McCAULEY™

THE 10 COMMANDMENTS OF PROPELLER CARE

ALONG WITH ANSWERS TO THE 16 MOST OFTEN ASKED QUESTIONS ABOUT PROPELLERS

10 Commandments

1. Read and respect your owner's manuals…know where to obtain service

Ah! There it is, your own plane. Bright, shiny and just begging for flight. But hold it! Have you read the owner's manuals? Many of the "commandments" in this booklet duplicate instructions in other manuals. But you can't repeat a good "thou shalt" or "thou shalt not" too many times. We urge you to keep the engine and aircraft in good shape…and to especially take care of the propeller. And now would be a good time to start a separate log book just for the propeller so you have a permanent record of prop maintenance and overhaul.

Sooner or later you'll need service on your prop, and you'll want to locate an approved propeller repair station with proper equipment to work on your McCauley propeller.* These are stations approved and certified by the Federal Aviation Administration to service, recondition, repair, or overhaul propellers. These firms demonstrate that they have the

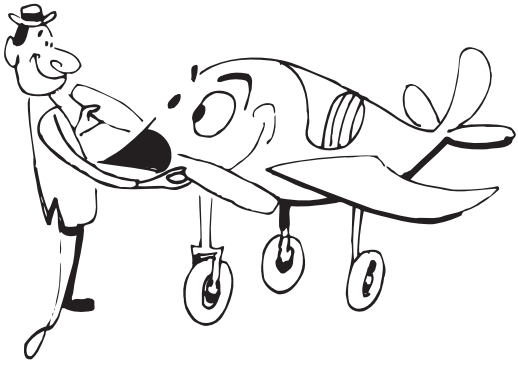
A listing of McCauley direct factory dealers can be obtained by accessing our website at:* ***www.mccauley.textron.com*

# of Propeller Care

equipment, technical information, and skills to perform such work. They are licensed and limited to working only on specified propeller models which are listed by manufacturer and model on their authorization. Know where your "home base" prop repair station is located…and also other stations in areas where you fly and land frequently.

2. Visually inspect the prop before each flight

You've got the eye of an eagle or you wouldn't be flying! So it should be pure joy for you to give the prop blades a visual inspection regularly, preferably before each flight.



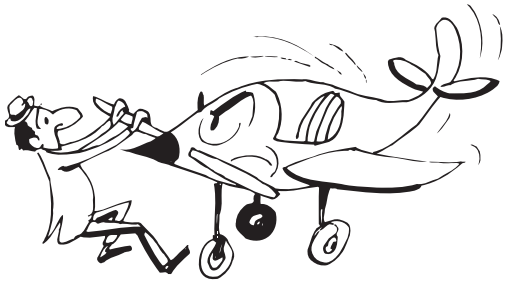
You should look for such surface damage and irregularities as dents, nicks, bruises, scratches, erosion, etc. When are these serious enough to require professional attention? Best rule is, when in doubt, let an approved FAA-licensed A&P (airframe and powerplant) mechanic look at the prop. He can correct minor damage by "dressing" it out. If you have a spinner, check external surfaces for damage and the attachment parts for normal tightness…also check the back surfaces of the hub. If no spinner is installed, visually examine the front and back surfaces of the propeller hub and its attachment onto the engine shaft for normal tightness.

3. Don't rev the engine over loose particles

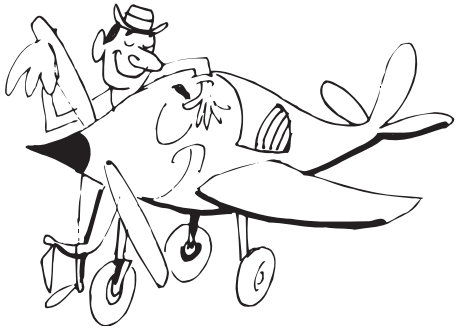
Unless a gang of Bad Guys is chasing you and the idea is to get away fast, you should avoid high static RPM when standing or taxiing over dirt, gravel or stony areas. Revving the engine to a cloud of dust may look dramatic on the late movie, but high speed operation of the propeller can cause nicks and other damage to the blades and tips if particles are sucked up and hit the prop. Do you ever take off from runways of this type? If safe operation permits, propeller speed control should not be opened to maximum RPM's until airspeed has picked up. Nicks and other minor imperfections should be dressed out before cracks have a chance to develop.

