TECHNICAL MANUAL

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AV1 Underwater Scooter

MOTOR & BULK HEAD

A Manual for Repair and Maintenance Technicians

CAUTION

This manual is designed to help technicians who are already experienced in workshop procedures and know how to handle tools.

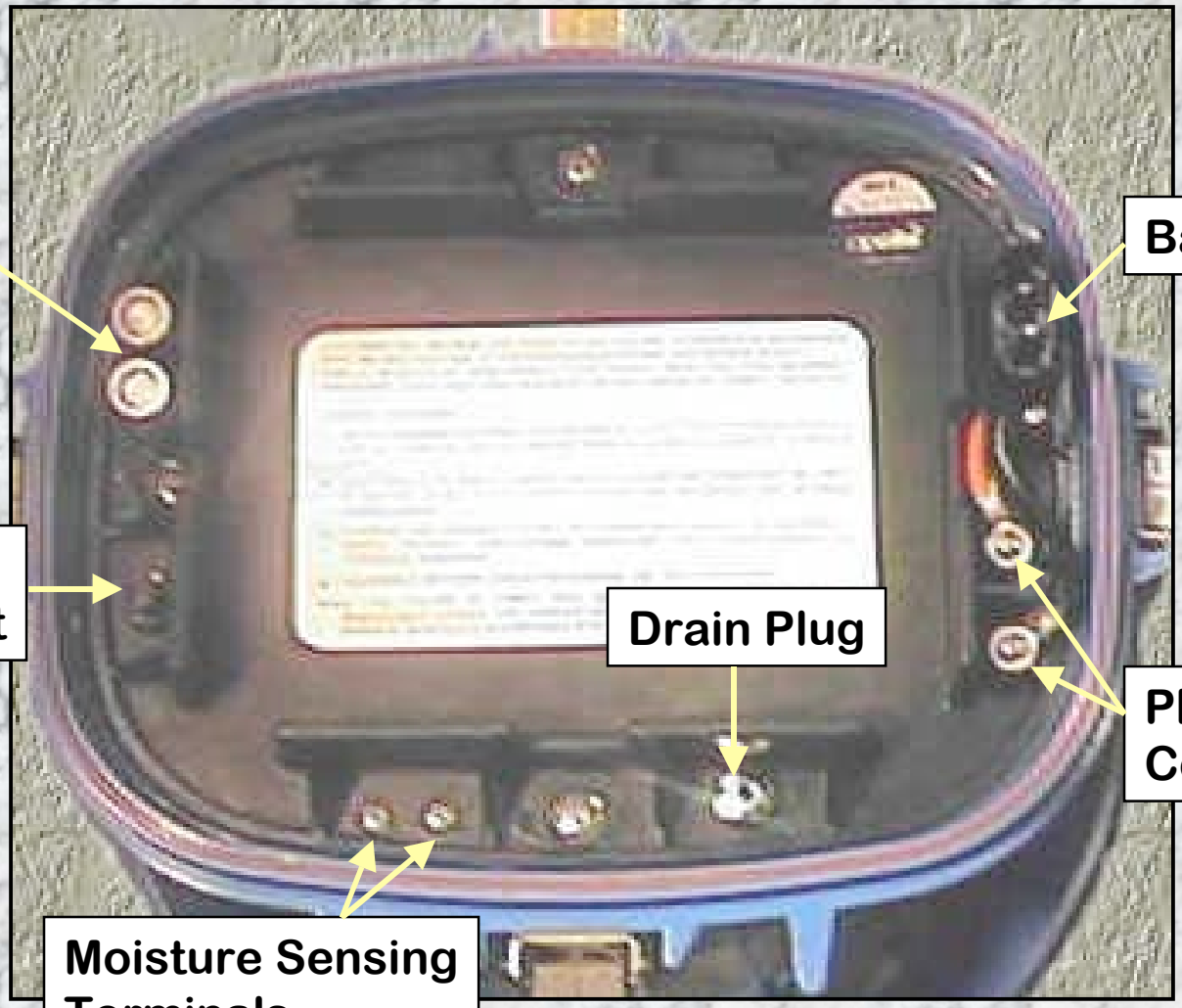
Only experienced technicians should attempt to use this manual.

Improper use of tools could result in personal injury or at the least damage to the AV1 scooter.

To use this presentation effectively a parts exploded view must be on hand to determine the correct assembly order plus to check if any parts are missing prior to reassembly.

Throughout the assembly care must be taken when tightening screws into the plastic components, overtightening could result in threads being stripped and the replacement of major body parts.

BULK HEAD COMPONENTS



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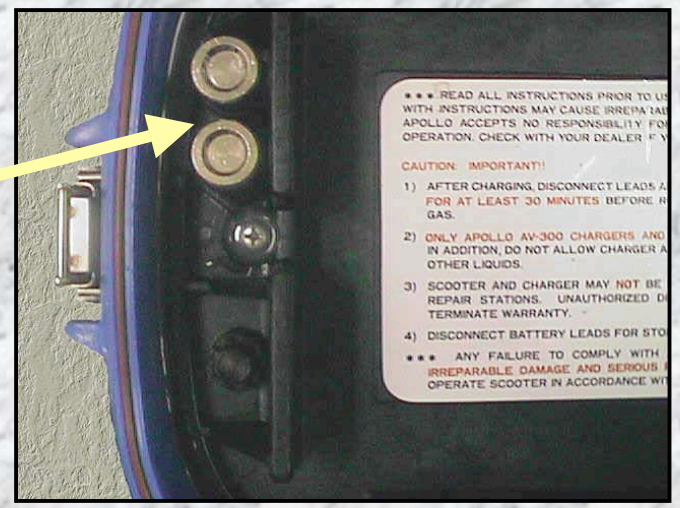
AV1

PRE-STRIP INSPECTION

Before dismantling the motor compartment a number of checks should be carried out to determine the source of any problems.

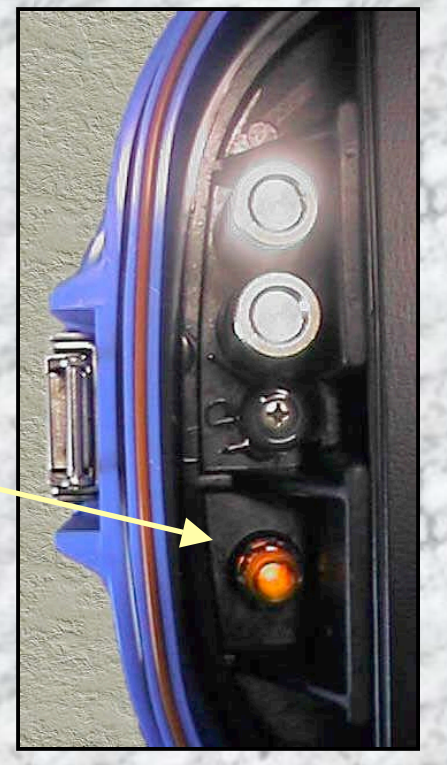
If the motor does not run, test the battery, the reed switch and the magnetic button on the front cover. Ensure these components are serviceable prior to dismantling the motor compartment.

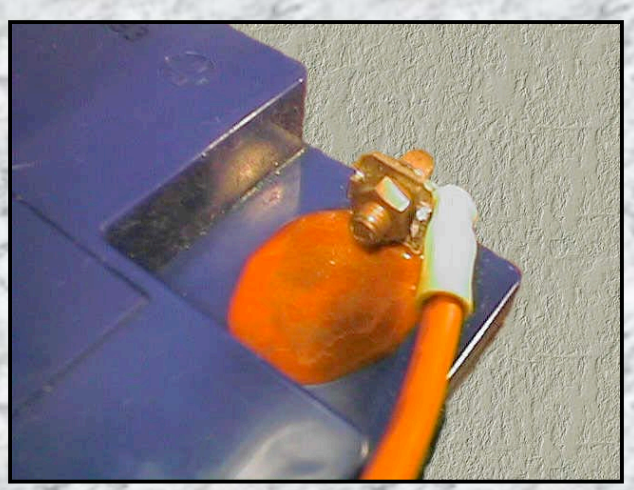
With the battery installed short the socket terminals on the bulk head if the motor does not run and a clicking sound is heard, the relay is usually faulty.



PRE-STRIP INSPECTION

Check the bulk head for any moisture, connect the battery if wet the warning light illuminates. Blow the bulk head dry with filtered air and test again with the battery.





Check the wiring, the battery plugs and electrical connections on the bulk head. Check for tightness and corrosion.

TOOLING REQUIREMENTS

No.1 Philip's tip screwdriver

No.2 Philip's tip screwdriver

9/32" x 1/4 Drive deep socket

Nylon Dowel 15mm x 10mm Dia.

Small ball pane engineer's hammer

Pin punch

6" Flat blade screwdriver

O ring pick

Magnifying glass

Hydraulic Ram & Dolly

Dispensing Gun (Silicone Sealant)

Hydraulic Ram

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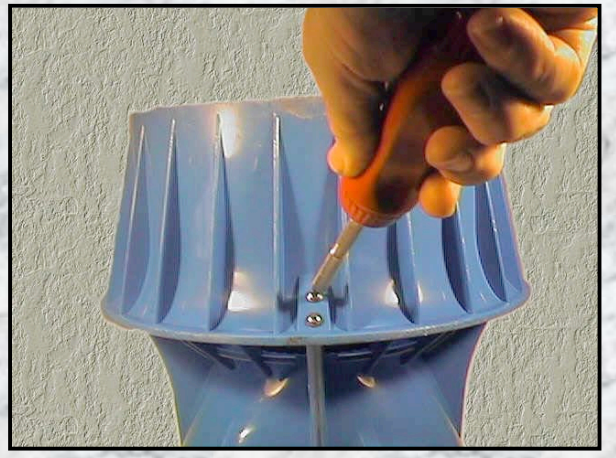
AV1

DISASSEMBLY

Place the body on a suitable support. This will prevent damage to the battery connection plug and the body o ring.

Remove the eight propeller cover support screws.



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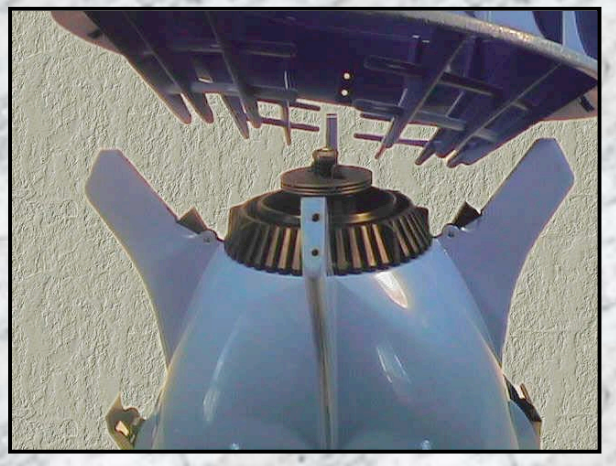
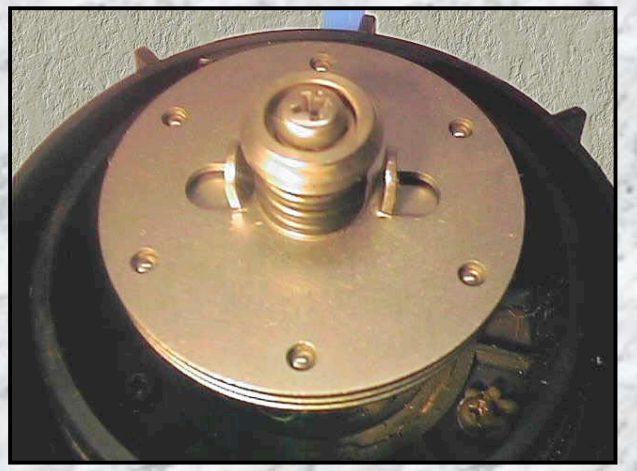
AV1

DISASSEMBLY

Lift off the propeller cover.



