

Technical Service Manual



MAINTENANCE SCHEDULE

PART DESCRIPTION		FREQUENCY IN HOURS		PARA-
WE	EAR PARTS	CHECK	REPLACE	GRAPH
Disk - Cylindrical	Squeegee blade, front	50	175	B2.3
Disk - Cylindrical	Squeegee blade, rear	50	175	B2.3
Disk - Cylindrical	PU rear blade , oil resistant	50	175	B2.3
Disk - Cylindrical	Brush PPL	50	175	Check
Disk	Pad Holder	50	-	consumption indicator on
Cylindrical	Side Brush PPL	50	300	brush
Cylindrical	Belt for central brushes	50	500	A6.5
Cylindrical	Ball Bearing 6000	50	500	A6.5
Cylindrical	Ball Bearing 6002	50	500	A6.6
Disk - Cylindrical	Vacuum Filter	50	300	B1.3
Disk - Cylindrical	Gasket Tank Cap	50	500	B5.1
Disk - Cylindrical	Vacuum motor carbon brush	200	800	B1.2
Disk - Cylindrical	Brush motor carbon brush	400	1200	A1.4/5 - A6.3
Disk - Cylindrical	Traction Motor carbon brush	200	800	C2.1
ORDINARY MAINTENANCE				
Disk - Cylindrical	Vacuum motor gasket	200	400	B1.3
Disk - Cylindrical	Suction hose	50	500	В
Disk - Cylindrical	Recovery tank cap gasket	100	500	B1.3
Disk - Cylindrical	Solution tap filter	100	500	B3.1
Disk - Cylindrical	Vacuum motor	200	1400	B1.2
Disk	Left brush flap	50	1000	A4.4
Disk	Right brush flap	50	1000	A4.4
Cylindrical	Left brush head flap	50	1000	A6.5
Cylindrical	Right brush head flap	50	1000	A6.5
Disk - Cylindrical	Floating level sensor	200	1500	B4.1/2 - B4.3
Disk - Cylindrical	Recovery tank drain hose	200	1000	B5
Disk - Cylindrical	Potentiometer 5K	200	1400	C3.2
Disk - Cylindrical	Micro Switch, Accelerator	200	1400	C3.2
Disk - Cylindrical	Solenoid valve	250	1000	A5.1
Disk - Cylindrical	Motorwheel 's rubber	250	2000	C2.3
Disk - Cylindrical	Squeegee wheels	200	800	B2.5
Disk	Brush head flange spring	200	1000	A3.3
Disk	Bearing centering flap	200	800	A4.2
Cylindrical	Rubber star coupling motor brush	500	1000	A6.4
Cylindrical	Idle roller brush support	200	800	A6.4
Disk - Cylindrical	Squeegee Knob	200	1000	B2.4



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BRUSH HEAD



All maintenance operations described and illustrated in this manual must be carried out by an IPC-approved technician.

Go to the designated draining area and empty the detergent solution and/or dirty water tanks by way of the relative hoses.

Move the machine onto a level surface and apply the parking brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or depressing the emergency stop button.

Disconnect the machine electronics from the batteries by unplugging the Anderson connector.

i INFORMATION

Indications of particular importance

In this Service Manual, RIGHT and LEFT are used to indicate the side of the machine, and will always refer to the direction of forward movement.

In this Service Manual, the version of the machine may be indicated in brackets "()" for identification purposes (Disk 31 in / 80 mm, Disk 36 in / 90 mm, Cylindrical 30 in / 75 mm). This is to inform the reader that the instructions refer only to the version indicated in brackets.



A1 BRUSH MOTORS

A1.1 Checking brush motor current draw

- **1** Make sure that the batteries on the machine are charged and that there is detergent solution in the tank.
- **2** Move the machine onto a substantially smooth floor, to ensure a steady current reading.
- **3** Access the programming mode of the machine, using the "Circuit Board Programming" guide attached, or as described further on in the manual.
- **4** With the machine off, and the key in position "0", press and hold buttons "1" and "3" and turn the key to position "1", continuing to hold the buttons until UP 1.0 appears in the display window.



Now cycle through the menu with the "display" button until UP.B 0 appears. Using the water control buttons "+"
and "-", (only two values will appear: 0 and 1) select: 1, with this setting, it becomes possible to view the current drawn by the two motors together when scrubbing.



all'





For disc versions only (Disc 80 – Disc 90), adjust the tolerance setting (T0.X) on management of the brush head actuator response.

For other versions (Rollers 75 R - BT 75 R Sweep), the default setting is "0".

Press the "display" button again just once to pass on to the next setting listed in the programming menu, which is that associated with parameter T0. 5. Using the water control buttons "+" and "-", set the value to 0 (zero), which corresponds to the minimum tolerance setting possible 10%, scrolling between 0 and 9.









- **7** Press the display button and hold until the battery voltage appears in the window, to store the new settings.
- 8 Press the display button again and hold for at least 10 seconds until the first selectable parameter appears in the window: language.
- **9** Use the display button to scroll through the selectable parameters until "Program 1 Pressure 0X0" appears: default setting 020 = 20%.



10 Use the "+" and "-" buttons to select the maximum pressure setting: 100 = 100%.



11 Continue scrolling through the menu with the display button until the parameter shown in the window is: "Program 1 AutoPowerOFF ON".



12 Press the display button and hold for a few seconds to store the new parameters.

For practical purposes, Auto Power Off is by-passed so that the brushes can be used independently of the drive system. In effect, with the Auto Power Off function activated (ON), the brush motors would be interlocked to the accelerator pedal, and on releasing the pedal each time, the brushes would stop turning after a delay of around 5 seconds.

It is preferable to change the settings of Program 1, so that these settings can be accessed by the buttons used to control the machine in manual mode: button E for the brushes, and the button operating the vacuum motor. In short, pressing the "brush" button, all the settings of Program 1 will be accessed directly, and the brushes will operate in accordance with these same settings.





Check that there is sufficient liquid in the detergent solution tank to carry out the tests; the tank must not be completely empty.

Conduct the tests on a part of the floor relatively out of sight, or at least where the risk of leaving marks on the surface (due to chafing of the brushes) is not particularly important.

- 13 Proceed to check the current draw of the brush motors under no load conditions, with the brushes removed.
- 14 Press the dedicated "release brushes" button: the corresponding Led will blink; when done, remove the brushes.



15 Press the "attach brushes" button to effect a no-load coupling: the corresponding Led will blink.



With the (no load) coupling step complete, and the Led extinguished, scroll through the menu with the displaybutton; the parameter in the window changes from Volts to battery charge level, and following these in sequence, values indicating the current drawn by the brush motors (lbr – Tare).



17 As water is not required for the test, set the flow to zero (all Leds extinguished) using the "+" and "-" buttons.





18 Press the "manual brush control" button to set the motors running.



The circuit board provides two distinct current draw readings, both of which very important. The first line lbr:indicates the current drawn by the motors when scrubbing, in this instance without brushes (no load). The second line Tare: indicates the current drawn by the motors in no-load conditions (all instances).

When the brushes start up, the ECU reads the current draw at the moment rotation is induced, and immediately before the control signal is given to lower the brush head actuator; it then calculates an arithmetical average of these two values, denoted TARA.





Having calculated the TARE, the ECU proceeds during the descent of the brush head to make another calculation, by way of the actuator, namely the pressure to be applied to the brushes according to the parameter setting (in this case, in "Program 1").

The brushes are forced downwards onto the floor by the actuator, piloted by the ECU, to the point at which the current drawn by the brush motors reaches the value calculated by the ECU, taking account of the selected tolerance (T0.X, in this case, in "Program 1").

The maximum current assigned by the ECU to the brush motors during normal use is 50 A, which will be limited when the current drawn by the motors exceeds 65A for more than 10 (ten) seconds.

The up/down actuator of the brush head is controlled by the ECU in such a way that the set pressure will remain steady. In the event of a current-limiting situation occurring, the ECU causes the brush head to reascend to the minimum acceptable height, and if the high current draw persists beyond the ten second time limit, the supply of current to the brush motors will cut out and the brush head returns to the at-rest position.

returns to the at-rest position.

No error message will appear in the display.

If an attempt is made to lower the brushes with the motors still protected by the cutout, the brush head will remain in the at-rest position. The cause of the cutout may be internally of the motor (seized bearing or rotor) or a mechanical obstruction (brushes jammed).





In this situation the ECU will extend the actuator to its maximum downstroke, so that the calculated current draw of the brush motors can be read, and to the point of engaging the travel limit microswitch. This same switch also serves to indicate the maximum limit of wear on the brushes, generating a visual alert in the display and an audible warning via the buzzer.



- 20 The first line of the display **lbr** shows the current draw of the brush motors; to obtain a correct reading of this value, wait a few minutes (with the motors turning) so that it has time to stabilize.
- **21** The value that appears after a few minutes (in this instance lbr = 5.3 A) is the stabilized level of current drawn by the brush motors under no load, without brushes fitted.
- **22** The next step is to run a scrubbing test with the brushes fitted, bearing in mind the warnings indicated above.
- Fit the brushes to the head: position the brushes directly under the head (alignment is automatic) and press the
 "attach/release brushes" button to couple the brushes; the "attach" Led will blink while a dummy release operation is carried out, and when this has been completed, press the "attach/release brushes" button again. The "release"
- Led will now blink as the operation of coupling the brushes is completed.
- **24** Move the machine onto a substantially smooth floor, to ensure a steady reading.
- Using the water control buttons "+" and "-", set the flow of water to minimum, so that just one Led is alight (0.7 1 l/min): this reduces waste by using only as much water as is needed to wet the floor, while also ensuring the brush bristles do not run dry and overheat.



26 Press the "manual brush control" button to start up the brushes.

Read both of the two current draw values: **lbr** (current drawn by the brush motors when scrubbing), and **Tare**

- 27 (current drawn by the brush motors under no load, with brushes fitted, before the brushes are lowered into contact with the floor).
- **28** Compare the readings against the table below.

Current draw A (amperes)	Min	Max
No load, without brushes (Tare)	3.0 A	6.0 A
No load, with brushes (Tare)	4.0 A	10.0 A
Scrubbing, without brushes "P1" (lbr)	3.0 A	6.0 A
Scrubbing, with brushes "P1" (lbr)	10.0 A	45.0 A

Important: for test purposes, set maximum brush pressure



A1.2 Checking brush motor current draw with clamp-on ammeter

- **1** Make sure the machine batteries are charged.
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes), see photo 26.
- **3** Move the machine onto a level, dry floor with a substantially smooth surface.
- **4** Make sure that there is enough room around the machine to carry out the tests.
- **5** Turn the ignition key to position "0".
- 6 Undo the six screws securing the footplate to the tank and to the pillar.
- 7 Raise the footplate and undo the two side screws.
- 8 Undo the two screws near the bottom of the pillar.
- 9 Undo the four screws higher up on the rear of the pillar.





10 Remove the brushes from the head.

11 Locate and disconnect the operator-on-board sensor and wire in a jumper as illustrated





- **12** Turn the ignition key to position "1", and wait for at least 5 seconds.
- **13** Use the "-" water control button to set the flow of water at zero for the scrubbing step.
- 14 Press the display button and hold for at least 10 seconds,
- **15** Make sure that there is enough room around the machine to carry out the tests.
- **16** Turn the ignition key to position "0".
- 17 Go to "Program 1 Auto Power OFF".
- **18** Select "OFF" using the water control buttons "+" and "-".





- 17 More exact information on control of the "Auto Power OFF" function can be found in the "User Programming" guide accompanying this manual.
- 18 Press the display button again and hold for at least ten seconds to store the selected settings.
- **19** Press the "manual brush control" button to lower the head and set the brushes in rotation.
- 20 Pressing the manual control button, the brushes will operate with the same settings as program 1.





- 21 Locate the negative cable (black) of the brushes, which is also indicated on the circuit board.
- **22** Apply the clamp-on ammeter to the cable and read the current drawn by both motors together under no load conditions.



23 Refit the STANDARD brushes and run the measurement tests as in the steps described previously.

Take both of the lbr current draw readings, (current drawn by the brush motors with and without brushes), and ifall is as it should be, refit the pillar panel and the footplate, reconnect the operator-on-board sensor and restore the parameters (water, Auto power OFF) altered for testing purposes.

25 If the values do not correspond to those indicated below (i.e. higher), proceed to identify the problem, checking each single brush motor in turn as described in the next heading A1.3.

Current draw A (amperes)	Min	Max
Scrubbing, without brushes "P1"	3.0 A	6.0 A
Scrubbing, with brushes "P1"	10.0 A	45.0 A

Important: for test purposes, set maximum brush pressure



A1.3 Checking the current draw of brush motors individually

- **1** Make sure the machine batteries are charged.
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- **3** Move the machine onto a level, dry floor with a substantially smooth surface.
- **4** Make sure that there is enough room around the machine to carry out the tests.
- **5** Use lifting equipment, if available, for greater convenience when taking measurements.
- **6** Follow the procedure as described in steps 8 to 20 of the previous heading A1.2.
- 7 Lower the brush head and locate the power cable of one of the two brush motors.
- 8 Check the current draw of the brush motor under no load, without brushes fitted.
- **9** Take the measurements and make a note of the readings.



- 10 Repeat the procedure on the second motor
- **11** Compare the readings with those taken for the first motor.
- The two motors must draw roughly the same current.

The sum of the two motors is equal to the value read directly on the circuit board — see step 21,

heading A1.1 — or on the clamp-on ammeter, see heading A1.2.





- 11a If the levels of current drawn by the two brush motors are identical to one another and the sum is roughly equal to the value read on the circuit board, proceed to check the current drawn when scrubbing, see step 12.
- **11b** If the levels of current drawn by the two brush motors are noticeably different, proceed as follows.
- Measure the current drawn by the motors (individually) with STANDARD brushes fitted (both brushes must be fitted); this test serves not only to check the current draw of the motors (individually) but also that the brushes rotate as they should, free of interference with other mechanical components.
- **13** Refit the brushes to the head: position the brushes directly under the head (alignment is automatic) and press the "attach/release brushes" button; the "attach" Led will blink while a dummy release operation is carried out



14 When this has been completed, press the "attach/release brushes" button again: the "attach" Led will blink as the brushes are coupled automatically.



With the brushes fitted, proceed as for a normal scrubbing operation, "Program 1", scrub for a few minutes, read and take note of the current drawn by the two motors individually, check that the two values for the single brush

15 motors are roughly identical and that the sum of the two values for the two motors is roughly equal to the value read directly on the circuit board, see table in heading A1.2.

If the values measured are consistent with the conditions of step 15 and fall with the minimum and maximum values of the table in heading A1.2, restore the initial electronic and mechanical settings that were altered for testing purposes.

If the values are not consistent with the conditions of step 15, check for possible interference between the brushes and the head or any of its parts, both at standstill and when running, caused by impact with fixed parts or

by a defective brush coupling (damage or incorrect alignment). If the values are not consistent with the conditions of step 15 (higher), whereas the head and the brushes are

15c in good condition and there is no friction or interference between parts. Inspect the carbon brushes of the motor drawing the higher current (A), or of both motors, if both are drawing a high current (A) than normal, following the procedure described in heading A1.4.

If the values are not consistent with the conditions of step 15 and the readings are much lower, this means that the brush motors have started to demagnetize and will soon need replacing. In effect, it can happen that the

15d motors will turn only if the brushes are not fitted, or if the selected scrubbing program is one with a very low brush pressure setting.



A1.4 Checking and replacing the brush motor carbon brushes Disassembly

- **1** Go to the designated draining area, and empty the solution tank and the dirty water tank.
- 2 Move the machine onto a level, dry floor, using a fork lift, if available, for convenience.
- **3** Apply the pedal-operated parking brake.
- **4** Press the "release brushes" button; the release Led will blink.
- **5** Turn the ignition key to position "0", and remove the brushes from underneath the head.
- 6 Locate and unscrew the innermost bolts securing the two motor mounting flanges to the head.







- 7 With the bolts removed from the head, couple the brushes to the motors, again using the "attach/release brushes" button; the "attach" Led will blink while this operation is in progress.
- **8** With the brush head completely lowered, turn the ignition key to position "0" to keep the head locked in place.
- **9** Lift the driver seat and isolate the batteries by unplugging the connector.







10 Locate and remove the clips that retain the metal bands (one per motor) shielding the carbon brushes of the brush motors.





- **11** Use a tool with a hook end to lift the tension spring of the carbon brush.
- **12** Pull the carbon brush back by its wire so as to free it from the relative seat.





- 13 Assess the extent of wear on the carbon brush positioned outermost, which is the more convenient to inspect.
- 14 Check that the length dimensions of the carbon brushes measure between $18 \pm 0.5 \text{ mm} / 0.7 \pm 0.019$ ins and $11 \pm 0.5 \text{ mm} / 0.43 \pm 0.019$ ins, as illustrated below; if less than $11 \pm 0.5 \text{ mm} / 0.43 \pm 0.019$ ins, they must be replaced.

Always replace all four carbon brushes of the motor at one time. If the two brush motors mounted on the head have been in operation for the same number of hours, replace all eight carbon brushes together.









15 To replace all of the carbon brushes, following inspection, first remove the other two bolts by which the mounting flange (of each motor) is secured to the brush head.





- **16** Disassemble all the anti-vibration mounts so that the motors can rotate freely on the brush head, thereby enabling removal of all the carbon brushes without difficulty.
- 17 If the power cable of the motor is too short to allow free movement, disconnect it from the main harness.





18 Undo the screw clamping the eyelet terminal of the carbon brush to the holder.





- **19** Clean the contact area of the carbon brush holders and the rotor by blowing with compressed air.
- 20 Make sure there is no excessive or localized wear on the commutator of either brush motor.
- 21 Check that all connecting wires are secured firmly to their contacts, with the nuts fully tightened.







Reassembly

- 1 To fit the new carbon brushes, repeat the steps of the disassembly procedure in reverse order.
- 2 Before fitting the new carbon brushes, check carefully that they are of the right dimensions and that they slide freely in their seats; the only measurement that must differ from those replaced is the length.
- **3** Having fitted the carbon brushes, refit the protective metal band.





- 4 Position the motors as installed previously, with the power cable directed toward the rear.
- **5** First, position the bottom rubber anti-vibration washers under the mounting flanges of the brush motors.
- 6 Insert the spacers through the flanges, as illustrated, aligning them in the holes of the brush head.
- **7** Now fit the top washers of the anti-vibration mounts onto the spacers, on the top side of the flanges.
- 8 Add the bolts, making certain before they are tightened that the spacers have remained in position.
- **9** Tighten the bolts, but do not overtighten.
- **10** The innermost bolts will be refitted more easily with the brush head raised.
- **11** Check the current draw of the brush motors as described in heading A1.1.







A1.5 Replacing the carbon brushes on the bench

If the carbon brushes of the brush motors cannot be inspected and/or replaced without detaching the brush head from the machine, as described in heading A1.4, the head must be removed as described in heading A3.1, and the carbon brushes then replaced on the workbench.

- **1** Remove the brush head from the machine as described in heading A3.1.
- 2 To enable inspection and replacement of the carbon brushes, first remove the protective metal bands by pulling the plastic spring clips outwards.
- 3 Locate the four carbon brushes, which are spaced 90° degrees apart.
- **4** To remove the carbon brush, lift the retaining spring and pull the brush outwards.



5 Undo the screw to free the carbon brush from its holder.





- 6 Measure the carbon brush to verify the extent of wear; the minimum acceptable length is 11 mm / 0.43 ins.
- 7 When replacing carbon brushes, compare the new part with the old part, or check it against the dimensions illustrated below. The only measurement that must differ is the length.
- 8 Always make sure that the carbon brushes slide freely in their seats.



- **9** Blow the inside of the motor clean with compressed air, paying particular attention to the area of sliding contact between the carbon brushes and the commutator.
- 10 Check the commutator of each motor for wear, paying particular attention to the area of sliding contact with the carbon brushes.
- **11** Check that all connecting wires are secured firmly to their contacts, with the screws fully tightened.
- **12** For refitment of the protective band, refer to the photograph below.





Reassembly

- **1** To fit the new carbon brushes, repeat the steps of the disassembly procedure in reverse order.
- **2** To refit the brush head, repeat the steps of the disassembly procedure in reverse order.



A2 BRUSH HEAD ACTUATOR

A2.1 Checking brush head actuator current draw

When measuring the current drawn by electric motors on the machine, it is important to ensure the batteries are charged, given that if battery voltage (V), in the case of the T 981, is other than 36 V, the current draw measurements in amperes (A) will give a false reading.

The power of the electric motors in watts (W) is the product of $A \times V = W$, so that if the value of the voltage (V) is low, a higher current (A) will be needed to produce the same amount of power, thus distorting the reference value, hence the importance of the batteries being charged.

