



METAL PROPELLER REPAIR MANUAL

INTRODUCTION

The purpose of this Service Manual is to provide the repair information necessary to maintain a fixed-pitch metal propeller in an airworthy condition.

The types of service-damage which may render a fixed-pitch metal propeller unairworthy are mainly mechanical injuries such as cuts, nicks, and dents caused by the impact of stones, gravel, sand, etc. Usually a displacement of the metal is involved and the void is roughly V-shaped in cross-section with the sharp point of the "V" pointing inward, away from the surface of the metal. There is also a type of chemical damage which involves corrosion at the interfaces of the grain structure of the metal. In this manual it is called corrosion pitting. The mechanical effect of this on the strength of the metal is like that of a "V" notch with the sharpest possible edge. It is the objective of all repair techniques to remove this V-shaped notch and to leave the repair area in a smooth, rounded well-faired condition. It is worthwhile to understand the reasons behind these procedures.

A metal propeller is subjected to two kinds of loads or stresses. A stress is merely the load or force which acts across a unit area of the blade cross-section. The first of these stresses is steady and continuous and due to the combination of the centrifugal forces associated with the rotation of the propeller, and forces which are the reaction of the airload on the blade. These centrifugal forces are very large when a typical light-plane propeller is operating at its rated rotational speed. A particle of metal near the tip of the blade may exert an outward pull roughly 7500 times greater than its own weight. The forces due to the reaction of the blade to the airload tend to bend it out of the plane of rotation and the centrifugal forces tend to straighten the blade and bring it back into the plane of rotation, so that in operation the blade will seek some intermediate or equilibrium position. The sum of the stresses caused by these steady forces constitutes the total steady stress to which a blade is subjected at a given rotational speed, power input, and forward speed of the propeller. It varies, of course, along the radius of the blade in a manner which is determined by the shape of the blade. At rated conditions of power, rotational speed, and forward speed, it is possible, by proper design of the blade, to hold the maximum value of these steady stresses below a value of about 7500 pounds per square inch. This is about one-fourth of the yield strength of aluminum alloy 2025, heat-treated to Specification T6, which is the metal universally used throughout the light-plane propeller industry.

The second type of stress is an alternating or vibratory stress. In this type of stress, the blade is subjected alter-

nately to loads which tend to stretch the metal and then to compress it. The sequence of events which occur as the load on a portion of the blade section varies from the point of maximum tension thru maximum compression and back to maximum tension is called a cycle of vibration. The time which elapses during a cycle is called the period of vibration. The number of cycles per second, or other unit of time, is called the frequency of the vibration. The number of cycles per revolution of the propeller is called the order of the vibration.

The forces which shake a propeller and cause it to vibrate arise mainly in the piston engine which drives it. A piston engine does not produce a smooth and constant torque. The rated torque of a direct-drive engine is merely the mean value of the torque impulses taken over a period of one revolution of the crankshaft. The orders of the torque impulses are determined by the number of engine cylinders and their arrangement. These orders are usually integer multiples of the number of firing impulses per revolution of the engine crankshaft. For example, a four-cylinder engine, with the cylinders in two banks, arranged at an angle of 180° to each other, will produce torque impulses at frequencies which are 2, 4, 6, 8, . . . times the rotational speed of the engine.

A metal propeller, like a tuning fork, has a set of natural frequencies of vibration. These frequencies are determined by the shape of the blade—its length, thickness distribution, and width distribution. When one of the natural frequencies of the propeller coincides with the frequency of a shaking force put out by the engine, a resonance peak occurs. At this condition, depending upon the magnitude of the shaking forces coming from the engine and the damping forces in the propeller, vibratory stresses may become very large. During the design of a metal propeller intended for use on engines of a particular model, an effort is made to tune the propeller so that dangerous resonance peaks will fall outside the operating range of engine rotational speed.

Over the period of many years in which forged aluminum alloy propellers have been in use, service records have shown that a propeller can operate safely, provided the values of steady stress and vibratory stress are held to certain well-established levels. When a combination of steady and vibratory stresses is allowed to exceed these levels, after the accumulation of a sufficient number of vibration cycles, or fatigue cycles as we may call them, the strength of the metal begins to deteriorate and a fatigue crack may develop which can quickly lead to a failure of the propeller. Much test work has been done to determine the number of fatigue cycles required, at a

given level of stress, to produce a fatigue failure. Metal propellers are not type certificated until it has been demonstrated that the steady stresses and vibratory stresses for each propeller-engine combination are at a satisfactory level.

