Composite Aircraft Propellers

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INSTRUCTIONS FOR CONTINUED AIRWORTHINESS MANUAL

G-SHANK SERIES

COMPOSITE GROUND ADJUSTABLE PROPELLERS

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RECORD OF REVISIONS

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SECTION 1: PROPELLER MAINTENANCE

A) INTRODUCTION

1) Description of Propeller

(a) The G-Shank Series propellers are ground adjustable propellers consisting of two blades manufactured from fiberglass and carbon fiber prepreg composite and a two-piece clam shell hub made from aluminum alloy.

(b) Static blade balance is verified before shipment from the factory. It is highly recommended that dynamic balancing be performed with the propeller installed on the aircraft. This can help reduce vibration and wear of engine accessories and other aircraft components.

(c) The propeller finish provides UV and environmental protection. Rain and sand protection is provided by metal erosion shields on the blade leading edges. The erosion shields are co-cured with the blade prepreg during blade manufacture.

(d) In addition to templates and digital level/protractors, Sensenich's pitch gage system allows its users to set a broad range of pitches using the preset gages.

(e) Hub assemblies used for operation on aircraft engines:

(i) 2G0M6 model hub intended for use with SAE#2 flange configurations with 3/8" mounting bolts.

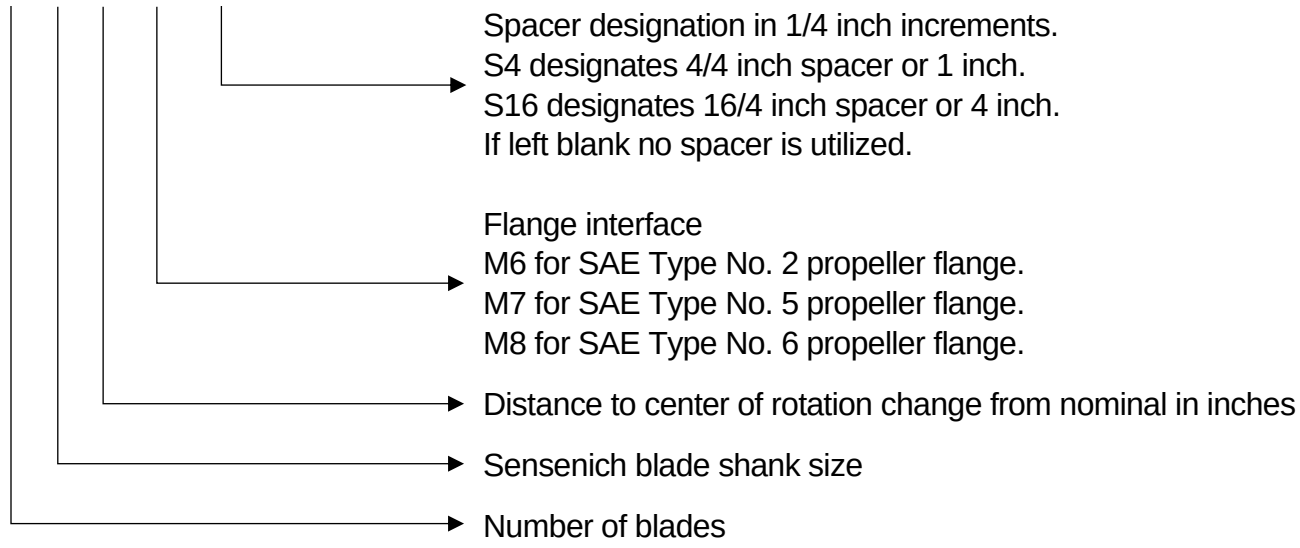
(ii) 2G0M7 model hub intended for use with SAE #5 flange configurations with 7/16" mounting bolts.

(iii) 2G0M8 model hub intended for use with SAE #6 flange configurations with 1/2" mounting bolts.

