Service and Maintenance for Scooters

Technical Manual
Sapphire 2

STEPS®

KNOWLEDGE
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PRODUCT INFORMATION

CERTIFICATION:

Sunrise Medical is ISO 9001 certified, which ensures quality at all stages of the development and production of this scooter.
This product is manufactured to comply with the requirements of EEC directives 89/336/EEC

IMPORTANT:

It is potentially hazardous to fit or use any parts other than genuine Sterling parts. The company disclaims all liability for the consequences of such use, which in addition voids the machine warranty.

USAGE:

This vehicle is for the carriage of ONE PERSON and must not be used for any other purpose.

DESCRIPTION:

The Sapphire 2 is designed to be a flexible four-wheel scooter.
The Sapphire 2 is rear wheel drive Single Transaxle configuration.
Features include:
Fold down, height adjustable swivel seat with flip up width adjustable armrests, Split battery boxes for easy removal/transport, Easily detachable rear drive pack fitted with twin handles for secure lifting, Fold down tiller to accommodate luggage compartment or cupboard storage and bright, reliable and economical LED lighting.
All parts interconnect in a logical sequence, ultimately combining to create an elegant yet simple modular construction.
It is this simplicity that makes the Sapphire 2 easy to understand therefore quick and straight forward to service.

WARRANTY

WARRANTY CONDITIONS

1. The repair or replacement will be carried out by an authorised Sunrise Medical dealer/service agent.

2. To apply the warranty conditions, should your scooter require attention under these arrangements, notify the designated Sunrise Medical service agent immediately giving full information about the nature of the difficulty. Should you be operating the scooter away from the locality of the designated Sunrise Medical service agent, work under the "Warranty Conditions" will be carried out by any other service agent designated by the manufacturer.

3. Should any part of the scooter require repair or replacement, as a result of a specific manufacturing or material defect, within twenty four months from the date on which the possession of the scooter was transferred to the original purchaser and subject to it remaining within that ownership, the part or parts will be repaired or replaced completely free of charge if returned to the authorised servicing agent.

NOTE: This guarantee is not transferable.

4. Any repaired or replaced part will benefit from these arrangements for the balance of the warranty period applicable to the scooter.
5. Parts purchased after the original warranty has expired are covered for twelve months.
6. Items of a consumable nature will not generally be covered during the normal warranty period, unless such items have clearly suffered undue wear as a direct result of an original manufacturing defect. These items include amongst others: batteries, upholstery, tyres, inner tubes and similar parts.
7. The above warranty conditions apply to all scooter parts for models purchased at full retail price.
8. Under normal circumstances, no responsibility will be accepted where the scooter has required repair or replacement as a direct result of:

- **a)** The scooter or part not having been maintained in accordance with the manufacturer's recommendations, where such exist, or failing to use only the specified original equipment parts.
- **b)** The scooter or part having been damaged by neglect, accident or improper use.
- **c)** The scooter or part having been altered from the manufacturer's specifications, or repairs being attempted prior to the service agent being notified.

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Health & Safety

Good Working Practice

Whilst working on powered mobility products, it is essential to observe good working practice. Below are a series of safety guidelines and recommendations.
Please note that these precautions are intended to serve only as a guide and are not intended to supersede or replace any safety statute, NHS or other safety regulations.

General

- Always wear suitable protective clothing when handling batteries.
- Always wear suitable eye protection when drilling or inspecting.
- When safe to do so, wear protective gloves when handling the running gear or batteries, as these parts are exposed to paths, parks etc..
- If the drive wheels have to be raised off the floor, always use a pair of axle stands to secure the vehicle correctly.

Batteries

All work carried out on batteries or battery boxes should demand a degree of extra caution.

- Always make sure that the batteries are disconnected from the vehicle before commencing work.
- Always check that the battery charger is disconnected from the vehicle / batteries before commencing work.
- Do not smoke.
- Keep batteries away from all sources of ignition.
- Do not place objects on the battery tops.
- Always try to keep someone within earshot of your work area so that they may come to your assistance if needed.
- Always wear personal protection when handling batteries including eye / face protection and gloves.
- Make sure there is easy access to soap and water in case of acid spills.
- Avoid touching eyes or unprotected parts of the body while working on batteries.
- Remember that non-sealed batteries can contaminate any packaging, housing or boxes they may have been transported in, so handle all packaging with care especially when disposing of.
- If battery acid should come into contact with bare skin or clothing, be sure to wash immediately using plenty of soap and water. If battery acid enters the eyes, flush with running cold water for as long as possible while medical help is sought.

Batteries continued

- When the tops of batteries are exposed, take extra care when working on or around the terminals.
- Do not allow metal tools to drop on to or touch the exposed terminals of the batteries or other exposed connections as this could cause a short circuit, which may result in an explosion.
- Remove personal items of jewel lery such as rings, watches, chains etc. before commencing work on batteries.
  If such items were to cause short circuit whist being worn, very seri ous burns would result.
- Batteries are constructed using very heavy materials. Because of this it is essential that correct lifting tech niques be employed when moving batteries around. It is also recom mended that safety footwear be worn.
- When disposing of old batteries, please ensure that correct disposal procedures are followed. Contact your local authority for their recomendations.

Battery Chargers

Remember battery chargers are con nected to Mains Electricity

- Always observe all guidelines and laws relating to mains-connected installations and equipment.
- Never operate the battery charger in wet or damp conditions.
- If you suspect that the charger has been exposed to water or excessive damp, do not use it Return the unit back to the dealer/supplier for inspection.
- If the battery charger is suspected of being defective or is visibly damaged, return the unit back to the dealer for inspection.

Tool Box

Tool Box

The following list of tools will enable any task covered by this module, to be carried out quickly, effectively and safely.
The order in which tasks are executed can vary depending on individual circumstances.

Be Aware!

It is the responsibility of the Servicing Engineer to use their own judgement as to the suitability of a particular work area for the task in hand.
If the safety of the engineer or others close by is in question, we recommend that the vehicle is removed to a more suitable safe area or workshop.

1. Metric socket set.
2. Hexagon wrenches (Allen Keys).
3. 3.5 - 8mm flat screwdriver.
4. No. 0 cross-head screwdriver.
5. No. 1 cross-head screwdriver.
6. No. 2 cross-head screwdriver.
7. Metric spanner set 5 - 25mm
8. Mole grips.
9. Long nose pliers.
10. Adjustable spanner.
11. Combination pliers.
12. Circlip pliers.
13. Soft hammer (rubber, hide or nylon).
14. Stanley knife.
15. Pin punches.
16. Torque wrench.
17. Steel engineering rule.
18. Tape measure.
19. Tyre pump.
20. Tyre pressure gauge.
21. Personal safety gear.
22. Wire strippers/cutters.
23. Tag crimper.
24. Multi-meter.
25. Battery tester.
26. PC programmer.
27. Parts, Owners & Workshop Manuals.

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SERVICE INFORMATION

IMPORTANT

All scooter components should be regularly checked for loose, damaged or corroded connectors, terminals or cabling. All cables should be restrained to protect them from damage. Damaged components should be replaced.

All switchable functions on the electronics system should be regularly tested to ensure they function correctly.

All electronic components should be kept free of dust, dirt and liquids.
If necessary, wipe with a cloth dampened with warm water. Do not use solvents or abrasive cleaners.

There are no serviceable parts in the Main Control Box, Batteries or Battery Charger.
Do not attempt to open the case, or undertake any repairs what so ever, as safety critical systems could be compromised.

Use Sunrise Medical spare parts only.
When replacing fasteners be sure to tighten to the correct torque settings.
All fasteners must be replaced like for like using the correct length, tensile strength and materials.
Never use nylok nuts twice.

Any drive testing should take place in a clear safe space.
It is recommended that the servicing of this equipment is best undertaken in a controlled workshop environment away from children, animals and the general public.
Failure to comply with this recommendation is the sole responsibility of the servicing agent.

Annual Service & Inspection

Controller

- Plug Connections
- Switches & Buttons
- External Connections
- Dynamic Braking (See Test Run).
- Programmable Settings
- Multi Profile Settings (Where Used).
- Drive Profile (See Test Run).
- Disable functions (safety circuits).
- Rubber Gaiters/Grommets
- Check for Water Incursion
- Fasteners & Brackets

Batteries

- Physical Inspection
- Check Type
- Charger Operation & Output Power
- Charger Type (GEL, WET, Automatic etc.).
- Connections
- Discharge Test
- Fuses & Resets

Wheels & Tyres

- Tyre Wear/cuts
- Pressure (Pneumatic Tyre).
- Bonding to Rim (Solid Tyre).
- Bearings (Where appropriate).
- Wheel/Hub Nuts & Rim Studs
- Drive Key & Key-ways

Motors & Actuators

- Wiring
- Brushes
- Noise
- Connections & Looms
- Brake & Freewheel
- Micro Switch(s)
- Seals (leaks).
- Performance (Up -Down & See Test Run)

Chassis & Seat

- Condition (Welded Joints etc.).
- Alignment (Twists etc.).
- Bearing Housing
- All Fasteners & Brackets
- Handles & Grips
- Arm Rests & Upholstery
- Seat Post & Securing Pin

Electrical

- Looms
- Micro Switches
- Cable Ties
- Connections
- Lights/Indicators
- Unauthorised Modifications?

Full Drive Profile (Test Run)

- Forward Speed (max - min)
- Reverse Speed (max - min)
- Acceleration (fwd - rev)
- Deceleration (fwd - rev)
- Stopping Distance
- Brake
- Emergency Stop
- Drive a Straight Line
- Left/Right Arc Turn
- Ascend Slope
- Stop on Ascent
- Pull Away on Ascent
- Descend Slope
- Stop on Descent (Dynamic Braking).
- Pull Away on Descent
- Over obstacles
- Freewheel Push

Accessories

- Posture Belts
- Head Rest
- Dining Tray
- Auxiliary Equipment & Brackets

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SERVICE INFORMATION

IMPORTANT

The Technical Specifications shown on the facing page are intended for information purposes only. Small differences may occur.
Sunrise Medical reserve the right to alter any specification without notice.

The range figures are calculated to the industry standard ISO 7178 Part 4: Scooter Energy Consumption Theoretical Range.

***User weight, terrain, environmental conditions, battery condition/age and other factors, can all affect the maximum range of the vehicle.**

CHAPTER 4

Technical Specifications General

LENGTH	121 cms (47.5”)
REAR WIDTH	59 cms (23”)
MAXIMUM USER WEIGHT	150kg (330 lbs)
BATTERIES	35 AH
MAXIMUM SAFE ANGLE	14 degrees
TURN RADIUS	140 cms (56”)
BASE to SEAT HEIGHT	50 - 62 cms (20 - 24.5”)
MOTOR POWER	270 Watts (@ rated load)
MAXIMUM SPEED	6 kph (4 mph)
WHEEL SIZE FRONT	22.5 cms (9“)
WHEEL SIZE REAR	26.5 cms (10.5”)
CHARGER OFF-BOARD	5 A
MAXIMUM RANGE*	40 km (25 mls)
OVERALL WEIGHT	67 kg (148 lbs)
SEAT WEIGHT	12.5 kg (28 lbs)
BATTERY WEIGHT (each)	12 kg (26 lbs)
DRIVE UNIT WEIGHT	19.5 kg (43 lbs)
HEAVIEST PART (footboard & tiller Assy.)	22.5 kg (50 lbs)
TYRE PRESSURE	25 P. S. I. (1.7 Bar)
FRONT BASKET LOAD (max)	4.5 kg (10 lbs)
GROUND CLEARANCE	9.5 cms (3.5”)
CONTROLLER PGDT S-DRIVE	(Programmable by dealer)

Technical Specifications
Torque

Generic Settings

FASTENER SIZE	TORQUE SETTING (Nm)
M3 Bolt / Stud	1
M4 Bolt / Stud	2.5 - 3
M5 Bolt / Stud	5 - 6
M6 Bolt / Stud	9 - 10
M8 Bolt / Stud	19 - 20
M10 Bolt / Stud	30
M12 Bolt / Stud	47.5
M16 Bolt / Stud	54
No6 Screw	1.5

Specific Settings

FASTENER SIZE	TORQUE SETTINGS (Nm)
GIMBLE BOLT (Through Front Axle)	36 - 37
WHEEL NUTS	33 - 34
TILLER HINGE BOLTS	6.15 - 6.4
AIR STRUT HINGE BOLTS	6.15 - 6.4
STEM BEARING CUP ASSY.	3.5 - 3.6
STEM BOLT	26 - 27

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SERVICE INFORMATION

IMPORTANT

The service & maintenance of any mobility scooter or powered wheelchair should only be undertaken by qualified or experienced engineering personnel.

This document is not intended for use by the general public.

This Technical Manual may recommend the use of certain tools/equipment during maintenance procedures. It requires that the servicing engineer has by means of qualification or experience, the skills necessary to use such tools/equipment correctly and safely.
It is highly recommended that all specific instruction manuals & safety recommendations supplied with the tools/equipment, should be read and understood before such equipment is used.

It is recommended that all mandatory safety procedures are strictly adhered to.

No responsibility is accepted by Sunrise Medical for any consequence, directly or indirectly, resulting from incorrect use of tools/equipment during any service procedure pertaining to this or any other Technical/Workshop Manual issued by Sunrise Medical.

SERVICE INFORMATION

IMPORTANT

Use extreme care when working on batteries.
Take all precautions and observe all safety rules and best working practice.
Use suitable protective gear.

When using electronic measuring devices be sure to read, understand and follow the product instruction booklet.

Do not touch the metal portion of the probes or allow them to touch each other when measuring voltage.

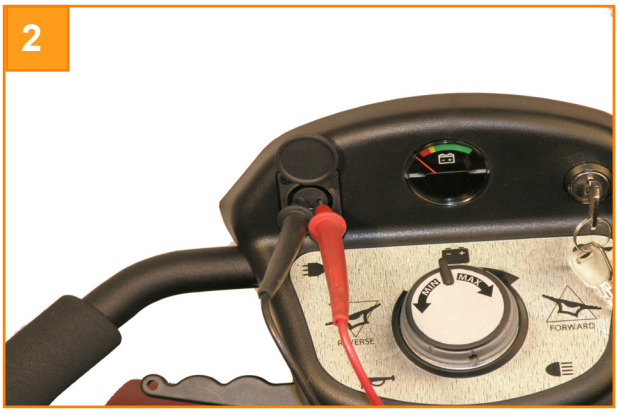
CHAPTER 5 Batteries & Battery Boxes Checking the Voltage

This is only an approximate field test. The true battery state should be determined by using a proprietary battery test unit.

1

Set the Multimeter to dc voltage on a suitable range to measure up to 30v.

2



Carefully insert the probes into the charging socket as shown.

3

Take note of the reading obtained. If it is less than 24.5v charge the batteries & start again.

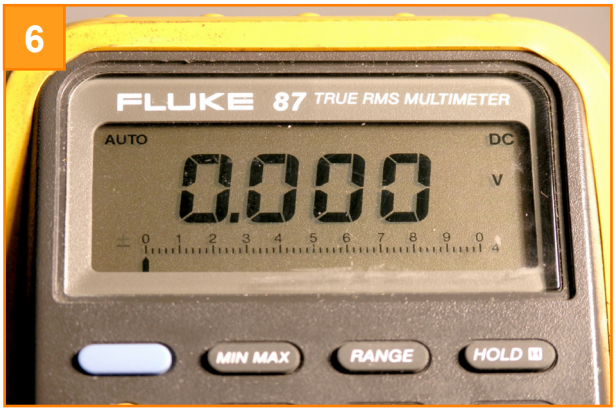
4

Now switch the scooter ON. Drive/run the scooter for a couple of minutes. Stop the scooter, but don't turn it off. Ensure the lights are OFF.

5

Note the reading. If there is a difference of more than 1.5v the batteries may be worn out.
22v = Deep Cycle Discharge.
23v = Full Discharge.
24v = Discharged.
24v - 24.5v Partial Discharge.
25v and above = Fully Charged.

6



If the initial voltage reading is 0v check the fuses, reset button & wiring in the battery boxes. If these are OK, check the main loom.

Batteries & Battery Boxes
Opening the Battery Boxes

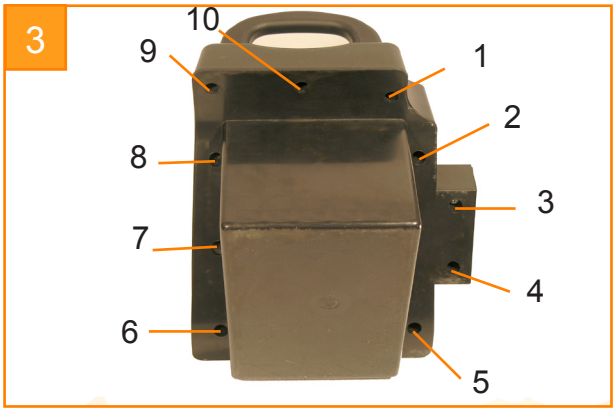
1

There are two battery boxes, a socket type marked “A” & a plain type marked “B”.

2

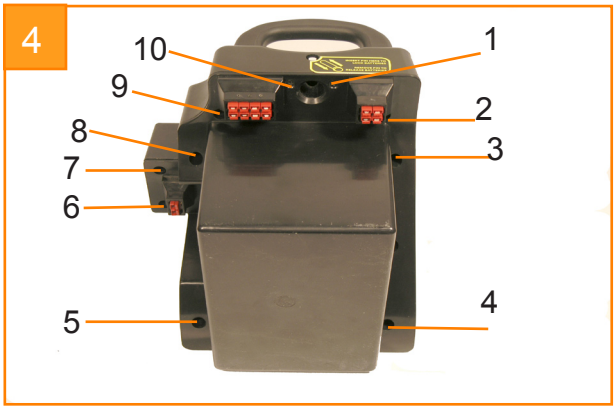
The handles are secured by screws. Check for tightness. Note: these screws do not hold the battery box together.

3



10 screws hold the plain “B” battery box together. Stand the battery box on its end & use a Phillips screw driver to release the screws.

4



Do the same with battery box “A”.

5

Note that screws 1 & 10 are smaller self tapping screws.

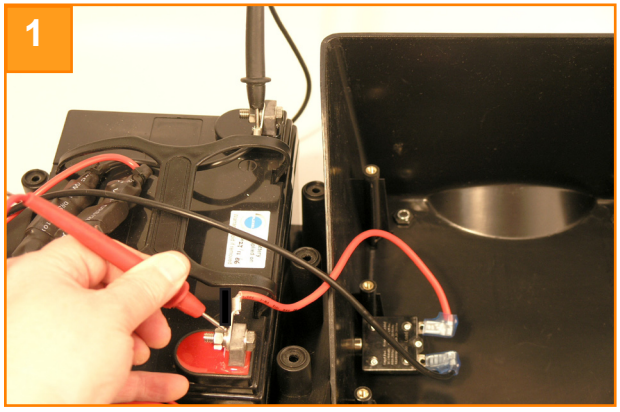
6

Place the battery box the correct way up & lift the lid. Be careful as wiring is attached. Use a 10mm spanner/socket to undo the battery terminals if the batteries need to be changed.

Batteries & Battery Boxes
Checking the Fuses

The Fuses are contained within heat-shrink sheaths and are non-serviceable. If a blown fuse is found, the relevant battery box assembly must be replaced.

1

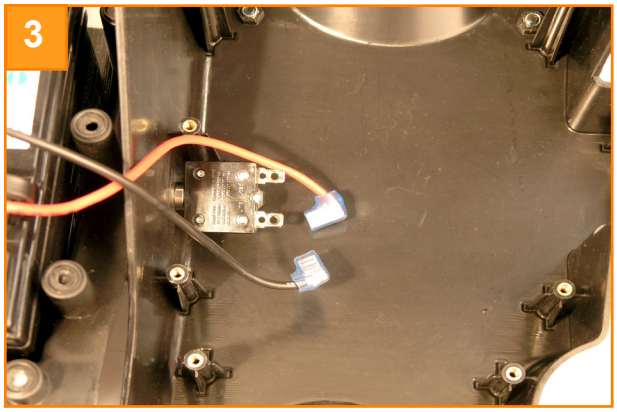


Start by checking the terminal voltage of each battery by placing the probes directly onto the +ve & -ve terminals.

