



**PLDC04364**

**REVISION DATE**

*December 16, 2020*

**DATE**

*December 17, 2020*

**TECHNICAL OFFICE**

# S7 / Scout 7



**TECHNICAL SERVICE MANUAL**





**PLDC04364**

**REVISION 00**

*December 16, 2020*

**TECHNICAL OFFICE**

## **Contents**

A1.1 Checking main brush motor current draw .....	7
A1.2 Checking and replacing the main brush motor carbon brushes.....	8
A1.3 Replacing the main brush motor .....	11
A1.4 Replacing the main brush .....	13
A1.5 Adjusting the height of the main brush.....	14
A1.6 Checking for wear on side brush drive belt.....	15
A1.7 Side brush belt replacement .....	17
B1.1 Checking suction motor current draw.....	21
B1.2 Replacing the suction motor.....	23
B1.3 Checking and replacing the suction motor carbon brushes .....	27
B2.1 Checking filter shaker current draw.....	31
B2.2 Removing the filter shaker motor .....	33
C1.1 Checking drive motor current draw .....	36
C1.2 Check drive belt wear status.....	38
C1.3 Replacing the drive belt .....	39
C1.4 Replacing the drive motor .....	41
C1.5 Checking and replacing the drive motor carbon brushes .....	43
D1.1 Inspection and replacement of control panel board F2 fuse (1.6A F) .....	49
D1.2 Checking and replacing control panel card 50A fuse F1 .....	51
D1.3 Disassembly and removal of the control panel board.....	53
E1.1 Troubleshooting.....	57
TECHNICAL SERVICE MANUAL REVISIONS - UPDATES .....	61



**PLDC04364**  
**REVISION 00**  
December 16, 2020  
**TECHNICAL OFFICE**



## **IMPORTANT**

Take the machine to the waste disposal area, clean the suction filter and empty the dirt bin.

Move the machine onto flat ground and apply the brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or pressing the emergency switch

Disconnect the electronic circuit from the batteries by detaching one or both battery connectors.

## **i INFORMATION**

Important information

When consulting this Service manual, the reader will encounter the expressions **RIGHT** and **LEFT** indicating the side of the machine. These indications always refer to the direction of movement of the machine.

In this Service Manual, the version of the machine may be written in brackets “()”, i.e. (E, DP-P, P, D). This note indicates that the instructions only refer to the model or version specified in brackets.

## A1 MAIN BRUSH MOTOR / DRIVE MOTOR

**i** The motor of the centre brush or drive motor is equipped with a right angle or bevel helical gear reducer with worm gear drive, the rotor shaft having a double-start thread. The maximum rotational speed at the gear reducer output shaft is 210 rpm. The rated power of the motor is 25.5W, while the voltage is 12V DC. The maximum current draw of the motor at starting is 57A with a maximum torque of 21 N · m - 185.9 lbf · in, while the motor at no load draws 4.0A. Other specifications of the motor are insulation class 'F' and protection IP30 against ingress of solids and liquids.

The motor is equipped with replaceable carbon brushes. With the motor mounted to the machine, the brush must be driven in anticlockwise rotation, otherwise it will not operate correctly. Check the current draw to assess the need for motor disassembly to replace the carbon brushes.



## A1.1 Checking main brush motor current draw.

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the checks safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4 Make sure that the batteries on the machine are charged ( $12\text{ V} \pm 1\text{ V}$ ).
- 5 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- 6 Move the machine onto a flat and smooth floor to ensure a correct current reading.
- 7 Remove the left side guard and locate the brush motor.
- 8 Pick out the Red wire of the centre brush motor and apply the clamp-on ammeter to it.
- 9 Operate the main brush motor from the control panel by turning the key switch to the "I" position
- 10 Read the value on the clamp-on ammeter display and compare it against the values shown in the table.
- 11 If the value falls within the range indicated in the table, disconnect the instrument and reinstate the side guard and top cover of the machine.
- 12 Conversely, if the value is at variance with those indicated in the table, proceed to make the following checks.
- 13 Lift the side brush and check that the current draw under no-load conditions is within the values in the table.
- 13a If the reading is different (usually higher) from those in the table, check the bearings mounted on the brush shaft, the motor and gear reducer for noise and/or the motor carbon brushes for wear.
- 13b Replace the brush motor with a new one.



**Carry out the test with the side brush disengaged (the control lever on the control panel must remain in the "0" position) without activating the fan nor the filter shaker via the switch provided.**



**Carry out the test with the machine at standstill: as the brush rotates in the direction opposite to the direction of travel, this could lead to an increase in the current draw value.**



Current draw A (amperes)	Min	Max
No-load (brush raised)	2.6 A	3.2 A
Load applied (brush operating)	7.8 A	9.5 A

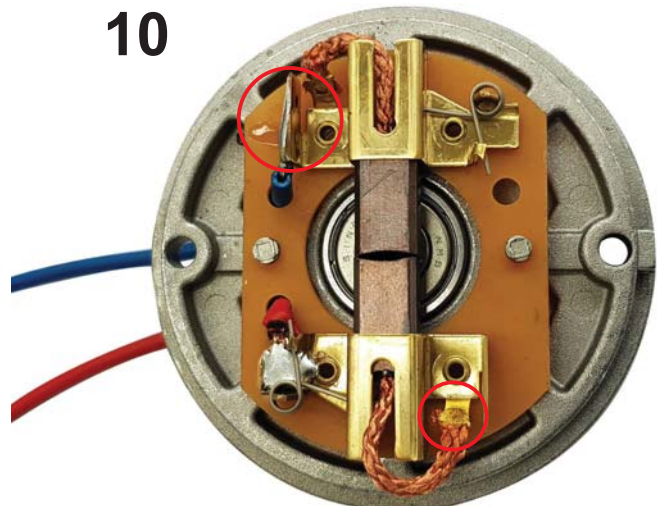
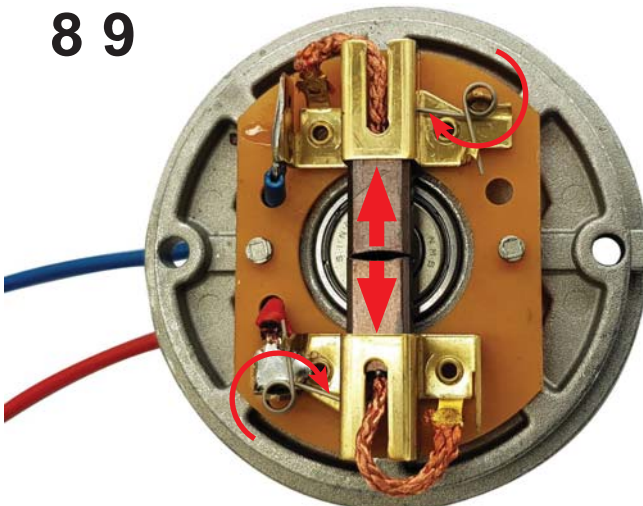
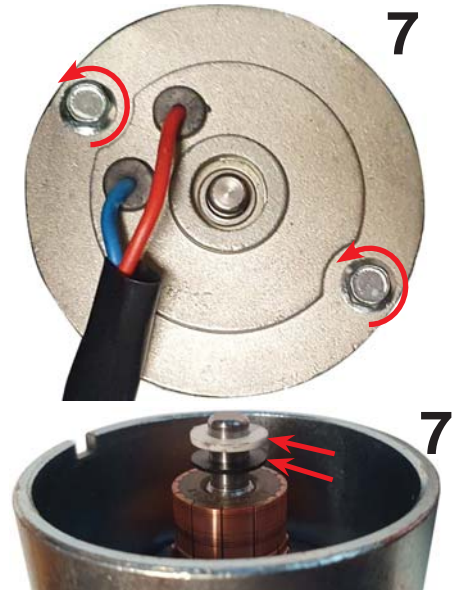
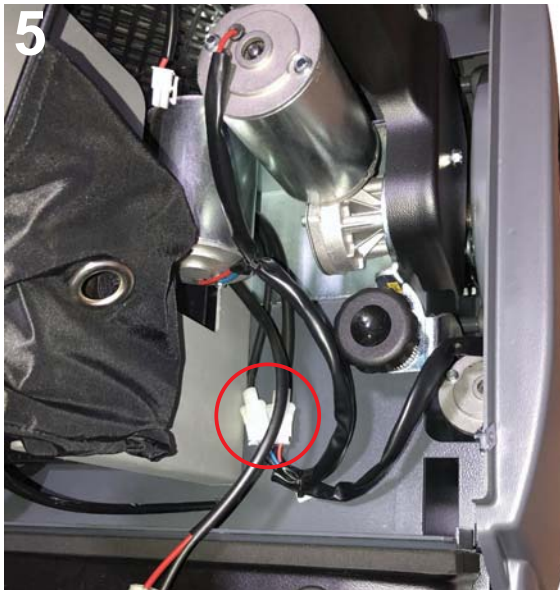


## A1.2 Checking and replacing the main brush motor carbon brushes

**i** To verify the extent of wear on the carbon brushes and replace them if necessary, simply remove the motor end cap.

### Disassembly

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowl and, after undoing the screws, remove the top cowl to access the battery compartment.
- 4 Disconnect and remove the battery.
- 5 Disconnect the two connectors of the three motors.
- 6 Remove the left side guard and locate centre brush motor.
- 7 Unscrew the two nuts and remove the motor cap taking care not to lose the shims placed on the rotor.
- 8 Rotate the spring so that you can remove the carbon brushes.
- 9 Remove the carbon brushes from their seat and check their dimensions.
- 10 Unsolder the carbon brush leads from their respective tags only if they need to be replaced after checking dimensions.





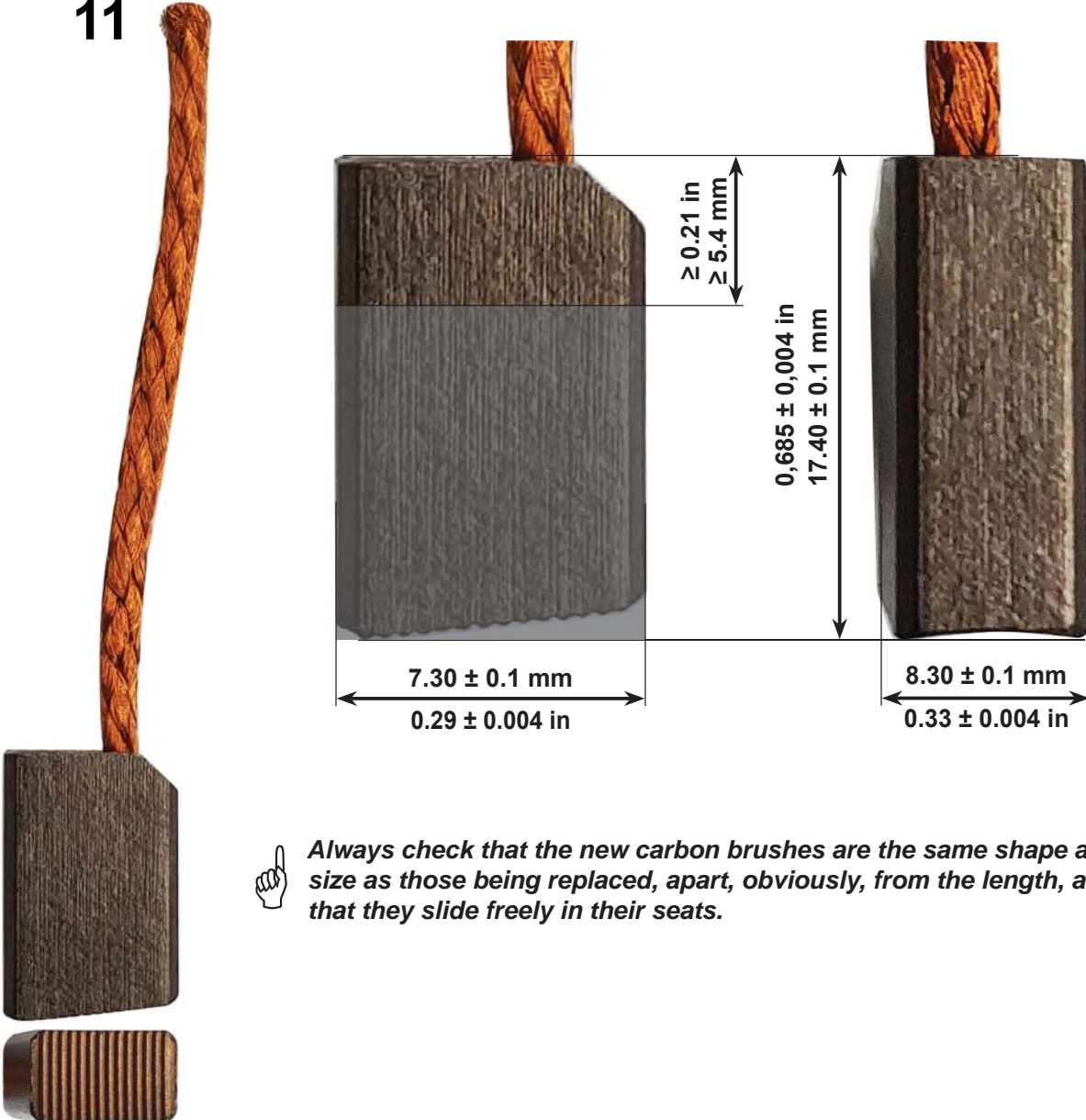
## Checks

- 11 Check the sliding contact surface of the carbon brushes for signs of abnormal wear or burning and possibly replace them even if still within tolerance.
- 12 Measure the carbon brush to determine wear, and then compare the values against those shown below.
- 13 The length of the carbon brush must be no less than  $\geq 5.4$  mm (0.21 inches).
- 14 In the event that the measurement is close to the value indicated in the table, replace the carbon brush after detaching it from the end cap.
- 15 Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and the rotor where the carbon brushes slide.
- 16 Check wear in the places where the carbon brushes slide before replacement. A damaged rotor would cause premature wear of the new carbon brushes.



**Both carbon brushes must be replaced at the same time.**

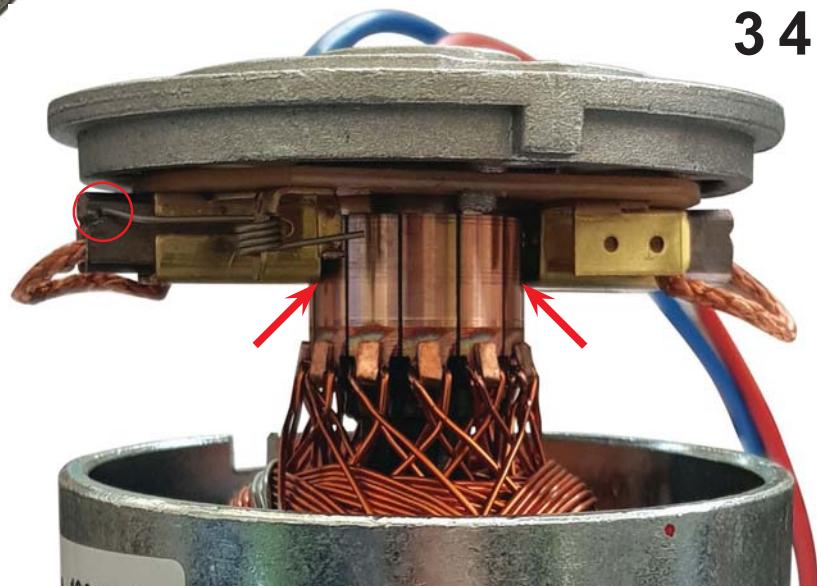
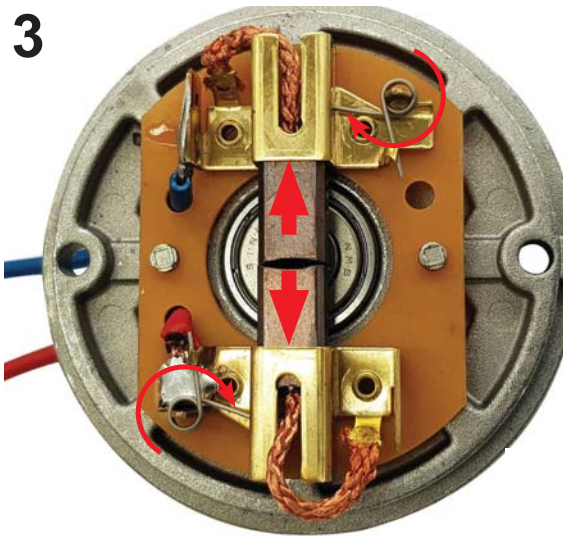
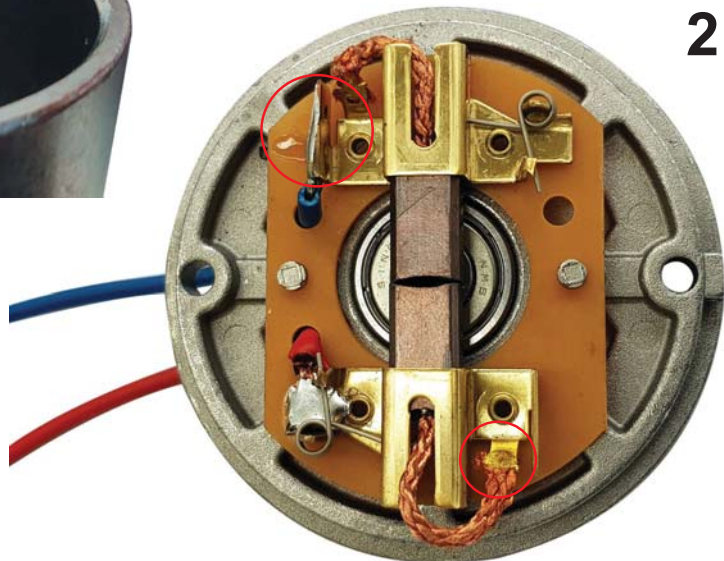
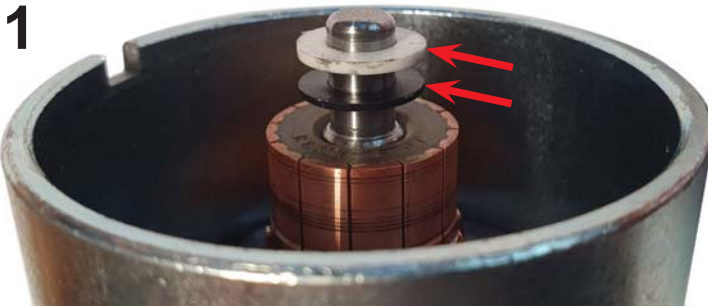
**11**



**Always check that the new carbon brushes are the same shape and size as those being replaced, apart, obviously, from the length, and that they slide freely in their seats.**

## Reassembly

- 1 Position the shims on the rotor in the correct order: the white one (usually one) resting on the bearing and the black one (one or two) between the gear reducer and the bearing (depending on the thickness) and resting on the gear reducer.
- 2 Solder the leads of the carbon brushes to the same position where the power leads are soldered.
- 3 Shift the springs to facilitate installation of the carbon brushes on the rotor.
- 4 Refit the rotor cap: after positioning the cap, correctly position the springs so that the carbon brushes press on the rotor.
- 5 Proceed with reassembly, repeating the steps of the disassembly sequence in reverse order.

