APL-SI-0015

SETTING ADJUSTABLE PITCH LIMIT STOPS

PROCEDURE
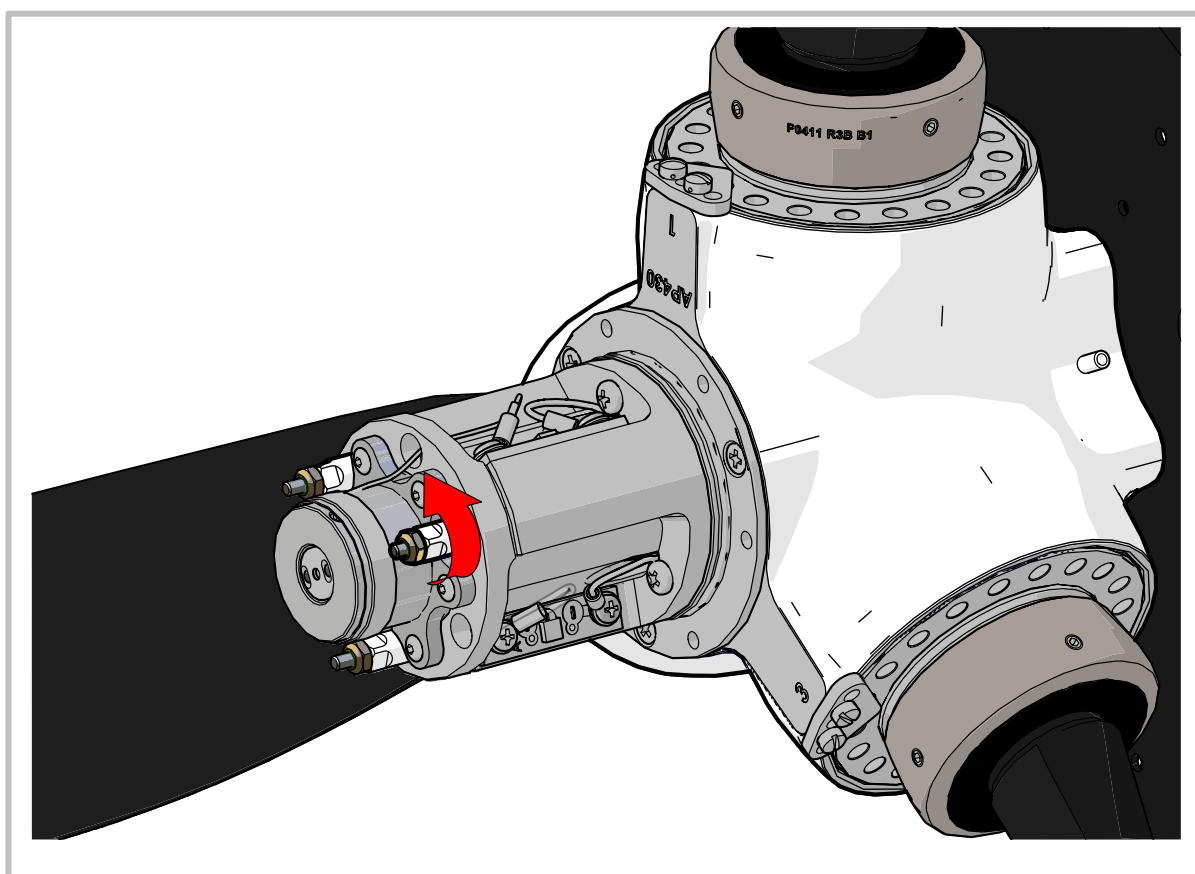
SUBJECT:

PROPELLER SETUP

ASSEMBLY NO:	APPLICABILITY:
AP-*xxx*	All propeller models

1.   TOPIC

1.1   Introduction

This instruction covers the procedure for setting the adjustable pitch limit stops for an Airmaster propeller. These settings are determined by aircraft and engine performance, rather than blade angle. Generally, only the propeller's fine pitch limit stop requires adjustment during initial setup.

Operators should begin this process by performing static ground tests where the aircraft is prevented from moving, ideally in calm, zero wind conditions. Afterwards, in-flight testing is required to verify that the initial pitch limit settings meet requirements to maintain safe flight in all reasonable conditions and these settings deliver good performance from the engine. Recommendations are provided below for the initial pitch limit settings for various engine types.