Example; if, with the batteries charged at 36 V, the current drawn by the motor is measured at 10 A, the power output of the motor is 360 W when performing a given task, whereas if the voltage falls to 31 V, and the same 360 W of power is still needed by the motor to perform the same task, then the current (A) drawn by the motor must increase to 11.6 A.

- 1 Make sure the batteries on the machine are charged ($36V \pm 1V$).
- 2 Switch off the machine and apply the pedal-operated parking brake.
- **3** Move the machine onto a level and dry floor.
- 4 Carry out the test with brushes fitted: preferably new brushes.
- 5 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- **6** Disconnect the operator-on-board sensor and wire in a jumper as illustrated.
- **7** For convenience, check the current draw of the actuator from the instrument panel.
- 8 Set the flow of water to zero (no Leds alight) by means of the relative control buttons "+" and "-".







- **9** Undo the screws securing the instrument panel to the pillar.
- 10 Lift the instrument panel and locate the twelve-way connector.



11 Locate the pink wire at pin 5 and the yellow wire at pin 6 of the twelve way connector, and apply the clamp-on ammeter to both.



- **12** Select the <u>down</u> movement of the brush head using the "manual brush control" button.
- **13** Measure the current draw in amperes and compare the reading with the value in the table below.







- **14** Select the <u>up</u> movement of the brush head using the "manual brush control" button.
- **15** Measure the current draw in amperes and compare the reading with the value in the table below.





- 16 If the readings fall within the values indicated in the table below, then everything is as it should be: remove the clamp-on ammeter and refit the instrument panel.
- **17** If the values do not correspond to those indicated, and are higher:
- **17a** Check that the parallelogram linkage of the head operates freely and without interference, and that no creaking or chafing noises are heard during the up or down movement.
- 17b Measure the current drawn by the actuator under no load conditions, or fit a new replacement.

Controlled by the circuit board on its upstroke and downstroke, the brush head actuator is supplied with power via MOSFETs in ON-OFF (switch) mode, receiving current of up to 5 amperes (A) maximum.

If the actuator requires a higher current, or requires the maximum available current (5 A) too long a duration, the electronics of the circuit board are programmed to protect the MOSFETs against overheating by cutting off power to the contactor. To reset the control circuit, after waiting (very short delay) for the temperature of the MOSFETs to normalize, the machine must be switched off and switched on again with the ignition key

Current draw A (amperes)	Min	Max
Downstroke	0.8 A	5.0 A
Upstroke	1.8 A	5.0 A



A2.2 Replacing the brush head actuator

Disassembly

- 1 Make sure the batteries on the machine are charged ($36V \pm 1V$).
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes).
- **3** Go to the designated draining area and empty the dirty water tank completely.
- **4** Move the machine onto a level and dry floor.
- 5 Apply the pedal-operated parking brake.
- **6** Turn the ignition key to position "0".
- 7 Lift the driver seat and the dirty water tank to expose the battery compartment.
- 8 Isolate the batteries from the machine electronics by unplugging the Anderson connector.
- **9** Remove the batteries from the compartment.
- 10 Remove the battery tray, lifting out by means of the two holes located on opposite sides
- 11 Undo the screws to allow the removal of the Anderson socket and the fuseholder from the battery box.

















- **12** Undo the screw that secures the travel limiting stay rod of the dirty water tank.
- **13** Uncouple the rod, swing it forward and rest it on the seat stop.



14 Undo the four screws securing the battery box to the chassis, and remove the box.



- **15** Detach the vacuum hose and position it under the squeegee bumper.
- **16** Bridge the gap between the bumper and the dirty water tank with soft material that will not mark the tank.





- **17** Lift out the battery box and separate it from the edge of the dirty water tank.
- 18 With the chassis now exposed, locate the brush head actuator and its electrical connections.
- **19** Remove the two cable ties and unplug the connector of the brush motors.



Testing

- **20** If there is a power cord extension available, measure the current draw of the brush head actuator before disassembling the component.
- The operation and current draw of the brush head actuator can also be checked with the brush motors disconnected, although without electronic error diagnostics available.



- 21 If the values read are significantly low, check that the connector of the actuator is free of oxidation, and verify the integrity of the machine wiring harness.
- 22 If the readings are no better after any problems of this kind have been remedied, unplug the connector and replace the actuator.



- **23** Use a tool with a hook end to lift the spring and free it from the hole in the brush head bracket.
- **24** Using a pair of snap ring pliers, release the circlip fitted to the bottom clevis pin.





- **25** Grip the bottom arm of the parallelogram linkage with one hand and lift the brush head, while drawing out the clevis pin with the other hand, using a pair of long nose pliers
- 26 Proceed with care, as the brush head bracket does not allow the pin to be removed completely.
- **27** Rest the brush head on the floor.



- 28 Using the same snap ring pliers, remove the circlip V1 fitted to the top clevis pin V.
- 29 Clean the surface of the pin with sandpaper, to facilitate its insertion when reassembled.







Checking and Adjustment of Microswitch Cams

- 1 Replace the actuator with a new component, the specifications of which must match those indicated below
- 2 Take careful note of the label affixed to the microswitch cover.



- **3** Undo the two screws to remove the cover from the actuator body.
- 4 Unscrew the rod, turning anticlockwise, until the length measurement is 35 ± 0.5 mm / 1.37 ± 0.01 ins.
- 5 Position the hole in the rod with the axis parallel to that of the hole at the rigid mounting end.
- **6** Using a hex key, loosen the grubscrew locking the top cam so that the position of the cam can be adjusted.





- 7 Turn the top cam until the "click" of the microswitch is heard, then tighten the grubscrew to lock the cam in position.
- **8** Loosen the grubscrew of the bottom cam and set the cam at an angle of 90° relative to the top cam.
- **9** The two cams must be positioned as if coinciding with a time of 12:15 or 12:16 on a clock face.

The top cam controls the height of the actuator on the upstroke, whereas the bottom cam determines the limit on the downstroke; this same cam also serves as the reference for the brush wear alert, which is generated on the instrument panel.



- 10 Now check the positions of the cams electrically.
- 11 Connect the actuator to a power source, even providing less than 36 V, using just one 6V battery for example.

For adjustment purposes, actuators can be supplied with power at less than 36V. Just one 6V battery can be used, as long as it is able to provide ample current (A), given that with fewer volts (V) the power supply needs to be balanced with correspondingly more amperes (A)

12 Prepare two leads with female Faston terminals suitable for attachment to those of the **5 way** connector; the positive lead (red) to incorporate a fuse, and a switch with pushbutton function.



- 13 Connect the red lead to the Yellow wire of the 5 way connector and the black lead to the Blue wire
- **14** Hold the rod of the actuator in position with one hand to prevent it from rotating.







- **15** Press the switch and allow the rod to extend (downstroke) until the bottom microswitch is engaged by the **bottom** cam and shuts off electrical power to the actuator.
- 16 If the bottom cam was adjusted correctly, the rod should have extended to 66.5 ±0.5 mm / 2.61 ±0.01 ins



In the event that the rod has extended to a length shorter than required, loosen the grubscrew of the **bottom**

- **17** cam and, with great care, rotate the cam fractionally in the anticlockwise direction. If the length is greater than required, rotate in the opposite direction.
- **18** Now change the connections, attaching the red lead to the White wire of the 5 way connector and the black lead to the Red wire of the connector.
- **19** Hold the rod of the actuator in position with one hand to prevent it from rotating.
- 20 Press the switch and allow the rod to retract (upstroke) until the top microswitch is engaged by the top cam and shuts off electrical power to the actuator.
- **21** The exposed length of the rod should measure 35 ± 0.5 mm / 1.37 ± 0.01 ins, as adjusted at the outset.

In the event that the rod has retracted to a shorter length, loosen the grubscrew of the bottom cam and, with

- **22** great care, rotate the cam fractionally in the anticlockwise direction. If the length is greater, rotate in the opposite direction.
- 23 To facilitate refitment of the actuator to the machine, extend the rod (downstroke) as described in steps 13 to 17.
- **24** To avoid losing the position of the rod, when fitting the actuator, it is advisable to make a witness mark with a felt tip pen.
- 25 Reinstate the cover on the actuator body, and refit the actuator to the machine.







Reassembly

- 1 To fit the new actuator, repeat the steps of the disassembly procedure in reverse order.
- 2 Remember to clean the top clevis pin with sandpaper see step 29 of Disassembly.
- **3** Check the integrity of the circlips and renew if necessary, especially if out of shape.
- 4 Fit the actuator, maintaining the position of the rod relative to the body.
- 5 Having secured the actuator mechanically, proceed to check the positioning of the brush head relative to the chassis of the machine, and the drive discs relative to the floor.

Checks

If possible, plug the actuator into the connector of the machine wiring harness and select the upstroke by meansof the dedicated control button, otherwise use the same connection as adopted for the Inspection and Adjustment procedure.

- **7** Raise the head completely, using either of the controls described in the previous step, and check that the clearance between the brush motors and the chassis is 5 mm / 0.19 ins approx.
- 8 The distance can be measured with a standard key or wrench having a thickness of 5 mm / 0.19 ins approx.



- **9** Lower the head completely, using one of the control systems described in step 6, and check that the clearance between the brush drive discs and the floor is 5 mm / 0.19 ins approx.
- **10** Push the machine forward or back so that the flaps can bend under the weight of the head, allowing the head to use the full stroke of the actuator; this will ensure the value measured is dependable.
- 11 Should the set-up on the bench not have been satisfactory, open the cover of the actuator and readjust the cam as necessary.
- **12** Be sure to check the changes made.
- 13 Close the cover, taking care to reseat the seal correctly.





A3 BRUSH HEAD (DISC)

A3.1 Disassembling the brush head

Disassembly

- 1 Proceed as per disassembly of the brush head actuator see heading A2. 2.
- 2 Before removing the actuator, mark the position of the rod relative to the body.
- **3** Locate the four bolts that must be undone to detach the brush head from the arms of the parallelogram linkage.
- 4 Start with those uppermost, loosening the bolts: unscrew the nut, then lift the arm and screw the nut on again to avoid losing the bushes and the washers.
- **5** Be sure to position the washers as before when reassembling.
- 6 Now detach the lower arm, removing the bolts and taking the same precautions as mentioned for the top bolts.





- 7 With the head disassembled mechanically, proceed with removal of the solenoid valve, mounted on the brush head plate.
- 8 Raise the head plate on the right hand side by ten centimetres or so, and wedge it in this elevated position with a block of wood or other non-compressible material.
- **9** On the underside of the head, locate the two screws securing the solenoid valve mounting to the head plate.
- **10** Undo the screws and remove the water delivery hose, so that the solenoid valve assembly can be separated from the head.








11 Disconnect the solenoid valve electrically by unplugging the connector, and place the valve at the top of the tank.



- 12 With the brush head freed completely from the rest of the machine, elevate the front end of the machine fifteen centimetres off the floor, using the lifting point provided.
- **13** Remove the brush head, pulling it out from the right hand side, being careful with the connector of the brush motor cables.





Reassembly

- **1** To refit the brush head plate on the machine, repeat the steps of the disassembly procedure in reverse order.
- **2** Take care when positioning the washers and bushes on the bolts securing the arms of the parallelogram linkage.
- **3** Check the integrity of all the flaps before refitting the head.
- **4** Examine the carbon brushes of the motors for wear before refitting the brush head see heading A1.4.
- **5** Check the integrity and efficiency of the anti-vibration mounts.

If possible, before reinstating the battery box and the batteries, use an extension cable to check all the
functions of the machine: up and down movements of the head, direction of rotation of the brush motors
— the right hand motor anticlockwise, the left hand motor clockwise.



A3.2 Replacing the brush motor end cap and bearing

If the motors mounted on the head have been operating for the same number of hours, it is advisable to replace the two end caps and the relative bearings both at the same time.

Disassembly

- 1 First remove the brush head, as described in heading A3.1.
- 2 If the intention is to service one motor only, establish which motor requires attention.
- 3 Free the carbon brushes from their supports, as described in heading A3.2, without detaching them.
- 4 Remove the protective sheath from the wires and fit them over the wires of the new end cap.
- **5** Procure a new connector to replace the one cut off, so that the wires of the new end cap can be joined to the wires of the existing motor.







- **6** Unscrew the two nuts securing the end cap to the motor frame.
- **7** Use a rubber mallet to help separate the end cap from the stator.
- **8** If the bearing remains in place on the rotor shaft, remove it using a puller designed for the purpose.











Reassembly

- 1 Clean the shaft, removing dirt and eliminating any traces of rust using emery cloth.
- **2** Blow compressed air at the cleaned area and at the rotor.
- **3** Proceed with assembly of the new bearing and new end cap.
- **4** Position the bearing on the rotor shaft, ensuring its correct alignment, then drive fully home using a plastic mallet.
- **5** Detach the carbon brushes from the old end cap and refit them in the same position on the new end cap.
- 6 Position the new end cap on the motor, lining up the bearing and the two studs.
- 7 Tap the end cap down with a plastic mallet, striking where the bearing seat is located, until breasted fully in contact with the motor frame.
- Screw the nuts onto the studs, securing the end cap to the motor. Do not overtighten: maximum torque 9 Nm / 6.63 ft lb.





- **9** Connect the new connectors to the brush motors, observing the correct polarity.
- **10** The red motor cables must be inserted into the hole marked with "+" Positive.
- **11** The black motor cables must be inserted into the hole marked with "-" Negative.
- **12** Position the carbon brushes in their seats as indicated in heading A3.2.
- **13** Refit the protective metal band around the carbon brushes.
- **14** Reinstate the brush head on the machine as described in heading A3.1.







A3.3 Replacing the brush motors

Disassembly

If the brush motor is being replaced because of wear, a noisy bearing - top, and especially bottom - oil leaks from the mechanical gear unit (which can be seen from under the head, on the shaft to which the drive flange is mounted), and the two motors have been in operation for the same number of hours, it is advisable to replace both motors.

Even when replacing one only of the two brush motors, it is advisable to purchase a new Anderson connector as well, so that the wiring to the two motors can be reinstated neatly and reliably.

- 1 First remove the brush head, as described in heading A3.1.
- 2 If the intention is to renew one motor only, establish which motor needs replacing.
- **3** Procure a new Anderson connector, needed to complete the wiring for the new motor.
- **4** Proceed by removing the brush drive flange.
- **5** Loosen and remove the screw, being careful to retain the washer, which is not standard hardware.

Pay attention to purchasing the correct brush motor, the right brush motor is different from the left brush motor. It is only recognizable by its identification label.











- 6 Remove the flange from the shaft of the brush motor gear unit, using a puller.
- 7 Remove the key from the shaft.



- **8** Undo the three bolts securing the motor mounting flange to the head.
- **9** Remove the anti-vibration mounts from the brush motor flange in order to evaluate their wear and/or deformation.
- **10** Remove the four screws securing the flange to the brush motor.
- **11** Replace the motor with a new one.
- 12 Align the connecting wires of the new motor with one of the holes in the flange as indicated: Rx when replacing the right hand motor, Lx when replacing the left hand motor.





Reassembly

1 Position the new brush motor according to where the relative wires are located.

2 Position the flange on the brush motor.

When installing the right hand motor of the brush head, align the hole in the flange with the connecting wires

3 of the brush motor, as indicated. When installing the left hand motor of the brush head, position the hole in the flange to the right of the connecting wires.



Before reassembling the anti-vibration, check their state of wear and deformation.

- **4** Apply threadlocker to the screws and tighten: maximum torque 18.5 Nm / ~ 13.64 ft·lb.
- **5** Fit the anti-vibration mounts to the flange, checking that the bushes are positioned correctly.
- **6** Fit the flange complete with anti-vibration mounts to the head, making certain that the smaller diameter of each bush locates in the relative hole of the brush head.
- 7 Tighten the three bolts, wire up the new Anderson connector and proceed with reinstatement of the brush head, repeating the steps of the disassembly in reverse order.

Check the wear and efficiency of the anti-release spring on the drive disc and replace it if necessary.







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The brush head is equipped with a set of flaps, certain of which are particularly important to the effectiveness of the scrubbing step, like the right and left hand flap, others slightly less so, as in the case of the front flap and the rear flap and the two brush alignment flaps, right and left respectively.







A4.1 Replacing the brush alignment flaps

The importance of the brush alignment flaps to the scrubbing step is incidental, as their purpose is simply to facilitate the task of positioning the brushes under the head; they are therefore not subject to wear, but it is advisable to renew them when they begin to deteriorate. In this eventuality, it is similarly advisable to replace both of the alignment flaps (left and right) at the same time.

Disassembly

- 1 There is no need to remove the brush head for replacement purposes; it is sufficient to detach the entire brush alignment frame.
- **2** Undo the two screws securing the frame to the head plate, taking care with the bushes.
- **3** Undo the six screws on each frame, and remove the flaps.
- **4** Replace the flaps with new parts.





Reassembly

1 To fit the new brush alignment flaps and reattach the frame to the head plate, repeat the steps of the disassembly procedure in reverse order.



A4.2 Replacing the brush alignment roller and bearing

The function of the brush alignment bearing and roller is that of allowing the brush to turn when set in rotation, without touching the brush alignment frame, before it comes into contact with the surface of the floor. There is no need to remove the brush head for replacement purposes.

Disassembly

- 1 First, with the brush head in the raised position, release the brushes.
- **2** To disassemble the right hand bearing and roller, take up a position on the left of the machine, raise the left hand alignment flap, insert the hex key through the hole and undo the screw.
- **3** To disassemble the left hand bearing and roller, take up a position on the right of the machine, raise the right hand alignment flap, insert the hex key through the hole and undo the screw.
- 4 Check that the bearing turns noiselessly and without jerking, and that the rubber roller is not deformed by wear.





Reassembly

1 To fit new rollers or bearings, repeat the steps of the disassembly procedure in reverse order.



A4.3 Replacing the front flap and back flap

The function of the front flap is to prevent splashes of water and detergent from being projected onto the front drive wheel and adversely affecting its traction capability, as well as fouling the entire drive assembly with detergent. There is no need to remove the brush head for replacement of the flap.

Disassembly

- 1 First release the brushes, keeping the brush head in the raised position.
- 2 Unscrew and remove the nine bolts, along with the flat retaining strip, by which the flap is secured to the head.





Reassembly

- 1 To fit the new front flap, repeat the steps of the disassembly procedure in reverse order.
- **2** Avoid tightening the bolts with undue force, as this could deform the flap.
- The function of the **rear flap** is to ensure that splashes of water and detergent produced when scrubbing will not foul the entire rear section of the machine, or be projected onto the area of the floor that has already been scrubbed and dried.

Disassembly

1 Proceed as for the front flap.





Reassembly

1 When fitting a new rear flap, proceed as described for the front flap.





A4.4 Replacing the side baffle flaps

The side baffle flaps serve an especially important function when scrubbing, as they prevent splashes of detergent solution being projected onto areas of the floor that have already been scrubbed and dried by taking up the swirl from the brushes and directing it toward the squeegee. These are the only flaps that remain constantly in contact with the floor when scrubbing is in progress, and consequently are subject to wear. These flaps self-adjust automatically, until the frame by which they are held ultimately touches the head plate, at which point they must be replaced. Replacement is quick and simple.

Disassembly

- 1 The side baffle flaps can be replaced with the the brush head either lowered or raised.
- 2 Undo and remove the six bolts, along with the stainless steel retaining strip.







Reassembly

- **1** To fit the new flaps, repeat the steps of the disassembly procedure in reverse order.
- 2 Take care when positioning the new flaps: the cutaway must be directed toward the front end of the machine.
- **3** Avoid tightening the bolts with undue force, as this could deform the rubber of the flap.



A5 SOLENOID VALVE

A5.1 Checking and/or replacing the solenoid valve Inspection

1 Use a digital multimeter able to measure direct current at least in the 50V range.

- 2 Move the machine onto a level and dry floor.
- 3 Locate and disconnect the operator-on-board sensor and wire in a jumper as illustrated.
- **4** Release the brushes using the manual control button, and remove them from beneath the head.
- **5** Switch off the machine and apply the parking brake.
- **6** Locate the mounting position of the solenoid valve on the brush head.
- 7 On the underside of the head, locate the two screws securing the solenoid valve mounting to the head plate.
- **8** Undo the two screws to free the solenoid valve from the plate and isolate it electrically by unplugging the cap connector.







- **9** Undo the screw securing the cap connector, and unplug it from the valve.
- **10** Take care with the seal located under the solenoid valve connector
- 11 Offer the prods of the multimeter to the connector, placing the black prod (negative) on position 1 and the red prod (positive) on position 2.



