5. Electrical system components 76.8V

5.1. Troubleshooting

Battery does not charge

- Anomaly in charging point/external charger cable to type 2
- Cable or connection Type 2 to Charger interrupted
- Defective internal charger

The lighting does not work

- Check whether it is a particular lighting component (see chapter 6) or the whole assembly: headlamp, rear lamp, stop lamp, indicators, horn and instrument cluster.
- DC/DC converter fault → 5.4.4.
- Check fuse circuit 12V → 6.20.1. and 6.20.2.

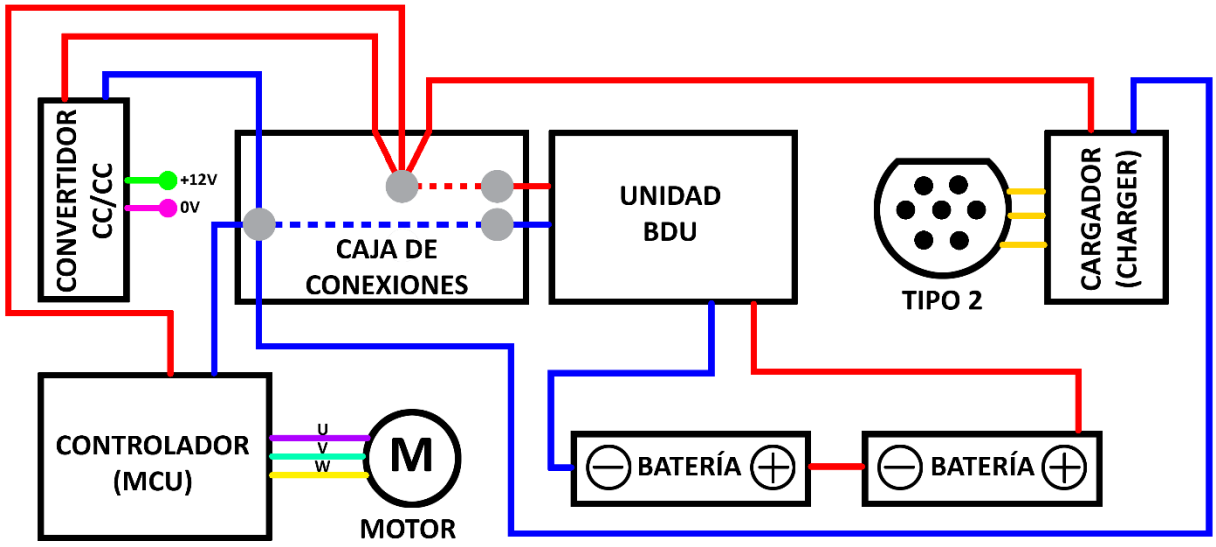
The vehicle does not work and nothing lights up

- Battery connector to BDU disconnected → 5.6
- Loose connection in circuit 76.8V
- CAN BUS cable interrupted or loose connector
- Defective BDU
- Battery problem
- Defective DC/DC converter

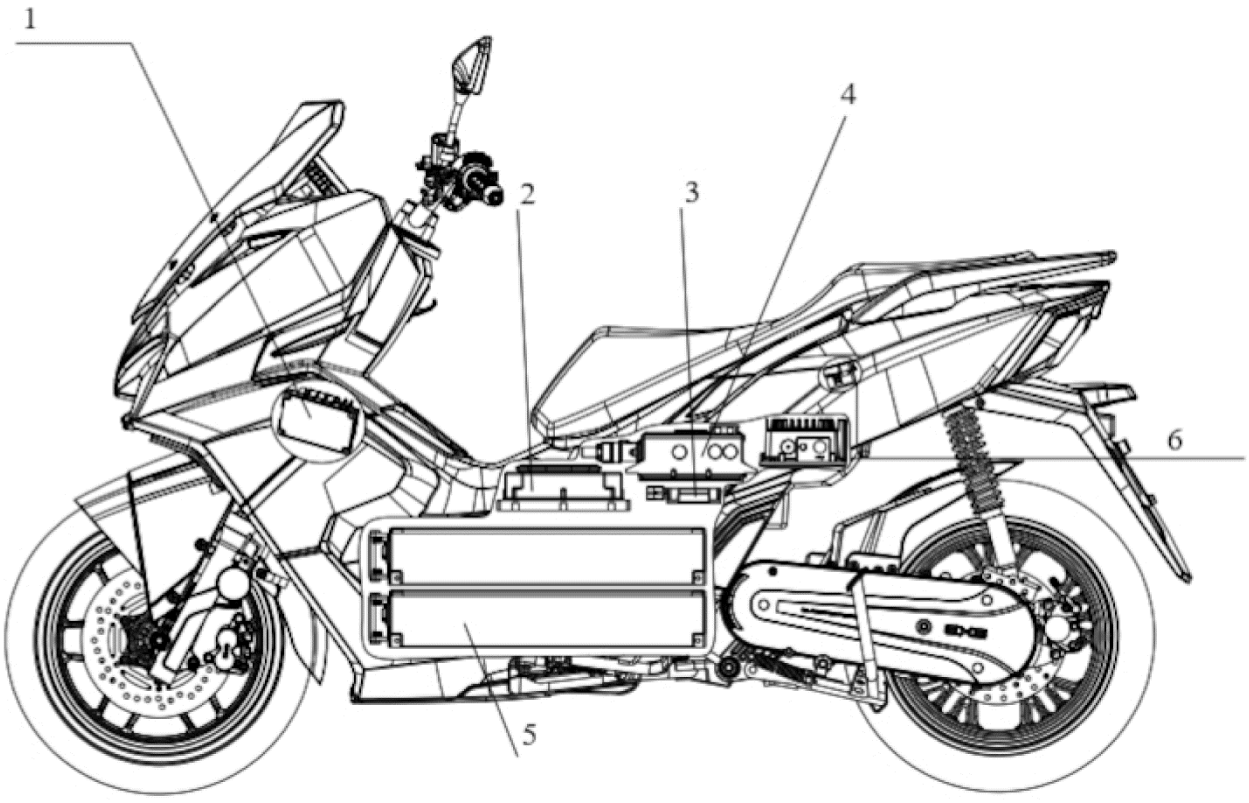
The engine does not work

- The "P" button has not been activated by switching to "D" (Direct) mode.
- Loose or interrupted phase cables
- CAN BUS cable interrupted
- Broken drive belt
- STOP message on TFT screen (this message may appear for various reasons; take the vehicle to a Nerva Service Centre).
- -Defective engine.

