

# **ELECTRIC VEHICLE CHARGING STATION**

## **SERVICE MANUAL**

Document No.: **3-21-11.0042- Plug Charger Go 30\_SER\_A\_EN**

TYPE	Plug Charger Go 30
YEAR OF PRODUCTION	2022
DOCUMENTATION VERSION	A

**KEEP TO USE IN THE FUTURE**

**Zielona Góra 2022**

This documentation is the property of Ekoenergetyka-Polska S.A. and cannot be used or reproduced without the consent of the owner.

Table of changes			
Revision No.	Date	Responsible for the change	Brief description
A	11.10.2022	N. Bukowiecka	Creation of documentation

<u>Created</u>	<u>Checked</u>	<u>Approved</u>
Natalia Bukowiecka	Julita Gmyrek	Wojciech Bordych









## TABLE OF CONTENTS

1.	SAFETY.....	5
1.1.	Designation of symbols.....	5
1.2.	General information.....	5
1.3.	The 5 safety rules .....	6
2.	INTRODUCTION.....	8
3.	ELECTRICAL CIRCUITS .....	9
3.1.	AC current circuits supplying all elements of the charging station .....	9
3.2.	The VDC circuit .....	10
3.3.	Control and signal circuits .....	11
4.	CONNECTING INSTRUCTION .....	14
4.1.	Charging station supply cables connecting introduction .....	14
5.	DIAGNOSTICS.....	15
5.1.	Rules of conduct in case of failure or interference in the charging station.....	15
6.	PERIODIC CHECKS OF THE CHARGING STATION.....	16
6.1.	Periodic checks.....	16
6.2.	Visual inspection.....	16
6.3.	Checking the electric installation.....	17
6.4.	Checking the tightening torques of the apparatus.....	18
7.	EQUIPMENT OF THE AUTHORIZED SERVICE FACILITY.....	20
8.	SUMMARY OF THE BASIC CONTROL AND SERVICE ACTIVITIES ALONG WITH INFORMATION REGARDING APPLICABLE TOOL AND MEANS OF PERSONAL PROTECTION	21
9.	REPAIR INSTRUCTIONS.....	23
9.1.	Removing the service cover .....	23
9.2.	Replacement of the power module .....	23
9.3.	Particles filters changing.....	24
9.4.	Tests of safety devices .....	26
9.5.	Measuring of resistance insulation .....	26
10.	CHECKING THE INSULATION.....	28
11.	REGISTER OF CONDUCTED SERVICE INSPECTIONS .....	30
12.	REGISTER OF CONDUCTED MEASUREMENTS .....	31


13. FAILURE REGISTER .....	32
14. REPAIR / REPLACEMENT REGISTER .....	33
15. LIST OF FIGURE AND TABLES.....	34



# 1. SAFETY

## 1.1. Designation of symbols

Danger	
 <b>Danger !</b>	Not following these rules may lead to the threat of death or heavy health damage.
 <b>Warning !</b>	Potentially dangerous situations. Not following these rules may lead to the threat of death or heavy health damage.
 <b>Caution !</b>	Not following these rules may lead to heavy health damage.
 <b>Beware !</b>	Not following these rules may lead to the equipment damage.
	ATTENTION – Possibility of electric shock, pay specific attention.
Information	
 <b>Note!</b>	INFORMATION-ADVICE - We bring this specific detail to your attention.
	Before starting read the user manual.
	The device may be serviced only by the trained staff.

## 1.2. General information

- There are **dangerous voltages** in the charging stations. Not following the warnings or failing to follow the instructions of this documentation may result in significant property damage, serious injury, or even death from  **Danger !** electrical shock.
- The charging station can be operated by **qualified people only**. Those people must be thoroughly familiar with the safety notices, terms, method of installation and operation, and measures to maintain the equipment in good condition included in this documentation.

- **Risk of electric shock!** Charging station contains large capacity values, which is why when one turns the power supply off the voltage inside the device may remain. 
- The device may be used for the purpose specified by the manufacturer only. Any modifications and the use of replacement parts that are not sold or recommended by the manufacturer may cause an electric shock or equipment damage.
- Proper device operation is related to the proper storage and safe transportation to place of the installation, as well as professional connection and maintenance. Instructions to these aspects are given in later on in this documentation.
- This documentation should be kept near the device and, if necessary, be available to each user.  **Note!**
- If one needs to take measurements with the device being turned on, he or she should follow the safety rules and use technically efficient measuring instruments.
- Repairs of the device may be performed only by the service personnel from Ekoenergetyka - Service sp. z o. o. (contact: +48 690 23 23 23; e-mail: service@ekoenergetyka-service.com) or authorized service. Self-repair can lead to electric shock and significant damage to property both during the repair and the subsequent operation.
- The device requires an inspection every 12 months, which is a condition for safe operation and to maintain the warranty.
- The device is equipped with an emergency button.