The clutch must be removed next.



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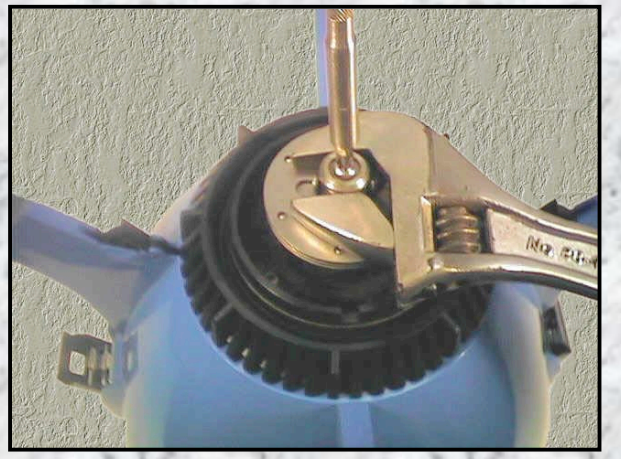
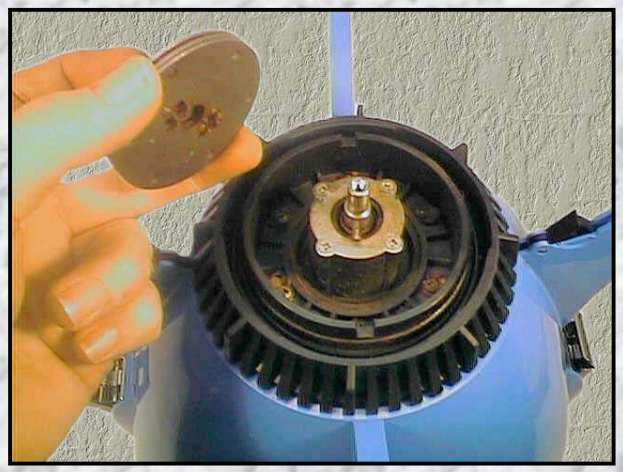
AV1

DISASSEMBLY

The clutch retainer screw is a left hand thread. The screw is removed by turning clockwise.
An adjustable wrench may be used to prevent the clutch turning.
Loctite is used to secure this screw.



Lift off the clutch assembly, this will expose the drive pin. Take care not to lose the ball bearings.



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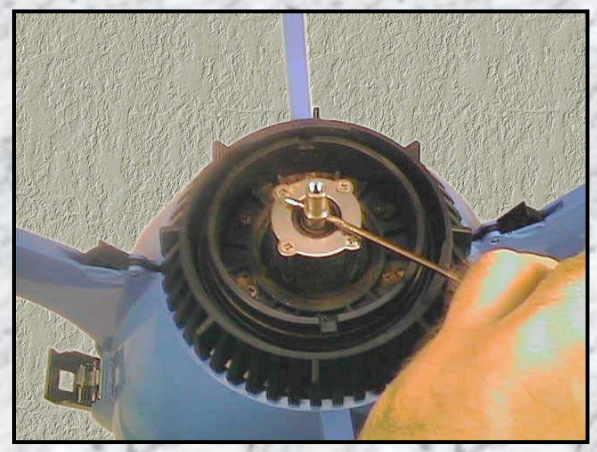
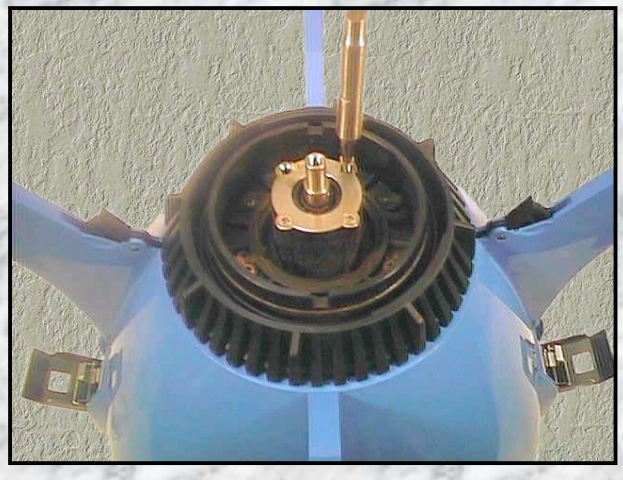
AV1

DISASSEMBLY

The drive pin may be removed by using a pin punch gently tapping the pin through the shaft.



To remove the seal retainer, undo the four counter sunk Philip's head screws and lift off the plate.



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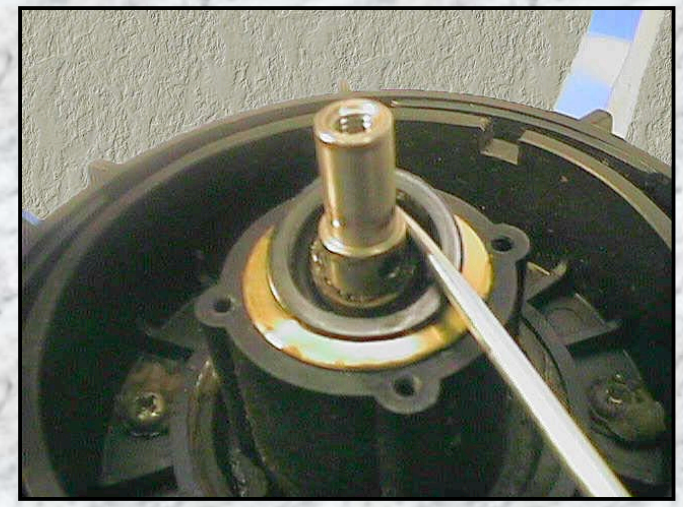
AV1

DISASSEMBLY

The rotation seal is removed by careful use of an o ring picker. Prise the seal up and remove.

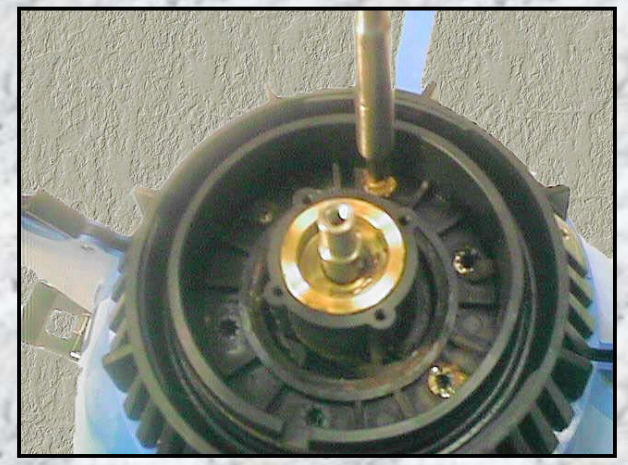
Do not push the picker completely through the seal and score the brass seal holder.



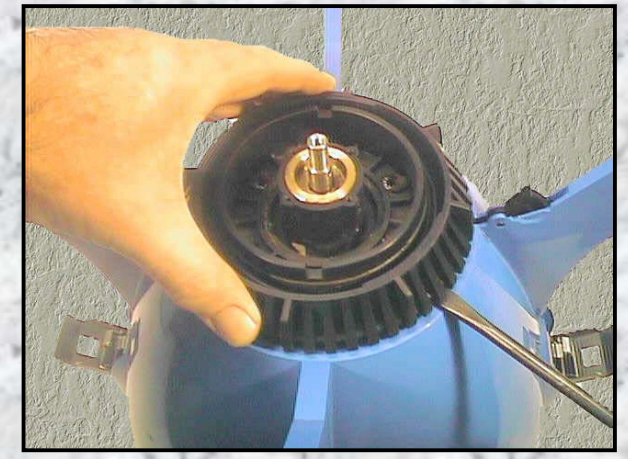
If only stripping down to change the seal, this is the point where you begin your cleaning, inspection and reassembly.

DISASSEMBLY

To gain access to the motor compartment.
Remove the six Philip head screws securing the propeller clamp ring assembly.

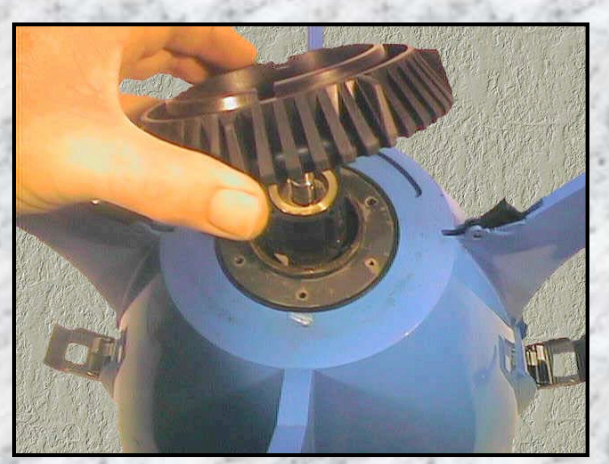


The clamp ring is sealed with silicone sealant, this acts like a glue so the bond must be broken after removing the screws.
A wide thin bladed screw driver is used to gently prise up. (Do not twist the screw driver, this will mark cover)

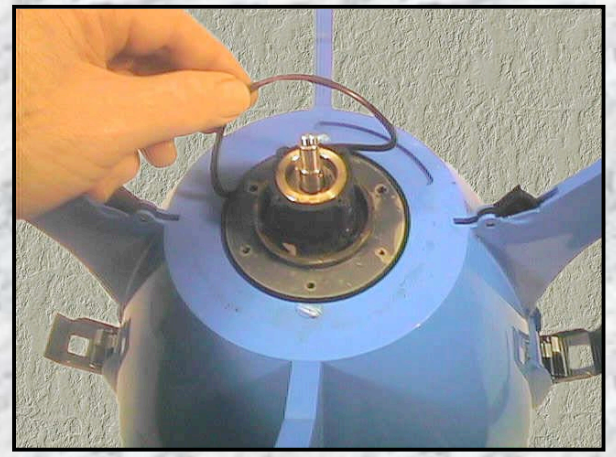


DISASSEMBLY

Once the seal is broken the retainer and the clamp ring is removed by hand.



The gear case o ring is removed and discarded.



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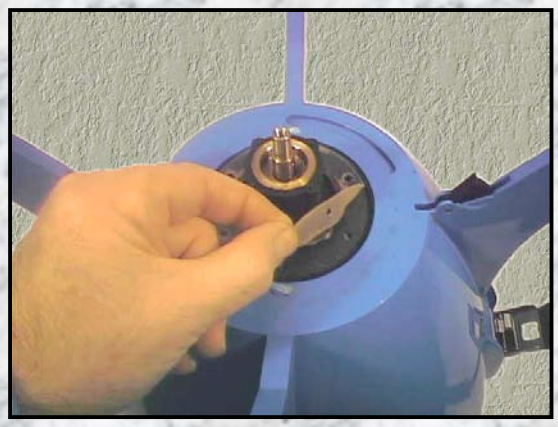
DISASSEMBLY

Clean any excess silicone sealant from around the gear case.