5.2. Circuit diagram 76.8V Nerva Lift



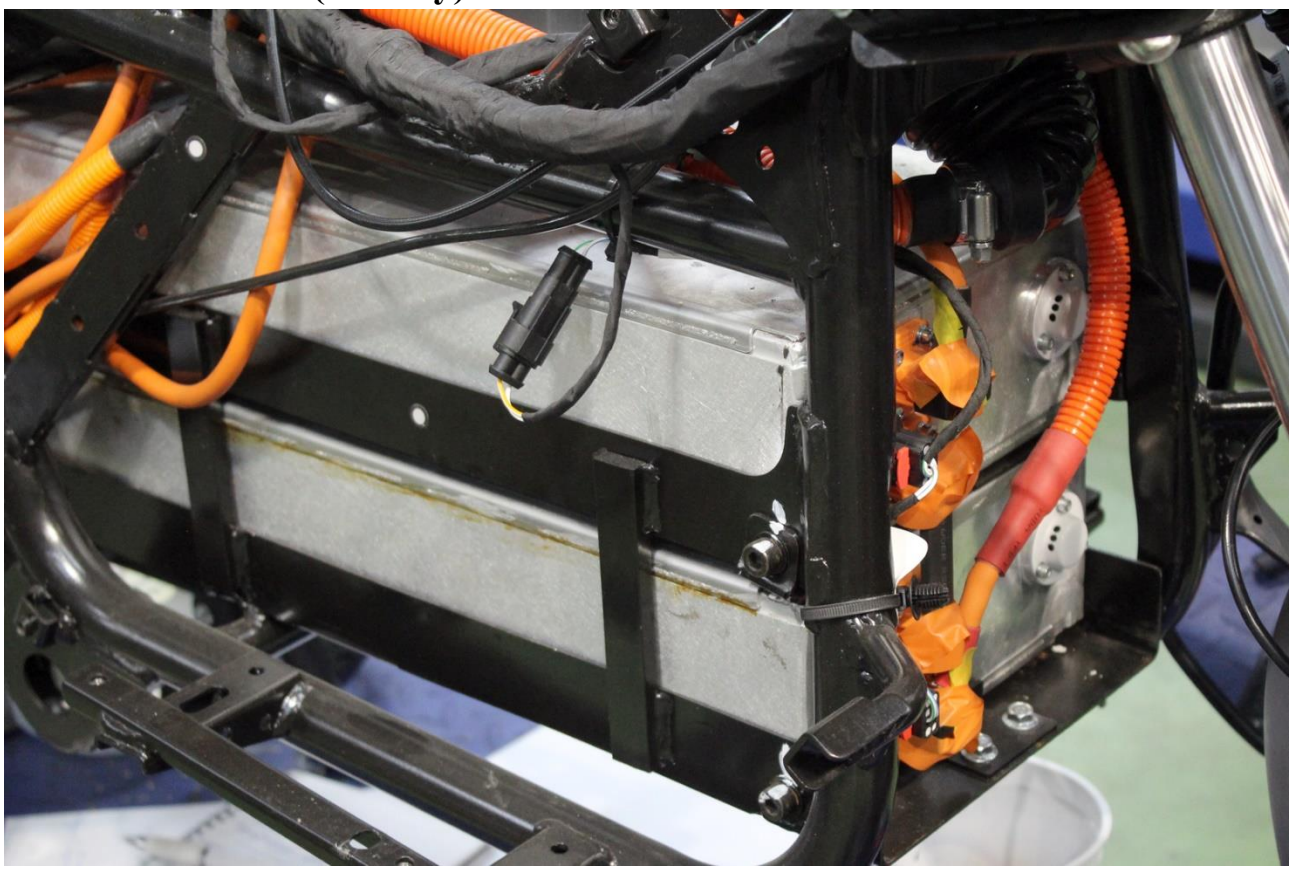
5.3. Circuit component location 76.8V



① DC-DC converter
② Engine controller
③ VCU
④ BDU
⑤ Battery module
⑥ Charger

5.4. Introduction of 76.8V Nerva Lift circuit components

5.4.1. Batteries (Battery)



Nerva is the only motorcycle brand with access to **BYD's Blade battery technology,** which has proven to be **the safest** to date – able to remain virtually undamaged even in accidents involving direct punctures.

With this new battery technology, Nerva takes another step towards its goal of facilitating access to sustainable mobility. Blade batteries are named for their shape, as they have a **form similar to that of a blade** and are atypically small compared to other batteries.

The Blade batteries used in the Lift model consist of individual cells adapted to the dimensions of the vehicle. All these cells are fitted into a kind of matrix, which significantly increases the **use of space by up to 50%.** Their **energy density** is **140 Wh/kg**, which is comparable to the same figure as NCM batteries.

Another important feature to note is that Blade batteries offer a high **degree of safety**. This is based on their design, which makes them a very robust system, to the use of **Lithium Phosphate (LFP) itself,** which has a more stable chemical composition than other lithium batteries. This means that the Blades do not catch fire and do not suffer major damage in the event of accidents.

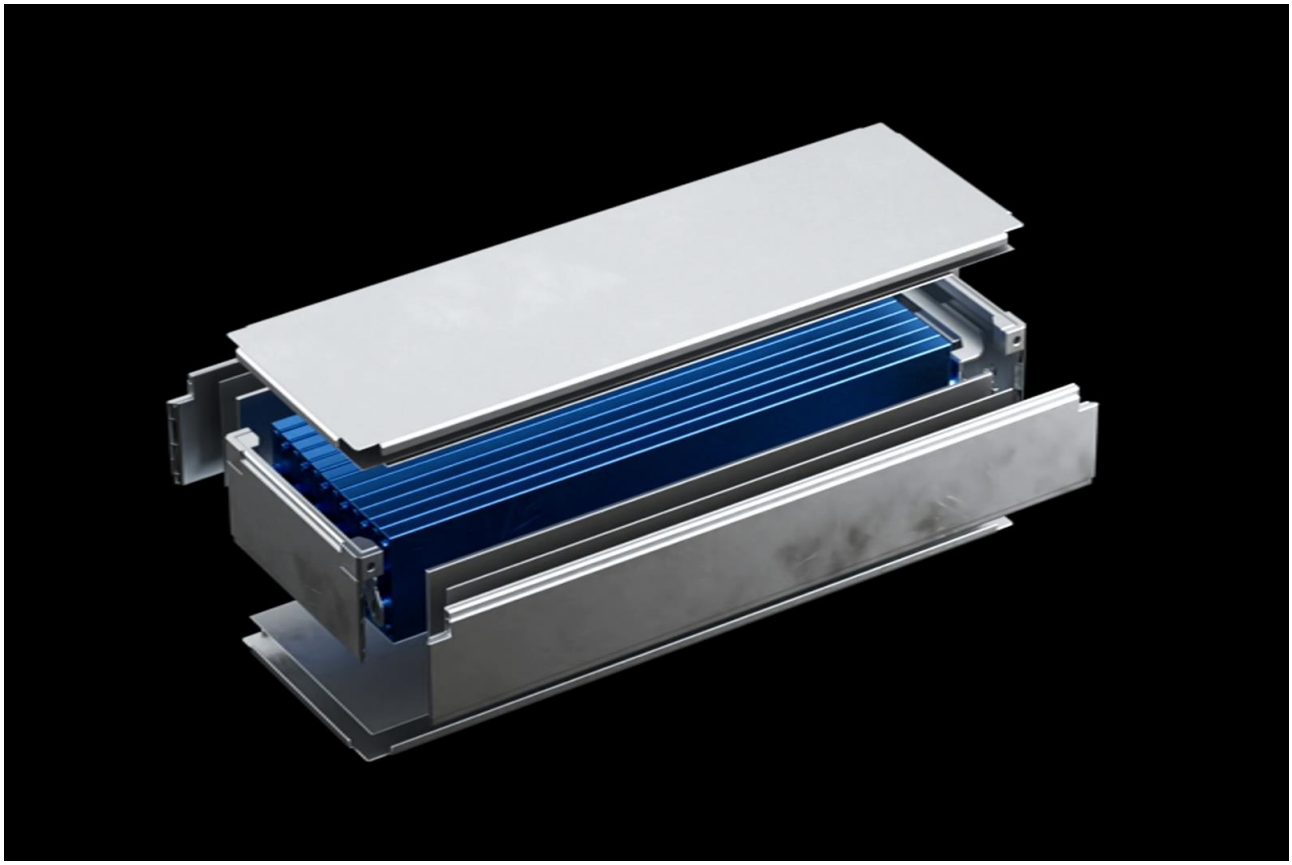
This can be amply demonstrated by what is considered to be the most demanding test for electric batteries. Namely, this is the **piercing test,** which seeks primarily to check how the battery would react to a **short circuit caused by a puncture**. While many other batteries quickly heat up to fire-causing temperatures within seconds, **Blade batteries manage to stay between 30 and 60 degrees** throughout the entire test — meaning the only damage

they sustain is from the actual puncture itself. **No signs of fire are to be seen**.

In addition to this test, BYD has subjected its Blade batteries to many others, including extreme conditions where they were heated to 300 degrees without igniting, and even faced another tough challenge: **crushing**. However, even when subjected to **forces equivalent to a 46-tonne lorry driving over them,** the batteries **remain undamaged** and in good condition for installation and use.

Another advantage of these batteries is that they **can withstand more charge cycles than NMC batteries**. Thus, while NMC batteries are rated for 1,000–2,000 charge cycles, LFP batteries boast a tripled longevity of **4,000–6,000 charge cycles.**

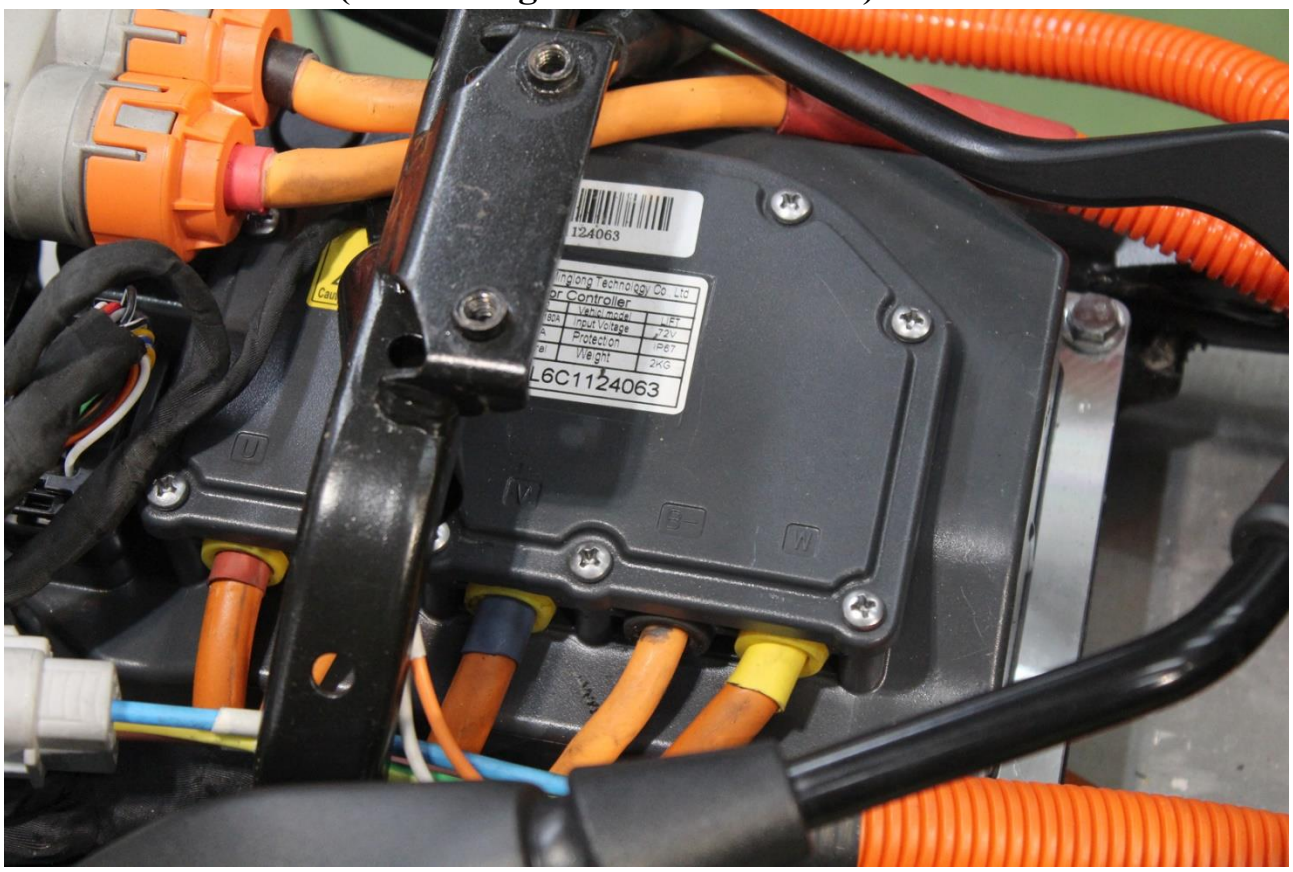
The reliability and safety achieved by Blade batteries is leading more and more manufacturers to opt for them – with these clients including Mercedes Benz, Toyota and Tesla, among others. Currently, **Nerca is the only brand of electric motorbikes on the market that incorporates Blade batteries**. This is a stand-out selling point for this young brand, which was unveiled just over a year and a half ago.



