or 6x), heat-shrink black 2:1 Ø 25.4 mm.
- Tools: wire cutter, wire stripper, crimp pliers, spanner (size18), torque wrench (size 18), cross-head screwdriver.

Note: The 150-300kW rated systems will not include this junction box. Connections (DC +/-) are to be made into the ACM directly.

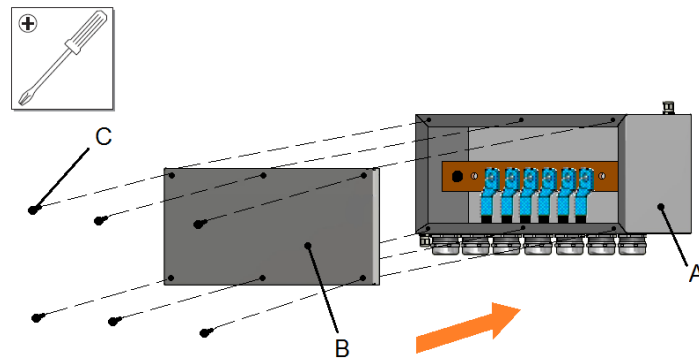


Bottom view


1. Loosen and remove the cable gland's (#03 - #08) nuts for the DC power cables.
2. Slide the cable gland's nuts over the DC power cables.
3. Insert the DC- input power cable(s) into the cable gland (#03, #04 and #05, see picture above).
4. Insert the DC- output power cables into the cable gland (#06, #07 and #08, see picture above).
5. Place 80 mm long heat-shrink (black on DC- power cables).
6. Strip the insulation on the required length specified by the used lug from the end of the DC power cables.



7. Attach cable lug (C) at the end of the wires (D) and use the heat-shrink to cover the crimp connection.
8. Remove the M12 bolts, washers and nuts from the bus-bar (G).
9. Fit the bolt (E) with flat washer (F) and the wire (D) (6x).
10. Insert the bolt fitted with the wire into the bus-bar (G) (6x).
11. Secure the bolt (E) onto the bus-bar (G) with the spring washer (H) and the nut (I) (6x).
12. Tighten the bolts (E) and nuts (I) with a tightening torque of 80 N·m.
13. Tighten the cable gland's nut to secure the DC power cables.



14. Place the cover (B) back onto the Junction Box (A).

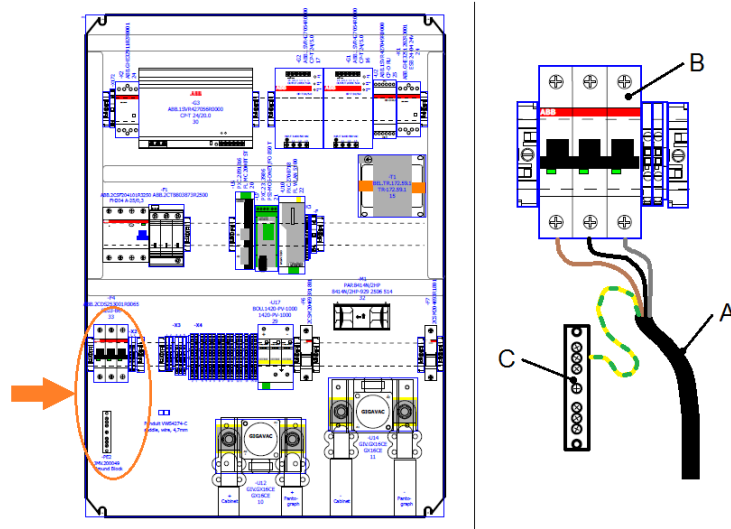
	WARNING
	<p>If the PE braided wire between the cover and cabinet is disconnected during the installation of the DC- power cables, make sure that the PE braided wire of the cover is electrically connected to the cabinet.</p>

15. Tighten the screws (C) (6x) to secure the Junction Box.

5.16.4. Connect the AC utility power cable from Power Cabinet

Preconditions:

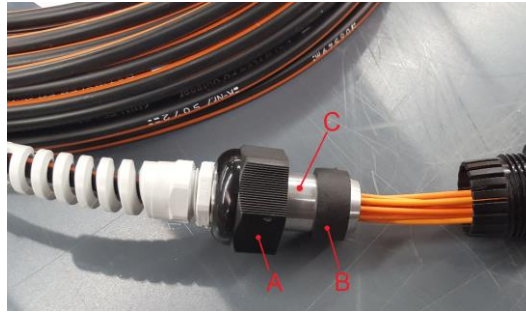
- Parts: 2.5 x 8 ferrule (4x).
- Tools: wire cutter, wire stripper, crimp pliers, screwdriver, crimp pliers.




1. Loosen and remove the cable gland's (#1) nut for the AC utility power cable.
2. Slide the cable gland's nut over the AC utility power cable.
3. Route the AC utility power cable (A) through gland #1 to the circuit breaker (B), with sufficient cable length (do not make the cable routing too tight, or too loose).
4. Tighten the nut of the gland to secure the AC utility power cable.
5. Strip the insulation from the AC utility power cable (A).
6. Cut the wires of the AC utility power cable (A) to the correct lengths to reach the connectors. Make sure the PE wire is longer than the other wires.
7. Strip 11 mm of the insulation from the ends of the wires.
8. Crimp a ferrule onto the end of the wire.
9. Loosen the connector screws.
10. Insert the PE wire (green/yellow) into the one of the free connectors of GND-rail (C).
11. Tighten the connector screw of GND-rail (C).
12. Insert the other 3 wires into the connectors of circuit breaker (B).
 - From left to right:
 - L1 (brown),
 - L2 (black),
 - L3 (grey).
13. Tighten the connector screws of circuit breaker (B) with a tightening torque of 3.0 N·m.

5.16.5. Connect the communication cable from the Power Cabinet

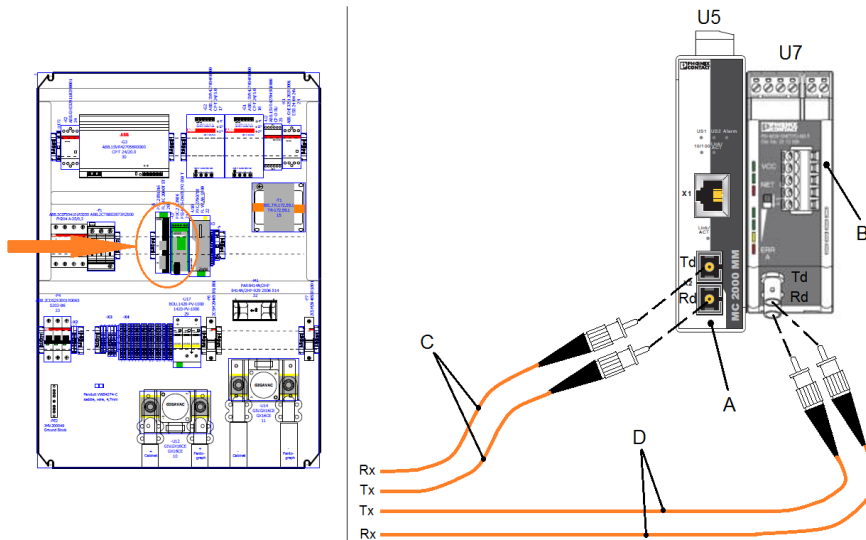
1. Loosen and remove the cable gland's (#11) nut for the communication cable.
2. Remove the rubber seal inside the cable gland (#11).



3. Slide the cable gland's nut (A) over the metal finish tulle (C) of the communication glass fiber cable.
4. Slide the cable gland's rubber seal (B) over the metal finish tulle (C) of the communication glass fiber cable.


CAUTION	
	<p>To prevent damage to the glass fiber communication cable, always slide the cable gland's rubber seal over the metal finish tulle before insert the glass fiber communication cable into the cable gland.</p>

5. Insert the communication cable into the cable gland (#11) and tighten the cable gland's nut to secure the cable.




6. Route the communication fiber cables to module U5 (A) and U7 (B).
7. Remove the protection covers from the optical connectors.
8. Connect the two Ethernet fiber cables (C) onto module (A):
 - Rx with Td U5;
 - Tx with Rd U5.
9. Connect the two CAN bus fiber cables (D) onto module (B):
 - Rx with Td U7;
 - Tx with Rd U7.

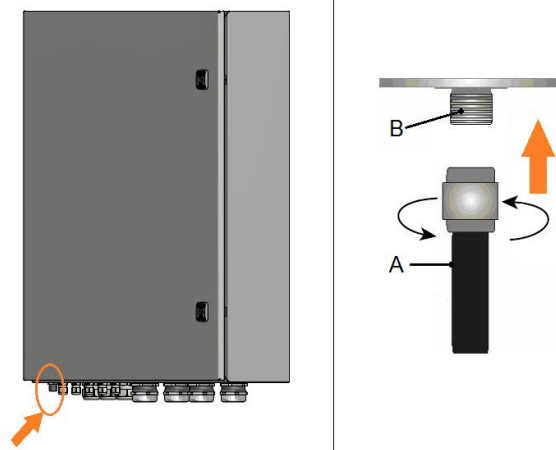
NOTICE

	<p>Four fiber cables are not connected. Those fiber cables are meant for spare.</p>
---	---

10. Bind the cables together and secure the loops loosely with a piece of tak-ty or ty-rap.


	<p>CAUTION</p>
	<p>Make the loop bend radius of the fiber cables not smaller than 64 mm, otherwise the core of the fiber cable may break.</p>

5.16.6. Connect the WiFi cable



1. Route the WiFi cable (A) from terminal X8 on the PantoDown Junction Box to the WiFi connector (B).
2. Insert the WiFi type N-plug into the WiFi connector (B).
3. Hand tighten the WiFi plug.

5.16.7. Connect the RFID cables

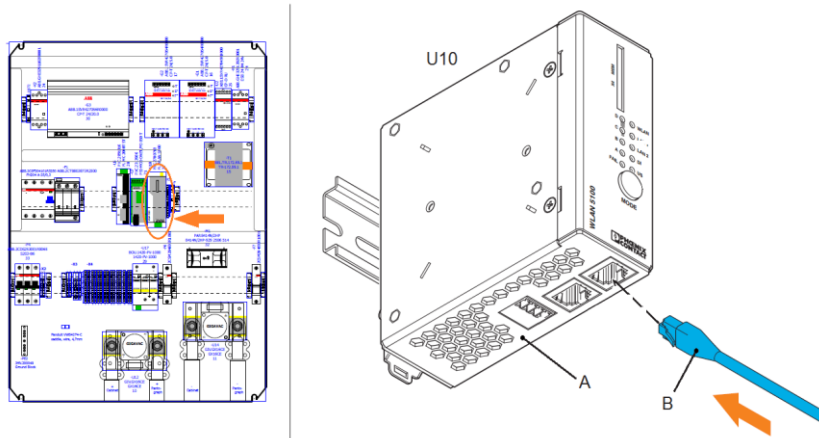
	<p>NOTICE</p>
	<p>This section is not required if the RFID module is not present.</p>

Preconditions:

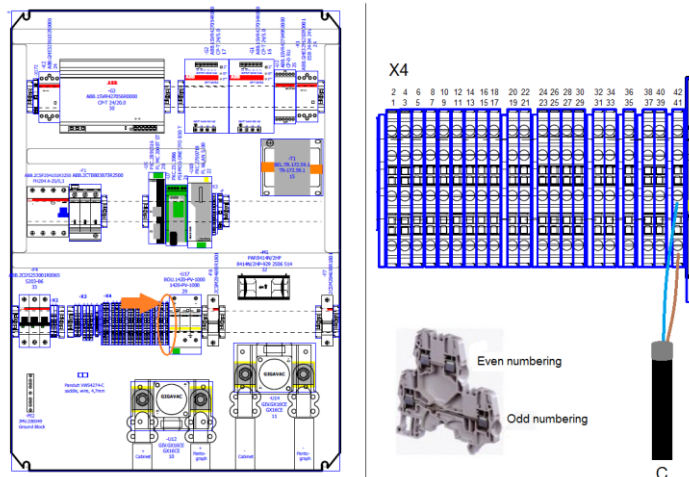
- Parts: 0.25 x 6 ferrule (2x), heat-shrink 2:1 Ø 12.7 mm.
- Tools: wire cutter, wire stripper, crimp pliers, screwdriver.

