



**WHIRLWIND**  
**A V I A T I O N**

Manufacturer of Composite Constant Speed Propellers

Model:	
Serial Number:	
Manufacture Date:	

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# Owner's Manual

## 284

(Rev 2014-2)

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***WHIRL WIND AVIATION***

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Congratulations on your propeller purchase from Whirl Wind Aviation!

## Section 1: Introduction

To ensure many hours of trouble free operation of your new Whirl Wind propeller please read and follow the operation and maintenance recommendations in this manual.

The Whirl Wind 284 Series propellers are composite constant speed hydraulically controlled propeller. This fully constant speed propeller will automatically adjust blade pitch angle to maintain the selected engine RPM setting. A single acting piston (inside the hub) powered by engine oil changes the blade pitch. Oil pressure is adjusted and regulated by the engine driven governor. Once an engine RPM is selected, it will be held constant at all flight airspeeds and power settings by the governor automatically.

The propeller control lever is used to set the desired engine RPM. Once the engine RPM is set, it is held constant by the governor, which maintains this preset RPM by varying the propeller oil pressure automatically. Mechanical stops for high and low pitch limit the pitch change travel of the propeller.

*Whirl Wind propellers are experimental class and are not subject to any Federal Aviation Administration regulations. The operator acknowledges that these are experimental propellers and agrees to assume all risk in operating them on an experimental aircraft or any other machine. Any and all information in the owner's manual, service letters and other documentation are suggestions only and may not apply to an operator's specific application.*

## Section 2: Overview

### 2.1 Description

The 284 Series propellers has been designed to maximize the performance of your airplane! This propeller delivers exceptional performance for the modern day utility aircraft. The exceptional performance is derived from advanced aerodynamic engineering techniques including computerized airfoil modeling.

Whirl Wind has made significant developments in the construction of the carbon composite propeller blades ensuring a strong, light and durable propeller system. The blade twist has been optimized for maximum performance and the wide chord allows for more low-speed thrust and braking.

The 284 Series is a two-blade hydraulically controlled constant speed propeller system designed for aircraft using the Lycoming IO-320, -360, -375 and -390 engines (150 - 265 hp).

## 2.2 Construction

The 284 Series propeller blades are constructed from advanced thermoset composite materials. Each blade is equipped with a nickel leading edge erosion shield to protect the blade leading edge from debris damage. The 284 Series System includes: propeller, spinner, and all hardware needed for installation.

The 284 Series hub is CNC machined from certified aerospace aluminum alloy, which is then shot peened and anodized. The hub blade sockets are equipped with ball bearings to ensure smooth pitch change of the blades throughout the life of the propeller system. This propeller can be flown in rain and off unimproved airstrips.

# Section 3

## Section 3: Propeller Identification

Each Whirl Wind propeller system has a factory designated model number and serial number, which will identify the hub and propeller serial number. The propeller system blades will have individual serial numbers etched on the ferrule of each blade near the root end. All Serial numbers can be found on the owner's data sheet.

### Example: 284-108

Series and Hub Style	284
Propeller Serial Number	108
Blade Serial Numbers	112, 113

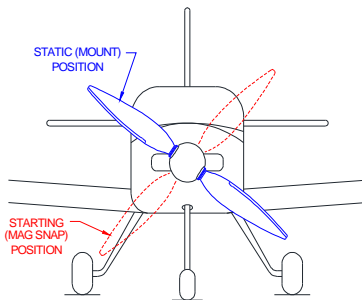
## Section 4: Instructions For Installation

### 4.1 Propeller and Spinner Installation

#### **WARNING! DO NOT OPERATE THE ENGINE / PROPELLER WITH ONLY THE SPINNER FILL-IN PIECES INSTALLED!**

IF THE ENGINE AND PROPELLER ARE TO BE RUN WITHOUT THE SPINNER DOME INSTALLED IT IS IMPARATIVE THAT THE FILL-IN PIECES ALSO BE REMOVED. The centrifugal force will damage or destroy the fill-in pieces without the support of the spinner dome. (The engine and propeller can be operated with only the spinner rear bulkhead installed.)

*\* For safety reasons always turn the propeller opposite of the usual direction of rotation.*



**Propeller Clocking:** The historical installation position of a two blade propeller is to place the upper blade in the 10 o'clock position as shown above.