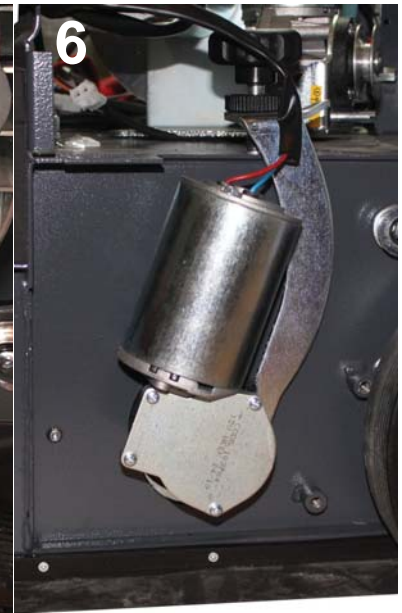
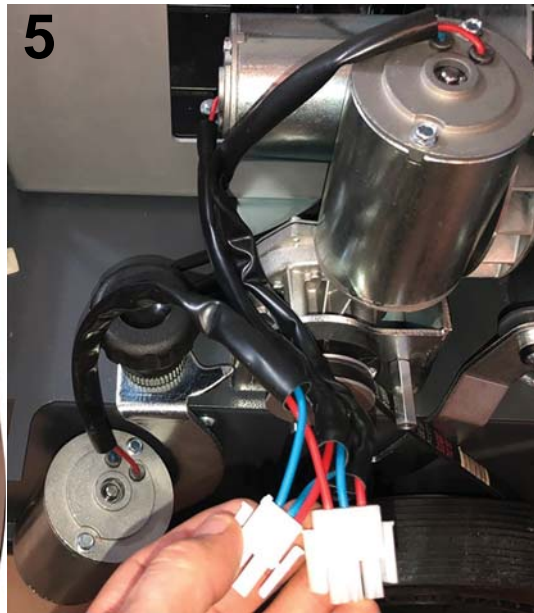




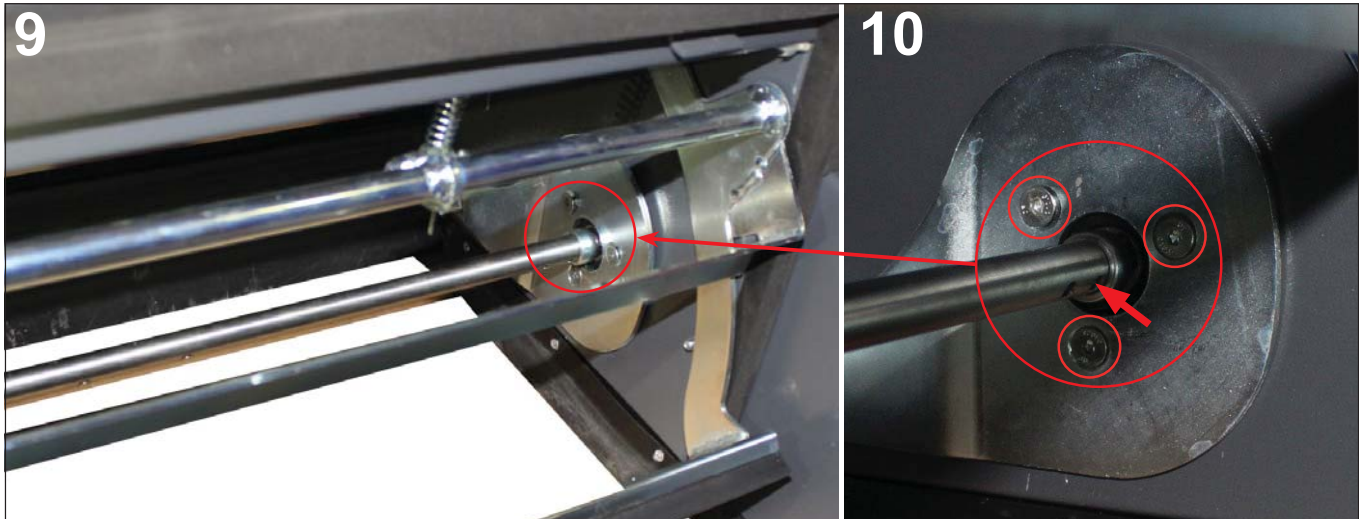
## A1.3 Replacing the main brush motor

### *Disassembly*

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4 Disconnect the battery and remove it.
- 5 Disconnect the two connectors of the three motors from the main wiring and release the cables from the clamps.
- 6 Remove the left side guard and locate brush motor.
- 7 Remove the front and rear debris bins, then lay the machine on its side in order to reach the central brush.
- 8 Disassemble the four-piece central brush by unscrewing the four fixing screws and remove it.



- 9** Identify and undo the three countersunk screws that secure the motor to the axis of the central brush.
- 10** Undo the three screws, insert a pointed punch or screwdriver into the hole closest to the motor and extract the brush motor.
- 11** Remove the motor and take it to the bench for overhaul or complete replacement.
- 12** When disassembling, pay attention to the tab on the brush motor shaft. In case of replacement of the brush motor it must be reused for the new motor.



### ***Reassembly***

- 1** In case of replacement of the complete brush motor, remember to remove the keyway.
- 2** Replace the brush motor.



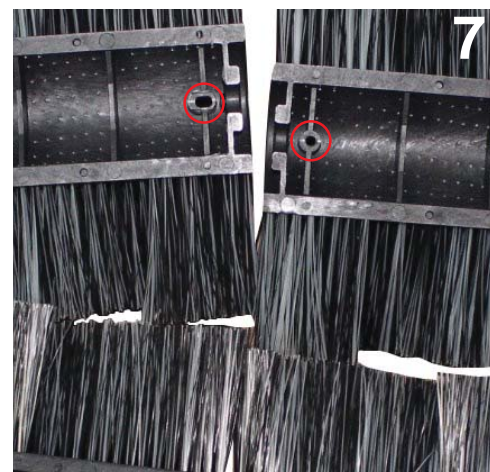
## A1.4 Replacing the main brush



*The brush will need to be replaced generally as the result of normal wear.*

### *Disassembly*

- 1** Move the machine to flat, dry flooring.
- 2** Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3** Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4** Disconnect and remove the battery.
- 5** Tilt the machine backwards to reach the main brush.
- 6** Remove the centre brush by unscrewing the four fixing bolts.
- 7** Replace the brush.



### *Reassembly*

- 1** To reassemble, repeat the disassembly operations in reverse order.



## A1.5 Adjusting the height of the main brush

### *Adjustment*

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that you have enough room around the machine for safe adjustment and testing.
- 3 Turn the front cowling and pick out the adjustment knob.
- 4 Adjust the height of the brush using the appropriate knob in order to find the correct pressure of the centre brush on the floor: for the adjustment, refer to the graduated yellow label.
- 5 If the brush is correctly adjusted, the bristles will be slightly bent backwards with respect to the rolling direction, which must be in the opposite direction to the advancement, to ensure a slight pressure on the ground.



***Always check the consumption of the centre brush and adjust the height as needed.***

***The brush must always exert a slight pressure on the floor, indicated by a small bending of the bristle to the side opposite to the rolling direction.***



***When replacing the brush with a new one, don't forget to restore the original positions of the knob and in any case to adjust the brush.***



## A1.6 Checking for wear on side brush drive belt

### *Disassembly*

- 1 Move the machine onto flat and dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowl and, after undoing the screws, remove the top cowl to access the battery compartment.
- 4 Disconnect and remove the battery.
- 5 Lie the machine down on its left side to facilitate disassembly of the plastic side.
- 6 Unscrew the hex screw securing the side brush and remove the brush.
- 7 With a flat-head screwdriver remove the wheel covers that hide the fixing screw.
- 8 To undo the screw that secures the wheel, hold the wheel steady and unscrew or use a pulse screwdriver.
- 9 Remove the wheel from the axle.



***In case of disassembly of both wheels together, remember or identify the respective disassembly side, as they differ between right and left. The wheels features a ratchet system inside that makes it idle only in one direction of rotation, allowing the machine to turn.***



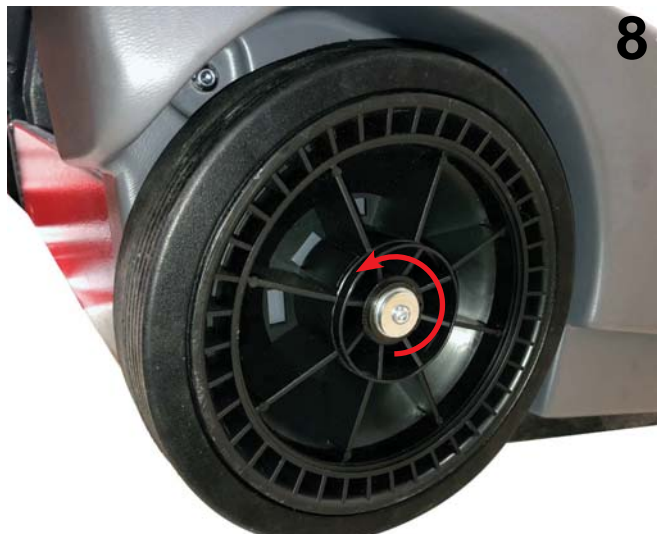
**5**



**6**



**7**



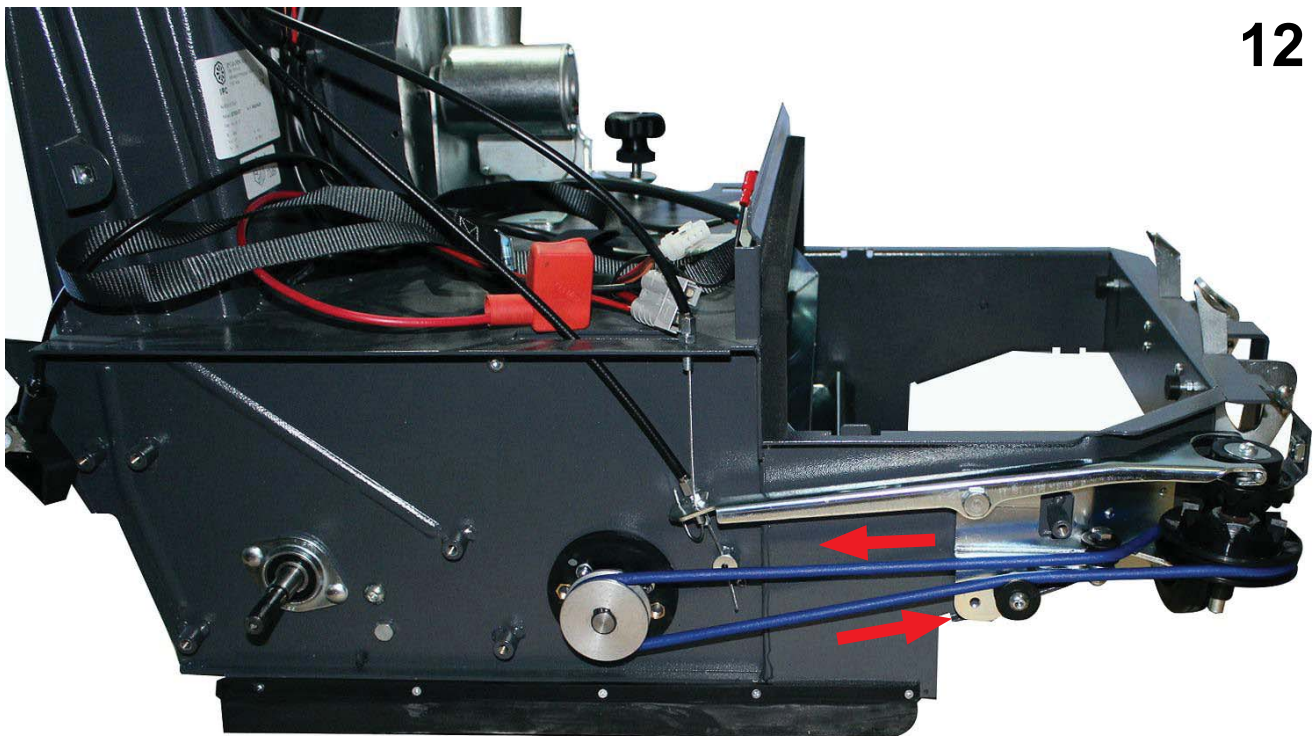
**8**



- 10 Unscrew the four Allen screws, the self-tapping screw and remove the right side guard.
- 11 Check the round belt for wear.
- 12 Grasp the belt in the free centre section and pull it to make sure it exerts friction.



**11**



**12**

### ***Reassembly***

- 1 To reassemble, repeat the disassembly operations in reverse order.

## A1.7 Side brush belt replacement

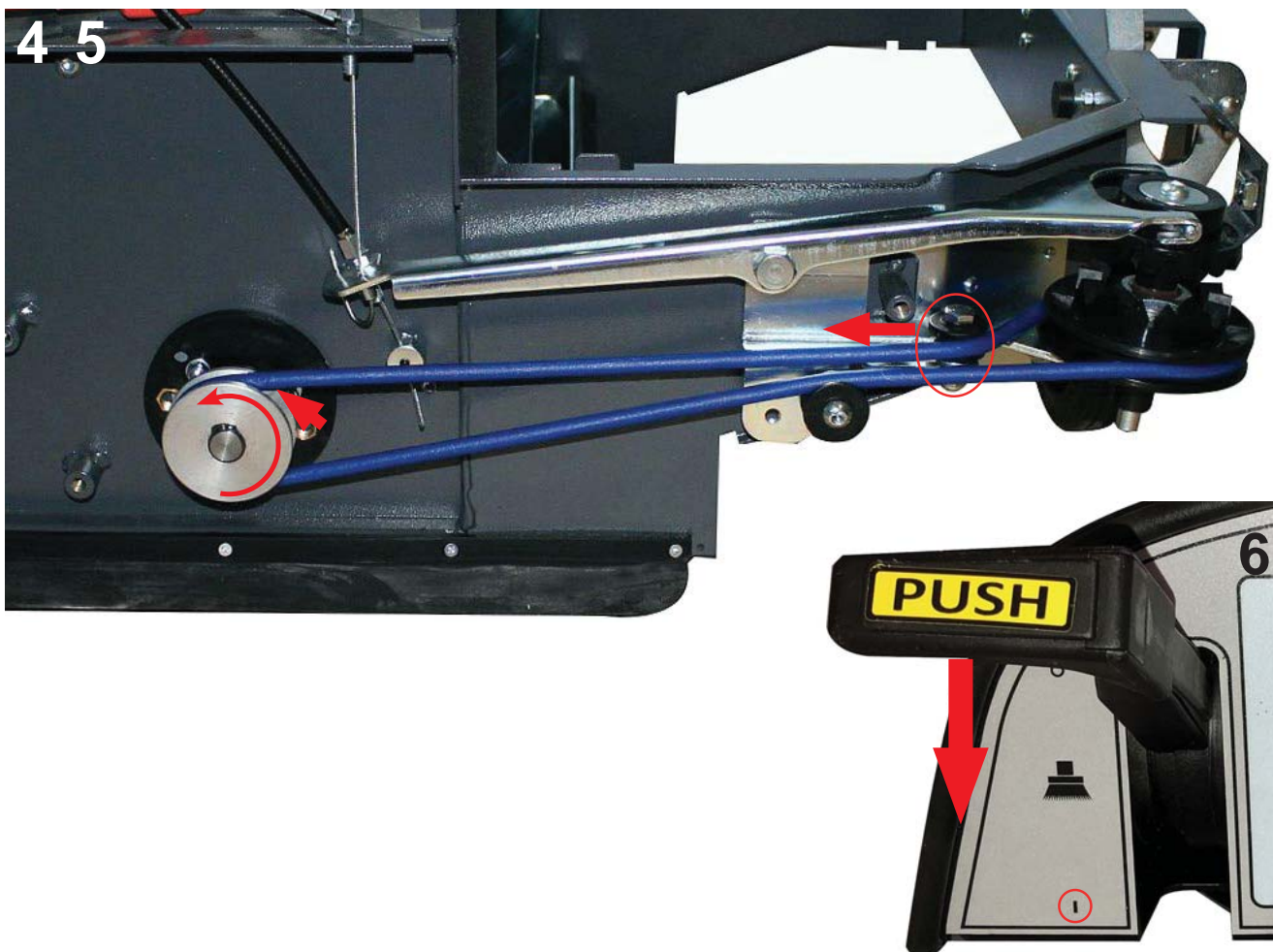
**i** The belts are usually replaced after breakage. However, in order to avoid machine downtime, it may be useful to replace the belts in advance, before they break. Belt wear is showing on the surface in contact with the pulleys, smoother and with small cracks, in addition to loss of elasticity with consequent elongation of the belt.  
 If the belt shows an excessive elongation, even if still intact, it is recommended to replace it to avoid slipping during work.