The battery pack of the Nerva Lift scooter consists of **two units arranged in series for a total of 76.8 V with a capacity of 54 Ah**. The weight of both batteries is **35 kg** and is located in the lower centre of the chassis, contributing to its dynamic qualities with optimal mass distribution and a low centre of gravity.

NOTE: Batteries may not be tampered with except with the consent of Nerva. Any suspicious activity involving the battery **will automatically void the warranty**.

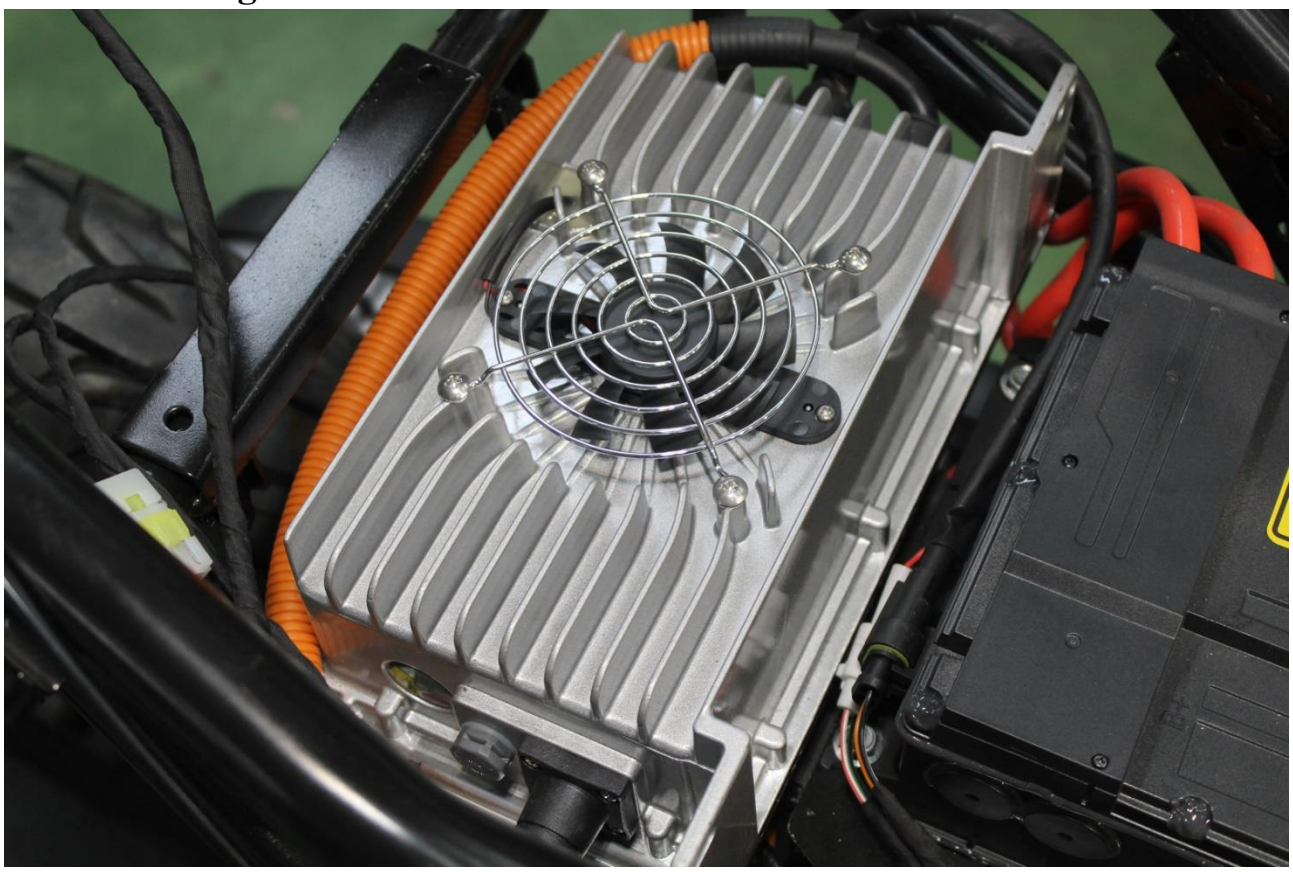
5.4.2. Controller (MCU: Engine Controller Unit)



The controller's task is to regulate the electric engine with the DC power supplied by the batteries, according to the user's dosage via the throttle. Internally, it converts the direct current into the three-phase alternating current needed to power the engine.

It is located above the batteries and in front of the BDU.

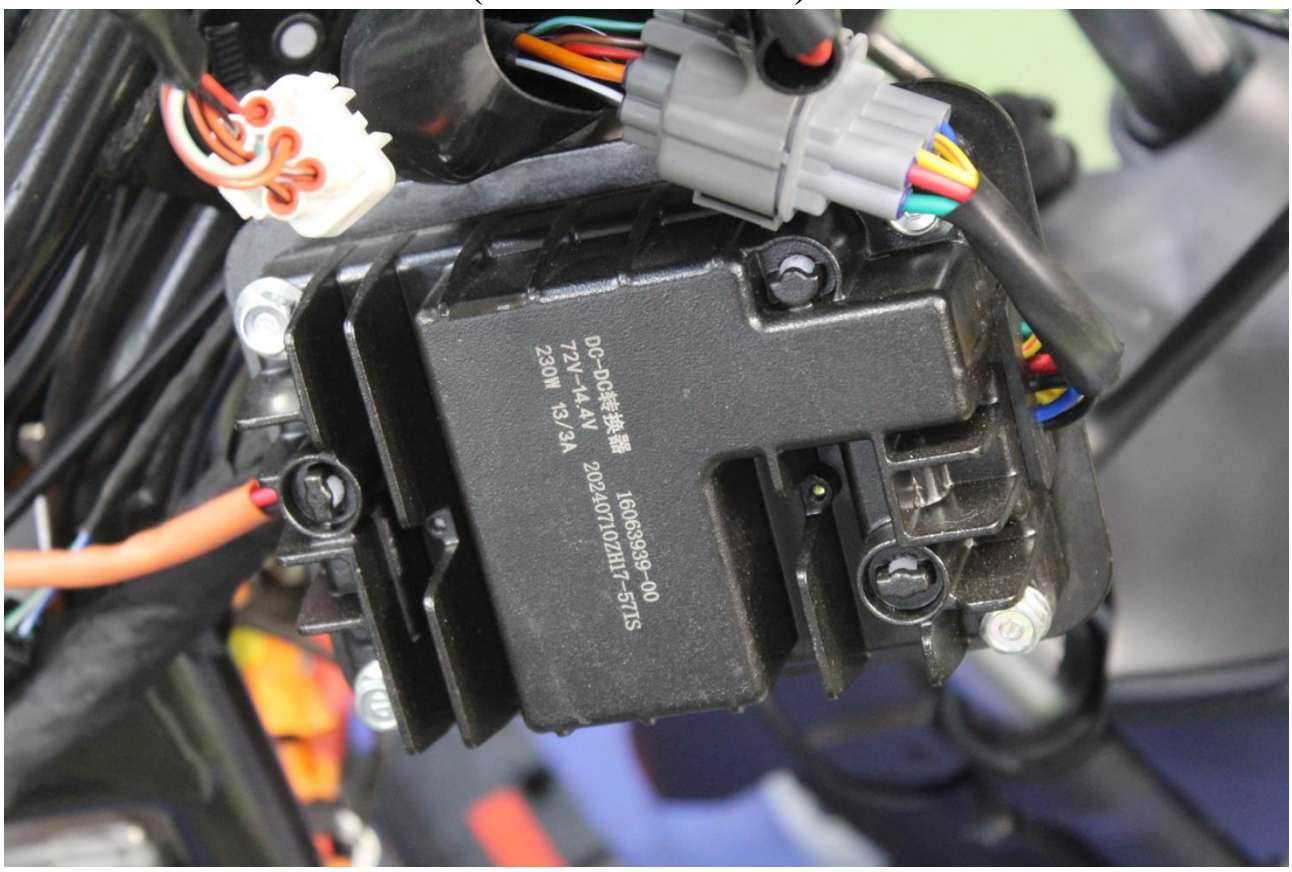
5.4.3. Charger



The purpose of the charger is to recharge the batteries. It starts from an input provided by the three phases of alternating current supplied by the Type 2 connector, either via the external charger connected to the domestic mains via the Shuko connector supplied with the vehicle, or by connecting it to a recharging point. The Charger is contained in a case with a heat sink, to which a fan is added to further cool the electronics inside.