1. Loosen and remove the cable gland's (#5 and #10) nuts for the RFID Ethernet and the RFID Power cables respectively.

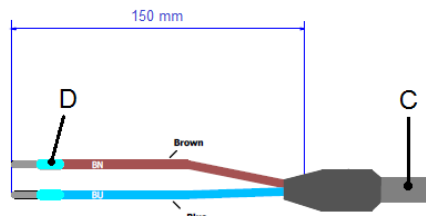
- Slide the cable gland's nuts over the RFID Ethernet and RFID Power cable.



- Route the RFID Ethernet cable through gland #5 to module U10 (A).
- Insert the RJ45 connector (B) of the Ethernet cable into the Ethernet port X2 of module U10 (A)
- Tighten the nut of the gland to secure the RFID Ethernet cable.



- Route the RFID Power cable (C) through gland #10 to connector block X4, with sufficient cable length (do not make the cable routing too tight, or too loose).
- Tighten the nut of the gland to secure the RFID Power cable.



- Strip 150 mm insulation from the cable (C).
- Place a 40 mm long heat-shrink at the end of the cable (C).
- Strip 11 mm of the insulation from the ends of **only the Brown and Blue wire!**
- Crimp the ferrules (D) onto the end of the Brown and Blue wire.

12. Cut the other wires, **except the Brown and Blue wire**, at the end of the striped insulation of the cable and shrink the heat-shrink (see picture above).
13. Loosen the connector screws.
14. Insert the wires into the correct connectors, see table below:

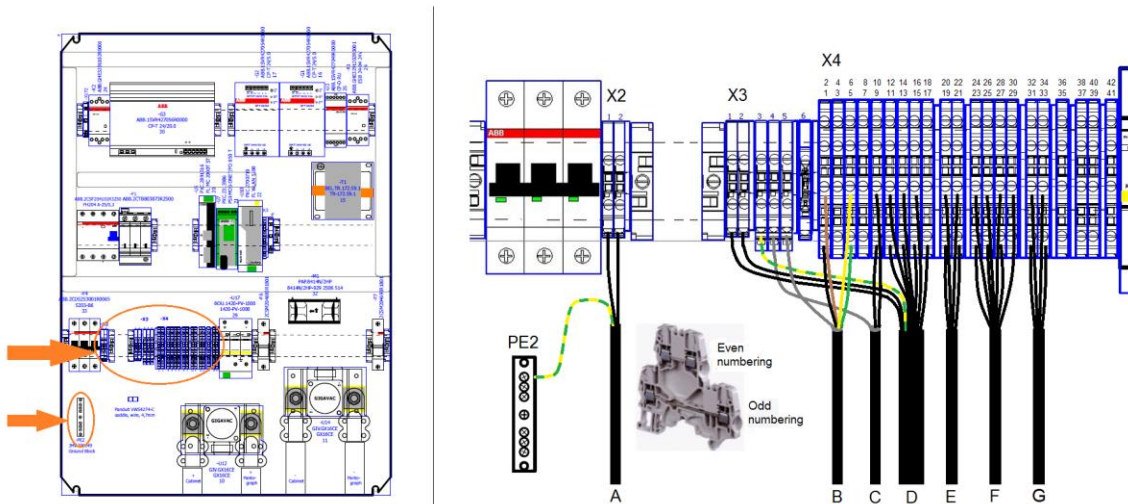
Functional description	Connector	Wire color
24 V RFID	X4-41	Brown
GND RFID	X4-42	Blue

15. Tighten the connector screw with a tightening torque of 1.3 N·m.

5.16.8. Connect the other cables to the ACS Control Module

Preconditions:

- Parts: 0.5 x 8 ferrule (8x), 1.5 x 8 ferrule (6x), 2.5 x 8 ferrule (11x).
- Tools: wire cutter, wire stripper, crimp pliers, screwdriver.



Overview of the terminal block

- | | |
|--------------------|---------------------|
| A ACS heater cable | D ACS Control cable |
| B Interlock cable | E EMO cable |
| C ACS CP/PE cable | F Beacon cable |

1. Loosen and remove the cable gland's nuts (see for overview *Gland layout of the ACS Control Module* in Page 105) for the cables.
2. Slide the cable gland's nut over the cables.
3. Route the cables through the right glands to the connector blocks (X2, X3 and X4), with sufficient cable length (do not make the cable routing too tight, or too loose).
4. Tighten the nuts of the glands to secure the cables.
5. Strip the insulation from the cables.
6. Cut the wires of the cables to the correct lengths to reach the connectors
7. Strip 11 mm of the insulation from the ends of the wires.
8. Crimp a ferrule onto the end of the wire.
9. Loosen the connector screws.
10. Insert the PE wire from the Pantograph heater cable into the one of the free connectors of GND-rail (PE2).
11. Tighten the connector screw of GND-rail (PE2).
12. Insert the other wires into the correct connectors, see table below:

X2	ACS heater cable
----	------------------

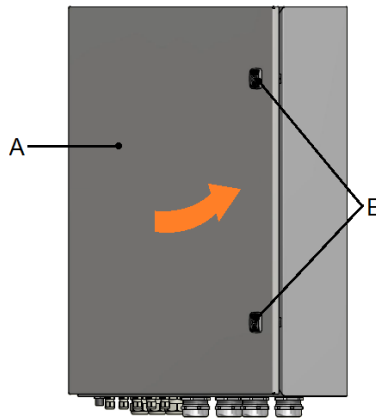
1		Wire 1	ACS L Heater
2		Wire 2	ACS N Heater
PE2		GND (green/yellow)	GND
X3	X4	Interlock cable	
4		Shield	GND
	1	White	Ext Interlock In
	2	Brown	Ext Interlock Out
	5	Green	DC Guard A
	6	Yellow	DC Guard GND
X3	X4	ACS CP/PE cable	
4		Shield	GND
	9	Wire 1	CP
	10	Wire 2	PE
X3	X4	ACS Control cable	
1		Wire 1	ACS +24V
2		Wire 2	ACS -24V
3		GND (green/yellow)	GND
	11	Wire 3	ACS Extend/Retract Out
	13	Wire 4	ACS Supply/Retract Out
	14	Wire 5	ACS Retracted In
	16	Wire 6	ACS GND_B
	17	Wire 7	ACS Extended In
X4		EMO cable	
19		Wire 1	EMO S1
20		Wire 2	EMO S1
21		Wire 3	EMO S2
22		Wire 4	EMO S2
X4		Beacon/Sensor cable	
23		Wire 1	AUX1_Out
24		Wire 2	AUX2_Out
25		Wire 3	AUX3_Out
27		Wire 4	+24V

13. Tighten the connector screws with a tightening torque of 1.3 N·m.

5.17. Close the door of the ACS Control Module

Preconditions:


- Key



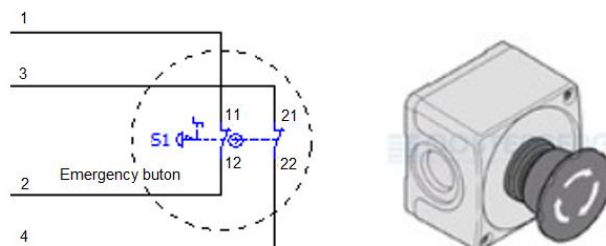
1. Close the door (A).
2. Close the locks (B).

5.18. Mounting the emergency unit

The emergency unit (EMO) must be placed on an easily accessible position for the operator.

NOTICE	
	<p>The emergency button EMO does not disconnect the whole system from the mains voltage! This emergency button disconnect only the DC voltage lines, the control of the charger are still operational.</p>

1. Mount the emergency unit with M4 bolts, washers and nuts on a wall or construction (location depended).
2. Route the EMO cable to the emergency unit.



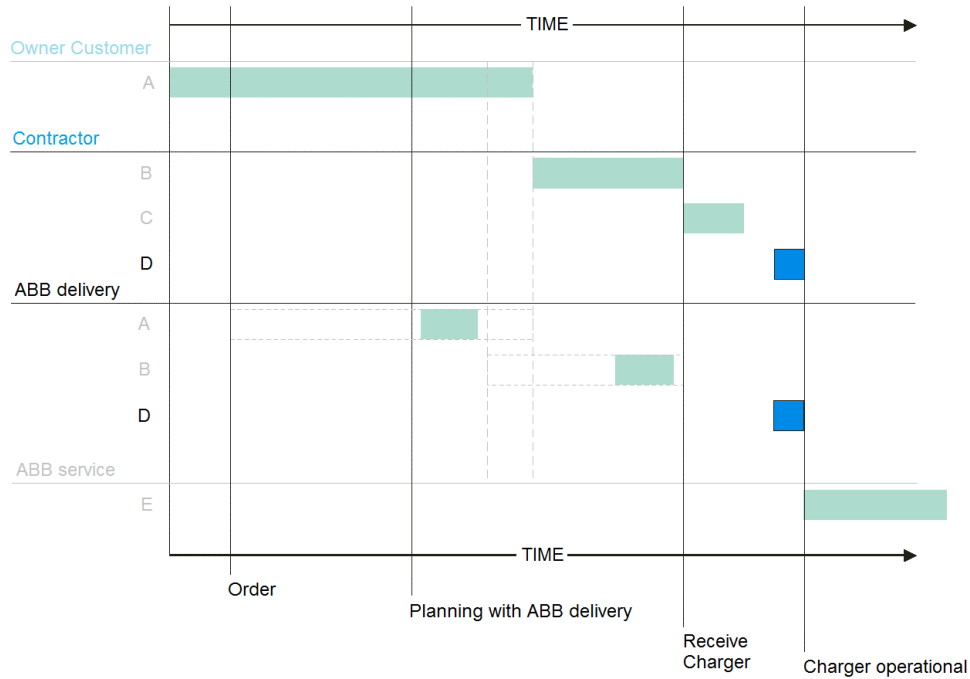
3. Connect the EMO cable to the switch, see picture above for the connection diagram.

6. Commissioning

6.1. Commissioning preparation

Commissioning is the last phase necessary to get the HVC-PD Depot E-Bus Charger into operation.

The planning steps for the commissioning phase are shown in the figure below.




D Commissioning

The commissioning of the HVC-PD Depot E-Bus Charger need to be performed by a service engineer from the ABB Delivery department and/or a certified local ABB service engineer. Both will need the support from the local contractor.

Before the service engineer can start, the following conditions must be met:

- All installation work is done.
- Grid power is available.
- A local technician is present for assistance and to switch the power on.
- An electric or hybrid bus available to perform the functional tests.

CAUTION	
	<p>Warranty</p> <p>It is not permitted to move the whole or parts of the HVC-PD Depot E-Bus Charger after the commissioning. If the whole or parts of the HVC-PD Depot E-Bus Charger is moved without contacting the ABB Service department, the warranty will be considered void.</p>

6.2. Customer Acceptance Form (CAF)

After the commissioning is completed, the owner / site operator will sign the Customer Acceptance Form (CAF). In certain circumstances ABB will be represented by a project engineer.