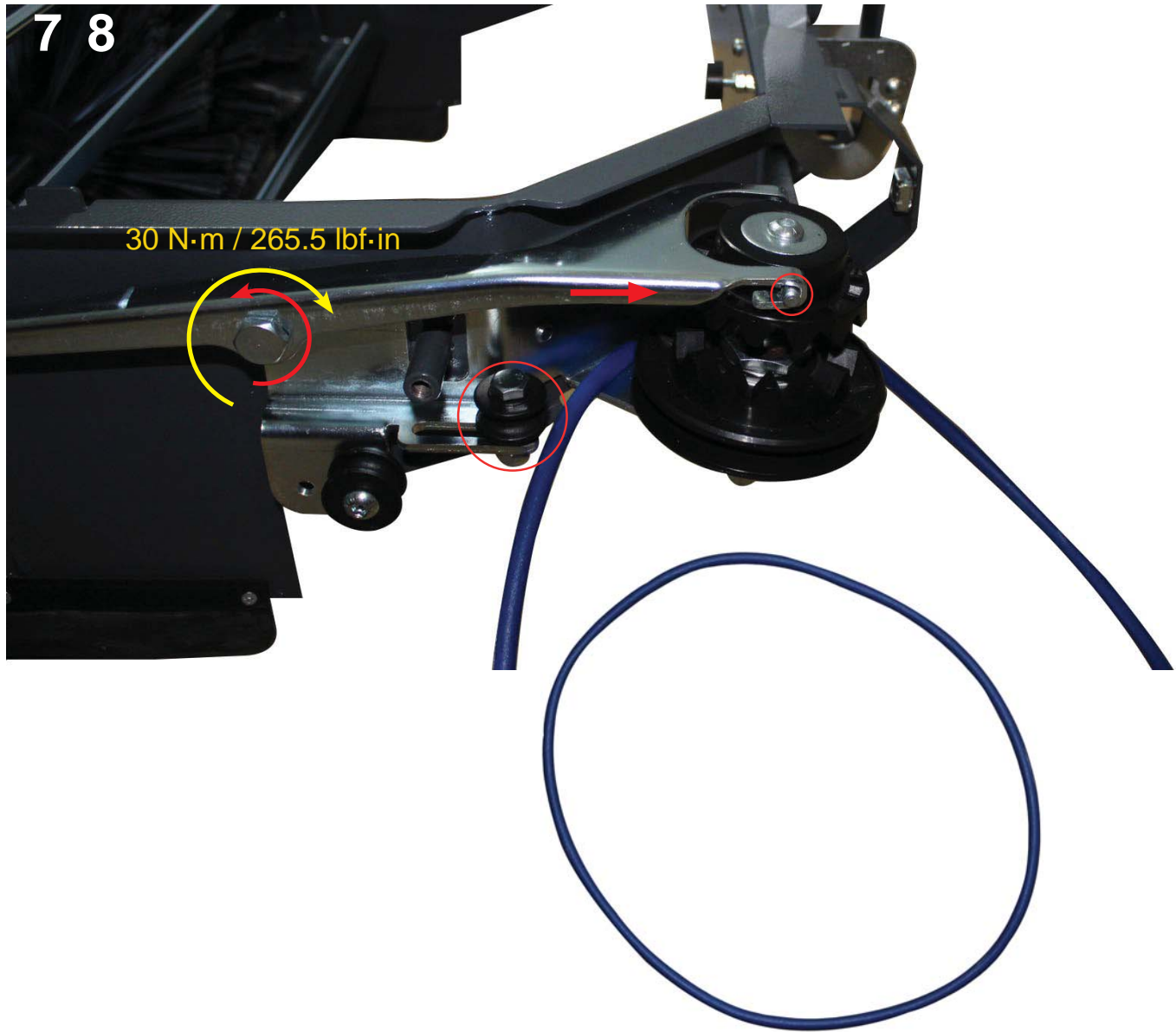
Take care when removing and assembling the belt from/onto the pulley; use protective leather work gloves.

### Disassembly

- 1 Move the machine onto flat and dry flooring.
- 2 Make sure that there is enough room around the machine to perform the disassembly operations safely.
- 3 Proceed with disassembly until reaching the belt as indicated in the previous paragraph.
- 4 If necessary, unscrew the bolt securing the tensioning roller and slide it towards the rear of the machine in order to facilitate removal of the belt.
- 5 Push the belt towards the outside of the pulley, while rotating the pulley fixed on the centre brush shaft, to make it unseat from the pulley.
- 6 Move the side brush control lever to position "1".



- 7 Unscrew the pin of the brush lifting arm, then move the arm forward to release it from the shaft.
- 8 Remove the worn belt from the drive shaft with driven gear.



### ***Reassembly***

- 1 After removing the worn belt, fit a new belt.
- 2 Refit the brush lifting arm and screw the pin to the frame with threadlocker.
- 3 **Tighten the brush arm pin with a maximum torque of 30 N·m - 265.5 lbf·in.**
- 4 Return the tension roller to the bottom of the adjustment slot and tighten the bolt.
- 5 Refit the belt and seat it on the pulley as indicated for disassembly.
- 6 To complete the reassembly, repeat the disassembly steps in reverse order.





**B**

## **SUCTION UNIT**



### **IMPORTANT**

Take the machine to the waste disposal area, clean the suction filter and empty the dirt bin.

Move the machine onto flat ground and apply the brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or pressing the emergency switch

Disconnect the electronic circuit from the batteries by detaching one or both battery connectors.

### **i INFORMATION**

Important information

When consulting this Service manual, the reader will encounter the expressions RIGHT and LEFT indicating the side of the machine. These indications always refer to the direction of movement of the machine.

In this Service Manual, the version of the machine may be written in brackets “()”, i.e. (E, DP-P, P, D). This note indicates that the instructions only refer to the model or version specified in brackets.

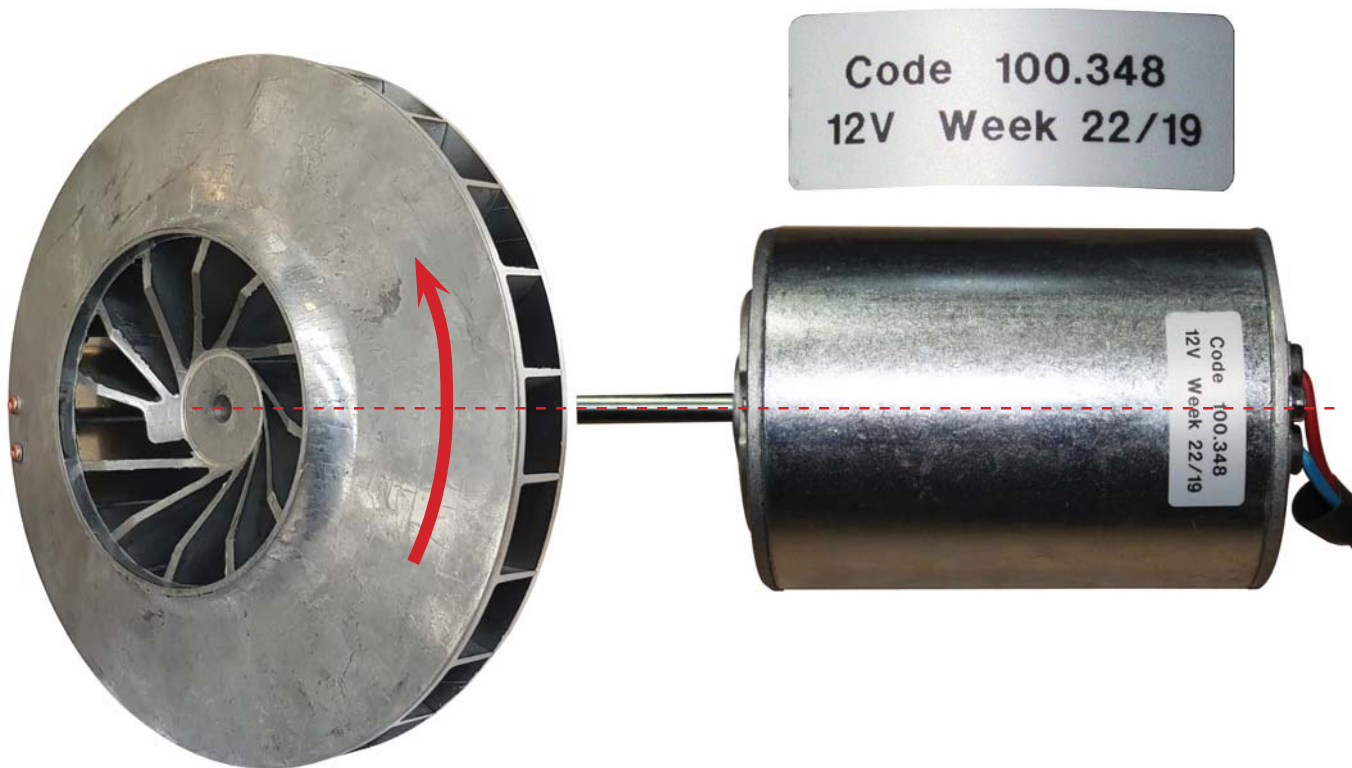
## B1 SUCTION MOTOR

*The function of the extractor fan is to vacuum up the dust raised by the revolving brush during operation, and direct it first through a special filter so as to make the air cleaner.*

*The extractor is of the centrifugal type with a 200 mm diameter two-piece aluminium fan, fixed to the electric motor by means of an M8 dowel. For smooth operation, rotation must necessarily be left or anticlockwise. The maximum rotation is 3500 rpm, while the electric motor rated power is 30 W.*

*The motor is a “brushed” type, equipped with two replaceable carbon brushes. In the event of the extractor fan malfunctioning, it must be replaced, having first verified power draw. The standard current draw of the motor is ~4.8A with a peak value of ~14A on starting.*

*The replacement of the complete extractor or of the motor alone requires aligning the fan with respect to the hole in the intake casing.*



## B1.1 Checking suction motor current draw

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the checks safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4 Make sure that the batteries on the machine are charged ( $12\text{ V} \pm 1\text{ V}$ ).
- 5 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- 6 Remove the rear debris bins and panel filter to make the test reliable.
- 7 Insert a shim under the front wheel to prevent the centre brush from coming into contact with the ground.
- 8 Pick out the blue wire of the suction motor and connect the clamp-on ammeter to it.
- 9 Turn the key to position "I" to turn on the machine: the brush will start turning.
- 10 Press the switch on the control panel that controls the suction motor "❄️".
- 11 Wait for the current draw to stabilize, read the value on the clamp-on ammeter and compare it with that in the table.
- 12 If the value falls within the range indicated in the table, disconnect the instrument and reinstate the top cover of the machine.



*Carry out the test with the centre brush raised, the side brush disengaged (the control lever on the control panel must remain in position "0"), the panel filter and the rear debris bins removed.*



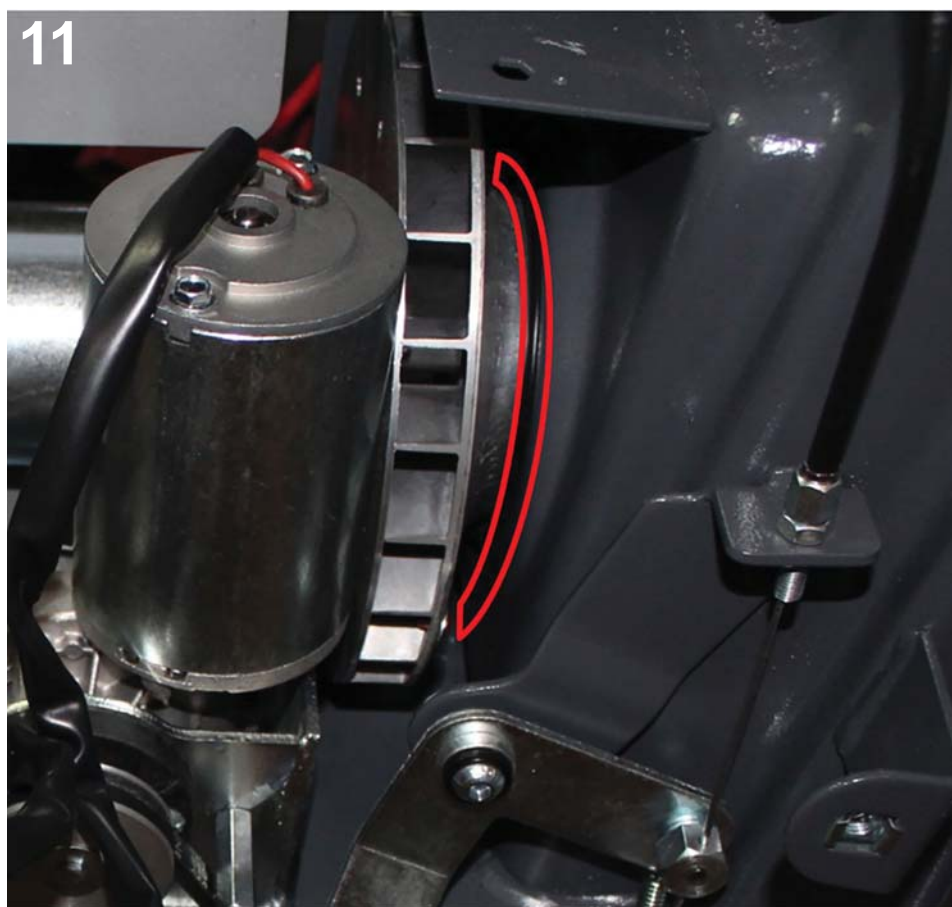
**i** Depending on the direction in which the current crosses the callipers, and therefore on the wire chosen for the measurement, the instrument may read negative values. This is not an error. The absolute value must be taken into account (without + or -). In case of a negative value, to read the positive value, simply reverse the position of the callipers.