- 12 Switch on the machine and, using the buttons, set the flow of detergent solution at minimum (one Led alight).
- **13** Lower the brushes, using the manual control button.
- 14 With the brush head in the scrubbing position, depress the accelerator pedal lightly and momentarily to set the brushes in rotation, and consequently energize the solenoid valve.
- **15** Read the voltage on the digital multimeter:
- **15a** if the voltage reading is between 24V and 21V, and the valve fails to lift the membrane when the connector is reattached, the solenoid valve needs to be renewed.
- **15b** If the voltage reading is lower than 21V or altogether absent and the batteries are fully charged, check the power supply wiring to the solenoid valve and/or the output from the circuit board, see heading B3.2 from step 22.
- **15c** If the circuit board and the solenoid valve are operating correctly and the wiring is sound, check that the water filters and delivery hoses are clean and free of obstruction, see heading B3.







Replacement

- 1 If the solenoid valve is to be replaced, close the tap at the outlet of the detergent solution tank.
- 2 Proceed with disassembly of the solenoid valve, first removing the hose to the brush head, by unscrewing the clip, then detaching the hose coming from the detergent solution tank.
- 3 Unscrew the two bolts to release the solenoid valve from its mounting bracket.



Reassembly

1 To fit the new solenoid valve, repeat the steps of the disassembly procedure in reverse order.



A6 ROLLER HEAD

A6.1 Checking brush motor current draw from the instrument panel

- 1 Carry out the operations as per disc brush heads, see heading A1.1
- 2 Current draw can also be measured without drive belt, as described below.



Checking current draw with drive belt disassembled.

- **29** Measuring current draw with the drive belt removed, any influences on the reading attributable to the mechanical power transmission can be excluded, and the test limited solely to the electric motor.
- 30 For directions on removal of the belt, refer to heading A6.5.
- 31 Carry out the test as when measuring current draw of the motor with brushes removed, as described from step 4 to step 21.
- **32** The test can also be conducted with the brushes fitted; the reading will not be affected.
- **33** Take a reading of both current draw values, **Ibr** and **Tare**.
- **34** Compare the readings against the table below.
- **35** If the readings differ noticeably from the values indicated in the table, it is advisable to take measurements with the clamp-on ammeter.
- **36** For indications regarding problems and how to remedy them, refer to the next heading.

Current draw A (amperes)	Min	Max
No load, without brushes (Tare)	3.0 A	6.0 A
No load, with brushes (Tare)	4.0 A	10.0 A
Scrubbing, without brushes "P1" (lbr)	3.0 A	6.0 A
Scrubbing, with brushes "P1" (lbr)	10.0 A	45.0 A
No load, without belt	3.0 A	6.0 A

Important: for test purposes, set maximum brush pressure



A6.2 Checking brush motor current draw with clamp-on ammeter

- 1 Carry out the operations as per disc brush heads, see heading A1.2
- 2 Current draw can also be measured without drive belt, as described below.



Checking current draw with drive belt disassembled

- 25 Measuring current draw with the drive belt removed, any influences on the reading attributable to the mechanical power transmission can be excluded, and the test limited solely to the electric motor.
- 26 For directions on removal of the belt, refer to heading A6.5.
- 27 Carry out the test as when measuring current draw of the motor with brushes removed, as described from step 10 to step 23.
- 28 The test can also be conducted with the brushes fitted; the reading will not be affected.
- **29** Take a reading of both current draw values, **Ibr** and **Tare**.
- **30** Compare the readings against the table below.
- **31** If all is as it should be, refit the pillar panel and the footplate, reconnect the operator-on-board sensor and restore the parameters (water, Auto power OFF) altered for testing purposes.
- **32** If the values do not correspond to those indicated in the table below (higher), proceed to identify the problem, as described in the following steps.

Unseat the belt as described in heading A6.5 and measure the current draw of the brush motor in amperes, via

32a the circuit board or directly on the motor: if the value measured falls within the values of the table below, move on to the next step; if the value falls outside of those indicated in the table, inspect the carbon brushes of the motor as described in heading A6.3.

With the brushes removed, check the bearings of the drive spindles and the bearings of the movable supports,

- **32b** mounted to the side plate, to ensure they turn unimpeded. If there is any interference, replace the bearing or bearings affected as described in heading A6.5. If the bearings turn freely, pass on to the next step.
- *32c* Fit the brushes and check their transverse interference with the mechanical elements of the head by moving them from right to left. The brushes must ride on the head with 3 to 6 millimetres end float; if the distance is less, check the assembly of the spindles, the movable supports and the length of the brush.

Current draw A (amperes)	Min	Мах
Scrubbing, without brushes "P1"	3.0 A	6.0 A
Scrubbing, with brushes "P1"	10.0 A	45.0 A
Motor only, without belt "P1"	3.0 A	6.0 A

Important: for test purposes, set maximum brush pressure



A6.3 Checking and replacing the brush motor carbon brushes

aal)

The carbon brushes should be inspected and if necessary replaced after around 600 - 700 hours operation. It is advisable to replace all four (4) carbon brushes at the same time.

Disassembly

- 1 Move the machine onto a level and dry floor.
- **2** Use a platform lift, if available, as this will simplify operations.
- **3** Apply the pedal-operated parking brake.
- **4** Remove the brushes from the head.
- **5** Lower the brush head, using the manual control button.
- 6 Depress the emergency stop button to lock the head in the lowered position.
- 7 Make a visual inspection of the brush motor carbon brushes (those accessible without removing the motor).
- 8 Release the plastic clip to remove the protective metal band from the brush head motor.
- **9** Check that the inside of the end cap is not excessively fouled by dust from the carbon brushes, or rust left by the infiltration of water.
- 10 Remove the carbon brush nearest the drive wheel (the only one accessible) and measure its length, so as to assess the degree of wear (given normal operation, the wear will be similar on all four brushes).
- **11** Undo the screw and pull out the wire of the carbon brush.
- **12** Remove the carbon brush by raising the spring with one finger and at the same time pulling on the wire.











Inspection of carbon brushes

- **13** Measure the length of the carbon brush. If greater than 8.0 to 10.0 mm (0.31 to 0.39 ins) the carbon brush can remain in service; if the measured length is approaching the specified minimum, schedule its replacement.
- 14 Inspect the sliding surfaces of the carbon brushes and of the commutator, to verify their integrity.



Replacing the Carbon Brushes

- 15 If the wear on the carbon brushes is such that they need to be replaced, start by disassembling the brush motor as described in the next heading.
- 16 With the motor on the bench, proceed with inspection, beginning with removal of the other three carbon brushes.
- 17 Carry out an inspection of the motor bearings, turning the shaft and verifying that the bearings turn smoothly, without making any noise and/or without any jerkiness in rotation.





Reassembly

- 1 Before fitting the new carbon brushes, compare their dimensions with those of the old brushes: the new parts must differ only in length.
- 2 Always make sure that the carbon brushes slide freely in their seats, and that the seats do not show signs of deformation, or simply that they are not dirty.
- 3 Blow compressed air around the inside of the motor to remove dust produced by the carbon brushes.
- **4** Remember always to inspect the rotor for wear.
- **5** To fit the new carbon brushes and reinstall the motor on the head, repeat the steps of the disassembly procedure in reverse order.







A6.4 Replacing the brush motor

Disassembly

- **1** Go to the designated draining area, and empty the dirty water tank and the detergent solution tank.
- 2 Move the machine onto a level and dry floor.
- **3** Apply the pedal-operated parking brake.
- **4** Remove the brushes from the head.
- 5 Elevate the front of the machine to enable the removal of the motor, lifting preferably by a distance of at least 10 cm / 3.93 ins.
- **6** Lower the brush head, using the manual control button.
- **7** Depress the emergency stop button to lock the head in position.
- 8 Unplug the connector of the electrical power line to the brush motor, which is positioned on the left of the head.
- **g** Remove the drive belt guard, undoing the two screws that secure it to the frame of the brush head.









10 Remove the drive shaft guard, undoing the two screws with a single washer and the single screw with two washers.



- **11** Locate the coupling that connects the motor shaft to the drive shaft.
- 12 Undo the grubscrew by which the coupling is secured to the motor shaft, exercising care, as it will have been coated with threadlocker.







- **13** Position a spacer under the motor to keep it elevated; this will facilitate the removal of the coupling.
- 14 Cut the plastic tie securing the power cable of the motor to the frame of the brush head.



- 15 Undo the four (4) screws securing the motor to the brush head frame, and ease the motor free.
- **16** Use a lever to facilitate the separation of the motor from the coupling.



- **17** If difficulty is encountered in separating the motor from the coupling, remove the second grubscrew.
- **18** While using the screwdriver as a lever, tap the coupling firmly but gently with a copper hammer to facilitate separation.





- **19** Should there be further difficulty in separating the motor from the coupling, remove the motor from the machine complete with coupling and drive shaft, as described below.
- **20** Remove the timing belt, as described in heading A6.5.
- 21 Undo the two screws of the U-clamp that retains the bearing.



22 Draw the motor out from the right hand side, complete with coupling, drive shaft, pulley and bearing.



23 Transfer the motor to the bench and continue with disassembly of the coupling, if necessary with the aid of a descaling liquid, or warming the part with a heat gun.





Reassembly

- 1 Before reassembling, clean the coupling and the shaft, and check that the key slots into the grooves without too much interference. Brush surfaces lightly with grease when assembling. **Do not tighten the grubscrews.**
- 2 Assemble the motor with the drive shaft and proceed with refitment to the frame of the brush head.
- **3** Snug the motor mounting bolts, without tightening.
- 4 Fit the bearing, and snug the clamp screws without tightening.



- **5** Distance the motor from the brush head frame with the aid of a lever, then tighten the nuts: maximum torque 20 Nm (~14.75 ft·lb).
- **6** Tap gently on the retaining screw of the pulley, using a plastic mallet, to ensure that the end of the drive shaft is inserted all the way into the coupling.



- Position the bearing perpendicular to the brush head as far as possible, and tighten the screws: maximum torque 25 Nm (~18.44 ft·lb).
- 8 Apply threadlocker to the two grubscrews of the coupling, and reinstate without overtightening.



9 Complete the assembly operation, repeating the steps of the disassembly procedure in reverse order.



A6.5 Inspection and replacement of belt

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Use a platform lift, if available, as this will simplify operations.
- **3** Remove the brushes from the head.
- 4 Lower the brush head, using the manual control button.
- **5** Depress the emergency stop button to lock the head in position.
- 6 Apply the pedal-operated parking brake.
- **7** Undo the two screws securing the drive belt guard to the frame of the brush head.



- **8** To enable removal of the belt, or to facilitate refitment, it is advisable to detach the guard protecting the drive shaft by which motion is transmitted to the brushes.
- **9** Undo the two screws with single washer and the single screw with two washers.





10 Draw out the drive shaft guard from the left hand side.



11 In the event that the belt must simply be removed, but not replaced, it is advisable to mark the position of the tensioner with a felt tip pen, so that the setting adopted for the previous installation can be restored.



- 12 Locate the fixing screw and the adjustment screw of the belt tensioner assembly.
- **13** Slacken off the screws so that the belt tensioner can turn on its axis.





14 Unseat the belt from the pulleys, starting with those of the drive rollers.



- **15** Check that the belt has not gone out of shape, developed cracks or cuts, or lost its flexibility.
- 16 If any of the defects mentioned are in evidence, replace the belt with a new and identical part, having the same circumference and the same power and strength specifications.
- 17 Before refitting the belt (existing or replacement), be certain to check and assess the state of wear of the two pulley bearings mounted to the driving and driven centres of the train.
- **18** Turn the bearings by hand and listen, ensuring that rotation is smooth and noiseless. If the bearings need to be replaced, proceed as described in the next heading.



Reassembly

- 1 To fit the new drive belt, repeat the steps of the disassembly procedure in reverse order.
- 2 Loop the belt around the pulleys, bring the roller of the tensioner into position, tension the belt and snug the screws without tightening.
- **3** Check the tensioning of the belt, as explained below. Having obtained and made certain of the right tension, tighten the screws: maximum torque 20 Nm (~14.75 ft·lb).



Checking the belt tension

1 When checking the tension of the belts, there are two methods that can be used to ensure a satisfactory outcome:



Press down on the belt with one finger at mid-point on the top branch, applying a moderate amount of force (maximum 7 kg - 14.43 lb), and check that it does not touch the branch looped around the timing pulley directly beneath.



Grip the belt at the mid-point of the top branch between finger and thumb, and twist it through one quarter turn
(90°) without applying excessive force. If the belt can be twisted beyond one quarter turn (90°), the tension of the belt needs to be increased, whereas if it cannot be twisted as far as 90°, then the tension needs to be reduced.

1c The most accurate method of checking the belt tension is to use a belt tension meter, which in the case of the timing belt used on the brush head of this machine should be set at between 50 and 60 Hz.



A6.6 Checking and replacing the brush spindle bearings

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Use a platform lift, if available, as this will simplify operations.
- **3** Remove the brushes from the head.
- **4** Lower the brush head, using the manual control button.
- **5** Depress the emergency stop button to lock the head in position.
- 6 Apply the pedal-operated parking brake.
- 7 Remove the timing belt from the head, as described in the previous heading.
- 8 To gain access to the brush spindles, it will be sufficient to remove only the drive belt guard.
- **9** Mark the position of the belt tensioner with a felt tip pen, as described in the previous heading.
- 10 Undo the eight M6 countersunk screws securing the two brush drive units, proceeding with care, as these fasteners will have been smeared initially with threadlocker.
- 11 Transfer the two brush drive units to the bench and proceed to disassemble the brush mandrels, the hubs and the pulleys, so as to access the bearings.

It is strongly recommended that all four bearings be renewed at the same time.









- 12 Secure the pulley in a vice (using jaws of soft metal, such as aluminium), without overtightening, as this could damage the toothed surface.
- **13** Unscrew the brush mandrel.



- 14 Secure the plastic hub in the vice (likewise using jaws of soft metal, and without overtightening) and, using a plastic or copper mallet, tap the brush drive spindle down to the level of the hub.
- Return the pulley to the vice, again taking the precautions indicated above, and with the aid of two screwdrivers**15** inserted between the hub and the body of the brush drive unit, lever the hub upwards until entirely separated from the spindle. Remove the spacer and the two thrust washers with care, and set aside.









- **16** The thickness of the two thrust washers combined must be $0.6 \pm 0.1 \text{ mm} / 0.02 \pm 0.003$ ins. If only the bearings are replaced, the thrust washers do not need to be renewed.
- **17** Using snap ring pliers, remove the circlip.
- **18** Undo the screw securing the pulley to the spindle.



- **19** Separate the body of the drive unit from the timing pulley, and remove the key with care.
- **20** Using a plastic or copper mallet, tap the spindle out until entirely free of the bearing mounted to the drive unit, then free the spindle from the second bearing.





- 21 Remove the second circlip from the drive unit, then the other bearing.
- 22 Replace both the bearings with new parts, then proceed to reinstate the brush drive unit.
- 23 Repeat the same operations for the second brush drive unit.
- 24 Remove the second circlip from the drive unit, then the other bearing.







Reassembly

- 1 First, fit the new bearing on the hub side of the brush drive unit, and seat the relative circlip.
- 2 When inserting each bearing in the relative seat of the brush drive unit, use a socket wrench to serve as a driver.



- **3** Insert the spindle through the bearing fitted to the drive unit, using a plastic mallet to apply the necessary force.
- **4** Now fit the second bearing, slipping it over the inside end of the spindle and using the socket wrench to drive it into the bore of the body.





- **5** Fit the circlip to lock the bearing in place.
- 6 Take care when refitting the two thrust washers. These are placed between the spacer and the bearing.
- **7** To reinstate the two brush drive units, repeat the steps of the disassembly procedure in reverse order.
- 8 Apply threadlocker to the screw and tighten: maximum torque 6.0 Nm / ~4.42 ft·lb.
- **9** Apply threadlocker to the screw of the spindle. Use moderate force when tightening the brush spindles.
- **10** Apply threadlocker to the eight retaining screws of the drive units and tighten: maximum torque 8.0 Nm / \sim 5.9 ft·lb).





A6.7 Checking current draw of the brush head actuator

- 1 Make sure the batteries on the machine are charged (36V ±1V).
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A.
- **3** Move the machine onto a level and dry floor.
- **4** Switch off the machine and apply the pedal-operated parking brake.
- 5 Carry out the test with brushes fitted: preferably new brushes.
- 6 Perform the measurement as described in heading A2.1.
- 7 The measurement will be more precise if taken directly on the power supply wires to the actuator, using external batteries.
- 8 Expose the actuator by disassembling the machine as described in heading A2.2.
- **9** Apply the clamp-on ammeter to the power leads of the brush head actuator.
- 10 Now operate the raise and lower controls of the brush head, repeating the sequence several times. Calculate the averages of upstroke readings and downstroke readings.



- 11 Check the average values with those of the table below.
- 12 If the averages (upstroke and downstroke) fall within the values of the table below, everything is as it should be.
- 13 If the averages are not consistent with the values in the table, proceed as described in heading A2.1.

Current draw A (amperes)	Min	Max
downstroke	0.8 A	5.0 A
upstroke	1.8 A	5.0 A



A6.8 Replacing the brush head actuator

Disassembly

- **1** Go to the designated draining area and empty the dirty water tank completely.
- 2 Move the machine onto a level and dry floor.
- **3** Remove the brushes from the head.
- 4 Lower the brush head using the manual control button, so as to facilitate the disassembly operation.
- **5** Depress the emergency stop button to lock the head in position.
- 6 Apply the pedal-operated parking brake.
- **7** To expose the actuator, remove the battery box as explained in heading A2.2.
- 8 Make a mark on the rod of the actuator to indicate the position of the head when lowered.
- **9** Unplug the connector and cut through the plastic tie to free the actuator power cable.
- **10** Procure two leads as described in step 12 of heading A2.2 and wire them to the connector of the actuator as described in step 18 of the same heading.
- **11** Raise the brush head, and make a mark on the rod of the actuator to indicate the raised position, so as to avoid losing the positions in the event of the rod being rotated unexpectedly.
- 12 Return the actuator to the position with the brush head lowered, so as to facilitate disassembly of the head, wiring the two leads to the connector as described in step 13 of heading A2.2.










- **13** Unscrew the top bolt and elevate the brush head slightly, so that the threaded pivot can be removed.
- **14** With the head resting on the floor, unscrew the bolt.



15 To free the threaded pivot completely, continue by unscrewing the two bolts so that the parallelogram linkage can rotate.



- **16** Elevate the parallelogram and remove the threaded pivot.
- 17 When disassembling the actuator for inspection purposes, avoid screwing or unscrewing the rod manually.
- 18 In the event of the actuator being replaced, continue by measuring the two stroke limit lengths.
- 19 Measure the length of the rod in the position with the head lowered (rod extended to longer length).





20 Measure the length of the rod in the position with the head raised (rod extended to shorter length).



21 To facilitate the adjustment of the brush head height, both raised and lowered, set the travel distance for the rod of the new actuator on the bench, as described in heading A2.2, or as indicated briefly below.

Adjustment

- Important: motion must be induced in the rod exclusively by means of the motor, and holding it fast withone hand to prevent rotation. In effect, any rotation of the rod will alter its length dimension relative to the top and bottom cams.
- 23 Wire the two leads to the connector as illustrated in the photographs above, power up the motor and stop the movement at the longer length of the rod, which in this instance is \sim 72 mm / 2.83 ins.
- 24 Adjust the bottom cam so that it operates the dedicated microswitch.





- 25 Wire the two leads to the connector as illustrated in the photographs above, power up the motor and stop the movement at the shorter length of the rod, which in this instance is ~52 mm / 2.04 ins.
- **26** Adjust the top cam so that it operates the dedicated microswitch.





Continue by extending and retracting the rod repeatedly, powering the motor with the wiring configurations atthe connector as illustrated above, so as to verify that the cams are operating correctly, stopping the rod on the requisite lengths. If not, readjust the cams as necessary.

28 Once the correct adjustment is obtained, refit the cover and reinstate the actuator.

Reassembly

- 1 To fit the new actuator, repeat the steps of the disassembly procedure in reverse order.
- 2 Before proceeding with refitment of the battery box, check that the brush head and its mechanical linkages do not interfere with any part of the head frame or the machine.

Checks

When in the raised position, the head should normally be separated from the detergent solution tank by a distance of between 5 and 20 mm / 0.19 and 0.78 ins, measured from the highest point of the debris bin, and on both sides.

The distance between the detergent solution tank and the debris bin is of relative importance; in effect, only if the machine has to negotiate ramps or must be loaded regularly onto a vehicle for transport purposes will an adjustment close to the minimum distance be advisable. At all events, it is important that when the brushes are lifted, or when fully raised, there should be no interference with other parts of the head or with the solution tank.



- 2 To facilitate the task of measuring the distance of the brush head from the floor when in the lowered position, removal of the belt guard is recommended.
- 3 Undo the two screws securing the belt guard to the brush head.