### 1.3. The 5 safety rules

1. Disconnect completely - meaning that the electrical installation must be disconnected from live parts on all poles.
2. Secure against re-connection - reliably prevent the accidental re-connection of an installation where work is in progress. This is achieved by replacing turned off fuses in the low-voltage system with lock-out devices.
3. Verify that the installation is dead - is the installation really dead now? Use suitable measuring / test equipment, such as a voltage detector, to verify the absence of operating voltage on all poles of the electrical installation. Check the correct function of the voltage detector prior to use.

4. Carry out earthing and short-circuiting - if the installation is dead, connect the cables and the earthing system with short-circuit-proof earthing and short-circuiting devices. Important: The relevant parts must be earthed before they are short-circuited!
5. Provide protection against adjacent live parts - according to the five safety rules, adjacent parts are parts located in the vicinity zone. If parts of an electrical installation in the vicinity zone of the work location cannot be disconnected, additional precautions must be taken before work starts. In this case use insulating protective shutters or covering material as protection against accidental contact.

## 2. INTRODUCTION

This service manual is the basic source of information for personnel conducting installation, inspection and repair activities. Scope of the use and operation conditions of the charging station have been described in the operation manual. Any user who proceeds to install, start and use the charging station, should thoroughly read this documentation and every time before starting, technical condition of the device must be checked.



Attention: Emergency stop may be used to stop the charging only in the case of situations that are dangerous to life or property. Its use will result in immediate shut down of the device.

Unlocking of the emergency stop is done by twisting it and it is allowed only after removal of the causes of device failure.



**Warning !**

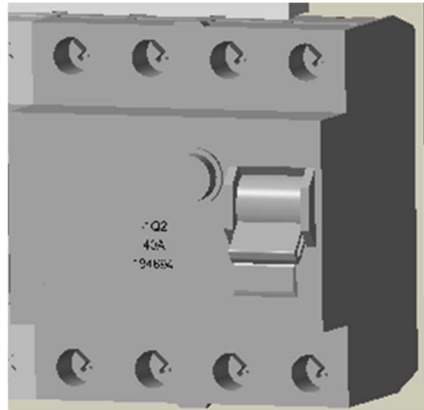


### 3. ELECTRICAL CIRCUITS

All electric circuits of the charging station can be divided into three main groups:

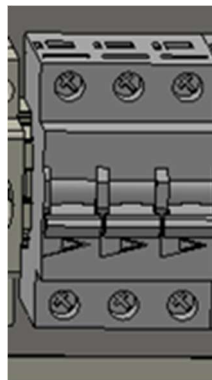
#### 3.1. AC current circuits supplying all elements of the charging station

The charging station is powered by an 3 x 400 V AC. The main protection of the charging station at the input is a circuit breaker (Fig. 1).



**Figure 1 Circuit breaker**

Power modules are over-current protected. Each module is protected by a 63A miniature circuit breaker. The power supply of the power modules is switched on via the AC contactor.



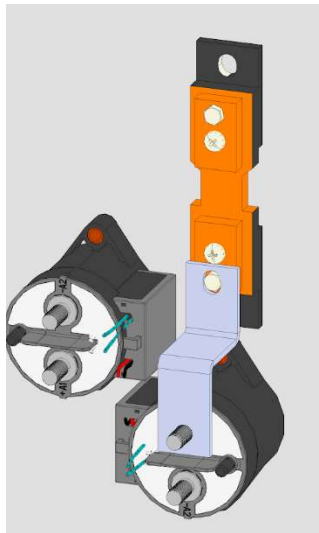
**Figure 2 Over-current protection of modules**



**Figure 3 Power modules**

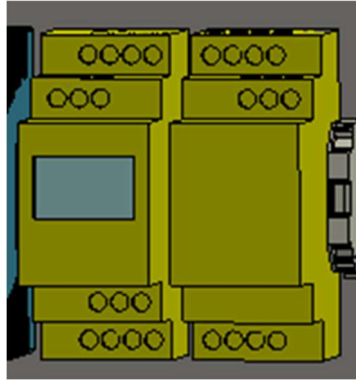
### 3.2. The VDC circuit

The voltage supplied by the power modules, within the range of 150 VDC to 950 VDC, is then applied to the copper bus bars, that serve as connection points for the cables connecting the charging station with the charging platform. The output circuit is being connected and disconnected by the means of a power contactor. The DC output circuits of the power modules are individually protected by an internal fuse. In the event of damage, the power module must be replaced.