2

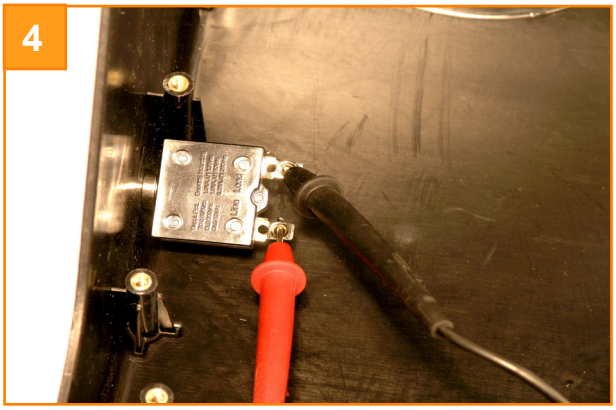
Each battery should give a reading of at least 12v. If it is less, charge the batteries and check again. If the voltage is still low, change both batteries.

3



The 40A circuit breaker is in series between the two batteries. To check the circuit breaker disconnect the two leads.

4



Ensure the cutout button is pressed in. Place the probes onto the terminals.

5

Set the Multimeter to RESISTANCE Ω.
The meter should display a very low resistance reading.

6

If the meter displays a high resistance value or an open circuit, change the preset cutout.

Batteries & Battery Boxes
Checking the Fuses

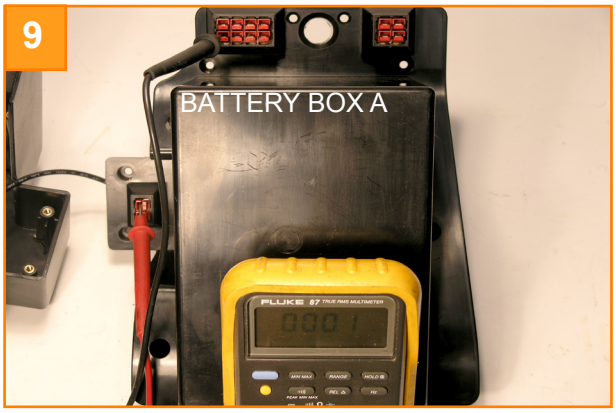
7

Use a 10.0mm spanner/socket to undo the battery terminals to remove the batteries if required.

8

Set the multimeter to RESISTANCE Ω.

9



Place probe on the top pin of the 2 pin socket & the bottom left pin of the 8 pin socket. The meter should display 0.1 or less.

10

Place probe in the lower terminal of the two pin socket & the other at the end of the fuse lead. The meter should read 0.1 or less.

11

The meter should display a very low resistance < 2 Ω

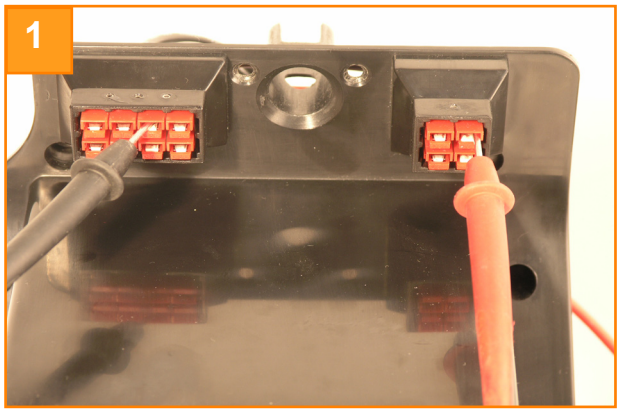
12

If the meter shows high resistance > 2 Ω or open circuit the wiring is faulty & has to be replaced.

Batteries & Battery Boxes
Checking the Wiring

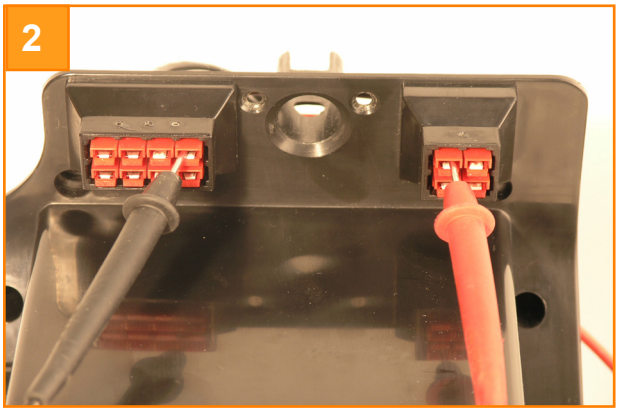
The task of checking the fuses means that 50% of the wiring has already been checked. Follow the instructions below to check the remainder. All readings should show a short circuit (continuity).

1



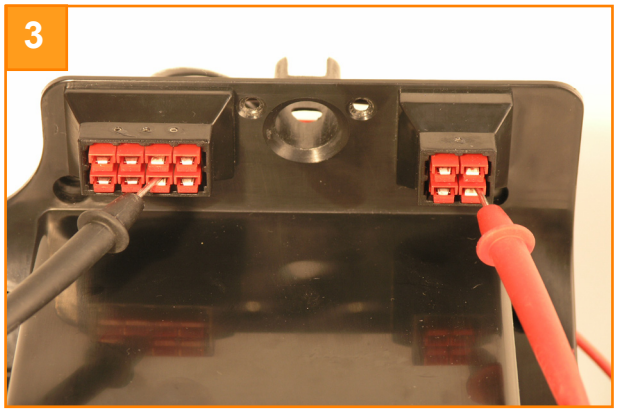
Place one probe into the third pin from the left on the top row of the LH socket and the other into the top right pin of the RH socket as shown.

2



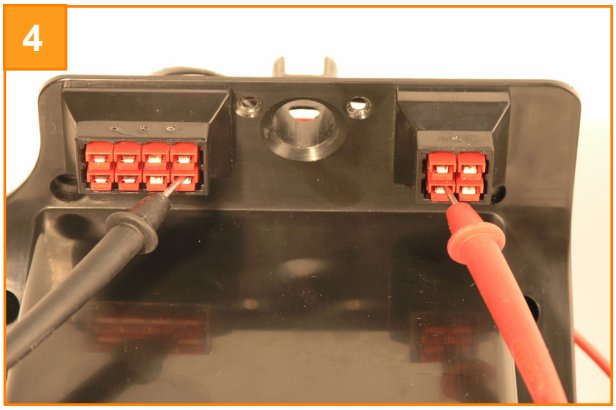
Place one probe into the top RH pin on the LH socket and the other into the top LH pin of the RH socket as shown.

3



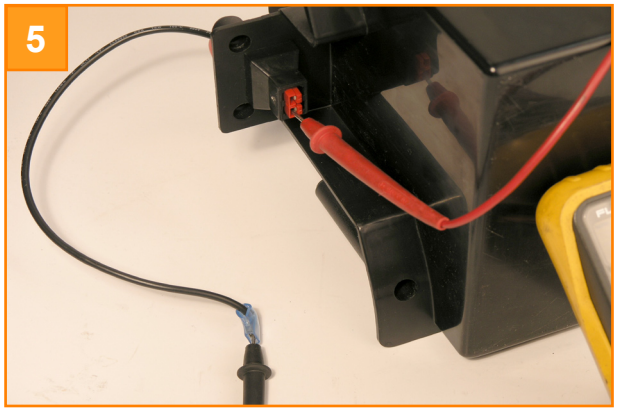
Place one probe into the third pin from the left on the bottom row of the LH socket and the other into the bottom right pin of the RH socket as shown.

4



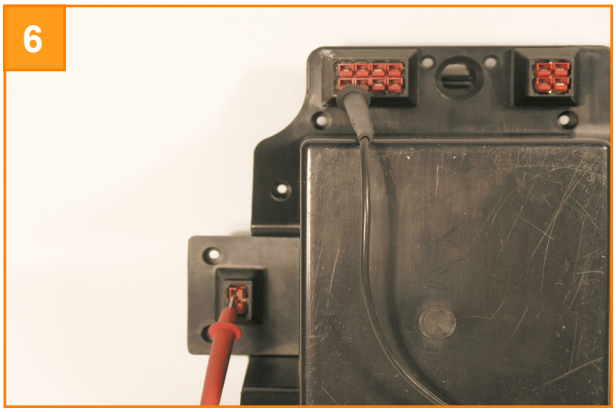
Place one probe into the bottom RH pin of the LH socket and the other into the bottom left pin of the RH socket as shown.

5



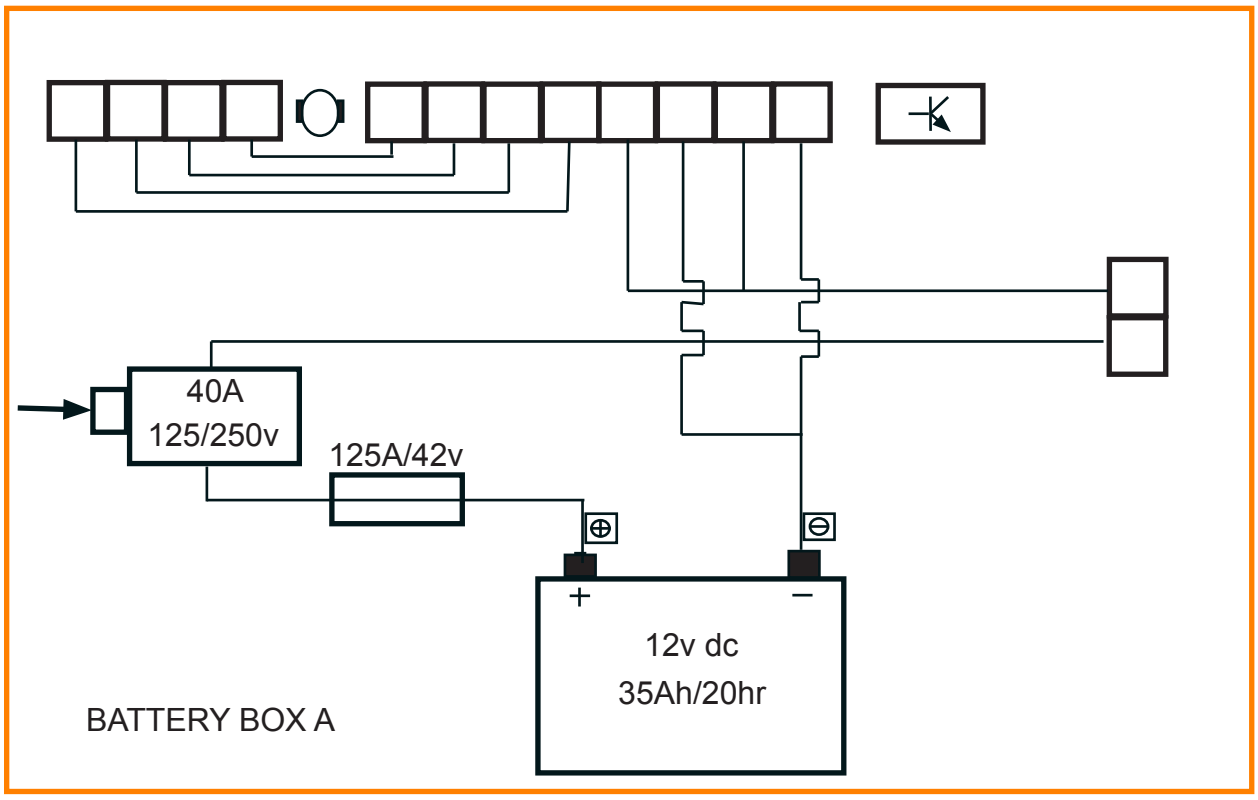
Place one probe into the tag terminal of the flying lead coming from the two pin plug and the other into the bottom pin of the two pin plug.

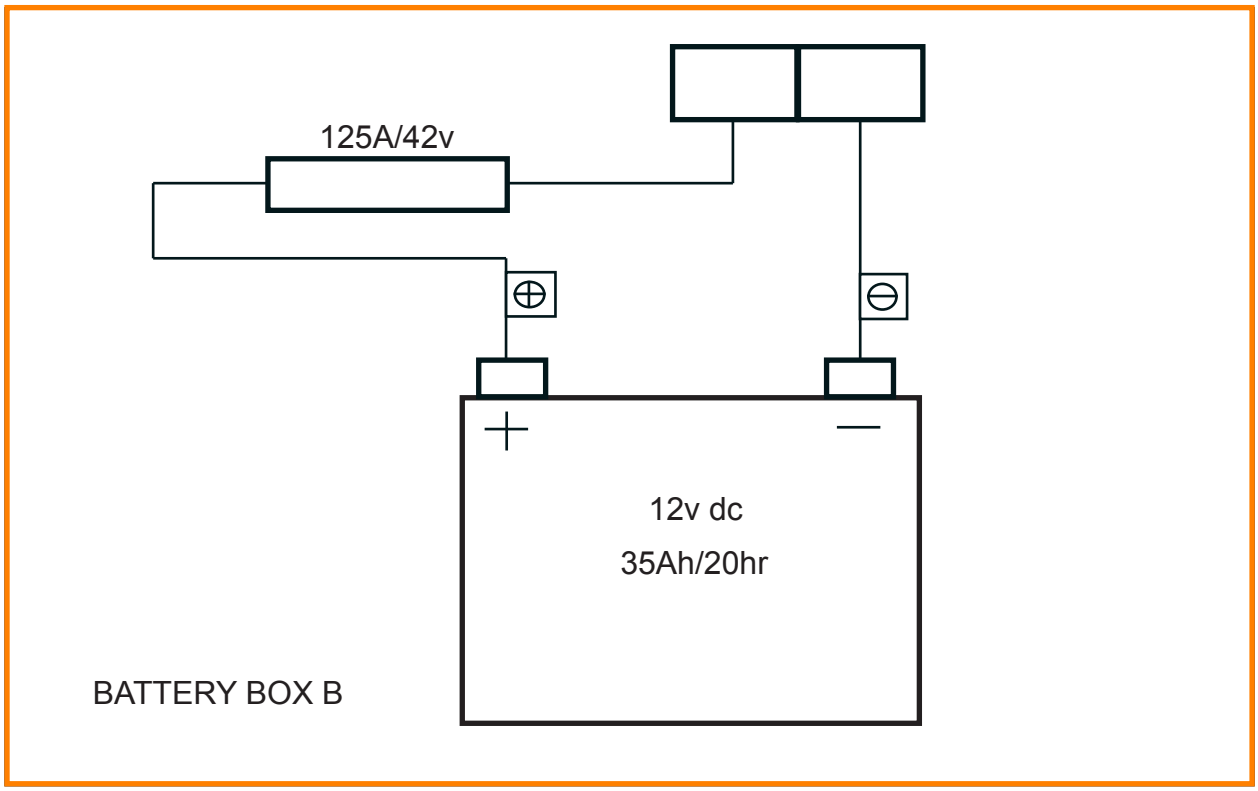
6



Place one probe in the top terminal of the 2 pin socket & the other in the bottom left terminal of the 8 pin socket. Meter reading = 0.1 or less for all measurements. If not, change the battery box.

Batteries & Battery Boxes
Battery Box Decals





CHAPTER 6 Battery Charger Connection

Always connect the charger to the scooter before switching on the mains power.
Observe all safety recommendations when charging batteries.
This charger is for Indoor Use Only. Do not expose to moisture. Do not block the vents.

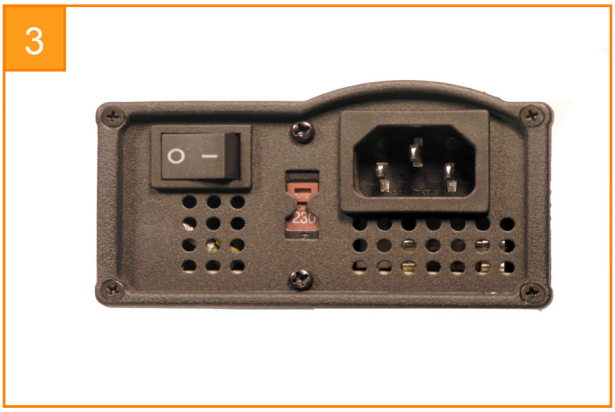
1

The battery charger has a detachable mains lead.

2

The front panel has the charge indicator LED's, output fuse, output lead & fan.

3



The rear panel has the On/Off switch, voltage change switch & power socket.

4

The charger output plug connects to the charging socket on the tiller top.

5

The power lead connects to the socket at the rear.

6

When there is mains power connected to the charger & the On/Off switch is turned ON, the RED LED illuminates.

Battery Charger Charge Sequence

Charger switched OFF & not connected to batteries.

Charger switched ON & not connected to batteries.

Charger switched ON, connected to batteries & charging.

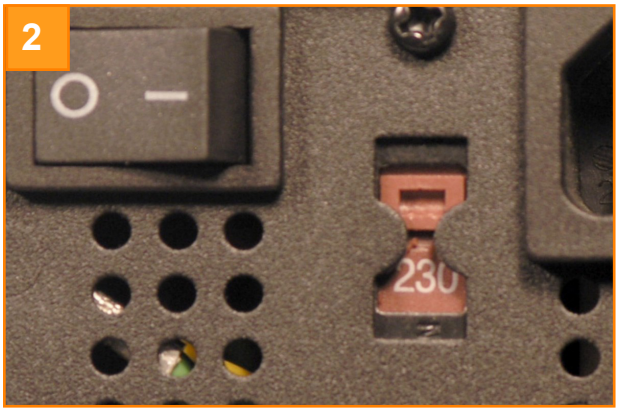
Charger switched ON, connected to batteries & charge completed. It is OK to leave the charger connected to the scooter in this condition for up to 2 weeks. This will help to extend battery life.

Battery Charger Troubleshooting

1

NO LIGHTS when batteries & mains are connected.

2

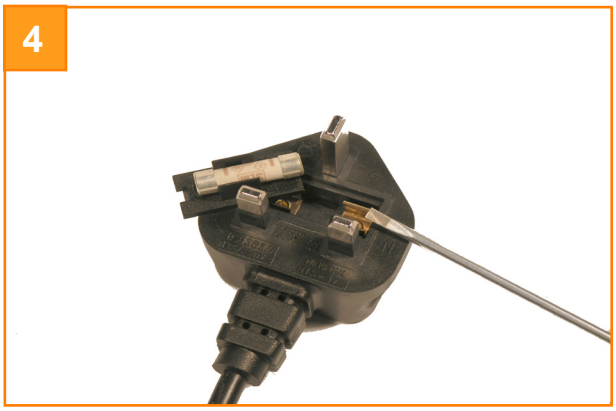


Disconnect from mains. Check voltage switch is correctly set. Use a small screw driver to set it.

3

NO LIGHTS when batteries & mains are connected & Voltage switch is set OK.

4



Check the On/Off switch. Check the mains lead is plugged into the charger. Check the 3A mains plug fuse. Confirm mains wall socket is working.

5

RED LIGHT only, batteries are connected.

6

Check charger plug is pushed home into socket on scooter. Press the RESET button on the battery box. Ensure the battery boxes are seated correctly. Check Battery Voltage for low value. Disconnect from mains & check the 10A output fuse on the charger.

CHAPTER 7

Tiller Control Console

The Tiller Console is sold as a complete assembly for spares. Only Keys and Fuses are sold separately

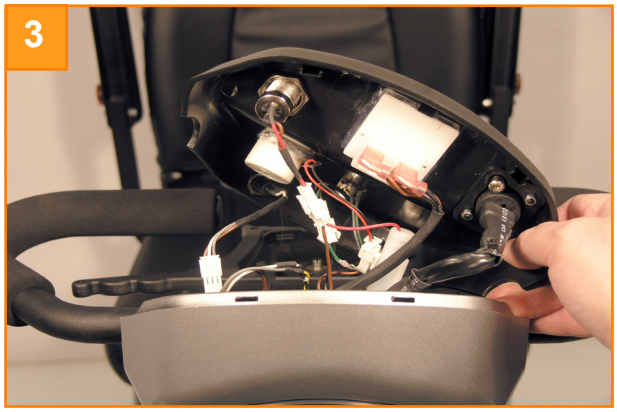
1

Use a small Phillips screw driver to release the single screw as shown.

2

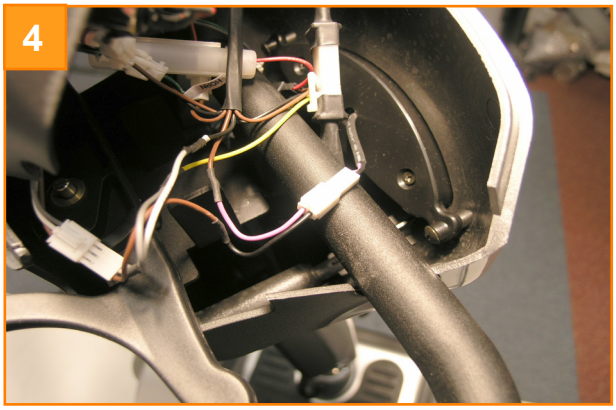
Carefully lift the tiller console part way up.

