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**TECHNICAL OFFICE**
*Stavale*

# T581


## TECHNICAL SERVICE MANUAL

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# A BRUSH HEAD

## WARNING!

**Move the machine to the tank draining area and empty the solution and dirty water tanks using the hoses provided.**

**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 means of the Anderson connector with handle.**

## i INFORMATION

**Very important instructions.**

**In this Service Manual, the terms RIGHT and LEFT are used to indicate the sides of the machine; these always refer to the direction of travel of the machine.**

**In this Service Manual, the version of the machine may be written in brackets "()", i.e. (2180SR, A670).**
**This note indicates that the instructions only refer to the model or version specified in brackets.**

# A1 BRUSH MOTORS

***The models features three head sizes, two with double brush, 600 mm / 24 in (2180SR) and 700 mm / 28 in (A670), and one with single-brush, 550 mm / 20 in (2180SR).***
***All versions are fitted with 24 V, 400 W motors.***
***They are all also fitted with thermal protector to protect the motor against overheating.***

# A1.1 Checking brush motor current draw

1. **Make sure that the batteries on the machine are charged and that there is solution inside the tank.**
2. **Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).**
3. Move the machine to the tank draining area and empty the dirty water tank.
4. **Move the machine onto a floor that is neither too rough nor too smooth, to ensure a correct current reading.**
5. Make sure that there is enough room around the machine to perform the checks safely.
6. **Make sure that the standard brushes are fitted.**
7. Lift the dirty water tank and then the electronics support plate.
8. Access the four-pin connector that connects the functions board.
9. Identify the **Red** and **Black** power wires on the right and left brush motors.
10. Connect the clamp-on ammeter to the **Red** wires to read the current draw for the left and right motor.
11. Then spin the brushes on the floor in the same way as when washing, but without moving the machine.
12. Note down the values read and compare them against the values shown in the table below.
13. If the values measured fall within those specified in the table, restore the machine to normal operating conditions, otherwise perform the following checks

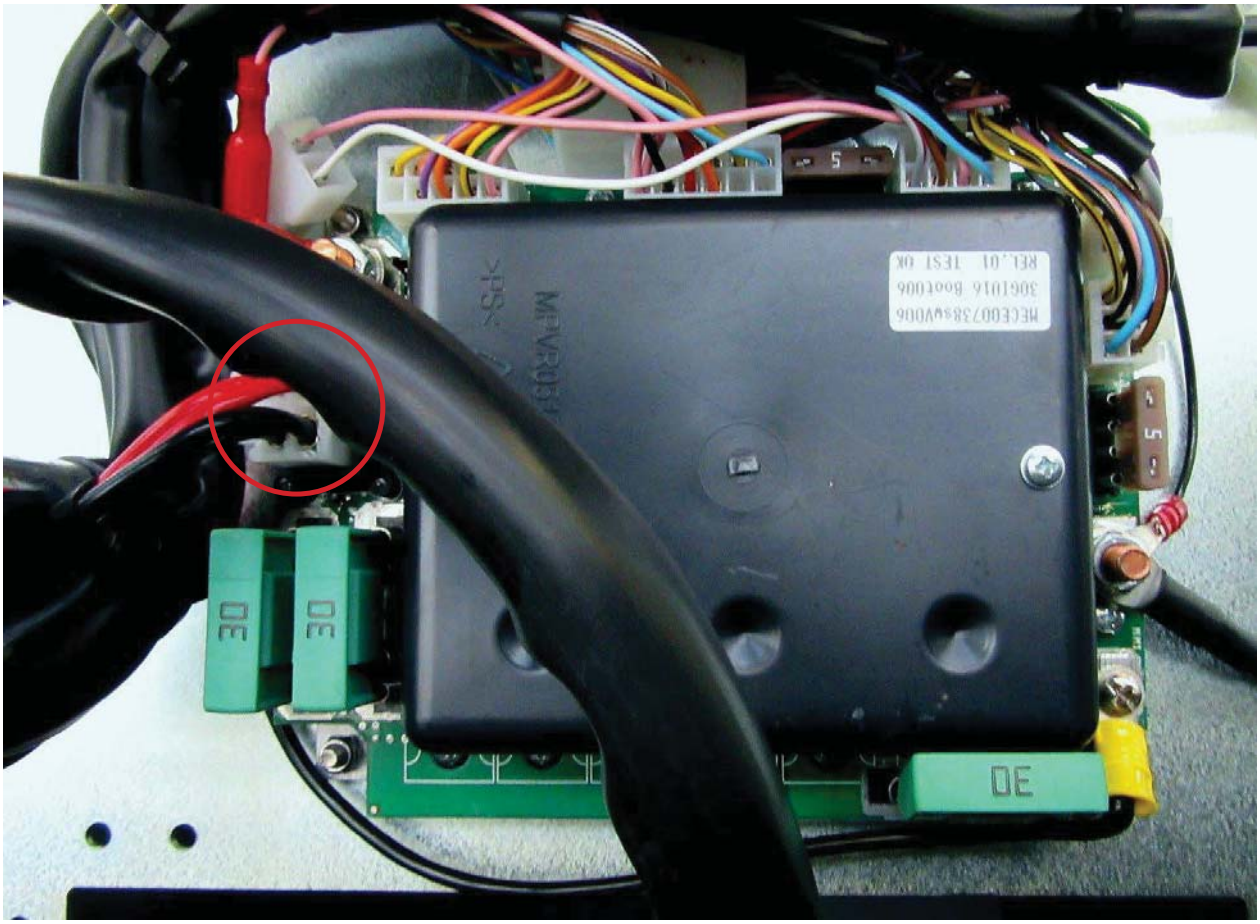
*13a Remove the brushes and check that the no-load current is within the values shown in the table.*

*13b Make sure that the brushes are not rubbing against the head or other parts.*

*13c Make sure that the brush motor carbon brushes are not worn down or show signs of abnormal wear.*

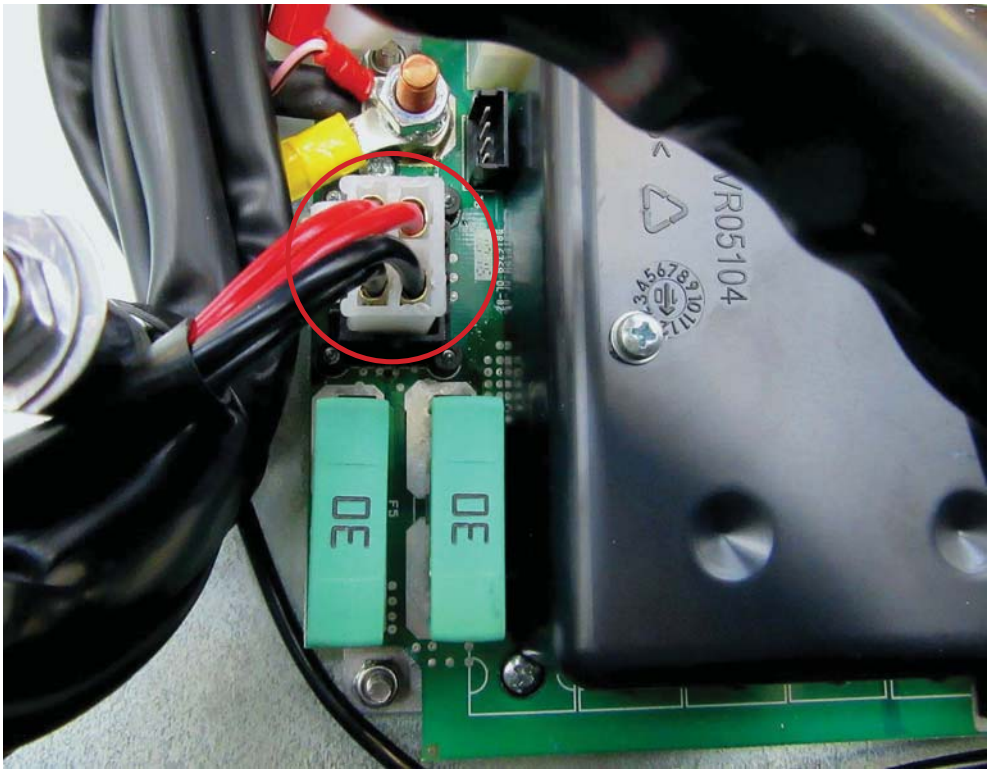
*13d Make sure there is no abnormal noise from the reduction drives, or that the noise from each is not different.*

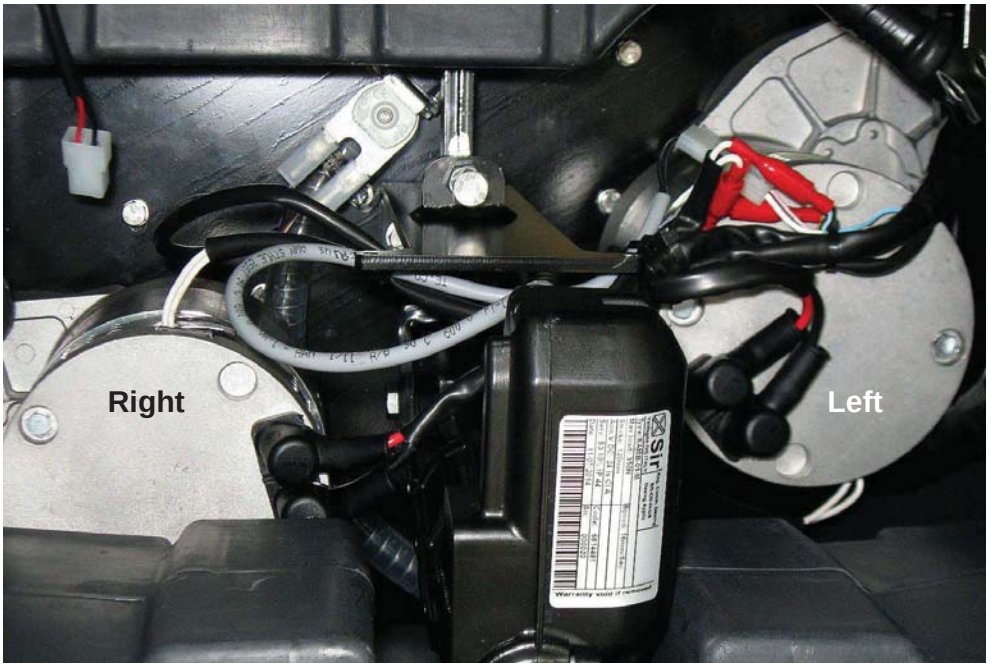
*13e Replace one or both brush motors.*



***To obtain current draw readings that can be compared to those in the table, make sure that the machine is fitted with a standard brush and that the floor surface is neither excessively rough nor excessively smooth. Use a moderate amount of detergent so as to not distort the test, and consequently the reading.***

***The current values measured on the two brush motors must not deviate by more than 20% from one another.***



## DOUBLE BRUSH

| Current draw A (amperes) | RIGHT | | % | LEFT | |
|---|---|---|---|---|---|
| | Min | Max | | Min | Max |
| No load (without brushes) | 2,5 A | 5,0 A | ± 20 % | 2,5 A | 5,0 A |
| Load applied (brushes operating) Pressure 1 | 8,0 A | 10,0 A | ± 20 % | 8,0 A | 10,0 A |
| Load applied (brushes operating) Pressure 5 | 15,0 A | 17,0 A | ± 20 % | 15,0 A | 17,0 A |

## SINGLE BRUSH

| Current draw A (amperes) | Min | Max |
|---|---|---|
| No load (without brushes) | 2,5 A | 5,0 A |
| Load applied (brushes operating) | 9,0 A | 15,0 A |

# A1.2 Checking brush motor thermal protector operation

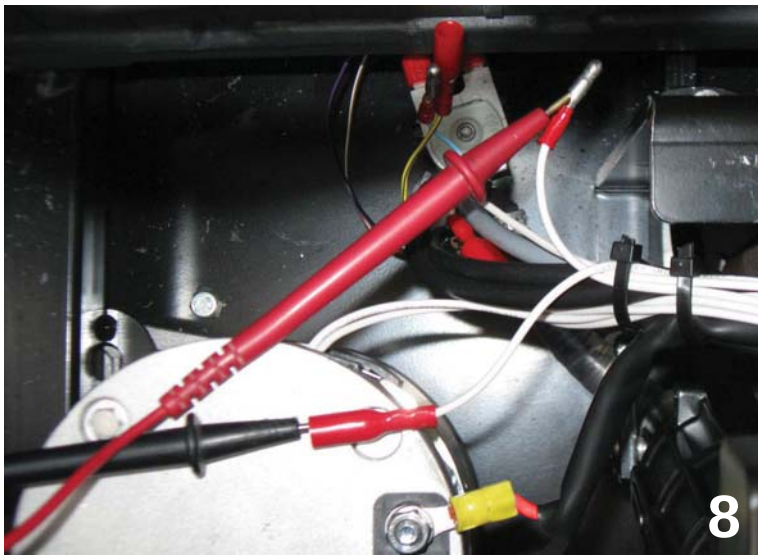
## Checks

1. Use a digital multimeter able to check continuity.
2. Move the machine to the tank draining area and empty the dirty water tank.
3. Move the machine onto flat and dry flooring.
4. Make sure that there is enough room around the machine to perform the dismantling operations safely.
5. Disconnect the batteries from the machine's main circuit, and lift the electronics support plate.
6. Identify the two cylindrical thermal protector connectors and disconnect them from the machine's electrical circuit.
7. Connect the digital multimeter probes to the two thermal protector connectors.
8. Both thermal protectors are tested together, being connected in series.

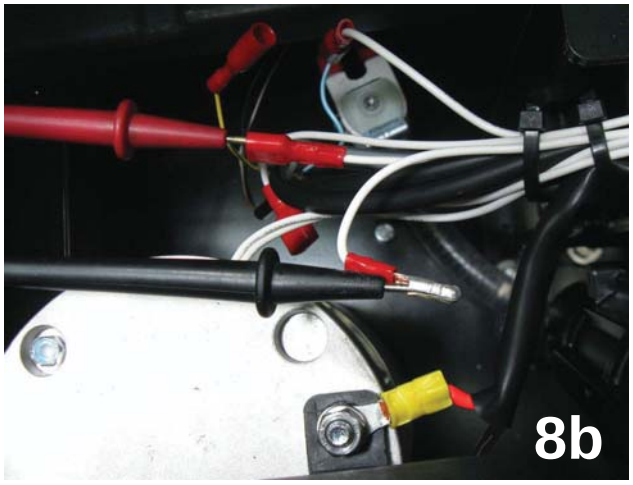
8a. If the multimeter measures continuity, the thermal protectors are working.

8b. If, on the other hand, the multimeter does not measure continuity, check each individual thermal protector.

8c. Once having identified the motor with the faulty thermal protector, dismantle the motor and replace the thermal protector or the complete motor cover.







# A1.3 Adjusting and replacing the head flaps

## Dismantling

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. Dismantling simply requires one 10 mm / 0,4 in spanner.
4. Unscrew the four bolts on each side of the head, and remove the flap retainers and the flaps.
5. Clean the contact surface between the head and the flaps.



## Adjustment

1. With the brushes fitted, lower the head, let it rotate a short while, then press the emergency switch.
2. Work first on one side of the head, and then on the other.
3. Place the new flap, or the existing flap that was previously removed for adjustment, against the head.
4. Insert all four bolts inside the slots on the flap.
5. Arrange the flap so that it touches the floor uniformly, without folds.
6. Place the flap retainers in position and tighten the nuts; before tightening, make sure that the flap has remained in position.
7. Tighten the nuts without applying excessive pressure, to avoid deforming the flap under the force of the flap retainers.
8. Repeat the operation for the flap of the opposite side.



# A2 DISMANTLING THE BRUSH HEAD

***The models features three head sizes, one 550 mm / 20 in version for the single-brush machine (2180SR), and two for the double-brush machine, 600 mm / 24 in and 700 mm / 28 in (2180SR and A670 respectively).***

***The double-brush versions also feature two brush motors. All use 400 W motors.***

***The head is connected to the chassis by four arms at the rear, and an electrical-mechanical actuator at the front, which via the electronic board on the instrument panel controls the lowering, raising and pressure adjustment of the brush head (the latter function only for versions 2180SR and A670).***

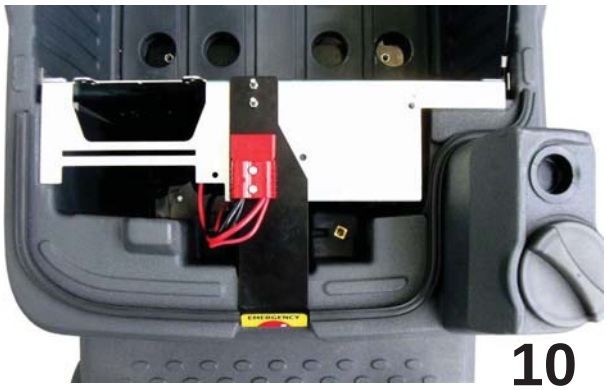
# A2.1 Dismantling the head on the double-brush version

## *Dismantling*

1. **Move the machine to the tank draining area and completely empty both tanks.**
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. If fitted, release the brushes and remove them from underneath the head.
5. If still fitted, remove the squeegee.
6. **Disconnect power to the machine using the emergency switch.**
7. **Lift the electronics support plate, identify the head pressure spring and detach it.**
8. **Reconnect power to the machine and lower the brush head using the actuator.**
9. Remove the bumper springs that secure the actuator to the solution tank. Remove the actuator from its housing.
10. **Reposition the electronics support plate, and remove the batteries.**





11 Place the bubble wrap and the foam cushions on the floor, on the right side of the machine.

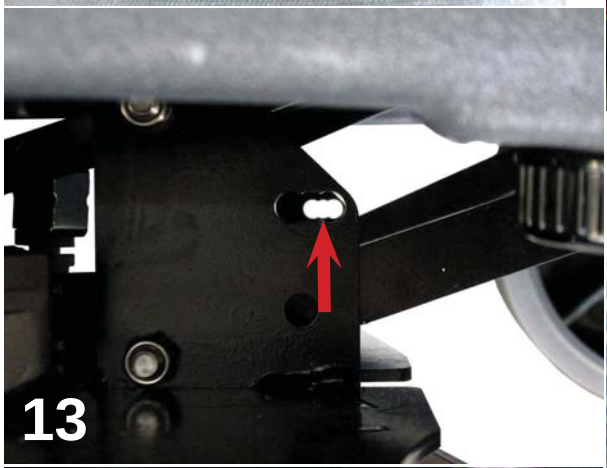
12 Tip the machine over onto its right side and pull the head

13 **Unscrew the right and left bolts that limit vertical movement of the head.**

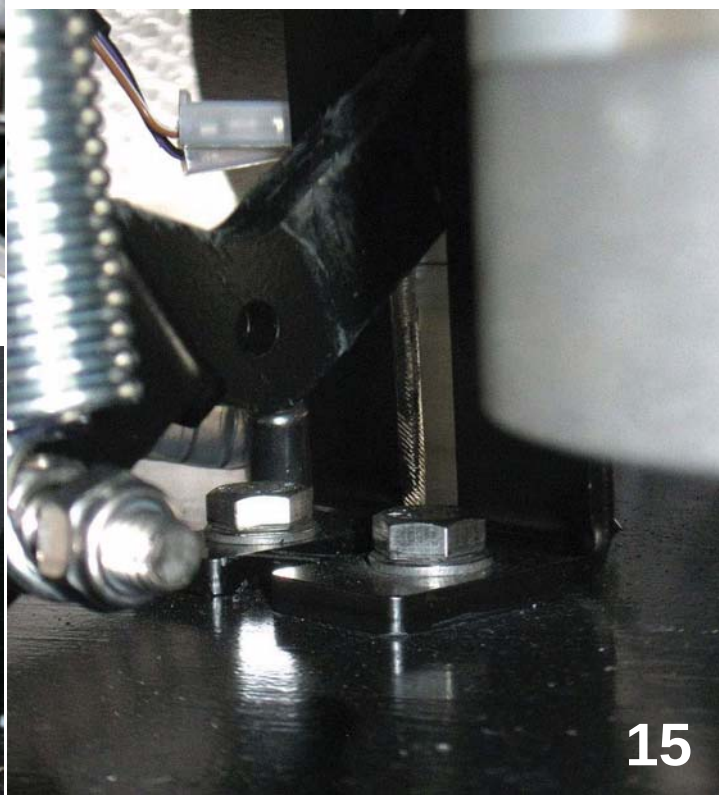
14 Continue removing the head, to simplify the rest of the dismantling operations.

15 Remove the central head attachment bracket by unscrewing the two bolts.



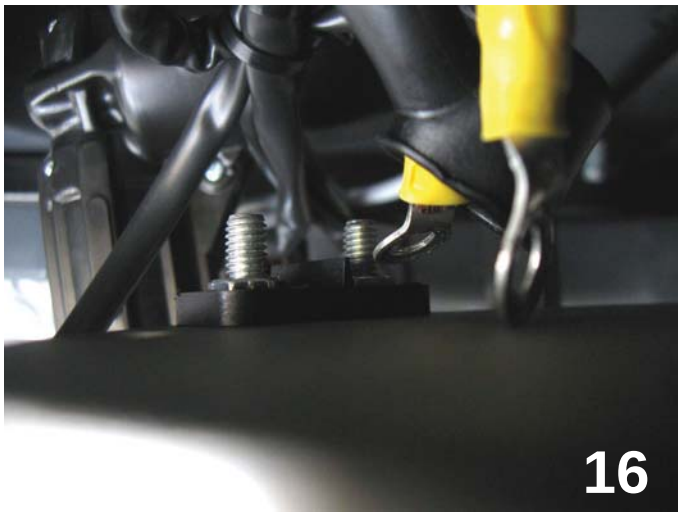


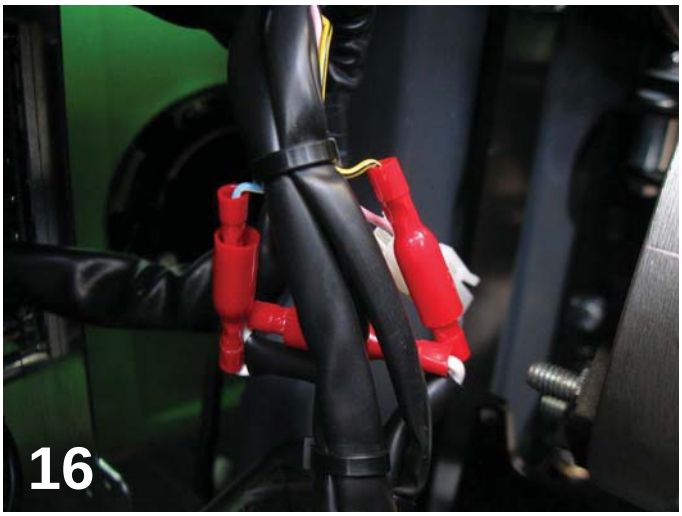


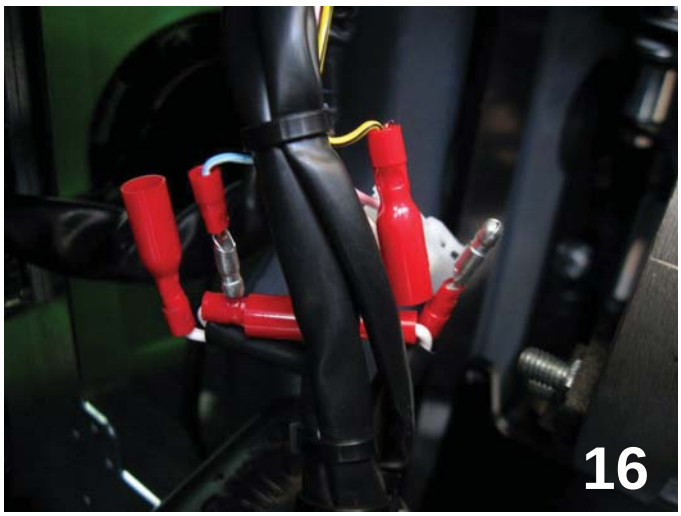


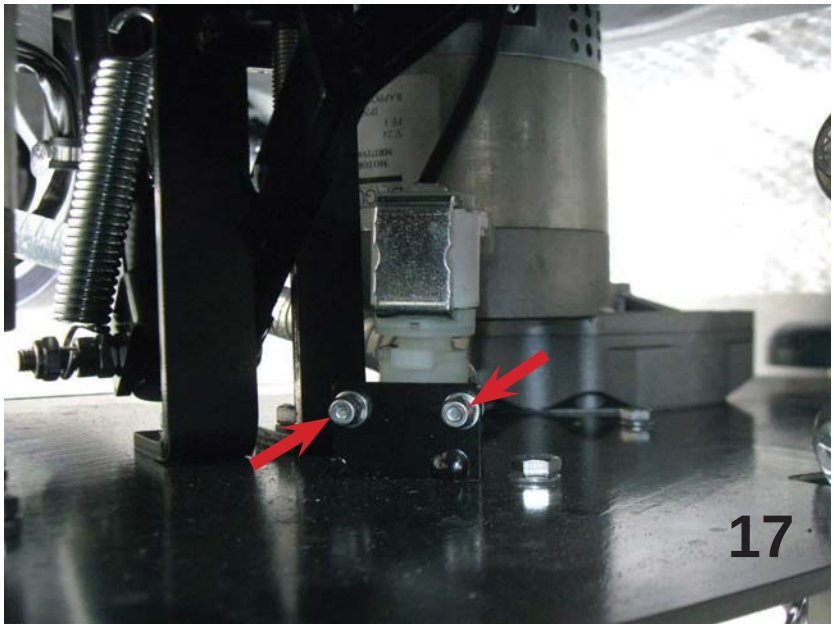
**16** Electrically disconnect the two brush motors, both the power supply and the motor thermal protectors connected to the board.