**Figure 4 DC power contactors**

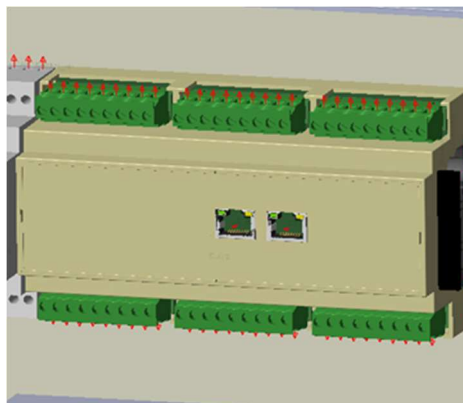
An additional protection is ensured by electronic insulation monitoring devices (*Fig. 5*), serve to protecting people from the threat of an electric shock as well as increasing the fire safety.



**Figure 5 Electronic insulation monitoring devices**

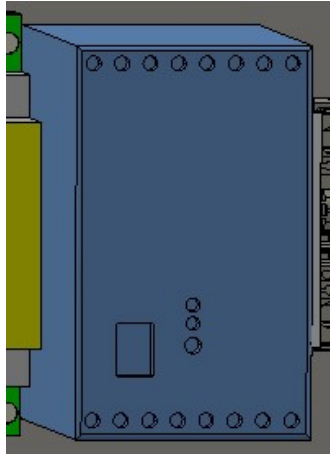
### **3.3. Control and signal circuits**

The CLC3 charger controller (fig. 6) is responsible for managing the vehicle charging process. The device is equipped with a CP (Control Pilot) line controller for communication with the vehicle being charged, as well as interfaces: CAN, RS485, Ethernet, and binary inputs and relay outputs. Thanks to this, it is possible to control the operation of other elements of the charger, such as: power modules, contactors, buttons, measuring devices, etc.



**Figure 6 CLC3 charger controller**

The device responsible for the communication between the vehicle and the charging station is Insys communication module (Fig. 7). This device converts the information transmitted from the main controller CLC3 in accordance with the standard IEC 61851-23, IEC 61851-24, ISO 15118 and DIN 70121 standard via PLC.



**Figure 7 Insys module**

Control circuits are powered by 24 V DC through a power supply (*Fig. 8*).



**Figure 8 Power supply**

In the signaling circuits there is a control panel in the form of a 7 " touch screen integrated with an RFID reader. Additionally, in the rear part of the charger there is an ignition switch for the charging station, an Ethernet socket and a safety switch:



**Figure 9 Arrangement of the user interface elements on the charging station**

1. Touch screen integrated with RFID reader
2. Charging connector no. 1 (Combo-2 (Type2 / Mode4))
3. Safety switch
4. Ethernet socket
5. Ignition switch to start the charging station
6. Receiver socket 63A

The emergency switch is only used to finish charging in situations where life or property is at risk. Its use will immediately turn off the device.

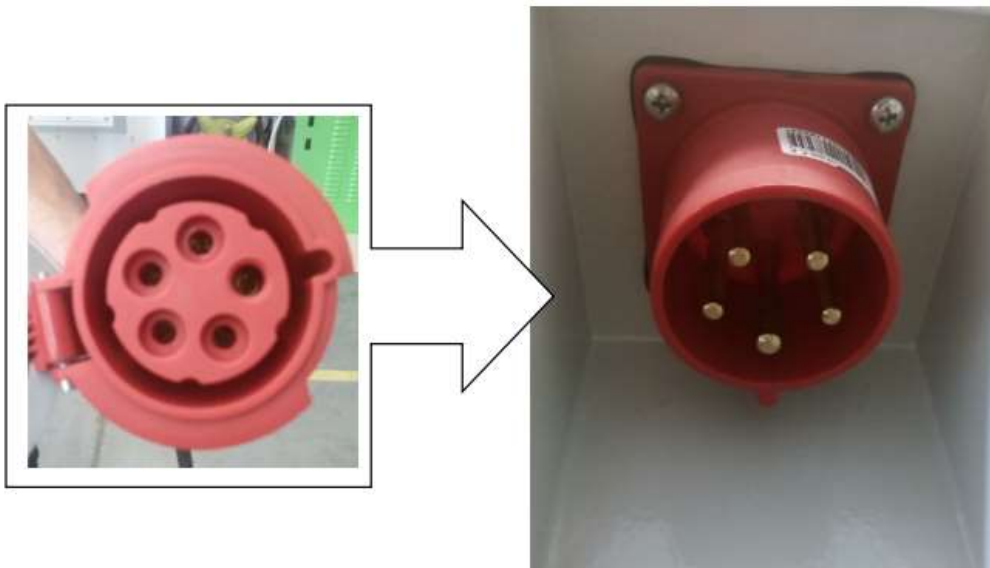
The emergency stop switch is unlocked by turning the safety button and is allowed only after removing the causes of the failure of the device.