The values of allowable steady and vibratory stress which experience has shown to be satisfactory apply to well-faired undamaged blades. When a propeller blade sustains damage in the form of a sharp-bottomed notch, the stress level at the root of the notch may be increased by an amount many times greater than the stress at the same location in an undamaged blade. The notch effect or stress concentration factor, is dependent upon the depth and the sharpness of the bottom of the notch. This local stress may increase to a level at which very little more flight time is required to initiate a crack which may propagate rapidly and lead to an early blade failure. It is for this reason that frequent inspections and prompt repair of damage of this type are urgently recommended.

There is another way in which, during the service life of the propeller, the vibration characteristics of an engine-propeller combination may be altered so that vibratory stresses rise to dangerous levels. This situation is brought about by a shift of one or more of the resonance peaks into a frequently used range of engine rotational speeds. When the thickness and width of the blade have been reduced by repeated repairs, the stiffness and therefore, the natural frequencies of vibration are also reduced.

The effect of a diameter reduction of the propeller is to increase the natural frequencies of the blades. Any alteration of the original blade dimensions large enough to cause a significant shift, either up or down, away from the set of natural frequencies originally designed into the propeller, may bring an undesirable resonance peak into the cruising range of engine rotational speeds. This is why minimum repair dimensions and diameter limits are established for each engine-propeller combination.

Alternating stresses are the cause of metal fatigue. It is the number of fatigue cycles and the stress level at which they have been accumulated which determines the endurance life of a propeller. Research has shown that the life expectancy of metal specimens, which have been fatigue-cycled to 50% of their endurance life, can be extended by the removal of a thin layer of surface metal. It is good practice then, periodically to remove the layer of fatigued surface metal and the accumulation of small cuts and scratches by reconditioning the entire blade.

In summary then, it may be said that the general policy behind safe blade repairs is to hold reductions from the original blade dimensions to a minimum, and to remove any "V" notch type of damage as promptly as possible by rounding-out, fairing, and polishing the area of damage. It is intended that the methods, techniques, and practices of FAA Advisory Circular 43.13-1A be followed, however minimum blade dimensions after repair shall be governed by the data in this manual.

DEFINITIONS; COMMON TYPES OF SERVICE DAMAGE TO ALUMINUM ALLOY PROPELLERS

CORROSION PITTING - Tiny deep cavities extending inward from the surface of the metal; may tunnel under the surface, re-appear at another location.

CRACK - Physical separation of adjacent portions of the metal, which may extend far below the surface of the blade. Usually initiated by a nick, scratch, or corrosion pits in an area of the blade subjected to continuous vibration.

CUT - Loss of metal over a relatively long and narrow area, sometimes extending to an appreciable depth, caused by a sharp-edged object striking the blade a glancing blow.

DENT - A depression in the blade surface produced by direct impact of a hard object.

EDGE ALIGNMENT - Blades out of edge alignment are bent about an axis nearly perpendicular to the chord so that a line through corresponding stations of the two blades no longer cuts the center of the hub bore.

EROSION - Loss of metal from the surface by mechanical action of small foreign objects such as grit or sand; usually found in the area of the leading edge and flat side of the blade.

FACE ALIGNMENT - Blades out of face alignment are bent about an axis nearly parallel to the chord so that the blades do not "track".

FRETTING - Breakdown or deterioration of a metal surface by a vibratory or chafing type of action.

GOUGE - Deep grooves in a blade caused by contact with a foreign object under heavy pressure.

INCLUSION - Scale or other foreign material embedded in the metal.

NICK - A sharp bottomed notch involving displacement of metal, usually found on the leading and trailing edges of a propeller blade.

SCORE - A tear or break in the metal surface intermediate in size and depth between a gouge and a scratch.

SCRATCH - A small and superficial cut in the metal surface. Usually found on the flat side of the propeller blade.

SURFACE CORROSION - Loss of metal from the surface by chemical or electro-chemical action. The corrosion products can easily be removed by sanding.