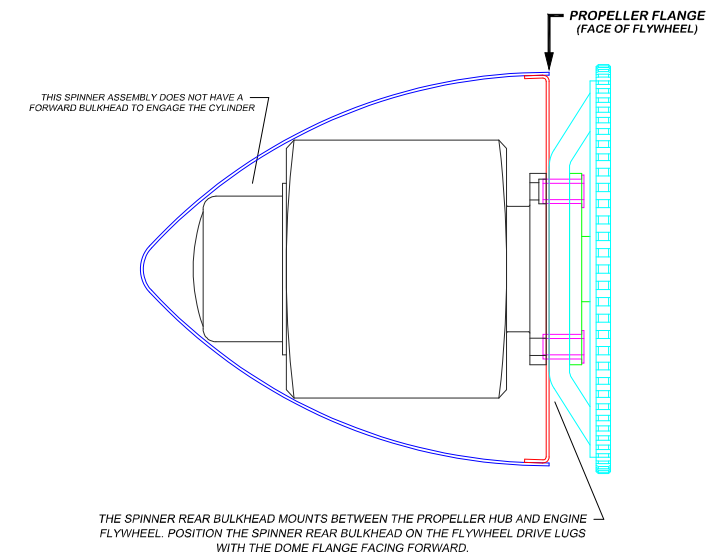
The 10 o'clock position allows for the easiest hand / prop starting of the engine by pulling the left blade down from the 10 o'clock position to the approximate 7 o'clock position where the magneto snaps and the ignition fires.

The Whirl Wind 284 Series propeller comes equipped with a composite spinner and rear bulkhead.

**Step 1:** Before beginning installation of the 284 Series propeller system inspect the O-Ring located in the propeller hub flange and make sure the O-Ring is in good condition.

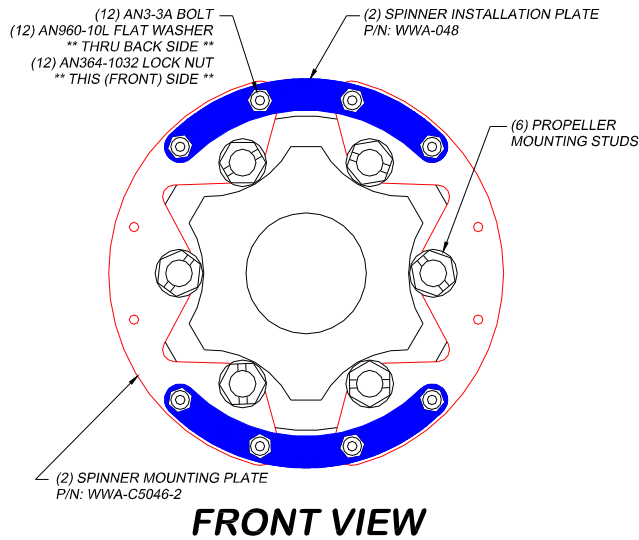
#### **For Cub Crafters and Similar One Piece Rear Spinner Bulkhead Installation:**

This spinner assembly requires that the rear bulkhead be installed between the propeller hub and flywheel as detailed below:



#### **For Two Piece Rear Spinner Bulkhead Installation:**

**Step 2:** Using the supplied AN3 bolts and nuts, install the (2) temporary spinner installation plates as detailed below. The installation plates are provided to maintain the proper spacing of the (2) spinner mounting plates when the propeller mounting studs are tightened.



**For One Piece Rear Spinner Bulkhead Installation:**

**Step 2:** Note the factory position of the spinner rear bulkhead in the spinner dome in relation to the blade cutouts to determine its required position on the propeller hub. The spinner and spinner rear bulkhead have been number coordinated to match the blade cutout openings. Using the supplied AN3 bolts and nuts install the spinner rear bulkhead to the spinner mounting plates. The supplied flat washers are to be installed on the fiberglass side. The bulkhead is to be installed on the aft side of the mounting plates. (The standard 200C 14" rear bulkhead is an exception; it is to be installed on the forward side of the mounting plates. A slot is provided in the bulkhead so it can be slipped over the mounting plates into its forward position.) Tighten the bulkhead mounting hardware.

**Step 3:** After lightly lubricating the O-Ring with clean oil or O-Ring lube, carefully install the propeller on the engine crankshaft by tightening the (6) propeller bolts.

**Warning:** To avoid severe damage to the hub, when tightening the propeller bolts insure that the face of the prop hub is kept parallel with the face of the flywheel. In most cases this will require tightening the propeller bolts a little at a time in an alternating pattern.