**17** Unscrew the two bolts that fasten the solenoid valve to the corresponding bracket.

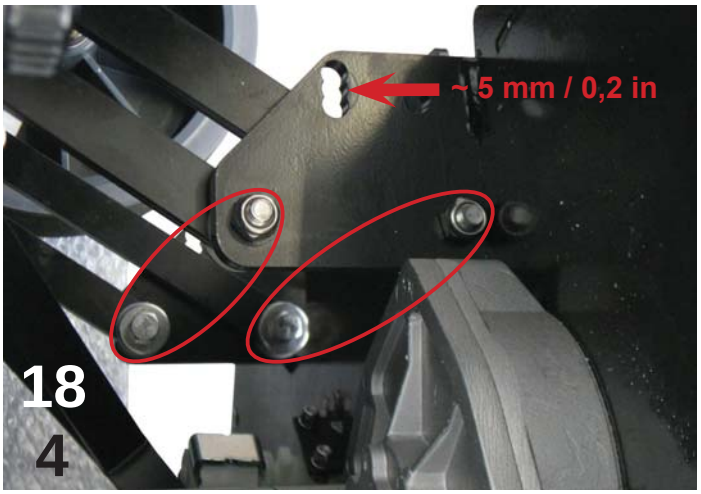



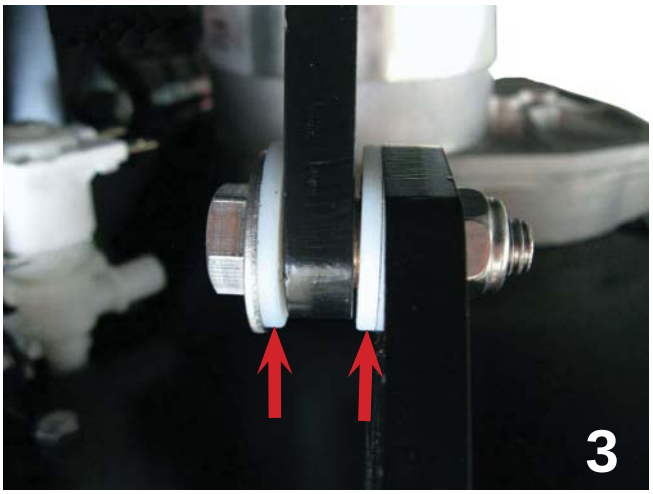



18 Unscrew the four bolts that fasten the parallelogram arms to the head plate.

19 Remove the head from underneath the machine.




## Reassembly

1 To reassemble the brush head, repeat the dismantling operations in reverse order.

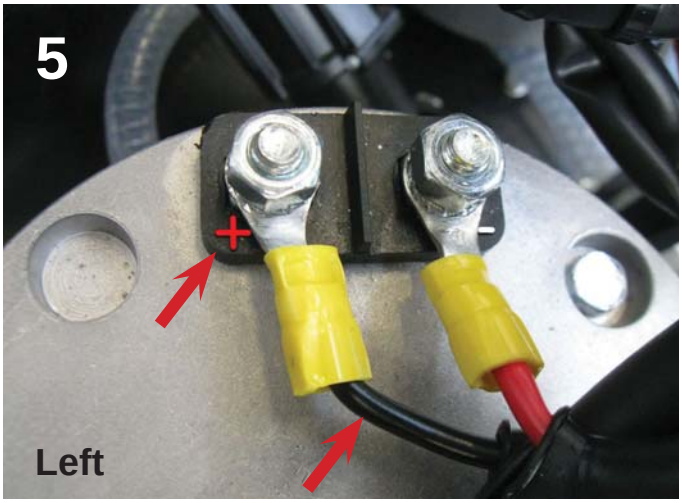
2 **Tighten all the M8 bolts to a maximum torque of 20 Nm / ~ 177 lbf in.**

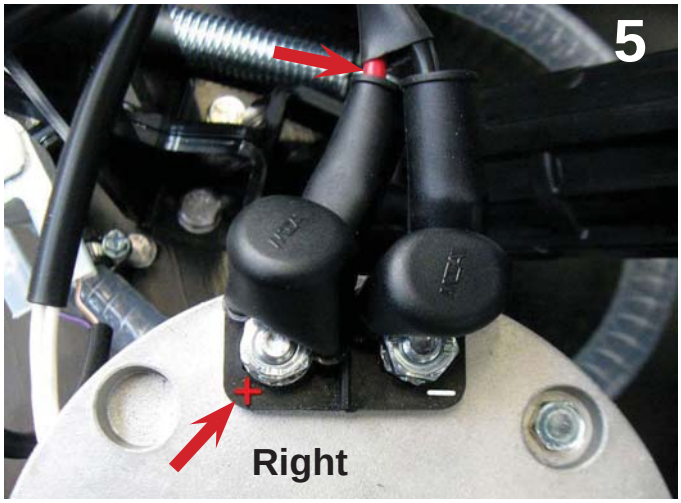
3 **Take care when positioning the Teflon washers when assembling the parallelogram arms.**

4 **Place the bolts that limit head movement when lowering in the hole in the centre.**

5 **Connect the brush motor power supply, reversing the polarity of the wires (red wire on minus - and black wire on plus +) for the left motor only.**

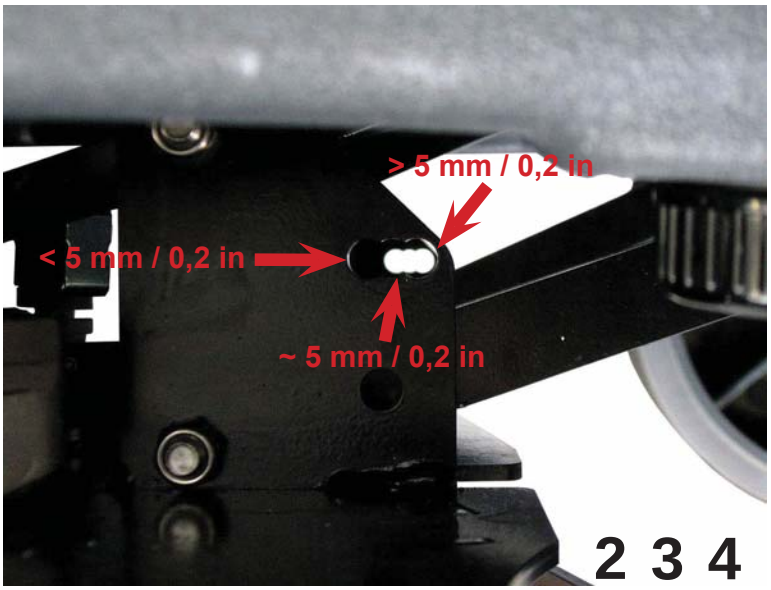
6 Connect the motor thermal protectors to the machine's main wiring.

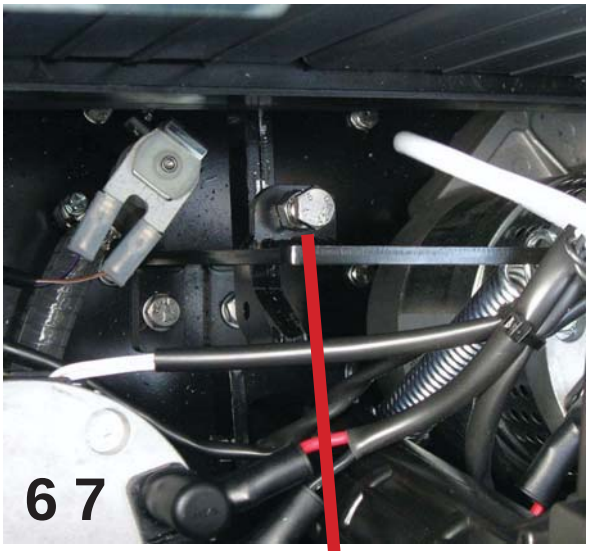


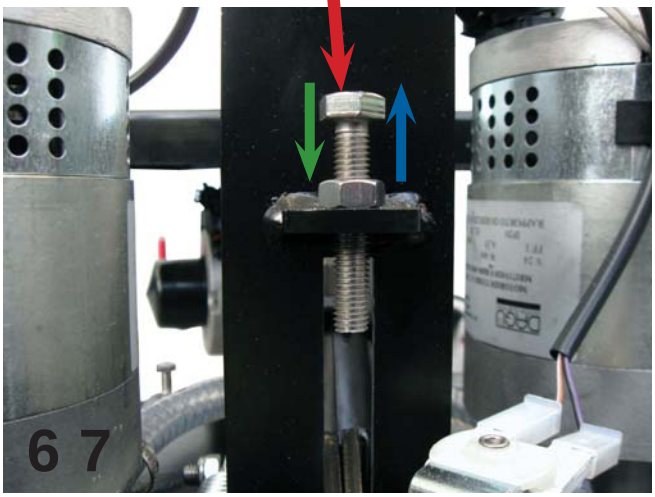



# Adjustments

1. With the machine completely reassembled, make any adjustments required on the head.
2. **Check the distance between the flange and the floor in the working position; this must be around ~ 5 mm / ~ 0,2 in.**
3. **If the distance is lower, move the bolt in the hole further backwards (> 5 mm / ~ 0,2 in).**
4. **If the distance is higher, move the bolt in the hole further forwards (< 5 mm / ~ 0,2 in).**
5. After having activated the raise command, make sure that the head reaches the maximum height, against the solution tank however without obstructions; the actuator must not exert excessive force when raising the head.
6. **If the actuator exerts excessive force and/or there are obstructions, adjust the corresponding bolt upwards (unscrew).**
7. **If the head is away from the solution tank, adjust the corresponding bolt downwards (tighten).**




# A2.2 Dismantling and replacing the brush motors

## Dismantling

1. Move the machine to the tank draining area and completely empty both tanks.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. **Continue removing the head as described in the previous paragraph.**
5. Take the head to the bench, and dismantle the faulty motor or both motors.
6. Remove the flange or drive disk from the brush motor hub.
7. If needed, use a special puller to remove the flange.
8. Remove the tab from the brush motor shaft.
9. Unscrew the four screws that fix the brush motor to the head plate.
11. Replace the motor (or motors) with one of the same type.




## Reassembly

1. To fit the new motors, repeat the steps for dismantling in reverse order.
2. Tighten the motor screws to a maximum torque of 8 Nm / ~ 71 lbf in.
3. Replace the tab and grease the brush motor shaft and the tab.
4. Replace the flange on the shaft, use a plastic mallet if necessary.
5. Tighten the screw that fixes the flange to the brush motor to a maximum torque of 25 Nm / ~ 221,3 lbf in.

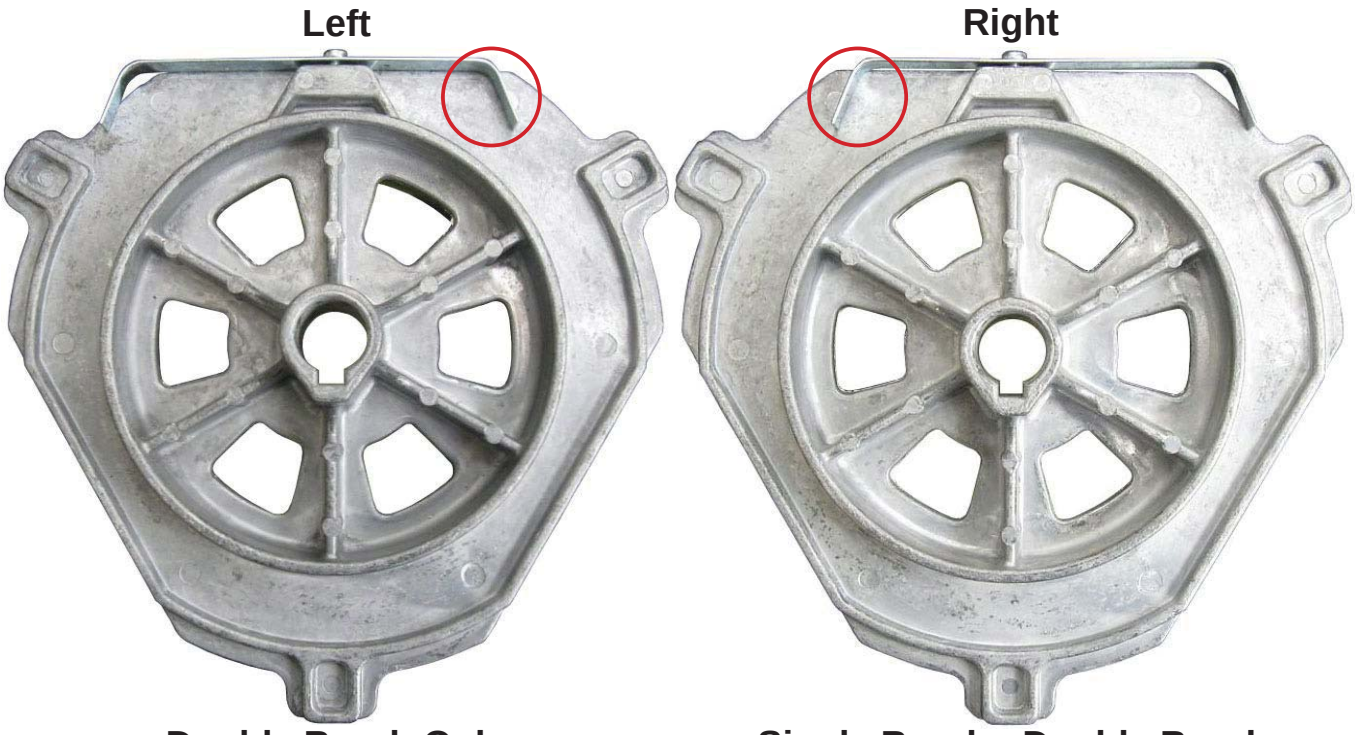
# Spring flange

**If replacing one or two brush motor flanges or replacing both motors on a double brush head, take care when positioning the brush retaining spring.**

## Assembling the spring flange

1. Fit the asymmetrical brush retaining spring in reverse between the left brush flange and the right brush flange.
2. For flanges on single-brush machines, fit the spring in the same way as for the right brush flange.
3. Fit the spring on the flange so that this does not interfere with the flange and there are no bends.
4. If replacing of both brush motors, check coupling of the flanges.
5. To assemble the spring, insert a Grover washer between the spring and the flange.
6. When tightening the screw that fixes the spring, use threadlocker.

**Make sure, even if rotated, that the flanges maintain the same position, the right flange will be on the right once fitted on the head; the same applies to the left flange. The terms right and left refer to forward travel of the machine.**



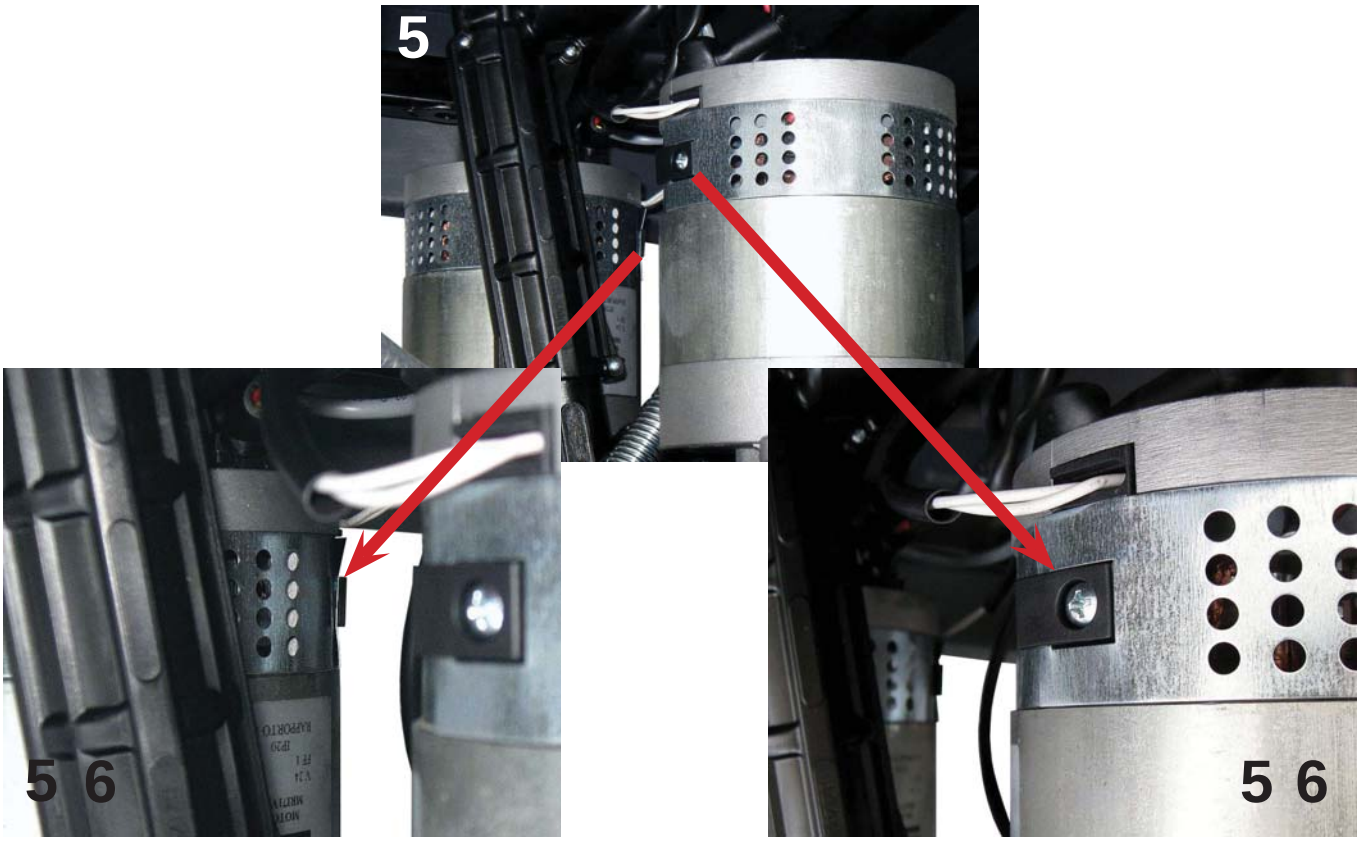

Double Brush Only

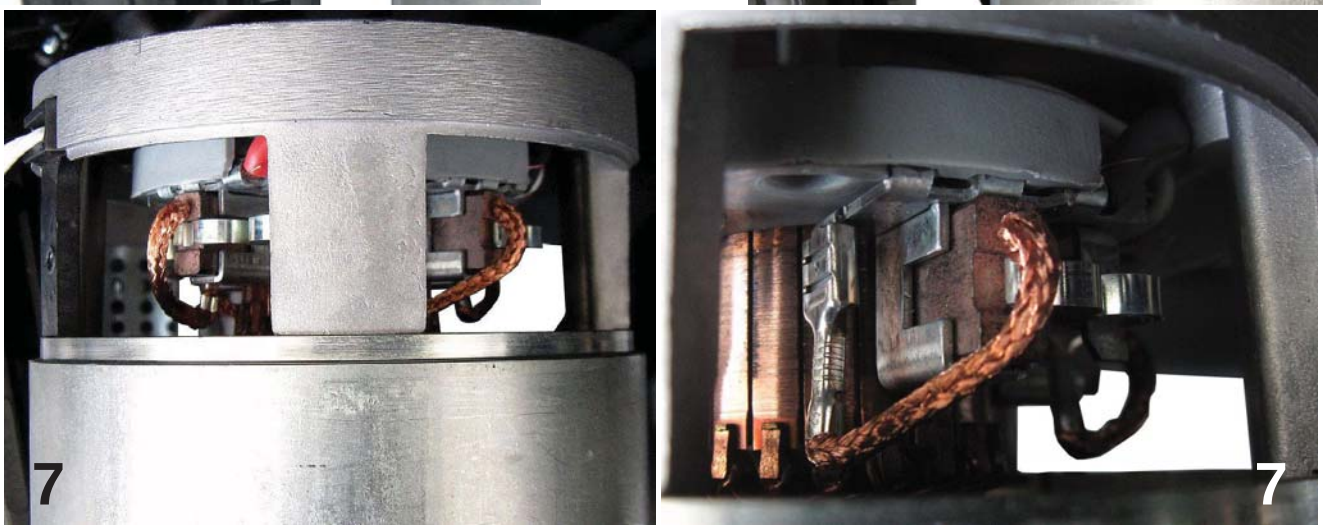
Single Brush - Double Brush

# A2.3 Checking and replacing the brush motor carbon brushes

## *Dismantling*

1. Move the machine to the tank draining area and completely empty both tanks.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. **To access the brush motor carbon brushes, follow the instructions shown in paragraph A2.1 for dismantling the brush head, up to point 14.**
5. Identify the two rocker arm catches that fasten the protective metal ties.
6. Unscrew the screw that fastens the rocker arm catch to the metal tie, on both motors.
7. Identify the spade terminal that connects the carbon brush to the plate, and disconnect it.



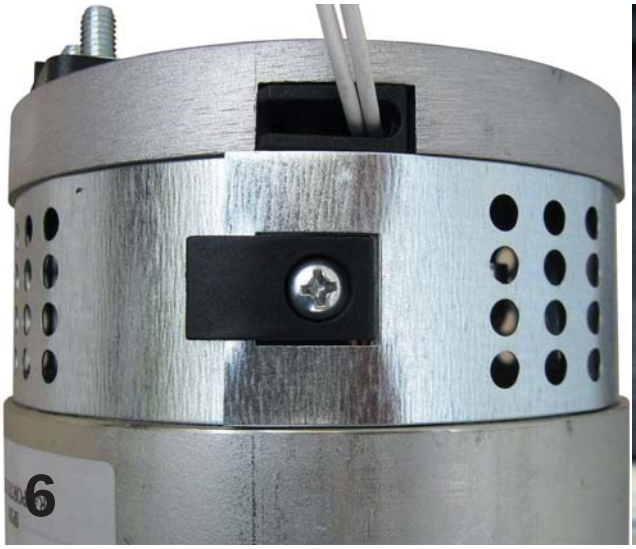



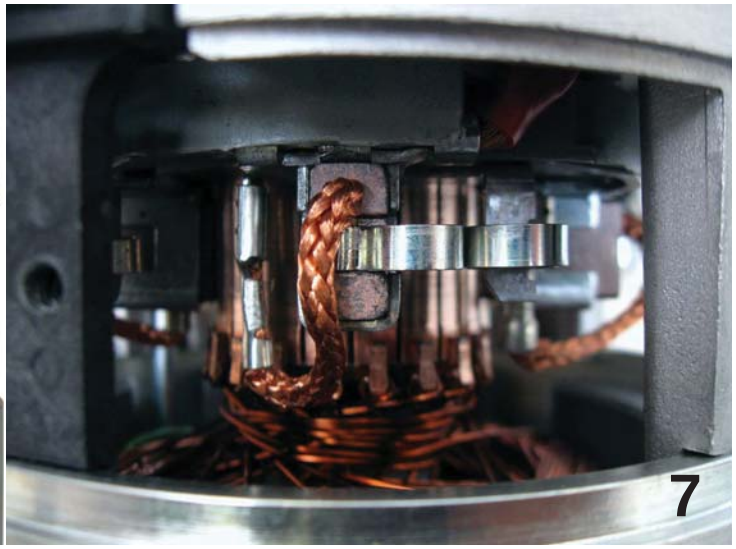
8 Remove the spade terminal towards the outside and use it to pull the carbon brush off the motor.

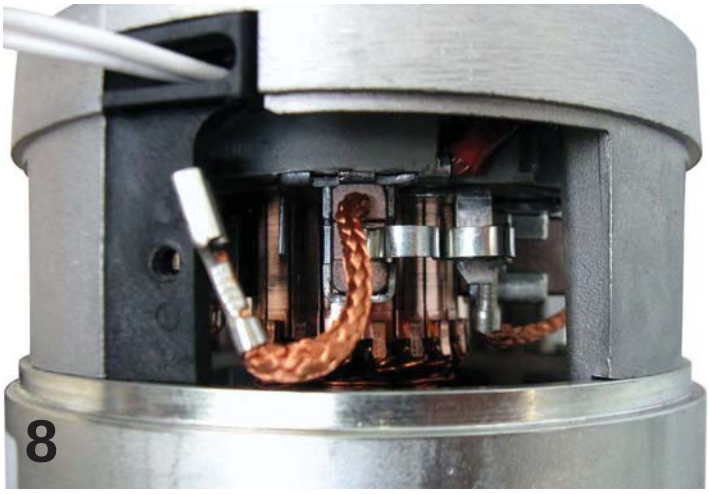
9 Lift and detach the spring that presses the carbon brush against the rotor, and remove the carbon brushes using the spade terminal.

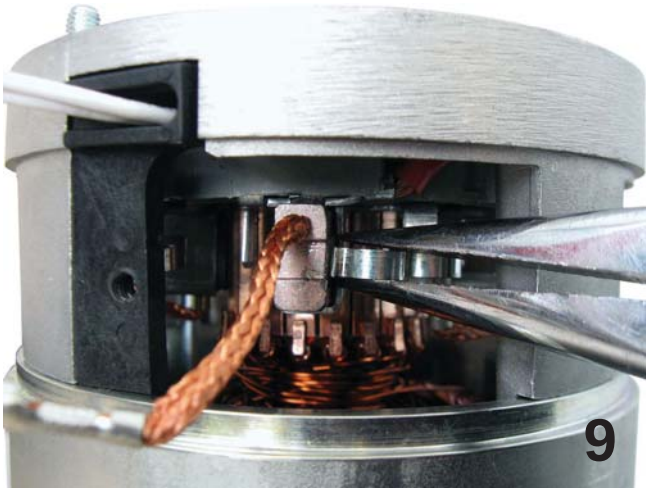
10 Repeat the operation for the other (three) carbon brushes, and the other motor.

***Always replace all four brush motor carbon brushes at the same time. If the two brush motors fitted on the head have the same number of operating hours, replace all eight carbon brushes (four on each motor).***



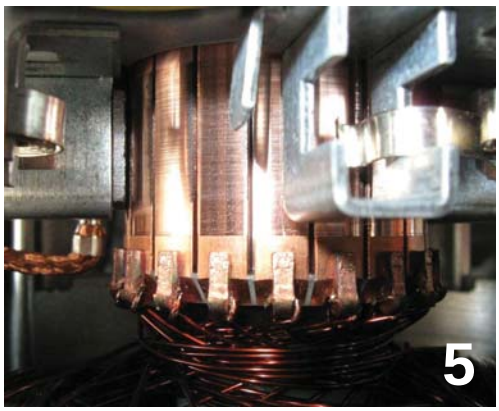



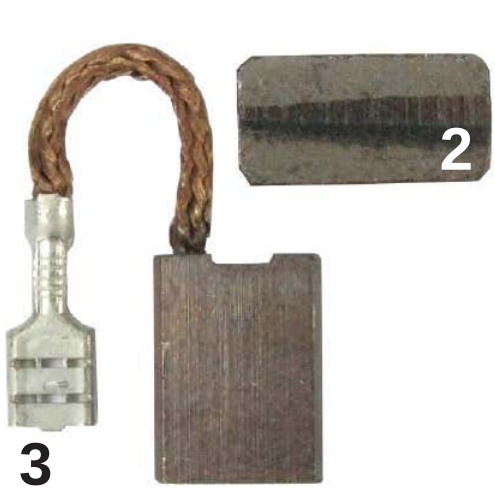



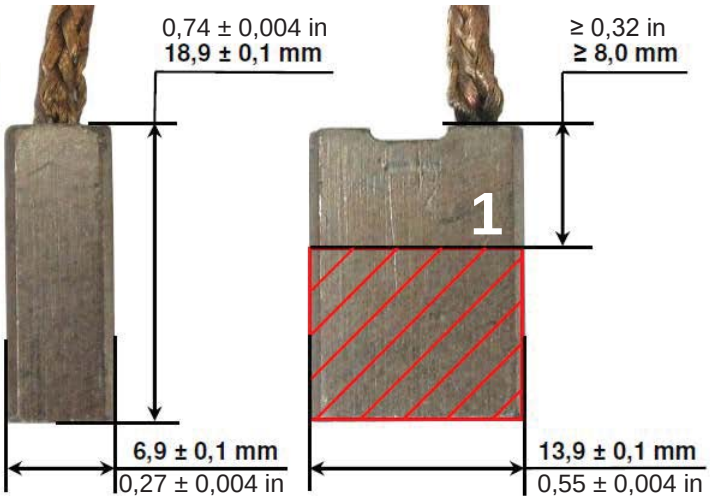
## Checks

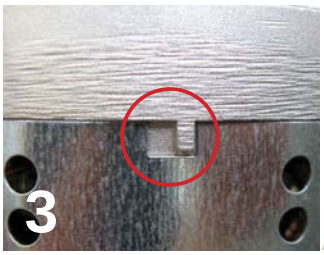
1. Check that the length of the carbon brush removed extract is within the tolerances shown in the box, and in any case not less than 8.0 mm / 0,3 in.
2. Check the sliding contact surface of the carbon brush for signs of abnormal wear or burning.
3. When fitting new carbon brush, compare the new one with the old one or against the dimensions shown below; only the length must be different.
4. Check the suction motor rotor for wear before fitting new carbon brushes.
5. Make sure that the carbon brushes slide freely in their seats.