3



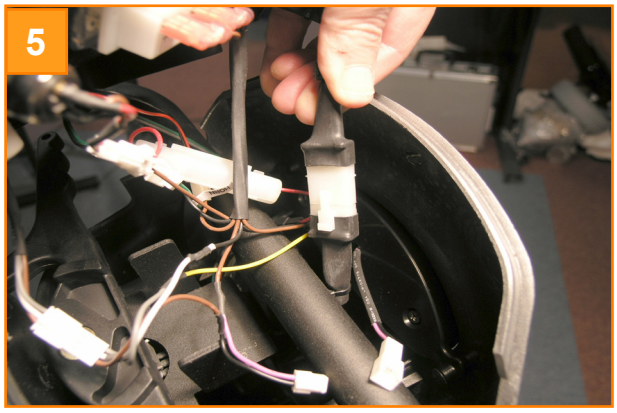
Lift the other side of the console out of the locating lugs.

4



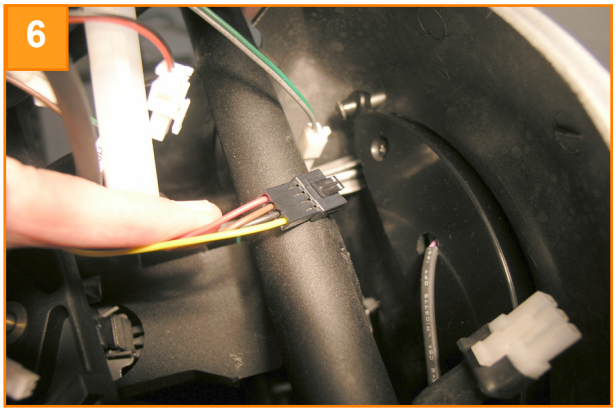
Release the locking clip & disconnect the 2 pin white plastic plug that has BLACK & PURPLE wires attached.

5



Release the locking clip on the large white 3 pin plug & disconnect.

6

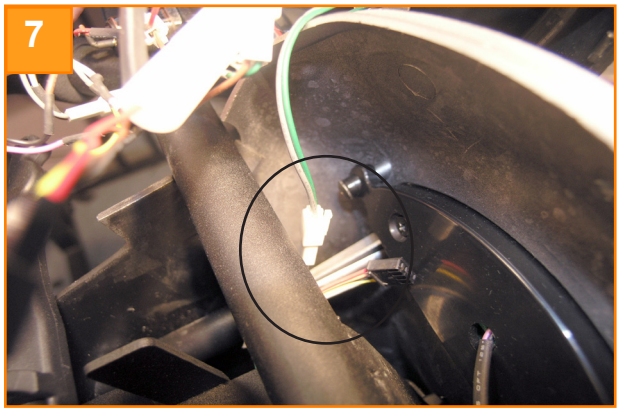


Release the locking clip on the black flat 4 pin plug & disconnect.

Tiller
Control Console

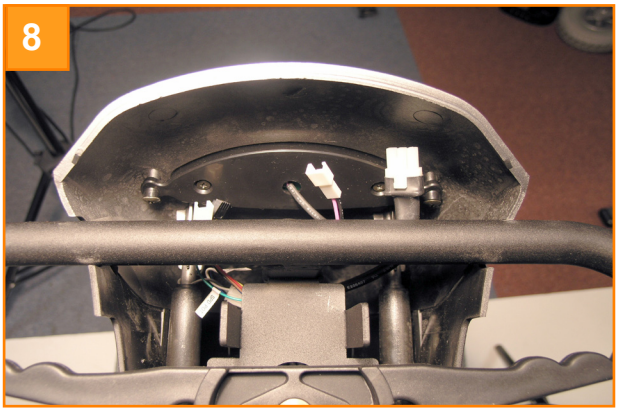
To refit the Tiller Console, reverse this process. Ensure that the battery boxes are removed from the scooter when replacing the Tiller Console to prevent accidental short circuits.

7



Release the locking clip & disconnect the 2 pin white plastic plug that has GREEN & GREY wires attached.

8

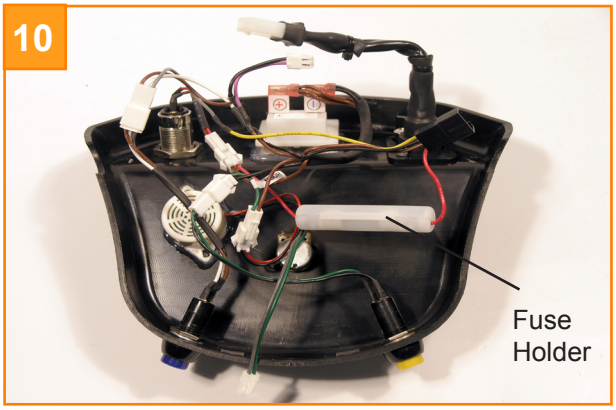


Note that all the wiring is routed in front of the tiller bar to prevent interference with the wig wag throttle operation.

9

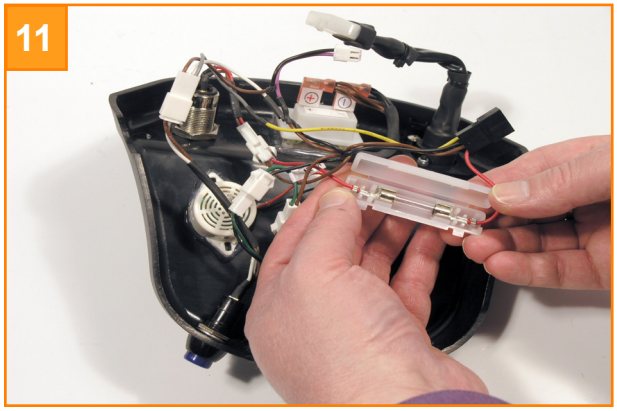
The Tiller Console removed.

10



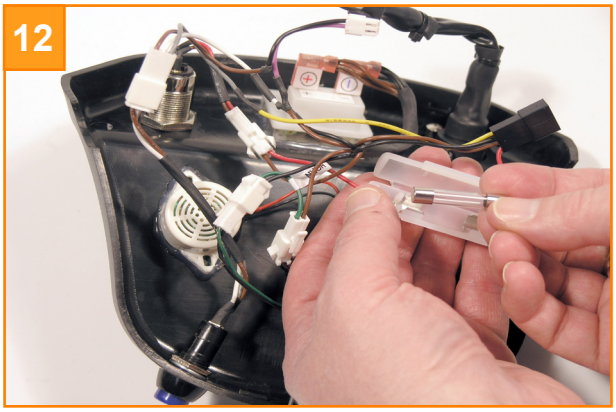
View of the under-side of the tiller console.
Note that the only replaceable part is the 2A fuse contained within the fuse holder.

11



If the key switch fails to turn the scooter ON, check the 2A fuse by opening the fuse holder to access the fuse.

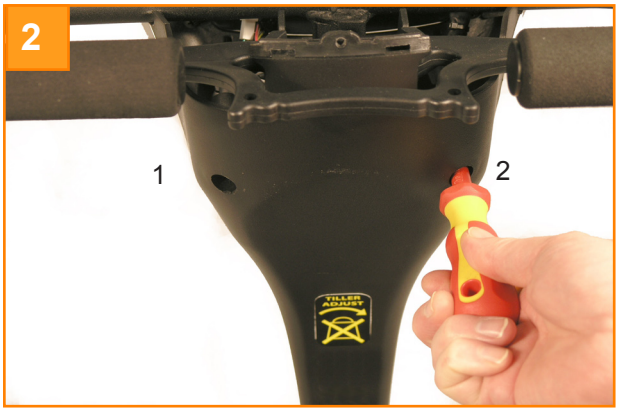
12



Carefully lift the fuse out.
Check it with a multimeter, using the method previously described in Chapter 5.

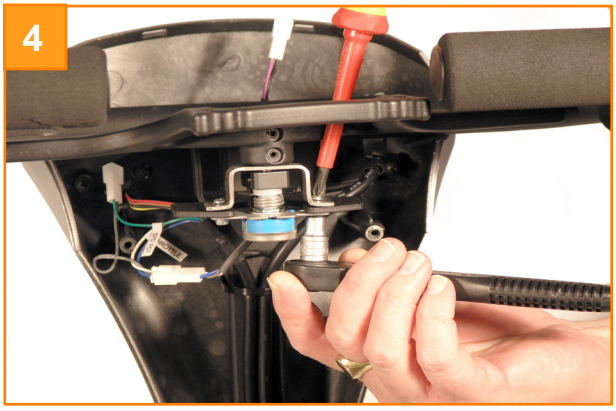
Tiller
Throttle Pot (wig wag).

Unscrew the Tiller Adjuster Knob.

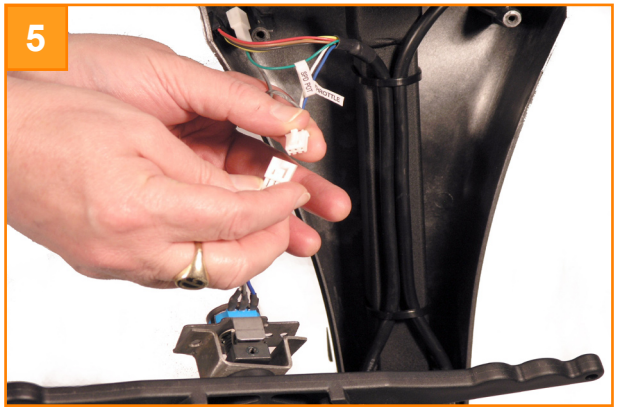


Use a Phillips screw driver to undo the 2 screws as shown above.

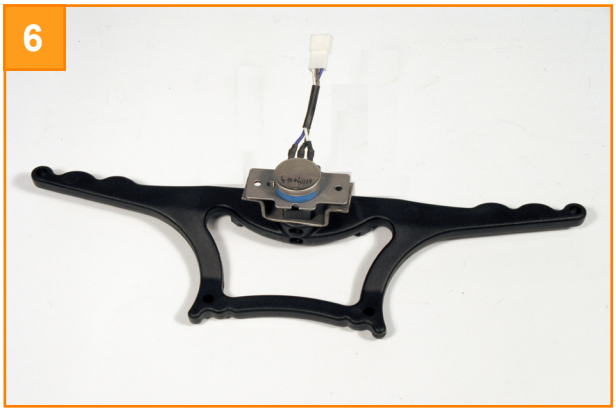
Carefully lift the Tiller Panel away.



Undo the 2 small bolts on the wig wag pot bracket using a small Phillips screw driver & 5.5 mm spanner/socket.



Disconnect the 3 pin plug.



The wig wag throttle pot assembly removed, (shown inverted for clarity).
Note that it is better to replace this part as a whole assembly, to preserve throttle calibration.

Tiller Panels

Remove the Control Console as described in Steps 1 - 12 “Control Console” at the start of this chapter.

1

Unscrew the Tiller Adjuster Knob.

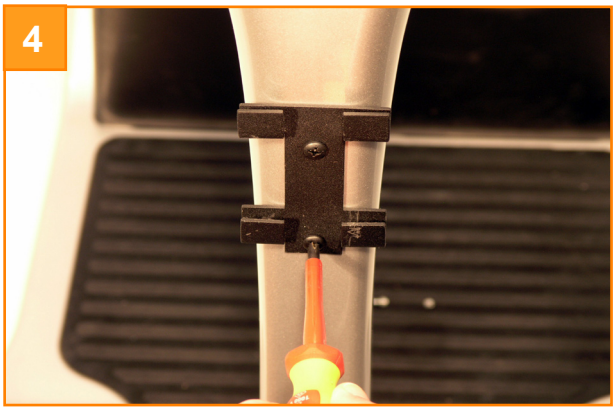
2

Use a Phillips screw driver to undo the 2 screws as shown above.

3

Carefully lift the Tiller Panel away.

4



Lift the basket off the bracket & undo the 2 screws securing the bracket to the tiller frame.

5

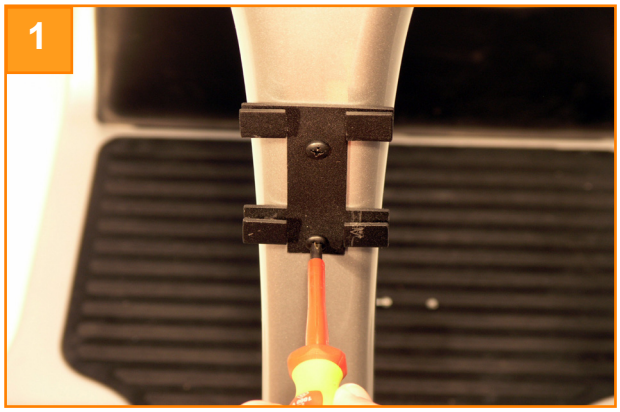
Remove the bracket & the panel will come with it.

6

Front & Rear Tiller panels, Basket Bracket, Console & Wig Wag assembly.

Tiller
Front Light

1

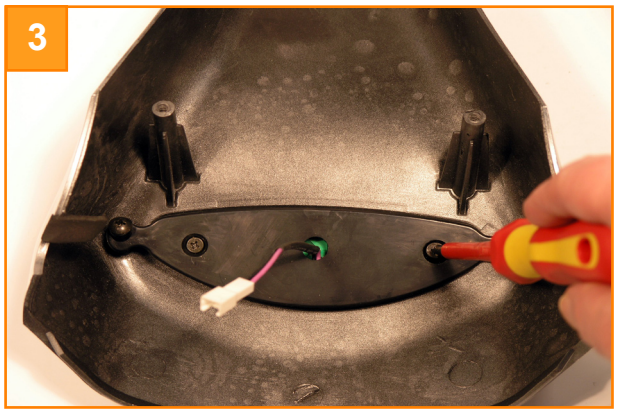


Remove the Console & undo the Basket Bracket as previously shown.

2

Remove the Front Tiller Panel as previously shown.

3



Use a Phillips screw driver to undo the 2 inner screws on the back of the Front Light.

4

Turn the panel over & lift the Front Light Lens off.

5

Carefully withdraw the LED array. Ensure that the 2 pin plug clears the hole OK. Do not force it by pulling the wires.

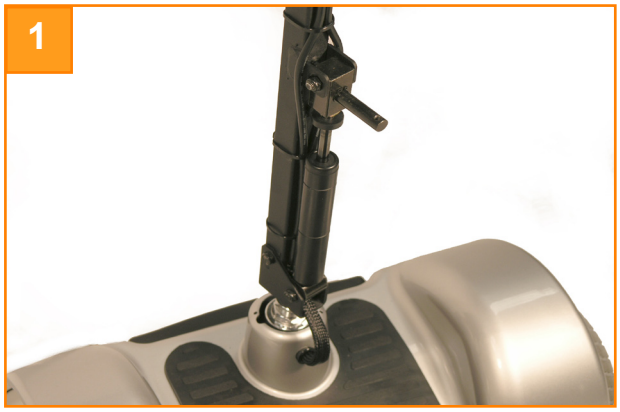
6

The LED Array & Lens.
Use caution when refitting as over-tightening the screws can crack the Lens.

Tiller
Air Strut

Remove the Tiller Console & Panels as previously described, to access the Air Strut.

1

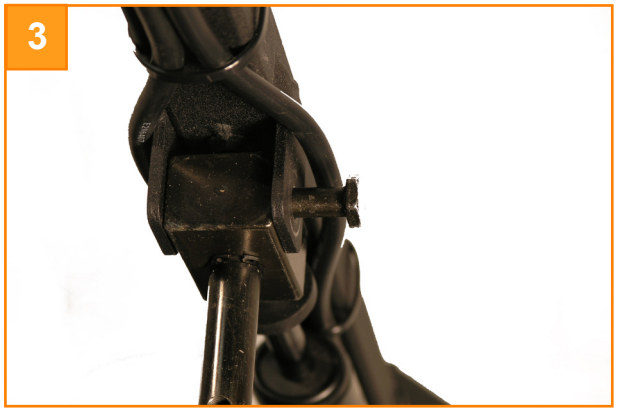


The Air Strut is located behind the Tiller Bar.

2

Use a 13mm spanner/socket to remove the nut on the top bolt.

3



Leave the top bolt partially in place to prevent the tiller bar from dropping.

4

Do the same for the bottom bolt.

5

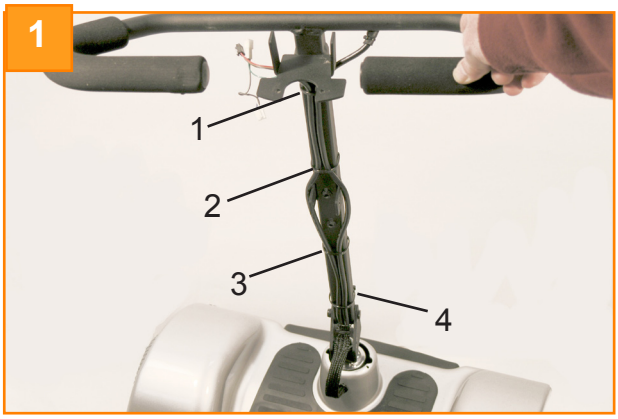
Hold the Tiller Bar to prevent it falling and remove the bolts & Air Strut.
Note that when refitting, place the loom sock between the bottom front edge of the air strut & the tiller bar so that it is sandwiched between the two.

6

The Air Strut assembly.

Tiller
Bar Removal

1



Cut the 4 cable ties that secure the 2 looms to the tiller frame.

2

Gently pull the loom away from the tiller frame.

3

Lay the tiller flat & use a 13.0mm spanner/socket to undo and remove the tiller pivot bolt.

4

Lift the tiller out of the tilt bracket.

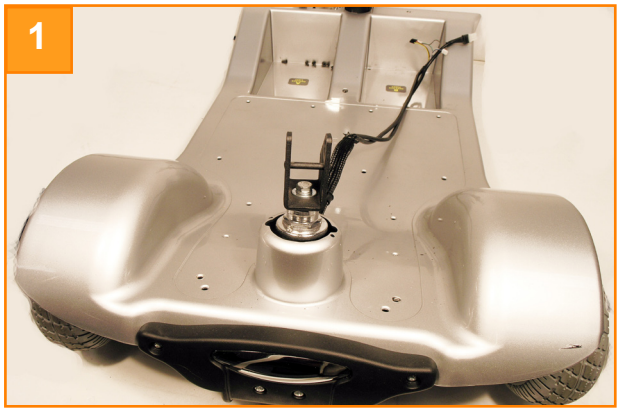
5

The Tiller Frame removed.

6

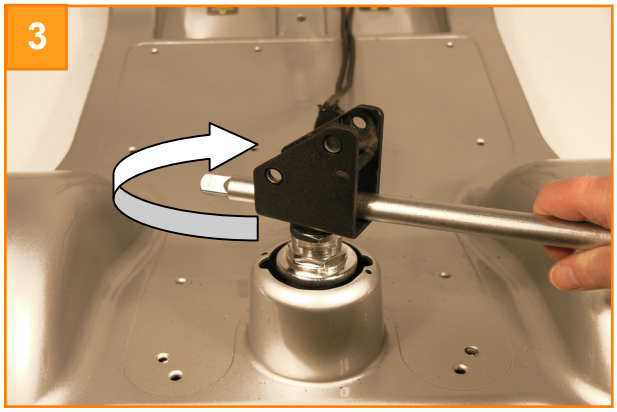
To remove the foam handlebar grip, lift the plastic end cap out using a flat blade screw driver and slide the foam off. Reverse the process to refit a new foam grip.

Tiller
Connecting Bracket

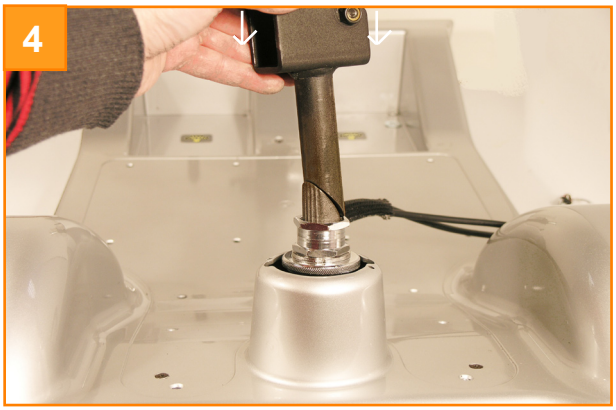


The connecting bracket is secured by one long bolt.