The CAF contains information about:

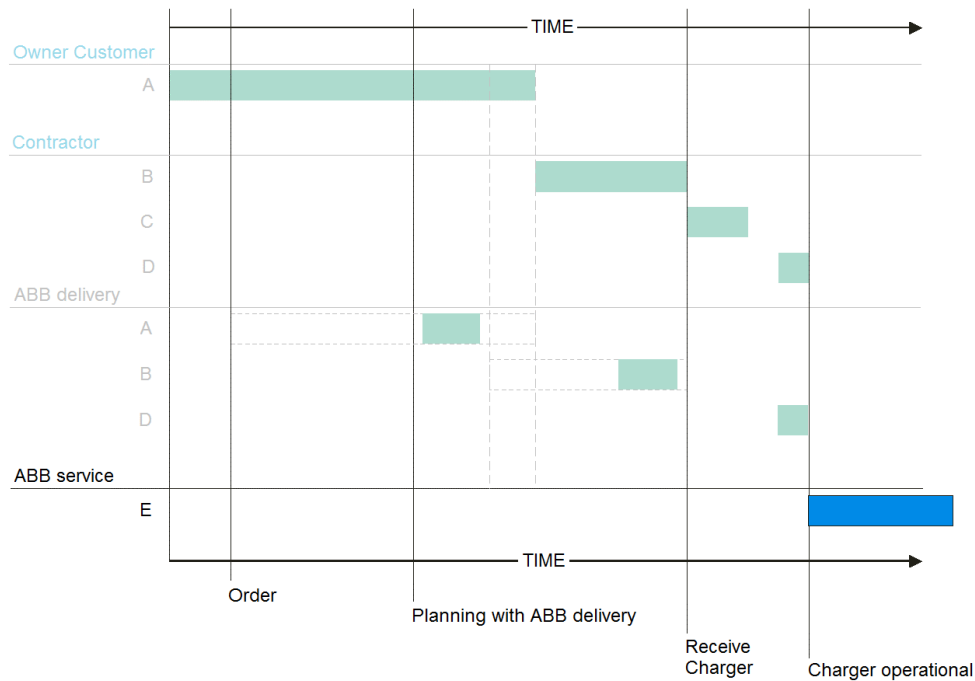
- the project (number, location, charger type),
- a checklist about the delivery,
- the commissioning SAT checklist,
- list of remaining items.

After the CAF has been signed, the customer support will be handled by the ABB Service department.

If there are any remaining items, they can be noted on the CAF document, together with the agreed solution and the expected date of completion.


7. Service and Maintenance

7.1. About Service and Maintenance



E Service and Maintenance



Maintenance is done according to the maintenance schedule. This is outside of the scope of this document.

	DANGER
	<p>Any service and maintenance work on pantograph and or charger system has to be only executed on powered-off device. Make sure that the main switch of the power supply group for the product is set to the OFF position. Do a voltage check to make sure that the electrical power is disconnected from the system. Secure against resetting.</p>

7.2. Cleaning of the cabinet

The Power Cabinet and ABB Pole is powder coated. This coating must be kept in good condition. Clean the Power Cabinet and ABB Pole three times a year in the following way:

- Remove rough dirt by spraying with low-pressure tap water.
- Apply a neutral or weak alkaline cleaning solution and let it soak.
- Remove dirt by hand with a non-woven nylon hand pad.
- Rinse thoroughly with tap water.
- Optionally, apply wax on the front for extra protection and gloss.
- Do a check on the coating for damage.

	NOTICE
	<p>When the HVC-PD Depot E-Bus Charger is exposed to rain, it is sufficient to clean it twice a year.</p>
	CAUTION
	<p>Do not apply high-pressure water jets. Water may leak into the Power Cabinet. If a high-pressure water jet has been used, make sure that the inside of the Power Cabinet is dry.</p> <ul style="list-style-type: none"> - Only use cleaning agents with a pH value between 6 and 8. - Do not use cleaning agents with abrasive components. - Do not use abrasive tools.

8. Technical Specification

8.1. Electrical specification complete 150 kW system

Input	
Supply voltage	3-phase, 400 V AC: PE, L1, L2, L3
Input voltage range	400 V AC \pm 10%
Input frequency range	50 Hz \pm 4%
Maximum power dissipation	174 kVA
Power factor (cos φ)	\geq 0.95
Standby power consumption	60 W for 1x HVC cabinet 30 W for the ACM
Efficiency	94% and 96% in power spectrum between 20% and 100% of full power
Maximum input current	265 A AC
Nominal input current	238 A AC
Earth Leakage Current Protection	AC 300 mA (RCD integrated in HVC150(S)) AC 30 mA (RCD integrated in ACS Control Module)
Short Circuit Capacity	25 kA
AC power connection	240 mm ² (max)
DC output	
Maximum output power	150 kW
Output voltage range	150 – 850 V DC
Maximum output current	250 A DC

8.2. Electrical specification complete 300 kW system

Input	
Supply voltage	3-phase, 400 V AC: PE, L1, L2, L3
Input voltage range	400 V AC \pm 10%
Input frequency range	50 Hz \pm 4%
Maximum power dissipation	348 kVA
Power factor (cos φ)	\geq 0.95
Standby power consumption	120 W for 2x HVC cabinets 30 W for the ACM
Efficiency	94% and 96% in power spectrum between 20% and 100% of full power
Maximum input current	530 A AC
Nominal input current	476 A AC
Earth Leakage Current Protection	AC 300 mA (RCD integrated in HVC150(S)) AC 30 mA (RCD integrated in ACS Control Module)
Short Circuit Capacity	25 kA
AC power connection	240 mm ² (max) (in both HVC 150 and 150S)
DC output	
Maximum output power	300 kW
Output voltage range	150 – 850 V DC
Maximum output current	500 A DC

8.3. Electrical specification complete 450 kW system

Input	
Supply voltage	3-phase, 400 V AC: PE, L1, L2, L3
Input voltage range	400 V AC \pm 10%
Input frequency range	50 Hz \pm 4%
Maximum power dissipation	520 kVA
Power factor (cos φ)	\geq 0.95
Standby power consumption	180 W for 3x HVC cabinets 30 W for the ACM
Efficiency	94% and 96% in power spectrum between 20% and 100% of full power
Nominal input current	713 A AC
Maximum nominal input current	792 A AC
Earth Leakage Current Protection	AC 300 mA (RCD integrated in HVC150(S)) AC 30 mA (RCD integrated in ACS Control Module)
Short Circuit Capacity	25 kA
AC power connection	240 mm ² (max) (in both HVC 150 and 150S)
DC output	
Maximum output power	450 kW
Output voltage range	150 – 850 V DC
Maximum output current	600 A DC

8.4. Mechanical data

Mechanical specification Power Cabinet

Dimensions (H x W x D)	2092 x 1170 x 770 mm (including swivel eye bolts)
Weight	1340 kg
Volume	1.87 m ³
Dimensions including packaging (H x W x D)	2250 x 1200 x 800 mm
Weight including packing	1400 kg
Weight concrete foundation	1300 kg
Mechanical impact protection	IK10
Housing	Stainless steel 430

Mechanical specification ACS Control Module/Junction Box

Dimensions ACM (H x W x D)	841.5 x 610.6 x 220.0 mm
Dimension Junction Box (H x W x D)	280.0 x 606.0 x 124.0 mm
Weight ACM	49.0 kg
Weight Junction Box	10.5 kg
Volume ACM	0.10 m ³
Volume Junction Box	0.102 m ³
Dimensions including packaging (H x W x D)	400.0 x 1010.0 x 750.0 mm
Weight including packing	66.5 kg
Mechanical impact protection	IK10
Housing	Painted steel

Mechanical specification Pantograph

Dimensions footprint (W x D)	2011 x 899 mm
Height	474 mm (in standby mode)
Weight	180 kg \pm 5 kg
Static contact force	30 N – 200 N
Load force spindle drive	4500 N (dynamic), 18000 N (static)
Frame	Steel
Collector head guidance	Aluminum-allow / stainless steel
Collector head	Steel / copper

8.5. Environment

Environment specification Power Cabinet


Ingression protection	IP54
Temperature range – Operation	-35 °C to +45 °C
Temperature range – Storage	-10 °C to +70 °C
Humidity	5 % to 95 %, RH – non-condensing
Airflow	1450 m ³ /h
Pressure drop	300 pA
Altitude	2000 m (max.)
Storage conditions	Indoors, dry

Environment specification ACS Control Module/Junction Box

Ingression protection	IP65
Temperature range – Operation	-35 °C to +60 °C
Temperature range – Storage	-10 °C to +75 °C
Humidity	5 % to 95 %, RH – non-condensing
Altitude	2000 m (max.)
Storage conditions	Indoors, dry

Environment specification Pantograph

Ingression protection	IP65
Temperature range – Operation	-40 °C to +45 °C
Temperature range – Storage	-10 °C to +70 °C
Storage conditions	Indoors, dry

	CAUTION
	<p>Warranty Warranty will be considered void when the HVC-PD E-Bus Charger is damaged while badly stored at the customer's location.</p>

8.6. Certifications

Certifications for complete system

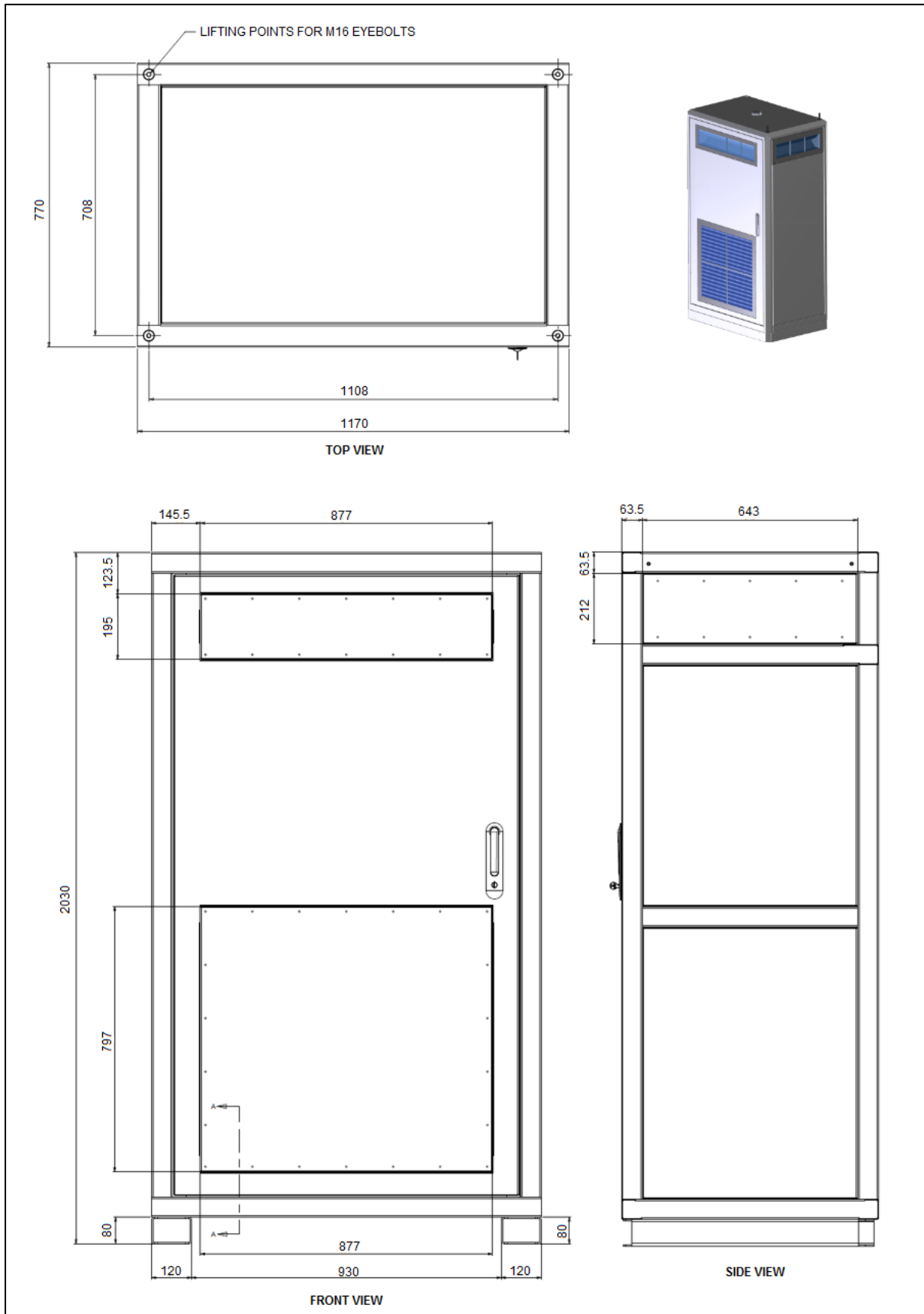
CE	Certificate number pole: 2388-CPR-0044
	Declaration of Conformity HVC150: 20160609
Class of protection	1 with PE connection