## 4. CONNECTING INSTRUCTION

### 4.1. Charging station supply cables connecting introduction

Fig. 10 shows the charging station's power connection point. The power cord must be connected to the receiver socket. The receiver socket that will be used to power the charging station must have a 63A fuse.

Attention! Before connecting to the network, make sure that the device is properly secured.



**Figure 10 Connection point**

## 5. DIAGNOSTICS

### 5.1. Rules of conduct in case of failure or interference in the charging station

A failure during charging is indicated by information on the display.

In the event of any failure, it is necessary to discontinue use of the charging station and to follow the instructions below.

In the event of a failure or disturbance in the operation of the charging station, follow the steps below:

- Pull the plug out of the vehicle;
- Reset the vehicle;
- Connect the plug and perform a charging test.

If the charging process is not carried out correctly, repeat the above steps.

If the charging station is still not working properly:

- Pull out the plug;
- Reset the charger by pressing the safety switch and unlocking it;
- Retry charging after the device has booted up.

If the charging process does not start, repeat the steps from the above.

If the charging station still does not work properly after carrying out all the above steps, contact the operator (contact the service center).

## 6. PERIODIC CHECKS OF THE CHARGING STATION

### 6.1. Periodic checks

Electric vehicles charging stations require periodic inspection conducted every 12 months by authorized service. The inspections ensure safety and proper operation of the charging station. This type of inspection must be conducted every time after any additional service works. Two people should be present during the performance of inspection.

Inspection consists of:

- Detailed visual inspection of the device – visual assessment of mechanical condition on the outside of the housing and on the inside of the housing,
- Examination of the electrical installation – inspection in the context of 12-months intervals allowing for the verification of proper operation and functioning of the electric and electronic installation. Every 5 years, measurements of electric shock protection must be conducted.

### 6.2. Visual inspection

During visual inspection, the power supply of charging station must be turned off, unless the specific inspection points require to be checked with enabled power supply. To do this, you need to disconnect main protection i.e. . circuit breaker. During visual inspection of the charger, service doors should be opened to provide free access to all components inside the device. During inspection, you need to pay particular attention to:

- technical condition of wheels,
- any mechanical damages of the device housing,
- occurrence of corrosion in places particularly exposed to atmospheric conditions,
- technical condition of the locks in the inspection doors,
- technical conditions of the gaskets on inspection doors and protective walls,
- presence of water inside the housing of charging station,
- technical conditions of the cable grommets,
- presence of nameplate,
- presence of electrical diagrams fixed on the inner side of the inspection doors,



- correctness and stability of the assembly of individual components of the device, (first of all contactors, power modules).
- contamination level of filters in the ventilators and their permeability,
- correct operation of the outside and inside (service) lighting of the charging station (inspection must be conducted with enabled power supply).

### 6.3. Checking the electric installation

During every 12-month inspection, visual and basic control of the electric installation must be conducted by electrician with operational authorization for electric devices up to 1 kV. During inspection of the electric installation, the following elements should be carefully examined:

- condition of the wire insulation,
- condition of the electric connections.

At the same time, the following elements should be checked:

- presence of all phases supplying the charging station (after enabling the voltage),
- condition of the protections of individual circuits,
- correct operation of differential current switches with the use of testing button,
- whether the voltage is correct on the service sockets inside the charging station,
- condition of the voltage of batteries sustaining the operation of main electronic module in the case of power failure (if any),
- technical condition and functioning of the emergency stop button - pressing of this button results in disabling of the safety, which is responsible for feeding the power to the control electronics,
- whether the automatic breakers have been replaced for the improper ones,
- whether the fuse links have been replaced for the improper ones,
- whether the modifications have been implemented that are not compliant with electric diagram of the device,

- whether the protective wires have been removed (which can exist as separate wires) in the protection system against electric shock (ground).

During every 5-year inspection, measurements and examination of electric shock protection must be conducted by electrician with measuring authorizations.



Range of the measurements includes:

- measurement of trigger current of differential current switch,
- measurements of insulation resistance of the device,
- measurement of the PE circuit continuity,
- measurement of earth fault loop impedance test.

#### 6.4. Checking the tightening torques of the apparatus

Twice a year, for mobile charging stations, the tightening torques of the following devices should be checked. Use a torque wrench for this.