***Always make sure that the carbon brushes slide freely in their seats.***






## Reassembly

1. Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and rotor where the carbon brushes are located.
2. To assemble the new carbon brushes, repeat the dismantling operations in reverse order
3. To assemble the protective metal tie, see the corresponding illustrations.
4. For instructions on assembling the machine, see paragraph A1.1.

# A2.4 Dismantling the brush motor thermal protector

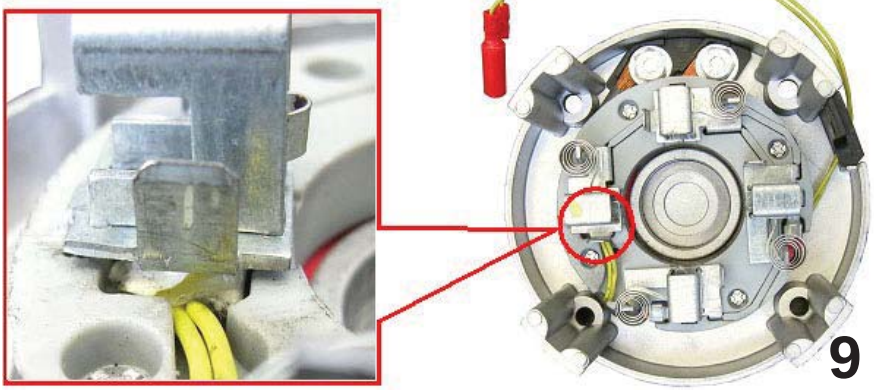
***It is not possible to replace the thermal protector alone, as it is integrated in the carbon brush flange inside the cover. Therefore, to replace the thermal protector a compete new cover needs to be replaced.***

## *Dismantling*

1. Once having verified a fault or malfunction on the brush motor thermal protector, replace the protector.
2. Move the machine to the tank draining area and completely empty both tanks.
3. Move the machine onto flat and dry flooring.
4. Make sure that there is enough room around the machine to perform the dismantling operations safely.
5. **Remove the head, as shown in paragraph A2.1 up to point 14, so as to access the brush motor thermal protector or protectors.**
4. **Remove the motor or motors from the head, as shown in paragraph A2.2.**
5. Take the motor in question to the bench and remove the cover.
6. Unscrew the two long screws (then make sure) the electric motor complete to the mechanical reduction drive.
7. Remove the protective metal tie and the carbon brushes, as shown in the previous paragraph.
8. Lift the cover to remove it from the rotor bearing, if necessary use a plastic mallet.
9. The thermal protector is glued on underneath one of the four carbon brush slides.
10. Replace the cover that has the faulty thermal protector with a new one.

6

8



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## Reassembly

1. Before assembling the new cover, check correct operation of the thermal protector.
2. Also make sure that all the carbon brushes slide freely in their seats.
3. Fit the new cover, performing the dismantling operations in reverse order.
4. Pay attention to the spacer washer in the cover bearing housing.
5. Centre the cover on the bearing and use a plastic mallet to tap the centre of the cover, so as to make sure the bearing enters correctly.
6. Insert and tighten the two long screws that fasten the electric motor to the reduction drive, tighten to a maximum torque of 4.5 Nm / ~ 0.40 lbf in.
7. Replace the carbon brushes and the protective metal tie.

1


2

# A3 BRUSH HEAD ACTUATOR

***The actuators are electro-mechanical mechanisms that lower and raise the brush or squeegee head when pressing the corresponding buttons on the instrument panel.***

***These are powered directly by the instrument panel board. Inside is a microswitch that cuts off power when reaching the two stroke limits, top and bottom. Consequently, it is very important that these are replaced with the same model and above all actuators with the same stroke.***

***The head actuators on the double disc have a stroke of 130 mm / 5,12 in, while on the single disc 20 in it is 110 mm / 4,33 in.***

*Brush Head Model*

***24 in - 600 mm***

***28 in - 700 mm***


***Spare Part MOCC00423***


*Brush Head Model*

***20 in - 550 mm***


***Spare Part MOCC00424***

# A3.1 Checking head actuator current draw

1 **Make sure the batteries on the machine are charged.**

2 **Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).**

3 Move the machine to the tank draining area and empty the dirty water tank.

4 Move the machine onto flat and dry flooring.

5 Make sure that there is enough room around the machine to perform the checks safely.

6 Lift the dirty water tank and then the electronics support plate.

7 Identify the four-pin connector on the functions board.

8 Identify the two power wires for the head actuator, *white* wire and *pink-black* wire, and connect the clamp-on ammeter to one of these two wires.

9 Switch the machine on and set maximum pressure on the instrument panel.

10 Lower the head and read the value, if the value read is preceded by the minus sign, move the ammeter to the other wire or turn the ammeter around on the wire.

11 Read current draw when lowering and when raising the head.

12 Note down the values read and compare them against the values shown in the table below.

13 If the values measured fall within those specified in the table, restore the machine to normal operating conditions.

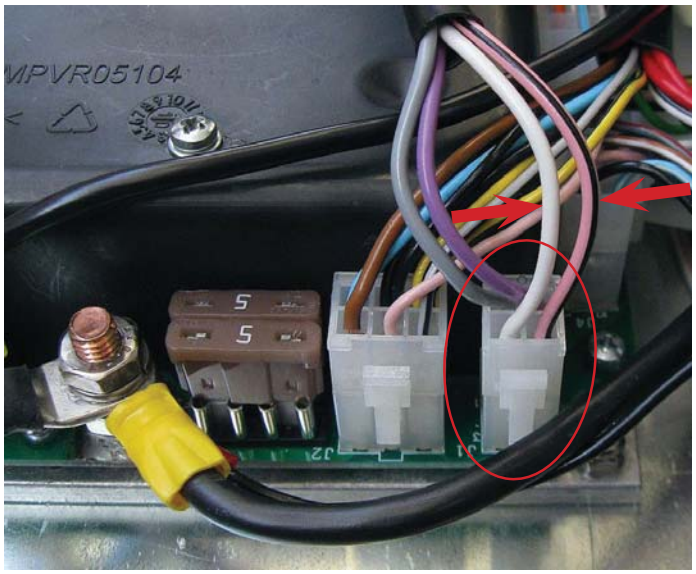
14 If on the other hand the values read do not match those shown in the table, perform the following checks.

14a *The values are higher. Release the actuator by removing the two catches on the solution tank, only when the head is raised, and then check current draw with no load on the actuator.*

14b *If the actuator still shows high current draw, replace it with a new one of the same type.*

14c *If the no-load current is normal, check that there is nothing blocking the head fastening and rotation mechanisms.*

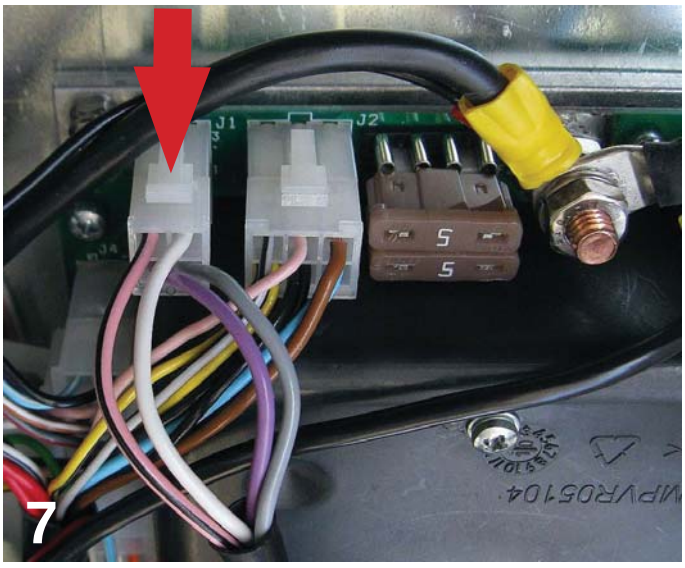
14d *If there is nothing blocking the head, replace the actuator.*

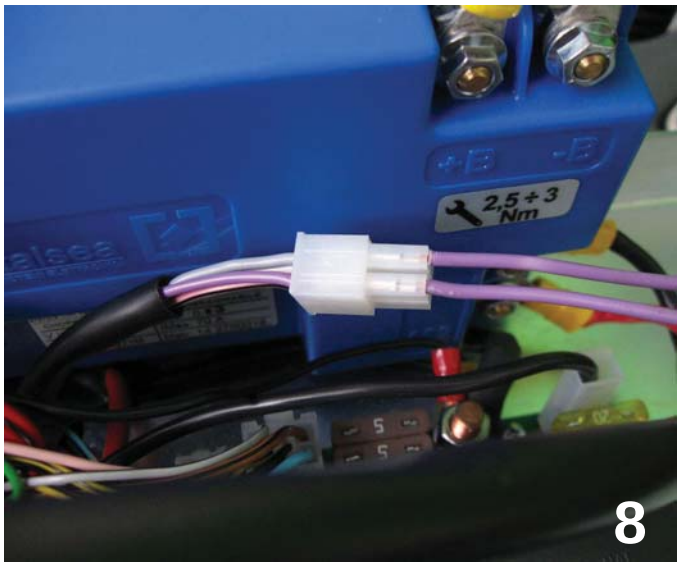



| Current draw A (amperes) | RAISING | | LOWERING | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| No load (without squeegee) | 0,8 A | 1,5 A | 0,5 A | 1,2 A |
| Load applied (with squeegee) | 0,8 A | 2,0 A | 0,5 A | 1,2 A |

# A3.2 Checking head actuator electrical operation

1. **If the machine is not fitted with batteries or the batteries are discharged, acquire a battery, even a smaller capacity battery with a voltage less than the standard 24 V (down to 12 V).**
2. Acquire two pieces of thin diameter wire.
3. Move the machine to the tank draining area and empty the dirty water tank.
4. Move the machine onto flat and dry flooring.
5. Make sure that there is enough room around the machine to perform the checks safely.
6. Lift the dirty water tank and then the electronics support plate.
7. Identify the four-pin connector connected to the functions board, and unplug it.
8. Identify the two power wires for the head actuator, *purple* wire and *grey* wire, and connect the two pieces of wire to these.
9. Connect the other ends of the wires to the battery poles.
10. If the actuator moves, it means that it is working correctly, otherwise reverse the polarity of the wires on the battery.
11. If when reversing the polarity the actuator moves, it means that it is working correctly, otherwise replace it or check continuity of the power wires.
12. If the wires that power the actuator are intact, replace the actuator with a new one of the same type.



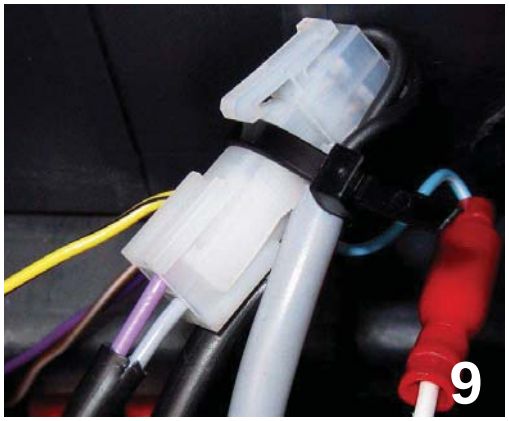
# A3.3 Replacing the head actuator

## *Dismantling*

1. Move the machine to the tank draining area and completely empty both tanks.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. If fitted, release the brushes using the control on the instrument panel, and remove them from underneath the head.
5. Lift the dirty water tank and then the electronics support plate.
6. **Detach the head pressure spring and then remove the bumper springs.**
7. **On the instrument panel, activate the lower brush head command.**
8. **Disconnect power to the machine using the emergency switch.**
9. Disconnect the actuator power connector.





**10** Remove the actuator from its housing unscrew the two screws that fasten the central head attachment bracket.

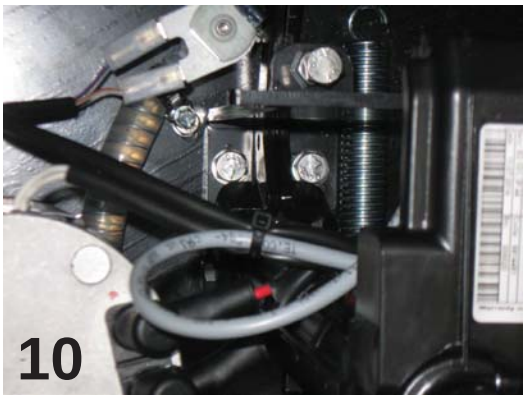
**10*** On the first series of machines, there are two bolts instead of the two screws, added at a later stage; in this case, the machine needs to be raised to dismantle the actuator.

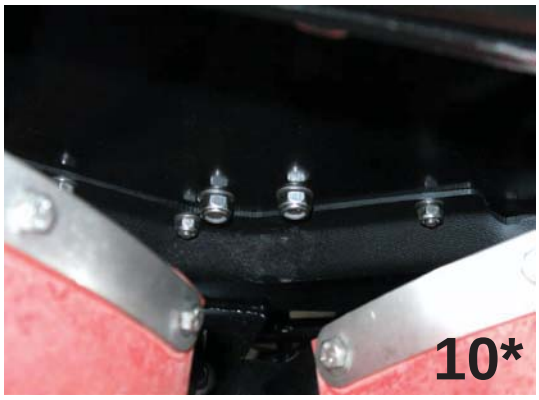
**11** Lift the actuator and remove it from the head actuator lifting arm

**12** Unscrew and remove the two nuts and the self-locking nut from the actuator fastening bolt.

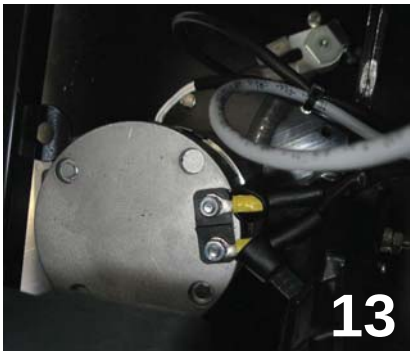
**13** Electrically disconnect the right brush motor, to allow the actuator fastening bolt to be released.

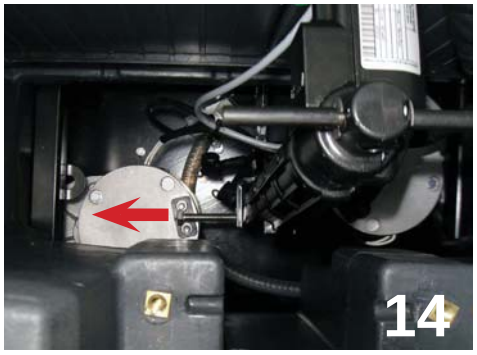
**14** Unscrew the bolt and remove the actuator, replace it with a new one of the same type.






***The new actuator, supplied as a spare part, does not require any adjustments or calibration To simplify the procedure, almost completely extend the rod from the actuator before assembly. Use an ordinary battery for this operation.***

## *Reassembly*

**1** To assemble the new actuator, repeat the dismantling operations in reverse order.

**2** The bolt that fixes the actuator to the head must not be excessively tightened, as it acts as a pin.

**3** When raising the head, make sure the actuator pin is positioned in the corresponding grooves.

**4** Electrically connect the brush motor, respecting the polarity indicated on the motor.

## WARNING!

**Move the machine to the tank draining area and empty the solution and dirty water tanks using the hoses provided.**

**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 means of the Anderson connector with handle.**

## i INFORMATION

**Very important instructions.**

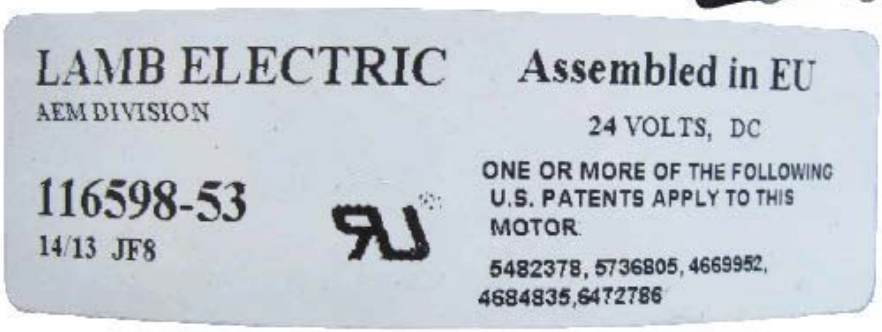
**In this Service Manual, the terms RIGHT and LEFT are used to indicate the sides of the machine; these always refer to the direction of travel of the machine.**

**In this Service Manual, the version of the machine may be written in brackets "()", i.e. (A670, 2180SR). This note indicates that the instructions only refer to the model or version specified in brackets.**

# B1 THREE-STAGE SUCTION MOTOR

***The suction motor on the double disc versions is a THREE-STAGE radial motor, meaning outlet of the intake air at the end of the third stage from the outer circumference of the turbine body, through specially made vents. Power supply is 24 volts, and maximum power is 640 watts. It is fitted with a pair of motor carbon brushes; these need to be checked in the event of high current draw. There is no problem with power wire polarity - there are no positive and negative wires.***



# B1 TWO-STAGE SUCTION MOTOR

***The suction motor on the single disc version is a TWO-STAGE radial motor, meaning outlet of the intake air at the end of the second stage from the outer circumference of the turbine body, through specially made vents. Power supply is 24 volts, and maximum power is 480 watts. It is fitted with a pair of motor carbon brushes; these need to be checked in the event of high current draw.***
***There is no problem with power wire polarity - there are no positive and negative wires.***

# B1.1 Checking suction motor current draw

***The procedure for checking current draw of the suction motor is the same for two- and three-stage suction motors.***

## *Checks*

***1*** **Make sure the batteries on the machine are charged.**

***2*** **Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).**

***3*** Move the machine to the tank draining area and empty the dirty water tank.

***4*** Move the machine onto flat and dry flooring.

***5*** Make sure that there is enough room around the machine to perform the checks safely.

***6*** Lift the dirty water tank and remove the suction motor cover.

***7*** Remove the sound absorbing sponge so as to access the power cable.

***8*** Identify the suction motor power cable and connect the clamp-on ammeter to this.

***9*** Connect the clamp-on ammeter to one of the two power wires, if the value read is preceded by the minus sign, move the ammeter to the other wire or turn the ammeter around on the wire.

***10*** Make a first reading with the dirty water tank lid and anti-foam sponge removed, so as to obtain maximum suction motor current draw.

***11*** Make a second reading with everything in the normal position (sponge, cover, suction hose) and with the suction hose detached from the squeegee, so as to obtain current draw in reliable working conditions.

***12*** Note down the values read and compare them against the values shown in the table below

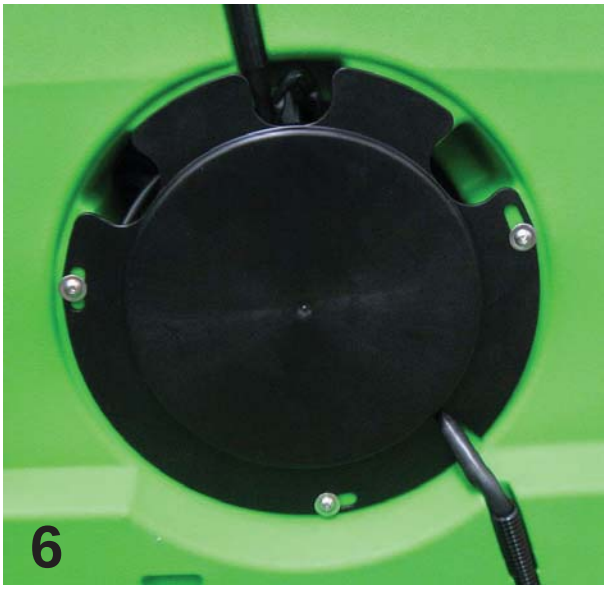
***13*** If the values measured fall within those specified in the table, restore the machine to normal operating conditions.

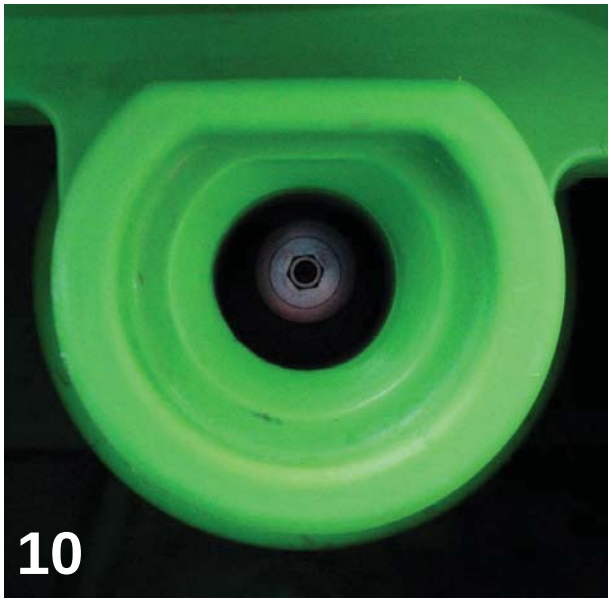
***14*** If the values read are not within the limits shown in the table, perform the following checks:

***14a*** *Make sure that the brush motor carbon brushes are not worn down or show signs of abnormal wear.*

***14b*** *Make sure that the rotor bearings are not jammed, as highlighted by abnormal noise coming from the rotor.*

***14c*** *Replace the suction motor with a new one of the same type.*



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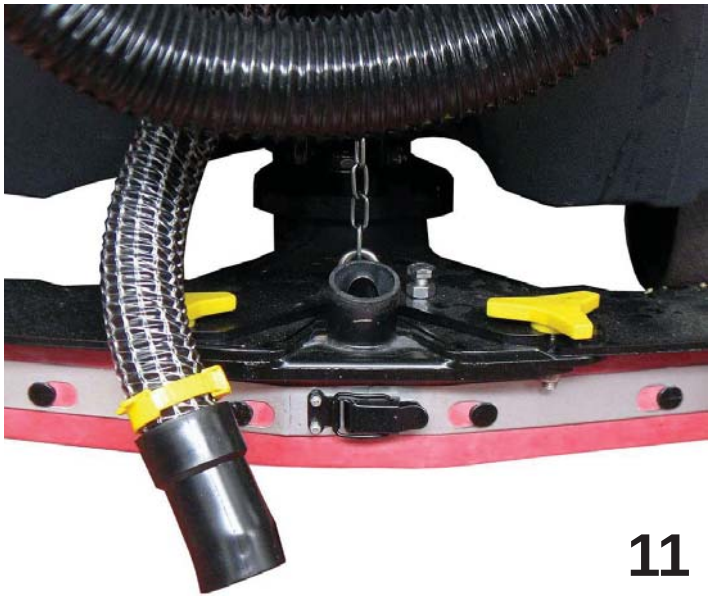

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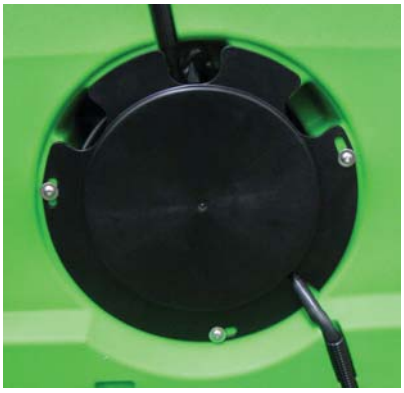
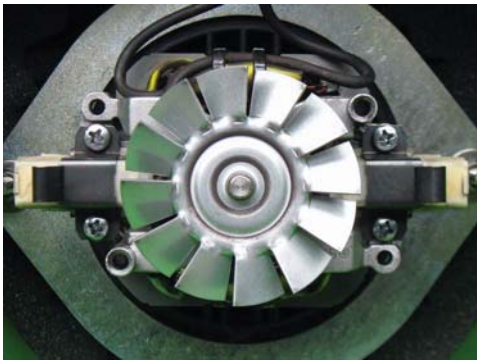
| Current draw A (amperes) | 2 Stage | | 3 Stage | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| No-load (cover, filter and wire mesh removed) | 15,0 A | 20,0 A | 22,0 A | 27,0 A |
| Load applied (in operation but with suction hose disconnected) | 13,0 A | 19,0 A | 20,0 A | 25,0 A |

# B1.2 Checking and replacing the suction motor carbon brushes

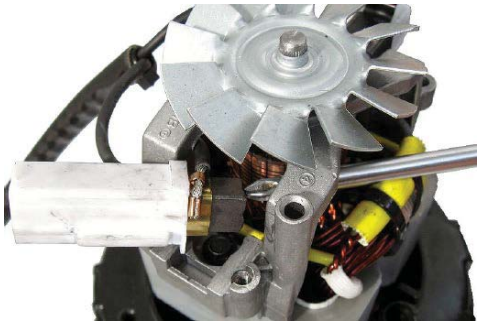
## *Dismantling*

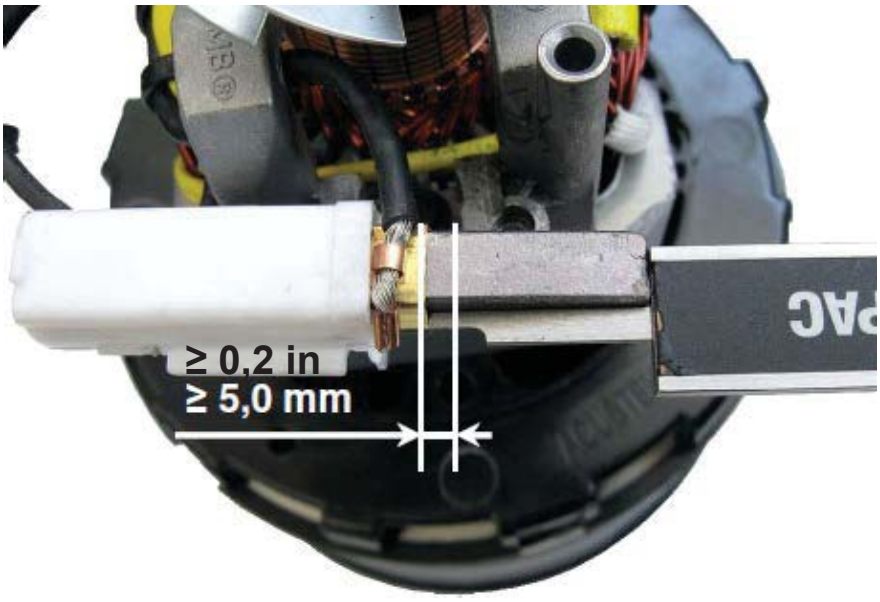
1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Lift the dirty water tank and remove the suction motor cover.
5. Remove the sound absorbing sponge so as to access the power cable.
6. Disconnect the suction motor power connector from the machine's main circuit.
7. The checks and replacements can be performed both with the motor fitted on the tank and on the bench.
8. If the motor is fitted on the tank, remove the protective plastic cover from the cooling fan.
9. Unscrew the two screws that secure the motor brush to the suction motor body.
10. Remove the carbon brush using a screwdriver and check wear and the contact surface.
11. Remove the second carbon brush and check wear and the contact surface.
12. When checking wear, refer to the following instructions.
13. If even just one carbon brush shows abnormal wear or both are worn down, replace them both.
14. For instructions on replacing the carbon brushes, see the following paragraph.