2) **Model Designations**

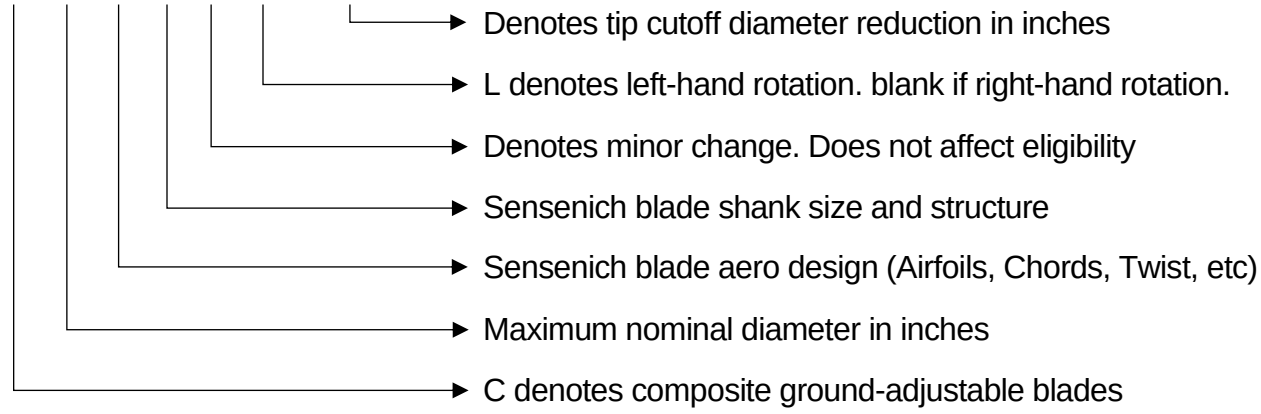
(a) HUB MODEL DESIGNATION

2 G 0 M8 S4



(b) BLADE MODEL DESIGNATION

C 82 B G F __ - 2



3) **Propeller Configurations**

TABLE 1: Propeller Combinations and Limitations

Hub Model	**Blade Model**	**Configuration**	**Max / Min Diameter** (inches)	**Weight** (lbs)	**Mass Moment of Inertia** (ft.-lb. sec^2)	**Mounting Pattern**	**Operating Limits**
2G0M6	C76PGF	Tractor 4.0” Max Spacer	76 / 72	19	< .5	SAE 2 3/8-24” Bolts	160 HP @ 2700 RPM
	C82BGF	Tractor 4.0” Max Spacer	82 / 78	20	< .5		
2G0M7	C76PGF	Tractor 4.0” Max Spacer	76 / 72	19	< .5	SAE 5 7/16-20” Bolts	
	C82BGF	Tractor 4.0” Max Spacer	82 / 78	20	< .5		
2G0M8	C76PGF	Tractor 4.0” Max Spacer	76 / 72	19	< .5	SAE 6 1/2-20” Bolts	180 HP @ 2700 RPM
	C82BGF	Tractor 4.0” Max Spacer	82 / 78	20	< .5		

4) **Abbreviations**

AC – Advisory Circular

A&P – Airframe and Powerplant Mechanic

CFR – Code of Federal Regulations

FOD – Foreign Objects Debris

RPM – Revolutions per Minute

SAE – Society of Automotive Engineers

STC – Supplemental Type Certificate

TCDS – Type Certificate Data Sheet

UV – Ultraviolet

5) **Referenced Publications**

14 CFR Part 35 – Propellers

14 CFR Part 43.16 – Airworthiness Limitations

14 CFR Part 91 Subpart E – Maintenance, Preventive Maintenance, and Alterations

AC20-37E – Aircraft Propeller Maintenance

AC35-1A – Certification of Propellers

ASTM E 1417 – Liquid Penetrant Examination

SSI-SP-202201 Supplemental Instructions for 12inch Cub Composite Spinners

SSI-SP-202202 Supplemental Instructions for Composite Spinners

SIIO-G_20220214 Propeller Installation and Operation Instructions

6) **Propeller Controls and Operation**

The G-Shank series ground adjustable propeller features no moving parts or special procedures during operation. As such, propeller operation is identical to fixed-pitch propeller operation and control. For a given installation:

- Power and engine speed are a function of throttle position, mixture, and airspeed.
- Do not operate your propeller outside of operating limitations for the engine or propeller. If your propeller has been subjected to an over speed condition of 10% over the maximum rating (example 2700 X 1.1 = 2970) for more than 2 minutes, you must perform the Inspection After Suspected Impact.
- Do not operate any aircraft after a propeller has been subjected to an impact without a thorough inspection. See Inspection After Suspected Impact.
- Static and climb RPM will be below the maximum rated engine and propeller speed. Propeller installation must not be able to exceed maximum RPM at a speed less than or equal to Vy, the speed at the maximum rate of climb. To ensure propeller does not exceed maximum rated RPM it must be pitched within limits established on the applicable aircraft TCDS or STC.
- Reference 14 CFR Part 91.407 before operation after maintenance, preventative maintenance, or alteration.

Operators of propellers on aircraft may want different performance characteristics. For instance, one person may require a high climb rate while another seeks maximum cruising efficiency or speed.

STANDARD PITCH / NORMAL FLYING

For normal or cross country flying, a propeller that turns up to maximum continuous engine RPM at full throttle level flight will give best all-around performance.

CRUISE PITCH

A cruise propeller will turn 100 to 200 engine RPM less than a standard pitch propeller. While cruise pitches will provide 4-7 mph higher airspeeds at cruise power rpm's, maximum level flight speeds are no better than climb or standard pitches, and the take-off and climb performance will noticeably suffer. (Refer to the aircraft TC or STC for propeller limitations)

CLIMB PITCH / HIGH ALTITUDE OPERATION

For improved take-off and climb performance, use a climb pitch propeller that will turn 100 to 200 engine rpm more than a standard pitch propeller (Refer to your aircraft operating manual for propeller limitations). Climb pitches will typically reduce flight speeds by 4-7 mph at cruise power RPM's. A climb pitch is recommended for aircraft operating from high density altitude runways. (Refer to the aircraft TC or STC for propeller limitations)

> **⚠ CAUTION**
>
> *Caution*: When pitching propeller for a climb pitch, the propeller WILL overspeed in full throttle level flight. Operation RPM should never exceed the engine manufacturers maximum RPM. Please refer to Table 1 for operating limits. Propeller pitch must fall within the propeller pitch limitations included in the applicable aircraft TC or STC.

7) **Propeller Care Tips and Operational Checks**

The following will help you operate your propeller safely, keep it looking good, and help it to last longer:

(a) Package propellers for storage to avoid parts colliding during storage or transport. Always store propeller components in a dry environment. Store propeller components between -20 and 120 Fahrenheit.

(b) Never install a propeller on an aircraft unless it is a model approved for the aircraft and the engine. (See applicable aircraft TCDS or STC for approved models). The service history must be properly documented, and a pre-installation inspection must indicate that the propeller is airworthy.

(c) Do not use the propeller as a tow-bar to move your aircraft.

(d) Static and climb RPM will be below the maximum rated engine and propeller speed. Propeller installation must not be able to exceed maximum RPM at a speed less than or equal to Vy, the speed at the maximum rate of climb.

(e) Avoid running-up in areas containing loose stones, sand, and gravel, to reduce erosion and/or damage to the leading edges and blades.

(f) When the propeller is not in use and exposed to weather, cover it with a waterproof cover to extend the life of the finish.

(g) Whenever there is evidence of roughness on operation, check bolt torque on both the clamping and mounting bolts and check the propeller blades for track. The blades should track within 3/16” of each other at the tip. For new installations, rotating the propeller 180 degrees and reinstalling may help.