**Table 1 Tightening torques**

TAG	DESCRIPTION	KATALOG	MANUFACTURER	PCS.	TIGHTENING TORQUES
-6Q2	2354431	Differential circuit breaker 4P, 63A, 30mA, 230-400V 50-60Hz	EATON	1	2 - 2,4 Nm
-15K5 -15K6	EVR250A-24B	Contacteur EVR250A-24B 1NO	YM Tech Co., Ltd.	2	2,5 - 3,5 Nm
-14K2 -14K2.2	862190	Interface relay 2P 8A 24V DC	RELPOL	2	0,7 Nm
-6K9	BF6500A230	Power contactor 65A AC3 3P 230V AC 0Z 0R	LOVATO	1	0,8 - 1 Nm

-8K5	863183	Time relay 2P 1sec-10days 12-240V AC / DC 50 / 60Hz multifunction RPC-2MA-U	RELPOL	1	0,5 Nm
<p>Further reviews: - twice a year- mobile charger.</p>					

## 7. EQUIPMENT OF THE AUTHORIZED SERVICE FACILITY

Set of tools needed to carry out periodic inspections of the charging stations:

- set of allen keys;
- set of flat keys;
- wrench set wrench;
- dynamometric key;
- set of insulated tools (flat and cross screwdrivers, side pliers, combination pliers, knife, stripping tool, voltage tester);
- a handle for replacing knife fuses;
- digital multimeter;
- a cable crimper with a cross-section of up to 16 mm<sup>2</sup>;
- inspection machine;
- a set of cleaning agents;
- equipped with spirit levels.

## 8. SUMMARY OF THE BASIC CONTROL AND SERVICE ACTIVITIES ALONG WITH INFORMATION REGARDING APPLICABLE TOOL AND MEANS OF PERSONAL PROTECTION

All the following procedures must be carried out with the use of technically operational tools and they must be used as intended. During each step, you need to take all necessary precautions and focus on the conducted activity.




**Caution !**

**Table 2 Summary of control and service activities**

Periodic checks of the charging station			
Tasks	Necessary tools	Protection measure	Remarks
Opening the service doors	Keys for locks	none	none
Disconnection of security	none	none	Binding of the switch fuse enables safe disconnection of the circuit without the use of additional tools. Be careful when switching on and off.
Disassembly of rear curtain wall	Allen key	Using of protective gloves is recommended	After unscrewing all mounting screws, gently remove the cover and store it in a safe place for the periodic inspection or service.
Visual inspection: - Technical condition wheels - Mechanical damage of the housing -Occurrence of corrosion - Condition of the door locks - Presence of water within the housing - Condition of the cable gland - Presence of the nameplate - Presence of electric diagrams - Condition of the charging station equipment installation - Functioning of the external and internal illumination (when the power is on)	Flash light inspection	Protective gloves are recommended here	none

Periodic checks of the charging station			
Tasks	Necessary tools	Protection measure	Remarks
- Control of signalization on the operator panel (when power is on)			
Visual inspection (service activity): - The level of filter contamination by ventilation grilles and its replacement	Socket wrench or flat spanners	none	In order to inspect the filter, unscrew the cover
Visual inspection of electrical charging stations: - Condition of electrical connections - Condition of the short-circuit - Checking the correctness of security - Checking the presence of all compensatory connections - Security status of each circuit - RCD test using the 'test' button	Flash light inspection	Protective gloves are recommended here	none
Checking the operation of the electrical system (with the power on): - Presence of the supply phases - Voltage at the service socket inside the charging station - State of the battery voltage supporting the functioning of the control modules - Functioning of the emergency switch button	Voltage tester, digital multimeter	none	These measurement procedures should be carried out with technically proficient insulated tools. Use extreme caution when working with the power on!
Replacement of the fuse links	Handle with protective sleeve to replace the fuse knife	Handle with protective sleeve to replace the fuse knife	none
Replacement of damaged charger connector	Set of keys. Set of insulated tools.	Use of protective gloves is recommended.	none
Replacing a DC contactor	A set of keys: combination wrenches, sockets, Allen. Set insulated tools.	Protective gloves are recommended here	none

## 9. REPAIR INSTRUCTIONS

Before making any service work make sure that the charging station is disconnected from the power supply, then wait 5 minutes for the capacity to discharge and check that there are no dangerous voltages on the terminals.  **Danger !**

### 9.1. Removing the service cover

Removing of the rear cover must be taken by two people. While holding the rear cover, you need to gradually loosen all the screws (the screws marked on the figure 11). Then carefully take off the cover and disconnect the protective wire. The cover should be put in a safe place, inaccessible to unauthorized people. Assembly activities must be carried out in the reverse order.