The charger is located behind the BDU at the rear of the scooter.

5.4.4. DC/DC Converter (DC/DC Converter)

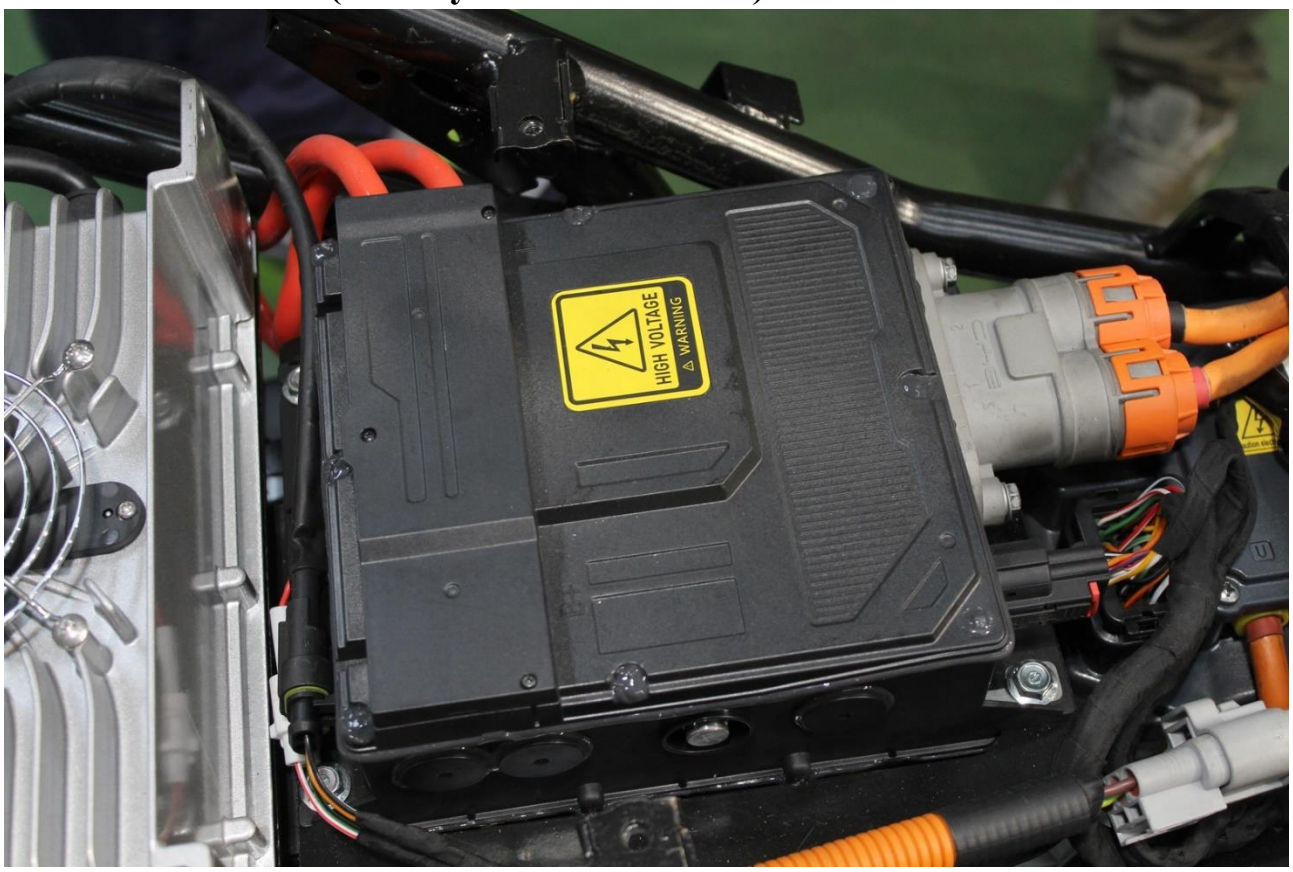


Logically, the components of the scooter's electrical system (headlight, rear light, horn, instrument cluster) are designed to operate on any type of motorbike, and therefore require a 12 volt DC power supply. The task of the converter is therefore to convert the 76.8 volts of direct current supplied by the two batteries into 12 volts of direct current.

In addition, it connects to the secondary 12V battery providing constant, converter-independent power for components such as the Keyless proximity key receiver or to retain settings in the ECU's memory.

The converter is located at the front of the scooter on the right-hand side.

5.4.5. BDU Unit (Battery Disconnect Unit)



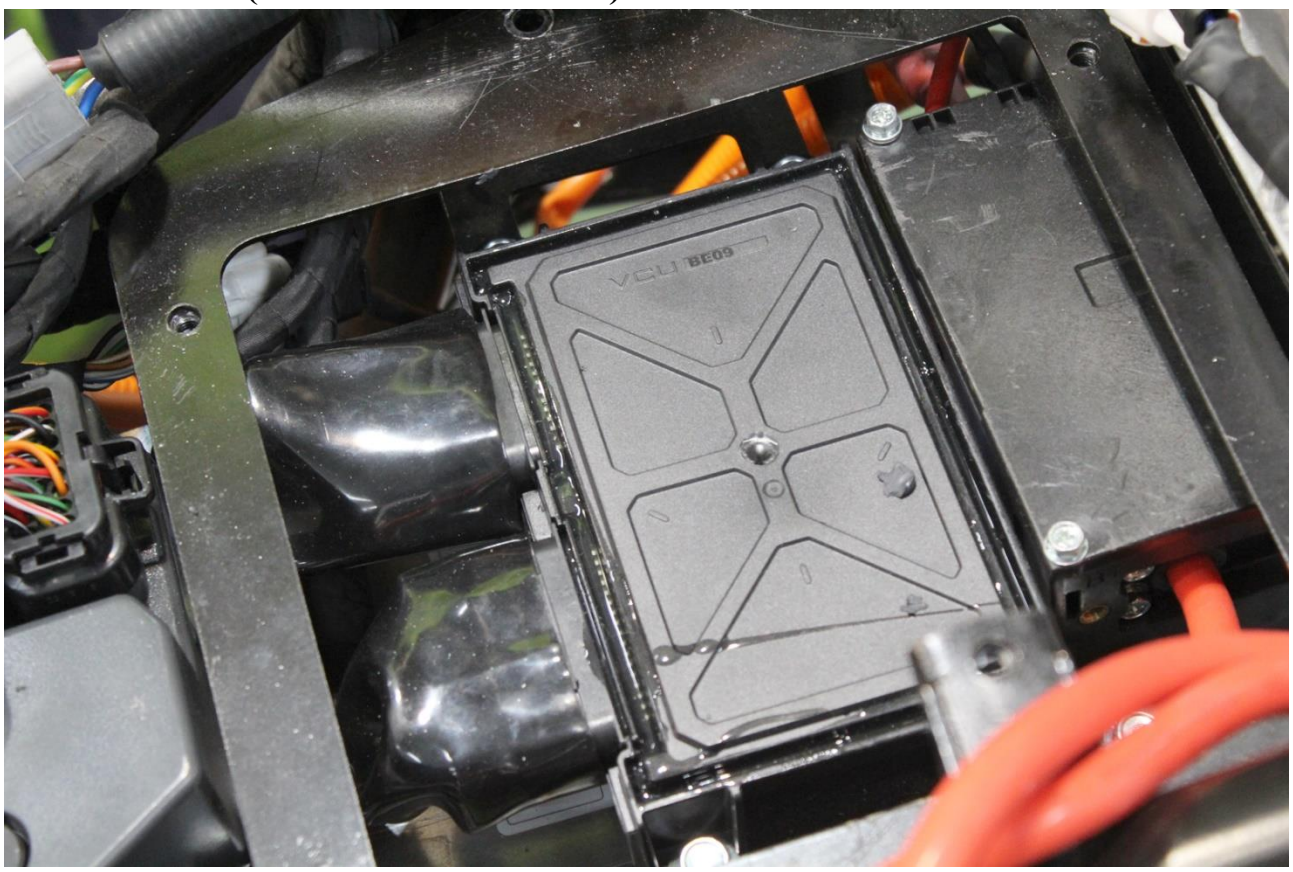
This unit acts as a main switch between the batteries and the rest of the high voltage circuit components. This unit disconnects and connects the battery if the vehicle is not in use or being used, as well as detecting overcurrents and short circuits by acting as a safety switch.