(h) An inaccurate indicating tachometer can cause operation of an engine to exceed the maximum RPM limits or allow operation unknowingly within a restricted RPM band. Since there are no post-manufacture accuracy requirements for engine tachometers, tachometer inaccuracy could be a direct cause of propeller failure, excessive vibration, or unscheduled maintenance. Proper tachometer operation and accuracy should always be checked (using the manufacturer’s procedure, if available) during normal maintenance intervals. One means of checking the tachometer’s accuracy is with a commercial optical unit which is pointed at the rotating propeller.

B) REQUIRED MAINTENANCE TOOLS

	Digital Level or Protractor
	Calibrated Torque Wrench
	3/8” socket (for AN3 bolts) 9/16” Socket (for 3/8” bolts) 5/8” Socket (for 7/16” bolts) 3/4” Socket (for 1/2” bolts)
	Socket Extension
	Measuring Tape
	Sharpie or Pencil
	Torque Screw Driver
	Propeller Tachometer
	Alcohol and Towel
	Soap and Water
	Coin or Tap Hammer (Tap Test)

C) INSTALLATION

Propeller is shipped from the factory unassembled. Carefully cut tape to open the box and place all components on a clean flat surface to ensure each part was received before proceeding with installation.

1) **Parts List**

Item	Description	Qty
1	Spacer (if applicable)	1
2	Rear Spinner Bulkhead (if applicable)	1
3	Hub Mount Half	1
4	***** Inner Mount Bolts	2
5	Propeller Blades	2
6	Clamp Bolts (7/16” Dia. x 2 Lg") *Sensenich specific hardware. Reference Drawings: D-3401, D-3402, D-3403.*	4
7	*****Outer Mount Bolts	4

Item	Description	Qty
8	Hub Cover Half	1
9	Clamp Bolt Washers (NL11 Nord-lock)	4
10	***** Inner and Outer Mount Bolt Washers	6
11	Front Spinner Bulkhead (if applicable)	1
12	Spinner Dome (if applicable)	1
13	A-1608 Pitch Setting Gage	3
14	75% Airfoil Template (A-1889 for C82BGF, A-1903 for C76PGF)	1

*** Mount Bolts:** *Sensenich specific hardware. Reference drawings D-3401, D-3402, D-3403.*
2G0M8 (1/2” Dia.)
2G0M7 (7/16” Dia.)
2G0M6 (3/8” Dia.)

*** Mount Bolt Washers:** *Sensenich specific hardware. Reference drawings D-3401, D-3402, D-3403.*
2G0M8 (NL1/2SP)
2G0M7 (NL11)
2G0M6 (NL3/8SP)

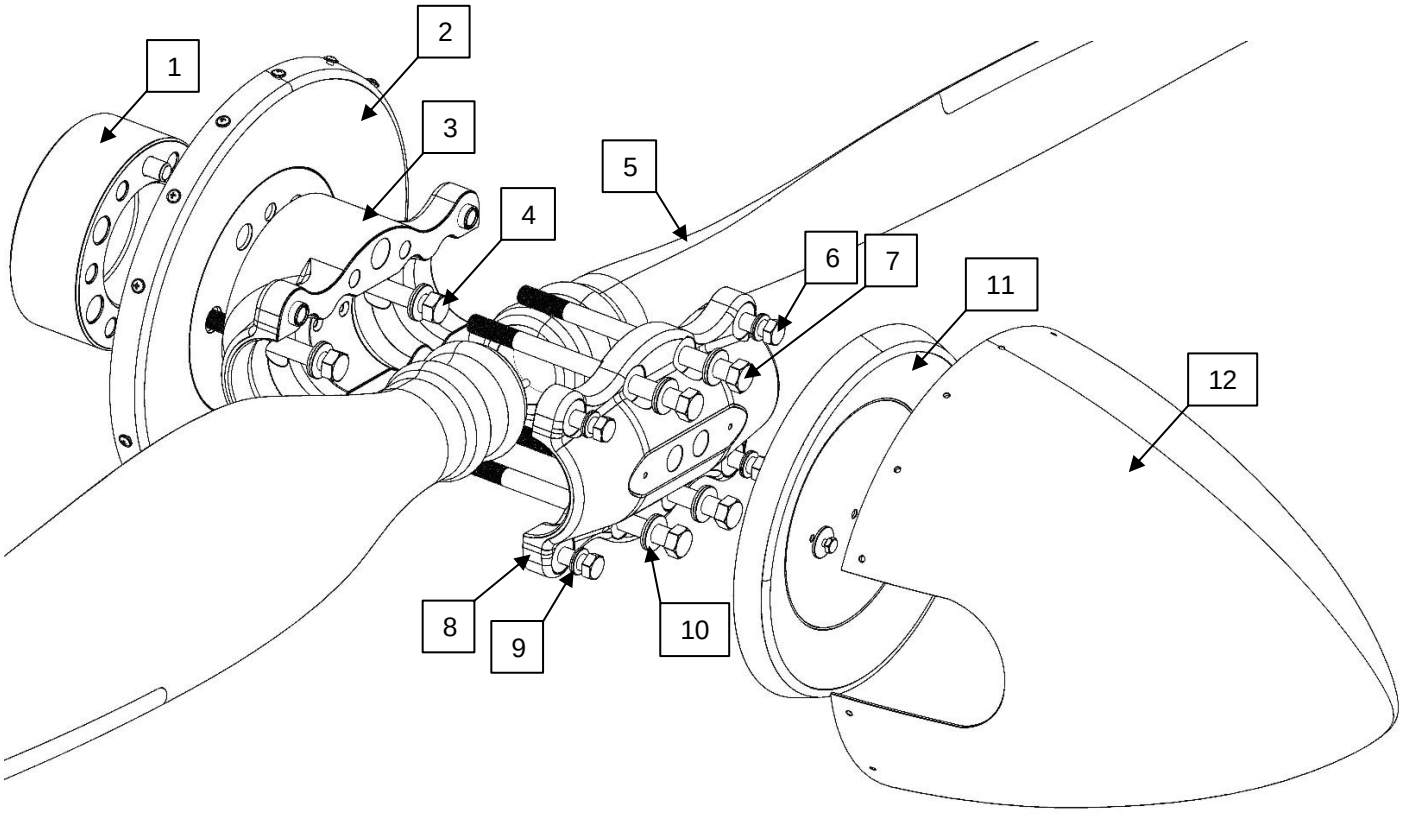


Figure 1: Propeller Assembly
A-1608 and Airfoil Template not included in Figure 1.