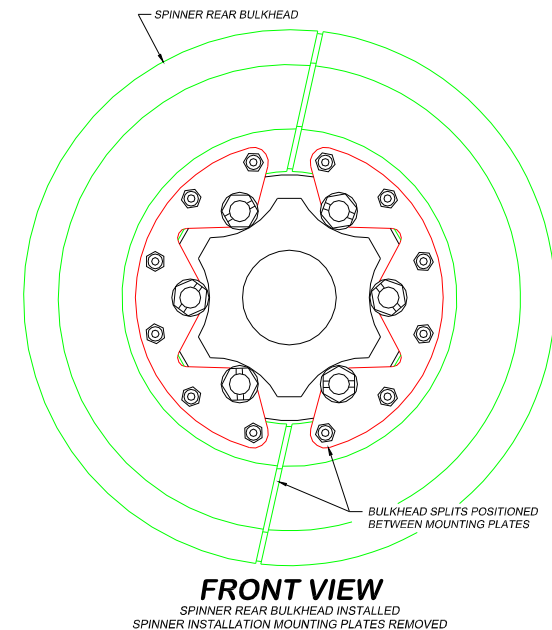
**Step 4:** Torque and safety wire the propeller hub bolts. Refer to data sheet for torque (dry, non-lubricated) values (65 ft-lbs for 1/2" hardware or 47 ft-lbs for 7/16" hardware). Safety wire the prop bolts in pairs with 0.32" stainless safety wire after installation.

\*\* Installation with a one piece rear bulkhead is complete. Proceed to Section 4.2 \*\*

**For Two Piece Rear Bulkhead Installation:**

**Step 5:** Remove the (2) spinner installation plates. Save them for future use.

**Step 6:** Note the factory position of the spinner rear bulkhead in the spinner dome in relation to the blade cutouts to determine its required position on the propeller hub. The spinner and spinner rear bulkhead have been number coordinated to match the blade cutout openings. Using the supplied AN3 bolts and nuts install the spinner rear bulkhead to the spinner mounting plates. The supplied flat washers are to be installed on the fiberglass side. The bulkhead is to be installed on the aft side of the mounting plates. Tighten the bulkhead mounting hardware.



## 4.2 Spinner Dome Installation

Install the spinner dome onto the propeller hub and rear bulkhead. The spinner and spinner rear bulkhead have been number coordinated to match the blade cutout openings.

The spinner dome has a forward bulkhead with a flanged hole that must engage the cylinder (cap) on the front of the propeller hub (except for the Cub Crafters type spinner assembly that does not have a forward bulkhead). The fit of the forward bulkhead to the cylinder is to be snug BUT NOT SO TIGHT that excessive force is required to push it on. If the fit is too tight, sand the inside of the forward bulkhead flange. If the fit is too loose, apply the provided Teflon tape to the cylinder. In some cases a combination of these processes will be required to obtain the proper fit.

Fasten the spinner dome and blade cutouts to the rear bulkhead using the supplied screws and nylon washers.

***IMPORTANT: Periodically verify that the spinner screws are tight during the first few hours of operation.***

## 4.3 Governor Installation

- Clean governor and engine governor mating surfaces.
- Place gasket on governor side.
- Align governor spline to engine drive and push governor up to seat against engine drive pad.
- Install governor mounting hardware and torque to 150 in-lbs.
- Attach control cable to the governor control arm with the appropriate hardware.

***Note: The control arm is spring loaded to high RPM. Make sure control arm moves freely through 45 degrees of travel.***

## Section 5: Propeller System Operation

**WARNING: Operation of this propeller over maximum RPM is strictly prohibited and may result in a catastrophic structural failure of the propeller system. Any type of structural failure may result in death or severe bodily injury. Refer to your propeller data sheet for Maximum RPM.**

Be sure to limit engine power settings when performing ground run-up. Engine and propeller manufacturers do NOT recommend high engine power settings on the ground because it can result in excessive engine temperatures and propeller blade foreign object damage.

### 5.1 First Run-Up

To ensure proper first run-up of your new Whirl Wind 284 Series propeller system refer to your engine's operation manual for the proper run-up power setting. At the proper run-up power setting pull the propeller control lever back until the RPM drops by 300 - 400 RPM. Push the propeller control lever forward and observe RPM increase. Cycle the pitch three times to purge air out of the system. After first run-up refer to "Section 5.2" for inspection.