Turn the bracket against the steering stop then use a 13.0mm socket & extension to undo the bolt approximately 3 - 4 turns. Do not undo completely.

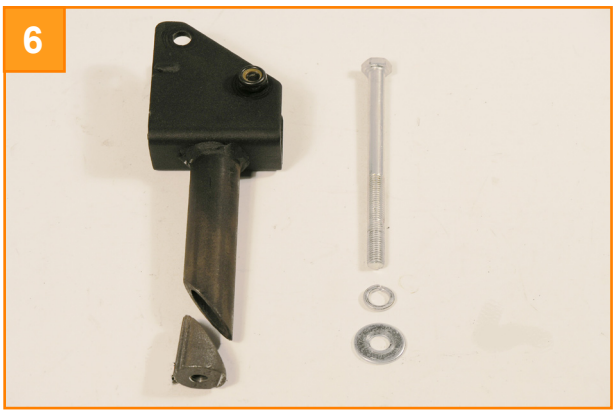


The bracket relies on the tightening of friction fittings & may require the seal breaking by turning with a “tommy” bar as shown.



Withdraw the bracket. When refitting ensure the drive wheels are front & parallel to each other & the tiller connecting bracket is facing straight ahead.

Notice the small segment at the foot of the connecting bracket. The segment is part of the friction fit. As the bolt tightens the segment moves in a shear motion that wedges it inside the tube of the steering head.



The Tiller Connecting Bracket.

CHAPTER 8

Wheels

Front Removal

If a clean safe space is available, it is a good idea to remove the seat and batteries from the scooter, loosen the axle stud and tip it on one side to remove the wheel.

1

With the wheel on the floor, use a 5.0mm allen key to loosen the axle stud.

2

Tip the scooter on to its side for better access to the wheel.

3

Remove the axle stud taking care not to lose the washers.

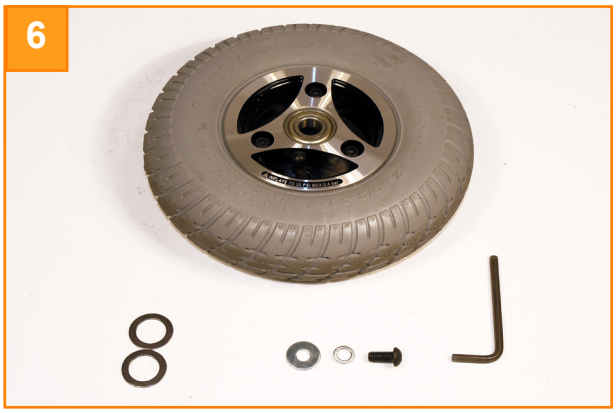
4

Lift the wheel of the stub axle.

5

Remove the 2 spacers.

6



The Front Wheel assembly removed.
Store all fixings in a safe place.

Wheels

Rear Removal

The scooter can be tipped on one side as for the front wheel removal, or the rear drive assy can be detached and worked on as a separate assembly.

1

Place the scooter into drive to stop the wheels turning.

2

With the wheel on the ground, use a 19.0mm socket to loosen the centre nut.

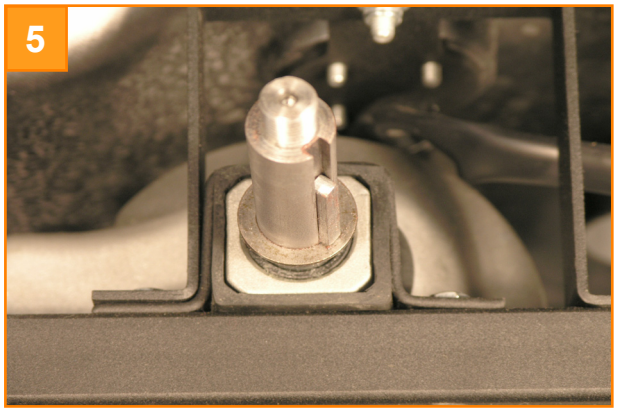
3

Either turn the scooter on one side or split the drive assembly & turn that on end, then remove the nylok nut & washer. Always use a new nut when refitting.

4

Gently remove the wheel.

5



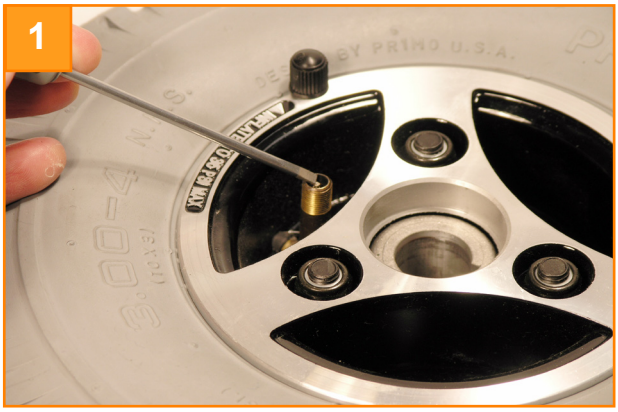
Take care not to lose the drive shaft key.

6

The Rear Wheel assembly.

Wheels
Tyre Removal

This process is similar for front and rear wheels (rear shown for process).



Remove the valve dust cover & use a valve extractor tool or small screw driver to depress the valve stem & let the air out.

Squeeze around the rim on both sides to loosen the tyre wall from the hub.

For the rear tyres use a 13.0mm socket on the 3 nylok nuts. Always use new nuts when replacing the wheel.

On the other side of the rear tyre rim, use a 5.0mm allen key or allen key driver to hold the studs.

For the front tyres use a 10.0mm socket on the 3 nylok nuts. Always use new nuts when replacing the wheel.

On the other side of the front tyre rim, use a 5.0mm allen key or allen key driver to hold the studs.

Wheels
Tyre Removal

7

Lift the rim out of the tyre. If the rim sticks to the tyre, gently tap the rubber tyre with a soft faced hammer to loosen it.

8

Lift the tyre off the other rim. If it sticks to the tyre do the same as the previous instruction.

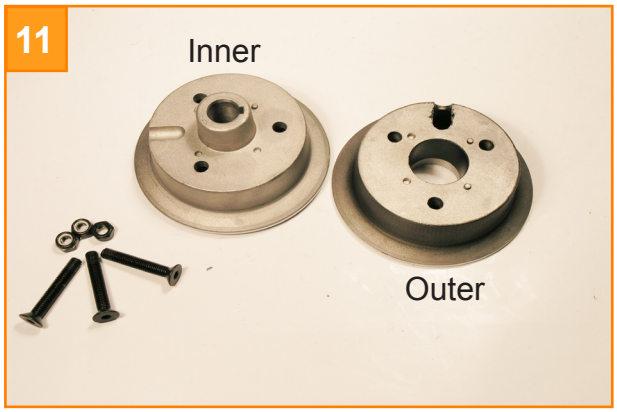
9

Squeeze the tyre down and let more air out of the inner tube.

10

With all the air removed, gently feed the inner tube out of the tyre taking care not to pull or twist on the valve stem.

11



The Inner & Outer Rims.
Note the outer rim always has a slot or hole to access the valve.

12

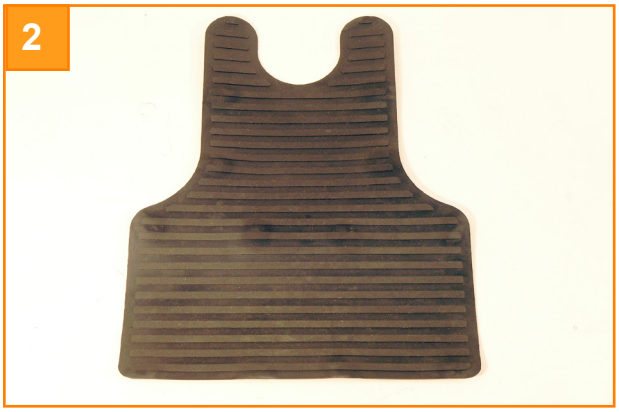
The Tyre & Inner Tube.
When refitting, once the tube is inside the tyre, inflate it slightly to aid replacement & prevent pinching.

CHAPTER 9 Front Frame
Front Panel, Mat & Bumper

1

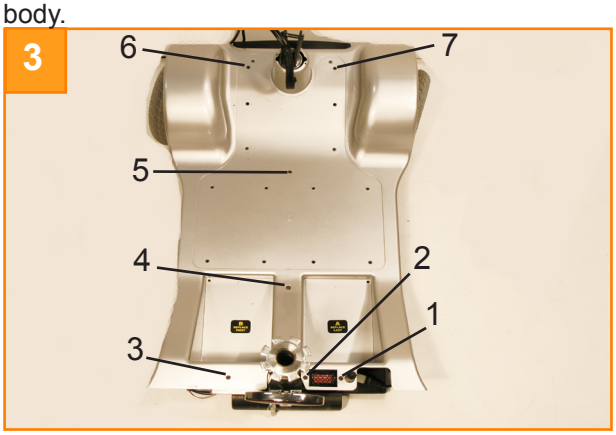
The foot mat will peel back for removal. When refitting, drop the mat in place & press down so that the soft rubber location bungs pop through the body.

2



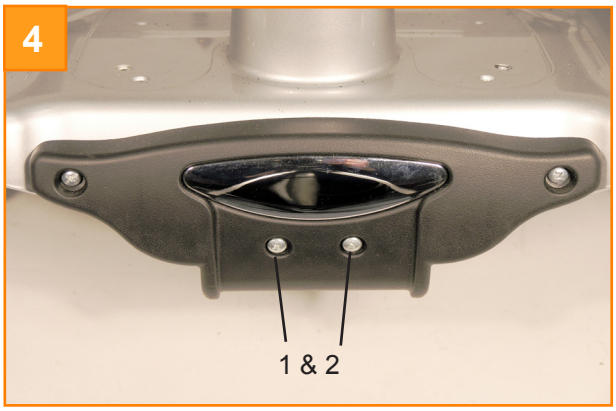
The Foot Mat removed.

3



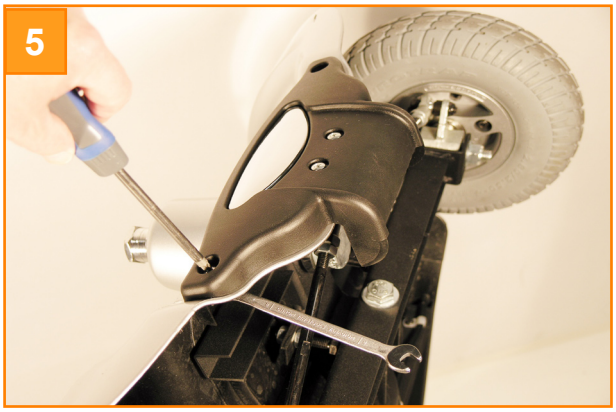
There are 7 screws securing the front panel accessible from the top side. Use a Phillips screw driver to undo them.

4



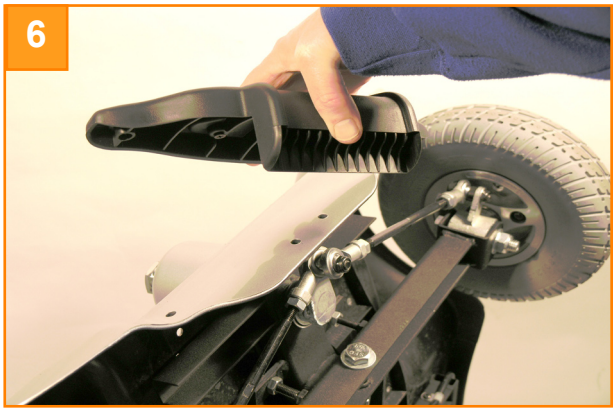
A further 2 screws secure the front panel through the bumper (1 & 2). Remove these 2 only to release the front panel with the bumper attached.

5



Use an 8.0mm spanner & phillips screw driver to undo the bumper bolts. Remove all 4 bolts to release the bumper assembly.

6



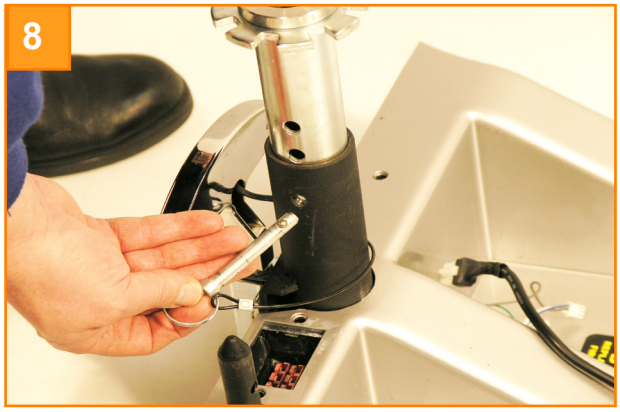
Lift the bumper away from the body panel.

Front Frame
Front Panel, Mat & Bumper

7

The Front Bumper assy. Note that the 2 small bolts locate on the edges of the assembly. To remove the silver trim, undo the 2 screws located behind it.

8



Remove the seat height locking pin.

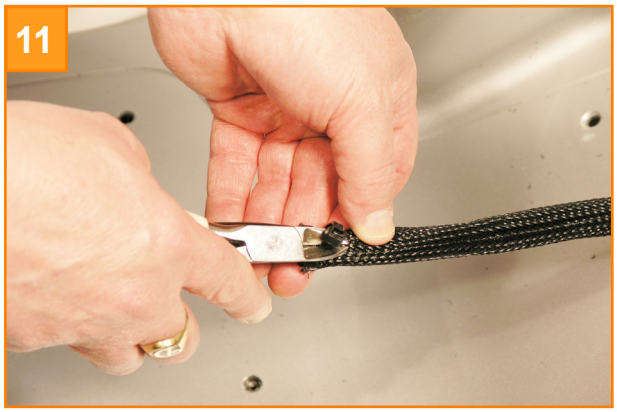
9

Ensure that the panel can move freely over the battery box locating pin.

10

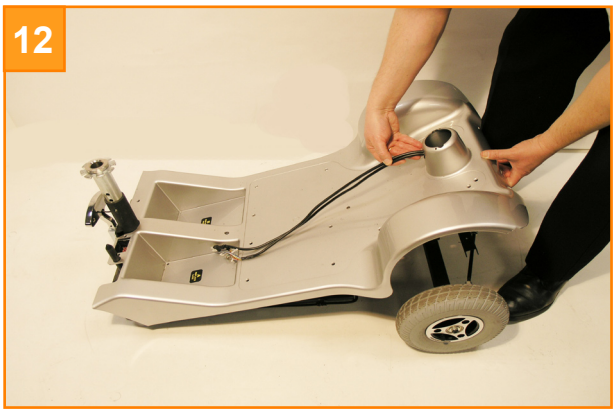
Pop the grommet out & slide it over the tiller console end of the main loom.

11



Cut the cable tie to allow the grommet to pass.

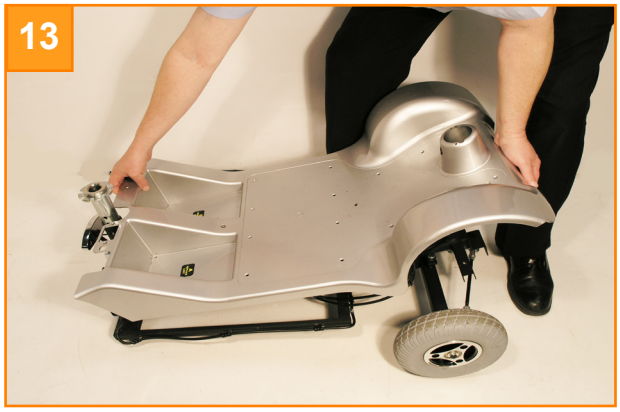
12



Lift the front of the panel & carefully feed the main loom through the hole.

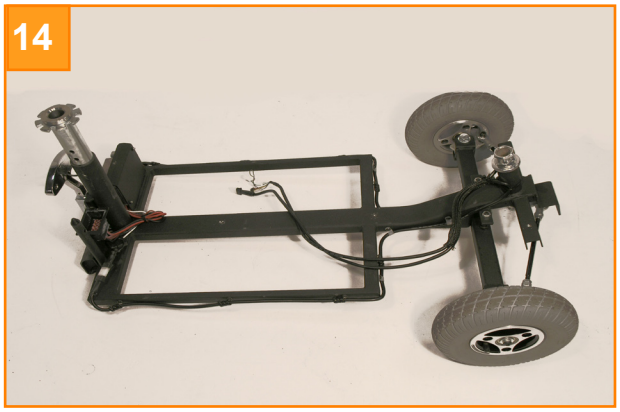
Front Frame
Front Panel, Mat & Bumper

13



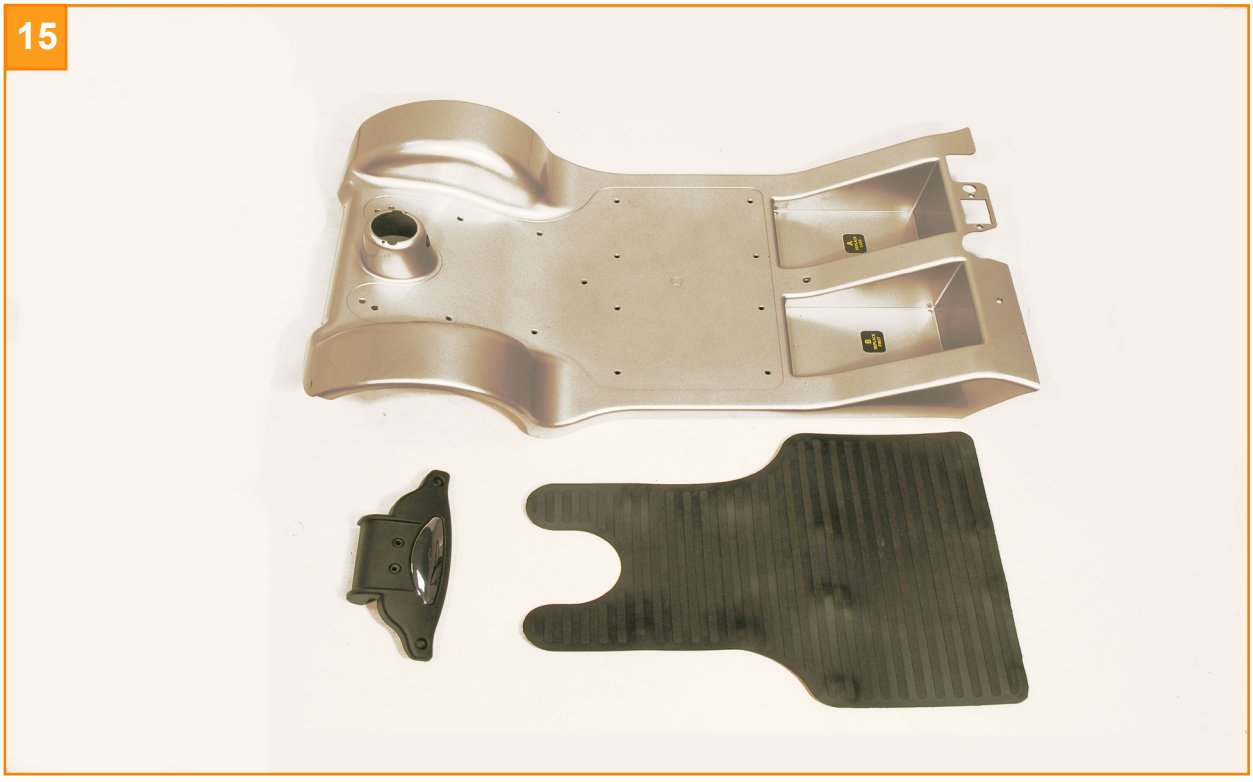
Carefully tilt the front end up slightly then lift the back to clear the battery box locating pin.

14



The scooter chassis revealed.

15



The Front Panel, Mat & Front Bumper removed.

Front Frame
Steering Connecting Rods

This process is best carried out with the front panel removed.

1

Use a 6.0mm allen key & 13.0mm spanner to undo the wheel end of the steering connecting rod.

2

Carefully remove the bolt.