2) **Installation Procedure**

To be accomplished by maintenance personnel appropriately certificated under CFR part 65, or appropriately rated Repair Station:

> ⚠ **WARNING**
>
> *WARNING*: Installing or operating a propeller outside of limitations may cause damage to the propeller, engine, or aircraft. All applicable TCDS and STC documentation should be acquired and referenced during installation.

(a) Ensure the aircraft magneto switch is in the “OFF” position and that both magnetos are grounded any time the propeller is handled. Chock the aircraft wheels to prevent movement. Clean dirt and oil residue from the engine flange. Refer to Figure 1 for views of the two-piece hub and blade exploded assembly.

(b) Zero the level or protractor on the engine flange (If digital level/protractor is being used make sure it does not turn off during the installation process). Place spacer (if used), rear spinner bulkhead (if used) and the hub mount, as shown in Figure 1, on the engine flange. The hub MUST sit flush on the engine flange. Refer to Sensenich Supplemental Instructions for Composite Spinners, document numbers SSI-SP-202201 and SSI-SP-202202.

> ⚠ **WARNING**
>
> *WARNING*: Bolt breakage will occur if there is a gap between the propeller hub and the engine flange.

Note: There are no propeller indexing requirements, standard practice is to index the propeller in a position conducive to hand propping.

(c) Refer to Figure 1 for views of the two-piece hub and blade exploded assembly. Using two Nord-Lock mount bolt washers and the two inner mount bolts, secure the hub mount half and rear spinner bulkhead (if used) to the engine flange. Using a calibrated torque wrench, torque the two inner mounting bolts evenly using an alternating pattern. Tighten the bolts in several increments up to full torque, such as 50%, 75%, and full torque. See Table 2.

Table 2: Torque Figures for Specific Bolt Sizes

Bolt Size	Specified Torque	Never Exceed Torque
3/8”	350 in-lbs	420 in-lbs
7/16"	530 in-lbs	630 in-lbs
1/2"	770 in-lbs	920 in-lbs

Note: Torque callout for bolts with dry threads and Nord-lock Washers. Must check bolt torque at least once a year or if vibration occurs.

⚠ WARNING

WARNING: If bolts are torqued beyond “Never Exceed” torque, retire them from service immediately.

(d) Each blade airfoil has a round side and a flat side. Insert the blades into the hub mount half with the round side facing away from the aircraft and then place the hub cover half over the blades.

(e) Place the four NL11 Nord-Lock clamp bolt washers on each of the four clamping bolts (7/16-20 x 2”) and insert bolts into the bolt holes at each outboard corner of the hub barrel.

Note: Nord-lock washers work in pairs with the “ramped” sides facing each other. See Figure 2.

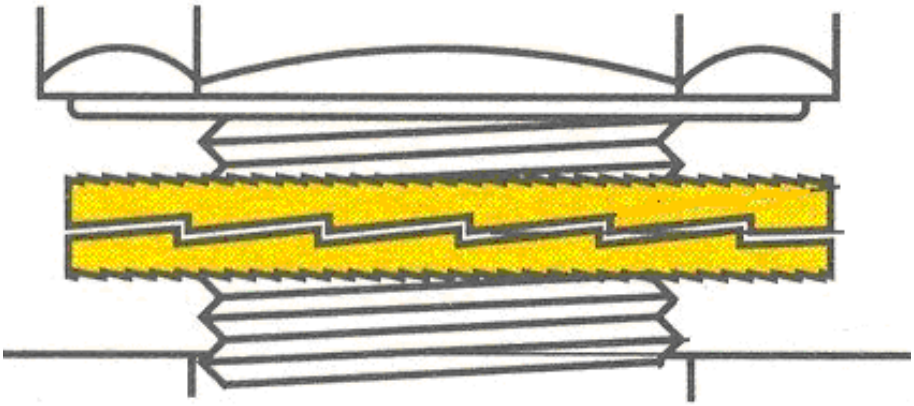


Figure 2: Nord-Lock Lock Washer

(f) Place four Nord-Lock mount bolt washers on each of the four outer mount bolts and insert bolts into the four bolt holes along the inboard hub barrel edge of the cover half.

(g) Hand tighten the clamping bolts and mount bolts while taking care to maintain an even clamp gap between hub halves. The blades should rotate in the hub, but they should not be loose. If the blades cannot rotate in the hub, loosen the bolts slightly.

(h) Rotate the propeller until it is parallel or level to the ground.

(i) Measure from the side of the hub radially out towards the blade tip and mark the blade at the 75% station for template location, see Figure 3 and Table 3. Reference Figures 4 and 5 for example template illustrations.

Note: Apply mark to blade with graphite pencil or sharpie marker, remove mark with denatured alcohol immediately after installation.