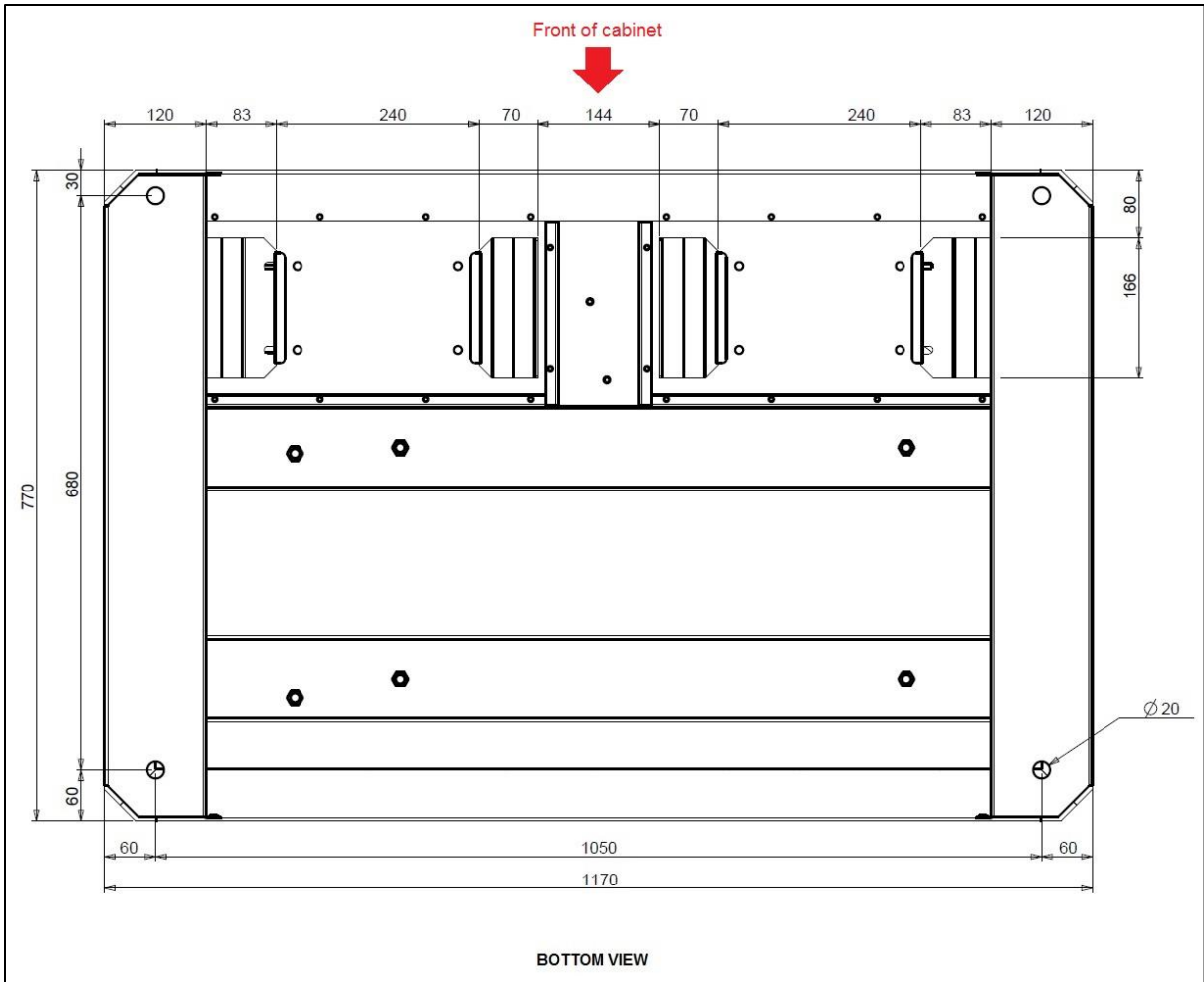


9. Appendix

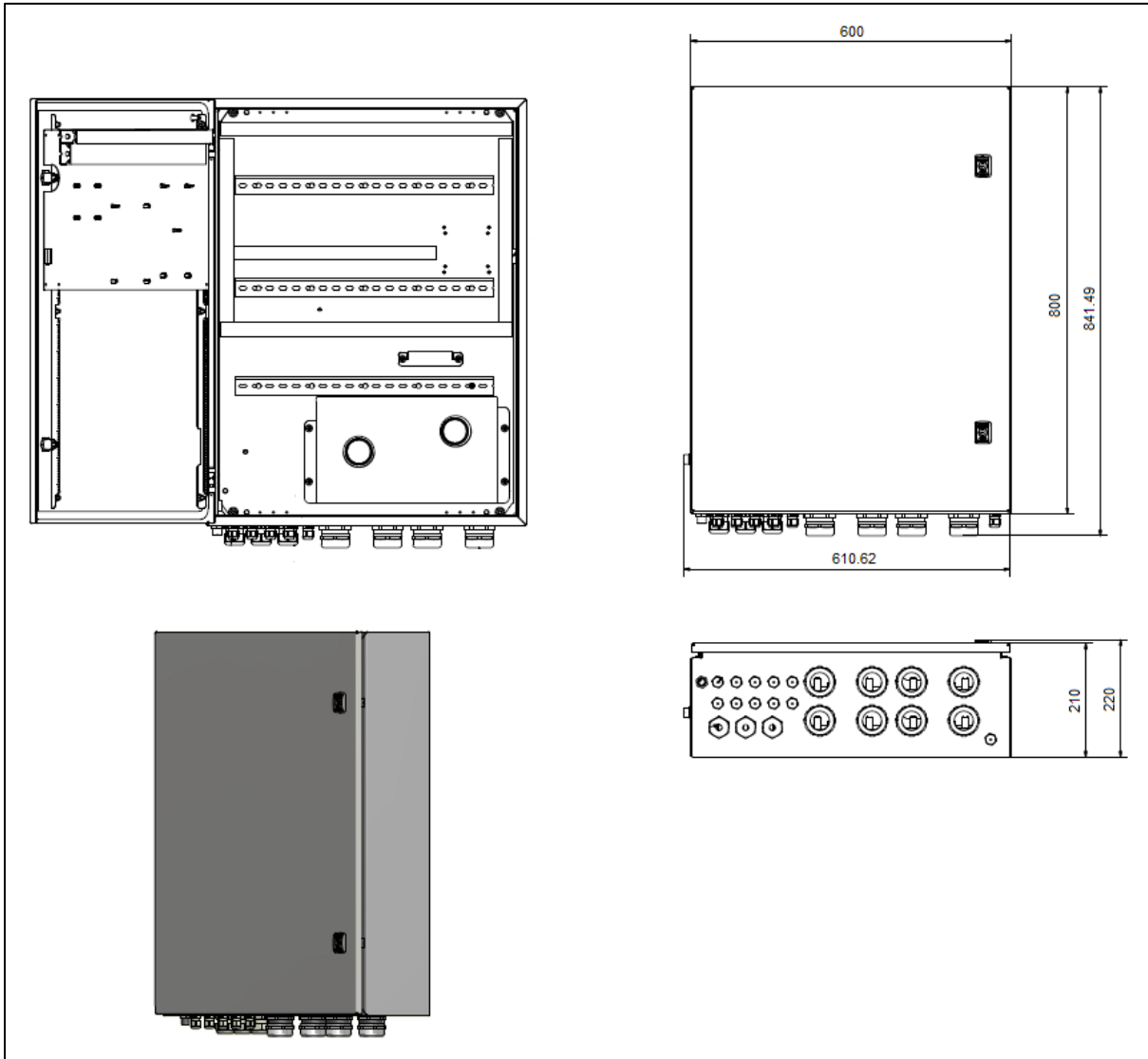
A	Dimensions Power Cabinet	127
B	Dimensions ACS Control Module	129
C	Dimensions Junction Box	130
D	Dimensions Pantograph	131
E	Dimensions Pantograph mounting brackets	132
F	Dimensions Concrete Foundation Power Cabinet	134
G	Dimensions Metal Foundation Power Cabinet	136
H	Power Cabinet – Outline with Foundation	137
I	Connection diagram	138
J	Ground overview of the system	141
K	WEEE disposal – 2012-19/EU	142