**12** Conversely, if the value is at variance with those indicated in the table, proceed to make the following checks.

**12a** Make sure the fan does not touch or rub against the machine frame.

**12b** Check the motor carbon brushes for wear.

**12c** Replace the suction motor with a new one.



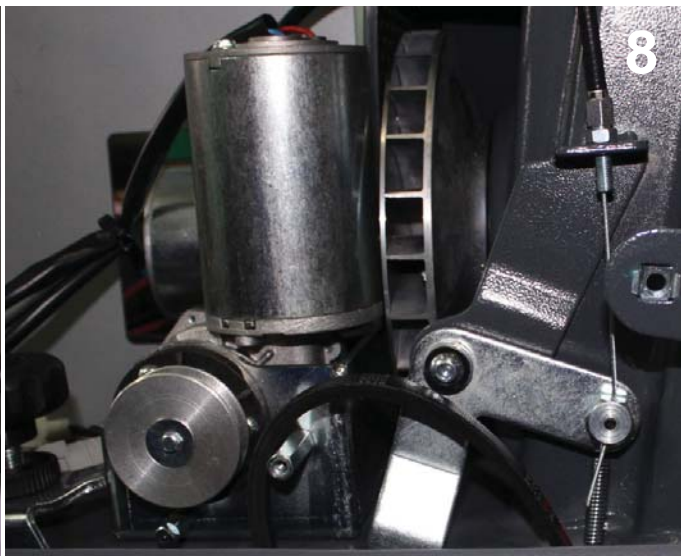
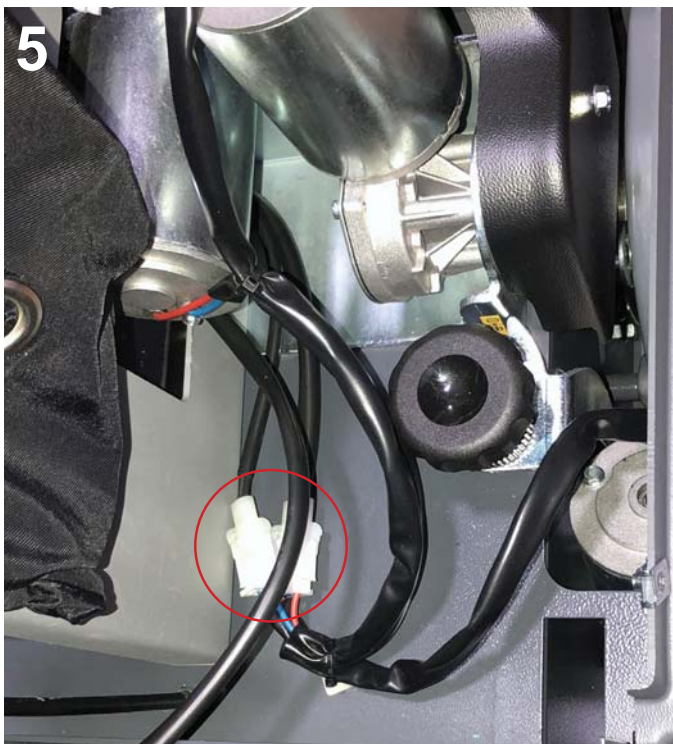
Current draw A (amperes)	Min	Max
No load (without fan)	2.3 A	2.9 A
Load applied (with fan)	2.9 A	3.5 A



## B1.2 Replacing the suction motor

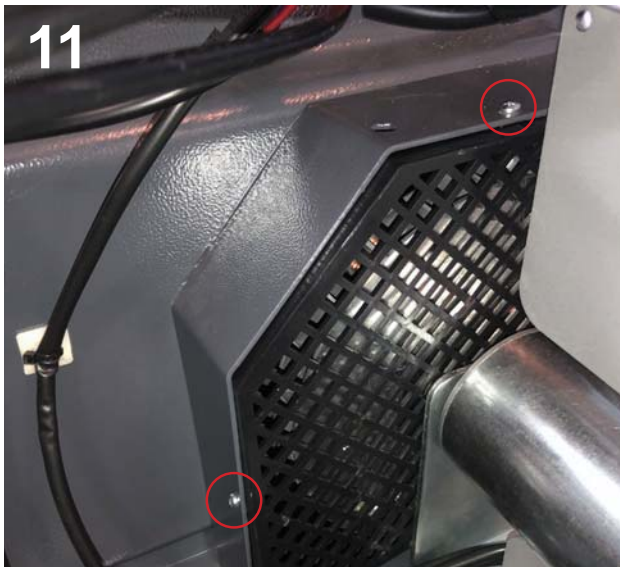
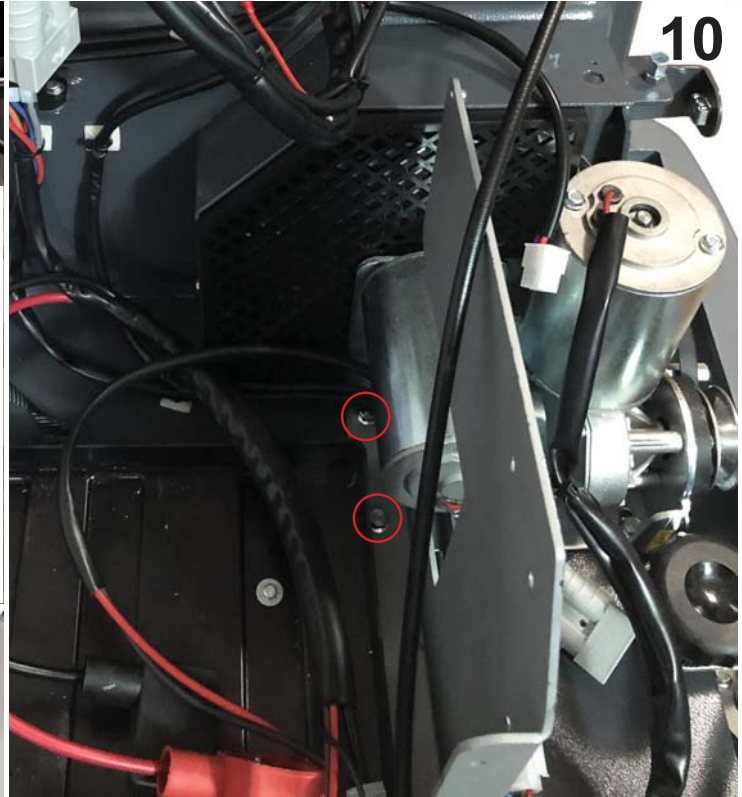
### *Disassembly*

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowl and, after undoing the screws, remove the top cowl to access the battery compartment.
- 4 Disconnect and remove the battery from the machine.
- 5 Disconnect the two connectors of the three motors.
- 6 Undo the two screws to remove the belt guard and access the engine.
- 7 Turn the lever clockwise to make it easier to unseat the belt from the pulley.
- 8 Push the belt out of the drive motor pulley.

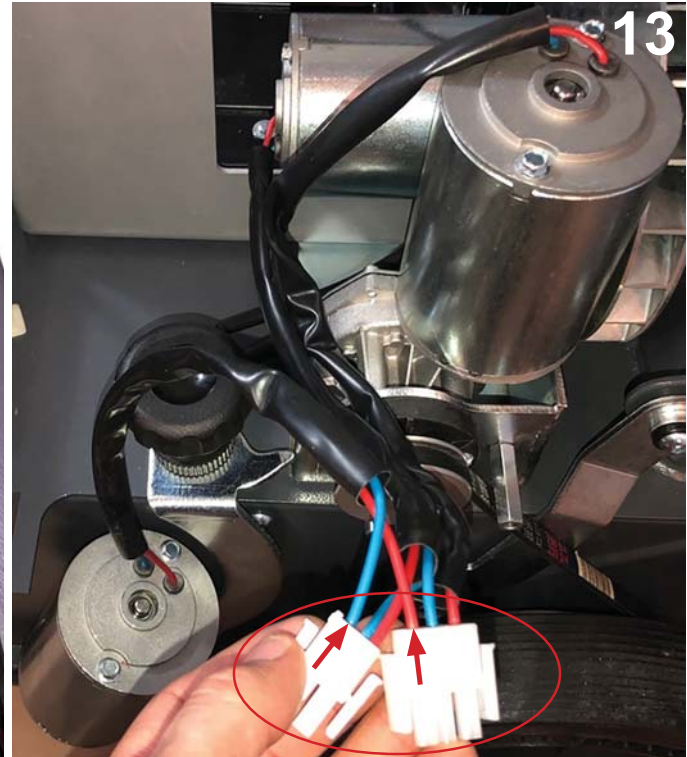
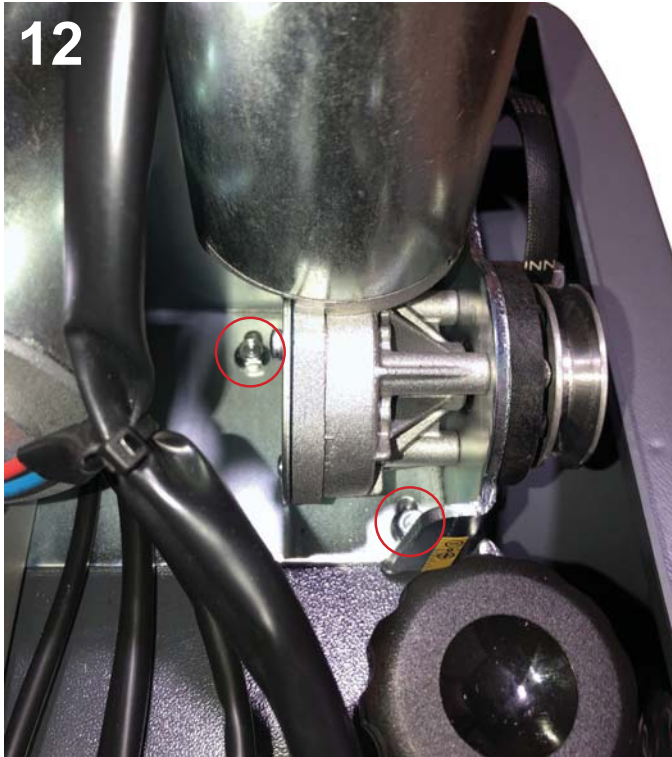




- 9** Remove the battery charger and the special bag for the charging cable from its support plate, after undoing the two screws for the battery charger and the two for the bag.
- 10** Unscrew the two hexagonal head screws to remove the battery charger support plate and cable bag.
- 11** Undo the two screws holding the protection grid of the extractor fan and remove it.



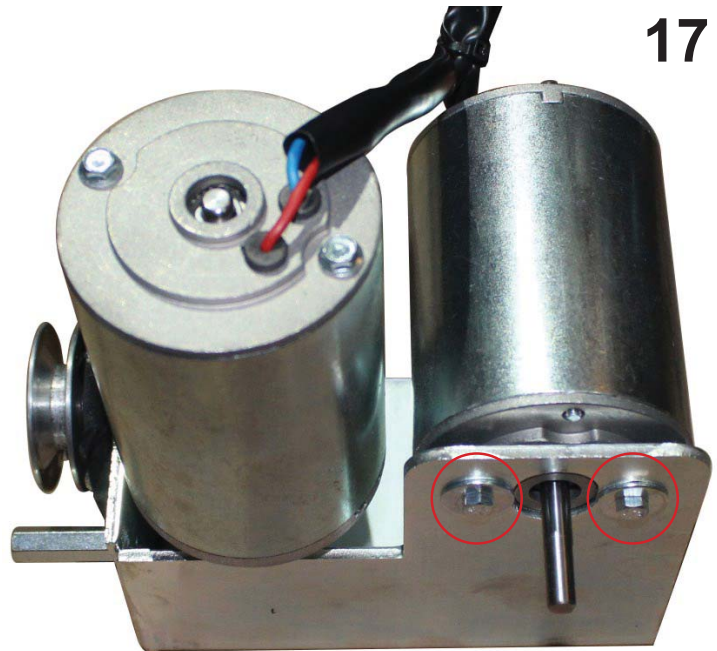
- 12** Unscrew the two bolts fixing the traction motor and extractor fan motor support plate and remove it.
- 13** Before removing the motor support plate, detach the brush motor cables from the two connectors.
- 14** Remove the motor plate together with the motors and take it to the bench for overhaul or replacement of the motors.





## ***Replacement***

- 15** In case of replacement of the motor, disconnect the power supply cables from the connector and remove the suction motor from its support plate.
- 16** Unscrew the dowel fixing the fan to the motor shaft and remove it.
- 17** Unscrew the two screws that fix the motor to the support plate and remove it.
- 18** Replace the motor.



## ***Reassembly***

- 1** To reassemble, repeat the disassembly operations in reverse order.
- 2** When mounting the motor plate on the frame, use the slots provided to adjust the distance of the fan from the intake casing.
- 3** Use the slots on the plate to adjust the alignment of the fan with respect to the hole in the intake casing.

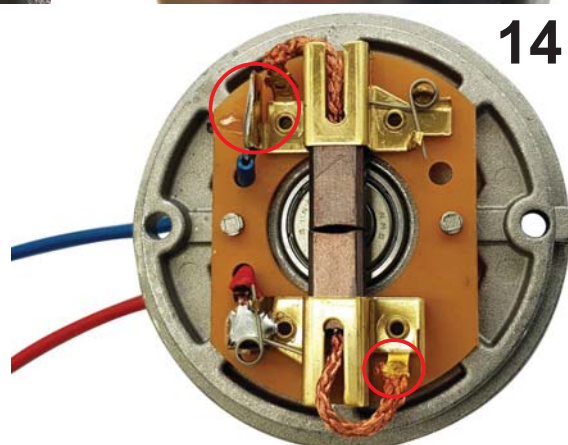
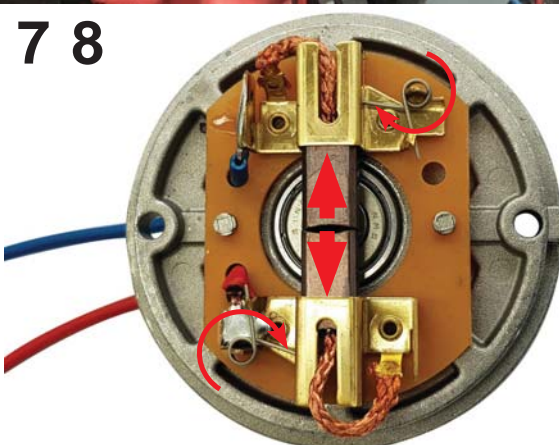
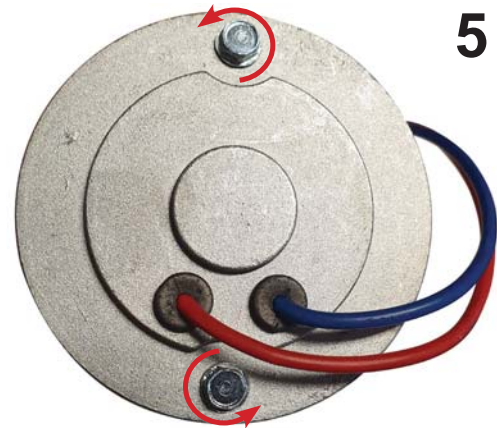


## B1.3 Checking and replacing the suction motor carbon brushes

**i** *To inspect the extent of wear on the carbon brushes and replace them if necessary, simply remove the motor end cap.*

### *Disassembly*

- 1 Move the machine onto flat and dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Remove the battery.
- 4 Disassemble the battery charger support bracket complete with battery charger and cable bag.
- 5 Undo the two screws on the vacuum motor end cap and remove it.
- 6 Pay attention to the shims on the rotor shaft, the number and their position.
- 7 Shift the spring, extract the carbon brush from its seat and proceed with the measurement.
- 8 Proceed to measure the carbon brush.

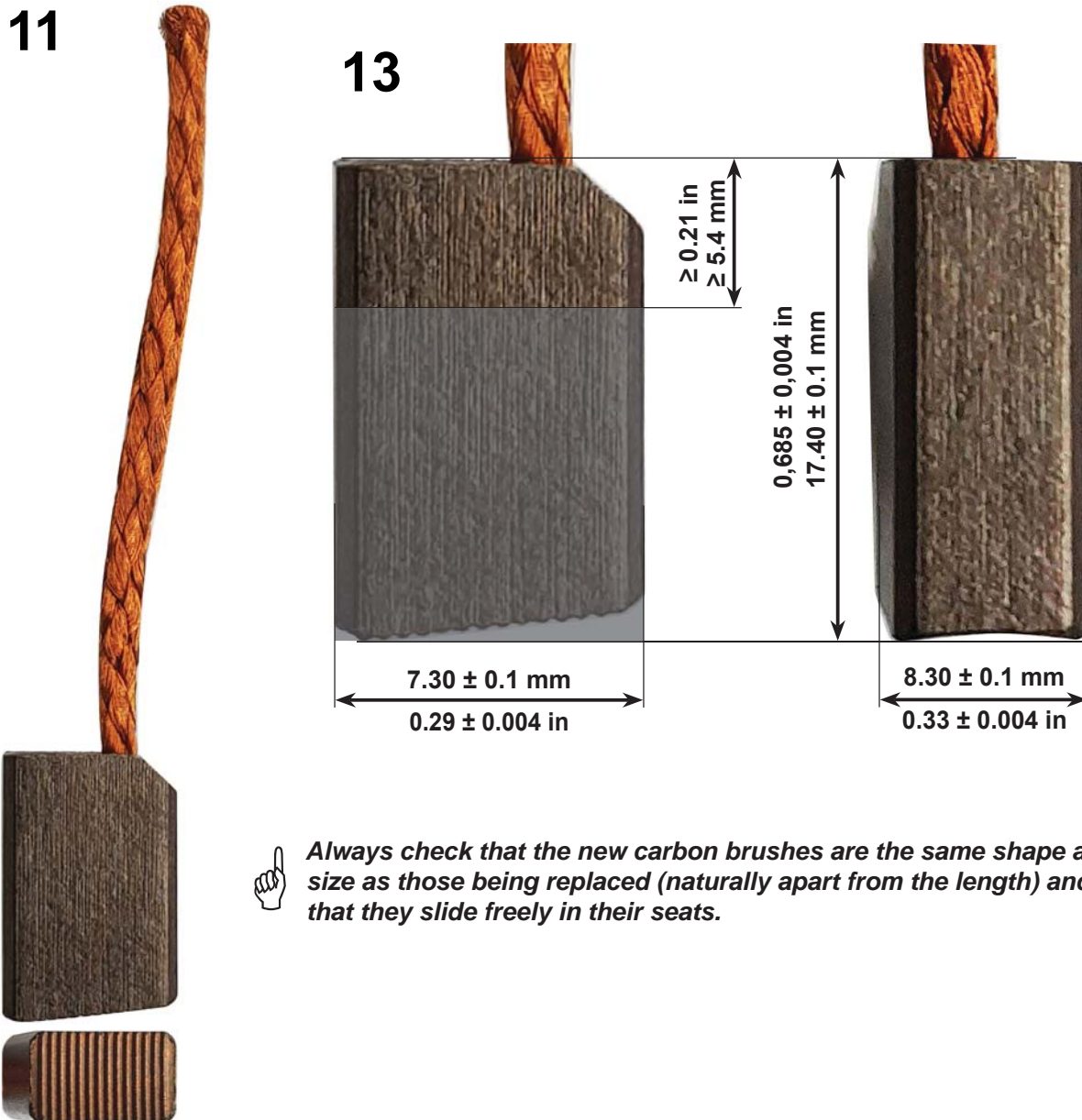


## Checks

- 11 Check the sliding contact surface of the carbon brushes for signs of abnormal wear or burning and possibly replace them even if still within tolerance.
- 12 Measure the carbon brush to determine wear, and then compare the values against those shown below.
- 13 The length of the carbon brush must be no less than  $\geq 5.4$  mm (0.21 inches).
- 14 In the event that the measurement is close to the value indicated in the table, replace the carbon brush after detaching it from the end cap.
- 15 Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and the rotor where the carbon brushes slide.
- 16 Check wear in the places where the carbon brushes slide before replacement. A damaged rotor would cause premature wear of the new carbon brushes.