***Both carbon brushes should always be replaced at the same time.***

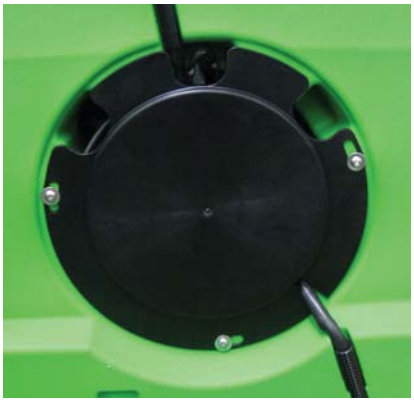




# B1.3 Disassembling and replacing the suction motor

## Dismantling

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Lift the dirty water tank and remove the suction motor cover.
5. Remove the sound absorbing sponge so as to access the power cable.
6. Disconnect the suction motor power connector from the machine's main circuit.
7. Unscrew the two nuts that through the plate hold the suction motor in position on the dirty water tank.
8. Remove the motor from its housing and remove the fastening plate from the motor.
9. Replace the motor with a new one of the same type.






## Reassembly

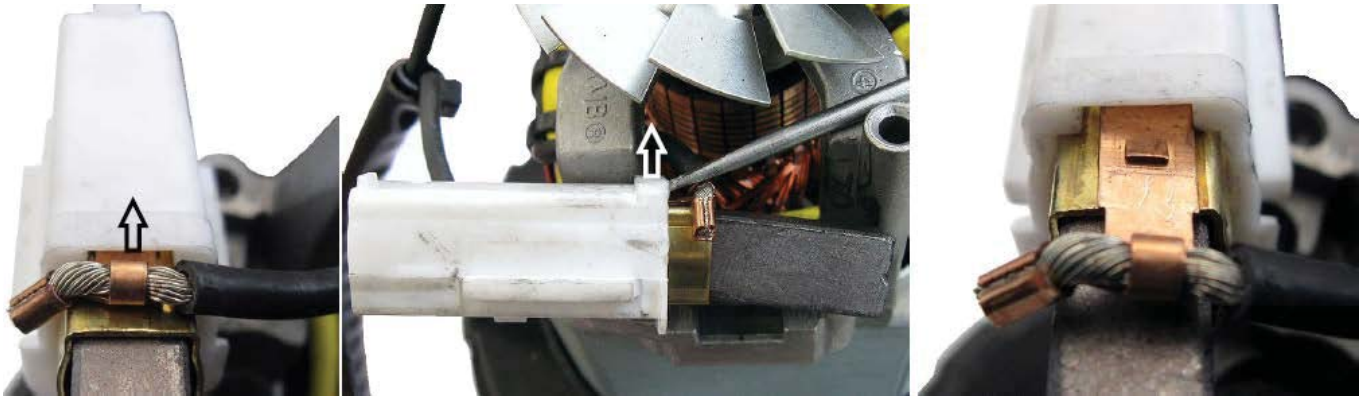
1. To fit the new motors, repeat the steps for dismantling in reverse order.
2. Fit the flange on the suction motor.
3. Place the motor in its housing, centering the studs in the holes provided on the flange.
4. Insert the washers and tighten the nuts. Before tightening the nuts, make sure that the spacers are centred in the holes on the flange.
5. With the suction motor not yet completely fixed in place, centre it with the flange.
6. Finish moderately tightening the screws, never exceed the maximum torque applicable to the screws of 25 Nm / ~ 221,3 lbf in.

# B1.4 Replacing the suction motor carbon brushes on the bench

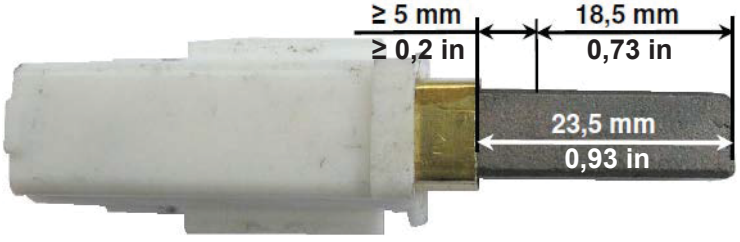
## *Dismantling - Checks*

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Dismantle the suction motor as described in the previous paragraph.
5. Take the suction motor to the bench, and remove the protective plastic cover from the fan.
6. Unscrew the two screws that secure the motor brush to the suction motor body.
7. Remove the carbon brush using a screwdriver and check wear and the contact surface.
8. Remove the second carbon brush and check wear and the contact surface.
9. When checking wear, refer to the following instructions.
10. If the carbon brush needs to be replaced, use a screwdriver to remove the contact tab.
11. Replace the carbon brushes with others of the same type, as recommended by the motor manufacturer.



***Both carbon brushes should always be replaced at the same time.***

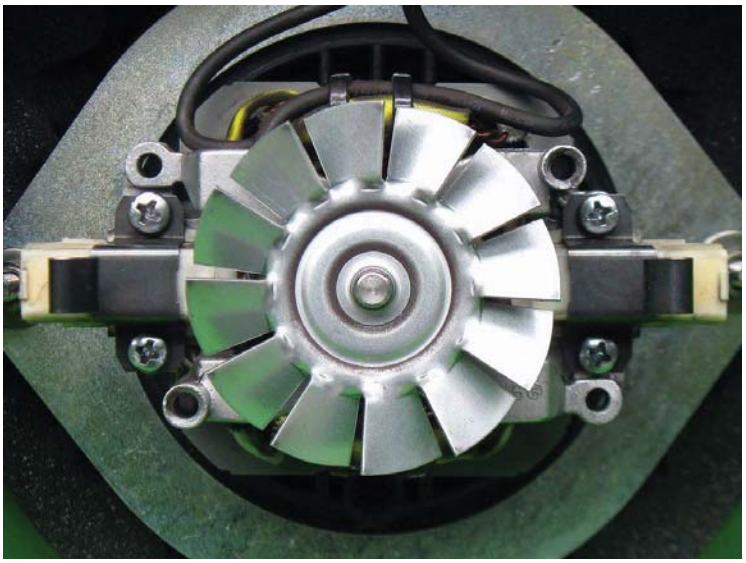


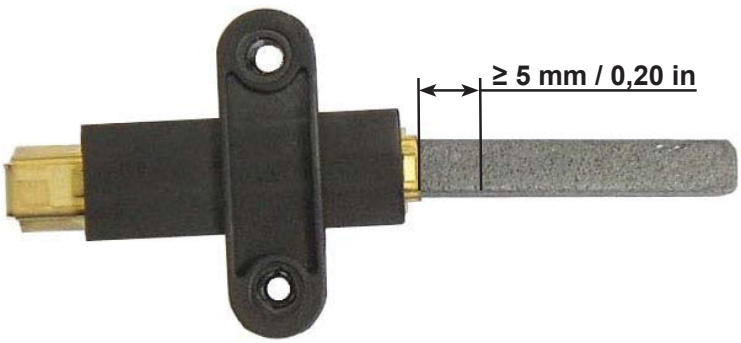
# B1.5 Replacing the carbon brushes on two-stage suction motors

***For version single disc in only, the suction motor is two-stage rather than three-stage.***

## *Dismantling - Checks*

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. To reach the suction motor, proceed as described for the three-stage motor.
5. Remove the protective plastic cover from the fan by unscrewing and removing the two screws.
6. Unscrew the two screws that secure the motor brush to the suction motor body.
7. Remove the carbon brush by lifting it out.
8. Disconnect the spade terminal from the carbon brush, and carry out the measurements.
9. When checking wear, refer to the following instructions.
10. Maximum carbon brush wear must not go beyond 5 mm / 0,2 in.
11. If necessary, replace the carbon brushes with others of the same type, as recommended by the motor manufacturer.





# B2 SQUEEGEE ACTUATOR

***The actuators are electro-mechanical mechanisms that lower and raise the brush or squeegee head when pressing the corresponding buttons on the instrument panel.***

***These are powered directly by the instrument panel board. Inside is a microswitch that cuts off power when reaching the two stroke limits, top and bottom. Consequently, it is very important that these are replaced with the same model and above all actuators with the same stroke.***

***The squeegee stroke is 110 mm / 4,33 in on all versions.***

## *Squeegee Actuator for all version*



***Spare Part MOCC00424***

# B2.1 Checking squeegee actuator current draw

1 **Make sure the batteries on the machine are charged.**

2 **Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).**

3 Move the machine to the tank draining area and empty the dirty water tank.

4 Move the machine onto flat and dry flooring.

5 Make sure that there is enough room around the machine to perform the checks safely.

6 Lift the dirty water tank and then the electronics mounting plate.

7 Identify the four-pin connector on the functions board.

8 Identify the two power wires for the head actuator, *grey* wire and *purple* wire, and connect the clamp-on ammeter to one of these two wires.

9 Lower the squeegee and read the value, if the value read is preceded by the minus sign, move the ammeter to the other wire or turn the ammeter around on the wire.

10 Read current draw when lowering and when raising the actuator.

11 Note down the values read and compare them against the values shown in the table below.

12 If the values measured fall within those specified in the table, restore the machine to normal operating conditions.

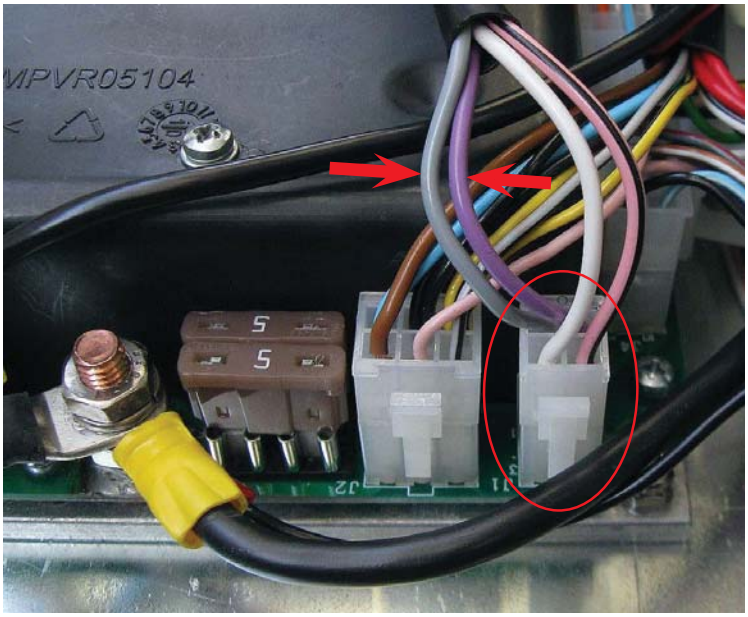
13 If on the other hand the values read do not match those shown in the table, perform the following checks.

13a *The values are higher. Above all when raising, release the actuator from the squeegee by removing the chain from the rod and then check current draw with no load on the actuator.*

13b *If the actuator still shows high current draw, replace it with a new one of the same type.*

13c *If the no-load current is normal, check that there is nothing blocking the squeegee support fastening and rotation mechanisms.*

13d *If there is nothing blocking the squeegee support, replace the actuator.*

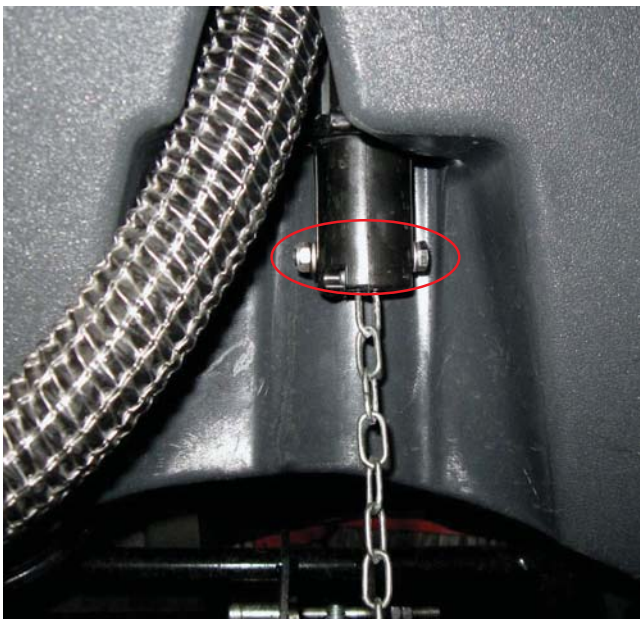



| Current draw A (amperes) | RAISING | | LOWERING | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| No load (without squeegee) | 0,8 A | 1,5 A | 0,5 A | 1,2 A |
| Load applied (with squeegee) | 0,8 A | 2,0 A | 0,5 A | 1,2 A |

# B2.2 Replacing the squeegee actuator

## *Dismantling*

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Remove the squeegee and unscrew the bolt that fixes the squeegee lifting chain.
5. From the inside, disconnect the actuator power connector.
6. Lift the actuator and remove the pin that keeps it suspended from the solution tank.
7. Replace the actuator with a new one, making sure that the rod extension stroke is 110 mm / 4,33 in.



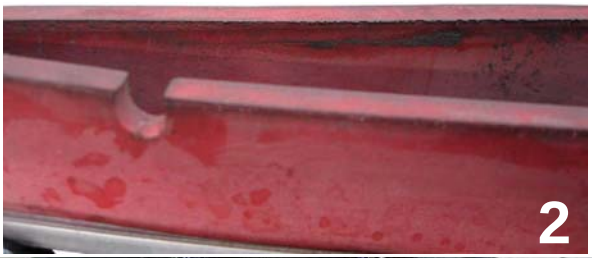
## *Reassembly*

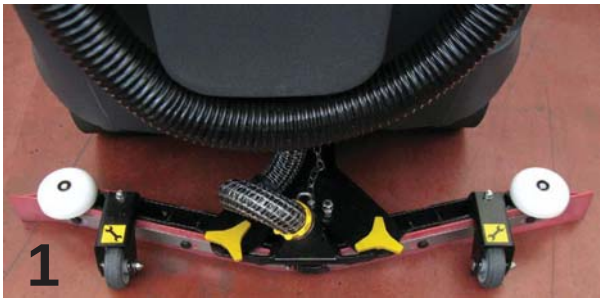
1. To assemble the new actuator, repeat the dismantling operations in reverse order.
2. Tighten the bolt moderately, it simply needs to reach the plastic self-locking ring on the nut.
3. Remember to connect the actuator to the power supply and test operation.
4. **The actuator does not need adjustments or calibration.**

# B2.2 Adjusting the squeegee

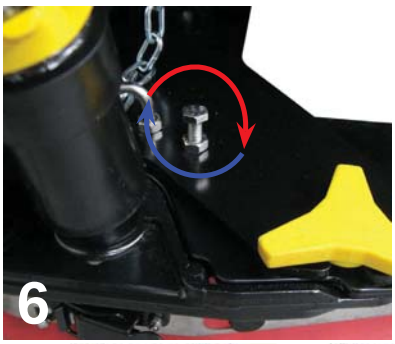
## Adjustment

1. Prepare the machine for use and go to a flat, dry area of floor.
2. Make sure that the bottom inside edge of the rear squeegee blade or flap is in good condition.
3. Make sure that there is enough room around the machine to perform the tests and adjustments safely.
4. Clean a few metres of floor under normal working conditions to check the position of the rear blade on the floor: correct gradient all along the squeegee.
5. Two types of adjustment can be made on the squeegee; transversal gradient, using the screw located on the squeegee bracket, and height, by adjusting the wheels.
6. If the blade or flap is not uniformly pressed onto the floor along the entire length of the squeegee, adjust the screw located on the squeegee support, tightening it to lower the ends of the squeegee, and vice-versa unscrewing it.
7. If the pressure exerted is insufficient, or excessive, adjust this using the two wheels on the sides of the squeegee.
8. Once adjustment has been completed, tighten the locking nut on the bolt on the squeegee plate, and the two bolts that fasten the wheels.

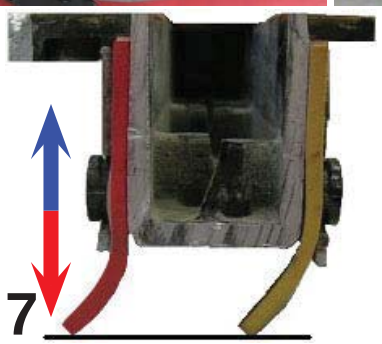



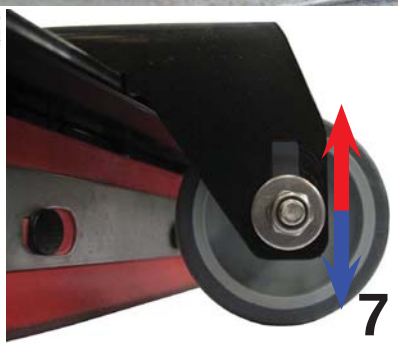







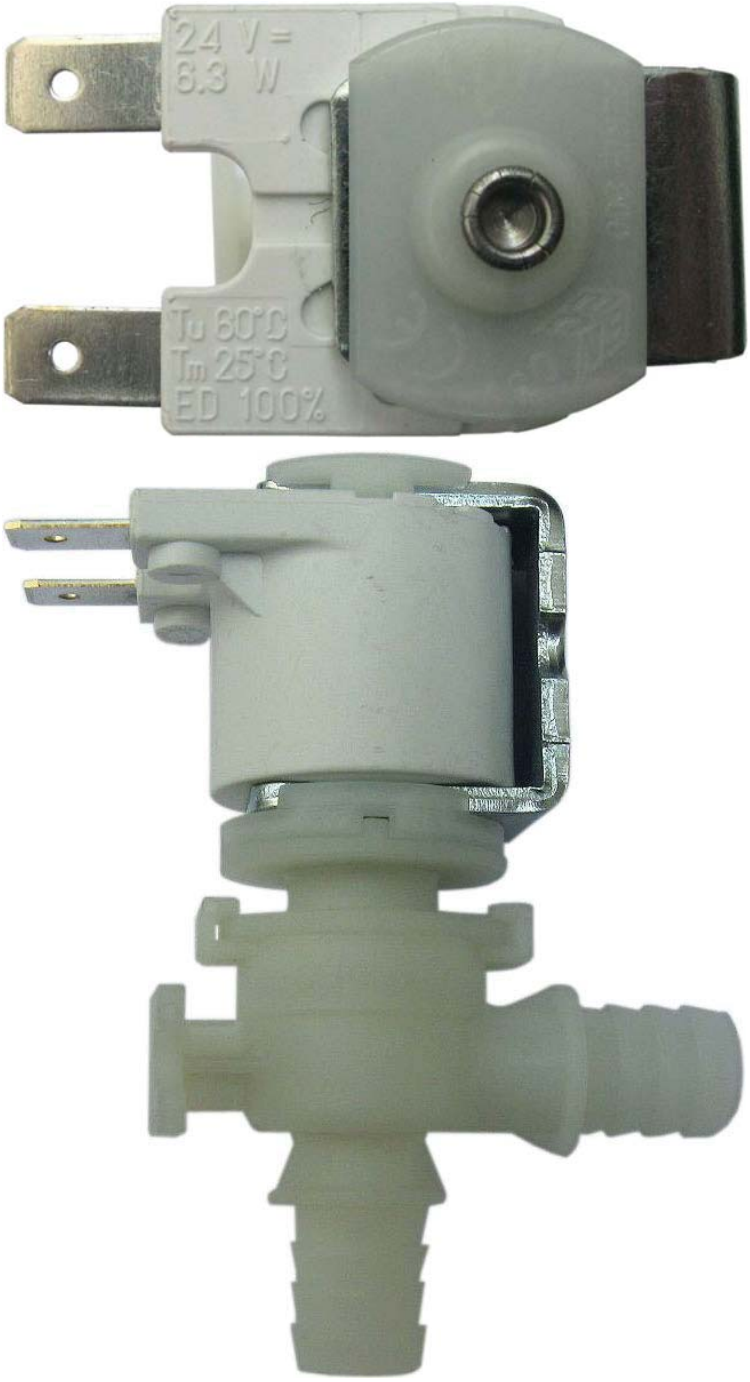




# B3 SOLENOID VALVE - CLEANING THE FILTERS

***The solenoid valve is an electro-mechanical device in which a rubber membrane is opened and closed by a solenoid. Its purpose is to manage the flow-rate of water or solution delivered to the brushes, depending on the quantity selected on the instrument panel. The solenoid valve is powered at 24 V by the functions board, which interfaces with the instrument panel board to control the valve opening times at the required intervals so as to deliver the correct amount of water or solution, as selected on the instrument panel. Consequently, the amount of water or solution delivered by the solenoid valve depends on the number of pulses sent by the functions board over a set time; the higher the number of pulses sent by the functions board over time, the more water or solution will be delivered to the brushes.***



# B3.1 Checking solenoid valve operation

## Checks

1 **Use a digital multimeter.**

2 Move the machine to the tank draining area and empty the dirty water tank.

3 Move the machine onto flat and dry flooring.

4 Make sure that there is enough room around the machine to perform the checks safely.

5 Lift the dirty water tank and then the electronics mounting plate.

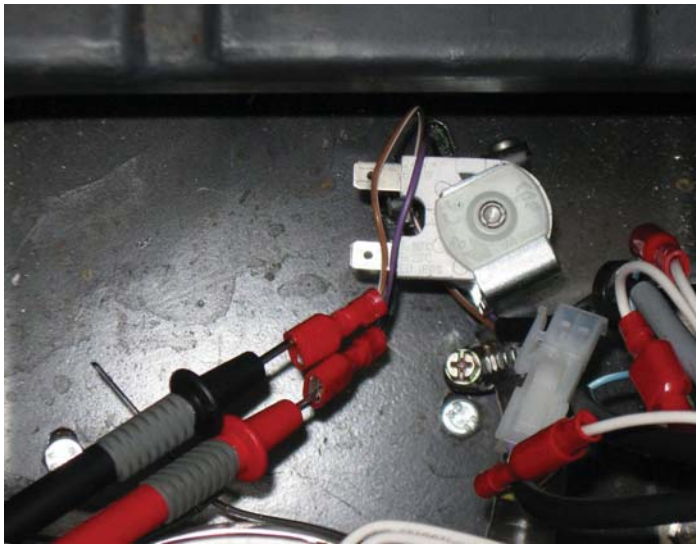
6 On the head, identify the solenoid valve, disconnect the wires and connect them to the digital multimeter probes, or identify the coloured wires running from the functions board that power the solenoid valve, and then use the digital multimeter probes to read the output voltage directly from the functions board.

7 Switch the machine on and select maximum water flow-rate.

8 Perform a short washing cycle to check operation of the solenoid valve:

8a If there is voltage on the functions board or the wires that power the solenoid valve and the solenoid valve is not working, replace the valve.

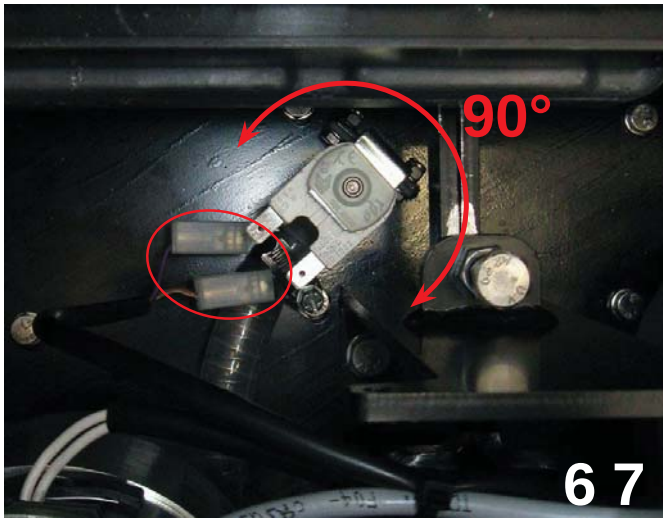
8b If on the other hand there is no voltage on the wires, check continuity, check the 5 A functions fuse, make sure the board supplies 24 V, or alternatively replace the functions board.



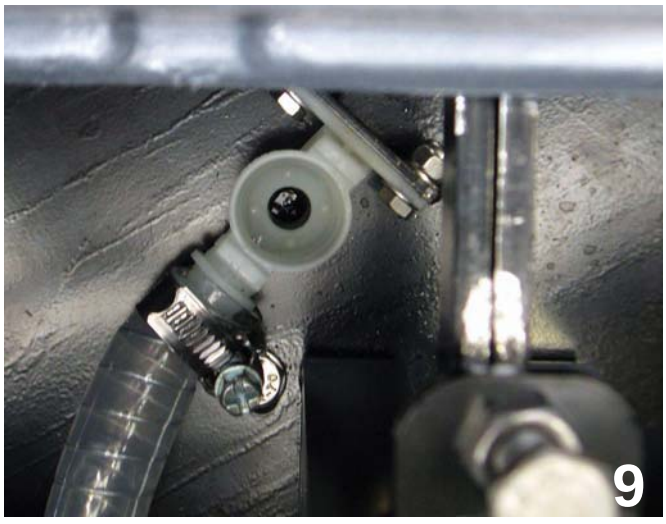
# B3.2 Inspecting and replacing the solenoid valve

## Dismantling

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Turn the water/solution outlet tap so as to stop outlet flow.
5. Lift the dirty water tank and then the electronics mounting plate.
6. On the head, identify the solenoid valve and disconnect the power wires.
7. Rotate the electromagnet on the solenoid valve around 90° in either direction, and lift it up.
8. Visually inspect the condition of the gasket and operation of the electromechanical actuator, powering it at 24 VDC.
9. If the solenoid valve is working correctly, before reassembling it, check to see that the other part of the solenoid valve is clean (the part fitted on the head). If necessary, blow it clean with a compressed air.
10. If the solenoid valve is not working, replace it with a new one.







