MAINTENANCE GUIDE

HVC Overhead E-Bus Charger

Maintenance Guide for NAM products

Version 0.1

Revision: 0.1
Date released: 2019-08-19

Notice

This document contains information about one or more ABB products and may include a description of or a reference to one or more standards that may be generally relevant to the ABB products. The presence of any such description of a standard or reference to a standard is not a representation that all the ABB products referenced in this document support all the features of the described or referenced standard. In order to determine the specific features supported by an ABB product, the reader should consult the product specifications for the ABB product.

ABB may have one or more patents or pending patent applications protecting the intellectual property in the ABB products described in this document.

The information in this document is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this document.
In no event shall ABB be liable for direct, indirect, special, incidental or consequential damages of any nature or kind arising from the use of this document, nor shall ABB be liable for incidental or consequential damages arising from the use of any software or hardware described in this document.
This document is originally written in English. Other language versions are a translation of the original document and ABB cannot be held liable for errors in the translation.

Copyrights

Version control

Documents data	
Title	HVC Overhead E-Bus Charger Maintenance Guide for NAM products
Author	EVCI Service team - ABB Canada, Montreal Campus
Version	0.1
Version Date	2019-08-19
Status	revision

Version	Date	Remarks
V0.1	2019-08-19	Initial release NAM version

Table of Contents

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.

Charge control set
Set of sub-system of the charger systems which includes the ACS, the control module for the ACS, the communication unit and a status indicator of the charge process.

DC
Direct Current.

GFCI
Ground Fault Circuit Interrupter.

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 electrical vehicle.

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.

PE
Protective Earth.

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

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 provides maintenance and preventive maintenance procedures for the HVC Overhead E-Bus Charger for the North American (NAM) region.

The HVC Overhead E-Bus Charger is a DC fast charger system for hybrid or electrical buses that are compatible with the OPP Charging standard[1]. It is not permitted to use the HVC Overhead E-Bus Charger to charge any other equipment, or to use the HVC Overhead E-Bus Charger for any other purposes.

Before performing maintenance procedures on the HVC Overhead E-Bus Charger, read this Maintenance Guide carefully and attentively. Follow the instructions in this Maintenance Guide. ABB is not responsible for any damage that has been caused by not or incorrectly following and executing the instructions described in this manual. If the instructions listed in this guide are not followed the warranty will be voided

1.2. Intended document users

This document is intended to be used by:

- Certified customers who purchased an HVC 150/300/450 kW E-Bus Charger or are in the process of ordering and want to know in more detail how the maintenance is performed.
- Certified contractors who are responsible for the maintenance of the HVC 150/300/450 kW E-Bus Charger. Any person who will carry out maintenance activities on the Charger must be certified by ABB. You can ask your local ABB service center to get a certification.

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.

[1] More information on OPP Charge via www.oppcharge.org.

	**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.
	**WARNING** **Pinch Hazard** Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed.
	**WARNING** **Fall Hazard** Identifies a hazard that could result in injury due to unsafe work at height.
	**CAUTION** **Various** Identifies a hazard that could result in damage to the machine, other equipment, and/or environmental pollution.
	**CAUTION** **Environmental damage** Identifies special indications as well as biddings and prohibitions to avoid damages in the environment. This sign refers to present national regulation according to the environment.
	**NOTICE** Contains remarks, suggestions or advice.

1.4. Safety regulations

1.4.1. Owner responsibilities

The owner and site operator are required:

- To operate the charge station with the protective devices installed and to make sure all protective devices are correctly installed after carrying out maintenance.
- To write an emergency plan that instructs people what to do in case of an emergency.
- 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 station and for the coordination of all work.
- All works must be carried out from qualified personnel. All qualified personnel have to estimate their transmitted works, identify and avoid. 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 the occurrence of danger (especially remaining risk) possible dangers.
- You are not allowed to modify the charging 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. Electric hazards

	**DANGER**
	Hazardous voltage The HVC Overhead 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.

1.4.3. Maintenance safety

	**WARNING** **Personal safety (PPE)** Always wear a safety helmet, safety gloves, and safety shoes.
	**DANGER** **Hazardous voltage** Instructions: 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. 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. 4. The maintenance personnel must supply their own lighting equipment since the HVC Overhead E-Bus Charger has no lights inside the cabinet. 5. Correctly lock the door after maintenance or service operations.
	**WARNING** 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.
	**WARNING** Make sure that there is a minimum free space of 1000 mm in front of the door of the Depot Charge Box. 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.
	**CAUTION** **Warranty** Maintenance work must be carried out by certified personnel. The warranty will be void if any work carried out by non-certified personnel.

1.5. Environment and disposal of waste

	**CAUTION**
	Always observe the local rules and regulations with respect to processing (non-reusable) parts of the HVC Overhead E-Bus Charger.

1.6. Contact information

ABB EV Infrastructure North America

ABB Montreal Campus

Address 800 Boul. Hymus
Saint-Laurent, QC
Canada
H4S 0B5

E-mail: EVCI-CAService@ca.abb.com
Service Hotline: 1-800-HELP365

ABB USA

E-mail: us.evci.techteam@abb.com
Service Hotline: 1-800-825-2556

2. Preventive maintenance for the charging system

Applying a preventive maintenance plan keeps your operation running efficiently, extends the lifetime of your charging system and decreases your maintenance cost or time consumption that could be spent in performing proactive maintenance actions.

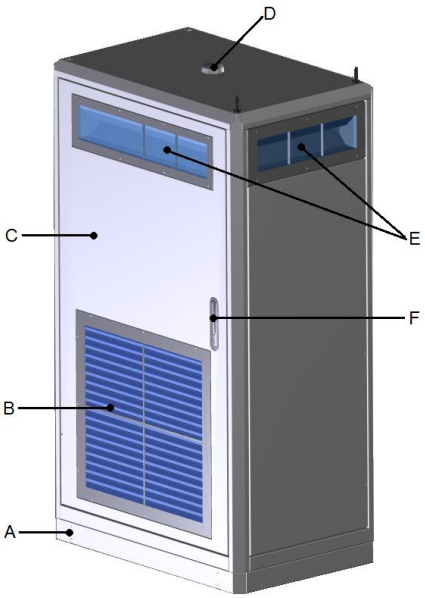
In this section, we will go through the required periodical inspection, replacement, and adjustment actions that are needed to improve the system's operational performance and reduce the unexpected breakdowns.

2.1. Overview of the system

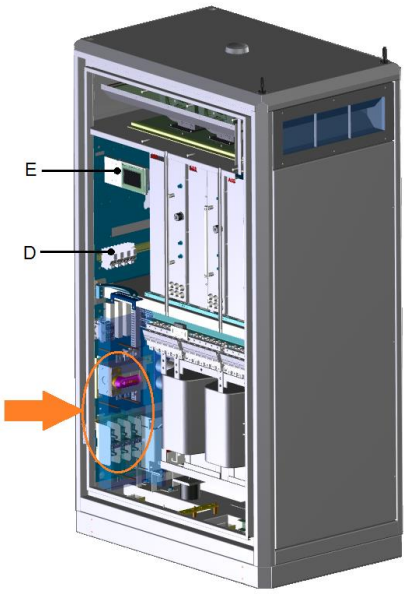
ABB offers three standard system configurations for the HVC Overhead E-Bus Charger:

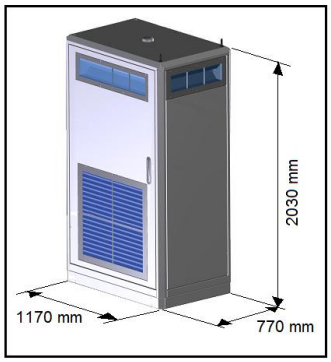
	HVC 150 kW E-Bus Charger with (or without) Pole
	HVC 300 kW E-Bus Charger with (or without) Pole
	HVC 450 kW E-Bus Charger with (or without) Pole

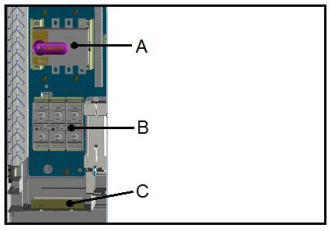
2.1.1. Power Cabinet



A	Base cover
B	Air outlet
C	Door
D	3G Antenna
E	Air inlets
F	Door handle/lock

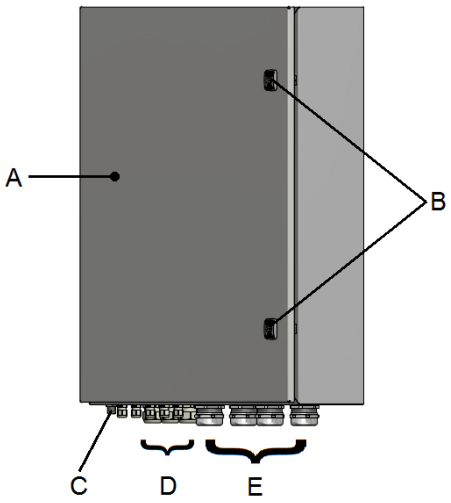
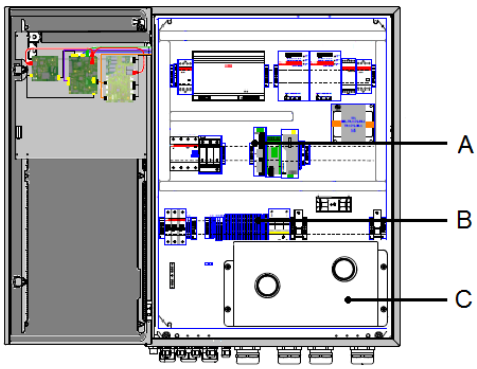




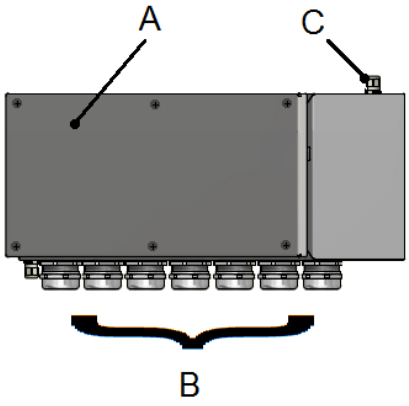


A	Main switch
B	AC Power connection
C	Guidance plate of the cables
D	Data/communication connection
E	Display

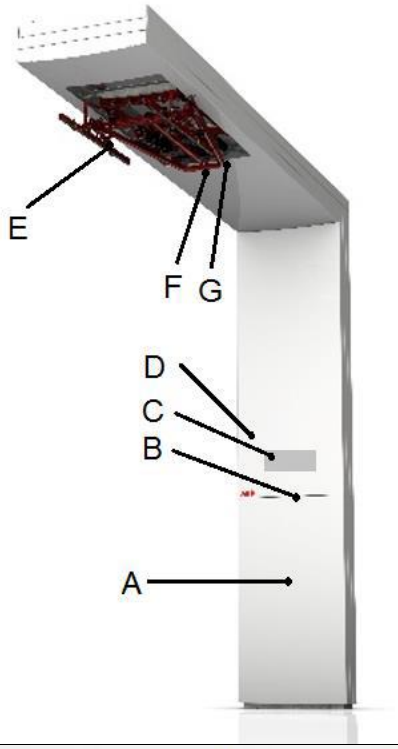
2.1.2. ACS Control Module

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

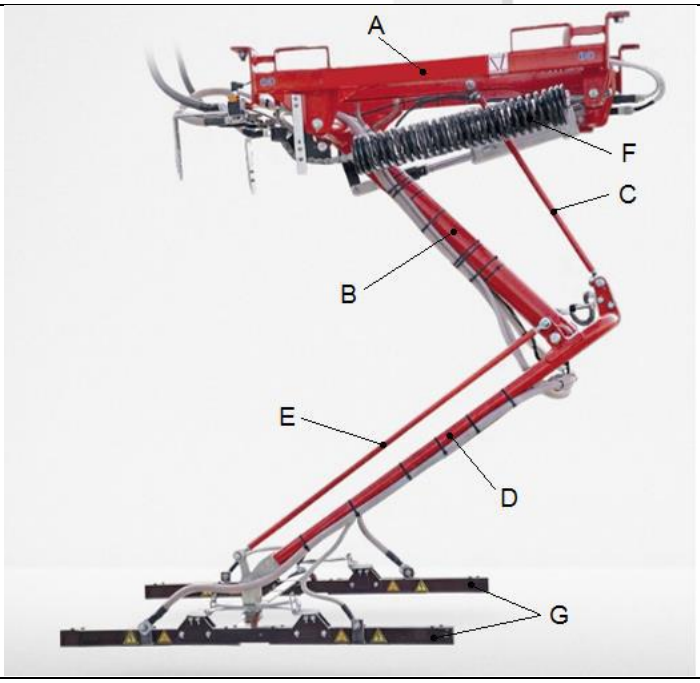
2.1.3. Junction Box (HVC 450 kW E-Bus Charger only)

	A Cover B In and outputs DC power cables C Output DC - OVP sensing cable

2.1.4. ABB Pole and Pantograph



A	Door
B	Emergency button (EMO)
C	Charge state indicator light (beacon)
D	Distance sensor
E	Pantograph (installation specific)
F	WiFi communication unit
G	RFID unit (optional)



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. Maintenance Schedule

SI-HVC-0000	Maintenance Schedule				
		P	C	Pages	4
Subjected chargers	HVC	X	X	Version	1.3
				Date	05-12-2018

Procedure:	
Inspection (visual inspection and required maintenance action if needed)	I
Performance of on-site work (commissioning, tests, measurements or other activities)	P
Replacement of component (see related service instruction)	R

	Years from start up										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Start-up / Commissioning	P										
SERVICE											
RCD tests		P	P	P	P	P	P	P	P	P	P
RMS measurement (Country dependent)		P	P	P	P	P	P	P	P	P	P
Isolation measurements (Country dependent)		P	P	P	P	P	P	P	P	P	P
Grounding system measurement		P	P	P	P	P	P	P	P	P	P
Visual inspection		P	P	P	P	P	P	P	P	P	P
Improvements Based on Service Letters		I	I	I	I	I	I	I	I	I	I
MAIN CABINET											
FILTER INLET KIT		I	R	I	R	I	R	I	R	I	R
FILTER OUTLET KIT		I	I	I	I	R	I	I	I	I	R
FAN POWER MODULE		I	I	I	I	R	I	I	I	I	R
FAN CABINET		I	I	I	I	R	I	I	I	I	R
AC FUSE / BREAKERS		I	I	I	I	R	I	I	I	I	R
CCB		I	I	I	I	I	I	I	I	I	R
POWER SUPPLY;24VDC;240W (2X)		I	I	I	I	R	I	I	I	I	R
POWER MODULE		I	I	I	I	I	I	I	I	I	R
HVC HMI Assy 7"		I	I	I	I	R	I	I	I	I	R