**The carbon brushes must always be replaced as a pair, at one and the same time.**

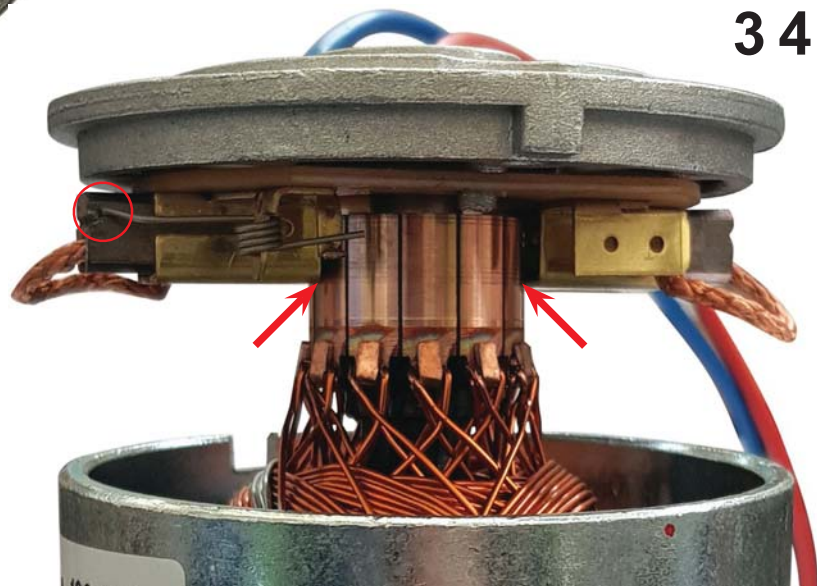
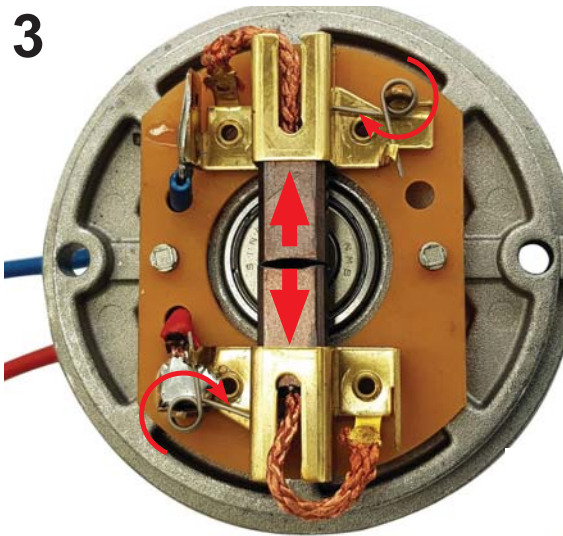
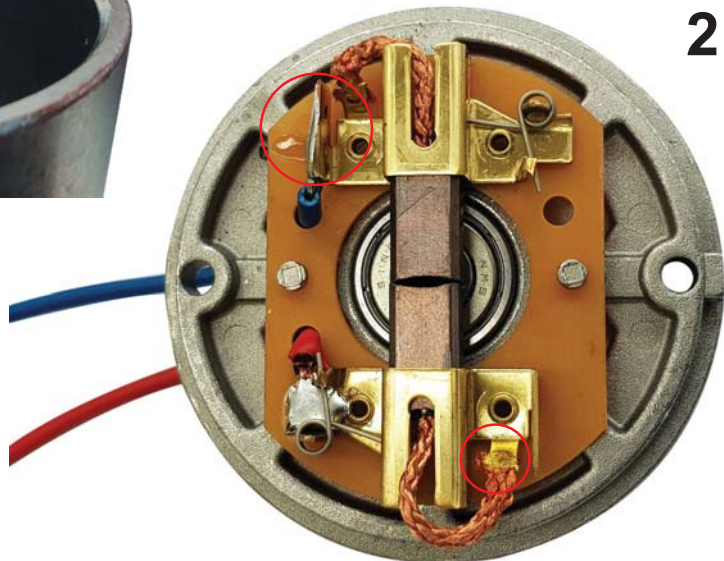
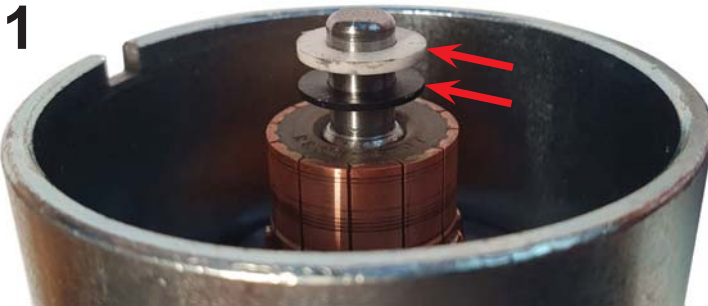


**Always check that the new carbon brushes are the same shape and size as those being replaced (naturally apart from the length) and that they slide freely in their seats.**



## Reassembly

- 1 Position the shims on the rotor in the correct order: the white one (usually one) resting on the bearing and the black one (one or two) between the gear reducer and the bearing (depending on the thickness) and resting on the gear reducer.
- 2 Solder the leads of the carbon brushes to the same position where the power leads are soldered.
- 3 Shift the springs to facilitate installation of the carbon brushes on the rotor.
- 4 Refit the rotor cap: after positioning the cap, correctly position the springs so that the carbon brushes press on the rotor.
- 5 Proceed with reassembly, repeating the steps of the disassembly sequence in reverse order.







## **B2 FILTER SHAKER MOTOR**

**i** The filter shaker comprises an electric motor and two opposing eccentric weights on the outside of the electric motor shaft that, when rotating, create strong vibrations across the entire filter. The electric motor is powered at 12V with a nominal power of 40 W and a rotation speed of 4200 rpm.


The function of the filter shaker is to shake the filter so as to clean it from dust and/or light debris, such as leaves, and ensure a longer working life, extending the replacement time for the panel filter.



For a better cleaning of the filter using the filter shaker, the extractor fan motor must be switched off.



## B2.1 Checking filter shaker current draw

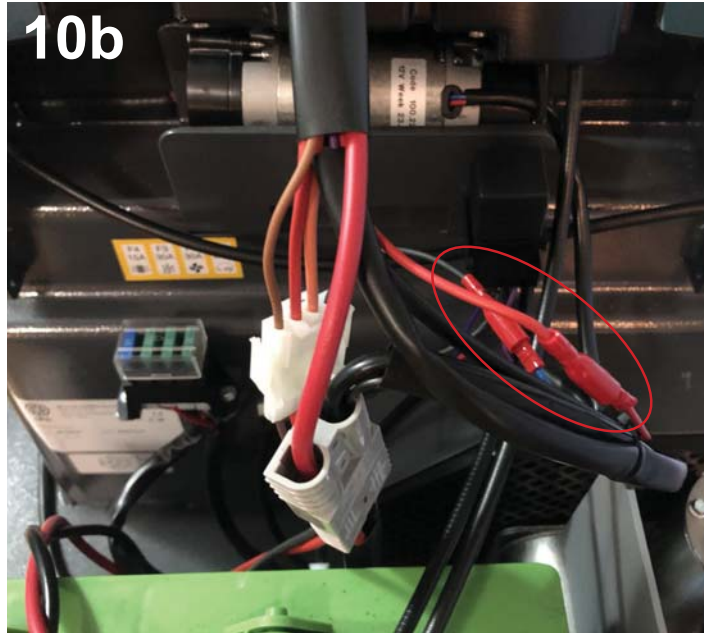
- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the test safely.
- 3 Make sure that the batteries on the machine are charged ( $12\text{ V} \pm 1\text{ V}$ ).
- 4 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- 5 Open the front cowling, pick out the red wire of the filter shaker motor and connect the ammeter clamp to it.
- 6 Turn the key to position "I" to turn on the machine: the brush will start turning.
- 7 Press and hold the button on the control panel that controls the filter shaker "".
- 8 Keep the button pressed until the current draw stabilizes, read the value on the clamp-on ammeter and compare it with that in the table.
- 9 If the value falls within the range indicated in the table, disconnect the instrument and reinstate the machine front panel.



**10** Conversely, if the value is at variance with those indicated in the table, proceed to make the following checks.

**10a** Make sure that the wiring that powers the filter shaker motor is intact and the connections are tight.

**10b** Replace the filter shaker motor with a new one



<i>Current draw A (amperes)</i>	<i>Min</i>	<i>Max</i>
Filter shaker motor	4.8 A	5.9 A



## B2.2 Removing the filter shaker motor

### *Disassembly*

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4 Disconnect and remove the battery from the machine.
- 5 Locate the two cylindrical filter shaker connectors clamped on the main wiring and disconnect them.
- 6 Remove the complete control panel by undoing the four screws on the sides.
- 7 Undo the lower lock nut a few turns to disassemble the filter shaker.
- 8 Completely unscrew the shaft together with the hammer from the filter shaker.
- 9 Remove the filter shaker and replace it with a new one.



### *Reassembly*

- 1 To reassemble, repeat the disassembly steps in reverse order.
- 2 Screw the hammer shaft all the way to the nut on the filter shaker before tightening the lock nut.



## **IMPORTANT**

Move the machine to the waste disposal area, clean the suction filter and empty the dirt bin.

Move the machine onto flat ground and apply the brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or pressing the emergency switch

Disconnect the electronic circuit from the batteries by detaching one or both battery connectors.

## **i INFORMATION**

Important information

When consulting this Service manual, the reader will encounter the expressions **RIGHT** and **LEFT** indicating the side of the machine. These indications always refer to the direction of movement of the machine.

In this Service Manual, the version of the machine may be written in brackets “()”, i.e. (E, DP-P, P, D). This note indicates that the instructions only refer to the model or version specified in brackets.



## C1 TRACTION MOTOR / CENTRE BRUSH MOTOR

**i** The drive motor or centre brush motor is equipped with an angle or bevel helical gear reducer with worm gear drive, the rotor shaft having a double-start thread. The maximum rotational speed at the gear reducer output shaft is 210 rpm. The rated power of the motor is 25.5W, while the voltage is 12V DC. The maximum current draw of the motor at starting is 57A with a maximum torque of 21 N · m - 185.9 lbf · in, while the motor at no load draws 4.0A. Other specifications of the motor are insulation class 'F' and protection IP30 against ingress of solids and liquids.

The motor is equipped with replaceable carbon brushes. Check the current draw to assess the need for motor disassembly to replace the carbon brushes.





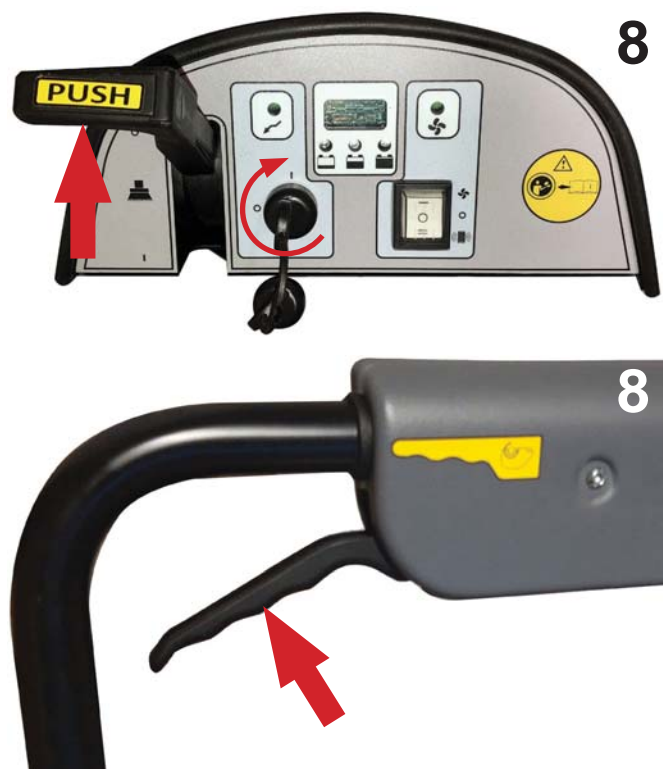
## C1.1 Checking drive motor current draw

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the drive motor.
- 4 Make sure that the batteries on the machine are charged ( $12\text{ V} \pm 1\text{ V}$ ).
- 5 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- 6 Raise both rear wheels high enough not to touch the ground.
- 7 Pick out the red wire of the drive motor and connect the clamp-on ammeter to it.
- 8 Turn the key to position "I" and start the drive motor by pulling the right control lever.
- 9 Wait for the current draw to stabilize, read the value on the clamp-on ammeter display and compare it with that in the table.
- 10 If the value falls within the range indicated in the table, disconnect the instrument and reinstate the machine front panel.
- 11 Conversely, if the value is at variance with those indicated in the table, make the following checks.

**i** Depending on the direction in which the current crosses the callipers, and therefore on the wire chosen for the measurement, the instrument may read negative values. This is not an error. The absolute value must be taken into account (without + or -). In case of a negative value, to read the positive value, simply reverse the position of the callipers.



Carry out the test with the side brush disengaged (control lever on the control panel on "0"), the filter shaker and the extractor fan motor must be deactivated (switch on position "0").



- 12** Remove the belt from the drive motor pulley and check the no-load current draw.
- 12a** If the reading is outside of the values shown in the table (usually higher), check motor carbon brush wear.
- 12b** If the reading is included in the values in the table below, rotate the wheels by hand to check that the bearings mounted on the axle and wheels do not present abnormal noise and that the wheels are free to turn.
- 12c** If necessary, replace the drive motor with a new one.



<i><b>Current draw A (amperes)</b></i>	<i><b>Min</b></i>	<i><b>Max</b></i>
<b>No load (with belt removed)</b>	<b>2.9 A</b>	<b>3.5 A</b>
<b>With load (with belt fitted)</b>	<b>10.8 A</b>	<b>13.2 A</b>

## C1.2 Check drive belt wear status

- i** *Belt wear can be seen on the surface in contact with the pulleys, which is smoother and shows small cracks, as well as by fraying on the outside of the belt, or evident cuts due to foreign bodies wedged between the belt and the pulley.*



### Disassembly

- 1** Move the machine to flat, dry flooring.
- 2** Make sure that there is enough room around the machine to perform disassembly operations and checks safely.
- 3** Turn the front cowling and, after undoing the screws, remove the top cowling to access the drive motor.
- 4** Undo the two screws to remove the belt guard.
- 5** Unseat the belt from the pulley on the drive motor to facilitate a visual check of its wear.
- 6** Rotate the belt by hand to check its mechanical condition.



### Reassembly

- 1** To reassemble the belt repeat the disassembly operations in reverse order.



## C1.3 Replacing the drive belt

**i** *The drive belt will need replacing typically when worn to the point of breaking. However, in order to avoid machine downtime, it may be useful to replace the belts in advance, before they break. Belt wear is showing on the surface in contact with the pulleys, smoother, with small cracks and fraying at the top edge of the belt.*



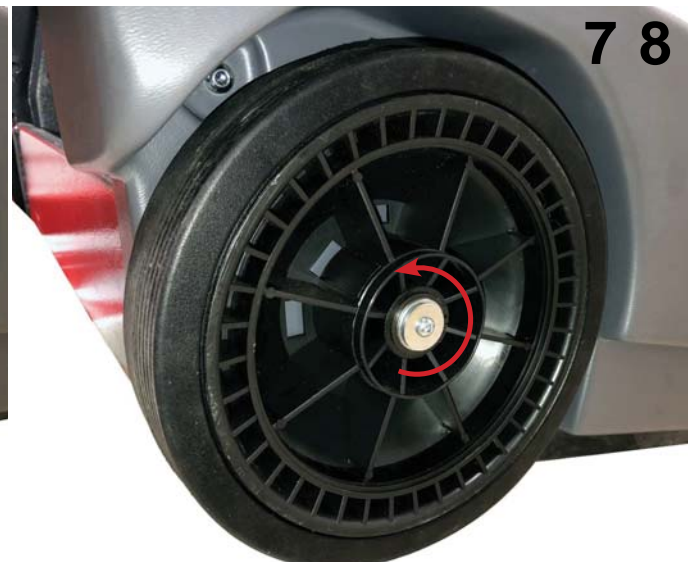
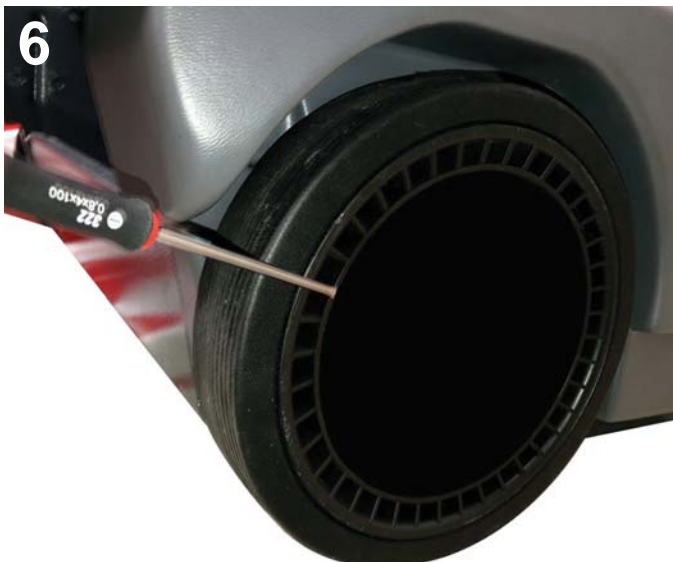
*Take care when removing and assembling the belt from/onto the pulley; use protective leather work gloves.*

### Disassembly

- 1** Move the machine onto flat and dry flooring.
- 2** Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3** If necessary, clean the working area with a jet of compressed air.
- 4** Disconnect and remove the battery from the machine.
- 5** Lift the left wheel by inserting an object under the rear frame.
- 6** With a flat-head screwdriver remove the wheel covers that hide the fixing screw.
- 7** To undo the screw that secures the wheel, hold the wheel steady and unscrew or use a pulse screwdriver.
- 8** Remove the wheel from the axle.