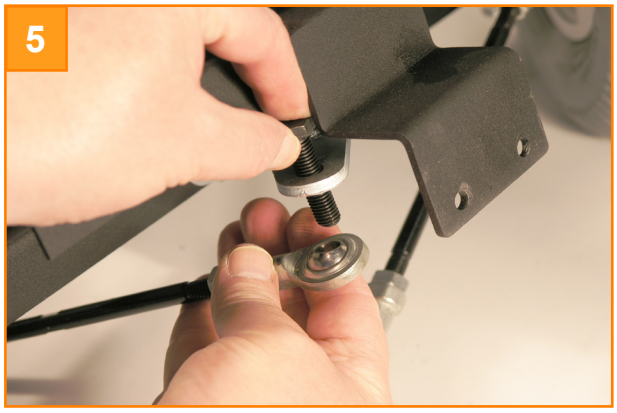
3

Remove the spacer & keep it in a safe place. Repeat the process for the other rod/wheel connection.

4

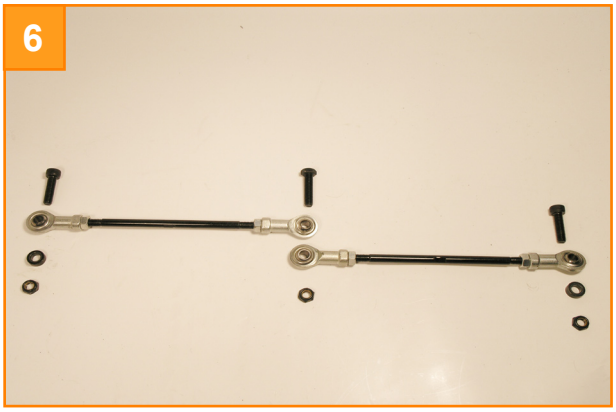
Using a 13.0mm flat spanner & 13.0mm socket, remove the centre nut.

5



Drop both steering connecting rods off the centre bolt taking care not to bend the rods. Move the steering stem to gain access to withdraw the bolt.

6



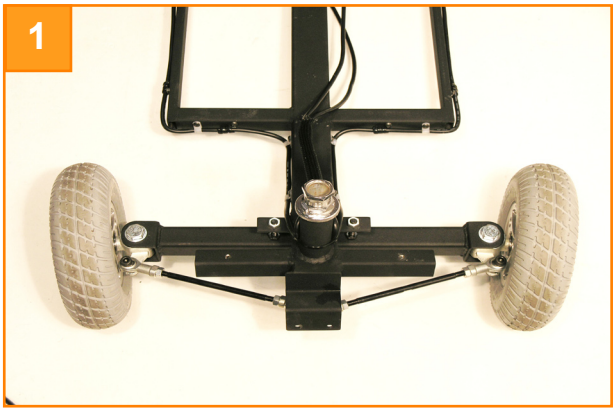
The Steering Connector Rods.
Note that if excessive tyre wear is evident ensure that these rods are not bent or out of adjustment.
See next page.

Front Frame

Adjusting the Steering Track

If the steering is not set up correctly severe tyre wear and low range become evident. Below are some examples to identify this problem.

1

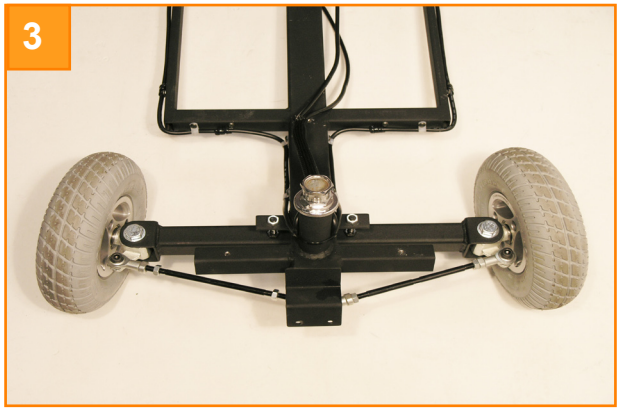


Above is an example of TOW IN.

2

The tyre exhibits scuffing or a lightening of the tread colour on the outside half of the tyre.
View from front of scooter.

3

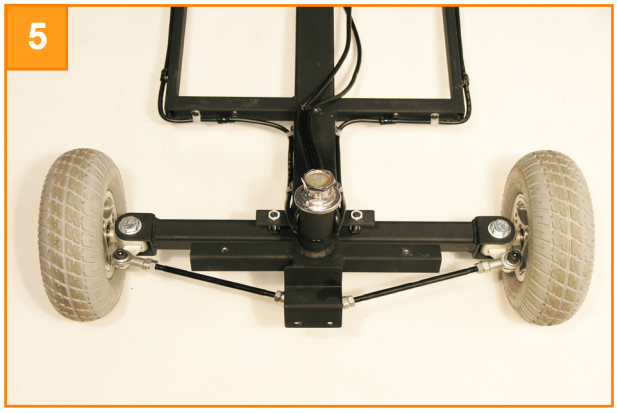


Above is an example of TOW OUT.

4

The tyre exhibits similar wear patterns as the tow in fault, but the damage is on the inside edge.
View from front of scooter.

5



Above is an example of correctly set tracking.

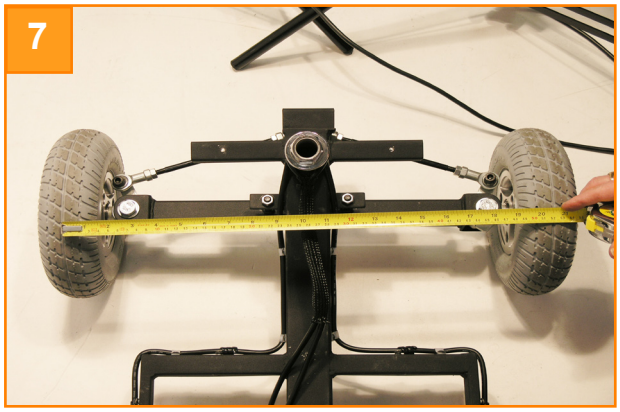
6

The tyre has no scuffing & any signs of normal wear are symmetrical.

Front Frame
Adjusting The Steering Track

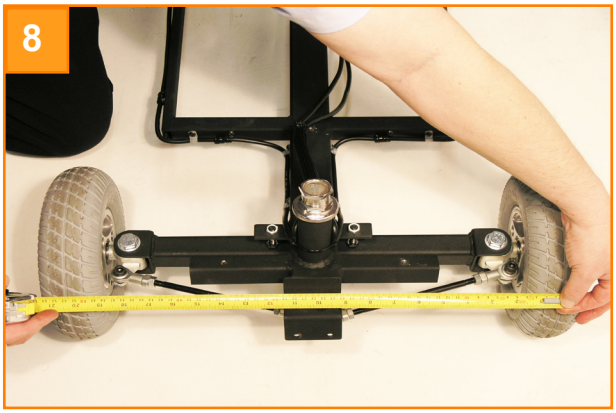
The steering should be turned straight ahead during this process. This process can also be done with the front panel in place by removing the batteries, seat and drive assy and turning the scooter on its back.

7



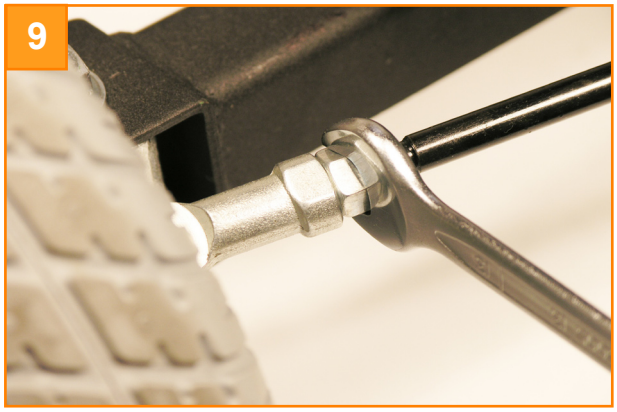
The easiest way to check for correct tracking is to measure the distance between the tyre centre tread line. Start at the back of the tyres.

8



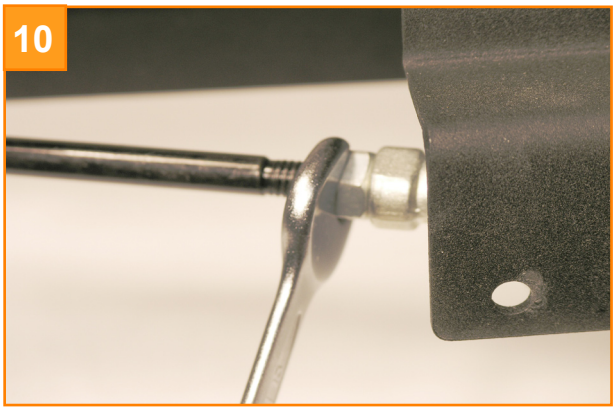
Then measure the front of the tyres. The measurement should be the same (520mm).

9



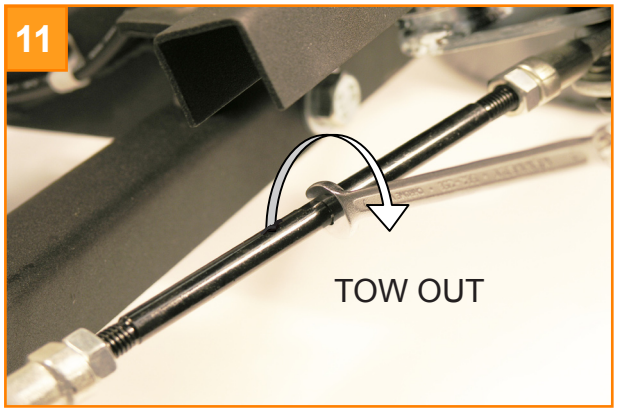
To adjust the steering tow, loosen the lock nut on the wheel end of the connecting rods using a 13.0mm spanner.

10



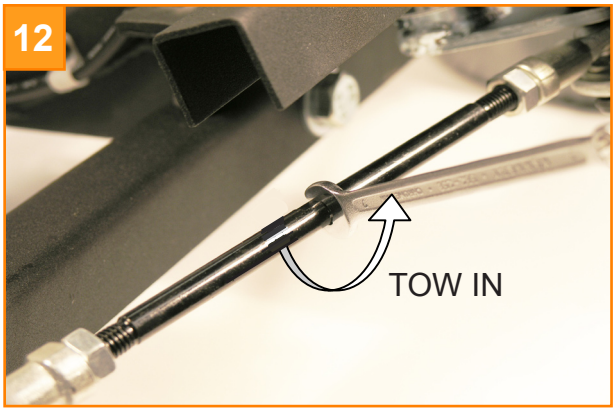
Next, loosen the lock nuts at the steering stem end.

11



The connecting rods should turn by hand for adjustment. If not, use a 7.0mm spanner or pliers. Turn as shown above for TOW OUT.

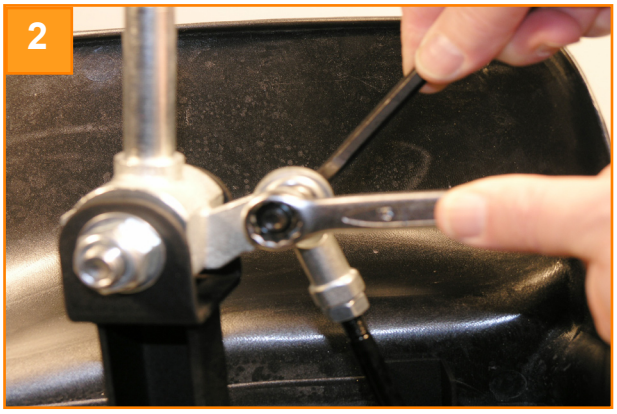
12



Turn as shown for TOW IN. When the steering is set, tighten all locking nuts. Measure the steering to check all is OK.

Front Frame
Stub Axles

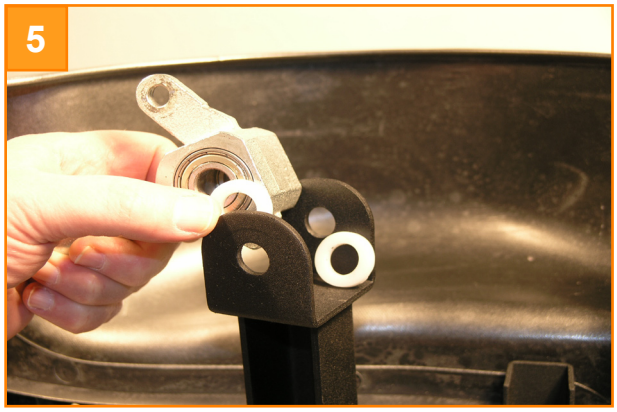
Remove the front wheel using a 5.0mm allen key, as previously described.



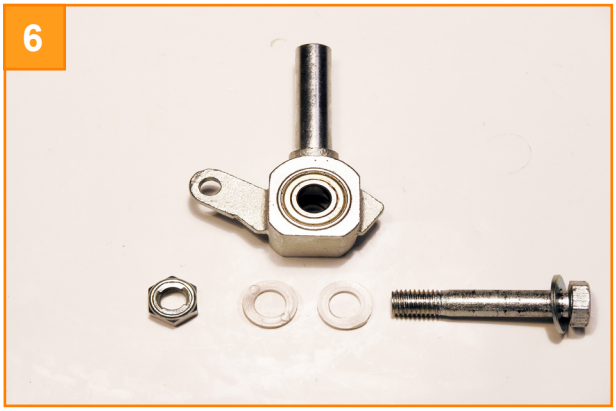
Disconnect the steering connecting rod from the stub axle using a 6.0mm allen key & 13.0mm spanner, as previously described

Move the end of the rod out of the way.

Undo the stub axle nut & bolt using a19.0mm spanner/socket as shown.



Lift the stub axle out of the cross member. Take care not to lose the 2 nylon washers.
Repeat for the other side if required.

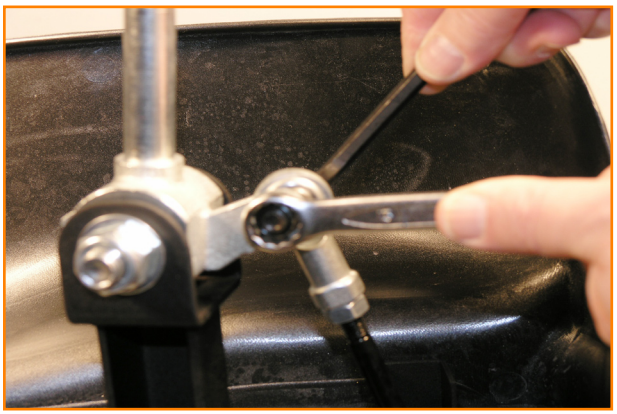


The Stub Axle assembly.

Front Frame
Front Axle

Turn the front frame assy on it's side or back to aid access.

Remove the front wheels as previously described.



Disconnect the steering connecting rods from the stub axles as previously described.

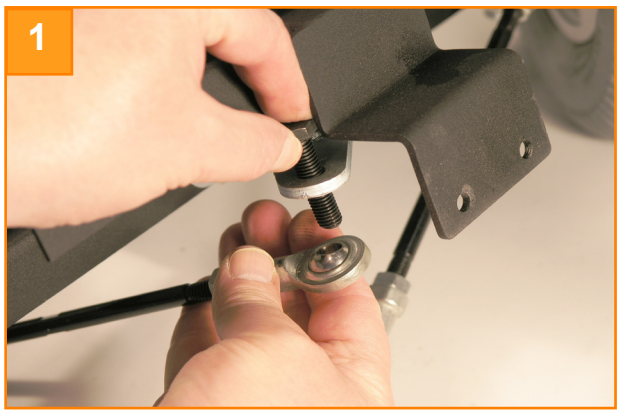
Remove the stub axles as previously described.

Use a 19.0mm spanner/socket to undo the lock nut on the front axle bolt.

Remove the lock-nut & unscrew the bolt from the welded nut.

The Front Axle.

Front Frame
Steering Stem



Undo the steering connector rods at the steering stem end, as previously shown.

To avoid removing the front panel. Remove the seat, batteries & rear drive assembly. Invert the scooter. Use a 13.0mm spanner & socket.

Use an adjustable spanner (or 32.0mm spanner) to loosen the top nut.

Remove the sleeve nut. Note that the sleeve faces downwards. On refitting tighten onto the bottom nut. Hold the bottom nut with a second spanner.

Loosen the bottom nut in the same way.

Carefully remove this by hand. Note that the sleeve faces upwards on the bottom nut. On refitting, tighten down using finger pressure only.

Front Frame
Steering Stem

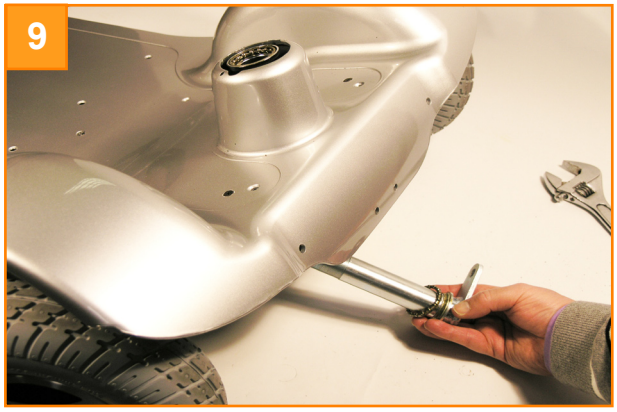
7

Lift the lock washer off. On refitting, tighten down to finger pressure onto the locking ring.

8

Unscrew the upper head cup locking ring. The ring usually unscrews using hand pressure. On refitting, tighten to finger pressure then loosen by half a turn.

9



Withdraw the steering stem from below the steering head.

10

The bottom bearing should come out with the shaft. If it does not, fingers can be used to lift it out of the lower steering head cup.

11

Lift the upper bearing out of the steering head cup.

12

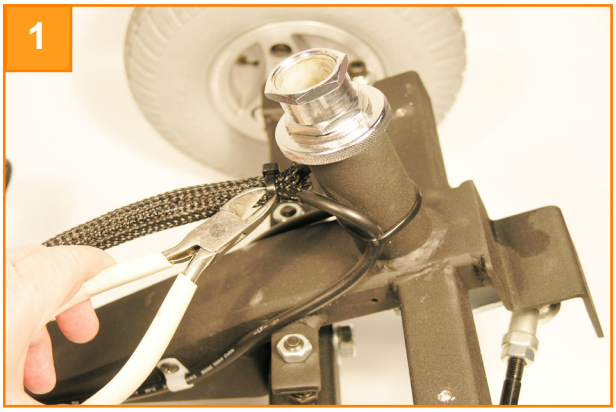
The Steering Stem assembly.

On refitting, check that the steering is fully free to move from left hand lock to right hand lock without stiffness & that there is no up & down play in the steering head.

Front Frame
Main Loom (Charger)

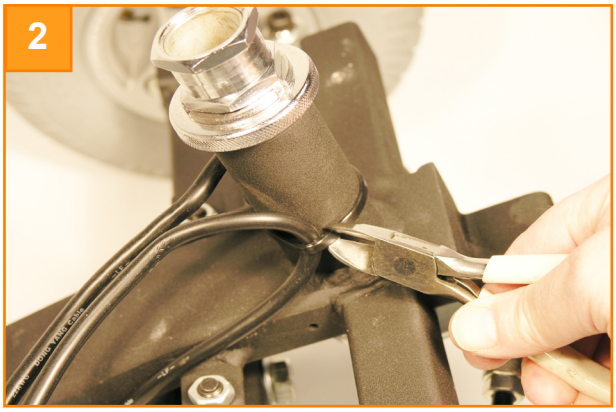
The Main Loom is 2 looms running down the tiller & onto the frame where they split down each side. Follow the procedures for removing the Tiller, Panels, Console & Front Panel.

1



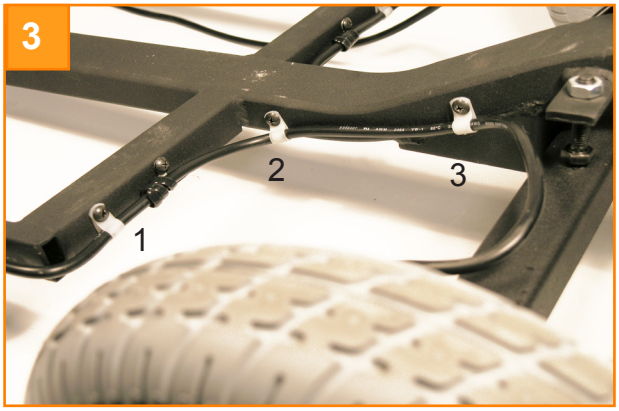
Cut the cable tie on the loom sock & slide the sock up the charger loom & over the plugs.