POLE ACM													
	Years from start up												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Fan		I	I	I	I	R	I	I	I	I	R	I	I
CCB		I	I	I	I	I	I	I	I	I	R	I	I
CPI COMBO CCS		I	I	I	I	I	I	I	I	I	R	I	I
IMI COMBO CCS		I	I	I	I	I	I	I	I	I	R	I	I
POWER SUPPLY;24VDC;480W;		I	I	I	I	R	I	I	I	I	R	I	I
POWER SUPPLY;24VDC;120W; (2x) Tri-phase		I	I	I	I	R	I	I	I	I	R	I	I
Pantograph (Stemmann)													
	Years from start up												
Cycles per day up to 70	0	1	2	3	4	5	6	7	8	9	10	11	12
Tooth belt									R				
Plug-in relays, 2 changer									R				
bridging strand		I	I	I	I	I	I	I	R	I	I	I	I
connection cable set		I	I	I	I	I	I	I	R	I	I	I	I
flat spring + plastic plate + Pin		I	I	I	I	I	I	I	R	I	I	I	I
Slide Bearing		I	I	I	I	I	I	I	R	I	I	I	I
Electric motor		I	I	I	I	I	I	I	R	I	I	I	I
Contact rails		R	R	R	R	R	R	R	R	R	R	R	R
	Years from start up												
Cycles per day up to 140	0	1	2	3	4	5	6	7	8	9	10	11	12
Tooth belt					R				R				R
Plug-in relays, 2 changer							R						R
bridging strand		I	I	I	I	I	R	I	I	I	I	I	R
connection cable set		I	I	I	I	I	R	I	I	I	I	I	R
flat spring + plastic plate + Pin		I	I	I	I	I	R	I	I	I	I	I	R
Slide Bearing		I	I	I	I	I	R	I	I	I	I	I	R
Electric motor		I	I	I	I	I	R	I	I	I	I	I	R
Contact rail		R	R	R	R	R	R	R	R	R	R	R	R
Overhaul / Main Inspection*													R

Notes:
*Overhaul / Main Inspection cannot be performed on site and must be carried out in a suitable work shop. We recommend obtaining a spare pantograph for replacement during the maintenance and/or considering redundant charging poles in the project.

Pantograph : Periodic maintenance and cleaning
Every 3 Months - Contact rails:

- Functional testing / Visual inspection of the rail, cleaning, sanding or replacing if needed.
- Recommended interval, this may vary based on usage, weather conditions and bus design.
- Failing to inspect and cleaning the Contact rails may cause additional wearing that requires an early replacement.
- Earlier need to perform this action can be monitored remotely via ABB tools by analyzing the increase in disconnection during charging sessions.
- The wear of the contact rails is expected during the operation and therefore must be monitored by the operator acc. to their operational experience.

The contact rails must be replaced if one of any following condition are present:

- Minimum height of copper of 3mm over the whole length
- Deformation or damages due to arcs

Every 6 Months - Testing and greasing:

- Check of spring force and contact force
- Cycle time and cleaning
- Greasing as per service instruction
- Recommended interval, this may vary based on usage, weather conditions and bus design.

Air Filter:
Environment characteristic and number of charging sessions may require additional replacement of the air filters during the lifetime of the charger.

Power Cabinet:
The Maintenance Schedule was defined based on the following charging cycle options:

- Ambient temperature=25°C and every day 8 consecutive hours charging at full load
- Ambient temperature=25 °C and cycles of 6 minutes charging at full load every 15 minutes for 8 hours a day

Apart from the time-related maintenance, there are several components which wear with use. At this moment, the use on those parts is not counted or calculated:

- CCS Cable with connectors - replace after 10 000 charge sessions.
- Cable holder - yearly inspection, replace after 5 years.
- Contact rails - inspection every 3 months / cleaning / replacing.

	**WARNING**
	Safety First Read and apply Appendix 4.1. SI-HVC-0003 Safety Instruction and Appendix 4.2. SI-HVC-0005 Safety guide servicing the Pantograph before performing any maintenance procedures.

Each test or preventive maintenance of a component of the Power Cabinet, ACS Control Module, Pole or Pantograph is described in the sub sections below. At the end of the manual is a list of instructions on how to perform the maintenance procedure for each component. The Component-Description manual of the Pantograph is also included in the Appendix. It contains security information, as well as preventive maintenance and replacement procedures for the Pantograph. The inspection or the replacement of a component is determined by the maintenance schedule.

2.2.1. Cleaning of the cabinet

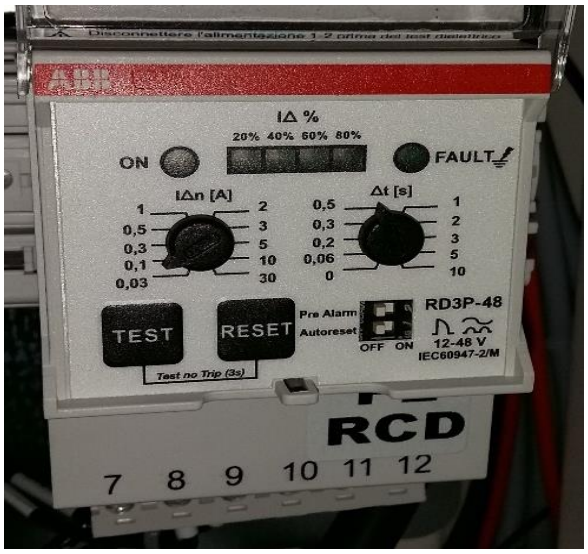
The Power Cabinet is powder coated. This coating must be kept in good condition. Clean the Power Cabinet three times a year in the following way:

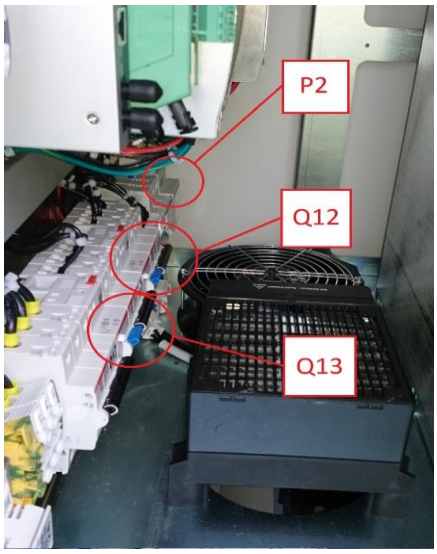
- Remove rough dirt by spraying with low-pressure tap water.
- Apply a neutral or weak alkaline cleaning solution and let it soak.
- Remove dirt by hand with a non-woven nylon hand pad.
- Rinse thoroughly with tap water.
- Optionally, apply wax on the front for extra protection and gloss.
- Do a check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

	**NOTICE** When the HVC E-Bus Charger is exposed to rain, it is sufficient to clean it twice a year.
	**CAUTION** 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. - 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.

2.2.2. RCD tests

The RCD functionality of Q12 and Q13 can be tested using the test buttons on the RCD's themselves. The test buttons will create a leakage current that will trip the RCD. Reset the RCD by first pushing up the blue lever when this is set then push up the black lever. The RCD functionality of P2 can also be tested using the test button on the device. When a trip occurred there should be a LED lit up stating that a fault has occurred on the device. The reset is done by pressing the reset button on the device. See picture of the adjustable RCD below. For more information see Appendix 4.11. SI-HVC-0115 RCD Functional test.





2.2.3. RMS measurement (Country dependent)

RMS voltage can be calculated by measuring the peak voltage level and multiplying it by 0.707. This value can then be used to calculate RMS power.

2.2.4. Isolation measurements (Country dependent)

Performing a charge test ensure that the current and voltage values fall between the normal limits of the charger expected power delivery as indicated in the installation manual and datasheets. While charging the system should remain stable without any switches/ breakers tripped or the beacon light indicated red.

2.2.5. Grounding system measurement

Performed the resistance measurements for all ground connections related to the system and sub cabinets "if applicable". The ground connections should be connected to the main grounding earth terminal plugged to the main cabinet.

2.2.6. Visual inspection

A) External visual inspection:

1. Check whether the emergency stop is pushed and not returned to the original position.
2. Check the housing for damage.
3. Check the charging cable for damage. Make sure that the charging cable is installed correctly.

• If the charging cable is damaged, replace the charging cable.

4. Check the antenna for damage. Make sure that the antenna is installed and tightened correctly to make a watertight seal.
5. Check whether the display is on.

B) Internal visual inspection:

1. Open the door.
2. Check the voltage under the main power switch.

• If the voltage is not as indicated in the installation manual, call the site owner.

3. Check whether the residual-current devices (2x) are on.
4. Check whether the circuit breakers are on.
5. Switch off the main power.
6. Check the cabinet for signs of moisture, icing or extreme heat.

• If there are signs of moisture, icing or extreme heat, check the antenna.

• If there are signs of moisture, icing or extreme heat, check the hygrothermal.

7. Check the cabinet for burn marks and burn smells, in particular at the fuses.

• If the fuse of the power board is blown, replace the fuse and proceed to replace the power board.

• If the fuse of the heater is blown, replace the fuse and proceed to replace the heater

8. Switch on the main power.
9. Close the door.

For more information, see Appendix 4.3. SI-HVC-0008 Visual Inspection.

2.2.7. Filter kit

Filters are always exposed to dirt and moisture. A visual inspection is to be performed according to the time frame indicated in the maintenance schedule. If applicable a cleaning of the filters will be necessary. To verify how to replace the filters, see Appendix 4.9. SI-HVC-0110 Replace Filters.

2.2.8. Power Module Fan

See Appendix 4.8. SI-HVC-0107 Replace power module fan.

2.2.9. Cabinet Fan

See Appendix 4.12. SI-HVC-0116 Replace HVC Cabinet Fan.

2.2.10. ACM Fan

See Appendix 4.14. SI-HVC-0119 Replace ACM Fan.

2.2.11. CCB Board

See Appendix 4.5. SI-HVC-0104 Replace CCB boards.

2.2.12. Power Supply 24VDC

See Appendix 4.13. SI-HVC-0117 Replace 24VDC Power Supply.

2.2.13. Power Module

See Appendix 4.4. SI-HVC-0103 Replace a 50-kW power module.

2.2.14. HVC HMI Assy 7”

See Appendix 4.10. SI-HVC-0114 Replace HMI Assembly (Human Machine Interface).

2.2.15. CPI COMBO CCS

See Appendix 4.6. SI-HVC-0105 Replace CPI board.

2.2.16. IMI COMBO CCS

See Appendix 4.7. SI-HVC-0106 Replace IMI board (Insulation Monitoring Interface).

2.2.17. Tooth Belt

See section 7.4.1. Replacement of the tooth belt in the Pantograph manual.

2.2.18. Plug-in Relays

According to Pantograph wear, see section 7.5.1. Replacement of electric parts of the switch cabinet (6 years or 300 000 cycles) in the Pantograph manual.

2.2.19. Bridging Strand

See section 7.2.4. Visual check of the bridging strands and section 7.5.2. Replacement of the bridging strands in the Pantograph manual.

2.2.20. Connection Cable Set

See section 7.2.5. Visual check of the connection cables and section 7.5.3. Replacement of the connection cables in the Pantograph manual.

2.2.21. Flat spring + Plastic plate + Pin

See section 7.5.5. Replace the leaf springs in the Pantograph manual.

2.2.22. Slide Bearing

According to Pantograph wear, see section 7.5.6. Replacement of the sliding bearing (6 years or 300 000 cycles) in the Pantograph manual.

2.2.23. Electric Motor

See section 7.5.4. Replacement of the electric motor in the Pantograph manual.

2.2.24. Contact Rail

See section 7.2.3. Visual check of the contact rails and section 7.5.3. Replacement of the connection cables in the Pantograph manual.

2.2.25. Overhaul / Main Inspection

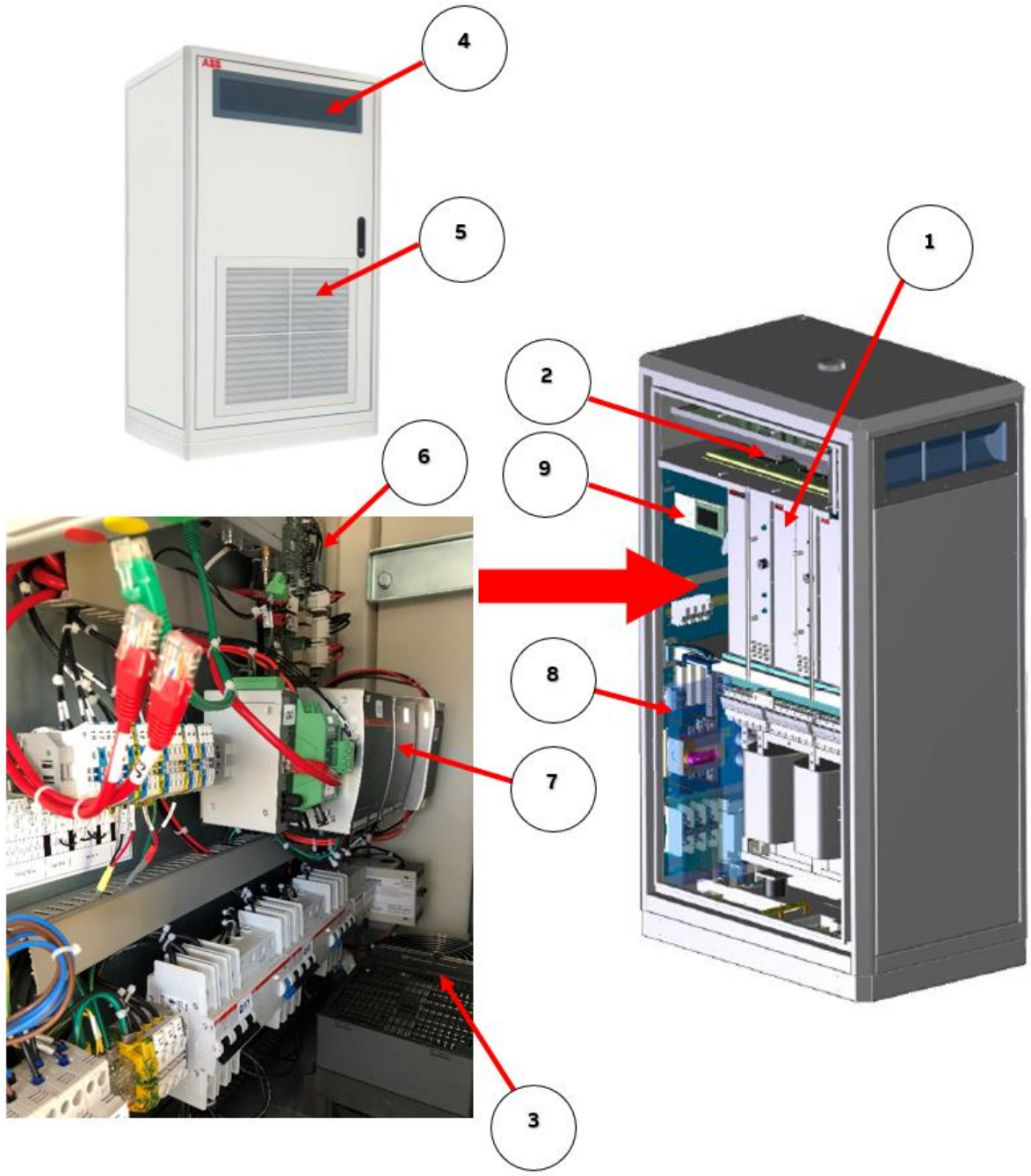
See section 7.6. Main inspection in the pantograph manual.