The BDU integrates the functions of the BMS, or Battery Management System, providing many safety measures to protect the integrity of the batteries that impact on their longevity. Its purpose is to monitor the charge and discharge currents not only of the battery as a whole, but also internally with each of the cells that make up the battery.

The BDU parameterises the temperatures, voltages and currents of the individual cells at all times and makes decisions based on the current state of the battery. It is also responsible for calculating the remaining battery percentage (SOC) during discharge or adjusting the SOC during charging. It also includes a passive balancing functionality which allows to keep the battery in optimal condition so that the autonomy is not affected.

The BDU is located under the main charging compartment under the seat.

5.4.6. VCU (Vehicle Control Unit)

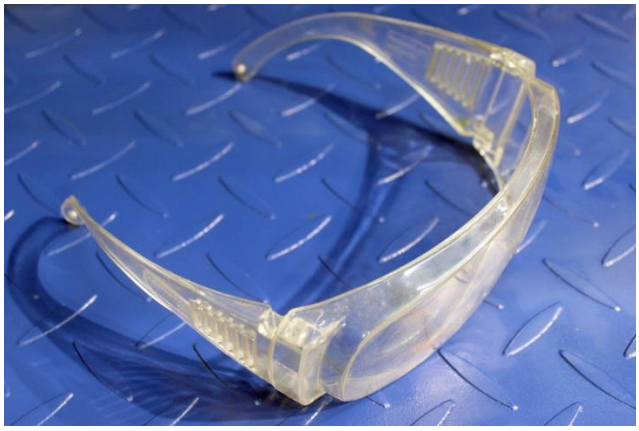


This is the brain of the vehicle's electrical system, monitoring and regulating all components such as the engine controller, battery management, component temperatures, energy regeneration system, diagnostics, safety measures and energy efficiency.

It is based on a microprocessor that receives data from the vehicle's various sensors and executes control algorithms. It includes analogue-to-digital and digital-to-analogue converters for signal conversion, CAN bus communication interfaces, RAM and ROM memories for data storage and the management software with preset instructions.

To access the VCU, the BDU must be removed.

5.5. Personal Protection Equipment (PPE).



Before starting any maintenance or repair work on the Nerva Exe scooter, it is important to address safety precautions when handling components of the 76.8-volt electrical system: due to the high capacity of the batteries, the mechanic may be exposed to currents of up to 200 amps – the same as the rating of the two blade fuses that protect this circuit.

Basic Personal Protective Equipment (PPE) for the mechanic consisting of gloves and goggles. The gloves must have category 00 dielectric protection capable of insulating up to 750 volts direct current, and must be visually checked for holes and cuts prior to use.

The goggles must protect the field of vision (at least in the eyes) against impacts caused by short circuits or electric arcs.

Other recommended equipment includes footwear with dielectric protection, and insulating overalls covering the operator's chest.

An additional preventive measure is to use tools with insulation in the handle area of the tool.

5.6. Disconnecting the BDU (Battery Disconnect Unit)

HAZARD
• Wear dielectric gloves to protect against short circuits or electric shock. • Before working on any component of the electrical system of the high voltage circuit, the battery disconnect unit BDU must be disconnected to isolate the battery from the other components. • Even if you have disconnected the BDU you must, as a precaution, continue to at least use gloves to handle the components of the high-voltage circuit, as the capacitors of some components may have become charged.

Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)

Necessary tools

8 and 10 mm socket spanners

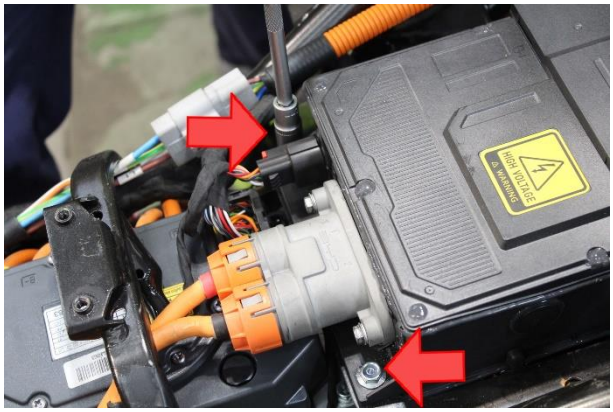
Phillips screwdriver, tip #0

Polymeter

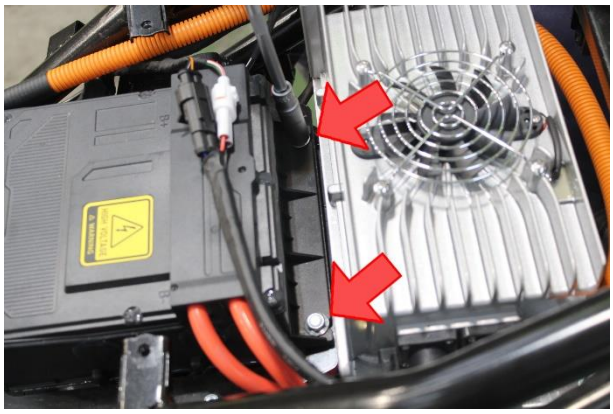
Insulating tape

Before disconnecting the BDU, ensure that the entire vehicle is in a de-energised off state by allowing it to stand for more than 60 seconds.

Remove the two front screws securing the BDU with a 10 mm socket spanner.



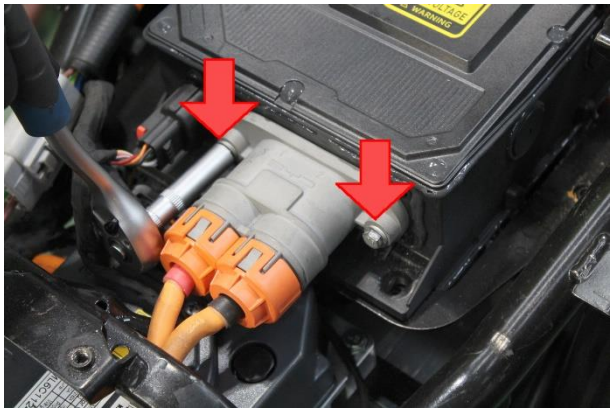
Remove the two rear screws securing the BDU with a 10 mm socket spanner.



Tightening torque:

BDU fixing screws: 9±2 Nm.

Remove the 2 screws securing the battery connector with an 8 mm socket spanner.



Tightening torque:

Screws for fixing the battery cable connector to the BDU: 3±0.6 Nm.

Remove the battery connector.

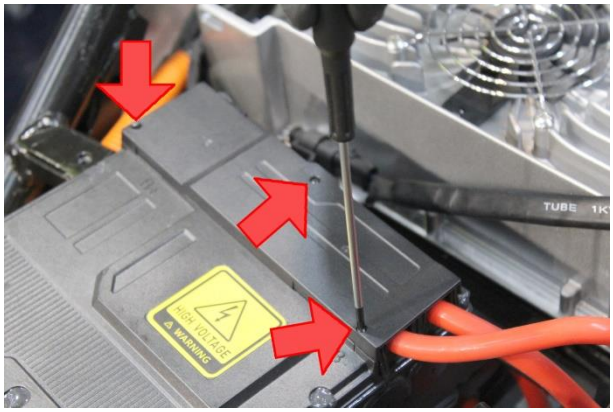
Slide out the red latch on the data connector.

Remove the data connector.

Remove the three cover screws covering the output wires with a #0 Phillips screwdriver.

Tightening torque:

BDU cover screws: 0.2±0.1 Nm.

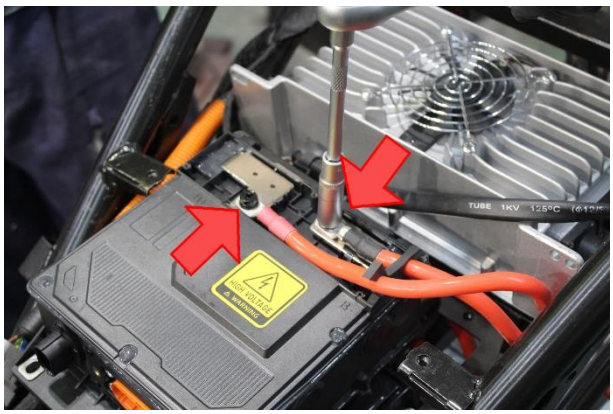


Remove the cover and check with a multimeter (voltmeter on 200V DC scale) that there is no load on the output terminals.

Use a 10 mm socket spanner to remove the two black screws securing the output terminals.

