



IPC
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TECHNICAL DEPT.

Stavale

CT 15



TECHNICAL SERVICE MANUAL

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CT15 Technical Specifications

Version		B	C
Electrical system	Battery voltage	2 x 12 V	230 V 50 Hz (EU)
	Battery charger voltage	24 V - 5 A	—
	Circuit protection	Fuses / electronic card	Grounding
	Hour meter	NO	
	Digital display	NO	
	Indicator battery level	LED to three colors	—
	Protection battery low	First the brush stop later the vacuum stop too	
Scrubbing head	Scrubbing width	350 mm	
	Number of brushes	1	
	Brush diameter	350 mm	
	Brush speed	140 g/min	
	Brush head adjustment	—	
	Maximum pressure	—	
	Raising system	—	
	Transmission	Gear box	
	Motors power	200 W	
	Productivity	1300 m ² /h	
	Brush (standard)	Material	Tipo standard - nylon
Bristle section		0,8 mm	
Brush connection		Automatic - without the use of tools	
Brush disconnection		Automatic - without the use of tools	
Solution tank	Capacity	16 Lt	
	Material	high density polythene	
	Filter	—	
	Water flow adjustment	Manual with water cock	
	Discharge hose	—	
Recovery tank	Capacity	19 Lt	
	Material	high density polythene	
	Discharge hose	25 mm	
Vacuum	Vacuum motor power	550 W	400 W
	Stage	3 - Type tangential	2 - Type tangential
	Value in water column	—	—
	Max air flow	—	—
	Motor position	On the solution tank	
	Motor accessibility	Under the recovery tank	
	Motor protection filter	Metal grid on motor	
	Type of float	Mechanic in polyurethane	
Squeegee	Shape	" Parabolic " Type	
	Width	450 mm	
	Mainbody material	Polypropylene	
	Blade material	Latex	
	Pressure adjustment	Three easily adjustable independent wheels	
	Raising system	Manual	
	Blade replacement	without the use of tools	
Type battery	Max capacity C5 / 5h	31 Ah	—
	Autonomy	~ 1,5 h	—
	Max capacity battery charger	24 V - 5 A	—
Wheels	Diameter - front	—	
	Diameter - rear	N°2 - 50mm x 250 mm	

CT15 Technical Specifications

Version		B	C
Steering	External radius (wall to wall)	—	
Traction	Traction system	Mechanical (by brush motor)	
	Operated	Lever on handle bar	
	Forward speed	—	
	Reverse gear speed	—	
	Speed adjustment	—	
	Maximum speed	3,5 Km/h	
	Motor power	—	
	Maximum climbing angle	2%	
Brakes	Service brake	—	
	Parking brake	—	
Chassis	Material	Steel Fe 360	
	Thickness	Tubular oval 1,5 mm	
	Treatment	Fully coated with eposidic powder paint	
Dimensions	Length	950 mm	
	Width (without squeegee)	450 mm	
	Heigth	1200 mm	
Battery box dimensions	Length	205 mm	—
	Width	265 mm	—
	Heigth	205 mm	—
Weigth (Empty tanks)	Weight without battery	36 Kg	36 Kg
	Weight battery	11 Kg	—
Ergonomics	Traction	—	
	Seat	—	
	Controls	Easy to understand	
Safety systems	Emergency switch ▲	NO	
	Acoustic warning	NO	
	Total "Auto stop"	Auto switch Off if no functions are activated	
	Functions "Auto stop"	Brush and vacuum stop after 2sec lever release	
	Horn	NO	
	Beacon	NO	
		All moving parts fully protected	
Noise level	Guaranteed sonorous power	LWA,g — dB	LWA,g — dB
	Sonorous pressure	LPA 68 dB	LPA 70 dB
Vibrations	Hand	1 m/sec ²	1,1 m/sec ²
	Body	— m/sec ²	— m/sec ²
Certification	European	CE	



CT15 B - C Quick Guide

This Guide is intended for quick consultation only and does not replace the Use and Maintenance Manual. Before using the machine, read the Use and Maintenance Manual contained in the machine packaging thoroughly and rigorously respect all the instructions.

PREPARATION/ OPERATION

1. Fill the detergent tank.



2. Adjust the slope of the handle by pulling the handle release lever.



3. Lower the squeegee using the lever.



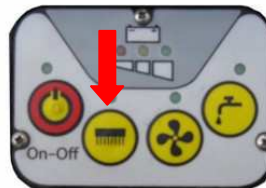
4. Open the detergent tank tap.



5. Press the ON button.



6. Press the brush button to activate suction and water delivery.



7. Operate the drive lever.



8. Begin working.

9. When you have finished cleaning, proceed as follows:
 - Press the brush button.
 - Turn the machine off by pressing the ON button for at least 4 seconds.
 - Raise the squeegee.
 - Close the detergent tank tap.
 - If necessary, charge the batteries (BATTERY VERSION)



DAILY MAINTENANCE

Empty the dirty water tank.



Clean the dirty water tank.



Check the dirty water tank float is undamaged and clean and moves freely on the pin.



Clean the brush.



Check the squeegee is clean and the blades are not damaged.



Check the battery charge (BATTERY VERSION)



To recharge the batteries, plug in the battery charger (OPTIONAL) using the extension provided with the machine.



REPLACING THE SQUEEGEE BLADES

- unscrew the nuts fixing the blade retainers;
- remove the two blade retainers;
- remove the blade;
- put the same blade back, reversing the edge in contact with the floor until all four edges are worn, or replace with a new one;
- put the two blade retainers back on the squeegee and screw up the nuts again;

AUTOMATIC BRUSH ATTACHMENT

Attaching the brush: rest the brush on the floor in front of the machine. Raise the front of the machine by levering on the handle, then lower it onto the brush, centring it with the brush cover. Action the drive lever repeatedly until the brush engages.

Removing the brush: Raise the front of the machine by levering on the handle, then operate the brush lever repeatedly. After operating the lever a few times, the brush is released and falls to the ground.

TROUBLESHOOTING

THE MACHINE DOES NOT COME ON/START UP	CHECK THE BATTERY CHARGE (BATTERY VERSION)
	CHECK THE POWER CABLE IS PLUGGED INTO A FUNCTIONING SOCKET (CABLE VERSION)
THE MACHINE LEAVES THE FLOOR WET	CHECK THE SQUEEGEE BLADES ARE NOT WORN
	CHECK THERE IS NO DEBRIS BETWEEN THE TWO SQUEEGEE BLADES
	CHECK THERE IS NO DEBRIS IN THE SUCTION HOSE
	CHECK THE DIRTY WATER TANK IS NOT FULL
	CHECK THE DETERGENT TANK LID IS CLOSED CORRECTLY
THE MACHINE LEAVES THE FLOOR DIRTY	CHECK THE SUCTION HOSE IS CORRECTLY ATTACHED TO THE SQUEEGEE
	CHECK THE TYPE OF BRUSH IN USE IS SUITABLE FOR THE TYPE OF DIRT AND FLOOR.
THE MACHINE LEAVES STRIPES OF WET FLOOR	CHECK THE FLOOR HAS BEEN BRUSHED BEFORE USING THE MACHINE
	CHECK THERE IS NO DEBRIS BETWEEN THE TWO SQUEEGEE BLADES
	CHECK THE SQUEEGEE BLADES ARE NOT WORN
	CHECK THE SQUEEGEE IS CORRECTLY ADJUSTED



Istruzioni operative

Operative instruction

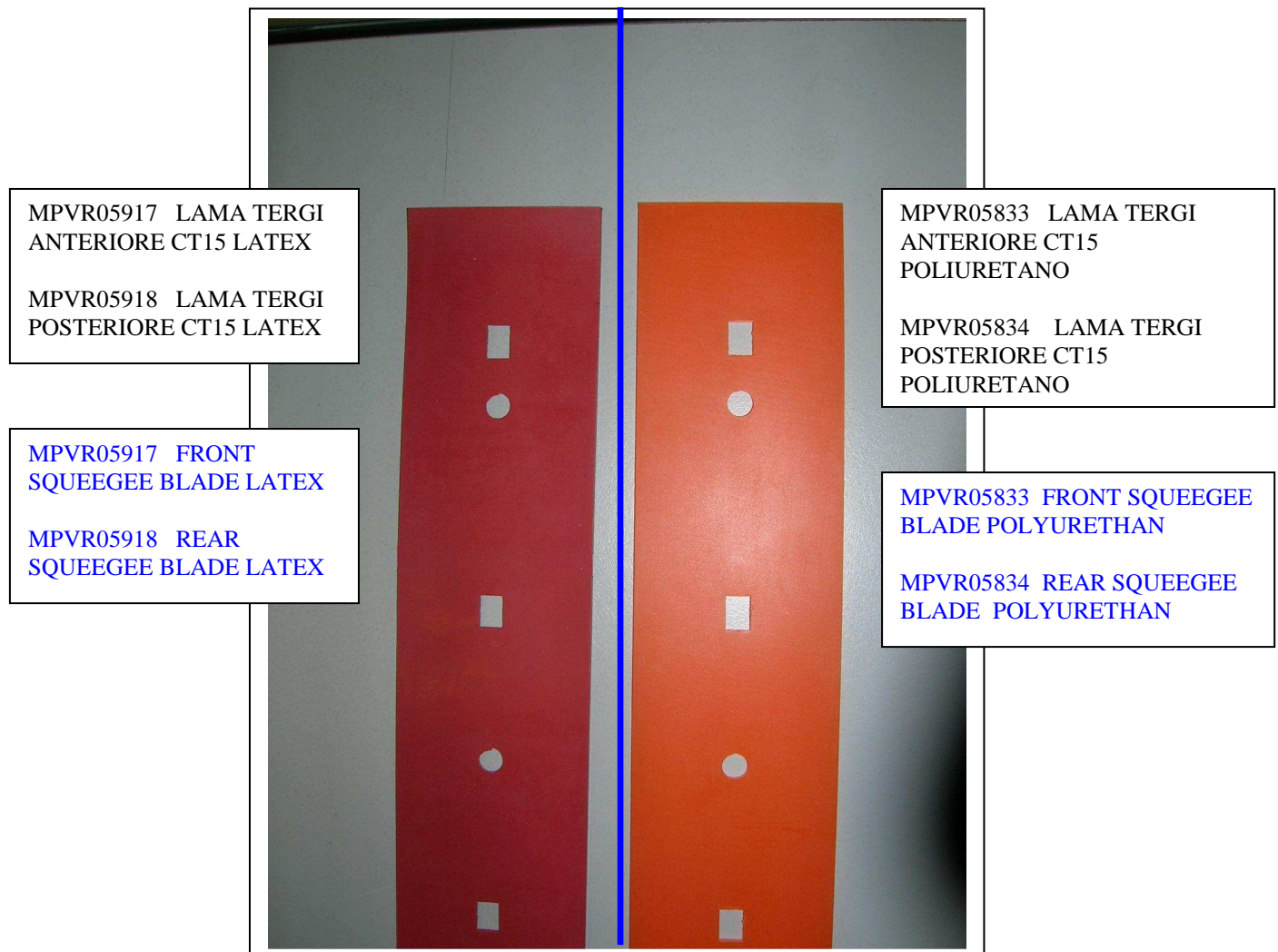
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16/03/2011

Modello / Model	CT15
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OGGETTO / SUBJECT	Lame tergipavimento disponibili / Squeegee blades types availability
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Sulla lavasciuga CT15 sono disponibili due tipi di lame tergi pavimento , differenti in colore e materiale , indicate sotto . La lama in Latex (di colore rosso) è in dotazione come standard. Le lame in poliuretano (di colore arancione) sono più indicate per applicazione su superfici con oli o grassi .

On scrubber model CT15 two blades type are available , they are different in compound and colour , as described below. Latex blade (red colour) is standard machine equipment . Polyurethane blades (orange colour) are more indicated for oily applications.





A	Brush head	A1	Measuring brush motor current draw Checking and replacing the carbon brushes
		A2	Removing the brush head Replacing the brush motor - Replacing the thermal protector
B	Tanks/suction assembly	B1	Measuring suction motor current draw Replacing the suction motor – Replacing the carbon brushes
		B2	Adjusting the squeegee Replacing the squeegee flaps
		B3	Testing and replacing the solenoid valve Cleaning the filters and hoses – Checking the float
		B4	Replacing the collection tank the solution tank
C	Drive assembly		
D	Electrical system control cards	D1	Function control card Power control card – Power supply
		D2	Battery charger
		D3	Wiring diagram
E	Error codes Troubleshooting	E1	Error codes
		E2	Troubleshooting



! DANGER

Indicates the need for attention in order to avoid a series of consequences which could cause death or damage to the health of the operator.

WARNING

Indicates the need for attention in order to avoid a series of consequences which could cause damage to the machine or work environment or financial loss.

i INFORMATION

Indicates particularly important instructions.

In line with the company's policy of constant product development and updating, the Manufacturer reserves the right to make modifications without warning.

Although your machine may differ appreciably from the illustrations in this document, safety and the information contained in this manual are guaranteed.



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OPTIONALS

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A

BRUSH HEAD

⚠ WARNING!

Go to the designated draining area and empty the solution and collection tanks using the drain plugs and the hoses provided.

Position the machine on a flat floor, and place wedges under the wheels to stop it moving.

Switch the machine off and disable all functions by pressing the “On–Off” button on the control panel.

Disconnect the machine’s electrical system by removing the main fuse F1, or by disconnecting the terminals from the battery poles (battery powered machines), or by removing the plug from the mains power socket (mains powered machines).

i INFORMATION

Important information

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

In this Service Manual, the machine version (15 B, 15 C) may appear between brackets “()”. This indicates that the instruction in question refers only to the version specified.



A1 MEASURING BRUSH MOTOR CURRENT DRAW

i On the CT 15, the brush motors of “B” type battery versions and “C” type mains versions are very similar. Apart from the power source (24 V DC for “B” versions and 230V AC for “C” versions), the differences lie in the motors’ maximum current draw and in the type of connections. The motors of mains powered versions feature waterproof terminals to provide increased protection against electric shock.



CT 15 B



CT 15 C

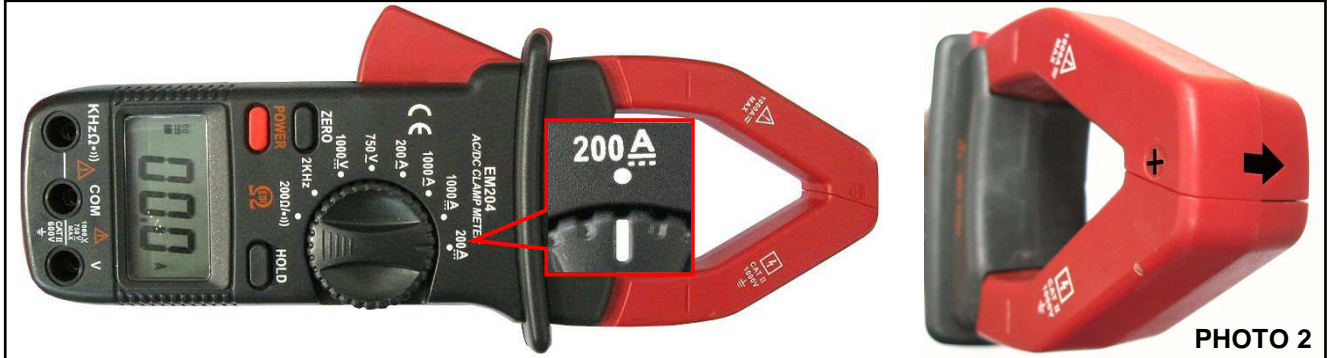


PHOTO 1

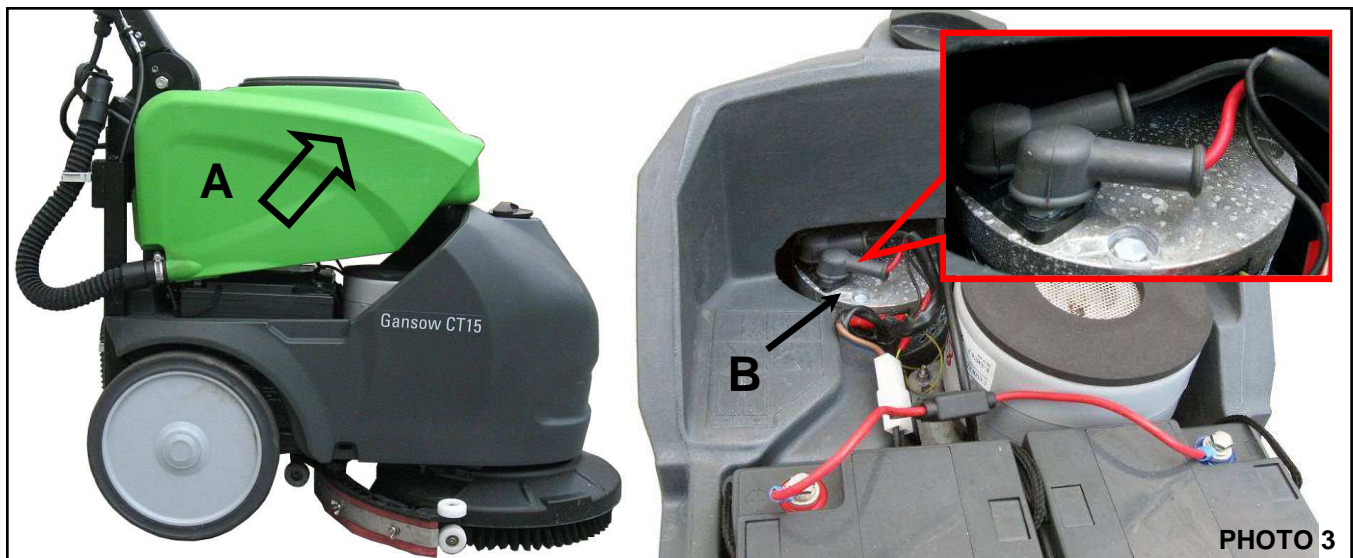


A1.1 Measuring brush motor current draw on the CT 15 B

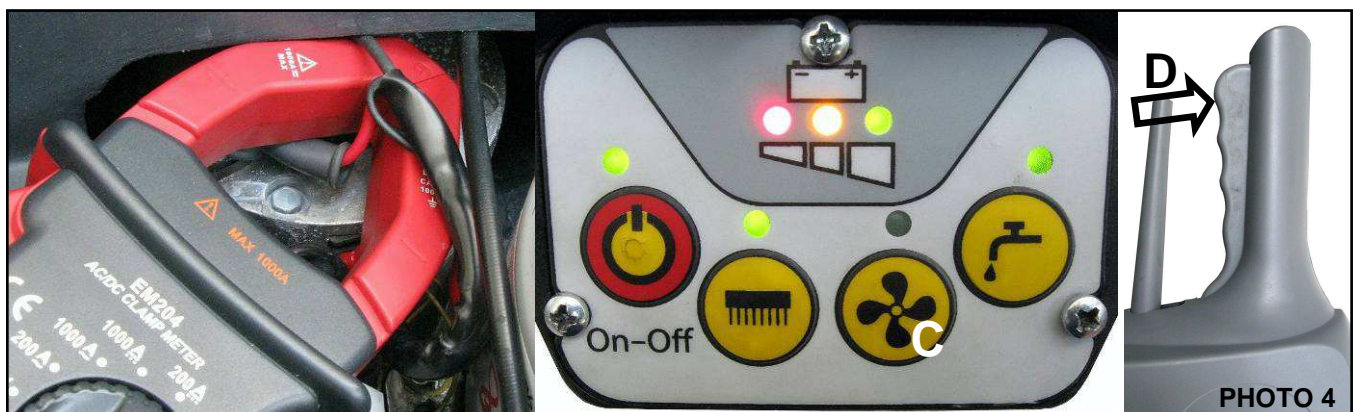
- 1 Make sure that the batteries on the machine are fully charged (24V ± 1V).
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes) as shown below.



- 3 Move the machine to the tank draining area, and completely empty the collection tank A.
- 4 Make sure that the solution tank contains only a small amount of solution before you start.
- 5 Move the machine to a flat, dry and smooth floor.
- 6 Make sure that you have enough room around the machine to perform the measurement safely.
- 7 Lift up and remove the collection tank A to access the cables B of the brush motor.



- 8 Set the clamp-on ammeter to measure amperes (A) of DC current, and clamp it to the red cable.
- 9 Press the "On-Off" button to switch the machine on, and press button C to switch off suction.
- 10 Pull in the control lever D on the handle. Read and record the current draw of the brush motor.





On the CT 15 B, the brush motor is powered by the power control card. This imposes a current ramp, so you are unlikely to see in-rush current peaks. For this reason, always wait a few seconds for current draw to stabilise before taking the reading.



To obtain current draw readings that can be compared to those in the table below, make sure that the machine is fitted with a standard brush and that the floor surface is neither excessively rough nor excessively smooth.

- 11 Completely fill the solution tank and measure current draw under full load.
- 12 Pull in the control lever **D** on the handle. Read and record the current draw of the brush motor.
- 13 Now lift the brush off the floor by pulling down on the handle and tilting the machine backwards.
- 14 Pull in the control lever **D** on the handle. Read and record the current draw of the brush motor under zero load.



PHOTO 5

- 15 Provided the current draw values lie between the minimum and maximum values specified in the table below, the motor is functioning correctly. You can now remove the ammeter and replace the collection tank.
- 16 If the measurements do not correspond to those specified, proceed as follows.
 - 16a If no-load current draw (brush raised) is correct, but full load current draw (brush on floor and solution tank full) is too high, first check that the solution is being dispensed properly. Also try moving to a smoother floor surface. Check that battery voltage has not fallen much under 24 V. Check the motor's carbon brushes and replace if necessary.
 - 16b If current draw is too high at full load and at zero load, check that the brush rotates freely without rubbing against the brush cover or any part of the frame. Check also that the gear unit is properly lubricated. Check the motor's carbon brushes and replace if necessary.
 - 16c If the above checks have not revealed the problem, replace the brush motor with a new one.

Current draw A (amperes)	Min	Max
<i>Light load (standard brush – solution tank almost empty)</i>	7 A	9 A
<i>Full load (standard brush – solution tank full)</i>	9 A	11 A
<i>No load (brush raised off floor)</i>	2 A	3.5 A

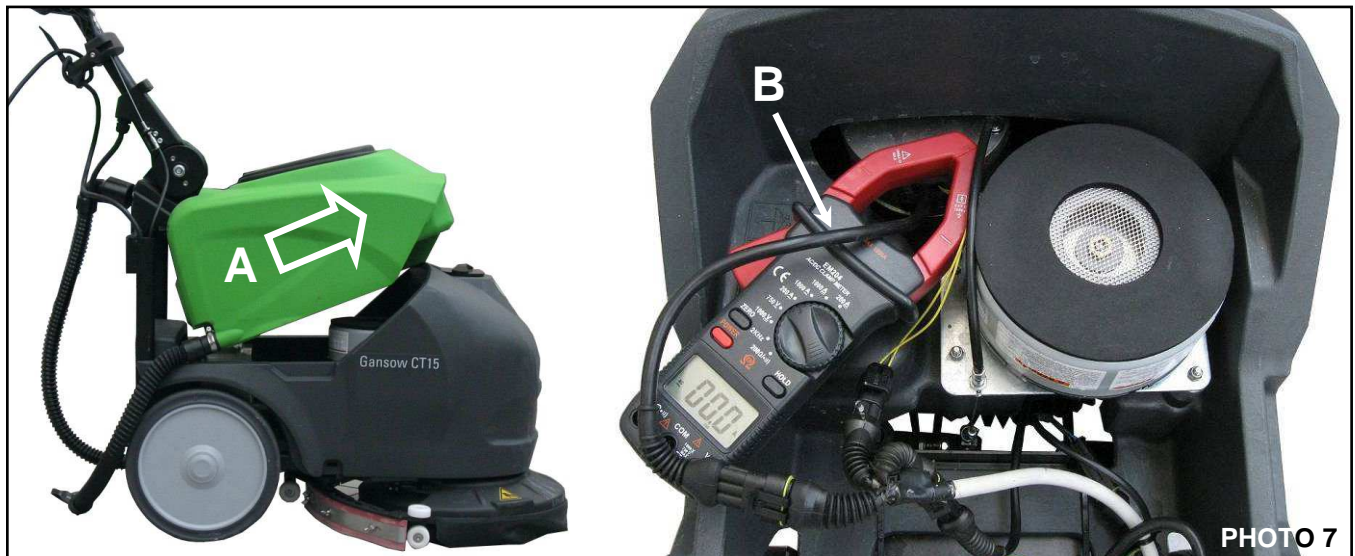


A1.2 Measuring brush motor current draw on the CT 15 C

- 1 Make sure that a mains power socket suitable for the machine is available (115V / 240V).
- 2 Use a clamp-on ammeter capable of measuring AC current as shown below.



- 3 Move the machine to the tank draining area, and completely empty the collection tank A.
- 4 Make sure that the solution tank contains only a small amount of solution before you start.
- 5 Move the machine onto a flat, dry and smooth floor.
- 6 Make sure that you have enough room around the machine to perform the measurement safely.
- 7 Lift up and remove the collection tank A to access the power cable B of the brush motor.



- 8 Set the clamp-on ammeter to measure amperes (A) of AC current, and clamp it to the power cable B.
- 9 Plug the machine's power cable into the power socket. LED C on the control panel lights to show that the machine is powered on.
- 10 Press the "On-Off" button to switch the machine on, and press button D to switch off suction.
- 11 Pull in the control lever E on the handle. Read and record the current draw of the brush motor.





On the mains powered CT 15 C, the brush motor is powered via a relay in a box in the power supply compartment. This relay is energised at 12 V by microswitches in the machine's handle, operated by levers E. This system ensures maximum protection for the operator against electric shock.



To obtain current draw readings that can be compared to those in the table below, make sure that the machine is fitted with a standard brush and that the floor surface is neither excessively rough nor excessively smooth.

- 12** Completely fill the solution tank and measure current draw under full load.
- 13** Pull in the control lever **E** on the handle. Read and record the current draw of the brush motor.
- 14** Now lift the brush off the floor by pulling down on the handle and tilting the machine backwards.
- 15** Pull in the control lever **E** on the handle. Read and record the current draw of the brush motor under zero load.



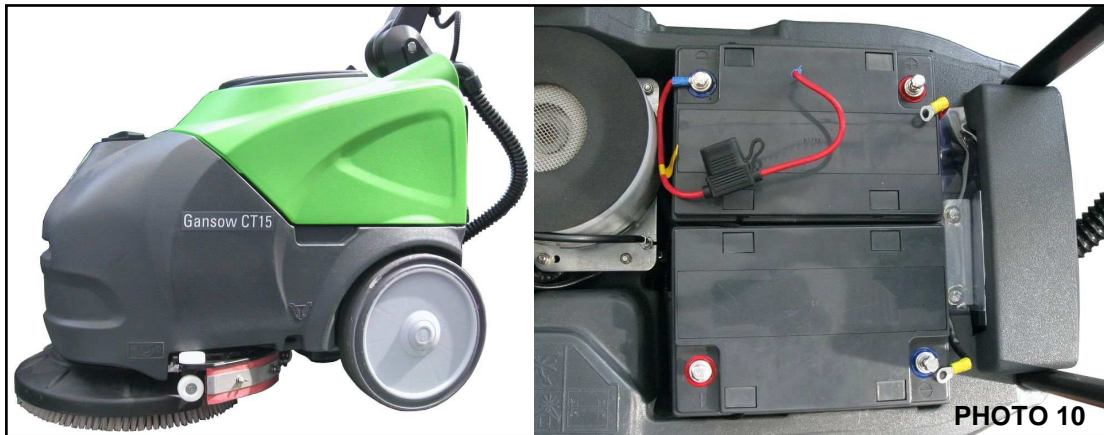
- 16** Provided the current draw values lie between the minimum and maximum values specified in the table below, the motor is functioning correctly. You can now remove the ammeter and replace the collection tank.
- 17** If the measurements do not correspond to those specified, proceed as follows.
- 17a** If no-load current draw (brush raised) is correct, but current draw under load (especially with a full solution tank) is too high, first check that the solution is being dispensed properly. Also try moving to a smoother floor surface. Check the voltage of the mains supply. Check the motor's carbon brushes and replace if necessary.
- 17b** If current draw is too high at full load and at zero load, check that the brush rotates freely without rubbing against the brush cover or any part of the frame. Check also that the gear unit is properly lubricated. Check the motor's carbon brushes and replace if necessary.
- 17c** If the above checks have not revealed the problem, replace the brush motor with a new one.

Current draw A (amperes)	Min	Max
<i>Light load (standard brush – solution tank almost empty)</i>	0.5 A	0.7 A
<i>Full load (standard brush – solution tank full)</i>	0.7 A	1 A
<i>No load (brush raised off floor)</i>	0.2 A	0.4 A

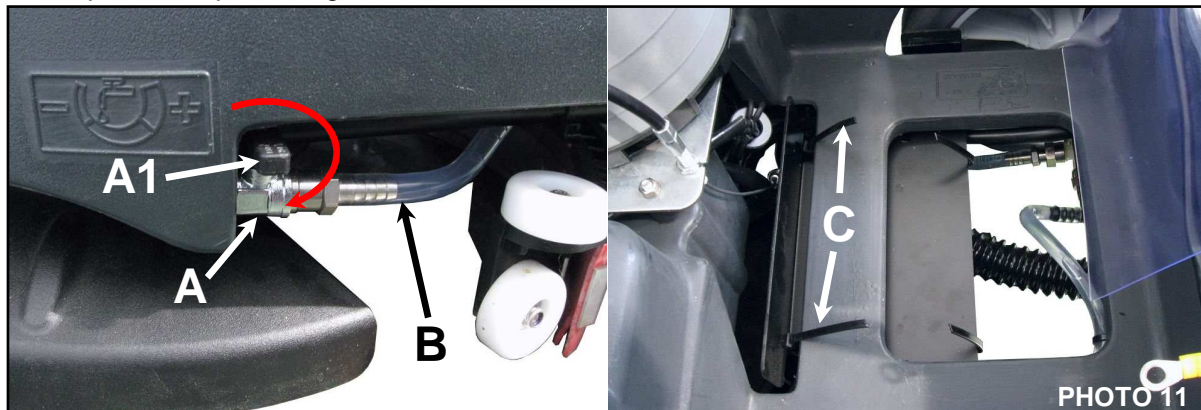


A1.3 Replacing the brush motor's carbon brushes on the CT 15 B *Disassembly*

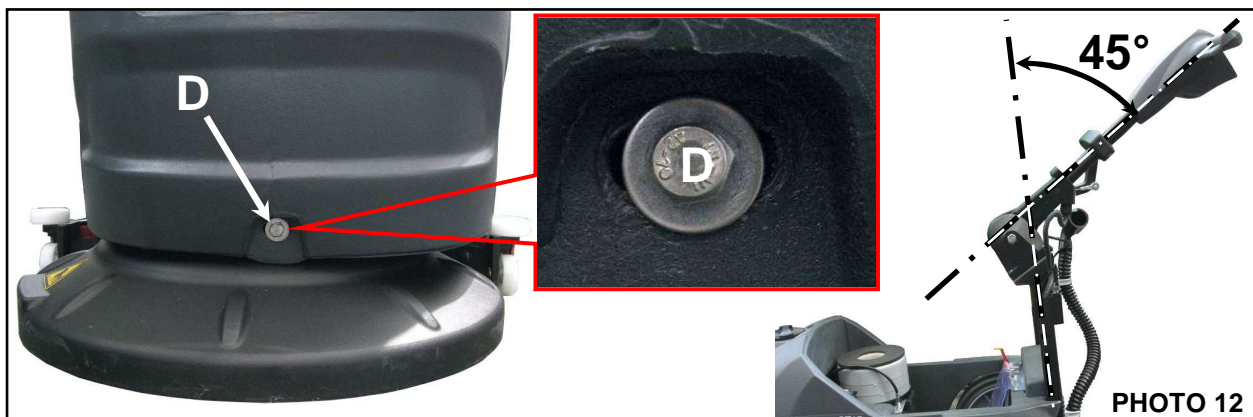
- 1 Move the machine to the tank draining area, and empty the solution tank and the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 Remove the brush and the collection tank.
- 4 Disconnect and remove the batteries from the battery compartment.



- 5 Lower the squeegee by means of its operating lever.
- 6 Close the solution dispensing cock **A**, at the bottom left of the tank.
- 7 Turn the handle **A1** of the cock **A** clockwise to shut off the solution supply.
- 8 Disconnect the hose **B** from the cock **A**.
- 9 Cut the plastic straps **C** fixing the rear of the tank to the frame.



- 10 Remove the screw **D** (if present) securing the solution tank to the bottom front of the machine frame.
- 11 Tilt the handle back through about 45°.





12 Tip the machine rearwards, until the handle rests on the floor.

13 Detach the cable from the squeegee mounting at clip **E**.

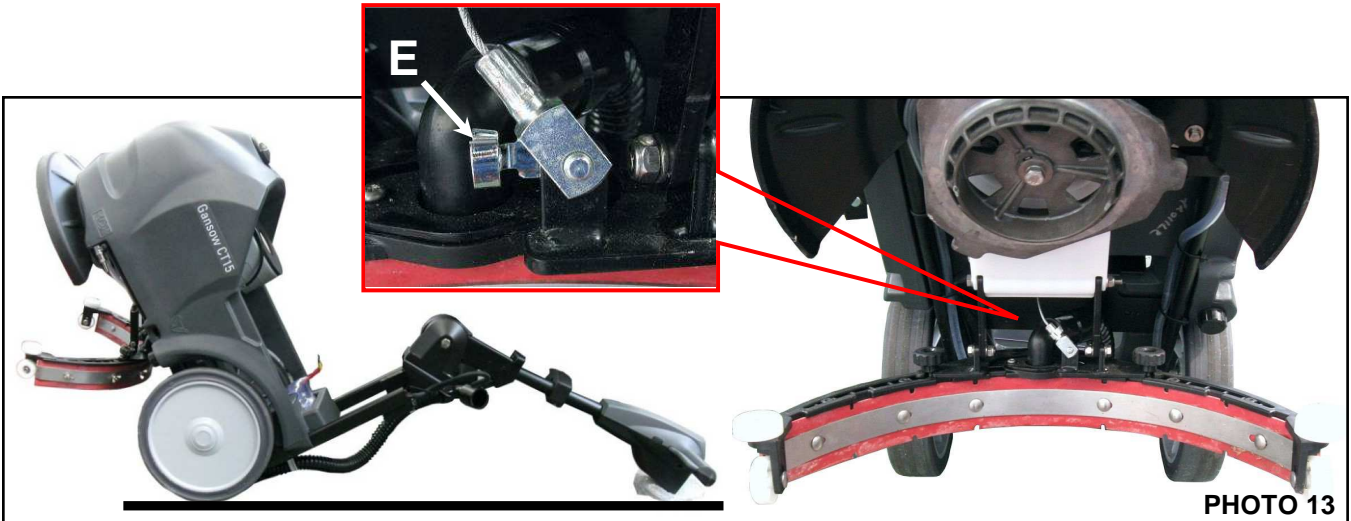


PHOTO 13

14 Pull the machine frame and brush motor mounting away from the solution tank.

15 If necessary, disconnect the thermal cutout connectors **F**.

16 Remove the screw **G** holding the metal strap **H** in place, to protection of carbon motor brushes **I**.



PHOTO 14

17 Disconnect the brush motor's four carbon brushes **I**, and pull them out one by one to check their condition.

18 Use a long nose pliers to disconnect the fast-on connector of each carbon brush **I**.

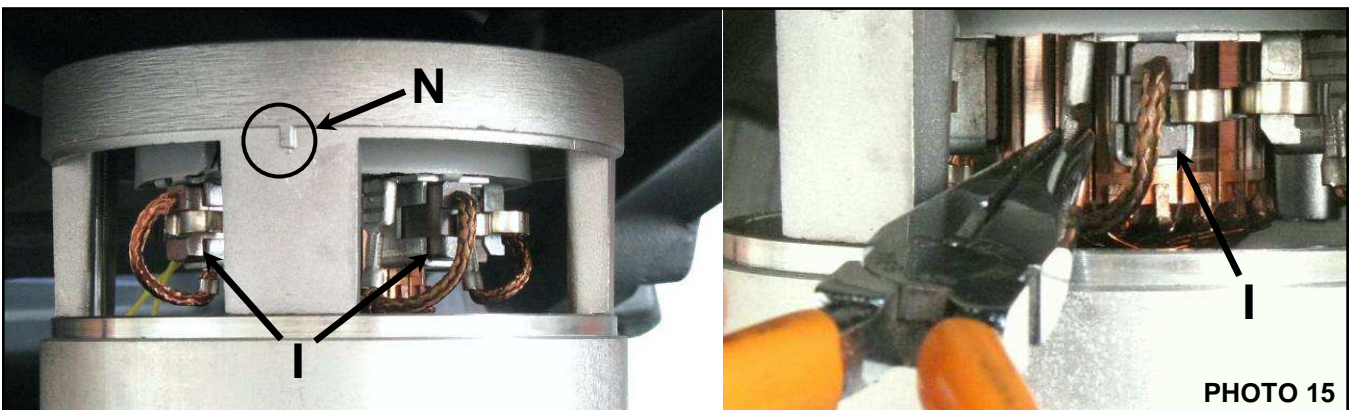
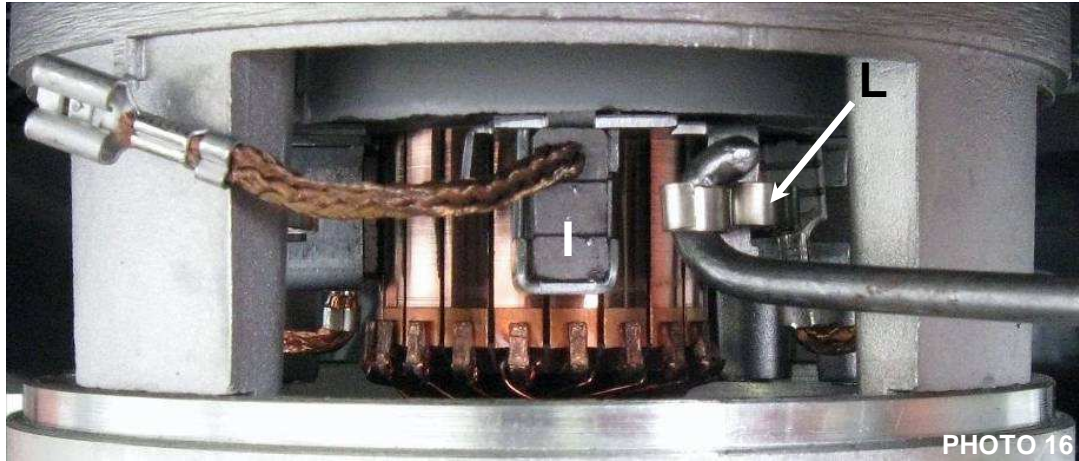


PHOTO 15



- 19 Use a suitable hook to pull away the spring clip **L** while lifting the carbon brush out by its cable.



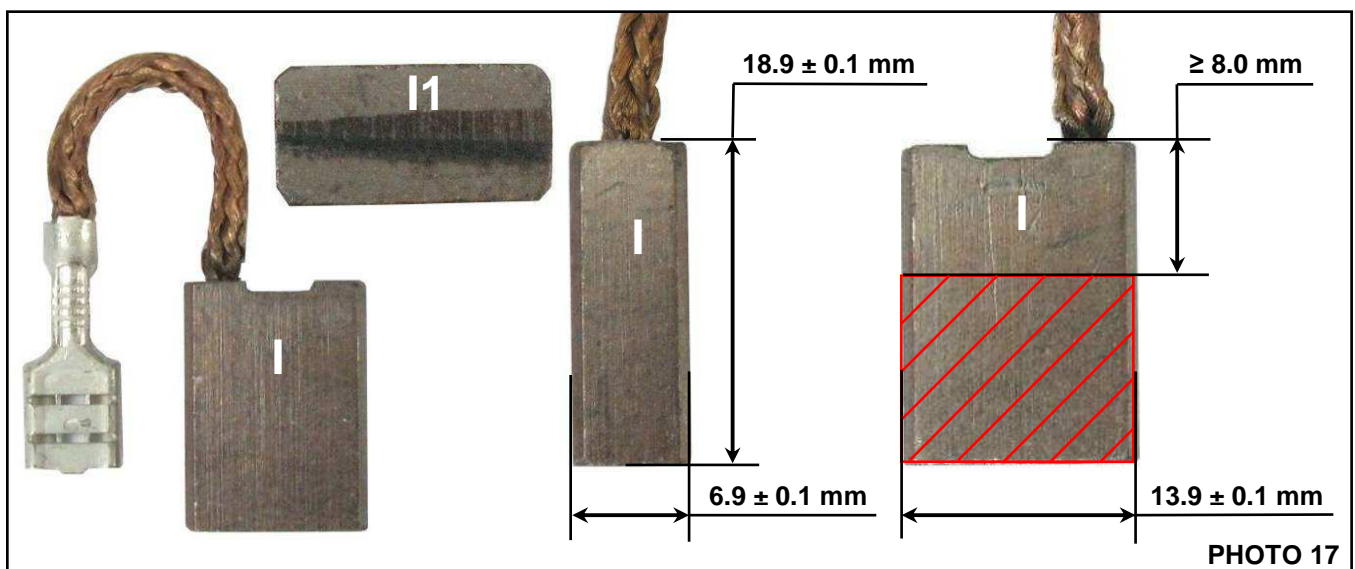
- 20 Check that the dimensions of the carbon brush **I** lie within the tolerances given in the figure below. The brush must have a minimum length of 8.0 mm.
- 21 Check the sliding contact surface **I1** of the carbon brushes **I** for wear or damage. The surface must not be badly worn or burned.
- 22 When fitting new carbon brushes, compare the new ones with the old ones, or check them against the dimensions given in the figure below. Only the length must be different.



Always replace all four carbon brushes at the same time.

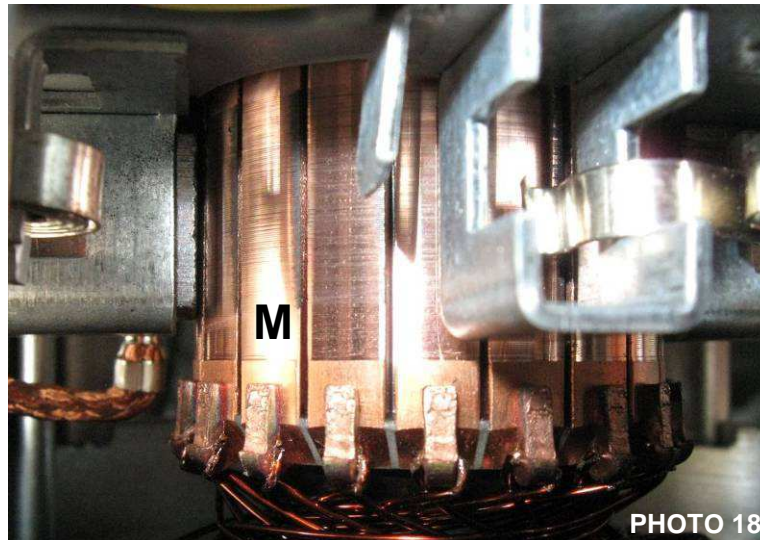


When fitting the carbon brushes, make sure that they slide freely in their seats.

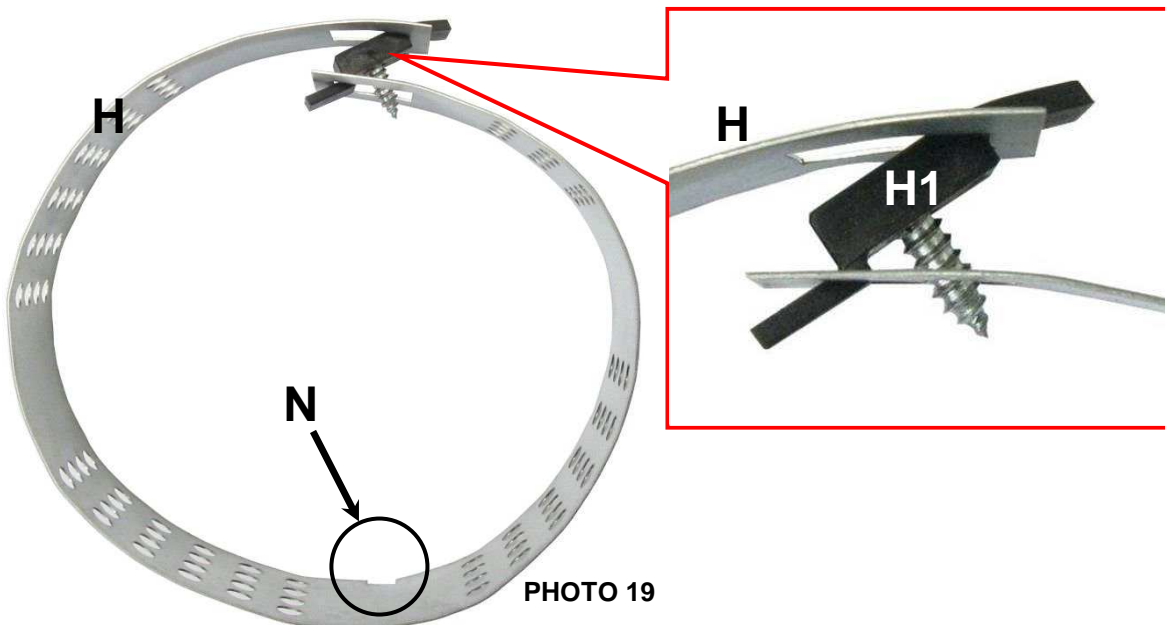




- 23 Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and to the part of the rotor **M** with which the carbon brushes come into sliding contact.
- 24 Check the rotor **M** for wear, paying particular attention to the area of contact with the carbon brushes.



- 25 When repositioning the metal strap **H** over the carbon brushes **I**, align the notch **N** in the strap with the corresponding reference on the motor body.
- 26 Arrange the clamp **H1** of the metal strap **H** as shown in the figure below when reassembling.



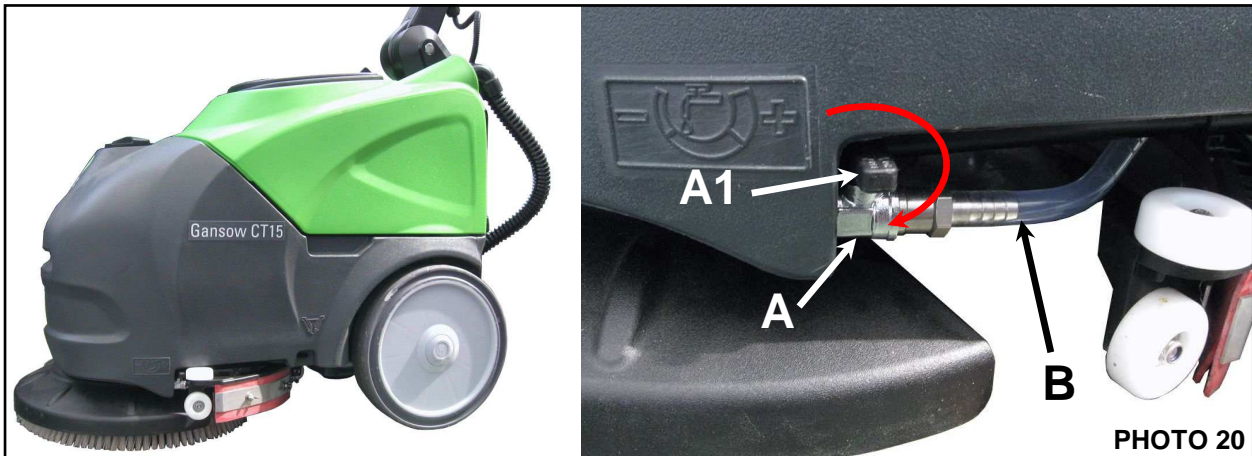
Reassembly

- 1 When fitting carbon brushes, make sure that all four slide freely in their seats.
- 2 Always check the rotor **M** for wear before fitting new carbon brushes.
- 3 To fit the new carbon brushes and reassemble the machine, repeat the steps for disassembly in reverse order.

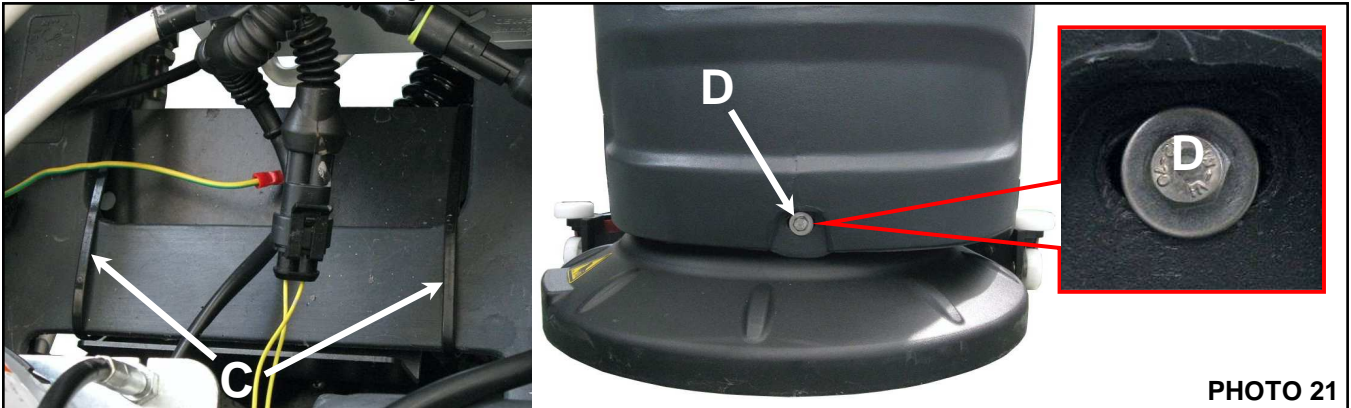


A1.4 Replacing the brush motor's carbon brushes on the CT 15 C Disassembly

- 1 Make sure that the machine is disconnected from the electricity supply.
- 2 Move the machine to the tank draining area, and empty the solution tank and the collection tank.
- 3 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 4 Remove the brush and the collection tank. Lower the squeegee.
- 5 Close the solution dispensing cock **A**, at the bottom left of the tank.
- 6 Turn the handle **A1** of the cock **A** clockwise to shut off the solution supply.
- 7 Disconnect the hose **B** from the cock **A**.



- 8 Cut the plastic straps **C** fixing the rear of the tank to the frame.
- 9 Remove the screw **D** securing the solution tank to the bottom front of the machine frame.

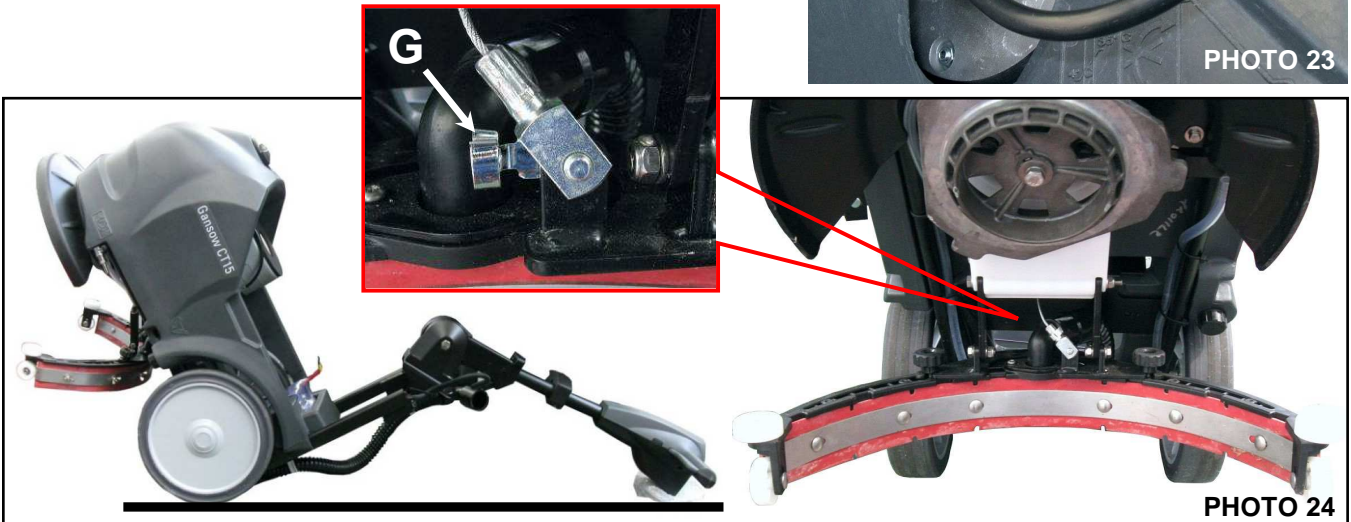
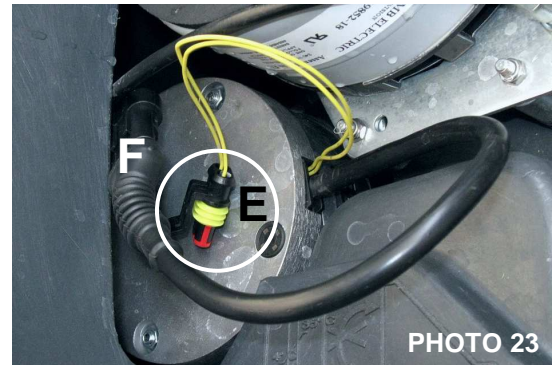


- 10 Disconnect the thermal cutout connector **E** and the brush motor's power connector **F**.
- 11 Tilt the handle back through about 45°.





- 12 Arrange the motor cables (thermal cutout **E** and power **F**) so that they are not pulled when the motor is moved away from the solution tank.
- 13 Tip the machine rearwards, until the handle rests on the floor.
- 14 Detach the cable from the squeegee mounting at clip **G**.



- 15 Pull the machine frame and brush motor mounting away from the solution tank.
- 16 Remove the screw **G** holding the metal strap **H** in place, to protection of carbon motor brushes **I**.

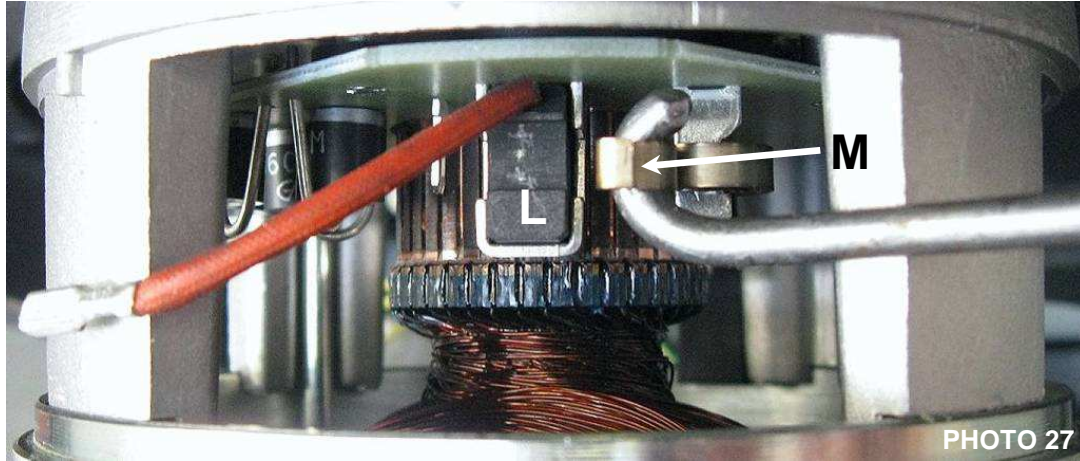


- 17 Disconnect the brush motor's two carbon brushes **L**, and pull them out one by one to check their condition.
- 18 Use a long nose pliers to disconnect the fast-on connector of each carbon brush from the circuit board.





- 19 Use a suitable hook to pull away the spring clip **M** while lifting the carbon brush **L** out by its cable.



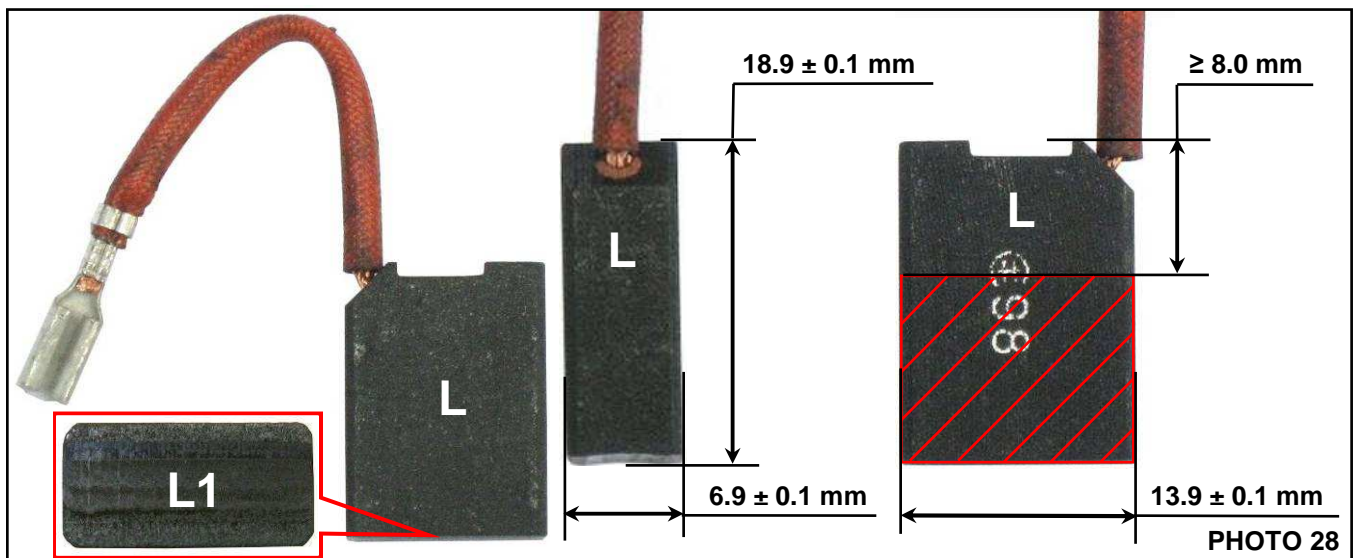
- 20 Check that the dimensions of the carbon brush **L** lie within the tolerances given in the figure below. The brush must have a minimum length of 8.0 mm.
- 21 Check the sliding contact surface **L1** of the carbon brush **L** for wear or damage. The surface must not be badly worn or burned.
- 22 When fitting new carbon brushes, compare the new ones with the old ones, or check them against the dimensions given in the figure below. Only the length must be different.