1.2   Adjustable Pitch Limit Settings

To set the adjustable pitch limit stops by method of ground static tests, the engine is operated at full throttle and the propeller pitch is adjusted to achieve a desired engine/propeller speed. After shutting down the engine, the relevant 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 for each of the propeller's adjustable pitch limit settings are detailed below:

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

- **COARSE PITCH LIMIT**
  Generally, the propeller's coarse pitch limit stop does not require adjustment. Airmaster typically sets this corresponding to a blade angle of 28° and modification is only required if the coarse pitch limit is reached during flight (coarse LED illuminates green on controller).
  Range of adjustment (blade angle): 21 – 38°.

- **FEATHER PITCH LIMIT (*Option*)**
  Generally, the propeller's feather pitch limit 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 limit 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:

- Complete installation of Airmaster propeller system on to suited aircraft.

- The operator should familiarise themselves with the propeller's adjustable pitch stops and the mechanism by which they operate. Refer to ***IDENTIFICATION & DESCRIPTION OF ADJUSTABLE PITCH LIMIT STOPS GUIDE***.

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)	
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" S.S Lockwire	

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**
>
> *Anchor 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.*
>
> ⓘ **Note**
>
> *For further detailed information about adjustable pitch stops and associated parts of the circuit within the propeller hub, wiring and controller, see CHAPTER 8. and ANNEX C of the Airmaster operator's manual.*

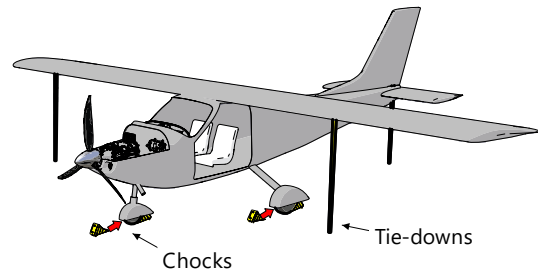# 3.   PROCEDURE

3.1   Static Ground Test

Procedure: Static Ground Testing

Step 1   Secure Aircraft

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

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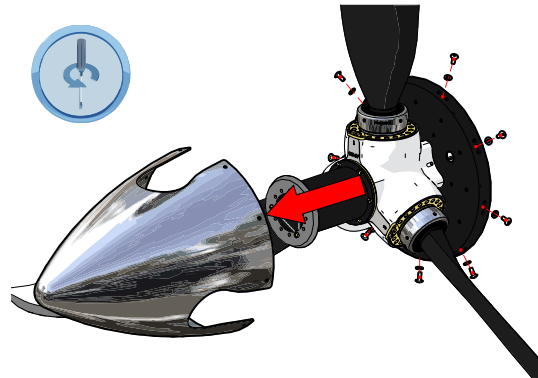> *Due to the high thrust that is achievable, the aircraft brakes and wheels alone should not be relied upon.*

Tie-downs

Chocks

Step 2   Remove Spinner Cone

- Remove the spinner cone from the backplate via truss-head screws.
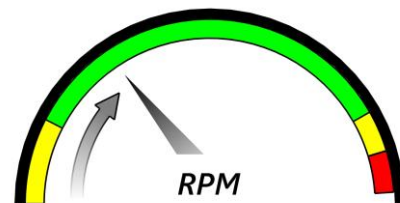
> ⓘ *Attention*
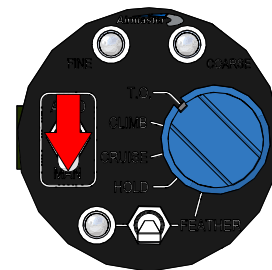>
> *PH2 Screwdriver*

Step 3   Warm Up Engine

- Start engine using normal warm-up procedure.

RPM

Step 4   Set Controller to Manual Override

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

Step 5   Set Pitch for Desired RPM at WOT

- Gently advance engine throttle to full (**W.O.T**) whilst adjusting propeller pitch (Fine/Coarse) to attain the desired engine speed.