Table 3: 75% Station Template Location

Blade Model	Distance from Hub
C82BGF	26”
C76PGF	23 3/4”

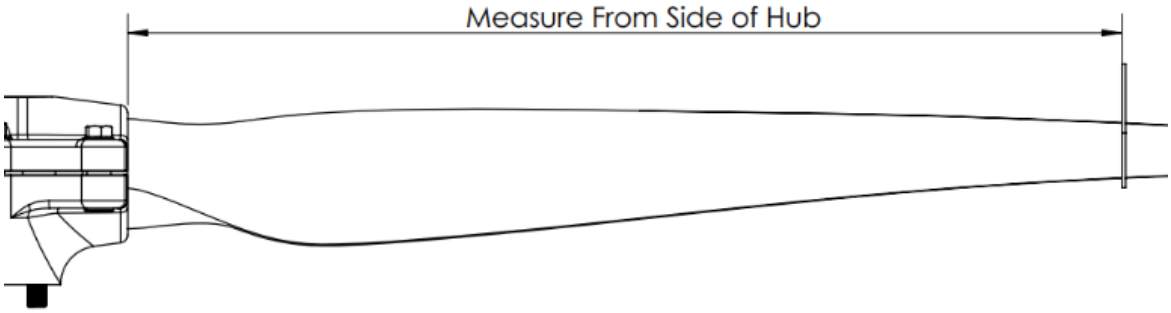


Figure 3: 75% Station Template Location

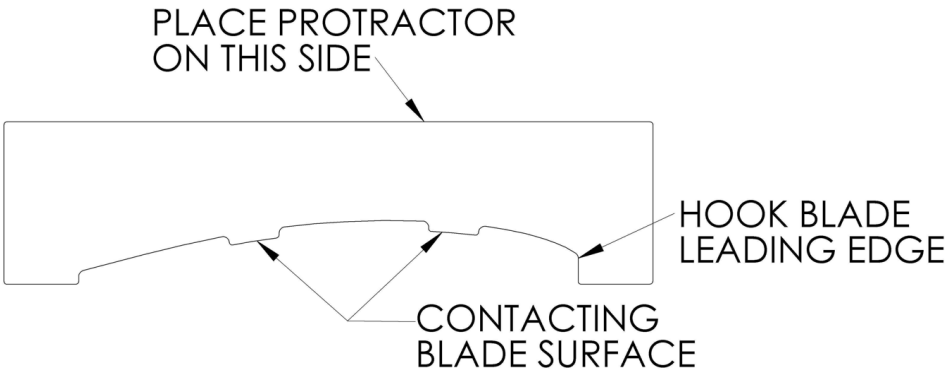


Figure 4: Sensenich 75% Partial Contact Template Example

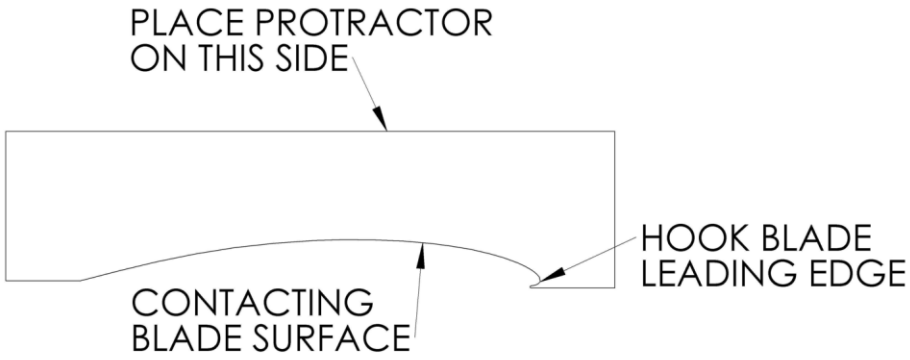


Figure 5: Sensenich 75% Full Contact Template Example

(j) Place the template on the round side of the blade at the 75% station mark from step (i). To ensure template is positioned on the blade correctly, hook the leading edge of the blade with the template and then rotate the template down until it contacts the blade surface. See Figures 6 and 7.

Note: Template must be sitting perpendicular to engine flange. Do not apply excessive force and flex the blade while holding the template and protractor on the 75 % station.