Always replace both carbon brushes at the same time.

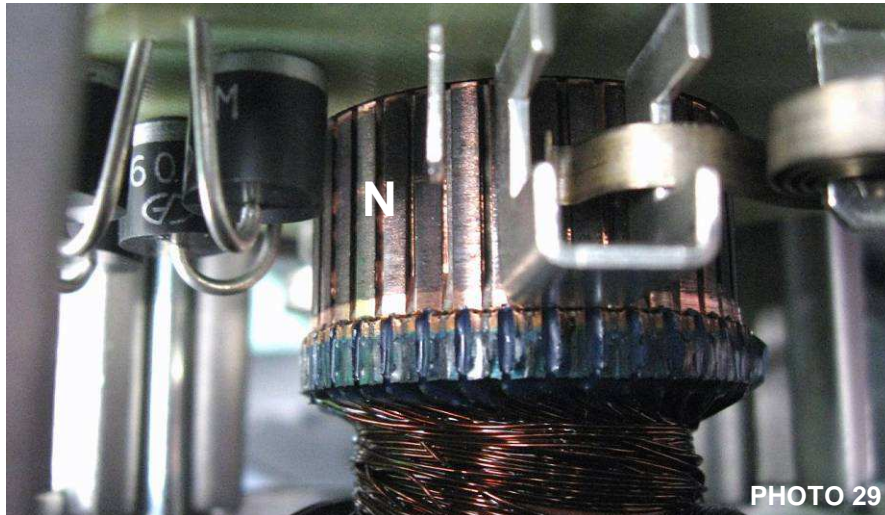


When fitting the carbon brushes, make sure that they slide freely in their seats.

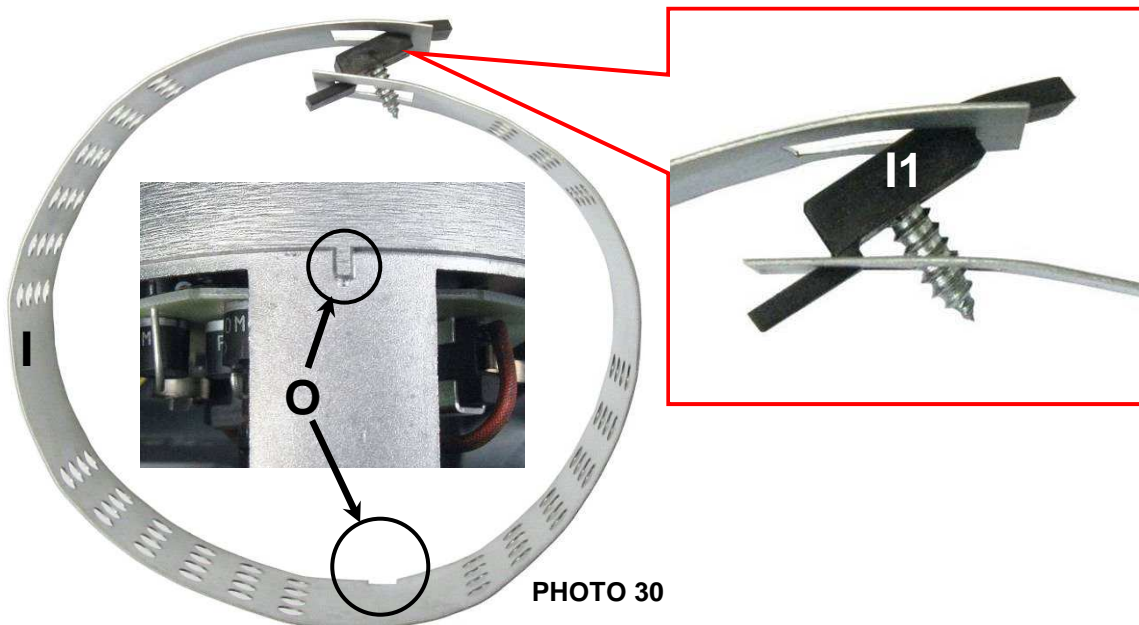




- 23** Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and to the part of the rotor **N** with which the carbon brushes come into sliding contact.
- 24** Check the rotor **N** for wear, paying particular attention to the area of contact with the carbon brushes.



- 25** When repositioning the metal strap **I** over the carbon brushes **L**, align the notch **O** in the strap with the reference on the motor body.
- 26** Arrange the clamp **I1** of the metal strap **I** as shown in the figure below when reassembling.



Reassembly

- 1** When fitting carbon brushes, make sure that they both slide freely in their seats.
- 2** Always check the rotor **N** for wear before fitting new carbon brushes.
- 3** To fit the new carbon brushes and reassemble the machine, repeat the steps for disassembly in reverse order.



A2 REMOVING THE BRUSH MOTOR AND BRUSH HEAD

Removing the CT 15 brush motor and brush head is a quick and easy operation. It is nevertheless important to take careful note of the polarity of the motor's power cables, to avoid problems caused by the brush that could compromise the washing.



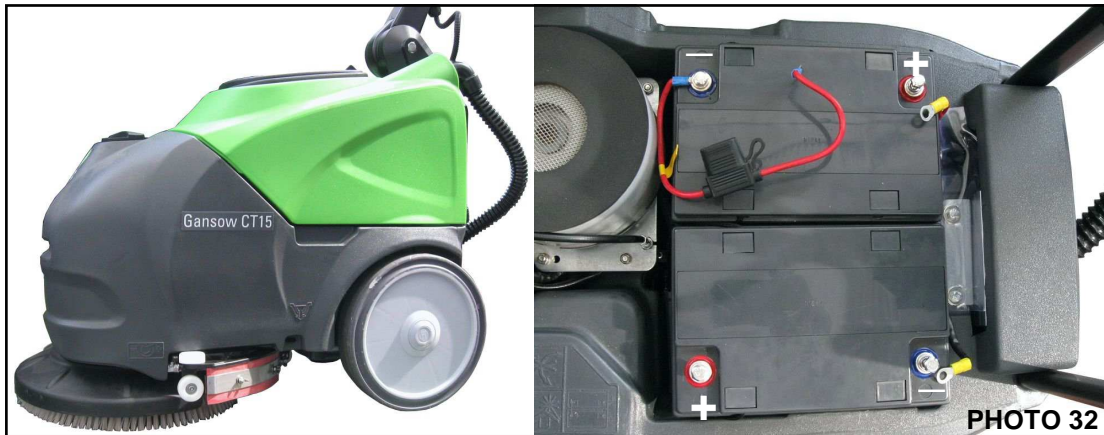
PHOTO 31



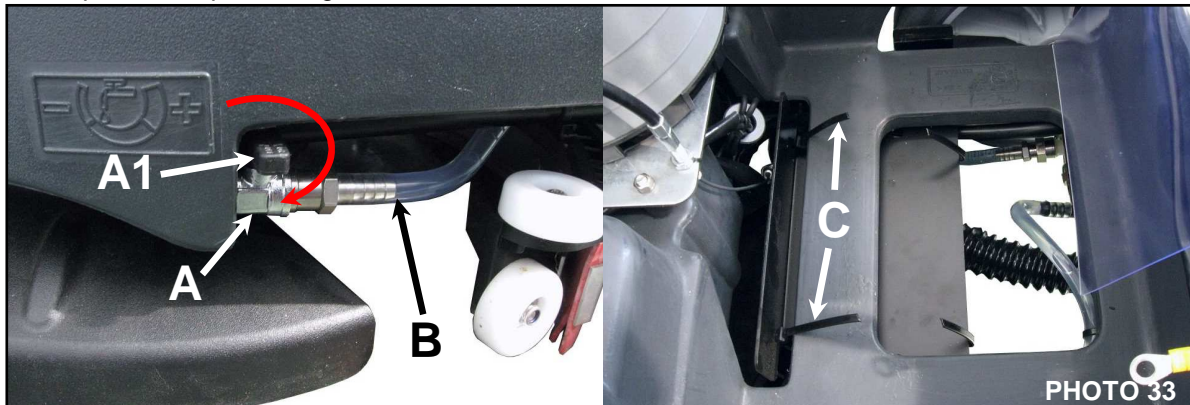
A2.1 Removing the brush motor from the CT 15 B

Disassembly

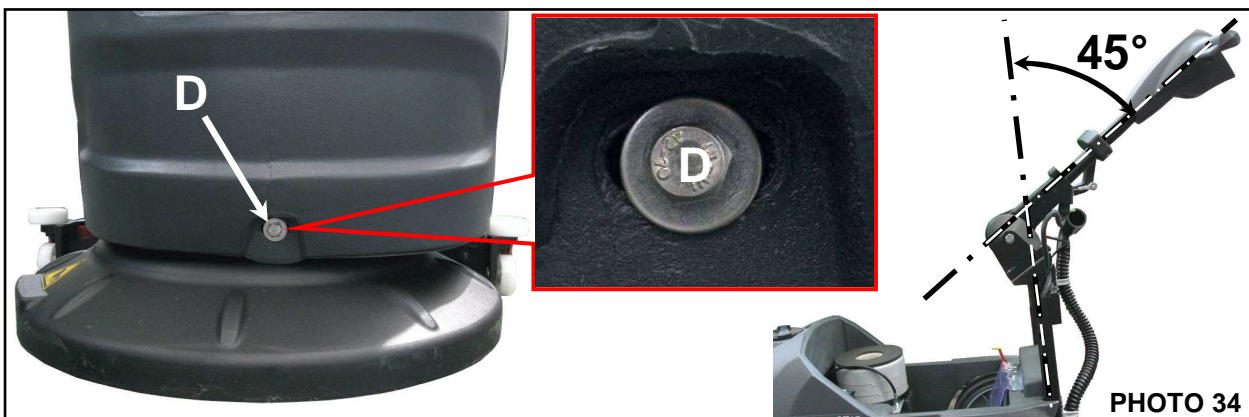
- 1 Move the machine to the tank draining area, and empty the solution tank and the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 Remove the brush and the collection tank.
- 4 Disconnect and remove the batteries from the battery compartment.



- 5 Lower the squeegee by means of its operating lever.
- 6 Close the solution dispensing cock **A**, at the bottom left of the tank.
- 7 Turn the handle **A1** of the cock **A** clockwise to shut off the solution supply.
- 8 Disconnect the hose **B** from the cock **A**.
- 9 Cut the plastic straps **C** fixing the rear of the tank to the frame.

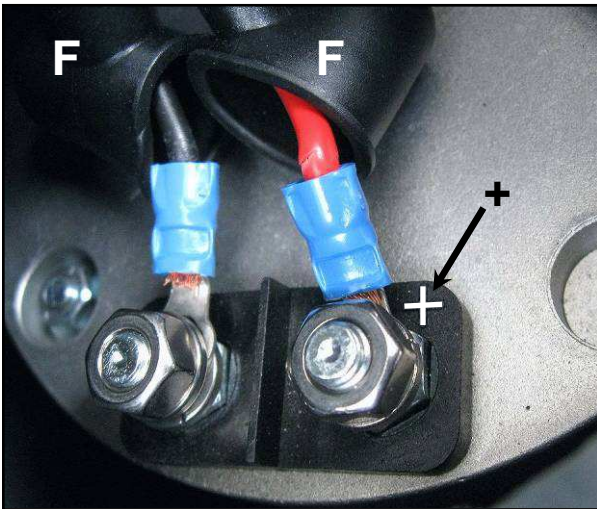
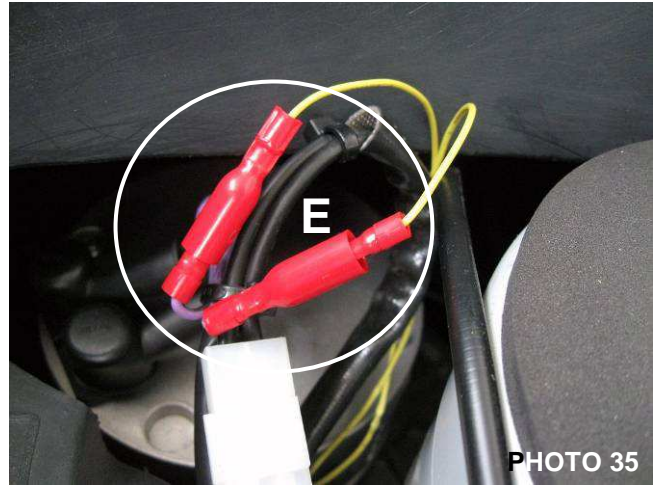


- 10 Remove the screw **D** (if present) securing the solution tank to the bottom front of the machine frame.
- 11 Tilt the handle back through about 45°.

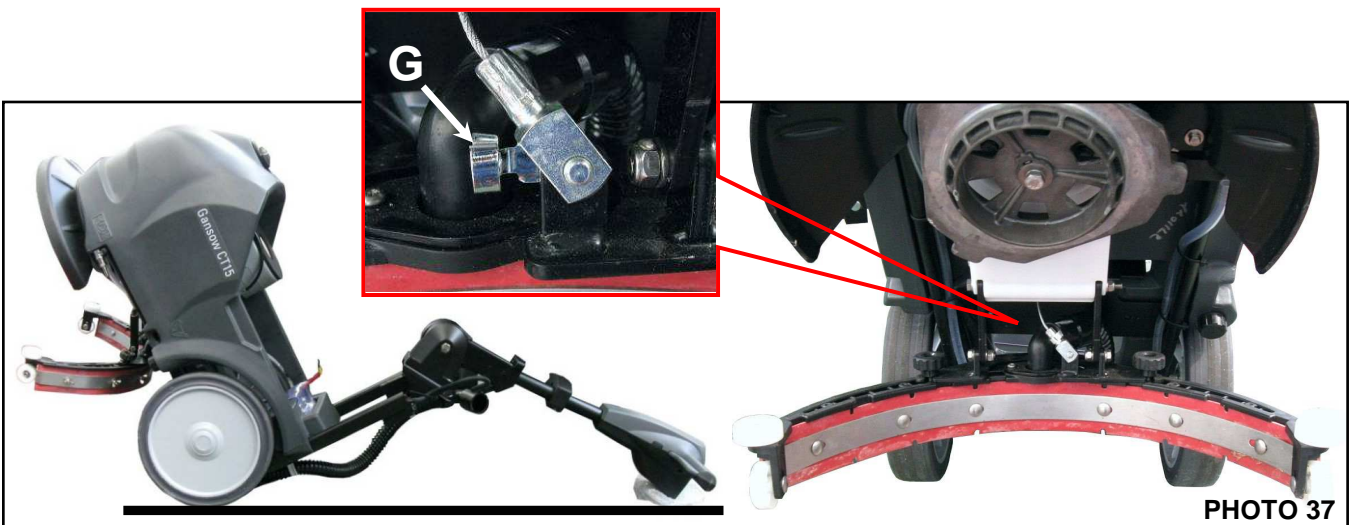




- 12 Disconnect the thermal cutout's two red bullet connectors **E**.
- 13 Pull the protective boots **F** away from power terminals and disconnect the power cables from the motor. When reassembling, make sure that you connect the cables correctly. The red cable must be connected to the positive "+" terminal.
- 14 Free the thermal cutout cables on the motor side and secure them to the motor. Move all the other cables out of the way.

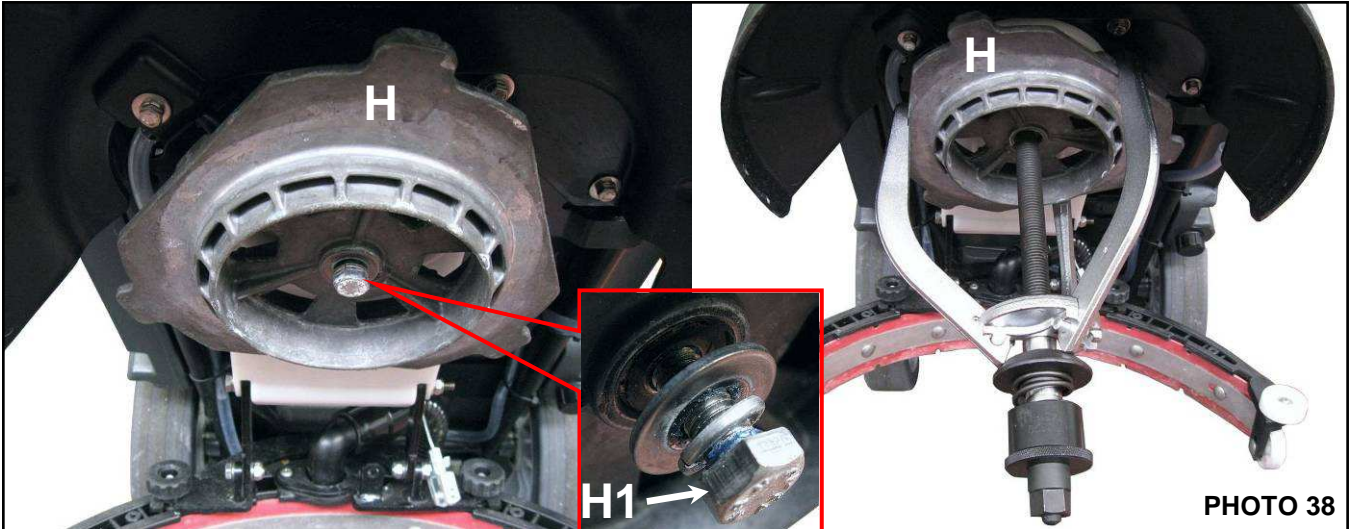


- 15 Tip the machine rearwards, until the handle rests on the floor.
- 16 Detach the cable from the squeegee mounting at clip **G**.

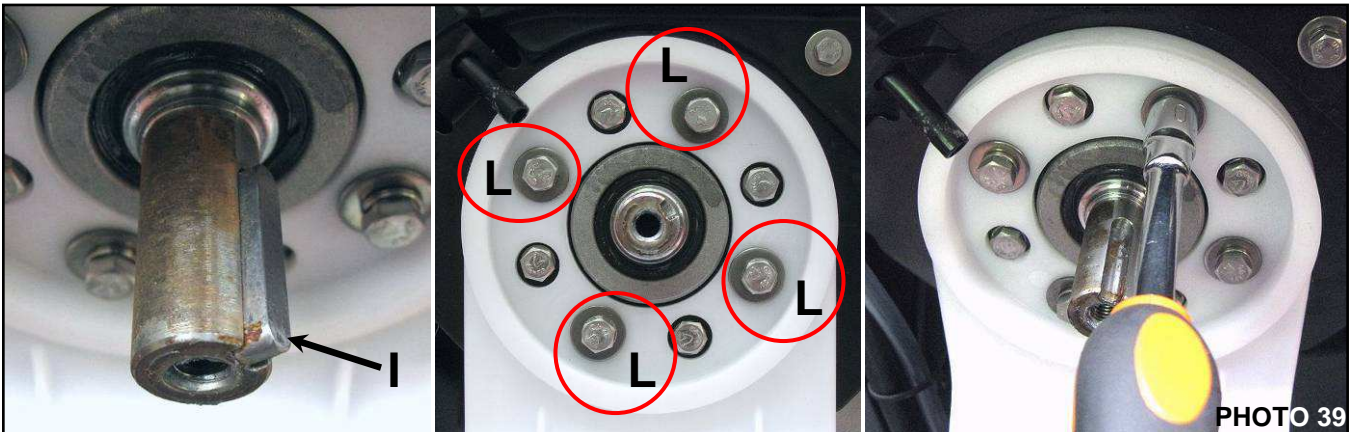




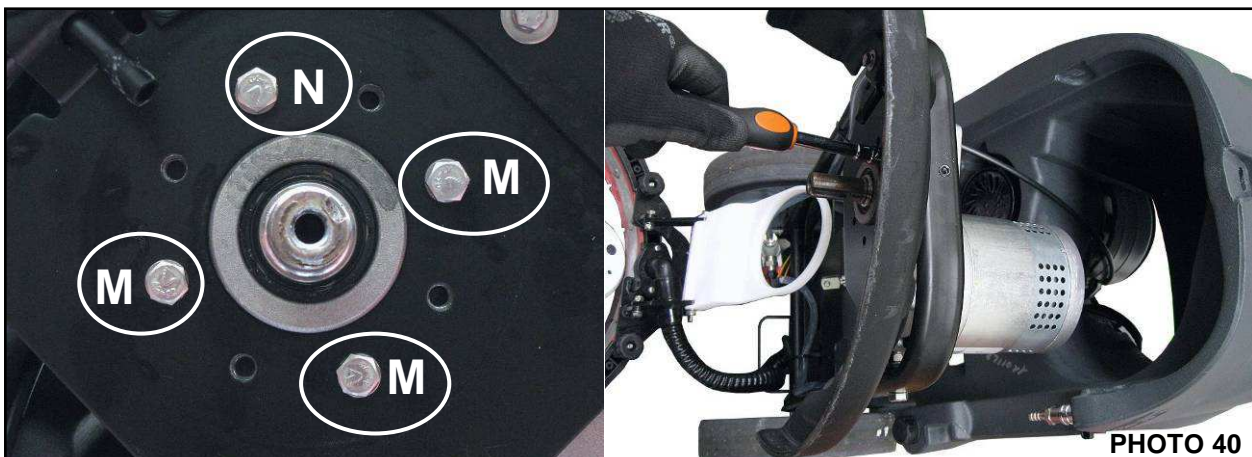
- 17 Remove the brush drive flange H.
- 18 Remove the stainless steel M8 x 20 bolt H1 along with its lock washer and flat washer.
- 19 Use a suitable puller to remove the brush drive flange H.



- 20 Remove the key I from the groove in the motor shaft and keep it safe.
- 21 Identify and remove the four bolts L securing the white plastic squeegee mounting.



- 22 Remove the three bolts M securing the brush motor to its mounting.
- 23 Pull the machine frame and brush motor mounting away from the solution tank.
- 24 Remove the last bolt N securing the motor to the machine frame, while supporting the motor by hand so that it does not fall.





- 25** Remove the motor and replace it with an identical new one.
- 26** Before you fit the new motor, make sure that the key **I** engages properly with the groove in its shaft. It must be neither too tight nor (worse still) too loose. Also check that the brush drive flange **H** slides over the motor shaft without having to be forced.



PHOTO 41

- 27** Make sure that the motor is positioned as shown in the figure below before fitting and tightening the bolts **N** and **M**.

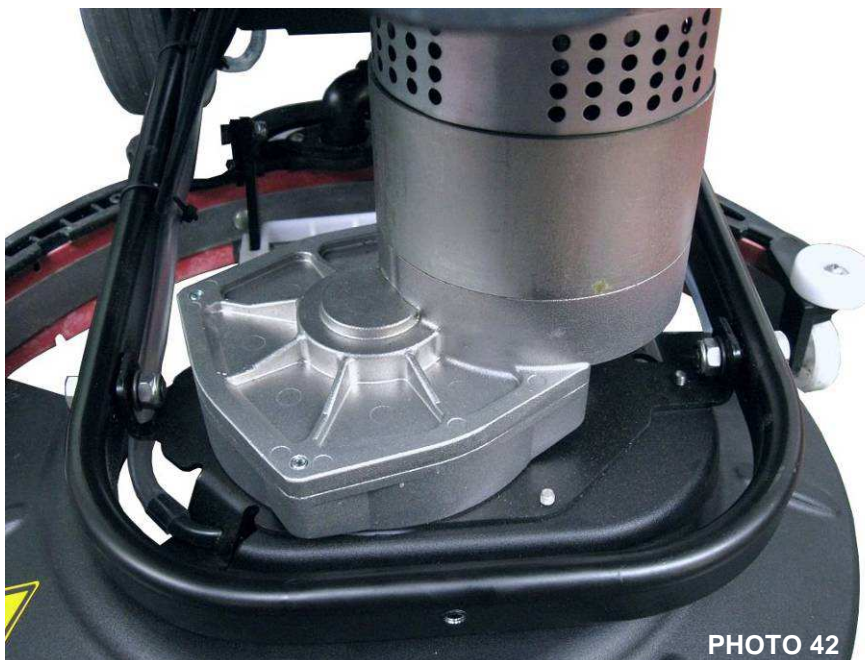


PHOTO 42

Reassembly

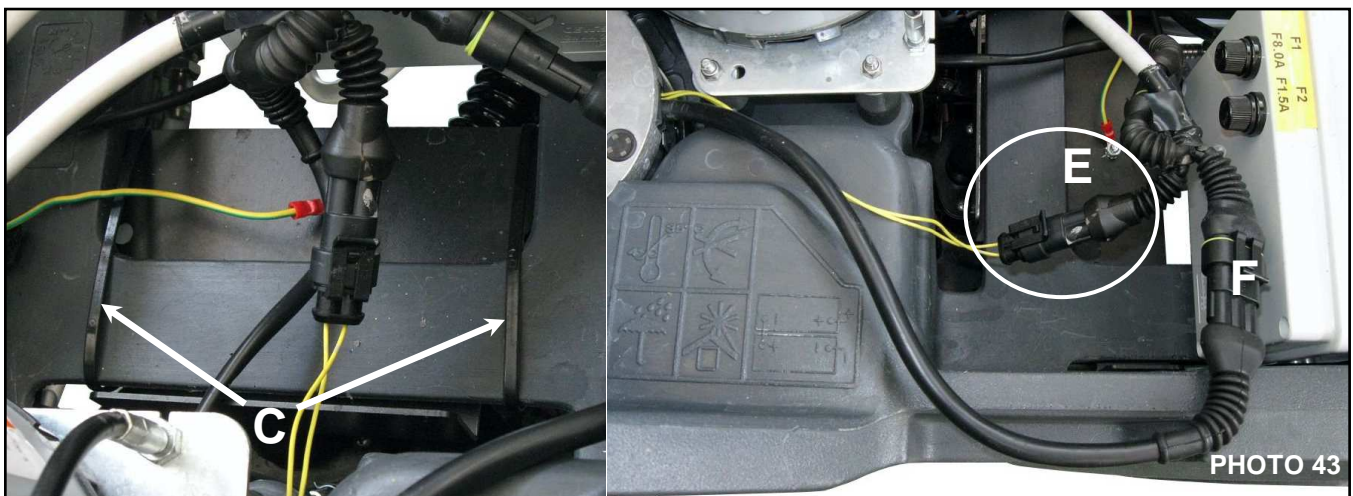
- 1** To fit the new motor, repeat the steps for disassembly in reverse order.
- 2** Make quite sure that the motor is correctly positioned on its mounting.
- 3** Tighten the bolts **L**, **M**, **N** to a maximum torque of 9 Nm (~ 0.9 Kgm).
- 4** Make sure that you connect the motor power cables the right way around, respecting polarity.



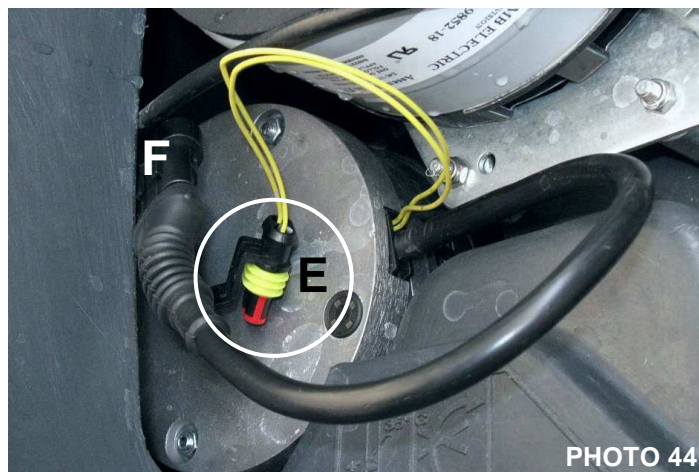
A2.2 Removing the brush motor from the CT 15 C

Disassembly

- 1 Move the machine to the tank draining area, and empty the solution tank and the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 **Make sure that the machine is disconnected from the electricity supply.**
- 4 Remove the brush and the collection tank.
- 5 Follow the procedure for removing the brush motor from "B" type battery powered machines. The only differences are that there is no need to remove the batteries, and that the brush motor connections are of a different type.
- 6 Cut the plastic straps **C** fixing the rear of the tank to the frame.
- 7 Locate and disconnect the waterproof electrical connectors **E** for the thermal cutout and **F** for the power cable.



- 8 Arrange the motor cables (thermal cutout **E** and power **F**) so that they are not pulled when the motor is moved away from the solution tank.



- 9 Follow the same procedure and precautions as for the "B" type battery powered version.

Reassembly

- 1 To fit the new motor, repeat the steps for disassembly in reverse order.
- 2 Make quite sure that the motor is correctly positioned on its mounting.
- 3 Tighten the bolts **L**, **M**, **N** to a maximum torque of 9 Nm (~ 0.9 Kgm).



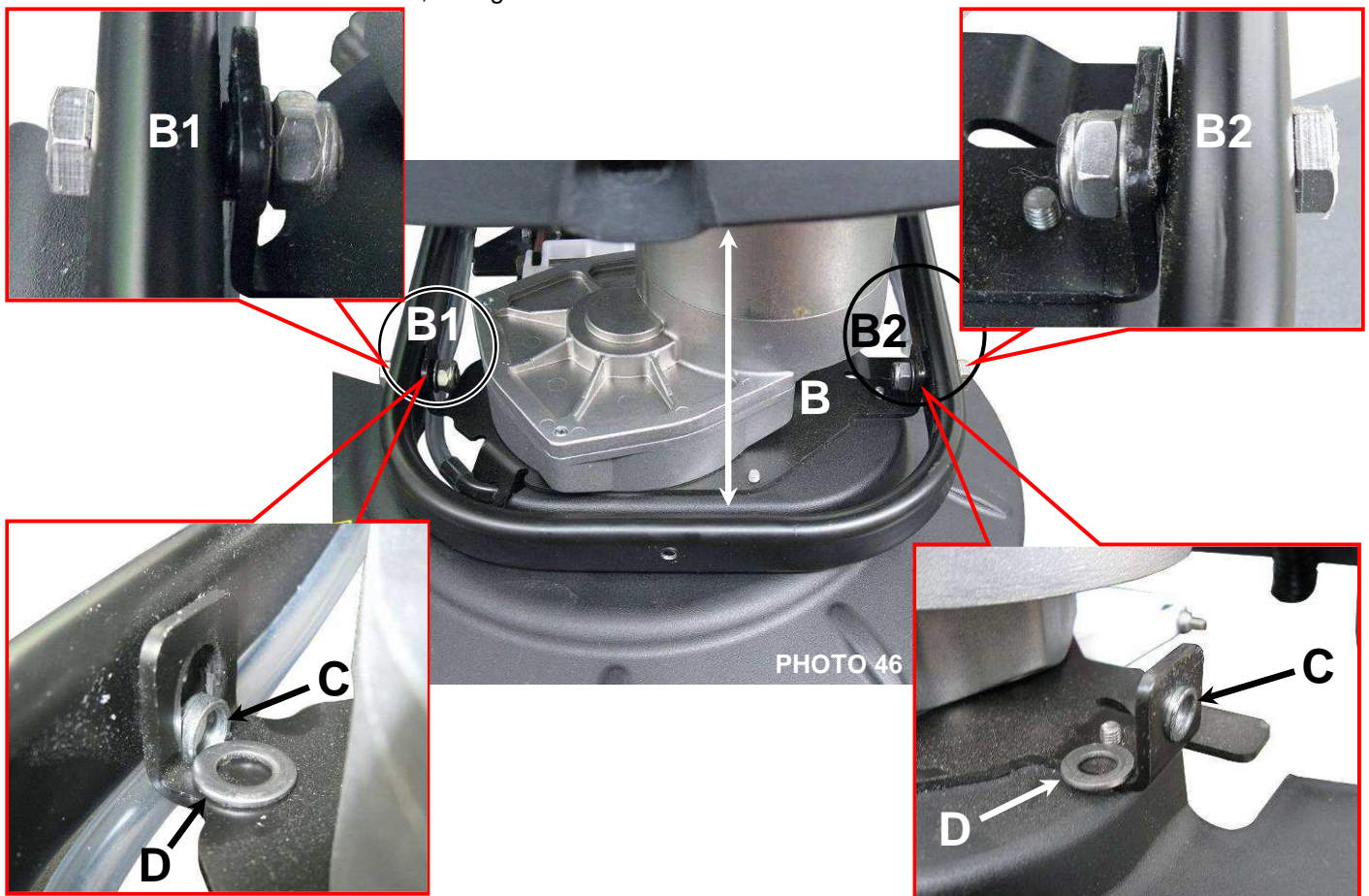
A2.3 Removing the brush head from the CT 15 B and C

Disassembly

- 1 On "B" (battery powered) versions, follow the procedure given in section A2.1 "Removing the brush motor from the CT 15 B", as far as step 16. On "C" (mains powered) versions, follow the procedure given in section A2.2 "Removing the brush motor from the CT 15 C", as far as step 7.
- 2 Remove the suction hose **A** from the union on the squeegee unit.
- 3 Remove the squeegee unit from its mounting.
- 4 Move the solution tank to gain access to the frame of the machine.
- 5 Disconnect the clear pipe **B** from the union on the brush head.



- 6 Identify the two bolts **B1** and **B2** securing the brush head **B** to the frame of the machine.
- 7 Remove the bolts **B1** and **B2**, taking care not to lose the bushes **C** and flat washers **D**.





- 8** Lift the machine frame and pull out the brush head complete with brush cover and squeegee mounting.



PHOTO 47

Reassembly

- 1** To fit the brush head, repeat the steps for disassembly in reverse order.
- 2** On completion of reassembly, make sure that the brush head pivots smoothly around the axes formed by bolts **B1** and **B2**.



It is extremely important for the head to pivot freely in order for the brush to follow any longitudinal slope in the floor irrespective of the position of the machine's rear wheels.

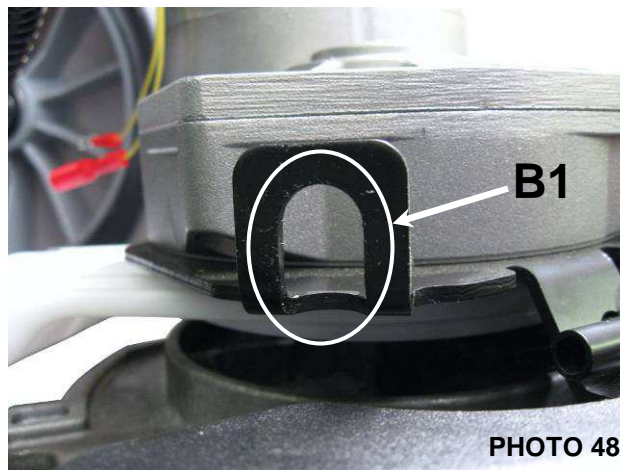


PHOTO 48

- 3** Tighten the bolts **B1** and **B2** to a maximum torque of 23 Nm (~ 2.3 Kgm).
- 4** Make sure that you connect the motor power cables the right way around respecting their polarity ("B" type battery version only).



A2.4 Replacing the brush motor's thermal protector

Disassembly

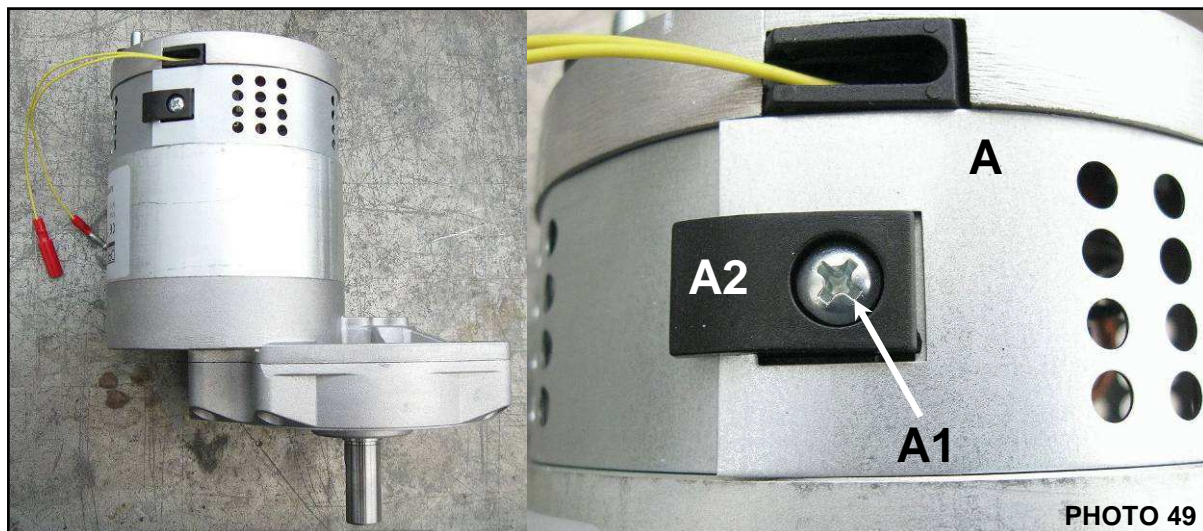


Though it is highly unlikely, the thermal protector in the brush motor may, in time, stop functioning properly and start cutting out at temperatures below that for which it was originally calibrated. It may even develop a fault causing its contacts to remain open, thus cutting off power to the motor.

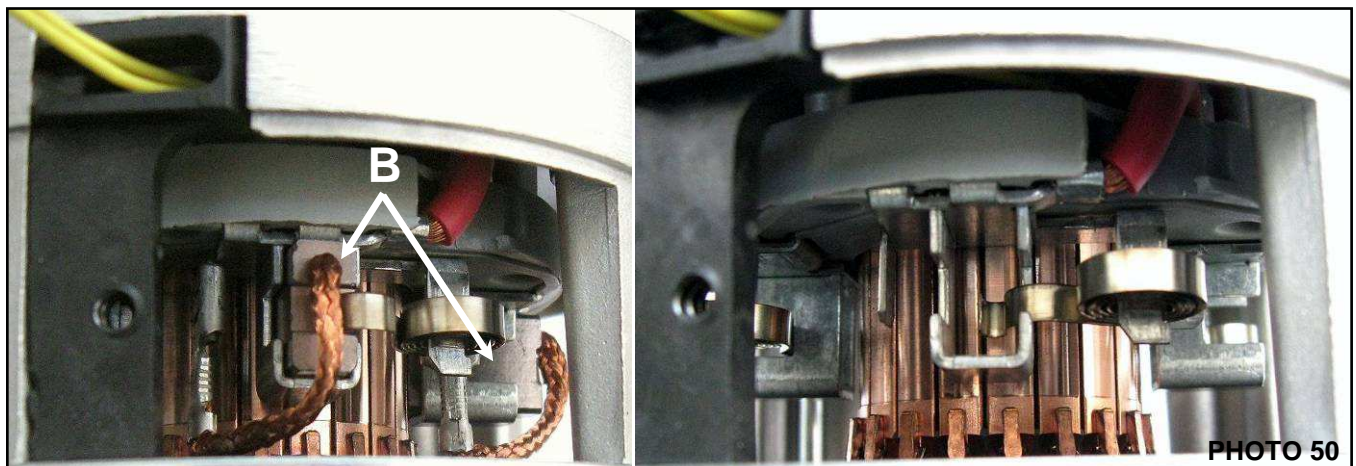


With "C" type mains powered versions, it is not possible to replace the thermal protector alone, as it is integrated in the carbon brush flange inside the motor cover C. If the thermal protector needs replacing on "C" type mains powered machines, the entire motor cover C has to be replaced.

- 1 Remove the brush motor from the machine as instructed in section A2.1, and take it to the work bench.
- 2 Remove the screw **A1** and remove the metallic strap **A** along with the plastic clamp **A2**.

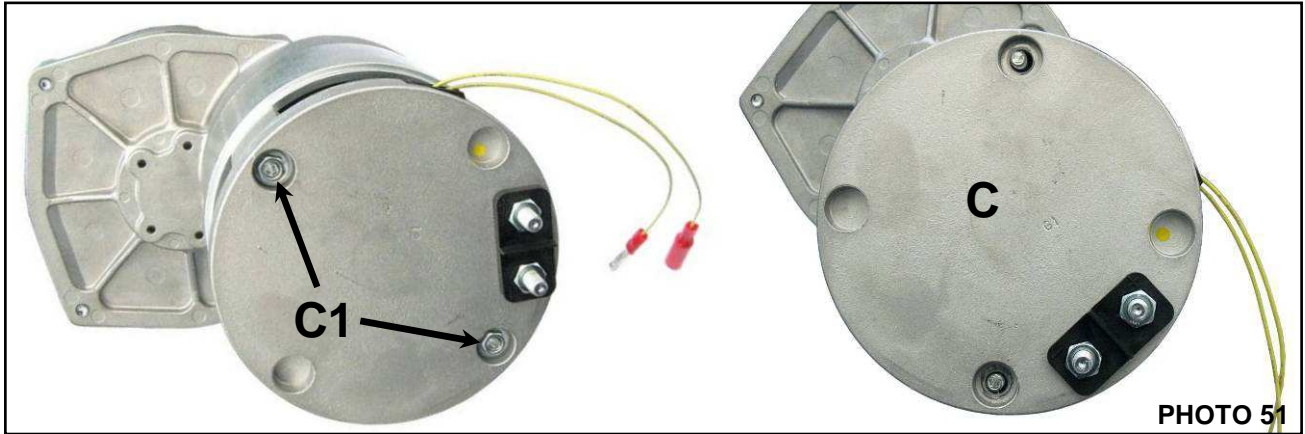


- 3 **CT 15 B:** Remove the four carbon brushes **B** as instructed in section A1.3.
CT 15 C: Remove the two carbon brushes **B** as instructed in section A1.4.

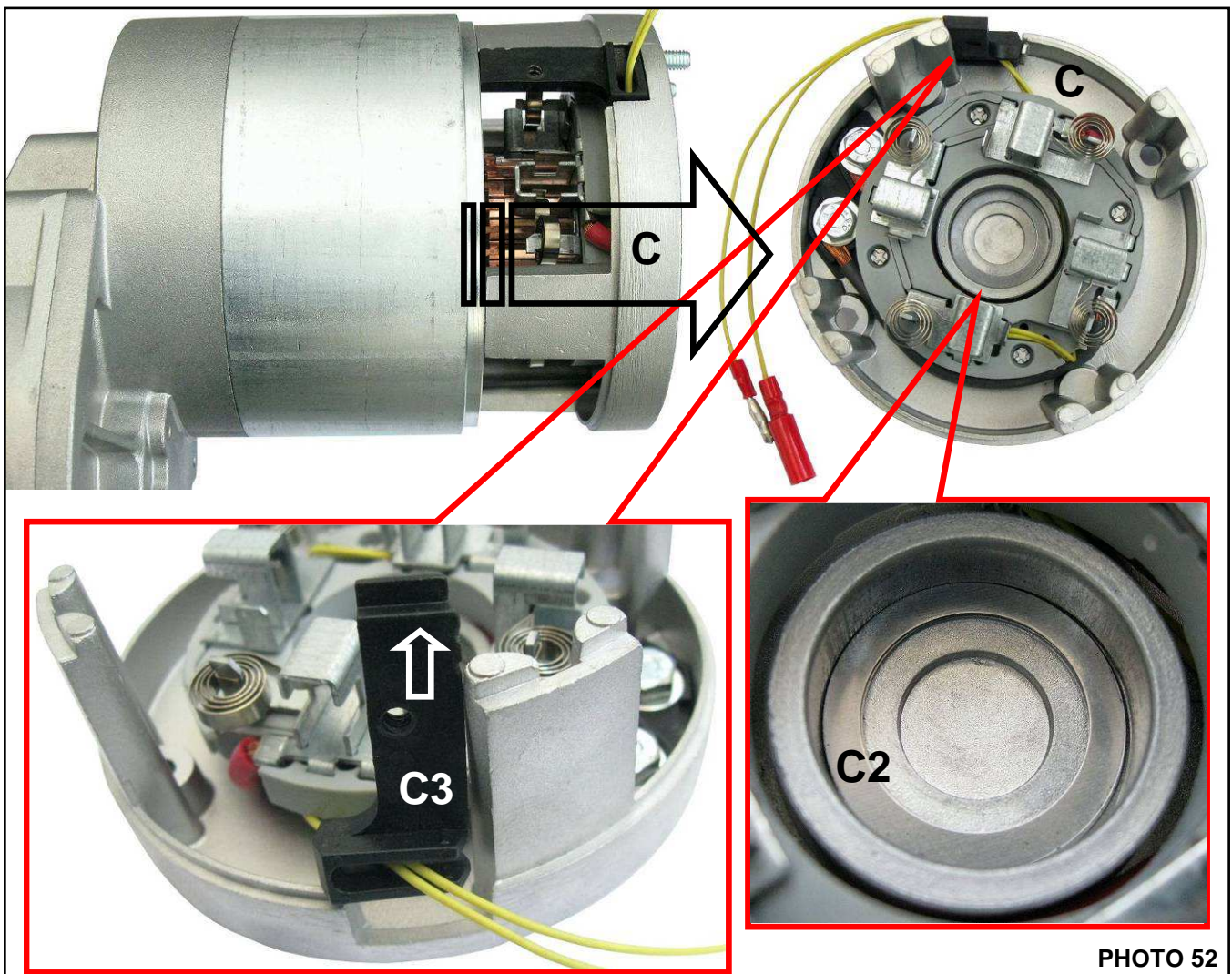




- 4 Remove the two bolts **C1** from the top of the motor cover **C**.



- 5 Rest the brush motor on its side, and pull off the cover **C**, applying the necessary force.
6 Take care not to lose the shims **C2** from the bearing housing in the cover. Remove the bearing **D**.
7 Pull the plastic guard **C3** for the thermal protector cables upwards and remove it.





Reassembly

- 1 Before fitting a new cover **C**, fit the shims **C2** and the bearing **D** in the bearing housing.
- 2 Check the rotor **E** for wear, paying particular attention to the area with which the carbon brushes come into sliding contact. Clean and/or recondition as necessary.
- 3 Also check the condition of bearing **D**, turning the races by hand to test for noise or roughness, and inspecting it carefully for any violet colouration that could indicate overheating.

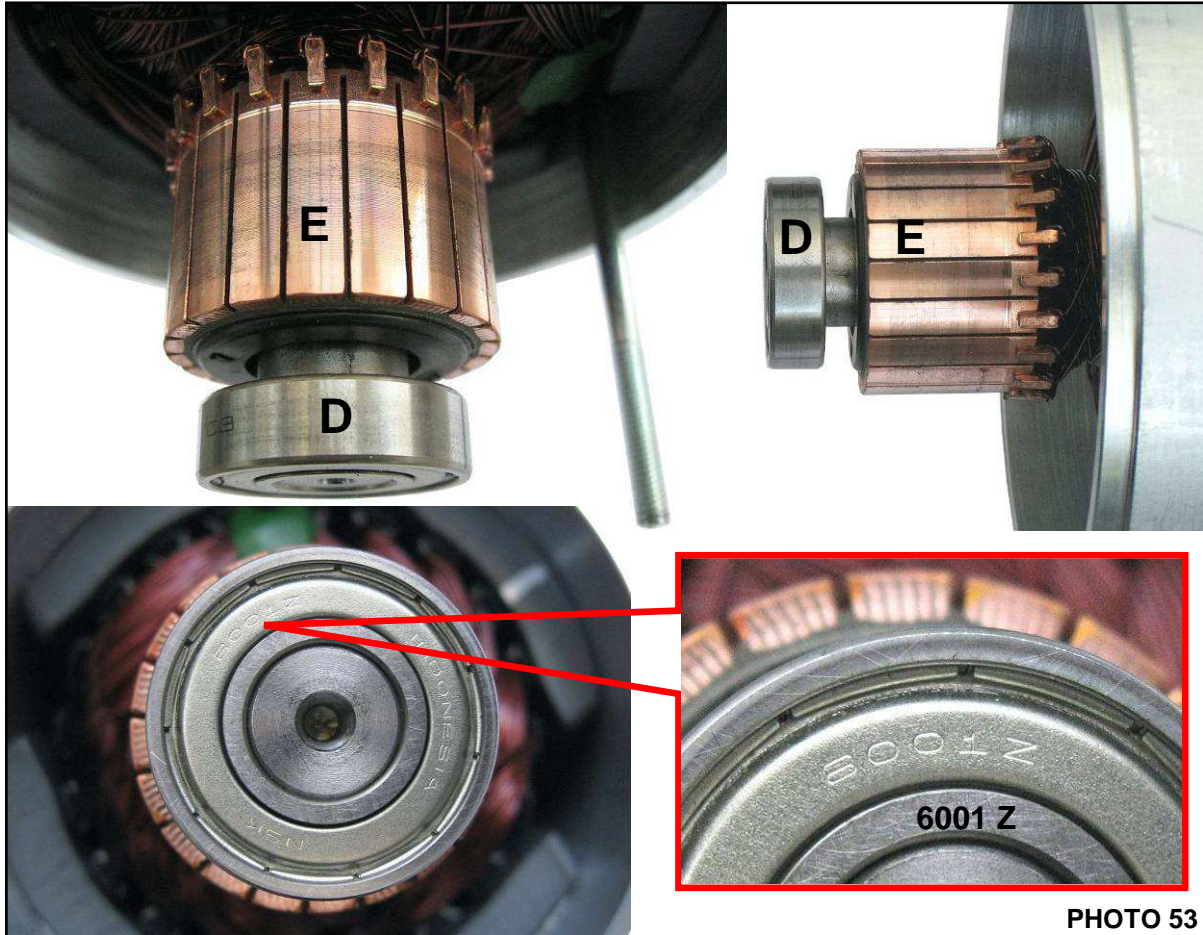


PHOTO 53

- 4 Fit the new cover **C** with the electrical connections on the opposite side to the gear unit, as shown in the figure below.

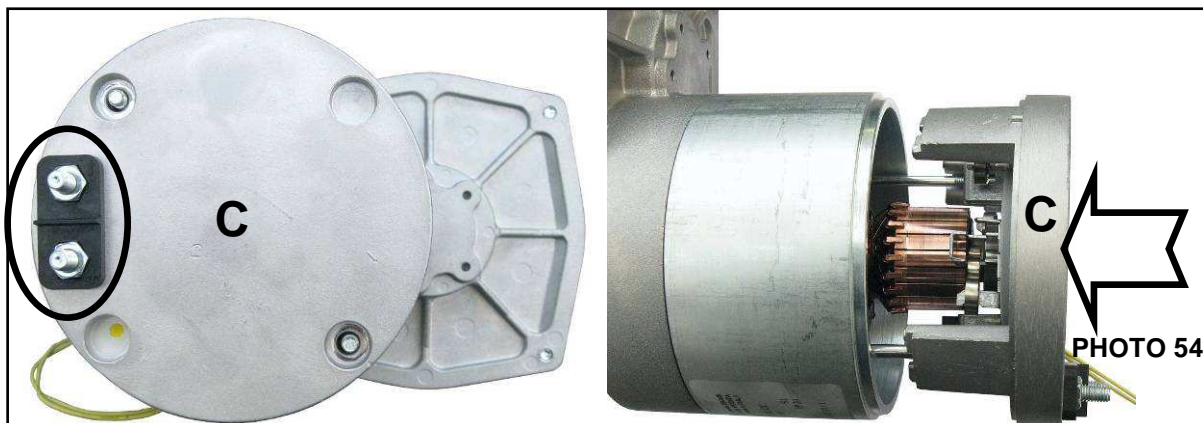


PHOTO 54

- 5 To fit the new cover, repeat the steps for disassembly in reverse order.
- 6 Tighten the bolts **C1** to a maximum torque of 6 Nm (~ 0.6 kgm).
- 7 To fit the carbon brushes, see sections A1.3 – A1.4.



B

TANKS AND SUCTION SYSTEM

👉 WARNING!

Go to the designated draining area and empty the solution and collection tanks using the drain plugs and the hoses provided.

Position the machine on a flat floor, and place wedges under the wheels to stop it moving.

Switch the machine off and disable all functions by pressing the “On–Off” button on the control panel.

Disconnect the machine’s electrical system by removing the main fuse F1, or by disconnecting the terminals from the battery poles (battery powered machines), or by removing the plug from the mains power socket (mains powered machines).

i INFORMATION

Important information

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

In this Service Manual, the machine version (15 B, 15 C) may appear between brackets “()”. This indicates that the instruction in question refers only to the version specified.

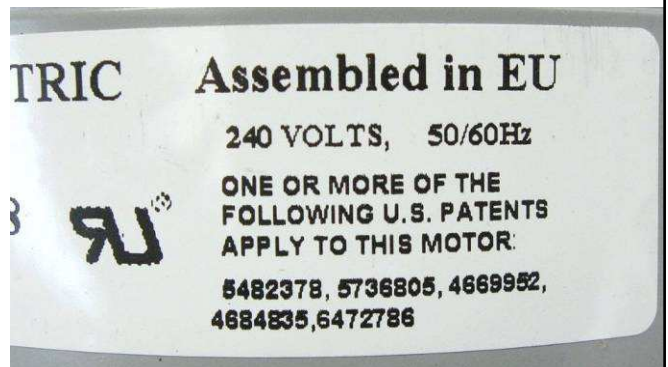
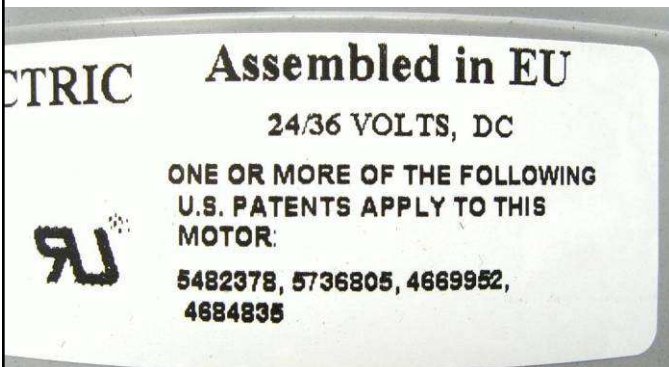


B1 SUCTION MOTOR

i On the CT 15, the suction motors of “B” type battery versions and “C” type mains versions are very similar. Apart from the power source (24 V DC for “B” versions and 240V AC for “C” versions), the differences lie in the motors’ maximum power consumption (550W for “B” type motors, and 400W per “C” type motors) and in the type of connections. The motors of mains powered versions feature waterproof terminals to provide increased protection against electric shock. The number of turbine stages also differs: three for “B” type machines and two for “C” type machines.



PHOTO 55

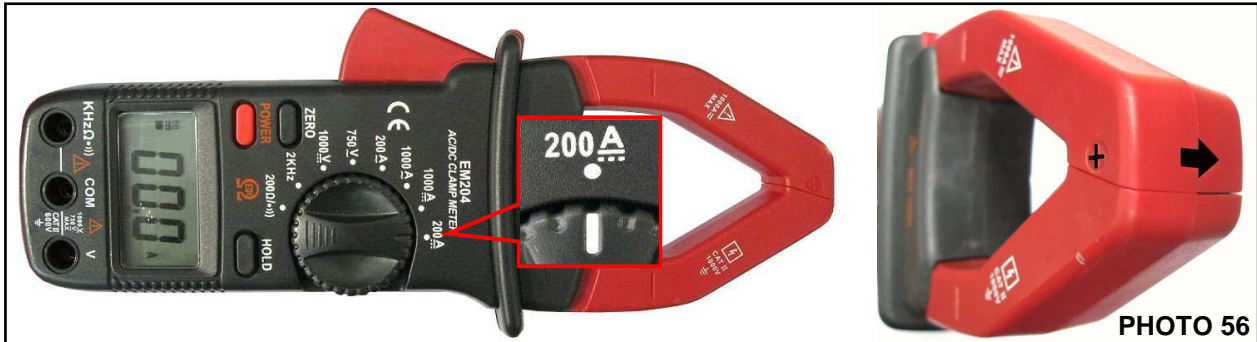




B1.1 Measuring suction motor current draw on the CT 15 B

Disassembly

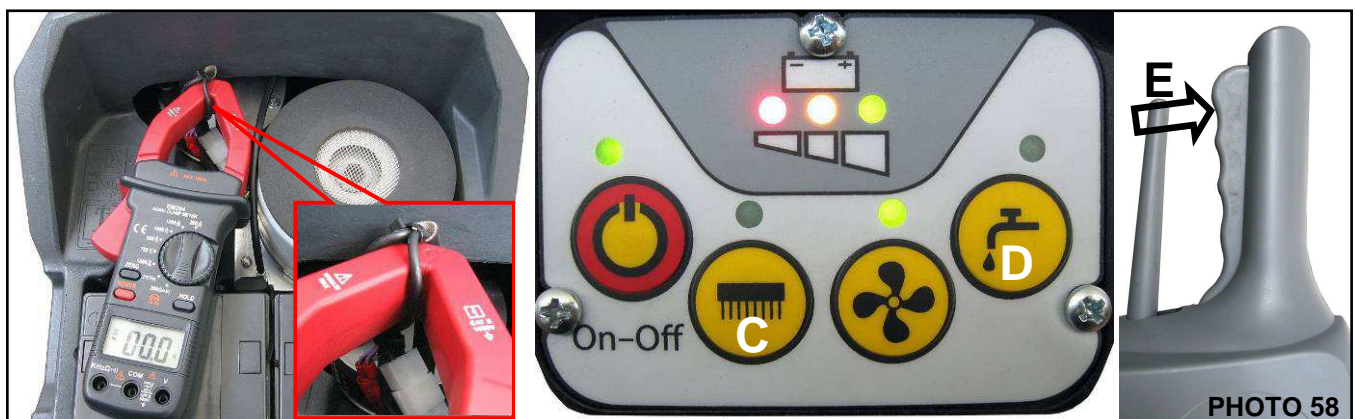
- 1 Make sure the batteries on the machine are fully charged ($24V \pm 1V$).
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes) as shown below.



- 3 Move the machine to the tank draining area, and completely empty the collection tank A.
- 4 Make sure that you have enough room around the machine to perform the measurement safely.
- 5 Lift up and remove the collection tank A to access the cables B of the suction motor.



- 6 Set the clamp-on ammeter to measure amperes (A) of DC current and clamp it to one of the cables of the suction motor.
- 7 Press the "On-Off" button to switch the machine on, and press the brush button C and the solution dispensing button D to switch off the associated functions.
- 8 Pull in the control lever E on the handle. Read and record the current draw of the suction motor.





