

Hercules

Fixed Pitch Wooden Propeller Installation, Maintenance and Inspection Manual

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Introduction

Hercules propellers are manufactured using the highest quality selected timber laminations bonded with resorcinol glue and feature the unique Hercuthane protective leading edges.

Our propellers are manufactured under closely controlled factory conditions with full traceability.

During manufacture, Hercules Propellers are constantly inspected for quality, dimensional accuracy and balance to ensure that every propeller we dispatch is of the highest standard.

Every Hercules propeller is designed for a specific airframe and engine combination and should only be fitted to the combination for which it was designed, unless prior agreement is sought from Hercules Propellers.

Please read this document in full before commencing the installation of your Hercules propeller.

We wish you many years of happy and enjoyable flying with your Hercules Propeller.

Drawing number and Serial designation

Every Hercules Propeller has a serial number and drawing number, either hand stamped on the side of the hub or displayed on a printed label, also on the side of the hub. The data can be translated as follows:

Drawing number example: 72 42 987-S/C

72 - Diameter inches
42 - Pitch inches at 75% radius
987 -Unique design number
S - Symmetrical plan form
C - Classic plan form

Serial number example: 11 17 999

11 - Month of manufacture - November
17 - Year of manufacture
999 -Unique serial number

Storage

The propeller should be stored in a dry place. Lie the propeller on the rear face of the hub, on a flat surface.

Never stand the propeller on a tip, in an upright position, as this can cause deformation of the propeller and render it unserviceable.

Avoid storing propeller in a heated area such as a house or office for more than a few days as this environment can significantly reduce the moisture content of the wood, causing shrinkage and possibly cracking of the propeller. The best environment to store a propeller is the same environment in which the aircraft resides.

It is recommended that the shipping container and packaging materials that the propeller arrived in are retained in case the propeller needs to be returned to Hercules for maintenance or repairs.

Propeller Installation

It is important that the propeller is installed only by a competent person and where appropriate, the installation is approved by a qualified engineer. The propeller must also be installed in accordance with the engine manufacturer's recommendations.

It has been shown that the engine delivers its driving torque to a wooden propeller through static friction. The force that resists movement between the propeller and the engine flange is created by the compression of the wood against the propeller flange. For this reason it is important to adequately compress the propeller hub during installation but also taking care not to crush the propeller.

The bushes incorporated into most engine flanges (sometimes referred as drive bushes or lugs) are designed for accurately locating the propeller and the driving load will only be imposed on the bushes if there was movement between the propeller and flange. If movement does occur between the propeller and drive flange, elongation of the counterbore holes in the rear of the prop hub will quickly occur and failure of the propeller mounting bolts is probable.

Installation of the propeller requires a front-plate of adequate thickness and of a similar diameter as the propeller flange. Using large diameter washers instead a front-plate under the bolt heads is inadequate and should not be done. If required, front plates can be purchased from Hercules Propellers.

Ensure that the magnetos or ignition system is off.

Propeller mounting methods can vary between different manufacturers of engine therefore the engine manufacturer's manuals should also be referred to before the propeller installation commences. The description below is applicable to most most light aircraft engine types.

Before the propeller is installed, ensure that the engine's propeller flange drive bushes, if fitted, are free from corrosion, thoroughly cleaned and de-greased. If applicable, repeat this action with the spinner front and rear bulkheads.

Similarly, if the existing propeller mounting bolts are to be re-used, ensure that they are also clean, free from corrosion and de-greased.

If drive bushes on the engine flange are present, ensure that the drive bush counter-bores in the propeller hub are at least 2 mm deeper than the length of the drive bushes. This is to avoid the drive bushes pressing against the bottom of the counter bores, which may prevent the hub contacting the drive flange with the requisite pressure.

If applicable, position the spinner rear bulkhead onto the propeller flange.

Position the propeller on the propeller flange. The drive bushes may be a little tight entering the counter bores in the propeller. If necessary, remove the paint from the inside of the counter bores with a rolled up piece of abrasive paper. It is not essential that the propeller locates all the way up to the drive flange at this point as the propeller can be

Propeller installation continued

pulled home with the mounting bolts but ensure that all the drive bushes are located into the respective holes.

If applicable, fit the forward spinner bulkhead, then the front plate, followed by the propeller mounting bolts. It is recommended that a zinc chromate anti corrosive jointing compound, such as 'Duralac' is smeared over the shanks of the bolts, but not the threads.

For bolt torques to be accurate, ensure that the threads are clean and dry.

Using a ratchet and socket or spanner, tighten all the attachment bolts in small increments, moving diagonally across the bolt circle until the propeller is snug against the drive flange. At this stage, for hand starting engines, make sure that the a propeller blade is in a convenient position for 'swinging' the propeller and if needs be, remove the propeller and rotate one bolt hole relative to the drive flange and then re-fit.

Using a calibrated torque wrench, tighten the attaching bolts in small increments, moving diagonally across the bolt circle, taking care to tighten the bolts evenly either side of the propeller centre line.

Torque all the bolts to the values specified in the table below:

Wood propeller recommended bolt torque (Clean dry threads)

Size of propeller mounting bolts			Recommended torque		
AN spec.	Diameter in.	Diameter mm	In-lb	ft-lbs	N-m
AN4	1/4	6	130	11	15
AN5	5/16	8	150	13	17
AN6	3/8	10	210	18	24
AN7	7/16	12	250	21	28
AN8	1/2	12.7	300	25	34

If stiff nuts are used to secure the propeller bolts and/or if the bolts are tight in the propeller hub, add the torque value(s) required to turn the bolt to the recommended torque values in the table.