- **4** When in the lowered position, the head should normally clear the floor by a distance of between 5 and 10 mm / 0.19 and 0.39 ins, measured on the front and on the rear of the left hand side (the lower side of the head).
- **5** Any difference between the measurement of the distance at the front of the head and that of the distance at the rear of the head must be minimal, between 0 and 4 mm / 0 and 0.15 ins.

The height adjustment of the head does not influence the quality of scrubbing. In practice, pressure on the brushes is maintained constant by the actuator. It is advisable to set the head toward the upper positioning limit if the floor is uneven, or if there are tracks or low relief textured surfaces present. Selecting an adjustment toward the lower height limit has the effect of maximizing brush life, as the setting limit of the brush wear sensor will be maximized.







A6.9 Testing and replacement of solenoid valve

1 Carry out the steps described in heading A5.1.



A6.10 Replacing the side flaps

The function of the side flaps is to contain the splash generated by the rotation of the roller brushes, and to direct the dirty water toward the squeegee. They have no influence on the quality of the scrubbing action, but are of great importance to the end result.

Whenever the brushes are replaced, it is advisable to replace the flaps at the same time.

Disassembly

- Move the machine onto a level and dry floor. 1
- Switch off the machine with the key and apply the pedal-operated parking brake. 2
- Undo the screws of the flap retaining strips. 3
- Remove the left and right hand retaining strips, the left hand flap and the right hand flap. 4
- 5 The right hand flap differs from the left only in length.



Reassembly

- Lower the brush head by operating the control. Once the brushes are in contact with the floor, depress the 1 emergency stop button to lock the brush head in position.
- Position the new flaps resting against the side baffles. 2
- Fit the flap retaining strips, inserting and snugging all of the screws; do not tighten yet. 3
- Adjust the height of the flaps so that they touch the floor without flexing overmuch. 4
- When positioned as appropriate, fasten the screws moderately tight, first those on the sides, then those at the 5 rear.



The slots in the flaps are designed purposely so that the flaps will self-adjust for height with scrubbing in progress and the edges remain constantly in contact with the floor.



A7 SIDE BRUSH MOTORS (SWEEPER)







A7.1 Adjusting and replacing the side brushes

Unlike the brushes mounted to the head, the side brushes are not adjusted automatically; they must be adjusted manually as the amount of wear increases. Once the motor reaches the lowest available position on the adjustment slots, it is essential that the brushes be replaced.

Adjustment

- **1** Move the machine onto a level and dry floor.
- 2 Switch the machine off by turning the ignition key to position "0".
- **3** Apply the pedal-operated parking brake.
- **4** With the key in position "0", lower one of the brushes by means of the relative control.



- **5** Slightly loosen the two screws securing the brush gearmotor to the side arm.
- **6** Push the gearmotor downwards to the point at which the bristles of the brush bend slightly on contact with the floor.
- 7 Once the pressure is appropriate, retighten the screws to lock the motor in position





Replacement, Disassembly

- 8 Continue with adjustment of the second side brush, as explained above for the first.
- **9** Undo the end-screw of the gearmotor shaft, on the underside of the brush, taking care to retain the washer.
- 10 Pull the brush down off the shaft, taking care with the key.





Replacement, Assembly

When fitting new side brushes, repeat the steps of the disassembly procedure in reverse order: position the keyin the slot of the gearmotor shaft and slide the brush onto the shaft, aligning the slot in the hub with the key on the shaft.

- 2 In the event that the gearmotor shaft (the end carrying the brush) and the key are completely unlubricated, smear lightly with grease.
- **3** Tighten the end-screw with moderate force: maximum torque 8 Nm /~5.9 ft·lb.



A7.2 Checking the current draw of the side brush gearmotors

When checking the current drawn by the side brush gearmotors, measure the current draw of one motor at a time.

- 1 Make sure the batteries on the machine are charged (36V ±1V).
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A; see photo below.
- 3 Move the machine onto a level, dry floor with a substantially smooth surface.
- 4 Switch the machine off by turning the ignition key to position "0".
- **5** Apply the pedal-operated parking brake.

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- 6 Locate the power supply cable of the side brush gearmotors.
- 7 Offer the clamp-on ammeter to the positive wire of one of the brush gearmotors.
- 8 Turn the ignition key to position "1" and set the brush in rotation by operating the relative control.





- **9** Read and make a note of the current drawn by the motor.
- 10 Remove the brush as described in the previous heading and take a measurement of the current drawn by the motor without the brush attached.
- **11** Repeat the test procedure for the second gearmotor, likewise with and without brush.
- 12 Compare the current draw values (right hand and left hand motor) with those indicated in the following table.
- **13** If the values fall within those of the table below, reassemble the brushes and proceed with other checks.
- 14 In the event that the values differ from those indicated in the table below (higher), proceed to identify the problem, as described in the following steps.
- **14a** Check the output voltage (V) at the terminals of the brush gearmotor wiring. The voltage must be the same as when measured at the batteries.
- 14b Assess the wear on the carbon brushes of the side brush gearmotors, as described in heading A7.3.
- **14c** Check that the output shafts of the gearmotors carrying the brushes do not appear skew.
- 14d Replace the defective gearmotor or gearmotors.



Current draw A (amperes)	Min	Мах
with brush	1.1 A	3.0 A
without brush	0.5 A	1.5 A



A7.3 Checking and/or replacing the gearmotor carbon brushes

The carbon brushes should be inspected and replaced if necessary at intervals of approx 600 - 700 hours operation, or whenever the carbon brushes of the roller brush motor are serviced. It is advisable to replace all four (4) carbon brushes at the same time: two on the gearmotor of the right hand side brush and two on that of the left hand side brush.

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Use a platform lift, if available, as this will simplify operations.
- **3** Apply the pedal-operated parking brake.

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- **4** Remove the brush from the gearmotor, as described in heading A7.1.
- **5** Detach the gearmotor from the wiring harness by disconnecting the relative terminals.
- **6** Use a felt tip pen to mark the position of the screws securing the gearmotor to the arm.
- 7 Undo the screws and remove the gearmotor from the machine.
- 8 Transfer the gearmotor to the bench and proceed with replacement of the two carbon brushes.
- **9** Remove the two plastic guards to gain access to the two carbon brushes on opposite sides of the rotor.









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- 10 Remove first one carbon brush, then the other, with the aid of long nose pliers.
- **11** First remove the Faston connector, using the pliers.
- 12 Lift the spring using a tool with a hook end, or the pliers used in step 11, and remove the carbon brush, pulling it by the Faston tab.
- **13** Inspect the condition of the carbon brushes and measure the length.
- 14 When fitting new carbon brush, compare the new one with the old one or against the dimensions shown below. The only measurement that must differ is the length.
- 15 Make sure in any event that the carbon brushes slide freely in their seats.
- **16** Blow the inside of the electric motor clean with a jet of compressed air, giving close attention to the area around the carbon brushes, and the part of the rotor in sliding contact with the carbon brushes.
- **17** Check the rotors for wear, giving close attention to the area of sliding contact with the carbon brushes.







Inspection of carbon brushes

- **18** Measure the length of the carbon brush. If greater than 8.0 to 9.0 mm (0.31 to 0.35 ins) the carbon brush can remain in service; if the measured length is approaching the specified minimum, schedule its replacement.
- **19** Inspect the sliding surfaces of the carbon brushes and of the commutator, to verify their integrity.



Reassembly

- **1** To fit the new carbon brushes and reassemble the gearmotors, repeat the steps of the disassembly procedure in reverse order.
- **2** Position the gearmotors at the height marked with the felt tip pen, or carry out the procedure for adjusting pressure on the brush as indicated in heading A7.1.
- **3** Retighten the screws: maximum torque 8 Nm / ~5.9 ft·lb.



A7.4 Testing the operation of side brush gearmotors

Disassembly

- 1 Make sure the batteries on the machine are charged (36V ±1V).
- 2 Use a digital multimeter.
- **3** Move the machine onto a level and dry floor.
- **4** Switch the machine off by turning the ignition key to position "0".
- **5** Apply the pedal-operated parking brake.
- 6 Offer the prods of the digital multimeter to the power leads of the gearmotor.
- 7 Turn the ignition key to position "1" and set the brush in rotation by operating the relative control.
- **8** First check the voltage at the terminals of the brush motor, which must be the same as when read at the battery terminals.
- **9** If the reading on the digital multimeter is the same as when measured at the battery terminals, and the gearmotor does not work, replace it with a new component as described in heading A7.5. Otherwise, proceed as follows.
- 10 If there is no voltage registering, check the resettable 5-amp fuse positioned below the control knob.
- 11 If the fuse is in the correct position (OK), check the mechanical and electrical operation of the microswitch, which is positioned behind the pillar panel near the side brush control knob.
- **12** To access the wiring and the microswitch serving the side brushes, the pillar panel must be removed.







- **13** Disassemble and detach the footplate to enable the removal of the pillar panel, undoing the four (4) M6x16 screws and the four self-tapping screws.
- 14 Undo the four screws on the back of the pillar, and the two at the side, and remove the pillar panel.
- **15** Locate the microswitch, which is positioned inside the panel, near the side brush operating lever.
- 16 The microswitch is wired in a normally open configuration, so that whenever the lever is shifted from the at-rest position, the circuit will close and power is directed by way of the positive to the motor of the corresponding brush.
- 17 The other component to check is the resettable fuse, which protects the brush motor from overloading, as well as protecting the entire motor branch circuit and the motor itself from the risk of short circuits.





Checking operation of the microswitches

- To verify correct operation of the microswitches, lower the brushes by means of the controls and select the**18** function on the digital multimeter for detecting continuity. Offer one prod of the multimeter to the insulator of the positive wires, and the other prod to the other wire on the microswitch.
- If electrical continuity is detected on both the microswitches, proceed by checking continuity of the resettablefuses and, naturally, part of the relative wiring. Alternatively, remove the microswitches and check the continuity of the selfsame switches in isolation.

Checking operation of the resettable fuses

- 20 Offer the two prods of the digital multimeter (still using the continuity function) to the two external contacts of the resettable fuse and check for electrical continuity of the fuse.
- 21 If continuity is not detected likewise in this instance, replace the fuse with a new component, or alternatively, check the wiring.



A7.5 Replacing the side brush gearmotor

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Use a platform lift, if available, as this will simplify operations.
- **3** Apply the pedal-operated parking brake.
- **4** Remove the brush from the gearmotor, as described in heading A7.1.
- **5** Detach the gearmotor from the wiring harness by disconnecting the relative terminals.
- 6 Undo the four screws securing the gearmotor to the arm.
- 7 Remove the gearmotor from the brush height adjustment bracket.
- 8 Replace the gearmotor with a new part.
- **9** Check that the power input voltage is 36V and that the power draw is 60W.





Reassembly

- **1** To fit the new gearmotor, repeat the steps of the disassembly procedure in reverse order.
- 2 Tighten the screws: maximum torque 8 Nm / ~5.9 ft·lb.





VACUUM UNIT - TANKS



All maintenance operations described and illustrated in this manual must be carried out by an IPC-approved technician.

Go to the designated draining area and empty the detergent solution and/or dirty water tanks by way of the relative hoses.

Move the machine onto a level surface and apply the parking brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or depressing the emergency stop button.

Disconnect the machine electronics from the batteries by unplugging the Anderson connector.

i INFORMATION

Indications of particular importance

In this Service Manual, RIGHT and LEFT are used to indicate the side of the machine, and will always refer to the direction of forward movement.

In this Service Manual, the version of the machine may be indicated in brackets "()" for identification purposes (Disk 31 in / 80 mm, Disk 36 in / 90 mm, Cylindrical 30 in / 75 mm). This is to inform the reader that the instructions refer only to the version indicated in brackets.



B1 VACUUM MOTOR: MEASURING CURRENT DRAW

B1.1 Checking vacuum motor current draw

- **1** Make sure the machine batteries are charged.
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes); see photo below.
- **3** Move the machine onto a level and dry floor.
- **4** Turn the ignition key to position "**0**".
- **5** Detach the vacuum hose **A** from the squeegee.
- 6 First tilt the driver seat **B** forward, then tilt the dirty water tank **C** back.





- 7 The vacuum motor is positioned at the top of the machine, under the dirty water tank.
- 8 Locate the wires D of the vacuum motor power circuit.
- **9** Apply the clamp-on ammeter to either one of the two wires **D**.



- 10 Set the ammeter to read A (amperes) and DC.
- **11** Turn the ignition key to position "**1**"





- 12 Change AUTO POWER OFF to OFF from the instrument panel, as indicated in the USER PROGRAMMING guide attached, or as described below.
- A Press the display button E and hold for at least 10 seconds until the first selectable parameter appears in the window: language.
- B Continue scrolling the menu with the display button **E** until the parameter shown in the window is: **"Program 1** AutoPowerOFF ON" — see also indications in heading A1.1.
- C Use the "+" e "-" buttons to change the setting from "ON" to "OFF".
- D Press the display button **E** and hold for a few seconds to store the new parameter.



13 Press the dedicated button G to set the vacuum motor running



14 Read the CURRENT (A) drawn by the vacuum motor.



- 15 If all is as it should be (see table above), remove the ammeter, close up the dirty water tank and the driver seat, and return the AUTO POWER OFF setting to ON.
- **16** If the measurements still do not correspond to those specified, proceed as follows.
- Check the integrity of the vacuum hose **A**, ensuring that it is not crushed and that there are no blockages **inside**, **16a** as this will generally result in a lower current draw.
- **16b** Check for wear on the carbon brushes of the vacuum motor.
- **16c** Replace the vacuum motor with a new part.



B1.2 Checking and/or replacing the vacuum motor carbon brushes

Disassembly Inspection

- **1** Move the machine onto a level and dry floor.
- **2** Apply the pedal-operated parking brake **A**.
- **3** Turn the ignition key **B** to position "**0**".
- **4** Tilt the driver seat **C** forward and isolate the batteries from the machine electronics by unplugging the Anderson connector **D**, then tilt the dirty water tank **E** back to gain access to the vacuum motor **F**.



5 Remove the fan cowl G from the vacuum motor F, by pulling the metal clips H outwards and at the same time spreading the two plastic tabs I, see photo below.







- 6 Undo the two screws L (two on each mount) securing the carbon brush M to the motor.
- 7 Remove the carbon brush **M** from its mount **N**, lifting it gently and drawing it out of its seat. If resistance is encountered during this operation, apply pressure to the dark part **M1** (carbon) with the aid of a screwdriver.



Check the carbon brush for wear and for signs of scorching on the surface that slides on the rotor. Check also

- **8** that the carbon brush slides freely in its seat and that the force applied by the spring remains sufficient along the entire stroke.
- **9** If all the requirements of the previous step are met, continue by measuring the dark part **M1** of the carbon brush.
- The correct length of the carbon brush is between 23.5 mm (0.92 ins) and 8.5 mm (0.33) ins;
- *10* if the length is less than this when measured, then the carbon brushes need to be replaced.





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It is always advisable to replace both carbon brushes at the same time.

Replacement

- **11** First remove the carbon brushes as described in the previous steps.
- 12 Locate the wire O connecting the carbon brush to the electrical system of the machine.
- **13** Ease the plastic part M2 of the carbon brush upwards gently and moderately with the aid of a screwdriver.
- 14 At the same time, pull the wire O with its snap-on terminal P until free, without tugging.



- 15 Having disconnected the old carbon brush, check that the snap-on terminal P is still fully raised.
- **16** Fit the new carbon brush, pushing the terminal P home and checking that it is firmly seated.
- 17 With the two new carbon brushes connected to the two wires **O**, reassemble the vacuum motor.

Reassembly

1 To fit the new carbon brushes, repeat the steps of the disassembly procedure in reverse.



B1.3 Replacing the vacuum motor

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Apply the pedal-operated parking brake **A** as in heading B1.2.
- **3** Turn the ignition key **B** to position "**0**".
- **4** Tilt the driver seat **C** forward and isolate the batteries from the machine electronics by unplugging the Anderson connector **D**.
- 5 Tilt the dirty water tank E back to access the vacuum motor F.
- 6 Lift the rubber flap **G** allowing inspection and cleaning of the vacuum filter, and remove the sponge filter **H** together with the protective mesh **I**.



- 7 Detach the air exhaust hose L from the clip M and remove the tie N.
- 8 Unplug the Anderson connector **O**.





- **9** Undo the three screws **P** with the relative hollow studs **Q**.
- 10 Remove the vacuum motor.
- **11** Remove the outer seal R, which is glued in place; the internal mousse S must be renewed check the part number in the catalogue when purchasing a replacement.



Use a utility knife to cut through the part of the heat shrinksheath T securing the hose to the turbine housing.

Pull the hose U away from the motor, twisting clockwise at **13** the same time.





- **14** Replace the vacuum motor with a new part.
- **15** Before installing the vacuum motor on the dirty water tank, preassemble the Anderson connector and the air exhaust hose.





Preassembly

16 Should the motor be without one for whatever reason, fit a grey Anderson connector **V**.



17 Complete the preassembly of the motor by adding the air exhaust hose U, using pre-glued heat shrink sheath Z.



- 18 Insert the air hose U into the hole on the turbine housing, pushing in and twisting clockwise at the same time.
- **19** Fit the heat shrink sheath over the hole of the impeller casing, taking it as far as the rib, and secure in place with a heat gun.



Reassembly

1 With preassembly complete, install the vacuum motor on the machine, repeating the steps of the disassembly operation in reverse order.



B2 SQUEEGEE UNIT AND ACTUATOR

B2.1 Inspecting and/or replacing the electromechanical actuator

The electromechanical actuator is a component that raises and lowers the squeegee, piloted by a electronic circuit board installed in the instrument panel. While the device is intrinsically simple, familiarity with its operation is nonetheless important.

- 1 Make sure the batteries on the machine are charged (36V ±1V).
- 2 Prepare two leads A with terminals A1-A2 suitable for attachment to those of the connector B; the positive lead (red) to incorporate a fuse A3, and a switch with pushbutton function A4.
- 3 Move the machine onto a level and dry floor.
- **4** Turn the ignition key to position "0".
- **5** Locate the connector B of the actuator C.
- **6** If the two leads A are long enough, the operation of the actuator C can be tested in situ; if not, the actuator must be removed.





Disassembly

With the squeegee raised: Unplug the connector B, unseat the left hand spring D, then undo the bolt E securing
the rod C1 to the mounting of the actuator C, and the bolt F securing the body of the actuator to the chassis of the machine.





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With the squeegee lowered: Unplug the connector **B**, detach the squeegee, push the machine back so as to bring the wheels of the squeegee frame forward, unseat the springs **D** and **G**, so that there is no load on the electromechanical actuator **C**, lift the squeegee frame **H**, and undo the bolt **E** securing the rod **C1** to the mounting of the actuator, also the bolt **F** securing the body of the actuator to the chassis of the machine.





Checking the motor

- 9 Inspect the motor C2 of the actuator C visually to ensure it is not burnt out.
- **10** Check that the rod **C1** extends without difficulty, unscrewing it by hand.
- If the conditions of steps 9 and 10 are satisfied, check with the test leads A that the actuator functions as it
- 11 should, attaching the leads to the pins of the connector C3: the red lead A1 to the pin of the red wire, position 1, and the black lead A2 to the pin of the black wire, position 2.
- 12 Connect the two leads A1 and A2 to the batteries of the machine: the black A2 to the negative pole; the red lead A1 to the positive pole, then operate the control.
- 13 If the rod turns and/or extends, then the actuator **C** is working; in any event, check that it also works in the opposite direction by swapping the positions of the red lead **A1** and the black lead **A2**.
- 14 To test the operation of the microswitch and the motor on the downstroke, connect the black lead A2 to position 1 and the red lead A1 to position 5, in contact with the white wire.
- **15** To test the operation of the microswitch and the motor on the upstroke, connect the black lead **A2** to position 2 and the red lead **A1** to position 3, in contact with the yellow wire.





Checking operation of the microswitch

There are two microswitches installed inside the body of the actuator, one (corresponding to the rod fully retracted position) mounted at the bottom, the motor end C2, and the other (corresponding to the rod fully extended position) mounted at the top, the rod end C1. Their function is to indicate the stroke limits (lower and upper) of the rod to the electronic circuit board by which the up and down movements of the actuator are controlled.

There is no need to remove the protective cover from the actuator when testing the operation of the microswitches, as they can be heard quite distinctly. The photos below illustrating the actuator body serve to provide a picture of how the microswitches work in different operating situations.

The rod incorporates a cam, which in the course of shifting along the linear stroke engages the two microswitches. Whenever either one of the microswitches is engaged (upper or lower) it will emit a mechanical sound, resembling a "click", indicating that the switch has been tripped.