4. Don't use prop blades as handles

An elephant may not mind being grabbed by the nose and pushed or pulled into position. But it can do really jumbo-size harm to a propeller if you use the prop blades as convenient handles for maneuvering the plane on the ground. If your plane is equipped with a steerable nose wheel and tow bar, use them as a means of jockeying



the plane. If the plane is not so equipped, certain areas of the airframe have been designated by the manufacturer as safe for push/pull pressure. Know where these points are, and just remember—for positioning, the nose is a no-no!



5. Use oily rags for wiping …don't hose the prop

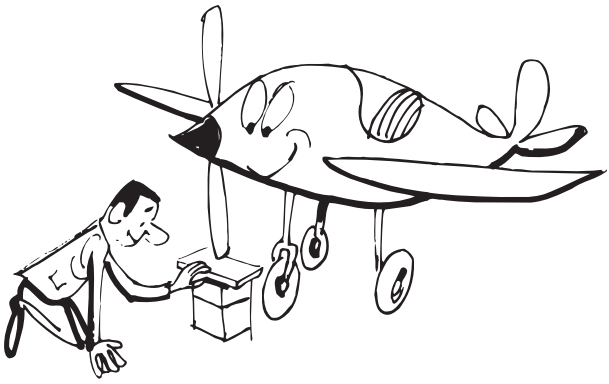
A clean cloth dampened with light oil is your propeller's best maintenance friend. Wipe the prop after each flight, or as regularly as possible, especially if you operate near salt water or fly a sea plane. An oily wipe-off removes substances that cause corrosion and prepares the prop to repel corrosives and water erosion. The oily rag wiping habit also gives you the opportunity to inspect the blades for nicks, cracks, and tears. Never scrape the blades or use abrasives as these damage the surface finish. And don't hose the propeller down with water …especially don't stick a water nozzle in the spinner opening and squirt the hub to clean it. This act may force water into the hub and lead to corrosion or lubricant breakdown.

6. Clean and wax blades often…repaint as required

Saturday afternoons are great for "messing around" with the plane. One of the tasks that should be maintenance regular is cleaning the prop blades with a non-oil base solvent (Stoddard). Then wax the blades, using any automotive type paste wax. The backs of the blades are painted a non-reflective black, and this coating may have to be renewed from time to time. On the opposite side, blade tips are painted a bright color.

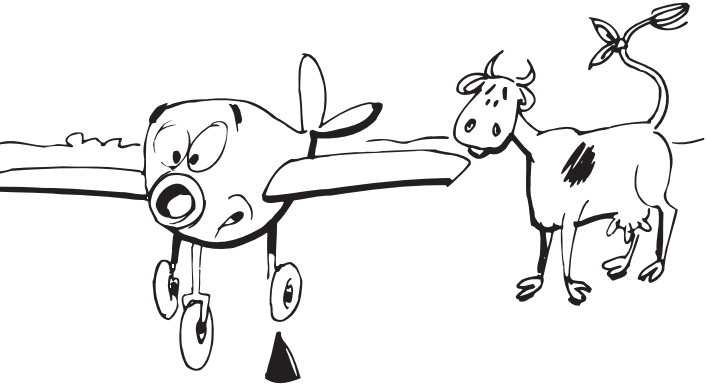
7. Recondition prop when necessary

The Bent Prop Club always welcomes new members. If you should happen to ground loop or hit a stray cow's tail, chances are your propeller can be straightened and repaired. About 90% of accident-caused damage is repairable. The need for reconditioning under these circumstances is obvious…it should also be performed when prop blades have been damaged and filed often. Reconditioning covers major and minor blade damage from accident or other causes and includes balancing the prop. This work is performed on an "as required" basis by the propeller manufacturer or an FAA-approved propeller repair station. For a one-piece fixed pitch prop, this operation is equivalent to an overhaul. For other types of props, if damage is major but repairable, an overhaul should be included with the reconditioning, although this is not mandatory.