3. Components identification

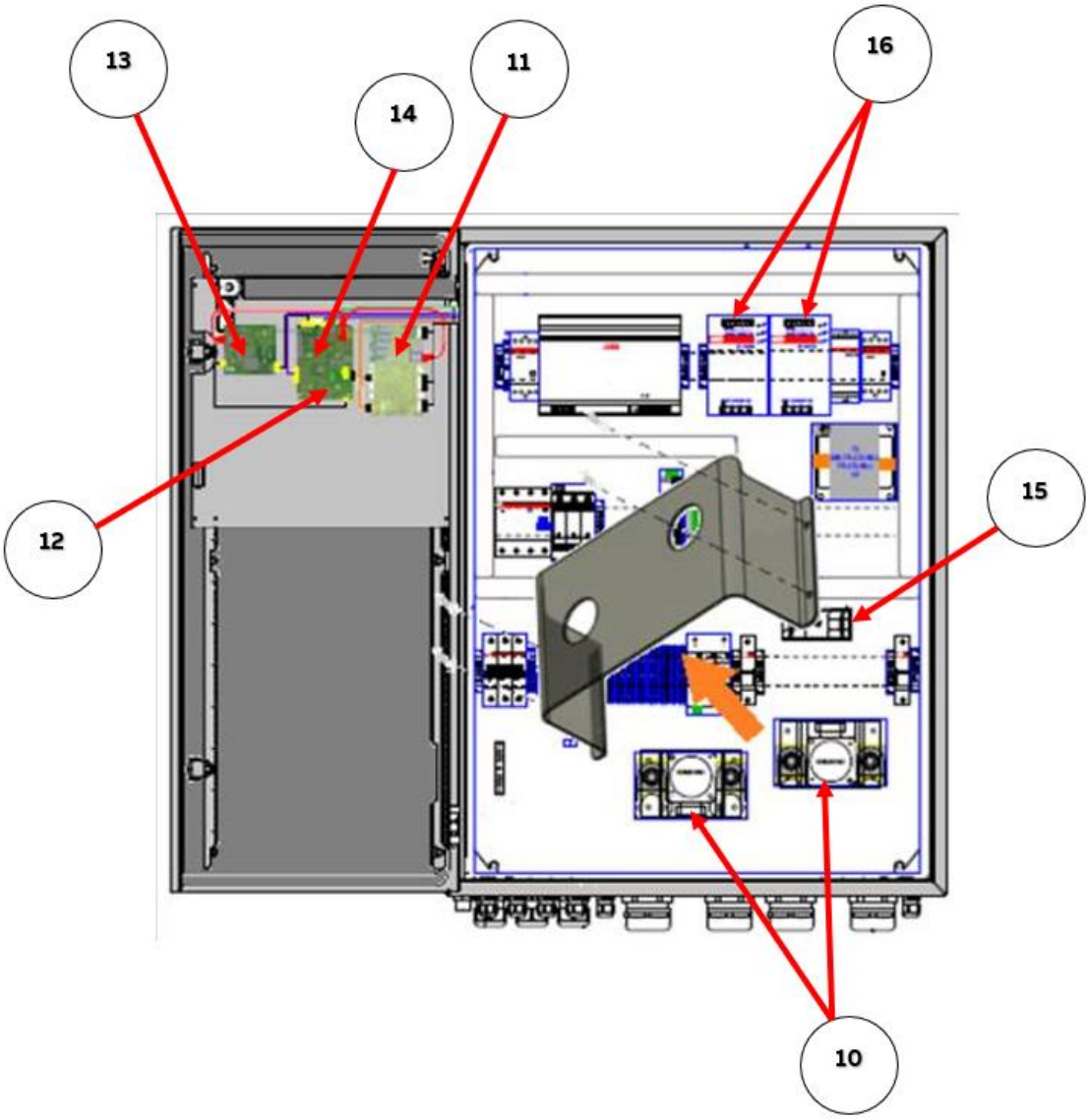
3.1. Spare parts list

Number	System Component	Location	Part Number	Description
1	HVC Cabinet	Inside, front	6AGC063800	Power Module 50 kW
2	HVC Cabinet	Inside, top	6AGC063801	Power Module Fan
3	HVC Cabinet	Inside, back	6AGC064024	Middle Fan
4	HVC Cabinet	Outside, top	6AGC063809	Air filter inlet KIT
5	HVC Cabinet	Outside, bottom	6AGC064101	Air filter outlet KIT
6	HVC Cabinet	Inside, back left	6AGC063811	ACS CCB Board
7	HVC Cabinet	Inside, back left	6AGC063817	Power Supply 24VDC 10A 240W
8	HVC Cabinet	Inside, front, behind Lexan cover	6AGC063854	AC Contactor 300A 100-250V
9	HVC Cabinet	Inside, front	6AGC063855	HMI Display
10	HVC Charge Pole ACM	Panel, behind Lexan cover	6AGC063810	ACS DC Contactor 600A 800V
11	HVC Charge Pole ACM	Door	6AGC063811	ACS CCB Board
12	HVC Charge Pole ACM	Door, on top of the CPI Combo Board	6AGC063812	ACS Control Board
13	HVC Charge Pole ACM	Door	6AGC063813	ACS IMI Board
14	HVC Charge Pole ACM	Door	6AGC072189	ACS CPI Combo Board
15	HVC Charge Pole ACM	Panel	6AGC063808	ACS Fan
16	HVC Charge Pole ACM	Panel	6AGC076541	Power Supply 24VDC 5A 120W
17	HVC Pantograph	Switch cabinet	6AGC072492	Plug-in relays
18	HVC Pantograph	Various location	6AGC072493	Bridging strand
19	HVC Pantograph	Various location	6AGC072494	Connection cable set
20	HVC Pantograph	Rails	6AGC072495	Leaf spring + plastic plate + Pin
21	HVC Pantograph	Rails	6AGC072497	Contact rail
22	HVC Pantograph	Behind switch cabinet	6AGC076677	Tooth Belt
23	HVC Pantograph	Behnd switch cabinet	6AGC076678	Electric Motor

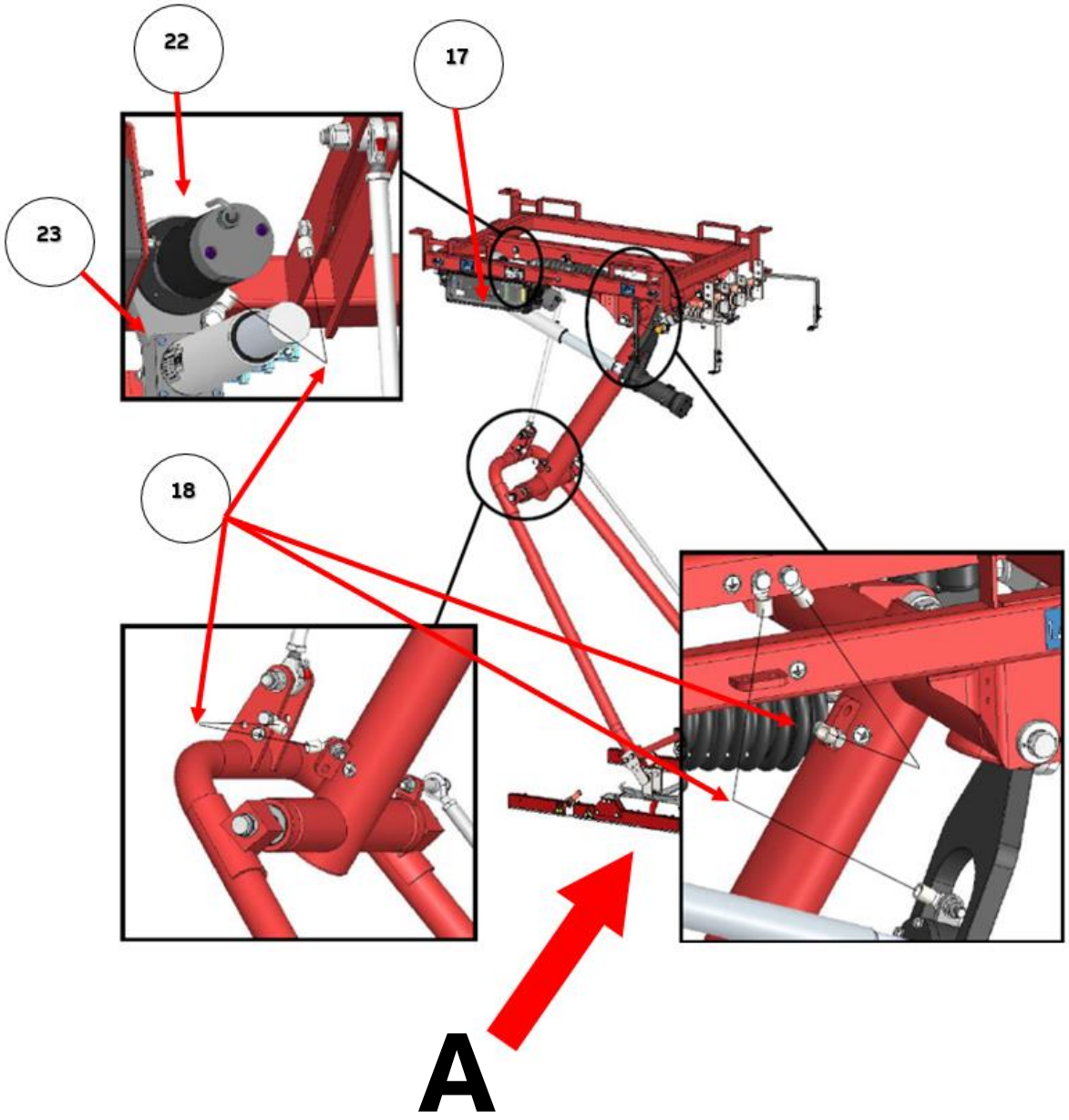
3.2. Power Cabinet



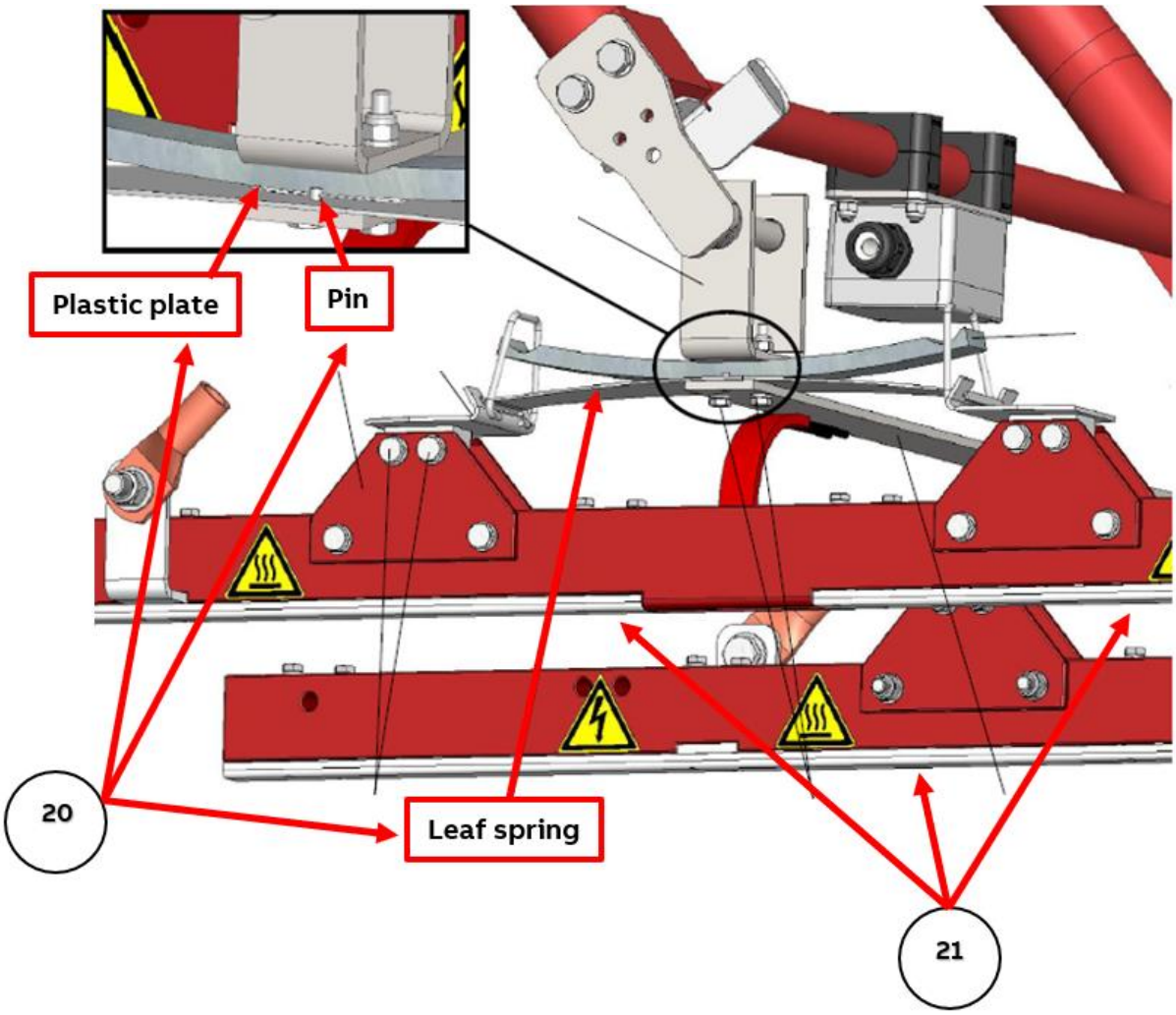
3.3. Pole ACM



3.4. Pantograph



A



4. Appendix

4.1. SI-HVC-0003 Safety Instruction

Purpose of the instruction and short description:
To be able to service the (HVS) Heavy Vehicle Systems in an electrically safe way it needs to be secured. This guide shows you how to safely shut down the system so that safe working conditions are guaranteed.