Tightening torque:

BDU power cable fixing screws: 9±2 Nm.



Remove the output terminals.

Insulate the output terminals with insulating tape.

Pull the BDU out of its housing by hand.

5.7. Disconnecting the engine cables from the Controller

Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Remove the rear body from the bodywork (→ See 1.3.2. Disassembly of the rear body of the bodywork)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)

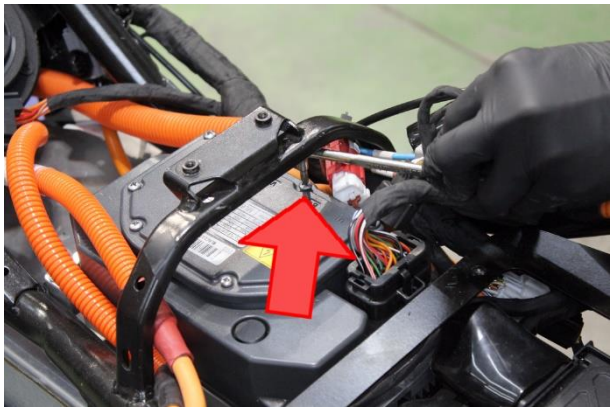
Necessary tools

Phillips screwdriver #2 tip

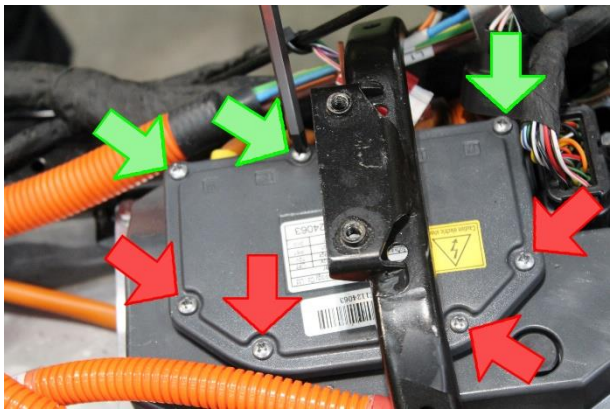
10 mm socket spanner

Phillips screwdriver, angled, #2 tip

Remove the screw on the upper cover of the controller that is half hidden by the frame bridge, using a #2 Phillips head screwdriver. This screw is short.



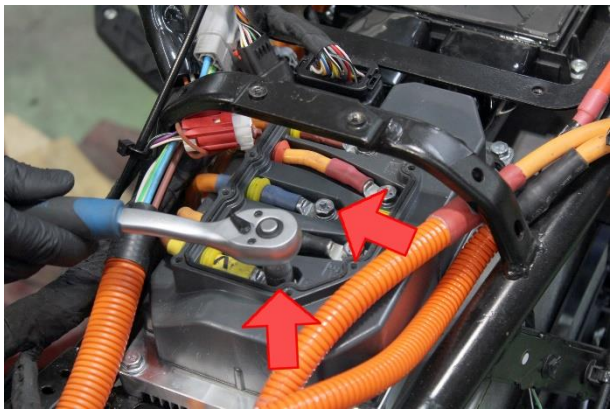
Remove the remaining screws from the upper cover of the controller with a standard #2 Phillips screwdriver. Screws marked with green arrows are short, while those marked with red arrows are long.



Tightening torque:

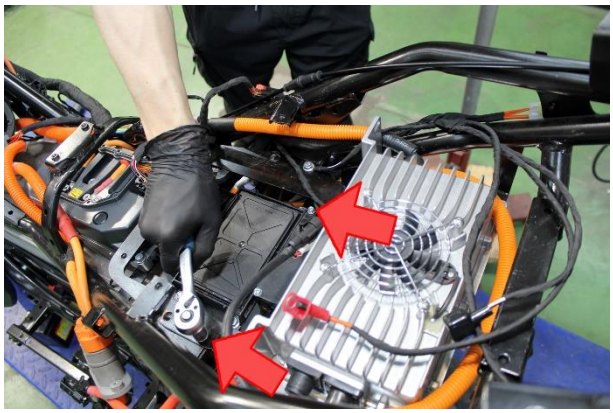
Controller cover fixing screws: 1±0.4 Nm.

Remove the screws securing the V (blue) and W (yellow) wires with a 10 mm socket spanner. Once they have been loosened, you can use a #2 Phillips screwdriver to remove them completely.

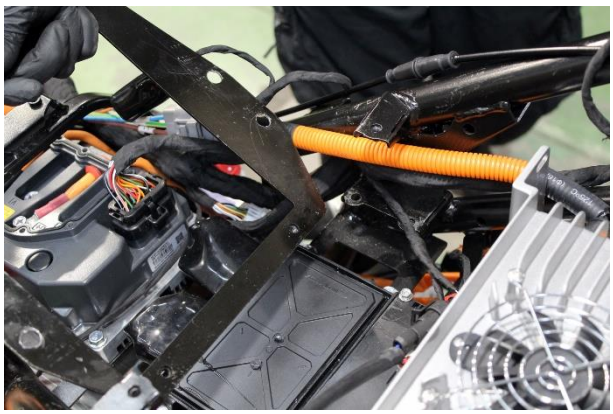


Remove the screw securing the U-wire (red) with a 10 mm socket spanner. Once it has been loosened, you can use a #2 Phillips screwdriver to remove it completely.

Remove the two screws securing the BDU support tray with a 10 mm socket spanner. Please note that the right-hand screw also fixes an earth connection.



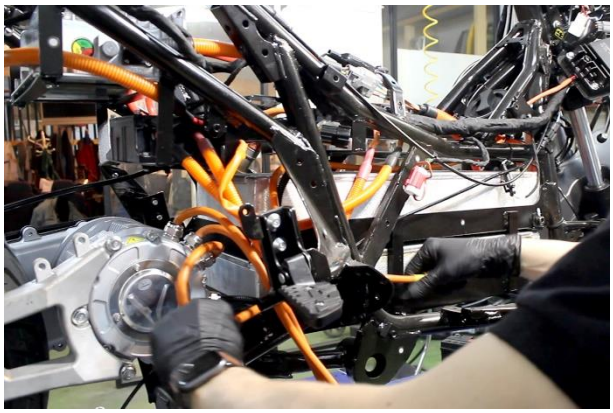
Remove the tray by hand.



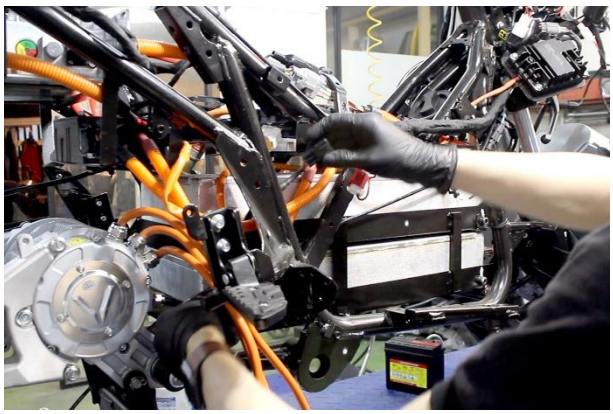
Use a screwdriver to press the locking flange on the engine cable connector.

Disconnect the engine cable connector.

Remove the three wires (U, V and W) for engine power from the controller and rack.



Remove the cable from the frame.



5.8. Removal of the Controller

Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Remove the rear body from the bodywork (→ See 1.3.2. Disassembly of the rear body of the bodywork)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)
- Remove the engine cables from the controller (→ See 5.7. Disconnection of the engine cables from the Controller)

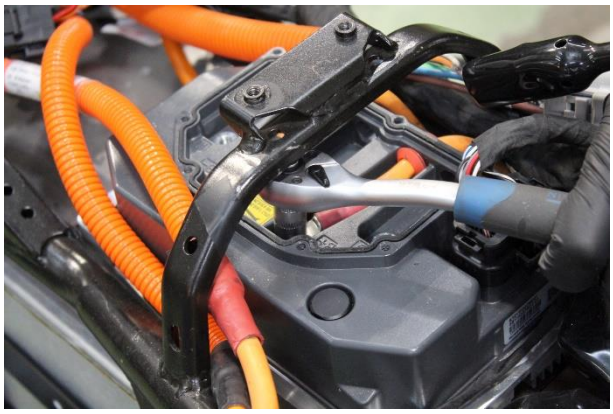
Necessary tools

Phillips screwdriver #2 tip

10 mm socket spanner

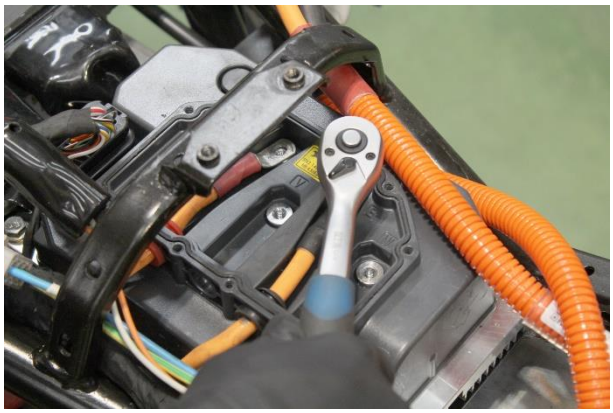
Using a 10 mm socket, loosen the screw securing the B+ (battery positive) cable and remove it completely with a #2 Phillips screwdriver.