On the CT 15 B, the suction motor is powered by the power control card. This imposes a current ramp, so you are unlikely to see in-rush current peaks. For this reason, always wait a few seconds for current draw to stabilise before taking the reading.

- 9** Compare the measured value with the values specified in the table below.
- 10** Provided the current draw values lie between the minimum and maximum values specified in the table below, the motor is functioning correctly. You can now remove the ammeter and replace the collection tank.
- 11** If the measured value is correct, but the machine's suction is poor, check the condition of the squeegee flaps. Also check the condition of the suction hose: there must be no holes or cracks in it. Check that the seals at the tank cap and on the suction motor are in good condition.
- 12** If the measurements still do not correspond to those specified, proceed as follows:
 - 12a** Check that battery voltage has not fallen under 24 V by more than 2 V. Larger drops in voltage indicate that the batteries are starting to lose their efficiency. Under such conditions the suction motor will tend to draw more current.
 - 12b** If the current draw of the suction motor exceeds the maximum values specified in the table below, but battery voltage has not fallen significantly, check the motor's carbon brushes.
 - 12c** If the current draw of the suction motor exceeds the maximum values specified in the table below, but the motor's carbon brushes are in good condition, replace the entire suction motor.

<i>Current draw A (amperes)</i>	<i>Min</i>	<i>Max</i>
<i>No load (without collection tank)</i>	<i>13 A</i>	<i>17 A</i>



B1.2 Measuring suction motor current draw on the CT 15 C

- 1 Make sure that a mains power socket suitable for the machine is available (115V / 240V).
- 2 Use a clamp-on ammeter capable of measuring AC current as shown below.



- 3 Move the machine to the tank draining area, and completely empty the collection tank A.
- 4 Make sure that you have enough room around the machine to perform the measurement safely.
- 5 Lift up and remove the collection tank A to access the power cable B of the suction motor.
- 6 Set the clamp-on ammeter to measure amperes (A) of AC current, and clamp it to the power cable B.



- 7 Plug the machine's power cable into the power socket. LED C on the control panel lights to show that the machine is powered on.
- 8 Press the "On-Off" button to switch the machine on, and press the brush button D and the solution dispensing button E to switch off the associated functions.
- 9 Pull in the control lever F on the handle. Read and record the current draw of the suction motor.





On the mains powered CT 15 C, the suction motor is powered via a relay in a box in the power supply compartment. This relay is energised at 12V by microswitches in the machine's handle, operated by levers F. This system ensures maximum protection for the operator against electric shock.

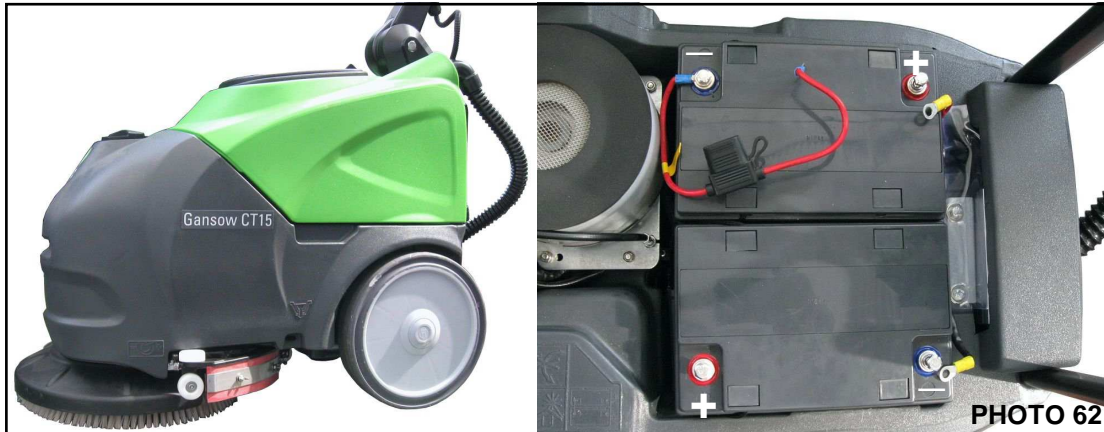
- 10** Compare the measured value with the values specified in the following table.
- 11** Provided the current draw values lie between the minimum and maximum values specified in the table below, the motor is functioning correctly. You can now remove the ammeter and replace the collection tank.
- 12** If the measured value is correct, but the machine's suction is poor, check the condition of the squeegee flaps. Also check the condition of the suction hose: there must be no holes or cracks in it. Check that the seals at the tank cap and on the suction motor are in good condition.
- 13** If the measurements still do not correspond to those specified, proceed as follows.
- 13a** Check that the mains voltage is within 10% of its rated value (220 V for Italy). Also check the condition of the mains power cable.
- 13b** If the current draw of the suction motor exceeds the maximum values specified in the table below, but mains voltage is within tolerance, check the motor's carbon brushes.
- 13c** If the current draw of the suction motor exceeds the maximum values specified in the table below, but the motor's carbon brushes are in good condition, replace the entire suction motor.

Current draw A (amperes)	Min	Max
<i>No load (without collection tank)</i>	1.7 A	2 A

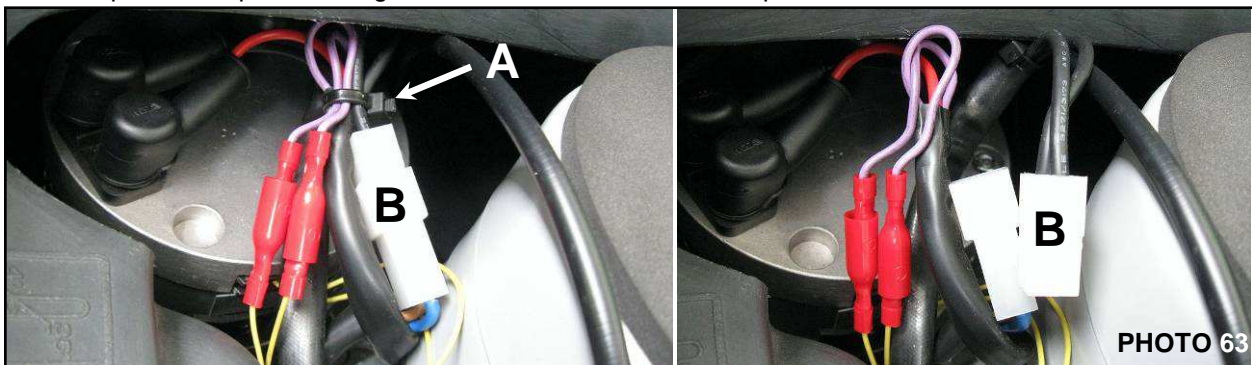


B1.3 Removing the suction motor from the CT 15 B *Disassembly*

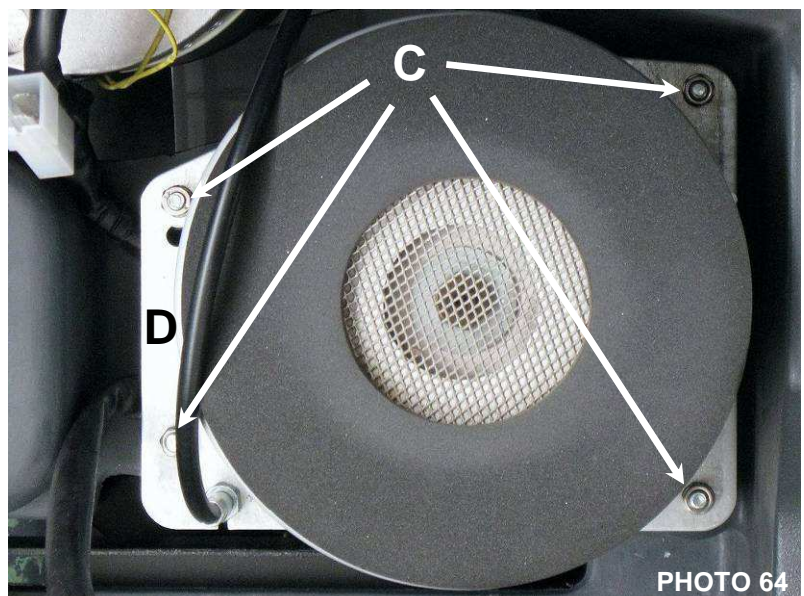
- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 Remove the collection tank from the machine.
- 4 Disconnect and remove the batteries from the battery compartment.



- 5 Lower the squeegee by means of its operating lever.
- 6 Cut the plastic strap **A** securing the cables, and disconnect the plastic connector **B** to the suction motor.



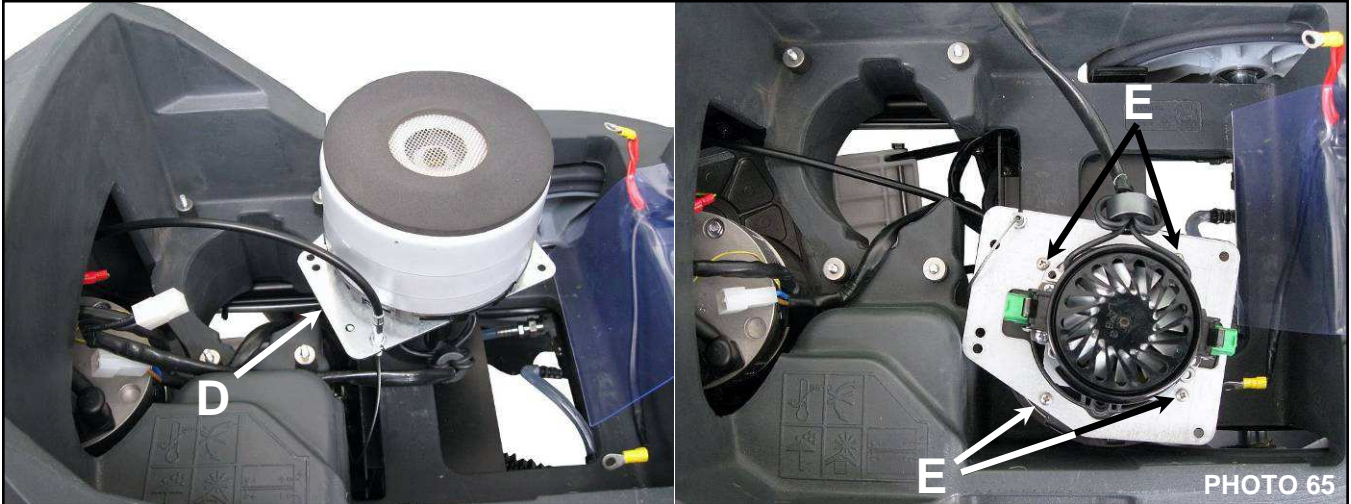
- 7 Free the power connector **B** from the other cables.
- 8 Identify the four nuts **C** securing the bracket **D** of the suction motor to the solution tank.
- 9 Remove the four nuts **C**, taking care not to lose the lock washers from underneath them.





10 Lift the motor, complete with its bracket **D**. Disengage it from the anti-vibration mountings, and turn it through 180° (upside down).

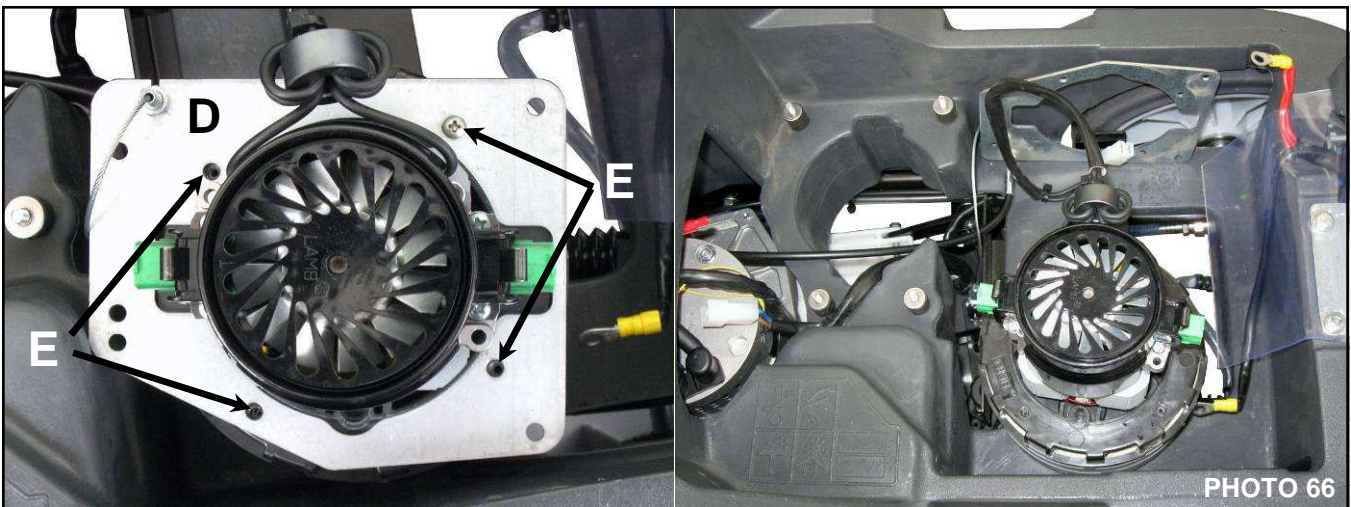
11 Identify the four self-tapping screws **E** securing the bracket **D** to the suction motor.



12 Remove the four self-tapping screws **E** securing the bracket **D** to the suction motor.

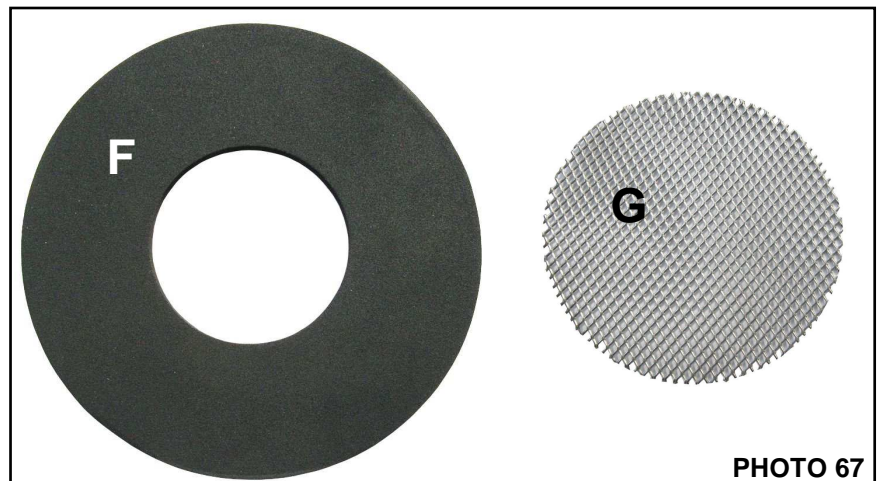
13 Remove the bracket **D** from the suction motor.

14 Replace the suction motor with a new one.



Reassembly

- 1** When fitting a new suction motor, also order and fit a new adhesive seal **F** and a new protective mesh **G**.
- 2** To fit the new suction motor, repeat the steps for disassembly in reverse order.
- 3** Take care not to over-tighten the screws **E**.

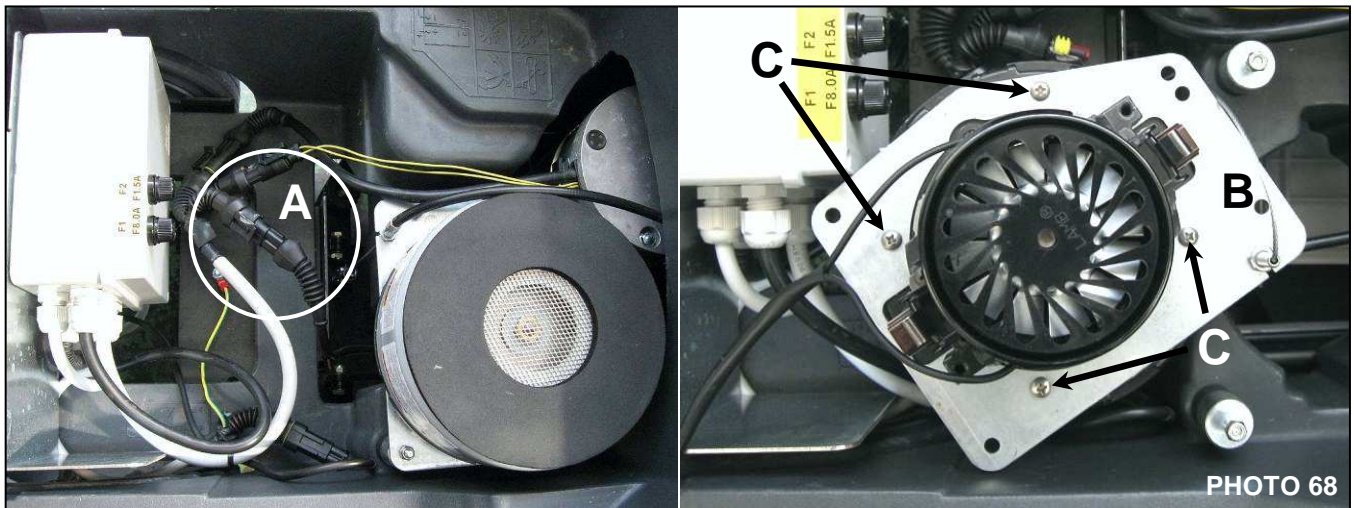




B1.4 Removing the suction motor from the CT 15 C

Disassembly

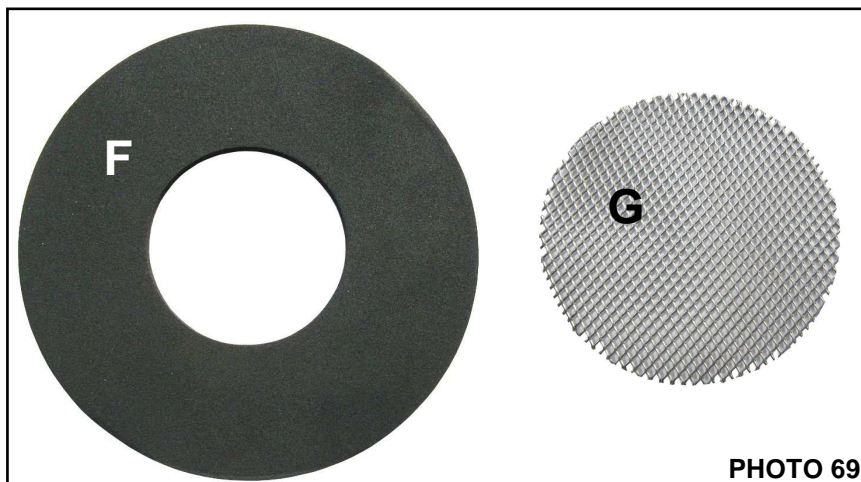
- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 **Make sure that the machine is disconnected from the electricity supply.**
- 4 Remove the collection tank from the machine.
- 5 Follow the procedure for removing the suction motor from "B" type battery powered machines. The only differences are that there is no need to remove the batteries, and that the suction motor connections are of a different type.
- 6 Locate and disconnect the waterproof electrical connector **A** for the power cable.
- 7 Lift the motor complete with its bracket **B**. Disengage it from the anti-vibration mountings, and turn it through 180° (upside down).
- 8 Identify the four self-tapping screws **C** securing the bracket **B** to the suction motor.
- 9 Remove the screws **C** and lift off the bracket **B** off the motor.
- 10 Replace the suction motor with a new one.



- 11 Follow the same procedure and precautions as for the "B" type battery powered version. Take care not to over-tighten the screws **C**.

Reassembly

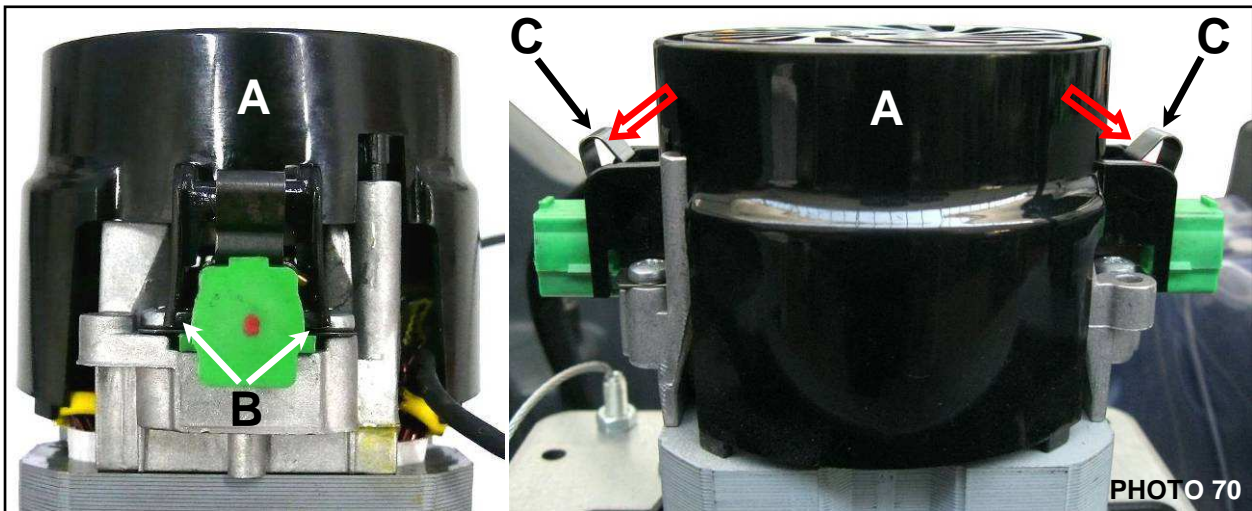
- 1 **When fitting a new suction motor, also order and fit a new adhesive seal F and a new protective mesh G.**
- 2 To fit the new suction motor, repeat the steps for disassembly in reverse order.



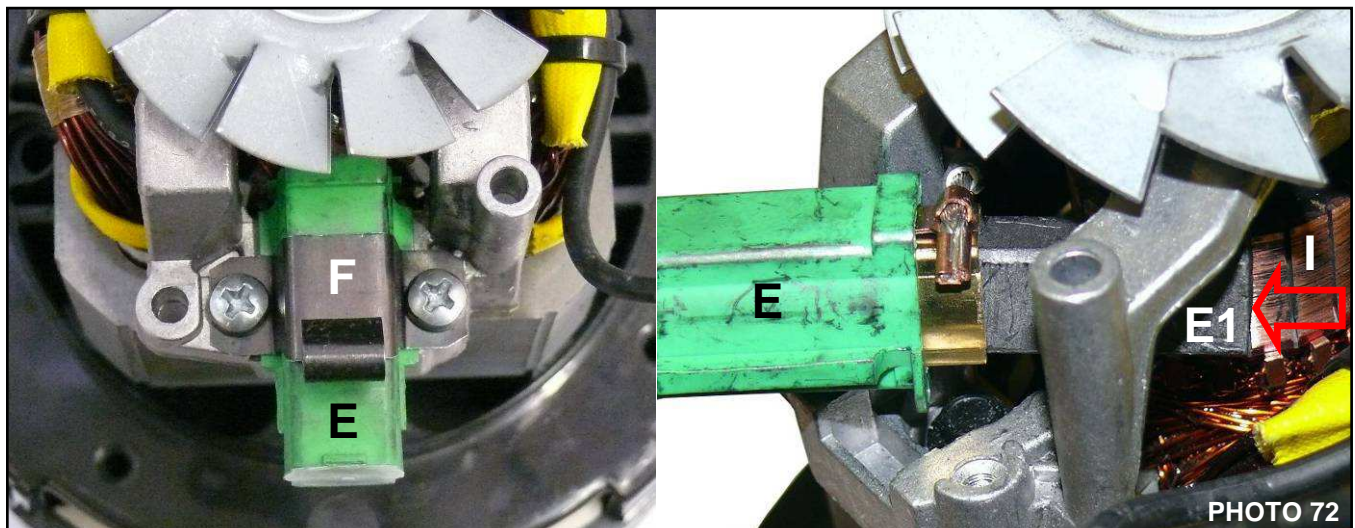
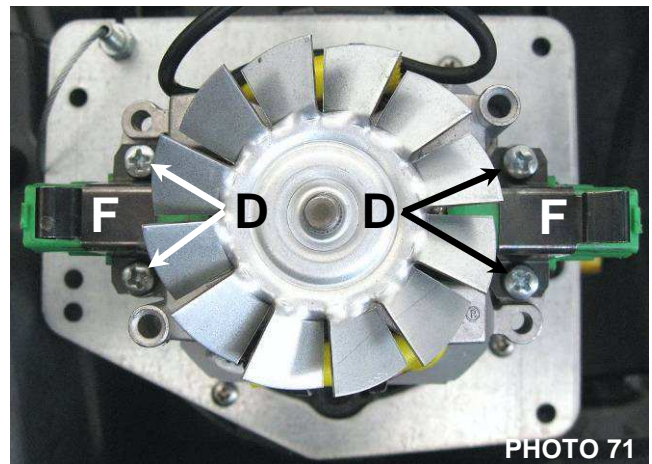


B1.5 Replacing the suction motor's carbon brushes on the CT15B Disassembly

- 1 Follow the procedure for removing the suction motor, given in section B1.3, as far as step 10.
- 2 With the suction motor turned upside down, remove the cover **A** from the cooling fan.
- 3 Gently press outward the two clips **B** and **C**, and lift the cover **A** off the cooling fan. Release one clip at a time.

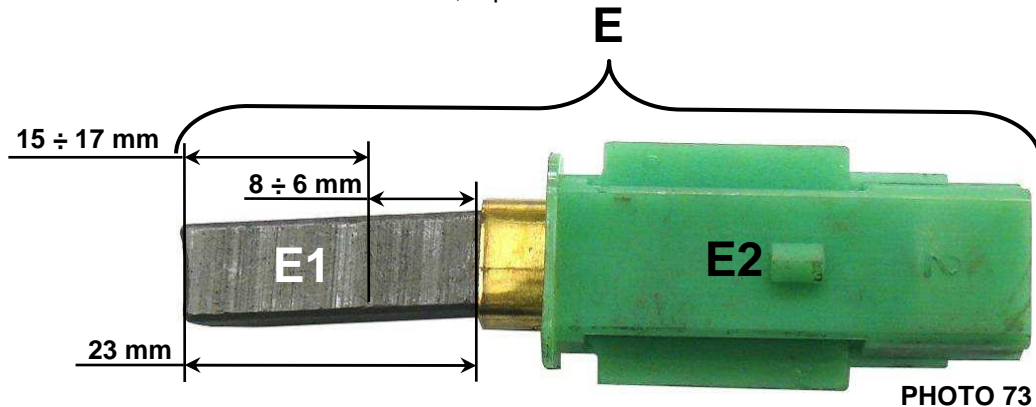


- 4 Remove the screws **D** (two per brush) securing the brackets **F** over the carbon brushes **E**.
- 5 Remove the carbon brushes **E** from the brackets **F**, lifting them gently and pulling them out of their seats. If you encounter any resistance, push the dark part **E1** in with a screwdriver.





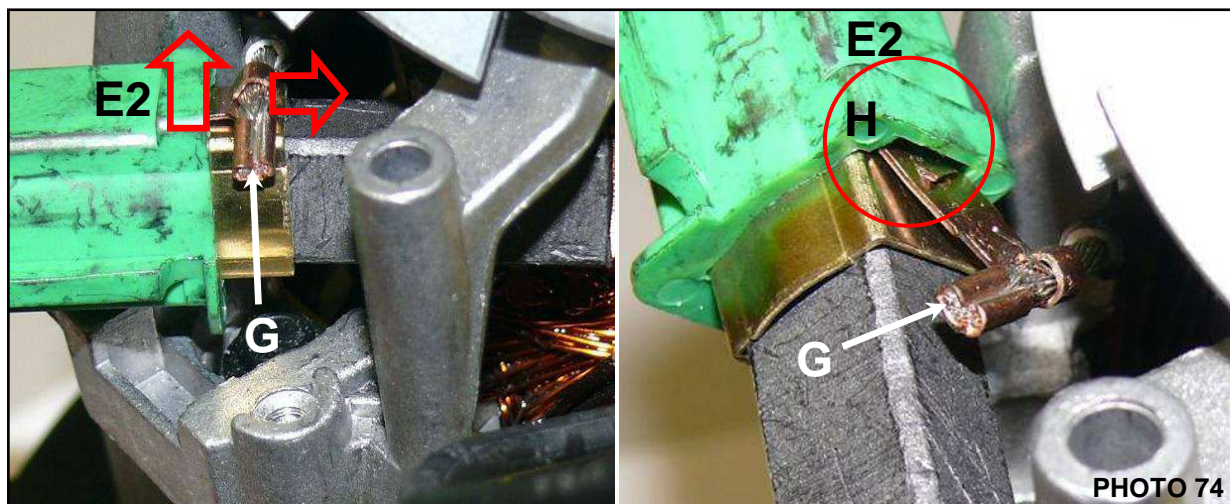
- 6 Check the carbon brushes for wear and for signs of burning on the surface that comes into sliding contact with the rotor. Check also that the carbon brushes are free to slide in their seats and that the springs push with sufficient force for their entire stroke.
- 7 Provided the carbon brushes satisfy the above conditions, measure the dark (carbon/graphite) part **E1**.
- 8 The correct length of the carbon brushes is between maximum 23 mm and minimum 8 to 6 mm. If the carbon brushes are shorter than 8 to 6 mm, replace them.



Always replace both carbon brushes together.

Replacement

- 9 Proceed as follows to replace the carbon brushes.
- 10 Identify the cable **G** connecting the carbon brush to the motor's electrical system.
- 11 Use a screwdriver to gently lift the plastic part **E2** of the carbon brush holder while simultaneously pulling out the cable **G** and terminal **H**.



- 12 Disconnect the old brush from the terminal **H** by opening the terminal clamp.
- 13 Fit the new carbon brushes. Push the terminals **H** into their seats and check that they make firm contact.
- 14 Connect the terminals of the two carbon brushes to the cables **G**, and reassemble the suction motor.

Reassembly

- 1 To fit the new carbon brushes, repeat the steps for disassembly in reverse.
- 2 Check the rotor **I** of the suction motor for wear before fitting new carbon brushes.
- 3 Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and to the area of the rotor **I** with which the carbon brushes **E** come into sliding contact.



B1.6 Replacing the suction motor's carbon brushes on the CT15C Disassembly

- 1 Follow the procedure for removing the suction motor, given in section B1.4, as far as step 7.
- 2 With the suction motor turned upside down, remove the cover **A** from the cooling fan, following the instructions given in section B1.5 for battery powered machines.
- 3 Remove the screws **B** (two per brush) securing the brackets **D** over the carbon brushes **C**.

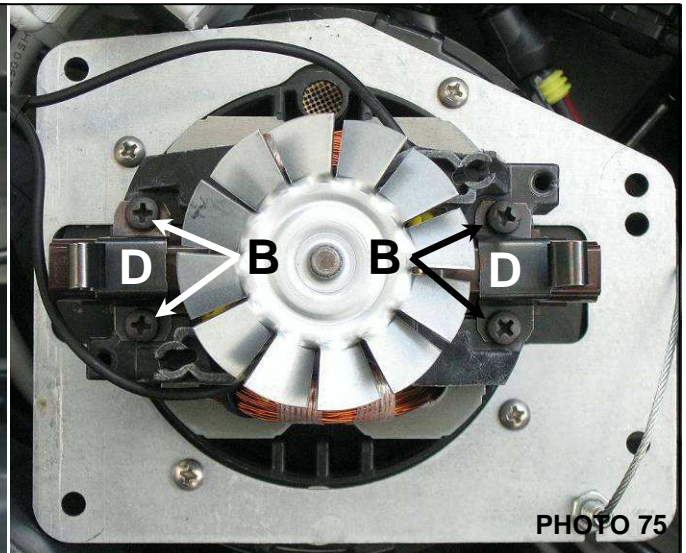


PHOTO 75

- 4 Remove the carbon brushes **C** from the brackets **D**, lifting them gently and pulling them out of their seats. If you encounter any resistance, push the dark part **C1** in with a screwdriver.
- 5 Check the carbon brushes for wear and for signs of burning on the surface that comes into sliding contact with the rotor. Check also that the carbon brushes are free to slide in their seats and that the springs push with sufficient force for their entire stroke.
- 6 Check the rotor **E** of the suction motor for wear.
- 7 Provided the carbon brushes satisfy the above conditions, measure the dark (carbon/graphite) part **C1**.
- 8 The correct length of the carbon brushes between maximum 23 mm and minimum 8 to 6 mm, (if the carbon brushes are shorter than 8 to 6 mm), replace them.

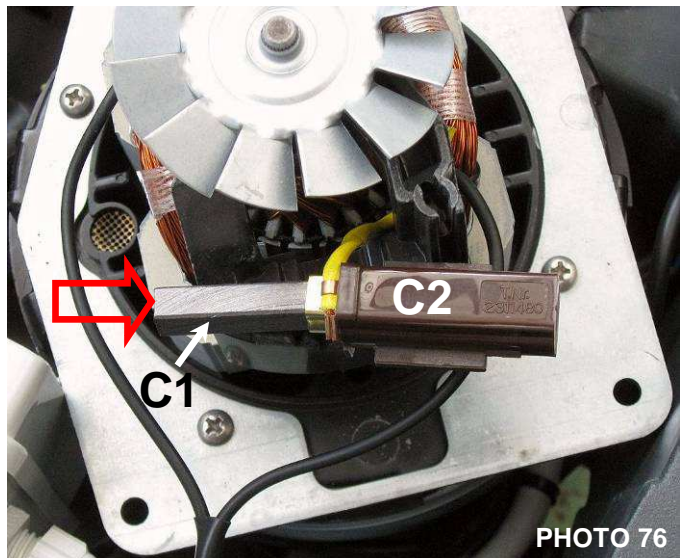


PHOTO 76

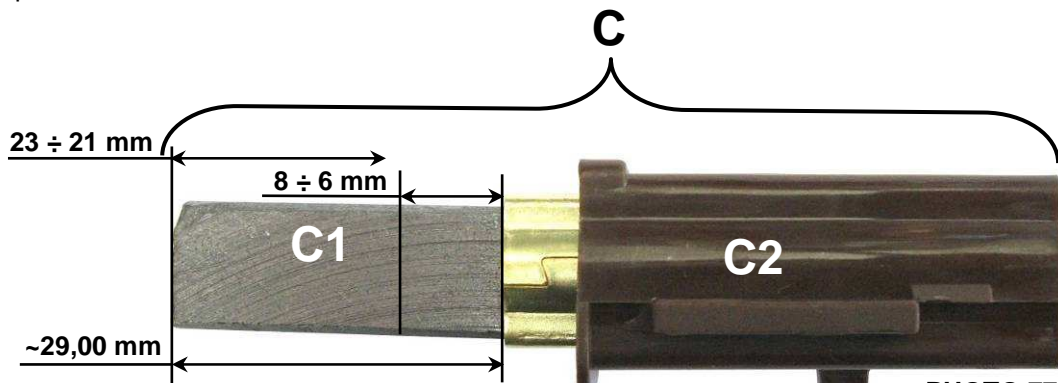


PHOTO 77

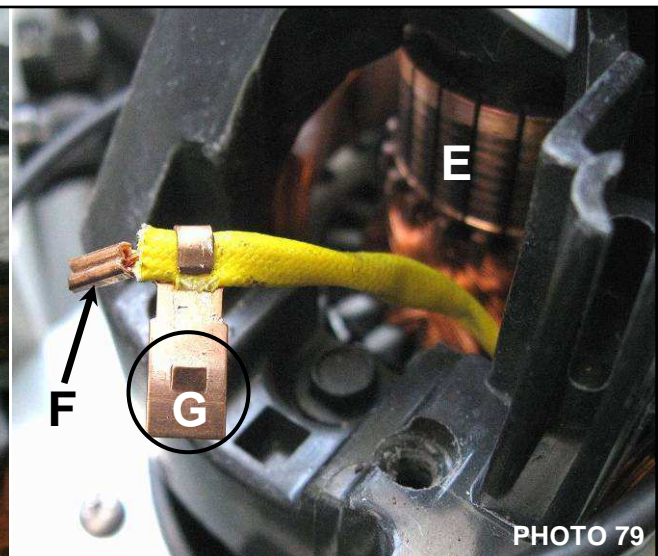
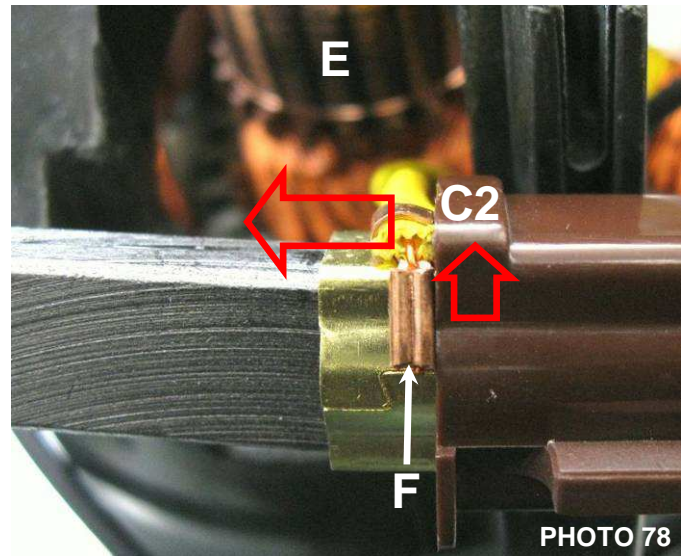


Replacement



Always replace both carbon brushes together.

- 9 Identify the cable **F** connecting the carbon brush to the motor's electrical system.
- 10 Use a screwdriver to disconnect the cable **F** from the carbon brush **C**. Gently lift the plastic part **C2** of the carbon brush holder while gently pulling out the cable **F** and terminal **G**.
- 11 Disconnect the old brush from the terminal **G** by opening the terminal clamp.



- 12 Fit the new carbon brushes. Push the terminals **G** into their seats and check that they make firm contact.
- 13 Connect the terminals of the two carbon brushes to the cables **F**, and reassemble the suction motor.

Reassembly

- 1 To fit the new carbon brushes, repeat the steps for disassembly in reverse.
- 2 Check the rotor **E** of the suction motor for wear before fitting new carbon brushes.
- 3 Blow the inside of the motor clean with a jet of compressed air, paying particular attention to the area around the carbon brushes and to the area of the rotor **E** with which the carbon brushes **C** come into sliding contact.



B2 SQUEEGEE UNIT

- i** *Unlike those of other scrubber driers, the squeegee unit on the CT 15 is mounted just behind the brush, and covers just over a third of its circumference. The squeegee mounting pivots directly under the brush motor so that the squeegee turns on the same axis as the brush, giving a better drying action around curves.*

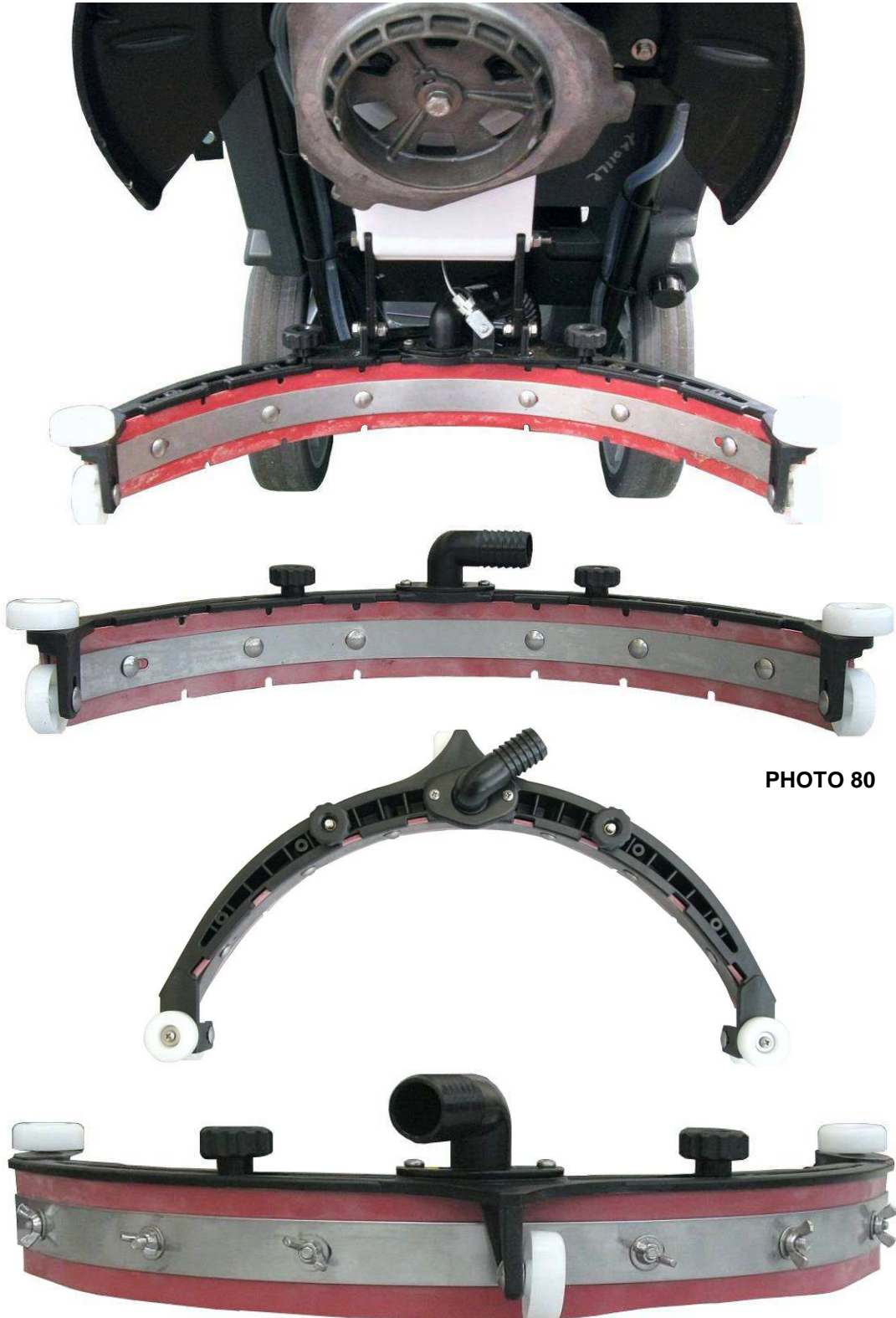


PHOTO 80



B2.1 Adjusting the squeegee

- 1 Prepare the machine for use and go to a flat, dry area of floor.
- 2 Make sure that the squeegee flaps are in good condition and that the tops of the flaps are firmly seated in the squeegee body before beginning adjustment.
- 3 Clean a few metres of floor under normal working conditions to ensure that the squeegee flaps are in their proper drying position.
- 4 Make sure that the rear flap rests evenly on the floor.
- 5 The figure below illustrates the ideal working condition.



- 6 If the flaps rest evenly on the floor, but apply very little pressure (shown by the flaps lying almost perpendicular to the floor), increase flap pressure by adjusting the three wheels on the squeegee unit.



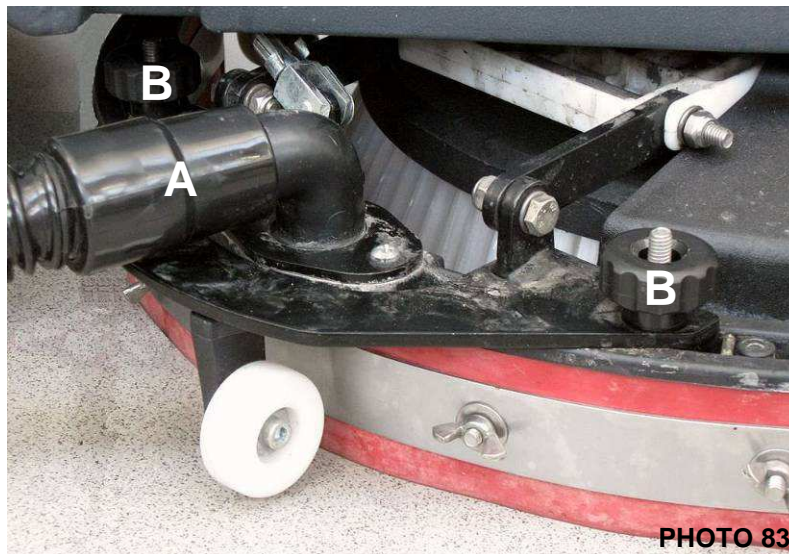
- 7 Raise the wheels to increase flap pressure and increase the angle of flap tilt. Lower the wheels to reduce flap pressure.
- 8 Under normal conditions (i.e. with evenly worn flaps) all three wheels should be adjusted by the same amount.



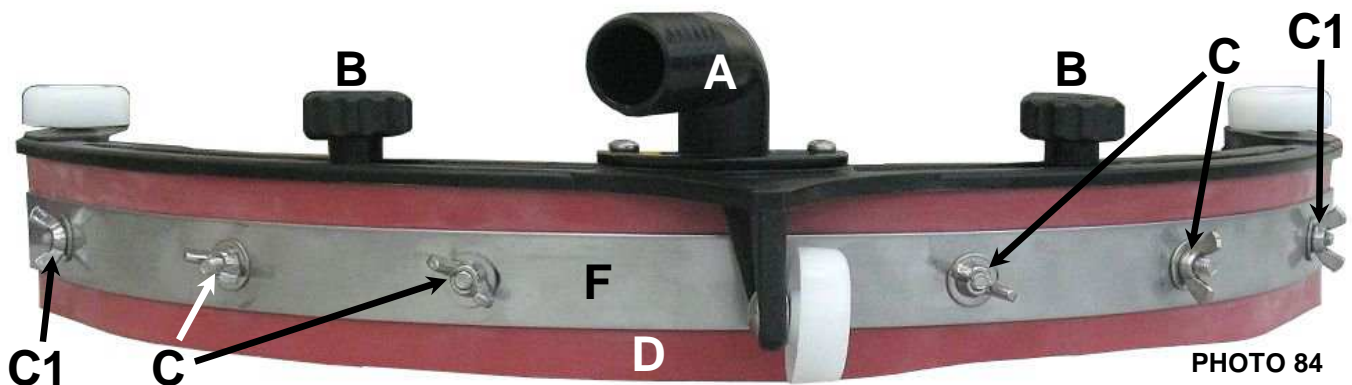
B2.2 Replacing the squeegee flaps

Disassembly

- 1 Lower the squeegee unit to working position to facilitate its removal.
- 2 Remove the suction hose **A** from the union on the squeegee unit.
- 3 Unscrew the two plastic knobs **B** securing the squeegee unit to its mounting.
- 4 Remove the squeegee unit from the machine and take it to the work bench.



- 5 Unscrew the six butterfly nuts **C** and **C1**, and remove the bolts holding the flaps **D** and **E** and the flap retainers **F** and **G**, taking care not to lose the washers under the butterfly nuts.
- 6 Remove the flap retainers **F** and **G** and the flaps **D** and **E** from the squeegee unit.





7 Clean the flap seats in the squeegee unit before fitting new flaps.

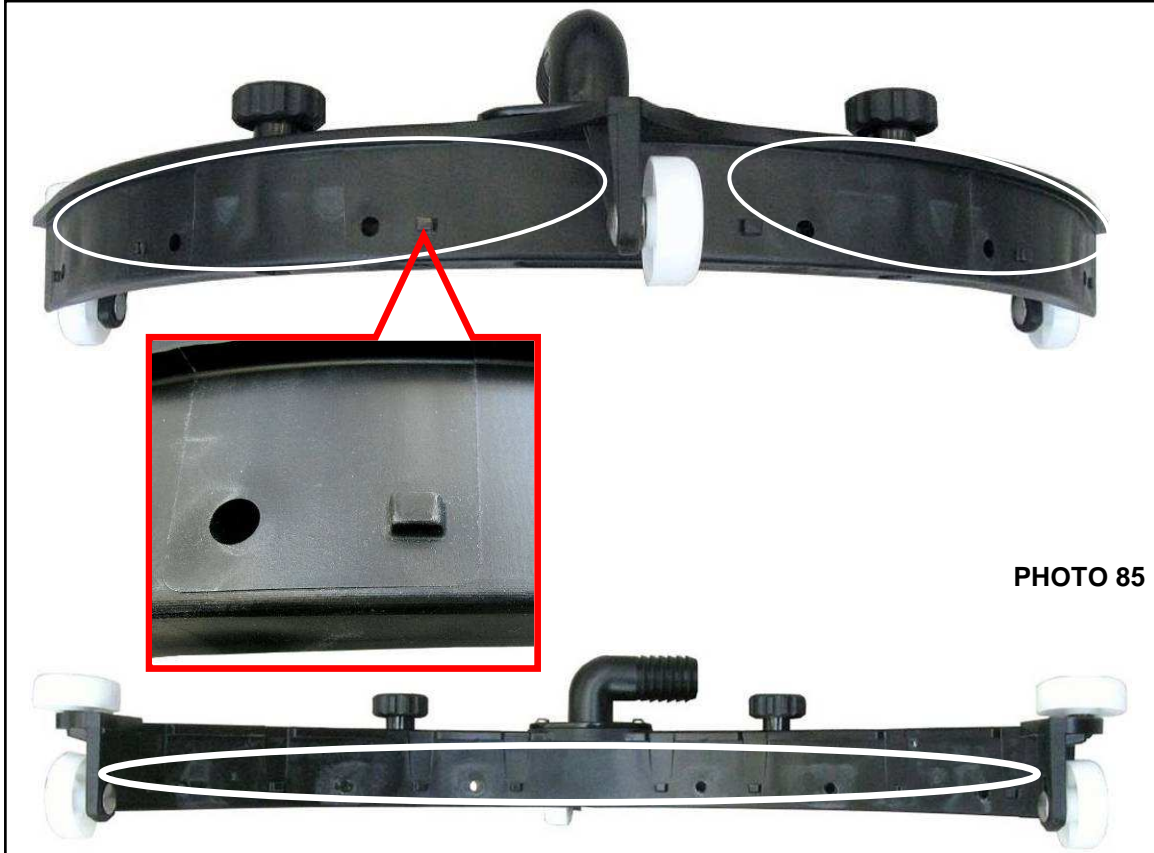


PHOTO 85

8 Identify the front flap E and the rear flap D, and fit them to the squeegee, aligning them with the raised plastic references.

i The front flap differs from the rear flap as it has notches in both long edges to permit some water to pass through during drying.

i Standard flaps (front and rear) are made from latex rubber and are 2 mm thick. The flaps are perfectly symmetrical in profile and can be reversed to permit use of all four corners. This extends their working life before replacement becomes necessary.

i Squeegee flaps should be rotated every 30 operating hours, approximately.

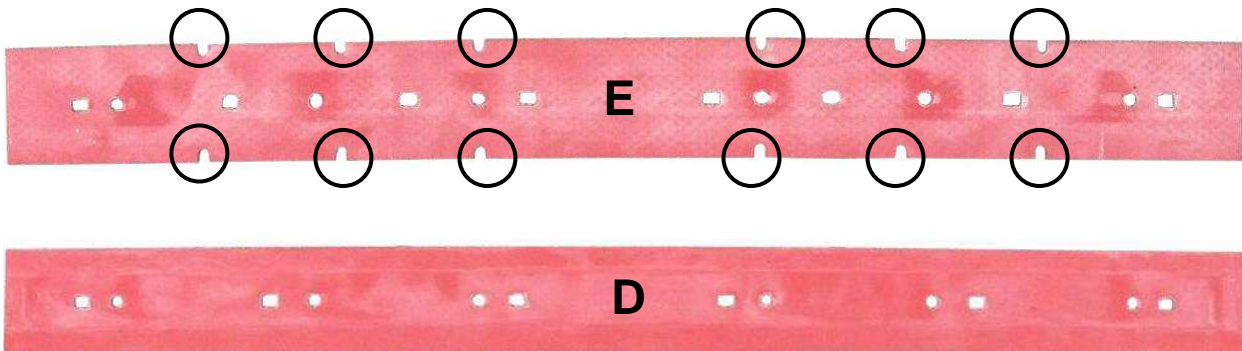


PHOTO 86

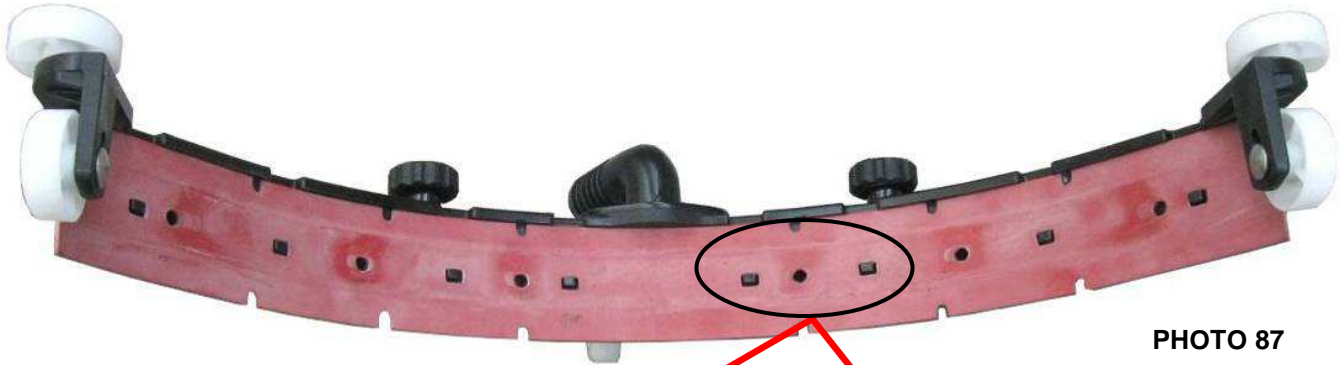


PHOTO 87



9 Position the flap retainers **G** and **F**, and fit the bolts **C**.

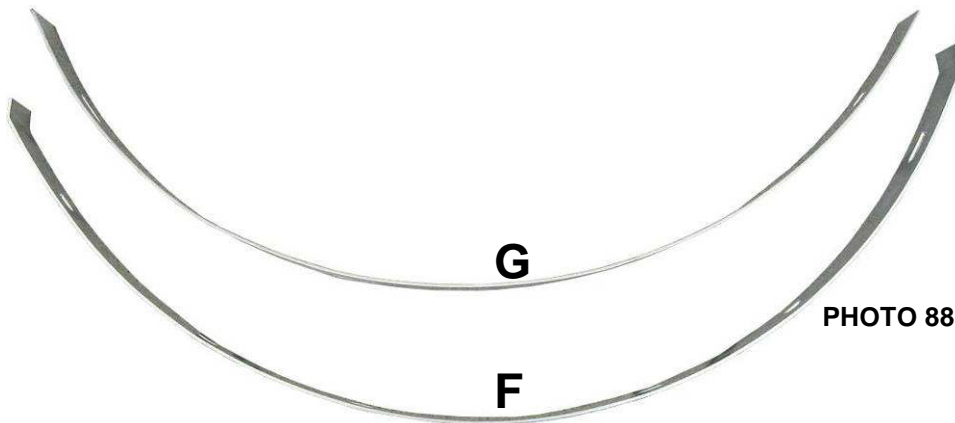


PHOTO 88

10 Fit the two short bolts **C1** in the outside holes of the squeegee unit (where thickness is reduced).

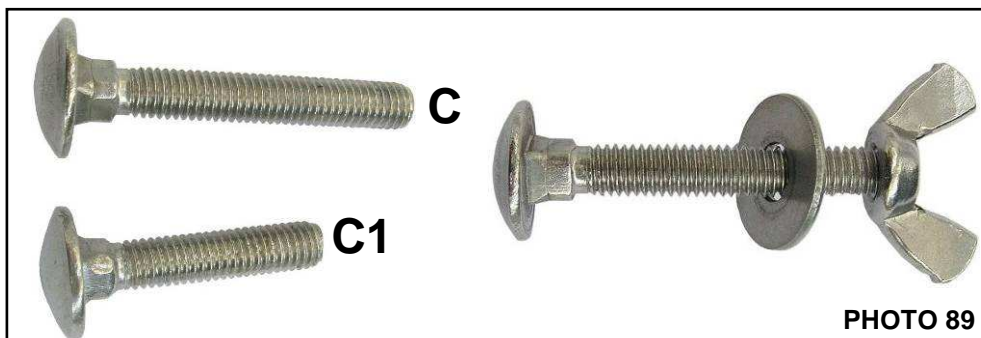
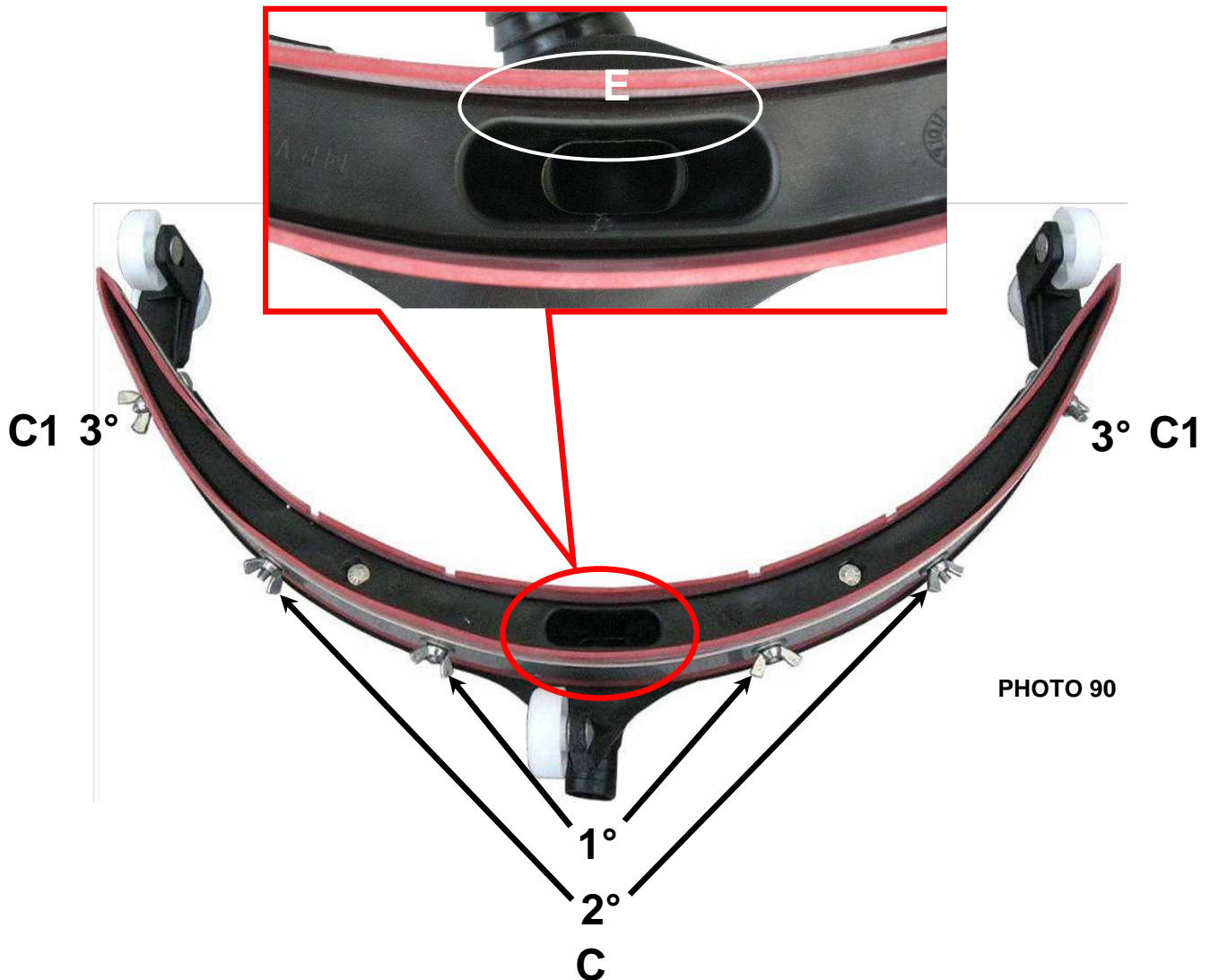


PHOTO 89



- 11 Position the flaps **E** and **D** and flap retainers **G** and **F** on the squeegee unit and fit the bolts **C** and **C1** to hold them in place. Leave the butterfly nuts slack until the flaps are properly seated in the squeegee unit.
- 12 Gradually tighten the butterfly nuts **C**, starting from the two nearest to the suction hose union. Make sure that the front flap **E** adheres perfectly to the front face of the squeegee unit.