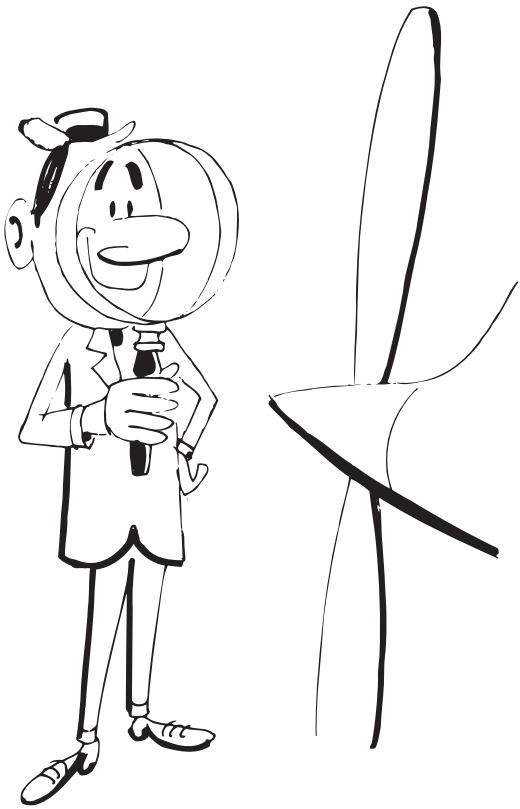
8. Check blade track periodically

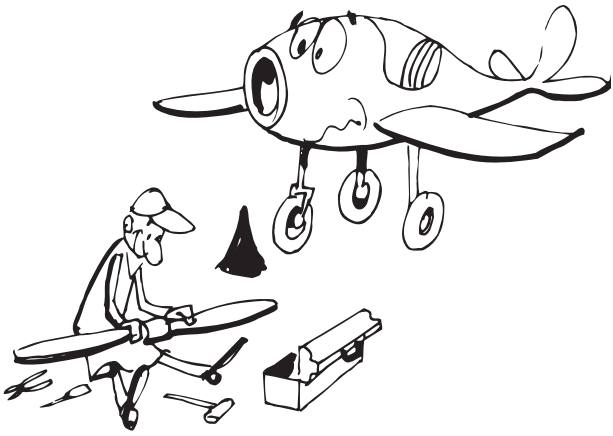
Blade track is the ability of one blade to follow the other in the same plane. Track is held to reasonable limits to prevent roughness. Excessive differences (more than 1/16 inch) may be an indication of bent blades or improper installation. To check track, a smooth board is blocked up just under the tip of the lower blade. On controllable props, the tip is moved fore and aft through its full "blade shake" travel (see Question #15). Small pencil marks are made at each position. Then center the blade between these marks, and draw a line the full width of the blade. The other blade tip is rotated to the board, centered, and marked. The lines should be separated by not more than 1/16 inch. If more, check for bent blades or for foreign particles between hub and crankshaft mounting faces.



9. Make thorough visual inspection yearly (or every 100 hours)

This is the same visual procedure you should be conducting before each flight – only this time inspect the prop inch by inch in the best possible light, looking for any evidence of damage you may have overlooked previously during your pre-flight inspections. This "fine tooth comb" inspection should be done once each year for one-piece fixed pitch propellers and every 100 flight hours for all other types of props. Have a licensed A&P mechanic remove the spinner if installed and check propeller installation bolts for tightness with a torque wrench.

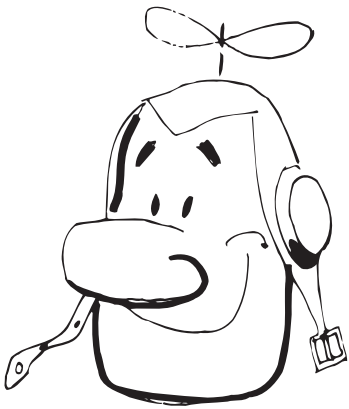




10. Follow overhaul recommendations

Much as you hate to part with your controllable prop, the day finally comes when the men in white coats must remove it for overhaul. Overhaul is the periodic disassembly, inspection, reconditioning and reassembly of the propeller (except one-piece, fixed pitch props which do not require overhaul). The overhaul interval is generally based on hours of service (operating time), but a calendar limit also applies. After being disassembled, the propeller is inspected for wear, cracks, corrosion or other abnormal conditions. Certain parts are replaced, while other parts are reconditioned and refinished. Reassembly and balancing complete the job. Overhaul is performed by the propeller manufacturer or by an approved propeller repair station and follows manufacturer's service manual instructions and service bulletins and letters, as applicable. A subscription service is available from McCauley for those owners desiring their own copies of these bulletins and letters.

16 Popular Questions and Answers about Propellers



1. What is the propeller's function?

The propeller is a twisted wing or airfoil. The prop converts the rotating power of the engine into "thrust" which propels the airplane through the air similar to the way that the wing (also an airfoil) provides the "lift" which enables the plane to be airborne.

