

**TECHNICAL  
MANUAL**

The Apollo logo is displayed in a stylized, bold, dark blue font. It features the word 'apollo' in lowercase, followed by a vertical bar and a circle. The logo is set against a dark blue background with a gradient and several light blue circles of varying sizes.

**AV1  
Underwater  
Scooter**

**PROPELLER CASING**

**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.

## **TOOLING REQUIREMENTS**

**No.1 Philip's tip screwdriver**

**No.2 Philip's tip screwdriver**

**No.3 Philip's tip screwdriver**

**Nylon Dowel 15mm x 10mm Dia.**

**Small ball pane engineer's hammer**

**Pin punch**

**6" Flat blade screwdriver**

**O ring pick**

**Magnifying glass**

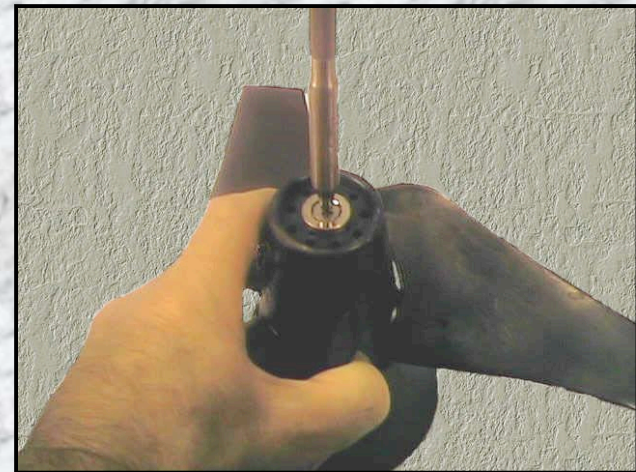


## DISASSEMBLY

Propeller Housing is shown positioned ready for dismantling.

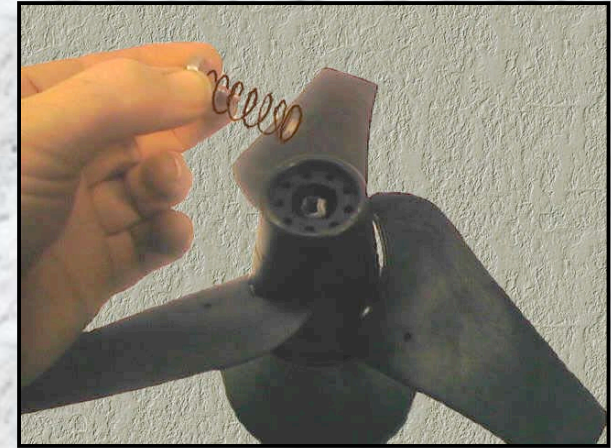


Remove pitch adjusting knob screw.  
(counterclockwise)

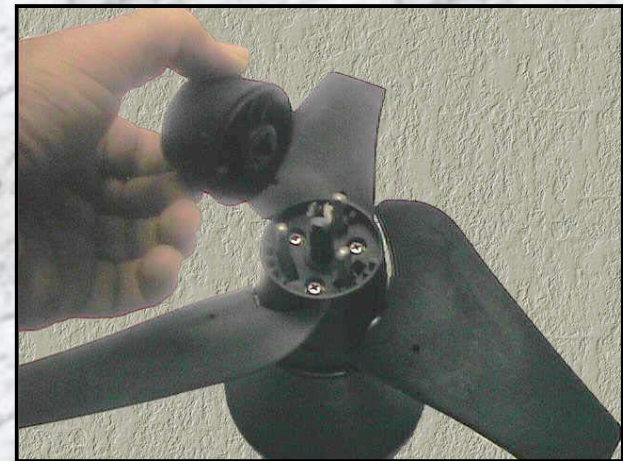


## DISASSEMBLY

Lift out the screw washer and the knob return spring.