Invert the body, remove the battery plug from the bulk head.
Make a note of the + and - wire, this will ensure the correct polarity for assembly.

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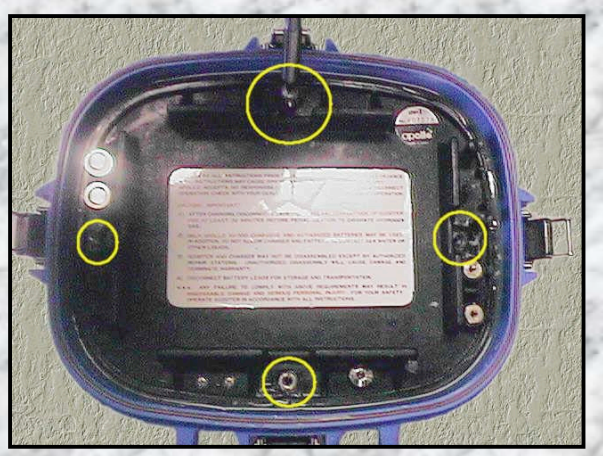
AV1

DISASSEMBLY

The four bulk head support screws are removed next. These will be covered with silicone sealant, this can be removed by scraping with a small screw driver as shown here.



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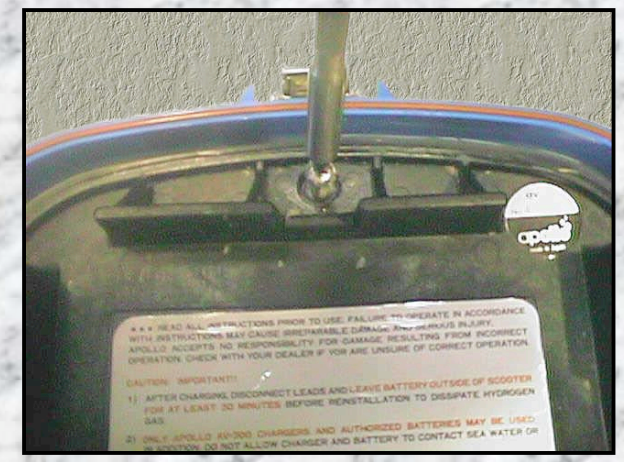
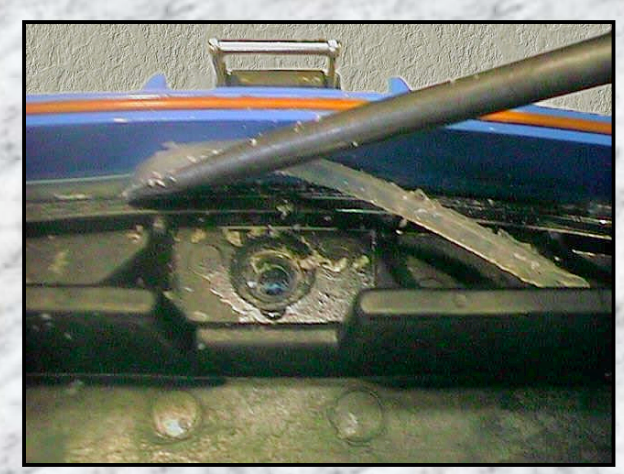
AV1

DISASSEMBLY

After removal of the sealant the four screws are removed.



The bulk head is triple sealed to the body. There is a layer of sealant on the underside, an o ring seal and a further application of sealant around the upper edge.



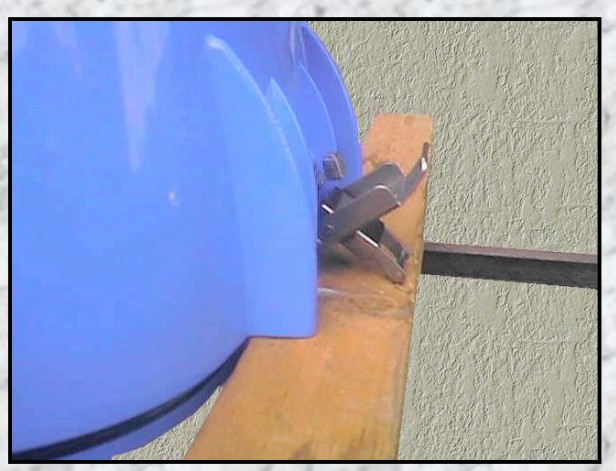
The outer layer of sealant is removed using a screw driver, take care not to scratch the body.

DISASSEMBLY

The bulk head is now ready to be pressed from the body using a hydraulic ram.

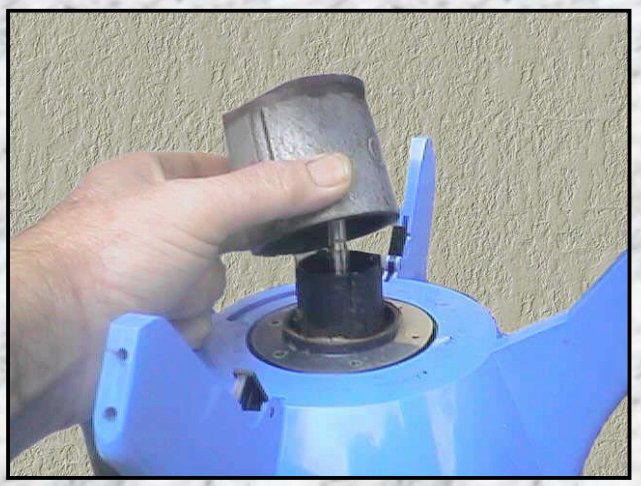
The body must be supported as shown. DO NOT place any supports directly under the body where the red elliptical ring is situated, this could result in damage to the body.

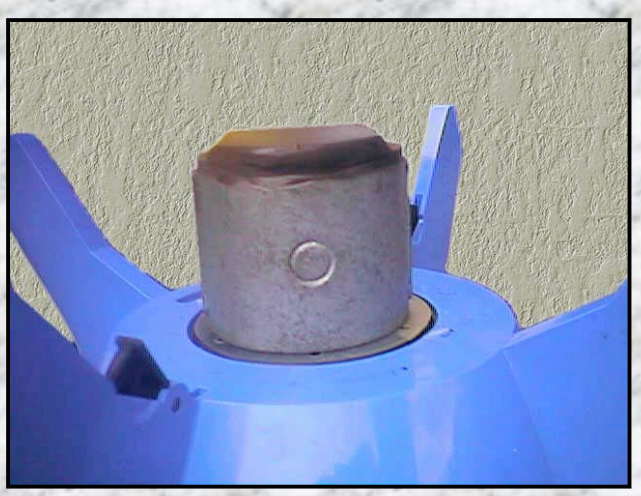
Note the centre support shown here does not support the body, as the bulk head is pressed from the body it will rest on the centre support. Each workshop may have a different type of press, this is acceptable provided the basic principles explained here are followed.



DISASSEMBLY

The ram dolly is now positioned.





NOTE:
The dolly fits over the clutch axle, the dolly is pressing on the motor gear case not the axle.

DISASSEMBLY

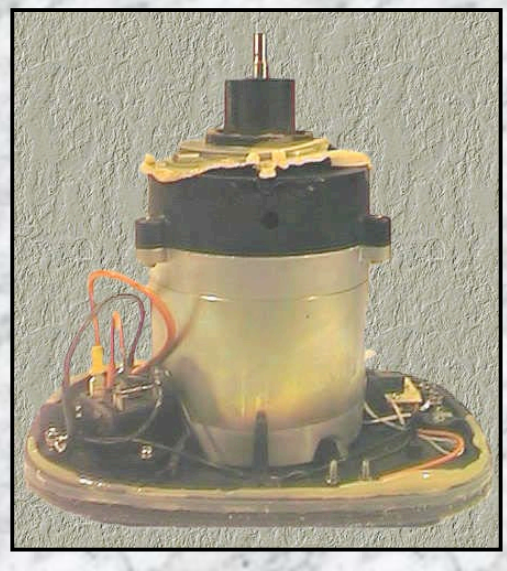
Operate the ram slowly, the motor and gear case will be pressed into the body.

The motor must then be positioned squarely on the bulk head. The motor and bulk head are not connected, however the motor is used to press out the bulk head.

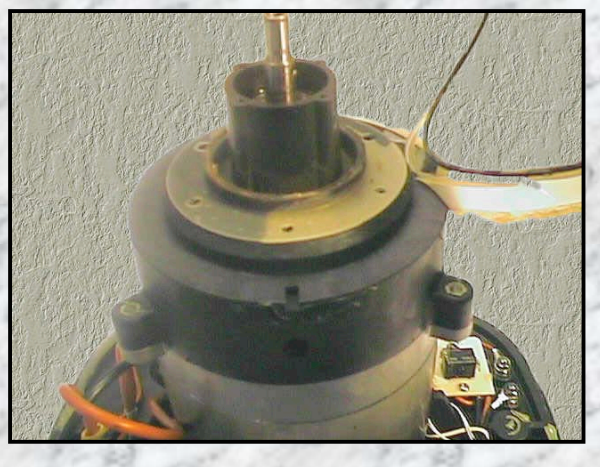
Once the bulk head is clear of the body the body may be lifted by hand as shown on the right

DISASSEMBLY

Carefully lift the motor and bulk head onto the bench, they are still joined by the wiring harness and the heat sensor.

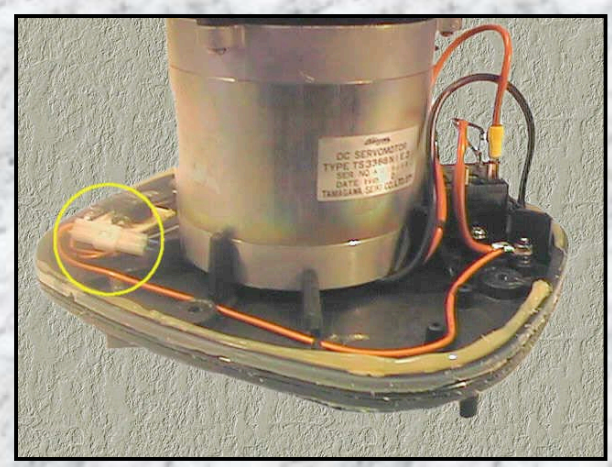


Remove the gear case o ring and any excess sealant. Note, the gear case was also sealed from the underside with both sealant and an o ring.

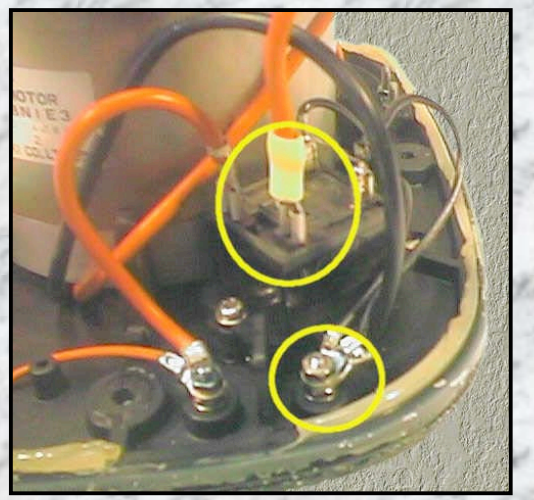


DISASSEMBLY

To separate the motor disconnect the heat sensor plug.



Next disconnect the motor wires. The red wire from the motor is unclipped from the relay box. The black wire is disconnected from the battery terminal using a 9/32” deep socket.



