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WhirlWind Propeller
Field Inspection & Limited Repair Manual

Composite Ground-Adjustable &
Constant-Speed Propellers

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WARNING

People who fly should recognize that various types of risks are involved; and they should take all precautions to minimize them, since they cannot be eliminated entirely. The propeller is a vital component of the aircraft. A mechanical failure of the propeller could cause a forced landing or create vibrations sufficiently severe to damage the aircraft, possibly causing it to become uncontrollable.

Propellers are subject to constant vibration stresses from the engine and airstream, which are added to high bending and centrifugal stresses.

It is essential that the propeller is properly maintained according to the recommended service procedures and a close watch is exercised to detect impending problems before they become serious. Any grease or oil leakage, loss of air pressure, unusual vibration, or unusual operation should be investigated and repaired, as it could be a warning that something serious is wrong.

Operators of uncertified or experimental aircraft an even greater level of vigilance is required in the maintenance and inspection of the propeller. Experimental installations often use propeller-engine combinations that have not been tested and approved. In these cases, the stress on the propeller and, therefore, its safety margin is unknown. Failure could be as severe as loss of propeller or propeller blades and cause loss of propeller control and/or loss of aircraft control.

TABLE OF CONTENTS

TABLE OF CONTENTS, continued

1. Introduction

A. Statement of Purpose

(1) This manual provides inspection, condition evaluation, and limited cosmetic repair procedures for WhirlWind composite propellers. It applies to both ground-adjustable and constant-speed propeller models and is intended for use by qualified maintenance personnel as defined in the section, "Applicability".

(2) The guidance in this manual supports safe, reliable operation while maintaining WhirlWind's design intent and product integrity.

NOTE: This document does not authorize major repairs, structural composite repairs, hub overhauls, or internal hub disassembly.

B. Scope

(1) This manual covers the following WhirlWind propeller families:

(a) Ground-Adjustable Propellers

(b) Constant-Speed Composite Propellers (300 and 330-series)

C. Applicability

(1) This manual supports:

(a) Aircraft owners and operators

(b) A&P mechanics and experimental aircraft builders

(c) Maintenance personnel working with WhirlWind products

(d) WhirlWind technical support and field representatives

(2) Where discrepancies exist between this manual and model-specific instructions, the more restrictive requirement applies.

D. Definitions

(1) A basic understanding of the following terms will assist in maintaining and operating Hartzell propeller systems.

Term	Definition
Aviation Experimental	Intended for aircraft/propeller applications not certified by the FAA or international equivalent. Products marked with an “X” at or near the end of the model number or part number are not certified by the FAA or international equivalent and are not intended to use on certificated aircraft.
Blade Angle	Measurement of blade airfoil location described as the angle between the blade airfoil and the surface described by propeller rotation
Blemish	An imperfection with visible attributes, but having no impact on safety or utility
Brinelling	A depression caused by failure of the material in compression
Bulge	An outward curve or bend
Camber	The surface of the blade that is directed toward the front of the aircraft. It is the low pressure, or suction, side of the blade. The camber side is convex in shape over the entire length of the blade.
Chord	A straight line distance between the leading and trailing edges of an airfoil
Chordwise	A direction that is generally from the leading edge to the trailing edge of an airfoil
Composite Material	Carbon, or fiberglass fibers bound together with, or encapsulated within an epoxy resin
Constant Speed	A propeller system that employs a governing device to maintain a selected engine RPM
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface
Debond	Separation of two materials that were originally bonded together in a separate operation
Defect	An imperfection that affects safety or utility

Term	Definition
Delamination	Internal separation of the layers of composite material
Dent	The permanent deflection of the cross section that is visible on both sides with no visible change in cross sectional thickness
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component
Erosion	Gradual wearing away or deterioration due to action of the elements
Exposure	Leaving material open to action of the elements
Face	The surface of the blade that is directed toward the rear of the aircraft. The face side is the high pressure, or thrusting, side of the blade. The blade airfoil sections are normally cambered or curved such that the face side of the blade may be flat or even concave in the midblade and tip region.
Fretting	Damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface
Galling	To fret or wear away by friction
Gouge	Surface area where material has been removed
Impact Damage	Damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object while in flight or on the ground
Inboard	Toward the butt of the blade
Loose Material	Material that is no longer fixed or fully attached
Low Pitch	The lowest blade angle attainable by the governor for constant speed operation
Minor Deformation	Deformed material not associated with a crack or missing material
Nick	Removal of paint and possibly a small amount of material
Outboard	Toward the tip of the blade

Term	Definition
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control/condition lever
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip
Track	In an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly
Trailing Edge	The aft edge of an airfoil over which the air passes last
Voids	Air or gas that has been trapped and cured into a laminate
Wrinkle (composite blade)	Overlap or fold within the material

2. Safety and Precautions

A. Rotating Propeller Hazards

(1) Never stand in the plane of rotation.