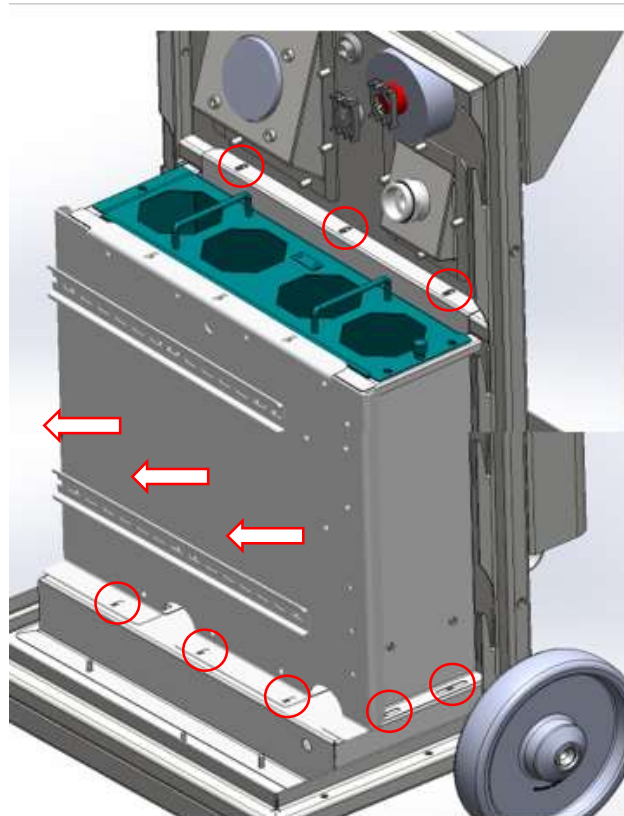
**Figure 11 Removing the cover**

### 9.2. Replacement of the power module

The photo (Fig. 4) shows the power module located inside the station. To replace the module, perform the following steps (Fig. 12).

- Disconnect the charging station from the power supply and wait 5 minutes to allow the devices to discharge,
- Check with the meter that there is no voltage on the terminals,
- Unscrew the screws securing the walls and remove the side walls of the charger;
- Loosen the fastener marked in Fig.12 and slide the whole assembly slightly forward;

- unscrew the module mounting screws,
- Unscrew and disassemble the power socket and the panel socket, and then arrange the wires to enable the module disassembly;
- Pull the module out of the mounting cassette;
- Place the new power module in the chassis and screw the screws back into place;
- Reassemble everything in reverse order;



**Figure 12 The power module view**

### **9.3. Particles filters changing**

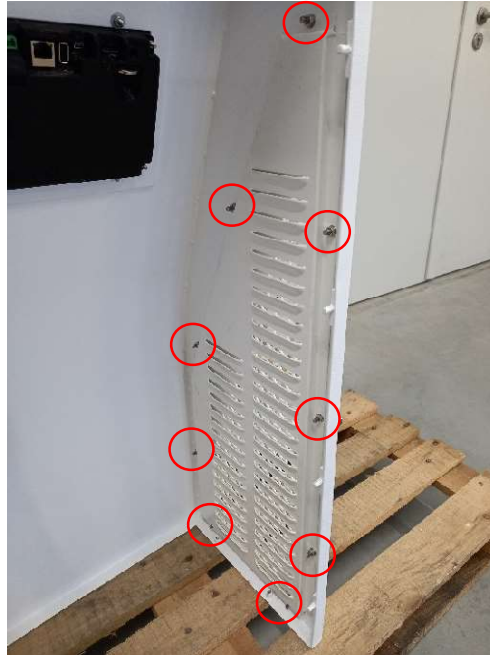
To replace the filter mat, follow these steps:

- Disconnect the charging station from the power supply and wait 5 minutes to allow the devices to discharge;
- Check with a meter that there is no voltage on the terminals;
- Unscrew the fastening screws marked in Fig.13 and remove the cover of the ventilation opening;
- Remove the filter mat;



## Plug Charger Go 30

- Clean the vents from dust and dirt particles;
- Cut a new sheet of filter material (FL 200);
- Place a new mat over the air vent, making sure the blue side of the mat is facing out of the housing, and screw the cover down.



**Figure 13 Filter covers view**

#### 9.4. Tests of safety devices

To test the functionality of the safety button, do the following:

- start the charging process;
- press the safety button;
- check that the display is turned off.

If the display is off, the charging process has been interrupted and the safety button is working properly.

After the test, the button should be unlocked by turning it.

To test the operation of the "STOP" button, proceed as follows:

- start the charging process;
- press the "STOP" button.

If the display shows that charging has been interrupted, the charging process has been interrupted and the button is working properly.

#### 9.5. Measuring of resistance insulation

In order to perform the **insulation resistance measuring** device efficiency test, follow these steps:

- connect the resistor at the test points in accordance with the given sequence (*Fig. 14*),
- run the charging process by connecting a vehicle simulation device and perform the test.

The insulation meter BENDER ISOEV 425 has two alarm threshold:

- 1st threshold - 400k $\Omega$  - warning about insulation drop,
- 2nd threshold - 80 k $\Omega$  – alarm, stops the charging process.

If the LEDs on the operator panel turn off within 10 seconds or the indicator light turns red, the meter is functioning properly.