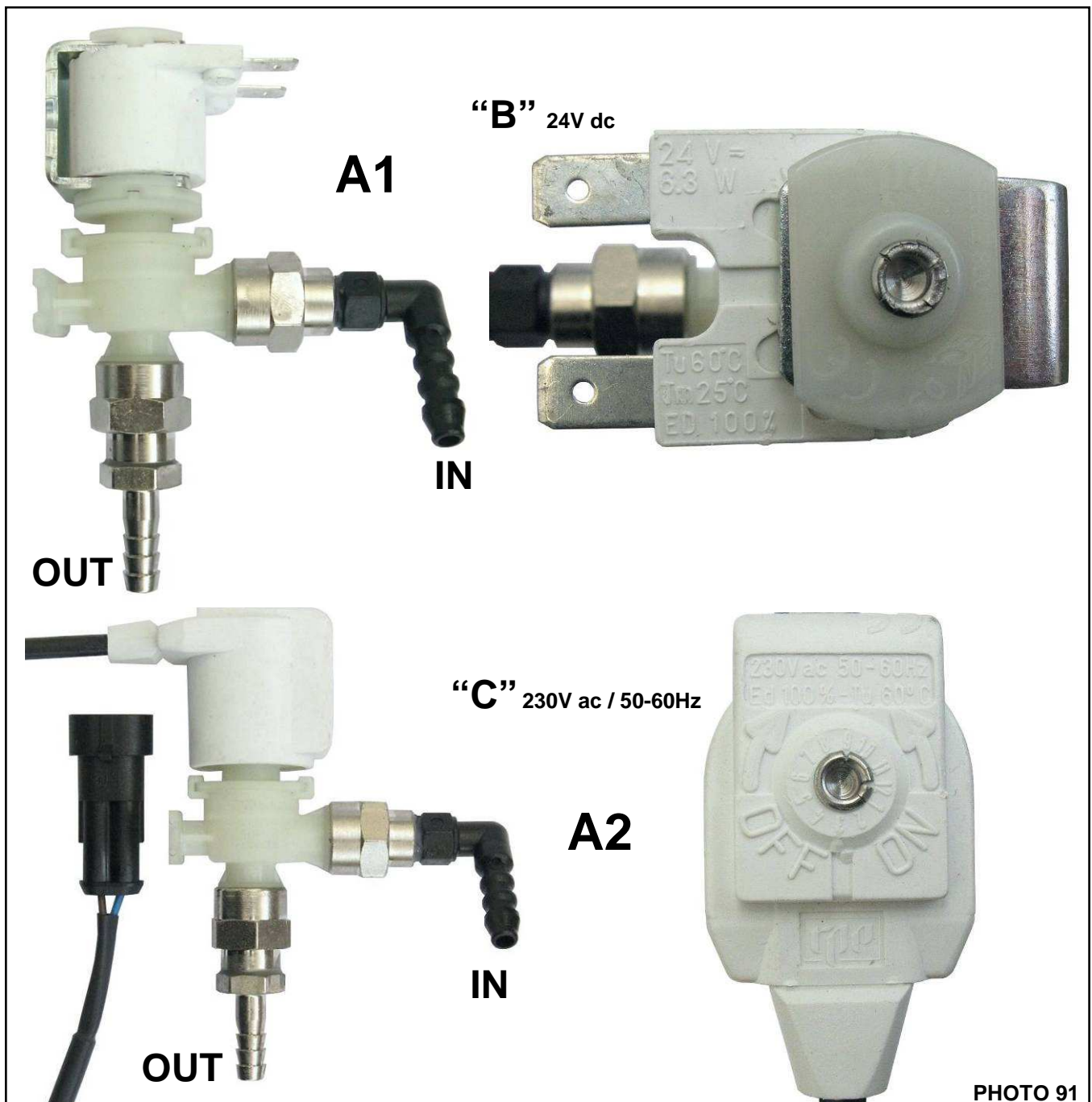
Reassembly

- 1 To fit new squeegee flaps, repeat the steps for disassembly in reverse order.
- 2 **Thoroughly clean the flap contact surfaces on the squeegee unit before fitting new flaps.**
- 3 Do not over-tighten the butterfly nuts **C** - **C1**, as this could cause the flaps to deform, reducing their drying efficiency.



B3 CLEANING FILTERS AND HOSES, CHECKING THE SOLENOID VALVE, CHECKING THE FLOAT

To ensure correct functioning, it is essential for all machine components to be fully efficient in addition to the brush. It is therefore important to verify the correct functioning of the solenoid valve and its cleanliness. The hose from the solution dispensing cock to the dispenser on the brush head must be kept clean. The float system must also be kept in good condition and fully functional. The solenoid valve (A1) on the "B" battery version and the solenoid valve (A2) on the "C" mains version differ not only for the type of power supply but for the type of connection to the machine's electrical system.





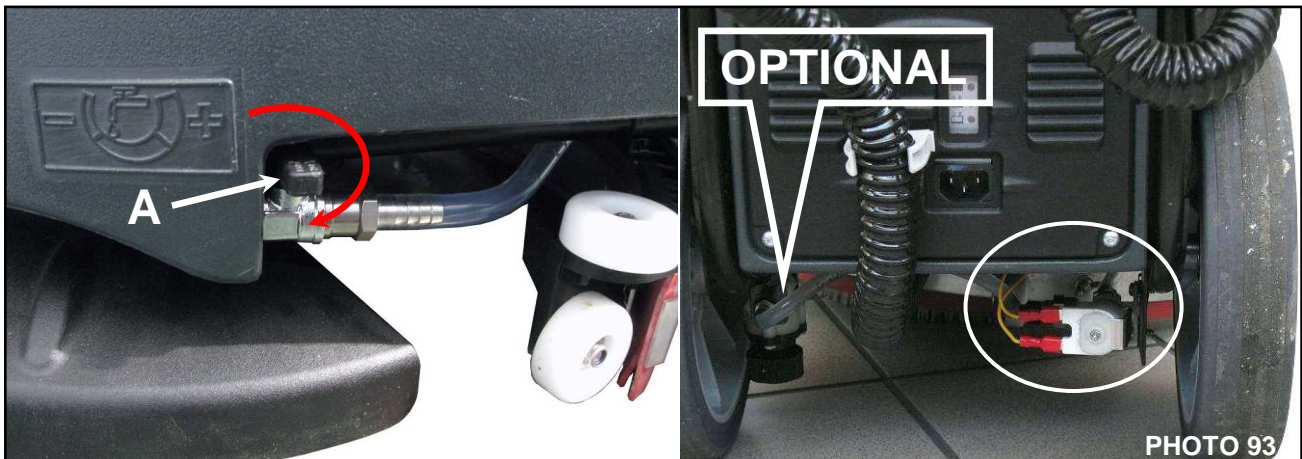
B3.1 Testing the solenoid valve

“B” type battery version

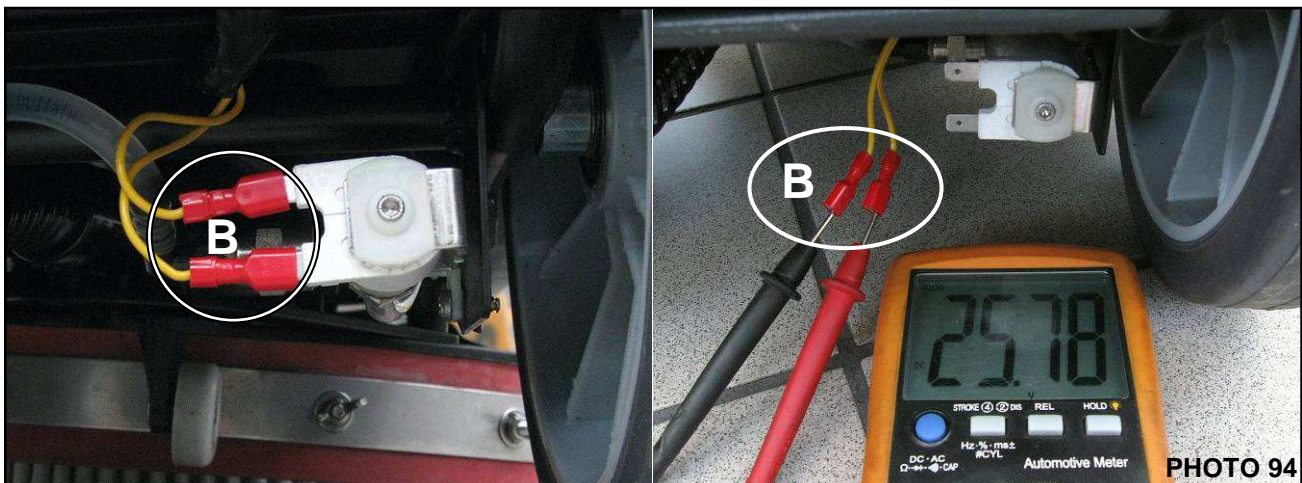
- 1 Make sure the batteries on the machine are fully charged (24V ± 1V).
- 2 Use a digital multi-meter able to measure DC voltages of at least 50 V.
- 3 Make sure that the button on the control panel operates the solution dispensing solenoid valve (LED lit).



- 4 Take the machine to a flat, dry floor area.
- 5 Close the solution dispensing cock **A** by turning it clockwise.
- 6 Identify the solution dispensing solenoid valve at the bottom rear of the machine, under the battery charger.



- 7 Switch off the machine and disconnect the solenoid valve from the electrical system by disconnecting the two fast-ons **B**. Connect the probes of the digital multimeter to the two fast-ons.





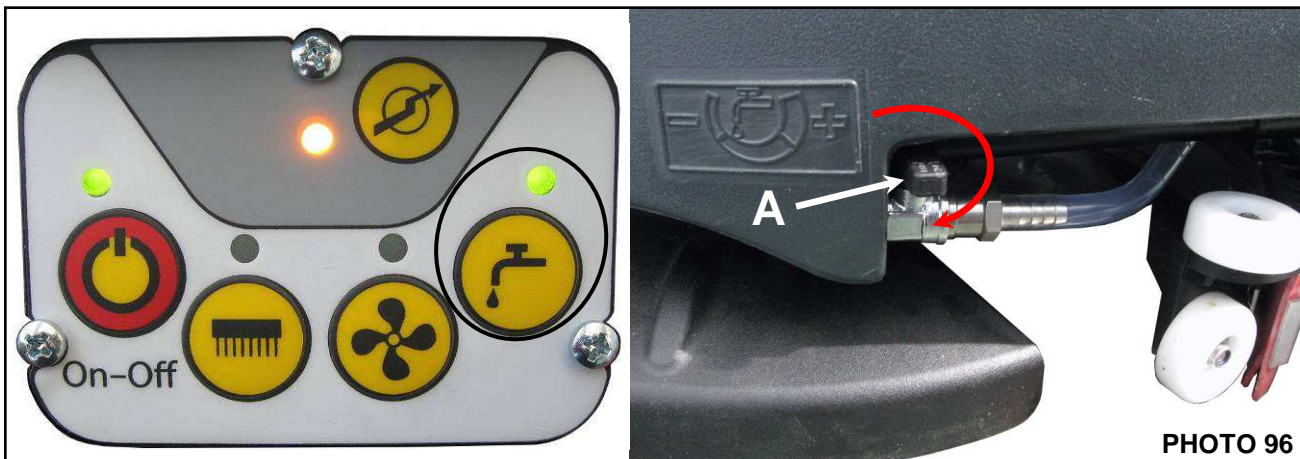
- 8 Switch the machine back on and press the solution dispensing button.
- 9 Pull the lever **C** on the handle and measure the voltage (V) between the two fast-ons **B**.



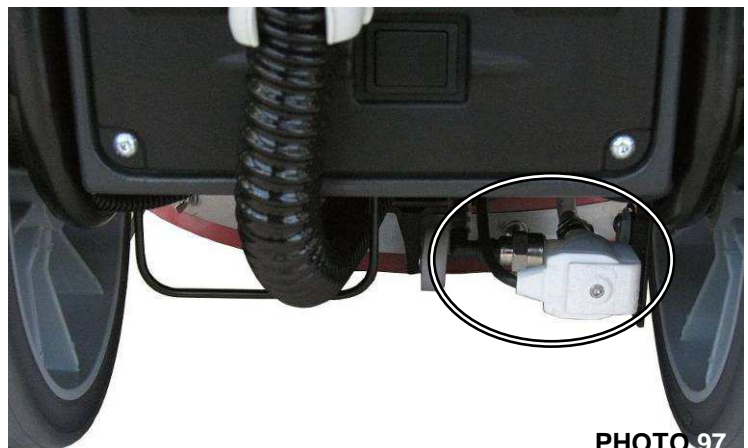
- 10 Provided measured voltage is between 25 and 21.4 V, the cabling and the electronic control system are functioning correctly. Re-connect the fast-ons to the solenoid valve. You should hear a click, showing that the solenoid valve is working. If you hear no noise, check the functioning of the solenoid valve as instructed in section B3.2, and replace it if necessary.

“C” type mains version

- 11 Make sure that a mains power socket suitable for the machine is available (115V / 230V).
- 12 Make sure that the button on the control panel operates the solution dispensing solenoid valve (LED lit).
- 13 Take the machine to a flat, dry floor area.
- 14 Close the solution dispensing cock **A** by turning it clockwise.



- 15 Identify the solution dispensing solenoid valve at the bottom rear of the machine, under the tank.
- 16 On mains powered machines, the solenoid valve features a waterproof connection. The connector is located under the collection tank.





- 17 Lift up and remove the collection tank and disconnect the connector D to the solenoid valve.

WARNING! RISK OF ELECTRIC SHOCK



Since the machine is powered by the high voltage mains supply, it is not advisable to use a multi-meter to test functioning. The most practical, and by far the safest way to test the efficiency of the electronic control system is to test it with a new solenoid valve.



PHOTO 98

- 18 Connect up a new, fully functional solenoid valve to test the machine's electronic control system.
19 Pull the lever E on the handle. You should hear a click, showing that the solenoid valve is working.

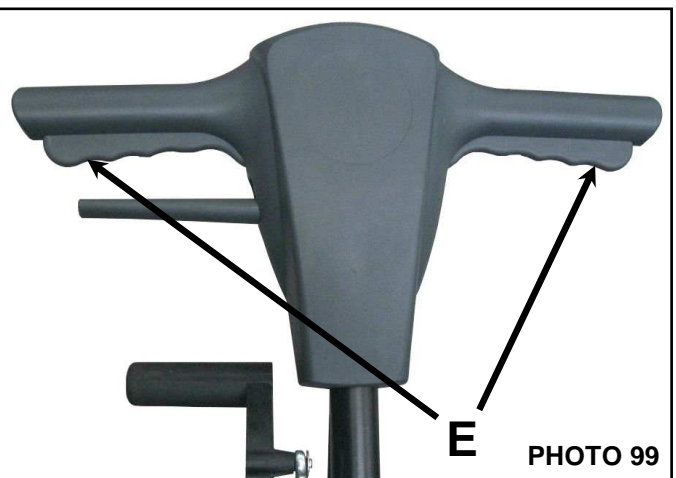
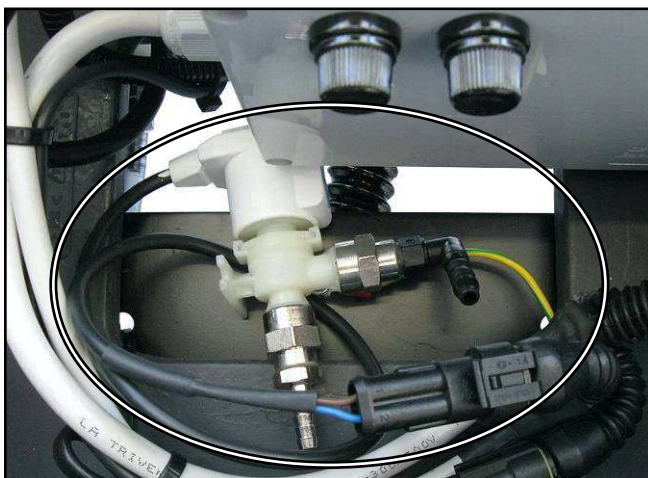


PHOTO 99

- 20 If the new solenoid valve produces an audible click, any problems are due to the old solenoid valve. Check its functioning as instructed in section B3.2, or replace it.



B3.2 Testing and replacing the solenoid valve on “B” type machines

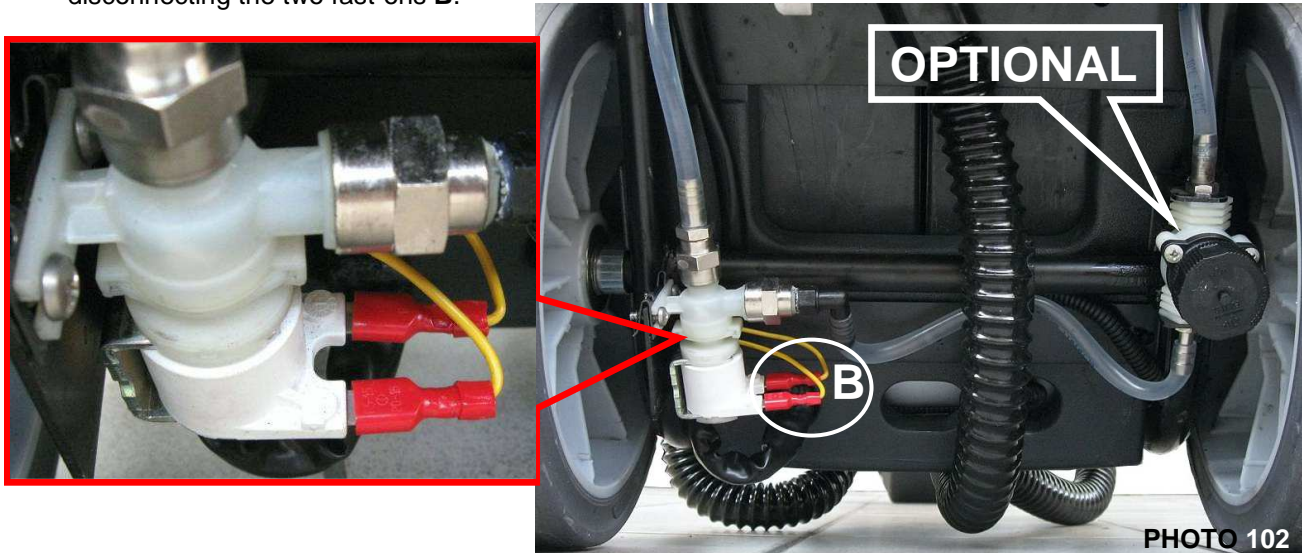
- 1 Make sure the batteries on the machine are fully charged ($24V \pm 1V$).
- 2 Use a digital multi-meter able to measure DC voltages of at least 50 V.
- 3 Make sure that the button on the control panel operates the dispensing solenoid valve (LED lit).



- 4 Move the machine to the tank draining area, and empty the solution and collection tanks.
- 5 Take the machine to a flat, dry floor area.
- 6 Close the solution dispensing cock **A** by turning it clockwise. Tilt the handle back through about 60° .
- 7 Tip the machine rearwards, until the handle rests on the floor.



- 8 Make sure the machine is switched off. Disconnect the solenoid valve from the electrical system by disconnecting the two fast-ons **B**.





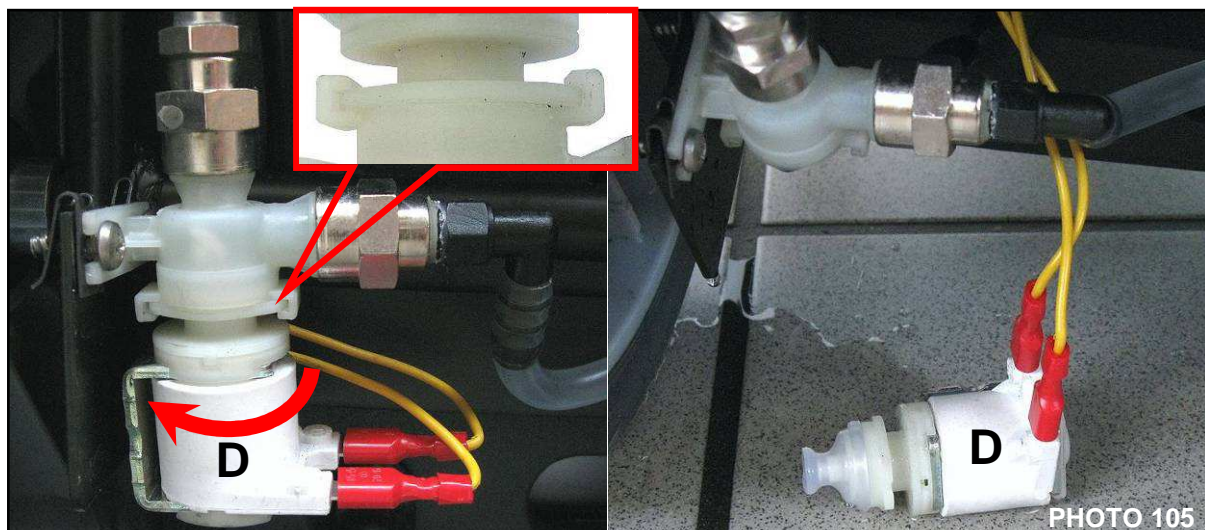
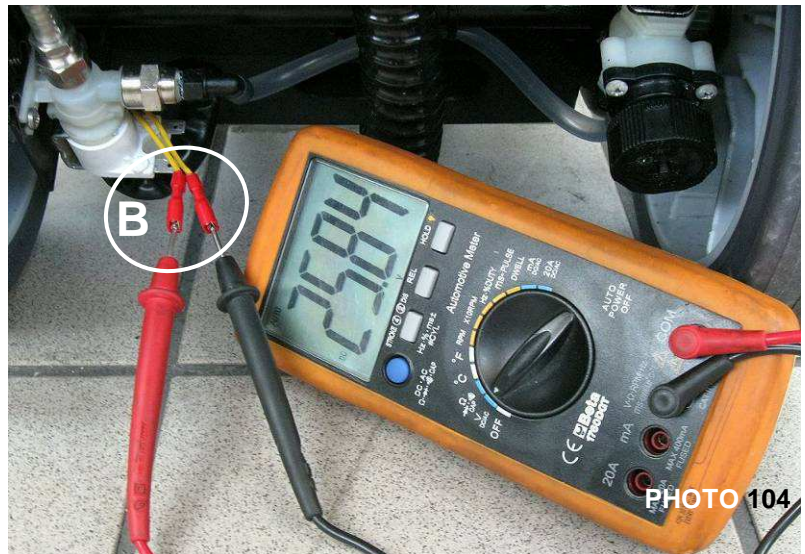
- 9 Connect the probes of the digital multimeter to the two fast-ons **B**.
- 10 Switch the machine back on and press the solution dispensing button.
- 11 Pull the lever **C** on the handle and measure the voltage (V) between the two fast-ons **B**.

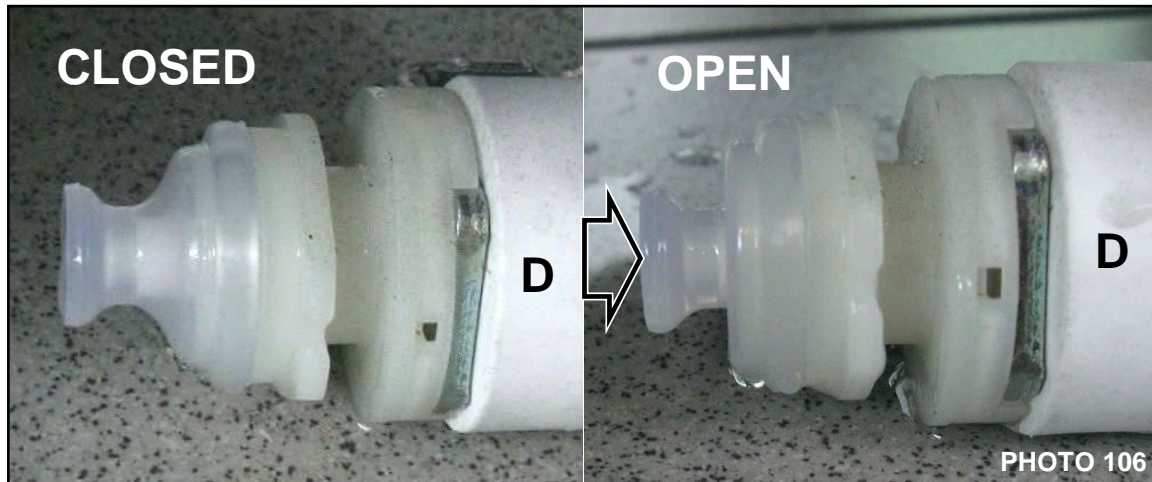


- 12 Read the voltage off the digital multi-meter.

12a Provided measured voltage is between 25 and 21.4 V, the cabling and the electronic control system are functioning correctly. Re-connect the fast-ons to the solenoid valve. You should hear a click, showing that the solenoid valve is working. If you hear no noise, check the functioning of the solenoid valve **D**, and replace it if necessary.

12b To check the functioning of the valve's solenoid **D**, remove it from the valve body and check whether the rubber membrane moves. If the rubber membrane does not move when the solenoid is energised, replace the entire solenoid valve.



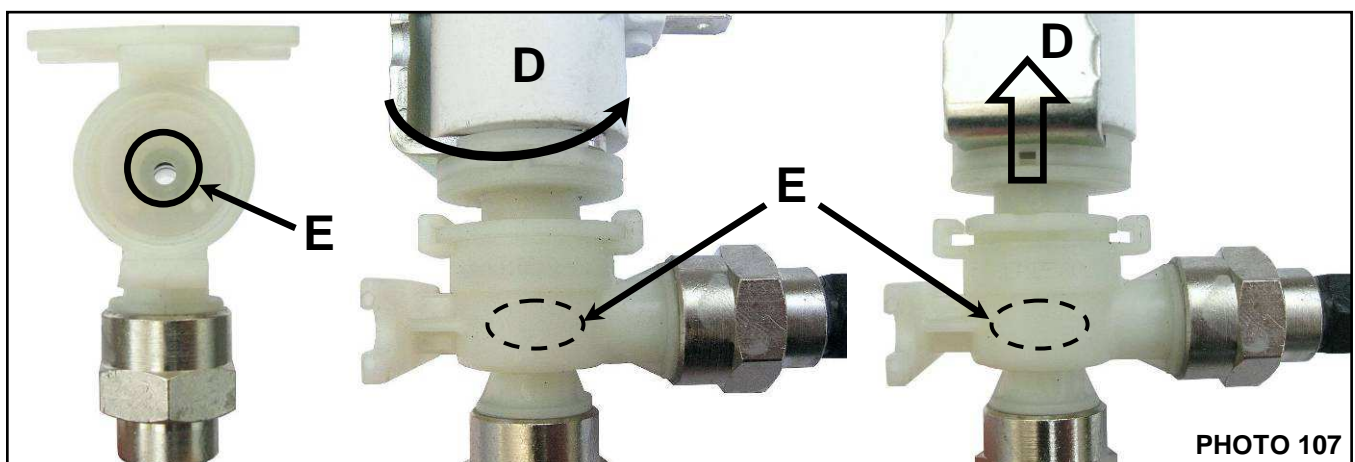


12c If, with fully charged batteries, voltage across the fast-ons is between 21 and 1 V, check the connections at the power control card and check the continuity of the wires to the solenoid valve. If the connections and the wiring are efficient, replace the power control card.

12d If, with fully charged batteries, and with the dispensing LED on the control panel lit, there is no voltage across the fast-ons, check the continuity of the wiring between the two electronic control cards. If there are no continuity problems in the wiring, check whether the problem is due to the power control card or to the function control card, as instructed in sections D1.2 / D1.4.

Cleaning the solenoid valve

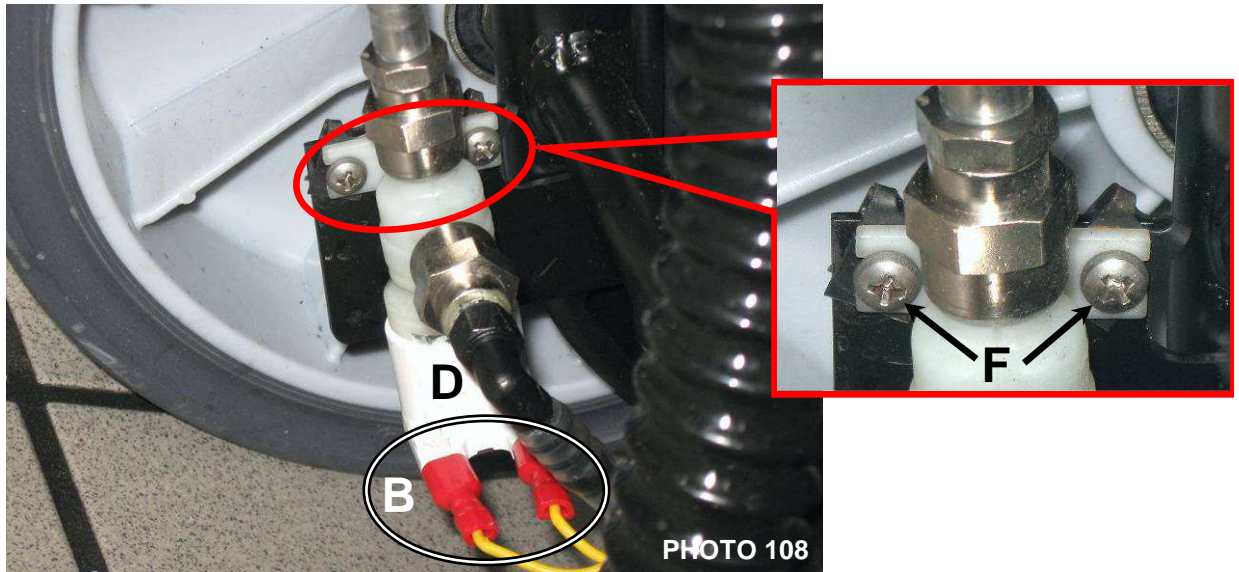
- 13** The solenoid valve can be cleaned on the machine or on the bench.
- 14** With the solenoid valve on the machine, disconnect the solenoid **D**, turn it and remove it from the valve body as shown above. Clean the outlet hole **E** in the valve body.
- 15** To remove the solenoid valve from the machine, follow the instructions given below. With the solenoid valve on the bench, clean the outlet hole **E** in the valve body.



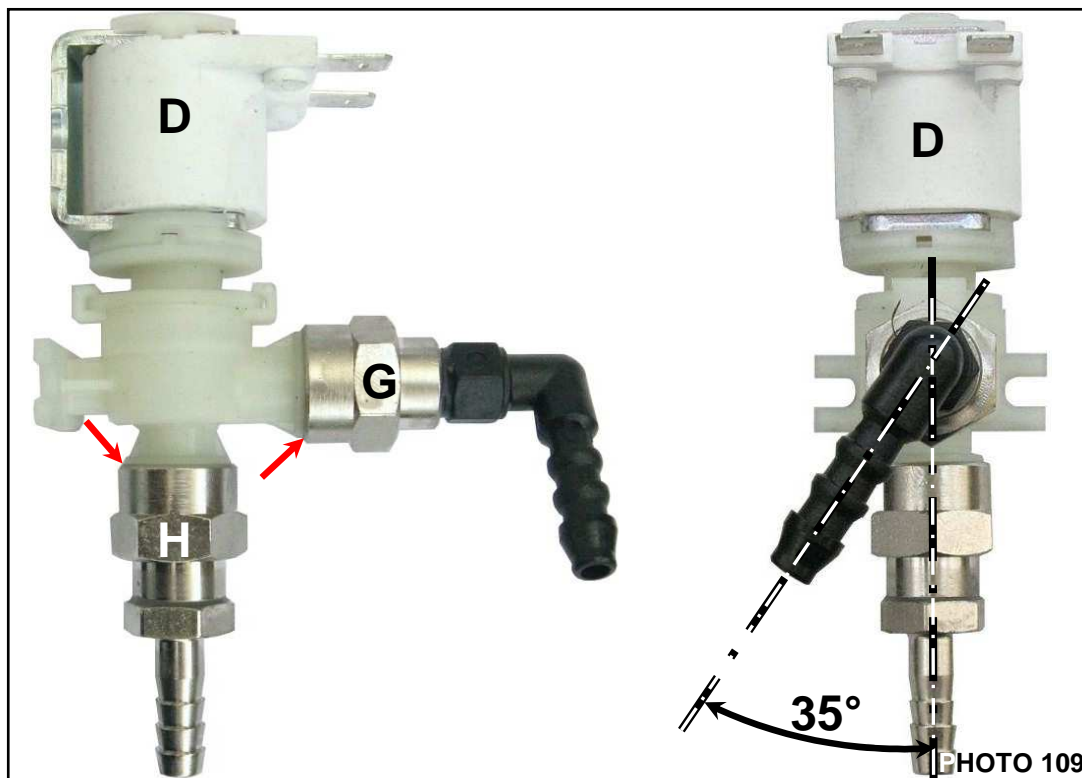


Replacing the solenoid valve

- 16** Disconnect the two fast-ons **B** (if still connected), and replace just the solenoid **D**. Alternatively, proceed as instructed below.
- 17** Remove the two screws **F** securing the body of the solenoid valve to the machine frame.
- 18** Remove the rubber hoses from the unions **G** and **H**.



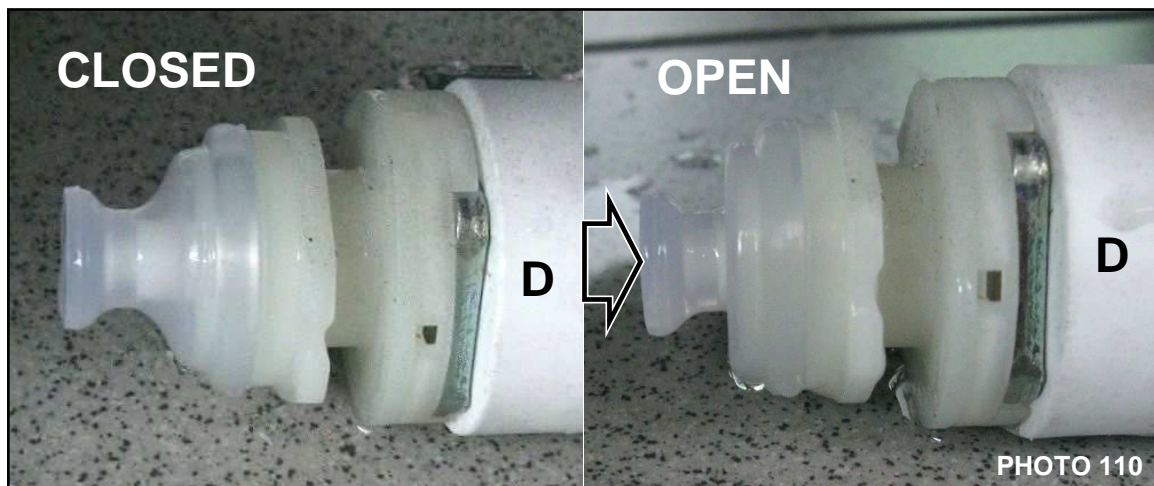
- 19** Remove the unions **G** and **H** from the old valve body and fit them to the new valve body. Adjust the 'L' union **G** to an angle of approximately 35°.





Testing and replacing the solenoid valve on "C" type machines

- 20 Make sure that a mains power socket suitable for the machine (115V / 230V) is available.
- 21 Make sure that the button on the control panel operates the dispensing solenoid valve (LED lit).
- 22 Move the machine to the tank draining area, and empty the solution and collection tanks.
- 23 Take the machine to a flat, dry floor area.
- 24 Close the solution dispensing cock **A** by turning it clockwise (see previous section).
- 25 Tilt the handle back through about 60° (see previous section).
- 26 Tip the machine rearwards, until the handle rests on the floor.
- 27 Turn the solenoid and remove it from the valve body to test it.
- 28 Plug the power cable into the power socket. Switch the machine on and press the solution dispensing button to open the solenoid valve.
- 29 Check that the membrane at the end of the solenoid **D** moves.



- 30 If the solenoid functions correctly, clean the body of the valve and reassemble it. If the solenoid does not function correctly, proceed as follows.
 - 30a Connect up a new solenoid valve and check that it functions correctly. If it does, install it instead of the old solenoid valve. If it does not function correctly, proceed to the next step.
 - 30b Check whether the problem is due to the power control card or to the function control card, as instructed in sections D1.2, D1.4, and D1.5.

Reassembly

- 1 To fit the solenoid valve, repeat the steps for disassembly in reverse order.
- 2 Apply a drop of liquid Teflon or similar sealant to the threads of the solenoid valve where the unions **H** and **G** will be fitted.
- 3 Remember to adjust the 'L' shaped union **G** to an angle of about 35°.



B3.3 Checking the condition of the float



The collection tank float serves two purposes: it warns when the collection tank is full and, more importantly it prevents the suction motor from sucking in water, which would cause it to malfunction.

i

The CT 15 uses a very simple float system, based on a rigid block of foam. When suction is switched on to dry the floor, the dirty water rising in the collection tank gradually lifts the float towards the suction holes. When the float becomes very close to the holes, the suction pulls it against the holes and shuts them off. When this occurs, the operator will notice a clear increase in suction noise.

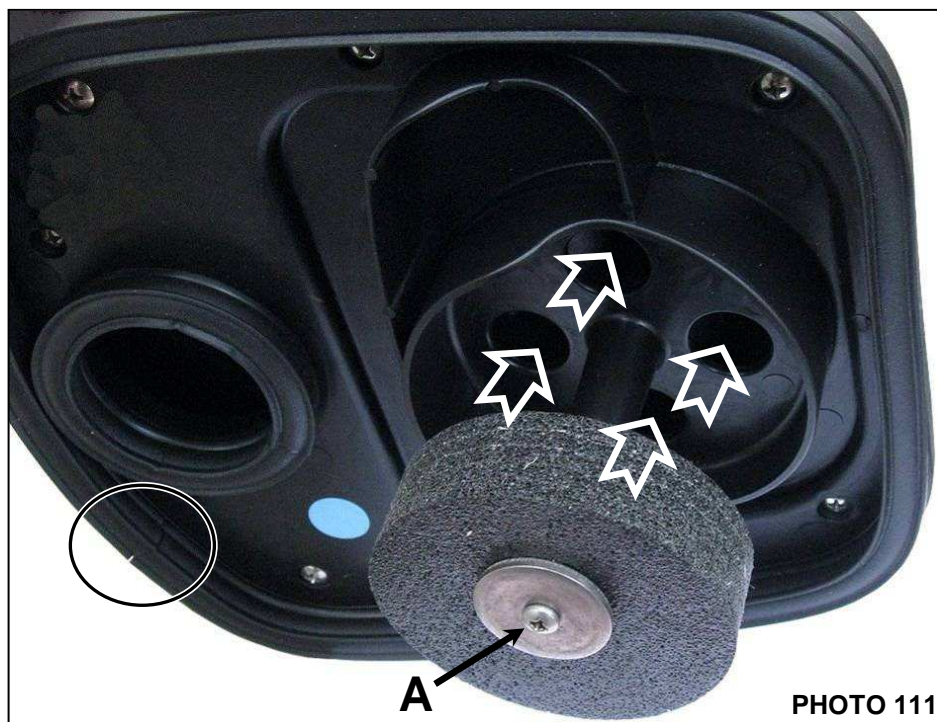


PHOTO 111

Checking and replacement

- 1** Check that the float is in good condition, and that there are no cracks or holes in the surface that comes into contact with the suction holes in the collection tank cover.
- 2** To replace the float, simply remove the screw **A**.
- 3** If no new float is available, but the underside of the old float is in good condition, turn the old float over.



PHOTO 112



B3.4 Cleaning the filters, hoses and solution dispensing cock

i Because its solution tank only contains a limited volume, and because the solution dispensing solenoid valve can be cleaned so easily, the CT 15 is not fitted as standard with a solution filter. If required, an optional filter can be fitted, as shown below. Even with a filter fitted, however, the solution dispensing hoses and the dispensing cock must be kept clean to ensure correct flow and control.

Disassembly and inspection

- 1 Move the machine to the tank draining area, and empty the solution and collection tanks.
- 2 Take the machine to a flat, dry floor area.
- 3 Tilt the handle back through about 60°.
- 4 Tip the machine rearwards, until the handle rests on the floor.
- 5 Inspect the clear hose from the dispensing cock to the brush head.
- 6 If necessary, remove the solenoid from the solenoid valve and clean the valve as instructed in the previous sections.

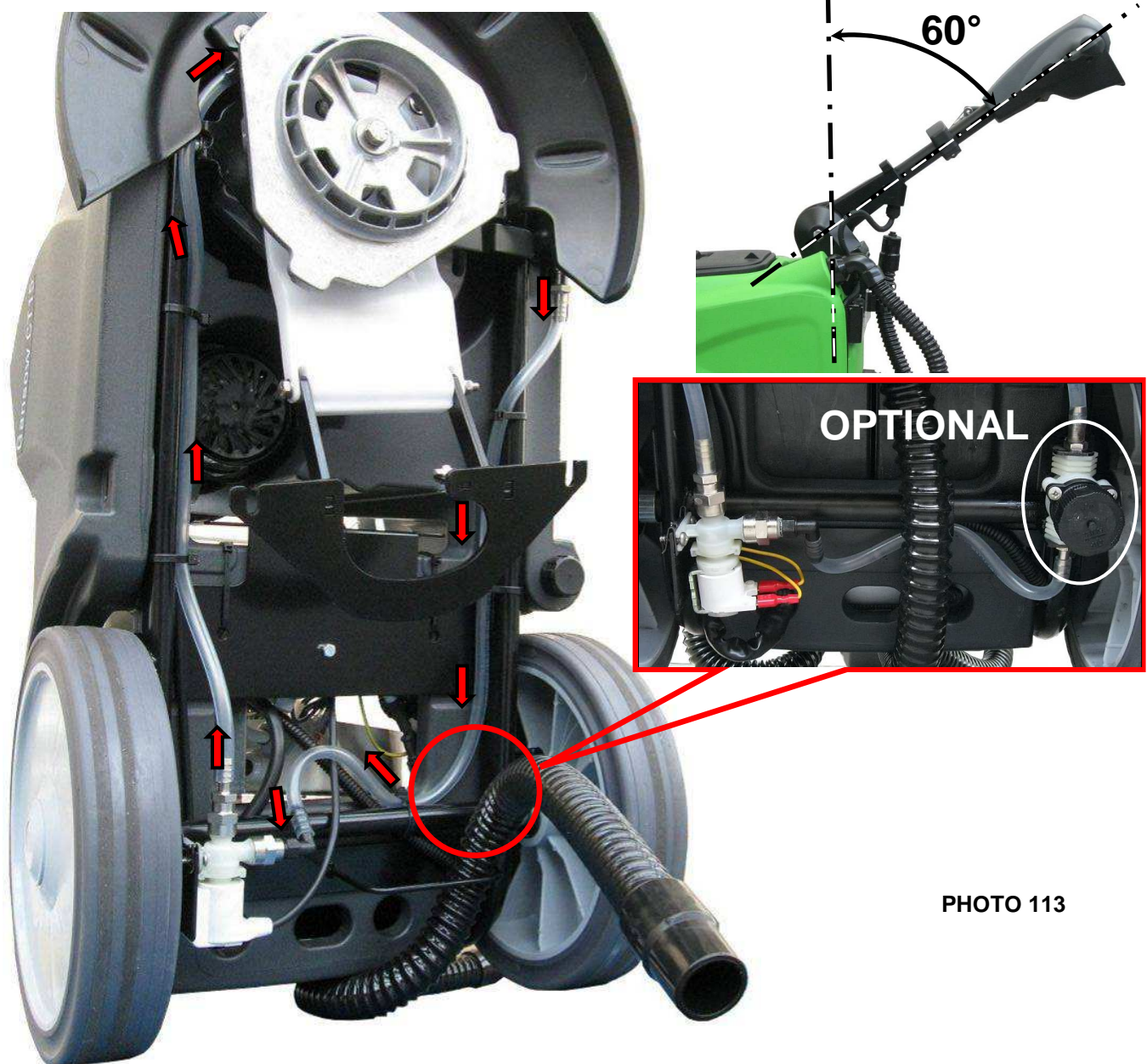
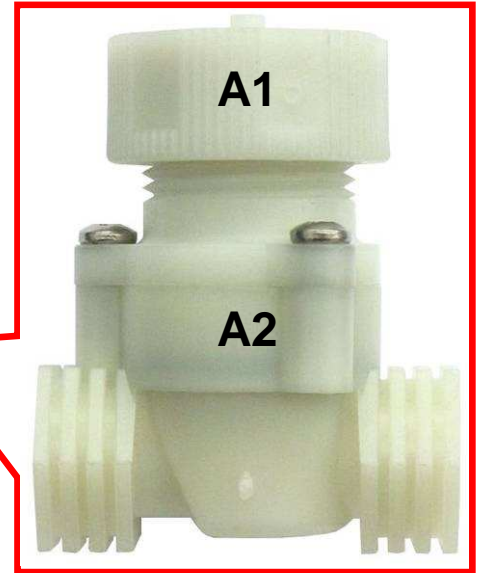
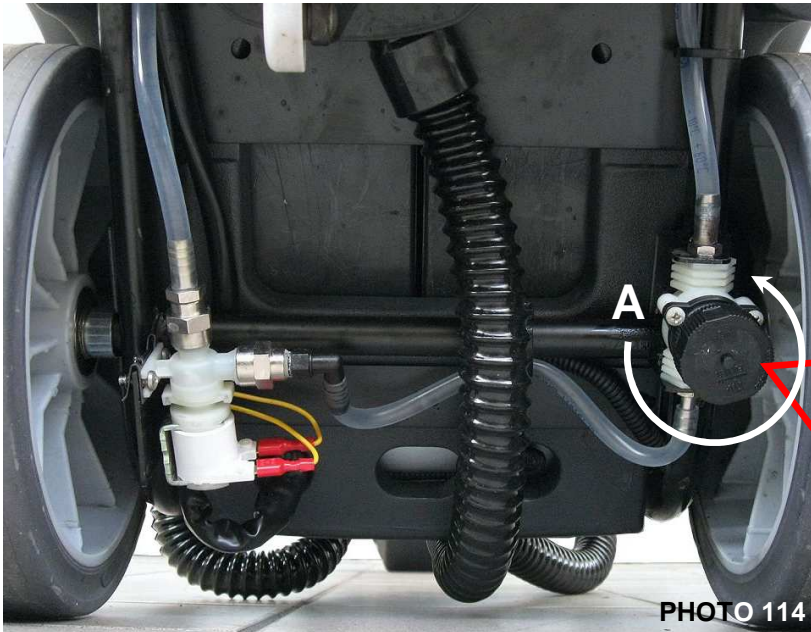


PHOTO 113

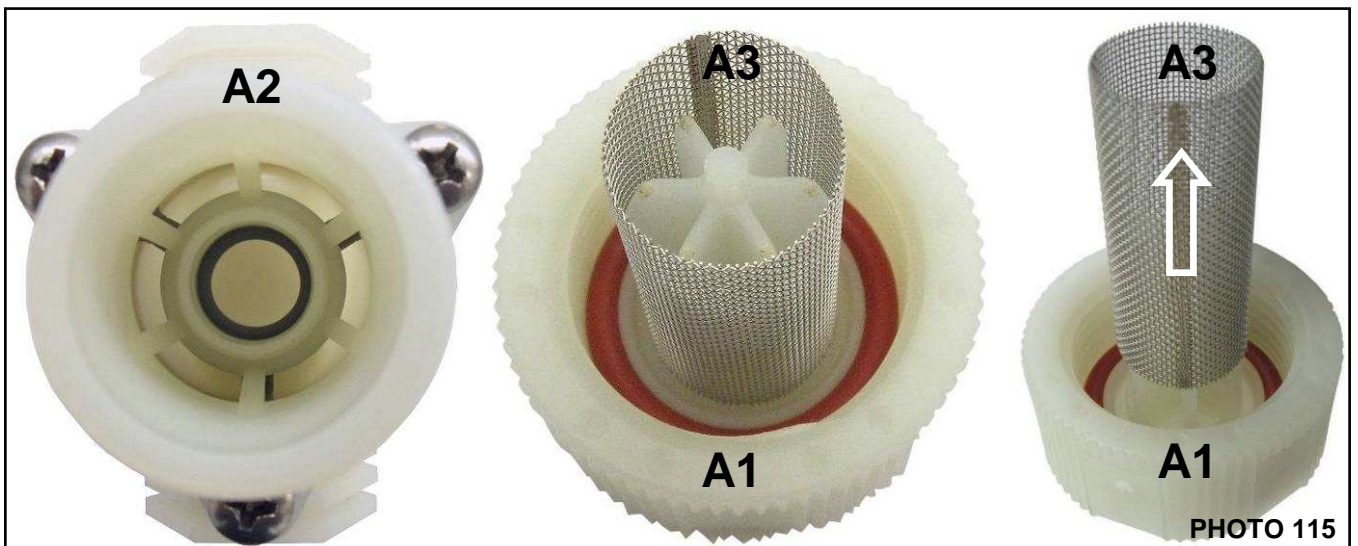


Optional solution filter

- 7** Tip the machine up rearwards as instructed above, and identify the optional solution filter **A**.

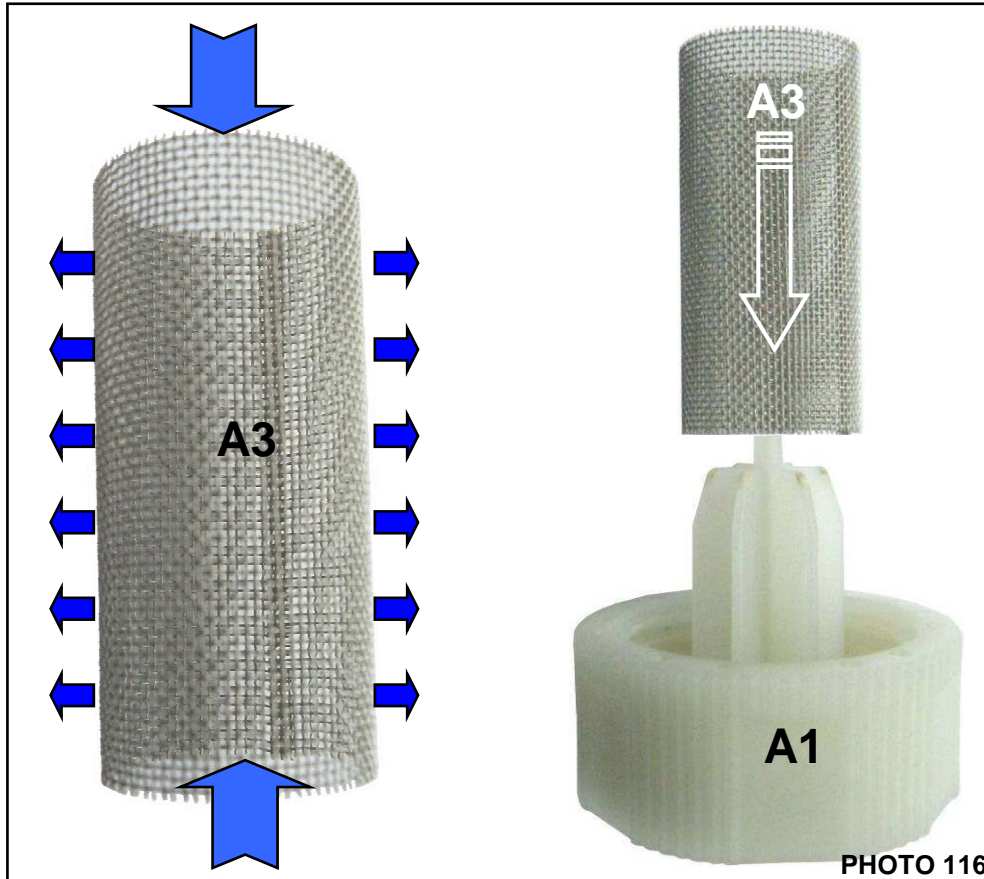


- 8** Unscrew the cap **A1** from the body **A2** and remove the metal mesh filter **A3**.
9 Make sure that there are no foreign bodies lodged inside the filter body **A2**.
10 Remove the metal mesh filter **A3** from the cap **A1**.



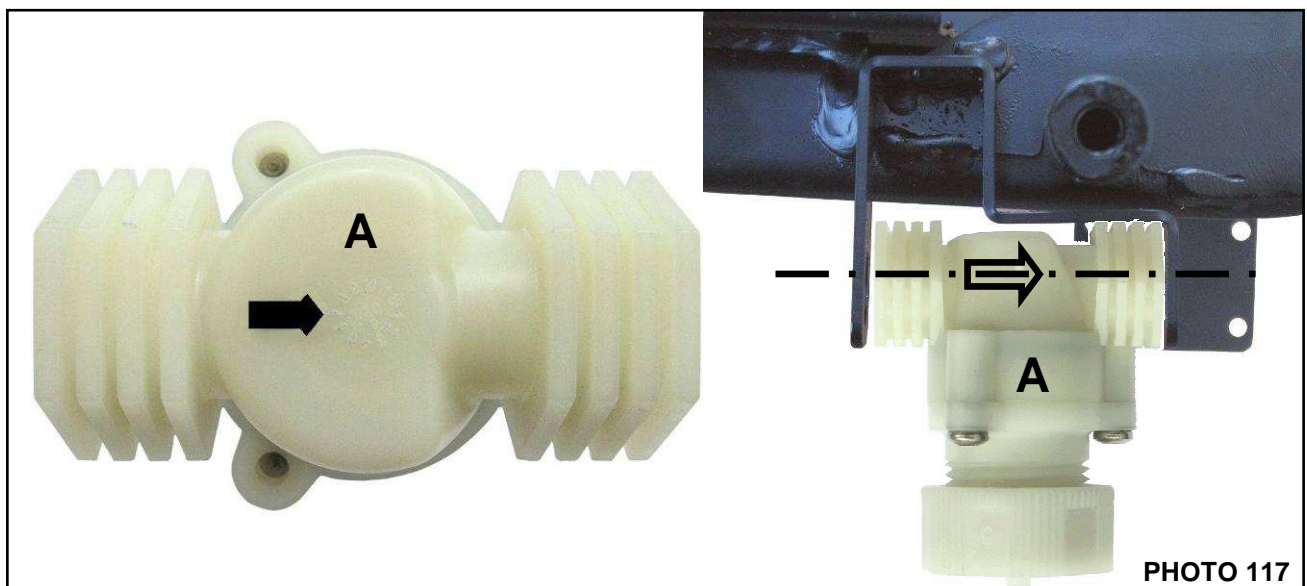


- 11 Clean the metal mesh filter **A3** by running water from the inside towards the outside. Use a small brush to remove any stubborn dirt.
- 12 Fit the metal mesh filter **A3** in the cap **A1**, then screw the cap **A1** back on to the body **A2**.