Specific risks and attention points:
Only trained and competent people can service the charger. All personnel working with the system must have a full understanding of the applicable safety instructions. This work may only be carried out by persons trained in the use of the complete system and who are aware of the special risks involved with these different parts.

1. RISK OF ELECTRIC SHOCK:

DANGER
Hazardous voltage
Identifies a hazard that could result in severe injury or death through electrocution.

2. RISK OF FALLING:

DANGER
Falling hazard
Identifies a hazard that could result in severe injury or death through falling of heights.

3. VARIOUS HAZARDS:

WARNING
Various
Identifies a hazard that could result in severe injury or death.

4. PINCH HAZARD:

WARNING
Pinch Hazard
Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed

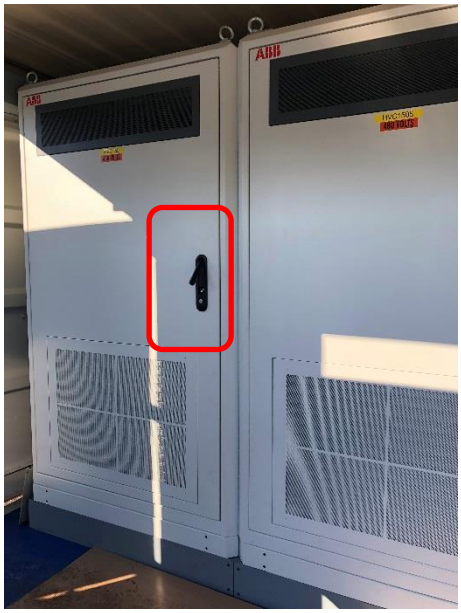
5. ROTATING PARTS:

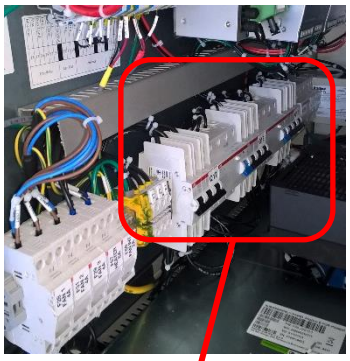
WARNING
Rotating parts
Identifies a hazard that could result in injury due to the presence of rotating or moving parts

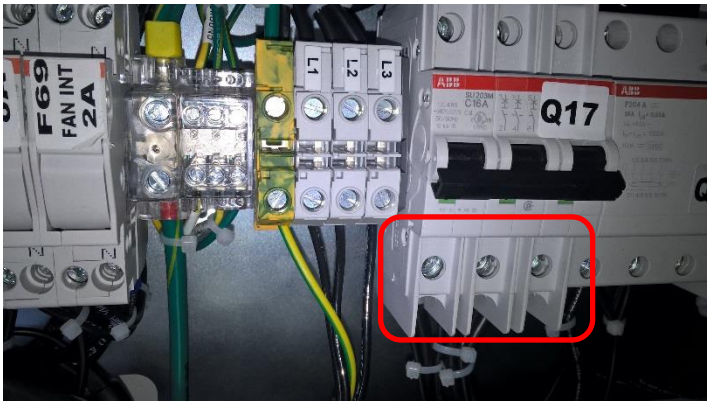
Specific risks and attention points:
6. VARIOUS HAZARDS:  **CAUTION** **Various** Identifies a hazard that could result in damage to the machine, other equipment, and/or environmental pollution 7. VARIOUS NOTICES:  **NOTICE** Contains remarks, suggestions or advice.

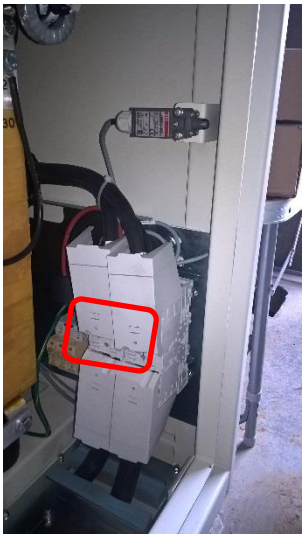
PPE Personal Protective Equipment	
	1) Please use the following PPE while working on a live system: a. Facial mask b. Insulated gloves c. Safety shoes d. Arc flash clothing Cat1 2) Local safety regulations need to be followed in addition to the prescribed PPE above. 3) While working on a system that has been shut down, use at least the following PPE. a. Safety glasses b. Safety shoes c. Arc flash clothing Cat1

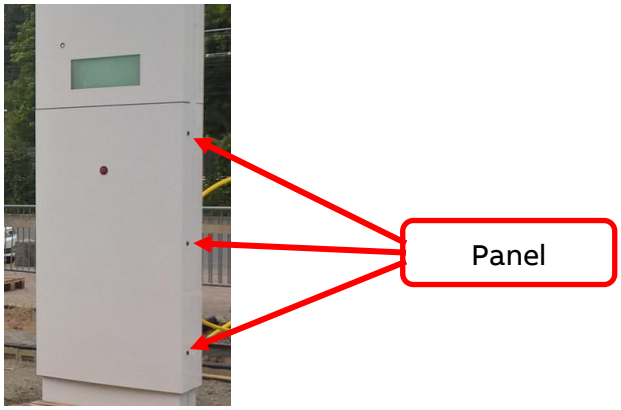
Procedure: Shutting down power supply at the low voltage switchgear (External supply).	
	**DANGER** **Hazardous voltage** Terminals will be live. Dangerous voltages will be present. Take extra precaution switching off or on the main power.
	1) Locate the keys for the external supply cabinet. 2) Open the cabinet and locate the switchgear powering the HVC charger. 3) Perform a Lockout Tagout procedure to make sure no power is present on the charger.

Procedure: Shutting down the power supply of all the cabinets.	
	**DANGER** **Hazardous voltage** Terminals will be live. Dangerous voltages will be present. Take extra precaution switching off or on the main power.
	1) Insert the key in the key lock and rotate the key counterclockwise. If the lock is open pull the handle towards you. 2) Rotate the handle clockwise to unlock the door locking mechanism. 3) Pull the door towards you to open the door completely. 4) Please be aware by opening the front door of the cabinet there are live terminals inside. (in case the external power supply could not be shut down) 5) If the door is opened completely you can lock the door in open position by pushing the door open while pressing against the lock bar in the middle of the door near the hinges.

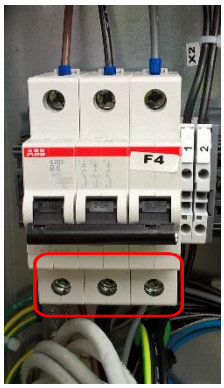
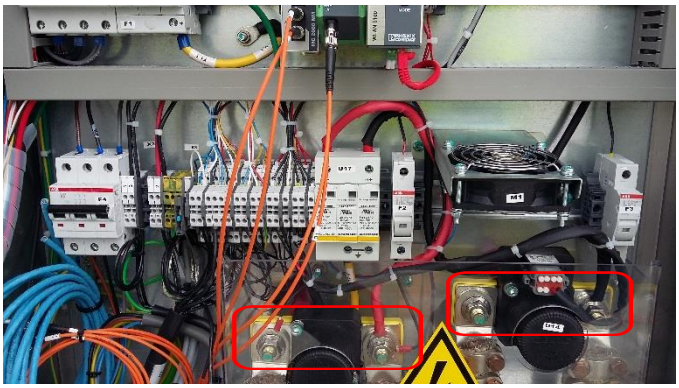
Procedure: Shutting down the power supply of all the cabinets.	
	**WARNING** **Presence of multiple power cabinets** Please be aware that there could be multiple power cabinets. Please perform shutdown procedure for all cabinets present.
 	6) Switch off the incoming AC supply by turning the handle of Q16 counter-clockwise 7) Pull-out the red lever out from the switch and insert your safety lock. Use the Lockout Tagout procedure.
 	8) After opening the door, identify and switch off Q12, Q13, and Q17 which are located on the top-left side inside the power cabinet

Procedure: Verify that all the charger cabinets are powered down.	
	**WARNING** **Presence of multiple power cabinets** Please be aware that there could be multiple power cabinets. Please perform verification on all cabinets present.
 	1) With the voltage tester safety measuring device or multimeter, measure the voltage on both AC & DC sides to ensure there is no dangerous voltage present in the system. 2) Before measuring, please make sure the voltage tester is functioning properly via testing at a functioning voltage source (e.g. wall power socket)
	3) Measure on the Bottom terminals of Q17 to verify the power is switched off. The terminals are directly linked to the top side of the main disconnect switch.

Procedure: Verify the charger cabinet is powered down.	
	**DANGER** **Hazardous voltage** There can be residual voltages on the DC contactors due to capacitors in the power converters. Be aware of the risk of electric shock.
	**WARNING** **Presence of multiple power cabinets** Please be aware that there could be multiple power cabinets. Please perform verification on all cabinets present.
 	4) Measure between the DC terminals on the right-hand bottom side of the cabinet. Use the prefabricated measurement holes for safety reasons to measure the voltage. 5) Measure between DC+ terminal and ground. 6) Measure between DC- terminal and ground. 7) If residual voltage was a present wait for 5 to 10 minutes to let the voltage level drop to a safe level (less than 25V) and re-measure.

Procedure: Shutting down the power supply of the ACM.	
	**DANGER** **Hazardous voltage** There can be residual voltages on the DC contactors due to capacitors in the power cabinet. Be aware of the risk of electric shock.
	1) Open the front panel using the EK333 key for the three-panel locks. 2) Open the ACM module using a Double bit key (Rittal key).

Procedure: Shutting down the power supply of the ACM.	
 	3) After opening the door, identify and switch off F4 and Q1 which are located on the left side inside the ACM.

Procedure: Verify that the ACM is powered down.	
	**DANGER** **Hazardous voltage** There can be residual voltages on the DC contactors due to capacitors in the power cabinets. Be aware of the risk of electric shock.
	1) Measure on the Bottom terminals of F4 to verify the power is switched off.
	2) Measure the voltages between U12: A2+ and U14: A1– on the left sides of both DC contactors. 3) Measure the voltages between U12: A1– and U14: A2+ on the right sides of the DC contactors. 4) Measure both terminals of the left DC contactor to ground. 5) Measure both terminals of the right DC contactor to ground. 6) If residual voltage was a present wait for 5 to 10 minutes to let the voltage level drop to a safe level (less than 25V) and re-measure.

4.2. SI-HVC-0005 Safety guide servicing the Pantograph

Purpose of the instruction and short description:
To be able to service the pantograph system in an electrically safe way it needs to be secured. This guide shows you how to safely shut down and short-circuit the electrical feed of the pantograph system to ensure it is and will remain powerless while servicing.

Specific risks and attention points:
Only trained and competent people can service the charger. All personnel working with the system must have a full understanding of the applicable safety instructions. This work may only be carried out by persons trained in the use of the complete system and who are aware of the special risks involved with these different parts.

1) RISK OF ELECTRIC SHOCK:

DANGER
Hazardous voltage
Identifies a hazard that could result in severe injury or death through electrocution.

2) RISK OF FALLING:

DANGER
Falling hazard
Identifies a hazard that could result in severe injury or death through falling of heights.

3) VARIOUS HAZARDS:

WARNING
Various
Identifies a hazard that could result in severe injury or death.

4) PINCH HAZARD:

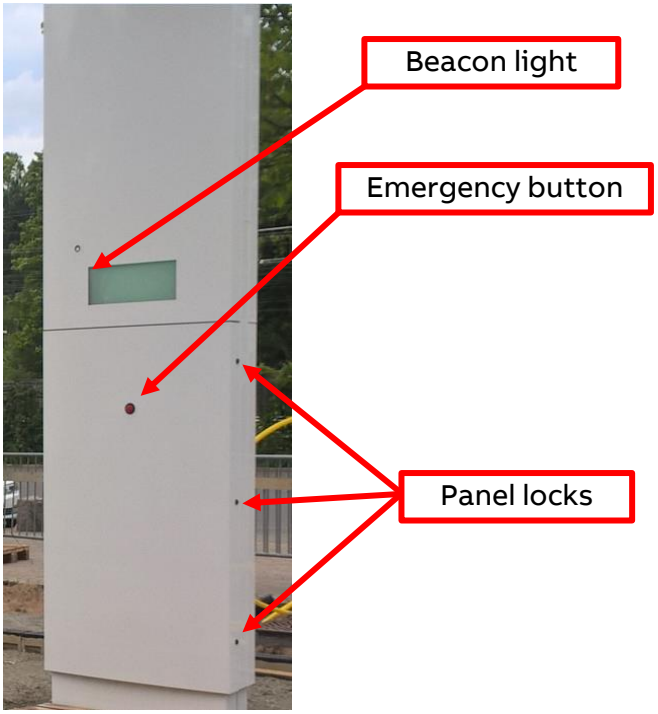
WARNING
Pinch Hazard
Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed

5) ROTATING PARTS:

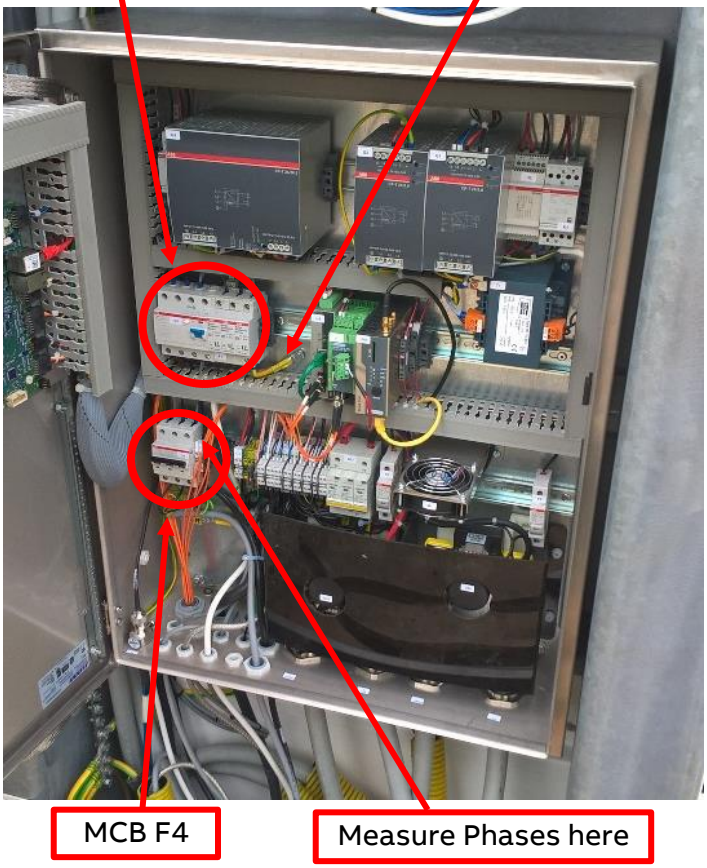
WARNING
Rotating parts
Identifies a hazard that could result in injury due to the presence of rotating or moving parts

Specific risks and attention points:
6) VARIOUS HAZARDS:  **CAUTION** **Various** Identifies a hazard that could result in damage to the machine, other equipment, and/or environmental pollution 7) VARIOUS NOTICES:  **NOTICE** Contains remarks, suggestions or advice.