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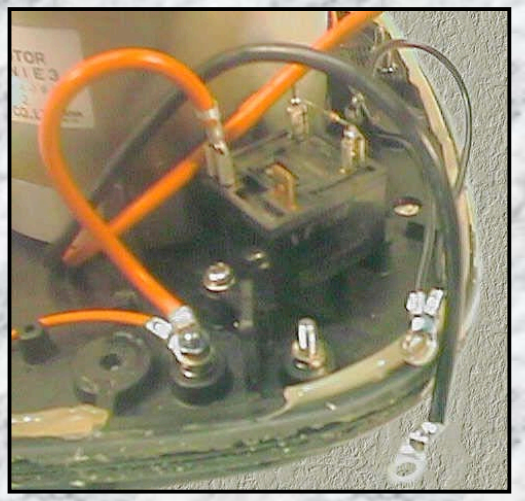
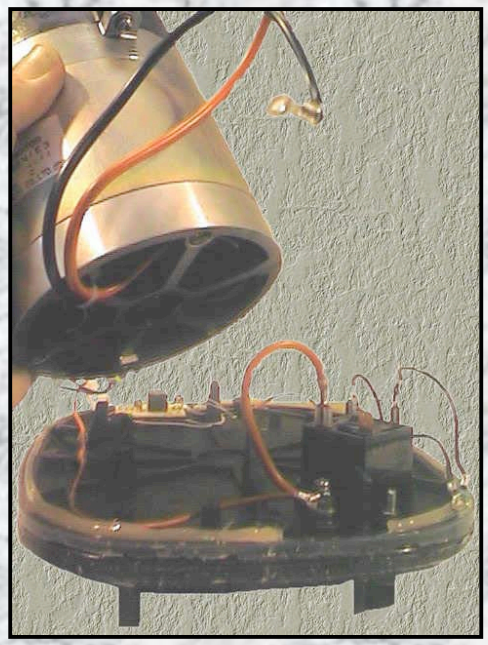
DISASSEMBLY

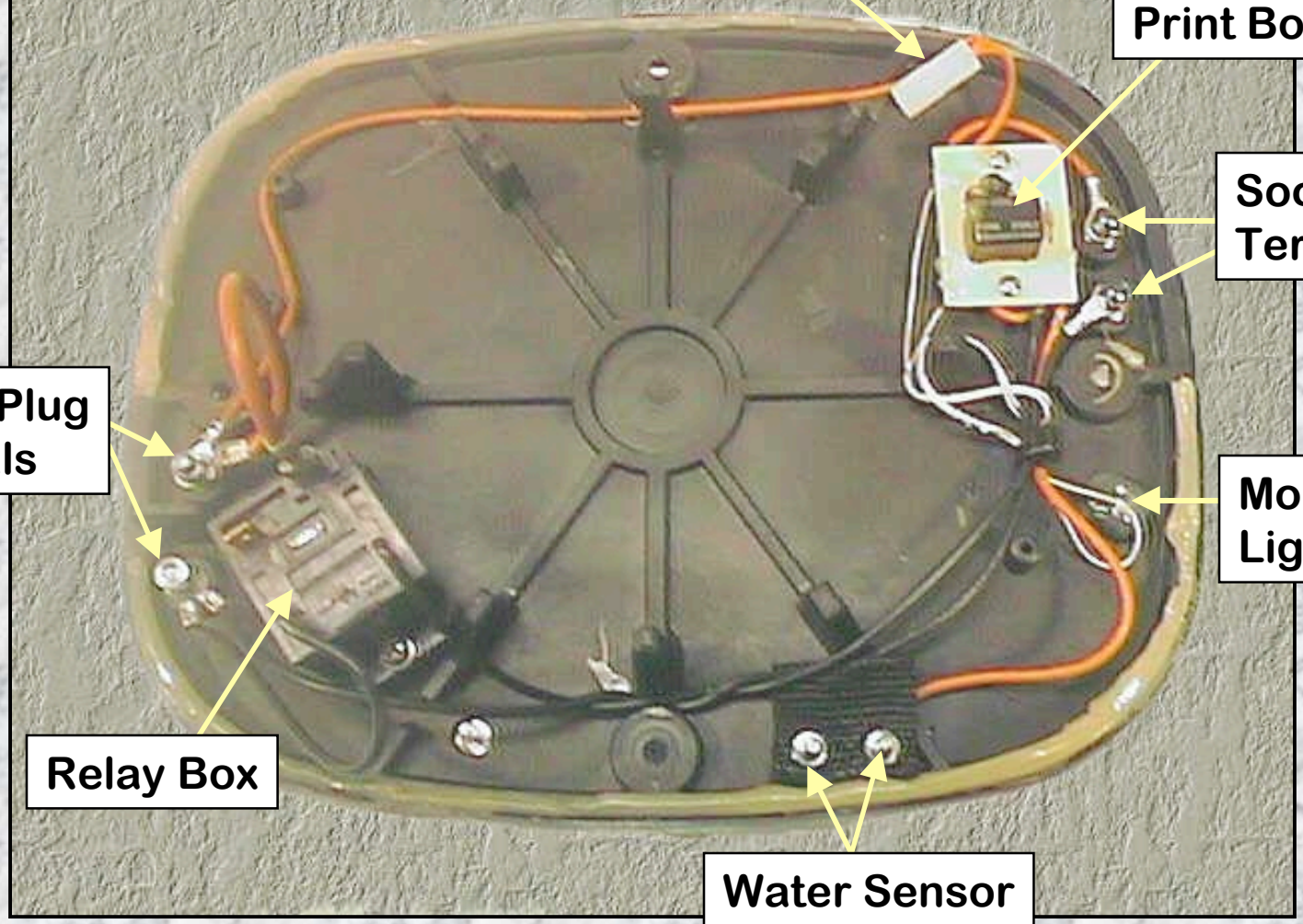


With the wiring disconnected the motor may now be lifted from the bulk head.



At this point any repairs may be made to the bulk head.
If the motor is serviceable no further dismantling need take place.

BULK HEAD COMPONENTS (Underside)



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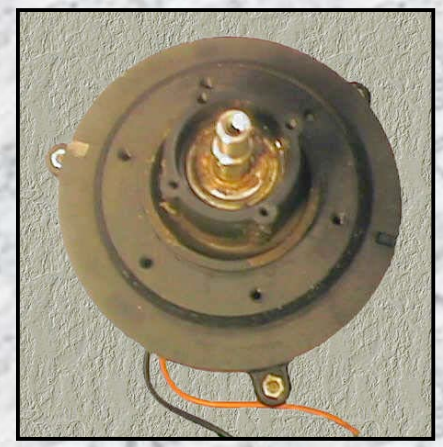
AV1

DISASSEMBLY

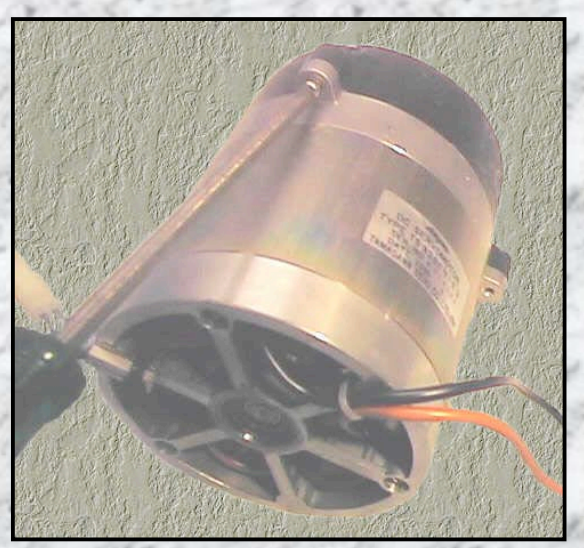
The clutch axle bearing shown here is rusted. To change this bearing proceed as follows.



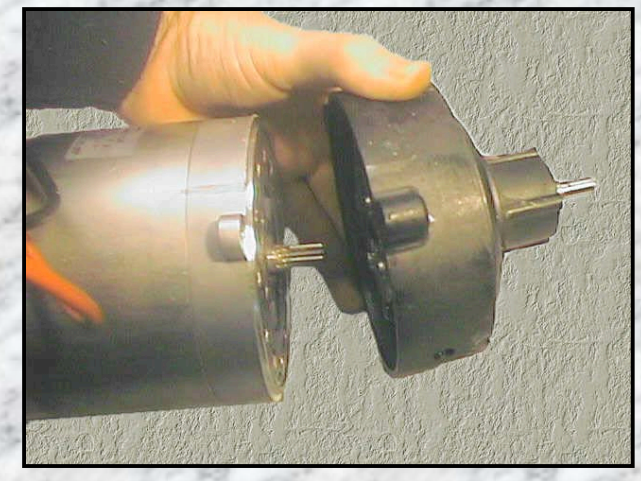
Mark the motor to the gear case before disassembly. This simply makes alignment a little quicker for reassembly.

DISASSEMBLY

Remove the three Philip's head screws securing the gear case to the motor.



Separate the gear case from the motor. This can be quite messy as the gear case is full of grease.



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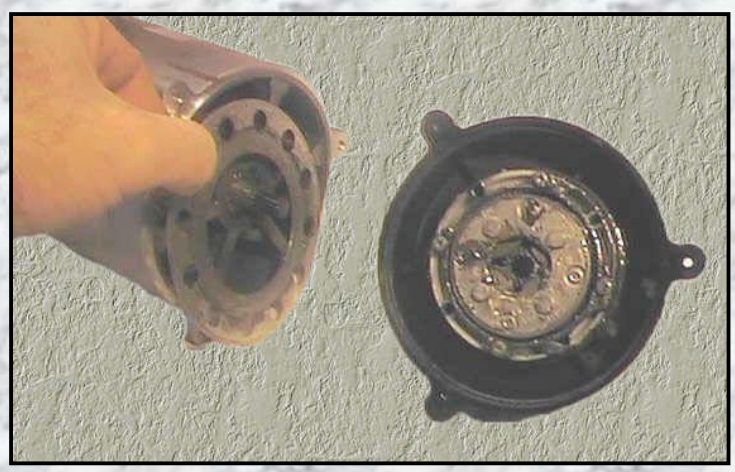
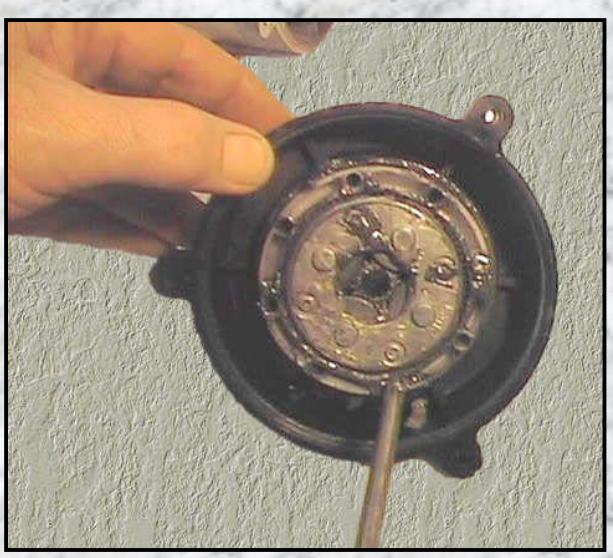
AV1

DISASSEMBLY

Lift out the gear plate



Undo four Philip's head screws securing the gears to the gear case. Lift out the gears.