Replacing / fitting the solution filter

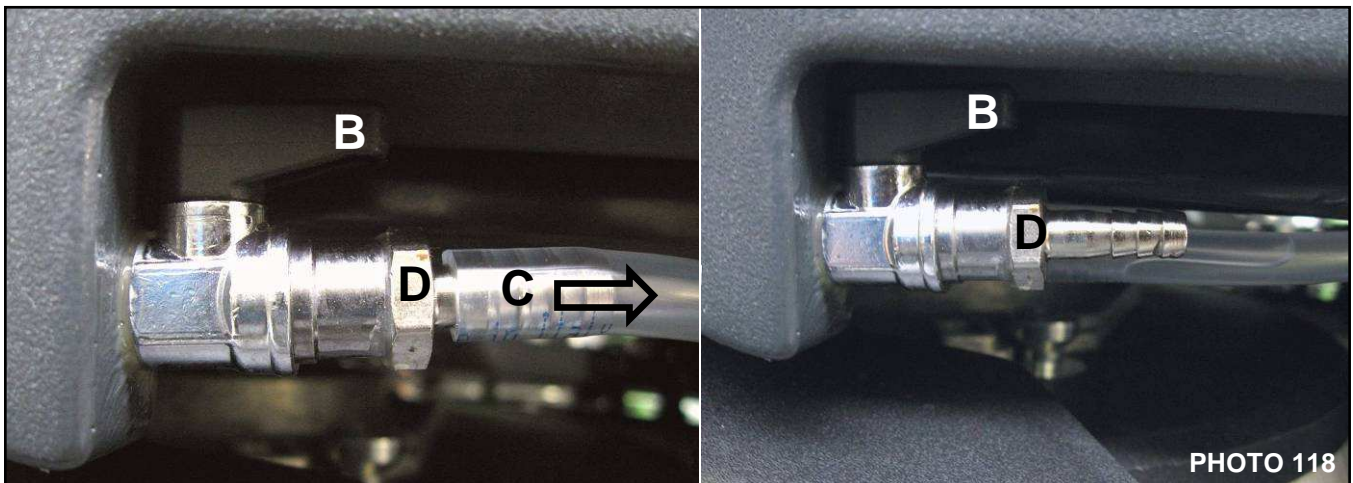
- 13 If it ever proves necessary to replace the entire filter **A**, take care to fit the new filter the right way around. The arrow on the bottom of the filter body indicates the direction of flow.
- 14 To fit the optional solution filter, place the filter **A** between the two mounting brackets, and fix it in place by means of the two straight hose unions. Apply a drop of sealant or liquid Teflon to the threads of the unions.



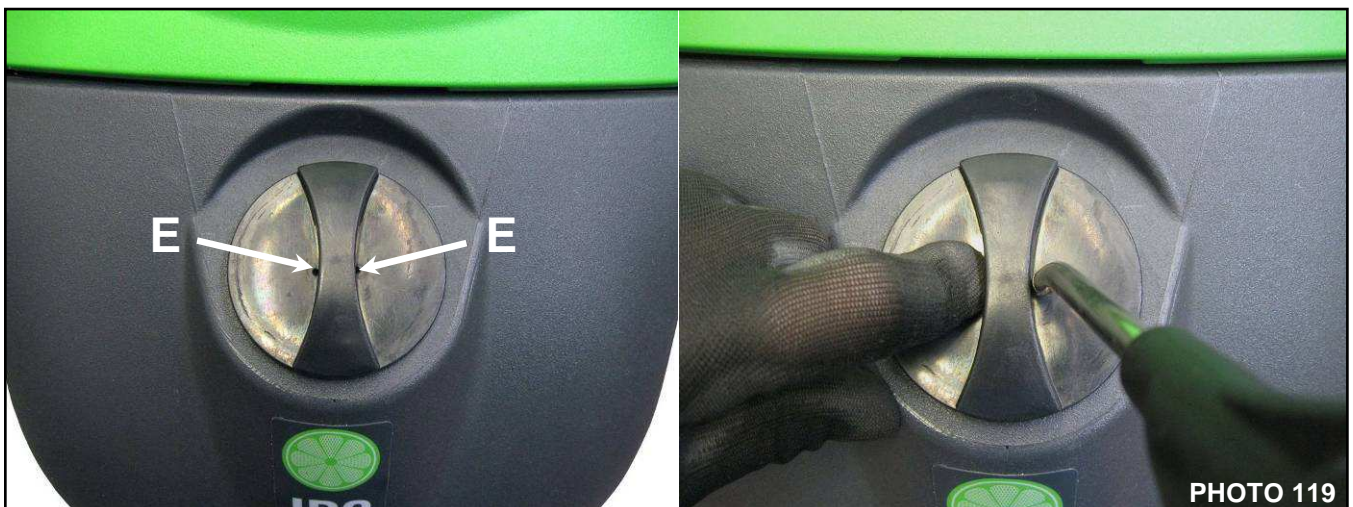


Cleaning and replacing the solution dispensing cock

- 15** If little or no solution comes out even when the dispensing cock **B** is completely open, dirt may have built up at the inlet to the cock.
- 16** The cock **B** can be cleaned either by blowing compressed air through it to free any obstruction, or by removing the cock and physically removing the dirt.
- 17** Cleaning with compressed air is obviously the easiest method. To do so, either blow compressed air into the tank (without applying too much pressure) to blow any dirt out through the cock's outlet, or blow into the cock's outlet. This latter method, however, will blow dirt into the tank, so the tank must then be emptied and rinsed.
- 18** Move the machine to the tank draining area to clean the solution dispensing cock **B**.
- 19** Disconnect the clear hose **C** from the union **D** of the cock **B**.
- 20** Rapidly open and close the cock **B** a few times, then leave it open.

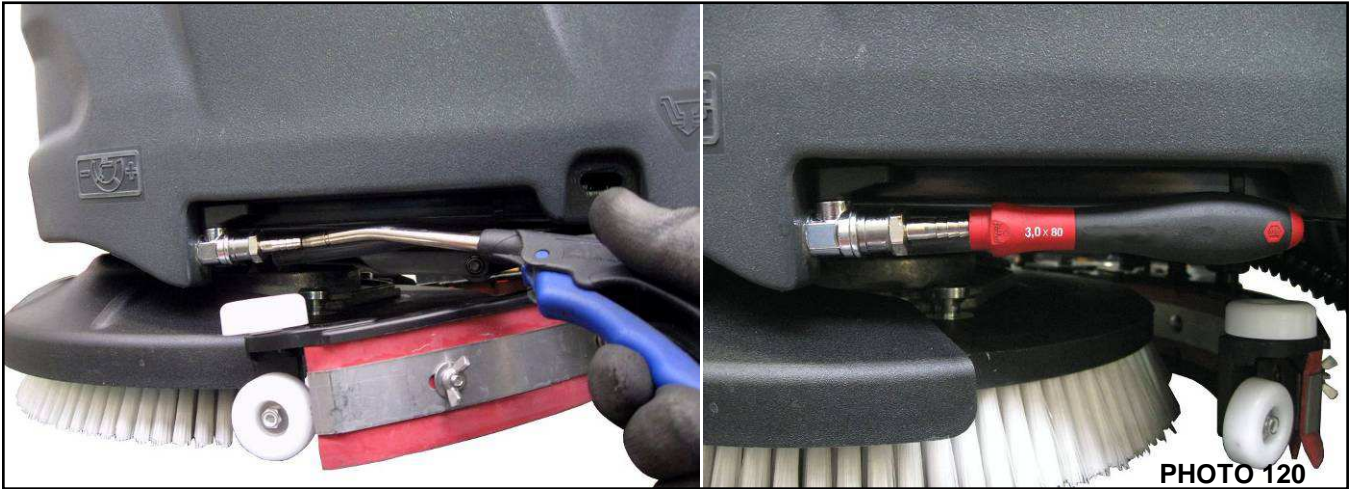


- 21** Position the compressed air gun at either of the two holes **E** in the cap of the solution tank, and close the other with a finger.
- 22** Blow air into the tank to pressurise it, without applying excess pressure, until any obstruction in the cock **B** is expelled from the outlet. If this does not work, blow air into the union **D** on the cock **B**.

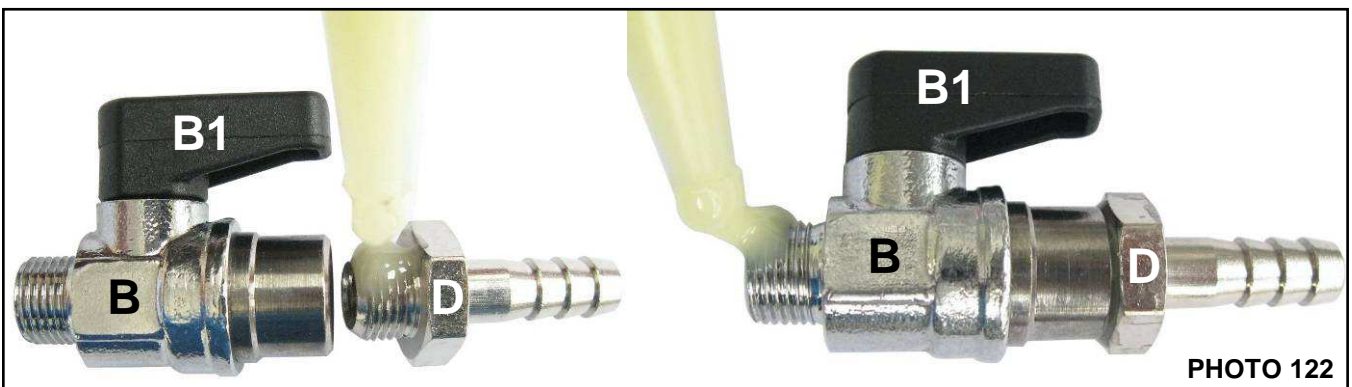




- 23** If even this fails to dislodge the obstruction, gently push a small screwdriver through the cock **B**.



- 24** After blowing air into the cock, empty the solution tank through its drain plug and rinse the tank to remove any dirt deposited inside it.
- 25** If the problem persists, the cock **B** must be replaced. Remove the cock from the solution tank.
- 26** Turn the cock's lever **B1** to the open position to allow the cock to turn.
- 27** Remove the clear hose from the cock's hose union, then use a 14 mm spanner to unscrew the cock **B** from the solution tank.



Reassembly

- 1** To fit a new cock **B**, repeat the steps for disassembly in reverse order.
- 2** When re-fitting cock **B** after cleaning, or when fitting a new cock, apply a drop of sealant to the threads of the cock **B** and to those of the union **D**.
- 3** Take care when screwing the cock **B** into the tank. The lever **B1** must come to rest at the top.



B4 THE COLLECTION TANK AND SOLUTION TANK

i The CT 15 is fitted with two tanks: the COLLECTION TANK **A** and the SOLUTION TANK **B**. Both tanks are formed by rotational moulding. This forming method makes it possible to create tanks of complex shape, with metal inserts in place for connection to components like the suction motor and control unit, etc..





B4.1 Removing the collection and solution tanks

Removing the collection tank

- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Take the machine to a flat, dry floor area.
- 3 Lift up the collection tank and remove it from the machine.
- 4 Remove the cap **A**. Loosen the hose clamp **B1** and remove the drain hose **B**.
- 5 Replace the tank with a new one.



B



PHOTO 124

Reassembly

- 1 To fit the new collection tank, repeat the steps for disassembly in reverse order.

Removing the solution tank

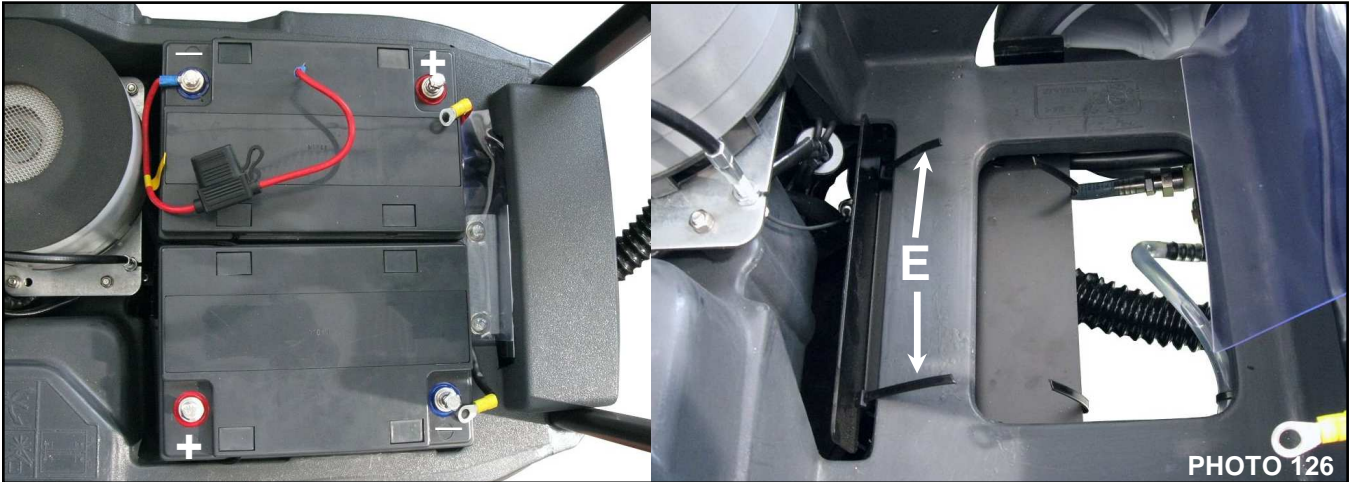
- 1 Move the machine to the tank draining area, and empty the solution and collection tanks.
- 2 Take the machine to a flat, dry floor area.
- 3 Disconnect the suction hose **C** and arrange safely it under the machine.
- 4 Lift up the collection tank and remove it from the machine. Remove the rubber cap **D** from the solution tank.



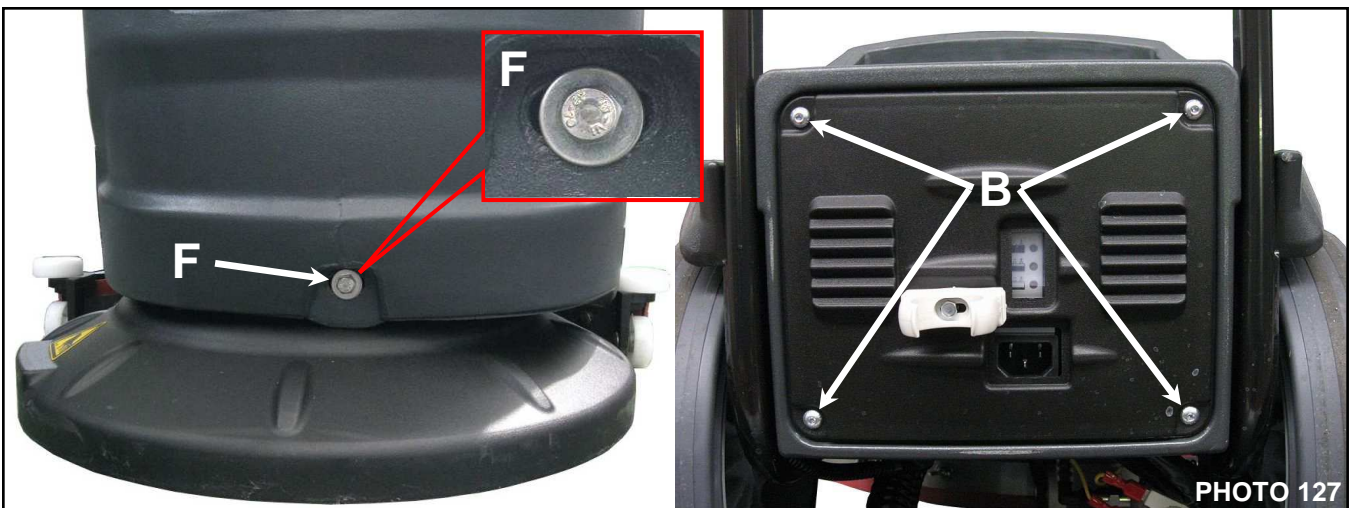
PHOTO 125



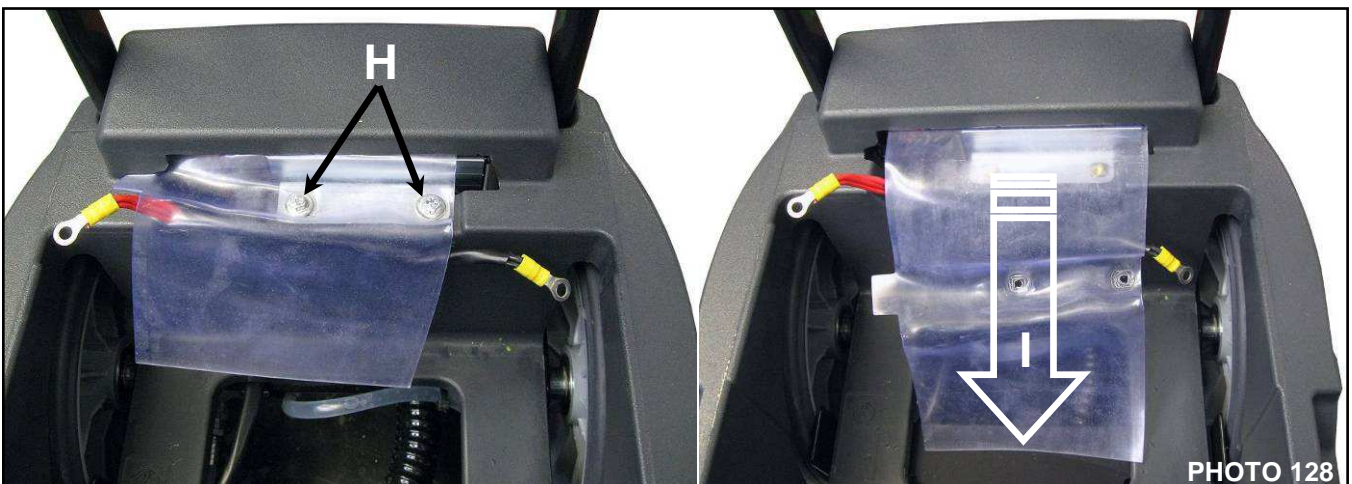
- 5 Disconnect and remove the batteries from the battery compartment.
- 6 Cut the plastic straps **E** fixing the rear of the tank to the frame.



- 7 Remove the screw **F** securing the solution tank to the bottom front of the machine frame.
- 8 Remove the four screws **B** and remove the rear cover from the power compartment.

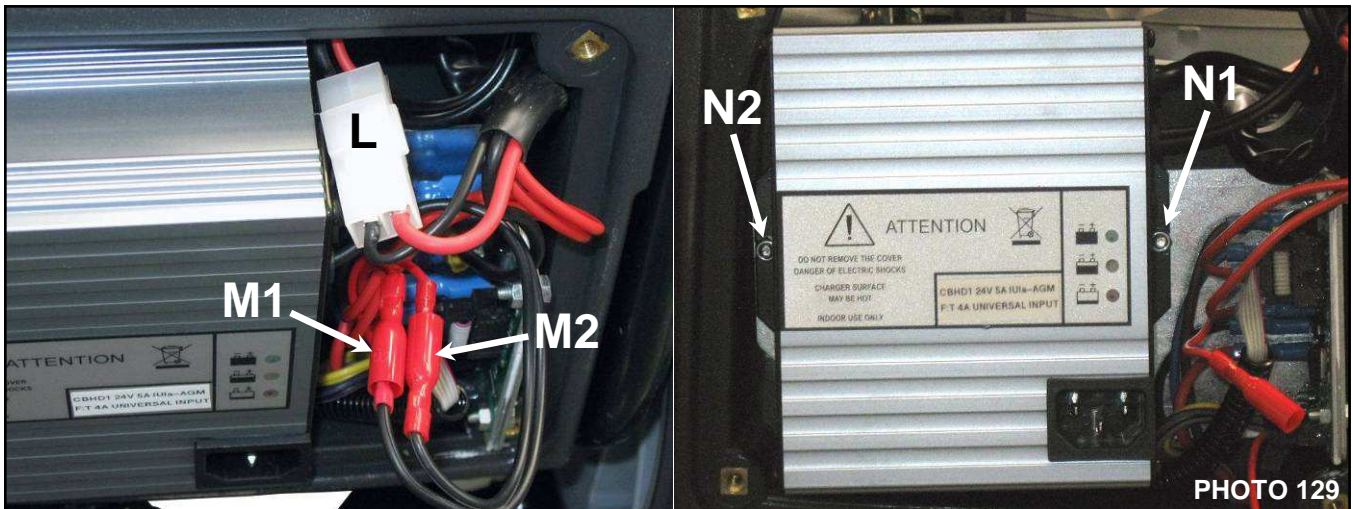


- 9 Remove the two bolts **H** securing the power unit and its protective PVC sheet to the solution tank.
- 10 Pull the protective PVC sheet **I** out from over the battery charger.

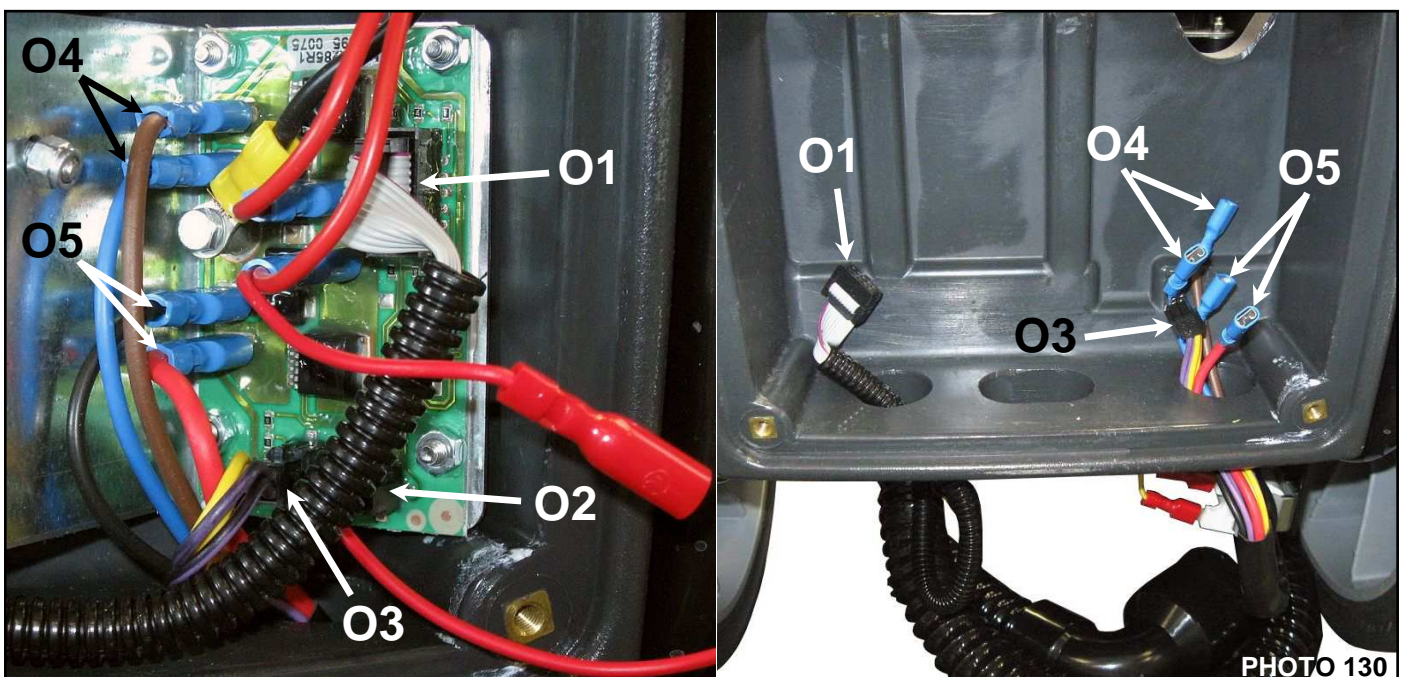




- 11 Pull the power unit out just enough to disconnect the connector **L** and the connectors **M1** and **M2** for the battery charger. Remove the battery charger from the mounting plate to avoid damaging the connections on the power control card.
- 12 Loosen the bolt **N1** and remove the bolt **N2** to release and remove the battery charger from the mounting plate.

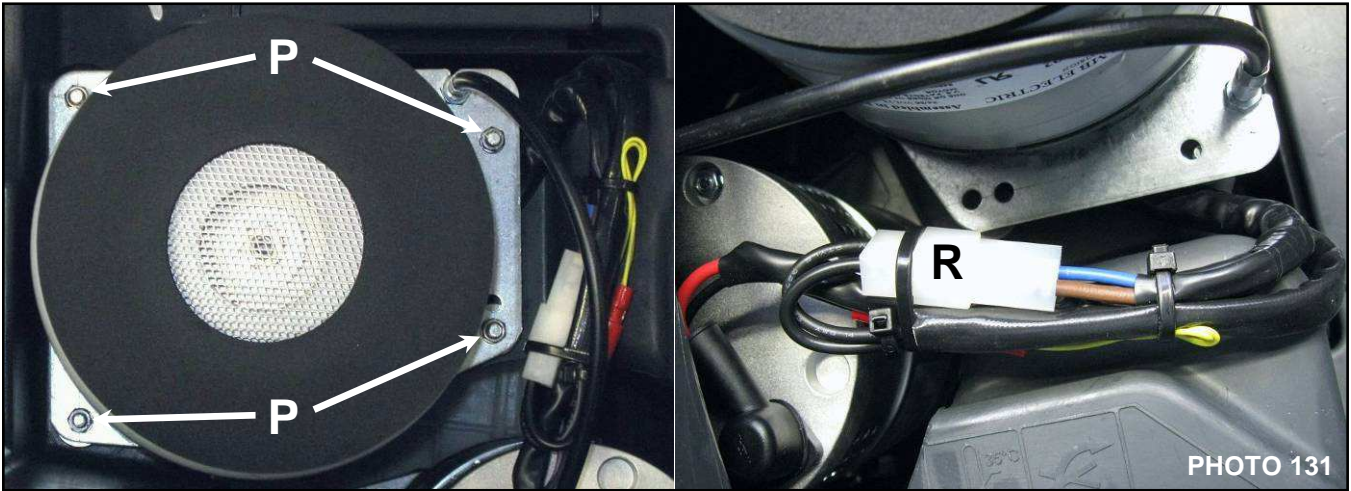


- 13 Disconnect the remaining cables from the power control card. Disconnect the flat cable **O1**, the two pin connector **O2** for the red lead wired to the other red lead with the male connector for the battery charger, the four pin connector for the solenoid valve and brush motor thermal cutout **O3**, the cables to the suction motor **O4**, and those to the brush motor **O5**. Take particular care when disconnecting these last four cables. Leaving all other cables attached, remove the power control card.
- 14 Reconnect the connector **O2** to its connector on power control card.
- 15 Pull the flat cable **O1** and the other cables (**O2**, **O3**, **O4**, **O5**) out through the holes in the solution tank.





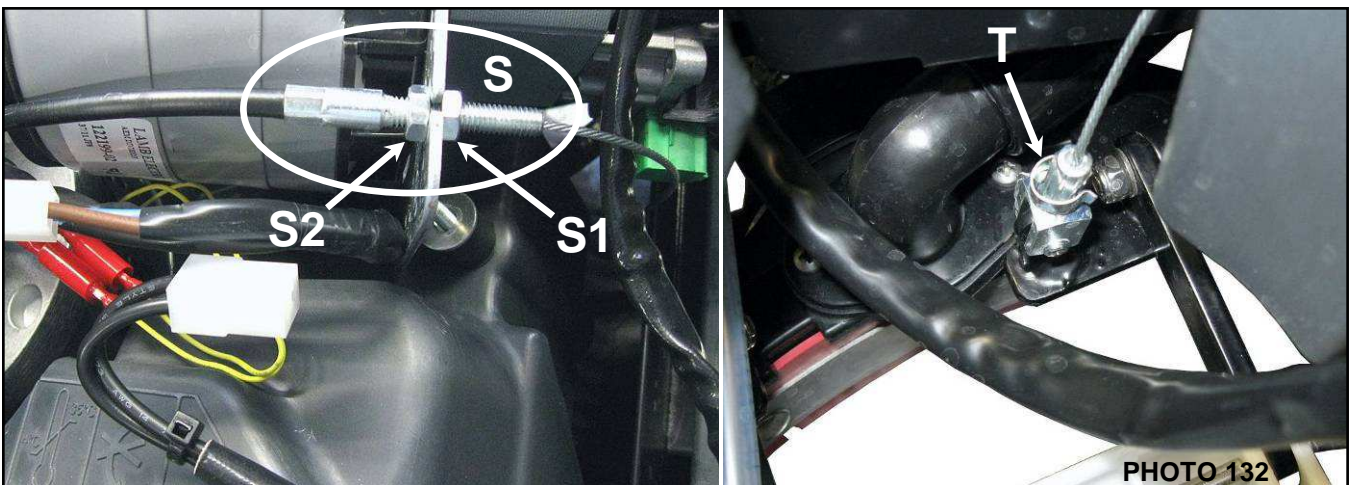
- 16 Remove the suction motor by unscrewing the four nuts **P** securing the motor to its anti-vibration mountings **Q**. Identify the motor power connector **R**. Release it from the cable strap and disconnect it.



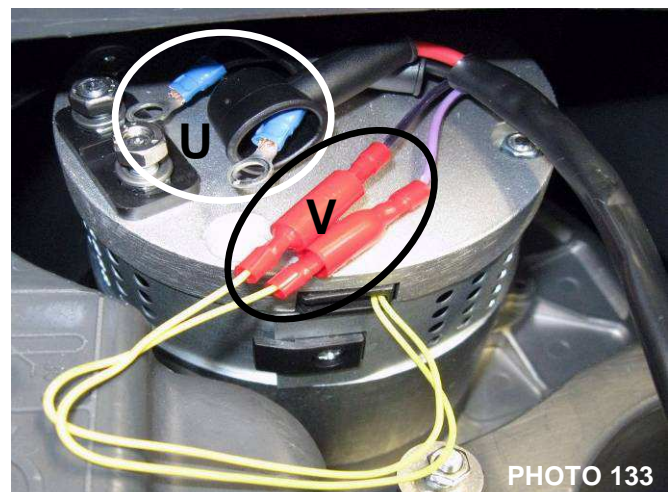
- 17 Lift the suction motor and place it on its side. Remove the squeegee unit cable adjuster **S**. Remove the suction motor from the solution tank.

- 18 Loosen the nut **S1**, without altering the position of the nut **S2** so that the adjuster can be replaced without altering the adjustment of the squeegee unit.

- 19 Remove the clip **T** from the fork and release the squeegee unit lifting cable.

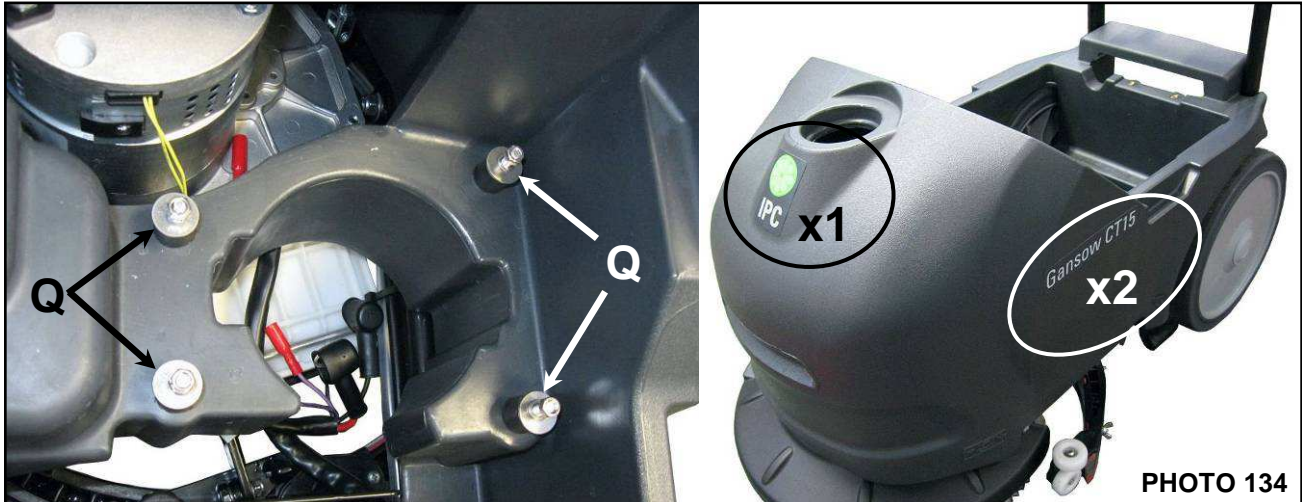


- 20 Disconnect the motor power cables **U** and the thermal cutout cables **V** and pull them out from under the solution tank so that they do not become entangled when the tank is removed.





- 21 Remove the four anti-vibration mountings **Q** from the solution tank. This operation generally does not require tools.
- 22 If you are fitting a new solution tank, remember to order new identification labels for it.



- 23 Disconnect the clear hose **Z** from the solution dispensing cock. Place the lever in fully open position and remove the dispensing cock from the solution tank.
- 24 If not already removed, also unscrew and remove the drain plug.



- 25 Lift and remove the solution tank from the machine, and replace it with a new one.

Reassembly

- 1 To fit the new solution tank, repeat the steps for disassembly in reverse order.
- 2 New identification labels have to be purchased as the ones on the old tank cannot be re-used.





**D FUNCTION CONTROL CARD, POWER CONTROL CARD,
AND BATTERY CHARGER**

👉 WARNING!

Go to the designated draining area and empty the solution and collection tanks using the drain plugs and the hoses provided.

Position the machine on a flat floor, and place wedges under the wheels to stop it moving.

Switch the machine off and disable all functions by pressing the “On–Off” button on the control panel.

Disconnect the machine’s electrical system by removing the main fuse F1, or by disconnecting the terminals from the battery poles (battery powered machines), or by removing the plug from the mains power socket (mains powered machines).

i INFORMATION

Important information

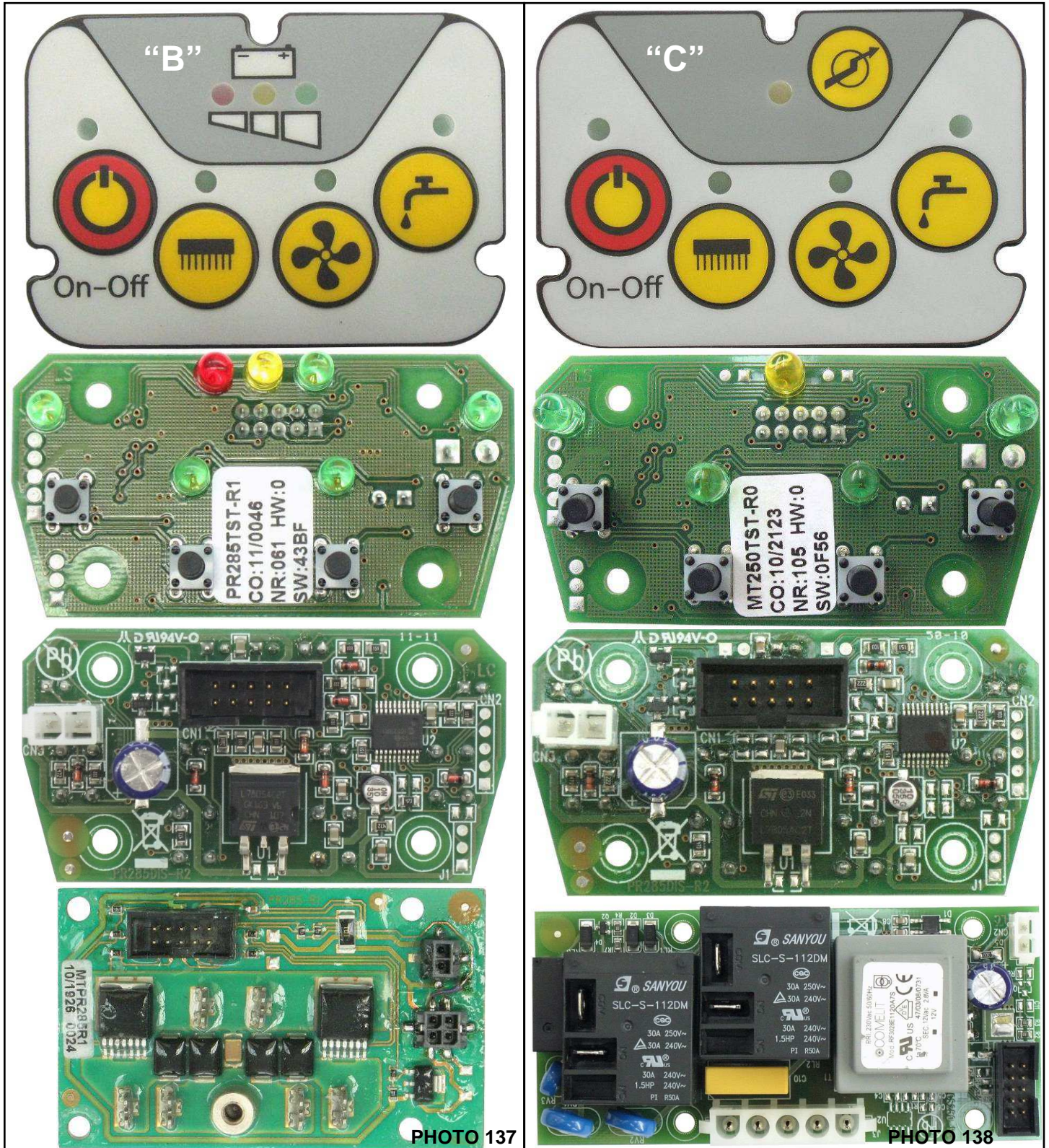
In this Service Manual, the terms RIGHT and LEFT are used to indicate the sides of the machine. They always refer to the direction of travel.

In this Service Manual, the machine version (15 B, 15 C) may appear between brackets “()”. This indicates that the instruction in question refers only to the version specified.



D1 FUNCTION CONTROL CARD AND POWER CONTROL CARD

On "B" type battery and "C" type mains machines, the function control card receives its power from the power control card via a flat cable. The function control card controls the machine's functions (suction motor, brush motor, solenoid valve) via the same flat cable.





D1.1 Replacing the function control card on "B" and "C" machines

Disassembly, "B" type machines

- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Take the machine to a flat, dry floor area.
- 3 Lift up and remove the collection tank to gain access to the fuse holder A.

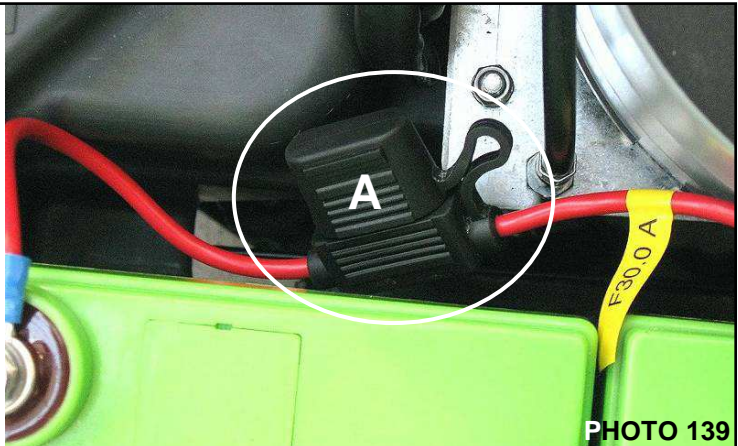


PHOTO 139

- 4 Remove the fuse A1 from the fuse holder A to isolate the machine's electrical system from the batteries.
- 5 Remove the three screws B1 securing the control panel B to the handle.

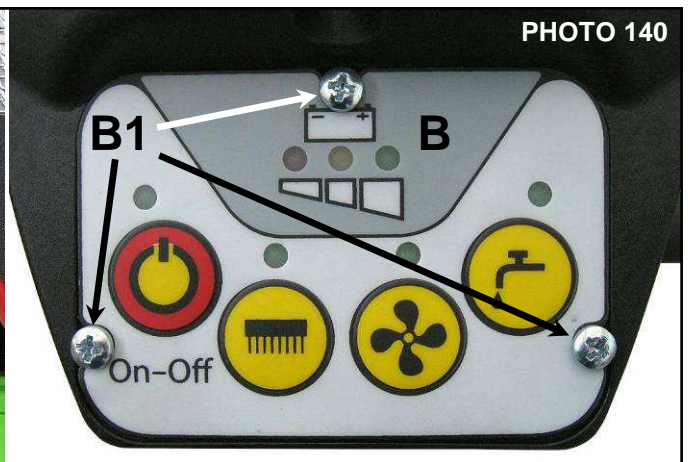


PHOTO 140

- 6 Disconnect the connector flat cable C, and the brush motor connector D from the function control card B.
- 7 Remove the four nuts E securing the function control card to the back of the screen printed control panel.

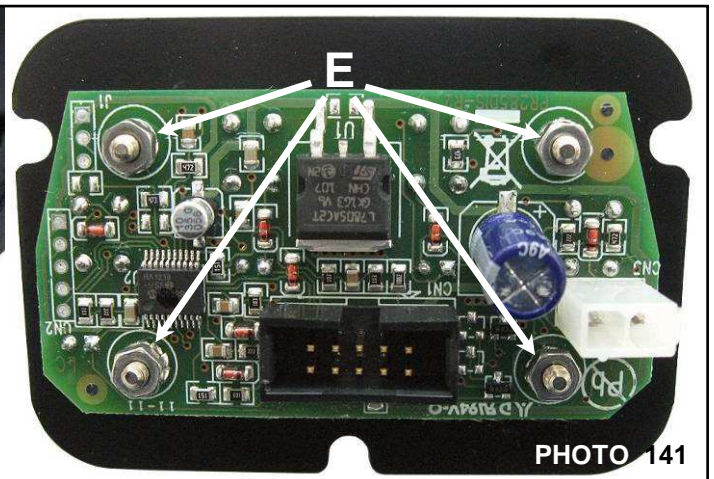
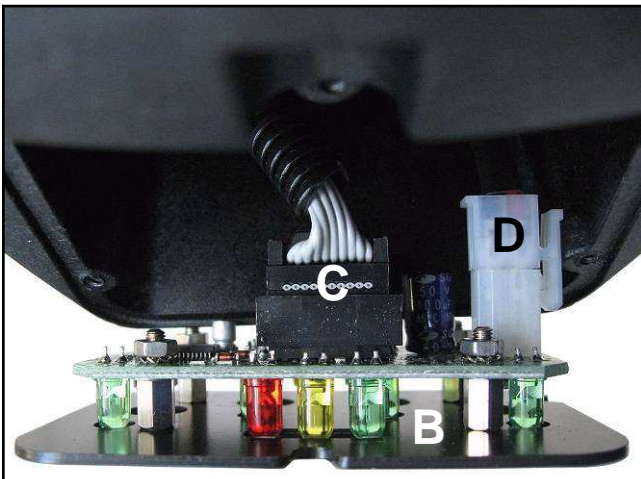
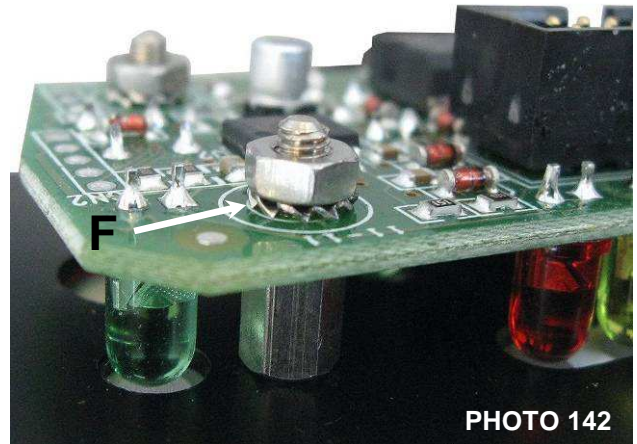


PHOTO 141



Reassembly

- 1 Replace the function control card with a new one of the same type and part number.
- 2 To fit the new function control card, repeat the steps for disassembly in reverse order.
- 3 Do not forget to locate the lock washers **F** between the nuts and the control card.
- 4 Tighten the nuts **E** to a maximum torque of 1 Nm (~ 0.1 Kgm).



Disassembly, "C" type machines

- 1 Take the machine to a flat, dry floor area.
- 2 Make sure that the power indicator **G** on the control panel shows that the machine is switched off.
- 3 **Make sure that the machine's mains power cable is disconnected from the electricity supply.**
- 4 Remove the function control card following the same instructions as for "B" type machines.



Reassembly

- 1 Replace the function control card with a new one of the same type and part number.
- 2 To fit the new function control card, repeat the steps for disassembly in reverse order.
- 3 Do not forget to locate the lock washers **F** between the nuts and the control card.
- 4 Tighten the nuts **E** to a maximum torque of 1 Nm (~ 0.1 Kgm).



D1.2 Testing the function control card on “B” and “C” machines

i There are very few differences between the function control cards of “B” type battery machines and “C” type mains machines. The differences are that the “C” type version has no battery charge level indicator, and uses different control software. Testing can nevertheless be performed in the same way on both card versions.

i The function control card is powered via the power control card, at 24 V on “B” type battery machines and at 12 V on “C” type mains machines. Via its flat cable, the function control card controls the machine’s actuators (brush motor, suction motor, solenoid valve). It also constantly monitors motor functioning by measuring current draw and MOS-FET temperature readings, and cuts out power if necessary.

Measuring power supply voltage

- 1 Use a digital multimeter able to read direct current voltage (V DC).
- 2 Access the function control card inside the control panel as instructed in the previous section.
- 3 Remove the function control card from its housing to measure voltage.
- 4 Without disconnecting any cables from the function control card, measure voltage between points A and C. To be acceptable, voltage must lie between 18 and 26 V.

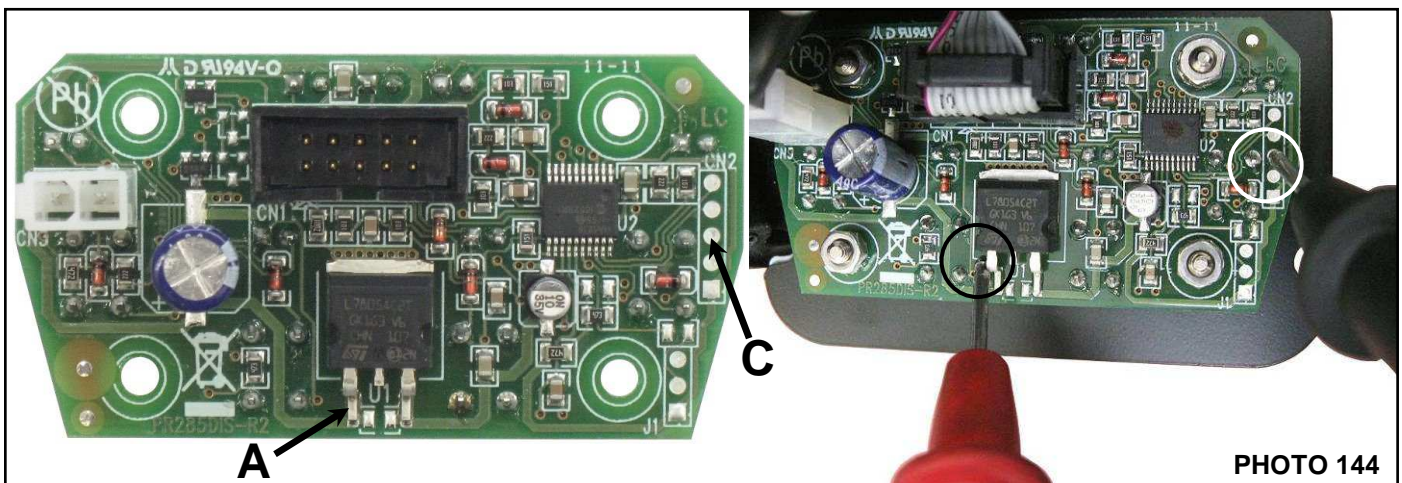


PHOTO 144

- 5 Move the probe from point A to point B, keeping the other probe at point C. Measure the voltage. To be acceptable, it must lie between 4.5 and 5.5 V.

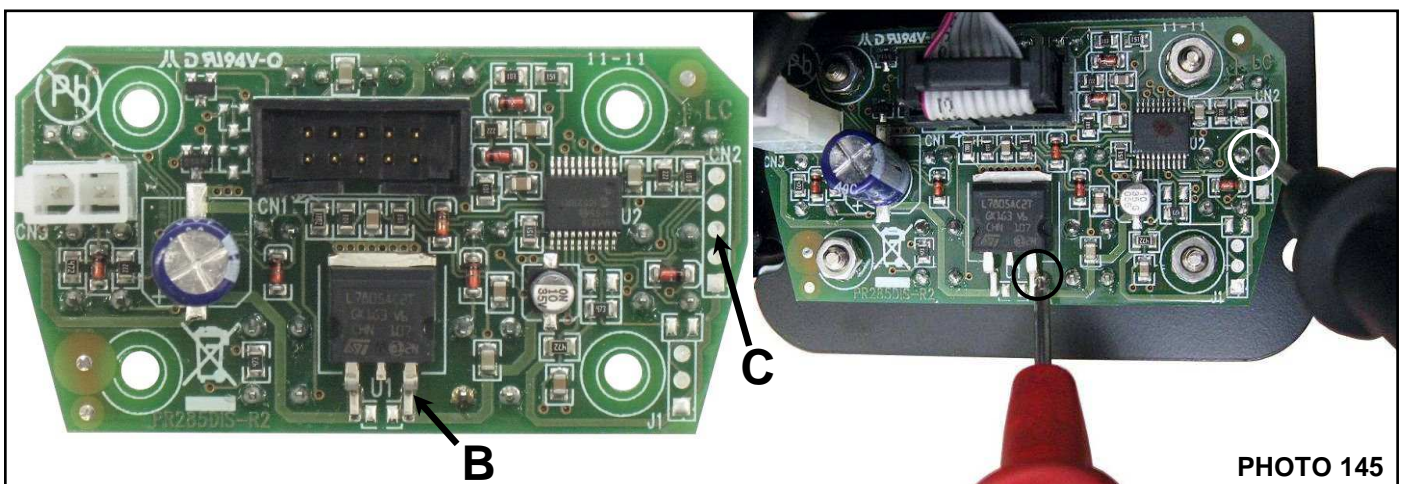


PHOTO 145



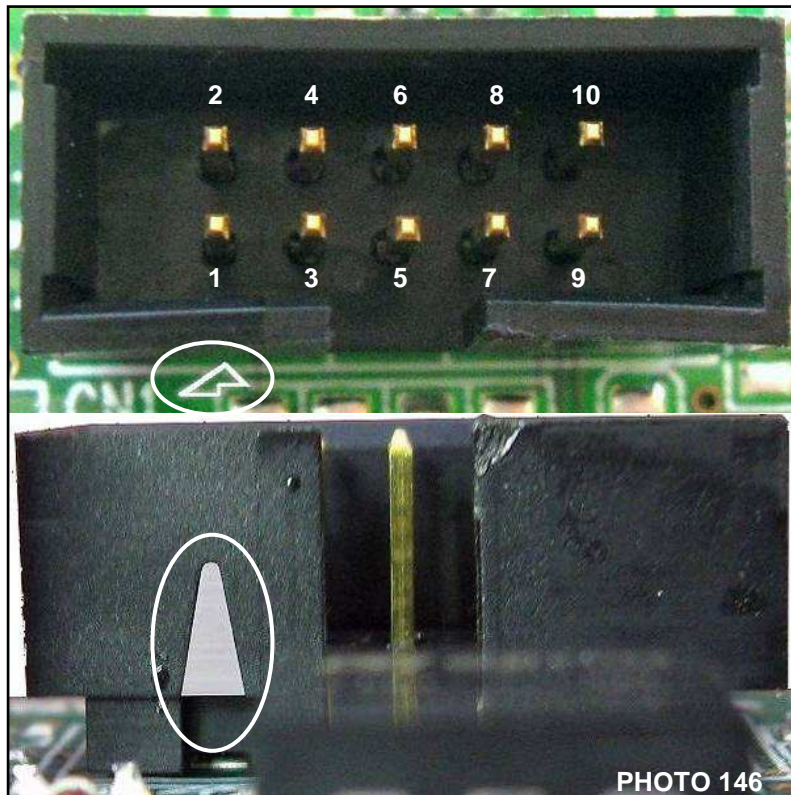
Measuring output voltage from the power control card



If no voltage is detected between points A and C, check the flat cable and the power control card before replacing the function control card.

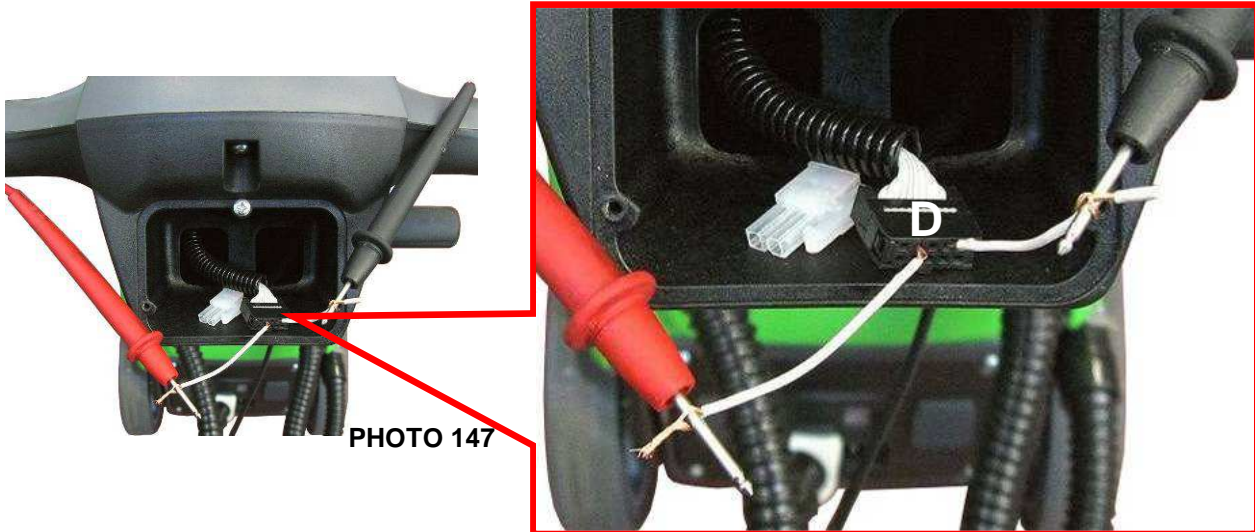


Take careful note of the numbering of the pins on the function control card and power control card. Pin 1 is identified by an arrow on the connector and/or on the function control card. Pin numbering increments alternating between the rows, so that all odd numbers are on one row and all even numbers on the other.



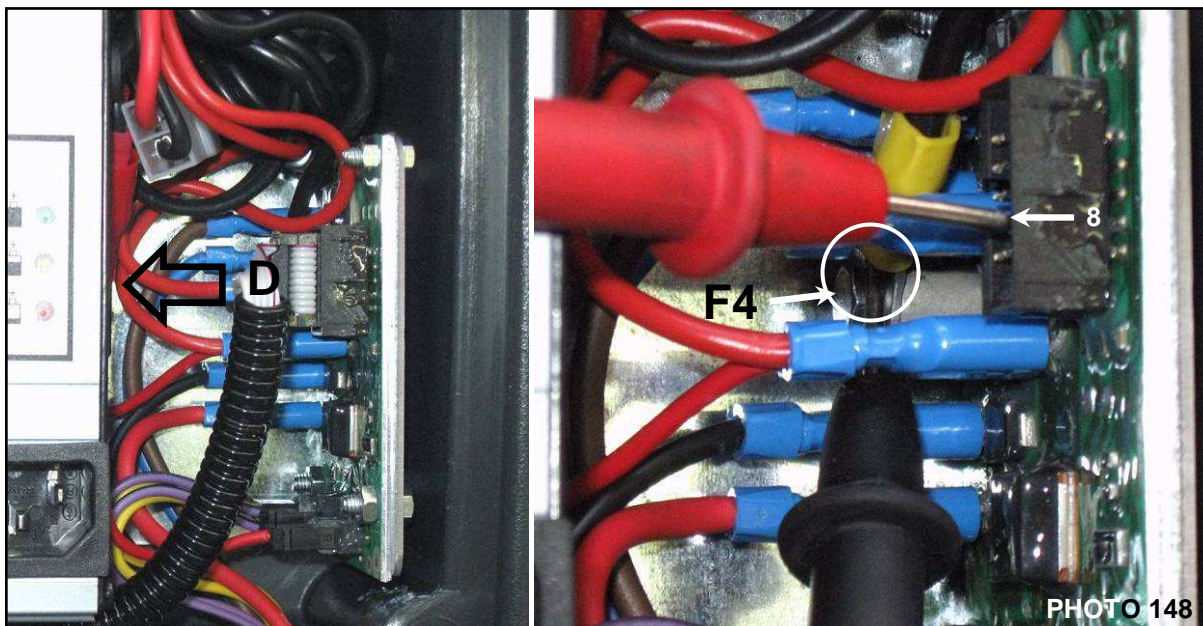


- 6** Disconnect the flat cable **D** from the function control card. Connect the black negative probe to pin **4** or **6** and connect the red positive probe to pin **8** and measure the voltage. Use two pieces of wire to make the connection if the probes are too big to enter the contacts.



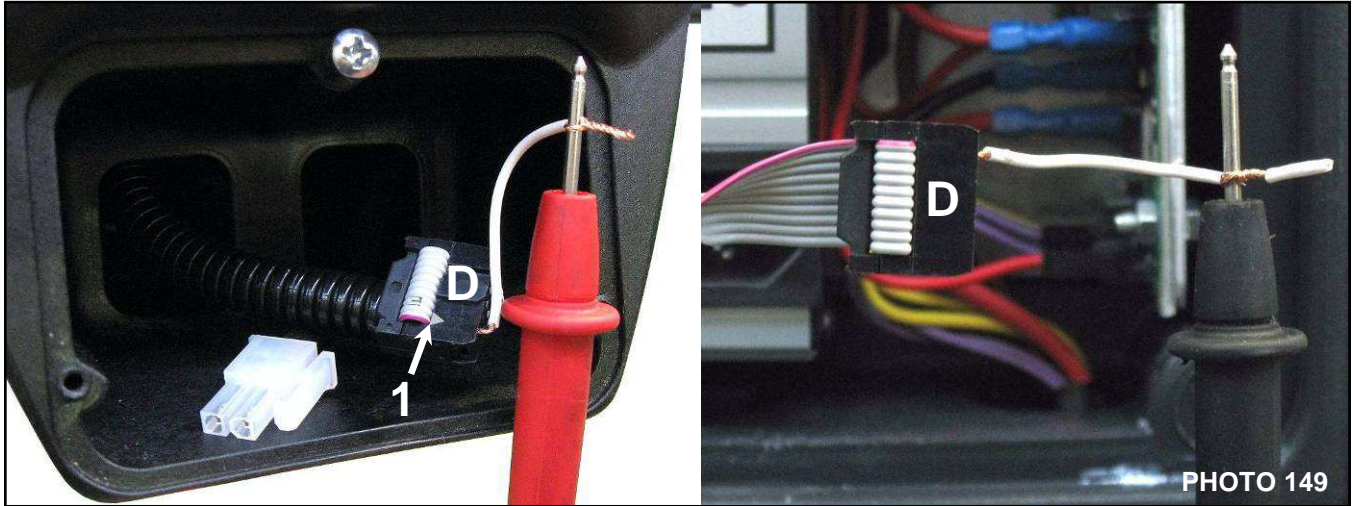
- 6a** If voltage measured at the connector is the same as that measured at the batteries, check the electrical path between pin **8** and point **A** at the voltage regulator chip. Replace the function control card with a new one if necessary.
- 6b** If no voltage is detected, proceed to test the power control card.