16 Use a digital multimeter with a function for detecting continuity: see photo below.

17 Screw in the rod C1 of the actuator C completely.







18 Unscrew the rod slowly until the "click" of the microswitch is heard, indicating the rod is fully retracted, then screw the rod back in until the "click" of the microswitch is heard again: leave the rod in this position.

Screwing the rod in to its stroke limit, a single "click" should be heard, corresponding to the fully retracted position of the rod.

- **19** Connect the red lead **A1** to the pin of the yellow wire, position 3, or the green and pink wire, position 4.
- 20 Connect the black lead A2 to the pin of the green and pink wire, position 4, or the yellow wire, position 3.
- 21 Connect the opposite ends of the leads A to the digital multimeter.
- 22 If the multimeter shifts (on the display) from the initial position, this means that continuity has been detected, and the rod-fully-retracted microswitch is working correctly; now check on the rod-fully-extended microswitch.



- **23** Move the red lead **A1** to the pin of the white wire, position 5.
- 24 Connect the opposite ends of the leads A to the digital multimeter.



25 If the multimeter remains in the initial position (on the display), then continuity has not been detected, and the rod-fully-extended microswitch is working correctly.



26 Unscrew the rod completely until the "click" of the microswitch is heard.

Unscrewing the rod completely, a single "click" should be heard, corresponding to the fully extended position of the rod.

Moving the rod from bottom stroke limit to top stroke limit, and viceversa, two (2) "clicks" of the microswitches should be heard (rod fully retracted - rod fully extended) one when the contact opens, the other when the contact closes.

- 27 Connect the red lead A1 to the pin of the yellow wire, position 3, or the green and pink wire, position 4.
- 28 Connect the black lead A2 to the pin of the green and pink wire, position 4, or the yellow wire, position 3.
- 29 Connect the opposite ends of the leads A to the digital multimeter.
- **30** If the multimeter remains in the initial position (on the display), then continuity has not been detected, and the microswitch **C4** is working correctly.



- **31** Move the red lead **A1** to the pin of the white wire, position 5.
- 32 Connect the opposite ends of the leads A to the digital multimeter.



- 33 If the multimeter changes from the initial position (on the display), then continuity has been detected, and the microswitch **C5** is working correctly.
- Having verified correct operation of the motor **C2** and the microswitches **C4** and **C5**, it can be established that the actuator is efficient, and that the cause of any problem must lie elsewhere.

Reassembly

1 When refitting the actuator, repeat the steps of the disassembly procedure in reverse order.



B2.2 Checking current draw of the electromechanical actuator

It is advisable to measure the current draw of the actuator briefly, whenever it is replaced, and if possible with every change of the squeegee blades. This will help to minimize the need for early replacement of the actuator, or of the instrument panel circuit board.

- **1** Make sure the machine batteries are charged.
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 A (amperes); see photo below.
- **3** Move the machine onto a level and dry floor.
- 4 Make sure that the squeegee is correctly attached and perfectly operational.
- **5** Turn the ignition key to position "**0**".
- 6 Apply the pedal-operated parking brake.
- 7 Locate the connector C3 of the actuator, under the detergent solution tank and on the right of the machine.
- 8 Set the ammeter to read amperes and DC.
- 9 Apply the ammeter to the red wire I of the connector C3 on the actuator side.
- **10** Turn the ignition key to position "1".
- **11** Raise and lower the squeegee by means of the relative button **L**.
- 12 Read and make a note of the values that appear in the display, on both upstroke and downstroke.
- 13 Compare the measured values with those in the table below.
- 14 If the values measured fall within those specified in the table, then the actuator and its linkage are working correctly.
- **15** If the values do not correspond to those indicated in the table, and are higher:
- **15a** Check that there is no undue stiffness in the various linkage elements of the squeegee frame.
- 15b Check that the rod can be rotated by hand without noticeable difficulty, or binding.
- 15c Measure the current drawn by the actuator with no load (detached from the squeegee).
- **15d** Replace the actuator with a new component.









Current draw A (amperes)	Min	Max
With squeegee fitted (upstroke; downstroke)	1.5 A	3.5 A



B2.3 Replacing the squeegee blades Disassembly

- DISUSS
- **1** Move the machine onto a level and dry floor.
- **2** Turn the ignition key to position "**0**".
- **3** Apply the pedal-operated parking brake.
- **4** Detach the vacuum hose **A** from the union on the squeegee frame.
- 5 Unscrew the two knobs B, to release the squeegee from the frame.



Rear blade

- 6 Undo the four wing nuts C that secure the retainers of the rear squeegee blade.
- 7 Release the lever clamp D of the right hand retainer, having first disengaged the safety catch E.
- 8 Remove the right hand retainer F, the left hand retainer G, and the rear squeegee blade H.



- **9** Undo the 8 wing nuts **I**.
- **10** Remove the front blade retainer L and the front squeegee blade M.





Reassembly

- **1** The rear squeegee blade M is symmetrical in design, so that all four wiping edges can be utilized, whereas the front squeegee blade H can be used twice.
- 2 The rear blade M should be turned around every 50 hours operation.
- **3** Before refitting the blades when turned, it is advisable to clean both the blades and the body of the squeegee.
- **4** Align all the holes in the blade and the retainer.
- 5 Fit the squeegee complete with the assembled blades to the frame, and check that it wipes dry.



B2.4 Adjusting the squeegee

- **1** Move the machine onto a level and dry floor.
- 2 Make sure that the squeegee flaps are in good condition before proceeding with adjustment.
- **3** Begin by scrubbing a few metres of floor under normal working conditions, so as to position the squeegee blades for wiping the surface dry.
- 4 Check that the blade is in uniform contact with the floor, with adequate wiping pressure applied along its entire length.
- 5 An example of the ideal working condition is illustrated below.



6 If the blade wipes uniformly, but applying insufficient pressure, make the necessary adjustment by way of the knobs A.



- 7 Turning the knob A clockwise, the squeegee is raised toward the swivel plate of the caster, reducing pressure on the blade (–). Turning anticlockwise produces the opposite effect (+).
- 8 Adjust the height of the blade using the two knobs **A** so that the pressure is uniform along the entire edge.




- **9** If the blade does not ride uniformly on the floor, that is to say, if the wiping pressure at the middle of the squeegee is greater or less than at the ends, adjust the angle of inclination of the blades by way of the knurled metal knobs B and C.
- Loosen the lock nut D and make the adjustment: loosening the knob denoted C and tightening the knob denotedB has the effect of lowering the ends of the squeegee and elevating the middle section.
- 11 Conversely, loosening the knob denoted **B** and tightening the knob denoted **C** has the effect of lowering the middle section of the squeegee and elevating the ends.
- **12** Check the operation of the squeegee by running a wipe test; once the correct adjustment is obtained, retighten the lock nut D against the relative knob B.





B2.5 Squeegee frame

Squeegee stabilizer Disassembly

The function of the squeegee stabilizer is to reposition the squeegee swiftly after it has struck an obstacle during operation. It also serves to prevent the squeegee from snaking, which would adversely affect the quality of the drying action.

- **1** Move the machine onto a level and dry floor.
- 2 Switch off the machine and apply the pedal-operated parking brake.
- 3 Release the clevis retaining clip A to detach the stabilizer B from its mounting.
- 4 Undo the bolt C to remove the stabilizer from the frame.



5 Check (by pulling and pushing) that there is no backlash between the rod **B1** and the body **B2** of the stabilizer.



- 6 If there is backlash between the rod **B1** and the body **B2** of the stabilizer, check the integrity of the springs **B3**, or that the screw **B4** locking the springs is properly tightened.
- 7 To disassemble the stabilizer **B**, remove the circlip **B5**, and take out the rod complete with the springs.



- **1** When fitting the new stabilizer, repeat the steps of the disassembly procedure in reverse order.
- **2** Check that the distance between the body B2 and the lock nut of the clevis is 27 mm (1.06 ins).





Squeegee caster Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Switch off the machine and apply the pedal-operated parking brake.
- 3 Hold the head of the bolt A fast with a size 19 ring wrench, and using another wrench, loosen the lock nut B.
- 4 If possible, change both casters **C** of the squeegee at the same time.



Reassembly

- **5** When fitting the new caster, repeat the steps of the disassembly procedure in reverse order.
- 6 Continue with adjustment (wiping pressure) of the squeegee, as described in heading B2.4.

Squeegee joint Disassembly

- **1** Move the machine onto a level and dry floor.
- 2 Switch off the machine and apply the pedal-operated parking brake.
- **3** Detach the vacuum hose and disassemble the squeegee from its frame.
- 4 Locate and unhook the springs A by which the squeegee frame is prevented from rocking and **maintained** parallel to the axis of the wheels or to the surface of the floor.
- 5 Remove the "**R**" spring **B** and the plain washer **C**, so that the squeegee frame can be pulled off the pivot **D** mounted to the **parallelogram linkage.**
- **6** Transfer the squeegee frame to the bench and complete the disassembly steps, then replace the joint **E**.





- 7 Undo the two screws **F** by which the pivot **G** is secured to the frame.
- 8 Turn the joint E around and separate it from the squeegee camber adjuster H.



- **9** Fit the new aluminium joint **I**, which is fashioned with perfectly flat surfaces and incorporates anti-wear **bushes**.
- 10 Clean the surface of the pivot G and that of the camber adjuster H before inserting them into the joint I.
- **11** Fit the joint to the squeegee frame by means of the two screws F.
- 12 Reposition the stainless steel 14 mm plain washer **M** on the linkage pivot **D**.





- **1** To reassemble the squeegee, repeat the steps of the disassembly procedure in reverse order.
- 2 Refit the "R" spring B without the plain washer C.





Positioning the squeegee joint

The position in which the squeegee joint is secured to the rear axle assembly will vary according to the size of the squeegee blade and the model of the machine.

Consequently, the position in which the squeegee stabilizer and the return springs are secured will also change.

The following indications are given in the event that it should be necessary to disassemble the entire squeegee unit, or to change the set-up by replacing the squeegee with one of a different size (70-85-95-75R).

Disassembly

- **1** Move the machine onto a level and dry floor.
- 2 Switch off the machine and apply the pedal-operated parking brake.
- **3** Detach the vacuum hose and disassemble the squeegee from its frame.
- **4** Unhook the springs **A** from the squeegee joint **B**.
- 5 Disassemble the squeegee stabilizer, undoing the bolt C.
- 6 Locate the bolt D by which the joint of the squeegee frame B is fixed to the rear axle E.
- 7 Locate the bolt **F** securing the bracket **G** of the squeegee stabilizer.





- 8 Referring to the illustration below, position the various components according to the length of the existing squeegee or to the replacement part, if different.
- 9 Position the springs A in one of the holes denoted H and I, according to the length of the squeegee fitted.
- **10** Position the squeegee joint **B** in one of the holes denoted **L**, according to the length of the squeegee fitted.
- 11 Position the bracket **G** of the squeegee stabilizer in one of the holes denoted **M**, according to **the length of the squeegee fitted.**



In the case of the BT 75 R Sweeper version, refer to positions BT 85 - BT 75 R

Reassembly

1 To reassemble the squeegee, repeat the steps of the disassembly procedure in reverse order.



B3 CLEANING THE FILTERS - HOSES - DETERGENT SOLUTION PUMP

B3.1 Cleaning the filters

Water inlet filter

- **1** Move the machine onto a level and dry floor.
- 2 Switch off the machine and apply the pedal-operated parking brake.
- **3** The water inlet filter A, with the relative cap B, is located at the front of the machine, on the detergent solution tank.
- **4** Remove the cap **B** and take out the filter **A**.
- Clean the filter A under running water, working from the outside inwards, then blow
- 5 through with compressed air, likewise from the outside inwards.
- 6 Refit the filter A and the cap B to the detergent solution tank.









Water outlet filter.

When cleaning or replacing the water outlet filter, the detergent solution tank must be emptied out completely; accordingly, it is advisable to clean at regular intervals, preferably before the detergent solution tank is filled

- **1** Move the machine onto a level and dry floor.
- 2 Switch off the machine and apply the pedal-operated parking brake.
- 3 Locate the position of the water outlet filter A.
- 4 Unscrew the bowl A1 from the filter body A2 and remove the filter element A3.









- 5 Clean the filter A3 under running water, working from the outside inwards, then blow through with compressed air, likewise from the outside inwards.
- 6 Make sure that the rubber seal A4 is in place at the top of the bowl A1, and verify its integrity.
- 7 Refit the filter element A3, aligning it with the bowl A1 and with the body A2.
- 8 Screw the bowl A1 onto the body A2 by hand, tightening moderately.



Reassembly

To fit a new filter, repeat the steps of the disassembly procedure in reverse order.





Replacing the water outlet filter. Disassembly

- **1** Go to the designated draining area and empty the detergent solution tank completely.
- 2 Move the machine onto a level and dry floor.
- **3** Switch off the machine and apply the pedal-operated parking brake.
- **4** Undo the two screws **A** securing the filter **B** to the detergent solution tank.
- 5 Remove the metal hose clips C.
- **6** Detach the two hoses **D** from the relative fittings.
- 7 Unscrew the two fittings E and F, taking care with the O-rings G placed against the flanges.





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Preassembly

Before fitting the new filter B, the area of interface with the tank needs to be reduced in depth in order to ensure that the drive wheel will not rub against the component when in rotation.

- 8 Cut the hollow studs on the back of the filter **B** obliquely, as illustrated below.
- **9** The left hand stud **A5** must measure 57 mm (2.24 ins), and the right hand stud **A6** must measure 54 mm (2.12 ins).
- 10 Trim the burrs off the cuts and reassemble the filter **B** with its various parts **E**, **F**, **C**, D.





B3.2 Checking operation of the detergent solution pump

On the T981, dosage of the required quantity of water is controlled by the ECU at the instrument panel: according to the amount of water selected (on the panel), a given level of voltage will be supplied to the water pump, which consequently is caused to turn faster or slower.

The ECU at the panel also functions as a switch, inasmuch as by setting the quantity of liquid at zero, with no indicator Led alight, the pump remains off. Consequently, the solenoid value also remains off. The minimum output voltage is ~ 9.5 V, at which one indicator Led will be alight, with further settings of ~ 15.5 V (two Leds alight), ~ 19.5 V (three Leds alight), ~ 25.5 V (four Leds alight), and ~ 34.5 V (five Leds alight), up to a maximum of ~ 36.6 V, at which all six Leds are alight.

Check output voltage (V)

- 1 Make sure the batteries on the machine are charged (36V ±1V).
- **2** Go the designated draining area where the tanks are emptied.
- **3** Switch off the machine and apply the pedal-operated parking brake.
- 4 Access the user programming menu and, in Program 1, set "AutoPowerOFF" to OFF.
- 5 Release the brushes by operating the relative control A on the instrument panel.
- **6** Start by checking that the panel is supplying voltage to the water pump.
- 7 Unplug the connector **B** of the operator-on-board sensor and wire in a jumper as illustrated.
- 8 Undo the screws**C** securing the instrument panel to the pillar of the machine.
- 9 Lift the instrument panel and locate the twelve-way connector D.







- **10** Using a digital multimeter with prods, set the reading mode to Volts (V) DC.
- 11 On the male connector **D**, locate pin **D4** with the blue wire.
- 12 Insert the negative prod E of the digital multimeter (colour black) between the wire and the connector.
- 13 Locate the red wire F that runs to the key, with the round red insulated terminal.
- **14** Insert the positive prod **G** (colour red) in the terminal.
- 15 Switch the machine on, turning the ignition key to position "1".
- 16 Select the downward movement of the brushes using the relative button H .
- **17** Use the controls I on the instrument panel to set the quantity of water at zero (no Leds alight).





18 Depress the accelerator pedal lightly and momentarily: the brushes will begin to turn, but the click of the solenoid valve being energized will <u>not</u> be heard, as there must be no release of water in this situation.

Pay attention to the alarms that can be generated in this configuration: in effect, without brushes fitted to the head, the "Brushes Worn" message could appear, and with the parking brake applied, the "Parking Brake On" warning. Ignore the errors and proceed with testing.

Keep pressing the accelerator lightly and momentarily to make certain that voltage signals continue to be supplied correctly by the instrument panel to the water pump and to the solenoid valve.

- **19** The digital multimeter will not detect any significant level of voltage.
- 20 Continue by checking that there is <u>no</u> voltage reaching the solenoid valve from pin D3 of the male connector D:
- 21 Move the negative prod **E** of the digital multimeter (colour black) from pin **D4** to pin **D3**, with the red wire (which carries the control signal to the solenoid valve).
- 22 Check the operation of the solenoid valve, and that voltage is supplied correctly by the instrument panel to the water pump:
- 23 Press the I+ button once to bring the pump and the solenoid valve into operation, and release the quantity of detergent solution corresponding to the level with one Led alight.
- 24 Check that the voltage reading on pin D3 of the connector D, which controls the solenoid valve, is 36 ±1 V.



- 25 Move the negative prod E of the digital multimeter back to pin D4 of the connector D, and measure the output voltage at the various selections made by way of the instrument panel.
- 26 Keep the negative prod E on pin D3 and the positive prod G on the round red terminal F.
- 27 Check that the output voltage at the 6 different dosage levels is as indicated in the table below.

	Output voltage
level 1 (1 Led alight)	9.60 V
level 2 (2 Leds alight)	15.87 V
level 3 (3 Leds alight)	19.8 1V
level 4 (4 Leds alight)	25.91 V
level 5 (5 Leds alight)	34.47 V
level 6 (6 Leds alight)	36.65 V

- 28 If the values measured are similar to those indicated above, then the instrument panel is working correctly and the cause of any malfunction must be sought elsewhere.
- **29** Press button **H** to produce the upward movement of the brush head.
- **30** In Program 1, return the setting of the "AutoPowerOFF" function to ON, as described in the user programming guide.
- **31** Switch the machine off by turning the ignition key to position "0".
- **32** Move the machine onto a level and dry floor.
- 33 Continue by removing the pillar panel to gain access to the water pump and test the component directly.



Checking operation of the detergent solution pump

- **1** Prepare two leads A for use as a by-pass circuit, as described in heading B2.1
- 2 Undo the two screws **B** securing the footplate, and remove the pillar panel.
- 3 Elevate the footplate and remove the two screws **C**, then remove the screws **D** low down on the pillar and the 4 screws **E on the panel.**
- 4 Locate the connector **F** of the pump, and unplug it.



- **5** Join the two leads **A** to the connector **F** of the pump, with polarity as follows.
- 6 Connect the red lead A1 to the red wire F1 of the pump, and the black lead A2 to the blue wire A2 of the pump.
- 7 Unplug the main connector **G** of the batteries, and connect the two leads **A**, matching the colours: red **to red**, **black to black**.
- 8 Press the switch A4 to set the detergent solution pump in operation.
- **9** Check by feel and sound whether the pump is working, otherwise disassemble the casing as described in heading B3.4 and verify that the impeller is turning.
- **10** If the pump is working correctly, check the water FLOW RATE (quantity).
- 11 Detach the hose H that connects with the solenoid valve, removing the relative clip I (T981 Disk).
- 12 Detach the hose H that connects with the solenoid valve, removing the relative clip I (T981 Cylindrical).





13 In the case of the roller head version, be careful to ensure that the reduction L mounted on the solenoid valve does not remain caught in the hose H.









14 If possible, procure a graduated recipient of 5 litres capacity, so as to obtain a precise and reliable verification of the flow rate.

Even when the pump is off, the solution will pour out of the hose by gravity; accordingly, before placing the hose in the recipient, stop the end with one finger, then release it at the moment of pressing the switch A4.

Place the hose H in the graduated recipient, and press the switch A4 to activate the flow of

15 detergent solution for half a minute (30 seconds); if the pump is efficient, it should deliver approximately 4.5 litres.



B3.3 Cleaning the water delivery hose

It can happen that coarse particles of dirt find their way into the detergent solution tank and ultimately block the outlet, at points where there are fittings with bends.

It is advisable to check for correct operation and possible clogging of the solenoid valve, also for correct operation of the water pump, as described in heading B3.2, before checking the remainder of the water delivery circuit.

- 1 Go to the designated draining area and empty the detergent solution tank completely.
- 2 Move the machine onto a level and dry floor.
- 3 Switch off the machine and apply the pedal-operated parking brake.
- 4 Check the sections of hoses **A** and **B** that carry the detergent solution from the tank to the pump.
- 5 Detach the hose from the outlet of the pump C and from the solenoid valve, and blow through with compressed air.
- 6 Detach the hose from the outlet of the solenoid valve D and blow through with compressed air.





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B3.4 Checking and/or replacing the detergent solution pump

The detergent solution pump has undergone a design change from serial n° 8000127901 onwards, consisting in the addition of a ferrite (A4), to protect the electronics of the machine from possible electromagnetic interference. See Service Bulletin 104-08

The water pump is a centrifugal type. If operated off the correct power supply at 36 V, without any obstruction, if will deliver a flow rate of up to approximately 9 litres/minute.