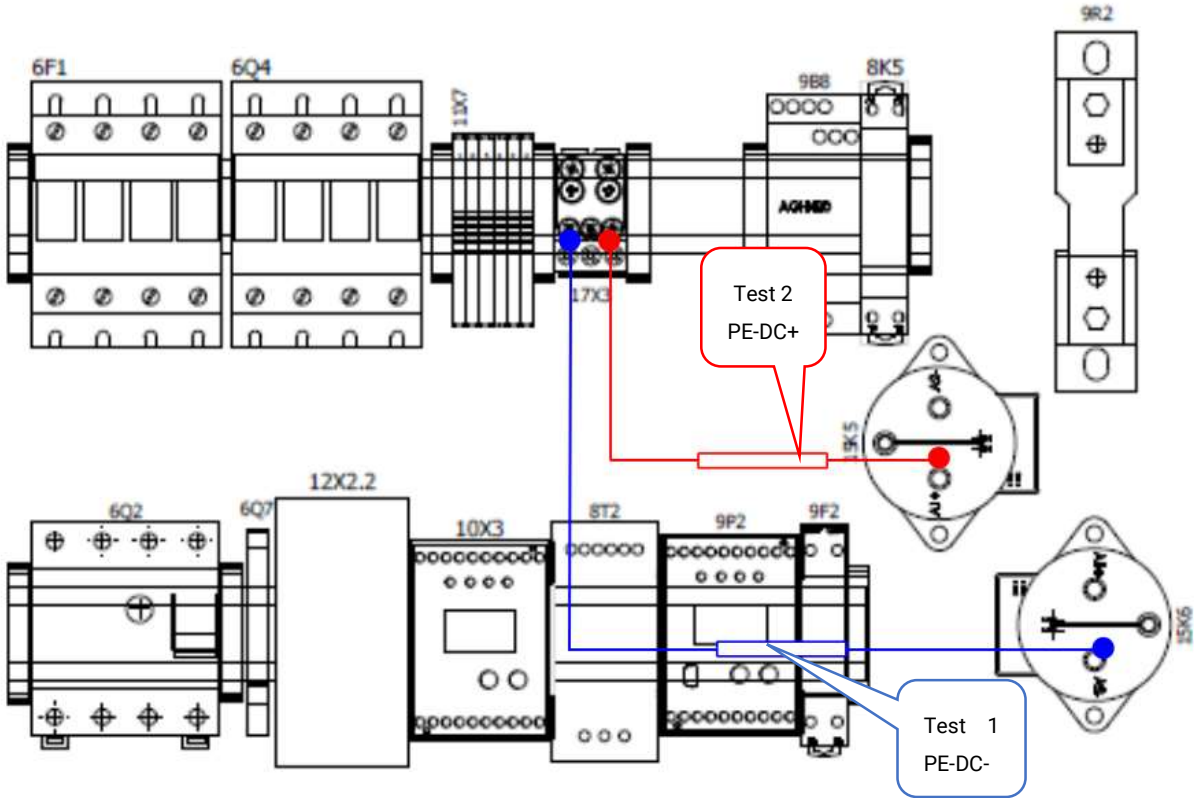


Figure 14 Test of insulation resistance measuring device Bender ISOEV 425

## 10. CHECKING THE INSULATION

When measuring the insulation resistance, the device must not be live!  
Electrical measurements may only be performed by an electrician with  
operating licenses for electrical devices up to 1kV.



The measurement should be performed in accordance with the PN-HD 60364 -6:2016-07.

Measurement of insulation resistance should be performed in accordance with the instruction manual of the measuring instrument used, the measurement result is read after the indication becomes stable.

Before taking measurements:

- Disconnect the charging station from the power supply
- Remove the power modules (-7F4),
- Short the current terminals of the AC contactor (-6K9) (L1-T1, L2-T2, L3-T3),
- Short-circuit the current terminals of the DC contactors (-15K5, -15K6) (A1+, A2-),
- Disable security -6Q2, -9R2,
- Disconnect the wires L1/+ i L2/- from insulation meters -9B7, -9B8,

Measurement of the insulation resistance of the AC side should be performed with a test voltage of 500V.

The AC side insulation resistance measurement must be at least 1MΩ (RISO ≥ 1MΩ). This value is considered to be the limit (acceptable) value.

Measurement of the DC side insulation resistance should be performed with a test voltage 1000V.

The result of the measurement of the insulation resistance of the DC side must be at least 1MΩ (RISO ≥ 1MΩ). This value is considered to be the limit (acceptable) value.