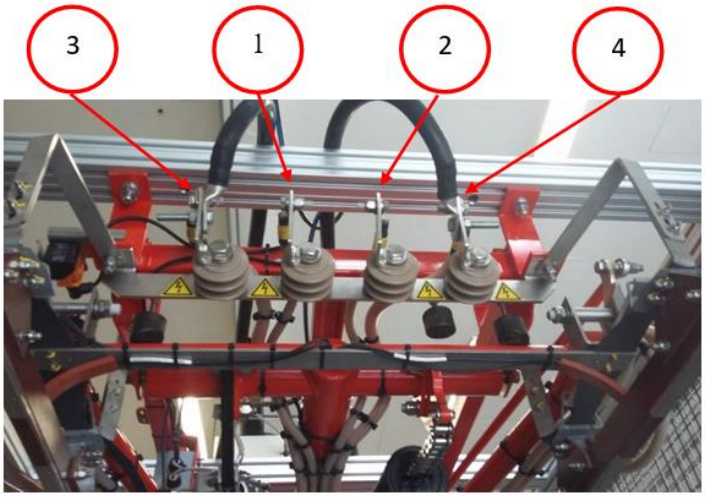
PPE Personal Protective Equipment	
	1) Please use the following PPE while working on a live system: a. Facial mask b. Insulated gloves c. Safety shoes d. Arc flash clothing Cat1 2) Local safety regulations need to be followed in addition to the prescribed PPE above. 3) While working on a system that has been shut down, use at least the following PPE. a. Safety glasses b. Safety shoes c. Arc flash clothing Cat1

Procedure: Disabling the charger and securing the electrical system.	
	1) Opening the pole front panel: a. Press the emergency button on the front of the charge pole. b. Check if the beacon light turns red. c. Open the front Panel using the EK333 key.

Procedure: Opening the ACM (ACS Control Module) and shutting down the pole.	
	**DANGER** **Hazardous voltage** Opening the ACM module will give you access to live circuitry. Be aware of the risk of electric shock. When switching off MCB F4 hazardous voltages will remain on the bottom side of MCB F4. Wear personal protection clothing according the ABB personal protection matrix.
	**DANGER** **Hazardous voltage** There can be residual voltages on the DC contactors due to capacitors in the power converters. Be aware of the risk of electric shock.

Procedure: Opening the ACM (ACS Control Module) and shutting down the pole.	
 	1) Open the ACM module using the Double bit key. 2) Switch off MCB (Mini Circuit Breaker) F4 by switching the black bar downwards. 3) Switch off RCD Q1 by switching the blue latch downwards. 4) Test the function of the Duspol by measuring between one of the phases on the bottom side of MCB F4 and ground. 5) Measure if there are no more voltages on the top side of MCB F4 with your Duspol. Measure between the phases and between the phases and ground. 6) Be aware that hazardous voltages remain on the bottom side of MCB F4. 7) Measure the voltages between + and – on the left sides of the DC contactors. 8) Measure the voltages between + and – on the right sides of the DC contactors. 9) Measure both sides of the left DC contactor to ground. 10) Measure both sides of the right DC contactor to ground. 11) All measured voltages should not exceed 24 Volts. The residual voltages will dissipate while measuring. Keep the Duspol connected till the voltage drops under 24 Volt. 12) Test the function of the Duspol again by measuring between one of the phases on the bottom side of MCB F4 and ground. 13) Close the ACM module using the Double bit key. 14) Close the front panel using the EK333 key.

Procedure: Short-circuit the ACS (Automatic Connection System, Pantograph).	
	**DANGER** **Hazardous voltage** There could be residual voltages present on the pantograph. Do not touch the pantograph rails and connecting flags until proven to be safe.
	**DANGER** **Falling hazard** Working on a mobile elevated work platform brings risk of falling down. Follow rules and legislation concerning operating a mobile elevated work platform. Only certified people can operate the Mobile elevated work platform.
	**WARNING** **Pinch hazard** Be aware of moving parts of the machinery. There are multiple points where there is a pinch hazard.
	**WARNING** **Rotating parts** Be aware of moving parts of the machinery. There are multiple rotating parts.
	**CAUTION** **Various** Be aware that work is done in a ***public area*** near other machinery. Keep track of your surroundings before you move any part of the Mobile elevated work platform.

Procedure: Short-circuit the ACS (Automatic Connection System, Pantograph).	
 	1) Use a Mobile elevated work platform to reach the pantograph's connection flags. 2) Short-circuit and ground the pantograph using the (SCK) Short Circuiting Kit. Do not touch the pantograph until the pantograph is short-circuited and earthed. 01. Connect the SCK to a ground point (either on the pantograph or the pole itself). 02. Connect the second wire of the SCK to the CP line flag on the pantograph. 03. Connect the SCK's third wire to the DC Minus. 04. Connect the SCK's fourth wire to the DC Plus. 3) Short-circuiting the pantograph will ensure the safety of the engineers that are performing the service on the pantograph. Once the SCK is in place the engineers can perform the service tasks.

Procedure: Enabling the Charger	
	1) Remove the Short Circuit Kit from the pantograph using a Mobile elevated work platform. 2) Open the front Panel using the EK333 key. 3) Open the ACM module using the Double bit key. 4) Switch on RCD Q1 by switching the blue latch upwards. 5) Switch on MCB (Mini Circuit Breaker) F4 by switching the black bar upwards. 6) Close the ACM module using the Double bit key. 7) Close the front panel using the EK333 key. 8) Release the emergency button on the front of the charge pole by rotating it clockwise. 9) Check if the beacon light turns green.

Procedure: Testing the Heavy Vehicle Charger	
	1) Test with a bus if the charger functions normally. Wait until a bus uses the charger. Or when an electric bus is at a different Bus stop ask the chauffeur to start using the charger.

4.3. SI-HVC-0008 Visual Inspection

Purpose of the instruction and short description:
The Visual inspection is to determine if there are defects in the system due to aging or other over time effects such as dirt, connections that are not well mounted which lead to burning marks,

Required tools, spare parts, and miscellaneous items:
Basic toolset:
• Screwdrivers, Plyers, Allen keys, Ratchet, and Sockets.
• Universal meter with extra test leads and clamps.
• Duspol
• Lockout Tagout set.
Extended toolset:
• Torque screwdriver 3N to tighten fuse holder screws
• Small step ladder: to calibrate the distance sensor
• Power 240Vsocket in sub-station, small generator or power converter in the car.
• Extension cord for power to charge laptops, phones, etc.
• Cleaning cloth
Weather-related tools:
• Heater 240Vto warmup the cabinet before startup.
• A tent to protect yourself and the cabinet for sun and rain.
• Plastic tarp: to protect the PCBA's in the charge box.
Miscellaneous items:
• Laptop with a mobile internet connection.
• Access to sub-station if present
• Cable ties

Abbreviations:
DCB = Depot Charge Box
HVC = Heavy Vehicle Charger

Site safety check	
Item	Pass/Fail
Safety of the site.	
Check the work environment. Can you commission safely? (Jump away space, etc.)	
Check the weather, when it rains, or snows too heavily take proper actions by setting up a tent, etc.	
Check for road signs/blocks. The area should be properly closed for public access.	
Do all people involve wearing proper clothing and personal protection?	
Lock the main switch in the cabinet with the Lock-out tag-out set.	
Remarks:	

Visual and physical inspection of the cabinet(s):	
General inspection cabinet(s).	
Check for damages on the cabinet(s) exterior paneling.	
Check if the door(s) can be opened and closed easily and safely.	
Check if the airflow of the cabinet(s) is (are) guaranteed in this setup (See installation manual).	
Check for spiderwebs, moss, etc. and remove	
Clean the outside of the cabinet with the cloth	
General inspection of the electrical components in the cabinet(s).	
Check the system(s) is (are) powered-down; measure voltage levels (Duspol).	
Check if the connections are good by (gently) pulling the cables/wires.	
Check if all the boards are firmly mounted and no free hanging cables.	
Check the dip switches on the CAN converter(s), only dip switch 2 and 3 must be ON.	
Check all connections on the following items: - Burn marks on cable lugs and cable connections - Other aging marks	
All of the power module fuse holders/circuit breakers (F58 to F63) screws must be tightened at 3N.	
The resistance between input AC phases (should be around 1MOhom or more)	
Measure between phase and ground (should be infinite).	
Remaining wiring and components in the cabinet(s).	
Check if wires and cables have a good connection and are undamaged	
Check if all components are properly mounted and without damages	
Check for water leakage, signs of animals and dirt	
Remarks:	
Visual and physical inspection of the Depot Box:	
Item	Pass/Fail

General inspection of the Depot Box.	
Check for damages on the Depot Box exterior paneling.	
Check if the door can be opened and closed easily and safely	
General inspection of the electrical components in the Depot Box.	
Check if all the boards are firmly mounted and no free hanging cables	
Check if the connections are good by (gently) pulling the cables/wires	
Check all connections on the following items: - Burn marks on cable lugs and cable connections - Other aging marks	

Wire check interconnections:	
Wiring check -> interconnections between Depot Box and Master Cabinet.	
DC+	
DC-	
Fiber CAN	
Fiber Ethernet	
Interlock (See appendix C)	
AC	

Wire check interconnections:	
Wiring check -> interconnections between Depot Box (2 or 3) for sequential charging	
DC+	
DC-	
Fiber CAN	
Fiber Ethernet	
Interlock (See appendix C)	
AC	

4.4. SI-HVC-0103 Replace a 50 kW power module

Specific risks and attention points:

1. RISK OF ELECTRIC SHOCK:

DANGER
Hazardous voltage
Identifies a hazard that could result in severe injury or death through electrocution.

2. PINCH HAZARD:

WARNING
Pinch Hazard
Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed

- Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**.
- When sliding in and out the power boards into their bay, pay attention not to damage to the wires and connectors.
- Pay attention that the weight of a power module is approximately 50 kgs. ABB recommends doing the replacement of the power modules with at least two people.

Procedure: Hardware replacement.

Power module removal

1) Identify the power module to be replaced.
2) Unscrew the fan driver Cable (A), Disconnect the CAN Cable (B) and Unscrew the Fuse/Circuit breaker feedback Cable(C).
3) Unscrew the 6 AC power input Cables (D) running to the Fuse/Circuit breakers.
4) Unscrew the two hex bolts (E), holding the metal bracket and remove the bracket.
5) Slide-out the power module slowly by using the handle. Make sure no cables are in the way.

Power module installation

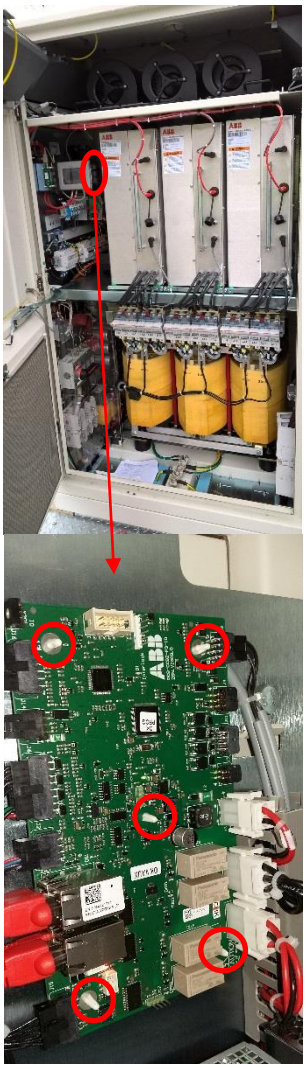
1) Slide in the new power module.
2) Mount the metal bracket using the hex bolts (E).
3) Reconnect the AC input cables (D) and tighten the bolts to 3N. The left Fuse/Circuit breaker is used for the upper cables of the power module input. The right Fuse/Circuit breaker is used for the bottom row cables of the power module input. The leftmost cable needs to go to the leftmost terminal of the 3phase circuit breaker.
4) Reconnect the Fuse/circuit breaker feedback cables (C), Reconnect the CAN cable (B) and the fan driver cable (A).
5) Make sure the Fuses/Circuit breakers are in the closed position.
6) Switch on the power using the main switch and close the front door.

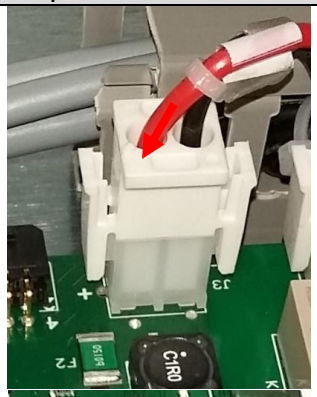
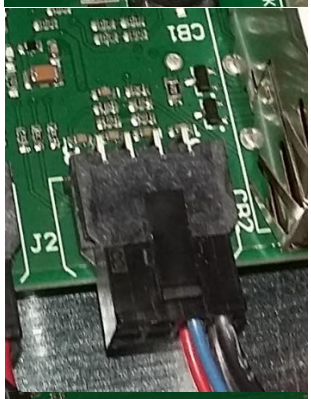
Procedure: Software reconfiguration.	
	Board configuration 1) If you do not have access to the ABB software platform, please contact ABB for assistance. 2) On Helios > EV Charger page > Settings tab: a. Notify hardware change on next restart, click on [send action] and confirm. b. Restart application, click on [send action] and confirm. 3) Allow the charger 10 minutes to configure the boards. It may display error messages in the meantime. 4) Check if the configuration has been successful. On Helios > EV Charger page > Summary tab > [Show service page]. 5) In the power modules section, check the software version of the power module is updated. It should state a valid number, and not “unknown”. 6) Run a Power Module Self-Test and check if all tests pass.