Pull out the B+ cable.



Using a 10 mm socket, loosen the screw securing the B- (negative battery) cable and remove it completely with a #2 Phillips screwdriver.

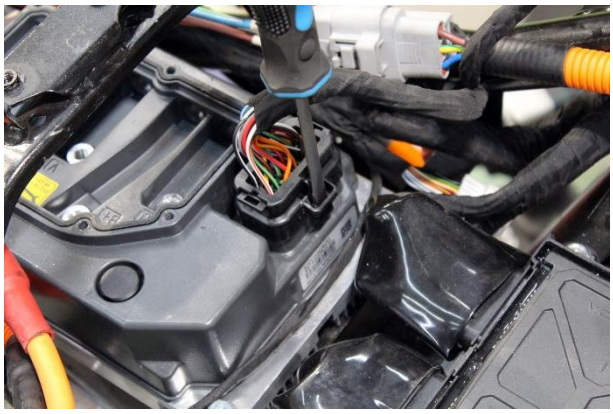
Pull out cable B-.



Tightening torque:

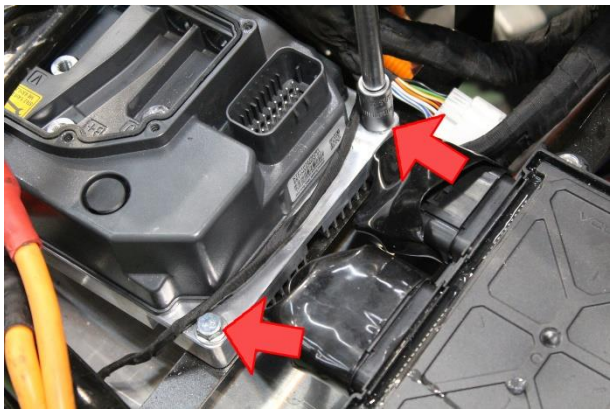
Screws for fixing power supply cables and engine phases: 4.8±0.2 Nm

Insert a screwdriver into the hole in the locking flange of the signal cable connector to press the flange.



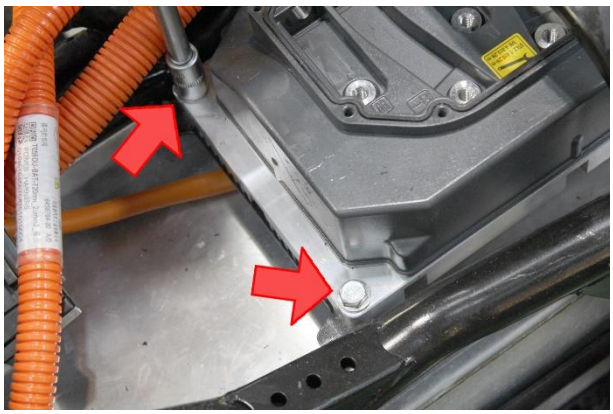
Disconnect the connector from the signal cables.

Using a 10 mm socket spanner, remove the two rear screws securing the controller.



Using a 10 mm socket spanner, remove the two front screws securing the controller.

You will have better access to the left screw if you remove the cables connecting the battery to the BDU (without the controller cover they are easier to release).



Remove the controller by hand by moving it forwards and upwards.

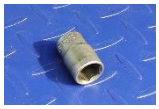
Follow the reverse order of disassembly to reassemble the controller.

5.9. Charger Removal

Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)

Necessary tools



10 and 8 mm socket spanners

Flat-blade screwdriver fine tip

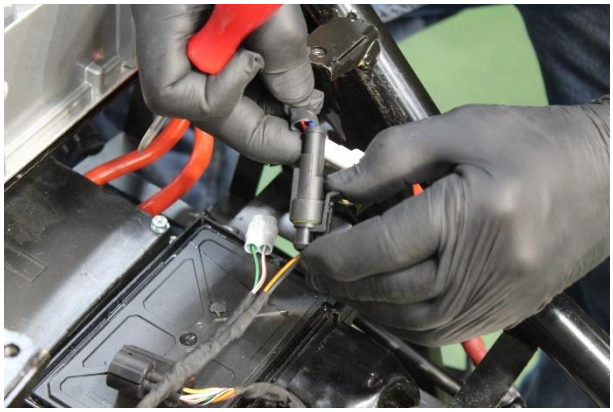
Phillips screwdriver with #2 bit

10 mm ring spanner

Locate the white connector on the front of the charger and insert a flat-blade screwdriver into the slot in the locking flange to open it.

Disconnect the white connector.

Next to the white connector you will find a black connector. Pull out the locking flange with your fingers.



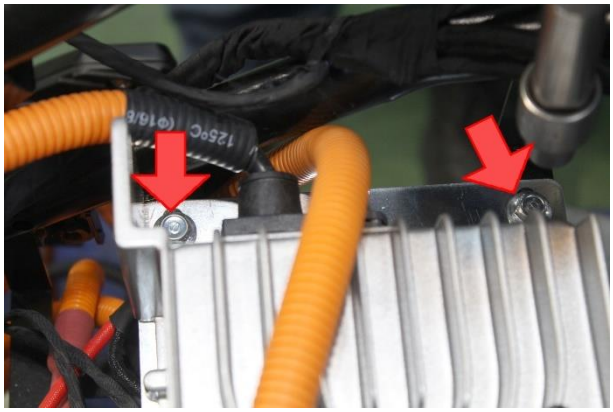
Disconnect the black connector.

Locate the white three-wire connector next to the main wiring attached to the right upper tube of the frame.

Insert a white, fine-tipped screwdriver into the hole in the locking flange.

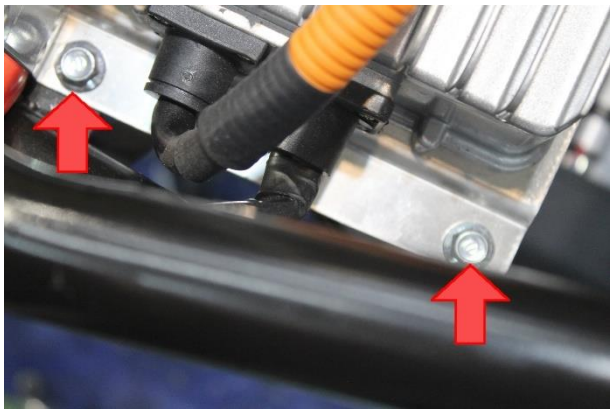
Disconnect the white connector.

Remove the two screws securing the charger to the frame on the right-hand side using a 10 mm socket.



Remove the two screws securing the charger to the frame on the left-hand side using a 10 mm socket.

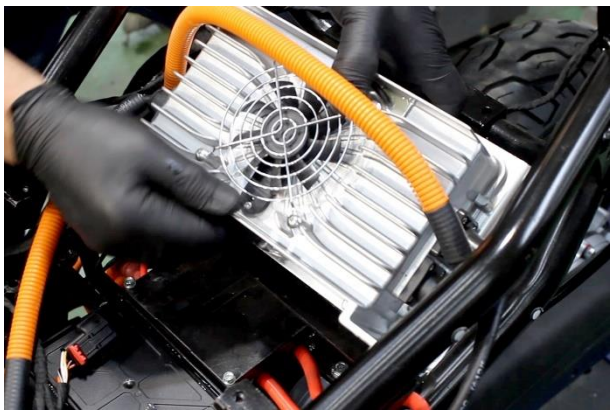
Tightening torque of charger fixing screws: 9±2 Nm



Remove the loader from the right-hand side of the vehicle by resting it on the passenger footrest.

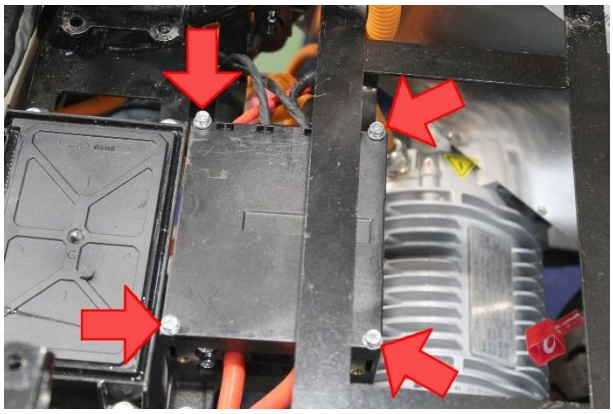
Tightening torque:

Magazine fixing screws 9±2 Nm



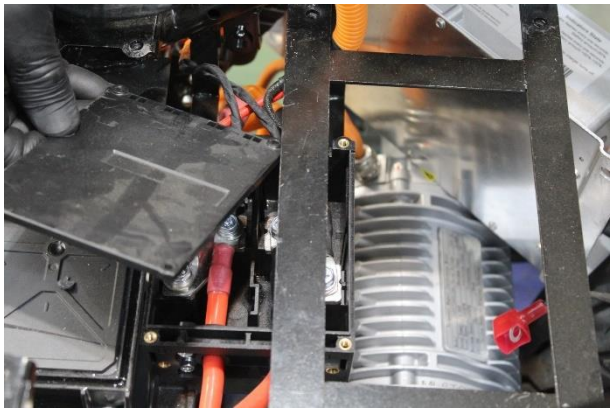
Once you have removed the charger, you will see the junction box.