2



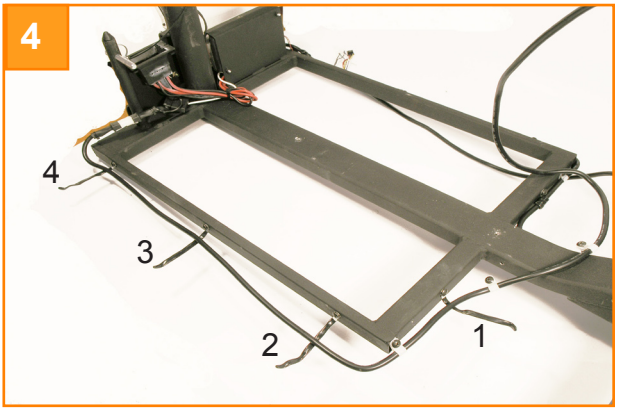
Cut the cable tie located on the steering stem housing.

3



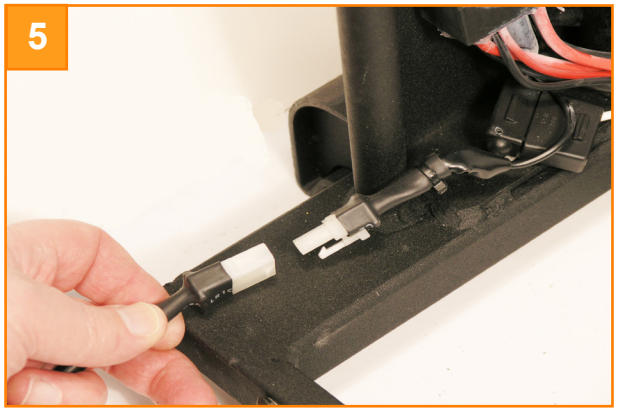
Use a Phillips screw driver to unscrew the 3 “P” clips holding the front of the charger loom. Repeat this for the control loom on the other side if required.

4



Uncurl the remaining 4 wire cable grips to free the charger loom. Repeat this for the control loom on the other side if required.

5



Disconnect the loom at the plug as shown.

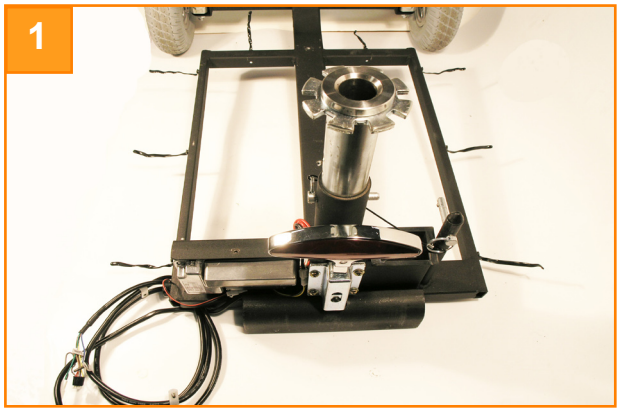
6

The charger loom has a 7.5 auto blade fuse. If charging fails, check this fuse & the fuses in the charger & mains plug, before replacing the charger or charging loom.

Front Frame
Control Box & Looms

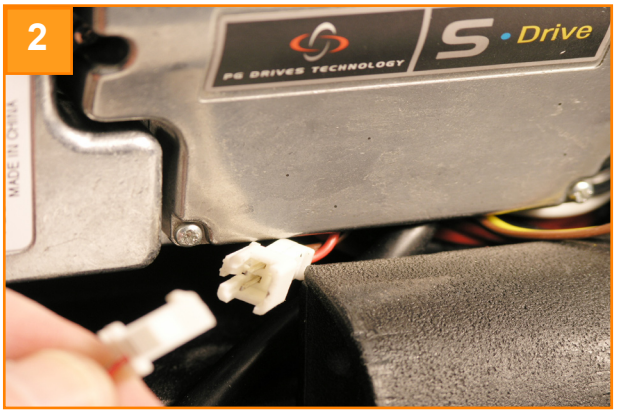
Follow steps 1 to 4 on the previous page.

1



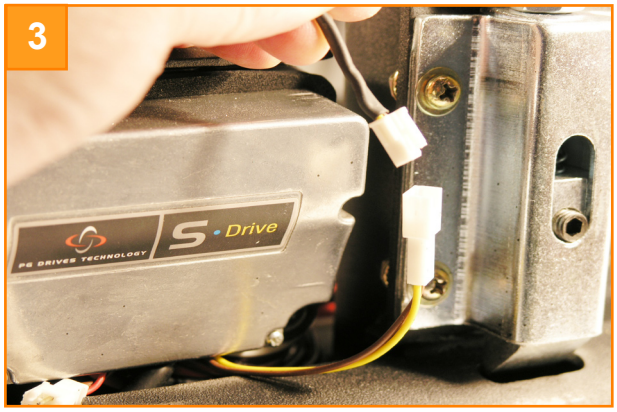
Free the control loom from the “P” clips & cable ties as previously described.

2



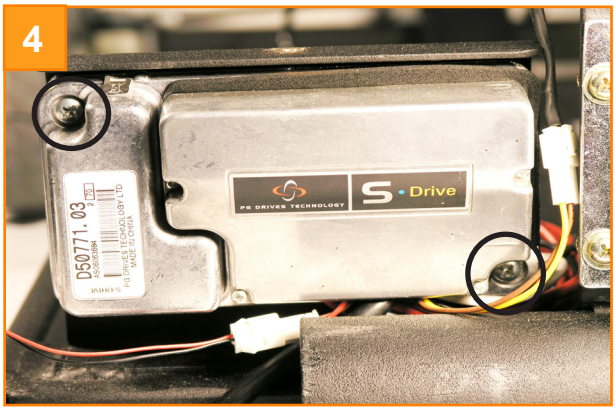
Unplug the reverse alarm.

3



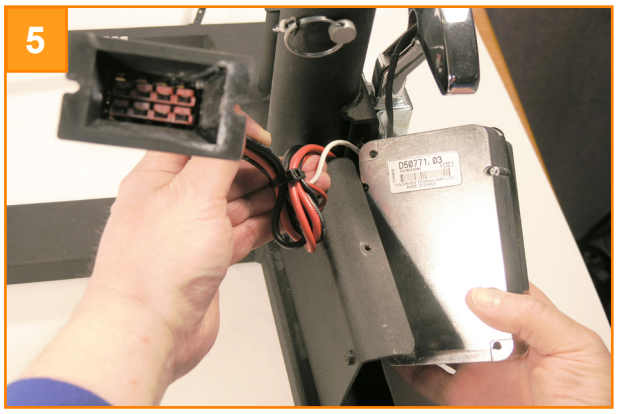
Unplug the rear light.

4



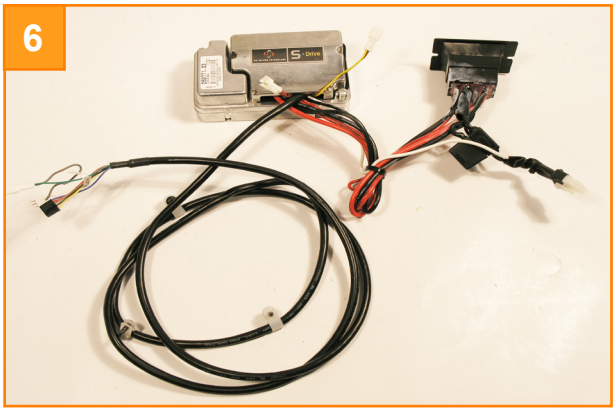
Use a Phillips screw driver to undo the 2 bolts on the controller.

5



Feed the 8 pin socket loom through the gap & lift the controller away from the bracket.

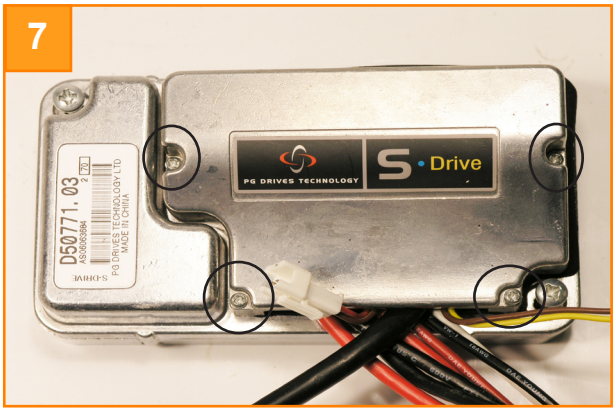
6



The controller with the 8 pin loom & control loom attached.

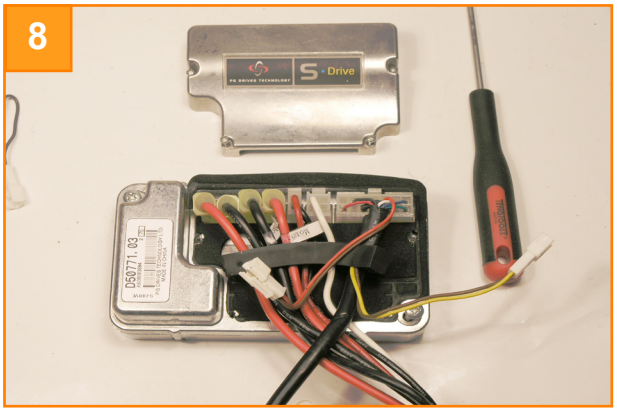
Front Frame
Control Box & Looms

7



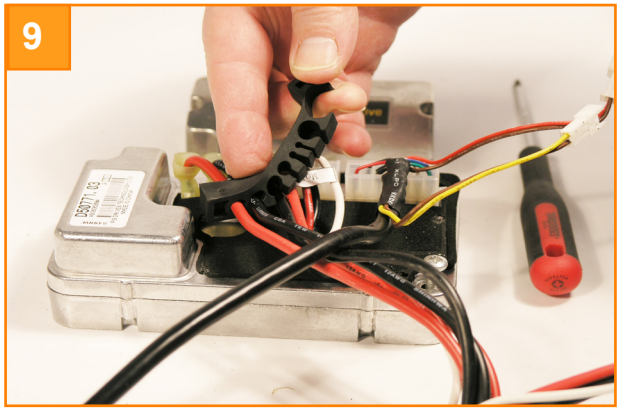
Undo the 4 screws to release the wiring cover.

8



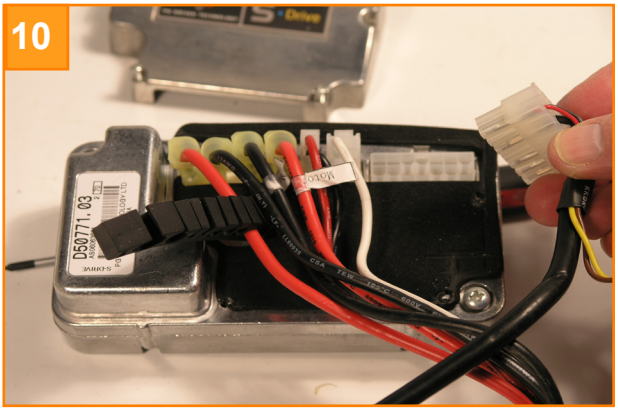
Removing the cover exposes the terminals & plugs.

9



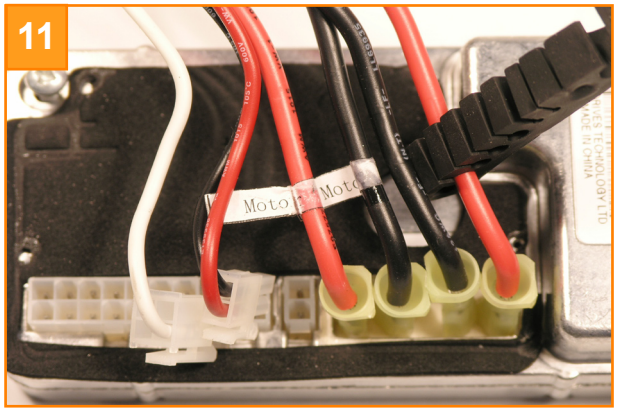
Peel off the rubber cable spacer.

10



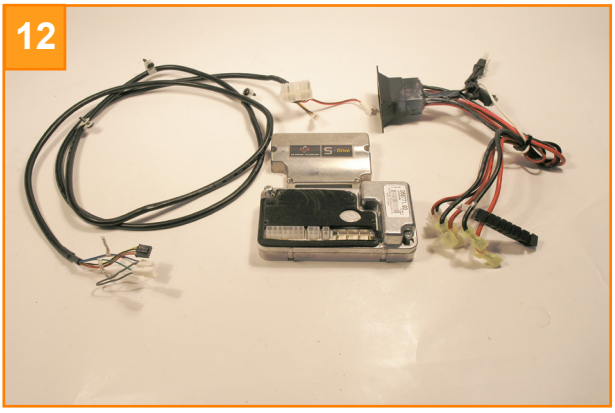
Unplug the Control Loom.

11



Make a note of the wiring layout before disconnecting any wires.

12

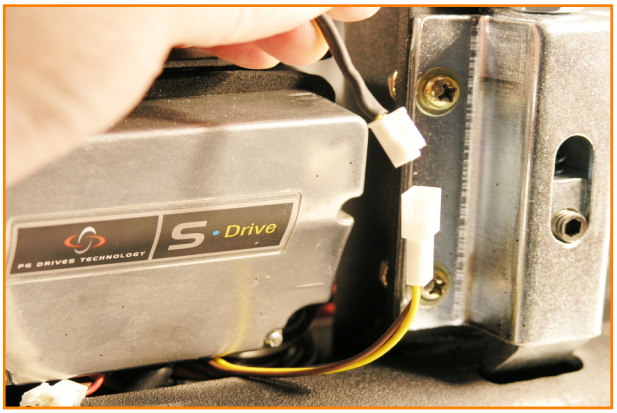


The Control Loom, Controller & 8 pin Loom. Always ensure that the black water seal gasket is in place before refitting the cover

Front Frame
Rear Light

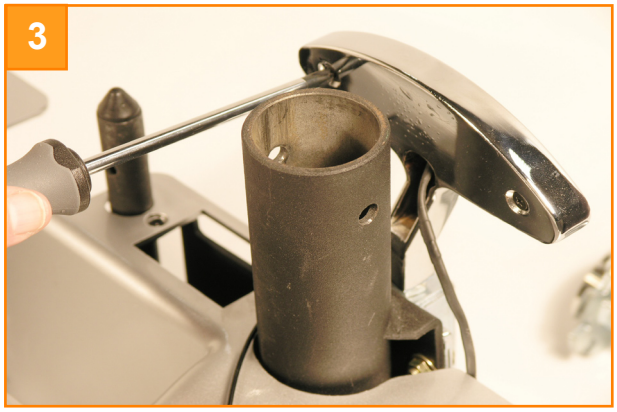
1

Withdraw the pin from the seat stem & lift the seat stem out to aid access to the rear light.



Disconnect the rear light loom from the controller.

3



Use a Phillips screw driver to undo the 2 screws at the back of the rear light.

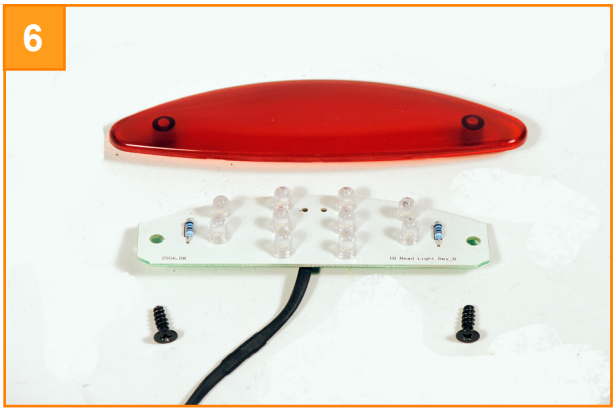
4

Gently remove the red lens.

5

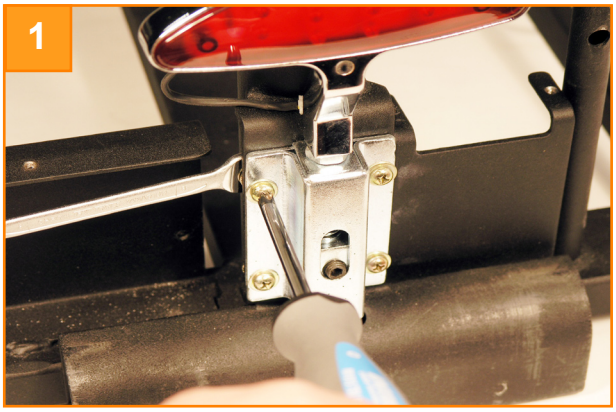
Carefully remove the LED pcb. The loom will come out with it.

6



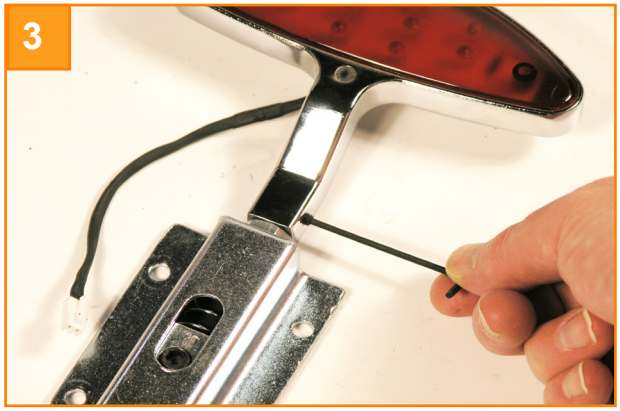
The Rear Light Lens & LED PCB.

Front Frame
Docking Lock

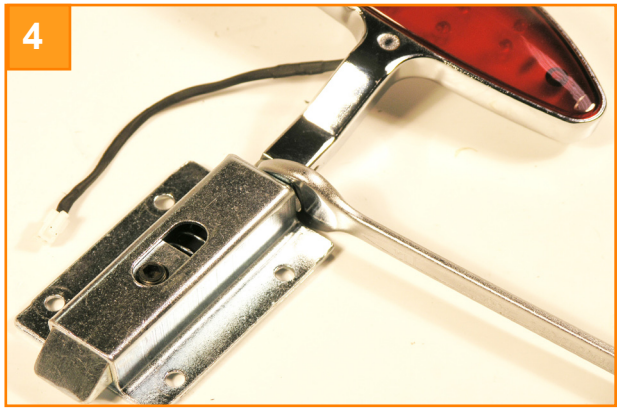


Use an 8.0mm spanner & Phillips screw driver to undo the 4 screws directly beneath the rear light.

Lift the rear light & docking lock assembly away from the chassis.

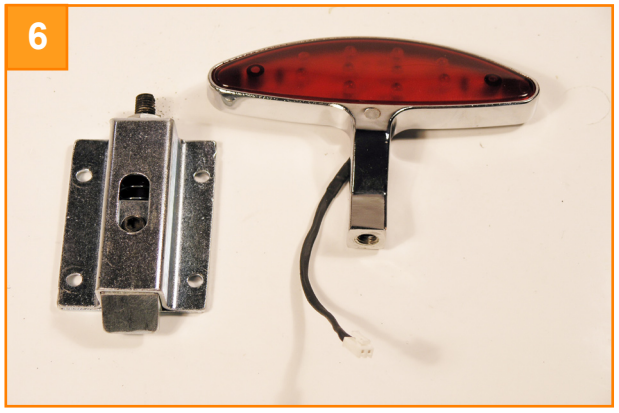


Use a 2.0mm allen key to undo the set screw on the rear light stem.



Loosen the lock nut using a 14.0mm spanner.

Turn the body of the rear light to unscrew it from the docking lock.



The Docking Lock & Rear Light.

Sunrise Training and Education Programmes

SERVICE INFORMATION

IMPORTANT

Sunrise Medical recommend and support the factory installed programme only. Details of the recommended programme are set out in this Technical Manual within Chapter 10.

Any deviation from this programme is deemed to be a third party fit and as such the responsibility for any modification lies with the person amending the programme.

Any alterations or amendments must be carried out by competent personnel and a full function test should be performed to confirm suitability and safety of the installed programme. All parameters should comply with acceptable safety standards.

If in any doubt do not change anything, as a wrongly installed programme could lead to a dangerous drive profile.