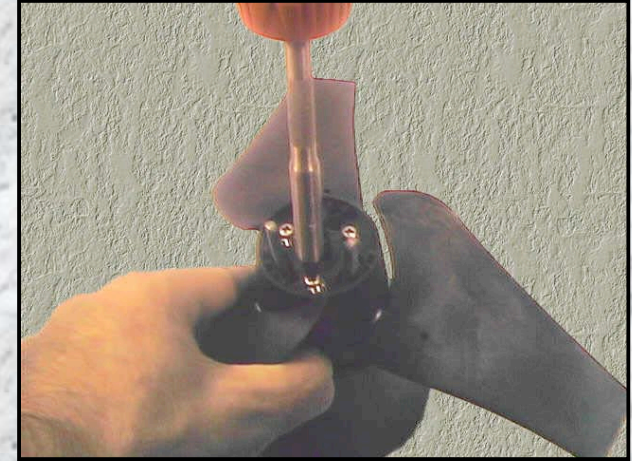
Lift the pitch adjusting knob from the propeller blades.



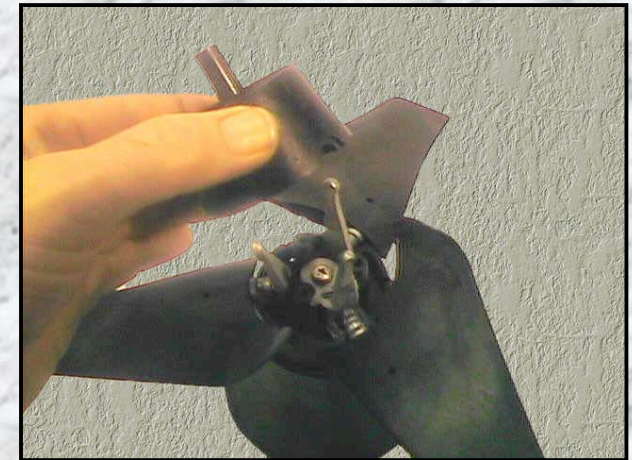


## DISASSEMBLY

Remove the three Philip's screws and star washers that secure the propeller blade retainer in position.



Lift the blade retainer from the casing.



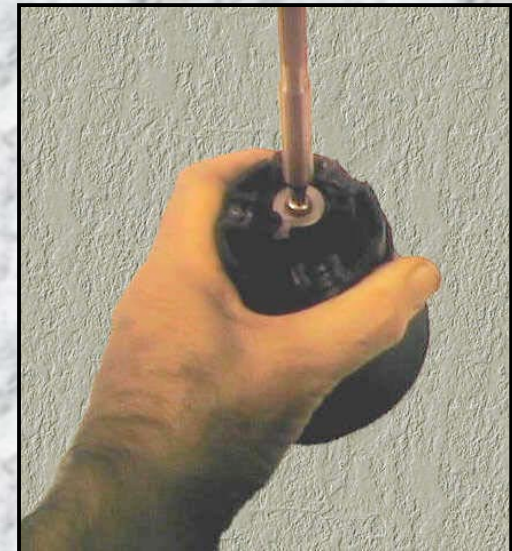
## DISASSEMBLY

Each blade can now be removed from the propeller base.



A No.3 Philip's screw driver is required to undo the centre screw from the propeller base.

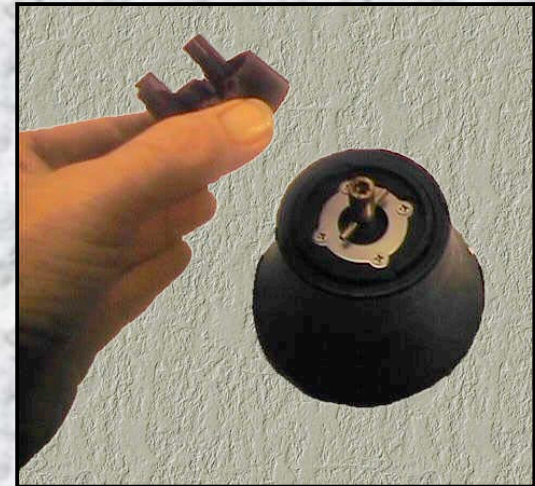
This screw is a left hand thread (**to remove turn clockwise**) plus it usually has a drop of loctite so it could require a little more than normal effort to undo.





