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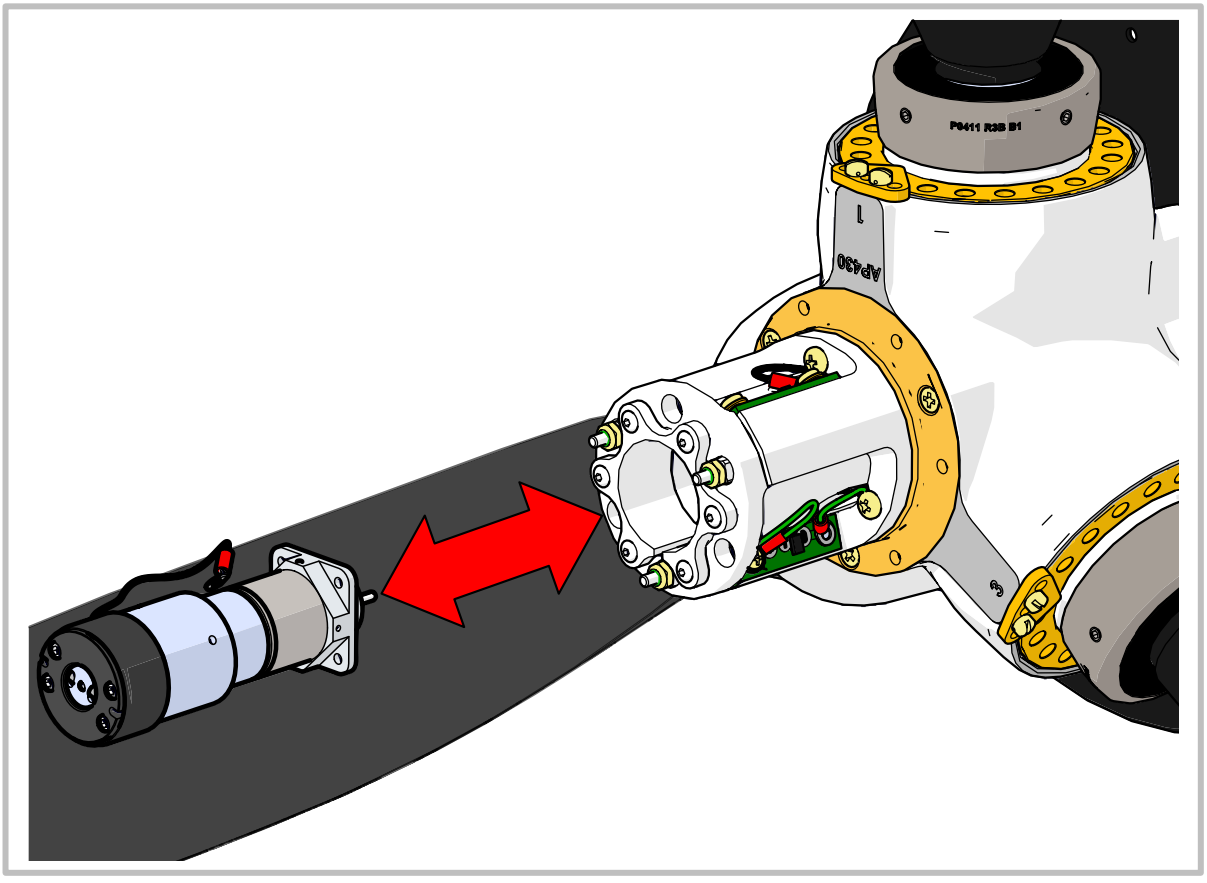
ASI-7-5-2

PITCH CHANGE MOTOR REPLACEMENT (DC MOTOR)

PROCEDURE



SUBJECT:	
Repairs & Upgrades	
ASSEMBLY NO:	**APPLICABILITY:**
AH-xxx	All propellers excluding DSD models

1. TOPIC

1.1 Introduction

This document covers the procedure for replacing the pitch change motor inside DC versions of the Airmaster propeller hub. This procedure does not apply for brushless motors used in digital servo-drive (DSD) propeller systems. This procedure may be performed with the hub mounted to the engine flange, and the blades installed.

Airmaster offers several types of DC pitch change motors, the most common being the Faulhaber and Maxon versions. Specific instruction pertaining to different motor types are provided in the following sections. After replacement, the controller may need to be reprogrammed before next flight.