A. Dimensions Power Cabinet

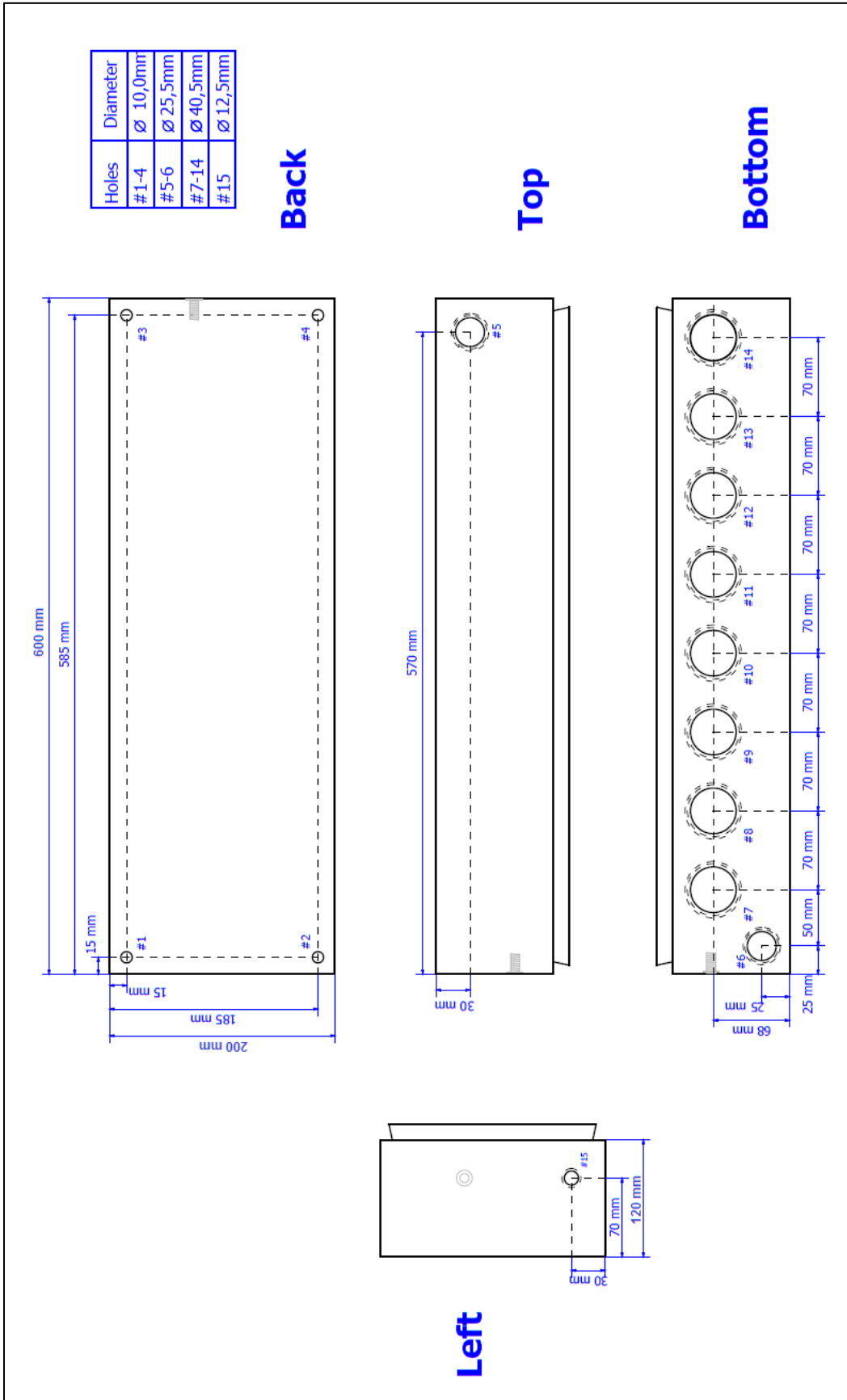




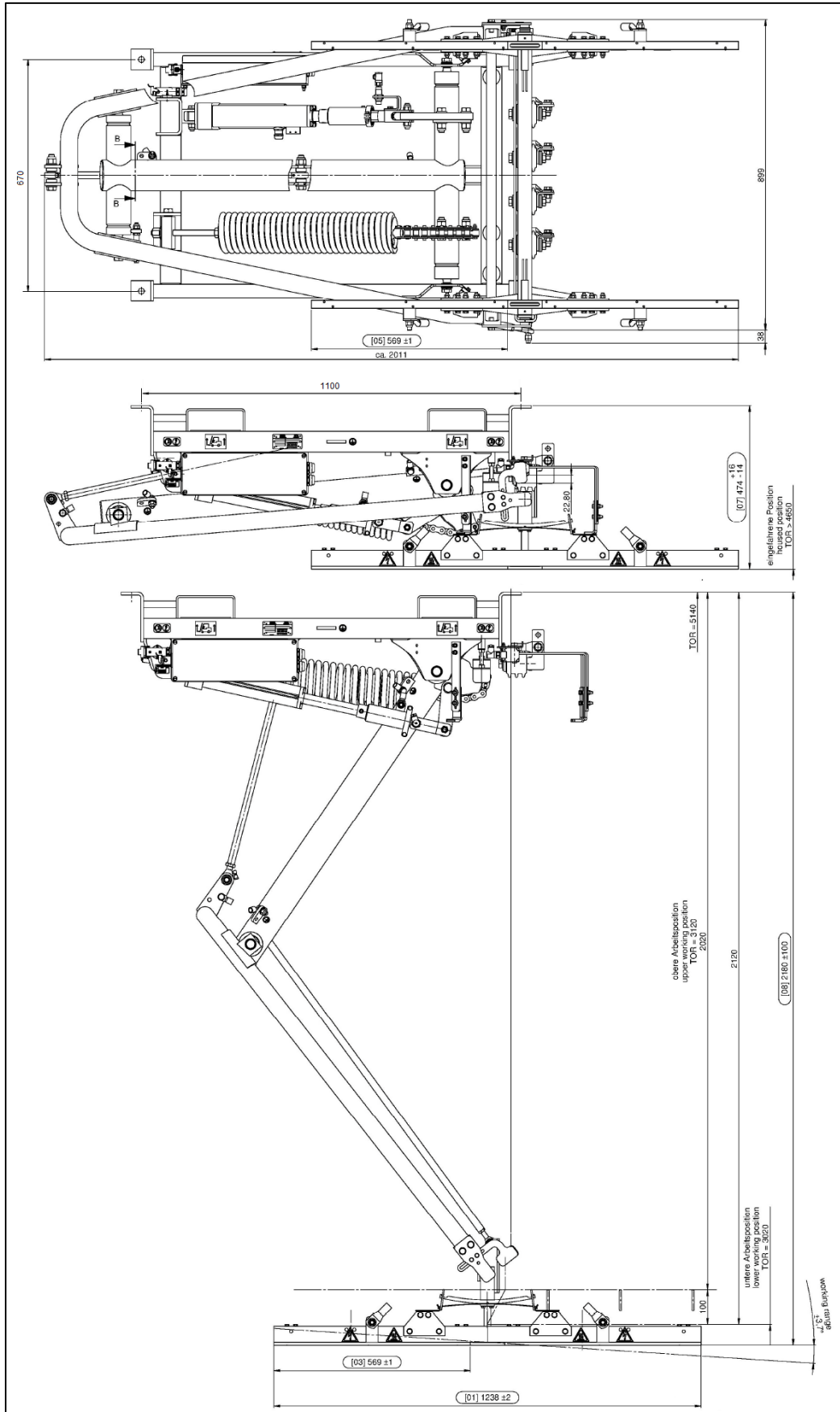
B. Dimensions ACS Control Module



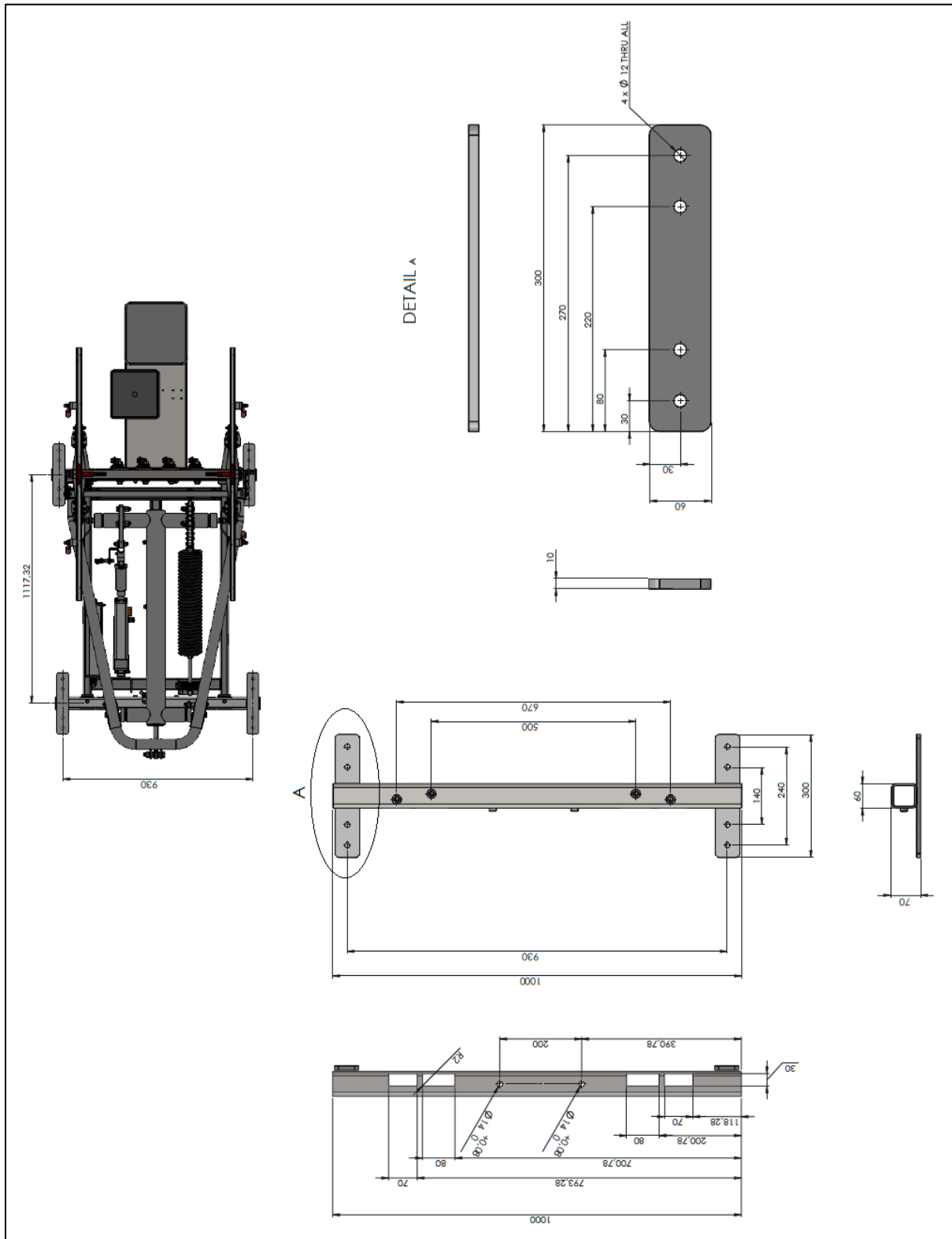
C. Dimensions Junction Box

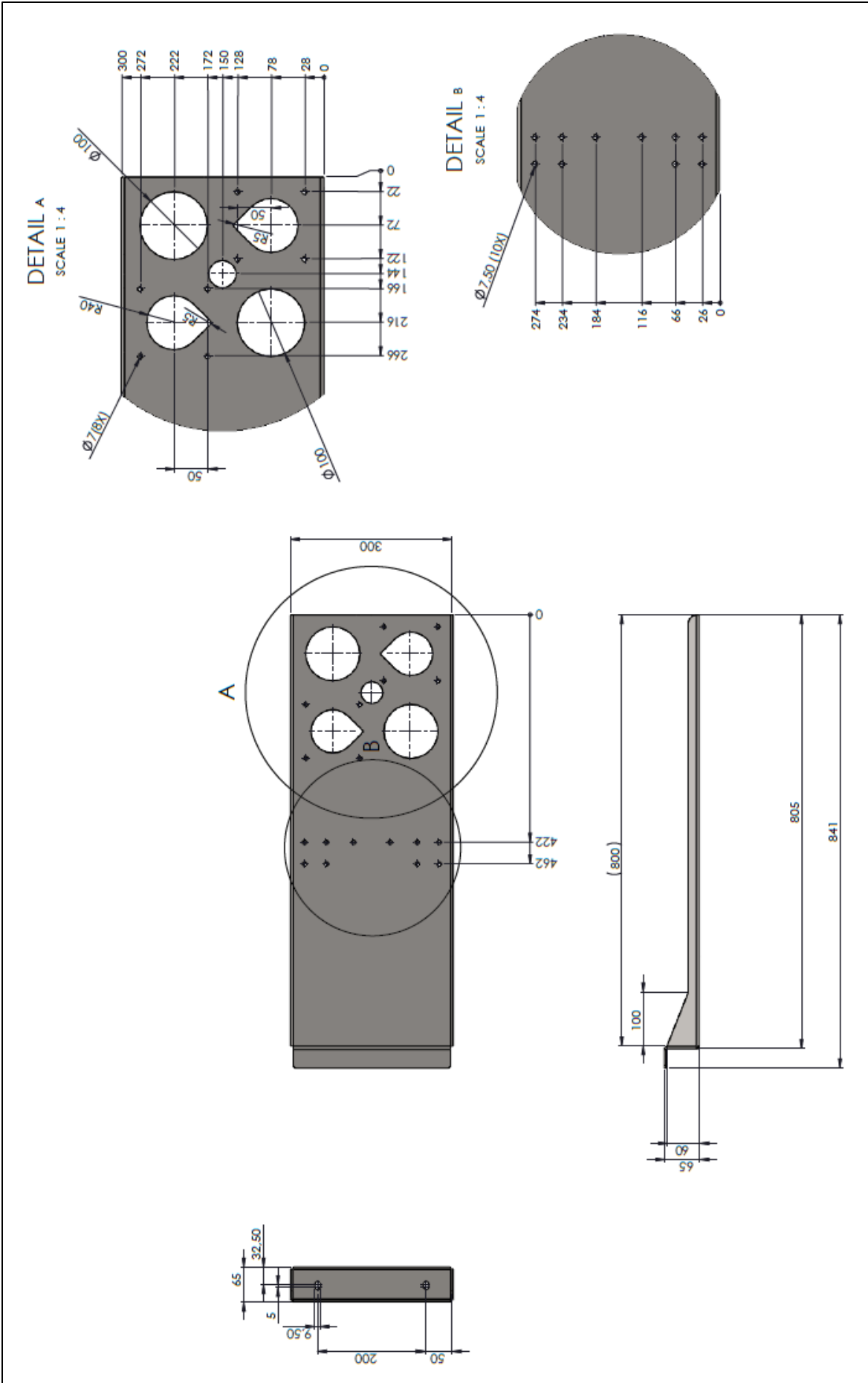