## DISASSEMBLY

Lift the propeller base from the shaft.



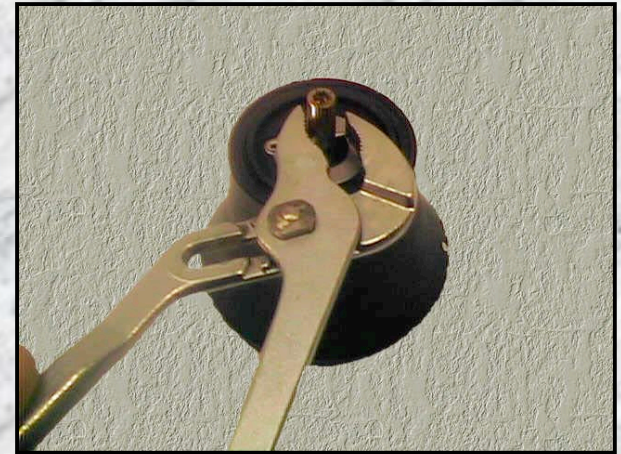
The drive pin must be removed from the propeller shaft next. This, at times, can be bent and may require straightening before removal. Align the pin with the slots in the casing before removal.



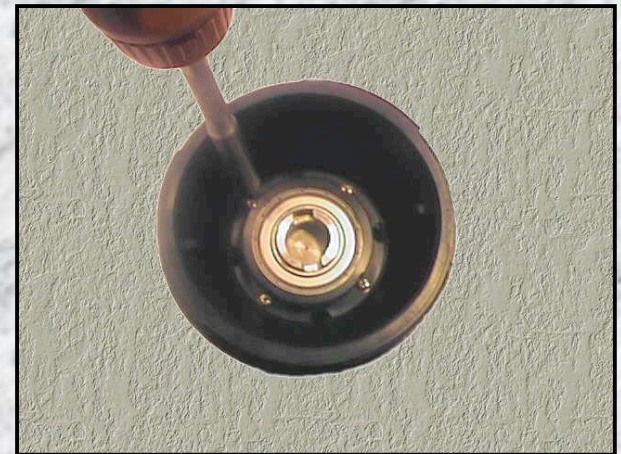


## DISASSEMBLY

If the drive pin has been bent or has surface rust a pair of multi grip pliers can be used to push the pin from the shaft. Take care to prevent the pliers from scoring the shaft.



Turn the housing over to gain access to the four screws that secure the large bearing housing. Remove these screws and washers.



## DISASSEMBLY

The propeller shaft can now be pushed from the casing. This is usually accomplished by hand, however, if the unit has flooded and surface rust is present you may need to tap the shaft out using a nylon dowel and small hammer.



The bearing, propeller shaft and bearing housing can be removed as a unit.



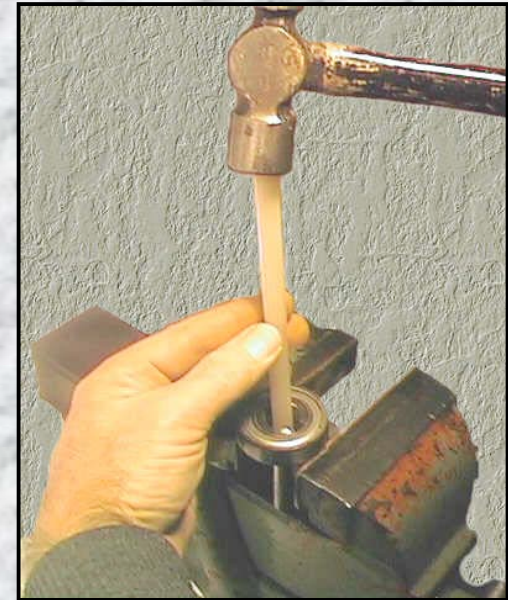


## DISASSEMBLY

The bearing housing is separated from the bearing by hand.