Caution: Over-tightening the bolts will result in crushing the wood of the propeller hub, breaking the moisture seal and rendering the propeller unserviceable.

AN76 propeller bolts have a long thread, but these bolts are no longer easily available. It is permissible to use a standard AN bolt as shown in the table, however be aware that the thread length is significantly shorter. Ensure that the threads of the bolts have not bottomed out in the drive bushes or self locking nuts before the correct compressive force is reached.

Propeller installation continued

It is recommended that 1 1/2 threads protrude through the rear of the drive bushes of self locking nuts to be considered in safety although if the thread length in the drive bush is long and a standard AN bolt is used, this may not be possible.

Having verified that the magnetos or ignition is off, turn the propeller by hand and check the track of the blade trailing edge 3 or 4 inches from the tip, ideally past an object that has been secured somewhere to the aircraft. If checking blade tracking against an object fixed to the floor, ensure that the aircraft is not moved whilst turning the propeller. The blades must track within 5 mm of each other when the installation is complete. If tracking is beyond the specified limit, refer to Hercules Propellers.

Install safety wire to lock the bolt heads together in pairs as per the diagram below.



Spinners

If a spinner is used, install the spinner dome and secure with screws. Make sure there is a positive clearance of at least 3 mm between the spinner and the propeller in all places. It is recommended that several layers of masking tape are applied to the propeller root area during test fitting, to avoid damaging the propeller finish with the edges of the spinner during test fitting. The masking tape can be removed once the spinner is fitted or when it has been ascertained that the cut-outs in the spinner match the shape of the propeller and it can be fitted without scuffing the propeller.

Maintenance

It is important to maintain the correct bolt torque. Environmental changes can cause the propeller hub to expand or contract as the moisture content of the propeller varies, therefore altering the bolt tightness. Too tight and the hub will be crushed, too loose and the propeller will move against the drive flange, resulting with in-flight mounting bolt failure and almost certainly loss of the propeller and catastrophic vibration. It is recommended that the bolt torque is checked following environmental changes such as the transition of seasons.

To check the bolt torque, remove the locking wire, loosen all the bolts by one revolution, then re-torque with a torque wrench. Re-lock wire the bolts.

Check the bolt torque after the first flight since fitting the propeller and after 25 hours of flying and the every 50 hours thereafter.

Propeller inspection procedure

Remove the propeller and clean the hub with a soft cloth moistened with soapy water. Inspect the propeller hub for crushing from the drive flange or front plate. Examine the hub for cracks and ovalisation of the counter bores and bolt holes.

If any cracks are evident or counter bores or bolt holes have ovalised by more than 1 mm the propeller must not be returned to service before advice is sought from Hercules Propellers. If ovalisation has occurred, the propeller bolts must be replaced in any case.

Inspect the propeller hub, propeller drive flange and spinner bulkheads (if applicable) for signs of fretting. If fretting is evident, thoroughly clean the associated components and inspect for excessive loss of material. If in any doubt about the serviceability of the propeller, contact Hercules Propellers for advice before returning to service.

Blades: Clean the blades with soapy water, removing all the bugs. Do not use an abrasive scouring pad when cleaning the propeller blades as this will permanently damage the surface finish.

Inspect the blades for cracks, scratching and dents. If any cracks are evident or scratches and dents deeper than 1 mm, contact Hercules propellers for advice before returning the propeller to service.

Inspect the Hercuthane leading edge material for security, ensuring that there is no detachment from the propeller blade. If there are any signs of detachment contact Hercules Propellers for advice before returning to service.

If paint or varnish is missing from any area of the propeller and bare wood is exposed, it is important to re-protect the wood using an oil based paint or polyurethane varnish. If preferred, the propeller can be returned to Hercules Propellers for overhaul and refinishing.

Continued Airworthiness Requirements

The following practices will extend the service life of your propeller:

1. Inspect and check the propeller attachment bolt torque at least every 50 hours and when the seasons change.
2. When the aircraft is not in use, store with the propeller set horizontally. Protect the propeller with a water proof cover if the aircraft is stored outside.
3. Do not use the propeller as a tow bar to move your aeroplane.
4. Additional protection can be gained by applying an automotive type wax at least once a year.
5. Avoid running in areas containing loose stones or gravel as the propeller will suck such debris from the ground which can potentially damage the propeller.
6. Touch up areas of missing paint or varnish to maintain the wood's moisture seal.
7. Inspect regularly for damage, scars and dents. Contact Hercules Propellers if there are any areas of concern.
8. Do not overspeed the propeller by exceeding the maximum rated RPM of your engine.
9. If an increase in vibration is noticed, inspect the propeller for damage and check the tracking and balance of the propeller. The balance can be checked by a suitably knowledgeable and equipped person or the propeller can be returned to Hercules Propellers for inspection and balancing.
10. If the propeller shows any signs of the following damage, it should be withdrawn from service for rectification work:
 - a. Cracks in the hub, centre bore, bolt holes, counter bores or blades.
 - b. A cut along or across the grain.
 - c. Separation of laminations.
 - d. Oversized or elongated hub bore, bolt holes or counter bores holes.
 - e. Exposed unprotected wood.

Hercules propellers are not life limited nor do they have a set service interval. If the above Continued Airworthiness Requirements are observed, many decades of service can be expected from a Hercules propeller.

Hercules Propellers offer an overhaul and re-finishing service with a quick turn around time to minimise aircraft down-time. Please contact Hercules Propellers for prices and shipping arrangements.