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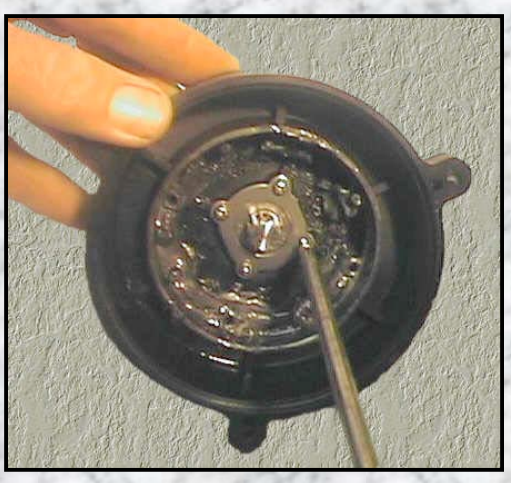
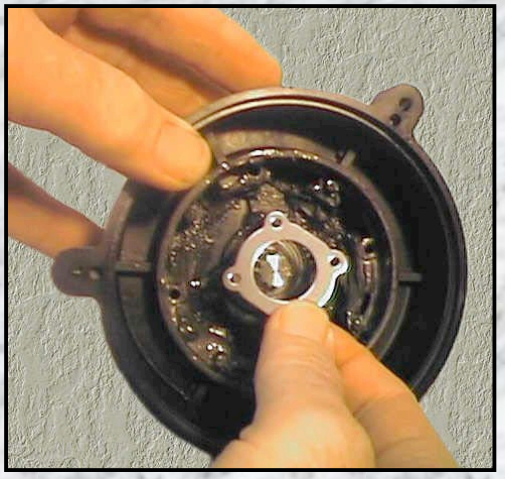
AV1

DISASSEMBLY

Remove four screws securing the bearing retainer on the clutch axle.



Remove the bearing retainer



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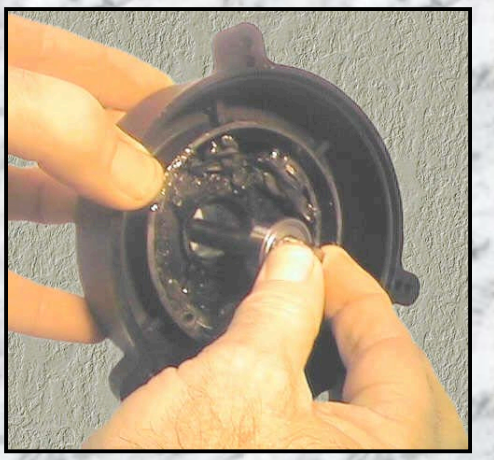
AV1

DISASSEMBLY

The clutch axle and bearing may now be pushed from the gear case.
The remaining axle bearing can now be pushed from the case, if corroded it may need to be gently taped out using a small hammer and nylon dowel.



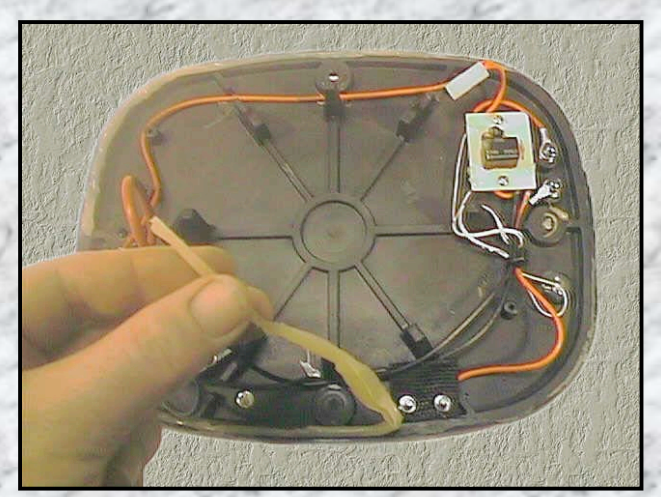
This completes the disassembly of the motor and motor compartment.
Before refitting all parts must be cleaned and carefully inspected for wear or defects.

INSPECTION

Clean old sealant from all surfaces.

Check the four bulk head screw supports for cracking and stripped threads.

Remove and discard old o rings and clean the o ring grooves.



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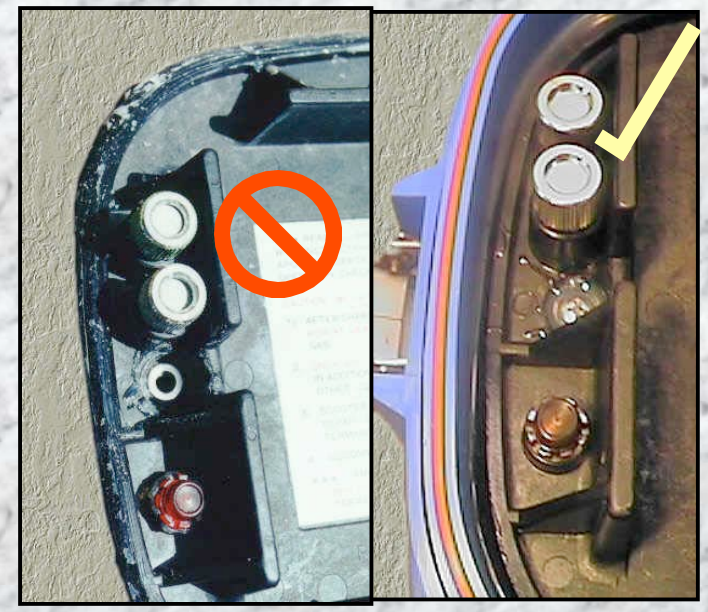
AV1

INSPECTION

The bulk head socket terminals through neglect can be immoveable due to salt build up, shown on the left here.



The socket can be cleaned by screwing the top off and exposing the piston and spring. These parts can be cleaned and refitted.
(There is no need to remove the bulk head to accomplish this)

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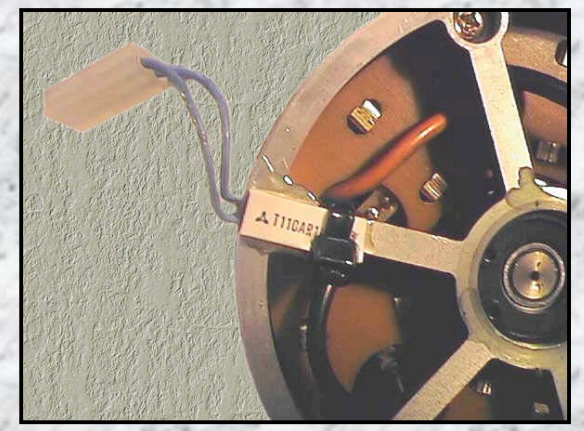
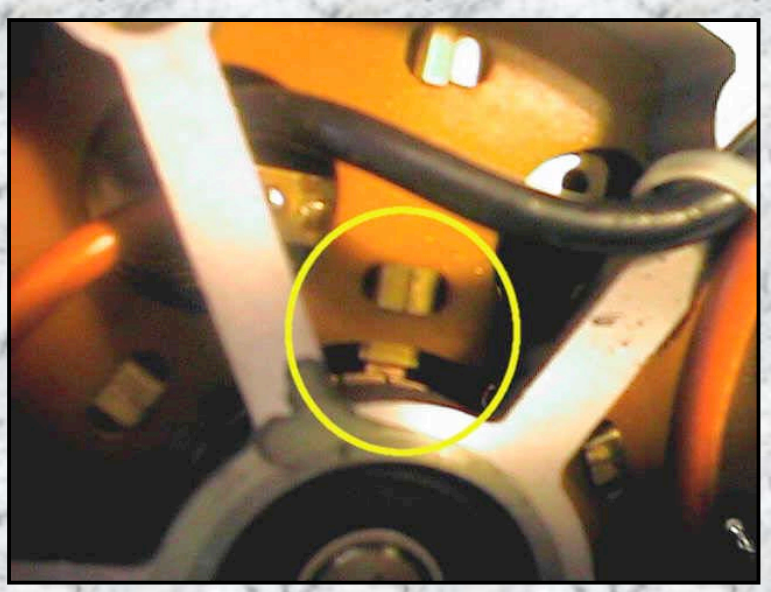
AV1

INSPECTION

If checking the motor after dismantling hold the motor in a suitable vice or clamp. The motor is very strong and can easily spin out of a persons hands or from under a foot and cause damage or injury.



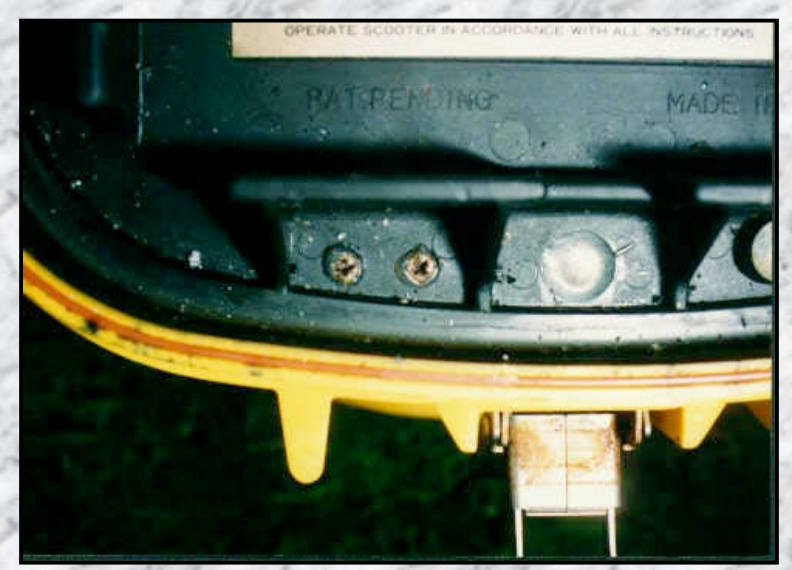
Check the heat sensor attached to the motor body is not crushed or moving about. The sensor is glued in position with contact glue and as a back up has a small loom tie fitted. Do not over tighten the tie and crush the sensor.



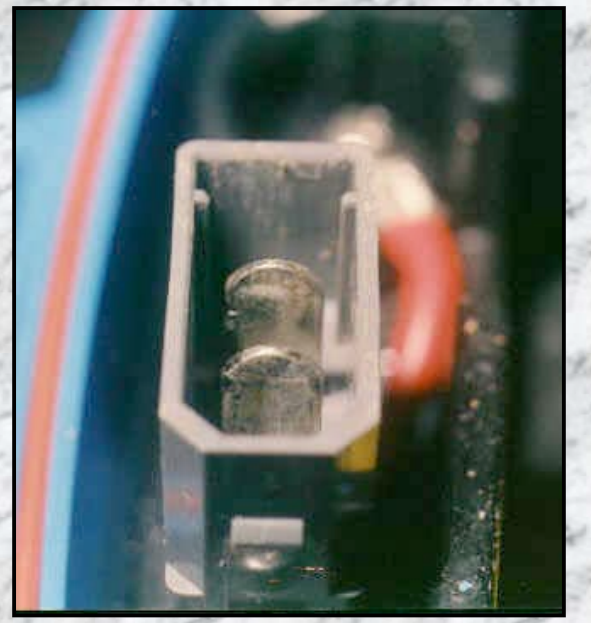
The motor brushes can be checked for wear (circled) however they normally last many years.

INSPECTION

The water sensor terminal screws shown here are rusted, all corrosion must be cleaned from electrical connections.



The battery plug can be stripped down into separate parts, this will allow all points of contact to be cleaned.