After removing the large 'C' ring from the propeller shaft support the bearing by the inner race in a suitable vice, using a nylon rod and small hammer, gently tap the shaft through the bearing.



## DISASSEMBLY

Position the case with the seal side up and remove the four countersunk screws securing the FA seal retainer, remove the retainer.



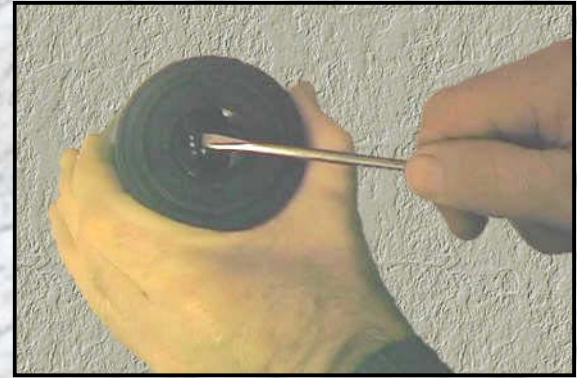
Use an o ring pick, taking care not to score the sealing surface, remove the seal retainer o ring from around the outer edge of the seal. Discard this o ring it is to be replaced after each removal.





## DISASSEMBLY

Using a screw driver or suitable probe prise up the FA seal, remove and discard.

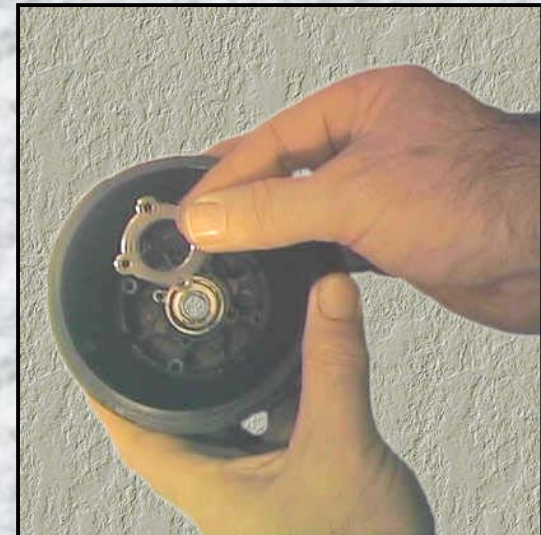


## DISASSEMBLY

Turn the propeller casing over to gain access to the small bearing retainer. Remove the four screws securing the retainer.



Lift out the bearing retainer.





## DISASSEMBLY

Place the casing on a solid surface (wide diameter down) and gently push or tap out the bearing.



The dismantling of the propeller casing and its components is now complete.



## **INSPECTION**

### **SEALS**

The FA seal P/No. 3993600000 together with seal o ring P/No.3993000022 are to be replaced after each disassembly.

### **PLASTIC COMPONENTS**

All non metal parts are to be cleaned in warm water and detergent using a brush to remove any built up grease or stains.

Dry with a lint free cloth or blow dry with clean air.

After cleaning check the o ring sealing surfaces for scoring or gouge marks.



# INSPECTION

## PROPELLER SHAFT

A critical sealing area to be checked using a magnifying glass is the sealing area for the FA seal.

Although the seal is rubber after prolonged use it can wear a groove in the metal shaft.

Any sign of pitting or grooving requires the shaft to be replaced.

Check both ends of the shaft for burrs, these can prevent assembly later. Any burrs can be carefully removed using a small warding file.