2. What is the difference between a "tractor" propeller and a "pusher" propeller?

A propeller mounted on the forward end of the engine, relative to flight direction, is a tractor type. A pusher type is one mounted behind. A tractor propeller pulls the aircraft, while a pusher prop pushes it.

3. Classified by pitch, what are the basic types of propellers?

***Fixed Pitch**...one piece prop with a single fixed blade angle. The pitch must be high enough to offer good cruising performance and yet low enough to achieve acceptable takeoff and climb characteristics. With a fixed throttle setting, the prop (and engine) RPM will change as airspeed changes; with a constant airspeed, the prop (and engine) RPM will change if power is increased or decreased.

Ground Adjustment...blade angle can be adjusted on the ground but cannot be altered in flight. Once fixed, this prop operates like a fixed pitch propeller. Blade angle can be set low for short fields and/or high terrain or for better load carrying capability; it is set at a higher angle for long runways, low terrain, or light loads when a better cruising speed is desired.

Two Position...blade angle may be adjusted during operation to either low angle or a high angle setting. Low angle is used for takeoff and climb, then a shift is made to high angle for cruise.

Controllable Pitch...blades may be altered infinitely to any desired angle during flight, starting with a low blade angle and then gradually increasing the angle during takeoff, climb, leveling out, and cruise.

Automatic Pitch...blade angle change occurs automatically as a result of aerodynamic forces acting on the blades, and the pilot has no control over the changes.

****Constant Speed***...a governor is used in conjunction with the propeller to automatically provide constant RPM as the pilot selects the proper setting. Blade angle is changed automatically and will increase or decrease if RPM setting is decreased or increased or if power is increased or decreased. With fixed RPM and power setting, the blade angle changes automatically as airspeed increases or decreases.

****Full Feathering***...blades can be rotated to a high positive angle to stop rotation (windmilling). This feature is common on multi-engine aircraft, because it allows an engine to be shut down and the prop stopped to reduce drag and asymmetric control forces.

Beta Control...normally used for ground operation, most often in taxiing, where thrust is manually controlled by adjusting blade angle with the power lever.

****Reversing***...blades can be rotated to a "negative" blade angle where they will provide a rearward thrust to slow down, stop or move the aircraft backward. This capability is normally provided for turbine installations.

**Types starred are available in various models.*

4. Why are props made of aluminum rather than wood?

Wood props were used almost exclusively on personal and business aircraft prior to World War II. Lightweight aluminum props were developed after the war. Compared to wood, an aluminum prop can be made with thinner blade sections, which have higher efficiency (more lift, less drag). The metal does not absorb moisture, which can cause weight change or warpage. High strength aluminum propellers have good elongation characteristics and can be rather extensively damaged yet repaired. (They resist woodpeckers, too!)

5. What other materials are used for props?

During World War II, solid steel propellers were made for the Armed Forces. Although no longer produced, some are still found on agricultural aircraft used for spraying and dusting. Fiberglass resins form the base for new composite materials which may be specified when reduced weight is critical.

6. Why are some prop blades tips rounded and others square?

Round or elliptical tips are used for increased ground or fuselage clearance, certain noise perameters, blade vibration resonant characteristics or special design conditions. In controlled tests, elliptical tips proved slightly more efficient than square tips, but the increase is insignificant. Most propellers have square tips to leave extra material which can be removed after damage to make the blade round or elliptical and still maintain diameter.

7. Why are propellers painted?

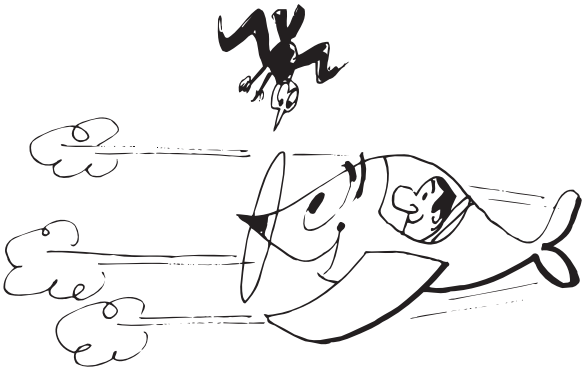
The faces of the propeller blades toward the pilot are painted non-reflective black so the spinning propeller is not seen as a shiny, hypnotic disc. The tips on the opposite side are painted bright colors so the spinning propeller can be more easily seen to warn those on the ground about walking into it.