- Stop pitch adjustment when the desired engine speed is 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.
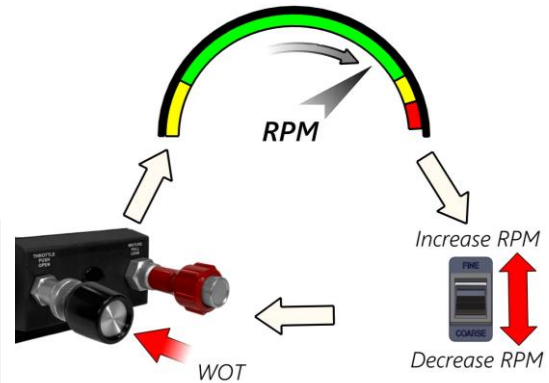
Step 6   Shut Down Engine

- Shut down engine and allow to cool between runs.

- Turn off aircraft power.
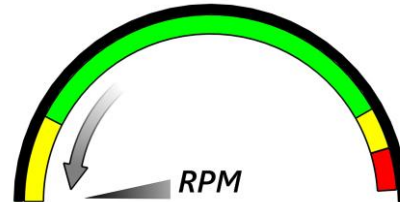
3.2   Adjust Pitch Feedback Cam

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

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

Procedure: Adjusting Pitch Feedback Cam
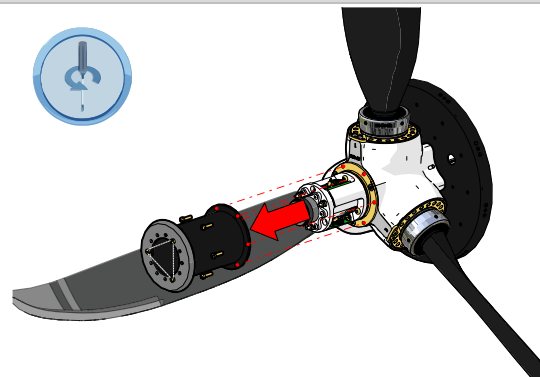
Step 1   Remove Motor Cap

- Remove the motor cap from the propeller hub via six philister head screws (*P0107*).

ⓘ *Note*
Remove any lockwire retaining the motor cap screws.

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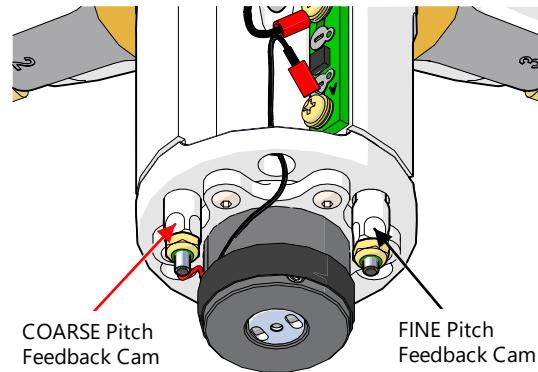*Flathead Screwdriver, Wire Cutter, Pliers*

Step 2   Identify Cam

- Locate the correct pitch feedback cam for adjustment.

ⓘ *Note*

   *Refer to **IDENTIFICATION OF ADJUSTABLE PITCH LIMT STOPS**.*

COARSE Pitch Feedback Cam

FINE Pitch Feedback Cam
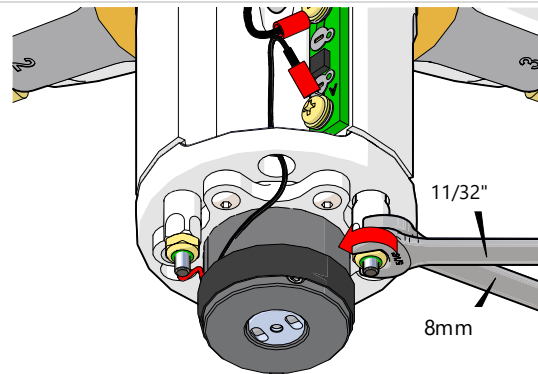
Step 3   Loosen Locknut

- Restrain the pitch feedback cam using an 8mm spanner while loosening the locknut two turns using an 11/32" spanner.

⚠ *Caution*

   Do not adjust the cam without loosening the locknut.