Test

- **1** Go to the designated draining area and empty the detergent solution tank.
- 2 Move the machine onto a level and dry floor.
- **3** Switch off the machine by turning the key to "0", and apply the pedal-operated parking brake.
- 4 Remove the pillar panel as described in heading A1.2, to gain access to the detergent solution pump.
- 5 Before replacing the detergent solution pump A, inspect the impeller internally to ensure that its rotation is not impeded by encrustations caused as a result of using particularly 'hard' water.
- 6 Rotate the impeller casing A1 of the detergent solution pump anticlockwise, if possible without detaching the outlet hose B, to the point of releasing it from the relative retaining lugs A2.
- 7 Check that it is clean inside, free of encrustations, and that the impeller A3 turns freely both when turned by hand and when driven electrically by operating the relative control on the instrument panel.







Disassembly

- 8 Disconnect the detergent solution pump A electrically by unplugging the watertight connector C.
- **9** Cut through the plastic ties **D** to free the cable from the rest of the wiring harness.
- 10 Loosen the clip E retaining the solution inlet hose, and the clip B retaining the outlet hose.
- 11 Undo the two screws **F** securing the pump **A** to the relative bracket.
- **12** Replace the pump **A** with a new part.



- **1** To fit the new pump, repeat the steps of the disassembly operation in reverse order.
- 2 Tighten the hose clips **B** and **E** and the screws **F** without forcing.
- **3** Fasten the ferrite **A4** to the mounting **A5** of the detergent solution pump by means of a plastic tie.



The function of the two float switches placed in the detergent solution and dirty water tanks is to trip an audible warning (buzzer) and a visual alert (Led indicator and display message on instrument panel) when the dirty water tank needs to be emptied, or the solution tank filled.

The operating principle of the float switch is very simple: the component comprises a moving part **A**, the float, containing a small magnet, and a fixed part **B**, the body, incorporating two metal strips, **one of which is flexible**. When the magnet of the moving part **A** approaches the fixed part **B**, the flexible metal strip is attracted to the other metal strip, thereby closing **the electrical circuit of the switch**.

The operation of the switch is audible without difficulty.





B4.1 Checking operation of the detergent solution tank float

In addition to generating the alert, the float switch mounted to the detergent solution tank also pilots the ECB installed in the instrument panel (only if programs P1, P2, P3 are in use) to raise the brush head, and consequently stop the rotation of the brushes.

Once the detergent solution tank has been filled, the machine must be switched off by turning the key to position "0" in order to restore operation of the brush head (reset) and cancel the alarms.

- **1** Move the machine onto a level and dry floor.
- 2 Make sure that the tank contains detergent solution, which can be seen through the inlet filter hole.
- **3** Use a digital multimeter with a function for detecting continuity: see photo.
- **4** Switch off the machine and apply the pedal-operated parking brake.
- 5 Locate the position where the float (sensor) is mounted to the detergent solution tank (on the inside).
- 6 Detach the float switch connector A from the main wiring harness.
- 7 Connect the two prods of the digital multimeter to the terminals of the float connector; the wires can be connected either way around. For convenience, use a lead with a male connector.
- 8 If the display window of the multimeter indicates a shift from the initial position, or all zeros, the float is working correctly, and the connector A can be reattached to the main wiring harness.

It is advisable to repeat the test, including with the tank completely empty: in these conditions the digital multimeter should not register any variation.

If no variation whatever is shown by the display of

9 the digital multimeter, take the machine to the designated draining area, empty the detergent solution tank and proceed as follows:

Remove the float switch and check that the

- **9a** angular motion of the moving part is not impeded in any way.
- **9b** If there is no such impediment, fit a replacement float switch.





B4.2 Replacing the detergent solution tank float switch

Disassembly

- **1** Go to the designated draining area and empty the detergent solution tank.
- **2** Move the machine onto a level and dry floor.
- **3** Switch off the machine and apply the pedal-operated parking brake.
- 4 Locate the position where the float (sensor) is mounted to the detergent solution tank (on the inside).
- 5 Cut through the tie A holding the float switch cable to the main wiring harness.
- 6 Detach the float switch connector **B** from the machine wiring harness.



- 7 Remove the float switch from the tank, holding the threaded body **C** fast and loosening the clamp nut **D**.
- 8 Continue drawing the body away from the tank, so as to ensure that the seal E does not find its way completely inside.
- 9 Remove the float switch from the detergent solution tank, and fit a replacement F.





- 1 To fit the new float switch, repeat the steps of the disassembly procedure in reverse order.
- 2 When fitting the new float switch, be careful to ensure that the rubber seal **E** is correctly installed.
- **3** Take care with the mounting position of the float switch: the moving float part must hang downwards.
- 4 Once in position, secure the component to the tank by holding the body **C** fast and tightening the clamp nut **D**, taking care not to damage the thread on the body **C** of the float, or the seal **E**. **Do not overtighten**.



B4.3 Checking float switch of dirty water tank

In addition to generating the alert when the dirty water tank needs emptying, the float switch mounted to the dirty water tank also pilots the ECB installed in the instrumental panel to raise the squeegee frame, and consequently shut off the vacuum motor. Once the dirty water tank has been emptied, the machine must be switched off by turning the key to position "0" in order to restore operation of the squeegee (reset) and cancel the alarms.

and

The dirty water tank full alert generated by the float switch is relayed to the ECU of the instrument panel, which causes the Led indicator to light up on the panel only if the float remains in the raised position for more than 5 seconds, and shuts off the vacuum motor, in which case after 20 seconds the squeegee frame will be raised to avoid the circuit switching on and off intermittently as the dirty water level approaches the capacity limit of the tank.

- 1 Use a digital multimeter with a function for detecting continuity.
- 2 Go to the designated draining area and empty the dirty water tank completely.
- **3** Move the machine onto a level and dry floor.
- **4** Switch off the machine and apply the pedal-operated parking brake.
- **5** Locate the position where the float switch is mounted to the dirty water tank.
- 6 Open the inspection cover of the dirty water tank and check the integrity of the float switch, ensuring that there is no impediment to its correct angular movement.
- **7** Release the vacuum motor air exhaust hose from its clip.
- 8 Detach the float switch connector A from the machine wiring harness.





- **10** Check that the moving part of the float hangs downwards.
- 11 If the display of the digital multimeter shows a variation from the initial position when the moving part C of the float is raised, then the float switch is working correctly.
- 12 If the display of the digital multimeter shows no such variation when the moving part C of the float is raised, replace the float switch with a new component.









B4.4 Replacing the dirty water tank float switch

Disassembly

- **1** Go to the designated draining area and empty the dirty water tank.
- **2** Move the machine onto a level and dry floor.
- **3** Switch off the machine and apply the pedal-operated parking brake.
- 4 Locate the position where the float (sensor) is mounted to the dirty water tank (on the inside).
- 5 Detach the float switch connector **A** from the machine wiring harness.



- 6 Remove the float switch from the tank, holding the threaded body **B** fast and loosening the clamp nut **C**.
- **7** Remove the float switch from the dirty water tank, and fit a replacement D.



- **1** To fit the new float switch, repeat the steps of the disassembly procedure in reverse order.
- 2 When fitting the new float switch, be careful to ensure that the rubber seal **E** is correctly installed.
- **3** Take care with the mounting position of the float switch: the moving float part must hang downwards.
- 4 Once in position, secure the component to the tank by holding the body **B** fast and tightening the clamp nut **C**, taking care not to damage the thread on the body **B** of the float, or the seal E. **Do not overtighten**.



The T981 is equipped with two tanks: a <u>dirty water</u> tank **A** and a <u>detergent solution</u> tank **B**, both of which are manufactured by a method known as Rotational Moulding, **or Rotomoulding**.

The advantages of this method are that tanks can be designed with complex geometries, and incorporating metal inserts that facilitate the steps of mounting them to the structure of the machine and attaching components such as the vacuum motor, drain hoses, water filters, etc.





B5.1 Replacing the dirty water tank

Disassembly

- **1** Go to the designated draining area and empty the dirty water tank.
- **2** Move the machine onto a level and dry floor.
- **3** Switch off the machine and apply the pedal-operated parking brake.
- **4** Detach the dirty water drain hose **A** and the relative supports **B**.







- 5 Remove the metal mesh C and the anti-foam sponge filter D.
- 6 Remove the rubber flap E allowing inspection of the vacuum pump, undoing the stainless M6 x 12 mm retaining screw F.
- 7 The gasket seal **G** under the rubber flap **E** must be renewed, to ensure that the efficiency of the vacuum and drying action **will remain unimpaired subsequently.**









8

- Remove the vacuum motor I, as described in heading B1.3. 8
- 9 Remove the float switch L, as described in heading B4.4.
- Cut through the plastic tie and remove the retaining 10 clip M of the vacuum motor exhaust hose.
- Remove the retaining straps N to free the squeegee 11 vacuum hose **O** and the electrical wiring **P**.
- Detach the squeegee vacuum hose O by pulling it from 12 the socket.
- Remove the vacuum deflector **Q** of the dirty water tank by 13 unscrewing the hose union R, being careful not to damage the seal S.













- **14** Having stripped the tank of all other accessories, proceed with disassembly from the chassis of the machine.
- **15** Undo the screw **T** that secures the travel limiting stay rod **U** of the dirty water tank.
- **16** Detach the stay rod **U** and swing it forward, resting it on the slide way or on the battery box.





- 17 Return the tank to the closed position and continue by removing the pivot V on which the tank hinges.
- 18 On the left hand side of the machine, locate the screw Z by which the hinge pivot V is secured to the chassis.
- **19** Be careful to retain the spacer **Y**.
- 20 Remove the pivot V by drawing it out from the left, with the aid of a rubber hammer if need be.
- **21** Lift the tank clear without tilting or turning it, and distance it from the machine.







Preassembly

- **1** Before fitting the new tank to the machine, it is advisable to preassemble certain of the parts.
- 2 Lubricate the thread of the vacuum deflector **Q**, smearing with liquid teflon or hydraulic sealant, and **position the part on the inside of the tank, substantially as illustrated.**
- 3 On the outside, insert the hose union R into the tank from beneath, with the seal **S**fitted, and screw it into the vacuum deflector**Q**, which must be positioned as illustrated below.











- **1** Fit the float switch **L** as described in heading B4.4.
- 2 Fit the clip **M** on the dirty water tank.
- 3 Insert the squeegee vacuum hose O into the socket of the hose union R.
- **4** Fit the vacuum motor **I** as described in heading B1.3.
- 5 Use a fast-bonding glue such as Loctite to fix the new gasket seal **G** for the rubber inspection flap **E**.





- **6** Continue with the assembly, repeating the steps of the disassembly procedure in reverse order.
- 7 Lift the dirty water tank and rest it on the detergent solution tank.
- **8** Before refitting the hinge pivot **V**, brush the circumferential surface of the endmost part with grease.
- **9** Insert the pivot **V** with the aid of a rubber hammer.



10 Tighten the screw Z without forcing.



B5.2 Replacing the detergent solution tank

Disassembly

- **1** Go to the designated draining area and empty the dirty water and detergent solution tanks.
- **2** Move the machine onto a level and dry floor.
- **3** Switch off the machine and apply the pedal-operated parking brake.
- 4 Isolate the batteries from the machine electronics by unplugging the Anderson connector **A**.
- 5 Remove the batteries or the battery box from the compartment.
- 6 Remove the battery tray **B**, lifting out by means of the two holes located on opposite sides.
- 7 Undo the screws C1to allow the removal of the Anderson socket C, from the battery box.







- 8 Undo the screw D that secures the travel limiting stay rod E of the dirty water tank.
- **9** Uncouple the rod, swing it forward and rest it on the seat stop.





- **10** Detach the vacuum hose **F** and position it under the squeegee bumper **G**.
- 11 Undo the four screws H1 securing the battery box to the chassis, and remove the box H.
- 12 Remove the cap I and take out the detergent solution inlet filterL.



- **13** Remove the solution drain hose **M** and the relative fitting mounted on the tank.
- **14** Continue with removal of the driver seat, first removing the beacon N.





- **15** Undo the three screws **O** securing the beacon to the seat structure.
- 16 Isolate the beacon from the electrical system by detaching the wires from the connectors P.
- **17** Disconnect the operator-on-board sensor **Q**.
- **18** Remove the five plastic cable clips **R** from the seat, and position the wires on the chassis.
- **19** Undo the four stainless M5 x 12 mm screws **S** securing the hinges, and remove the driver seat.













- 20 Remove the accelerator pedal T, first undoing the screw T2, then taking out the plastic guard T1.
- **21** Detach the accelerator pedal **T** by lifting and at the same time pulling the body of the pedal.
- 22 Undo the electrical connection T3.
- 23 Remove the black plastic footplate, undoing the four screws ${\bf U}.$
- 24 Undo the six screws V1, V2 and V3 to remove the pillar panel V from the machine.
- 25 Undo the screw T4 and remove the flange of the accelerator pedal T5.





- 26 Undo the hose clip Z1 to disconnect the detergent solution tank from the water pump Z.
- 27 With the tank away from the machine, detach the filter Z2 and remove the fitting Z3.







- 28 Cut through the tie W1 and unplug the connector W2 of the detergent solution level sensor (float switch) W.
- 29 With the tank away from the machine, remove the detergent solution level sensor W.



- **1** To fit the new tank, repeat the steps of the disassembly procedure in reverse order.
- 2 To fit the detergent solution level sensor (float switch) W, follow the steps described in heading B4.2.
- **3** To fit the detergent solution outlet filter Z2, follow the steps described in heading B3.1.




DRIVE UNIT



All maintenance operations described and illustrated in this manual must be carried out by an IPC-approved technician.

Go to the designated draining area and empty the detergent solution and/or dirty water tanks by way of the relative hoses.

Move the machine onto a level surface and apply the parking brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key to position "0".

Disconnect the machine electronics from the batteries by unplugging the Anderson connector.

i INFORMATION

Indications of particular importance

In this Service Manual, RIGHT and LEFT are used to indicate the side of the machine, and will always refer to the direction of forward movement.

In this Service Manual, the version of the machine may be indicated in brackets "()" for identification purposes (Disk 31 in / 80 mm, Disk 36 in / 90 mm, Cylindrical 30 in / 75 mm). This is to inform the reader that the instructions refer only to the version indicated in brackets.



The ITALSEA DRIVE circuit board supplies "current" to the drive motor. Abnormalities detected by the circuit board are indicated by the blinking of a Led on the instrument panel.





C1.1 Checking electrical connections and voltage circuit board

Test

- **1** Make sure the machine batteries are charged.
- 2 Use a digital multimeter (tester) of dependable precision.
- **3** Move the machine onto a level and dry floor.
- **4** Turn the ignition key to position "**0**".
- **5** Remove the front pillar panel as described in heading A1.2.
- 6 Using the digital multimeter, read the voltage at the "+" and "-" battery poles.



7 Locate the insulator of the negative wires and the power contact of the main contactor.







8 Check the voltage between the insulator of the negative wires and the positive wire coming from the fuse, at the contactor.



- **9** Switch on the machine by turning the ignition key to position "1"
- **10** Read the voltage at the poles of the drive control circuit board.



- 11 Voltages V1 V2 and V3 should give more or less identical readings.
- 11a If voltages V1-V2-V3 are noticeably different, check the wiring and/or the contacts of the contactor C.
- 11b If voltages V1 V2 V3 are identical, continue by testing the current draw of the drive motor.





C1.2 Checking drive motor current draw

- **1** Proceed as described in heading C1.1 above.
- 2 Use a clamp-on ammeter with a full scale reading of at least 200 amperes (A).
- 3 Locate and disconnect the operator-on-board sensor and wire in a jumper as illustrated.
- **4** Raise the drive wheel a few centimetres, using a jack.
- **5** Turn the ignition key to position "**1**".
- 6 Set the forward-reverse drive selector to forward.
- **7** First, test the operation of the accelerator pedal.
- 8 Connect the digital multimeter to the positive pole "M1" and the negative pole "M2" dedicated by the circuit board to the drive wheel.
- **9** In addition, place the clamp-on ammeter around the red wire to the drive wheel.
- 10 Set the ammeter to measure Amperes and DC.
- **11** Depress the accelerator pedal to its full travel.
- **12** First, read the output voltage from the circuit board.
- 13 The voltage reading must be equal to or lower by 1 to 2 V than the input voltage V3 to the circuit board A.
- 13a If the measured voltage V4 meets the conditions indicated, proceed to measure the current draw.
- **13b** If the measured voltage V4 is noticeably different, start by checking the operation of the accelerator pedal.









- 14 In addition, place the clamp-on ammeter around the red wire to the drive wheel.
- **15** Depress the accelerator pedal to its full travel.
- **16** Read and note down the value of the current (stabilized) drawn by the drive wheel.
- **17** Lower the machine back onto the ground and take a reading with the drive motor propelling the machine.
- **18** Compare the readings against the table below.
- **19** If all is as it should be, refit the pillar panel.
- 20 If the values do not correspond to those indicated (higher):
- 20a Check that when under no load (ignition key in position "**0**") the wheel turns without excessive effort, and **that** there are no scraping or binding noises audible, such as from worn bearings, or slip rings.
- 20b Check that carbon brushes slide freely in their seats, inspect them for wear and test their electrical connections.
- 20c Replace the complete drive wheel.



The power circuit board supplies current to the drive motor at a rate of up to 120 A maximum; this amount of current is delivered as long as the temperature of the MOSFETs does not reach and rise beyond 85 °C/185 °F. At a higher temperature, the circuit board will limit the level of its current output, continuing to reduce it until the MOSFETs are able to return (cool down) below the temperature threshold of 85 °C/ 185 °F.

Should the temperature continue to rise just the same (with minimum current output levels), once a temperature safety limit of 105 °C/221 °F is reached, the circuit board will stop supplying current altogether to the drive wheel until the MOSFETs have cooled down.

Current draw A (amperes)	Min	Max
No-load, wheel raised	3.0 A	7.0 A
Full load, on a level surface and when scrubbing	18.0 A	25.0 A







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C2.1 Checking and replacing the drive wheel motor carbon brushes

The carbon brushes should be inspected and if necessary replaced after around 600 - 700 hours operation. It is advisable to replace all four (4) carbon brushes at the same time.

Disassembly

- **1** Move the machine onto a level and dry floor.
- 2 Switch the machine off by turning the ignition key to position "**0**" and apply the parking brake.
- 3 Lift the driver seat and isolate the batteries by unplugging the Anderson connector
- **4** Remove the pillar panel as described in headings A1.2 and C2.3.
- **5** To facilitate disassembly of the drive motor, remove the detergent solution pump, undoing the two screws.
- **6** Turn the drive wheel to the point of locating the four (4) screws securing the two (2) plastic cover elements.
- 7 First, detach the cooling air fan cowl by removing the two M5 x 30 mm screws.
- 8 Now detach the wiring cover by removing the two M5 x 35 mm screws.





Disconnect the drive wheel unit electrically, undoing the two nuts that connect the thermal overload cutout of the

- **9** motor to the machine wiring harness, the nut securing the positive wire (red) and the nut securing the negative wire (black) to the drive wheel.
- **10** Take care to retain the four (4) wavy washers, positioned on each side of the terminations.
- 11 Remove the two (2) sponge dust filters **F** mounted on the sides of the motor **C**.
- 12 Undo the four (4) screws C5 securing the motor to the gear unit.
- **13** Remove the motor, keeping it positioned horizontally as far as possible.







- **14** Take particular care when removing the motor, to avoid damaging the seal positioned on the inside, at the interface with the gear unit.
- **15** Transfer the motor to the bench and proceed with inspection of the four (4) carbon brushes, which are spaced 90° apart.
- **16** The eyelet terminal on one carbon brush provides the connection for the red power supply wire and for the thermal overload cutout; the black power supply wire is connected to the carbon brush alongside.







17 Loosen the nut to release the wires of the thermal overload cutout, the power supply and the carbon brush.

18 Use a tool with a hook end to lift the tension spring of the carbon brush, and remove the brush from its seat.



Inspection of carbon brushes

- **19** Measure the carbon brush: if the length is greater than 8.0 to 9.0 mm the carbon brush can remain in place; if not, it must be renewed.
- 20 Check the integrity of the sliding surface on all the carbon brushes.







Testing operation of the thermal overload cutout

The purpose of the thermal overload cutout is to prevent the motor from reaching high temperatures that could cause irreparable damage. These devices are usually placed in the hottest part of the motor, near the carbon brushes, or in the end cap that houses the carbon brushes.

Their operating principle is very similar to that of an NC (normally closed) switch: when activated by the specified threshold temperature, they open the electrical circuit and cut off the power supply (via the drive circuit board) to the motor.