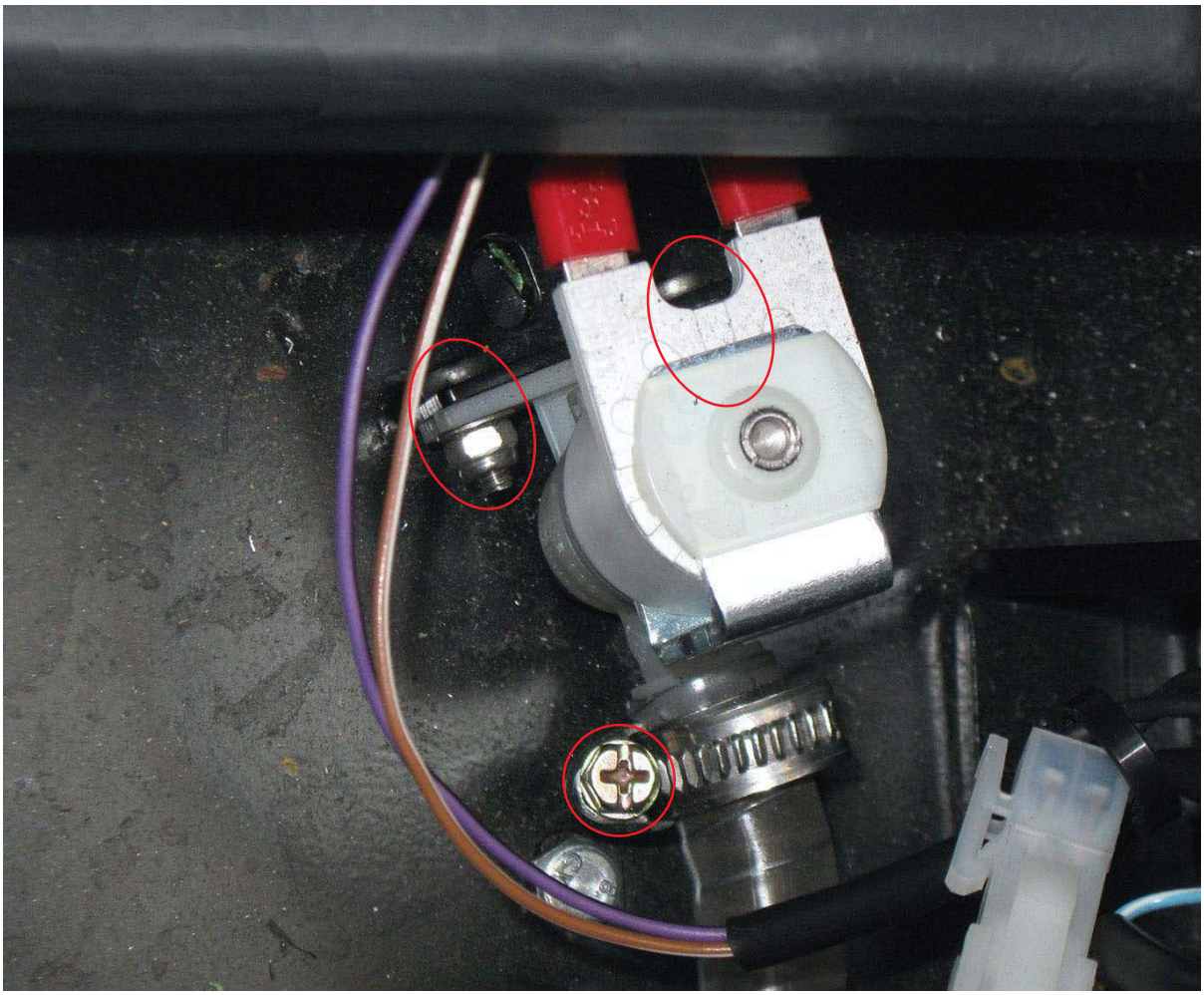
## Reassembly

1. To fit the new solenoid valve, repeat the steps for dismantling in reverse order.
2. Electrically connect the solenoid valve, the two wires can be connected in either position.

# B3.3 Replacing the complete solenoid valve

## Dismantling

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Lift the dirty water tank and then the electronics mounting plate.
5. On the head, identify the solenoid valve and disconnect the power wires.
6. Unscrew the ties that fasten the hose to the solenoid valve, and then remove the hose.
7. Unscrew the two screws that fix the solenoid valve to the head, remove it and replace it with a new one.



## Reassembly

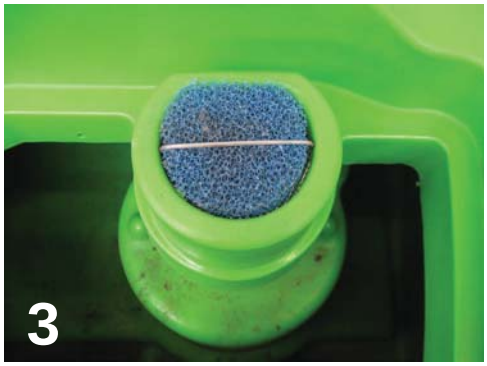
1. To fit the new solenoid valve, repeat the steps for dismantling in reverse order.
2. Moderately tighten the metal tie that secures the water supply hose.
3. Electrically connect the solenoid valve, the two wires can be connected in either position.

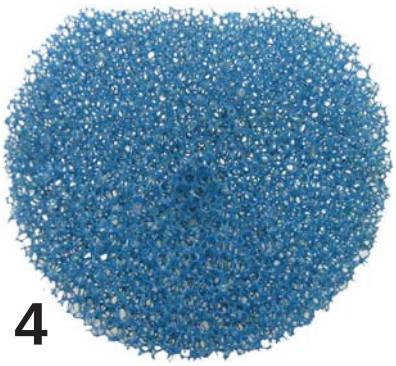
# B3.4 Cleaning the filters

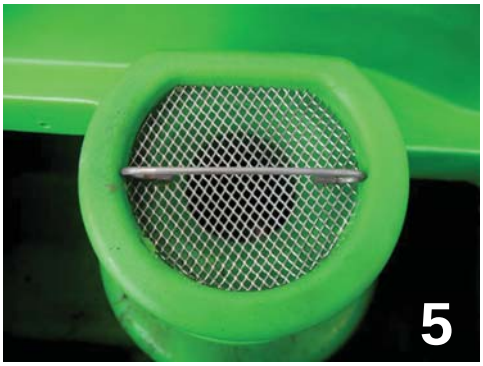
## Suction filter - Dismantling

1. Move the machine onto flat and dry flooring.
2. Make sure that there is enough room around the machine to perform cleaning operations safely..
3. Lift and remove the cover of the dirty water tank and identify the blue suction filter.
4. The main function of the suction filter is to trap foam.
5. Remove the filter from its metal support and wash it under running water.
6. Dry it thoroughly before putting it back in position.

***Before repositioning the suction filter, make sure that it is perfectly dry.***

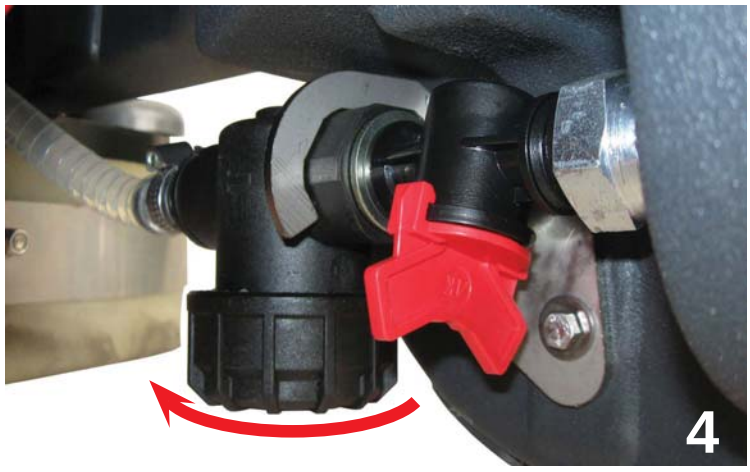


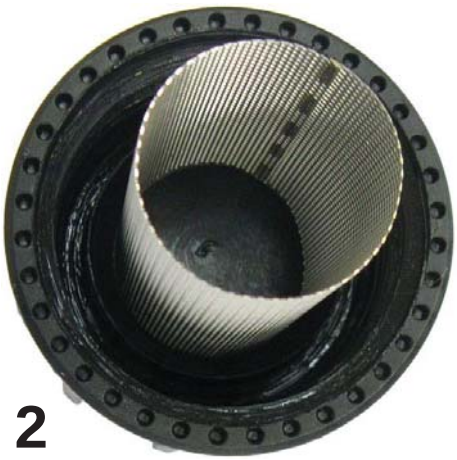

## Solution filter - Dismantling

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. Identify the solution filter under the footplate, on the left side of the machine.
4. Turn the water/solution outlet tap so as to stop outlet flow.
5. Unscrew the cover by hand and remove the thin stainless steel mesh filter.
6. Clean the mesh filter under running water, from the outside towards the inside, and then blow it with compressed air and reposition it on its support.

# Solution filter - Reassembly

1. Clean the bottom of the cap.
2. Position and centre the mesh filter on the bottom of the cap, inserting it fully, making sure it is perfectly centred.
3. Take the cap with the mesh filter under the body, lift it to the opening and screw it on, tighten moderately.
4. The complete filter comprises three pieces: the body **A** , the stainless steel mesh filter **B** and the cap **C**.
5. When closing the cap, pay attention to the O-ring.
6. If replacing the entire filter, when assembling pay attention to the arrow indicating the direction of water flow.

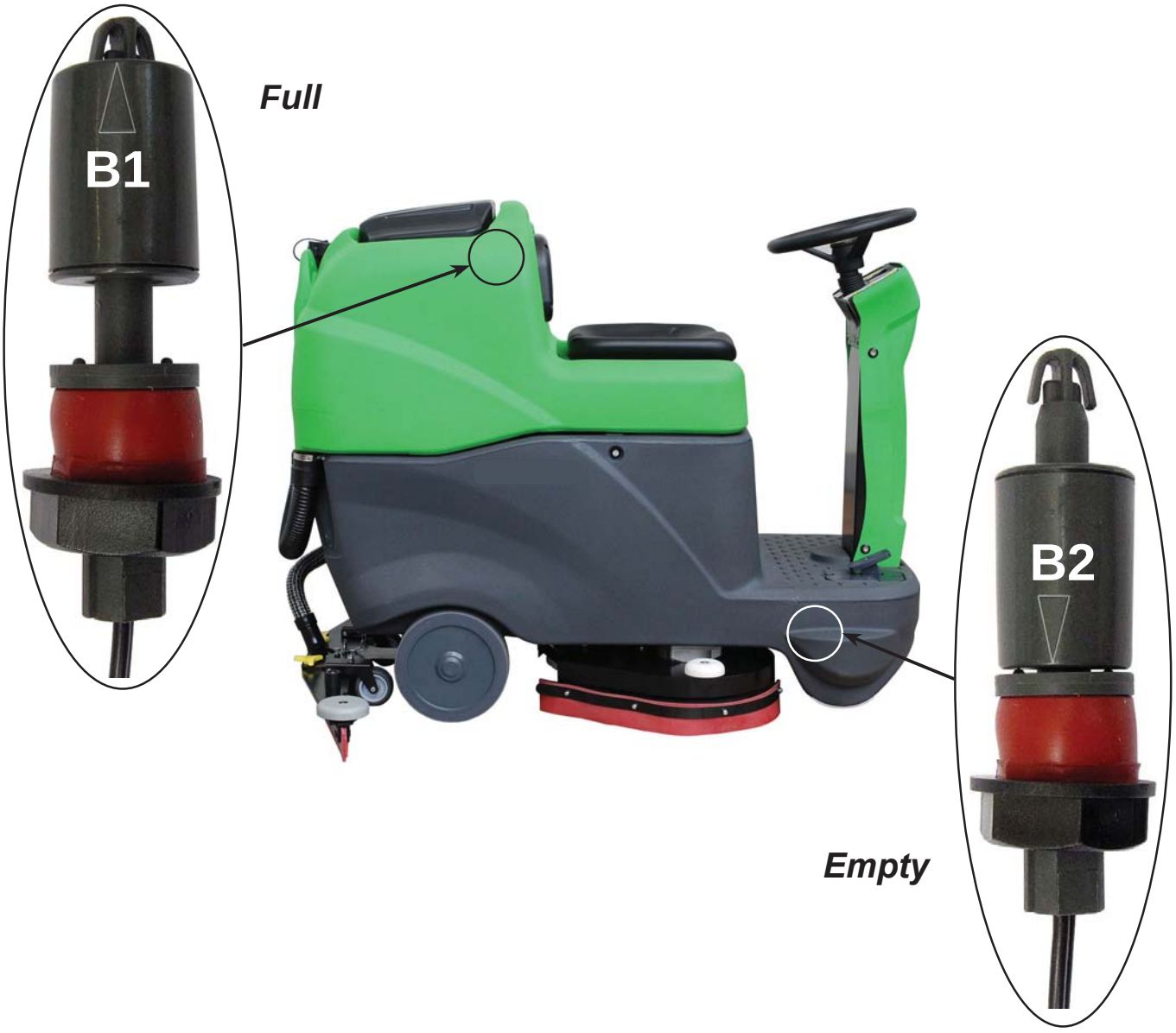






## B4 CHECKING AND REPLACING THE FLOATS

***The sensors A fitted on the solution tank and on the dirty water tank are electro-mechanical devices; their operating principle is similar to a button. When activated, they communicate with the instrument panel board, enabling a visual signal (LED and warning on the display) and audible signal (buzzer) that the level in the tanks is below a certain limit (and need to be emptied or refilled).***

***The two sensors A are practically identical, the only difference between them is the direction in which float B is inserted. The arrow marked on float B indicates the direction of operation.***
***When the arrow on float B1 points upwards, the sensor will be activated in the top position, away from the base.***
***When the arrow on float B2 points downwards, the sensor will be activated in the bottom position, or in contact with the base.***

# B4.1 Checking operation of the dirty water tank sensor

***Operation of the two floats is very simple, when activated they behave like a switch, remaining active until the conditions change. They signal activation to the board by closing the corresponding circuit.***

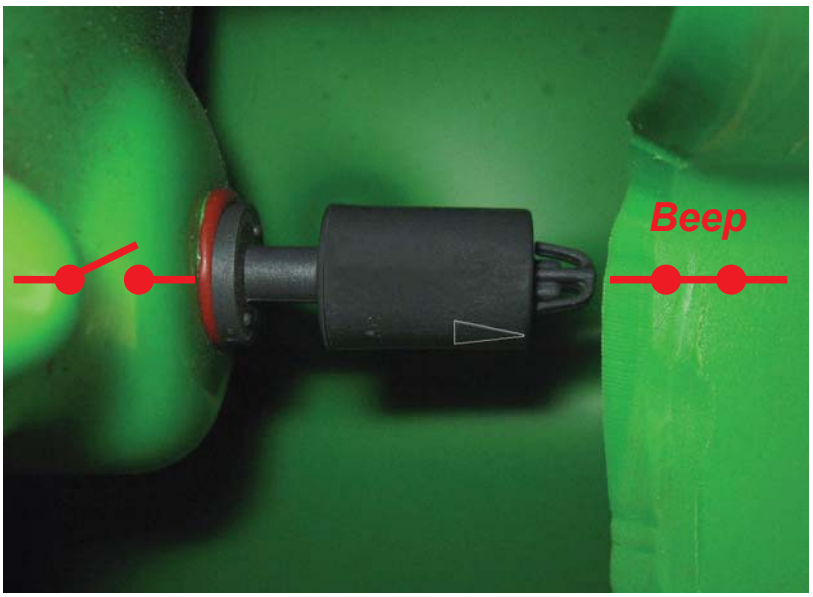
## Checks

1. Use a digital multimeter able to read continuity.
2. Move the machine to the tank draining area and empty the dirty water tank.
3. Move the machine onto flat and dry flooring.
4. Make sure that there is enough room around the machine to perform the checks safely.
5. Access the dirty water tank level sensor, as described in paragraph on dismantling.
6. Disconnect the corresponding connector and connect the multimeter probes.
7. With the dirty water tank lifted (and only in this condition), position the float at the end of its travel.
8. Carry out the checks using a multimeter, if the two conditions below are not true, replace the float with a new one.

8a With the tank empty (float on the base), the signal to the multimeter will be interrupted, therefore there will be no continuity.

8b With the tank full (float on the part opposite the base), the signal to the multimeter will be present, therefore the instrument will show continuity.

***It is very important check correct operation of the sensor on the dirty water tank, its wiring and the signal on the instrument panel. In fact, if this is not working correctly, the instrument panel board will not deactivate the suction motor, and consequently the suction motor will keep taking in water, leading to premature wear of the rotor bearings.***



# B4.2 Checking operation of the solution tank sensor

***Operation of the two floats is very simple, when activated they behave like a switch, remaining active until the conditions change. They signal activation to the board by closing the corresponding circuit.***

## *Checks*

***1*** Use a digital multimeter able to read continuity.

***2a*** If the solution tank is full, first of all check operation of the sensor with the tank full.
Then empty the tank, and check the sensor with the tank empty.

***2b*** If the solution tank is empty, first of all check operation of the sensor with the tank empty.
Then, if necessary, add around ten litres of water to the tank and check the sensor with the tank full.

***3*** Move the machine onto flat and dry flooring.

***4*** Make sure that there is enough room around the machine to perform the checks safely.

***5*** Access the solution tank level sensor, as described in paragraph dedicated to the dismantling.

***6*** Disconnect the corresponding connector and connect the multimeter probes.

***7*** Carry out the checks using a multimeter, if the two conditions below are not true, replace the float with a new one

***7a*** With the tank full (float on the part opposite the base), the signal to the multimeter will be interrupted, therefore there will be no continuity.

***7b*** With the tank empty (float on the base), the signal to the multimeter will be present, therefore the instrument will show continuity.

***It is very important check correct operation of the sensor on solution tank, , its wiring and the signal on the instrument panel. In fact, if this is not working correctly, the instrument panel board will not lift the brushes, due to lack of water/solution, with the risk of damaging the flooring and the brushes themselves.***

# B4.3 Replacing the solution and dirty water tank floats

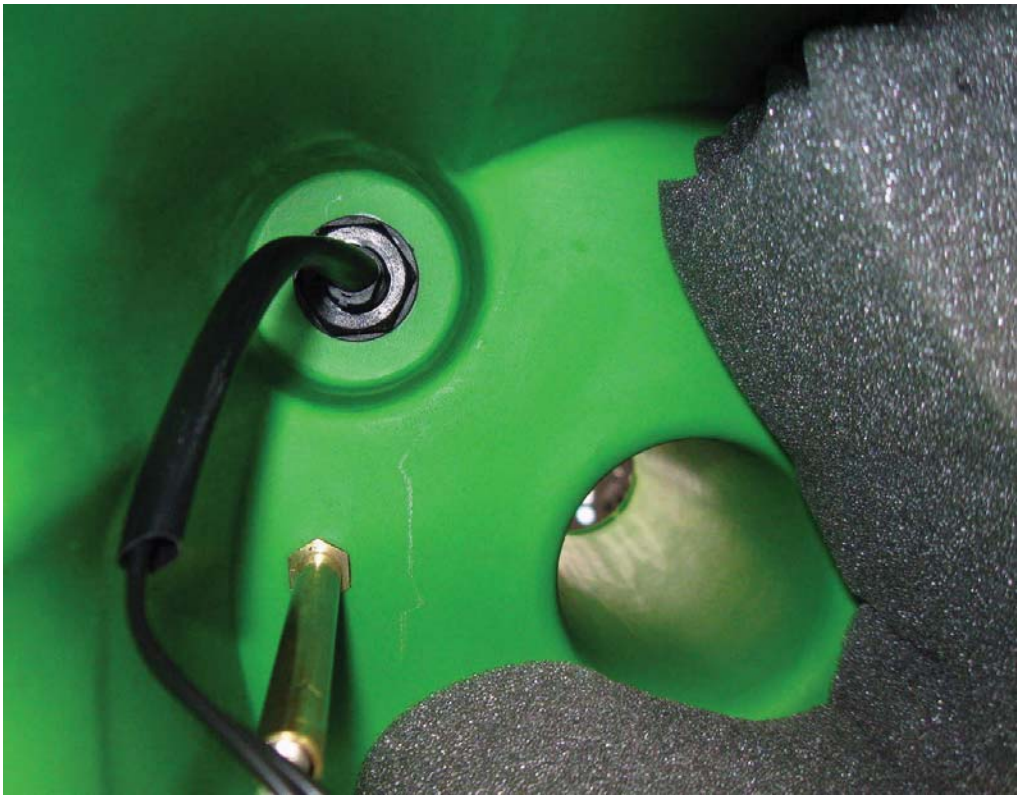
***As the two floats are identical (only the position of the float on the rod changes), the replacement procedure is the same. Only the way they are inserted is different.***

## *Dismantling - Solution tank*

1. Move the machine to the tank draining area and completely empty both tanks.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. If possible, lift the front of the machine, the float is located at the front on the inside right, next to the drive wheel.
5. Disconnect the float from the machine's main wiring.
6. Unscrew the plastic nut, and remove the complete float
7. With the sensor dismantled, check that the float slides freely on the rod, and then check operation on the bench.
8. If the malfunction is also found on the bench, replace the level sensor with a new one.
9. Always make sure that the arrow on the float points in the right direction, indicating correct operation for the specific use (solution tank or dirty water tank).

## Dismantling - Dirty water tank

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Lift the dirty water tank and remove the suction motor cover.
5. Continue by dismantling the suction motor, as described in the corresponding paragraph.
6. Disconnect the float from the machine's main wiring.
7. Unscrew the plastic nut, and remove the complete float
8. With the sensor dismantled, check that the float slides freely on the rod, and then check operation on the bench.
9. If the malfunction is also found on the bench, replace the level sensor with a new one.
10. Always make sure that the arrow on the float points in the right direction, indicating correct operation for the specific use (solution tank or dirty water tank).



## Reassembly

1. To fit the new sensor, repeat the steps for dismantling in reverse order.
2. Check that there are no burrs or dirt on the edge of the hole.
3. Tighten the plastic nut by hand until it presses against the gasket, and then tighten another half turn.
4. Insert the level sensor in the hole and carefully tighten the plastic nut.
5. Tighten the plastic nut moderately, maximum torque 8 Nm / ~ 71 lbf in.

## WARNING!

**Move the machine to the tank draining area and empty the solution and dirty water tanks using the hoses provided.**

**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 means of the Anderson connector with handle.**

## i INFORMATION

**Very important instructions.**

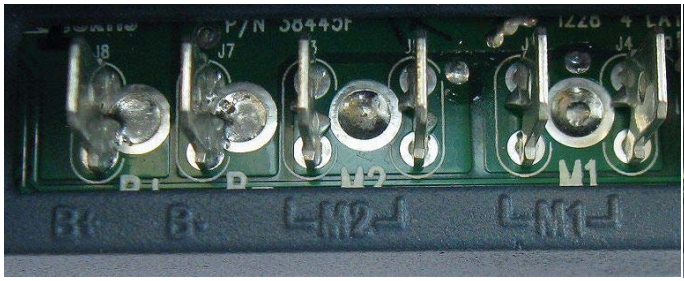
**In this Service Manual, the terms RIGHT and LEFT are used to indicate the sides of the machine; these always refer to the direction of travel of the machine.**

**In this Service Manual, the version of the machine may be written in brackets "()", i.e. (2180SR, A670).**
**This note indicates that the instructions only refer to the model or version specified in brackets.**

# C1 DRIVE CIRCUIT BOARD

## DOUBLE DISC VERSION

***The drive circuit board has the function of supplying power to the drive motor, according to the required speed. It interfaces with the accelerator pedal, the drive motor with electric brake, and the instrument panel board, where the maximum required speed can be set (irrespective of the accelerator pedal position) and any errors or faults are displayed. It provides 110 A (amperes) peak current and 40 A continuous current. It includes an error and fault diagnostics system which interfaces with the instrument panel board. Finally, it also features an energy recovery system to extend battery operation.***


# *SINGLE DISC VERSION*

***The drive circuit board has the function of supplying power to the drive motor, according to the required speed. It interfaces with the accelerator pedal, the drive motor with electric brake, and the instrument panel board, where the maximum required speed can be set (irrespective of the accelerator pedal position) and any errors or faults are displayed. It provides 70 A (amperes) peak current and 20 A continuous current. It includes an error and fault diagnostics system which interfaces with the instrument panel board. Finally, it also features an energy recovery system to extend battery operation.***

# C1.1 Curtis drive board connections

## *Connections*

***A*** Curtis drive board logic connector. Interfaces the functions drive board to the board and instrument panel board.

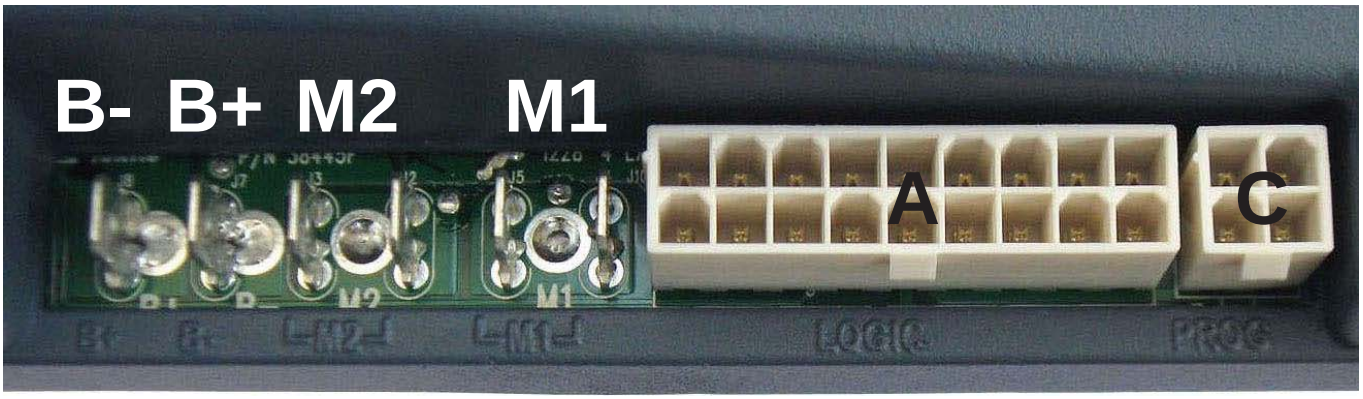
***C*** Curtis programmer keypad connector, for setting the standard parameters.

***M1*** Drive motor power supply spade connector, ±24 V. Make sure that the contact is stable and effective.

***M2*** Drive motor power supply spade connector, ±24 V. Make sure that the contact is stable and effective.

***B-*** Board, functions and drive motor negative power supply spade connector, -24 V. Make sure that the contact is stable and effective.

***B+*** Board, functions and drive motor positive power supply spade connector, +24 V. Make sure that the contact is stable and effective.

# C1.2 Italsea drive board connections

## *Connections*

***A*** Curtis drive board logic connector. Interfaces the functions drive board to the board and instrument panel board.

***C*** Curtis programmer keypad connector, for setting the standard parameters.

***M1*** Screw contact for drive motor power supply, ±24 V. Tighten moderately or to maximum torque of 5 Nm / ~ 44 lbf in.

***M2*** Screw contact for drive motor power supply, ±24 V. Tighten moderately or to maximum torque of 5 Nm / ~ 44 lbf in.

***B-*** Screw contact for board, functions and drive motor negative power supply, -24 V. Tighten moderately or to maximum torque of 5 Nm / ~ 44 lbf in.

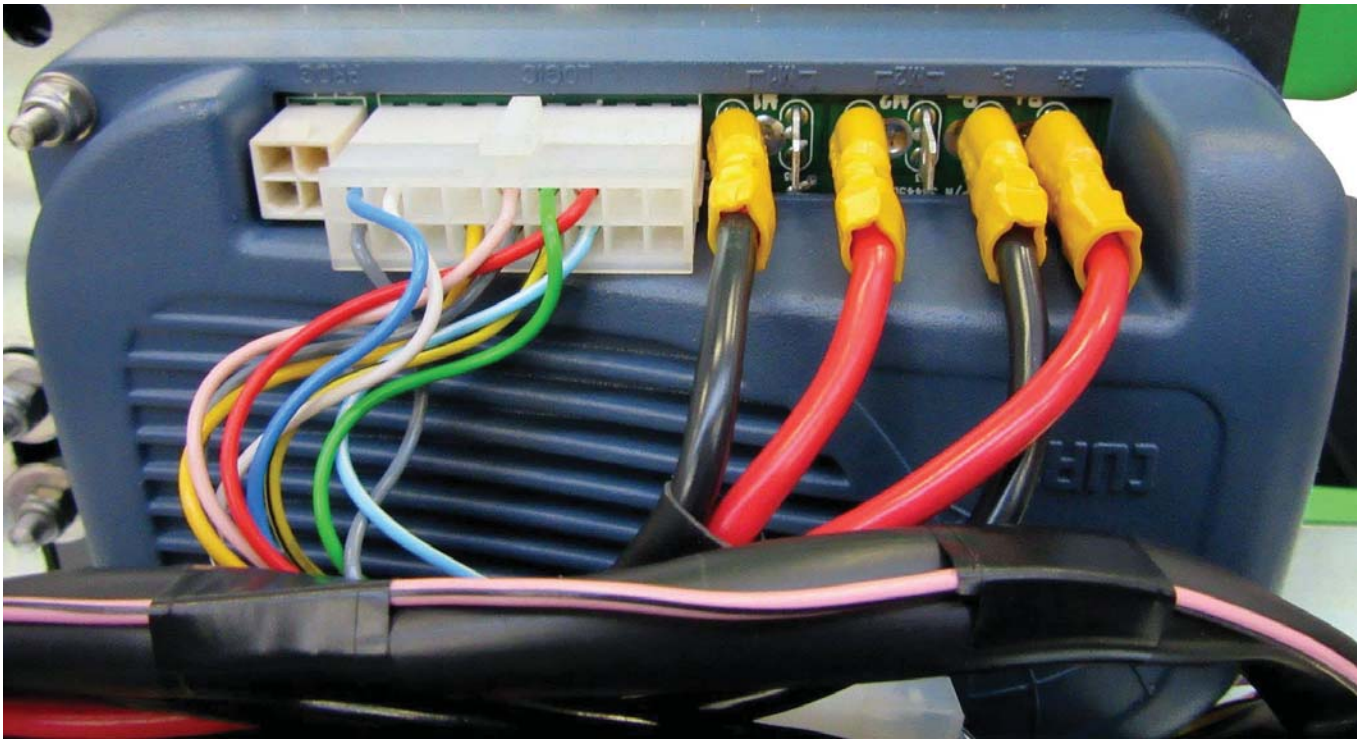
***B+*** Screw contact for board, functions and drive motor positive power supply, +24 V. Tighten moderately or to maximum torque of 5 Nm / ~ 44 lbf in.