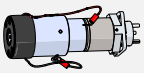
Replacement of the pitch change motor may be required due to a failure, or for compliance with service instruction. Symptoms for a failed pitch change motor may include an open circuit alarm (all lamps flashing red on the controller), intermittent control, or loss of operation of the propeller.

ⓘ *Note*
*If the propeller is suffering an open circuit, operators should perform the troubleshooting steps outlined in **ASI-7-3-2** first, to determine whether the pitch change motor may be at fault.*

ⓘ *Note*
*Airmaster Service Bulletins **APL-SB-17** and **APL-SB-22** discuss requirements to upgrade the legacy 'Globe' motor type and older versions of the 'Faulhaber' type, respectively.*

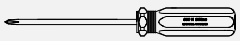
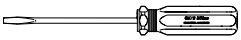
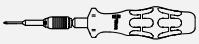
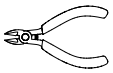
2. MATERIAL REQUIREMENTS

2.1 Parts

ITEM	QTY	PART NO.	DESCRIPTION	IMAGE
1.	1	A0457-xxx or A0455AMCxx-xxx	Airmaster PC Motor Assembly	
2.	1	AH-xxx	Airmaster Hub Assembly	
3.	4	P0114	Cap Screw 6-32 UNC x 3/8"	
4.	As required	P0469 or P0237	Panhead Screw 10-32 UNC x 5/8" (*P0237 used for AP332 models*)	
5.	As required	P0471	Panhead Screw 8-32 UNC x 1/2"	
6.	As required	A0480H or A0481H	Microswitch PCB Assy A or B (HP)	
7.	1	A0117	USB-Serial Cable	

ⓘ *Note*
The fasteners listed above may be reused if they are undamaged and residual thread-locking compound is removed from the threads before reassembly. High power version of microswitches are recommended.

2.2 Tooling

ITEM	QTY	DESCRIPTION	IMAGE
1.	1	PH2 Screwdriver	
2.	1	Flathead Screwdriver	
3.	1	2.5mm Hex Key	
4.	1	7/64” Hex Key	
5.	1	Torque Screwdriver (Bits: PH2, 3/32” Hex, 7/64” Hex)	
6.	1	Long-Nose Pliers	
7.	1	Twist Pliers	
8.	1	Wire Cutter	
9.	As required	Heat Gun	

2.3 Consumables

ITEM	QTY	DESCRIPTION	IMAGE
1.	As required	Loctite 222	
2.	As required	Loctite 243	
3.	As required	Aviation grease (Mobilgrease28)	
4.	As required	Small Paintbrush (Glue Brush)	
5.	As required	0.025” Stainless Steel Lockwire (Safety Wire)	
6.	As required	Cellotape (or similar)	
7.	As required	Torque-Seal	

2.4 Paperwork

ITEM	QTY	CODE	DESCRIPTION
1.	1	AH-xxx	Airmaster Hub Assembly Drawing & BoM
2.	1	As applicable	Airmaster Microswitch Mount Assembly Drawing & BoM
3.	1	As applicable	Airmaster Control System Circuit Diagram

4.	1	As applicable	AC200 Firmware & Parameters Sheet
5.	1	P0021	Airmaster Propeller Logbook

3. PROCEDURE

WARNING *Turn off aircraft power before working on propeller.*

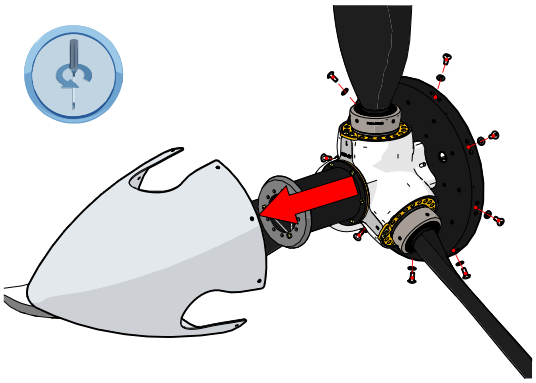
3.1 Remove PC Motor from Hub

PROCEDURE

Step 1 Remove Spinner Cone

- Remove spinner cone from backplate via truss-head screws.