REPAIR INSTRUCTIONS

1. CLEANING: Before a damaged propeller can be properly examined to determine whether it is repairable, it should be cleaned and the paint removed. Cleaning may be accomplished with soap and water, or with a suitable mineral solvent and a soft bristle brush. The paint must be soaked free with a suitable commercial paint remover and removed with a soft bristle brush or a rag. It should not be scraped off with a steel tool nor brushed off with a wire brush.

2. PRE-REPAIR INSPECTION: The purpose of a pre-repair inspection is to avoid investment of labor, only to later discover unrepairable damage had been sustained by the propeller.

When a blade is bent, the bend must be measured by the method shown in Figure 1 of this manual, and compared to the appropriate graph of maximum allowable bend vs. blade radius. Beware of repairing bends which, by the shape of the bend, indicate that the blade may have been pre-straightened to bring it within allowable limits. See A.C. 20-7J (August, 1972).

The depth of a cut or gouge should be measured to determine whether repair is possible within the limits of the appropriate minimum blade dimensions.

A pre-repair examination must include a visual inspection with a magnifying glass of at least three-power for the presence of fatigue cracks. An indispensable aid to visual inspection is either an etching or dye-penetrant process.

3. STRAIGHTENING A BENT BLADE: If the bend is within allowable limits, this should be the first repair operation. Using a suitable bending tool or repair bench, the blade should be straightened in small increments proceeding from the portion of the bend nearest the hub, where the blade is thicker, outward along the blade until the fairing and appearance of the blade are reasonably good. At this point, the results can be judged by sighting along the blade. Blade contours should flow smoothly from the tip inward, without apparent waves or curvature reversal. The propeller should then be placed on a propeller checking stand, and its face alignment checked by comparing corresponding stations of the repaired blade with those of the undamaged blade.

It is not feasible, in this manual, to include complete face alignment data for each propeller. However, if both blades of a propeller have been bent, and if an undamaged propeller of the same model and pitch is not available for comparison, the correct elevation of the blade tip from the rear hub face is given with the repair specifications

for each propeller model.

4. BLADE ANGLES CORRECTION: After the blades have been brought into face alignment, blade angles should be checked. Blade Angle Templates (available from the Sensenich factory) should be used as shown by Figure 4 as indicated by the appropriate repair specifications, which list the proper blade angles and tolerance for each specified pitch. The blades should be twisted to agree with these specifications. Note that bending a blade into face alignment and twisting to obtain the proper blade angles are not independent operations. After blade angles have been corrected, face alignment must be checked, and vice-versa until both are within tolerance.

5. EDGE ALIGNMENT: Inspection of edge alignment should not be attempted before face alignment and blade angles are correct. Edge alignment can then be measured on a propeller checking stand by setting height gauges to touch the leading edge of each blade at corresponding stations, then removing the propeller from the stand and rotating it 180 degrees before replacing it on the stand. It is never permissible to straighten a blade which has been bent out of edge alignment. If it is not possible to achieve proper 180 degree index of the blades by removal of metal from the leading edge of one blade and from the trailing edge of the opposite blade within allowable blade dimensions, the propeller must be removed from service.

6. REPAIR OF BLADE DAMAGE: Approved techniques for repair of damage to metal propeller blades are shown by Figures 2 and 3 of this manual.

Nicks or cuts into the leading or trailing edge of a blade may be individually repaired as shown by Figure 2, Illustration B. The repair should be accomplished by rounding out and fairing with a file to slightly deeper than the apparent depth of the damage, to ensure that the bottom of the injury is removed, and polishing with a fine abrasive cloth. The chordwise depth of the finished repair must not be greater than 3/16 inch (0.48 cm.) and the final chord must equal or exceed the minimum specified by this manual. The radius of curvature in the area of the repair must be 3/8 inch (0.95 cm.) minimum. The faired length of the repair should not exceed 1 1/2 inches (3.8 cm.). More than one of these repairs is permissible only if the repair areas do not overlap.

Dents or gouges in blade faces may be individually repaired as shown by Figure 2, Illustration A. This repair should be accomplished by rounding out and fairing with suitable abrasive paper or cloth to

a depth sufficient to ensure complete removal of the damaged metal and polishing with a fine abrasive cloth. The finished repair must not exceed 1/16 inch (0.16 cm.) in depth and curvature of the surface in the area of the repair must be 3/8 inch (0.95 cm.) radius minimum. The finished repair should not exceed 3/8 inch (0.95 cm.) chordwise by 1 inch (2.54 cm.) long. More than one of these repairs per blade is permissible only if the repair areas do not overlap a common blade radius.