## **INSPECTION**

### **RETAINERS, SCREWS, WASHERS etc.**

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**Stainless steel parts, seal retainers together with screws and washers can become contaminated with surface rust.**

**Most surface rust can be removed by polishing with a fine grade of 'Scotch Brite' (nylon scourer) after polishing all metal parts should be acid bathed, rinsed, dried and then examined for any surface pitting from corrosion.**

**If pitting is evident the faulty parts must be replaced.**



## INSPECTION

### BEARINGS

The large bearing (P/No.399 02 00 003) and the small bearing (P/No.399 02 00 002) must be inspected prior to refitting.

Any sign of surface rust is an indication that corrosion could be present on the internal balls and races.

The bearings are sealed and pre-lubricated so the bearings must not be immersed in any solvent cleaning baths, this will wash out the lubricant and there is no way to repack the bearings.

**Any signs of corrosion, stiffness or rough rotation and the bearings must be replaced.**

# INSPECTION

## PROPELLER BLADES

Blades can become bent at the support arms if the scooter has suffered an entanglement. Check carefully to prevent installing a bent blade.



## CLUTCH PLATES

Wear to the clutch plates can also result from entanglements. To check for wear or damage the plates must be removed, the wear marks will appear on the top and bottom plates on the side that faces the balls. Any sign of a groove between the outer holes worn by the balls will require the plate/s to be replaced.





## ASSEMBLY

**Prior to assembly ensure all parts have been cleaned and inspected for flaws.**

**To commence the assembly place the small bearing into the casing. The bearing can be pressed into the casing by hand. The bearing is symmetrical so either side can face up.**

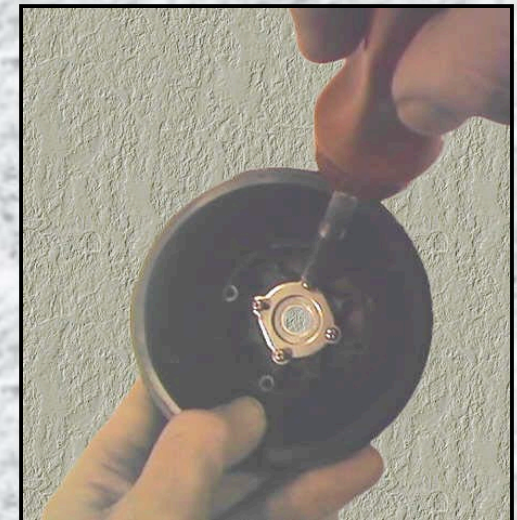


## ASSEMBLY

The bearing retainer is now fitted, the round edged side should face upwards.

**CAUTION** : Many of the screws fitted during assembly will be secured into plastic threads, care must be taken not to over tighten and strip threads therefore requiring expensive parts to be replaced.

Secure the retainer using four short shank round head No.1 Philip's screws.



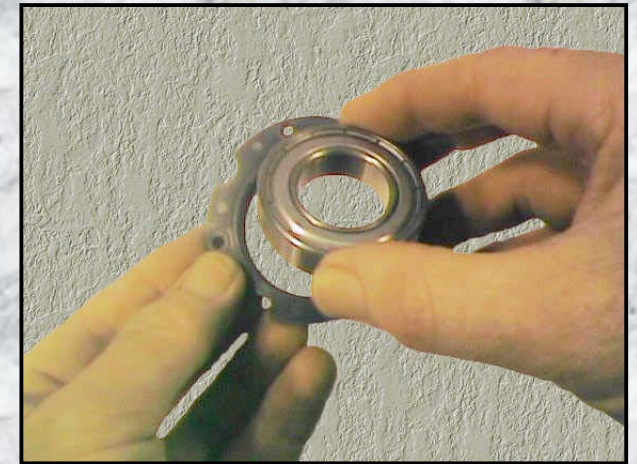


## ASSEMBLY

Fit the 'C' ring to the propeller shaft, then install the shaft through the small bearing. Press the shaft home by hand, if the shaft cannot be installed by hand check for burrs on the shaft.