Remove the four screws from the junction box cover using a Phillips screwdriver or an 8 mm socket spanner.



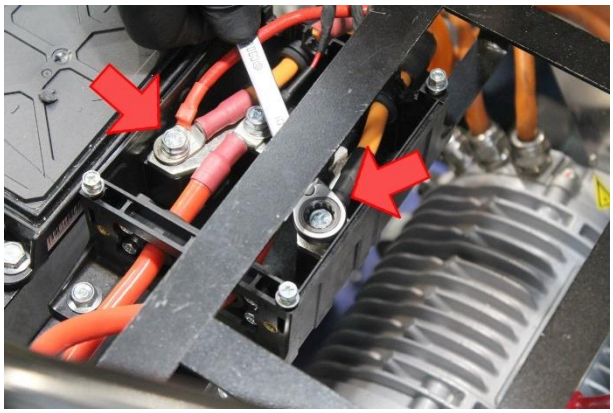
Tightening torque of the junction box cover fixing screws: 2±0.4 Nm

Remove the cover of the junction box.



Due to the position of the charger support tray, you will need to use a 10 mm ring spanner to remove the screw securing the negative (black) wires from the junction box.

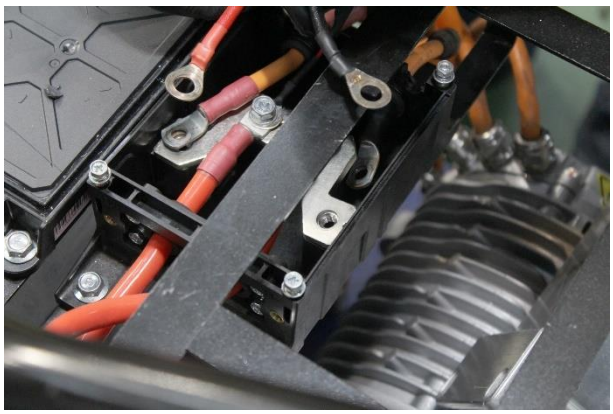
Remove the screw securing the positive (red) wires from the junction box.



Remove the disconnected cables from the junction box.

Remove the charger.

Follow the reverse order of disassembly to reassemble the charger.



Tightening torque of the cable fixing screws of the junction box: 9±1 Nm.

5.10.Removal of the VCU

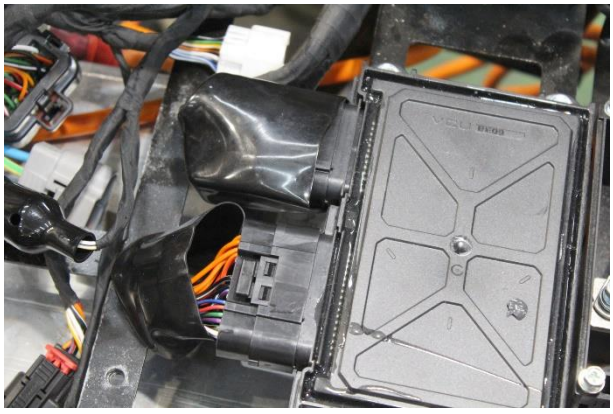
Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Remove the rear body from the bodywork (→ See 1.3.2. Disassembly of the rear body of the bodywork)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)
- Remove the engine cables from the controller (→ See 5.7. Disconnection of the engine cables from the Controller)

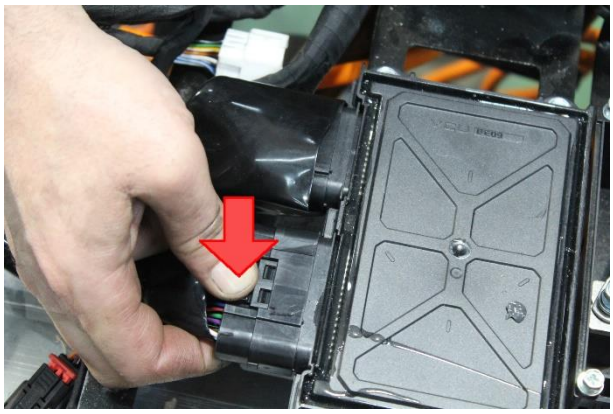
Necessary tools

10 mm socket spanner

The protective cover of the left VCU connector is removed.



Press the locking flange on the left connector with your fingers.



Disconnect the left connector.

The protective cover for the right-hand connector of the VCU is removed.

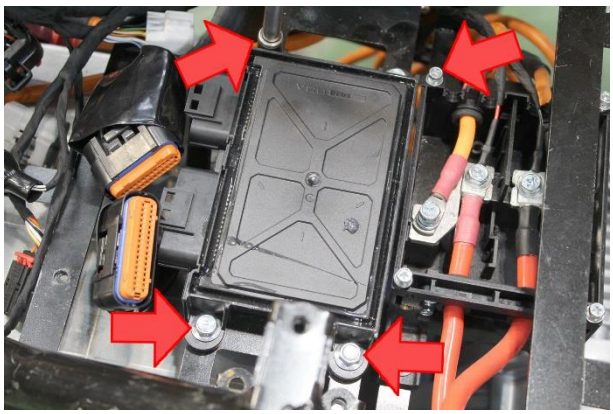
Press the locking flange on the right connector with your fingers.

Disconnect the right connector.

Use a 10 mm socket spanner to remove the four screws securing the VCU.

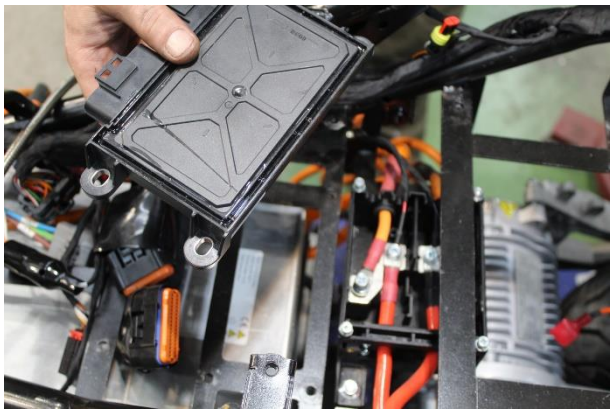
Tightening torque:

VCU fixing screws 8±1 Nm



Remove the VCU.

Follow the reverse order of disassembly to reassemble the VCU.



5.11.Removal of the DC-DC Converter

Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)
- Remove the windscreen (→ See 1.5.1. Disassembly of the windscreen)
- Remove the headlamp (→ See 1.5.2. Disassembly of the headlamp)

Necessary tools

10 mm socket spanner

Flat-blade screwdriver fine tip

Locate the input connector to the DC-DC converter on the front of this unit.

Press the locking flange of this connector with your fingers.

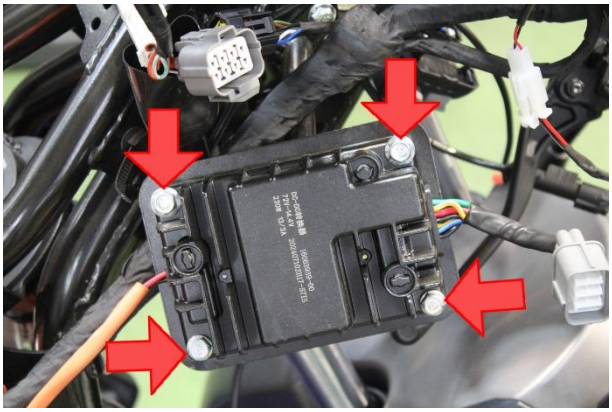
Disconnect the input connector from the DC-DC converter.

Locate the DC-DC converter output connector next to the charging socket.

Insert a flat-blade screwdriver with a fine tip into the hole in the locking flange of the DC-DC converter output connector.

Disconnect the output connector from the DC-DC converter.

Remove the four screws securing the DC-DC converter with a 10 mm socket spanner.



Tightening torque:

DC-DC converter fixing screws: 9±2 Nm.

Remove the DC-DC converter.

Follow the reverse order of disassembly to reassemble the DC-DC converter.

5.12.Battery voltage measurement

Required prior operations:

- Remove the seat, auxiliary battery and charging compartment (→ See 1.3.1. Removal of seat, auxiliary battery and charging compartment)
- Disconnect the battery connector to the BDU (Refer to 5.6. Disconnection of the BDU)

Necessary tools

10 mm socket spanner

Polymeter

Set the multimeter to measure DC voltages on the 200 V scale.

Measure the voltage between the two terminals of the connector by inserting the negative probe into the black terminal, and the positive probe into the red terminal.

Caution: Be careful not to short the two terminals of the connector.