- 7** Disconnect the flat cable **D** from the power control card. Connect the black negative probe to the connector of the negative cable **F4** and check that voltage at pin **8** of the power control card is the same as that at the batteries.



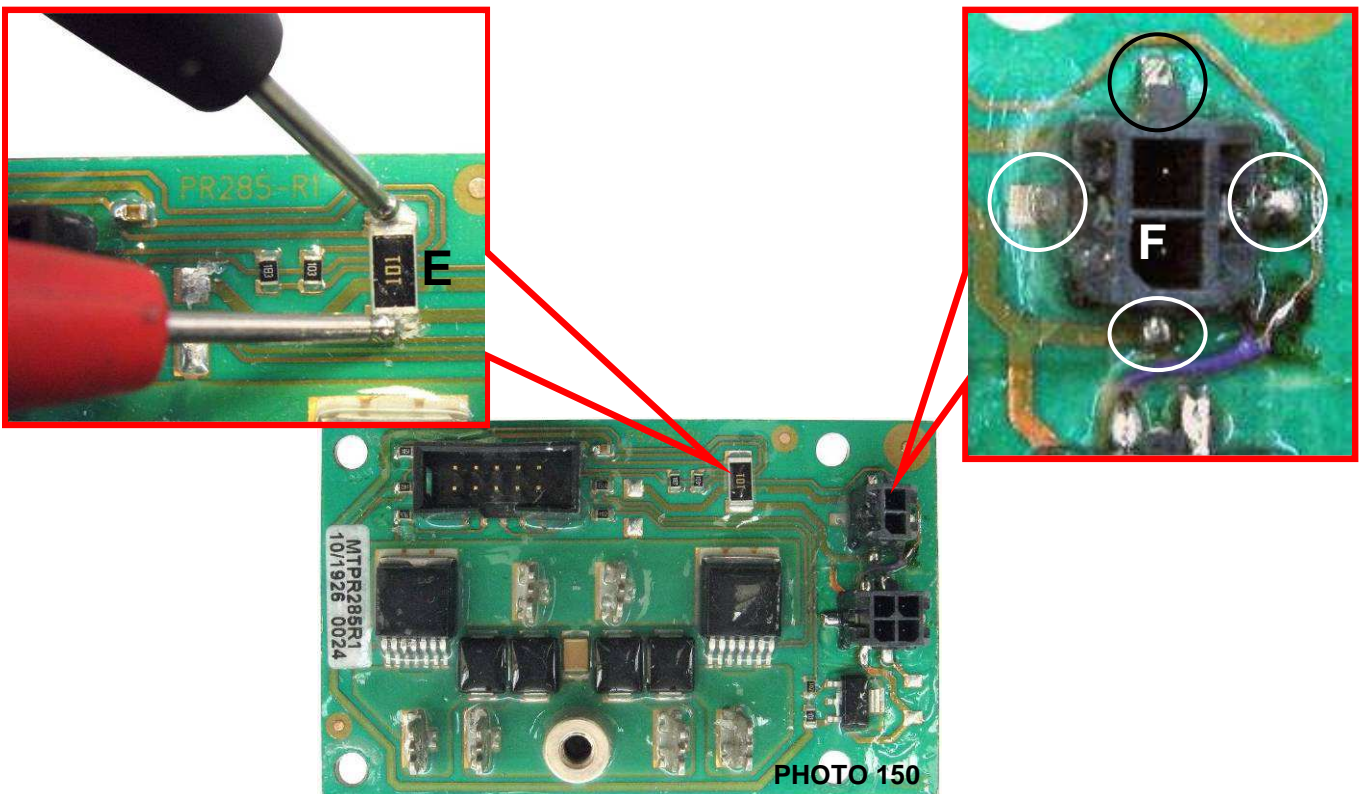


- 7a** If voltage is identical to that measured at the batteries, check the continuity of all ten wires in the flat cable **D**, starting from the wire identified by the red stripe or from contact **1** identified by the arrow on the connector. Replace the flat cable with a new one if necessary.



- 7b** If no voltage is detected, bypass the battery charger as instructed in section D2.1, and repeat the voltage measurement.

- 8** If no voltage is detected even with the battery charger bypassed, remove the power control card as instructed in section D2.1 and test the 100 Ohm (Ω) resistor **E** and the solder joints of connector **F**.



- 9** If necessary, replace the power control card with a new one as instructed in the next section.



Testing the voltage regulator

- 10 The test performed above was an active test. In other words the card was connected to the machine and powered by fully charged batteries.
- 11 It is also possible to perform a passive test, with the function control card removed and not receiving power. This test involves the measurement of resistance in Ohms at the voltage regulator chip.
- 12 Use a digital multimeter able to read electrical resistance in Ohms.

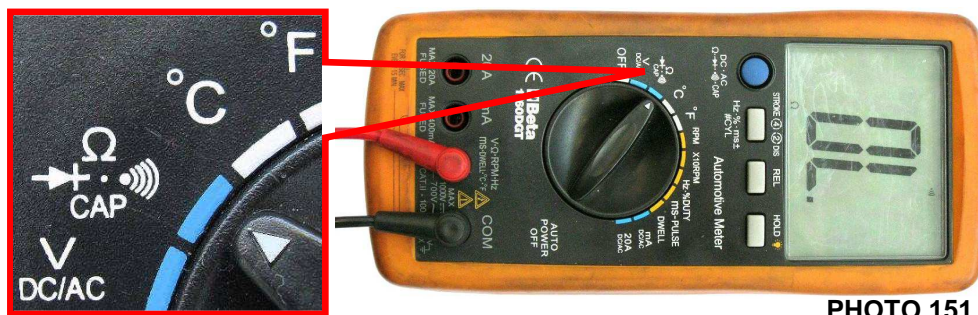


PHOTO 151

- 13 Place the black negative probe on the metal back plate of the voltage regulator and place the red positive probe first on pin **G** and then on pin **H**, and measure the resistance in Ohms. Any value under 500 Ohms is not acceptable and means that the chip has shorted out.

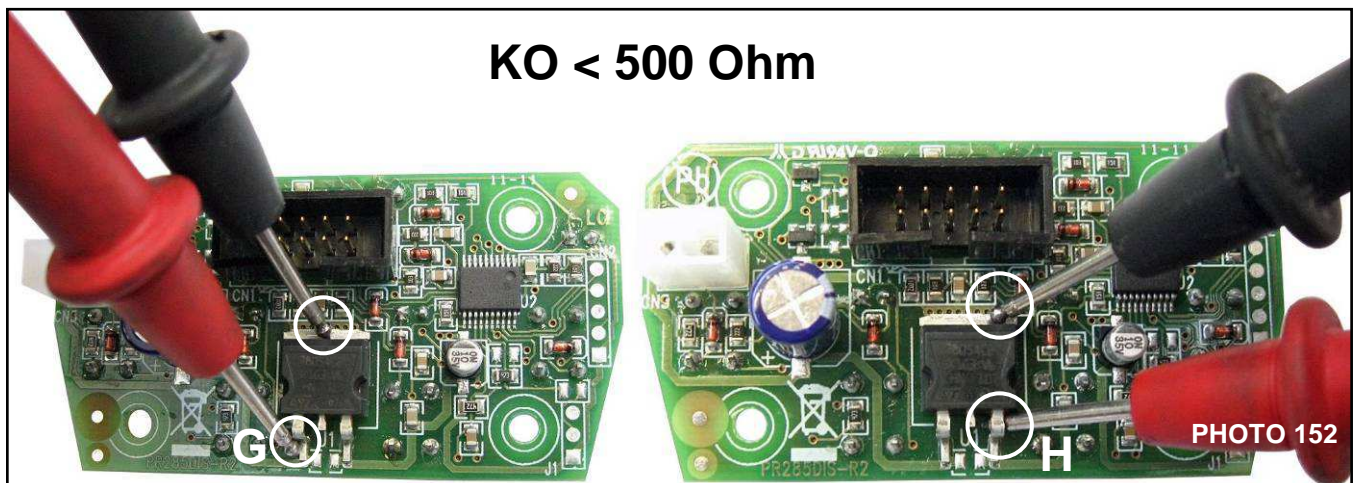


PHOTO 152

- 14 Even when just one electronic control card is being replaced (function control card or power control card), always test the functioning of both.

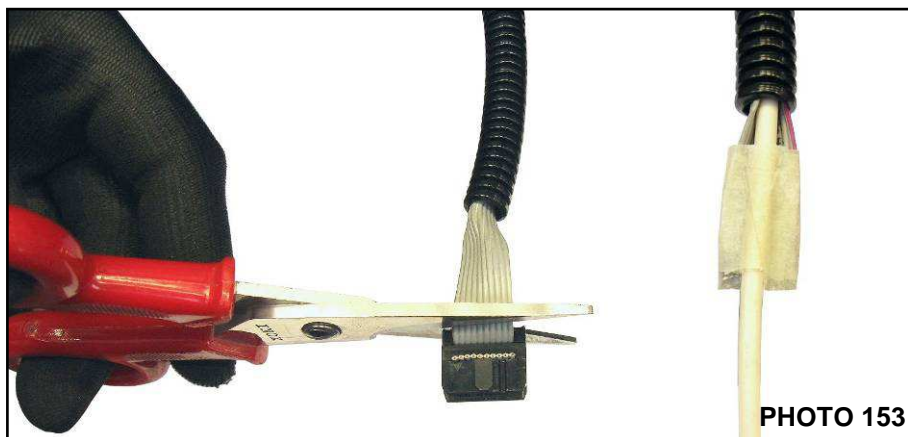


Replacing the flat cable

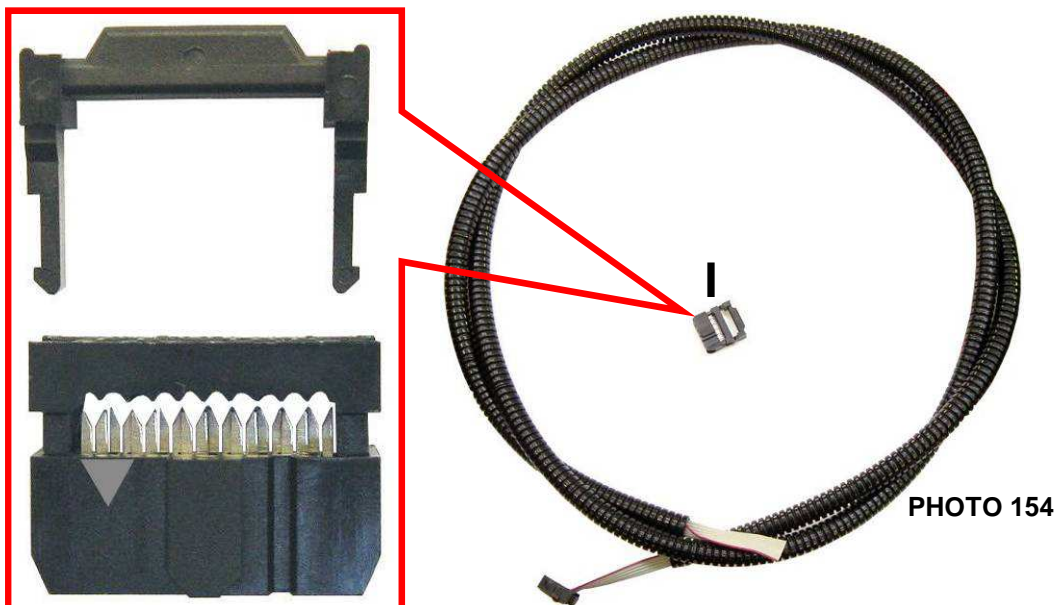
i There are two ways to replace the flat cable. The quickest way is to pull the old flat cable out of the sheath in the machine and pull the new flat cable through the sheath using a clip or a length of wire.

The other method, which should be used if the protective sheath is damaged, is to replace the flat cable and the sheath together.

- 15** Remove the 30 Amp power fuse in the case of "B" type battery machines, or unplug the power cable in the case of "C" type mains machines.
- 16** The procedure for replacing the flat cable is similar for both "B" and "C" type machines. Disconnect and remove the function control card as instructed above.
- 17** Remove the rear cover from the power compartment as instructed in sections D1.3 and D1.5.
- 18** Disconnect the flat cable from the power control card.
- 19** Use a scissors to cut the connector off the flat cable so that the cable can be pulled through the sheath.
- 20** Secure a length of wire to the end of the old cable with insulating tape.

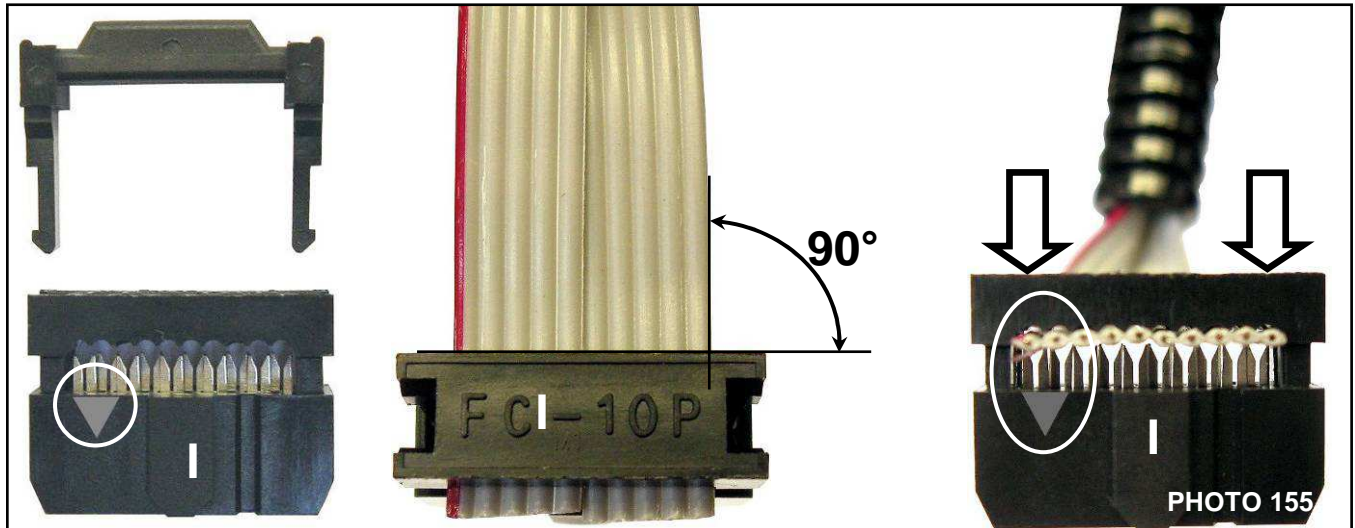


- 21** Pull the old flat cable through the sheath from the control panel end.
- 22** The new part consists of a flat cable, a sheath and a connector I. The connector comes in three parts, two pre-assembled and one to be fitted on the machine.

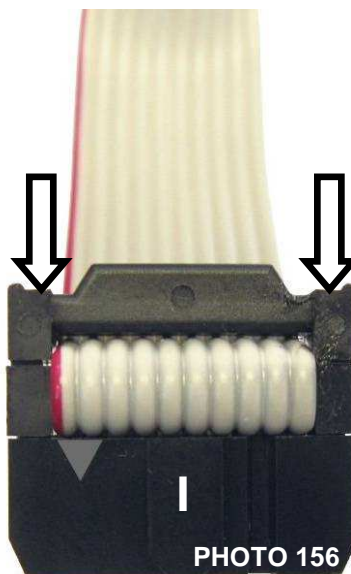




- 23** Attach the length of wire to the end of the new flat cable and pull it through the sheath to the power control card.
- 24** Fit the new connector **I** to the flat cable, taking care to align the wires correctly. The flat cable must be perfectly perpendicular to the connector **I**, and the red stripe on the cable must align with pin 1 on the connector **I**, identified by the arrow.
- 25** Push the outer part of the connector **I** firmly home until the side clips click into place.



- 26** Fold the flat cable over the connector and fix it in place with the push-in clip (the third part of the connector).



- 27** Connect the connector to the power control card. Put the cover back on the power compartment. Reassemble the function control card.



D1.3 Replacing the power control card on “B” type machines

Disassembly

- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 Disconnect the suction hose **A** and arrange safely it under the machine.
- 4 Remove the collection tank from the machine if you have not already done so.
- 5 Remove the four screws **B** and remove the rear cover from the power compartment.

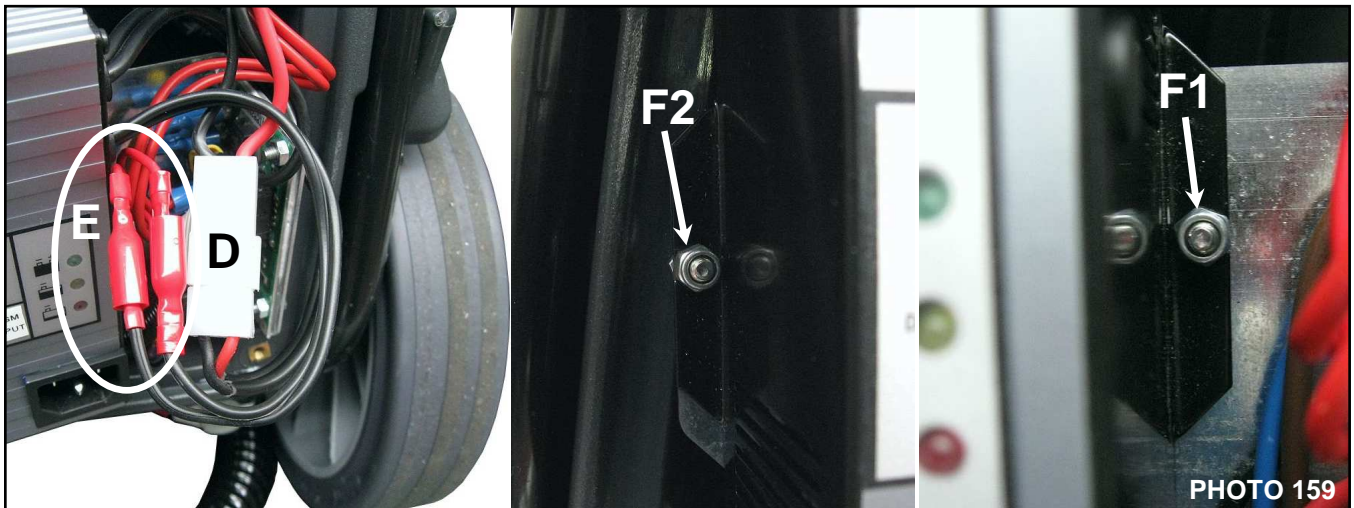


- 6 Identify the two bolts **C** securing the power unit to the solution tank.
- 7 Pull out the entire power unit. Remove the battery charger to access the power control card.

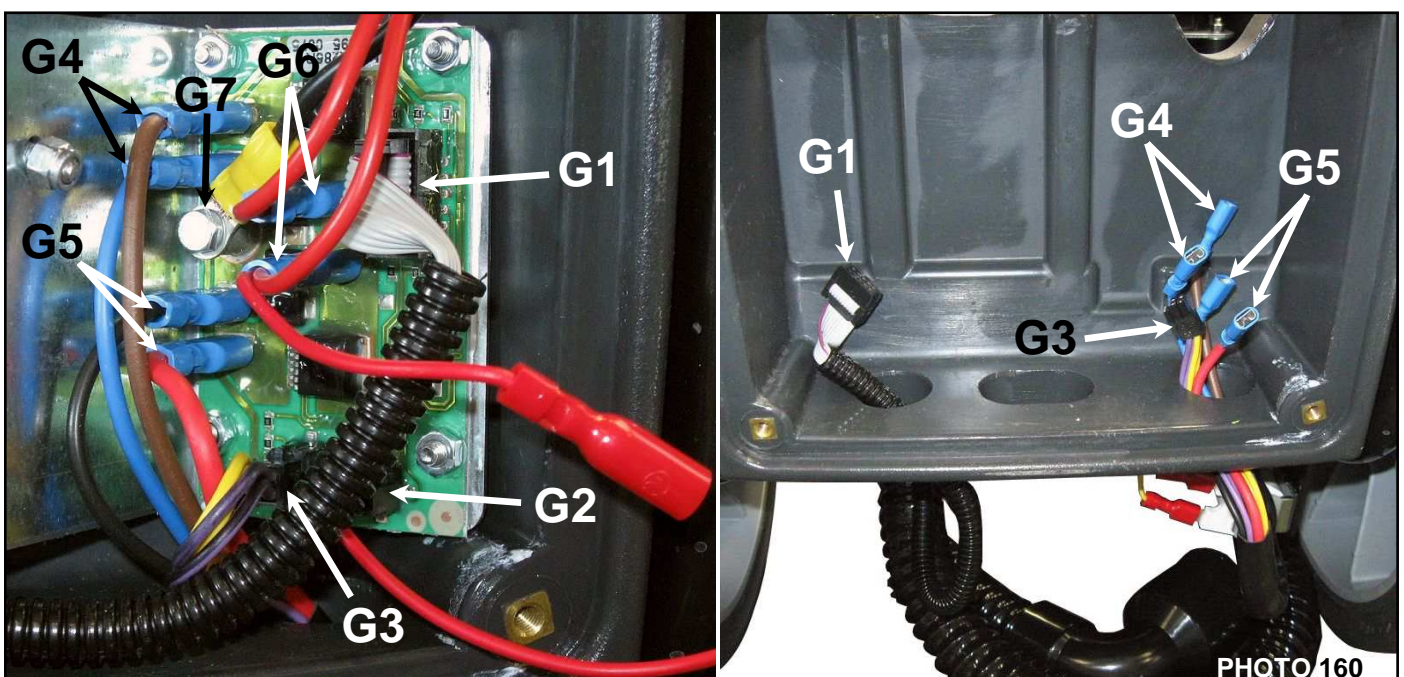




- 8 Disconnect the two pin connector **D** and the two bullet connectors **E** for the battery charger. (These connect the battery charger to the function control card to disable functioning while the batteries are under charge.)
- 9 With the battery charger disconnected, identify the two nuts **F1** and **F2** securing the battery charger to the mounting plate. Loosen the nut **F1**, without removing it.
- 10 Remove the second nut **F2** and detach the battery charger from the mounting plate.
- 11 Disconnect the power control card.

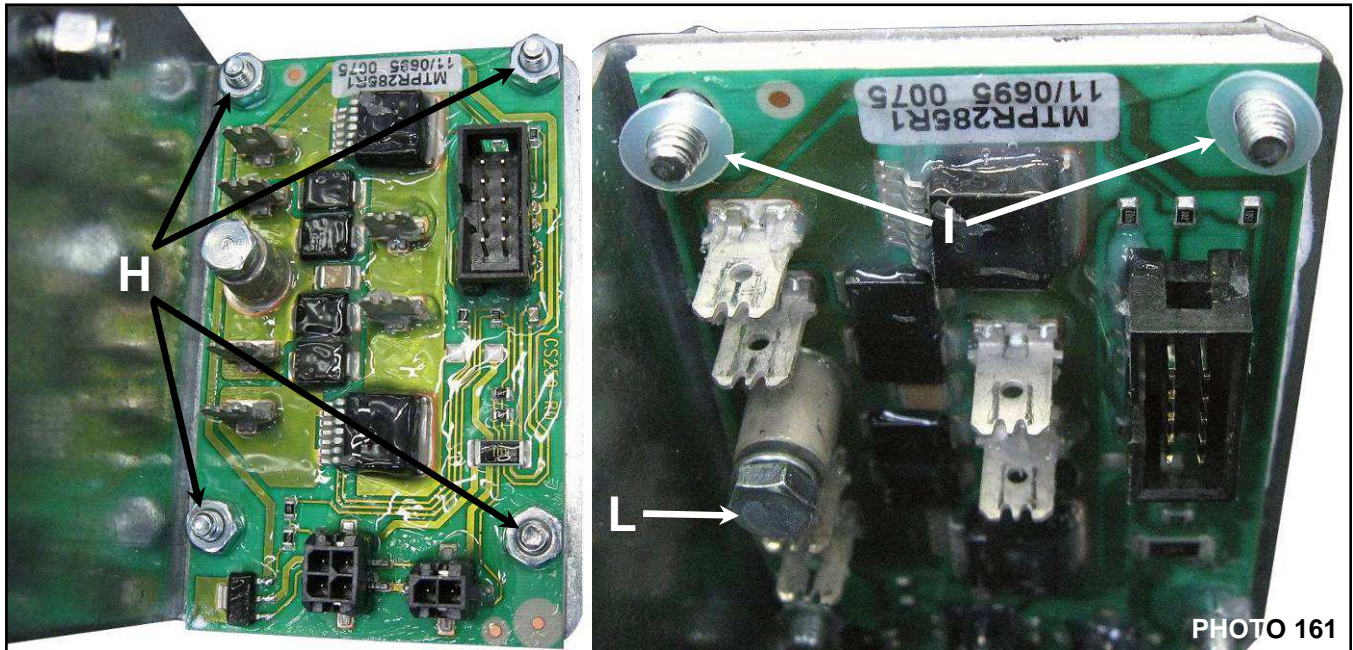


- 12 Disconnect the remaining cables from the power control card. Disconnecting the flat cable **G1**, the two pin connector **G2** for the red lead wired to the other red lead with the male connector for the battery charger, the four pin connector for the solenoid valve and brush motor thermal cutout **G3**, the cables to the suction motor **G4**, and those to the brush motor **G5**. Take particular care when disconnecting these last four cables (G4 and G5).
- 13 Disconnect all the other cables from the power control card. Disconnect the two fast-on connectors **G6** from the positive pole and remove the eye terminal **G7** from the power control card. Take particular care while disconnecting these cables.



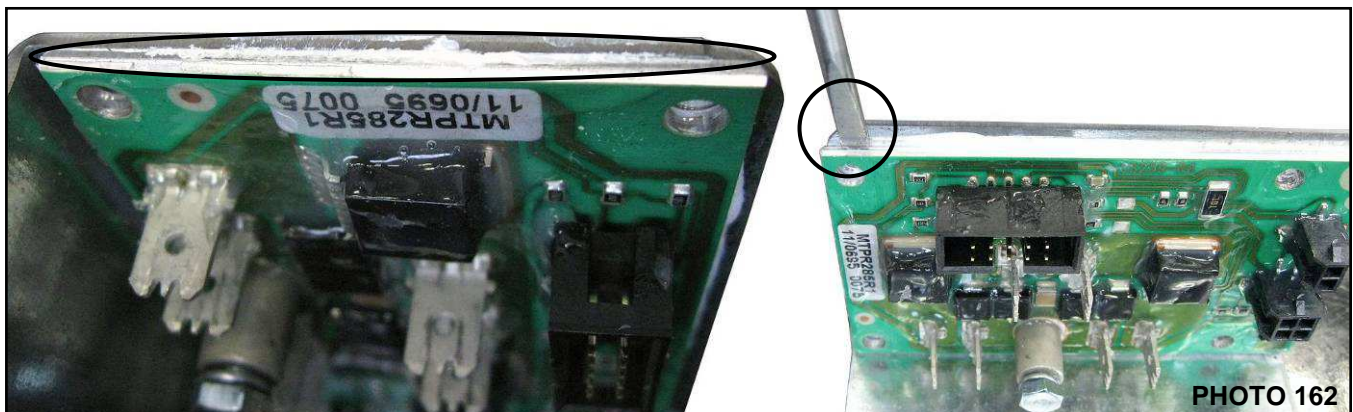


- 14 Before you remove the power control card from the power unit, check its functioning as instructed below.
- 15 Remove the four nuts **H** securing the power control card to the power unit mounting plate.
- 16 Take care not to lose the plastic washers **I** from underneath the nuts.



To facilitate the dissipation of the heat generated by the MOS-FETs, the power control card is attached to the power unit mounting plate with thermally conductive silicon paste.

- 17 Use a small flat blade screwdriver to gently lever the power control card off the mounting plate.



Reassembly

- 1 To fit the new power control card, repeat the steps for disassembly in reverse order.
- 2 Always apply thermally conductive paste between the back of the power control card and the power unit mounting plate.
- 3 Place the plastic washers between the fixing nuts and the power control card.
- 4 Tighten the four nuts to a maximum torque of 2.5 Nm (~ 0.25 Kg_m).
- 5 Tighten the bolt L to a maximum torque of 2 Nm (~ 0.20 kg_m).



D1.4 Testing the power control card on “B” type machines

The power control card supplies the function control card with power and signals for the current draw of the brush and suction motors. The function control card uses these signals to generate LED error code on the control panel and to disconnect power if current draw exceeds maximum limits. The power control card drives the brush and suction motors via MOS-FETs to provide a soft-start ramp.

- i** *The power control card also provides the function control card with signals for MOS-FET temperature, to prevent these components from overheating when the motors are running. Maximum permitted temperature is 150° C. If this limit is exceeded, the function control card commands the power control card to disconnect power to the affected motor.*

Testing the suction motor diodes and MOS-FETs

- 1 If the suction motor fails to operate when suction is switched on at the control panel, test the following components.
- 2 Use a pair of cables of adequate size to connect the suction motor directly to the batteries. If the motor runs, check the power supply from the power control card.

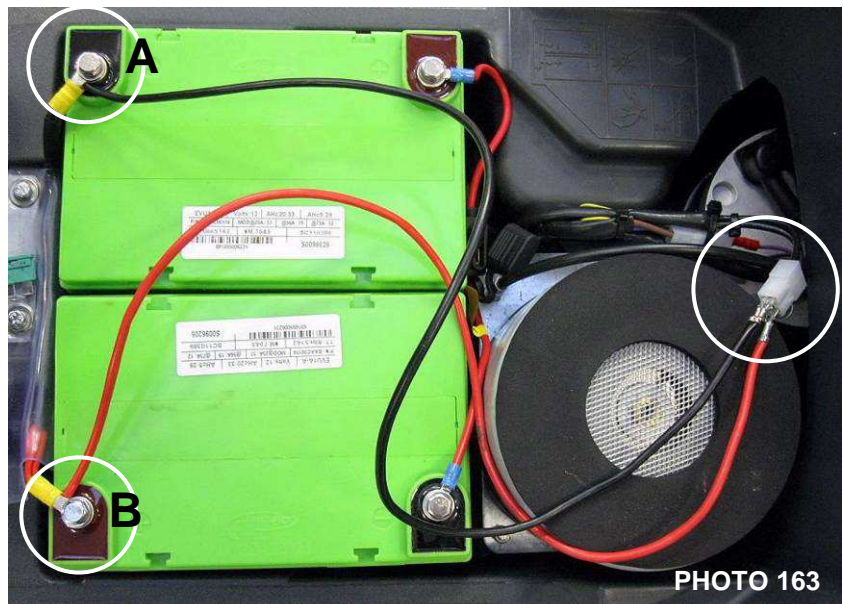


PHOTO 163

- 3 Use a digital multimeter able to read voltage (V).
- 4 Measure the voltage of power from the batteries to the power control card with the black negative probe on the dedicated contact **F4**, and the red positive probe on the fast-on **F1**. Voltage between these points must be identical to voltage across the battery terminals **A – B**. If voltage is correct, check the continuity of the cables powering the suction motor.



PHOTO 164



- 5 Use a digital multimeter able to read electrical resistance in Ohms.

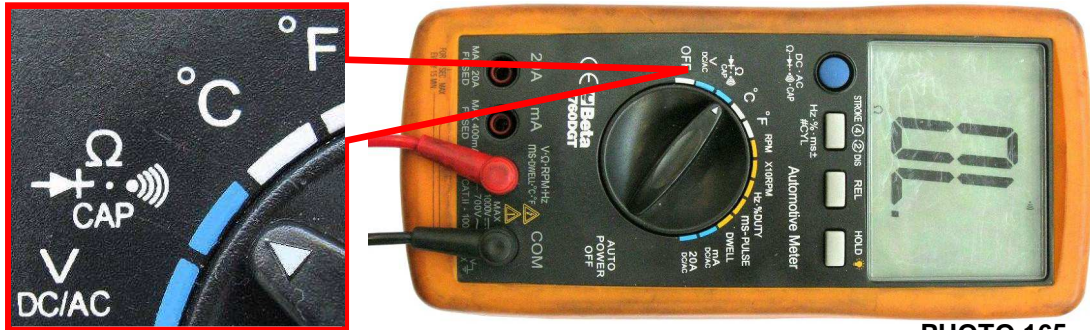


PHOTO 165

- 6 Use the digital multimeter to check the continuity of both power cables from the power control card to the suction motor.

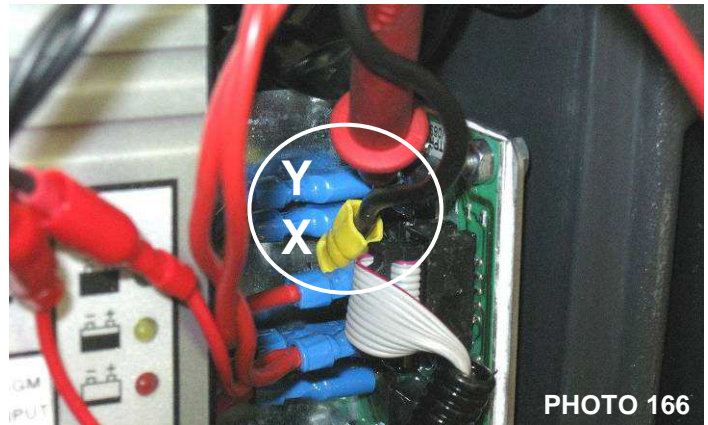


PHOTO 166

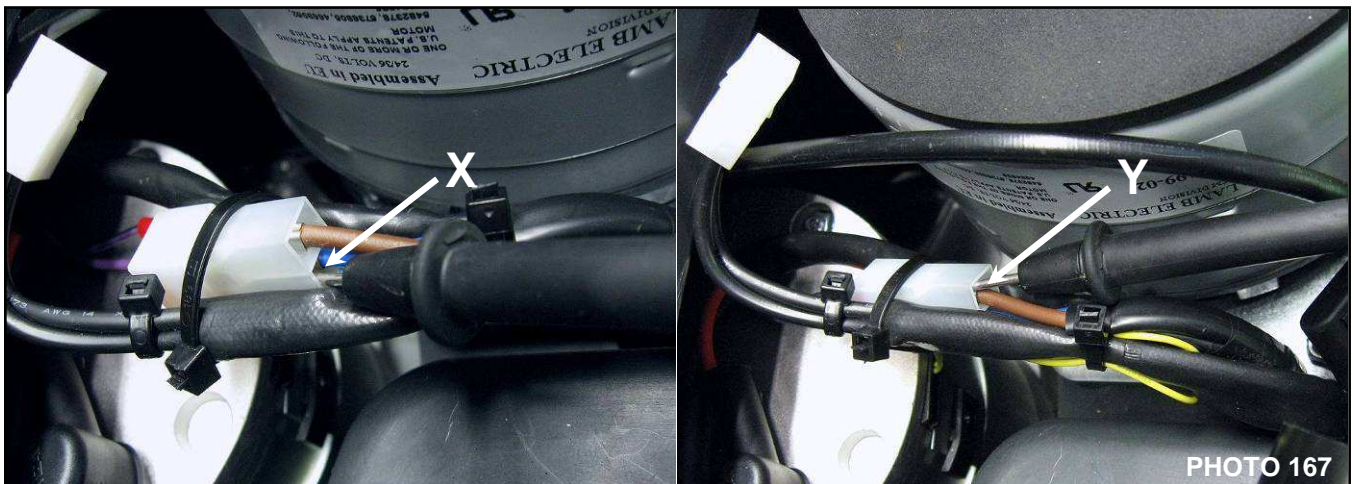


PHOTO 167

- 7 If the above tests find no faults, remove the power unit, but do not remove the power control card from it, as instructed in the previous section, and test the diodes and MOS-FETs for the suction motor.
- 8 With the power control card disconnected and removed from the power compartment, first test the diodes and then the MOS-FETs in the suction motor circuit.
- 9 Set the digital multimeter to read resistance in Ohms (Ω).



Checking the diodes

- 10** Place the black negative probe on the connection for the negative cable **F4**, and place the red positive probe on the fast-on **F3** of the suction motor's positive cable. If the multimeter shows no continuity between these points, the diodes are working efficiently. Proceed to test the MOS-FETs.

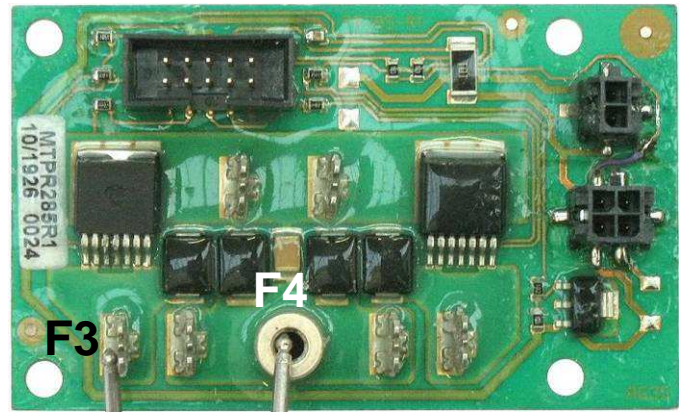


PHOTO 168



Testing the MOS-FETs

- 11** Place the black negative probe on the fast-on **F3** of the suction motor's positive cable, and place the red positive probe on the fast-on **F1** or **F2** of the card's power input. If the multimeter shows no continuity between these points, the MOS-FETs are working efficiently. Proceed to test the function control card.

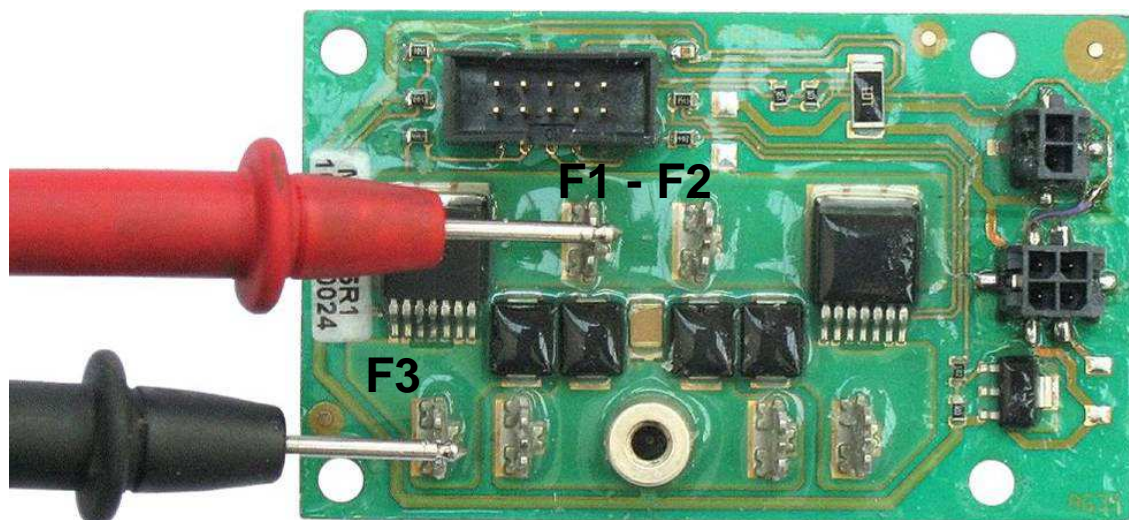


PHOTO 169





Testing the brush motor diodes and MOS-FETs

- 12 If the brush motor fails to operate when switched on at the control panel, test the components in the circuit. Start by testing the motor's thermal cutout, as instructed in section A2.4.
- 13 Raise the brush off the floor and remove it. Using a pair of cables of adequate size, connect the brush motor directly to the batteries. If the motor runs, first test the power supply from the batteries to the power control card as instructed in steps 3 and 4 above. If voltage is reaching the card, test the cables to the motor for continuity.

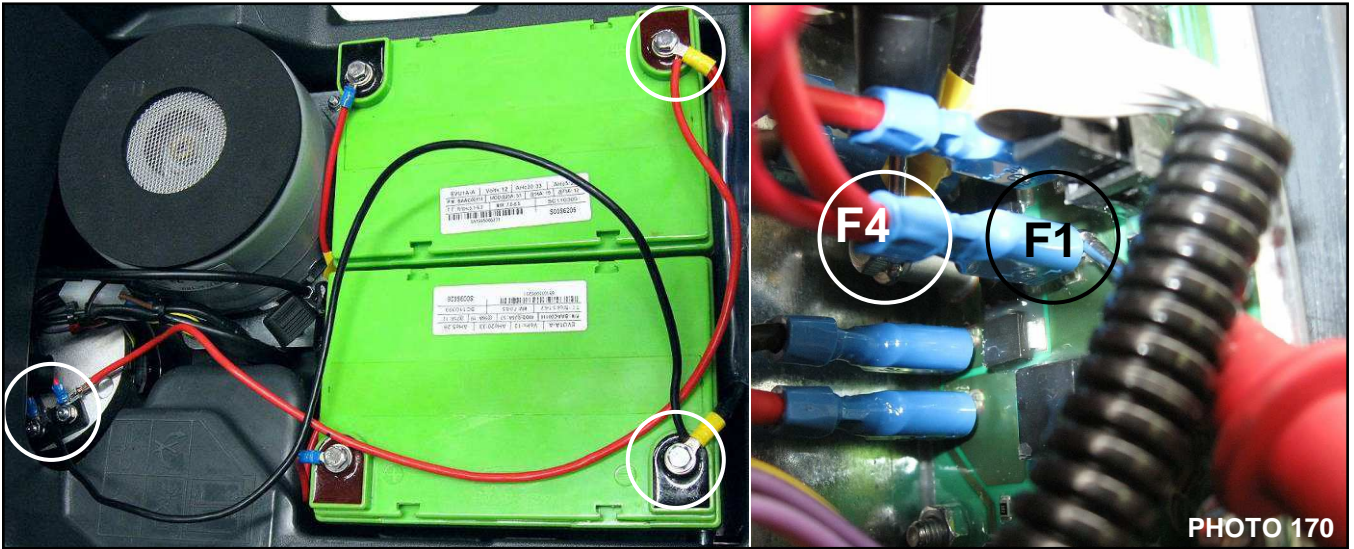


PHOTO 170

- 14 Use a digital multimeter able to read electrical resistance in Ohms (Ω).

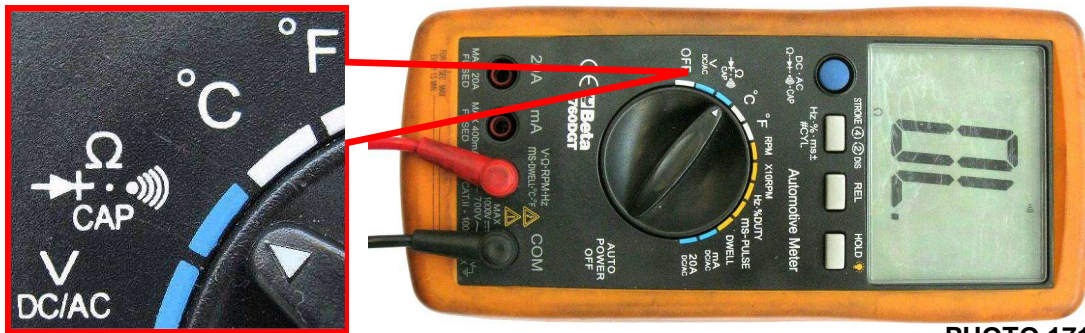


PHOTO 171

- 15 Use the digital multimeter to check the continuity of both power cables from the power control card to the brush motor.

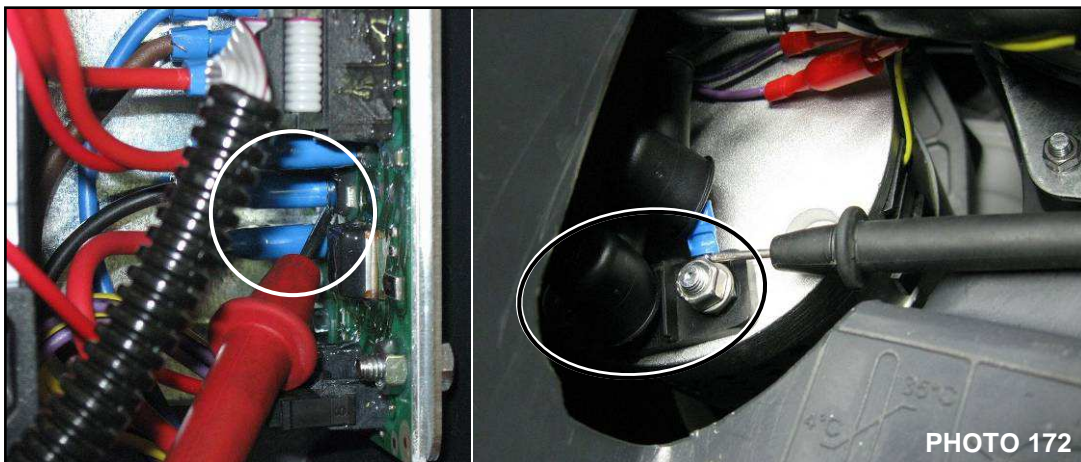


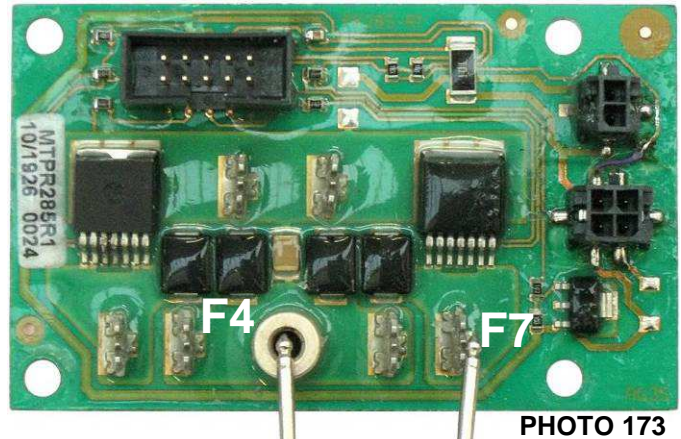
PHOTO 172



- 16 If the above tests find no faults, remove the power control card along with the power unit, as instructed in the previous section, and test the diodes and MOS-FETs in the brush motor circuit.
- 17 With the power control card disconnected and removed from the power compartment, first test the diodes and then the MOS-FETs for the brush motor.
- 18 Set the digital multimeter to read resistance in Ohms (Ω).

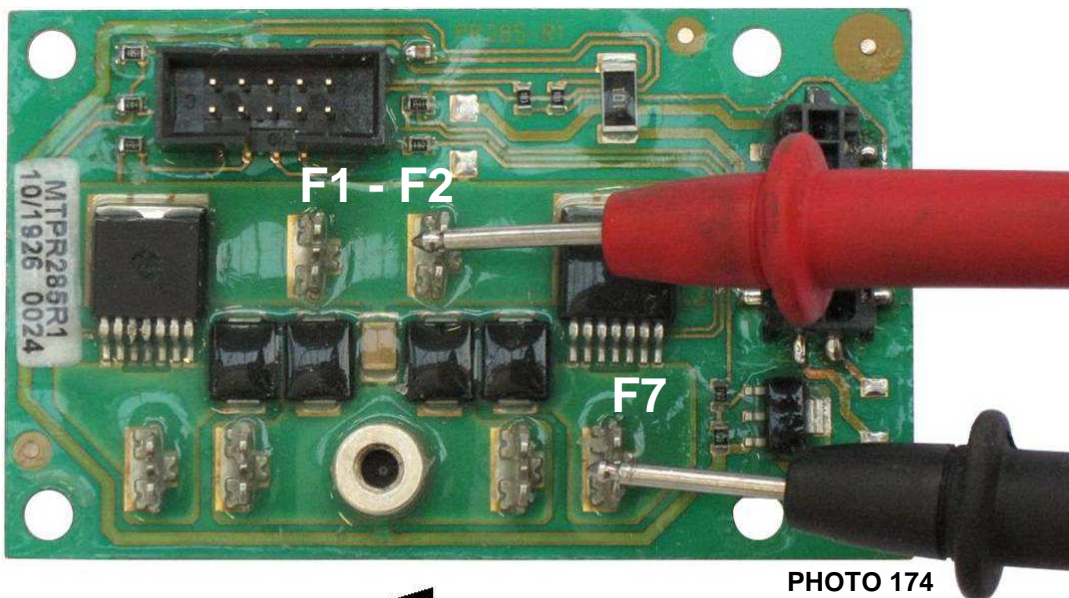
Checking the diodes

- 19 Place the black negative probe on the connection for the negative cable **F4**, and place the red positive probe on the fast-on **F7** of the brush motor's positive cable. If the multimeter shows no continuity between these points, the diodes are working efficiently. Proceed to test the MOS-FETs.



Testing the MOS-FETs

- 20 Place the black negative probe on the fast-on **F7** of the brush motor's positive cable, and place the red positive probe on the fast-on **F1** or **F2** of the card's power input. If the multimeter shows no continuity between these points, the MOS-FETs are working efficiently. Proceed to test the function control card.





Testing the solenoid valve MOS-FETs

- 21 First test the solenoid valve as instructed in section B3.2. If the solenoid valve is not functioning after step 12d of the procedure, test the MOS-FETs for the solenoid valve circuit.
- 22 Use a digital multimeter able to read electrical resistance in Ohms (Ω).



PHOTO 175

- 23 Remove the power unit, but do not remove the power control card from it, and test the MOS-FETs for the solenoid valve circuit.
- 24 Place the black negative probe on the connection for the negative cable **F4**, and place the red positive probe on pin **2** of connector **CN1A**. If the multimeter shows no continuity, the MOS-FETs are working efficiently. Proceed to test the function control card, and if that is working, replace the power control card.

TC = Brush Motor Thermal Cutout / SV = Solenoid Salve

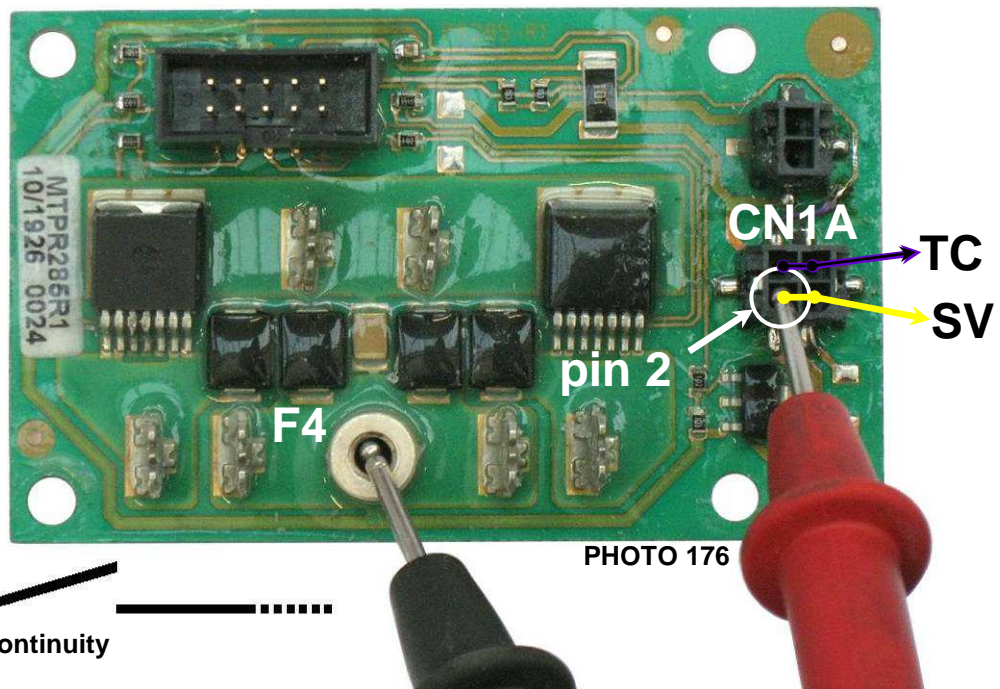


PHOTO 176

- 25 After replacing the function control card or power control card, test the whole electronic system before reassembling.
- 26 Make sure that the power control card is receiving battery power correctly by using the digital multimeter to read the voltage (V) between fast-on **F1** or **F2** and the connection **F4**. Voltage between these points must be identical to voltage across the battery terminals connected in series.
- 27 **Even when just one electronic control cord is being replaced (function control card or power control card), always test the functioning of both.**

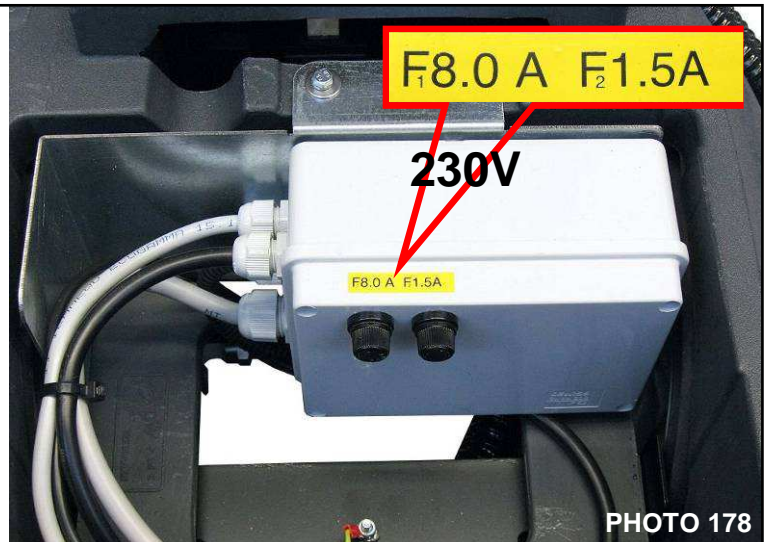


D1.5 Replacing the power control card on "C" type machines

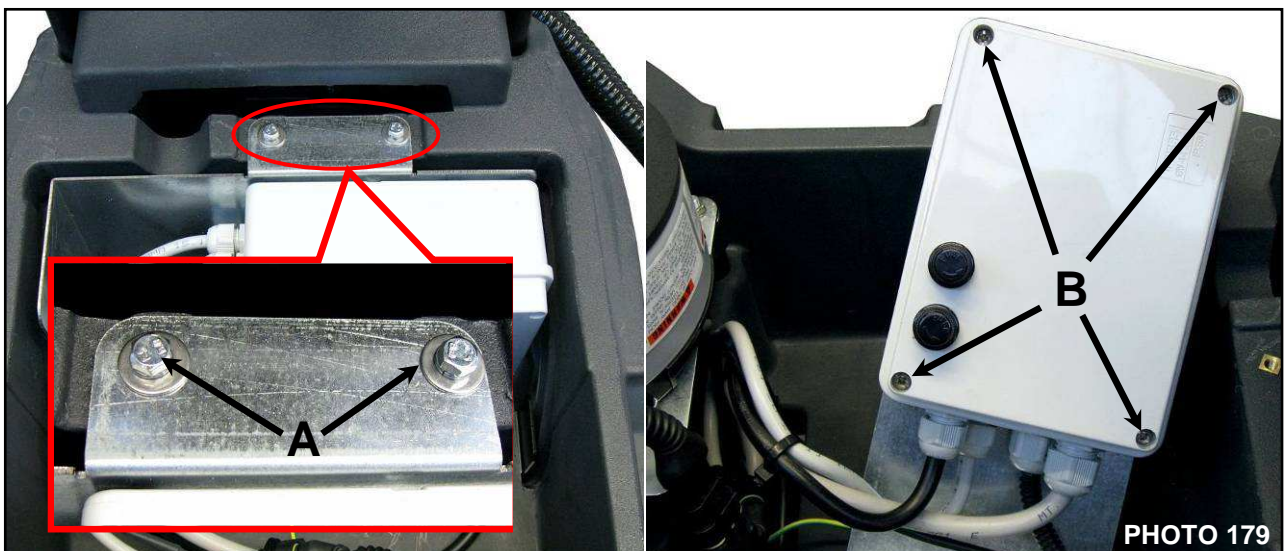
WARNING! RISK OF ELECTRIC SHOCK

Disassembly

- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.
- 3 **Make sure that the machine's mains power cable is disconnected from the electricity supply to avoid all risk of electric shock.**
- 4 Disconnect the suction hose from the collection tank. Lift up and remove the collection tank.
- 5 Locate the waterproof box containing the power control card.