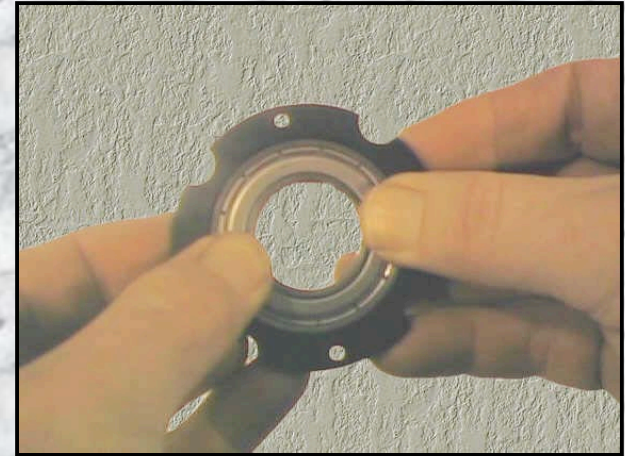


The large bearing is now pressed by hand into the bearing housing.



## ASSEMBLY

The bearing is set flush into the housing.



The large bearing and housing are now fitted to the shaft. The housing flange side (wide diameter) facing down.



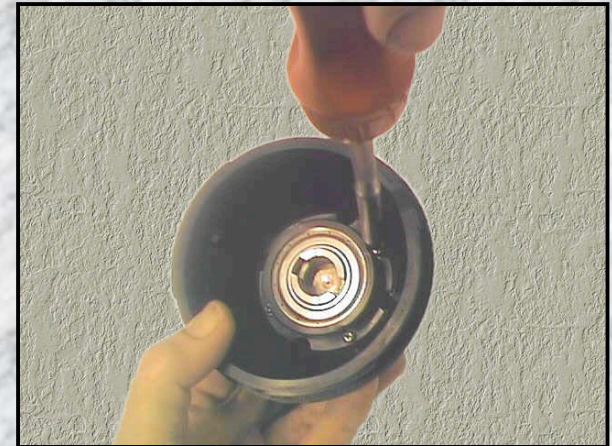


## ASSEMBLY

The bearing and housing are pressed home by hand.



Secure the bearing housing into the casing, use four long shank round head No.1 Philip's screws with four small flat washers.



The propeller shaft and bearing should now be secure. Test for smooth rotation by spinning the shaft, if using old bearings check carefully for any binding.

## ASSEMBLY

**NOTE :** There are two types of knife edge seal used on the AV1, the FA seal fitted on the propeller shaft has a small spring around the knife edge plus has a metal housing. The motor shaft seal is all rubber. Ensure the correct seal is used.

Lubricate the FA seal with silicone grease. Smear the lubrication on the opposite side to the spring, this will ensure the knife edge has lubrication after being installed.





## ASSEMBLY

The seal is installed with the flat face down.



Press the seal gently around the edges until it is flush in the casing.



## ASSEMBLY

A new bearing o ring is lightly lubricated with silicone grease and installed in the groove around the outer edge of the bearing.



Ensure the o ring is in position, fit the bearing retainer. The countersunk holes in the retainer face up.





## ASSEMBLY

Secure the retainer using four Philip's head counter sunk screws.



Line up the drive pin holes in the shaft with the slots in the casing and install the drive pin. Ensure the pin is centred.



## ASSEMBLY

The propeller base can now be fitted. The drive pin must be located in the moulded slot of the base, shown in the picture, or there will be no drive.



The clutch screw assembly is now fitted. The star washer sits on the boss first, next the spring cup washer, the inner edge should sit on the star washer and the outer edge is curved up.