Longitudinal cuts, as shown by Illustration C of Figure 2, may be repaired in the same manner as repair of a dent or gouge in a blade face.

A transverse (chordwise) crack in a blade face, or at the leading or trailing edge cannot be repaired. The presence of a crack indicates that blade failure is imminent. **The propeller must be immediately removed from service.**

WARNING: Repair of nicks, cuts, or cracks by peening over the adjacent edges is not permissible. This procedure will induce a tensile pre-stress at the bottom of the damage and will almost certainly initiate the development of a fatigue crack. Such a crack will usually progress rapidly and lead to an early fatigue failure.

The use of weld material to fill damaged areas is never permissible. This will result in substitution of low-strength cast material for the original high-strength forged aluminum.

- 7. PROPELLER RECONDITIONING:** It is recommended that the blades of a metal propeller should be reconditioned periodically. Flight-time intervals between reconditioning are recommended in note 5 of the repair specifications. More frequent reconditioning is advisable when minor repairs, and accumulated scratches and nicks, are numerous.

The reconditioning operation includes removal of the anodize coating from the entire surface of the propeller by 20% caustic soda etch, followed by 20% nitric acid rinse and inspection for cracks, and repair of all damage to the blade surface.

Metal removal during blade reconditioning should be at least 0.004 inch (0.01 cm.) per surface over the entire blade. In any case, whether chemical or mechanical, all traces of damage must be removed. Total removal of damage can only be assured by etching or dye-penetrant inspection.

When a propeller has been reworked to minimum chord, thickness, and diameter but does not clean up in the last inch of leading edge adjacent to the tip, it is permissible to round the tip as shown by Figure 3.

8. POST REPAIR INSPECTION: Repaired blades must be visually inspected, using a magnifying glass of at least three-power, to ensure that the bottom of the notch has been removed. If an incipient crack is suspected at the root of the notch, a local etch or dye-penetrant method of inspection should be employed.

- 9. BALANCE:** The maximum allowable Moment of Unbalance for each propeller is shown by the repair specifications. This is the maximum static unbalance which is allowed when the propeller is placed on a leveled propeller balancing stand with hardened and ground cylindrical rails, using a hardened and ground steel mandrel of diameter equal to the diameter of a standard mounting flange pilot stub inserted through the propeller pilot bore. The room in which propeller balance is inspected should be free from air currents. With this type of equipment, a balanced propeller will remain in any position with no tendency to rotate.

Horizontal balance may be corrected by removal of small amounts of metal from the heavy blade at locations where chord and thickness exceed the dimensions of the light blade. Vertical balance may be corrected by removal of metal from the heavy side of the hub.

- 10. REFINISHING:** Repaired propellers should be prepared for painting by chromic-acid anodizing (MIL-A-8625B) or ALODINE chemical conversion coating (MIL-C-5541). U.S. PAINT CO. ALUMI-GRIP or equivalent products may be used in accordance with the manufacturer's instructions.

The following color pattern is recommended: The rear (Thrust) face of each propeller blade should be finished dull black to reduce glare into the cockpit, from about 5 inches (13 cm.) radius to the tip. The remainder of the propeller should be painted gray, except for two 2-inch wide tip-stripes added on the camber (front) face of each blade.

A decal showing propeller model, Type Certificate Number, and attaching bolt wrench torque should be applied near the trailing edge on the front face with the inner edge at $6\frac{1}{4}$ inches (16 cm) blade radius.