Attention *PH2 Screwdriver*

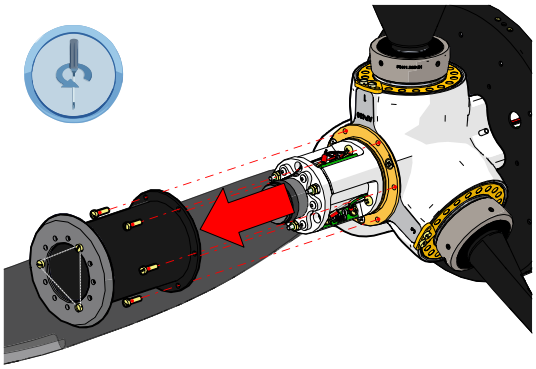


Step 2 Remove Motor Cap

- Remove motor cap from propeller hub via (6) fillister-head screws.

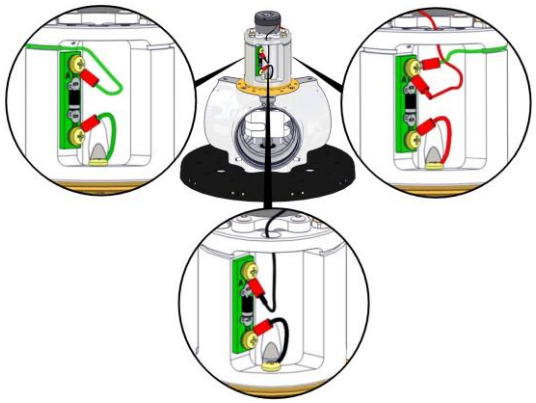
Note
Remove any lockwire retaining these screws.

Attention
Flathead screwdriver, Wire cutter, Pliers



Step 3 Record Microswitch Mount Wiring

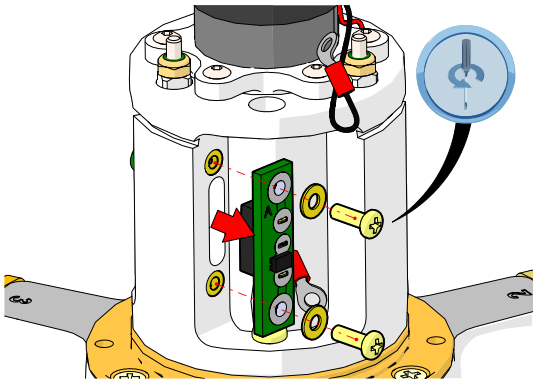
- Photograph the microswitch mount wiring at each hub port to serve as reference for subsequent reassembly, noting:
  - PC motor wires.
  - Hub power wires and link wires.
  - Microswitches.



Step 4 Dismantle Microswitch Mount

- Remove all fasteners (and washers) retaining the ring connectors of any wires fitted to the microswitch terminals.
- Withdraw microswitches.

Attention *PH2 Screwdriver*

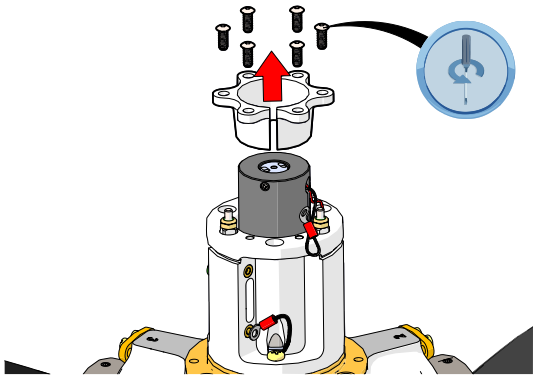


Step 5 Remove Motor Clamp

- Remove (6) riv-screws retaining motor clamp.
- Remove motor clamp by prying underneath tabs.

Attention *2.5mm Hex key*

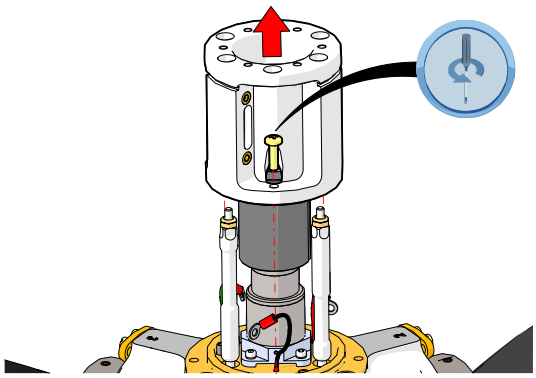
Note
A thin flathead screwdriver may be used to gently lever off the motor clamp if it is tight. Take care not to damage plastic parts.



Step 6 Remove Microswitch Mount

- Manoeuvre hub power wires and PC motor wires to prevent pinching when microswitch mount ('MsM') is subsequently removed.
- Remove panhead screws retaining microswitch mount to motor mount plate.
- Carefully withdraw MsM from hub.