## 5.2 Inspection After First Run-Up

1. Inspect the propeller system blades and spinner for any nicks, cracks, or chips.
2. Inspect each aluminum blade ferrule and blade intersection (located at the root end of blade where the silicone sealant is visible) for movement and/or signs of chafing. There should be no movement between aluminum ferrule and blade. Notify Whirl Wind Aviation immediately if movement is detected.
3. Gently shake each propeller blade to feel for blade movement in the hub. Blade shake movement is allowed up to 1/8 inch, measured from the tip. Radial play of up to 2 degrees is acceptable. If the check shows values above these tolerances contact Whirl Wind Aviation immediately. Movement is only allowed between the aluminum blade ferrule and the propeller hub, not as described in item #2 above.
4. Inspect the nickel leading edge erosion shield. The nickel erosion shield should not be loose or have any cracks. Small paint cracks parallel to and along the edge of the shield where the nickel and paint meet are acceptable.
5. Check spinner dome and the aft and forward bulkheads for cracks of any kind or looseness.
6. No grease or oil leaks should be detected. NOTE: A small amount of grease leakage may occur in new propellers (first 2 to 5 hours) or in hot climates with high RPM conditions.
7. Before every flight the prop-control should be cycled at least twice to circulate the engine oil. In cruise flight any number of RPM settings are possible within the engine and propeller limitations. The RPM restrictions from the engine and propeller manufacturers must be strictly observed.

## 5.3 Dynamic Balance of the Propeller

Your Whirl Wind Propeller System has been statically balanced at the factory. However, it is recommended to have the engine/propeller dynamically balanced before the first flight.

Repeat the same inspection after balancing as for first run-up. All engine RPM and power settings limitations must be followed when operating the Whirl Wind 284 Series propeller. Refer to your Whirl Wind propeller data sheet for propeller operation limitations.

## 5.4 Inspection after First 2 Hours of Flight

Repeat entire inspection done in section 5.2 "Inspection after first run-up" after the first two hours of flight.

**All engine RPM and power settings limitations must be followed when operating the Whirl Wind 284 Series propeller. Refer to your Whirl Wind propeller data sheet for propeller operation limitations.**



## 5.5 Overspeed Warning

It is possible to overspeed the propeller by rapid throttle advancement. Therefore, always adjust the power and RPM lever slowly and smoothly to avoid the possibility of overspeed.

### The 284 series propeller is rated for an absolute maximum 2,700 RPM.

The maximum rated RPM of the propeller is something to be taken very seriously and often is not by many pilots. All Whirl Wind propellers are designed with a conservative safety factor based on the maximum RPM of 2,700. The centrifugal blade forces are a squared function of RPM. For example, 2,700 RPM has double the blade centrifugal force than that of 2,000 RPM. Considering this relationship what could be perceived as a small 10% over speed will result in a 21% increase in blade centrifugal force loads. Therefore even a small increase in RPM over the maximum limit will quickly diminish the propeller's structural safety factor. It is critical to always follow the propeller's RPM limitations and over speed inspection procedures as detailed below.

#### If an overspeed occurs:

<b>Overspeed Occurrence</b>	<b>Required Action</b>
up to 110 % of the max RPM	A 50 hours inspection must be performed immediately by a certified A&P mechanic
111% to 120% of the max RPM	A mandatory teardown inspection at the factory is required
above 121% of the max RPM	<u>No further use of the propeller is permitted!</u> The propeller must be returned to the factory for inspection.

**WARNING: Failure to adhere to these guidelines may lead to a catastrophic propeller structural failure. Any type of structural failure may result in death or severe bodily injury.**

## 5.6 RPM Recommendation

### Maximum RPM Restriction

The only limitation or restriction on Whirl Wind propellers is the maximum operating engine speed of 2,700 RPM.

