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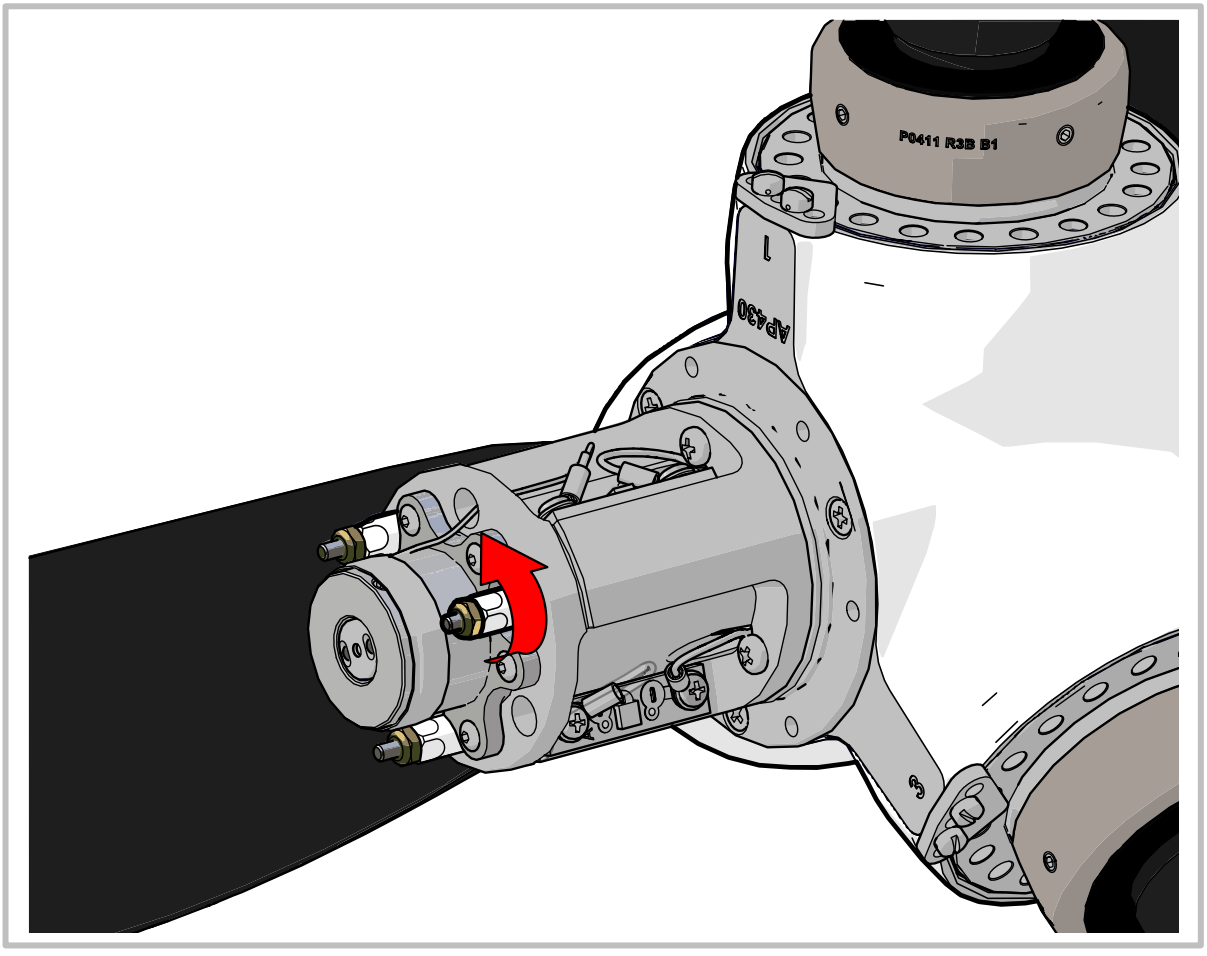
# ASI-5-3-2

# SETTING ADJUSTABLE PITCH STOPS FOR PROPELLER

## ***PROCEDURE***




| SUBJECT: | |
|---|---|
| Propeller Setup | |
| **ASSEMBLY NO:** | **APPLICABILITY:** |
| AP-xxx | All propeller models |

# 1. TOPIC

## 1.1 Introduction

This document covers the procedure for setting the adjustable pitch stops for an Airmaster propeller. Generally, only the fine pitch stop may require adjustment during initial setup of the propeller.