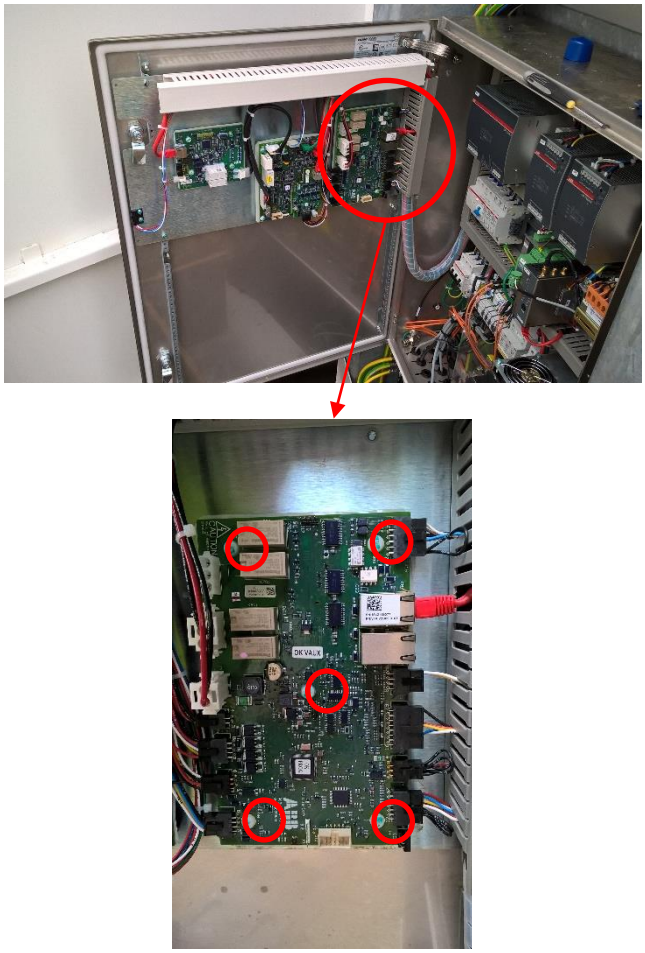
4.5. SI-HVC-0104 Replace CCB boards

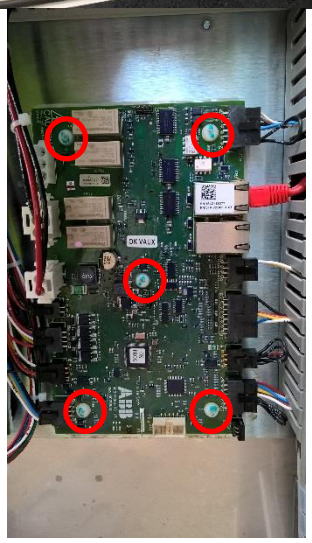
Purpose of the instruction and short description:
This document describes how to replace the CCB (Core Control Board). This service instruction applies for the cabinet, ACM and Depot box.

Specific risks and attention points:
1. RISK OF ELECTRIC SHOCK:  **DANGER** **Hazardous voltage** Identifies a hazard that could result in severe injury or death through electrocution. 2. PINCH HAZARD:  **WARNING** **Pinch Hazard** Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed Risk of electric shock. Make sure the system is completely powered down. Use the **safety instruction SI-HVC-0003** to power down the charger in a safe controlled manner. Pinch hazard. Please make sure in windy conditions to secure the doors.

Procedure: Replace the CCB in the Cabinet	
	1) Locate the CCB on the left-hand top side of the cabinet. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. 3) When every cable is disconnected, locate the five holding studs. Push in the lid that holds the CCB in place for every stud until the CCB comes loose (Use long nose plyers if needed). 4) To mount the new CCB line up the holes of the CCB with the holding studs and press the CCB down. Press until the holding lids pop out of the holding studs securing the CCB in place. 5) Plugin every cable in their respected positions. 6) For every cabinet make sure that the rotary switch is set in the correct position. a. The master cabinet needs to be set to “0”. b. The first slave cabinet needs to be set to “1”. c. The second slave cabinet needs to be set to “2” and so on…

Procedure: Replace the CCB in the Cabinet	
   	

Procedure: Replace the CCB in the ACM	
	1) Locate the CCB on the door of the ACM module. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. See page two for connector locking clip positions. 3) When every cable is disconnected, locate the five plastic screws. Use a Philips screwdriver to undo the screws 4) To mount the new CCB line up the holes of the CCB with the threaded studs and mount the CCB back into place with the plastic screws. 5) Plugin every cable in their respected positions. 6) Make sure that the rotating switch is set to “0”. See page two for reference.

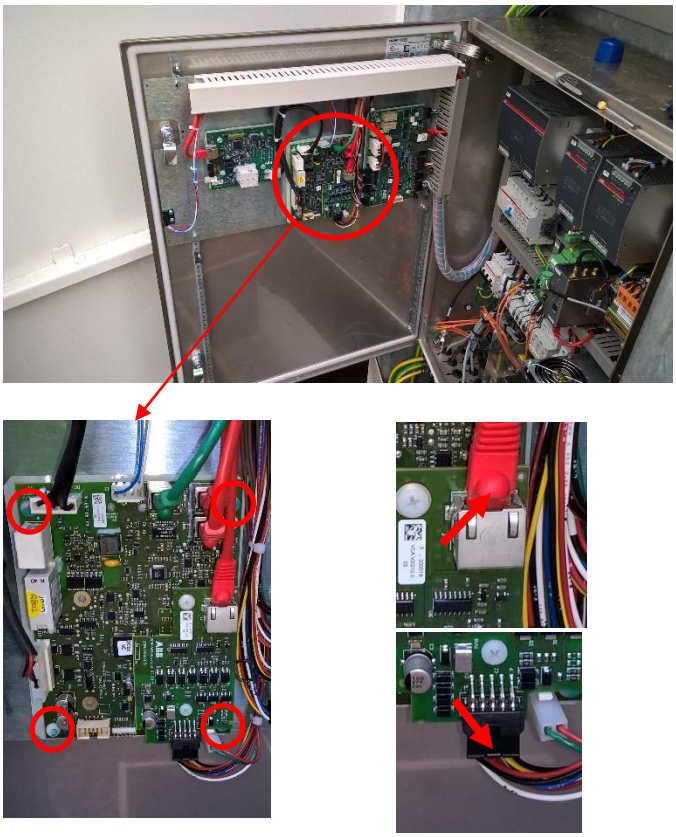
Procedure: Replace the CCB in the Depot Box	
 	1) Locate the CCB on the door of the Depot box module. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. See page two for connector locking clip positions. 3) When every cable is disconnected, locate the five plastic screws. Use a Philips screwdriver to undo the screws 4) To mount the new CCB line up the holes of the CCB with the threaded studs and mount the CCB back into place with the plastic screws. 5) Plugin every cable in their respected positions. 6) For every Depot Box make sure that the rotary switch is set in the correct position. a. The first Depot Box needs to be set to “0”. b. The second Depot Box needs to be set to “1”. c. The third Depot Box needs to be set to “2”. d. And so on……

Procedure: Software reconfiguration.	
	Board configuration 1) If you do not have access to the ABB software platform, please contact ABB for assistance. 2) On Helios > EV Charger page > Settings tab: c. Notify hardware change on next restart, click on [send action] and confirm. d. Restart application, click on [send action] and confirm. 3) Allow the charger 10 minutes to configure the boards. It may display error messages in the meantime. 4) Check if the configuration has been successful. On Helios > EV Charger page > Summary tab > [Show service page].

4.6. SI-HVC-0105 Replace CPI board

Purpose of the instruction and short description:
This document describes how to replace the CPI (Charge Protocol Interface). This service instruction applies for the ACM and Depot box.

Specific risks and attention points:
1. RISK OF ELECTRIC SHOCK:  **DANGER** **Hazardous voltage** Identifies a hazard that could result in severe injury or death through electrocution. 2. PINCH HAZARD:  **WARNING** **Pinch Hazard** Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed Risk of electric shock. Make sure the system is completely powered down. Use the **safety instruction SI-HVC-0003** to power down the charger in a safe controlled manner. Pinch hazard. Please make sure in windy conditions to secure the doors.

Procedure: Replace the CPI in the ACM	
	1) Locate the CPI on the door of the ACM module. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. 3) When every cable is disconnected, locate the four plastic screws. Use a Philips screwdriver to undo the screws 4) To mount the new CPI, line up the holes of the CPI with the threaded studs and mount the CPI back into place with the plastic screws. 5) Plugin every cable in their respected positions.

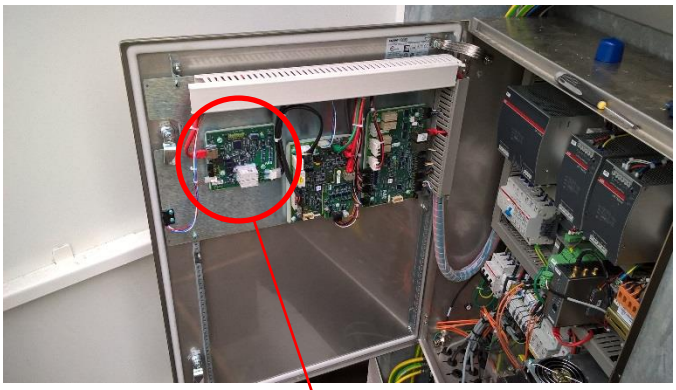
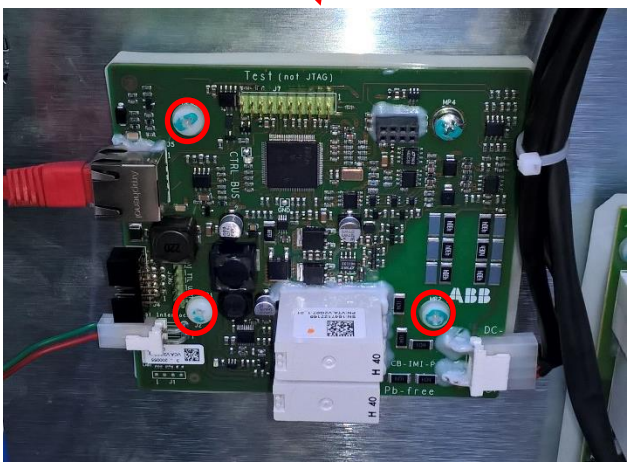
Procedure: Replace the CPI in the Depot Box	
	1) Locate the CPI on the door of the Depot box module. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. See page two for reference 3) When every cable is disconnected, locate the four plastic screws. Use a Philips screwdriver to undo the screws 4) To mount the new CPI line up the holes of the CPI with the threaded studs and mount the CPI back into place with the plastic screws. 5) Plugin every cable in their respected positions.

Procedure: Software reconfiguration.	
	Board configuration 1) If you do not have access to the ABB software platform, please contact ABB for assistance. 2) On Helios > EV Charger page > Settings tab: e. Notify hardware change on next restart, click on [send action] and confirm. f. Restart application, click on [send action] and confirm. 3) Allow the charger 10 minutes to configure the boards. It may display error messages in the meantime. 4) Check if the configuration has been successful. On Helios > EV Charger page > Summary tab > [Show service page].

4.7. SI-HVC-0106 Replace IMI board (Insulation Monitoring Interface)

Purpose of the instruction and short description:
This document describes how to replace the IMI (Insulation Monitoring Interface). This service instruction applies for the ACM and Depot box.

Specific risks and attention points:
1. RISK OF ELECTRIC SHOCK:  **DANGER** **Hazardous voltage** Identifies a hazard that could result in severe injury or death through electrocution. 2. PINCH HAZARD:  **WARNING** **Pinch Hazard** Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed Risk of electric shock. Make sure the system is completely powered down. Use the **safety instruction SI-HVC-0003** to power down the charger in a safe controlled manner. Pinch hazard. Please make sure in windy conditions to secure the doors.

Procedure: Replace the IMI in the ACM	
 	1) Locate the IMI on the door of the ACM. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. 3) When every cable is disconnected, locate the three plastic screws and the metal screw. Use a Philips screwdriver to undo the screws 4) To mount the new IMI and isolator plate line up the holes of the IMI and isolator plate with the threaded studs and mount the IMI back into place with the screws. 5) Plugin every cable in their respected positions.

Procedure: Replace the IMI in the Depot Box	
	1) Locate the IMI on the door of the Depot box module. 2) Disconnect all connected cables by opening the locking clip on each connector and pull them out. 3) When every cable is disconnected, locate the three plastic screws and the metal screw. Use a Philips screwdriver to undo the screws 4) To mount the new IMI and isolator plate line up the holes of the IMI and isolator plate with the threaded studs and mount the IMI back into place with the screws. 5) Plugin every cable in their respected positions.

Procedure: Software reconfiguration.	
	Board configuration 1) If you do not have access to the ABB software platform, please contact ABB for assistance. 2) On Helios > EV Charger page > Settings tab: g. Notify hardware change on next restart, click on [send action] and confirm. h. Restart application, click on [send action] and confirm. 3) Allow the charger 10 minutes to configure the boards. It may display error messages in the meantime. 4) Check if the configuration has been successful. On Helios > EV Charger page > Summary tab > [Show service page].