(2) Treat the engine as if it can start at any time.

(3) Keep clear of propeller arc when performing engine ground runs.

B. Composite-specific Hazards

(1) Composite failures may not be visually obvious.

(2) Any uncertainty about condition requires removal from service.

C. Unauthorized Actions

(1) The following actions are not permitted:

(a) Structural composite repairs

(b) Nickel leading-edge repair or metal removal

(c) Hub internal disassembly (constant-speed)

(d) Attempts to restore blade shape or contour

(e) Heat, pressure, or vacuum curing repairs

(f) Straightening or reforming damaged components

D. Propeller Strike Events

(1) Any impact with ground, debris, or foreign object, or any sudden engine stoppage requires: **Immediate removal from service and evaluation by an approved repair facility.**

E. Operating Limitations

(1) Do not exceed published power or RPM limits.

(2) Avoid high-power operation on loose surfaces.

(3) Use only approved hardware and torque values from applicable WhirlWind instruction manuals.

(4) Ensure governor and control systems operate correctly (constant-speed models).

(5) Do not operate with delamination, leading-edge damage, or known abnormalities.

3. Propeller Description

   A. Composite Blade Construction

      (1) WhirlWind composite blades consist of:

         (a) Carbon/epoxy, fiberglass, and foam matrix structure

         (b) Bonded electro-formed nickel leading-edge shield

         (c) Protective finish over composite substrate (paint/clear coat)

         (d) Precision balance and matched blade sets

   B. Ground-Adjustable Systems

      (1) Two-piece alodine aluminum clamp hub

      (2) Composite blades with adjustable pitch

      (3) Pitch set on-ground and held by clamping bolts

      (4) Model manuals define pitch stations and torque values

   C. Constant-Speed Systems (300 and 330-series)

      (1) Composite blades installed in a constant-speed hub

      (2) Hydraulically actuated pitch system using engine oil

      (3) External-only hub inspection in the field

      (4) Internal hub maintenance/repairs are not field-authorized

4. On-condition Maintenance Philosophy

   A. Philosophy

      (1) WhirlWind composite propellers are maintained on-condition.

         (a) Serviceable – Condition acceptable for continued operation.

         (b) Monitor – Condition acceptable but requires frequent observation.

         (c) Unserviceable – Condition unsuitable for flight; remove from service.

      (2) If there are questions about condition of safety, the propeller must be removed from service.

5. Inspection Requirements

A. Preflight Inspection (Every Flight)

(1) Inspect:

(a) Entire blade surface

(b) Leading and trailing edges

(c) Nickel shield for damage or lifting

(d) Spinner dome and fastener

(e) Hub and blade interface (with spinner installed)

(f) Evidence of oil leakage on constant-speed hubs

(g) Blade track and play

(h) Foreign object impacts or erosion

(i) For up to the first 10 hours of operation following installation of a new or repaired propeller assembly, a small amount of grease may be present on the blades and inner surface of the spinner dome.

B. Routine Inspection (On-Condition)

(1) Includes:

(a) Detailed blade surface evaluation

(b) Coin tap testing for evidence of delamination

(c) Hub exterior for cracks, fretting, or corrosion

(d) Torque check of mounting and clamping hardware

(e) Spinner bulkhead condition

(f) Verification of governor and control system operation (CS models)

(g) Refer to Owner’s/Instruction Manual for further inspection intervals

C. Special Inspections

(1) Required after:

(a) Suspected impact

(b) Roughness or abnormal vibration

(c) Overspeed event

(d) Exposure to severe weather or environmental contamination

(e) Paint loss large enough to expose carbon substrate

(f) Lightning Strike

D. Inspection Method

(1) Clean surfaces thoroughly

(2) Use bright, angled lighting

(3) Run your hand over the surface for irregularities

(4) Perform coin tap tests on composite areas and bond lines

(5) Document findings

(6) Lightning Strike Inspection

(a) In the event of a propeller lightning strike, an inspection is required before further flight. It may be permissible for a propeller to be operated for an additional five hours of operation if the propeller is not severely damaged and meets the requirements in step (6)(b) of this section.

(b) Procedure for Temporary Operation

1 For temporary additional operation before propeller removal and disassembly:

a Remove the spinner dome and make a visual examination of the propeller and sspinner for damage that would require repair before flight (such as arcing damage to the propeller hub).

b Make a visual examination and a coin tap inspection of each composite blade that has indications of arcing.

c Visually examine the blade for indication of buckled metal erosion shield.

d Perform a coin-tap inspection of the metal erosion shield to detect a debond and/or delamination.

e If the only damage is minor arcing burns that do not exceed serviceable limits specified above, then operation for five hours is permitted before disassembly and inspection.

6. Damage Assessment

NOTE: All findings must be categorized based on severity.