Testing with motor disassembled

- **21** Before assembling the motor with the gear unit, always test the electrical continuity of the thermal overload cutout.
- **22** Use a digital multimeter with a function for detecting electrical continuity: see photo below.
- 25 Insert the two prods of the multimeter through the eyelet terminals and test for continuity.
- **26** If the display of the multimeter shows a change from the initial position, continuity has been detected and the cutout is working correctly.
- 27 If the display of the multimeter shows no change from the initial position, the thermal overload cutout needs to be replaced.





Reassembly

- **1** To fit the new carbon brushes, repeat the steps of the disassembly procedure in reverse order.
- 2 Before fitting the new carbon brushes, compare their dimensions with those of the old brushes: the new parts <u>must</u>differ, but only in length.
- 3 Always make sure that the carbon brushes slide freely in their seats, and that the seats do not show signs of deformation, or simply that they are not dirty.
- **4** Blow compressed air onto the motor, holding it preferably with the pinionshaft directed downwards, so as to eliminate the dust left by the carbon brushes as they are gradually consumed.
- 5 Always check the rotor for wear (at the area of sliding contact with the carbon brushes).
- 6 Always check that the smooth part of the pinionshaft does not present any noticeable marks or abrasions, such as would compromise the tightness of the seal.
- 7 Always check the integrity of the seal, and its correct positioning in the seat of the gear unit flange.











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C2.2 Checking and replacing the drive wheel thermal overload cutout

The purpose of the thermal overload cutout is to prevent the motor from reaching high temperatures that could cause irreparable damage. These devices are usually placed in the hottest part of the motor, near the carbon brushes, or in the end cap that houses the carbon brushes.

Their operating principle is very similar to that of an NC (normally closed) switch: when activated by the specified threshold temperature, they open the electrical circuit and cut off the power supply (via the drive circuit board) to the motor.

Testing with motor assembled

Should the alarm warning Led of the drive circuit board blink when the drive motor is cold to the touch, it is advisable to test the electrical continuity of the cutout or the stability of the electrical contacts.

- 2 Use a digital multimeter with a function for detecting electrical continuity..
- **3** Switch off the machine by turning the key to position "**0**" and disconnect the batteries from the main wiring harness.
- **4** Detach the end cap that protects the connecting wires, undoing the two screws.
- **5** Offer the two prods of the multimeter to the eyelet terminals, without disconnecting them, and test for continuity.
- 6 If the display of the multimeter shows a change from the initial position, continuity has been detected and the cutout is working correctly: see previous heading.
- 7 If the display of the multimeter shows no change from the initial position, the thermal overload cutout needs to be replaced: see previous heading for procedure.

The thermal overload cutout can also be tested without disconnecting the terminals from the main wiring harness, if the conditions described above are met: in effect, there is no electrical continuity from the main wiring, and so the only continuity that can be detected will be attributable to the cutout.









In case of emergency

In the event that the "motor overload" alarm should appear when the motor is cold, and there is a need for the machine to be moved, a temporary connection can be created to bypass the ECU of the instrument panel and render the machine mobile. The normal configuration of the electrical system should be reinstated as soon as possible.

8 Detach the wires to the main harness from the cutout and join them together.



Reassembly

- **1** Refit the end cap **A** to the drive wheel motor.
- 2 In the event of the thermal overload cutout being replaced, refer to the previous heading and restore the electrical connection.



C2.3 Replacing the rubber tyred rim of the drive wheel

Disassembly

- **1** Move the machine onto a level and dry floor.
- 2 Switch the machine off with the ignition key, turning it to position "0".
- **3** Apply the pedal-operated parking brake, or place chocks under the rear wheels.
- **4** Raise the front drive wheel of the machine using a hydraulic jack, or as described in heading A3.1.



- **5** Remove the plastic guard, using a slotted head screwdriver.
- **6** Undo the four (4) central countersunk screws, exercising due care, as these fasteners will have been secured to the hub using threadlocker.
- **7** Undo the six (6) screws around the edge, securing the tyred rim to the alignment coupling.





- **8** Turn the drive wheel round to the other side and locate the four (4) threaded holes, provided as jacking points for the purpose of removing the tyred rim more easily.
- **9** Insert two (2) M10 bolts of suitable length, at least 80 mm, and drive them forward simultaneously, so as to force the rubber tyred rim outwards.
- **10** Remove the motor fan cowl if necessary, so that the bolt heads can be driven fully home.





- 11 First remove the alignment coupling A5, then continue turning the bolts B, until the tyred rim A4 is completely free.
- **12** Replace the tyred rim with a new part.



Reassembly

- **1** To fit the new tyred rim, repeat the steps of the disassembly procedure in reverse order.
- 2 Clean the contact surface of the drive hub and the four (4) threaded holes, and the contact surface of the alignment coupling.
- 3 Clean the six (6) screws and apply threadlocker to the first few turns of thread before inserting.
- **4** Preassemble the alignment coupling with the rim, by means of the screws, and tighten without forcing: maximum torque 7-8 Nm / 5.16-5.90 ft·lb.







- **5** Procure four (4) M8 screws of at least 40 mm length to use as a "replacer" for the new rubber tyred rim.
- 6 Smear the inner surface of the rim with graphite grease, on the aluminium part in relief.
- **7** Offer the preassembled rubber tyred rim to the gear unit of the drive wheel, and ease it onto the bearing.
- 8 Insert the four screws of whatever type, using washers under the heads if need be, to avoid damaging the countersunk holes on the alignment coupling.
- **9** Drive the screws forward a little at a time, each in turn, so as to force the rim gently onto the bearing.









- 10 When driving the four screws, take care over the position of the wheel hub relative to the casing of the gear unit.
- 11 With the alignment coupling almost up against the hub, unscrew the bolts and insert the new screws provided with the new tyred rim.
- **12** Apply threadlocker to the first few turns of thread before inserting.
- **13** Tighten the new screws without forcing: maximum torque 18.0 Nm / ~13.27 ft·lb).
- **14** Line up and refit the plastic guard, taking care to engage the snap retainers.







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C2.4 Replacing the complete drive motor and wheel unit

The drive motor has been designed as a part that should never need replacing: nonetheless, in the event of improper use, or one of the protection systems failing to function, the motor could suffer permanent damage. In this situation, the part must be replaced or repaired

Disassembly

- **1** Move the machine onto a level and dry floor.
- 2 Switch the machine off with the ignition key, turning it to position "0".
- **3** Isolate the batteries from the main electrical system of the machine by unplugging the Anderson connector.
- **4** Apply the pedal-operated parking brake.
- **5** Raise the front drive wheel of the machine using a hydraulic jack, or as described in heading A3.1.
- 6 Remove the front pillar panel as described in heading A1.2.
- **7** To facilitate disassembly of the motor, remove the detergent solution pump, undoing the four screws.
- 8 Detach the wiring cover by removing the two M5 x 35 mm screws.





Disconnect the wheel motor electrically, undoing the two nuts that connect the thermal overload cutout of the

- **9** motor to the machine wiring harness, the nut securing the positive wire (red), and the nut securing the negative wire (black) to the motor.
- 10 Take care to retain the four (4) wavy washers, positioned on each side of the terminations.
- 11 Return the nuts to their positions, without the wires, move the wires clear and proceed with disassembly of the drive wheel.
- 12 Place a wooden block or wedge under the rubber tyred rim to facilitate removal of the screws.
- 13 Undo the four screws securing the complete motor and wheel unit to the plate, beginning with the screws positioned to the rear of the unit.
- **14** Position the power cables (red and black) so that they will not get in the way of the disassembly operation.
- **15** Turn the drive wheel unit through 45° approx so that it can be distanced from the side walls of the detergent solution tank, remove the block or wedge, elevate the water pump and draw out the unit.
- **16** Transfer the drive wheel unit to the bench and set it in a stable position, head downwards.





Reassembly

- **1** To fit the new drive wheel unit, repeat the steps of the disassembly procedure in reverse order.
- 2 Tighten the four bolts securing the drive wheel unit to the plate: maximum torque 40 Nm / 29.50 ft·lb



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The function of the accelerator pedal is to regulate the speed of the machine both in transit and in operation; in operation, moreover, selecting one of the three work programs, the maximum speed can be preset and limited electronically from the instrument panel.

The pedal comprises certain key components that are subject to wear, like the potentiometer and the microswitch, which may need to be replaced over the course of time.

Other components of the pedal include bottom pedal, top pedal, spring, connecting rod and linkage.





C3.1 Replacing the accelerator pedal

Disassembly

- **1** Move the machine onto a level and dry floor.
- 2 Switch the machine off by turning the ignition key to position "0" and apply the parking brake.
- **3** Undo the screw fixing the pedal to the footplate of the machine.
- **4** Remove the plastic guard.
- 5 Lift the accelerator pedal, pulling at the same time, so as to free it from the footplate.
- **6** Unplug the watertight connectors so that the accelerator pedal is also isolated from the electrical system.





Reassembly

1 To fit the new pedal, repeat the steps of the disassembly procedure in reverse order.



C3.2 Replacing the accelerator potentiometer and microswitch

The potentiometer and the microswitch are supplied together as replacement parts; accordingly, when renewing either one, it is advisable to renew both.

Disassembly

- 1 Use a digital multimeter able to measure resistance at least up to 5 kOhm.
- 2 Move the machine onto a level and dry floor.
- **3** Switch the machine off by turning the ignition key to position "**0**" and apply the parking brake.
- 4 Remove the accelerator pedal as described in heading C3.1.
- 5 Place the pedal on the bench, remove the lever and clevis without unscrewing the nut, but simply by releasing the clip, and adjust the length of the lever.
- 6 Continue by removing the potentiometer and the microswitch.
- 7 Replace the potentiometer, complete with wiring components.







Replacement

- 8 Start by fitting the microswitch. If not in place, add the Ø 4 mm washers (provided in the kit) and snug the two nuts without tightening, to allow adjustment of the microswitch.
- **9** Position the potentiometer horizontally, with the wires running parallel to the base.
- **10** Tighten the nut of the potentiometer without excessive force, using a 13 mm wrench to hold the potentiometer in position (parallel to the base of the pedal) and a 12 mm wrench to tighten the nut.
- **11** Next, assemble the connecting rod with the potentiometer.
- 12 Attach the lever and clevis to the top of the pedal, first inserting the lever in the hole of the connecting rod, then inserting the clevis pin through the hole in the top of the pedal.
- **13** Tighten the bolt on the spindle of the potentiometer lightly, so that the spindle is able to turn with slight interference in the hole of the connecting rod.
- 14 Anchor the clevis to the lug as illustrated and secure the clip.
- 15 With the pedal fully raised, proceed with adjustment of the microswitch, shifting it forwards toward the connecting rod until the wheel on the microswitch is pushed in, emitting the familiar click.
- **16** Fix the position of the microswitch by screwing the first two nuts moderately tight, then secure the other two nuts as lock nuts, to prevent any looseness that would result in the position of the microswitch being lost.





- 17 Offer the two prods of a digital multimeter to the white wire, pin 2, and to the blue wire, pin 3, of the connector; select the resistance function (Ohms) of the multimeter, and proceed with adjustment of the potentiometer.
- **18** With the pedal raised, using a screwdriver, set the potentiometer to ZERO by turning the spindle clockwise as far as it will go.
- **19** Keeping the pedal raised, turn the spindle a few degrees anticlockwise back from the limit position, so as to ensure that the reliability of the potentiometer will not be affected.
- **20** With the pedal raised, set the minimum value of the potentiometer. This done, tighten the bolt on the connecting rod to lock the spindle of the potentiometer in position.
- 21 Depress the pedal fully and measure the Ohms resistance; the value **must absolutely be higher than 2 kOhm** (2000 Ohm), but less than 2.2 kOhm (2200 Ohm).





Testing

- 26 Depress the accelerator pedal repeatedly to check that the value returned by the potentiometer, measured by the multimeter, matches the adjusted value.
- 27 If the value does not fall within those indicated above, repeat the adjustment procedure more accurately.

Verify in any event that the value X in Ohms returned by the potentiometer, measured with a digital multimeter, is greater than zero (0) or between 5 and 80 Ohms







C4.1 Brake pedal

The brake pedal operates by braking the rear wheels, employing a mechanical control linkage (twin cables). It is therefore important that inspections be carried out, and adjustments when necessary, to ensure continued efficiency. The mechanical control linkage incorporates a system by which the pedal can be locked in position, thereby functioning as a parking brake.

A microswitch mounted to the brake pedal relays a signal, when tripped, to the circuit board of the instrument panel. After a delay of 5 seconds approx, the panel generates an audible warning (buzzer) and a visual alert (display message "PARKING BRAKE"), advising the operator not to use the propulsion system with the brake applied.

Disassembly

- **1** Use a digital multimeter with a function for detecting continuity.
- **2** Move the machine onto a level and dry floor.
- **3** Switch the machine off with the ignition key, turning it to position "**0**".
- **4** Position wedges under the rear wheels of the machine.
- **5** Remove the front pillar panel as described in heading A1.2.
- 6 In the case of Sweep versions, the pillar panel can be removed only after completely disassembling and removing the plastic footplate, undoing all four of the M5 screws and the four self-tapping screws.

Testing and/or replacing the microswitch

- 7 Locate the brake pedal, and the positioning of the microswitch on the pedal.
- 8 Disconnect the two preinsulated round terminations, and test for continuity with the digital multimeter.
- **9** Insert the prods of the multimeter into the preinsulated terminations.
- **10** With the pedal raised, there must be no continuity; with the pedal depressed, conversely, continuity must be detectable.
- **10a** If the microswitch meets these conditions, look for possible problems with the wiring or at the instrument panel circuit board.
- **10b** If the conditions of step 10 are not met, replace the microswitch with a new component.





Reassembly

- **1** To fit the new microswitch, repeat the steps of the disassembly procedure in reverse order.
- 2 Cut the connectors of the old microswitch to allow reutilization of the protective sheath.
- **3** Reinstate the screws without tightening, so that the microswitch can be adjusted.



Adjustment

4 With the pedal in the at-rest position, not depressed, move the microswitch closer to the pedal until the click is heard, then closer still, another one (1) millimetre max, and tighten the screws.





Replacing the pedal

- **1** Proceed as described in steps 1 to 6.
- 2 Set the pedal in the at-rest position (not depressed).
- 3 On all versions, remove the plastic footplate, as described in heading A3.1.
- **4** Disconnect the two preinsulated round terminations.
- **5** Undo the clips to free the pedal from the brake cables.
- **6** Undo the two screws securing the pedal to the chassis.



Reassembly

- 7 To fit the new pedal, repeat the steps of the disassembly procedure in reverse order.
- 8 Adjust the microswitch, if need be, as described in the previous heading.

Adjustment

- **9** When replacing the brake pedal, or after prolonged use, the brakes should be adjusted to ensure their continued efficiency.
- 11 Loosen the nut and adjust as necessary, then retighten the nut while holding the brake cable fast.
- 12 Secure the nut without overtightening, and make sure that the wheels turn freely: if not, unscrew the nut slightly.
- **13** Having completed the adjustment, tighten the nut.





All maintenance operations described and illustrated in this manual must be carried out by an IPC-approved technician.

Go to the designated draining area and empty the detergent solution and/or dirty water tanks by way of the relative hoses.

Move the machine onto a level surface and apply the parking brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or depressing the emergency stop button.

Disconnect the machine electronics from the batteries by unplugging the Anderson connector.

i INFORMATION

Indications of particular importance

In this Service Manual, RIGHT and LEFT are used to indicate the side of the machine, and will always refer to the direction of forward movement.

In this Service Manual, the version of the machine may be indicated in brackets "()" for identification purposes (Disk 31 in / 80 mm, Disk 36 in / 90 mm, Cylindrical 30 in / 75 mm). This is to inform the reader that the instructions refer only to the version indicated in brackets.



D1 INSTRUMENT PANEL CIRCUIT BOARD - POWER CIRCUIT BOARD



Β







D1.1 Description of instrument circuit board "A"

Controls

The instrument panel is equipped with touch-sensitive buttons under a screenprinted adhesive film (indicating the functions of the various buttons), an emergency stop button, a drive selector (forward - neutral - reverse) and an ignition key.

Buttons A, selection of the work program, from one of three stored in the permanent memory; each button
is independent of the others, which means they can be programmed with different functions: brush scrubbing pressure, amount of water, speed, operation of brushes, operation of vacuum system.

- 2 Button B, attachment and release of brushes (sequential).
- **3** Button **C**, manual operation of vacuum motor.
- 4 Button D, manual operation of brushes.
- 5 Buttons E, control determining the amount of water used for scrubbing, indicated visually by the Led **bar** alongside.
- **6** Selector **F**, selection of forward drive, neutral and reverse drive.
- 7 Ignition key G, switches on all functions of the machine.
- 8 Emergency stop button **H**, when depressed, inhibits all functions of the machine.
- **9** Button I, horn.
- 10 Button L, display information selector: toggles between n° of hours operation and battery charge level.
- 11 Selector F, key G, button H and the selector M, which controls ground speed, can be replaced individually, whereas for all other controls, the entire instrument panel must be replaced.





Connections

The circuit board of the instrument panel is connected to the main wiring harness of the machine via four connectors (M, N, O, P), all dissimilar to obviate the risk of wrong connections; the emergency stop button is wired to a dedicated connector, whereas the wiring for the ignition key uses two Faston clips that can be inverted during assembly. Care is needed only for the drive selector.

- 12 Connector **M** with six (6) pins, denoted **CN6** on the wiring diagram, assigned to control of the **main contactor and the buzzer.**
- 13 Connector **N** with twenty (20) pins, denoted **CN2** on the wiring diagram, assigned to communication between the power circuit board and the circuit board of the instrument panel.
- 14 Connector **O** with twelve (12) pins, denoted **CN3** on the wiring diagram, assigned to control of the water pump and the solenoid valve, and to monitoring and control of the brush head actuator and the **squeegee**.

Connector **P** with eight (8) pins, denoted **CN5** on the wiring diagram, assigned to all control functions using

15 microswitches: driver seat microswitch, parking brake microswitch, accelerator pedal microswitch. Also to the tank float switches, the thermal overload cutout of the drive motor and the accelerator pedal potentiometer. With the exception of the potentiometer, all wires converge at the opposite end on the negative insulator (black).

Connector **Q** with eight (8) pins, colour green, denoted **CN4**on the wiring diagram, assigned to the electrical connection of the drive selector **F** (forward – reverse), the ignition key **G**, the emergency stop button **H**, and the beacon power supply, red wire **R** with male Faston termination.

16 beacon power supply, red wire R with male Faston termination. Connector Q is the only connector not immediately accessible as it is hidden beneath the plastic guard R: to enable inspection, undo the four screws R1.





- 17 Connector Q, denoted CN4 on the wiring diagram, has six wires connected to it:
- Red wire Q1 brings current directly from the batteries (+36V), carried to the electronic circuit board by the
 17a Violet-Black wire. This must be connected to the preinsulated cylindrical red female termination Q9 of the emergency stop button H.
- 17b The preinsulated cylindrical red female termination Q7 joined by a Faston connector to the Pink wire Q3 is connected to the preinsulated cylindrical red male termination Q10 coming from the emergency stop button H.
- **17c** Faston connector of Violet wire **Q2** must be connected to either one of the two Faston terminations of the key **G**; with the key in position "**1**" this will supply power to the circuit board of the instrument panel.
- **17d** Faston connector of red wire **Q8** must be connected to the Faston termination **Q11** of the beacon.
- The Pink wire Q3 takes current from the red wire Q10 (to which it flows from the red wire Q1 after passing17e through the emergency stop button and the tracks of the circuit board), and carries it to connector M (CN6) from where it is conveyed by way of pin 1 and pin 2 to supply the buzzer and the main contactor.
 - Faston connector of Brown wire Q4 must be connected to the central Faston termination of the drive selector **H**. The wire carries negative voltage (-36V), which after passing across the circuit board goes from pin 4 of
- 17f In the wire carries negative voltage (-50V), which aller passing across the circuit board goes norm pin 4 of connector P (CN5) and, by way of the green wire, passes through the microswitches of the pedal and driver seat to connect with the black negative insulator.
- **17g** Faston connector of Orange wire **Q5** reverse drive must be connected to the top Faston termination of the drive selector **F**.
- 17h Faston connector of Orange wire Q
- 17i Faston connector of Blue wire Q7 forward drive must be connected to the bottom Faston termination of the drive selector F.










18 Disassemble the circuit board of the instrument panel, as described in heading D1.2.

To locate a fault in the logic elements of the circuit board: if when the key **G** is turned to position "1" the logic circuitry of the instrument panel remains off, whereas the beacon and the emergency stop button **H** are

functioning normally, the problem is with the logic pcb connected to the Violet wire, which must be tested and/or replaced.