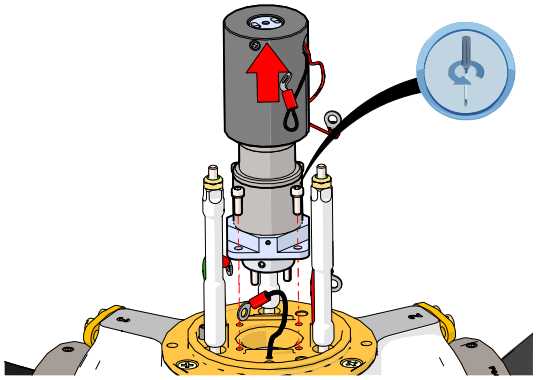
Attention *PH2 Screwdriver*



Step 7 Remove PC Motor

- Remove (4) cap screws retaining PC motor to motor mount plate.
- Withdraw PC motor from hub.

Attention *7/64" Hex key*



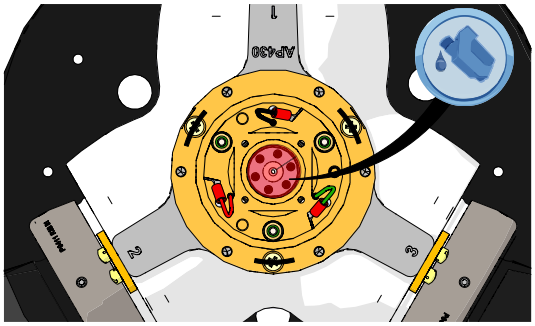
3.2 Assemble Replacement PC Motor

PROCEDURE

Step 1 Lubricate PC Spindle

- Lightly grease exposed end of PC spindle and coupling (centre of hub) for corrosion protection.

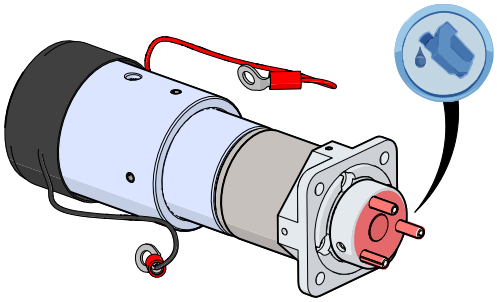
Attention *Brush, Aviation grease*



Step 2 Lubricate PC Motor Coupling

- Lightly grease mating face of motor coupling and its pins for corrosion protection.

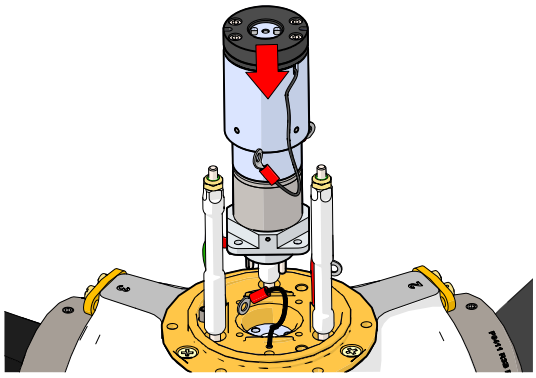
Attention *Brush, Aviation grease*



Step 3 Fit Replacement PC Motor

- Fit replacement PC motor into stepped edges of motor mount plate, align black wire with port 1.
- Ensure that motor coupling pins engage properly with PC spindle coupling, and motor seats flush (there should be no gap).

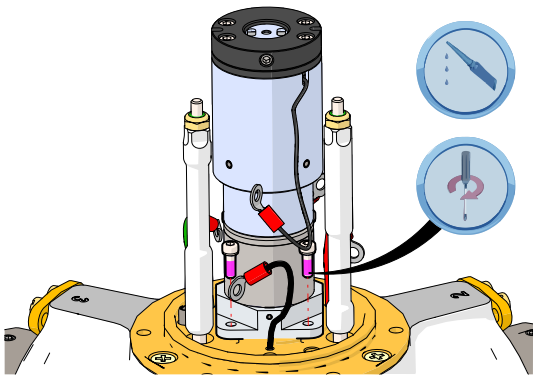
Note
If motor coupling pins misalign with coupling holes, use a small screwdriver (shaft size 3mm or less) to rotate the brake rotor disc on top until correct alignment is achieved.