The preferred pitch stop settings are determined by aircraft and engine performance, rather than blade angle. Operators should check the performance offered by the propeller's pitch stop settings by performing static ground tests where the aircraft is prevented from moving, ideally in calm, zero wind conditions.

Afterwards, in-flight testing is recommended to verify that the initial pitch stop settings meet requirements to maintain safe flight in all reasonable conditions and that these settings deliver good performance from the engine.

## 1.2 Adjustable Pitch Stop Settings

To set the adjustable pitch limit stops by method of ground static tests, the engine is operated at full throttle/power, and propeller pitch is manually adjusted to achieve a desired engine/propeller speed. After shutting down the engine, the corresponding pitch feedback cam is carefully adjusted so that it actuates it's respective microswitch at the pitch setting that the propeller was left at.

The recommended static engine speeds corresponding to each of the propeller's pitch limit settings are as follows:

- **FINE PITCH LIMIT**
  During initial setup, the propeller's fine pitch stop should be set to achieve a static engine speed that is approximately 100rpm less than the maximum rated speed rate for the engine.
  *Range of adjustment (blade angle): 10 – 25°.*

- **COARSE PITCH LIMIT**
  The propeller's coarse pitch stop may not require adjustment. Airmaster typically sets this corresponding to a blade angle of 35° and adjustment is only required if the coarse pitch limit is reached during normal flight (coarse lamp illuminates green on controller).
  *Range of adjustment (blade angle): 21 – 38°.*

- **FEATHER PITCH LIMIT *(Option)***
  Generally, the propeller's feather pitch stop does not require adjustment. Airmaster typically sets this corresponding to a blade angle of 81°, as determined by testing.
  *Range of adjustment (blade angle): 62 – 87°.*

- **BETA PITCH LIMIT *(Option)***
  Generally, the propeller's beta (reverse) pitch stop does not require adjustment. Airmaster typically sets this corresponding to a blade angle of -20°, as determined by testing.
  *Range of adjustment (blade angle): -20 – 3°.*

> ⓘ *Note*
> *The Feather (option) or Beta (option) pitch limits may be fine-tuned but will not influence normal flight characteristics of the propeller. If the operator wishes to fine-tune these settings, it is recommended that their setting is determined through measurement of the propeller blade angle by using a suitable blade protractor and setting the relevant pitch limit to the desired blade pitch angle. The blade protractor should be positioned at 75% of the propeller diameter. To find this reference position, a measurement of 1/8$^{th}$ of the propeller diameter may be made in from the tip of the blade.*

### 1.3 Prerequisites

Complete the following tasks before proceeding:

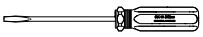
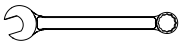
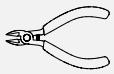
- Install Airmaster propeller system on to suited aircraft.
- Operators should familiarise themselves with the function of the propeller's adjustable pitch stops, the mechanism by which they operate, and their layout inside the hub. Refer to ***ASI-5-3-1***.

## 2. MATERIAL REQUIREMENTS

### 2.1 Parts

| ITEM | QTY | PART NO. | DESCRIPTION |
|---|---|---|---|
| **1.** | 1 | AP-xxx | Complete Airmaster Propeller System |

### 2.2 Tooling

| ITEM | QTY | DESCRIPTION | IMAGE |
|---|---|---|---|
| **1.** | 1 | PH2 Screwdriver |  |
| **2.** | 1 | Flathead Screwdriver |  |
| **3.** | 1 | 8mm Spanner |  |
| **4.** | 1 | 11/32" Spanner |  |
| **5.** | 1 | Torque Screwdriver (11/32" Deep Socket Bit) |  |
| **6.** | 1 | Twist Pliers |  |
| **7.** | 1 | Wire Cutter |  |
| **8.** | As required | Aircraft Tie-Downs |  |
| **9.** | As required | Aircraft Chocks |  |

### 2.3 Consumables

| ITEM | QTY | DESCRIPTION | IMAGE |
|---|---|---|---|
| **1.** | As required | 0.025" Stainless Steel Lockwire (Safety Wire) |  |