8. How are individual propellers identified?

McCauley propellers are identified by a model designation and a serial number. On one-piece fixed pitch props, the serial number is stamped on the camber side of the hub face. Variable pitch propellers have separate numbers for hub (stamped on side) and each detachable blade (stamped on flat face at hub end).

9. What is "feathering" the prop?

Changing the blade angle until the blades offer low resistance to flight and won't windmill. On single engine aircraft, the feathering feature adds cost and weight and offers little advantage. Multi-engine aircraft generally have full feathering props to eliminate asymmetric drag forces caused by windmilling when an engine is shut down.



10. What is meant by Beta Control and "reversing" the prop?

Beta control is the manual repositioning of the propeller blade angle beyond the normal low pitch stop. Reversing means changing the blade angle to a position less than the normal positive low blade angle setting until a negative blade angle is obtained. A blade with a negative blade angle produces a thrust in the opposite direction to the normal forward thrust. This acts to slow down, stop or even reverse the airplane when on the ground.

11. What is a spinner?

A metal cover which encloses the propeller hub. It has a pleasing, low drag shape which blends into the engine nacelle. Appearance is the common reason for using spinners, but on some aircraft they streamline the airflow for engine cooling purposes.

12. What is a governor, and how is it related to the propeller?

The governor is a device generally mounted on the engine, and driven by it, which senses and controls engine speed (RPM) by hydraulically adjusting the blade angle of the propeller. This product is manufactured by McCauley.

13. What is a governor, and how is it related to the propeller?

On twin-engine aircraft, governors also provide the means for synchronizing and

sychrophasing the two propellers. The synchronizing option measures the RPM of both propellers and adjusts one of them so that both are turning at the same speed. Once the speeds are synchronized, the synchrophaser option controls the phase relationship of the two props to eliminate engine beats and minimize sound and vibration in the aircraft.

14. What is the difference between propeller "anti-ice" and "de-ice" equipment?

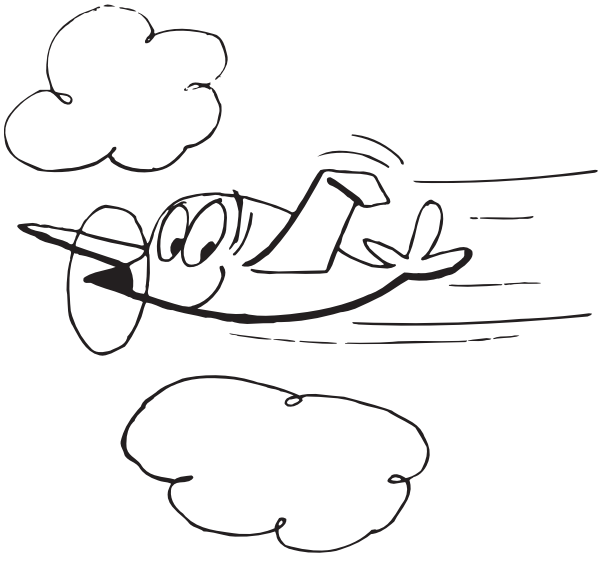
With anti-ice equipment, alcohol is permitted to flow over the propeller blades to prevent ice formation. It is not effective after ice has formed. A de-ice system applies electric heat to the blades after ice has formed so that it is melted near the surface and centrifugal force will cause the ice to "shed." De-ice systems are made by McCauley.

15. What is blade shake?

Blade shake is the tendency for the blade of a variable pitch propeller to wobble slightly when the tip is moved by hand. This tendency is the natural result of the fabrication of retention parts to close tolerances. Very small differences at the blade root are magnified many times when measured at the tip. Blade shake does not adversely affect prop strength or performance and disappears when the propeller rotates. With the first turn, the centrifugal force of the spinning blades seats them rigidly against the retention bearing.

16. What causes prop roughness?

All vibrate to some extent in operation. Assuming that the engine itself is not at fault, roughness relative to the propeller could be caused by bent blades, blades out of track due to improper mounting of the prop on the engine shaft, imbalance, propeller loosely mounted on engine shaft, blade angles between blades out of tolerance with respect to each other, and spinner imbalance due to improper mounting, or to dirt, snow or ice inside the shell.



This booklet is presented in the interest of happier, safer and wiser flying by

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