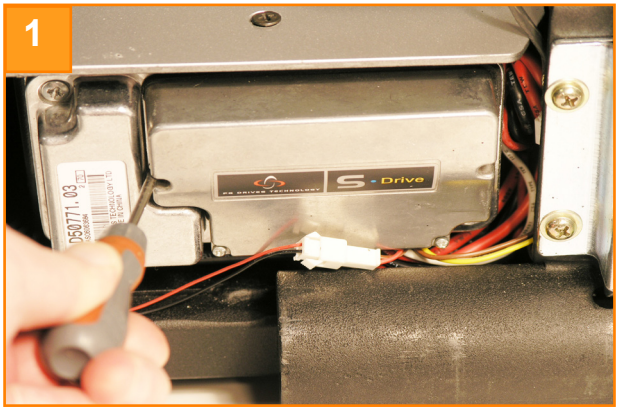
Contact Sunrise Medical for further advice.

CHAPTER 10

Programming Port Access

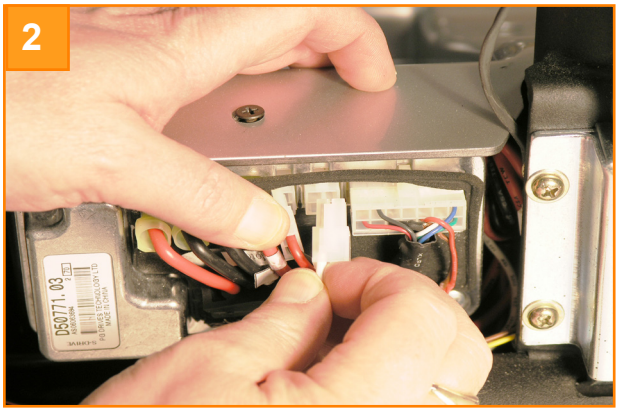
This process starts with the seat, batteries and drive assembly removed.
Use SP 1 Hand Held Programmer or PGDT PC Programming Software.

1



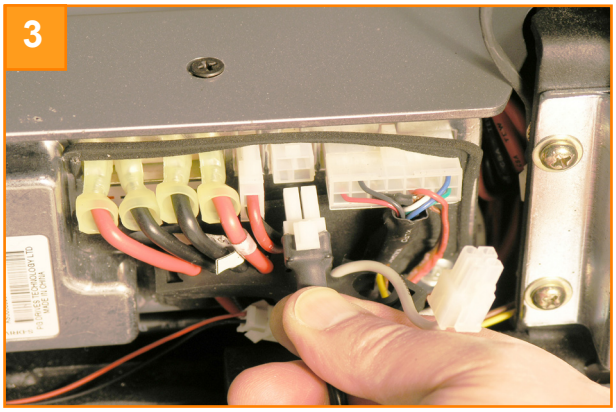
Use a small Phillips screw driver to undo the 4 screws securing the cover on the main controller

2



Unplug the 4 pin white Molex plug.

3



Plug the programmer lead into the now vacant 4 pin socket. Leave the cover off the controller during programming.

4

Tuck the programmer lead into the slot next to the seat stem to keep it out of the way.

5

Carefully refit the drive assembly holding the programme lead clear as it snaps shut.

6

Refit the battery boxes. Turn the scooter on. Follow the programming instruction manual, referring to the Sunrise approved programme overleaf.
When programming is done, disconnect the programme lead & refit the main controller cover.

Programming Parameter List

SPEED SETTINGS	FAST	SLOW
FWD ACCEL (0.1Sec. Increments)	25	25
FWD DECEL (0.1Sec. Increments)	9	6
REV ACCEL (0.1Sec. Increments)	30	30
REV DECEL (0.1Sec. Increments)	10	7
MAX FWD SPEED %	100	100
MIN FWD SPEED %	30	30
MAX REV SPEED %	50	50
MIN REV SPEED %	30	30
SPEED LIMIT POT ENABLED	OFF	
OPERATION SETTINGS		
SLEEP TIMER (Minutes)	15	
THROTTLE INVERT	NO	
BATTERY SETTINGS		
LOW BATTERY FLASH LEVEL (BARS)	2	
CABLE RESISTANCE (mΩ)	40	
CALIBRATION FACTOR	100	
LOW BATTERY ALARM	OFF	
INHIBIT SETTINGS		
INHIBIT 1 MODE	1	
INHIBIT 1 OPERATION	LATCHING	
INHIBIT 1 SPEED %	0	
INHIBIT 2 MODE	1	
INHIBIT 2 OPERATION	NON-LATCHING	
INHIBIT 2 SPEED %	50	
INHIBIT 3 MODE	1	
INHIBIT 3 OPERATION	LATCHING	
INHIBIT 3 SPEED %	0	
GENERAL SETTINGS		
SOFT STOP	ON	
BRAKE TIME (mS)	1400	
OUTPUT VOLTAGE	25V	
STATUS OUTPUT TYPE	0	
DIAGNOSTIC FLASH SEQUENCE	2	

Programming Parameter List

GENERAL SETTINGS CONT.	MAX	MIN
REVERSE ALARM	ON	
PULSED REVERSE ALARM	ON	
DIAGNOSTIC ALARM	ON	
BRAKE DISCONNECTED ALARM	ON	
BRAKE FAULT DETECT	ON	
BRAKE LIGHT	OFF	
FREEWHEEL SPEED LIMIT	60	
FREEWHEEL TIME OUT (0.1Sec.)	10	
FREEWHEEL ENABLE	DISABLE	
MOTOR SETTINGS		
CURRENT LIMIT MAX	60A	
BOOST DRIVE CURRENT	70A	
BOOST DRIVE TIME (Sec.)	10	
CURRENT FOLDBACK THRESHOLD	60A	
CURRENT FOLDBACK TIME (Sec.)	20	
CURRENT FOLDBACK LEVEL %	40	
MOTOR COOLING TIME (Sec.)	120	
CURRENT FOLDBACK TEMP. (C)	70	
CURRENT LIMIT MIN	10A	
MOTOR COMPENSATION (mΩ)	105	
ANTI ROLLBACK LEVEL	10	
PULL-AWAY DELAY (0.1 Sec)	35	
SLOPE FACTOR	300	
ANTI ROLLBACK VELOCITY	60	
FACTORY SETTINGS		
ACCELERATION (0.1 Sec)	100	1
DECELERATION (0.1 Sec)	100	1
FORWARD SPEED %	100	0
REVERSE SPEED %	100	0
THROTTLE SETTINGS		
THROTTLE TYPE	1 (WIGWAG)	
THROTTLE DEADBAND %	12	
THROTTLE GAIN %	160	
THROTTLE OPERATED AT POWER UP	2 (TRIP)	
THROTTLE REFERENCE TEST	ON	
ISO TEST RESISTOR	OFF	

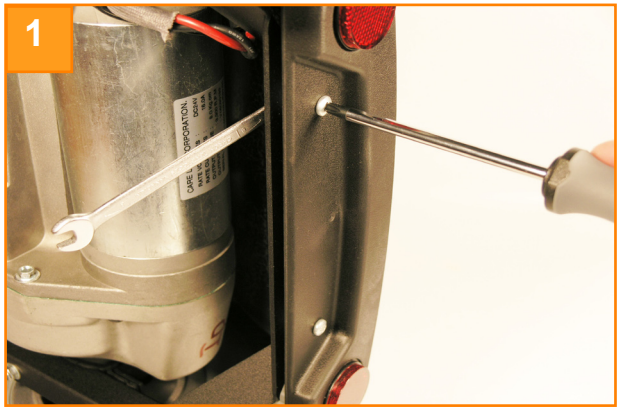
Programming
On-board Diagnostics

The on-board diagnostic status is indicated by a pulsed buzzer.
There will be a series of repeated pulses on the buzzer followed by a pause, then repeated pulses again and so on. It is the number of pulses between pauses that indicates the fault code.
Please refer to the table below for guidance.

The fault conditions can also be read by using the SP1 Hand Held programmer or PGDT PC Programming Software.

No. Pulses	Description	Remedy
None	All is OK	----
Slow Beep	Batteries deeply discharged	Charge batteries as soon as possible
1 x Pulse per 5 Sec.	Controller gone to sleep	Switch OFF & ON again
Pulses 1 x	Battery flat or bad connection	Charge batteries - Check all connections
Pulses 2 x	Motor connection bad or intermittent	Check all connections between Motor & Controller
Pulses 3 x	Motor short-circuit to battery	Check all Motor & Battery looms including plugs & sockets
Pulses 4 x	Freewheel activated	Check freewheel lever, check micro-switch & wiring
5 x Not Used	----	----
Pulses 6 x	Battery charger inhibit activated	Check charger is not plugged in
Pulses 7 x	Throttle fault	Check wig wag is central - check throttle & preset speed pot
Pulses 8 x	Possible controller fault	Check all connections between the tiller console & main controller
Pulses 9 x	Bad brake connection	Check Brake & Motor connections
Pulses 10 x	Over voltage detect	Check battery connections - check battery charger - Check batteries

CHAPTER 11 Rear Drive Assembly Rear Panel



Use an 8.0mm spanner & Phillips screw driver to undo the 2 bolts in the rear bumper.

Use a small Phillips screw driver to undo the 2 screws securing the 4 pin socket.

Undo the 4 screws on each handle, using a Phillips screw driver.

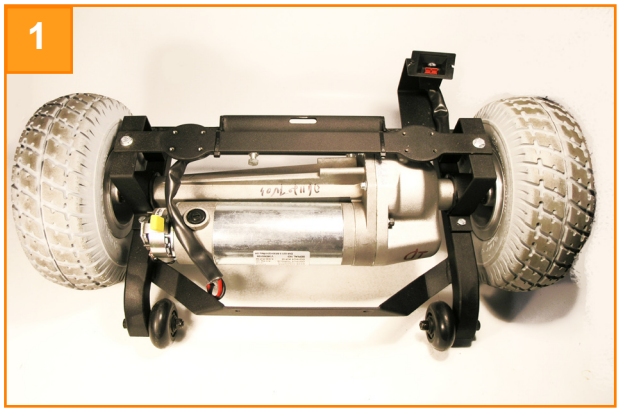
Remove both handles.

Carefully lift the rear panel clear of the rear frame.

The Rear Panel components.

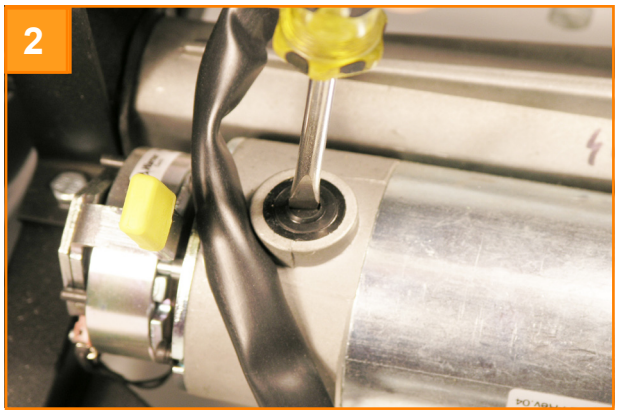
Rear Drive Assembly
Motor Brushes

1



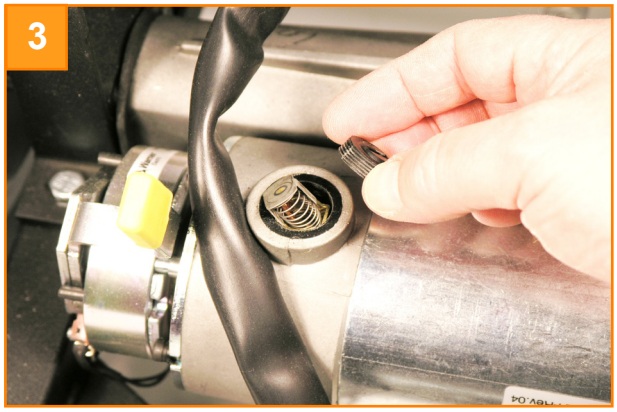
The rear drive assembly with the cover removed.

2



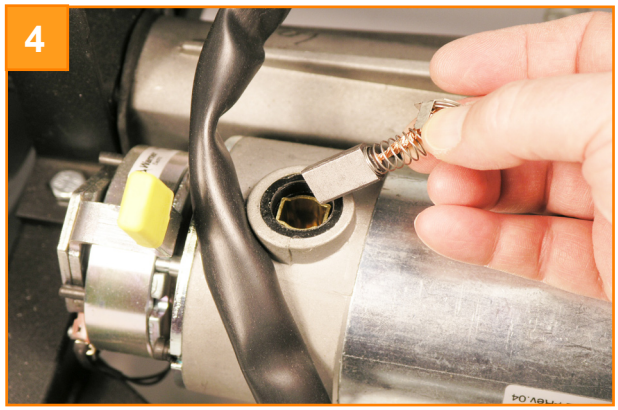
To access both of the motor brushes use a flat blade screw driver. One brush housing is on the top & one is underneath.

3



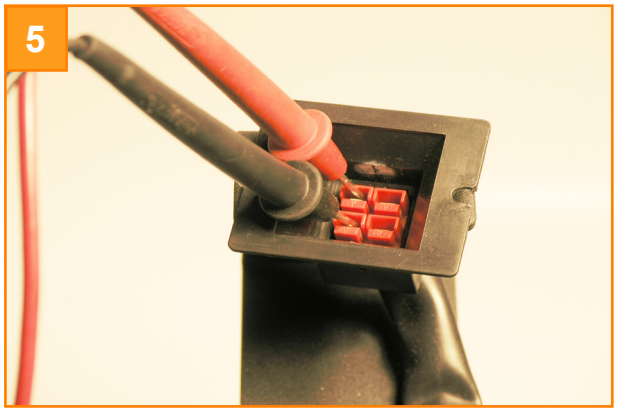
Carefully lift the brush cap off by hand. Do not loose the brush cap.

4



Gently pull the carbon brush out of the housing. Inspect the brush for cracks or chips. If the brush is a Blue colour, it may indicate excessive current. Check using a current clamp.

5



When the brushes are back in place insert the Multi-meter probes into the left hand pair of contacts (viewed from the rear).

6

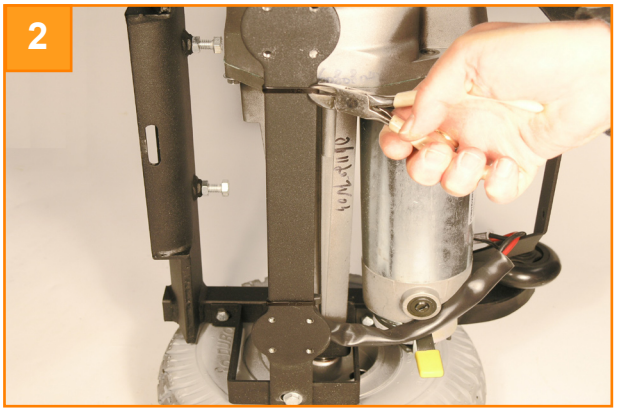
A low RESISTANCE reading should be displayed. If the reading is higher than 5.0 Ω check the wiring for bad joints or signs of heat damage, if OK change the brushes. If still the same change the motor.

Rear Drive Assembly
Motor & Brake Assembly

1

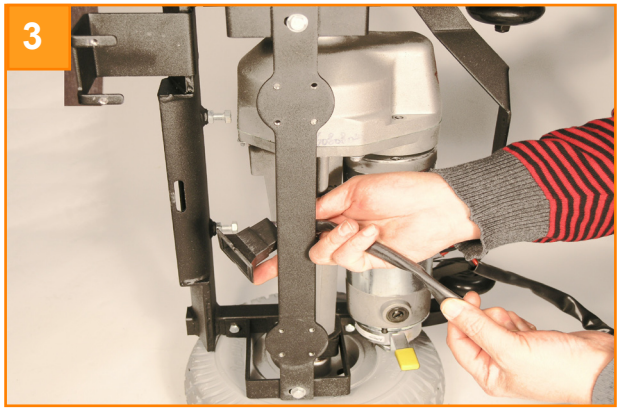
Stand the drive assembly up on one wheel as shown above.

2



Cut the 2 cable ties to release the motor loom.

3

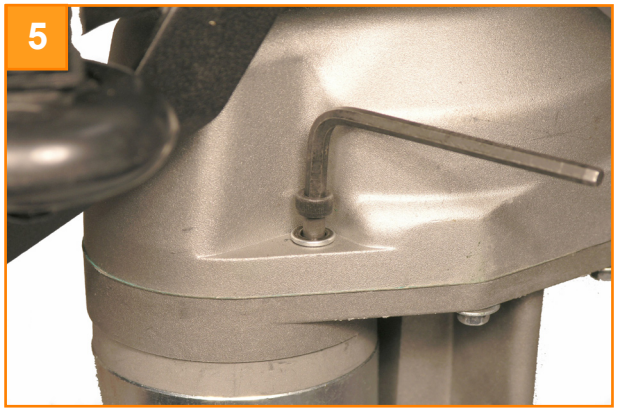


Feed the motor loom through the frame.

4

Mark the top of the motor as shown to help refitting.

5



Use a 5.0mm allen key to remove the lower stud.

6

Repeat the process for the other stud. Hold the motor to steady it before completely removing the last bolt.

Rear Drive Assembly
Motor & Brake Assembly

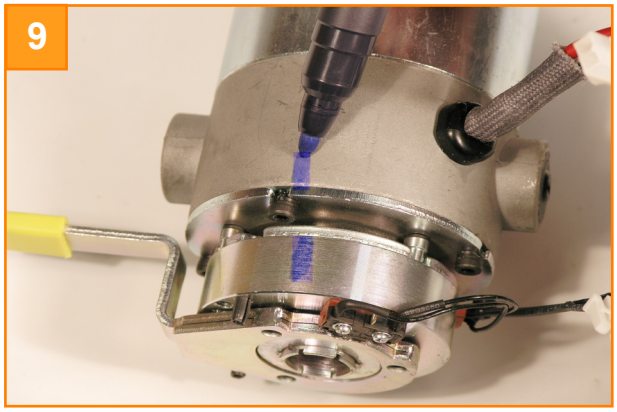
7

Gently withdraw the motor & brake by lowering at a slight angle & lifting away.

8

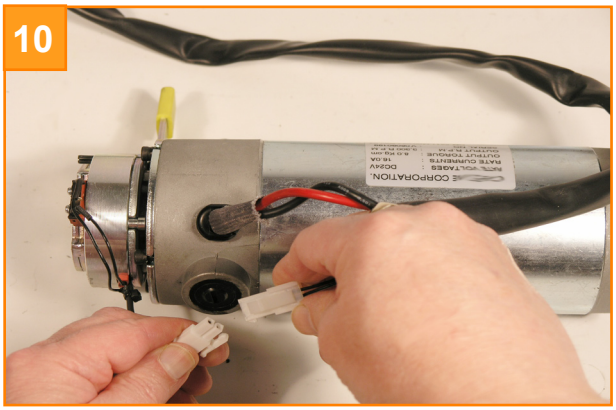
The Motor & Brake assembly removed. Note that on later models the loom has a plug to enable it to be disconnected completely from the motor.

9



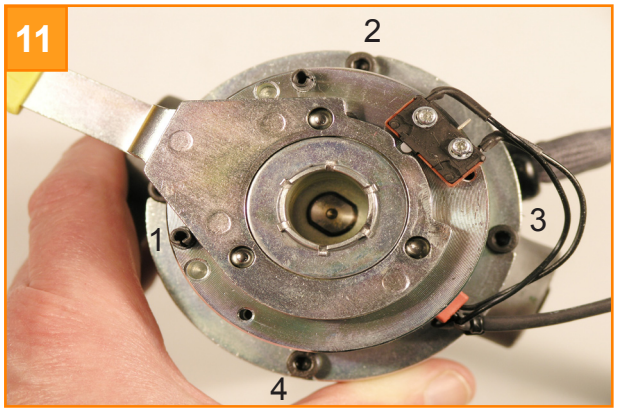
It is helpful to mark the brake & motor to help with positioning the brake for refitting.

10



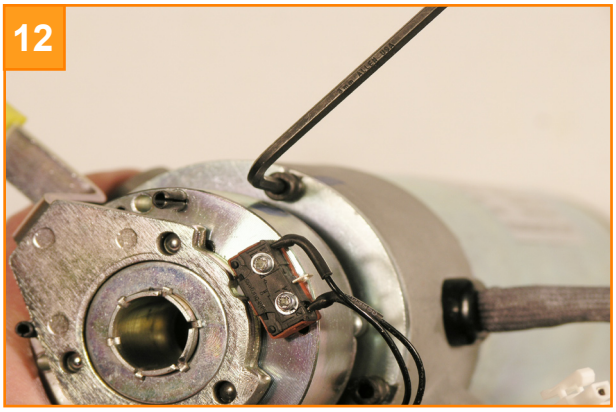
Unplug the 2 pin brake connector.