A. Serviceable Conditions

(1) Light surface scuffs

(2) Minor finish scratches not penetrating substrate

(3) Small paint chips

(4) Minor tip erosion confined to finish layer

(5) Clearcoat deterioration without composite exposure

(6) Nick leading edge dents that have not punctured the material.

B. Serviceable – Monitor

(1) Limited cosmetic surface wear with no impact on integrity

(2) Slight finish wear near tips or leading edges not exposing laminate

(3) Defects small enough that repainting or touching-up is optional

(4) Nickel leading edge dents that have not punctured the material.

C. Unserviceable Conditions

(1) The propeller must be removed from service if any of the following are found:

(a) Exposed fibers or laminate

(b) Cracks of any size in composite structure

(c) Delamination (dull coin tap-test indication)

(d) Soft spots, bulges, or depressions

(e) Nickel leading-edge punctures, gouges, or deformation

(f) Nickel shield lifting or peeling

(g) Trailing-edge cracks or separations

(h) Damage extending into substrate

(i) Damage at blade root or hub interface

(j) Any condition requiring structural restoration

(k) Any uncertainty about integrity

7. Permitted Minor Repairs
(Finish-Level Cosmetic Repairs Only)

   A. Composite Surface – Cosmetic Repairs

      (1) The following are permitted only if limited to the finish layer:

         (a) Very shallow scratches

         (b) Minor surface imperfections

         (c) Small cosmetic chips

         (d) Light finish erosion

      (2) Allowed Materials

         (a) 2-part 3M DP420 Epoxy Adhesive

         (b) Primer

         (c) Topcoat

         (d) Clearcoat

      (3) Permitted Actions

         (a) Clean affected area

         (b) Lightly scuff finish (avoid removing substrate)

         (c) Apply cosmetic epoxy filler

         (d) Sand smooth after cure

         (e) Prime and refinish as required

         (f) Ensure added material does not affect balance

   B. Paint and Clearcoat Restoration

      (1) Touch-up or full refinish of paint/clearcoat may be performed if no structural defects are present.

8. Prohibited Repairs

The following repairs are NOT permitted under any circumstances:

(1) Structural composite repairs
(2) Fiber/laminate restoration of any kind
(3) Repair of exposed fibers or substrate
(4) Layup of cloth or structural resin
(5) Re-bonding nickel leading-edge shields
(6) Filing, stoning, blending, or dressing metal leading edges
(7) Straightening dents or deformations
(8) Heat, pressure, or vacuum curing repairs
(9) Trailing-edge structural repairs
(10) Blade recontouring or reshaping
(11) Internal hub disassembly or servicing
(12) Any action altering blade weight or balance significantly

9. Field Maintenance

A. Mounting Bolt Torque
(1) Use model-specific WhirlWind torque values and tightening sequences.

B. Clamping Bolt Torque
(1) Verify torque per WhirlWind instructions.
(2) Ensure blades remain in intended pitch position.

C. Pitch Adjustment on Ground Adjustable Propellers
(1) Pitch may be adjusted:
(a) Loosen clamping bolts slightly
(b) Set pitch using approved pitch tools and specified station
(c) Torque bolts in required sequence
(d) Recheck pitch uniformity
(e) Conduct ground run and recheck tracking

D. Constant-Speed Hubs

(1) Field actions limited to:

(a) External inspection

(b) Leak detection

(c) Mounting bolt torque

(d) Spinner inspection

NOTE: No internal servicing allowed.

10. Removal From Service Criteria

Remove propeller from service if:

(1) Any defect listed in the section, "Unserviceable Conditions" is found

(2) Leading-edge shield is damaged

(3) Composite structure is exposed

(4) Vibration persists after installation checks

(a) This condition applies when vibration originating from the propeller remains present after all installation checks have been completed.

(5) Propeller exhibits abnormal behavior, including but not limited to overspeed conditions or irregular operation.

(6) Clamp or mounting torque cannot be maintained

(7) Paint loss exposes substrate

(8) Abnormal noise or performance is reported

(9) Any blade exhibits tracking deviation uncorrectable by permitted means

(10) Propeller strike or sudden stoppage occurred

11. Storage, Handling, & Shipping

A. Handling

(1) Avoid contact with tools, tow bars, and ladders

(2) Do not use blades as handles or steps

(3) Protect leading edges at all times

B. Storage

(1) Store indoors, in dry environment

(2) Support blades at root or hub, not at tips

C. Shipping

(1) Use original WhirlWind packaging whenever possible

(2) Secure blades to prevent movement

(3) Protect leading edges and tips from impact or abrasion

(4) Ensure the propeller assembly is adequately protected from damage, contamination, and moisture during handling, storage, and shipment

12. Documentation & Return to Service

Each maintenance entry must include:

(1) Propeller model and serial number

(2) Aircraft registration

(3) Condition findings

(4) Description of work performed

(5) Disposition (serviceable, monitor, unserviceable)

(6) Confirmation that propeller was returned to service in acceptable condition

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