*In case of disassembly of both wheels pay attention to their position as the wheels are not interchangeable: the right must be mounted on the right side and the left on the left side. This is because the bearings mounted on the wheels have a locked direction of rotation and the opposite direction idle, to respectively allow driving and steering the machine.*



- 9** Undo the four Allen screws, the self-tapping screw and remove the left side guard.
- 10** Undo the two screws to remove the belt guard.
- 11** Unseat the belt from the small pulley mounted on the drive lever.
- 12** Remove the belt and replace it with a new one.

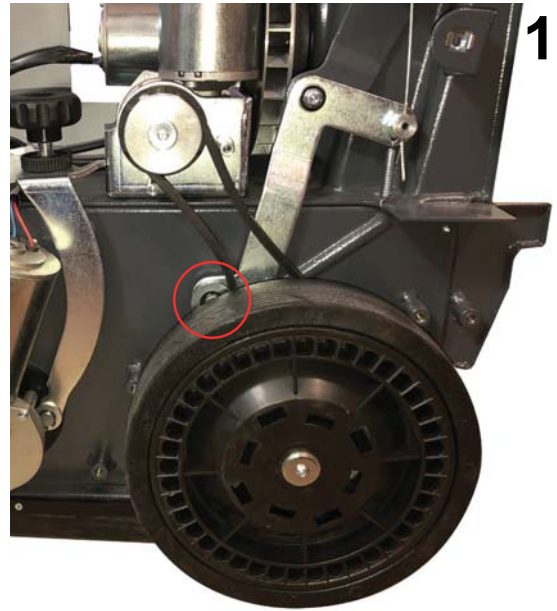
**9**



**10**



**11**



**12**



### **Reassembly**

- 1** To reassemble the new belt repeat the disassembly operations in reverse order.



## C1.4 Replacing the drive motor

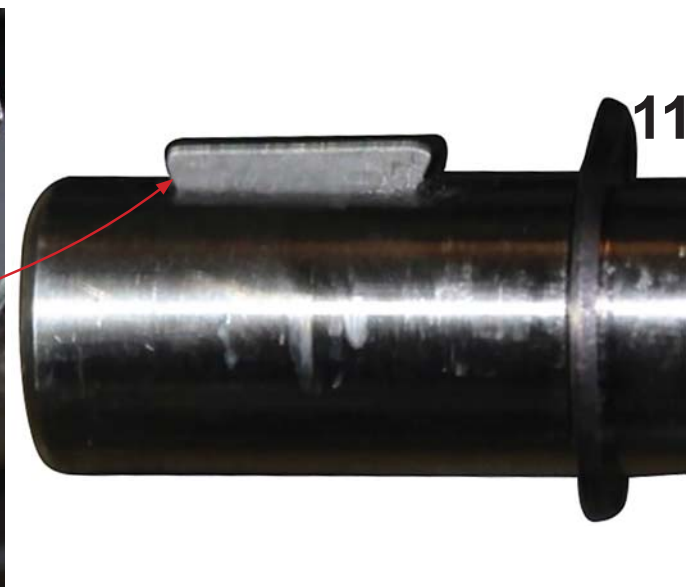
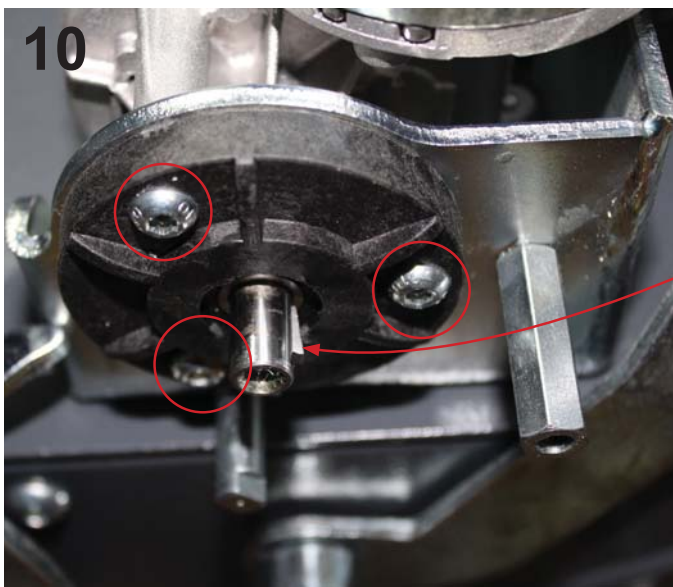
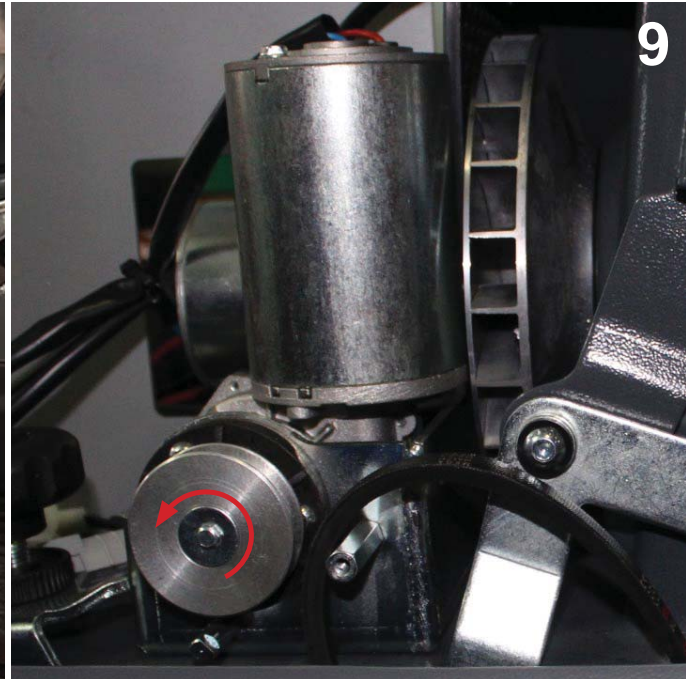
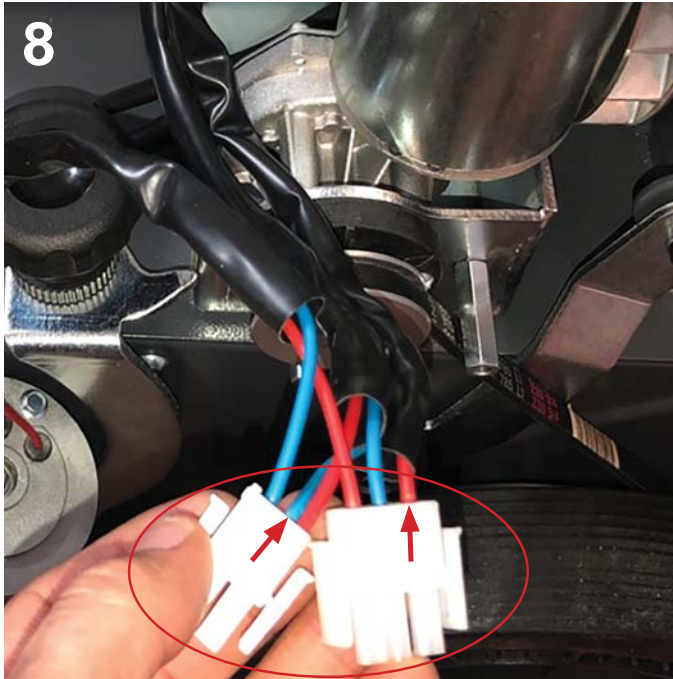
### *Disassembly*

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the drive motor.
- 4 Disconnect and remove the battery from the machine.
- 5 Disconnect the two connectors of the three motors.
- 6 Undo the two screws to remove the plastic protection and access the motor.
- 7 Unseat the belt from the alternator pulley.





- 8** Detach the drive motor cables from the two connectors.
- 9** Unscrew the hexagonal head screw and remove the pulley: if necessary, use a lever for extraction.
- 10** Unscrew the three Allen screws to remove the plastic centering device with bearing and the drive motor.
- 11** Remove the key from the drive motor shaft and reuse it for the new motor.
- 12** Rotate the motor counterclockwise and pull it out of the support plate.



## **Reassembly**

- 1** To refit the new motor, repeat the disassembly steps in reverse order.
- 2** Apply thread locking glue on the screws that fix the gearmotor and the one that fixes the pulley.

## C1.5 Checking and replacing the drive motor carbon brushes

**i** *To inspect the extent of wear on the carbon brushes and replace them, if necessary, simply remove the motor end cap.*

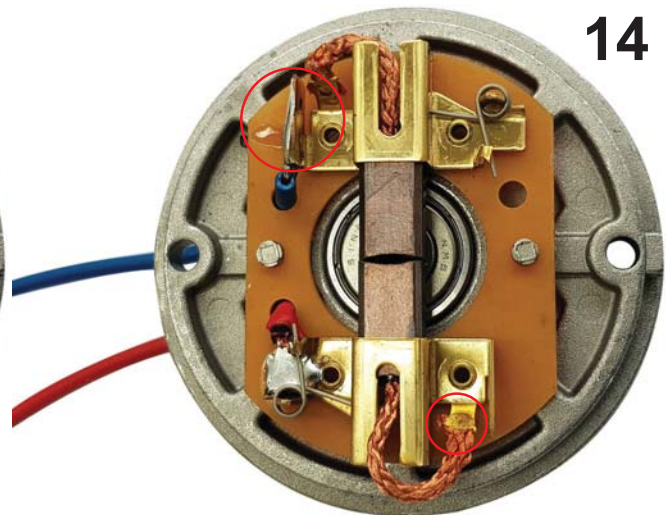
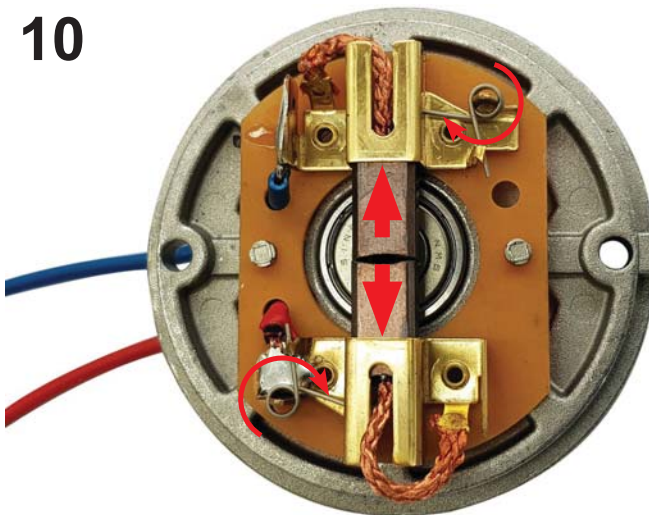
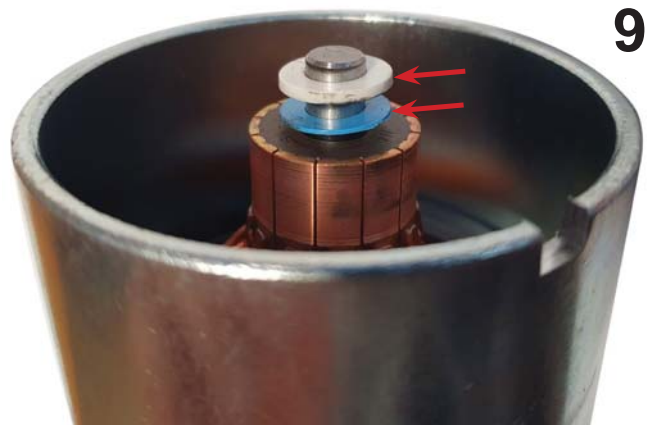
### **Disassembly**

- 1** Move the machine to flat, dry flooring.
- 2** Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3** Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4** Disconnect the battery from the machine.
- 5** Undo the two screws to remove the plastic protection and access the motor.
- 6** Disconnect the connector on the battery charger, undo the screw on the connector side and loosen the screw on the opposite side.
- 7** Rotate the battery charger upwards to allow the hood to be removed from the drive motor.





- 8** Undo the two screws on the drive motor securing the hood and lift the latter.
- 9** Pay attention to the shims on the rotor shaft, the number and their position.
- 10** Shift the spring, extract the carbon brushes from their seat and proceed with the measurement.





## Checks

- 11 Check the sliding contact surface of the carbon brushes for signs of abnormal wear or burning and possibly replace them even if still within tolerance.
- 12 Measure the carbon brush to determine wear, and then compare the values against those shown below.
- 13 The length of the carbon brush must be no less than  $\geq 5.4$  mm (0.21 inches).
- 14 In the event that the measurement is close to the value indicated in the table, replace the carbon brush after detaching it from the end cap.
- 15 Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and the rotor where the carbon brushes slide.
- 16 Check wear in the places where the carbon brushes slide before replacement. A damaged rotor would cause premature wear of the new carbon brushes.



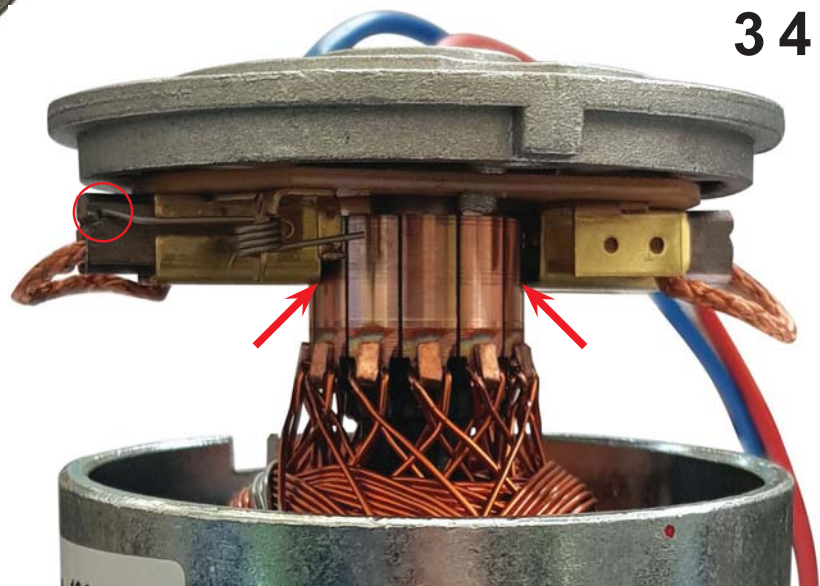
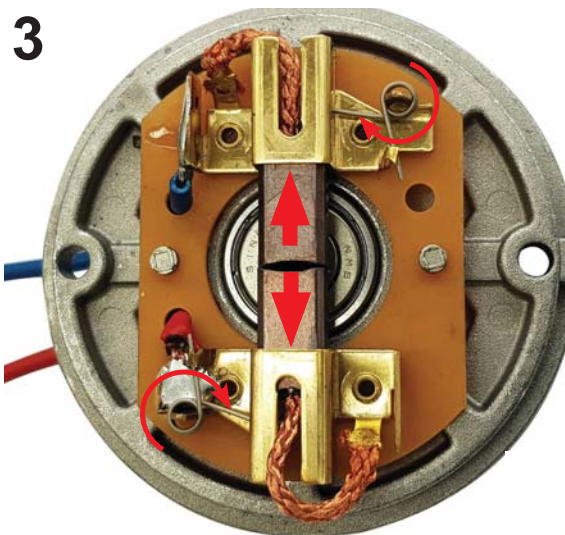
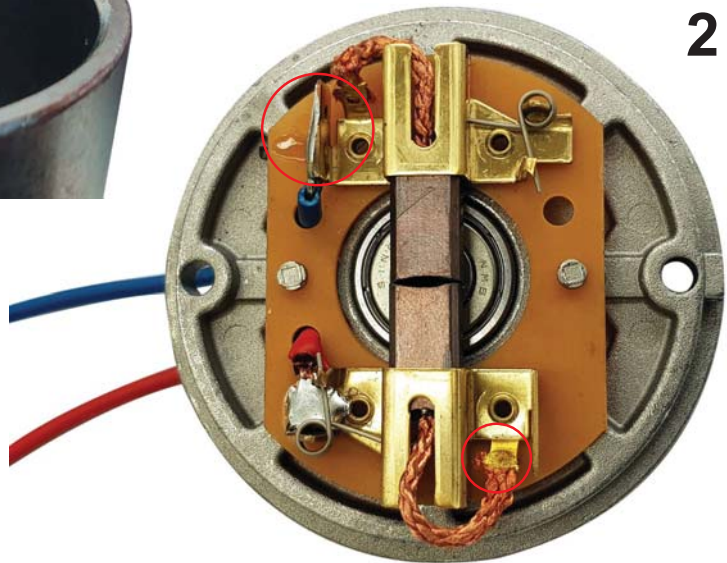
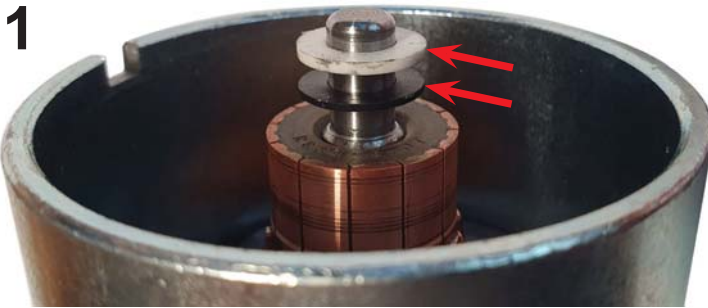
**The carbon brushes must always be replaced as a pair, at one and the same time.**



**Always check that the new carbon brushes are the same shape and size as those being replaced (naturally apart from the length) and that they slide freely in their seats.**

## Reassembly

- 1 Position the shims on the rotor in the correct order: the white one (usually one) resting on the bearing and the black one (one or two) between the gear reducer and the bearing (depending on the thickness) and resting on the gear reducer.
- 2 Solder the leads of the carbon brushes to the same position where the power leads are soldered.
- 3 Shift the springs to facilitate installation of the carbon brushes on the rotor.
- 4 Refit the rotor cap: after positioning the cap, correctly position the springs so that the carbon brushes press on the rotor.
- 5 Proceed with reassembly, repeating the steps of the disassembly sequence in reverse order.