Step 4 Attach PC Motor

- Apply a thin stripe of Loctite 222 to the threads of (4) 6-32 UNC cap screws (*P0114*).
- Use these screws to attach PC motor flange to motor mount plate finger tight.
- Torque screws to **1.6Nm (1.2ft-lbs)** in sequence of opposing pairs.
- Indicate with torque-seal.

Attention *Loctite 222, Torque screwdriver (7/64" Hex), Torque-seal*

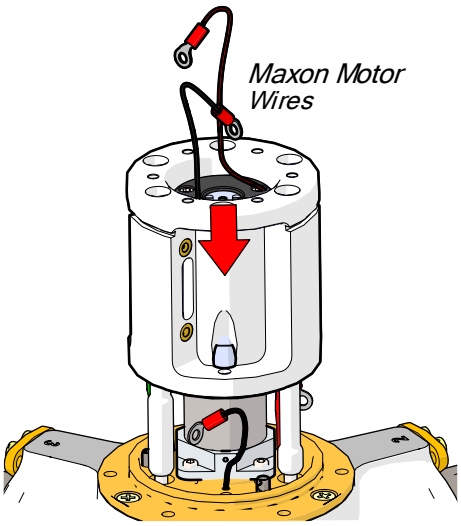


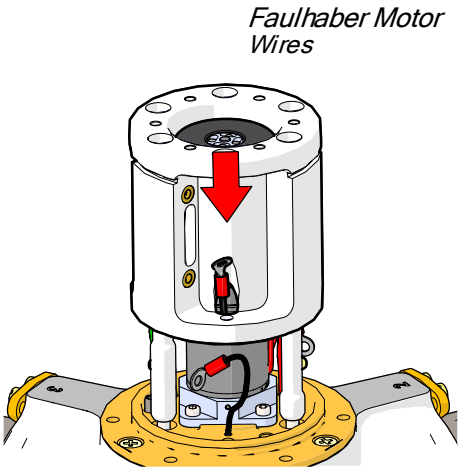
3.3 Assemble Microswitch Mount

PROCEDURE

Step 1 Seat Microswitch Mount

- Slide microswitch mount (MsM) slowly over PC cam rods, ensuring that before it is seated, the hub power wires are fed through the lower slots of the MsM, and the motor wires are manoeuvred correctly to avoid pinching:
  - *For Maxon Motors:*
    Fold motor wires upward to prevent initial pinching. For AMC versions, tuck wires firmly into the recess located either side of the motor head, clearance is limited here.
  - *For Faulhaber Motors:*
    Feed motor wires through lower slots of MsM (same as hub wires) to avoid pinching.
- Once ensured that no wires are pinched, apply a firm pressure to seat the MsM over the spring pins in the motor mount plate. Check no gap.
- Check cam rods align concentrically with corresponding holes in MsM.





> *Note*
> *For Faulhaber PC motors only, the black and red motor wires must be fed through the lower slots in the MsM (same as hub power wires) before seating.*

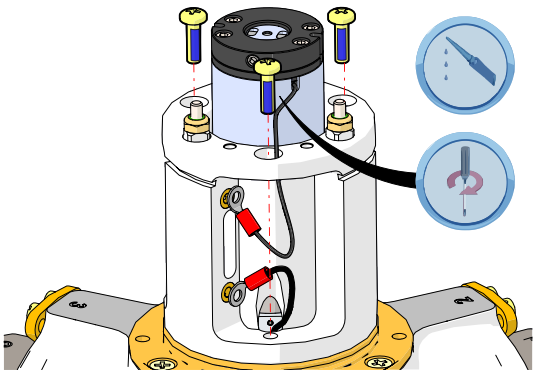
> *Note*
> *Some hubs (e.g. 2/4-port hubs or reversing types) require a specific orientation of the MsM. This does not apply for the AP430F model shown.*

Step 2 Attach Microswitch Mount

- Apply a thin stripe of Loctite 222 to the threads of (3) 10-32 UNC panhead screws (*P0469*).

> *Note*
> *For AP332 hubs, use 8-32 UNC panhead screw (P0237) instead.*

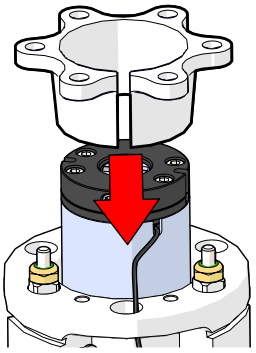
- Use screws to attach MsM to motor mount plate.
- Torque screws in increments to **1.6Nm (1.2ft-lbs).**



> *Attention* *Loctite 243, Torque Screwdriver (PH2)*

Step 3 Fit Motor Clamp

- Slide motor clamp (*P0472*) over head of PC motor, ensuring that wires aren't pinched.
- Align (6) holes in motor clamp with threaded holes in MsM.