ⓘ *Attention*

   8mm Spanner, 11/32" Spanner

11/32"

8mm

Step 4   Adjust Cam

- Rotate the pitch feedback cam by the adjustment flats at its end until the corresponding microswitch is actuated, as indicated by either:

   o The corresponding LED on the controller illuminates green (with power supplied to the controller and an observer in the cockpit).

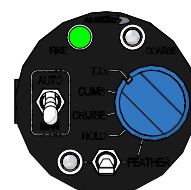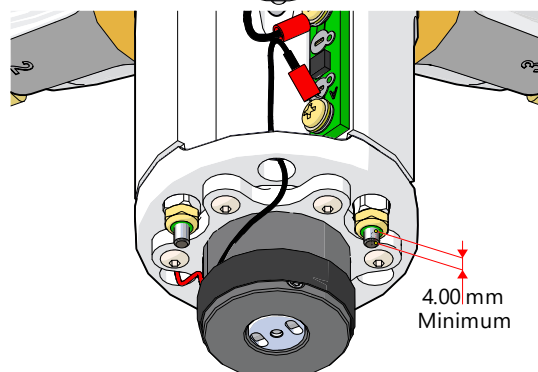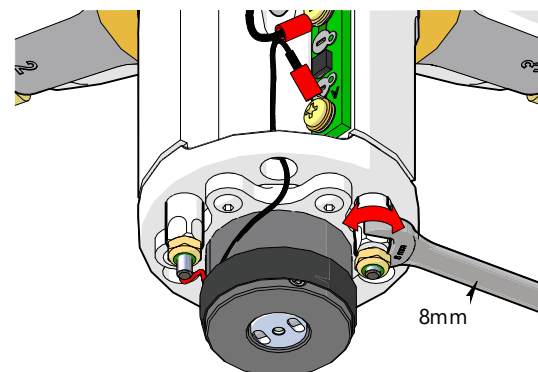   o A 'click' may be heard by the microswitch (in a quiet environment).

8mm

4.00 mm Minimum

⚠ *Caution*

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

ⓘ *Note*

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

ⓘ *Attention*

   8mm Spanner

Step 5   Lock Cam Position

- Resecure the locknut against the pitch feedback cam finger-tight, so that both are prevented from further rotation.

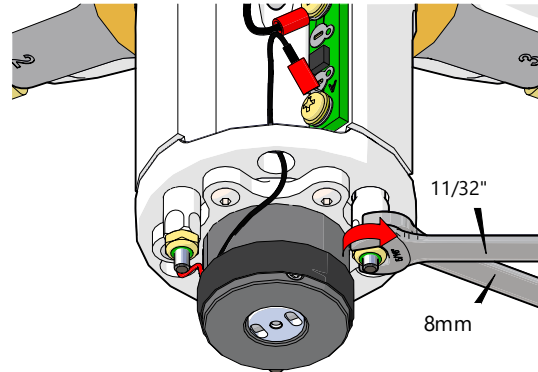- Torque locknut to **0.9Nm (0.7ft-lbs)**.

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

> ℹ️ *Note*
>
> *Secure the pitch feedback cam with an 8mm spanner to prevent it moving from its set position.*

> ⚠️ *Attention*
>
> *8mm Spanner, 11/32" Spanner, Torque Screwdriver (11/32" Deep Socket),*

Step 6   Check Hard Stops

- Ensure controller is set to **MAN**.

- Use the manual control switch to drive the propeller to the fine and coarse pitch limit stops (across normal flight pitch range) and verify the propeller drives and stops at the newly set pitch limits without impacting the hard stops.