## ASSEMBLY

A drop of 'Loctite 243' is used on the thread of the screw. ( No. 3 Philip's head )



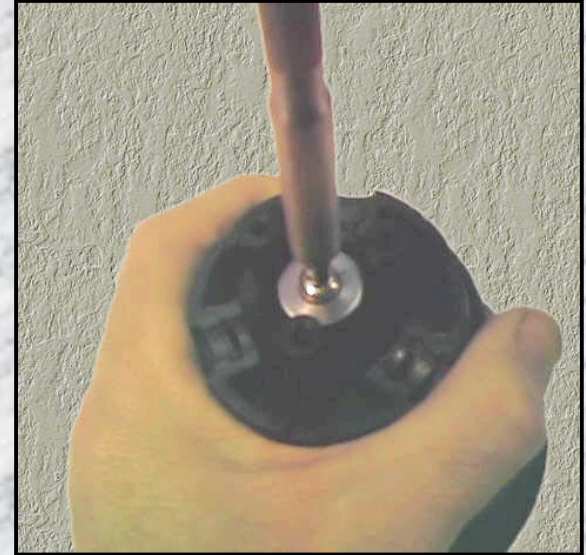
The flat washer is fitted to the screw and the screw installed.



## ASSEMBLY

The screw is tightened counter clockwise. ( left hand thread )

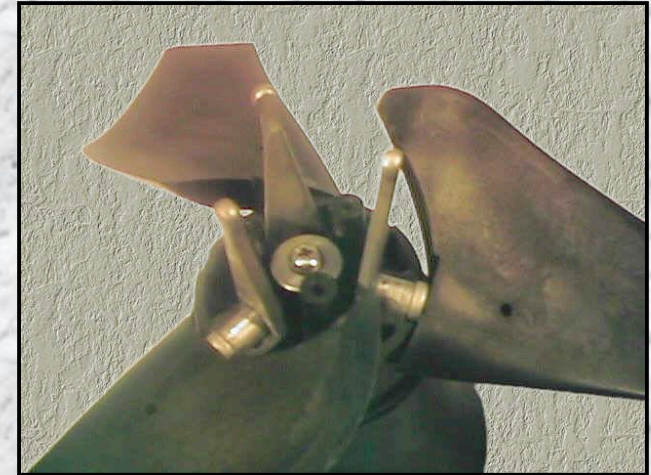
Lubricate the blade locating slots in the boss with silicone grease.  
A heavy lube is required.



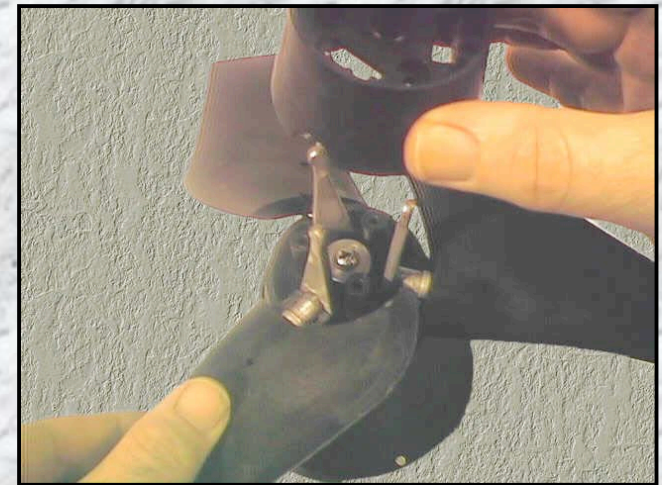


## ASSEMBLY

Install each blade as shown. The exposed part of each blade shaft (where they locate in the boss) are now lubricated with silicone grease.