Step 4 Attach Motor Clamp

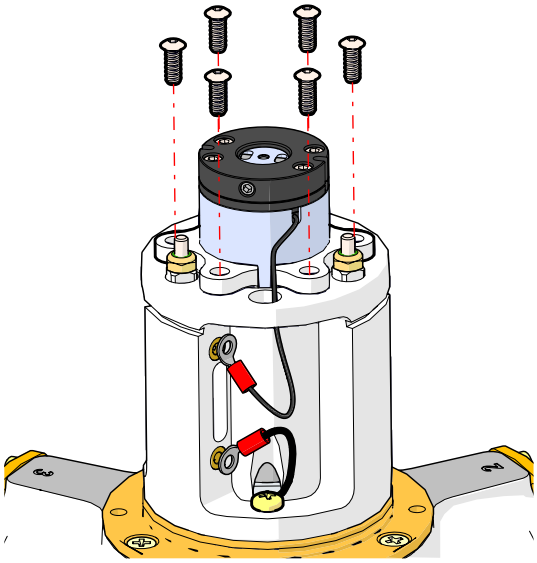
- Attach motor clamp to MsM with (6) riv-screws (*P0473*).

> **Note**
> *Apply pressure to the top of the screw head to start the initial thread.*

- Tighten screws in sequence of opposing pairs until their heads are seated against the motor clamp, and there is an even gap under each tab.

> **Attention** *2.5mm Hex key*

> **Note**
> *If any riv-screws are damaged and can't be reused, replace all six with 10-32 UNF x ½" panhead screw (P0469_12). In this case, the six threaded holes in the MsM must be reformed using a 10-32 UNF tap, then primed with Loctite SF 7471 primer, and a thin stripe of Loctite 277 applied to the threads of each panhead screw.*



3.4 Assemble Microswitch Mount Wiring

⚠ Caution
Check all wiring is in good, undamaged condition and ring connectors are well-secured.

⚠ Caution
Do not pull wires tight over edges or secure them under strain as this may lead to future damage.

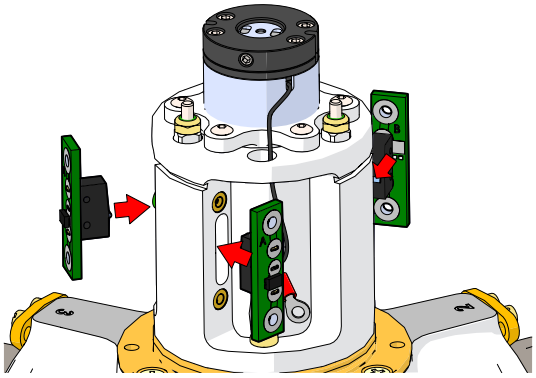
ⓘ Note
Secure all ring connectors such that the wires travel towards the centre of each microswitch.

PROCEDURE

Step 1 Insert Microswitches

- Insert microswitches into slots of microswitch mount as previously configured.

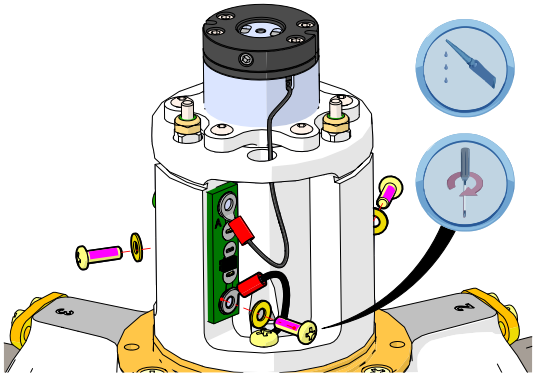
ⓘ Note
For some hub models, different microswitches are incorporated in different orientations. In the AP430F hub example shown, these are all A0480H microswitches with A-side up.



Step 2 Fit Hub Power Wires

- Fit a brass washer (*P0232*) to (6) 8-32 UNC panhead screws (*P0471*).
- Apply a thin stripe of Loctite 222 to the threads.
- Use panhead screws to attach (3) hub power wires to microswitch terminals as previously configured, finger tight.