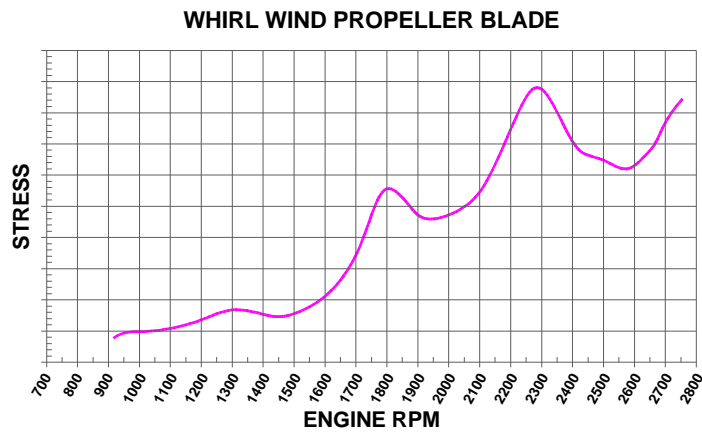
### Recommended Non-Continuous Operating Ranges

Whirl Wind follows historical industry standards and *recommends* that continuous operation between 2,050 - 2,300 RPM and 2,600 - 2,700 RPM be avoided when used on Lycoming and similar four cylinder aircraft engines. (Take off and climb out is not considered continuous operation.)

This *recommendation* is based on the fact that the four cylinder engines produce torsional vibrations on each power pulse (ignition firing). These vibrations are transferred from the crankshaft through the propeller hub to the propeller blades. Extensive research conducted by propeller manufacturers has demonstrated that these vibrations at engine speeds between 2,000 - 2,300 RPM and greater than 2,600 RPM can cause increased vibratory stresses in the propeller blades and in some cases this torsional vibration can be close to the blade's resonant frequency. Blades vibrating at their resonant frequencies, or more likely higher order overtones, can be stressed beyond their design limits and could result in limited or complete failure. This phenomenon is a greater concern with aluminum propeller blades because of their lower natural resonant frequency. The natural dampening, high natural resonant frequency and high fatigue resistance of Whirl Wind composite blades makes the likelihood of destructive failure less probable, but to ignore the RPM concerns recognized by the industry would be unwise.

Furthermore, flywheel dampening and / or crankshaft counterbalancing can mitigate the torsional vibrations but not eliminate them completely. It is only prudent to avoid operating in these critical RPM ranges whenever possible.

Whirl Wind's extensive testing and vibration mapping of blade stresses has further proven that this phenomena exists as shown in the following simplified engine RPM verse blade stress graph:



Every propeller is subject to these same conditions and yields similar test results. However, the material and construction of each distinct propeller design reacts differently to these conditions. As noted above, the natural properties of the Whirl Wind carbon fiber blades are much more tolerant of these conditions, and as detailed in the graph, even at the worst case stress scenario of 2,300 RPM the measured stresses on the Whirl Wind blades are significantly lower than our design standard of 50% (safety factor) of the unlimited life cycle strength of the blade material.

Regardless, it is simply safe practice to follow the RPM recommendations. It should also be considered that the propeller is not the only component of the aircraft that experiences these stresses; everything including the prop, engine and airframe are subject to these stresses simultaneously and it is better for all of the equipment to avoid these conditions.

# Section 6

## Section 6: Propeller System Inspection

### 6.1 Preflight Check

1. Inspect the propeller system blades and spinner for any nicks, cracks, or chips.
2. Inspect each aluminum blade ferrule and blade intersection (located at the root end of blade where the silicone sealant is visible) for movement and/or signs of chafing. There should be no movement between aluminum ferrule and blade. Notify Whirl Wind Aviation immediately if movement is detected.
3. Gently shake each propeller blade to feel for blade movement in the hub. Blade shake movement is allowed up to 1/8 inch, measured from the tip. Radial play of up to 2 degrees is acceptable. If the check shows values above these tolerances contact Whirl Wind Aviation immediately. Movement is only allowed between the aluminum blade ferrule and the propeller hub, not as described in item #2 above.
4. Inspect the nickel leading edge erosion shield. The nickel erosion shield should not be loose or have any cracks. Small paint cracks parallel to and along the edge of the shield where the nickel and paint meet are acceptable.
5. Check spinner dome and the aft and forward bulkheads for cracks of any kind or looseness.
6. No grease or oil leaks should be detected. **NOTE:** A small amount of grease leakage may occur in new propellers (first 2 to 5 hours) or in hot climates with high RPM conditions.
7. Before every flight the prop-control should be cycled at least twice to circulate the engine oil. In cruise flight any number of RPM settings are possible within engine and propeller limitations. The RPM restrictions from the engine and propeller manufacturers must be strictly observed.