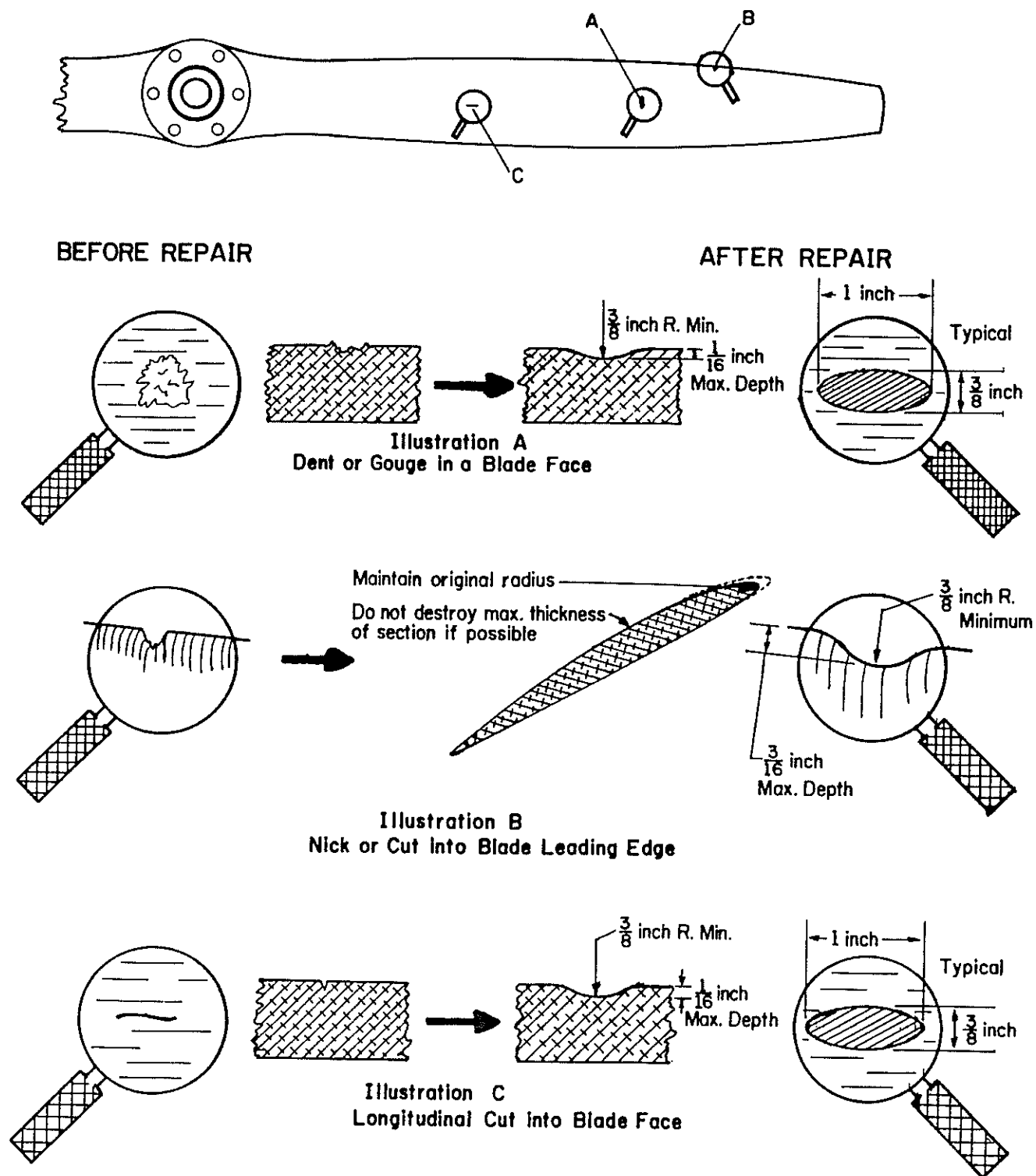


FIGURE 2
APPROVED TECHNIQUES FOR REPAIR OF BLADE DAMAGE

Adapted from Fig. 12.2, 12.3, A.C. 43.13-1A

SENSENICH PROPELLER MANUFACTURING COMPANY, INC.

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14 CITATION LANE
LITITZ, PA
17543

Fixed-Pitch Metal Propellers Instructions For Use And Care

4 September, 1997

Supersedes previous Use a Care Instructions

Service Bulletins and Airworthiness Directives are not affected by these instructions

Your Sensenich propeller has been manufactured under closely controlled conditions to the approved design in accordance with the applicable FAA Regulations. Stamped on the propeller hub face are the Model and Serial Number, the Type Certificate Number, and the Production Certificate Number (Sensenich Corp. PC. No. 1NE).