**D**

## **IMPORTANT**

**Move the machine to the waste disposal area, clean the suction filter and empty the dirt bin.**

**Move the machine onto flat ground and apply the brake. If necessary, place chocks under the wheels.**

**Switch the machine off by turning the ignition key anticlockwise and/or pressing the emergency switch**

**Disconnect the electronic circuit from the batteries by detaching one or both battery connectors.**

## **i INFORMATION** Important information

**When consulting this Service manual, the reader will encounter the expressions RIGHT and LEFT indicating the side of the machine. These indications always refer to the direction of movement of the machine.**

**In this Service Manual, the version of the machine may be written in brackets “()”, i.e. (E, DP-P, P, D). This note indicates that the instructions only refer to the model or version specified in brackets.**



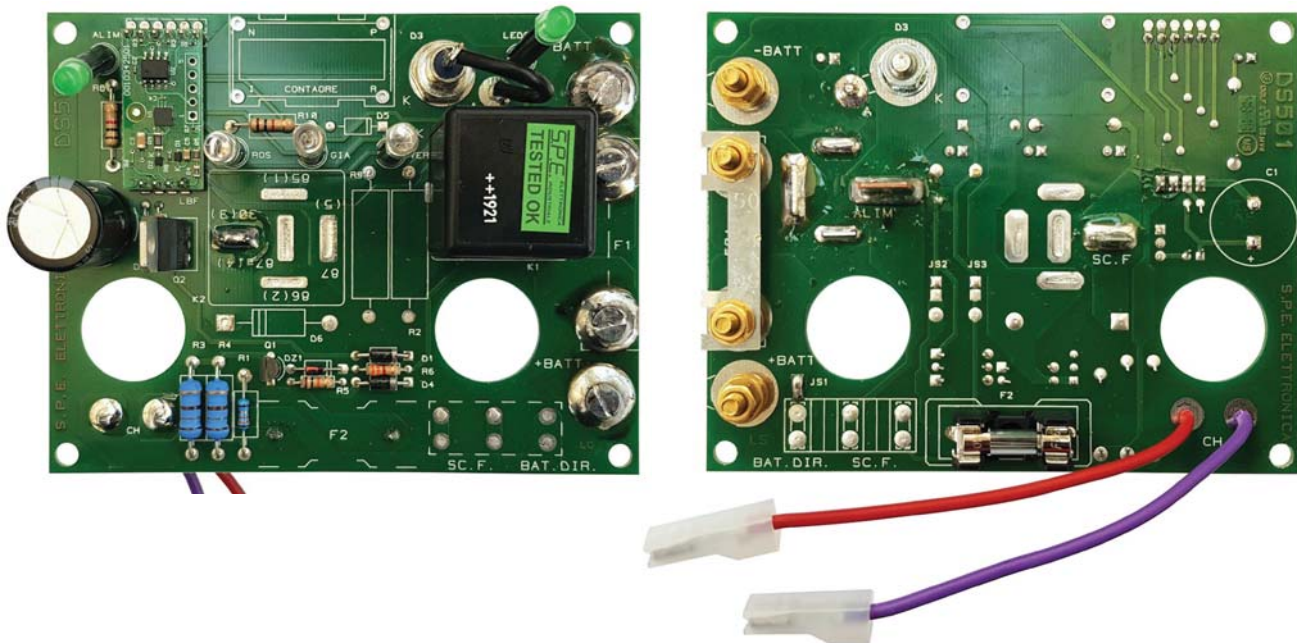
## D1 CONTROL PANEL BOARD

The control panel board has the function of showing the machine operation status through LEDs. It is equipped with three LEDs, Red, Yellow, Green, to indicate the charge level of the battery, and two green LEDs indicating the machine is ON and the central brush active together with the extractor fan, provided the switch on the control panel is ON. On the board there is a 1.6A 250V "Fast" type cartridge fuse F2 to protect the electronics of the control panel board and a 50A blade type fuse F1 to protect the machine motors (drive, brush, extractor, filter shaker) against short circuit.

The electronic board is powered by the ignition key: after checking the battery charge level, the key activates the power relay fitted on the board which powers the motors dedicated to the machine operation.

The drive and brush motors are operated exclusively by the power relay, while the extractor fan and the filter shaker are also controlled by means of the switch-button on the control panel.

The four machine engines are protected by a dedicated fuse, located between the F1 fuse on the control panel and the engine. The board features a standard fast-recovery or free-wheeling diode that prevents board overload when the motors are switched off: it is advisable to check diode operation in case of board anomalies.

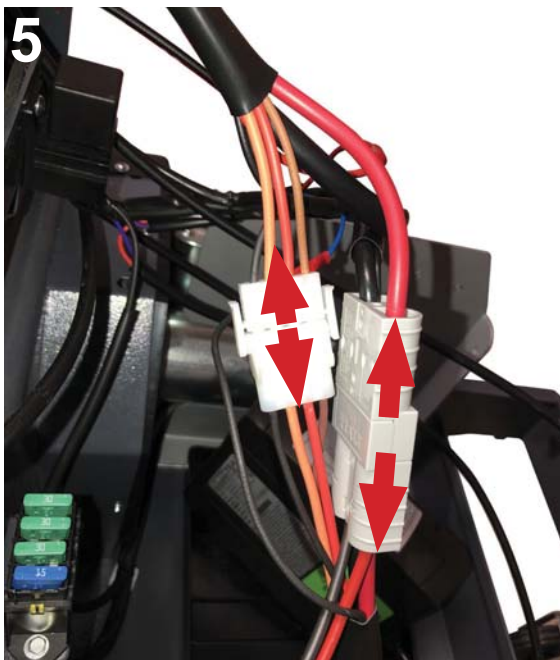


## D1.1 Inspection and replacement of control panel board F2 fuse (1.6A F)

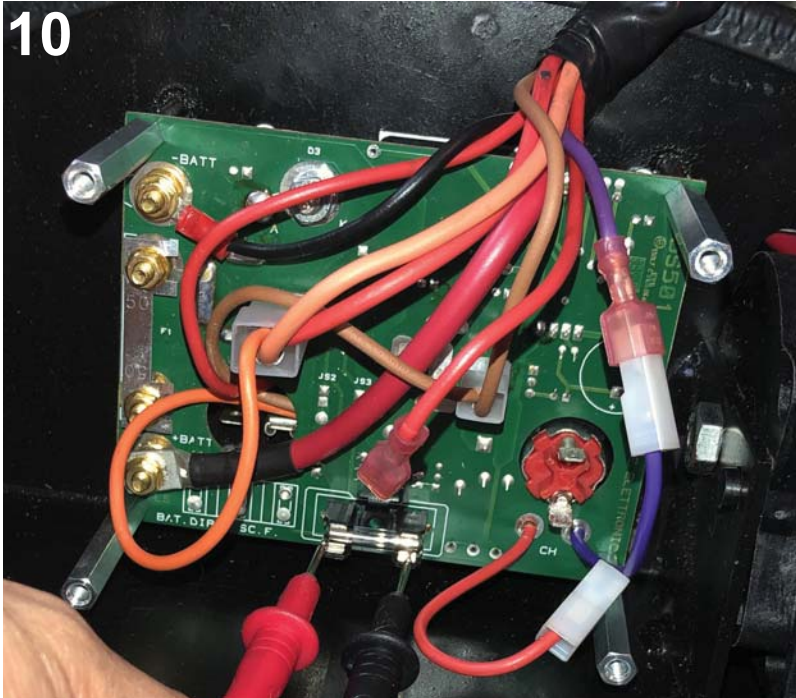
**i** *If when turning the key to the start position "I", with charged batteries, nothing turns on, check the 1.6A F cartridge display fuse F2 for continuity and replace it if necessary.*

### Checks

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowling and, after undoing the screws, remove the top cowling to access the battery compartment.
- 4 Use a digital multimeter able to check continuity.
- 5 Disconnect the control panel connectors from the main wiring.
- 6 Undo the 4 hexagonal screws of the control panel support and remove it.



- 7** Undo the 4 screws that secure the protective guard to access the display board.
- 8** Visually check that the fuse is not blown: if necessary, check it with a multimeter.
- 9** Position the red probe on one end of the fuse, the black probe on the other end and check that the multimeter emits a continuous sound.
- 10** If the fuse is blown, replace it.

**8**

### ***Reassembly***

- 1** To reassemble the control panel board, repeat the disassembly steps in reverse order.

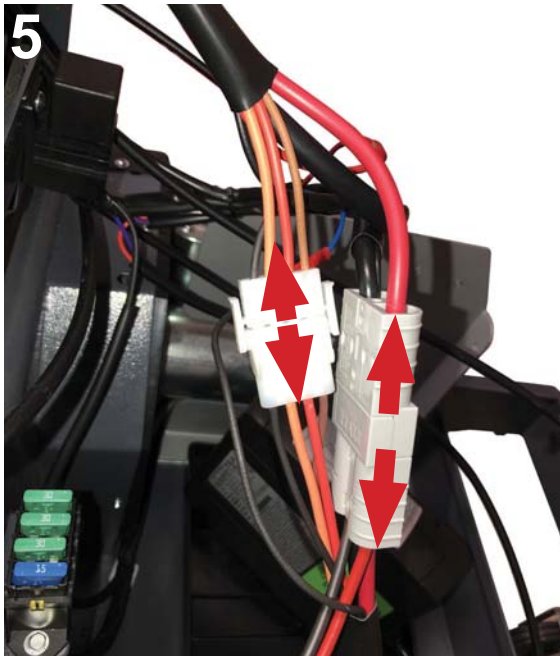


## D1.2 Checking and replacing control panel card 50A fuse F1

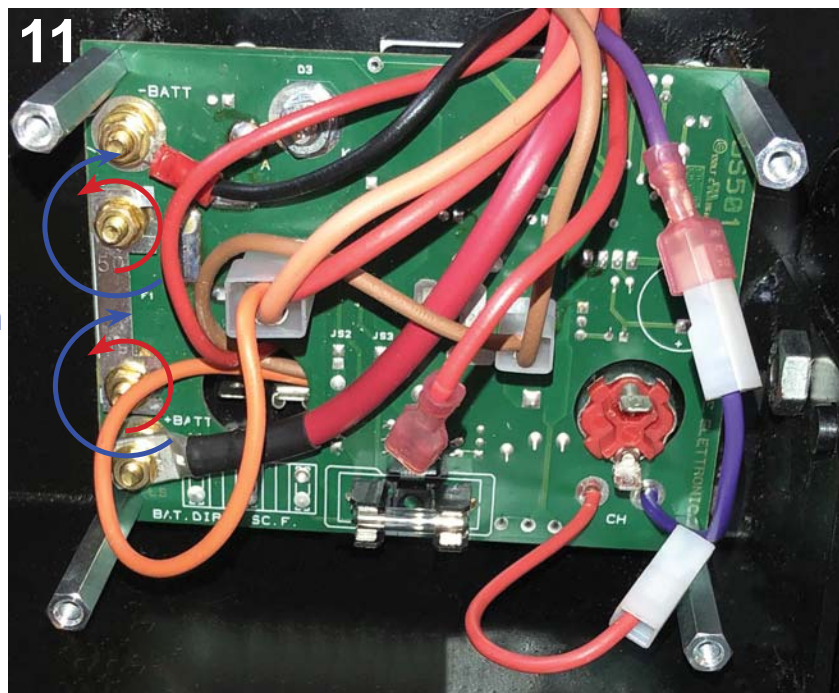
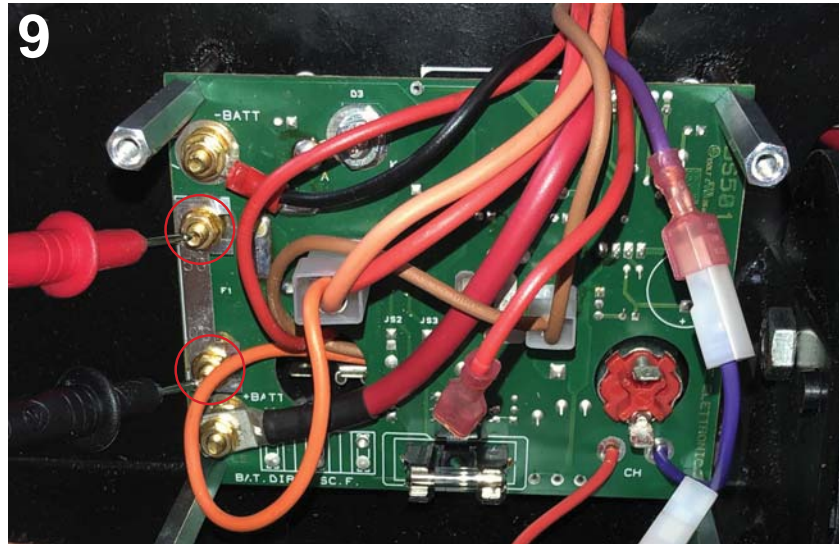
- i** *If when turning the key to the start position "I", with charged batteries, only the battery charge level LEDs light up on the control panel, while that indicating the machine ignition remains off, check the 50A fuse F1 for continuity and replace it if necessary.*

### Checks

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowl and, after undoing the screws, remove the top cowl to access the battery compartment.
- 4 Disconnect the control panel connectors from the main wiring.
- 5 Undo the 4 hexagonal screws of the control panel support and remove it.



- 7 Undo the 4 screws that secure the protective guard to access the display board.
- 8 Visually check that the fuse is not blown: if necessary, check it with a multimeter.
- 9 Position the red probe on one end of the fuse, the black probe on the other end and check that the multimeter emits a continuous sound.
- 10 If the fuse is blown, replace it.
- 11 Loosen the 2 locking screws and remove the blown fuse.



**2,0 N·m**  
**~ 17.7 lbf·in**

## ***Reassembly***

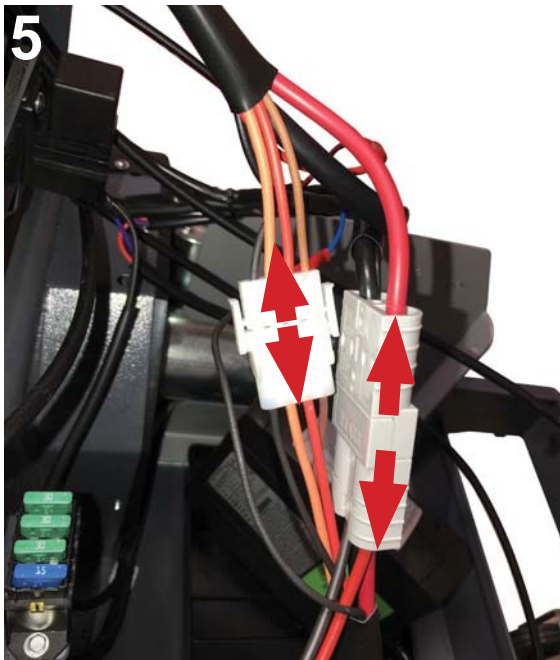
- 1 Insert the fuse between the two washers and tighten the nuts securing the fuse with a maximum torque of 2 N·m / ~ 17.7 lbf·in.
- 2 Complete reassembly of the control panel, repeating the disassembly operations in reverse order.