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AV1

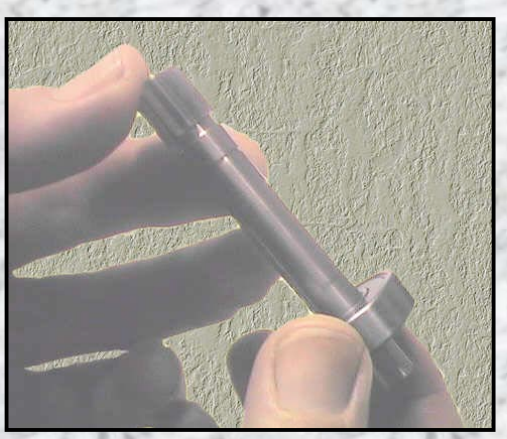
INSPECTION

Other parts of the AV1 scooter may require examination prior to refitting, this will be left to the discretion and common sense of the repair person.

After all parts have been cleaned, examined and tested we are now ready to reverse the procedure and reassemble the AV1 Scooter

ASSEMBLY

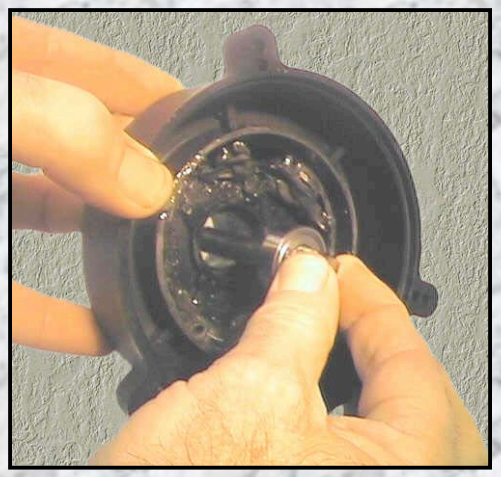
Examine the clutch axle for wear, pay carefull attention to the knife edge seal area . The axle may be polished using fine scotch brite. Ensure the bearing is serviceable and slide it along the axle.



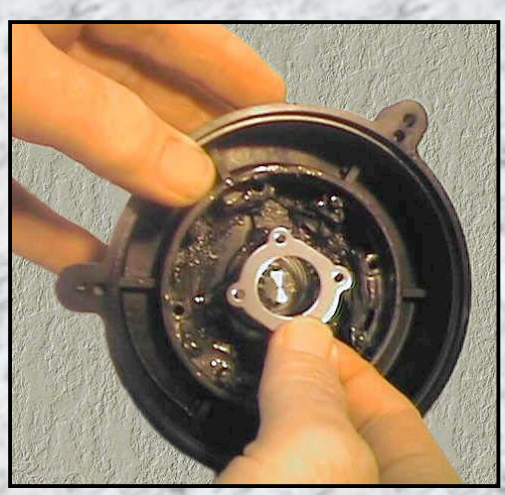
The bearing should be seated against the gear and the retaining clip is positioned in it's groove against the bearing.

ASSEMBLY

Fit the axle to gear case, the bearing should press home by hand.



Install the bearing retainer and secure in position using four Philip's head screws.



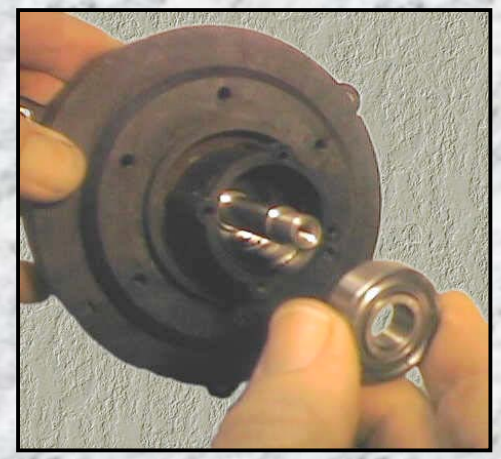
apollo

AV1

ASSEMBLY

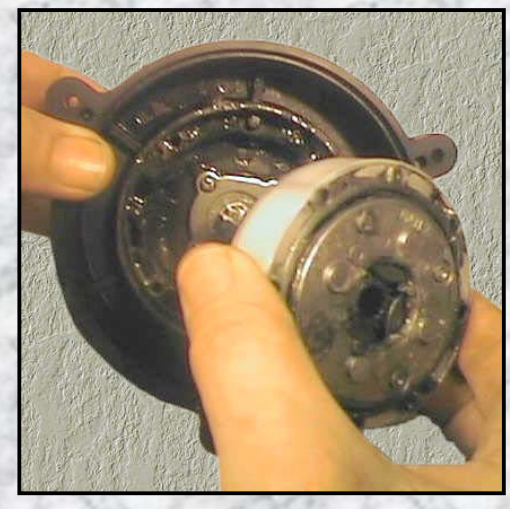
The second axle bearing is now installed.
The bearing can be pressed home by hand.

If unable to fit by hand check for burrs or corrosion on the shaft.

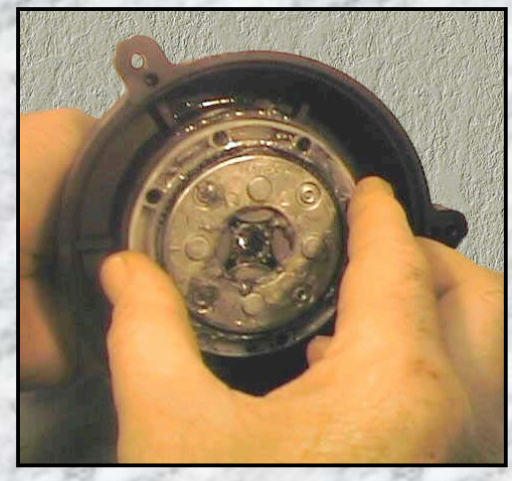


ASSEMBLY

Care should be taken when installing the gears. Ensure the flat face of the gears is facing the motor as shown right.



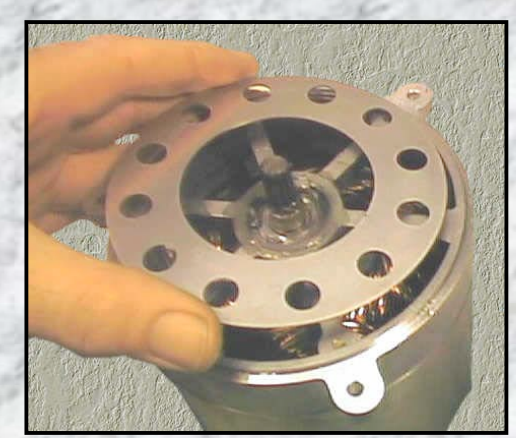
There are eight holes around the outer edge of the gears, four holes are for the securing screws. The remaining holes are to engage anti-rotation lugs moulded into the case. Ensure the anti-rotation lugs are properly engaged and the gears are sitting flat.



ASSEMBLY

Fit the four securing screws to the gears and tighten.
Do not over tighten, these screws are engaging plastic threads.

Turn the axle by hand to check for smooth operation of the bearings and gears.

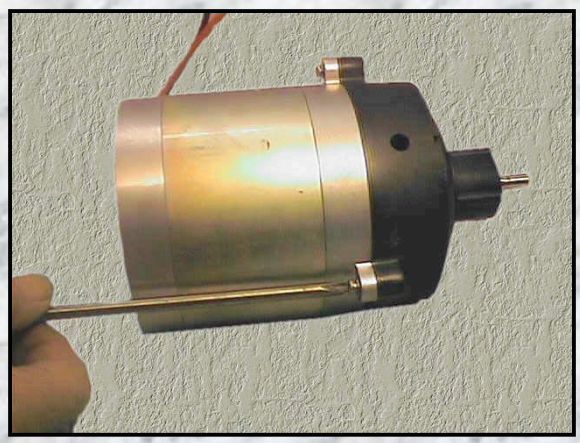


Sit the gear plate on top of the motor

ASSEMBLY

Position the gear case on the motor, align the index mark. Ensure the motor shaft is engaged in the gears and the gear case is flush on the motor housing.

Secure the gear case using three Philip's head screws with spring washers.



apollo

AV1

ASSEMBLY

The gear case assembly can now be completed.
Lightly lubricate and install a new o ring for the seal retainer. It simply sits against the face of the bearing.

Place the seal retainer into the gear case.

apollo

AV1

ASSEMBLY

A new rotation seal ‘L’ is fitted.
Never reuse a rotation seal always fit new seals during repairs.

This seal does not have a spring fitted to the inner lip.
Be sure to fit the correct seal.

Ensure the seal is sitting flush with the retainer, press gently around the edges until flat.

ASSEMBLY

Fit the seal retainer and secure using four counter sunk Philip's head screws.

Ensure the main body cover has been cleaned and inspected prior to assembly. Remove old o rings and any excess sealant.

apollo

AV1

ASSEMBLY

It is important to follow the next set of instructions carefully. If the motor, bulk head or propeller lock are installed incorrectly the AV1 will require disassembly and rebuilding. It could be beneficial to have a trail run, a build without using sealant for your first rebuild.

There are two anti-rotation lugs moulded in the body cover, these must engage the recess notches in the gear case.

ASSEMBLY

Install a new gear case o ring. Silicone sealant is then applied over the o ring, do not apply an excess of sealant, wipe around the o ring using your finger or a flat blade screw driver.

Before installing the motor check the wiring on the bulk head will line up correctly with motor. Also check the bulk head will not be installed 180 degrees out in the body cover, the front cover must engage the bulk head.

Place the motor on a suitable support, fit the body cover over the motor.

apollo

AV1

ASSEMBLY

The gear case must be flat and even in the body cover, if it is not flush check the anti-rotation lugs are engaged.

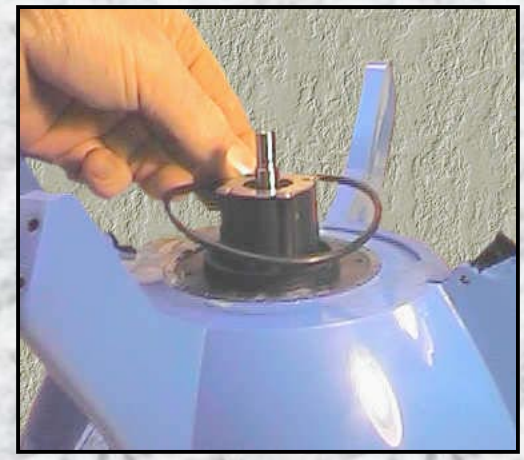
Apply a coating of sealant to the gear case o ring groove.

apollo

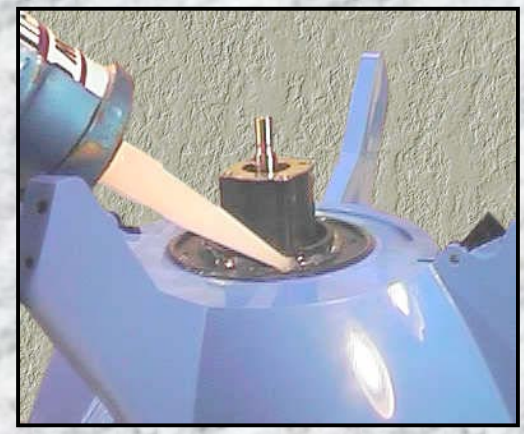
AV1

ASSEMBLY

Install a new gear case o ring. Any sealant pushed from the groove can be spread around the o ring with your finger or a flat blade screw driver.