ⓘ Attention *PH2 Screwdriver*

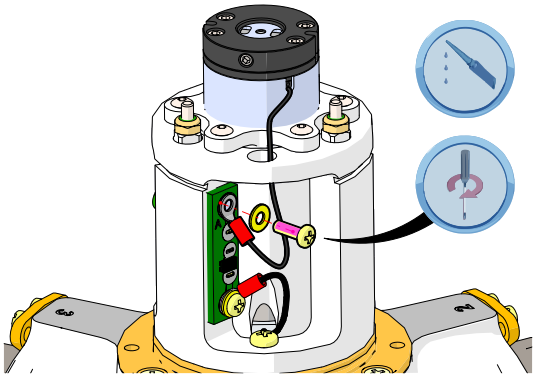


Step 3 Fit PC Motor Wires

- Route motor wires through the adjacent hole located at the top of the MsM.
- Use panhead screws to attach both motor wires to microswitch terminals as previously configured, finger tight.

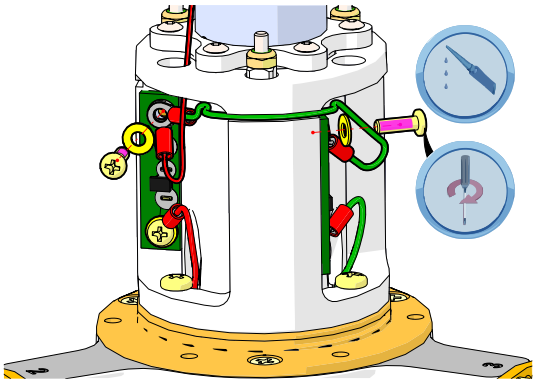
ⓘ Note
For Faulhaber motors, the motor wires are routed through the lower slot of the MsM instead (like the hub power wires) as shown in 3.3, Step 3.

ⓘ Attention *PH2 Screwdriver*



Step 4 Fit Link Wire(s)

- Use panhead screws to attach link wire(s) to microswitch terminals as previously configured, finger tight.



> *Note*
> *Ensure that link wires are fully seated inside the dedicated grooves on the outside of the MsM.*

Attention *PH2 Screwdriver*

Step 5 Secure Wires

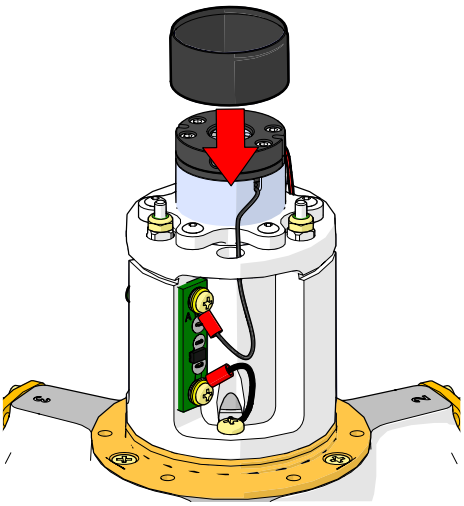
- Torque all panhead screws fitted to the microswitches to **1.6Nm (1.2ft-lbs).**
- Check all ring connectors are well-secured (no gap beneath screw head).
- Secure adjacent sections of wire with a zip-tie. Trim excess.

Attention *Torque screwdriver (PH2), Pliers, Wire cutter*

Step 6 Fit Heatshrink (As Required)

Applicable for Maxon PC motors only:

- Secure excess length of both motor wires to the sides of the motor head using a wrap of cellotape (~150mm), ensuring that some slack remains.
- Fit a 20mm tube of heat shrink over the head of the motor to encapsulate this excess wiring.
- Carefully apply heat to shrink the tube in place. Check it is secure.



Attention *Tape, Scissors, Heat gun*

> ***Caution***
> *Take care not to overheat as this may melt motor wires or other plastic parts.*

3.5 Final Hub Assembly & Testing

PROCEDURE

Step 1 Test Fine & Coarse Pitch Stops

- Turn on power to the propeller.
- Test manual operation of the propeller in accordance with procedure ***ASI-5-1-1*** to verify correct function of the propeller's fine and coarse pitch limit stops.

Step 2 Test Feather Pitch Stop (As Required)

For Feather-enabled propellers only:

- Test manual feather operation of the propeller in accordance with procedure ***ASI-5-1-1*** to verify correct function of the propeller's feather pitch limit stop.