4.8. SI-HVC-0107 Replace power module fan

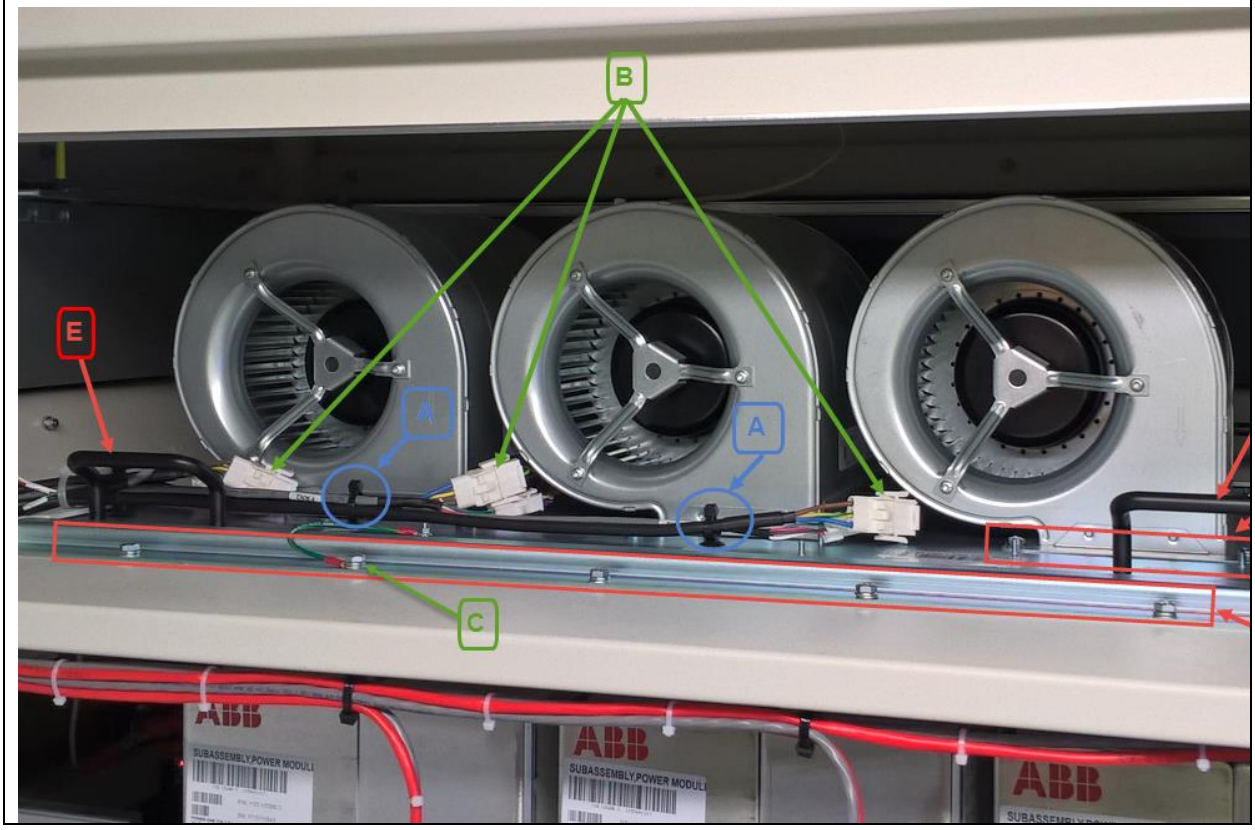
Specific risks and attention points:

1. PINCH HAZARD:

WARNING
Pinch Hazard
Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed

- Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**.
- Pay attention that the weight of bracket holding the fans could be heavy. ABB recommends doing the replacement of the fan with at least two people.

Procedure: Power Module Fan Replacement.



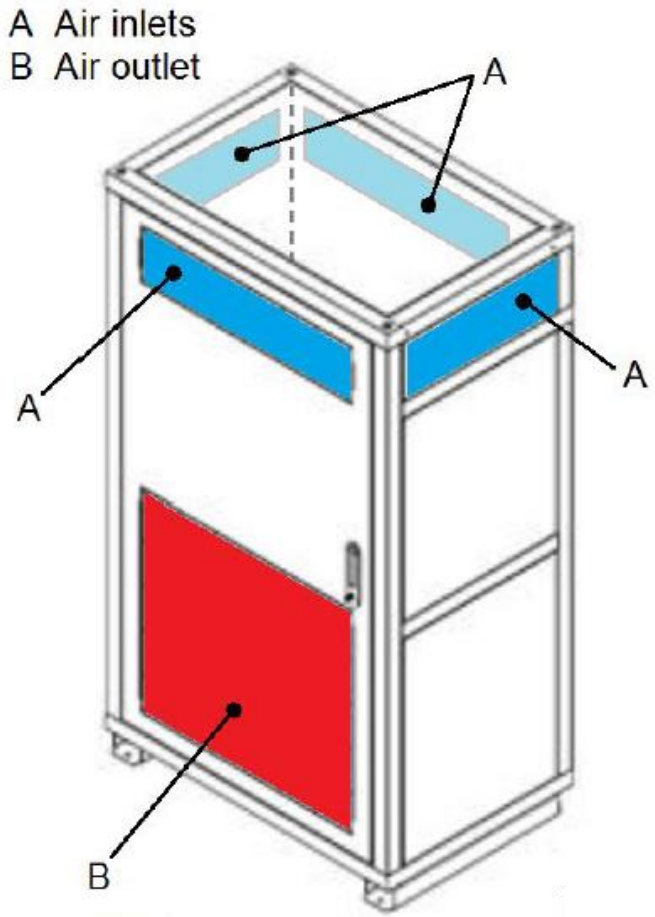
Procedure: Power Module Fan Replacement.

Power Module Fan Removal

1) Identify the power module fan to be replaced.
2) Cut and discard the ty-raps (A).
3) Unplug the fan control and supply wires (B).
    a. Keep the wires out of the way so they cannot be pinched while removing the bracket holding the fans.
4) Disconnect the grounding wire (C) connected between the cabinet structure and the bracket holding the power module fans.
    a. Leave the wire connected on the bracket side without disconnection.
5) Unscrew the 5 bolts (D) holding the stopper of the bracket for power module fans.
    a. Keep the bolts and stopper aside so they can be reused when the bracket is installed back.
6) Slide-out the bracket slowly using the handles (E) on the bracket and place the bracket on a work table.
    a. Make sure that none of the cables are pinched while doing so.
7) Remove the bolts and nuts (F) both at the front end and the back end of the fan to be replaced.
    a. Keep the bolts and nuts aside so they can be reused when the new fan is installed back.
8) Take the faulty fan out and replace it with the new one.
    a. Screw the bolts (F) back in place both at the front and the back end of the new fan. Use the tightening torque value of 10 Nm.
9) Slide in the bracket slowly using the handles (E) on the bracket.
    a. Make sure that none of the cables are pinched while doing so.
10) Place the stopper back in position and align the holes with the rivet nuts.
11) Screw the 5 bolts (D) back in to hold the bracket of the power module fans in place.Use the tightening torque value of 25 Nm.
12) Reconnect the grounding wire (C) between the cabinet structure and the bracket holding the power module fans.
13) Re-plug the fan control and supply wires (B).
14) Use new ty-raps (A) to hold the control and supply wires in place.

4.9. SI-HVC-0110 Replace Filters

Specific risks and attention points:
• Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**. • Air filters must be replaced at regular intervals as recommended in the Maintenance Schedule (**SI-HVC-0000**) • The frequency of filter replacement could be higher in the case the charger cabinets are installed in a location where they are exposed to dust or other sources of pollution that may block the filter.

Procedure: Input / Output Filter Replacement.	
	1) Identify the filters to be replaced. 2) Unscrew the filter detection switch found on the top edge of each filter. Set the screws aside to be reused during re-installation. 3) Remove the dirty filter gently so as not to shake off dust onto the components in the unit. 4) When replacing with the new filter, identify the direction in which the filter needs to be slid in. 5) Slide the new filters in each respective input/output filter slot. 6) Screw back in the filer detection switch on the top edge of each replaced filter.

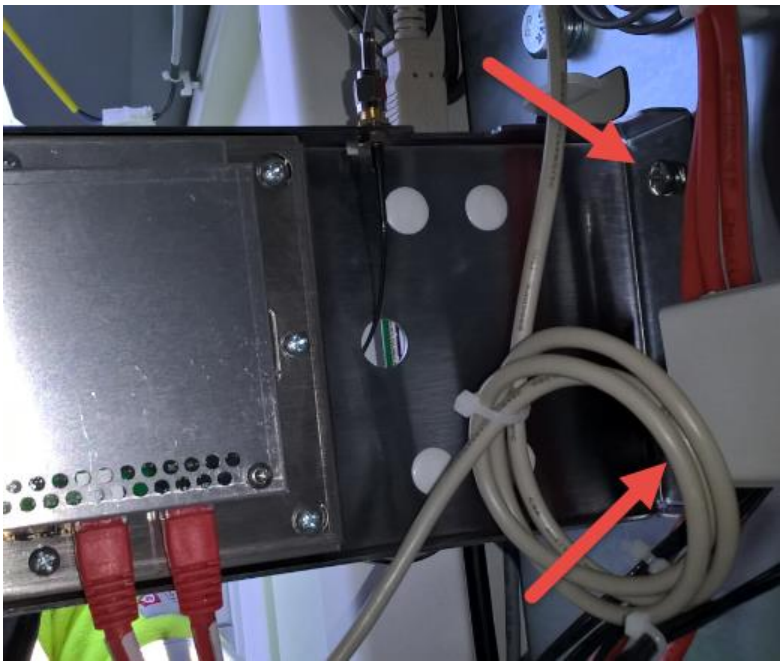
4.10. SI-HVC-0114 Replace HMI Assembly (Human Machine Interface)

Specific risks and attention points:

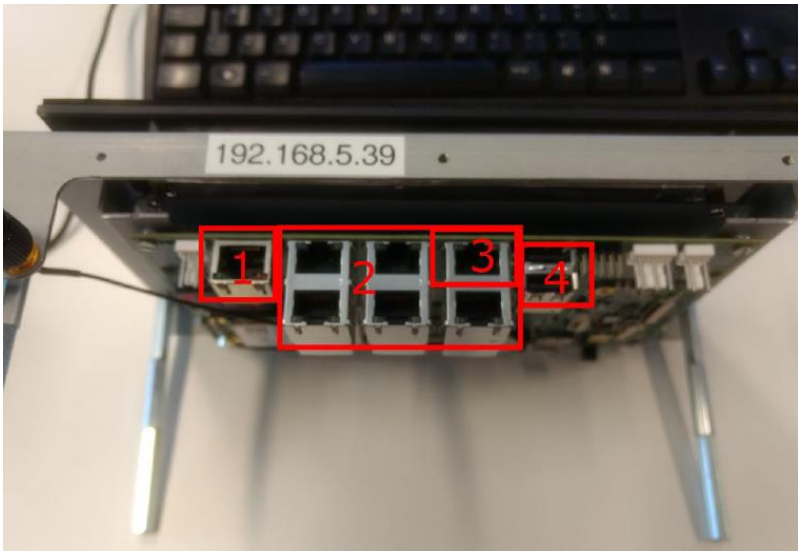
1. RISK OF ELECTRIC SHOCK:

DANGER
Hazardous voltage
Identifies a hazard that could result in severe injury or death through electrocution.

- Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**.

Procedure: Removal of old HMI Assembly.	
	**Removal of old HMI Assembly** 1) Identify the HMI Assembly (including the bracket) to be removed. 2) Unplug the cables connected on the assembly. a. There are 3 x RJ-45 terminated cables (to be re-used with the new assembly) and 1 x USB terminated cable (not to be re-used with the new assembly).
	3) Identify the 2 mounting points at the back of the assembly. In the newer version of the cabinets, three mounting points are used. 4) Unscrew the screws slowly by making sure that they do not fall on any other component inside the cabinet. Save the screws to be re-used later when installing the new HMI assembly.

Procedure: Installation of the new HMI Assembly.	
 	**Installation of new HMI Assembly** 1) Take the new Arm-XL HMI assembly (including the mounting bracket). a. The same mounting positions must be used also for this new HMI assembly. 2) Install the screws back in slowly to hold the assembly in place. Make sure the screws do not fall on any other component inside the cabinet.

Procedure: Programming the new HMI (remotely by ABB)	
	3) Plug-in back the 3 x RJ-45 terminated cables into the ports shown in the picture in the left column. a. Port#1: Control bus (CAN bus and power) b. Port#2: Local network (optical fiber converter) c. Port#3: External network (Modem) d. Port#4: USB not used. 4) Once done, safely re-close the circuit breakers and safely close the disconnect switch of the cabinet. 5) Close the charger cabinet door. 6) Re-supply the charger cabinet from the external power supply.

Procedure: Programming the new HMI (remotely by ABB)	
	Programming of the new HMI 1) At this point, contact ABB remote support to program the new HMI assembly.

4.11. SI-HVC-0115 RCD Functional test

Purpose of the instruction and short description:
This Service instruction describes how to functional test the RCD or GFCI devices on a Heavy vehicle charger.

Specific risks and attention points:

1. RISK OF ELECTRIC SHOCK:

DANGER

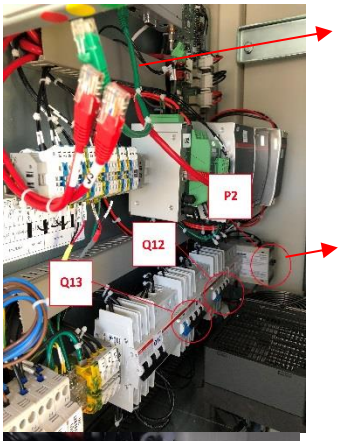
Hazardous voltage

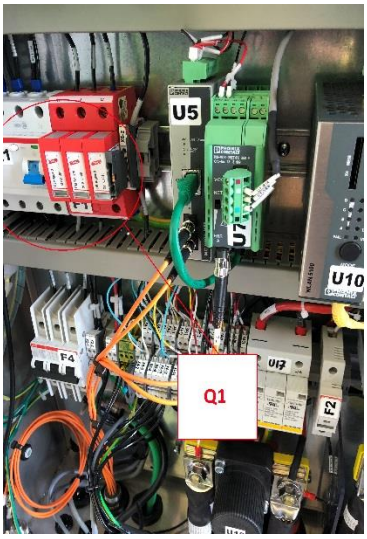
Identifies a hazard that could result in severe injury or death through electrocution.

Please be aware that the work is performed on a live system. Therefore, there is a high risk of electrocution or severe injury. Please always wear the described PPE during this inspection.

During this inspection no charging can take place, the system will be out of order due to opening the doors.

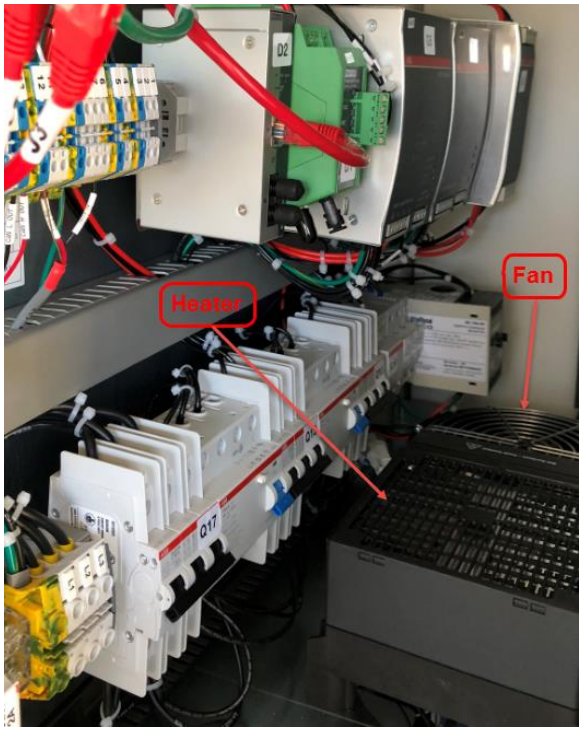
PPE Personal Protective Equipment	
	1) Please use the following PPE while working on a live system: a. Facial mask b. Insulated gloves c. Safety shoes d. Arc flash clothing Cat1 2) Local safety regulations need to be followed in addition to the prescribed PPE above.