D. Dimensions Pantograph

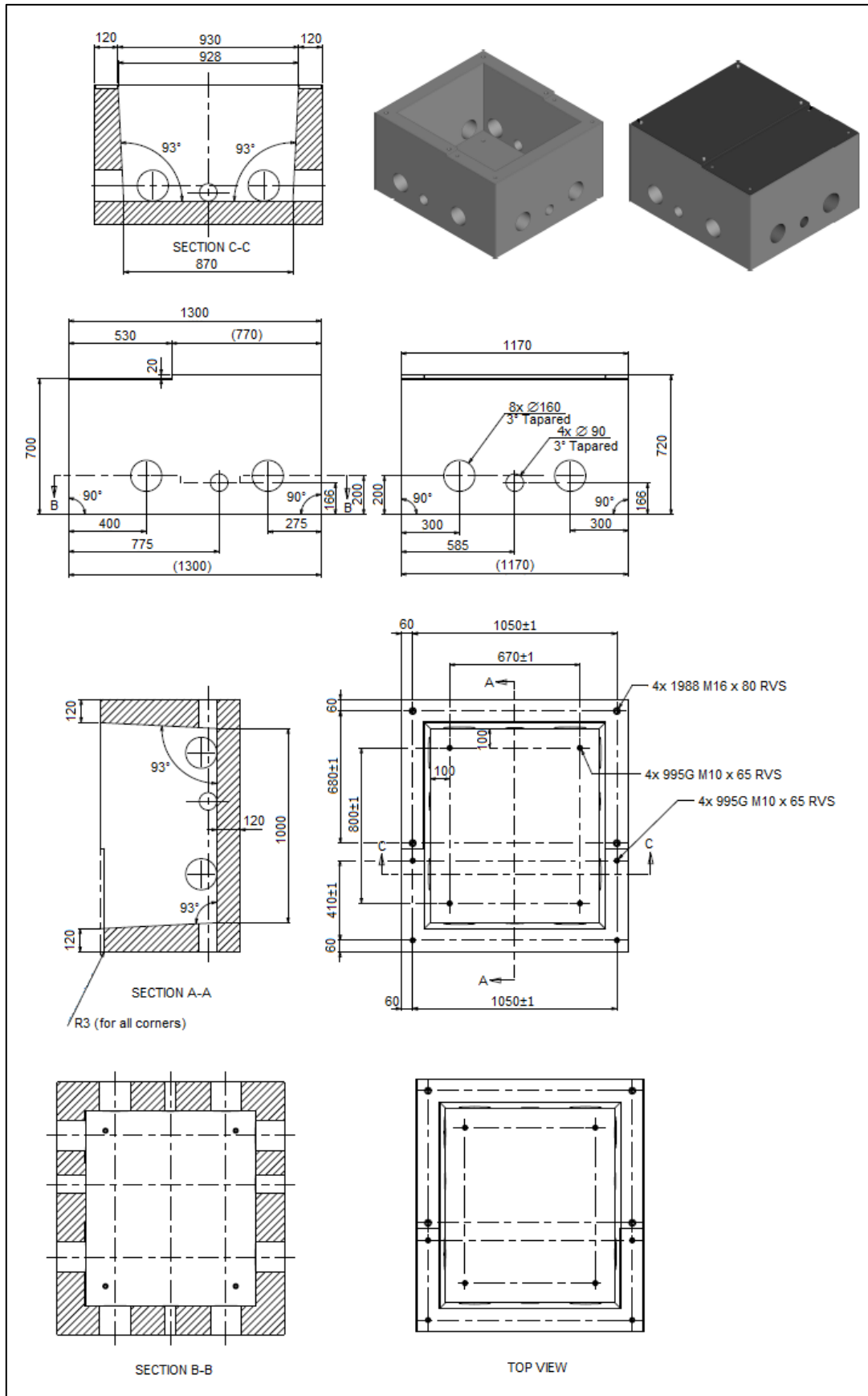


E. Dimensions Pantograph mounting brackets

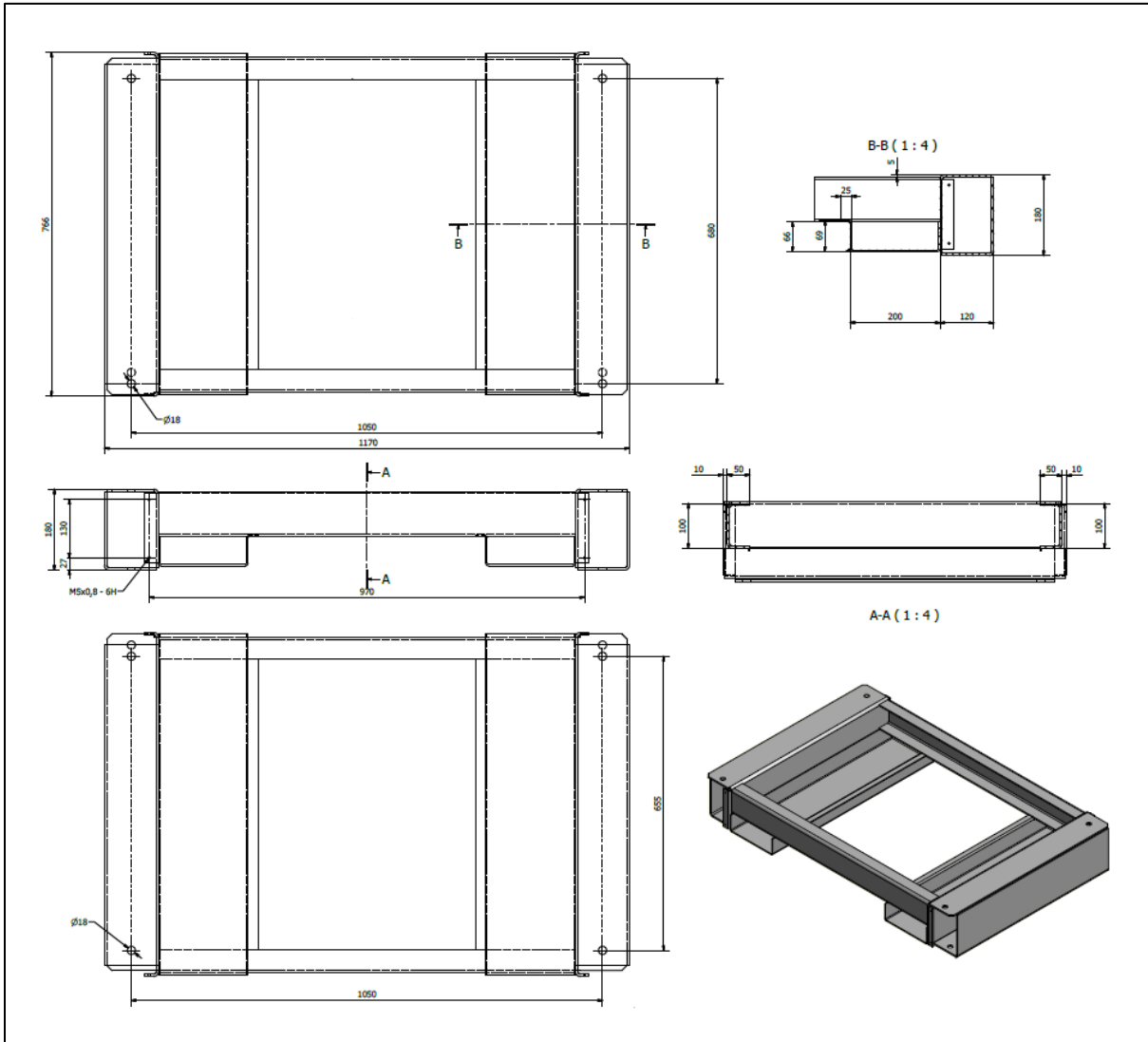




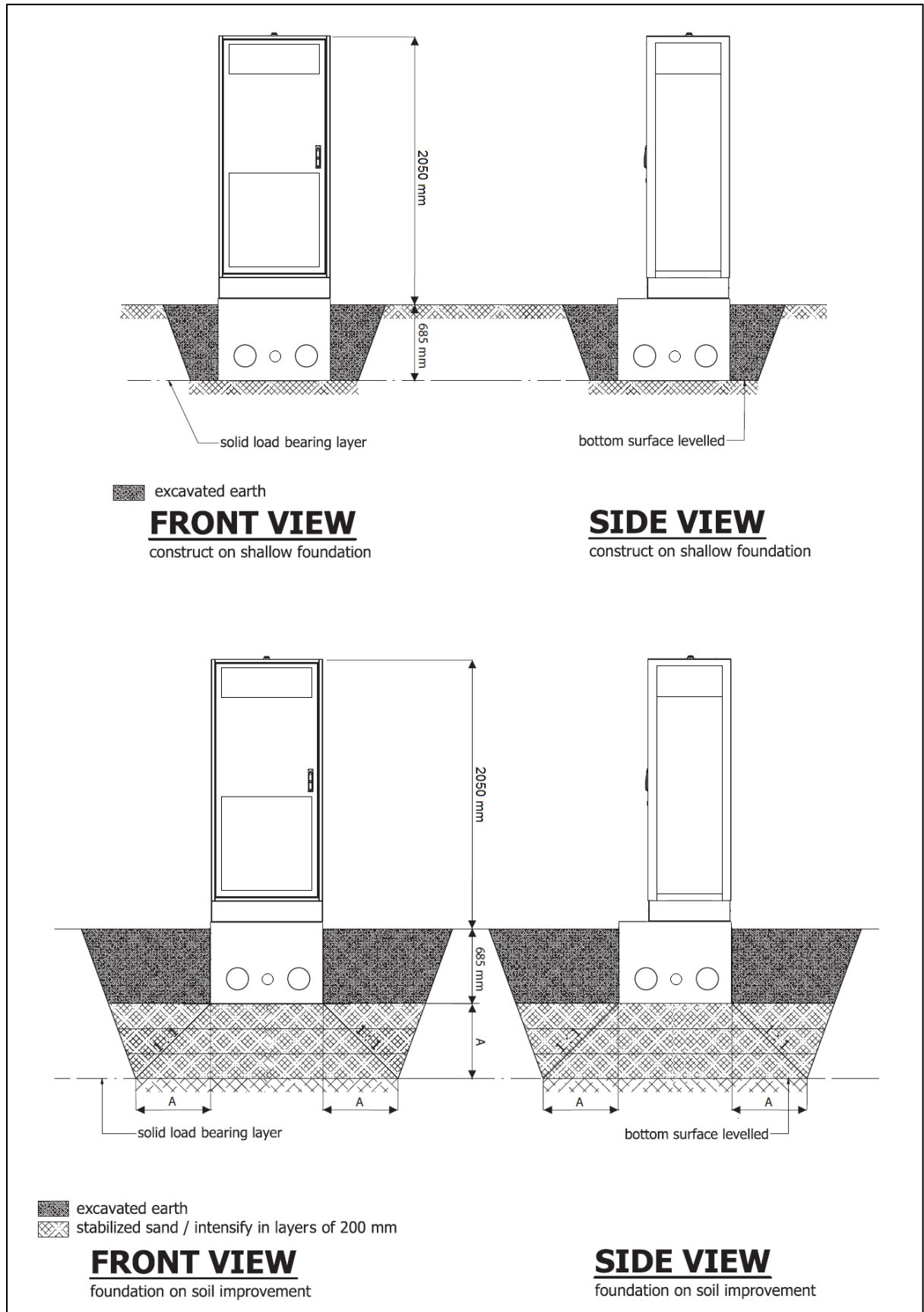
F. Dimensions Concrete Foundation Power Cabinet