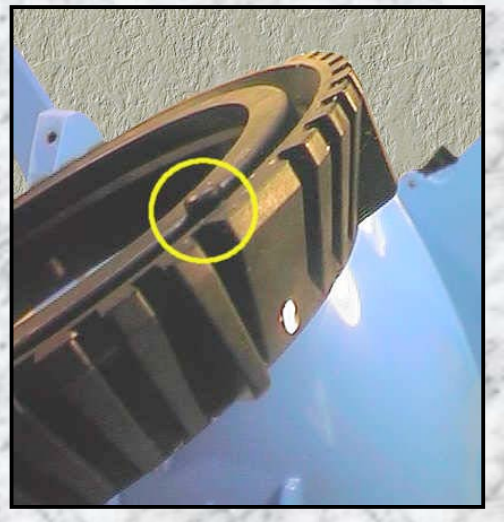


Sealant is applied to the inner shoulder on the gear case, do not apply a large quantity, any excess will squeeze out during assembly and cause problems when tightening screws.

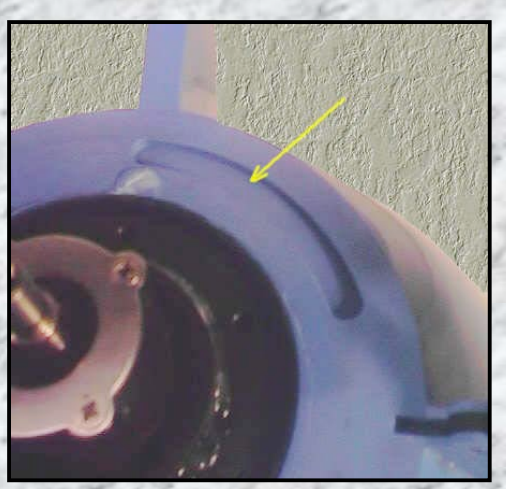


ASSEMBLY

The propeller clamp ring is installed next.



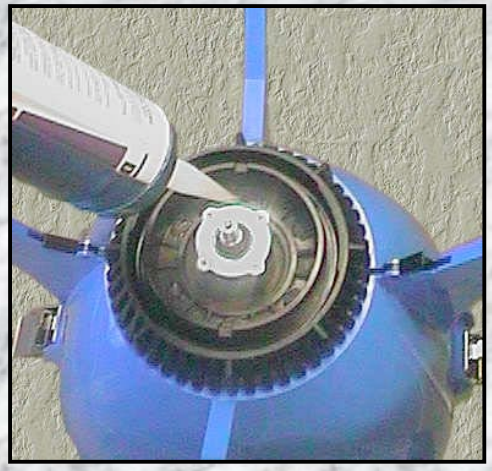
NOTE: The locating lug. (circled) This engages in the groove on the body cover shown with the arrow.



ASSEMBLY

The gear case retainer is fitted next.

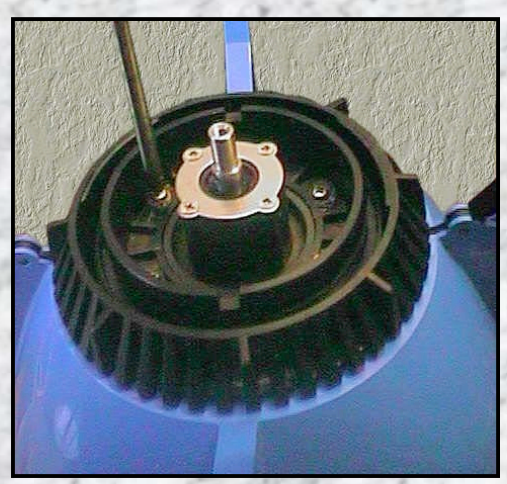
NOTE: The cut outs in the top of the retainer, these must be fitted at six and twelve o'clock respectively.



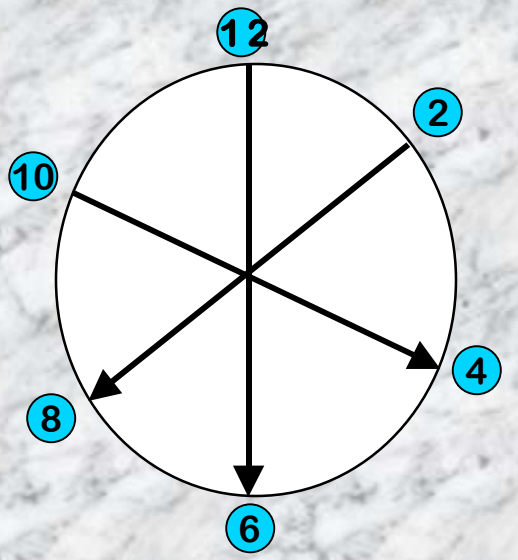
Before installing the six retaining screws and star washers each screw hole is covered with around 2mm of sealant.

ASSEMBLY

Install the six retaining screws with start washers through the sealant and tighten.



Do not tighten down hard initially.
The screws should be tightened in sequence.
Start with screw at 12 o'clock then six o'clock,
10 o'clock then 4 o'clock next 2 o'clock and lastly
8 o'clock. Repeat the order gradually tightening
more each time.
Remember these are plastic threads plus the sealant is squeezing out as you tighten.

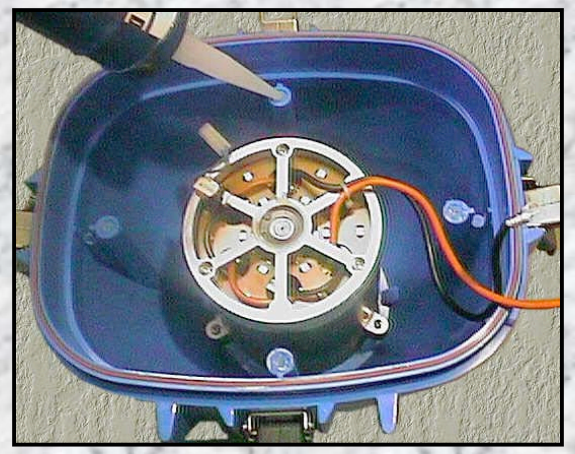


apollo

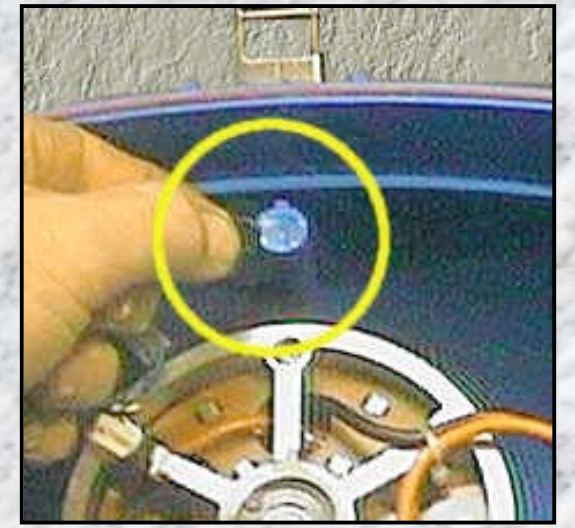
AV1

ASSEMBLY

Cover the four bulk head support screw holes on the body cover with sealant.



Place four new o rings in the grooves on the support holes, spread the sealant over the o rings.

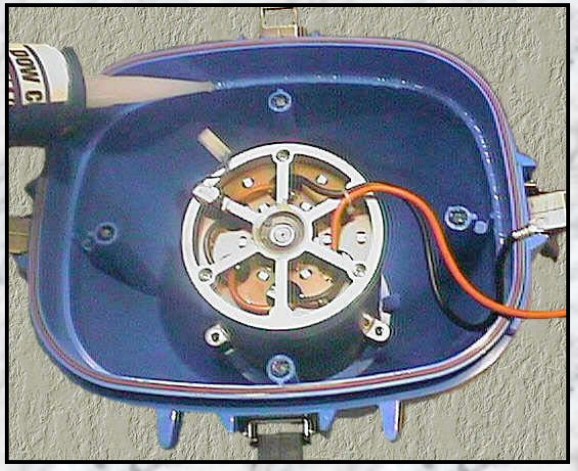


apollo

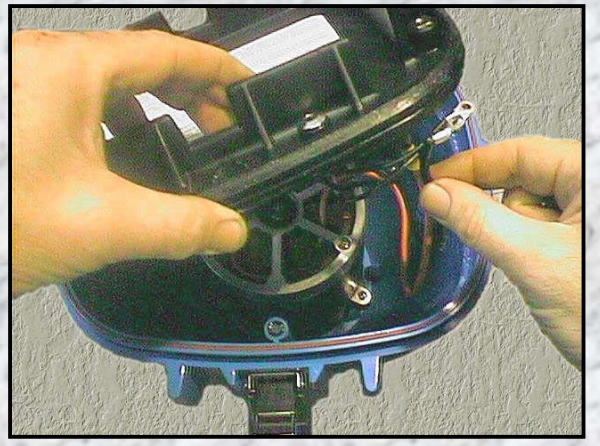
AV1

ASSEMBLY

Apply sealant to the inner shoulder where the bulk head sits. Ensure an even coverage around the entire shoulder.

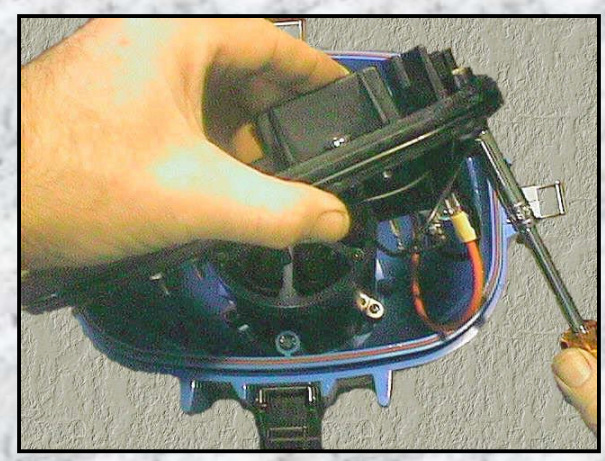


Reattach the wiring harness to the bulk head. Be sure to fit the heat sensor connector.



ASSEMBLY

Tighten the wiring terminal nut using a 9/32” deep socket. After tightening check that no wiring is likely to become caught up on the shoulder of the body cover or under any of the four bulk head support screw holes.



With all wiring tucked out of the way, press the bulk head home by hand. Ensure an even seating all the way around.

apollo

AV1

ASSEMBLY

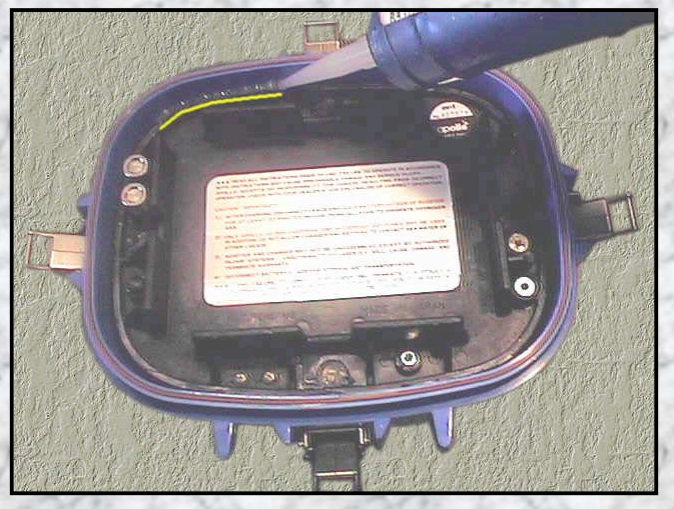
Install and tighten the four bulk head retaining screws.