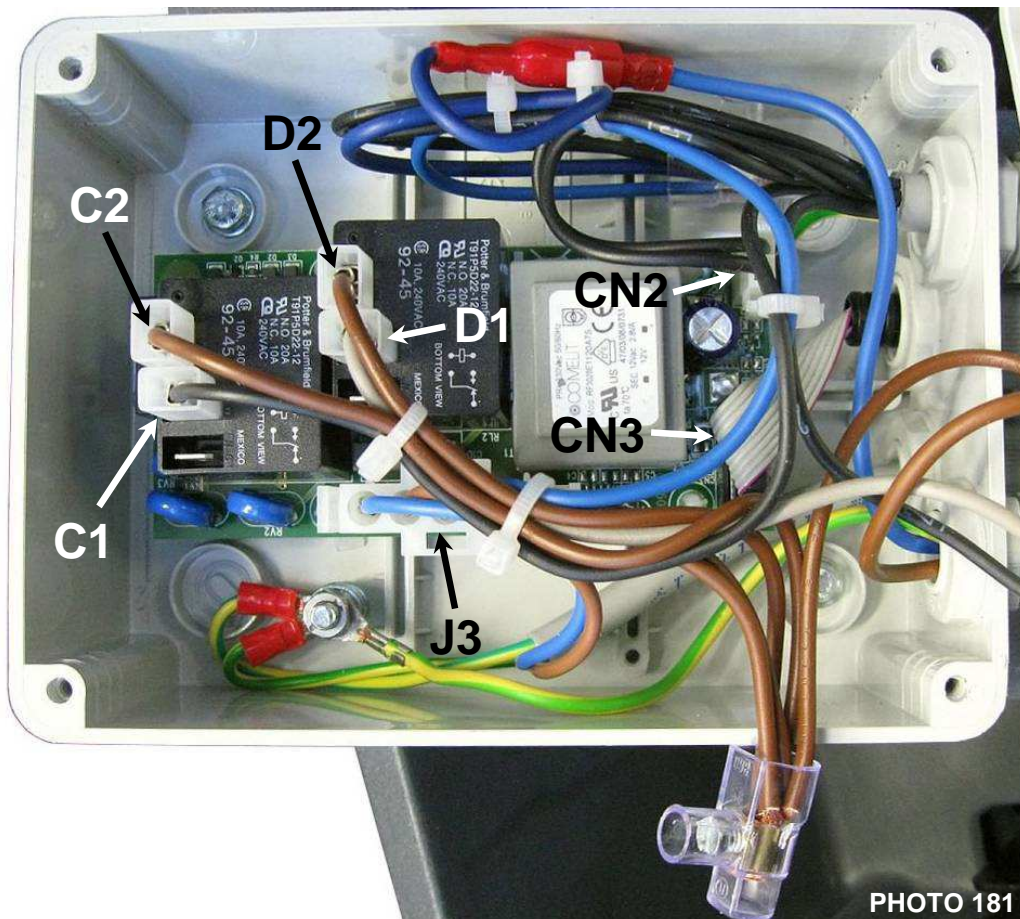
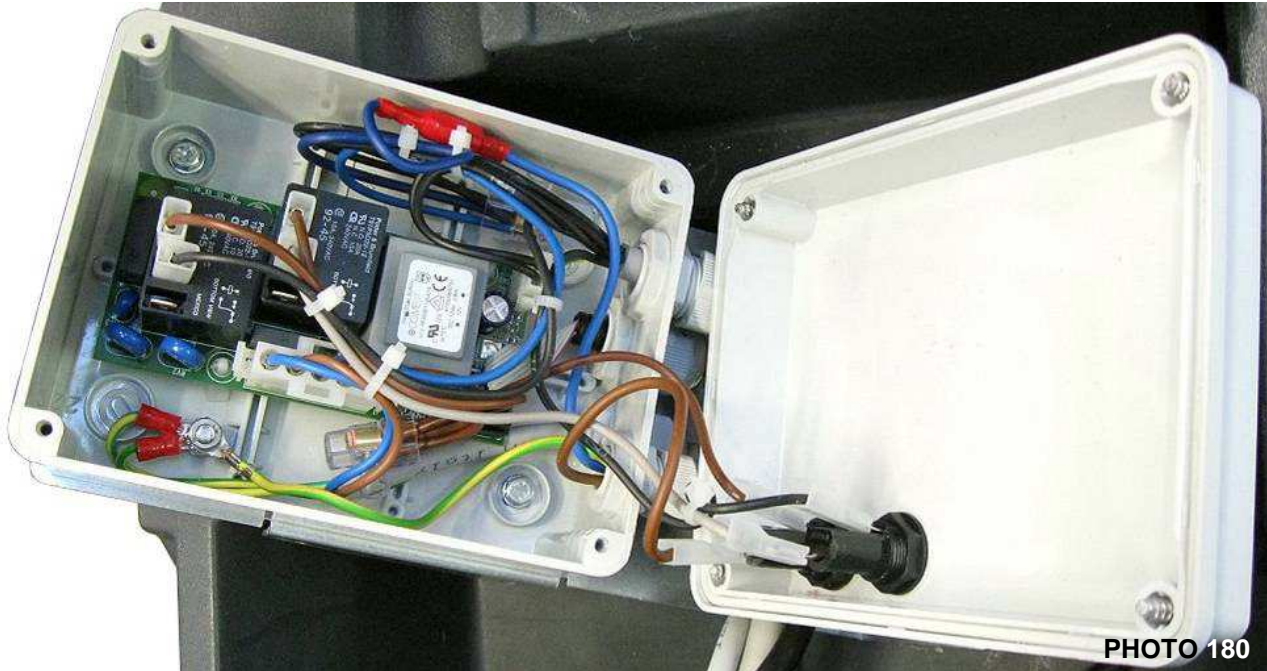


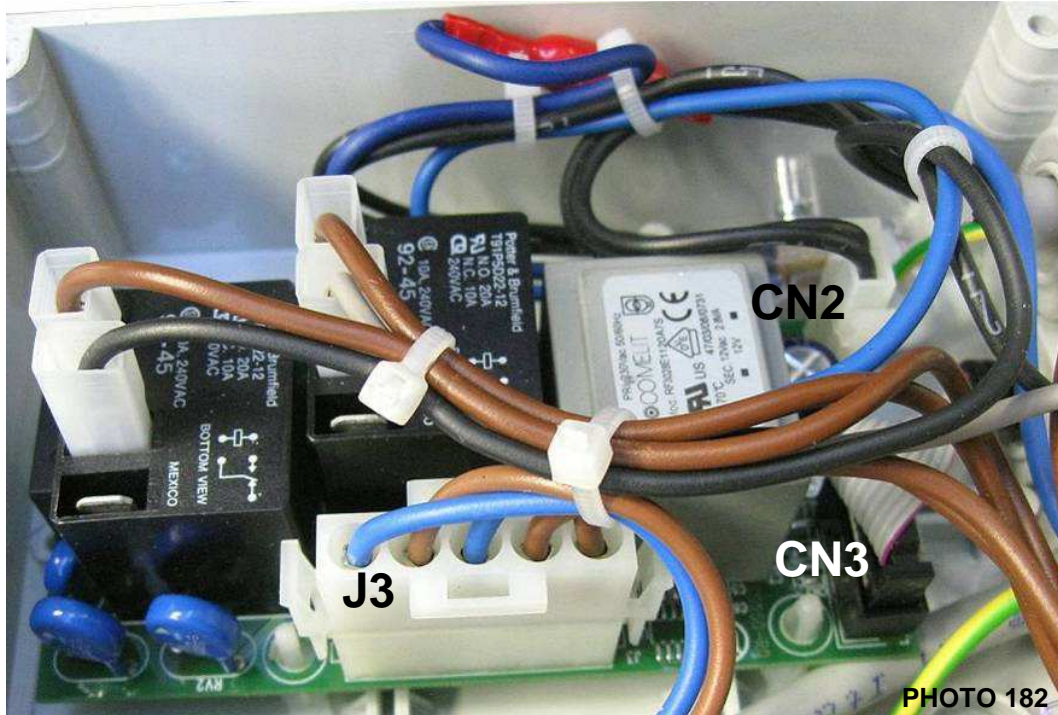
- 6 Unscrew the two bolts **A** fixing the box's mounting plate to the solution tank.
- 7 Arrange the box so that you can remove its cover without pulling on the cables going into it.
- 8 Unscrew the four screws **B** securing the cover to the box.





- 9** Identify the connectors you need to disconnect to remove the power control card from the waterproof box.
- 10** Disconnect the black wire **C1** and the brown wire **C2** (common) for the suction motor, and the grey wire **D1** and brown wire **D2** (common) for the brush motor. Disconnect the connector **CN2** of the brush motor's thermal cutout, the connector **CN3** of the flat cable, and the connector **J3** supplying power to the function control card and solenoid valve.





- 11 Once all the connectors have been disconnected, remove the power control card from the box.
- 12 Use a long nose pliers to release the four plastic clips **E** holding the power control card in place and lift the card out to remove it.

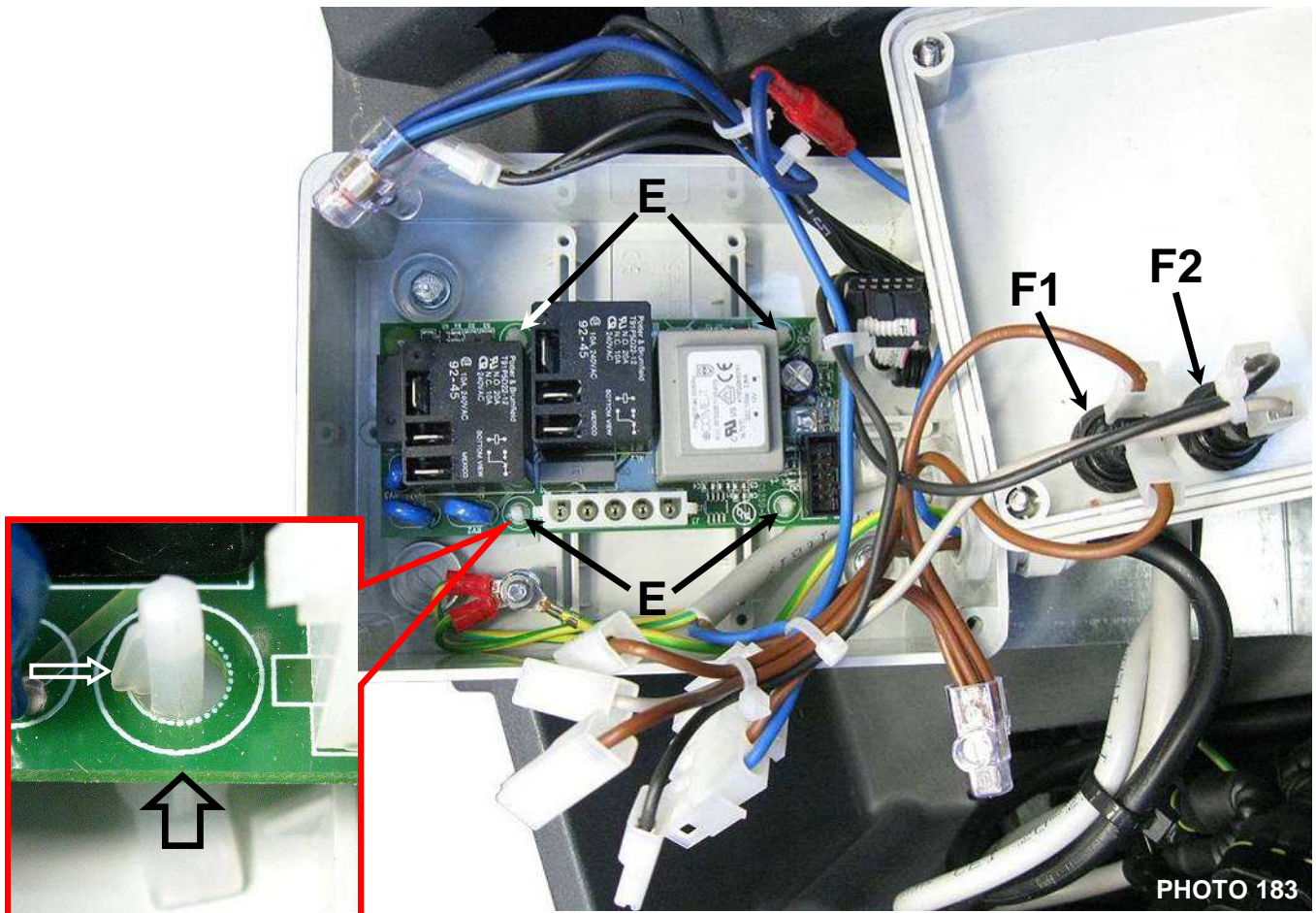




PHOTO 184

- 13 Take care not to damage the connections to the fuses. The fuse **F1** (8 A for 230 V machines, 16 A for 115 V machines) is the main fuse, and protects the motors and all main functions. The fuse **F2** (1.5 A for the 230 V version, 2.8 A T for the 115 V version) protects only the brush motor and is connected in series to the fuse **F1**.
- 14 Replace the power control card with a new one, making quite sure that the transformer power rating is identical to the old card (230 V / 115 V), since all functions depend on the transformer output (12 V).

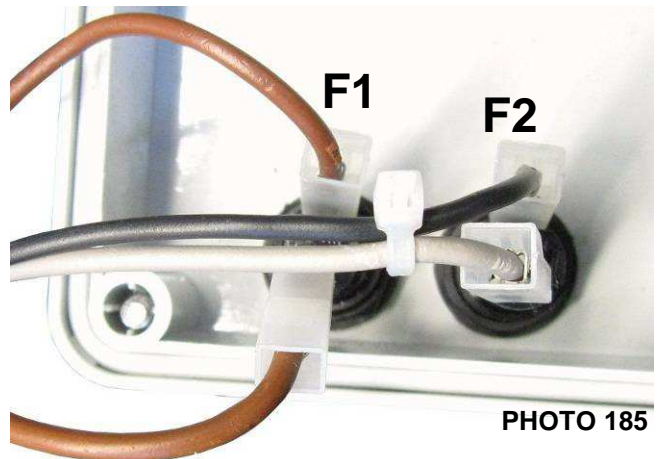


PHOTO 185

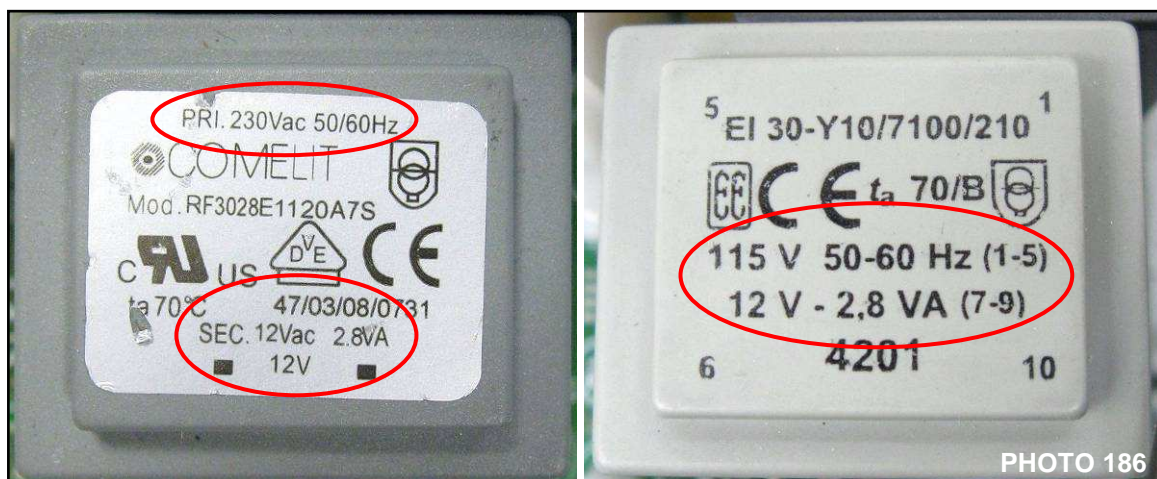


PHOTO 186

Reassembly

- 1 Replace the power control card with a new one, making quite sure that the transformer power rating is identical.
- 2 To fit the new power control card, repeat the steps for disassembly in reverse order.



D1.6 Testing the power control card on "C" type machines

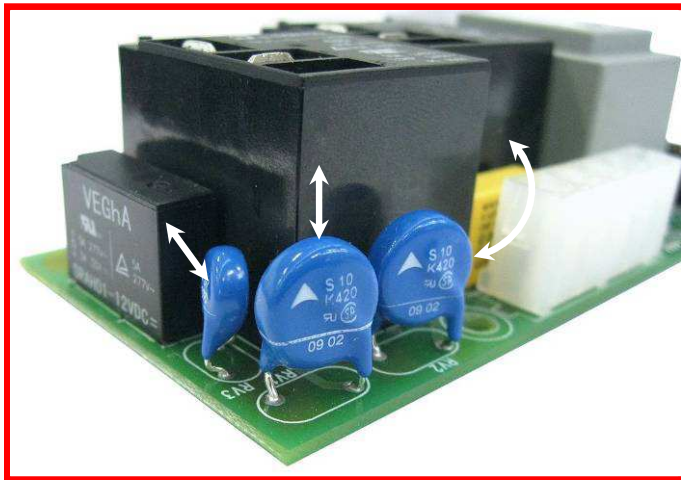
WARNING! RISK OF ELECTRIC SHOCK



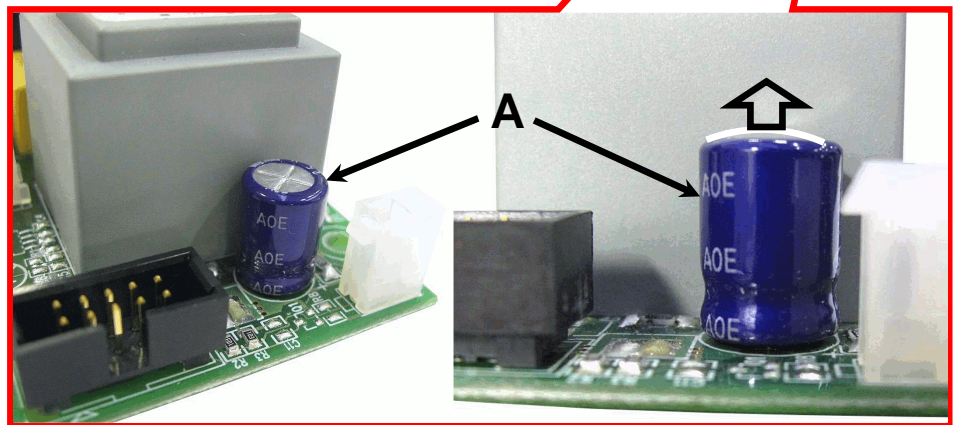
Make quite sure that the power cable is disconnected from the electricity supply before starting to test the power control card. Disconnect all connectors from the card and remove the card from the waterproof box before starting testing.

Inspection and testing

- 1 Make sure that the machine's mains power cable is disconnected from the electricity supply.
- 2 Remove the power control card as instructed in the previous section before starting testing, in order to avoid possible false readings.
- 3 Inspect the card visually for signs of burning.
- 4 The components most at risk of burning out are the MOV suppressors fitted on the inputs to the three relays to protect the power users.



- 5 If there are no signs of card components having burned out, visually inspect the capacitor A downstream from the transformer. If the upper part of the capacitor is swollen, it could well have lost its efficiency and be interfering with the correct functioning of the power control card.





230 V power control cards

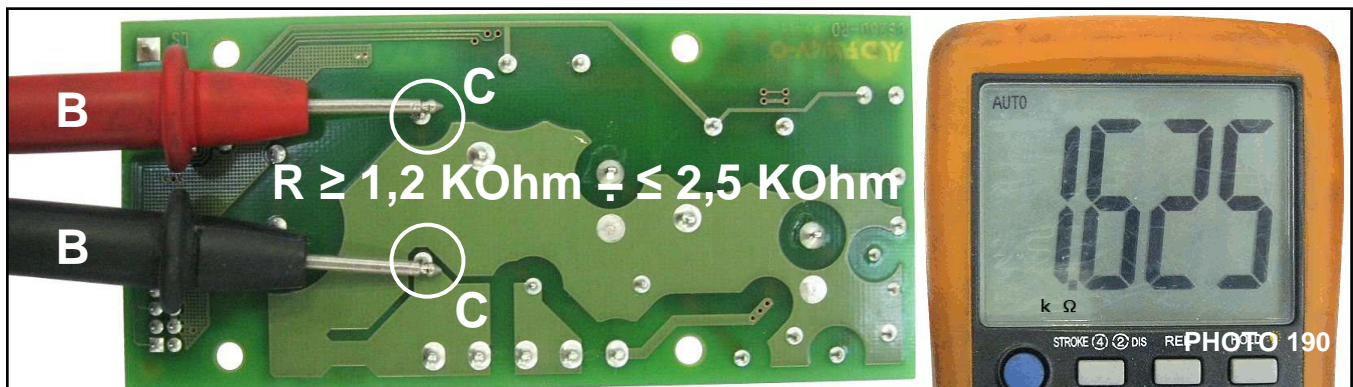
- 6 If there are no signs of any burned components and the capacitor is not swollen, measure the resistance of the transformer windings. The transformer is the most important component on the power control card as it generates the low voltage for the function control card and the three relays for the suction motor, brush motor and solenoid valve.
- 7 Use a digital multimeter able to read electrical resistance in Ohms (Ω).



PHOTO 189

Testing the 230 V primary windings

- 8 Use a digital multimeter able to measure resistance in Ohms. Measure the resistance of the transformer's primary winding. Connect the two probes **B** of the multimeter to the two ends of the transformer's primary winding. (The position is irrelevant.)
- 9 The resistance in Ohms (Ω) must lie between 1.2 KOhm and 2.5 KOhm (1200 Ohm and 2500 Ohm).

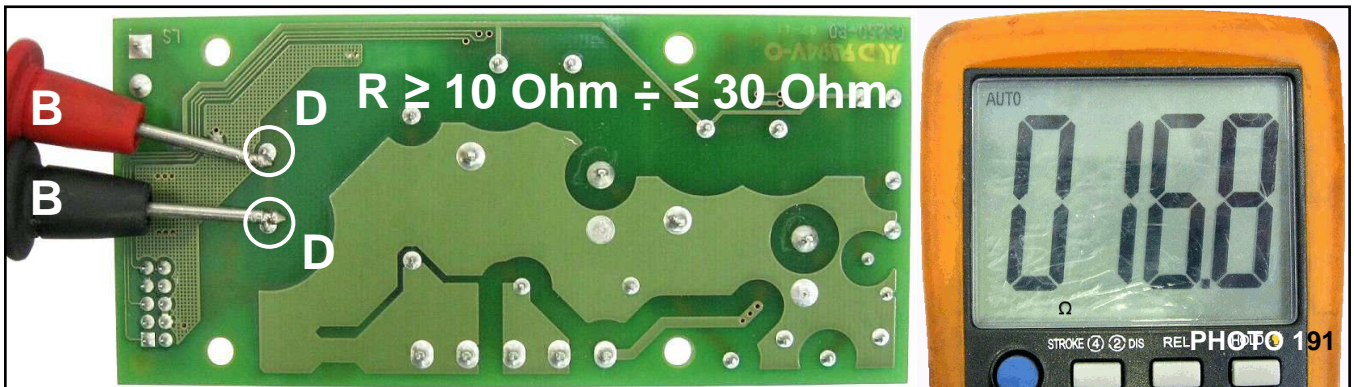


- 10 If the measured resistance lies outside this range, the winding is defective. This will cause the entire power control card to malfunction. The entire card must therefore be replaced to restore correct functioning.
- 11 If the measured resistance lies within the specified limits, proceed to measure the resistance of the transformer's secondary winding.



Testing the 12 V secondary windings (on a 230 V machine)

- 12** Use a digital multimeter able to measure resistance in Ohms. Measure the resistance of the transformer's secondary winding. Connect the two probes **B** of the multimeter to the two ends **D** of the transformer's secondary winding. (The position is irrelevant.)
- 13** The resistance R in Ohms (Ω) must lie between 10 Ohm and 30 Ohm.



- 14** If the measured resistance lies outside this range, the winding is defective. This will cause the entire power control card to malfunction. The entire card must therefore be replaced to restore correct functioning.
- 15** If the measured resistance lies within the specified limits, proceed to the next tests.

115 V power control cards

- 16** If there are no signs of any burned components and the capacitor is not swollen, measure the resistance of the transformer windings. The transformer is the most important component on the power control card as it generates low voltage for the function control card and the three relays for the suction motor, brush motor and solenoid valve.
- 17** Use a digital multimeter able to read electrical resistance in Ohms (Ω).

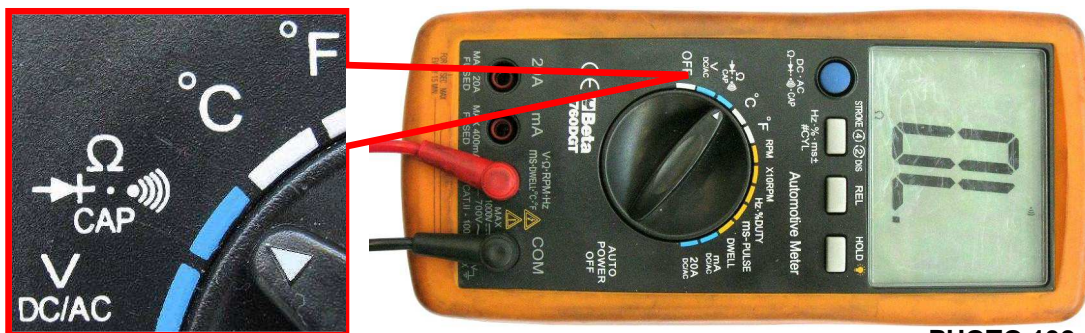
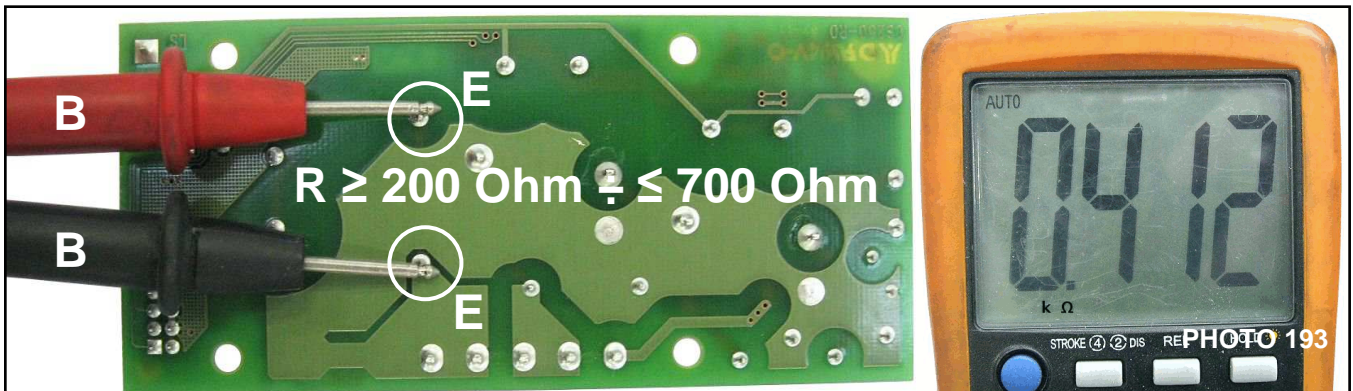


PHOTO 192



Testing the 115 V primary windings

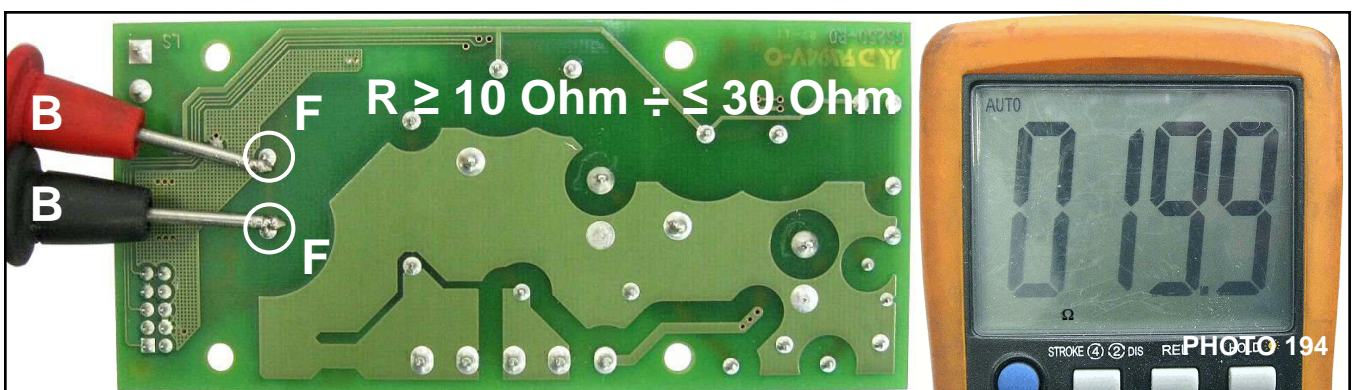
- 18** Use a digital multimeter able to measure resistance in Ohms. Measure the resistance of the transformer's primary winding. Connect the two probes **B** of the multimeter to the two ends **E** of the transformer's primary winding.
- 19** The resistance in Ohms (Ω) must lie between 200 Ohm and 700 Ohm.



- 20** If the measured resistance lies outside this range, the winding is defective. This will cause the entire power control card to malfunction. The entire card must therefore be replaced to restore correct functioning.
- 21** If the measured resistance lies within the specified limits, proceed to measure the resistance of the transformer's secondary winding.

Testing the 12 V secondary windings (on a 115 V machine)

- 22** Use a digital multimeter able to measure resistance in Ohms. Measure the resistance of the transformer's secondary winding. Connect the two probes **B** of the multimeter to the two ends **F** of the transformer's secondary winding.
- 23** The resistance R in Ohms (Ω) must lie between 10 Ohm and 30 Ohm.



- 24** If the measured resistance lies outside this range, the winding is defective. This will cause the entire power control card to malfunction. The entire card must therefore be replaced to restore correct functioning.
- 25** If the measured resistance lies within the specified limits, proceed to the next tests.



Measuring the resistance of the relay coils



The power control cards powers the brush and suction motors via relays, energised by the function control card. The relay coils are energised at 12 V DC, for both motors, irrespective of the voltage of the power supply to the power control card (230 V – 115 V). The relays are therefore theoretically interchangeable. The solenoid valve relay is also energised at 12 V DC.

- 26 The last operation required is to measure the resistance of the coil in the relay for the brush motor or suction motor. Only the coil of the relay for the malfunctioning motor need be tested.

Measuring resistance in the brush motor or suction motor relay coil.

- 27 Use a digital multimeter able to read electrical resistance in Ohms (Ω).



PHOTO 195

- 28 Use a digital multimeter able to measure resistance in Ohms. Measure the resistance of the relay's coil. Connect the probes **B** of the multimeter to the two ends **G** of the brush motor relay coil, or to the two ends **H** of the suction motor relay coil.
29 The resistance R in Ohms (Ω) must lie between 100 Ohm and 200 Ohm.

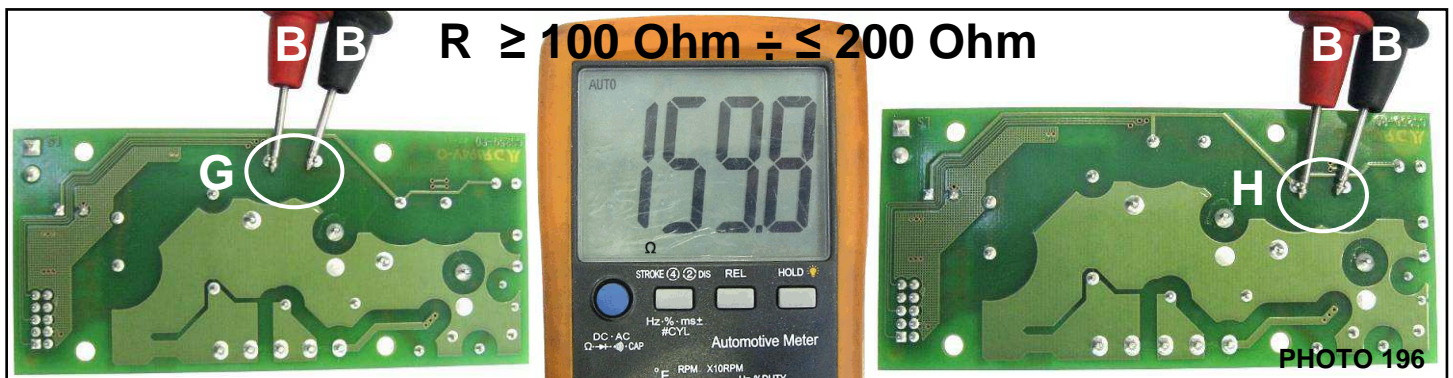


PHOTO 196

- 30 If the measured resistance lies outside this range, the relay coil is defective. This will prevent the brush motor or suction motor from starting up. Replace the entire power control card.

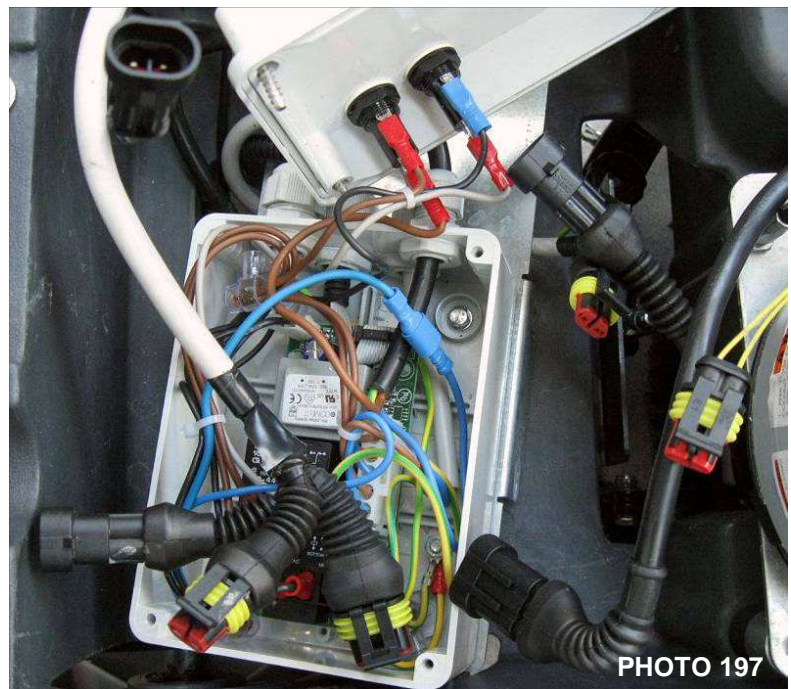


Testing for continuity in cables

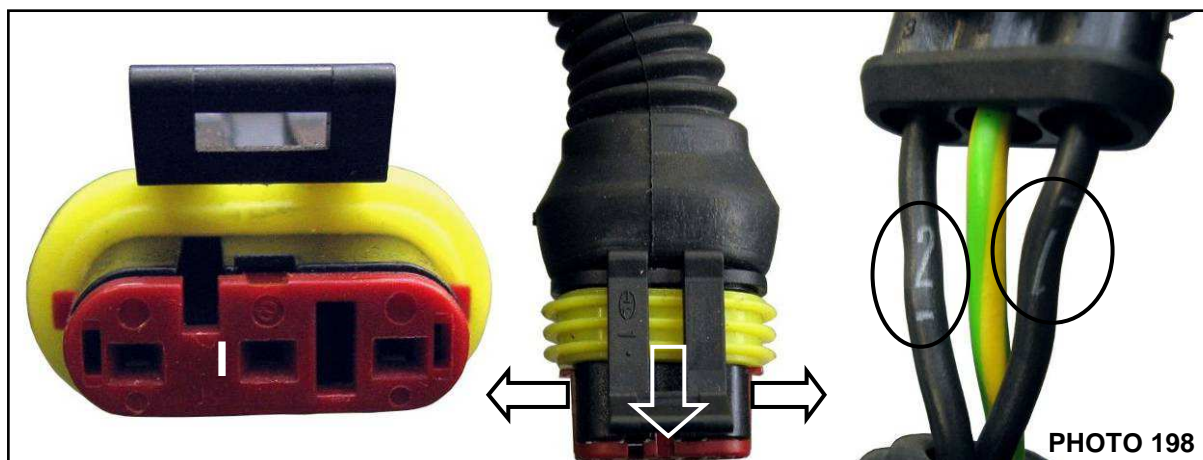
i If the measurements performed on the power control card have revealed no problems, test the continuity of the power cables to the motors and solenoid valve, as well as the signal cables for the brush motor thermal cutout.

In the following tests, there must be no breaks in continuity in any cable.

- 31** Make sure that the machine's mains power cable is disconnected from the electricity supply.
- 32** Remove the waterproof power box from the solution tank.
- 33** Remove the cover of the box to access the power control card.
- 34** Disconnect the waterproof electrical connections to the motors and solenoid valve.



- 35** To facilitate measurements at the connectors, remove the plastic clips covering the metal pins.
- 36** Take care to identify the black wires correctly. These are identified by numbers printed on the insulating sheath.

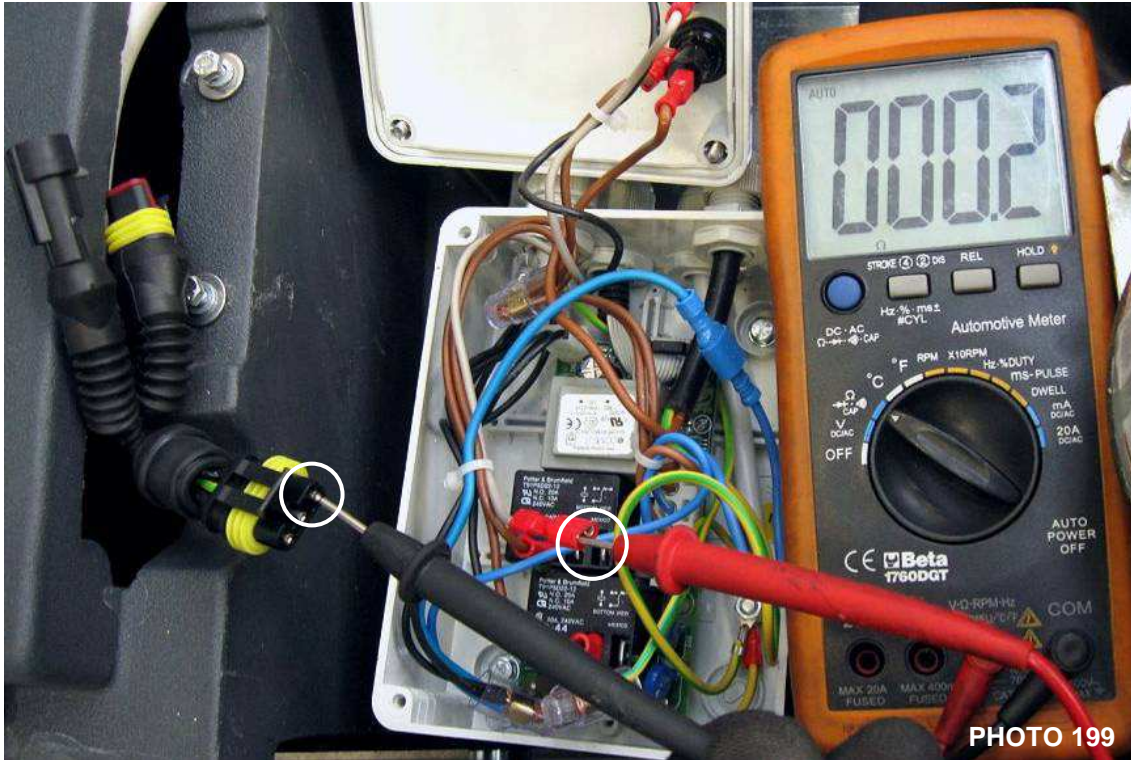


- 37** If it proves impossible to test for continuity at the fast-ons of the brush motor and suction motor relays, disconnect the fast-ons from the relays one at a time to test for continuity.

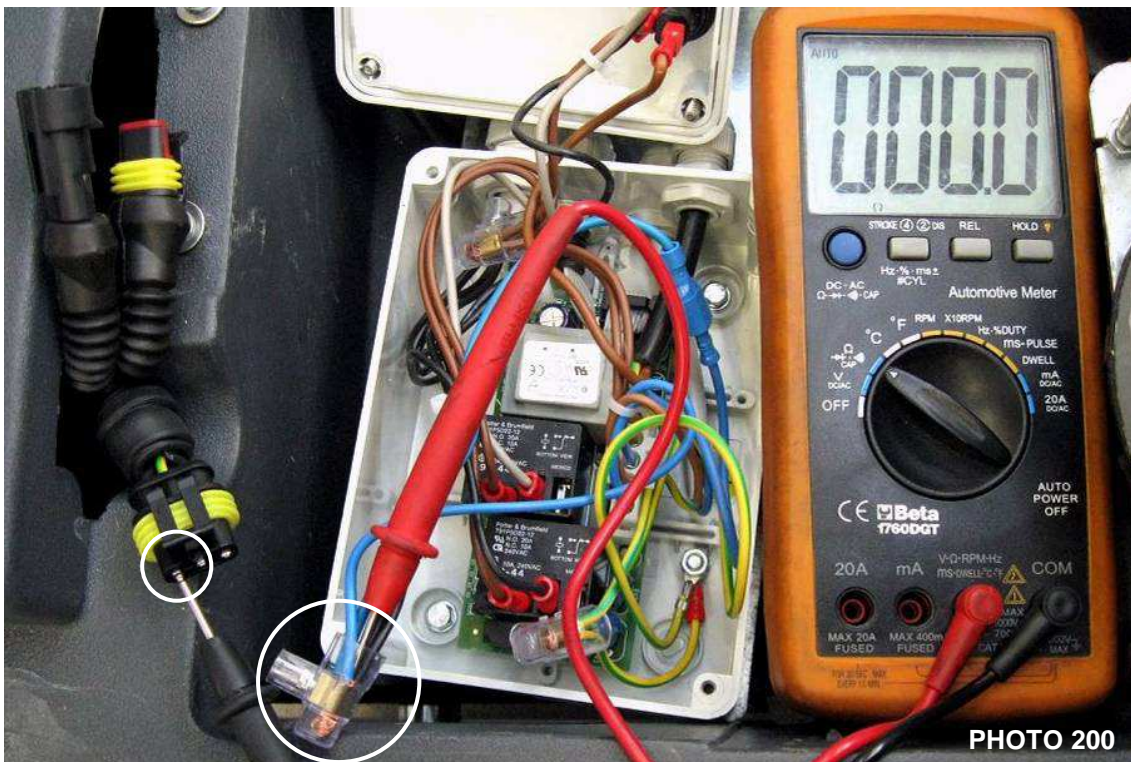


Testing the brush motor cables for continuity

- 38** First of all test the cable of the brush motor for continuity. This is easily identified as it is the only cable with a three way connector. Connect the red positive probe of the digital multimeter to the fast-on of the grey wire, and the black negative probe to black wire number 2, pin 3.

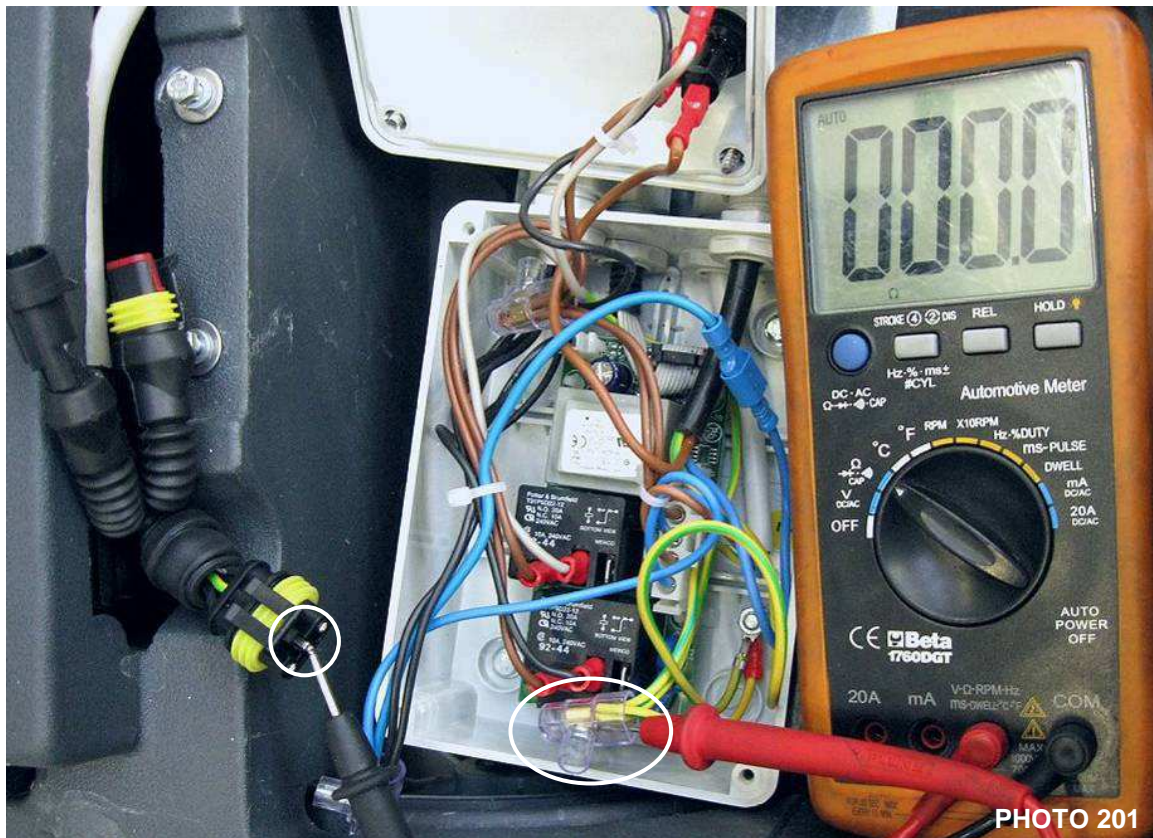


- 39** Now test black wire number 1. Move the black negative probe from pin 3 to black wire number 1, pin 1. Move the red positive probe from the fast-on to the clear common connector.





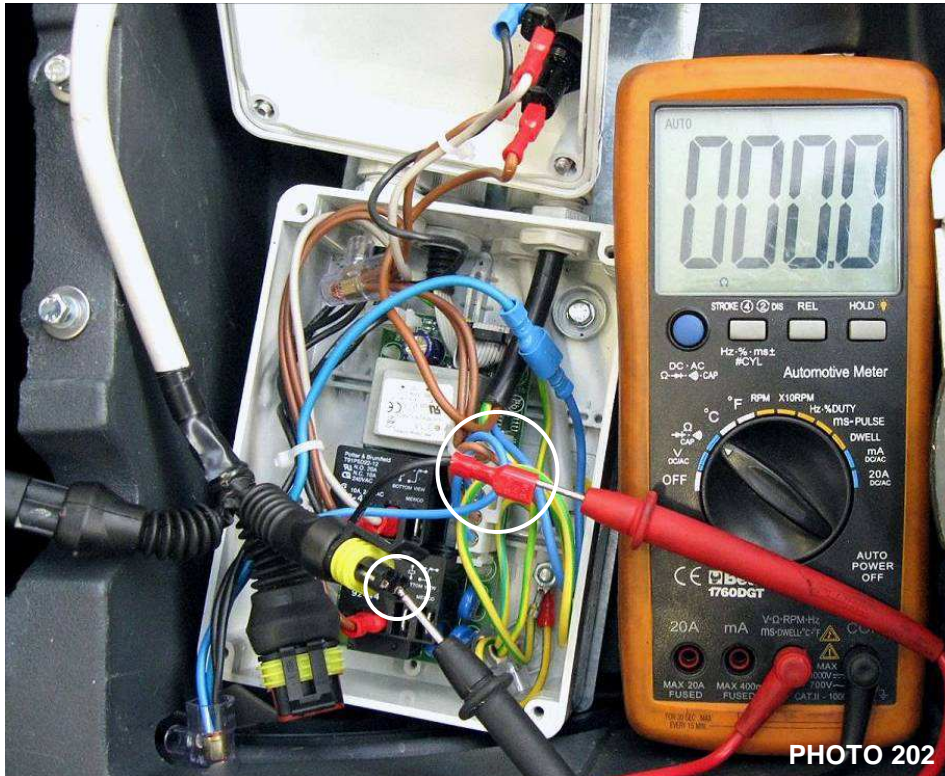
- 40** Now test the third, ground wire. Though this does not influence the functioning of the brush motor, its continuity is important for safety purposes. Move the black negative probe to the connector's central **pin 2**. Move the red positive probe to the common connector ground connector, recognisable for its yellow-green wires.



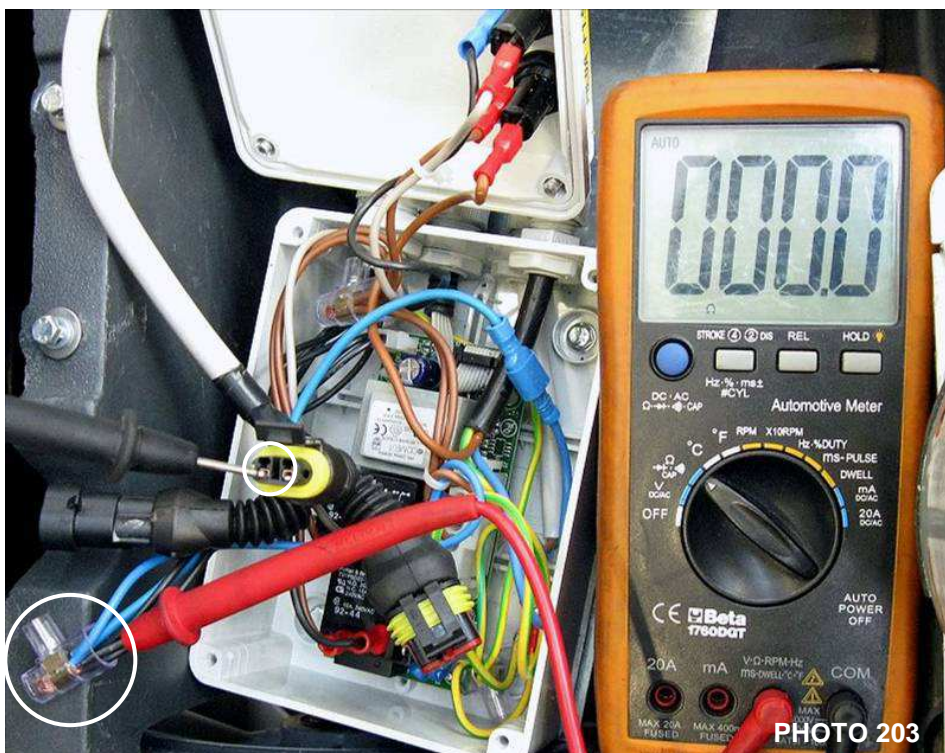


Testing the suction motor cables for continuity

- 41** Check the continuity of the suction motor cables. Move the black negative probe from the brush motor connector to **pin 2** on the male two-pin suction motor connector. Move the red positive probe to the fast-on of the black wire to the suction motor relay.



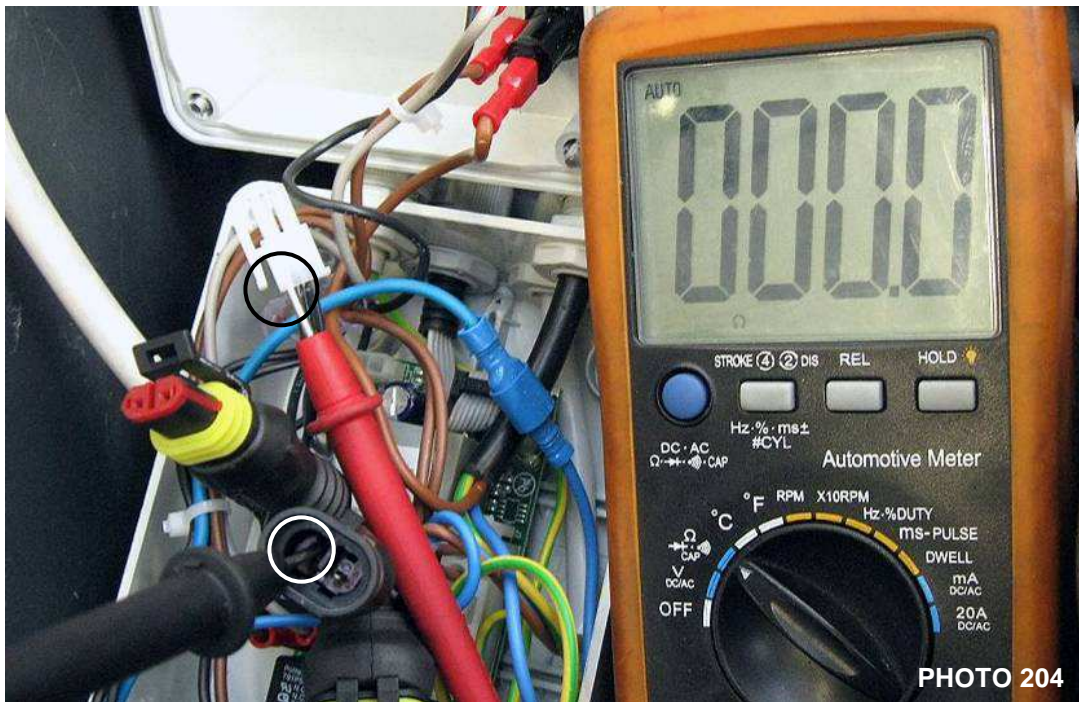
- 42** Move the black negative probe to **pin 1** of the same connector, and move the red positive probe from the fast-on to the common connector for the blue and black wires.



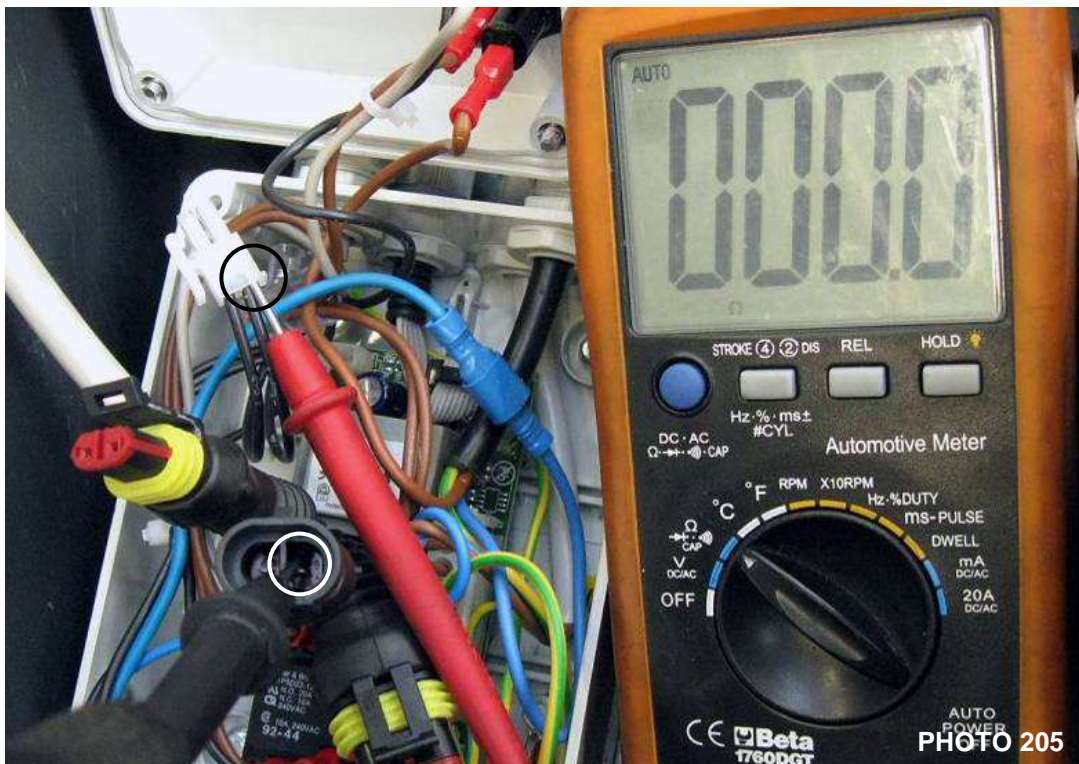


Testing the motor protector cables for continuity

- 43** Check the continuity of the brush motor's thermal protector cables. Disconnect the white connector from the card alongside the black connector of the flat cable.
- 44** Connect the red positive probe to the white connector at the number 3 black wire and connect the black negative probe to pin 2 of the black, female, two pin connector.



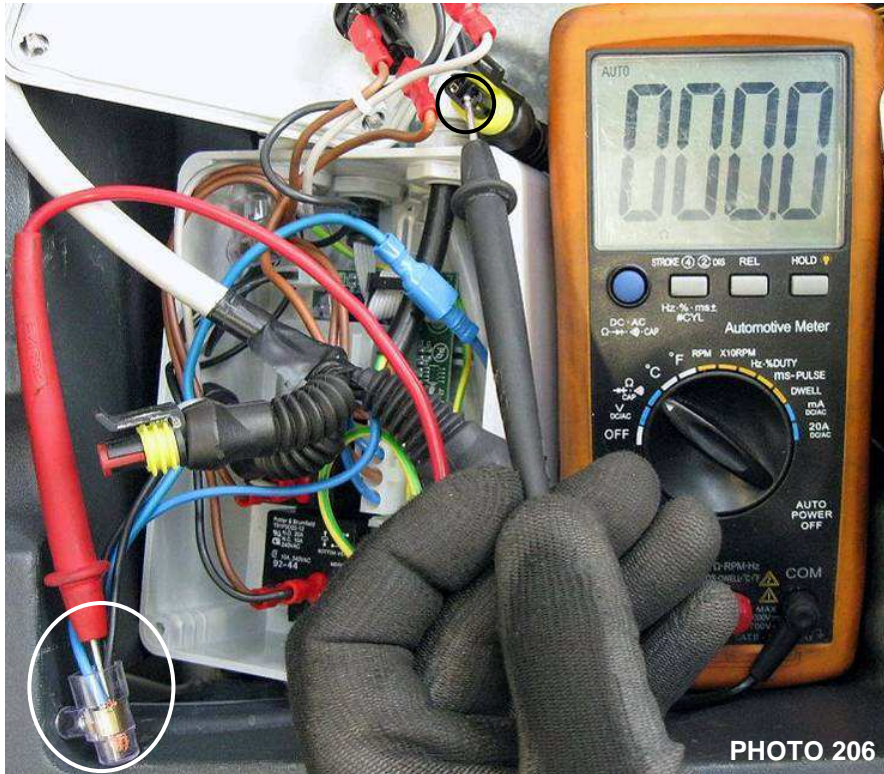
- 45** Move the red positive probe to wire number 4 in the same connector and move the black negative connector to pin 1 in the same connector.