## 2.4 Paperwork

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

## 2.5 Admonishments

***WARNING***

*Tether the aircraft with chocks and tie-downs to facilitate testing at maximum thrust. Due to the high thrust that is achievable, the aircraft brakes and wheels alone should not be relied upon.*

***WARNING***

*Before working on the propeller, ensure that the engine is safe by turning the ignition system off.*

***WARNING***

*The propeller operator may remain in the aircraft cockpit to monitor instrumental data when the propeller is running. Other persons must remain safely clear of the propeller during operation.*

***Caution***

*During ground static tests, engine operating conditions such as temperature should be carefully monitored. Some engine installations are not designed for sustained high power running on the ground. The engine should be allowed to cool between runs.*

***Caution***

*The engine and propeller should not be run with the motor cap removed from the propeller. All components of the system should be checked before operating.*

***Caution***

*Do not fly the propeller without lock-wiring the motor cap fasteners. However, the lock-wiring may be omitted during ground testing of the propeller.*

*Note*

*If possible, the operator may check that the engine is producing full power during ground static tests, to ensure that the propeller adjustable stops are not set too fine. If a MAP gauge is fitted, the manifold air pressure may be checked against the full throttle value detailed in the engine operator's manual.*

# 3. PROCEDURE

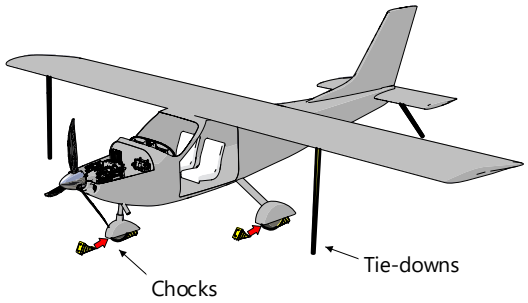
## 3.1 Set Propeller Pitch for Desired RPM (Static Ground Test)

**PROCEDURE**

### *Step 1* Tether Aircraft

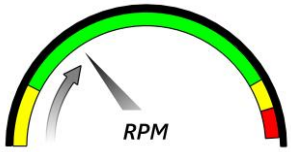
- Tether aircraft securely with chocks and tie-downs to prevent movement during maximum thrust operations.

***WARNING***
*Due to the high thrust that is achievable, the aircraft brakes and wheels alone should not be relied upon.*



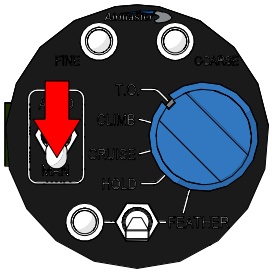

### *Step 2* Warm Up Engine

- Start engine using normal warm up procedure.




### *Step 3* Set Controller to Manual Over-ride

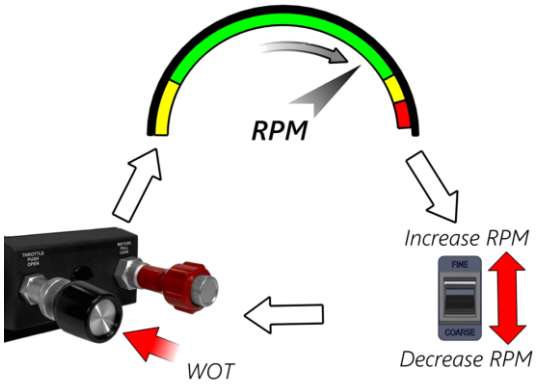
- Set controller to manual over-ride mode (**MAN**).




### *Step 4* Set Pitch for Desired RPM at WOT

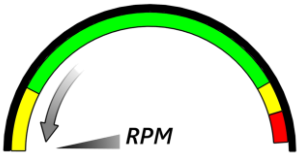
- Gently advance engine to full power (W.O.T) whilst adjusting propeller pitch (via the manual control switch) to reach desired engine speed.
- Halt pitch adjustment when the desired engine speed is reached and stable.

*Note*
*If maximum engine speed can't be reached through manual adjustment of propeller pitch, then the current setting of the Fine pitch stop is too coarse. In this case, adjust the fine pitch feedback cam 2 turns CW (refer to next section), then repeat this step.*




### *Step 5* Shut Down Engine

- Shut down engine and allow to cool between runs.
- Turn off aircraft power.