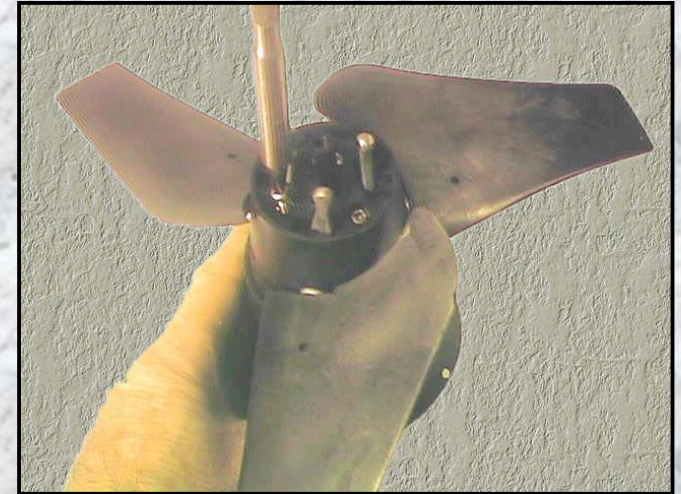


Install the propeller retainer taking care to align the blade arms through the slots in the retainer.

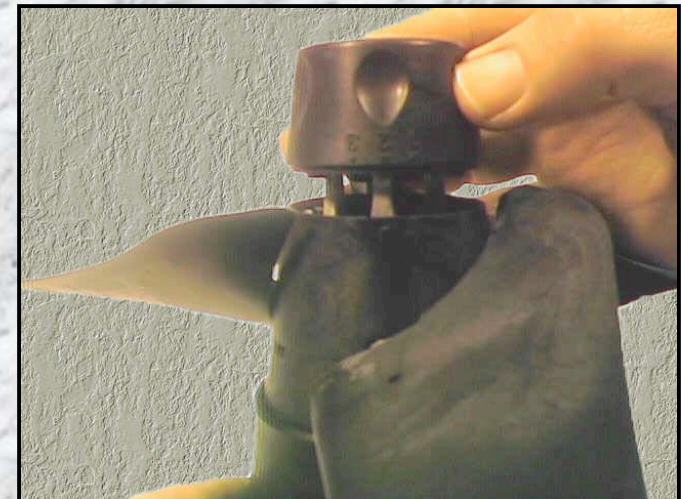


## ASSEMBLY

Three No.2 Philip's head screws with star washers are fitted and carefully tightened. ( into plastic threads )



Position the three blade arms centre (straight up) the pitch knob is now carefully lowered over the arms.

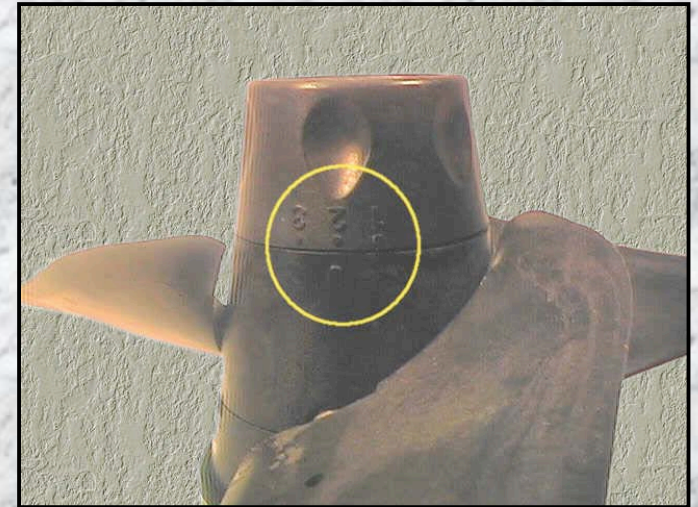




## ASSEMBLY

Ensure the pitch numbers (1, 2, 3) on the adjusting knob are aligned with the numbers on the propeller retainer.

If the blade arms are facing straight up pitch setting 2 must be aligned.



The pitch knob return spring, countersunk washer and counter sunk screw are now installed. Lubricate the spring with silicone grease prior to installation.



## ASSEMBLY

Using a No.3 Philip's screw driver tighten the pitch knob retaining screw.



Final checks can now be carried out.  
Ensure the blades spin freely.  
Check the operation of the pitch setting knob.