## D1.3 Disassembly and removal of the control panel board

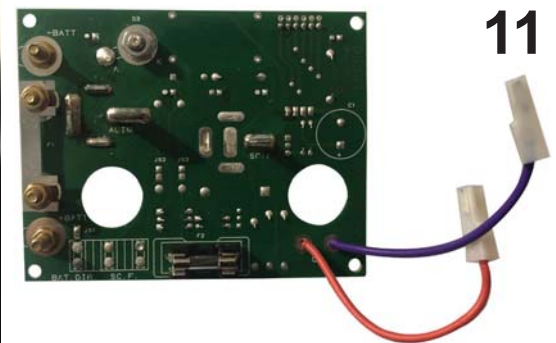
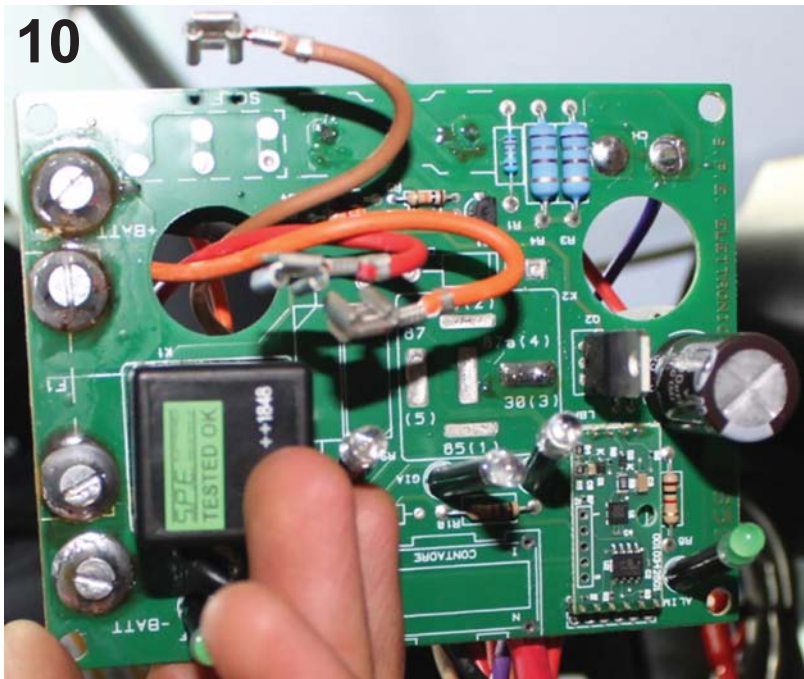
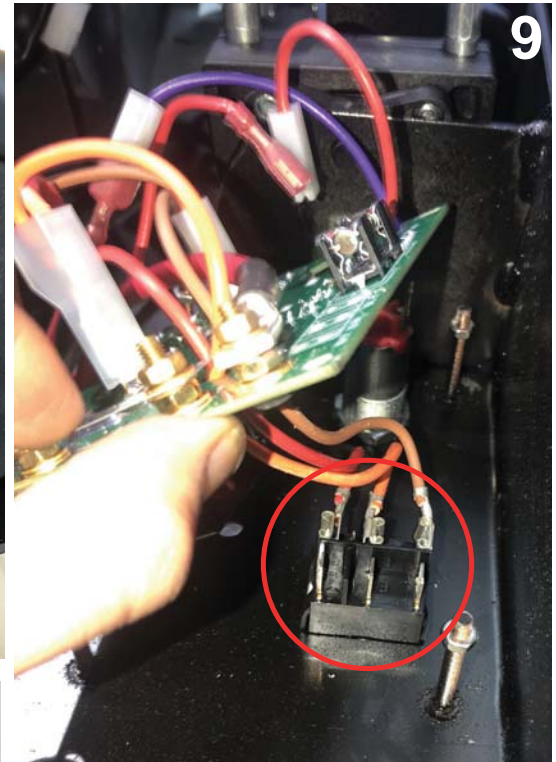
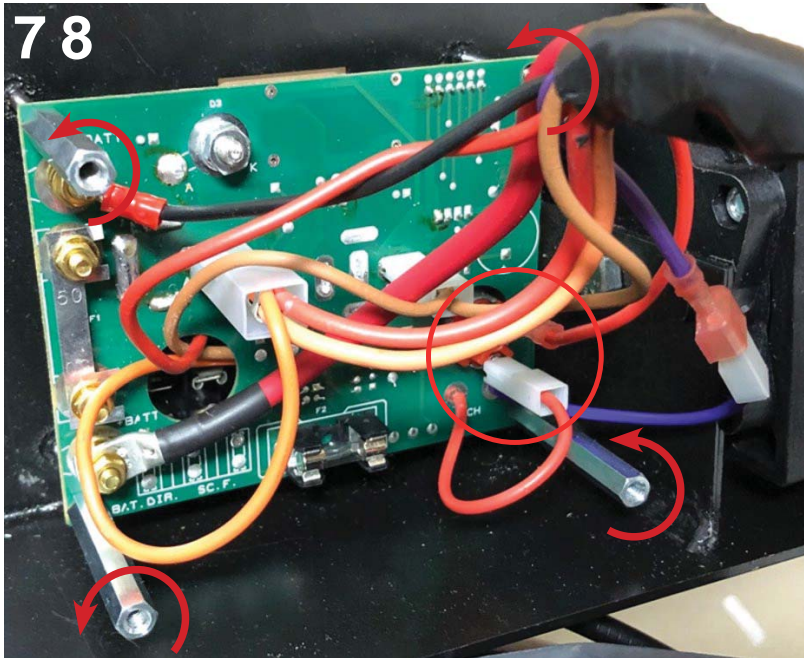
### *Disassembly*

- 1 Move the machine to flat, dry flooring.
- 2 Make sure that there is enough room around the machine to perform the dismantling operations safely.
- 3 Turn the front cowl and, after undoing the screws, remove the top cowl to access the battery compartment.
- 4 Disconnect the control panel connectors from the main wiring.
- 5 Undo the 4 hexagonal screws of the control panel support and remove it.
- 6 Undo the 4 screws that secure the protective guard to access the display board.





- 7 Disconnect the two fast-ons from the ignition key.
- 8 Unscrew the 4 studs to remove the display board from the control panel.
- 9 Carefully lift the display board to disconnect the 3 fast-ons from the extractor fan and filter shaker switch.
- 10 Release the board by pulling the 3 wires out of the hole provided.
- 11 Replace the display circuit board.

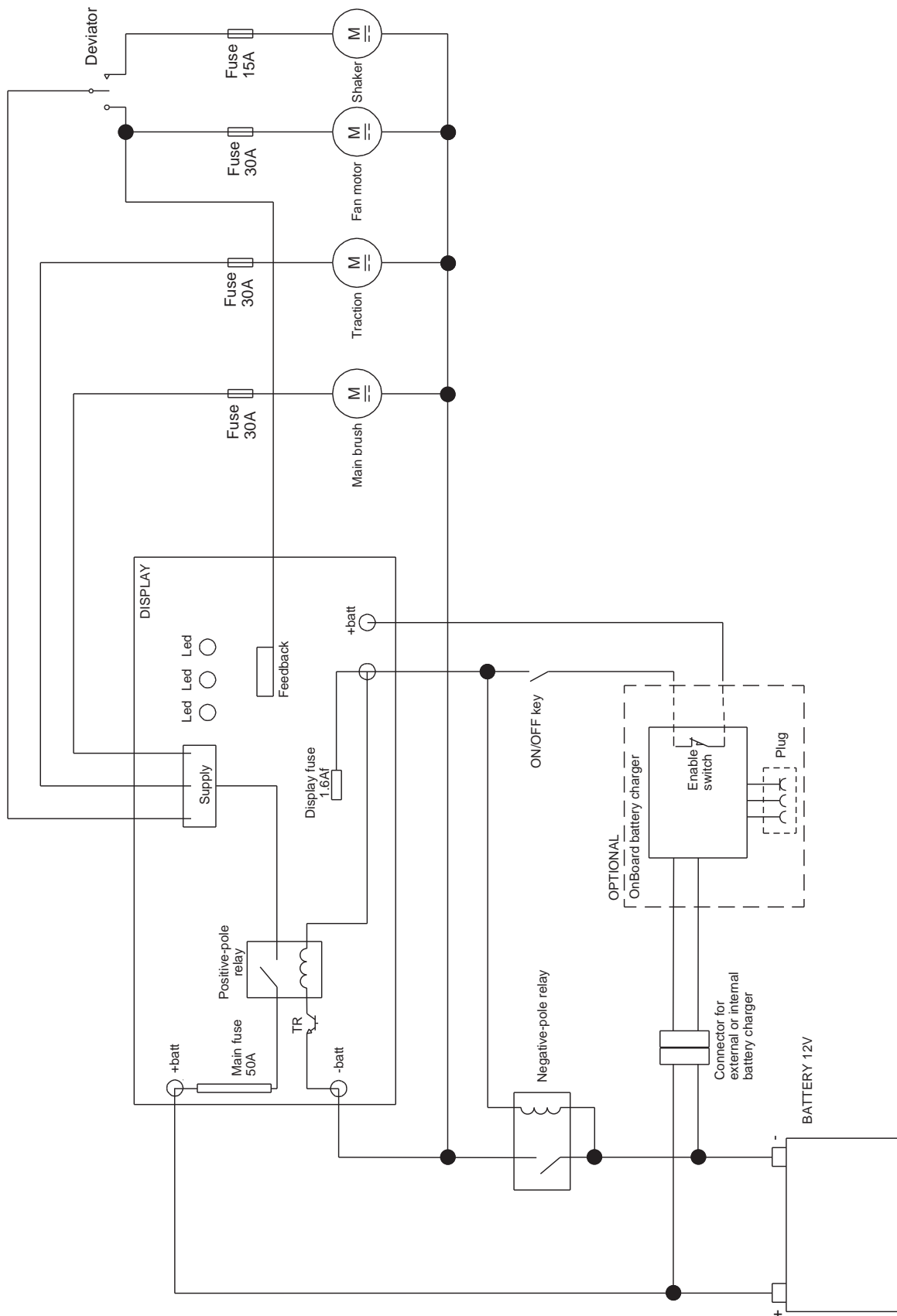


## Reassembly

- 1 To assemble the display board, repeat the disassembly operations in reverse order.



## D2 ELECTRICAL SYSTEM





## **IMPORTANT**

Move the machine to the waste disposal area, clean the suction filter and empty the dirt bin.

Move the machine onto flat ground and apply the brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or pressing the emergency switch

Disconnect the electronic circuit from the batteries by detaching one or both battery connectors.

## **i INFORMATION**

Important information

When consulting this Service manual, the reader will encounter the expressions **RIGHT** and **LEFT** indicating the side of the machine. These indications always refer to the direction of movement of the machine.

In this Service Manual, the version of the machine may be written in brackets “()”, i.e. (E, DP-P, P, D). This note indicates that the instructions only refer to the model or version specified in brackets.





## **E1 TROUBLESHOOTING**

### **E1.1 Troubleshooting**

#### **E1.1.1 The machine does not switch on**

<b>1</b>	Make certain that the battery of the machine is charged (12 V $\pm$ 1 V).	<b>A</b>	If charge is low, recharge the battery. If it is spent or does not charge, replace it.
		<b>B</b>	In versions with on-board battery charger, go to point 2.
		<b>C</b>	If the battery charges, go to point 3.
<b>2</b>	Checking operation of the battery charger	<b>A</b>	If the battery shows at least 12V when the charger is powered, replace the battery.
		<b>B</b>	If there is no voltage, go to point 3
<b>3</b>	Check battery wiring.	<b>A</b>	If the wiring is damaged, locate the break point and repair/replace the wiring.
		<b>B</b>	If wiring is intact, go to point 4.
<b>4</b>	Check the negative pole relay	<b>A</b>	If turning the key to ON you do not hear the metallic "TIC" of the relay activation, go to point 5.
		<b>B</b>	If turning the key to ON you can hear the metallic "TIC" of the relay activation, go to point 6.
<b>5</b>	Check the cable between the relay and the key lock and the cable between the relay and the battery negative pole	<b>A</b>	If the cables are good, replace the relay
		<b>B</b>	If the cables are damaged, repair / replace the wiring.
<b>6</b>	Check the voltage on the display board, between the 2 wires that connect the battery to the display board	<b>A</b>	If the value is 12V $\pm$ 1V, replace the display board.
		<b>B</b>	If the value is less than 12V $\pm$ 1V, check and repair / replace the wiring between the battery and the display board.

#### **E1.1.2 The machine releases dust**

<b>1</b>	Check the filter shaker for proper operation.	<b>A</b>	Switch the filter shaker on for 10 seconds. If it does not switch on, see F1.1.8.
		<b>B</b>	If it switches on, go to point 2.
<b>2</b>	Check for correct assembly of filter.	<b>A</b>	If assembly is wrong, reassemble correctly.
		<b>B</b>	If assembly is correct, go to point 3.
<b>3</b>	Check filter for clogging.	<b>A</b>	Remove the filter and check that there are no large foreign matters (e.g. leaves) or that it is not damaged.
		<b>B</b>	Replace filter element if damaged.



### E1.1.3 The machine leaves dirt on the ground

1	Check whether or not brushes operate when expected.	A	If they do not operate, see points F1.1.4 and F1.1.5.
		B	If they operate, go to step 2 and 3.
2	Check the centre brush for proper adjustment.	A	If necessary, adjust the centre brush.
		B	If it properly adjusted, go to point 4.
3	Check if the side brush lowers when you push the lever.	A	If it does not go down, check the lowering mechanism.
		B	If it does, go to point 5.
4	Check the centre brush for wear.	A	Replace brush if worn excessively.
		B	If not worn, go to point 6.
5	Check the side brush for wear.	A	Replace brush if worn excessively.
		B	If not worn, go to point 6.
6	Check if one of the brushes has picked up large foreign matters (leaves, threads, fabrics, etc.).	A	If there are any foreign matters, remove them.
		B	If the brushes are clean, go to step 7.
7	Check if the collection hopper is full.	A	If necessary, empty the collection hopper.

### E1.1.4 Centre brush not rotating

1	Check fuse F3 (30A)	A	If the fuse is blown, replace it.
		B	If the fuse is good, go to point 2.
2	Disconnect the 2 motor wires from the wiring, extend them with additional wire, then connect the positive to the battery "+" and the negative to the battery "-". Check engine operation.	A	If the motor does not run, go to point 3.
		B	If the motor runs, go to point 4.
3	Check the motor carbon brushes.	A	Replace carbon brushes if excessively worn.
		B	If the carbon brushes are in good condition, replace the motor.
4	Check wiring between motor and F3 fuse	A	If the wiring is damaged, locate the break point and repair/replace the wiring.
		B	If wiring is intact, go to point 5.
5	Check wiring between F3 fuse and display board	A	If the wiring is damaged, locate the break point and repair/replace the wiring.
		B	If wiring is intact, replace the display board.

### E1.1.5 The side brushes do not rotate.

1	Check the centre brush / side brush drive belt.	A	Replace belt if damaged.
		B	If the belt is intact, check the transmission mechanisms between the centre and side brushes and replace the damaged ones.



#### E1.1.6 The machine does not move

1	Check fuse F1 (30A)	A	If the fuse is blown, replace it.
		B	If the fuse is good, go to point 2.
2	Check the drive belt.	A	Replace belt if degraded.
		B	If belt is intact, go to step 3.
3	Disconnect the 2 motor wires from the wiring, extend them with additional wire, then connect the positive to the battery "+" and the negative to the battery "-". Check motor operation.	A	If the motor does not run, go to point 4.
		B	If the motor runs, go to point 5.
4	Check the motor carbon brushes.	A	Replace carbon brushes if excessively worn.
		B	If the carbon brushes are in good condition, replace the motor.
5	Check wiring between motor and F1 fuse	A	If the wiring is damaged, locate the break point and repair/replace the wiring.
		B	If wiring is intact, go to point 6.
6	Check wiring between F1 fuse and display board	A	If the wiring is damaged, locate the break point and repair/replace the wiring.
		B	If wiring is intact, replace the display board.

#### E1.1.7 There is no suction

1	Check F2 fuse (30A)	A	If the fuse is blown, replace it.
		B	If the fuse is good, go to point 2.
2	Disconnect the 2 motor wires from the wiring, extend them with additional wire, then connect the positive to the battery "+" and the negative to the battery "-". Check motor operation.	A	If the motor does not run, go to point 3.
		B	If the motor runs, go to point 4.
3	Check the motor carbon brushes.	A	Replace carbon brushes if excessively worn.
		B	If the carbon brushes are in good condition, replace the motor.
4	Check wiring between motor and F2 fuse	A	If the wiring is damaged, locate the break point and repair/replace the wiring.
		B	If wiring is intact, go to point 5.
5	Check wiring between F2 fuse and display board	A	If the wiring is damaged, locate the break point and repair/replace the wiring.
		B	If wiring is intact, replace the display board.





#### **E1.1.8 Filter shaker not working**

<b>1</b>	Check F4 fuse (15A)	<b>A</b>	If the fuse is blown, replace it.
		<b>B</b>	If the fuse is good, go to point 2.
<b>2</b>	Disconnect the 2 motor wires from the wiring, extend them with additional wire, then connect the positive to the battery "+" and the negative to the battery "-". Check motor operation.	<b>A</b>	If the motor does not run, replace it.
		<b>B</b>	If the motor runs, go to point 3.
<b>3</b>	Check wiring between motor and F4 fuse	<b>A</b>	If the wiring is damaged, locate the break point and repair/replace the wiring.
		<b>B</b>	If wiring is intact, go to point 4.
<b>4</b>	Check wiring between F4 fuse and display board	<b>A</b>	If the wiring is damaged, locate the break point and repair/replace the wiring.
		<b>B</b>	If wiring is intact, replace the display board.

#### **E1.1.9 The centre display does not light up**

<b>1</b>	Check the 1.6A fuse mounted on the back of the display board	<b>A</b>	If the fuse is blown, replace it.
		<b>B</b>	If the fuse is good, replace the display board.



**PLDC04364**  
**REVISION 00**  
December 16, 2020  
**TECHNICAL OFFICE**

## TECHNICAL SERVICE MANUAL REVISIONS - UPDATES

<b>EDITION No.</b>	<b>DATE</b>
<b>Edition 00</b>	
Completion of drafting and correction	<b>December 16, 2020</b>
<b>Edition 01</b>	