## 3.2 Adjust Pitch Feedback Cam

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

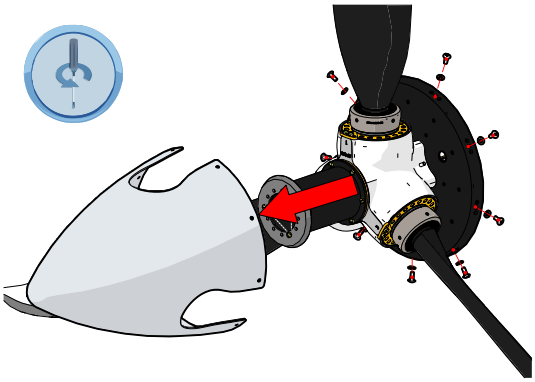
**Note**
*The pitch cam setting may be adjusted in small increments, with the propeller re-tested after each adjustment. Adjustment of the pitch cam by half a turn (or two flats) at a time is recommended.*

**PROCEDURE**

### *Step 1* Remove Spinner Cone

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

**Attention** *PH2 Screwdriver*

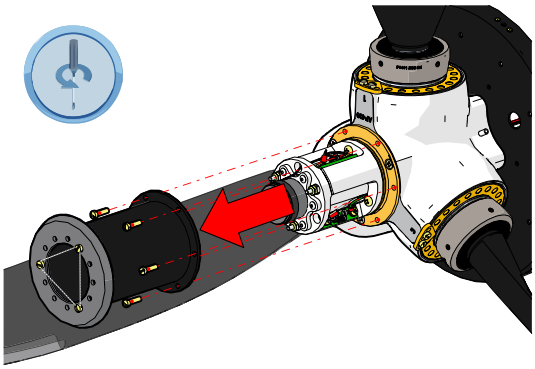


### *Step 2* Remove Motor Cap

- Remove any lock-wire retaining the motor cap screws.
- Remove motor cap from hub via (6) fillister-head screws.

**Note**
*Do not remove front support from motor cap.*

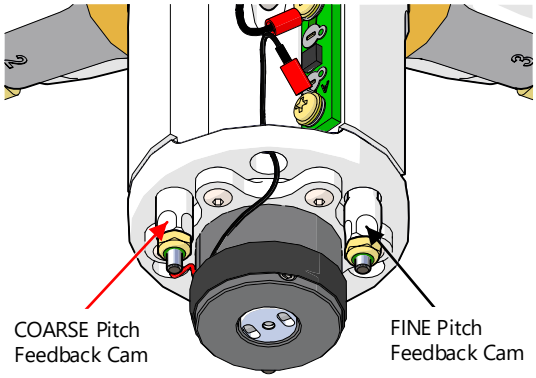
**Attention**
*Wire Cutter, Pliers, Flathead Screwdriver*



### *Step 3* Identify Cam

- Locate the correct pitch feedback cam for adjustment.

**Note**
*For more information on the layout of the adjustable pitch limit stops, refer to **ASI-5-3-1**.*

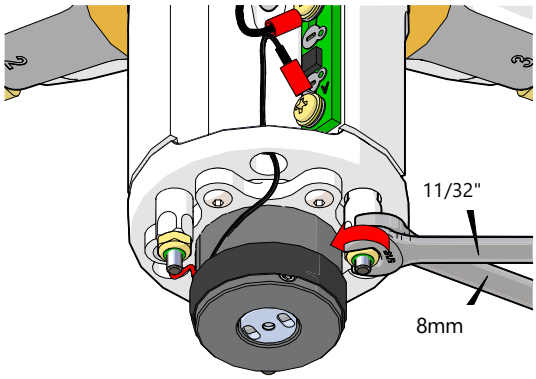


### *Step 4* Loosen Locknut

- Restrain pitch feedback cam using 8mm spanner.
- Loosen locknut two turns using 11/32” spanner.