The test should be performed according to the measuring points marked in the wiring diagram, in the order presented in the table below:

ON	Circuit name	Measurement point 1	Measurement point 2
1	Side AC	MP_L1	MP_PE
2		MP_L2	MP_PE
3		MP_L3	MP_PE
4		MP_L1	MP_N
5		MP_L2	MP_N
6		MP_L3	MP_N
7		MP_N	MP_PE
8		MP_L1	MP_L2
9		MP_L1	MP_L3
10		MP_L2	MP_L3
11	Connector	MP_C1_DC-	MP_C1_PE
12	Plug-In CCS	MP_C1_DC+	MP_C1_PE
13	COMBO	MP_C1_DC+	MP_C1_DC-

The completed insulation resistance measurement protocol with the results should be attached to the performed measurements.

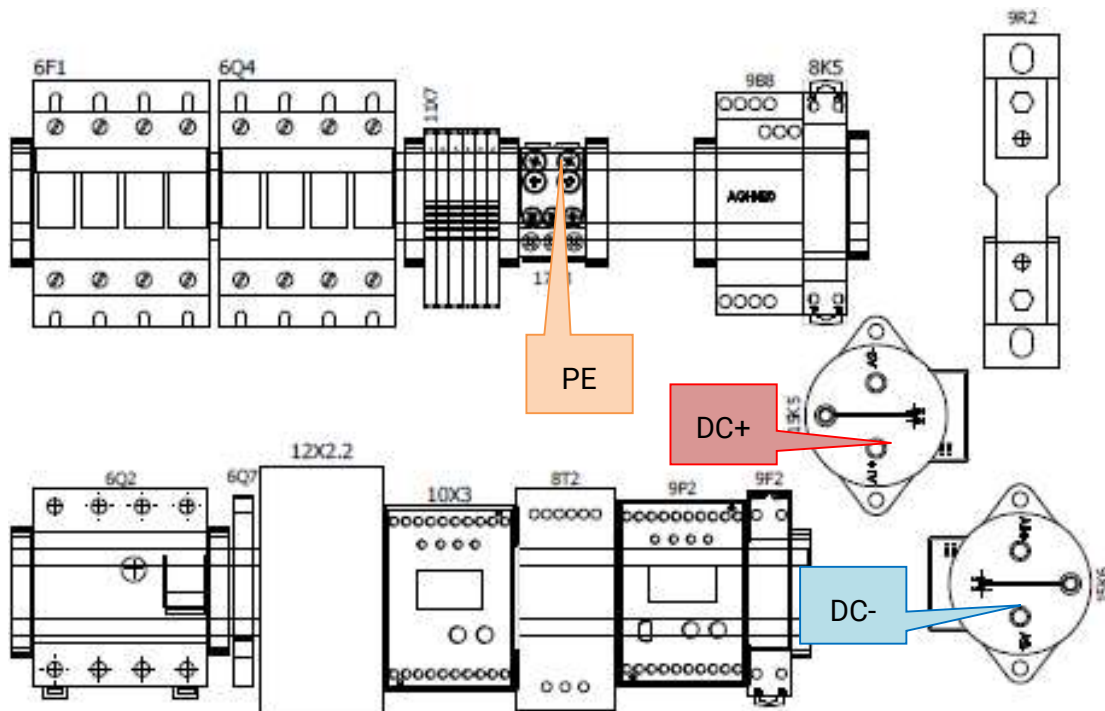


Figure 15 Test of insulation

### 11. REGISTER OF CONDUCTED SERVICE INSPECTIONS

Date	Signature	Visual inspection of the housing	Technical condition of power cables	Technical condition of the charging cable	Conductor insulation condition	Condition of electrical connections	Security status of individual circuits	The correctness of the voltage at the service sockets	Another / Remarks

## 12. REGISTER OF CONDUCTED MEASUREMENTS

Date	Insulation resistance measurement	Short circuit loop impedance measurement	Measurement of tripping of RCDs	Measurement of continuity of protective conductors	Testing the anti-shock installation	Signature

### 13. FAILURE REGISTER

Date	Description of the failure



### 14. REPAIR / REPLACEMENT REGISTER

Date	Description of repair / replacement	Signature

## 15. LIST OF FIGURE AND TABLES

Figure 1 Circuit breaker.....	9
Figure 2 Over-current protection of modules.....	9
Figure 3 Power modules.....	10
Figure 4 DC power contactors.....	10
Figure 5 Electronic insulation monitoring devices.....	11
Figure 6 CLC3 charger controller.....	11
Figure 7 Insys module.....	12
Figure 8 Power supply.....	12
Figure 9 Arrangement of the user interface elements on the charging station.....	13
Figure 10 Connection point.....	14
Figure 11 Removing the cover.....	23
Figure 12 The power module view.....	24
Figure 13 Filter covers view.....	25
Figure 14 Test of insulation resistance measuring device Bender ISOEV 425.....	27
Figure 15 Test of insulation.....	29
Table 1 Tightening torques.....	18
Table 2 Summary of control and service activities.....	21