G. Dimensions Metal Foundation Power Cabinet

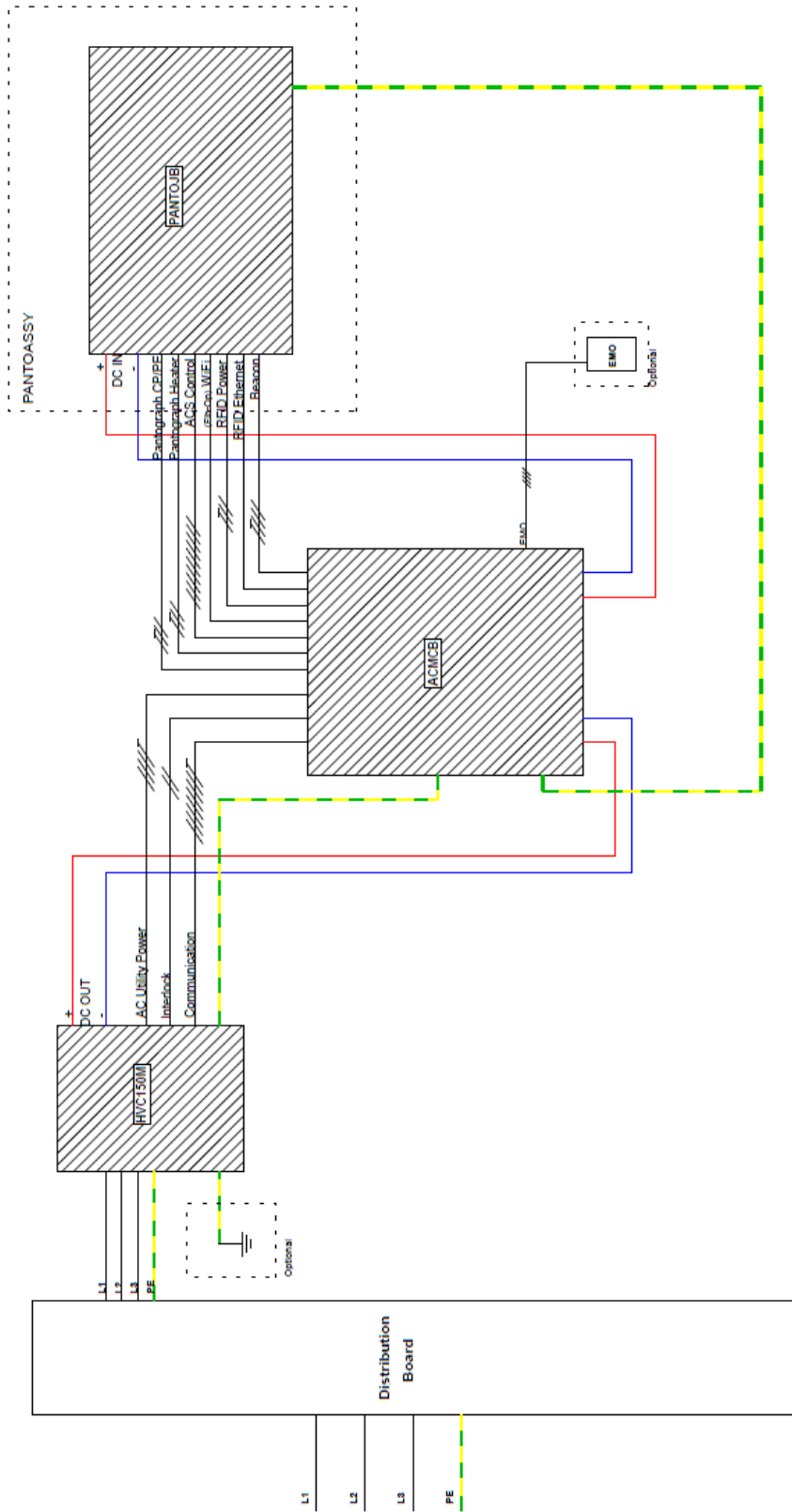


H. Power Cabinet – Outline with Foundation

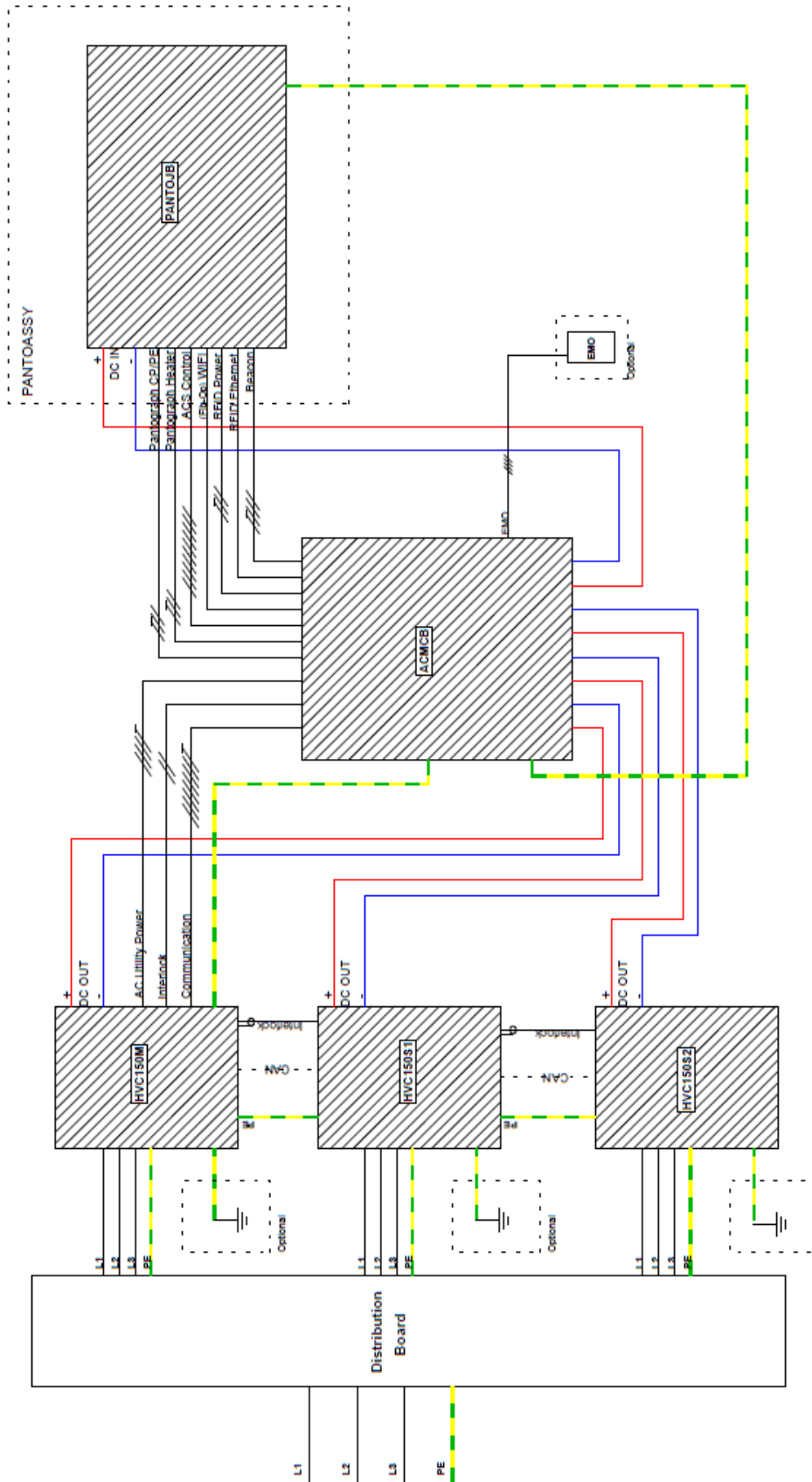


I. Connection diagram

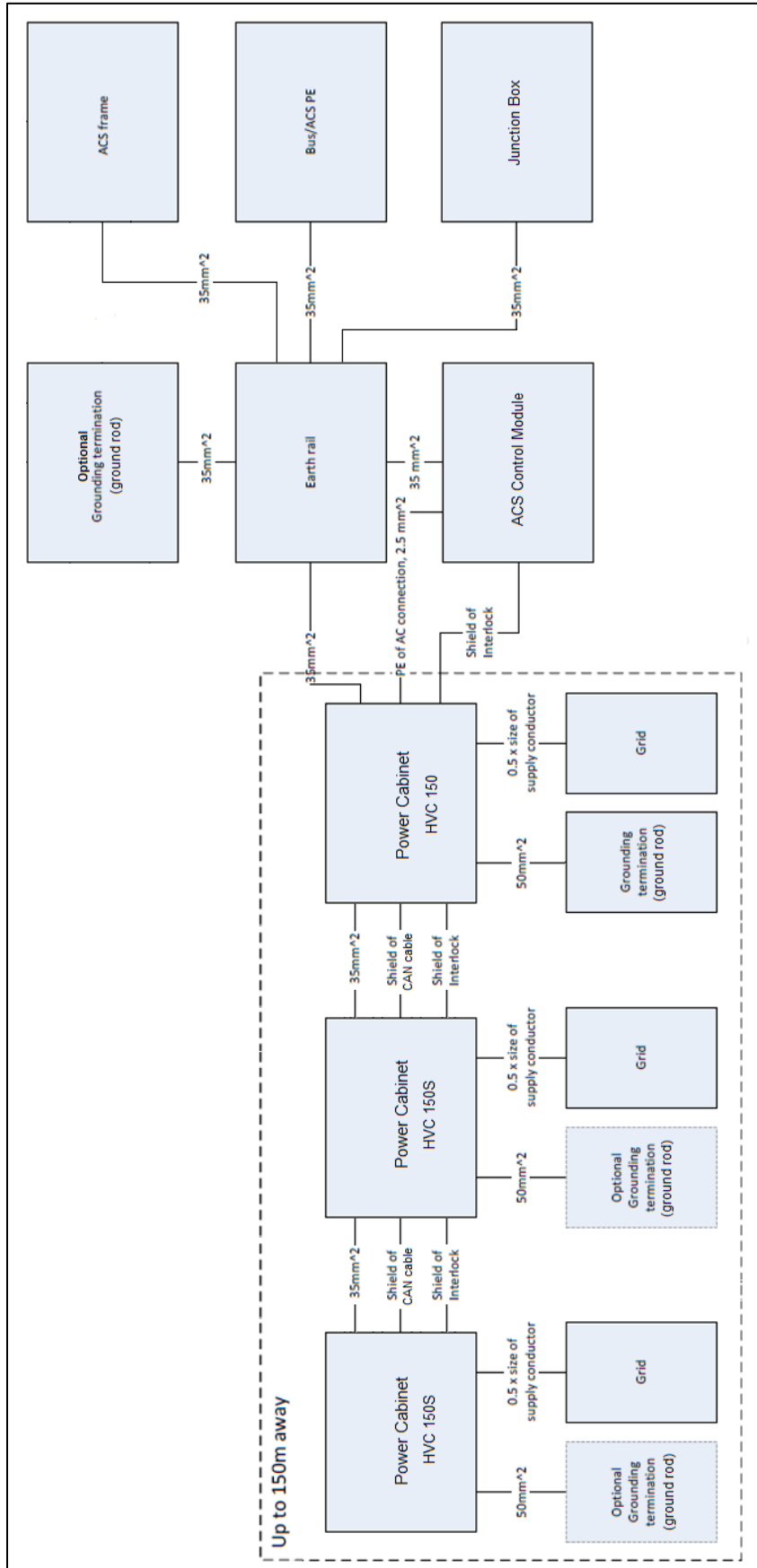
For HVC 150 kW system



For HVC 450 kW system



J. Ground overview of the system



K. WEEE disposal – 2012-19/EU



ENGLISH
 Electrical and electronic equipment to be separately collected in compliance with the Directive on waste electrical and electronic equipment (WEEE - 2012/19/EU)