DO:

1. Have your propeller installed by an A&P mechanic. For convenience, the proper installation bolt torque is shown on the blade decal near the hub. Always have blade track checked after the hub bolts are tightened. **Note:** Every propeller is accurately balanced at the factory. If the propeller-engine combination feels rough in flight, ask your mechanic to remove the propeller, rotate it 180 degrees on the engine crankshaft flange, and re-install. Again check blade track. This provides a means to verify that the crankshaft flange is true.
2. Inspect the blades of your propeller before each flight for nicks, cuts, and stone bruises. Have minor repairs promptly performed by an A&P mechanic. If a crack is discovered, **THE PROPELLER MUST BE IMMEDIATELY REMOVED FROM SERVICE.**
3. Have major repairs performed by an FAA Certificated Propeller Repair Station.
4. Conform to applicable RPM limitations and periodically have your tachometer checked for accuracy.

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5. Frequently wipe the propeller blades clean with an oily rag. This oily wipe will remove corrosive substances, and the oily residue will repel water and corrosives.

6. The recommended flight-time between reconditioning for your Sensenich fixed-pitch metal propeller is **Two Thousand hours PROVIDED IT HAS NOT RECEIVED PRIOR DAMAGE REQUIRING IMMEDIATE ATTENTION.** This accomplishes the removal of fatigued surface metal and the accumulation of small nicks and cuts too numerous to be repaired individually.

DO NOT...

permit installation of a propeller unless it is the model approved under the Aircraft Type Certificate or STC and has been obtained from a reliable source.

Beware of a propeller of unknown service history.

DO NOT...

push or pull on the propeller when moving an aircraft by hand.

DO NOT...

run up your engine/propeller over loose stones or gravel.

DO NOT...

paint over corroded or damaged blades. This hides the defect and may deter needed repair.

DO NOT...

permit repair of blade damage by peening or welding. These practices will lead to early blade failure.

DO NOT...

fly your aircraft under any circumstance before a thorough inspection by qualified personnel if the propeller has been subjected to impact.

DO NOT...

have your propeller straightened except by an FAA Certificated Propeller Repair Station. Even partial straightening of blades for convenience of shipping to a repair station may cause hidden damage which, if not detected, could result in the return to service of a non-airworthy propeller. Report anything of this nature before repair is initiated.

MINOR REPAIR:

Rounding out a shallow nick or cut shall be considered a minor repair provided that the strength, weight, and stiffness of the blade is not materially affected.

MAJOR REPAIR:

Major repairs to aluminum alloy propellers include diameter reduction (when permissible) to repair tip damage, repairs to deep cuts or nicks, and straightening of bent blades.

Box Marking	Serial Number Span				Totals per Cards	
	Starting #	Date	Ending #	Date		
Metal S0001-1399	1	4/12/48	1399	8/11/50		(2)
Metal 1400-2799	1400	8/7/50	2799	5/24/51		
Metal 2800-4299	2800	5/24/51	4299	2/29/52		
Metal 4300-5799	4300	3/20/52	5799	9/30/52		
Metal 5800-7299	5800	9/26/52	7299	2/18/53		
Metal 7300-9299	7300	2/18/53	9299	8/22/58		
Metal 9300-10999	9300	6/25/53	10999	6/7/54		
Metal 11000-12599	11000	7/1/54	12599	8/17/54		
Metal 12600-15199	12600	1/10/55	15199	2/15/55		
Metal 15200-16899	15200	3/7/55	16899	6/30/55		
Metal 16900-18599	16900	4/16/55	18599	4/13/56		
Metal 18600-20299	18600	4/30/56	20299	11/19/56		
Metal 20300-21999	20300	4/8/57	21999	3/29/57		
Metal 22000-23799	22000	3/29/57	23799	8/29/57		
76AK-76AM6-74CK	21641	4/30/69	23399	2/23/78		
76AK-76AM6-74CK	23400	5/12/76	24490	7/24/91		
Metal 23800-25599	23800	8/29/57	25599	9/24/57		
Metal 25600-27789	25600	10/15/58	27789	11/24/59		
Metal 27821-29899	27821	6/16/58	29899	9/8/59		
Metal 29900-A31799	29900	8/9/61	31166	-		
Metal	A31167	4/14/60	A31799	12/30/59		
Metal A31800-A33799	A31800	3/22/60	A33799	10/18/60		
74DM6	A32341	8/12/75	A40699	3/19/75		
Metal A33800-35999	A33800	10/18/60	35999	6/28/62		
Metal 36000-39447	36000	12/27/62	39447	9/23/65		
M76EMM	36430	1/31/63	38599	9/23/64		
M76EMM-M76EMMS	38600	8/31/64	40649	9/20/65		
M76EMM-M76EMMS	40650	9/20/65	43299	12/22/66		
Metal	41130	5/23/66	44799	12/21/67		
M76EMM-M76EMMS	43300	11/30/66	45049	1/19/68		
M76EMM-M76EMMS	45050	1/23/68	46459	11/10/71		
74DM6	A46000	1/25/78	A47899	3/2/79		
Metal	A47497	5/27/82	A49576	6/29/82		
74DM6	A49690	3/9/81	A51400	3/23/83		
74DM	A51401	7/13/83	A53229	2/10/89		
74DM	A53230	2/10/89	A55749	4/22/94		
74DM	A55708	3/29/94	A56800	9/24/96	56,800	(5)
M69CK	K100	7/11/58	K1926	5/26/61		
72CK	K01	7/31/68	K1699	10/4/79		
72CK	K1700	11/15/78	K3299	11/24/80		
72CK	K3300	8/22/80	K4899	4/23/86		
72CK	K4900	6/17/86	K7051	10/22/96	7,051	
Metal	B25	4/20/64	B1091	7/13/65	1,067	
Metal	BK8409	11/2/66	BK10216	1/11/67	1,808	
Metal	59060	10/22/54	59099			
"	59228		59267			
"	59413				81	(1)
M74DM-DC	K1735	6/30/61	K3699	11/12/63		
M74DM-DC	K3700	10/17/62	K5449	9/21/64		
M74DM-DC	K5450	9/14/64	K6999	3/24/66		
M74DM-DC	K7000	3/10/66	K8699	8/24/66		
M74DM-DC	K8700	8/25/66	K10449	4/6/67		
M74DM-DC	K10450	6/8/67	K12199	9/27/67		
M74DM-DC	K12200	10/13/67	K14084	1/19/68	12,350	