# C1.3 Dismantling the Curtis drive board

## Dismantling

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Disconnect the batteries from the machine's main wiring, using the "emergency" switch underneath the seat.
5. Lift the dirty water tank and then the electronics mounting plate.
6. Identify the Curtis drive board and first of all disconnect the four power supply spade terminals; use needle-nose pliers if necessary.
7. Continue by disconnecting the plug-in connector 18-pin for the logic.
8. Remove the two screws that fix the electronic functions board to the electronics mounting plate.
9. Replace the board with a new one.

***The electrical connection for the Curtis drive board uses a wiring interface. This allows either of the two drive boards available to be fitted without modifying the wiring***



## Reassembly

1. To fit the new drive board, repeat the steps for dismantling in reverse order.
2. Moderately tighten the two bolts that fasten the board to the electronics mounting plate.
3. First of all connect the four board and motor power supply spade terminals.
4. **Make sure that the four spade terminals are connected stably and securely to the connectors on the drive board, to avoid problems of overheating.**
5. Continue by connecting the two plug-in connectors, for the logic and the electric brake.
6. When completely assembled, check correct operation of the drive board.

# C2 DRIVE WHEEL

## ALL MODELS

***The drive wheel or drive motor fitted on the comes as standard with an electric brake. This has a power rating of 300 W and operates at 24 V, powered directly by the drive board. It features a thermal cutout to protect the motor against excessive overheating, fitted inside the motor near one of the carbon brushes. It has high ingress protection against dust and liquids (IP 44). Like all recent motors fitted, replacing the rubber ring is quite simple.***

# C2.1 Checking drive motor current draw

1. **Make sure the batteries on the machine are charged.**
2. **Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).**
3. **Acquire an extension wire with the same diameter as the electronic board power wire, terminating with a male and female spade terminal, between 50 ÷ 70 cm / 20 ÷ 28 in length.**
4. Move the machine to the tank draining area and empty the dirty water tank.
5. Move the machine onto flat and dry flooring.
6. Make sure that there is enough room around the machine to perform the checks safely.
7. Lift the dirty water tank and then the electronics mounting plate.
8. Identify the drive circuit board, and then the positive (red) wire running to the drive motor.
9. Disconnect the positive (red) wire from the drive board and connect it to the male connector on the extension.
10. Connect the female spade terminal on the extension to the drive circuit board.
11. Replace the electronic board and the tank in their “working” position, bringing the extension wire outside.
12. Make sure the wire is not crushed when running it outside the machine.
13. Check current draw, making a number of runs on the machine, including on ramps if available.
14. Note down the values read and compare them against the values shown in the table below.
15. If the values measured fall within those specified in the table, restore the machine to normal operating conditions.
16. If on the other hand the values read do not match those shown in the table, perform the following checks.

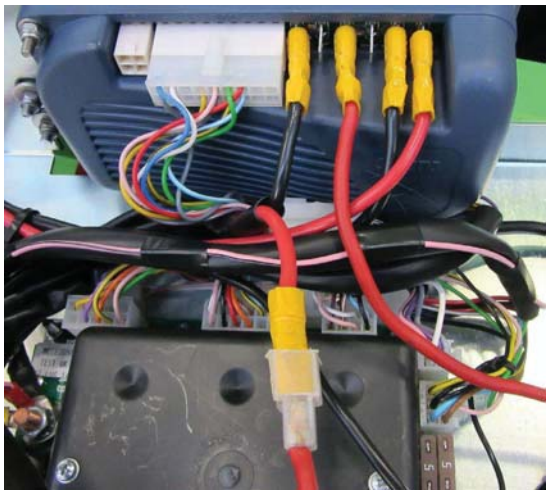
*16a The values are higher. Lift the drive wheel and read the no-load values.*

*16b If the drive wheel still shows high current draw, check the carbon brushes or replace the drive wheel.*

*16b If the no-load current is normal, check that there is nothing blocking rotation of the rear wheels.*

*16c If there is nothing blocking rotation of the rear wheels, check the carbon brushes or replace the drive wheel.*

*16d The values are lower. If the machine is working correctly, restore normal operating conditions, otherwise check the carbon brushes or replace the drive wheel.*



| *Current draw A (amperes)* | *Min* | *Max* |
|---|---|---|
| **No-load (wheel raised)** | ***5 A*** | ***8 A*** |
| **Load applied (normal operation)** | ***14 A*** | ***19 A*** |

# C2.2 Checking and replacing the drive motor electric brake

***The drive circuit board checks operation of the electric brake control, activating an audible signal (buzzer on instrument panel for around one minute) and visual signal (display board) until the problem is resolved.***
***Possible problems are circuit interrupted, wire cut or connector detached, and short circuit, the two wires (stripped) touch, shorting the electric brake magnet.***

## Checks

1. **Make sure the batteries on the machine are charged.**
2. **Acquire a pair of wires (small diameter wires are fine), around 150 cm / 60 in long.**
3. Move the machine to the tank draining area and empty the dirty water tank.
4. Move the machine onto flat and dry flooring.
5. Make sure that there is enough room around the machine to perform the checks safely.
3. Connect the two wires directly from the battery to the electric brake.

5a. If the noise of the electric magnet releasing can be heard, and the machine is no longer braking, it means that the electric brake is working correctly.

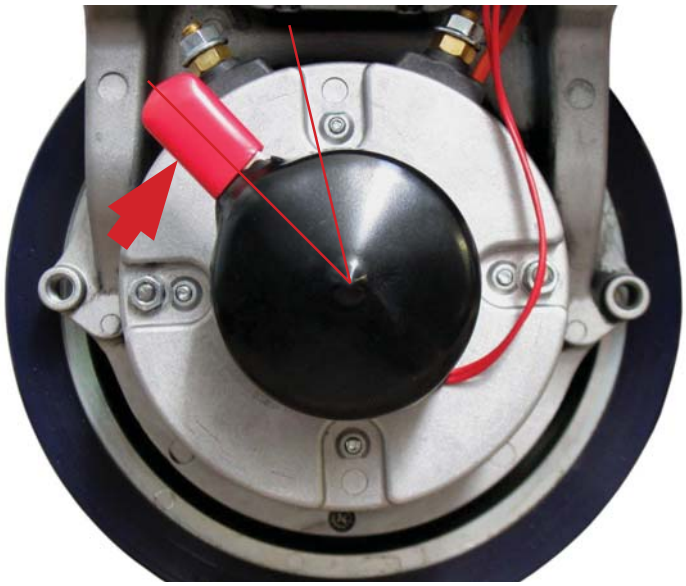
5b. If on the other hand no noise is heard, and the machine is still braking, replace the electric brake.

5c. If the noise of the electric magnet releasing can be heard, but the machine is still braked, remove the electric brake and check there is no dirt inside.

5d. If on the other hand it is working correctly but does not work when connected to its own connector, make sure that the board supplies 24 V to the actuator, probable cause: wires interrupted, repair or replace; faulty board, replace.

## Dismantling

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 available, use a lift table.
4. Turn the front wheel completely to the right until the electric brake can be seen.
5. **Block the wheels using chocks to prevent the machine from moving during dismantling.**
6. Manually detach the brake, turning the corresponding lever clockwise until heating a “click”
7. Remove the two rubber caps, one on the lever (red) and one on the electric brake (black).

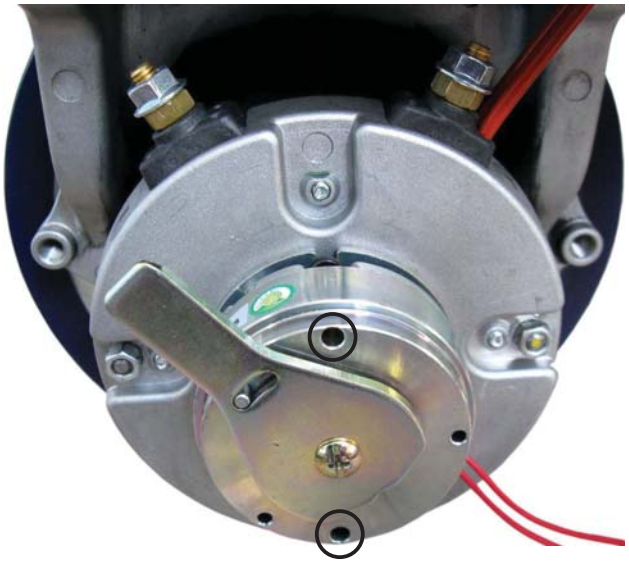


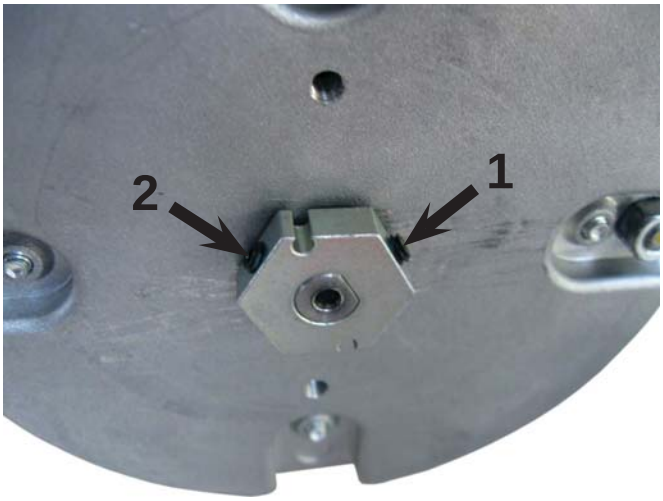
## Dismantling

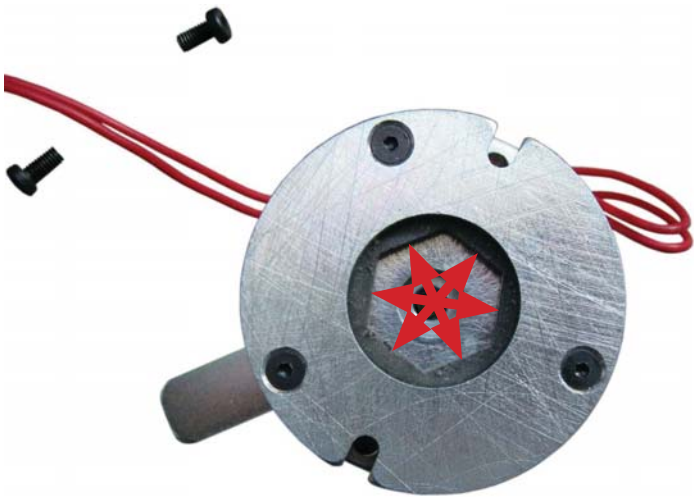
8 Identify the two screws that fix the electric brake to the motor cover, and unscrew them.

9 Remove the electric brake by pulling it outwards horizontally, and replace it with a new one.

10 If necessary, also remove the hexagonal pinion, identify the two dowels that secure it to the shaft and unscrew them.





## Reassembly

1 To fit the electric brake, repeat the steps for dismantling in reverse order.

2 Before replacing the electric brake, make sure that inside everything is in order and there is no dirt.

3 It is recommended to release the brake for assembly, thus allowing the inside disc to move.

3 When fitting the dowels for the hexagonal pinion, it is recommended to use threadlocker, such as Loctite.

4 Tighten the dowels in the order shown.

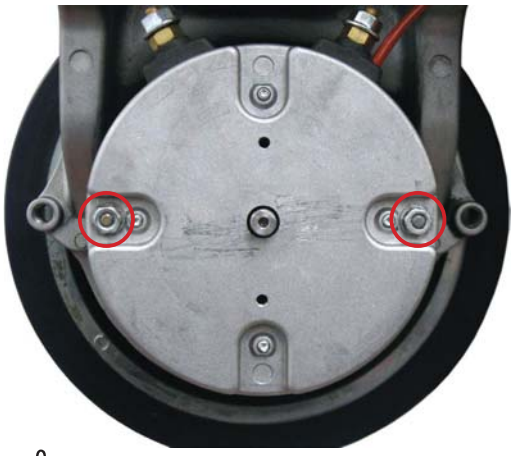
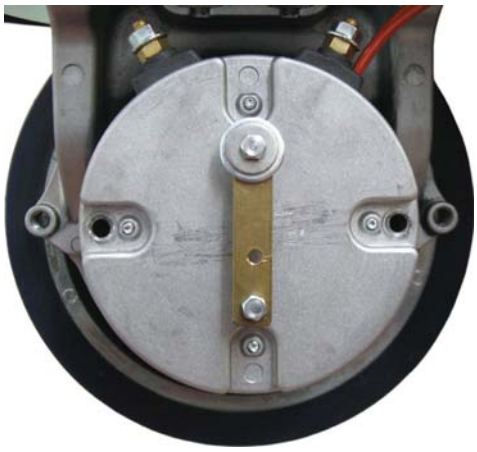
5 Moderately tighten the two screws that fix the electric brake.

6 Then fit the rubber caps and complete the electrical connections.

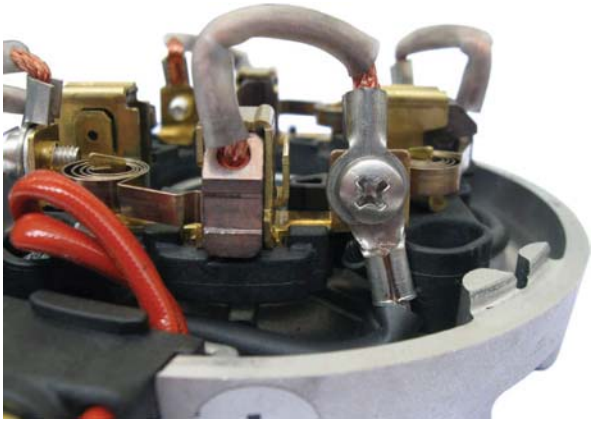
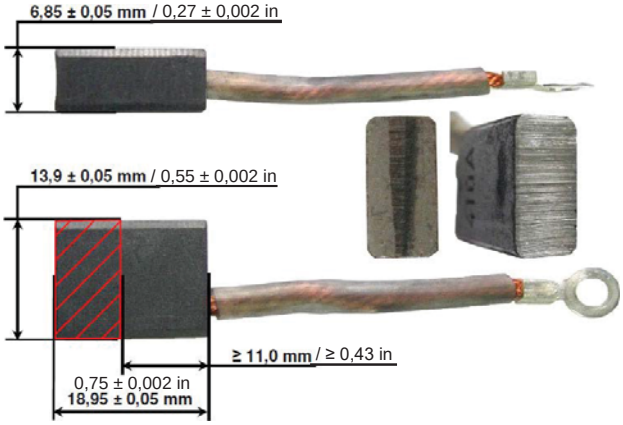
# C2.3 Checking and replacing the drive wheel carbon brushes

## *Dismantling*

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. If available, use a lift table.
5. **Block the wheels using chocks to prevent the machine from moving during dismantling.**
6. **Disconnect power to the machine using the emergency switch.**
7. Dismantle the electric brake, as described in the previous paragraph.
8. Disconnect the connector for the thermal protector and the drive wheel power wires.
9. Unscrew the two nuts that fasten the cover to the motor body.
10. Use a puller to remove the cover from the motor body, keeping the rotor in position.
11. Carefully remove the motor cover from the motor body, and take it to the bench.
12. Remove one carbon brush and carry out the measurements.
13. If the carbon brush or the carbon brushes are still within the specified tolerance, replace the cover.
14. If on the other hand even just one carbon brush is not within the specified values, replace all four carbon brushes.
15. Check that there is no abnormal wear or signs of burning on the contact surface between the carbon brushes and the rotor.
16. Check the rotor for wear and any signs of burning on the surface, before replacing the carbon brushes. If the rotor shows excessive wear, replace it, or replace the complete motor.

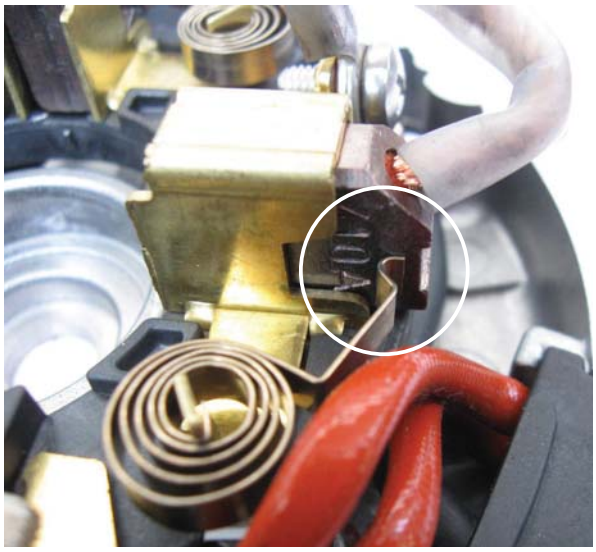

***Always replace all four carbon brushes at the same time.***

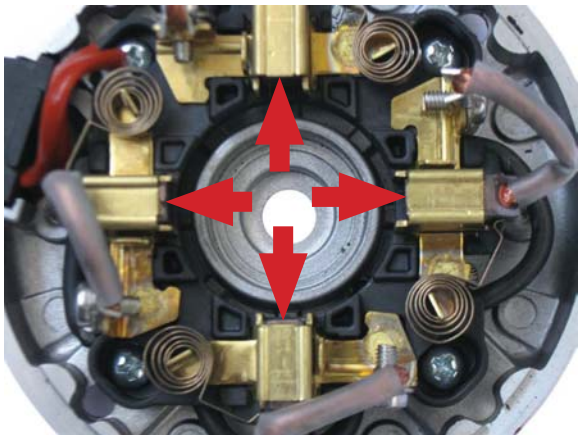



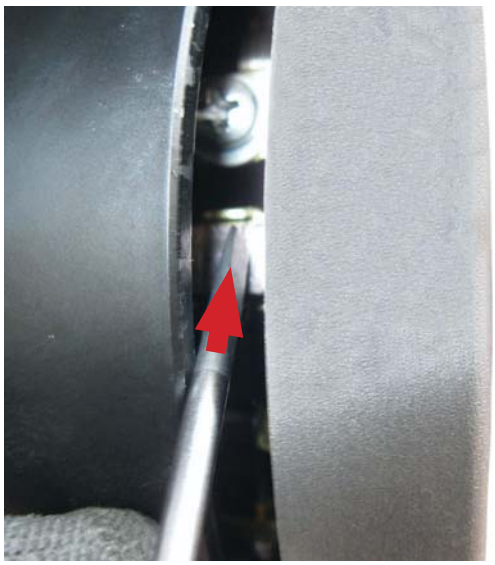
# Reassembly

1. If necessary, replace the carbon brushes with others of the same type and size, with reference to the specifications shown in the figure.
2. Make sure that the carbon brushes slide freely in their seats.
3. Fully tighten the screws that fix the eyelets on the carbon brushes to the supports.
3. Position the carbon brushes to allow reassembly of the cover on the motor body.
4. Pull the carbon brushes backwards so that the springs hold them in position for assembly.
5. **Use a fine tip screwdriver to push the carbon brushes against the rotor, so as to position the springs.**
6. Centre the studs and the rotor shaft in the holes provided on the motor cover.
7. Fit the cover on the motor body, using the studs and a plastic mallet.
8. Moderately tighten the nuts that fasten the cover, to a maximum torque of 5 Nm / ~ 44 lbf in.

***Always replace all four carbon brushes at the same time.***





# C2.4 Checking and replacing the drive motor thermal protector

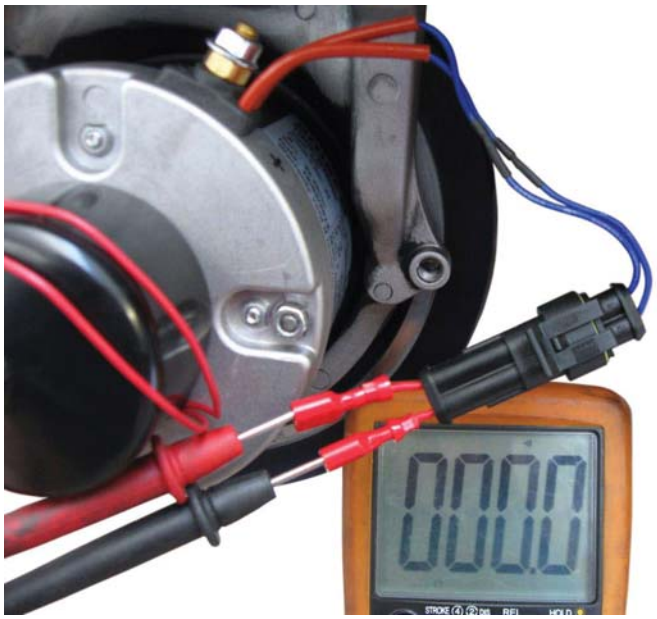
## Checks

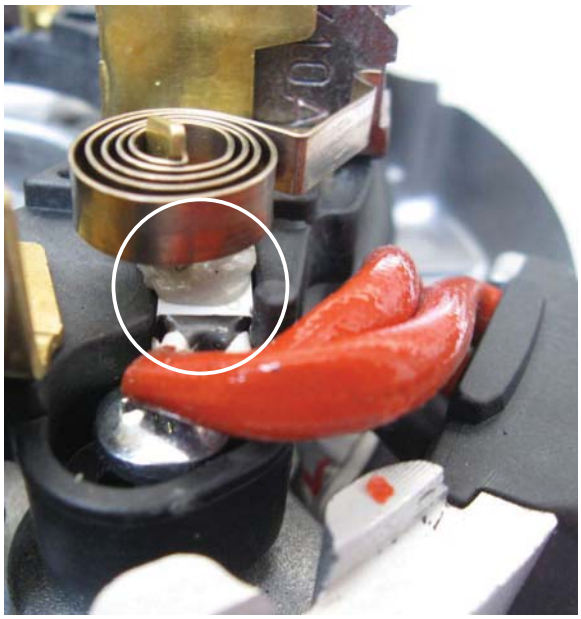
1. Use a digital multimeter able to read continuity.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Disconnect the thermal protector from the main wiring ,and use the multimeter to check continuity.
5. If continuity is measured, the thermal protector is working correctly; restore the connection.
6. If on the other hand there is no continuity, replace the thermal protector by dismantling the motor cover.

## Dismantling

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. If available, use a lift table.
5. **Block the wheels using chocks to prevent the machine from moving during dismantling.**
6. **Disconnect power to the machine using the emergency switch.**
7. Dismantle the cover, as described in the previous paragraph.
8. Once having dismantled the cover, identify the carbon brush with the cable end connected to the positive “+”.
9. The thermal protector is located underneath this carbon brush.
10. The thermal protector is fixed using conductive paste to prevent detachment, meaning the entire motor cover needs to be replaced.

***This means that to replace the thermal protector, the complete cover needs to be replaced.***





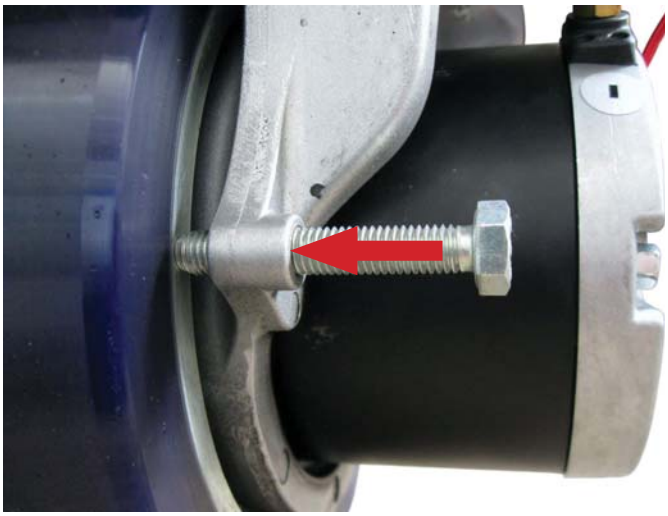
## Reassembly

1. To assemble the new cover and the carbon brushes, see the previous paragraph.
2. Make sure that the new cover is the same size as the one removed from the drive motor.

# C2.5 Replacing the drive motor rubber ring

## *Dismantling*

1. Move the machine to the tank draining area and completely empty both tanks.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. If available, use a lift table.
5. **Block the wheels using chocks to prevent the machine from moving during dismantling.**
6. **Disconnect power to the machine using the emergency switch.**
7. Unscrew the three screws that fix the flange via the rubber ring to the reduction drive joint.
8. If necessary, use a pin driver to tap the centre of the hex head.
9. Unscrew the three screws, and lift the machine until the drive wheel is off the floor.
10. Turn the drive wheel completely to the right and insert two screws, which act as a puller.
11. Tighten the two screws alternately until completely removing the rubber ring.
12. Take the ring to the bench and unscrew the six screws that fix the rubber ring to the flange.
13. Replace the rubber ring with a new one and replace the flange on the rubber ring.
14. Then assemble the rubber ring plus flange on the reduction drive joint.



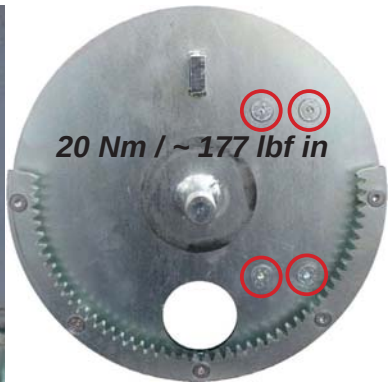
# Reassembly

1. To assemble the rubber ring, acquire bolts similar to the ones removed, however longer, or otherwise much longer hex head bolts, together with nuts and washers.
2. The longer bolts have the purpose of centering the flange on the reduction drive joint, and also allow the rubber ring to be inserted without needing to use a rubber mallet.
3. Tighten the three bolts or nuts in an alternating sequence, until the inside surface of the flange touches the joint.
4. When contact has been made, replace and tighten the bolts. Bring the drive wheel down onto the floor.
5. Tighten the three bolts to a maximum torque of 20 Nm / ~ 177 lbf in.
6. Also check correct tightness of the six screws that fix the rubber ring to the flange, the maximum recommended torque is 8 Nm / ~ 71 lbf in.