11



There are 4 studs securing the brake to the motor.

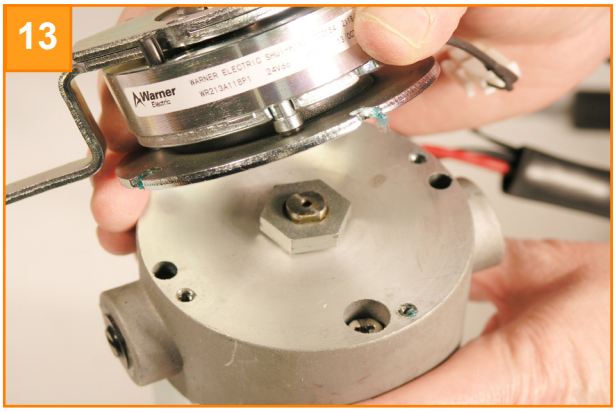
12



Use a 3.0mm allen key to undo the 4 studs. Do not lose the locking washers. Always use a thread locking fluid on the 4 studs when refitting.

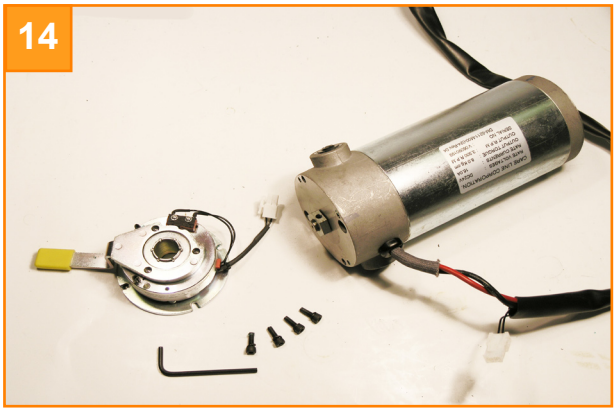
Rear Drive Assembly
Motor & Brake Assembly

13



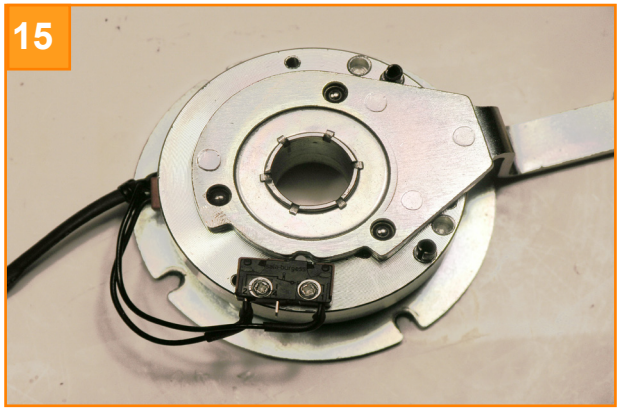
Carefully lift the brake off the hexagonal end nut.

14



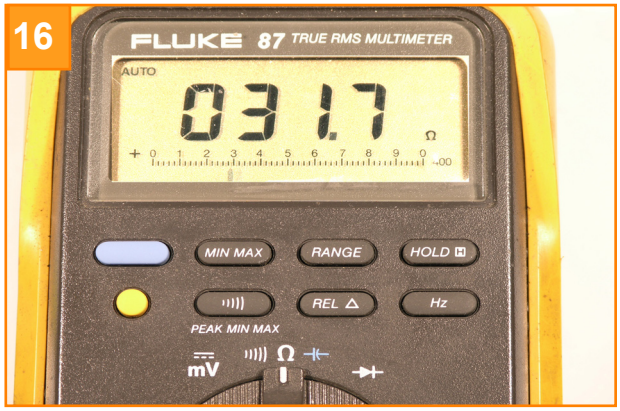
The Brake separated from the Motor.

15



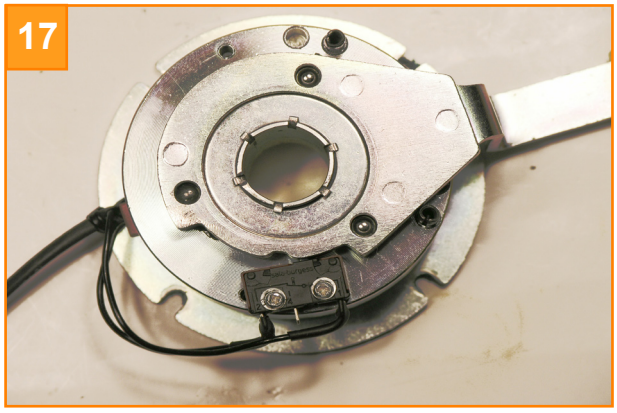
With the brake lever in the “DRIVE” position (micro-switch button out) insert the meter probes into the 2 pin plug.

16



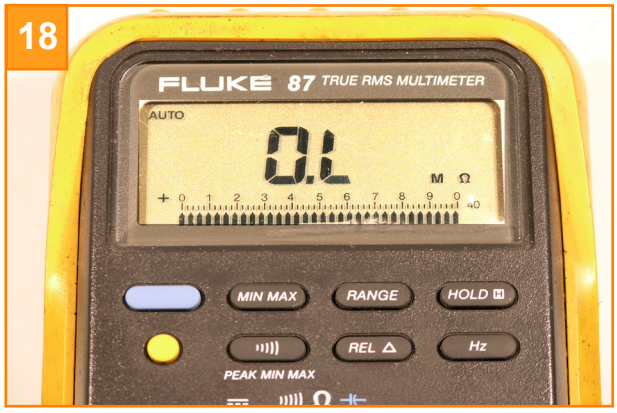
Set the meter to RESISTANCE. The meter should give an approximate reading between 25 - 35Ω.

17



With the brake lever in the “PARK” position (micro switch button in) insert the meter probes into the 2 pin plug.

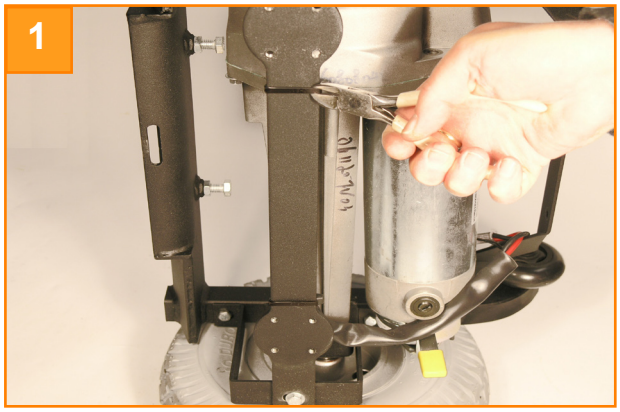
18



The meter should give an open circuit reading.

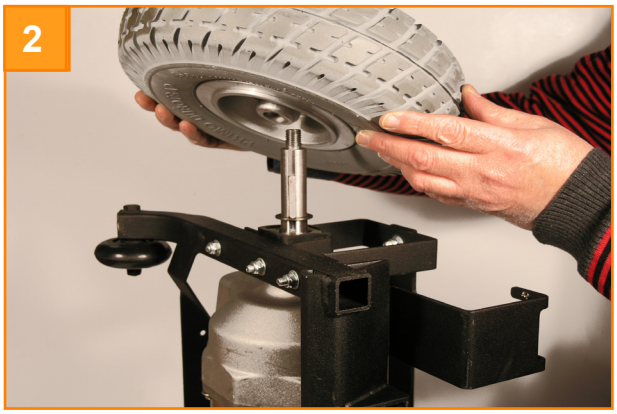
Rear Drive Assembly
Transaxle

1



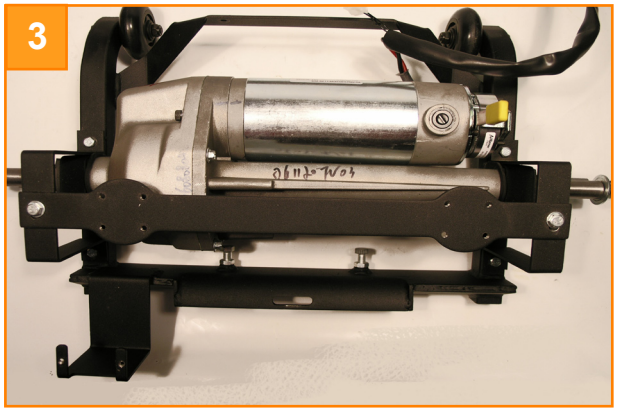
To remove the complete transaxle assembly, start by cutting the 2 cable ties as previously described.

2



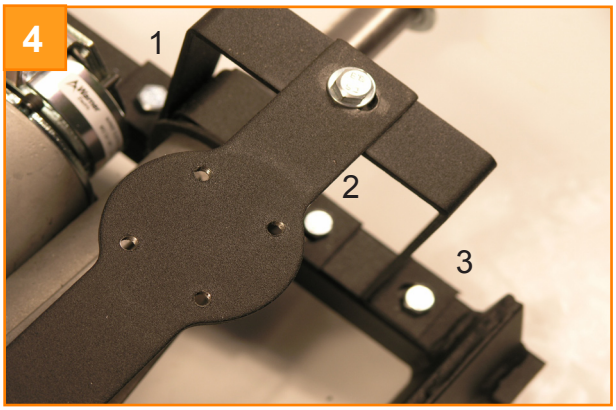
Remove the wheels & keep the drive shaft keys in a safe place.

3



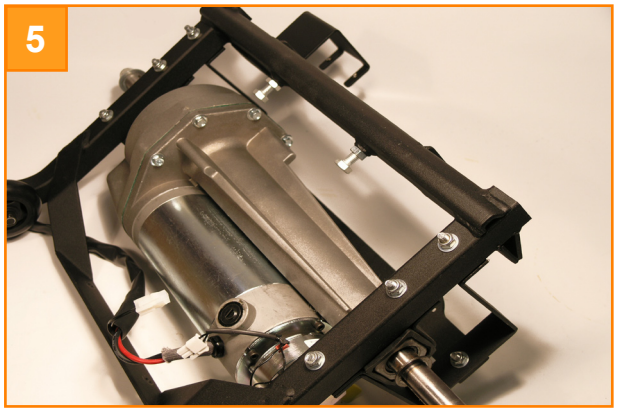
The transaxle is contained within the rear frame.

4



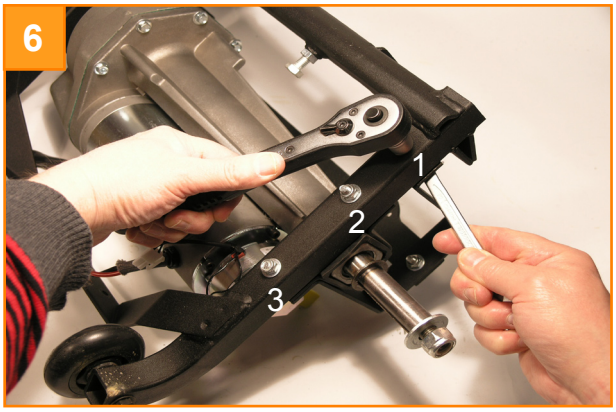
There are 3 bolts on each side of the rear frame securing the transaxle.

5



Turn the assembly up-side-down for easier access to the 6 bolts.

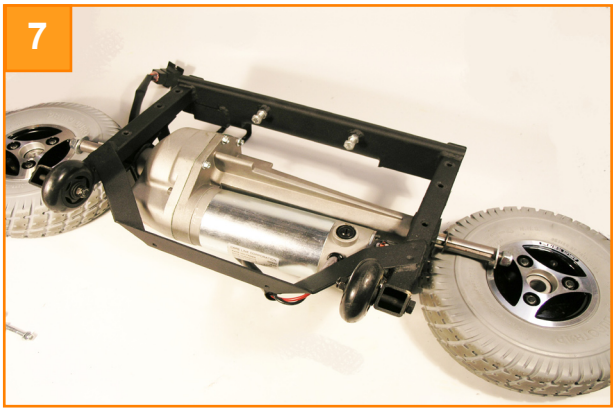
6



Use a 10.0mm spanner/socket to undo the top & bottom bolts first (1 & 3).

Rear Drive Assembly
Transaxle

7

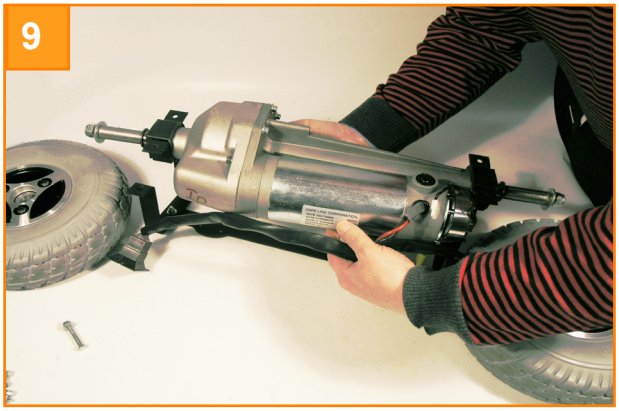


Support the ends of the drive shafts before removing the last 2 bolts. This will stop the transaxle dropping suddenly.

8

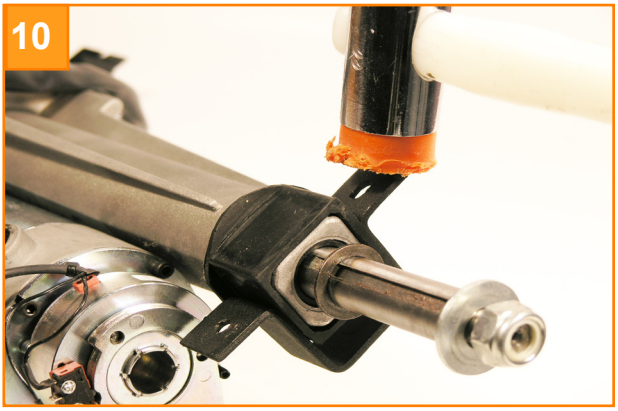
Lift the rear frame away from the transaxle.

9



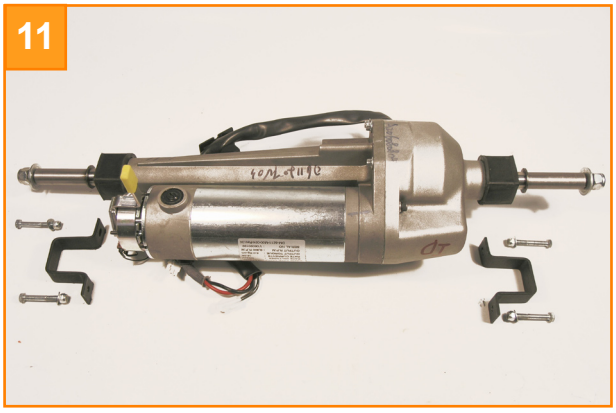
Carefully lift the transaxle off the remainder of the rear frame.

10



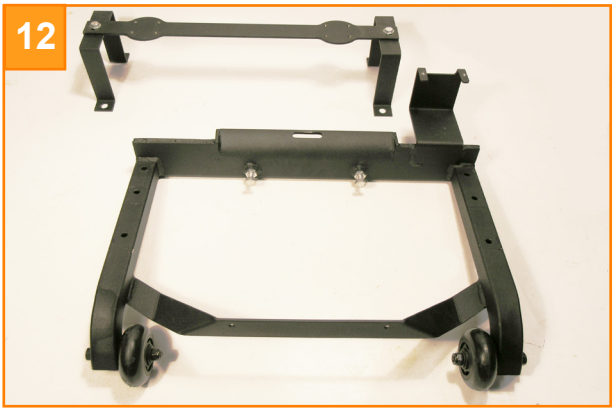
There is a “U” bracket on each end of the transaxle. Remove the brackets by gently tapping each one to loosen it.

11



The Transaxle Assembly & “U” Brackets.

12



The Rear Frame Assembly.

CHAPTER 12

Seat Assembly
Armrest Pads

1

Lift the armrest up.

2

Use a 10.0mm spanner/socket to undo the hinge bolt.

3

Lift the armrest off the bracket taking care not to lose the 2 plastic bushes on the inside edges.

4

Invert the armrest & use a Phillips screw driver to undo the 2 screws. Note that the countersunk screw is towards the back.

5

Lift the armrest away from the arm pad.

6

The Armrest & Arm pad.

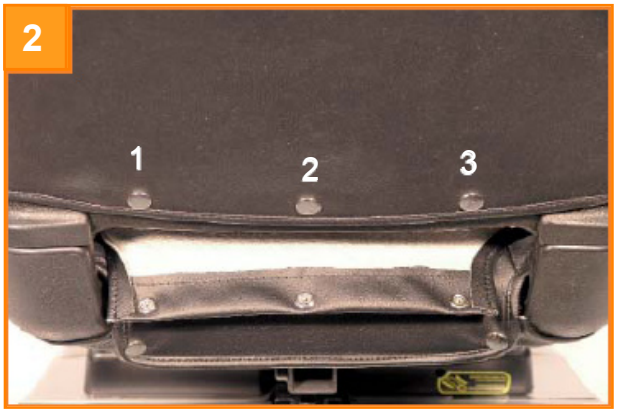
Seat Assembly Covers

To clean the upholstery, wipe down with a damp cloth using a mild detergent. DO NOT MACHINE WASH the covers.

1

The cushion covers can be replaced while the seat is still attached to the scooter.

2



To release the backrest cover, undo the 3 pop studs at the back.

3

Peel the backrest cover upwards & back over the backrest. The cover will turn inside-out, this is normal.

4

Release the 2 pop studs on the seat cover

5

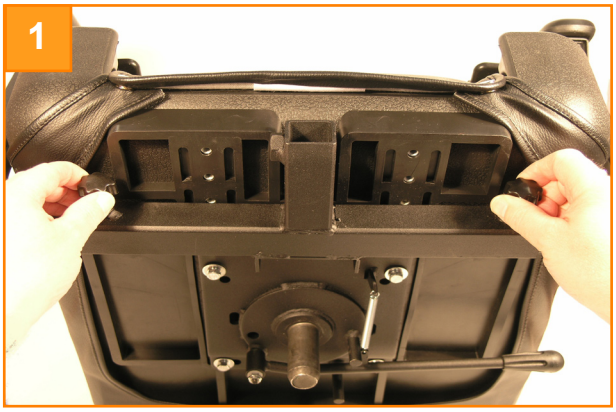
Peel the seat cover from the front, the cushion will lift & the cover will pull clear.

6

The Backrest & Seat Covers.

Seat Assembly
Seat Plate

1

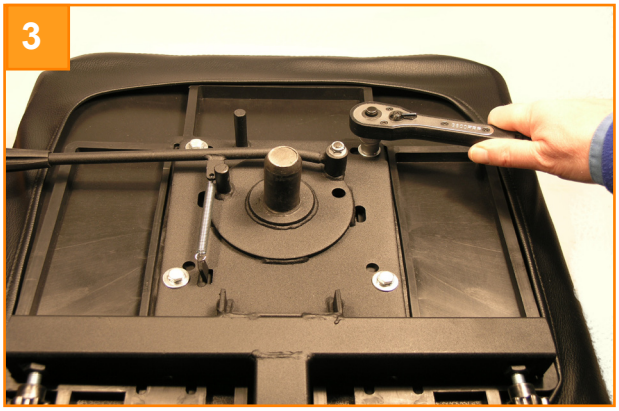


Unscrew by approximately 2 turns, the 2 width adjustment hand wheels.

2

Remove the armrests.

3



Use a 10.0mm spanner/socket to undo the 4 seat plate bolts as shown.

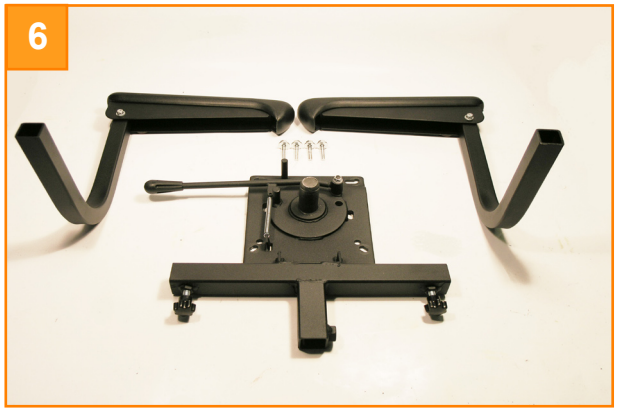
4

Remove the bolts and lift the seat plate away from the seat base.

5

The Seat Assembly.

6



The Armrest assemblies & Seat Plate assembly.

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