The symbol (crossed out wheeled bin) on your product indicates that the product shall not be mixed or disposed with your household waste, at their end of use. This product shall be handed over to your local community waste collection point for the recycling of the product.

For more information, please contact your Government Waste-Disposal department in your country. Inappropriate waste handling could possibly have a negative effect on the environment and human health due to potential hazardous substances. With your cooperation in the correct disposal of this product, you contribute to reuse, recycle and recover the product and our environment will be protected.

FRANÇAIS
 Équipements électriques et électroniques collectés séparément conformément à la Directive relative aux déchets d'équipements électriques et électroniques (WEEE - 2012/19/EU)

Ce symbole (poubelle interdite) apposé sur le produit indique qu'en fin de vie ce produit ne doit pas être traité avec les déchets ménagers. Il doit être remis à un point de collecte approprié pour le recyclage des appareils électriques et électroniques. Pour de plus amples informations, veuillez contacter le service de collecte des déchets ménagers local.

Ce produit contient des substances potentiellement dangereuses qui peuvent avoir des effets néfastes sur l'environnement et la santé humaine. En veillant à la mise au rebut correcte de ce produit, vous contribuerez à assurer le traitement, la récupération et le recyclage de ce produit et à protéger l'environnement.

DANSK
 Elektrisk og elektronisk udstyr indsamles særskilt i overensstemmelse med direktiv om affald af elektrisk og elektronisk udstyr (WEEE - 2012/19/EU)

Het symbool (doorgekruiste afvalbak op wielen) op het product geeft aan dat het product aan het einde van haar levensduur niet samen met of in de vorm van huishoudafval mag worden weggegooid. Het product moet naar een verzamelplaats (milieudepot) worden gebracht waar dergelijke producten worden gerecycled.

Neem voor meer informatie contact op met de relevante overheidsafdeling voor afvalvuilnis die in uw land bestaat. Het kan nadelige gevolgen hebben op voor mens en milieu als afval op een verkeerde manier wordt behandeld waardoor potentieel schadelijke stoffen vrij komen. Door uw medewerking te verlenen en dit product op de juiste wijze wegwerpt, kunt u een bijdrage leveren aan het herstellen, hergebruiken en recycelen van dit product om zo ons milieu te beschermen.

ESPAÑOL
 Aparatos eléctricos y electrónicos recopilados de modo separado en conformidad con la Directiva sobre residuos de aparatos eléctricos y electrónicos (WEEE - 2012/19/EU)

Los productos identificados con este símbolo (poubella tachada) no deben eliminarse como residuos domésticos una vez finalizada su vida útil. Este producto debe entregarse a un punto de recogida de la comunidad local para su recuperación y reciclado. Para mayor información, sírvase ponerse en contacto con el Departamento de Disposición de Resechos de su Ayuntamiento. El manejo inadecuado de los residuos supone riesgos para la salud humana o el medio ambiente. Con la reutilización, el reciclado de los materiales u otras formas de valorización de tales productos used contribuye de manera importante a la protección de nuestro medio ambiente.

O símbolo (caixole de lixo de rodas com uma linha cruzada) em seu produto indica que o produto, no fim da sua vida útil, não deve ser misturado ou eliminado com o lixo doméstico comum. Este produto deverá ser entregue a uma estação de recolha de lixo da comunidade local para a reciclagem do produto. Para mais informações, entre em contacto com o Departamento de Tratamento de Lixo do Governo do seu país. O tratamento de lixo incorrecto poderia provocar um efeito negativo no meio ambiente e saúde humana devido a substâncias potencialmente perigosas. Com a cooperação para a eliminação correcta deste produto, contribuirá para a reutilização, reciclagem e recuperação do produto, e nosso meio ambiente será protegido.

SVENSKA
 Elektriska och elektroniska produkter ska samlas in separat i enlighet med direktivet om avfall som utgörs av eller innehåller elektriskt eller elektroniskt utrustning (WEEE - 2012/19/EU)

Den symbol (en överkorsad soptunna) på produkten innebär att produkten ej ska blandas eller slängas med ditt hushållsavfall när den är förbrukat. Produkten ska lämnas till en lokal insamlingsplats för denna slags produkter för återvinning. Kontakta kommunkontoret för närmare detaljer om var du finner sådana insamlingsplatser. Ömlämplig avfallshandling kan få negativa effekter på miljön och på människors hälsa då en produkt kan innehålla farliga ämnen. Vi ber om ditt samarbete i bortskaffningen av denna produkt för att bidra till återvinning, återanvändning och en hälsosammare miljö.

Tuoteeseen merkitty symboli (yfyse rullattu jätessäiliö) osoittaa, että tuotetta ei saa sekoittaa eikä hävittää talousjätteen kanssa. Tuote on luovutettava sopivaan tällaisten laitteiden kierrätyksessä huolehtivaan keräyspisteeseen. Pyydä lisätietoja jätessäiliöistä vastaavilta paikallisilta viranomaisilta. Tämän tuotteen asianmukaisen hävittämisen varmistamiseksi otetaan esimain sen mahdolliset ympäristö- ja terveyteen kohdistuvat haittavaikutukset, joita voi aiheutua muussa tapauksessa tämän tuotteen epäasianmukaisesta käsittelystä. Hävittämällä tuotteen asianmukaisesti autat valmistamaan, että tuote uudelleenkäytetään, kierrätetään ja kerätään ja ympäristöä suojellaan.

ITALIANO
 Apparecchiatura Elettrica ed Elettronica oggetto di raccolta differenziata in conformità alla Direttiva sui Rifiuti di apparecchiature Elettriche ed Elettroniche (WEEE - 2012/19/EU)

Il simbolo (un bidone sbarrato da una croce) indica che il prodotto non deve essere smaltito con i rifiuti domestici, alla fine della sua vita. Questo prodotto deve essere consegnato al punto di raccolta rifiuti della propria comunità locale per il suo riciclaggio. Per ulteriori informazioni, rivolgersi all'organo statale preposto allo smaltimento dei rifiuti nel proprio paese. Uno smaltimento dei rifiuti inappropriato può avere effetti negativi sull'ambiente e sulla salute umana a causa di sostanze potenzialmente pericolose. Collaborando allo smaltimento corretto di questo prodotto, si contribuisce al riutilizzo, al riciclaggio e al recupero del prodotto, e alla protezione del nostro ambiente.

Dieses Symbol (ausgekennzeichnetes Mülltonne) auf dem Produkt bezeichnet, dass Abgeräte usw. nicht wie normaler Haushaltsabfall in den Müll gegeben werden dürfen, sondern zum Recycling an einer hierfür vorgesehenen Annahmestelle abzugeben ist. Für nähere Informationen wenden Sie sich bitte an die für Müllentsorgung zuständigen örtlichen Behörden. Bei unsachgemäßer Entsorgung besteht das Risiko nachteiliger Auswirkungen auf Umwelt und Gesundheit durch potentiell gefährliche Substanzen. Durch Ihre Kooperation zur ordnungsgemäßen Entsorgung fördern Sie die Wiederverwendung, das Recycling und die Rückgewinnung von Stoffen und tragen zum Umweltschutz bei.

SUOMI
 Sähkö- ja elektroniikkalaitteet on kierrätettävä erikseen sähkö- ja elektroniikkalaiteromusta annetun direktiivin (WEEE - 2012/19/EU) mukaisesti

Tuotteeseen merkitty symboli (yfyse rullattu jätessäiliö) osoittaa, että tuotetta ei saa sekoittaa eikä hävittää talousjätteen kanssa. Tuote on luovutettava sopivaan tällaisten laitteiden kierrätyksessä huolehtivaan keräyspisteeseen. Pyydä lisätietoja jätessäiliöistä vastaavilta paikallisilta viranomaisilta. Tämän tuotteen asianmukaisen hävittämisen varmistamiseksi otetaan esimain sen mahdolliset ympäristö- ja terveyteen kohdistuvat haittavaikutukset, joita voi aiheutua muussa tapauksessa tämän tuotteen epäasianmukaisesta käsittelystä. Hävittämällä tuotteen asianmukaisesti autat valmistamaan, että tuote uudelleenkäytetään, kierrätetään ja kerätään ja ympäristöä suojellaan.

PORTUGUÊS
 Equipamentos Eléctricos e Electrónicos recolhidos selectivamente de acordo com a Directiva relativa aos resíduos de equipamentos eléctricos e electrónicos (WEEE - 2012/19/EU)

O símbolo (caixole de lixo de rodas com uma linha cruzada) em seu produto indica que o produto, no fim da sua vida útil, não deve ser misturado ou eliminado com o lixo doméstico comum. Este produto deverá ser entregue a uma estação de recolha de lixo da comunidade local para a reciclagem do produto. Para mais informações, entre em contacto com o Departamento de Tratamento de Lixo do Governo do seu país. O tratamento de lixo incorrecto poderia provocar um efeito negativo no meio ambiente e saúde humana devido a substâncias potencialmente perigosas. Com a cooperação para a eliminação correcta deste produto, contribuirá para a reutilização, reciclagem e recuperação do produto, e nosso meio ambiente será protegido.

DEUTSCH
 Elektro- und Elektronikgeräte sind getrennt zu sammeln in Einklang mit der Richtlinie über Elektro- und Elektronik-Altgeräte (WEEE - 2012/19/EU)

Das Symbol (ausgekennzeichnete Mülltonne) auf dem Produkt bezeichnet, dass Abgeräte usw. nicht wie normaler Haushaltsabfall in den Müll gegeben werden dürfen, sondern zum Recycling an einer hierfür vorgesehenen Annahmestelle abzugeben ist. Für nähere Informationen wenden Sie sich bitte an die für Müllentsorgung zuständigen örtlichen Behörden. Bei unsachgemäßer Entsorgung besteht das Risiko nachteiliger Auswirkungen auf Umwelt und Gesundheit durch potentiell gefährliche Substanzen. Durch Ihre Kooperation zur ordnungsgemäßen Entsorgung fördern Sie die Wiederverwendung, das Recycling und die Rückgewinnung von Stoffen und tragen zum Umweltschutz bei.



BCA.00165.0