> ***Caution***
> *Do not adjust the cam without loosening the locknut.*

> *Attention* *8mm Spanner, 11/32” Spanner*



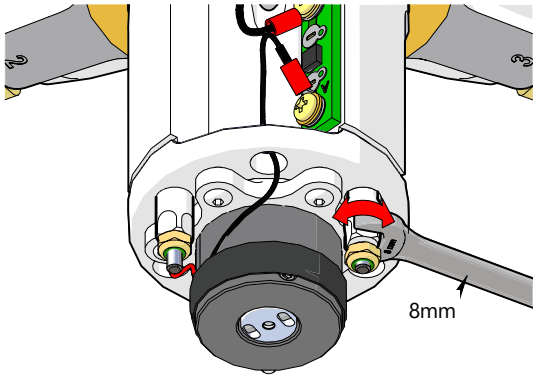

### *Step 5* Adjust Cam

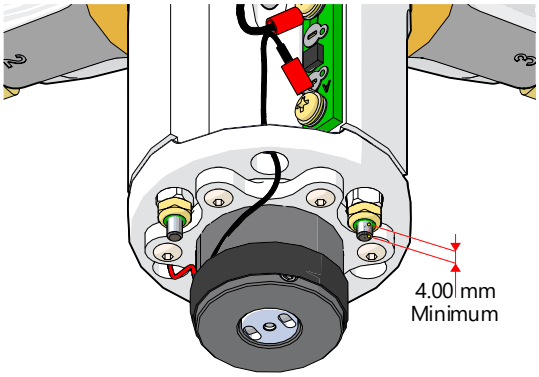
- Rotate pitch feedback cam by the adjustment flats at its end until the corresponding microswitch is actuated, as indicated by either of the following ways:
  - For DSD models (not shown), a small LED on the hub circuit board (‘LED1’) illuminates green when the fine pitch limit is reached (with power supplied to the propeller).
  - The corresponding lamp on the controller illuminates green (with power supplied to the controller and an observer in the cockpit).
  - A ‘click’ may be heard by the microswitch (in a quiet environment).

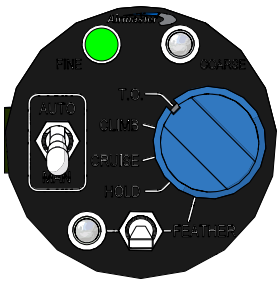
> ***Caution***
> *The design range of the fine pitch cam requires the distance between the locknut and feedback rod to be within 4-9 mm.*

> *Note*
> *Rotate the pitch feedback cam clockwise to decrease pitch setting (increase rpm attainable).*

> *Attention* *8mm Spanner*

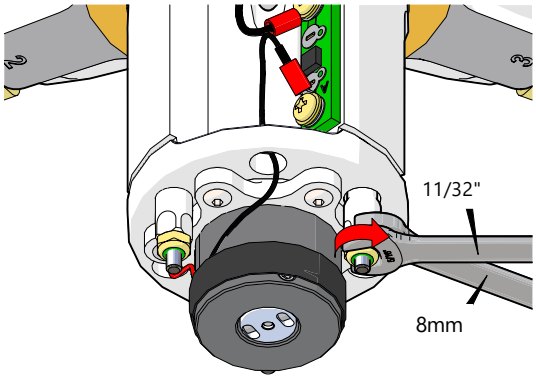


## *Step 6* Lock Cam Position

- Restrain pitch feedback cam in the newly set position using 8mm spanner.
- Tighten locknut (finger-tight) against pitch feedback cam (11/32” spanner) so that both are prevented from further rotation.
- Torque locknut to **0.9Nm (0.7ft-lbs)**.