> ℹ️ *Note*
>
> *This will be indicated by a laboured sound from the pitch change motor or an over-current indication from the controller (applicable LED illuminating red). In either situation, the pitch limit stop should be readjusted back within the design range.*
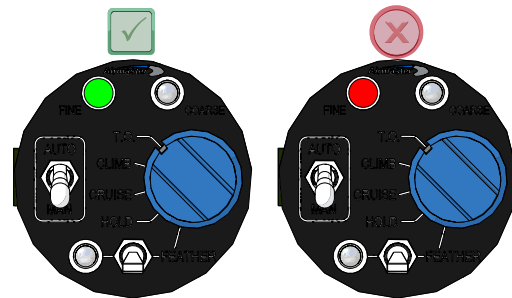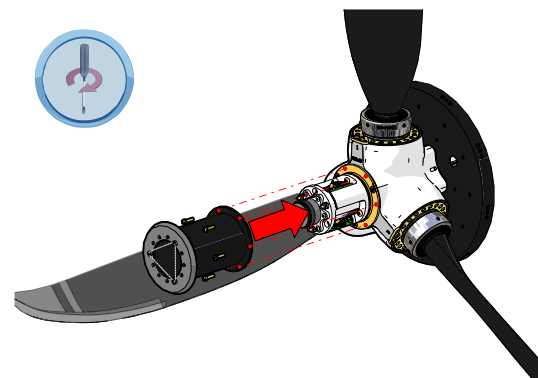

Step 7   Fit Motor Cap

- Refit the motor cap to the hub with six philister head screws (*P0107*).

- Torque screws to **2.0Nm (1.5ft-lbs)**.

> ℹ️ *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 8   Verify Desired RPM at Pitch Limit

- Repeat static ground tests to verify that the desired engine speed is attained at the newly set pitch limit setting.

- Repeat this process of adjusting then retesting the pitch limit setting until correct.

ⓘ *Note*

The operator may wish to verify the pitch limit settings in-flight before lock wiring the motor cap in the next step.
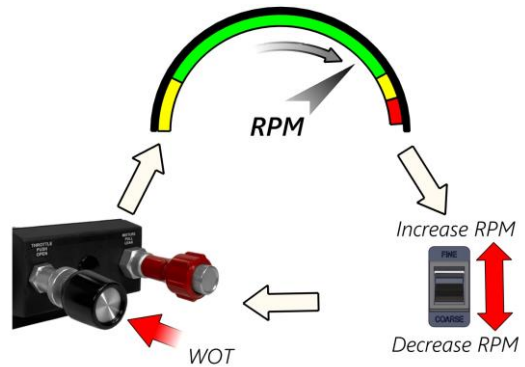
3.3   Lock Motor Cap & Fit Spinner Cone

ⓘ *Note*

This step assumes that the operator is satisfied with the propeller's pitch limit settings and has verified this through a combination of static ground tests and in-flight performance tests.

Procedure: *Locking Motor Cap & Attaching Spinner Cone*
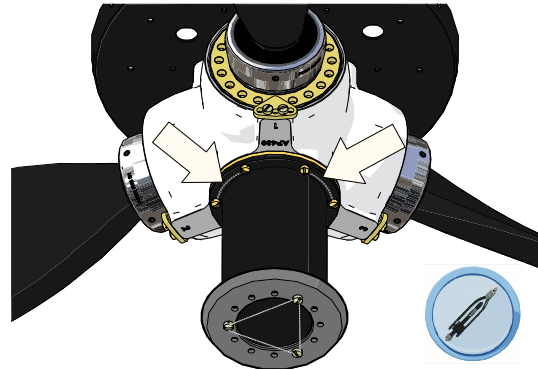
Step 1   Lock Motor Cap

- Lock-wire the six motor cap fasteners.

ⓘ *Note*

The single-wire method may be used.

⚠ *Attention*

0.025" SS Lockwire, Twist Pliers, Wire Cutter
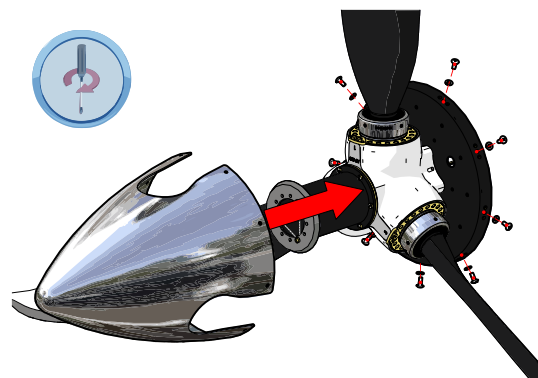
Step 2   Fit Spinner Cone

- Attach spinner cone to backplate with 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 performance in-flight.

- If not yet completed, check spinner cone fits snug and adjust the front support as necessary.