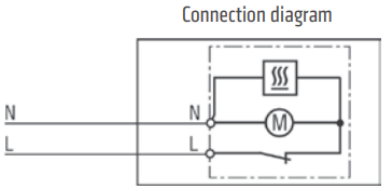
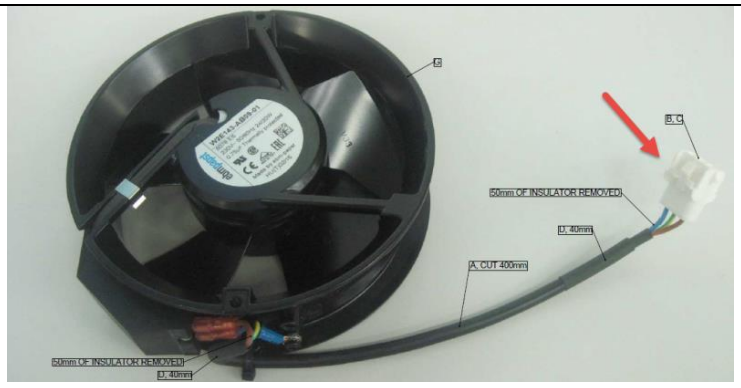
Procedure: testing the RCD's of the cabinet	
NAM cabinet  	1) The RCD functionality of Q12 and Q13 shall be tested using the test buttons on the RCD's themselves. The test buttons will create a leakage current that will trip the RCD. 2) Reset each RCD by first pushing the blue lever up. When this is set then push up the black lever. 3) The RCD functionality of P2 can be tested using the test button on the device. When a trip occurred a LED lights up stating that a fault/trip has occurred on the device. 4) The reset is done by pressing the reset button on the device. Please see attached a picture of the adjustable RCD.

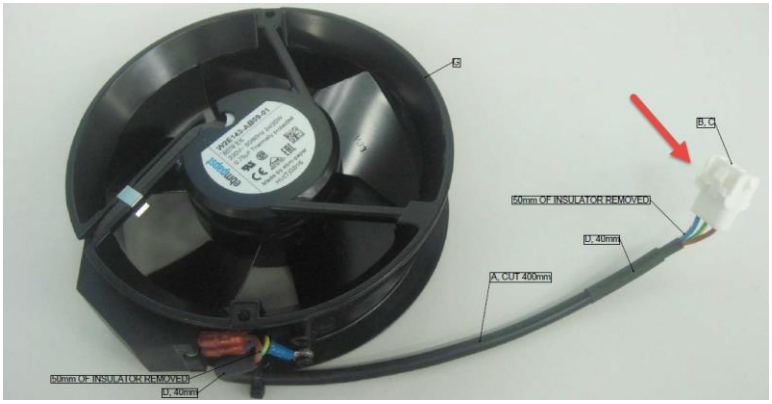
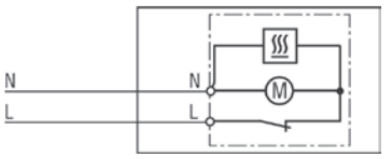
Procedure: testing the RCD's of the ACM	
NAM ACM 	1) The RCD functionality of Q1 shall be tested using the test button on the RCD. The test buttons will create a leakage current that will trip the RCD. 2) Reset the RCD by pushing up the blue lever.

4.12. SI-HVC-0116 Replace HVC Cabinet Fan

Specific risks and attention points:
1. RISK OF ELECTRIC SHOCK:  **DANGER** **Hazardous voltage** Identifies a hazard that could result in severe injury or death through electrocution. 2. PINCH HAZARD:  **WARNING** **Pinch Hazard** Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed • Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**.

Procedure: HVC Cabinet Fan replacement.	
	**Replacement of the cabinet fan** The fan is mounted within the HVC cabinet behind the HVC cabinet heater. Therefore, in order to remove and replace the fan, the heater in the unit has to be removed first.

Procedure: Removal of the heater and fan.	
	The heater and the fan are held in position by 2 rivet nuts each, as highlighted in the picture. Both mounting points for the fan have been highlighted in the picture for the fan; however, only one mounting point has been highlighted for the heater and there is one more mounting point (not visible in the picture) but diagonally across the one in the picture.
 	**Removal of the heater** 1) Disconnect the 1-phase supply wires (L, N) connected to the heater. 2) Remove the 2 rivet nuts holding the heater in place. a. Keep the heater aside to be installed back again. b. Keep the rivet nuts aside to be reused during reinstallation.
	**Removal of the fan** 1) Unplug the supply cable connector of the fan power supply cable. 2) Remove the 2 rivet nuts holding the fan in place. a. Keep the rivet nuts aside to be reused during reinstallation. 3) Remove the heater.

Procedure: Replacement of the fan	
	**Replacement of the fan** 1) Take the new fan. 2) Install the new fan at the defined installation position. 3) Plug the supply cable connector of the fan power supply cable. 4) Hold the fan in position by screwing in the 2 rivet nuts at the position indicated in the table above.
 Connection diagram 	**Reinstallation of the heater** 1) Take the heater that was kept aside. 2) Reconnect the 1-phase supply wires (L, N) connected to the heater. 3) Hold the heater in place by screwing in the 2 rivet nuts at the position indicated in the table above.

4.13. SI-HVC-0117 Replace 24VDC Power Supply

Purpose of the instruction and short description:
Replacement of the 24VDC Power Supply in HVC Charger Cabinet, ACM and Depot Charge Box.

Specific risks and attention points:

1. RISK OF ELECTRIC SHOCK:

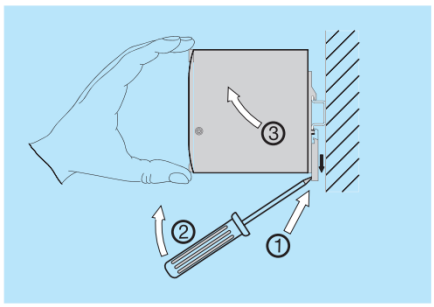
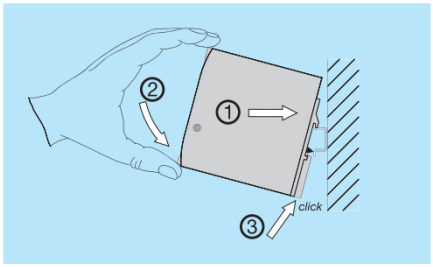
DANGER
Hazardous voltage
Identifies a hazard that could result in severe injury or death through electrocution.

- Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**.

Procedure: 24VDC Power Supply Replacement in HVC Cabinet	
	**Removal of 24VDC Power Supply** 1) Identify the power supply (G4 / G5) to be removed and replaced. 2) Refer to Demounting instructions presented later in this document.

Procedure: 24VDC Power Supply Replacement in ACM Module	
 	**Removal of 24VDC Power Supply** 1) Identify the power supply (G1 / G2 / G3) to be removed and replaced. 2) Refer to Demounting instructions presented later in this document.

Procedure: 24VDC Power Supply Replacement in Depot Charge Box	
	**Removal of 24VDC Power Supply** 1) Identify the power supply (G1 / G2) to be removed and replaced. 2) Refer to Demounting instructions presented later in this document.

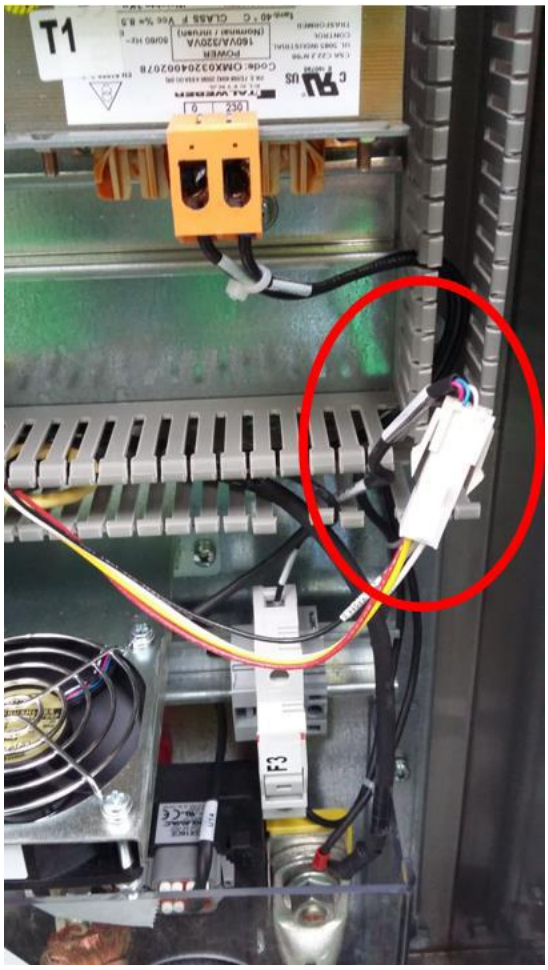
Procedure: Demounting and Remounting Instructions	
	**Disconnecting and Demounting** 1) Disconnect all the wires connected to the power supply module, and make sure to note down which wire goes into which terminal of the power supply module. 2) Remove the power supply as shown in the demounting picture shown on the left column. 3) Pull down the latching lever by means of the screwdriver. 4) Alternatively, press the unlock button to release the device. 5) In both cases above, the device can be unhinged from the mounting rail edge and removed.
	**Remounting and Reconnecting** 1) Reconnect all the respective wires connected to the power supply module, and make sure not to swap the polarity of connections. Use the tightening torque value of 0.4 Nm. 2) The new power supply can be snapped onto the DIN rail as shown in the picture in the left column. 3) The device is set with its mounting rail slide on the upper edge of the mounting rail and locked by lifting it downwards.

4.14. SI-HVC-0119 Replace the ACM fan

Purpose of the instruction and short description:
Replacing the HVC ACM fan.

Specific risks and attention points:
1. RISK OF ELECTRIC SHOCK:  **DANGER** **Hazardous voltage** Identifies a hazard that could result in severe injury or death through electrocution. 2. PINCH HAZARD:  **WARNING** **Pinch Hazard** Identifies a hazard that could result in injuries in which somebody parts are pinched or crushed Capacitors on the power boards can hold an electric charge for a long time, even if the charger is switched off. **Do not proceed before fully performing the Safety instructions SI-HVC-0003**.

Procedure: HVC ACM fan replacement.	
	**Replacement of the cabinet fan** The fan is mounted within the ACM cabinet at the bottom right and is marked as M1.

Procedure: Removal and installation of the fan.	
	**Replacement of the cabinet fan** The fan is mounted with two screws, which are mounted in the backplate. Open the wiring duct above and on the right-hand side of the fan. The fan is electrically connected with a connector. Remove the connector and loosen the screws. Then remove the old fan. Install the new fan by connecting the screws and connector.

Revision: 0.1
Date released: 2019-08-19

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.

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 (papelera 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 Desechos 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 usted contribuye de manera importante a la protección de nuestro medio ambiente.

NEDERLASNDS

Elektrische en elektronische apparatuur worden afzonderlijk ingezameld in naleving van de vereisten van de Richtlijn betreffende afgedankte elektrische en elektronische apparatuur (WEEE - 2012/19/EU)

Het symbool (doorgekruisde 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 afval/vuilnis 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 recyclen van dit product om zo ons milieu te beschermen.

DANSK

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

Symbolet (en overstreget affaldsspand med hjul) på produktet angiver, at produktet ikke må blandes med eller bortskaffes sammen med almindeligt husholdningsaffald, når det er udtjent.

Produktet skal afleveres til det lokale affaldsindleveringssted til genbrug.

Kontakt venligst afdelingen for bortskaffelse af affald i din kommune angående yderligere information.

Uhensigtsmæssig bortskaffelse af affald kan have en negativ virkning på miljøet og folks helbred, da det kan indeholde potentielle, farlige substanser. Med din medvirken i henseende til forskriftsmæssig bortskaffelse af dette produkt, kan du bidrage til genbruge, recirkulere og genindvinde produkterne og samtidigt medvirke til, at vores miljø vil blive beskyttet.

DEUTSCH

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

Dieses Symbol (ausgekreuzte Mülltonne) auf dem Produkt bezeichnet, dass Altgeräte 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.

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.

PORTUGUÊS

Equipamentos Eléctricos e Electrónicos recolhidos seletivamente de acordo com a Diretiva relativa aos resíduos de equipamentos elétricos e eletrónicos (WEEE - 2012/19/EU)

O símbolo (caixote 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 sua 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 elektrisk eller elektronisk utrustning (WEEE - 2012/19/EU)

Denna symbol (en överkorsad soptunna) på produkten innebär att produkten ej ska blandas eller slängas med ditt hushållsavfall när den är förbrukad.

Produkten ska lämnas till en lokal insamlingsplats för denna slags produkter för återvinning.Kontakta kommunkontoret för närmare detaljer om var du finner sådana insamlingsplatser.

Olämplig avfallshantering kan få negativa effekter på miljön och på mänsklig hälsa då en produkt kan innehålla farliga ämnen.

Vi ber om ditt samarbeta i bortskaffningen av denna produkt för att bidra till återvinning, återanvändning och en hälsosammare miljö.

SUOMI

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

Tuotteeseen merkitty symboli (ylitse ruksattu jätesäiliö) osoittaa, että tuotetta ei saa sekoittaa eikä hävittää talousjätteiden kanssa.

Tuote on luovutettava sopivaan tällaisten laitteiden kierrätyksestä huolehtivaan keräyspisteeseen.

Pyydä lisätietoja jäteasioista vastaavilta paikallisilta viranomaisilta.

Tämän tuotteen asianmukaisen hävittämisen varmistamisella autetaan estämään sen mahdolliset ympäristöön ja terveyteen kohdistuvat haittavaikutukset, joita voi aiheutua muussa tapauksessa tämän tuotteen epäasianmukaisesta käsittelystä. Hävittämällä tuotteen asianmukaisesti autat varmistamaan, että tuote uudelleenkäytetään, kierrätetään ja kerätään ja ympäristöä suojellaan.

BCA.00165.0

NOTES