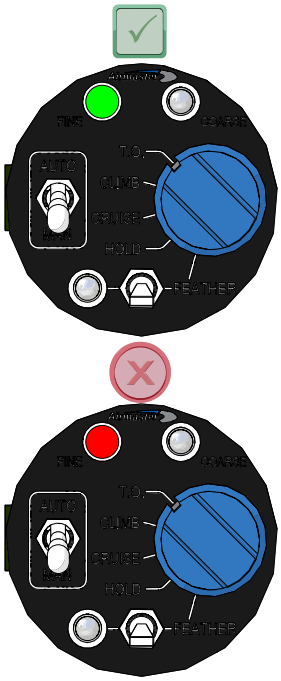



***Caution***
*Do not overtighten the locknut as this may damage the cam.*

***Attention***
*8mm Spanner, 11/32” Spanner, Torque Screwdriver (11/32” Deep Socket Bit),*

## *Step 7* Check Hard Stops

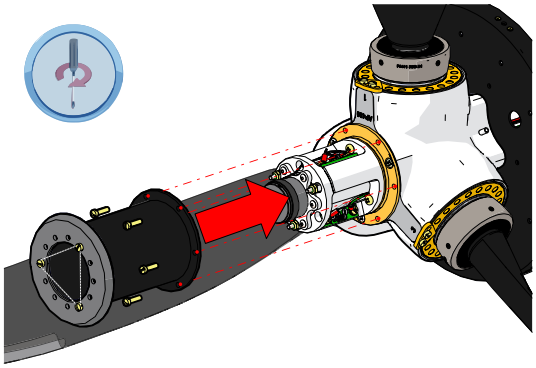
- With the controller set to **MAN** and power supplied to the controller, use the manual control switch to drive the propeller to the fine and coarse pitch limit stops (i.e. across the normal flight pitch range).
- Check propeller drives and stops at the newly set pitch limit stops without impacting the fixed hard stops.




***Note***
*If the fixed hard stops are reached, this will be indicated by a laboured sound from the pitch change motor or an over-current indication from the controller (applicable lamp illuminating red). In either situation, the pitch limit stop must be readjusted within the allowable design range.*

## *Step 8* Attach Motor Cap

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



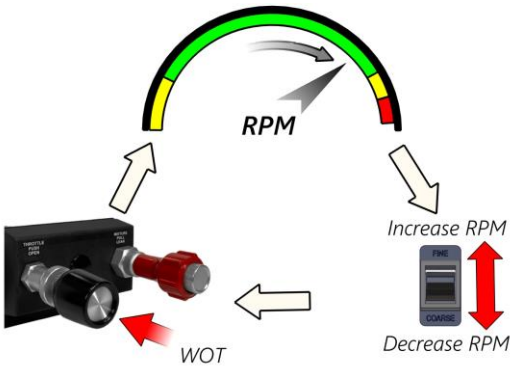
***Note***
*The motor cap flange is marked with a dot to denote its alignment with port 1 of the hub.*

***Attention***
*Flathead Screwdriver, Torque Screwdriver*

### *Step 9* Verify Desired RPM at Pitch Limit

- Repeat static ground tests (Section 3.1) to verify that the desired engine speed is attained at the newly set pitch limit stop.
- Repeat this process of adjusting then retesting the pitch limit setting until correct.

> *Note*
> *Operators may wish to verify the pitch limit settings in-flight before lock wiring the motor cap next.*




## 3.3 Lock Motor Cap & Attach Spinner Cone

> *Note*
> *This task assumes the operator is satisfied with the propeller's pitch limit settings by method of static ground tests.*

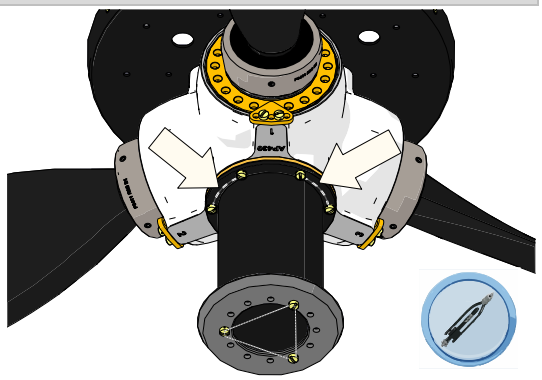
**PROCEDURE**

### *Step 1* Lock Motor Cap

- Lock-wire (6) motor cap screws.

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

> *Attention*
> *0.025" SS Lockwire, Twist Pliers, Wire Cutter*

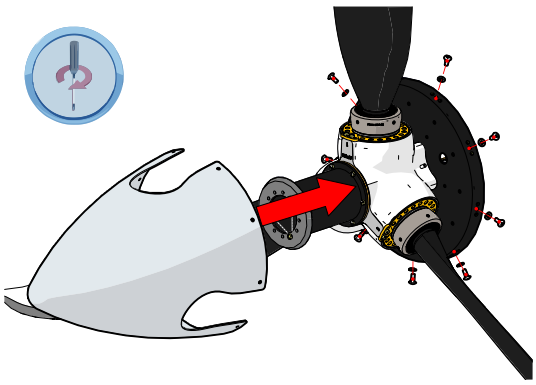


### *Step 2* Install Spinner Cone

- 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)*



## 3.4 Subsequent Action

Perform the following tasks once this procedure is complete:

- Verify that pitch limit settings are safe and suitable by testing propeller performance in-flight.