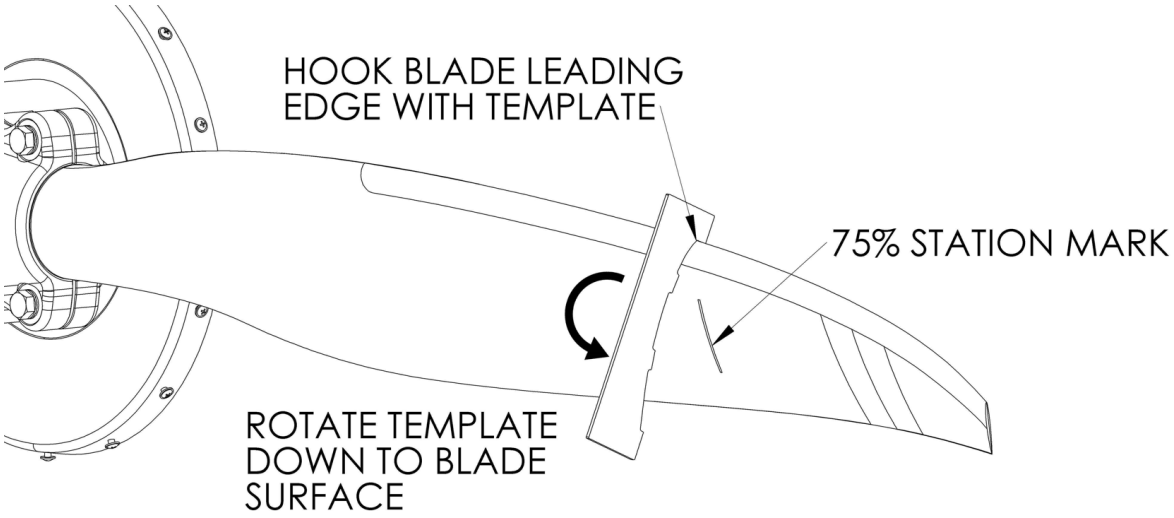


Figure 6: Locating Sensenich 75% Template

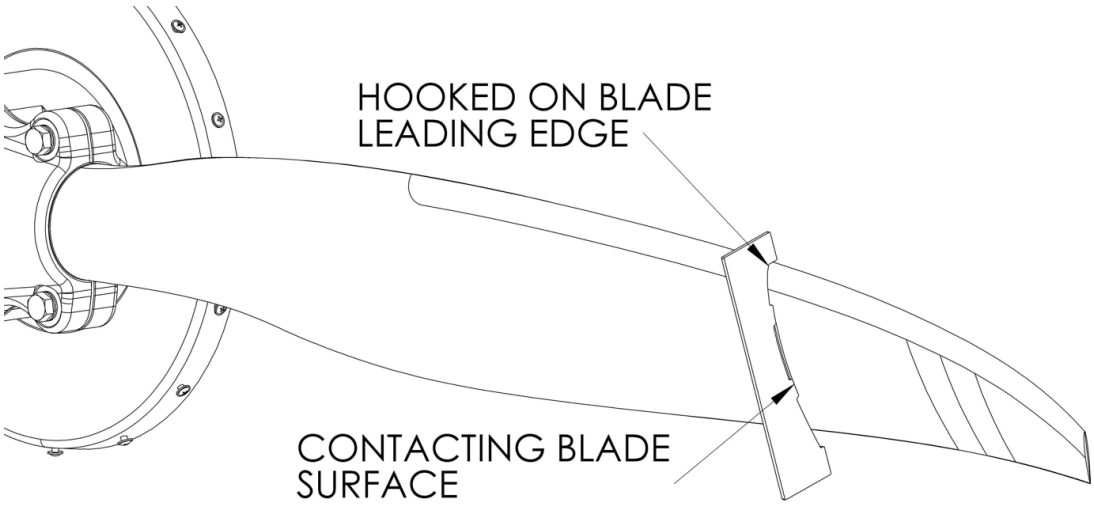


Figure 7: Sensenich 75% Template Placement

(k) Place the protractor (or level) against the template and rotate the blade until the desired angle is achieved, see Figure 8. See applicable aircraft TCDS or STC for approved blade angles and reference SIIO-G_20220214 for propeller pitch and corresponding blade angles. 75% blade angles must be set within 0.5° blade to blade.

Note: Blade angle MUST fall within the approved limits for each propeller diameter range. Pitch limits are installation specific per engine and aircraft. Refer to the aircraft STC or TCDS sheet for propeller pitch limits for the specific aircraft installation.

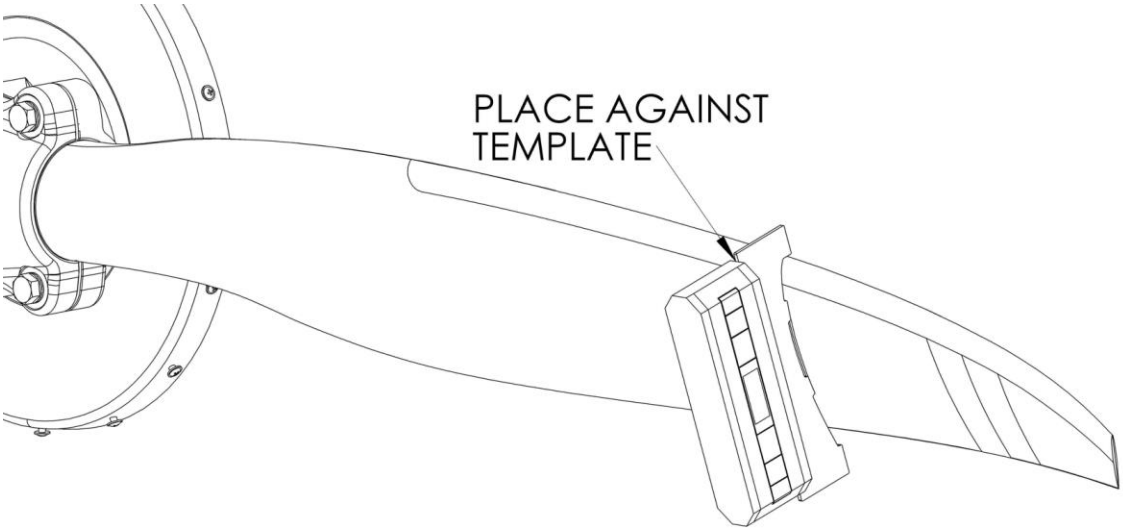


Figure 8: Template and Digital Level/Protractor Positioned on Blade.

(l) Set the torque wrench to 50% of final torque. Tighten the corresponding (2) clamping bolts to keep the blade from rotating. Take care to maintain an even gap between hub halves by tightening the bolts a quarter turn and alternating back and forth.

(m) Remove the template from the propeller blade and rotate the propeller to bring the next blade around to the exact same location the first blade was measured.

(n) Repeat steps (i)-(l) for the corresponding blade.

(o) Using a calibrated torque wrench, torque the four mount bolts and four clamp bolts in a criss-cross pattern. Tighten the bolts in several increments up to full torque, such as 50%, 75%, and full torque. See Table 2 or hub decal for bolt torque values.

(p) Check the propeller blades for track and blade angle. The blades should track within 3/16” of each other at the tip. Note that setting the pitch accurately is more important than track from blade to blade. See **Section 1C4** for propeller track instructions.

Note: A crankshaft “run-out” check is recommended before propeller installation. Follow the operators manual from the engine manufacturer.

(q) Ensure no interference occurs between propeller and ground or stationary components.

Before Engine Start: Ensure the runup area is clear of debris. Tachometer accuracy is critical for safe operation of the propeller. Refer to **SECTION 1A7(i)** for important considerations.

(r) Start engine and run propeller for approximately 5 minutes at 50% of the desired RPM. After such time, shut down the engine and check all eight bolts to see if they have lost torque. It is a normal occurrence for the bolts to lose a small amount of torque due to seating of the blades. If this has occurred, tighten again to the proper torque.

Note: This torque value should be checked after the first 5 hours of operation and at least once a year thereafter.

(s) See Table 1 for Propeller Combinations and Limitations.

> **⚠ CAUTION**
>
> *Caution*: You must never exceed the maximum RPM rating of your engine. Always operate your engine and propeller within approved limits.