Box Marking	Serial Number Span				Totals per Cards
	Starting #	Date	Ending #	Date	
74DM6	K26204	8/21/68	K28049	11/28/69	
74DM6	K28050	11/26/68	K29749	6/23/69	
74DM6	K29752	8/30/69	K31499	10/15/70	
74DM6	K31500	3/27/70	K33249	10/21/71	
74DM6	K33250	10/21/71	K34899	12/28/72	
74DM6	K34900	11/20/72	K36549	8/30/73	
74DM6	K36550	9/18/73	K38299	5/24/74	
74DM6	K38300	1/9/75	K39413	11/27/74	13,209
76EM	7000K	5/31/68	8349K	4/30/69	
76EM	8350K	6/3/69	9799K	6/28/71	
76EM	9800K	7/20/71	11390K	8/24/72	
76EM	11400K	7/24/72	13099K	12/14/73	
76EM	13100K	1/28/74	14799K	8/26/75	
76EM	14800K	8/25/75	16299K	8/19/76	
76EM	16300K	7/29/76	18099K	11/2/77	
76EM	18100K	11/23/77	19899K	2/22/79	
76EM	19900K	4/9/79	21600K	7/10/80	
76EM	21601K	7/23/80	23290K	2/7/83	
76EM	23291K	2/18/83	24890K	11/18/85	
76EM	24891K	2/26/86	27150K	5/30/90	
76EM	27151K	6/20/90	29419K	1/27/95	
76EM	29330K	12/20/93	31574K	5/12/97	
76EM				9/19/96	
76AK-76AM6-74CK	30498	5/14/96	30987		24,574 (3), (4)
Total # of Props: 116,940 (7)					

Notes:

(1) These series (out of sequence) were made from McCauley Forgings

(2) Originally all propellers used same serial sequence

(3) First Production 74CK after production stopped in 1987 starts with serial number 30498 (5/14/96)

(4) First Production 76AM after production stopped in 1987 starts with serial number 30529 (2/22/96)

(5) First Production 74DR after production stopped at unknown date, starts with serial number A55580 (12/20/93)

(6) Series sequences are currently used as follows:

69CK, 72CK "K"+4 digits

74DM, 74DC, 74DR "A"+5 digits (continuation of original metal serial number sequence)

74CK, 76AK, 76AM EM sequence minus "K" suffix

70CM, 76EM EM sequence

(7) Total for Cards listed only