# C2.6 Replacing the drive motor

## Dismantling

1. Move the machine to the tank draining area and completely empty both tanks.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
5. **Block the wheels using chocks to prevent the machine from moving during dismantling.**
6. Proceed in the same way as for dismantling the solution tank, simply lift the front of the machine.
7. Electrically disconnect the drive motor and its thermal protector.
8. Access the double nut that fixes the steering ring, mounted on the drive wheel, to the machine's chassis.
9. First unscrew the top nut, and then the bottom nut.
10. Lift the front of the machine and remove the drive wheel from the bearings.
11. Be careful with the ball-bearing fitted under the steering ring.
12. Unscrew the four countersunk screws that fasten the drive wheel to the steering ring, replace the drive wheel.


## Reassembly

1. To fit the new drive wheel, repeat the steps for dismantling in reverse order.
2. Tighten the four countersunk screws that fasten the drive wheel to the steering ring, to a maximum torque of 20 Nm / ~ 177 lbf in.
3. Clean and grease the two bearings, the ball-bearing at the bottom and the roller bearing at the top.
4. Insert the steering ring pin between the two bearings, and then the three washers.
5. Tighten the first nut until eliminating any perceptible play in the bearings, then tighten the lock nut (2) and finally fully tighten the two nuts together.
6. Complete reassembly of the drive wheel and the rest of the machine.

# C3 ACCELERATOR PEDAL

***The accelerator pedal, together with the corresponding control on the instrument panel, are used to adjust both travel and working speed. This is made entirely from plastic, so as to improve water-tightness in the event of contact with water spray when washing the machine or simply filling the solution tank. Electrical connection is made using two sealed connectors, one 2-pin for the microswitch to enable travel, and one 3-pin for the accelerator potentiometer.***

# C3.1 Dismantling and/or replacing the accelerator pedal

## *Dismantling*

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. To ensure safety, disconnect the battery from the main wiring, using the “emergency” switch underneath the seat.
4. Unscrew the two screws that fix the accelerator pedal to the footplate.
5. Pull the two accelerator pedal connectors (microswitch, potentiometer) downwards and disconnect them.
6. Pull the pedal out from above and replace it with a new one.
7. Carefully pull the board to detach it from the adhesive on the screen printing, use a screwdriver if needed.
8. Replace the instrument panel board with a new one.

***If desired, the components housed inside the accelerator pedal can be replaced on their own, i.e. the microswitch and potentiometer. Replacement requires special skill in adjusting the two components, and using special instruments, such as the dedicated programmer keypad (Curtis or Italsea), or a digital multimeter.***

## *Reassembly*

1. To fit the new accelerator pedal, complete the dismantling operations in reverse.
2. Insert the pedal and plug in the two connectors.
3. Arrange the cables plus connectors, including the level sensor connector, inside the hole underneath the footplate.
4. Carry out a general check on the machine and correct operation of the accelerator pedal.

# C3.2 Checking the pedal potentiometer and microswitch.

***To determine whether the accelerator pedal is working correctly, first establish whether the two internal electronic components, potentiometer and microswitch, are working correctly. Use a digital multimeter to perform the check on one component at a time.***

## *Dismantling*

***1*** Use a digital multimeter able to read electrical resistor and check continuity.

***2*** Move the machine onto flat and dry flooring.

***3*** Make sure that there is enough room around the machine to perform the dismantling operations safely.

***4*** Dismantle the accelerator pedal, as shown in the previous paragraph, and take it to the bench.

## *Checking the accelerator potentiometer*

***1*** Connect the accelerator pedal three-pin connector to the digital multimeter, white wire to pin 3 and yellow-black wire to pin 2.

***1a*** With the accelerator pedal in the neutral position, the resistance value in Ohms should be between 200 Ohms and 800 Ohms

***1b*** With the accelerator pedal fully pushed down, the resistance value should be greater than ≥ 4 kOhms.

***2*** When carrying out the checks, make sure that operation of the potentiometer is reasonably linear.

***3*** If the above checks have not revealed the problem, then check the microswitch.

***4*** If the checks do not give the results described above, adjust or replace the potentiometer.


# Checking the accelerator microswitch

1. Set the digital multimeter to measure continuity.
2. Connect the accelerator pedal two-pin connector to the digital multimeter, in either direction.

2a. With the accelerator pedal in the neutral position, there should be no continuity - circuit open.

2b. When pushing the accelerator pedal just a few millimetres, the multimeter should read continuity - circuit closed.

3. The continuity reading must be present along the entire stroke of the accelerator pedal, except for the first few millimetres.
4. If the above conditions are true, the microswitch is working correctly.
5. If the above conditions are not true, adjust or replace the microswitch.


# C3.3 Replacing the pedal potentiometer and microswitch.

## Dismantling

1. Use a digital multimeter able to read electrical resistor and check continuity.
2. Dismantle the accelerator pedal, as shown in the previous paragraph, and take it to the bench.
3. Remove the accelerator pedal foot pad and cover.
4. Remove the top pedal cover and unscrew the dowel that holds the potentiometer shaft in place on the pedal.
5. Remove the potentiometer and microswitch assembly attached to the base.
6. Remove the faulty component (potentiometer, microswitch or both) from the base.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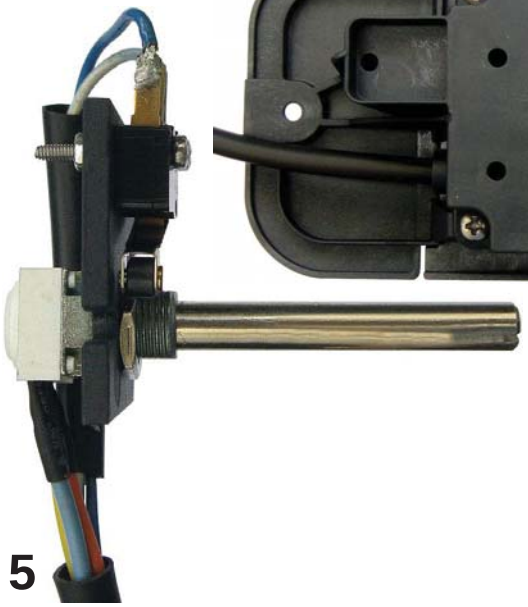
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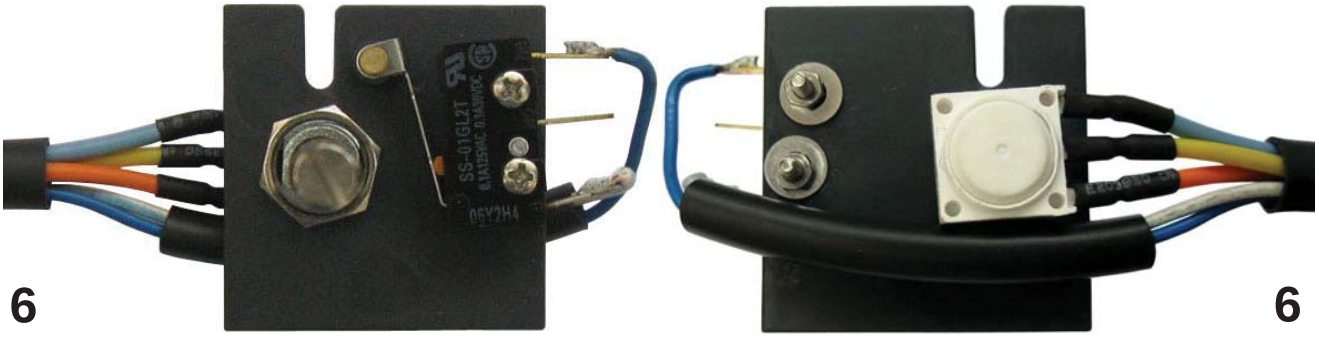
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## Reassembly

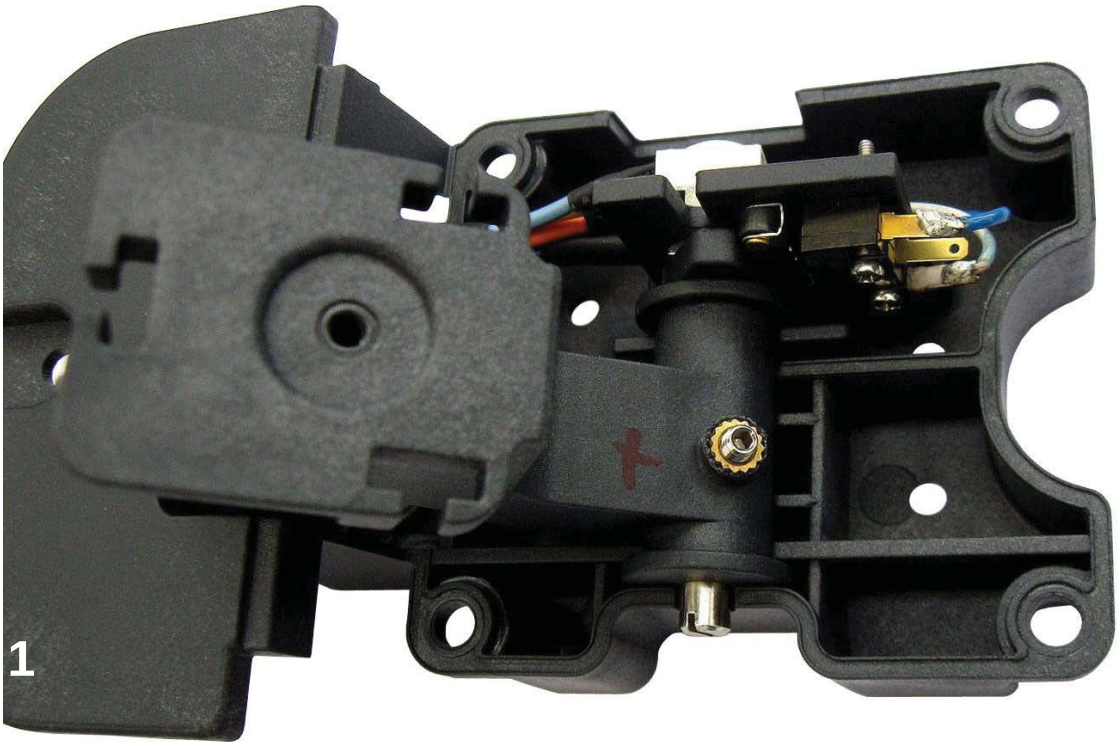
1. To assemble the new components, repeat the dismantling operations in reverse order.
2. Gently tighten the nut on the potentiometer.
3. Slightly tighten the two bolts so as to allow the microswitch to rotate, then perform the adjustments.
4. Reposition the potentiometer on the accelerator pedal and perform the adjustments.

# C3.4 Adjusting the pedal potentiometer and microswitch.

## *Adjusting the microswitch*

1. With the accelerator pedal partially assembled, firstly adjust the microswitch.
2. With the pedal completely raised, move the small wheel alongside to the pedal cam.
3. Push the pedal slightly and check operation of the microswitch; this must be activated after a few degrees of rotation of the pedal cam.
4. On completion moderately tighten the two bolts so as to fasten the microswitch in position.
5. Then adjust the potentiometer.

***Adjust the microswitch so that activation is as fast as possible, to avoid sudden acceleration when the machine starts to move. Nonetheless do not adjust it too finely, so as to avoid the adjustment being lost due to settling of the pedal during use.***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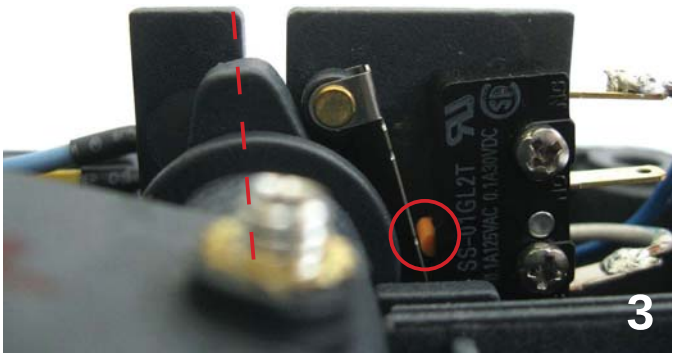
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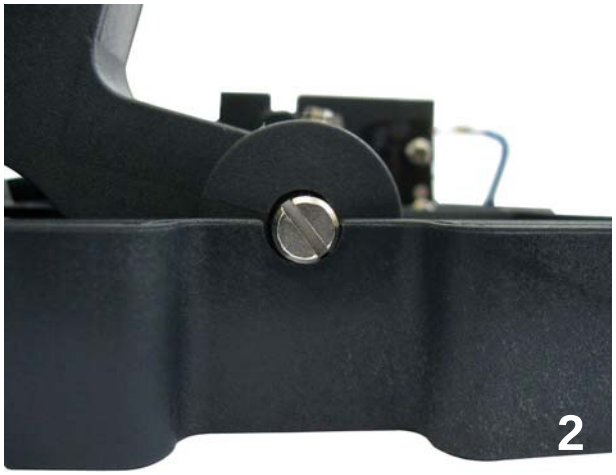
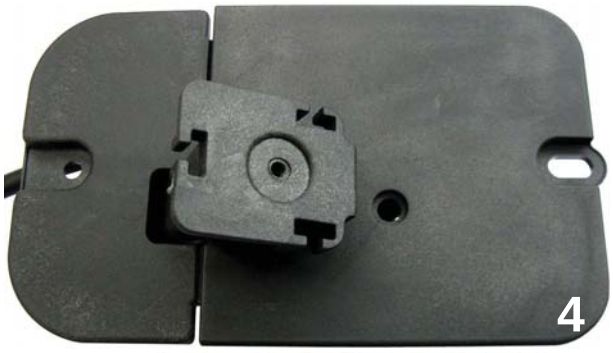
# Adjusting the potentiometer

1. Turn to the potentiometer shaft to zero.
2. Connect the digital multimeter to the potentiometer, see paragraph C3.2, and turn the potentiometer shaft until reading a value between 200 Ohms and 800 Ohms, as close to the minimum value as possible.
3. Slightly tighten the dowel on the accelerator pedal shaft, so that the shaft can rotate with just slight resistance, for fine adjustment.
4. Assemble the top pedal cover and then check the pedal, as explained in paragraph C3.2.
5. If the adjustment is correct, tighten the dowel through the hole on the cover.
6. Perform the general checks as described in paragraph 3.2; if the pedal passes the checks, assemble it on the machine, otherwise, perform the adjustments again.

***It is also recommended not to tighten the potentiometer shaft repeatedly using the dowel, otherwise the surface of the shaft may be damaged, making it more difficult to fine-adjust the potentiometer.***






## WARNING!

**Move the machine to the tank draining area and empty the solution and dirty water tanks using the hoses provided.**

**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 means of the Anderson connector with handle.**

## i INFORMATION

**Very important instructions.**

**In this Service Manual, the terms RIGHT and LEFT are used to indicate the sides of the machine; these always refer to the direction of travel of the machine.**

**In this Service Manual, the version of the machine may be written in brackets "()", i.e. (2180SR, A670).**
**This note indicates that the instructions only refer to the model or version specified in brackets.**

# D1 INSTRUMENT PANEL BOARD

***The instrument panel board features push-activated controls integrated into the board, to manage all the functions, including the speed control and the control to select travel direction (forwards, reverse). Drive board error signals are now shown on the display, making the warnings more immediate.***

***Moreover, an SD CARD reader has been added behind the plastic shield, to simplify firmware updates. In the future, on updating the firmware a series of parameters will be able to be saved to and read from an SD CARD, to monitor any faults during operation. The instrument panel board, interfaced with the battery charger, will also display the start and end of the battery charging cycle.***

# D1.1 Programming the board - Technical menu

## *Programming*

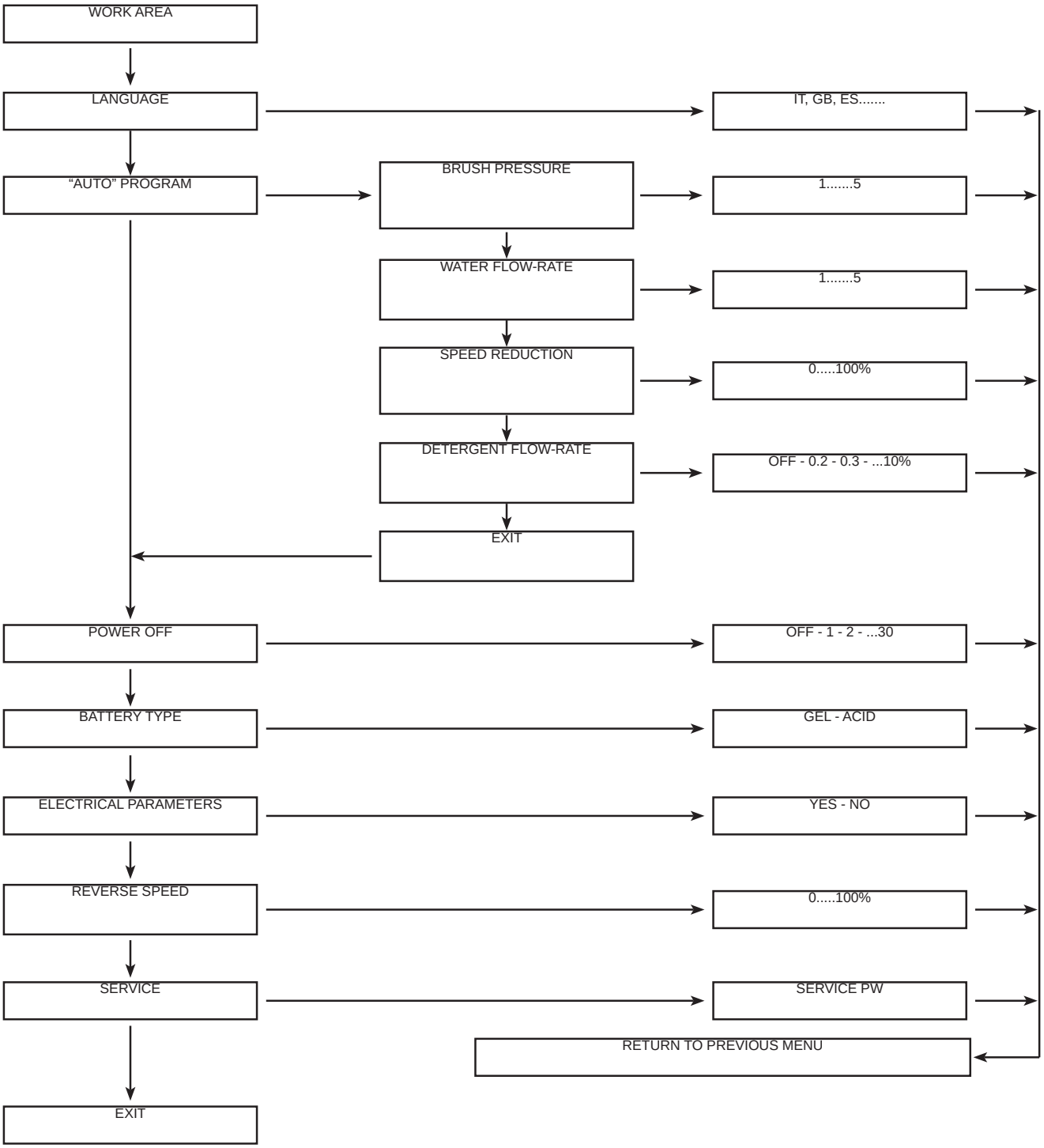
***1*** Deactivate any active functions.

***2*** Press the “+” and “-” buttons together, until changing screen.

***2a*** The “+” button scrolls forwards in the list of the parameters or increases the value of the parameter.

***2b*** The “-” button scrolls backwards in the list of the parameters or decreases the value of the parameter.

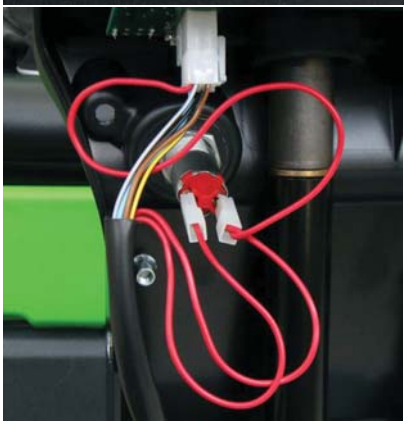
***3*** The “Attach-release brushes” button selects the parameter to be set and confirms the entered value.

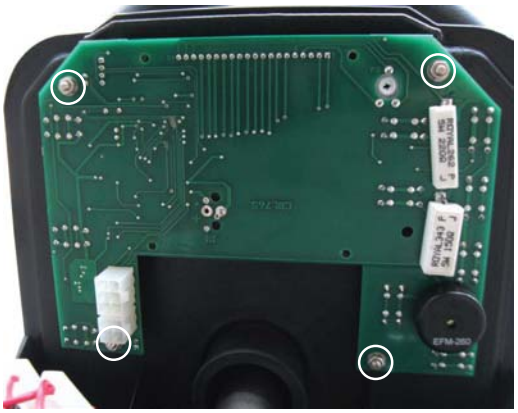


# D1.2 Dismantling the instrument panel board

## Dismantling

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. To ensure safety, disconnect the battery from the main wiring, using the “emergency” switch underneath the seat.
4. Remove the plastic front panel by unscrewing the four screws on the two sides, and the two behind to the front panel.
5. Disconnect the only 6-pin connector on the board.
6. Unscrew the four nuts with washers that fasten the board to the plastic panel with screen printing.
7. Carefully pull the board to detach it from the adhesive on the screen printing, use a screwdriver if needed.
8. Replace the instrument panel board with a new one.



***Before disposing of the instrument panel board as special waste, remove the backup battery (lithium); this can be reused or disposed of as special waste.***

***If possible (the board is not working but the parameters can still be read), copy the parameters on the faulty board and save them on the new board.***
***After having completed replacement of the instrument panel board, this needs to be configured with the default values, or those saved on the old board.***

## Reassembly

1. To assemble the new instrument panel board, repeat the dismantling operations in reverse order.
2. Place the washers between the nuts and the instrument panel board and moderately tighten the nuts.
3. Plug in the connector on the instrument panel board before resetting the emergency switch.
4. Configure the new board with the default values, or those saved (if still readable) on the old board.
5. Reset the emergency switch.

# D1.3 Updating the instrument panel board firmware

## Dismantling

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. To ensure safety, disconnect the battery from the main wiring, using the “emergency” switch underneath the seat.
4. Remove the plastic front panel by unscrewing the four screws on the two sides, and the two behind to the front panel.
5. Identify the SD card reader located on the right-hand side of the instrument panel, under the screen printing.
6. Complete the firmware update procedure.

## Updating the firmware

1. Save the firmware on the SD card from a PC.
2. Disconnect the batteries from the machine’s main wiring using the “emergency” switch underneath the seat.
3. Insert the SD card in the reader housed between the screen printing and the panel PCB.
4. Reset the emergency switch to power on the machine.
5. The display will show an automatic sequence of steps: READING - ERASE - PROGRAMMING.
6. To save the changes, disconnect and reconnect power to the machine using the emergency switch.

***The SD card must only be removed with the emergency switch activated. The machine must not be powered on.***

***If the SD card is write-protected (slider in LOCK position), the firmware will remain saved on the card, and whenever powering the machine off and on again using the emergency switch, the firmware will be updated.***

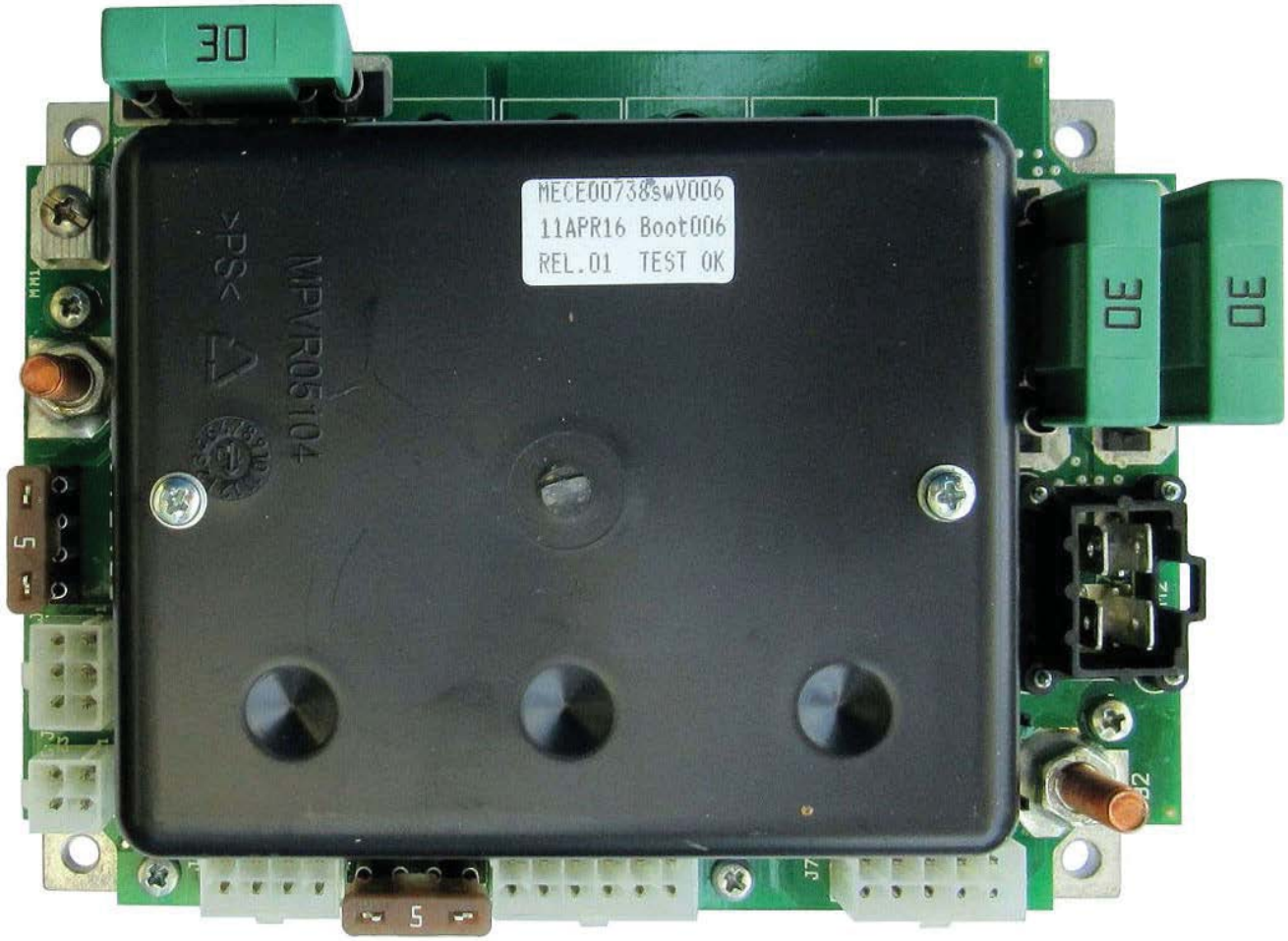
***To update the firmware on several different machines, the SD card must be write-protected, moving the slider (LOCK) on the board.***

***If the SD card is not write-protected, after updating the firmware will be deleted from the SD card, and the card will be used to save the machine’s LOGS.***