(t) With the brakes on, run up the propeller to check your pitch for desired maximum RPM. Remember, the propeller will pick up RPM at full throttle/level flight. If your RPM's are too low, adjust the blades to a lower pitch setting. If the RPM's are too high, adjust the blades to a higher pitch setting using the procedure below. Check your aircraft and/or engine manual for recommended static rpm. If you are not seeing your correct static RPM, be certain the tach was properly calibrated. Reference **SECTION 1H** for troubleshooting.

> **⚠ CAUTION**
>
> *Caution*: Never mask a possible engine problem with a pitch change.

Note: For every 0.5° degree increase in blade angle there will be a decrease of approximately 35-50 static RPM.

(u) Install spinner dome (if used). Refer to SSI-SP-202201 and SSI-SP-202202, Sensenich Supplemental Instructions for Composite Spinners for further details.

3) **Blade Repitching**

(a) STANDARD REPITCH METHOD

(i) Ensure that the aircraft magneto switch is in the “OFF” position and that both magnetos are grounded any time the propeller is handled.

(ii) Remove the spinner dome and then loosen the clamp bolts and outer mount bolts where the propeller blades can be rotated in the hub.

NOTE: The Nord-Lock washers may click loudly when loosened; this is normal. New Nord-Lock washers are assembled with rubber adhesive, which will fall apart after first use. Retire Nord-locks when they show excesses wear on the “ramped” faces. See **SECTION 1G.**

(iii) Follow steps **SECTION 1C2(h) – 1C2(u)** from the Propeller Installation section.

(b) ALTERNATE REPITCH METHOD

(i) To set pitch with the supplied pitch setting gages, replace steps **SECTION 1C2(i) – 1C2(n)** of the Propeller Installation section with the following steps.

Note: If pitch is set using pitch setting gage method, Sensenich recommends checking blade angles with the template after hub is completely torqued (See steps **SECTION 1C2(i) – 1C2(n)**).

Note: Blade angle MUST fall within the approved limits for each propeller diameter range. Pitch limits are determined during 14 CFR Part 23 flight testing. Refer to the aircraft STC or TCDS sheet for propeller pitch limits for the specific aircraft installation. Reference SIIO-G_20220214 for propeller pitch setting gage number and corresponding blade angles.

(ii) Rotate each blade towards high pitch ensuring that the pitch pin on the blade shank is not obstructing the receiving hole for the pitch setting gage. Rotate the blade’s leading edge away from the engine to produce high pitch (feathered).

(iii) Insert the pitch setting gage through the clearance hole in the hub cover half and into the receiving hole in the hub mount half. See applicable installation instructions for pitch settings. If desired pitch is unknown use the nominal setting of 4 to start. The pitch setting # indicates relative pitch; pitch 5 is higher pitch than pitch setting 4, etc.

(iv) With the pitch setting gage in place, rotate the blade to low pitch until the pitch pin is touching the pitch setting gage. Snug the two clamping bolts for the corresponding blade barrel to prevent unwanted rotation of the blade.

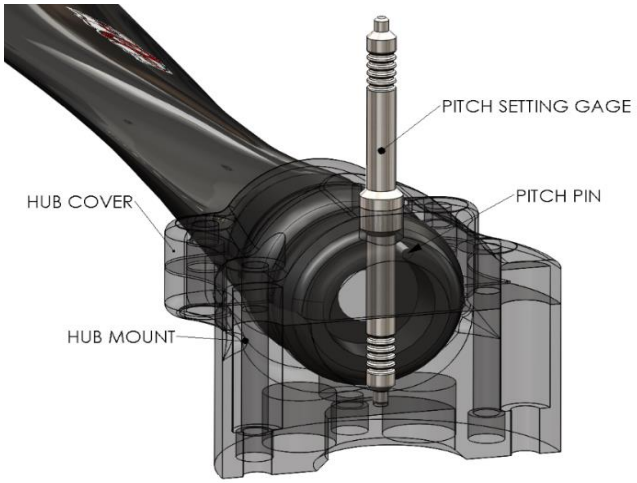


Figure 9: Pitch Setting Gage Detail

(v) Remove the pitch setting gage from the hub.

(vi) Repeat steps (i)-(v) for the opposite blade.

(vii) Complete steps **SECTION 1C2(o) – 1C2(u)** of the Propeller Installation section.

BEFORE ENGINE START: Make sure the pitch setting gages have been removed from the hub and check engine compartment for tools before starting the engine.

4) **Checking Blade Track**

(a) Ensure that the aircraft magneto switch is in the “OFF” position and that both magnetos are grounded any time the propeller is handled.

(b) Chock the wheels to ensure the aircraft does not move while rotating the propeller.

(c) It may be necessary to remove a spark plug from each cylinder for ease of rotating the propeller.

(d) Rotate the propeller where one blade is pointing down towards the ground.

(e) Measuring Track Method 1:

(i) Place a block or heavy object that won’t move under the tip of the propeller blade. Adjust the height of the block a necessary to achieve a clearance of approximately ¼” between the blade tip and the block.

(ii) Mark the blade tip location on the block with a pencil or marker.

(iii) Carefully rotate the propeller 180 degrees for second blade to be pointing down towards the block. Ensure aircraft does not move while rotating the propeller.

(iv) Mark the tip location of the second blade on the block. Measure the distance between the to tip marks to ensure it is 3/16” or less.

(f) Measuring Track Method 2:

(i) Place a heavy object such as a wooden block in front of the propeller blade. The blade should be able to rotate past the block with very little clearance (clearance approximately equal to the thickness of a piece of paper).

(ii) Rotate the propeller 180 degrees where the second blade is pointing towards the ground and in line with the block.

Note: If the second blade is contacts the block while rotating the propeller, restart track method 2 by setting up the block to the second blade.

(iii) Using shims, measure the distance between the blade and the edge of the block. The distance should be 3/16” or less.