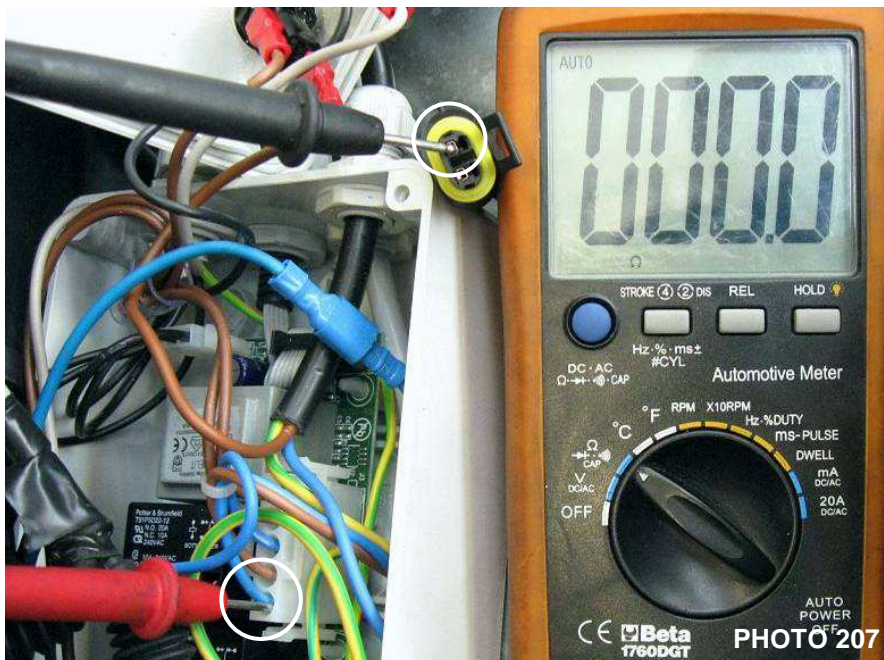


Testing the solenoid valve cables for continuity

- 46** Check the continuity of the solenoid valve cables. Connect the red positive probe to the common connector of the blue and black wires. Connect the black negative connector to **pin 2** of the solenoid valve's black connector.



- 47** Move the red positive probe to the blue wire, **pin 5**, in the connector to the card, and move the black negative probe to **pin 1** of the solenoid valve's black connector.



- 48** On completion of all tests, re-connect the various cables.



D2 BATTERY CHARGER

The battery charger is an advanced, high frequency electronic unit. It is designed to function at any supply voltage between 100 and 240 V AC. The charging process is entirely microprocessor controlled. Battery charging is therefore unaffected by variations in supply voltage. The charging cycle begins with a soft-start and ends with an automatic reset when the batteries are full charged. The minimum voltage difference required to initiate charging is 2V. The battery charger also incorporates an output relay to protect it against reversed polarity, short circuit, over-voltage, and other hazards. Any malfunction is signalled by a red or yellow flashing LED.

The battery charger's operating principle is extremely simple. When it is switched on, the battery charger tests the batteries to ascertain their level of charge. Whether the charge cycle begins or not depends on battery voltage. If the batteries are disconnected from the battery charger, the red LED flashes. If the batteries are properly connected to the battery charger, the red LED lights after about one second, and the relay energises to begin the first phase of the charge cycle, at a fixed high current. Battery voltage is constantly monitored. When the required voltage is reached, charging current drops to a predetermined level, at which point the second phase of the charge cycle begins, identified by the yellow LED lit. During this phase, charge current remains stable while voltage rises a little. If the batteries are disconnected during the course of the charge cycle, the battery charger resets itself after a few seconds ready for the next charge cycle. When the batteries reach the required level of charge, the battery charger ends the charge cycle and the green LED lights. Depending on the selected charge end state, the battery charger will either stop charging completely or will maintain a trickle charge to keep the batteries charged.



PHOTO 208



D2.1 Replacing the battery charger



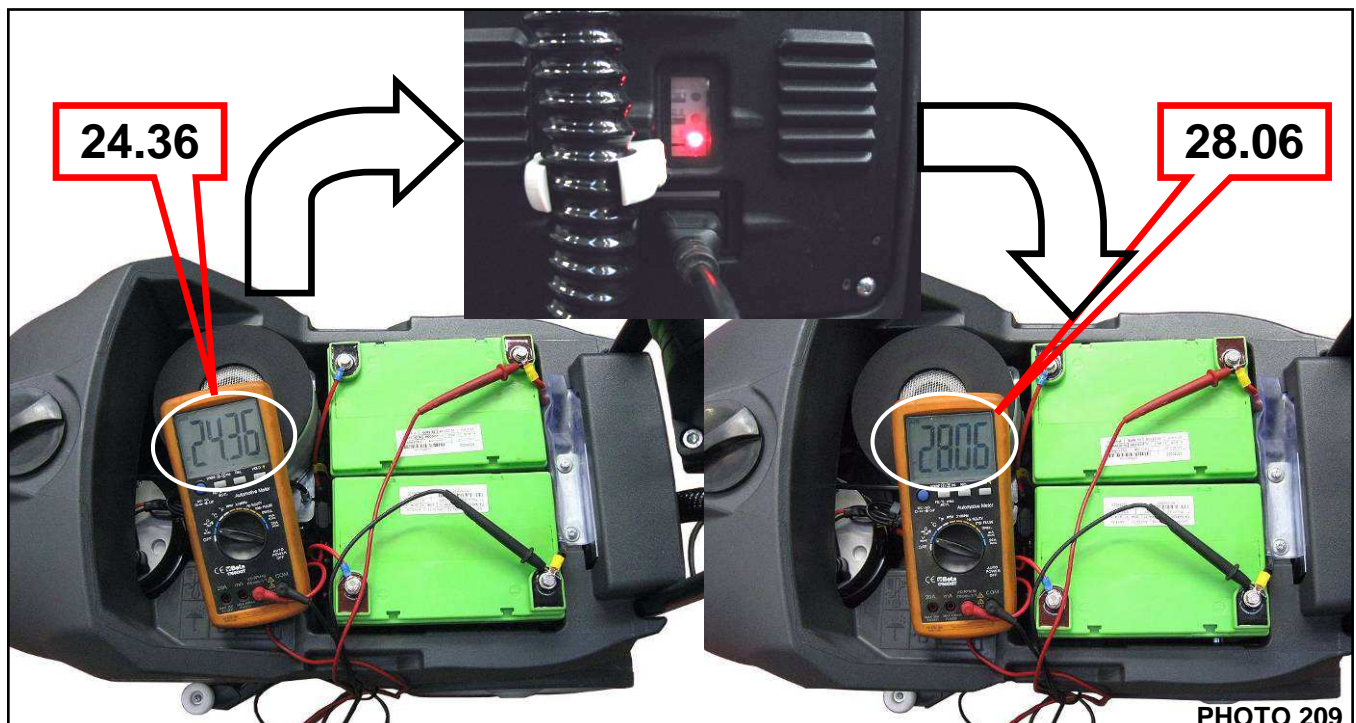
If battery charging problems are encountered on a machine, before you replace the battery charger, test whether it is functioning correctly or not. The problem may well be that the batteries are no longer holding their charge. Use a digital multimeter able to read both direct current voltage (Vdc) and direct current amperage (Adc).

Test 1



Measure the voltage of the batteries, then measure that supplied by the battery charger. Check that the Vdc voltage of the charger exceeds that of the batteries.

- 1 Move the machine to the tank draining area, and completely empty the collection tank.
- 2 Move the machine to a flat, dry floor, if possible with a power socket nearby.
- 3 Lift up and remove the collection tank.
- 4 With the battery charger disconnected from the mains supply, measure the voltage of the batteries.
- 5 Now plug the battery charger into the mains power socket and check that the voltage read by the multimeter starts to rise compared to that read from the batteries.



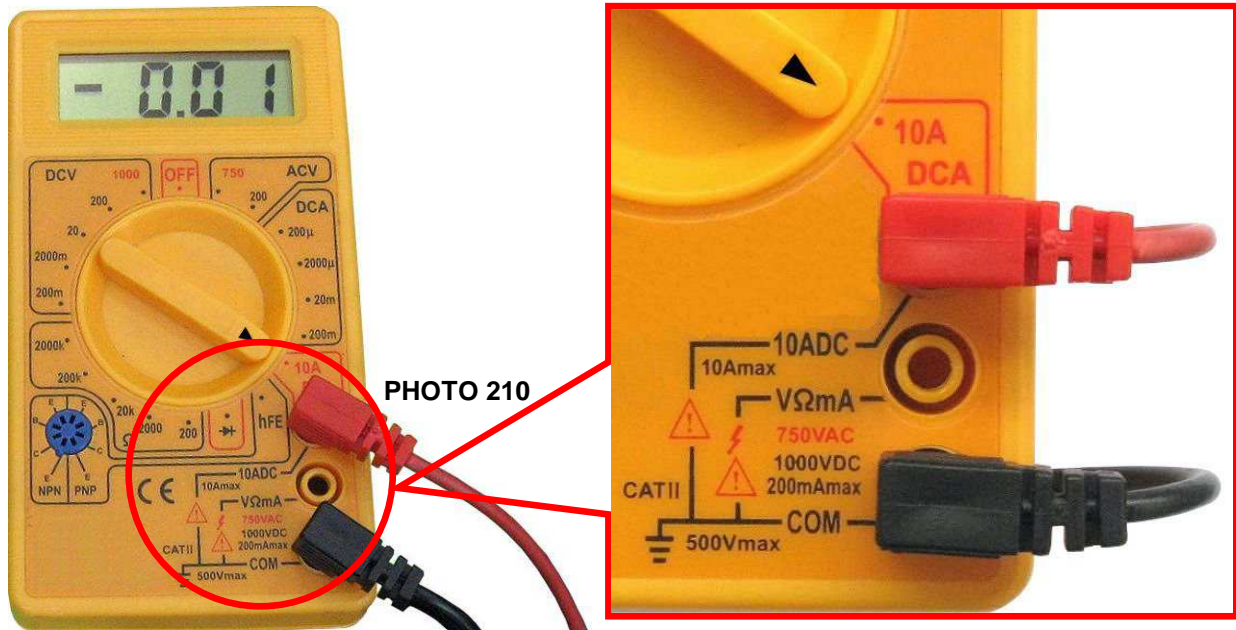


Test 2



Check that the battery charger is supplying current (in Amps) to recharge the batteries. The current supplied by the charger depends on the level of charge of the batteries. The lower the level of battery charge, the higher the charging current will be. The maximum current that the battery charger can supply is 5 A.

- 6 Disconnect the cable from the positive battery terminal.
- 7 Set the multimeter to read at least 10 A in direct current mode (Adc).




- 8 Connect the multimeter's red positive probe to the disconnected battery cable and connect the black negative probe to the battery terminal. If the probes are reversed, the same reading will be obtained, but preceded by a negative "-" sign.





9 If the battery charger passes both the above tests, replace the batteries with identical new ones.

 **It is important to replace the batteries with identical ones, as the charging curve of the battery charger is designed for the specific type of battery fitted to the machine.**

10 If the battery charger fails either or both of the above tests, proceed as instructed below to replace it.

Disassembly

11 Move the machine to a flat, dry floor. For convenience, use a fork lift if one is available.

12 Disconnect the suction tube **A** and arrange safely it under the machine.

13 Remove the collection tank from the machine if you have not already done so.

14 Remove the four screws **B** and remove the rear cover from the power compartment.



15 Identify the two bolts **C** securing the power unit to the solution tank.

16 Pull the power unit out from the left of the machine to access the battery charger.





- 17 Disconnect the two pin connector **D** to the batteries and the two bullet connectors **E** to the power control card. (This connection disables machine functioning while the batteries are under charge.)
- 18 With the battery charger disconnected, identify the two nuts **F1** and **F2** securing the battery charger to the power unit's mounting plate. Loosen the nut **F1**, without removing it.



- 19 Remove the second nut **F2** and detach the battery charger from the power unit mounting plate.
- 20 Replace the battery charger with a new one, identical to the one just removed.



Reassembly



Before fitting the new battery charger, configure it to suit the machine's batteries, as instructed in section D2.2.

- 1 To fit the new battery charger, repeat the steps for disassembly in reverse order.
- 2 Configure the new battery charging before fitting it to the power unit.
- 3 Connect up the new battery charger correctly. (The connectors are of different types and cannot be misconnected.)
- 4 If the two pin connector **D** does not make proper contact, the red LED on the battery charger flashes when you try to charge the batteries. If the bullet connectors **E** do not make proper contact, the control panel will not light, as the function control card will not receive any power.



Warnings & Suggestions



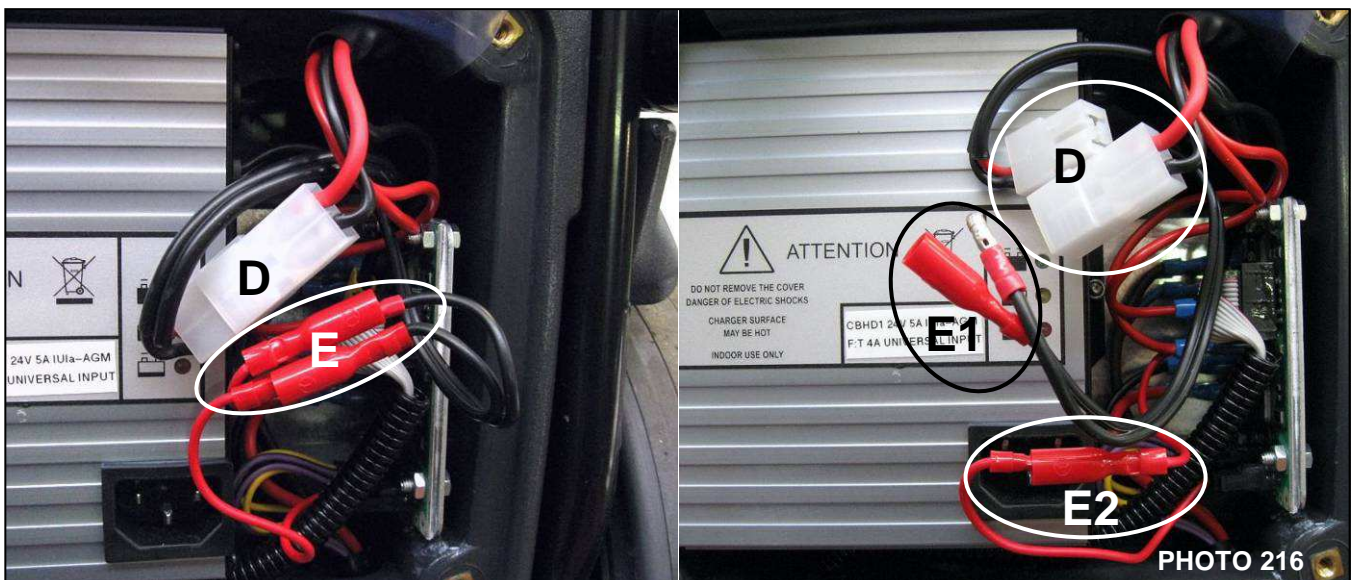
A relay inside the battery charger disconnects power to the machine's control system for the duration of the charge cycle, to prevent the machine being switched on or operated. This avoids loads being applied to the batteries, which the charger's electronics could interpret as malfunctions, resulting in the recharge cycle being interrupted. It is obvious therefore that power to the machine's control system depends not only on the presence of the battery charger, but on the correct functioning of this relay.



If the relay malfunctions, it can prevent the machine from being switched on even with the battery charger disconnected from the mains supply. In this case the battery charger will have to be removed and replaced. To carry on using the machine in such circumstances, the battery charger can be temporarily bypassed.

Bypassing the battery charger

- 1 Remove the cover from the power compartment as instructed above.
- 2 Disconnect the two red bullet connectors **E**. There is no need to remove the power unit mounting plate from the solution tank. Also disconnect the two pin connector **D**.
- 3 Move the two connectors **E1** from the battery charger (one male and one female) out of the way. Connect together the other two connectors **E2**. This connects the power control card directly to the batteries. With the machine connected in this way, and with the two pin connector **D** disconnected, the battery charger will be unable to recharge the batteries. Also, if the battery charger is plugged into the mains, the yellow LED will flash to indicate that the batteries are disconnected.



- 4 Replace the malfunctioning battery charger as soon as possible and remove the bypass.



D2.2 Configuring the battery charger



The battery charger is configured in the factory to work with the specific type of batteries installed on the machine. If a new battery charger has to be fitted, configure it in the same way as the old one, as instructed below. If the batteries are replaced with batteries of another type, the battery charger will have to be reconfigured to suit the new type of battery, as instructed below.

Disassembly

- 1 If the battery charger is installed in the machine, remove it from the power compartment as instructed above, and take it to the work bench.
- 2 If the battery charger is new and has been *obtained as a replacement part*, it should be pre-configured for the type of batteries on the machine. The correct configuration should nevertheless be checked. Take the battery charger to the work bench to check or configure it.
- 3 Identify the plastic cap over the hole through which the configuration DIP switches are accessible. The cap is on the same side as the connection cables.
- 4 Lever off the cap with a flat blade screwdriver.



- 5 Identify the two battery charger configuration DIP switches (SW1 – SW2).
- 6 Only switch **DP1** of the DIP switch **SW2** needs to be checked or changed. For the machine's standard Discover AGM batteries, **DP1** must be set **ON** (default setting).

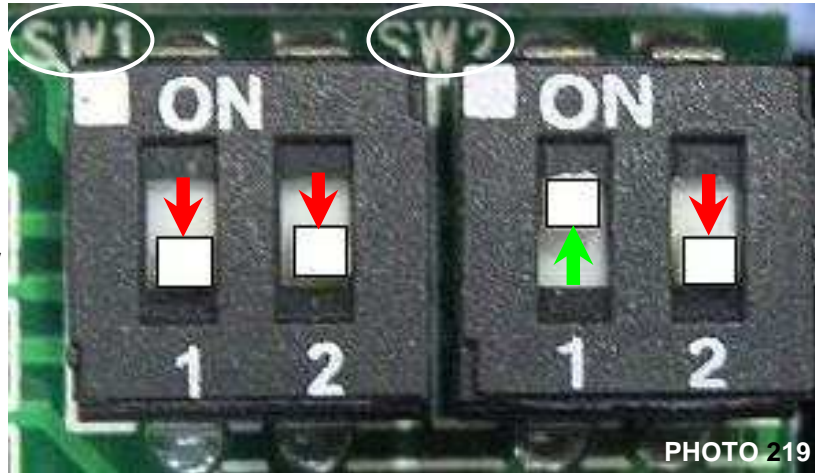




7 The figure below illustrates the settings of both DIP switches SW1 and SW2, with the cap removed. The figure shows the default setting for the CT 15.

Default (factory) DIP switch settings for the CT 15

**CT 15
IU1a
Discover
AGM
batteries**



SW1				SW2			
DP1		DP2		DP1		DP2	
Charge current		End of charge state		Charge curve		Battery voltage	
OFF	Maximum charge current 5 A	OFF	Trickle charge to maintain 27.6 V	ON	IU1a – AGM specific curve for standard DISCOVER AGM batteries	OFF	24 V

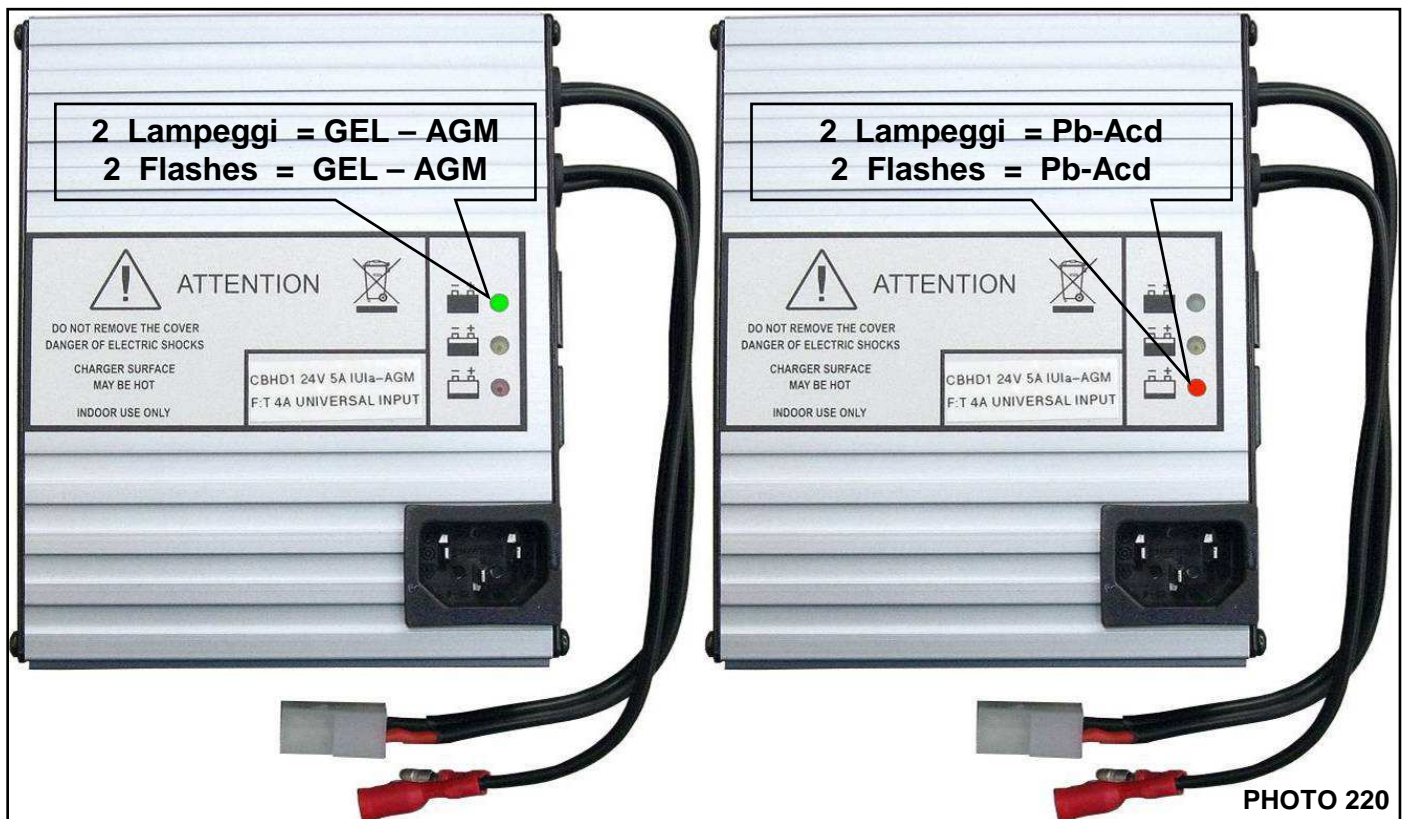
8 As explained above, if the machine’s standard batteries are replaced with others of a different type, the battery charger must be reconfigured to suit the new batteries. To do so, proceed as instructed below.

Changing the battery charger DIP switch settings to suit non-standard batteries

SW1				SW2			
DP1		DP2		DP1		DP2	
Charge current		End of charge state		Charge curve		Battery voltage	
ON	Half charge current 2.5 A	ON	STOP at end of charging	ON	IU1a – AGM specific curve for standard DISCOVER AGM batteries	ON	12 V
OFF	Maximum charge current 5 A	OFF	Trickle charge to maintain 27.6 V	OFF	IUU0 – GEL for GEL type and generic AGM batteries	OFF	24 V



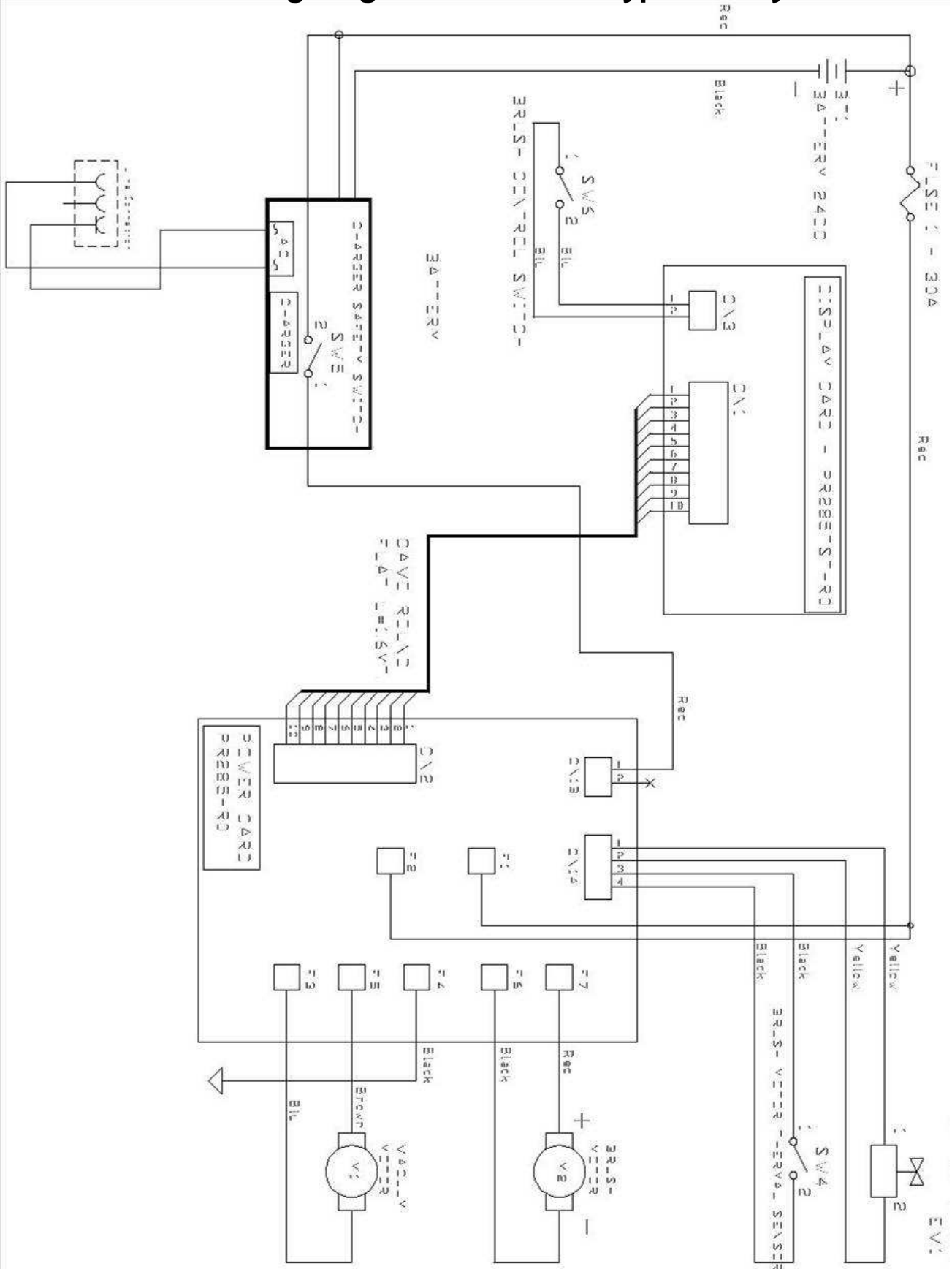
- 9 Refer to the above table to configure the DIP switches on the battery charger to suit the requirements of the batteries installed. Do not change the “**Battery voltage**” setting, as this is determined by the voltage needed by the machine.
- 10 The “**Charge current**” setting depends on the capacity of the batteries in Amperes. If the 12 V *batteries* (1) have a capacity greater than 25 Ah, maximum charge current should be selected.
- 11 The “**End of charge state**” setting depends on the recommendations issued by the battery manufacturer. If the manufacturer makes no recommendations, set the DIP switch to deliver a trickle charge on completion of charging.
- 12 The “**Charge curve**” setting is the most important of all, as the wrong setting can compromise not only the duration of charging but the life of the batteries too. The type of battery is shown on the battery case. There are three main types of battery: “Pb-Acd” lead-acid, “AGM” sealed acid, and “Gel” with gel-covered plates.
- 13 The battery charger shows the charge curve setting by means of the LEDs on its front panel, every time a charge cycle begins.
- 14 The GREEN LED flashes twice to indicate a setting for gel or AGM batteries.
- 15 The RED LED flashes twice to indicate a setting for Pb-Acd (LEAD-ACID) batteries.





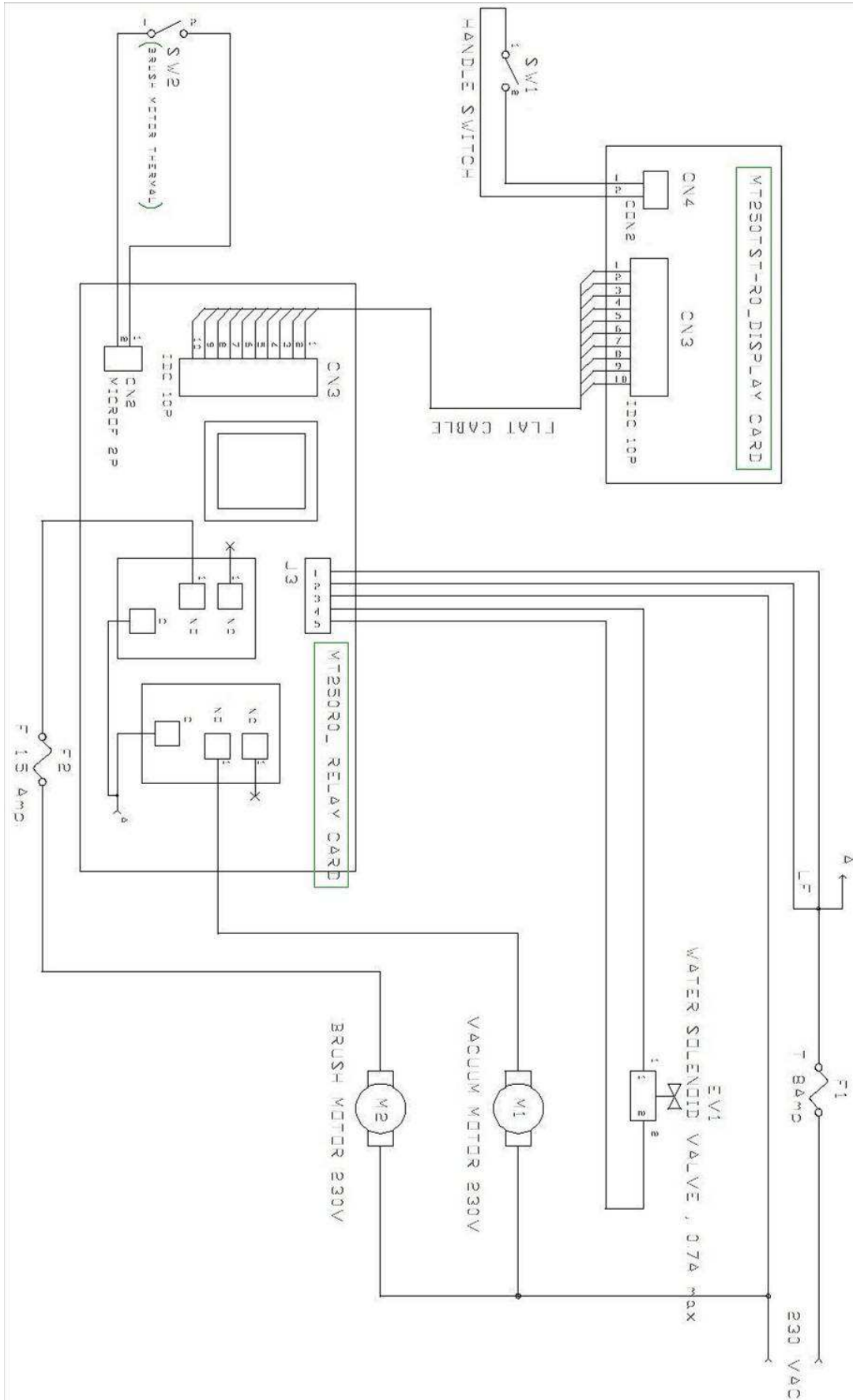
D3 D4 ELECTRICAL WIRING DIAGRAMS

D3.1 Electrical wiring diagram for the "B" type battery version





D3.2 Electrical wiring diagram for the "C" type mains version





WARNING!

Go to the designated draining area and empty the solution and collection tanks using the drain plugs and the hoses provided.

Position the machine on a flat floor, and place wedges under the wheels to stop it moving.

Switch the machine off and disable all functions by pressing the “On–Off” button on the control panel.

Disconnect the machine’s electrical system by removing the main fuse F1, or by disconnecting the terminals from the battery poles (battery powered machines), or by removing the plug from the mains power socket (mains powered machines).

i INFORMATION

Important information

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

In this Service Manual, the machine version (15 B, 15 C) may appear between brackets “()”. This indicates that the instruction in question refers only to the version specified.

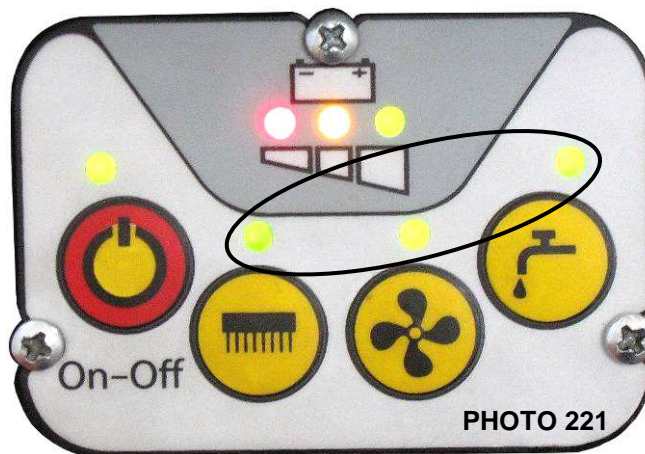


E1 DISPLAY OF ERROR CODES

E1.1 Error codes for the function control card on “B” type machines

i In conjunction with the power control card, the function card controls the brush and suction motors and monitors the level of battery charge. Functioning status is shown by the LEDs on the control panel.

i The “On-Off” button needs to be pressed for only 0.1 seconds to switch the machine on, but has to be held down for 4 seconds to switch it off. When the machine is switched on, the function control card performs a self-test of all functions. The self-test lasts for 1.7 seconds. During this period, all function LEDs (brush, suction, solution dispensing solenoid valve) remain lit.



BATTERY CHARGE STATE:

LEDs	LED state	Battery voltage
Red LED + Yellow LED + Green LED	Fixed light	≥ 23.3 Volts
Red LED + Yellow LED	Fixed light	23.3 to 22.5 Volts
Red LED	Fixed light	22.5 to 21.9 Volts
Red LED	Flashing	21.9 to 21.5 Volts
—	Off	21.5 to 21.4 Volts
—	Off – functions stop after 20 secs.	21.4 to 0 Volts





Brush motor alarms

Brush motor current limit (Amperes) exceeded.



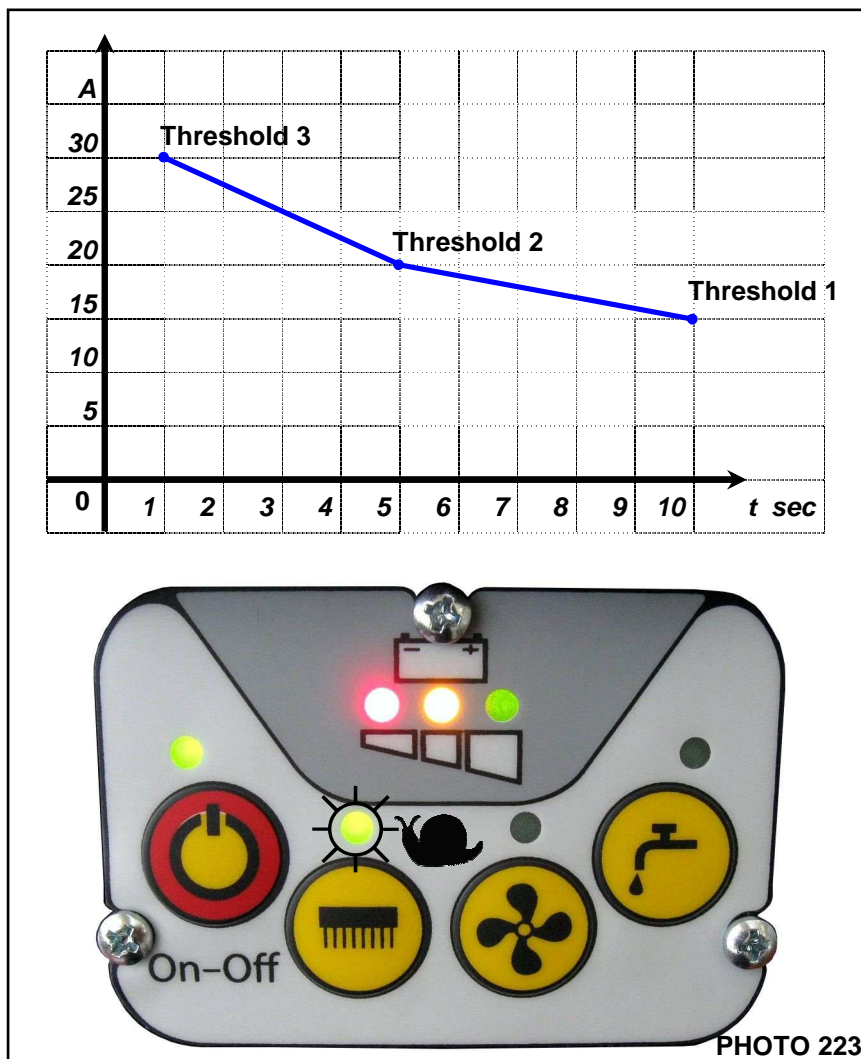
The power control card powers the brush motor via MOS-FETs to provide a soft-start ramp. The card also imposes a current draw limit and cuts out power to the motor if it draws too much current.



If the current draw limit is exceeded (there are actually three thresholds), the power control card disconnects power to the brush motor to shut it down, and warns of this by slowly flashing the brush LED on the control panel.



To restore power to the brush motor and re-start work, simply switch the machine off and back on again using the "On-Off" button.





Brush motor MOS-FET temperature limit exceeded.



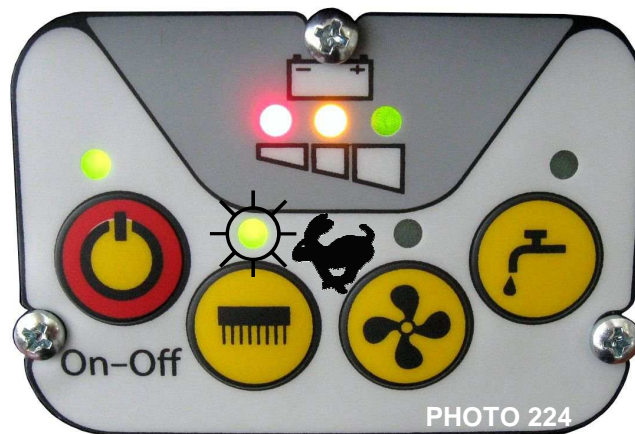
The power control card also monitors the operating temperature of the MOS-FETs to prevent them burning out. Maximum operating temperature is set at 150°C.



If this temperature (150°C) is exceeded, the power control card disconnects power to the brush motor and warns of this by rapidly flashing the brush LED on the control panel.



To restore power to the brush motor, switch the machine off using the “On-Off” button, wait for the temperature of the MOS-FETs to fall below 150°C, then switch the machine back on using the “On-Off” button.



Brush motor short circuit



The power control card checks for short circuits when the brush motor is switched on.



If a short circuit is detected when the button is pressed to switch the brush motor on, the power control card locks the functioning of the brush motor and warns of this by flashing the brush LED quickly in series of two flashes.



To restore functioning, check to see if the fault lies in the cables to the brush motor, and if it does not, replace the brush motor.





Brush motor thermal cutout tripped

- i** The power control card monitors the state of the brush motor's thermal cutout.

Important

THE INTERVENTION OF THE THERMAL CUTOUT IS NOT SHOWN ON THE CONTROL PANEL.



If the control panel shows no alarm condition, but the brush motor does not turn after the button has been pressed and the lever pulled in, the brush motor's thermal cutout may have tripped as a result of the motor overheating.



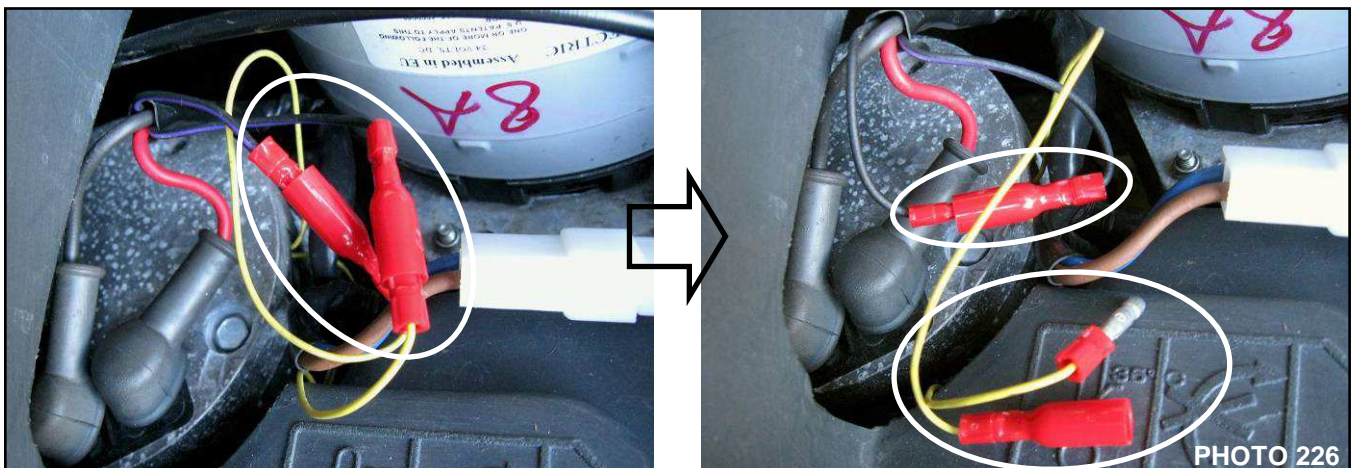
The thermal cutout resets itself automatically. Simply release the operating lever and wait a few minutes for the temperature of the motor to fall.



If the motor still does not turn after it has cooled to ambient temperature or just above, bypass the thermal cutout.

Bypassing the thermal cutout on "B" type machines:

Disconnect the thermal cutout by disconnecting its bullet connectors, and connect together the two male and female bullet connectors on the wiring harness. Test the functioning of the motor.

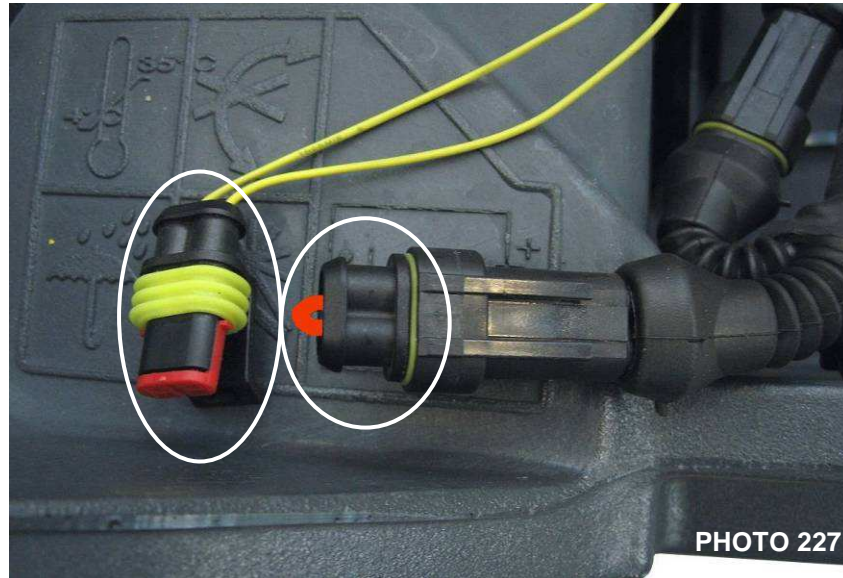


If the brush motor functions normally at ambient temperature with the thermal cutout bypassed, replace the thermal cutout as instructed in section A2.4.



Bypassing the thermal cutout on "C" type machines:

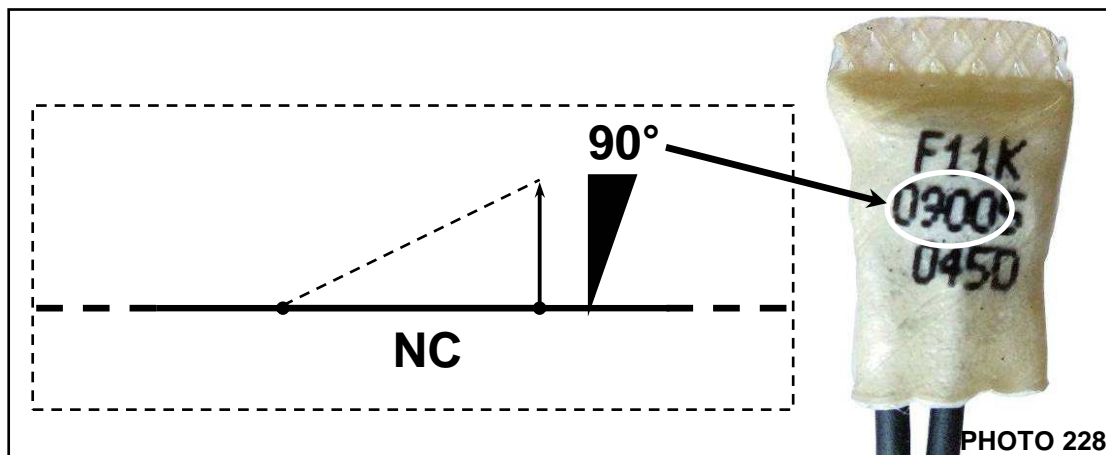
Disconnect the thermal cutout by disconnecting the waterproof connector, and connect the male by-pass connector to the female connector on the wiring harness. Test the functioning of the motor.



If the brush motor functions normally at ambient temperature with the thermal cutout bypassed, replace the thermal cutout as instructed in section A2.4.

Functioning of the thermal protector

The thermal protector incorporated in the electric motor prevents it from reaching high temperatures and being irreversibly damaged. Thermal protectors are usually installed on the hottest parts of the motor, near the motor's carbon brushes, or in the cover over the carbon brushes. The thermal protectors installed in the brush motors of IPC scrubber driers may easily encounter operating temperatures between 80°C and 110°C. Thermal protectors operate in much the same way as an NC (Normally Closed) switch. They open when their calibrated temperature is reached and disconnect power (via a relay or contactor or electronic card) to the motor.





Suction motor alarms

Suction motor current limit (Amperes) exceeded.



The power control card powers the suction motor via MOS-FETs to provide a soft-start ramp. The card also imposes a current draw limit and cuts out power to the motor if it draws too much current.

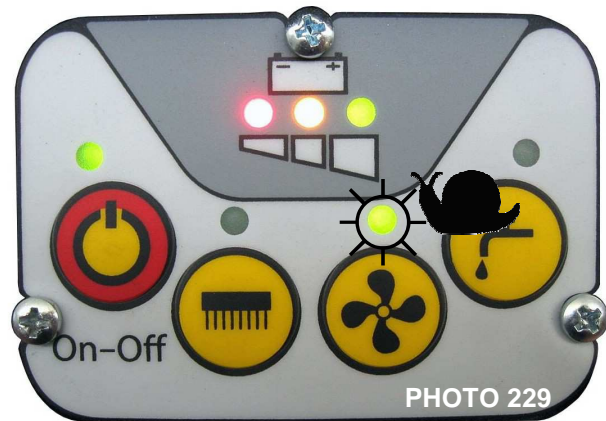
Current draw limit = Maximum current draw of 30A for maximum time of 2 seconds.



If the current draw limit is exceeded, the power control card disconnects power to the suction motor to shut it down, and warns of this by slowly flashing the suction LED on the control panel.



To restore power to the suction motor and re-start work, simply switch the machine off and back on again using the "On-Off" button.



Suction motor MOS-FET temperature limit exceeded.



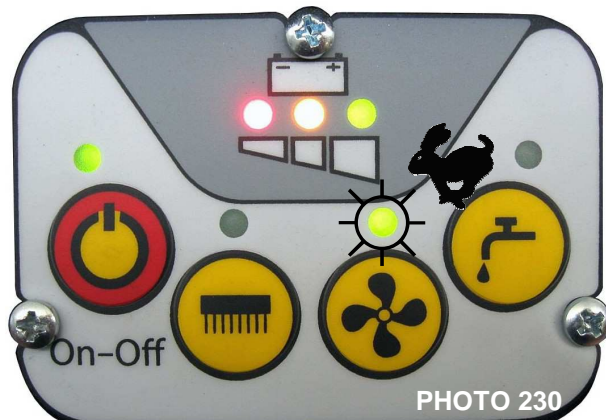
The power control card also monitors the operating temperature of the MOS-FETs to prevent them burning out. Maximum operating temperature is set at 150°C.



If this temperature (150°C) is exceeded, the power control card disconnects power to the suction motor and warns of this by rapidly flashing the suction LED on the control panel.



To restore power to the suction motor, switch the machine off using the "On-Off" button, wait for the temperature of the MOS-FETs to fall below 150°C, then switch the machine back on using the "On-Off" button.





E2 TROUBLESHOOTING

E2.1 Troubleshooting

E2.1.1 The control panel LEDs do not light

1	Check battery voltage (B type) or the presence of mains power (C type).	<p>A Recharge or replace the batteries (B type). Plug the machine into the mains power supply (C type).</p> <p>B If the batteries are charged or the machine already connected to the mains power supply, go to step 2.</p>
2	Check the main fuse F1 (30 Amps on B type, 8 Amps on C type). See sections D1.1, D1.5.	<p>A If the fuse is burnt out, replace it.</p> <p>B If the fuse is intact, go to step 3.</p>
3	Check that the function control card is receiving power from the power control card via the flat cable. See section D1.2.	<p>A If the function control card is receiving power correctly, replace it with a new card.</p> <p>B If the function control card is not receiving power, go to step 4.</p>
4	Check the continuity of the flat cable.	<p>A If continuity is broken, repair or replace the flat cable.</p> <p>B If continuity is OK, go to step 5.</p>
5	Check the correct functioning of the power control card (type B or type C). See sections D1.2, D1.6.	<p>A If the power control card (type B or type C) is not working, replace it.</p>

E2.1.2 The brush does not rotate on "B" type battery versions

1	Check the voltage of the batteries as shown by the control panel LEDs or as measured at the battery terminals.	<p>A If the batteries are discharged, recharge them or replace them.</p> <p>B If the batteries are charged, go to step 2.</p>
2	Check the 30 Amp main fuse F1. See section D1.1.	<p>A If the fuse is burnt out, replace it.</p> <p>B If the fuse is intact, go to step 3.</p>
3	Check the condition and functioning of the thermal protector as instructed in section E1.1, and by-pass it if necessary.	<p>A If the thermal protector is defective, replace it. See section A2.4.</p> <p>B If the thermal protector is working, go to step 4.</p>
4	Check whether the brush motor functions when connected directly to the batteries. See section D1.4.	<p>A If the brush motor does not function, go to step 5.</p> <p>B If the brush motor functions, go to step 6.</p>
5	Check the condition of the motor's carbon brushes as instructed in section A1.3.	<p>A If the carbon brushes are worn, replace them. See section A1.3.</p> <p>B If the carbon brushes are in good condition, replace the brush motor. See section A2.1.</p>
6	Check the continuity of the power cables to the brush motor. See section D1.4.	<p>A If continuity is broken in one or more cables, replace the cable or cables concerned.</p> <p>B If continuity is OK, go to step 7.</p>
7	Check the functioning of the power control card. See section D1.4.	<p>A If the power control card is not functioning correctly, replace it. See section D1.3.</p> <p>B If the power control card is functioning correctly, go to step 8.</p>
8	Check the correct functioning of the function control card. See section D1.2.	<p>A If the function control card is not functioning correctly, replace it. See section D1.1.</p> <p>B If the function control card is functioning correctly, go to step 9.</p>
9	Check the continuity of the flat cable. See section D1.2.	<p>A If continuity is broken, replace the flat cable,</p> <p>B If continuity is OK, replace the power control card and/or function control card. See sections D1.3, D1.1.</p>



E2.1.3 The brush does not rotate on “C” type mains machines

1	Check the LED on the control panel to see whether power is reaching it.	A Plug the machine into the mains power supply. B If the machine is already connected to the mains power supply, go to step 2.
2	Check the 8 Amp main fuse F1 and the 1.5 Amp fuse F2. See section D1.5.	A If any fuse is burnt out, replace it. B If the fuses are intact, go to step 3.
3	Check the condition and functioning of the thermal protector as instructed in section E1.1, and by-pass it if necessary.	A If the thermal protector is defective, replace it. See section A2.4. B If the thermal protector is working, go to step 4.
4	Check the condition of the motor's carbon brushes. See section A1.4.	A If the carbon brushes are worn, replace them. See section A1.4. B If the carbon brushes are in good condition, go to step 5.
5	Check the continuity of the power cables to the brush motor. See section D1.6.	A If continuity is broken in one or more cables, replace the cable or cables concerned. B If continuity is OK, go to step 6.
6	Check the functioning of the power control card. See section D1.6.	A If the power control card is not functioning correctly, replace it. See section D1.3. B If the power control card is functioning correctly, go to step 7.
7	Check the correct functioning of the function control card. See section D1.2.	A If the function control card is not functioning correctly, replace it. See section D1.1. B If the function control card is functioning correctly, go to step 8.
8	Check the continuity of the flat cable. See section D1.2.	A If continuity is broken, replace the flat cable. B If continuity is OK, replace the power control card and/or function control card. See sections D1.5, D1.1.

E2.1.4 There is no suction

1	Check that the suction hose is correctly connected to the union on the squeegee unit. See section B2.2.	A If the hose is not correctly connected, connect it. B If the hose is correctly connected, go to step 2.
2	Check that suction hose is correctly connected to the collection tank, that the seal is effective and that the hose is in good condition, with no cracks or holes.	A If the hose is not correctly connected, connect it. If the hose is damaged, replace it. B If the hose is correctly connected and in good condition, go to point 3.
3	Check the efficiency of the seal around the cap of the collection tank, especially at the point of contact. See section B3.3.	A If the seal is worn or damaged, or if it fails to mate snugly around the opening, repair or replace the seal. B If the seal is in good condition, go to step 4.
4	Check that the collection tank is seated correctly on the seal of the suction motor and that this seal is in good condition. See sections B1.3, B1.4.	A If the collection tank is not seated correctly, arrange it accordingly. B If the collection tank is correctly seated, go to step 5.
5	Check that the suction motor is functioning correctly. See sections B1.1, B1.2.	A If the suction motor is not functioning correctly, perform the checks in section E2.1.5. B If the suction motor is functioning correctly, check the flaps of the squeegee unit for wear or damage.



E2.1.5 The suction motor is not working on "B" type battery powered machines

1	Check the voltage of the batteries as shown at the control panel LEDs or as measured at the battery terminals.	A If the batteries are discharged, recharge them or replace them. B If the batteries are charged, go to step 2.
2	Check the 30 Amp main fuse F1. See section D1.1.	A If the fuse is burnt out, replace it. B If the fuse is intact, go to step 3.
3	Check whether the suction motor functions when connected directly to the batteries. See section D1.4.	A If the suction motor does not function, go to step 4. B If the suction motor functions, go to step 5.
4	Check the condition of the motor's carbon brushes. See section B1.5.	A If the carbon brushes are worn, replace them. See section B1.5. B If the carbon brushes are in good condition, replace the suction motor. See section A2.1.
5	Check the continuity of the power cables to the suction motor. See section D1.4.	A If continuity is broken in one or more cables, replace the cable or cables concerned. B If continuity is OK, go to step 6.
6	Check the functioning of the power control card. See section D1.4.	A If the power control card is not functioning correctly, replace it. See section D1.3. B If the power control card is functioning, go to step 7.
7	Check the correct functioning of the function control card. See section D1.2.	A If the function control card is not functioning correctly, replace it. See section D1.1. B If the function control card is functioning correctly, go to step 8.
8	Check the continuity of the flat cable. See section D1.2.	A If continuity is broken, replace the flat cable, B If continuity is OK, replace the power control card and/or function control card. See sections D1.3, D1.1.

E2.1.6 The suction motor is not working on "C" type mains powered machines

1	Check the LED on the control panel to see whether power is reaching it.	A If no power is present, plug the machine into the mains power supply. B If the machine is already connected to the mains power supply, go to step 2. 2.
2	Check the 8 Amp main fuse F1. See section D1.5.	A If the fuse is burnt out, replace it. B If the fuse is intact, go to step 3.
3	Check the condition of the motor's carbon brushes. See section B1.6.	A If the carbon brushes are worn, replace them. See section B1.6. B If the carbon brushes are in good condition, go to step 4.
4	Check the continuity of the power cables to the suction motor. See section D1.6.	A If continuity is broken in one or more cables, replace the cable or cables concerned. B If continuity is OK, go to step 5.
5	Check the functioning of the power control card. See section D1.6.	A If the power control card is not functioning, replace it. See section D1.5. B If the power control card are functioning, go to step 6.
6	Check the correct functioning of the function control card. See section D1.2.	A If the function control card is not functioning correctly, replace it. See section D1.1. B If the function control card is functioning correctly, go to step 7.
7	Check the continuity of the flat cable. See section D1.2.	A If continuity is broken, replace the flat cable, B If continuity is OK, replace the power control card and/or function control card. See sections D1.5, D1.1.

**E2.1.7 Solution is not being dispensed**

1	Check that there is solution in the solution tank.	A If the solution tank is empty, fill it. B If the solution tank is full, go to step 2.
2	Check that the dispensing cock under the solution tank is fully open. See section B3.4.	A If the dispensing cock is closed, open it fully. B If the dispensing cock is already open, go to step 3.
3	Disconnect the clear hose from the dispensing cock under the solution tank and check that solution comes out.	A If no solution comes out, clean the dispensing cock and the solution tank. See section B3.4. B If solution comes out, go to step 4.
4	Check that the solution filter (if fitted) is clean.	A If the filter is dirty, clean it. See section B3.4. B If the filter is clean, go to step 5.
5	Check that the solenoid valve is clean.	A If the solenoid valve is dirty, clean it. See section B3.2. B If the solenoid valve is clean, go to point 6.
6	Check that the solenoid valve is functioning correctly. See section B3.1.	A If the solenoid valve is not functioning correctly, replace it. See section B3.2. B If the solenoid valve is functioning correctly, clean out all hoses between the solution tank and the squeegee unit. See section B3.4.



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TECHNICAL DEPT.
Stavale

EDITIONS - UPDATES TECHNICAL SERVICE MANUAL

<i>EDITION No.</i>	<i>DATE</i>
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