If on turning the key to position "1" the logic pcb of the instrument panel, the beacon and the emergency stop
button all function normally, but there is no response from the reverse drive and buzzer, check the state of the tracks on the logic pcb indicated by colour pink PK.

- 21 If on turning the key to position "1" the logic pcb of the instrument panel, the emergency stop button and the
- beacon are unresponsive, check the tracks on the logic pcb indicated with colour red **RD**.
- 22 If one of the two tracks should appear scorched, replace the circuit board.
- 23 Remove the plastic guard R to gain access to the logic pcb, undoing the four screws R1.
- 24 Undo the five screws R2 to remove the logic circuit board from the instrument panel, so that it can be tested and/ or repaired.





D1.2 Removing and/or replacing the instrument panel circuit board "A"

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Turn the ignition key **A** to position "**0**".
- **3** Tilt the driver seat forward and isolate the batteries from the machine electronics by unplugging the Anderson connector **B**.
- **4** Remove the snap cap **C** from the steering wheel.
- 5 Fit the ready-made puller **D** or make one up using three M5 x 16 mm bolts **D1** for fixing purposes.









- 6 Remove the steering wheel **E** with the aid of the puller **D**, so as to access the instrument panel more easily, or to replace it.
- 7 Undo the dome head screw E1 by which the steering wheel E is secured to the column.
- 8 Remove the washer E? and return the screw E1 to the column (without tightening).
- **9** Position the puller **D**, applying the 3 screws **D1** to the steering wheel **E**.
- 10 Undo the screw E1 while tapping the hub of the steering wheel E on the outer surface with a plastic mallet.



11 Pull up the steering wheel E and detach it, undoing the screw E1 and removing the key E3, to avoid losing it.





12 Undo the eight screws **F** securing the instrument panel to the pillar.



Lift the instrument panel together with the dust boot G and proceed to unplug connectors M, N, O and P, the connector H of the emergency stop button, the two preinsulated cylindrical red connectors I1 and I2 and the steering wheel Faston connector L.



Disassembly

- **1** To fit the new instrument panel, repeat the steps of the disassembly procedure in reverse order.
- 2 Order and fit a new gasket seal Q before refitting the instrument panel.





D1.3 Removing the power circuit board "B"

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Apply the pedal-operated parking brake.
- 3 Isolate the machine from the batteries by unplugging the relative connector.
- **4** Remove the pillar panel as described in heading A1.2.
- **5** Disassemble the circuit board of the instrument panel as described in heading D1.2, without removing the steering wheel.
- 6 Unplug connector CN4, from the instrument panel circuit board.
- 7 Detach all cables connected to the power circuit board.
- **8** Undo the two white plastic screws **B2**, taking care not to damage them, and remove the power circuit board.



Reassembly

1 To fit the new power circuit board, repeat the steps of the disassembly procedure in reverse order.



D1.4 Replacement of components on electronics backboard

Disassembly

- **1** Move the machine onto a level and dry floor.
- **2** Apply the pedal-operated parking brake.
- 3 Isolate the machine from the batteries by unplugging the relative connector.
- **4** Remove the pillar panel as described in heading A1.2.
- **5** Identify the components to be replaced, mark the cables before disconnecting them, and unscrew the fasteners.

Parts

- 6 Drive circuit board
- 7 Power circuit board
- 8 Main fuse
- 9 Main contactor
- 10 Clamp nut positive pole
- 11 Clamp nut negative pole



Reassembly

1 When fitting new parts, repeat the steps of the disassembly procedure in reverse order, observing the correct tightening torques: M6 screws = 3 Nm (~2.21 ft·lb); M8 screws = 6 Nm (~4.42 ft·lb).



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D2 WIRING DIAGRAM

D2.1 Wiring diagram with ITALSEA drive circuit board





COMPONENTS CHART						
M1	PROPEL MOTOR	C1	CLIXON PROPEL-MOTOR			
M2	BRUSH MOTOR	<u></u>	SOLUTION-TANK LEVEL-SWITCH			
M3	BRUSH MOTOR	62	Switch CLOSED = full			
M4	VACUUM MOTOR	02	SEAT SWITCH			
M5	SQUEEGEE MOTOR	03	Switch CLOSED = seat pressed			
M6	SOLUTION PUMP	C4	RECOVERY-TANK LEVEL-SWITCH Switch CLOSED = full			
M7	BRUSH ACTUATOR					
M8	CHEMICAL DOSE PUMP	CE.	PROPEL PEDAL SWITCH			
M9	RIGHT SIDE BRUSH MOTOR	05	Switch CLOSED = pedal pressed			
M10	LEFT SIDE BRUSH MOTOR	6	PARKING BRAKE SWITCH			
M11	ROLLER BRUSH MOTOR	0	Switch CLOSED = brake ON			
TL1	MAIN CONTACTOR	C7	RIGHT-SIDE BRUSH SWITCH			
K1	TRACTION SAFETY RELAY	C8	LEFT-SIDE BRUSH SWITCH			
EV1	SOLUTION VALVE	C9	F/B DIRECTION SWITCH			
P1	PROPEL POTENTIOMETER (5K)	C10	CLIXON BRUSH MOTOR			
P2	SPEED-LIMIT POTENTIOMETER (100K)	C11	CLIXON BRUSH MOTOR			
KS	ON / OFF KEY SWITCH	C12	CHEMICAL-TANK LEVEL-SWITCH			
CD	SWITCH FOR CHEM-DOSE	012	Switch CLOSED = full			
PE	EMERGENCY PUSH BOTTON	F1	MAIN FUSE 100 A			
ΒZ	BUZZER	F2	RESETTABLE FUSE 4A KEY			
SK1	DASHBOARD	F3	RES. FUSE 3A BRUSH ACTUATOR			
SK2	MICROCONTROLLER BOARD	F4	RES. FUSE 3A SQUEEGEE ACTUATOR			
SK3	POWER BOARD	F5	RES. FUSE 3A SOLUTION PUMP			
SK4	CHEM-DOSE BOARD	F6	RES. FUSE 2A CHEM-DOSE PUMP			
SK5	PROPEL BOARD	F7	RES. FUSE 30A VACUUM MOTOR			
HL1	FLASHING LIGHT	F8	RES. FUSE 50A BRUSH MOTOR			
L1	PROPEL-BOARD STATUS-LED	F9	RES. FUSE 50A BRUSH MOTOR			
		F10	RES. FUSE 5A SIDE BRUSH MOTOR			
		F11	RES. FUSE 5A SIDE BRUSH MOTOR			
		F12	DELAYED FUSE 10A DASHBOARD			



ERROR CODES - TROUBLESHOOTING



All maintenance operations described and illustrated in this manual must be carried out by an IPC-approved technician.

Go to the designated draining area and empty the detergent solution and/or dirty water tanks by way of the relative hoses.

Move the machine onto a level surface and apply the parking brake. If necessary, place chocks under the wheels.

Switch the machine off by turning the ignition key anticlockwise and/or depressing the emergency stop button.

Disconnect the machine electronics from the batteries by unplugging the Anderson connector.

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E1 ERROR CODES

E1.1 Instrument panel circuit board display — alarms

ERROR CODE	CAUSE	REMEDY
	Machine being overworked, high brush pressure.	Wait 30 minutes for the temperature to come down.
BRUSH TEMPERATURE	Selected work program too heavy for the type of surface.	Drop from 3 to 2 or 1.
	Electronics damaged	Replace the power pcb.
BATTERY CHARGE	Low battery voltage.	Charge the battery.
BATTERY LOW	Low battery voltage.	Charge the battery.
BATTERY FLAT	Low battery voltage.	Check the battery acid level, top up if neces- sary, recharge.
	Parking brake engaged.	Release the parking brake.
PARKING BRAKE	Brake pedal microswitch not mounted correctly.	Adjust the position of the microswitch.
	Brake pedal microswitch not functioning correctly.	Replace the microswitch.
	Water level sensor tripped.	Empty the dirty water tank.
	Level sensor stuck.	Check the sensor.
	Water level sensor tripped.	Prepare to empty the dirty water tank.
	Level sensor stuck.	Check the sensor.
	Water level sensor tripped.	Fill the detergent solution tank.
NO WATER	Level sensor stuck.	Check the sensor.
DETERGENT LEVEL	Chemical detergent almost depleted.	Fill the detergent tank.
NO DETERGENT	Chemical detergent entirely depleted	Fill the detergent tank.



E1.2 ITALSEA drive circuit board alarms

- ALARMS -

Handheld programmer, SCT utility ("Alarm" on Tester Pages) and Alarm Led (on-board and/or external by counting blinks) display the failures or alarms: the following table shows the list, the meaning of this alarms, and how to solve the problem.

ALARM 1: Forward switch closed at power-up.

Led alarm status 1 blinks. •00000•00000•00000

Controller has detected the Forward switch on at power-up; to reset the alarm, set speed reference to zero and open the FW switch. If the application needs the switch on at power-up, the alarm can be disabled by setting parameter "ENABLE-ALARM 1".

ALARM 2: Reverse switch closed at power-up.

Controller has detected the Reverse switch on at power-up; to reset the alarm, set speed reference to zero and open the BW switch. If the application needs the switch on at power-up, the alarm can be disabled by setting parameter "ENABLE ALARM 2".

ALARM 3: Potentiometer fault.

Led alarm status 3 blinks.

Controller has detected the Speed Reference voltage out of maximum range. Check Speed Reference/potentiometer wires. If the application opens one or more potentiometer wires (for instance at the zero position), the alarm can be disabled by setting parameter "ENABLE ALARM 3".

ALARM 4: Potentiometer out of neutral position at power-up

Controller has detected the Speed Reference voltage out of stop position at power-up Move the potentiometer to neutral position, or if already in neutral position, calibrate the speed reference; the alarm can be disabled by setting parameter "ENABLE ALARM 4".

ALARM 5: Thermal overload cutout.

Heatsink temperature is higher than 85°C. Power-off, wait a few minutes and check motor consumption.

ALARM 6 / ALARM 6b: Controller power stage damaged

Led alarm status 6 blinks.

Controller self-test has detected a failure of internal power-stage. Change the controller.

ALARM 7: Overcurrent (short circuit)

Controller has failed safe by tripping external short circuit. Check the motor wiring: if good, and the controller repeats this alarm, change the controller.



ALARM 8: Power fuse or on-board contactor damaged.

Controller had detected a fault at the external power fuse or in power connections. If the controller repeats this alarm and the power connections are good, change the controller.

ALARM 9: Undervoltage.

Battery voltage lower than value set by parameter; check battery charge level.

ALARM 10: Overvoltage.

Battery voltage higher than 45V: check the battery status.

ALARM 11: Overload protection.

Check motor current draw, parameters "rated current" and "overload time".

ALARM 12: Disable switch on.

Disable input switch is active: this alarm will reset at power-off. The alarm can be disabled by setting parameter "ENABLE ALARM 12".

ALARM 13: Key-off sequence detected.

Key switch was opened: check the key switch connections.

ALARM 14: internal memory fail.

Check parameter settings: if the controller repeats the alarm, change the setting.



E5.1.1 Machine display does not light up

1	1 Check battery voltage	Α	If there is no voltage, replace the batteries.
'		в	If there is voltage present, go to point 2
	Check electrical continuity of power wire to the instru- ment panel circuit board "A"	A	Check electrical continuity of black-violet wire C5 in heading D1.5 and red wire Q1 then Q7 in heading D1.1.
2		в	Check condition of track on circuit board identified by colour red, see heading D1.1.
		с	If everything is as it should be, go to point 3
2	Check contacts of ignition key, see heading D1.1	A	Check efficiency of ignition key with multimeter.
3		в	If everything is as it should be, go to point 4
	Check for voltage of +36 V on violet wire Q2 supplying power to circuit board, see heading D1.1	A	Reinstate the wire and/or the connections.
4		в	If everything is as it should be, go to point 5
5	Check instrument panel circuit board "A"	Α	Test or repair the instrument panel circuit board "A"
5		В	Replace the instrument panel circuit board "A"

E2.1.2 Machine does not start or does not move

	Check for possible error messages on the instrument panel display - see heading E1.1	A	Reset the error message as described in heading E3.
		в	If there are no errors, go to point 2.
	Listen for activation of the main contactor "C", see heading D1.5.	A	If activation of the contactor cannot be heard, go to point 3.
		в	If activation occurs as expected, go to point 5.
2	Check that there is voltage present (36 V) on the coil power leads C2-C3, see heading D1.5.	A	If there is no voltage present, go to point 4
3		в	If everything is as it should be, go to point 5
4	Test for continuity of yellow wire C3, see headings D1.5 and D1.1, position 6 on connector M, and of bluewhite wire C2, heading D1.5, with pink wire Q3, see heading D1.1.	A	If continuity test on blue-white wire C2 is negative, check the condition of the track on the circuit board identified by colour pink, see heading D1.1.
		в	If continuity test is positive, replace the instrument panel circuit board "A".
_	Measure voltage V3 on the circuit board as described in heading C1.1.	A	If there is voltage present, go to point 6
5		в	Replace the main contactor C", see heading D1.5
6	Measure voltage V4 at the output of the circuit board "B" as described in heading C1.2.	Α	If everything is as it should be, check the carbon brushes of the motor C2.1.
		в	Replace the power circuit board "B".



E2.1.3 Brushes do not turn

4	Check for possible error messages on the instrument panel display - see heading E1.1	A	Reset the error message as described in table E1.1
'		в	If there are no errors, go to point 2.
	Using a digital multimeter, check for voltage (36 V) between position 4 and position 2 on the power circuit board "B", see heading D1.3.	A	If there is voltage present, go to point 3
2		в	If there is no voltage present, replace the power circuit board "B", as described in heading D1.4.
	Check for voltage (36 V) at the Anderson connector Q, see heading A1.4.	A	If there is voltage present, go to point 4
3		в	If there is no voltage present, check the continuity of the power cables.
	Assess the wear on the carbon brushes as described in heading A1.4., or heading A6.3 for R versions.	A	If the carbon brushes are worn, replace as described in heading A1.4., or heading A6.3 for R versions.
4		в	Replace the brush motors, as described in heading A3.4., or heading A6.4 for R versions.
5	Test the signal from the circuit board.	A	
5		В	

E2.1.4 Brush head does not descend

1	Check for possible error messages on the instrument	Α	Reset the error message as described in table E1.1
'	panel display - see heading E1.1	В	If there are no errors, go to point 2.
2	Disconnect the brush motors by unplugging connector Q, see heading A1.4, and select the brush head 'down' control.	A	If the head descends, measure current drawn by the brush motors, as described in headings A1.1 - A1.2 - A1.3, or headings A6.1 - A6.2 for R versions
		В	If there is no downward movement, go to point 3.
3	Check that there is voltage (36 V) at positions D5 and D6 on connector D when the 'up' or 'down' control of the brush head is selected, see heading A2.1.	Α	If a voltage reading of 36 V registers briefly (maximum 3 seconds), go to point 4.
		В	If there is no voltage present, replace the instrument panel circuit board "A", see heading D1.2.
4	Remove and test the actuator as described in heading A2.2.	A	If the actuator functions correctly when powered directly from the battery and the current draw is correct, see heading A2.2, go to point 5.
		В	If there is no response under power, replace the actuator, see heading A2.2.
_	Check that the linkages of the brush head raise/lower unit slide and turn freely, see heading A3.1.	A	If the linkages move freely when operated, go to point 6.
5		В	If not, repair/and or lubricate as necessary, and go to point 7.
6	Check the connections and wires of the actuator po- wer supply, see heading A2.2.	A	If the electrical connections are sound and there is continuity, go to point 7.
		В	If not, restore continuity.
7	Check the current draw of the actuator, as described in	Α	If the current draw is outside the values in the table, replace the actuator.
'	heading B2.2.	В	Replace the actuator.



E2.1.5 Machine not vacuuming

	Check that the vacuum hose is clean and intact.	A	If the hose is dirty or damaged, clean or replace it
'		в	Otherwise go to point 2
	Check that the metal clip is properly tightened and that the seal in the cap of the dirty water drain hose A is watertight, see heading B5.1.	Α	If everything is as it should be, go to point 3.
		в	if not. tighten the clip and/or replace the seal.
2	Check that the gasket seal G under the rubber flap E is clean and intact, likewise flap itself, see heading B5.1	A	If everything is as it should be, go to point 4.
		В	Clean or replace the dirty or damaged gasket seal and/or flap.
	Check that the squeegee blades are clean and intact, and that the squeegee is correctly adjusted, see hea- ding B2.4.	A	If everything is as it should be, go to point 5.
4		в	If not, replace the blades and/or adjust the squeegee, see hea- ding B2.4
Check that the vacuum motor	Check that the vacuum motor is securely attached to	A	If everything is as it should be, go to point 6
5	R and mousse S, see heading B1.3.	в	Replace the seals and/or tighten the screws P correctly, see heading B1.3.
6	Check the integrity of the dirty water tank, which must not be cracked or punctured.	A	If the tank is in good condition, go to point 7
0		В	Replace the tank with a new part, as described in heading B5.1.
7	Measure the current drawn by the vacuum motor, under no load and with the vacuum hose stopped, see heading B1.1.	A	Inspect the vacuum motor.

E2.1.6 Vacuum motor not working

1	Check for possible error messages on the instrument panel display - see heading E1.1	Α	Reset the error message as described in table E1.1
		в	If there are no errors, go to point 2.
2	Check the output voltage from the connector of the vacuum motor, see heading B1.1.	A	If there is voltage present, go to point 3
		в	If there is no voltage present, go to point 4.
3	Assess the extent of wear on the vacuum motor car- bon brushes, see heading B1.2.	A	If the carbon brushes are in good condition, replace the vacuum motor, see heading B1.3.
		в	Replace the carbon brushes of the motor, see heading B1.3.
4	Measure the output voltage at positions 7 and 2 on the power circuit board "B", see heading D1.3 – D1.4.	A	If there is voltage present, check the integrity of the wiring to the vacuum motor.
		в	If not, go to point 5
	Change the position of the connection on the power circuit board "B" from position 7 to position 8, see heading D1.3.	A	If the vacuum motor works, maintain the connection to position 8.
5		в	If the motor still does not work, replace the instrument panel circuit board "A" as described in heading D1.2.



E2.1.7 The squeegee does not move (up and down)

	Check for possible error messages on the instrument panel display - see heading E1.1	A	Reset the error message as described in table E1.1
		в	If there are no errors, go to point 2.
2	Check the operation of the actuator, as described in heading B2.1.	A	If actuator is working correctly, go to point 3
		в	If the actuator is not working, replace it.
2	Unplug the connector of the actuator and check the output voltage at positions 1 and 2 of connector CN3 on the instrument panel circuit board, see heading D1.1.	A	If a voltage of 36 V is detected briefly (3 seconds maximum), the circuit board is working correctly. Go to point 4.
3		в	If no voltage is detected, replace the instrument panel circuit board "A", as described in heading D1.2.
	Check the continuity of the wiring between the circuit board and the actuator.	A	If continuity is detected, go to point 5
4		в	If not, restore continuity.
5	Check that the linkage components of the squeegee frame slide and turn freely, see heading B3.1.	Α	Adjust and lubricate the linkage as necessary.
5		в	Otherwise go to point 6.
6	Measure the current drawn by the squeegee actuator, as described in heading B1.1.	Α	If the current draw is outside the values in the table, replace the actuator.
		В	Replace the actuator.

E2.1.8 Water not being released

	Check for possible error messages on the instrument	A	Reset the error message as described in table E1.1
panel display - see heading E1.1	panel display - see heading E1.1	в	If there are no errors, go to point 2.
	Check the cleanliness of the solenoid valve, as descri-	A	If the solenoid valve is dirty, clean it.
	bed in heading A5.1.	в	If the solenoid valve is clean, go to point 3.
		A	If the output voltage is 36 V, replace the solenoid valve - see heading A5.2.
3	Measure the output voltage from the cap connector F of the solenoid valve, see heading A5.1.	в	If there is voltage present, but with minimal release of water, go to point 5.
		С	If there is no voltage present, go to point 4.
	Measure the output voltage from the instrument panel circuit board "A", see heading B3.2 from point 14.	A	If there is voltage present, check the continuity of the wires con- necting with the solenoid valve.
4		в	If there is no voltage present, replace the instrument panel circuit board "A".
E	Check that the detergent solution outlet filter is clean, see heading B3.1.	A	If the filter is dirty, clean as described in heading B3.1.
5		в	If the filter is clean, go to point 6.
6	Check the operation of the detergent solution pump, as described in heading B3.2.	Α	If the pump is not operating correctly, replace it.
0		в	If everything is as it should be, go to point 7
7	Check that the water delivery hoses are clean, see heading B3.3.		



E3

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DRIVE PROBLEM E3.1 Solutions to drive problem





TECHNICAL SERVICE MANUAL REVISION - UPDATES

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