## 6.2 50 Hour Inspection

1. **BLADES:** Inspect the propeller system blades for any nicks, cracks, or chips. Inspect blades for cracks in the composite skins and nickel leading edges. No cracks are allowed in either. If cracks are present return propeller for repair to a Whirl Wind Aviation service center.
  - Inspect the cambered side of each blade for chord-wise cracks and the entire blade for any delamination of the composite skin or obvious discoloration.
  - Small cracks parallel along the nickel edge are allowed as long as the leading edge is not loose. Scratches or chips should be sealed up as soon as practicable.
  - In case of any questionable conditions, please contact the service department of Whirl Wind Aviation.
2. **BLADE FERRULES:** Inspect each aluminum blade ferrule and blade intersection (located at the root end of blade where the silicone sealant is visible) for movement and/or signs of chafing. Gently flex the blade at the tip to check for any movement between the aluminum ferrule and blade root – no movement is allowed. There should be no movement between aluminum ferrule and blade. Notify Whirl Wind Aviation immediately if movement is detected.
3. **BLADE MOVEMENT:** Gently shake each propeller blade to feel for blade movement in the hub. Blade shake movement is allowed up to 1/8 inch, measured from the tip. Radial play of up to 2 degrees is acceptable. If the check shows values above these tolerances, contact Whirl Wind Aviation immediately. Movement is only allowed between the aluminum blade ferrule and the propeller hub, not as described in item #2 above.
4. **LEADING EDGE:** Inspect the nickel leading edge erosion shield. The nickel erosion shield should not be loose or have any cracks. Small paint cracks parallel to and along the edge of the shield where the nickel and paint meet are acceptable.
5. **SPINNER:** Remove spinner and check for nicks, cracks or chips. Check spinner dome and the aft & forward bulkheads for cracks of any kind or looseness. Also inspect for any signs of chafing.
  - Ensure secure attachment to the hub.
  - Check AN3 bolt on aft bulkhead for tightness.
6. **GREASE:** No grease or oil leaks should be detected. NOTE: A small amount of grease leakage may occur in new propellers (first 2 to 5 hours) or in hot climates with high RPM conditions.
7. **FLANGE BOLTS:** Check propeller flange bolts for tightness (65 ft lbs).
8. Before every flight the prop-control should be cycled at least twice to circulate the engine oil. In cruise flight any number of RPM settings are possible within engine and propeller limitations. The RPM restrictions from the engine and propeller manufacturers must be strictly observed.

## Section 7: Propeller System Maintenance

There is no special maintenance schedule for the Whirl Wind 284 propeller system beyond the usual inspections listed in Section 6 and the teardown inspection schedule listed below. It is recommended that the operator apply a high quality paste wax on the blades at least once a month to aide in protection from the elements - it is important that the blades are always sealed from outside moisture. Automotive materials such as Acryluathane paint and Epoxy resin can be used to repair most small scratches and chips.

### 7.1 Teardown Inspection Schedule

Refer to the original propeller data sheet for recommended teardown inspection schedule. If the original data sheet cannot be found, please contact Whirl Wind Aviation directly to confirm the recommended schedule for your propeller.

### 7.2 Use of Propeller Log Book

1. Proper maintenance of this logbook is the owner's responsibility. It is an important record designed for the owner's information and protection.
2. If the propeller is sold or installed on another aircraft the logbook should be transferred with the propeller. New owner information should be registered with Whirl Wind Aviation by calling 440-275-1540.
3. It is recommended that maintenance release tags and work orders be attached inside the back cover of this book. If a copy of the work order is not available, the repair station and work order numbers should be referenced in the logbook entry.

## Section 8: Propeller Log Book

### 8.1 Maintenance & Service History

Date:	Total Propeller Time	Total Time Since Overhaul
Description of Work		Repairman & Repair Station Certificate Numbers

Date:	Total Propeller Time	Total Time Since Overhaul
Description of Work		Repairman & Repair Station Certificate Numbers

Date:	Total Propeller Time	Total Time Since Overhaul
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Date:	Total Propeller Time	Total Time Since Overhaul
Description of Work		Repairman & Repair Station Certificate Numbers

## 8.2 Transfer of Ownership

Please complete this form upon transfer of ownership and return to Whirl Wind Aviation, PO Box 190, Austinburg, OH 44010 U.S.A.

Propeller Model: \_\_\_\_\_

Propeller Serial No: \_\_\_\_\_

Date Transferred: \_\_\_\_\_

### **Original Owner**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Phone No: \_\_\_\_\_

### **Notes:**

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### **New Owner**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Phone No: \_\_\_\_\_

### **Notes:**

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