Tighten the screws opposite each other progressively, wait two minutes and retighten. Allow a little time or the sealant to squeeze out from the bulk head shoulder.

After tightening the four screws, cover the screw heads with sealant and smooth it over with a screw driver.

ASSEMBLY

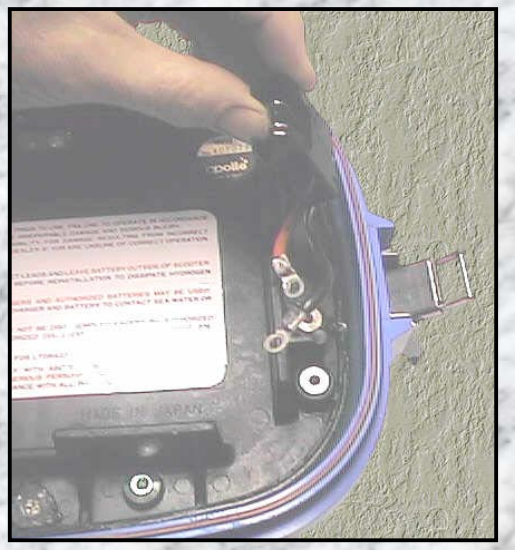
Apply sealant and fill the shoulder groove around the outer edge of the bulk head.



Smooth the surface of the sealant using a screw driver and wipe away any excess.

ASSEMBLY

Refit the battery plug assembly, check the the wires are connected with the correct polarity.



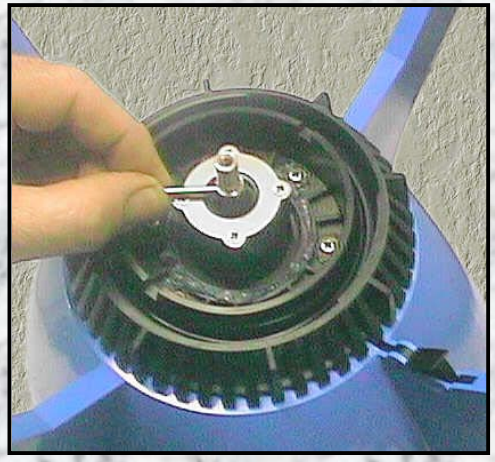
Tighten the plug retaining screws. Do not over tighten. (Plastic threads)

apollo

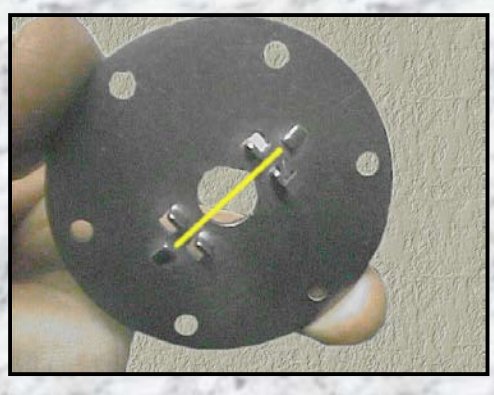
AV1

ASSEMBLY

Turn the scooter over to complete the final assembly. Install the clutch drive pin through the clutch axle. Check the pin is straight, if bent replace the pin.

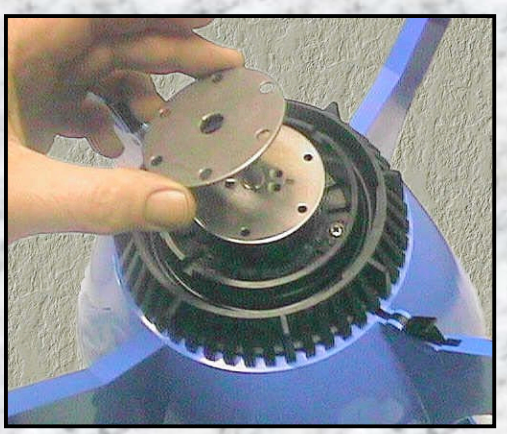


The clutch is now assembled onto the axle, the first plate ‘A’ is the driving plate shown here. Ensure the drive pin engages in the position shown.

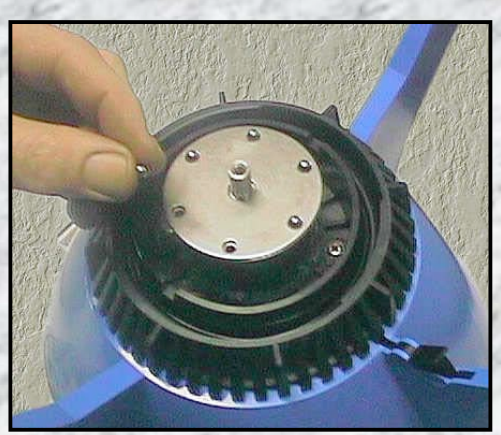


ASSEMBLY

Clutch plate ‘B’ is placed over the axle and sits loosely on plate ‘A’.

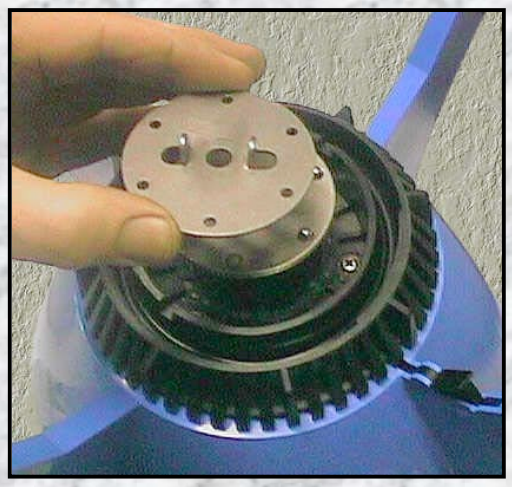


The six ball bearings are placed in the holes in plate ‘B’. Do not lubricate any parts of the clutch.

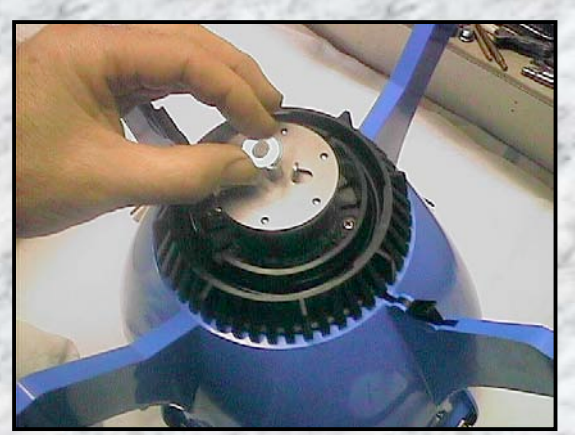


ASSEMBLY

Place plate ’C’ (the driven plate) onto the ball bearings, take care not to disturb the balls.



Place the bevel spring, curved outer edge up on the axle.



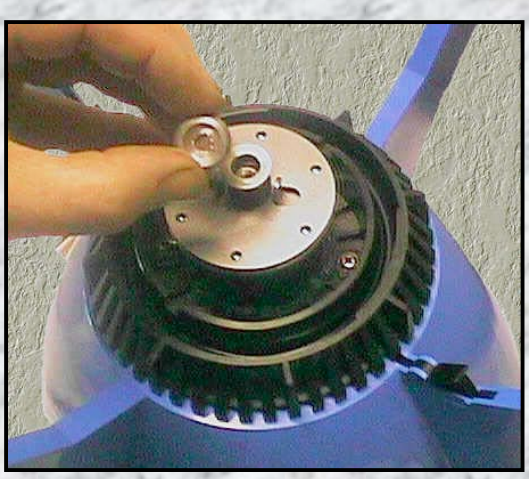
apollo

AV1

ASSEMBLY

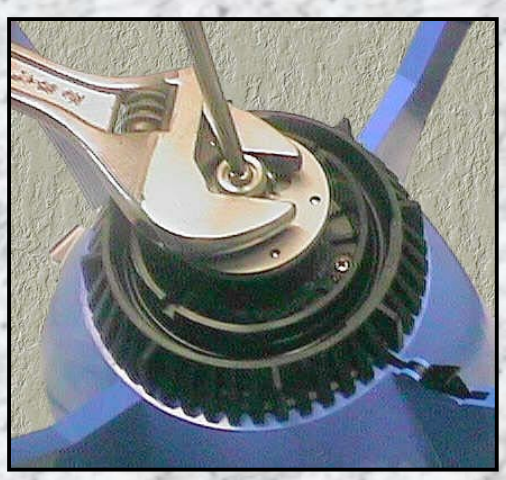
Install the clutch spring, and any flat washers.

The (thick) clutch washer is installed with the recess up.

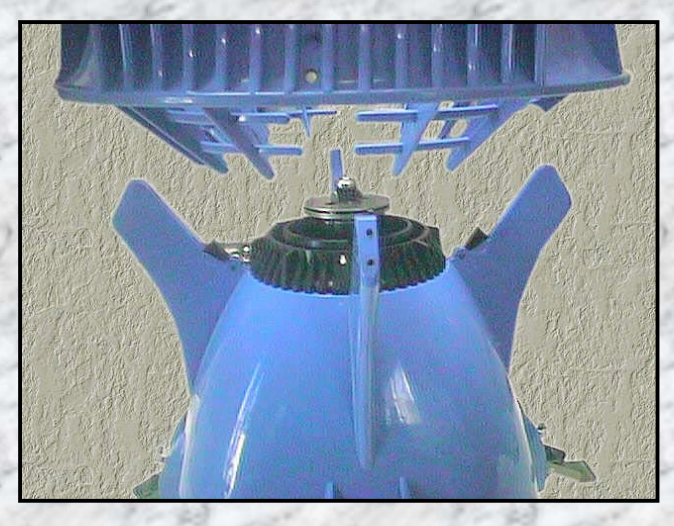


ASSEMBLY

Place the star washer on the retaining screw. The screw is held in position with a drop of '243 Loctite' applied to the thread.



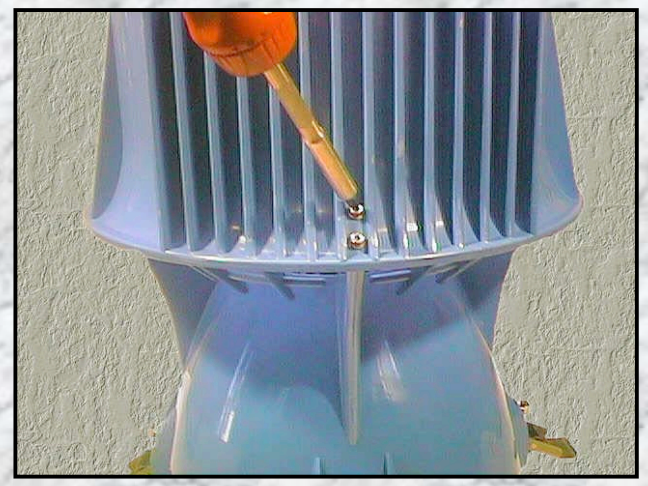
The screw is tightened counter clockwise, it is left hand thread.



Place the propeller cover on the body the multi finned section (shown) is to the top.

ASSEMBLY

Fit the eight propeller cover retaining screws and washers and tighten.
Do not over tighten. (Plastic threads)



The scooter is now ready for wet testing.

apollo

AV1