Step 3 Test Reverse Pitch Stop (As Required)

For Beta / Reverse / Pre-Rotate-enabled propellers only:

- Test beta operation of the propeller in accordance with procedure ***ASI-5-1-1*** to verify correct function of the propeller's beta pitch limit stop.

Step 4 Torque-Seal Fasteners

- Apply torque-seal to all panhead screws fitted to the microswitch mount.

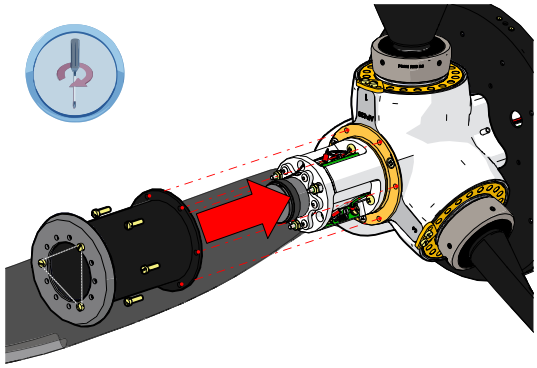
Attention *Torque-seal*

Step 5 Fit Motor Cap

- Attach motor cap to hub using (6) fillister head screws (*P0107*).
- Torque screws to **2.0Nm (1.5ft-lbs)**.

Note
The motor cap flange is marked with a dot to denote its alignment with port 1 of the hub.

Attention
Flathead screwdriver, Torque screwdriver

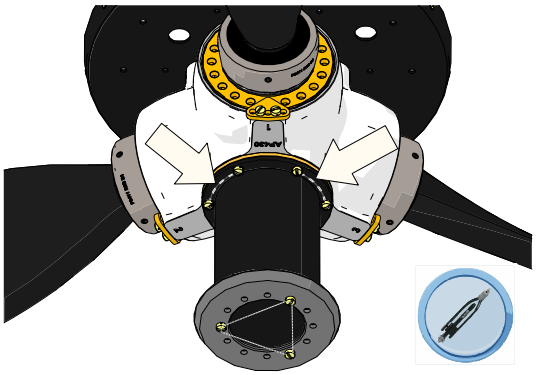


Step 6 Lock Motor Cap

- Lock-wire (6) motor cap fasteners.

> *Note*
> *The single-wire method may be used.*

> *Attention*
> *0.025" SS Lockwire, Twist pliers, Wire cutter*

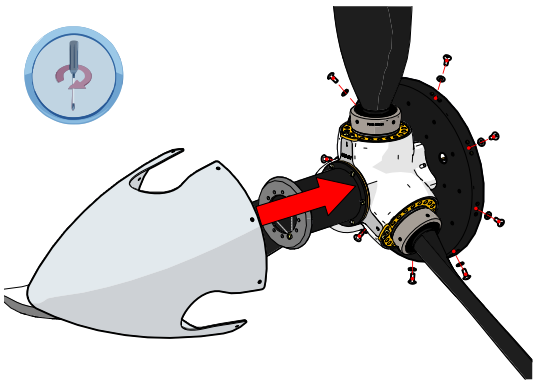


Step 7 Install Spinner Cone

- Attach spinner cone to backplate using truss-head screws (*P0150*) and fibre washers (*P0175*), starting with the central screws first.
- Torque screws to **1.2Nm (0.9ft-lbs)**.

> *Note*
> *The inside of the spinner cone is marked with a '1' to denote its alignment with port 1 of the hub.*

> *Attention* *Torque screwdriver (PH2)*



3.6 Subsequent Action

Perform the following tasks once this procedure is complete:

- If PC motor specification has changed, update the controller parameters as follows:
  - Request new parameter file from Airmaster (*support@propellor.com*).
  - Update controller parameters in accordance with procedure ***ASI-7-2-1***.
  - Save the updated parameter file from the controller in accordance with procedure ***ASI-7-2-1***, then e-mail the resultant (.par) file to Airmaster to verify that the parameter update was successful.
- Record the updated parameter values in a new column in the following locations:
  - "AC200 Firmware and Parameters" sheet.
  - Leading particulars section of propeller logbook.
- Make an entry in the propeller logbook to record the pitch change motor replacement and parameter update for the controller (if required).
- Return the faulty PC motor to Airmaster Propeller Ltd. If the replacement motor was supplied with a tag, transfer this tag to the faulty motor before returning.
- Test propeller function with the engine running in accordance with procedure ***ASI-5-1-2*** to verify correct function of the controller before next flight.