# D2 FUNCTIONS CIRCUIT BOARD

***The functions board has the purpose of electrically controlling all the machine's functions, such as suction, brush motors or motor, in the case of the 20 in (2180SR, A670), actuators, floats and solenoid valve. This interfaces with the instrument panel board so as to display any alarms that may occur during operation. It constantly controls brush motor current draw so as to save battery power (ECO function) while at the same time guaranteeing a uniform wash. If features a fuse holder to protect both the board itself and the connected functions against overload. The ECO function uses electronic voltage control to reduce brush and suction motor speed, so as to decrease noise and increase battery life, allowing longer operating time. This is connected directly to the batteries (where it draws power to distribute to the functions), constantly monitoring battery charge and sending the value to the display on the instrument panel board. When the voltage is too low, a function is activated to protect the batteries, stopping (bringing to the rest position) first of all the brush motors, then the suction motor (powering down the motor and raising the actuator) and in extreme cases also the drive motor.***



# D2.1 Functions board connections

## Connections

***A*** Brush motor connector, protected by 30 A fuse/fuses **A1**.

***B*** Positive connection pole, the point where the board draws +24 V power.

***C*** Drive board communication logic connector.

***D*** Alarm detection logic connector (thermal protectors, level sensors, seat microswitch).

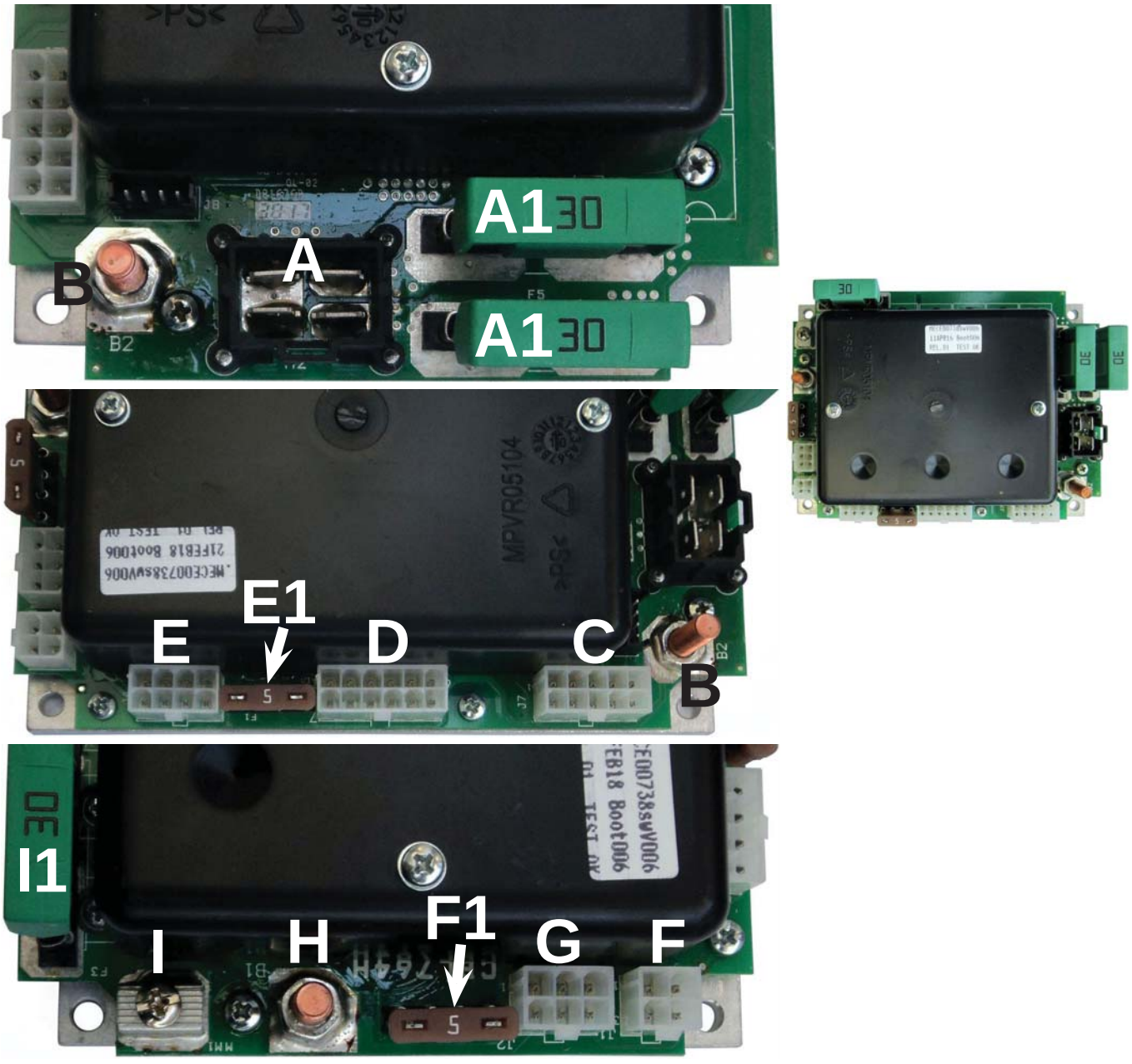
***E*** Functions logic connector, solenoid valve, audible warning, chemicals.

***F*** Actuator connector, ***purple*** and ***grey*** squeegee actuator; ***white*** and ***pink-black*** head actuator, protected by 5 A fuse **G1**.

***G*** Instrument panel board communication logic connector.

***H*** Negative connection pole, the point where the board draws -24 V power.

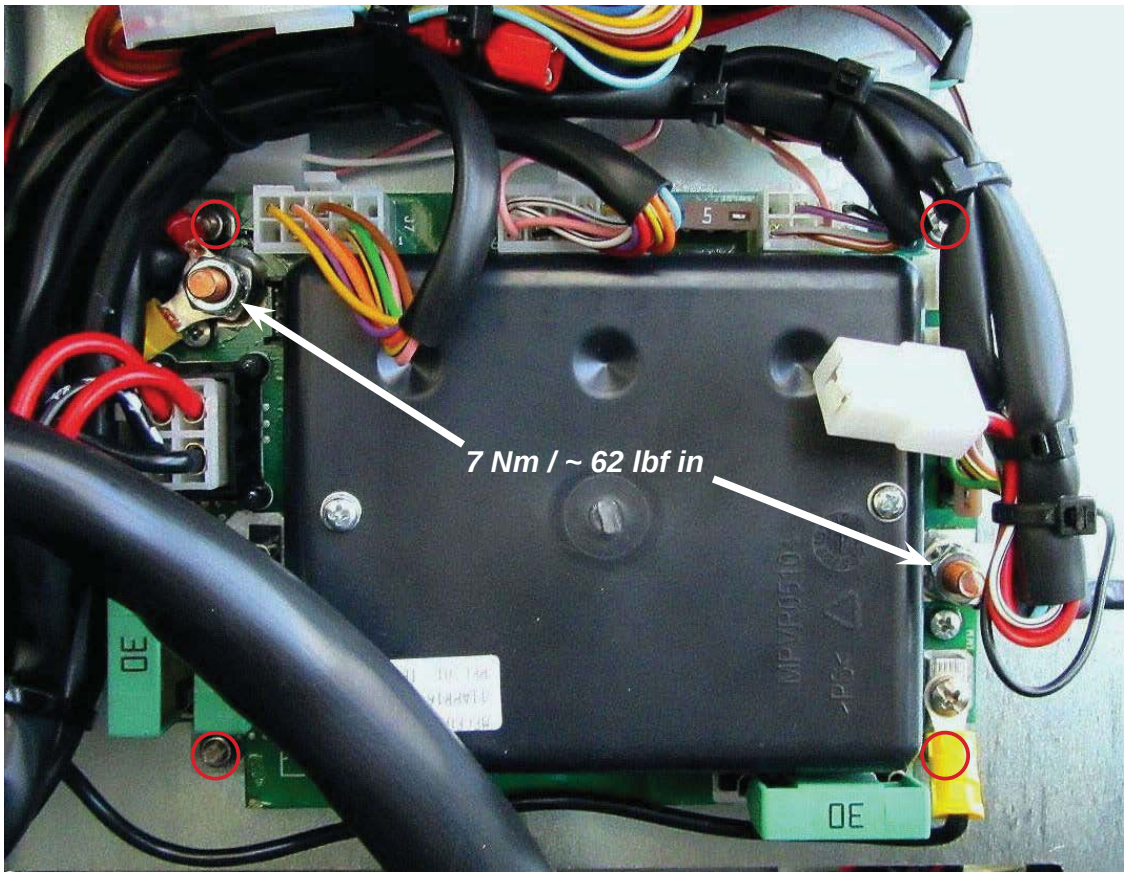
***I*** Negative wire, suction motor control, protected by 30 A fuse **I1**, positive connected on the board in point **B**.



# D2.2 Dismantling the functions board

## Dismantling

1. Move the machine to the tank draining area and empty the dirty water tank.
2. Move the machine onto flat and dry flooring.
3. Make sure that there is enough room around the machine to perform the dismantling operations safely.
4. Disconnect the batteries from the machine's main wiring, using the "emergency" switch underneath the seat.
5. Lift the dirty water tank and then the electronics mounting plate.
6. Identify the functions board and first of all disconnect the six connectors and then the spade terminal.
7. Continue by disconnecting the two power supply contacts, positive and negative.
8. Remove the four screws that fix the electronic functions board to the electronics mounting plate.
9. Replace the board with a new one.

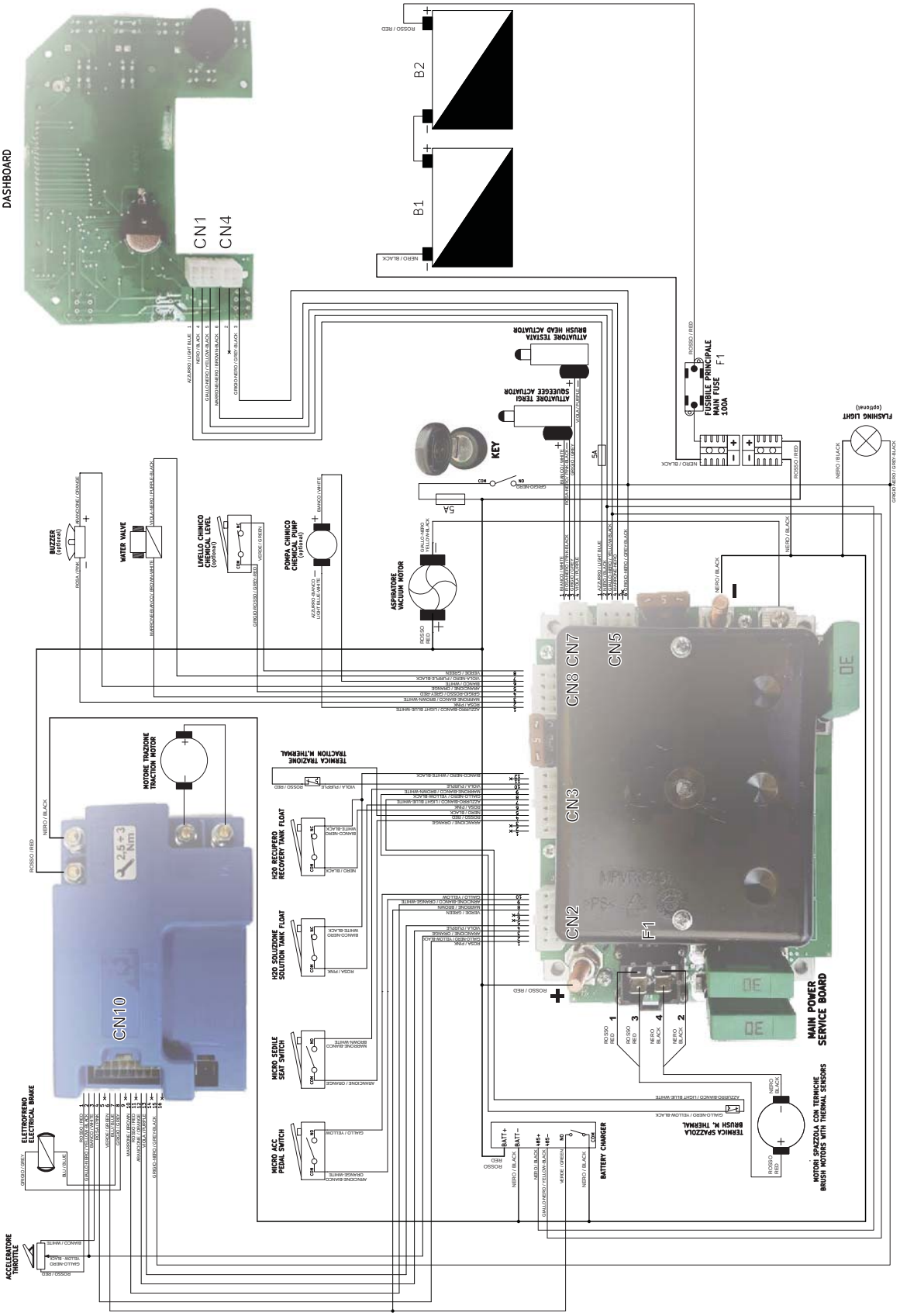



## Reassembly

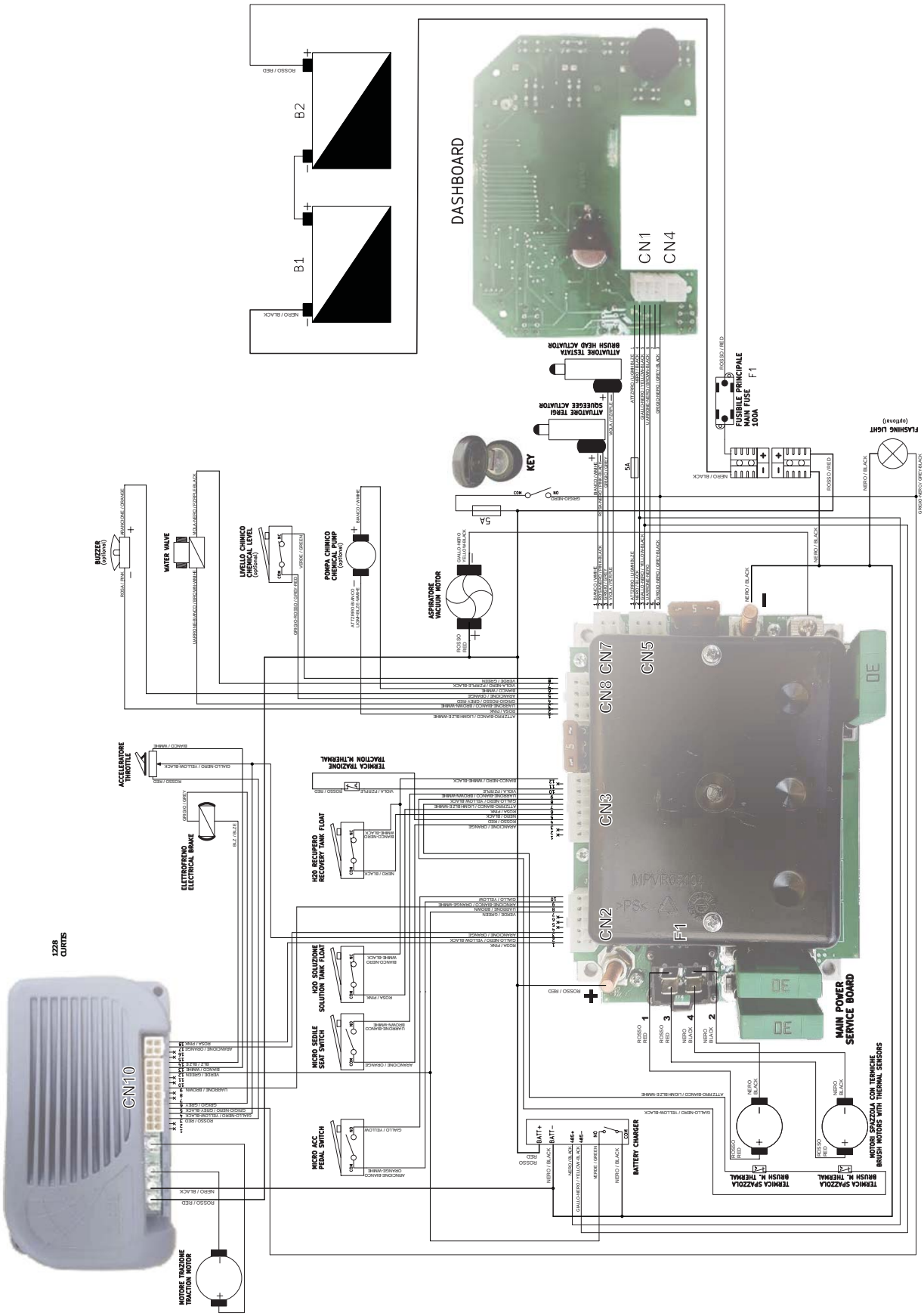
1. To fit the new functions board, repeat the steps for dismantling in reverse order.
2. Moderately tighten the four screws that fix the functions board to the electronics mounting plate.
3. Connect the two power supply contacts (four wires for positive, three for negative), then tighten the nuts to a maximum torque of 7 Nm / ~ 62 lbf in.
4. Connect the suction motor spade terminal to the male connector on the functions board.
5. Connect the six connectors to the functions board, suitably arranging the cables. The connections can only have one layout, make sure number of pins on the male connector matches the number on the female connector on the board.
6. When everything has been completed, make sure that all the functions are working correctly.

# *D3 ELECTRICAL WIRING DIAGRAMS*

## D3.1 *Electrical wiring diagrams single disc version*



## D3.2 *Electrical wiring diagrams double disc version*



## ☝ WARNING!

**Move the machine to the tank draining area and empty the solution and dirty water tanks using the hoses provided.**

**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 means of the Anderson connector with handle.**

## i INFORMATION

**Very important instructions**

**In this Service Manual, the terms RIGHT and LEFT are used to indicate the sides of the machine; these always refer to the direction of travel of the machine.**

**In this Service Manual, the version of the machine may be written in brackets "()", i.e. (2180SR, A670).**
**This note indicates that the instructions only refer to the model or version specified in brackets.**

# E1 ERROR CODES

## E1.1 Instrument panel board display alarms

| ALARMS | POSSIBLE CAUSES | REMEDY |
|---|---|---|
| **BRUSH THERMAL PROTECTOR** | The brush motor has overheated.<br>Faulty thermal protector contact on the motors.<br>Faulty connection. | Wait for the brush motors to cool down.<br>Replace the brush motor.<br>Check the connection. |
| **DRIVE THERMAL PROTECTOR** | The drive wheel has overheated.<br>Faulty thermal protector contact on the motor.<br>Faulty connection. | Wait for the drive wheel to cool down.<br>Replace the drive wheel.<br>Check the connection. |
| **OPERATOR PRESENT** | The driver detection microswitch is not detecting an operator. | Sit correctly in the seat.<br>Check the connection.<br>Check the seat microswitch. |
| **ACCELERATOR KEY** | Incorrect start-up sequence.<br>Faulty accelerator pedal microswitch.<br>Faulty connection. | Release the accelerator pedal during start-up.<br>Replace the accelerator pedal microswitch.<br>Check the connection. |
| **WATER RESERVE** | Solution tank empty.<br>Stuck sensor.<br>Faulty sensor or connection. | Fill the solution tank.<br>Clean the level sensor.<br>Replace the level sensor.<br>Check the connection. |
| **NO WATER** | Solution tank empty.<br>Stuck sensor.<br>Faulty sensor or connection. | Fill the solution tank.<br>Clean the level sensor.<br>Replace the level sensor.<br>Check the connection. |
| **DIRTY WATER TANK** | Solution tank empty.<br>Stuck sensor.<br>Faulty sensor or connection. | Empty the dirty water tank.<br>Clean the level sensor.<br>Replace the level sensor.<br>Check the connection. |
| **NO CHEM** | Chem-Dose tank empty.<br>Stuck sensor.<br>Faulty sensor or connection. | Fill the Chem-Dose tank.<br>Clean the level sensor.<br>Replace the level sensor.<br>Check the connection. |
| **FUNCTIONS BOARD NOT DETECTED** | Communication with functions board interrupted.<br>Faulty auxiliary boards. | Check the connection between the boards.<br>Check the auxiliary boards. |
| **FUNCTIONS U.V.** | Battery voltage less than: 20.7 V GEL/AGM - 20.3 V ACID. - Flat batteries. | Recharge the batteries.<br>Replace the batteries. |
| **DRIVE U.V.** | Battery voltage less than: 18.3 V GEL/AGM - 18.0 V ACID. - Flat batteries. | Recharge the batteries.<br>Replace the batteries. |
| **BATTERY RESERVE** | Battery voltage less than : 21.5 V GEL/AGM - 20.5 V ACID. - Flat batteries. | Recharge the batteries.<br>Replace the batteries. |
| **MOTOR FAULT** | Drive motor short.<br>Drive motor connection short.<br>Faulty board. | Check / replace the drive motor.<br>Check motor connections.<br>Replace the drive board. |
| **DRIVE BOARD FAULT** | Faulty drive motor connection.<br>Faulty board. | Check motor connection.<br>Replace the drive board. |
| **DRIVE BOARD POWER SUPPLY** | Battery not connected.<br>Faulty battery connection. | Connect battery cables.<br>Check battery cables |
| **OVERCURRENT** | Excessive machine effort.<br>Drive motor damaged. | Do not overwork the machine on long ramps.<br>Check / replace the drive motor. |
| **CALL SERVICE** | The set number of hours for scheduled service have been reached/exceeded. | Call a service centre to arrange scheduled service. |
| **BATTERY CHARGING** | The on-board battery charger is operating, all the machine's functions are disabled. | Disconnect the battery charger. |
| **CHARGING COMPLETE** | The on-board battery charger is operating, the charge is complete, all the machine's functions are disabled. | Disconnect the battery charger. |

## E1.2 Drive board display alarms

| *ALARMS* | *POSSIBLE CAUSES* | *REMEDY* |
|---|---|---|
| **DRIVE BOARD TEMPERATURE** | Board temperature between -10°C and +80°C.<br>Excessive vehicle effort.<br>Electric brake engaged. | Cool or heat the board.<br>Do not overwork the machine on long ramps.<br>Check the electric brake. |
| **ACCELERATOR FAULT** | Faulty potentiometer connections.<br>Faulty potentiometer.<br>Incorrect potentiometer type setting. | Check the connection.<br>Replace the potentiometer.<br>Set the correct potentiometer. |
| **SPEED FAULT** | Speed signal connections interrupted.<br>Faulty functions board. | Check connection between functions board and drive board.<br>Replace functions board. |
| **DRIVE BOARD U.V.** | Battery voltage less than 17 V.<br>Connection error between batteries and controller. | Charge or replace the batteries.<br>Check battery connection. |
| **DRIVE BOARD O.V.** | Battery voltage over 31 V.<br>Machine moving with battery charger connected.<br>Faulty battery connection. | Check or replace the batteries.<br>Disconnect the battery charger.<br>Check battery connection. |
| **RELAY FAULT** | Faulty relay.<br>Faulty drive board. | Replace the drive board. |
| **INPUT FAULT** | Emergency input activated on the drive board.<br>Key connection on the drive board. | Check connection between functions board and drive board. |
| **HPD 10 Sec** | Accelerator pedal pressed when starting for more than 10 seconds.<br>Potentiometer not adjusted. | Release accelerator pedal when starting the machine.<br>Check potentiometer adjustment. |
| **ELECTRIC BRAKE FAULT** | Faulty drive board.<br>Faulty electric brake. | Replace the drive board.<br>Check / replace the electric brake. |
| **PRE-CHARGE FAULT** | Check electric brake short.<br>Faulty board.<br>MOS-FET failure. | Replace the drive board. |
| **HPD** | Accelerator pedal pressed when starting.<br>Potentiometer not adjusted. | Release accelerator pedal when starting the machine.<br>Check potentiometer adjustment. |
| **TRACTION DRIVE FAULT** | Drive motor short<br>Drive motor connection short.<br>Faulty board. | Check / replace the drive motor.<br>Check motor connections.<br>Replace the drive board. |
| **DRIVE BOARD FAULT** | Faulty drive motor connection.<br>Faulty board. | Check motor connection.<br>Replace the drive board. |
| **DRIVE BOARD POWER SUPPLY** | Battery not connected.<br>Faulty battery connection. | Connect battery cables.<br>Check battery cables. |
| **OVERCURRENT** | Excessive machine effort.<br>Drive motor damaged. | Do not overwork the machine on long ramps.<br>Check / replace the drive motor. |
| **TRACTION ALARM** | Drive system problem. | Wait a few seconds with the machine on until the correct message is shown on the display. |

# E2 TROUBLESHOOTING

## E2.1 Troubleshooting

| PROBLEM | CAUSE | REMEDY |
|---|---|---|
| THE MACHINE DOES NOT WORK | The batteries are disconnected | Connect the batteries to the machine |
| | The batteries are flat | Recharge the batteries |
| | Battery disconnect lever pressed | Return the lever to its correct position |
| THE BRUSHES DO NOT TURN | The dirty water tank is full | Empty the dirty water tank |
| | Blown fuse | Replace |
| | Faulty switch | Replace |
| | The batteries are flat | Recharge the batteries |
| | Damaged motor | Replace |
| | Wire detached | Check |
| THE MACHINE DOES NOT CLEAN UNIFORMLY | The brushes or disks are worn | Replace |
| NO SOLUTION COMES OUT OF THE DETERGENT TANK | The tap upstream of the filter is closed | Open the tap |
| | Damaged solenoid valve | Replace |
| | Dirty solenoid valve | Check |
| | The detergent tank is empty | Top up |
| | The hose delivering detergent to the brush is blocked | Unblock |
| | Blown fuse | Replace |
| DETERGENT FLOW DOES NOT STOP | Damaged solenoid valve | Replace |
| | Damaged solenoid valve wiring | Check |

| *PROBLEM* | *CAUSE* | *REMEDY* |
|---|---|---|
| **THE SUCTION MOTOR DOES NOT START** | The dirty water tank is full | Empty the dirty water tank |
| | Blown fuse | Replace |
| | Faulty switch | Replace |
| | The batteries are flat | Recharge the batteries |
| | Damaged motor | Replace |
| | Wire detached | Check |
| **THE SQUEEGEE DOES NOT CLEAN OR HAS POOR SUCTION** | The edge of the rubber blades in contact with the floor is worn | Replace the blades |
| | Blockage or damage in the squeegee or in the hose | Check |
| | The dirty water tank float is activated or is blocked by dirt, or is faulty | Empty the dirty water tank, check the float. |
| | Blockage in the suction hose | Check |
| | The suction hose is not connected to the squeegee or is damaged | Check |
| | Suction motor not powered or faulty | Check |
| **THE MACHINE DOES NOT MOVE** | The batteries are flat | Recharge the batteries |
| | Drive wheel actuator problem | Check the alarm code shown on the display |
| **THE MACHINE DOES NOT BRAKE** | Electromagnetic brake disengaged | Check |
| **THE BATTERIES DO NOT PROVIDE THE NORMAL WORKING TIME** | The battery poles and charging terminals are dirty and oxidised | Clean and grease the poles and terminals, charge the batteries |
| | The battery charger does not work or is not suitable | Check |

# REVISIONS - UPDATES SERVICE MANUAL

| ***EDITION No.*** | ***DATE*** |
|---|---|
| ***Edition 00.*** | |
| Technical Service Manual for Tennant | **December 23, 2020** |