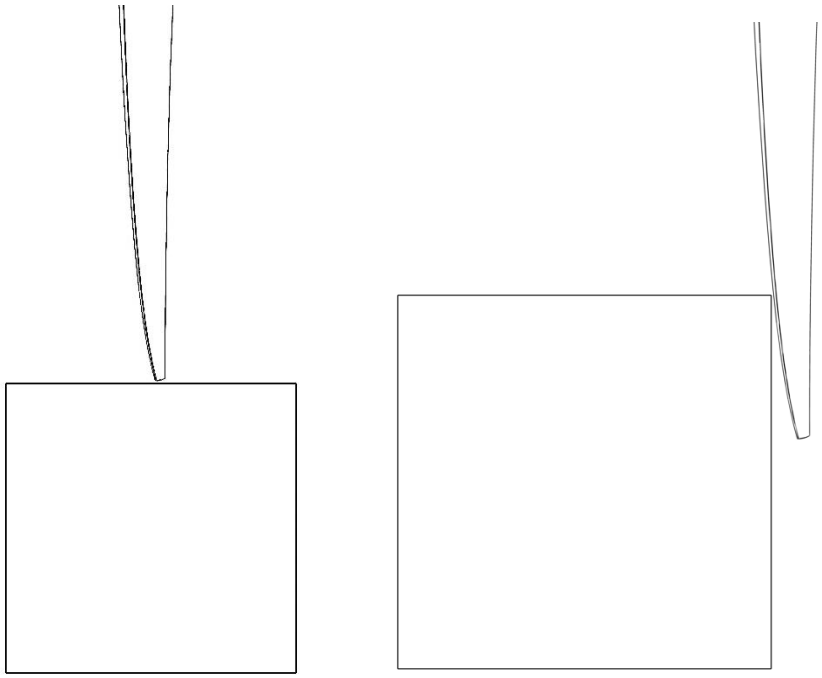


Figure 10: Track method 1 (left) and track method 2 (right)

D) SCHEDULED MAINTENENCE

Inspections must be performed in accordance with the procedures and timelines established in this section and **SECTION 1E** of this document.

1) **100-hr Operation or Annual Inspection (Whichever Comes First)**

To be accomplished by maintenance personnel appropriately certificated under CFR part 65, or appropriately rated Repair Station:

(a) Propeller is to be cleaned by hand washing with a rag, standard dish soap, and water. Alcohol may be utilized if there is residue that will not come off with soap and water. Allow propeller to thoroughly dry before proceeding.

(b) Examine the spinner assembly for missing hardware. Remove spinner dome. Examine spinner dome and bulkhead for security, chafing, cracks, or deterioration. If necessary, replace. See Spinner Repairs section.

(c) Examine each blade carefully, making sure each blade is still tight in the hub. If any loose blades are found, propeller must go through **SECTION 2** Overhaul. Perform a thorough visual inspection for security, chafing, deterioration, and cracks. Perform a coin tap inspection of each composite blade, including the metal erosion shield on the leading edge (see **SECTION 1F**). No dents in the metal erosion shield should be deeper than 1/8". No dents should puncture the metal erosion shield. If blade damage is beyond Minor Blade Repair limits, the blade must either be retired from service or sent to a repair station for evaluation before return to flight.

(d) Conditions requiring blade replacement:
  (i) Any hole in hollow blade shell (doesn't apply if a replacement metal erosion shield will cover hole)
  (ii) Any crack deeper than .025"
  (iii) Any solid tip damage that can't be trimmed off completely with a diameter reduction to minimum diameter, See Table 1.

(e) Check clamp bolt and outer mount bolt torque. – Tighten the bolts using a star pattern. See Table 2 or hub decal for bolt torques. If the bolt requires more than 1/4 revolution to tighten to full torque, propeller must go through **SECTION 2** Overhaul.

(f) Examine both hub halves and hardware for corrosion. Carefully inspect hub around clamp bushings, bolt holes and outside of barrels for any cracks. If necessary, carefully remove any flaked or blistered coating from the hub surface, taking care not to scratch the aluminum surface. If there is any corrosion, cracks or damage present to hub refer to Minor Hub Repair instructions below. Replace corroded hardware.

(g) Reinstall the spinner dome.

(h) Once clean and inspected, apply automotive wax to the blades.

E) UNSCHEDULED MAINTENANCE

1) Inspection After Suspected Ground Impact

To be accomplished by maintenance personnel appropriately certificated under CFR part 65, and/or appropriately rated Repair Station

Propellers that have been involved in a known or suspected static or rotating impact with relatively solid objects (e.g., ground, maintenance stands, runway lights, etc.) should be inspected for damage before further flight. Hub halves should undergo fluorescent penetrant inspection per ASTM E 1417 or AMS2647. If the inspection reveals one or more of the following listed indications, the propeller should be removed and sent to an Approved Propeller Repair Station for overhaul and or repair.

(a) A blade that tracks more than 3/16” to the other blades.

(b) Loose blades in the hub.

(c) Any noticeable or suspected damage to the blade pitch pins.

(d) Any diameter reduction (tip damage).

(e) Damage to the hub that cannot meet the Minor Hub Repairs criteria. In particular, inspect for cracks in the bolt holes, counterbores, and barrel cavities which clamp the blades.

(f) Visible major damage to a blade that cannot meet the Minor Blade Repairs criteria.

(g) Operating changes, such as vibration or abnormal RPM.

(h) Comply with the engine manufacturers requirements for propeller strike/sudden stoppage.

2) **Inspection After Suspected Bird Impact**

To be accomplished by maintenance personnel appropriately certificated under CFR part 65, and/or appropriately rated Repair Station

Propellers that have been involved in a known or suspected static or rotating impact with relatively soft objects (e.g. birds, light FOD, etc.) or relatively yielding objects (e.g., snow banks, puddles of water, heavy accumulation of slush, etc.) should be inspected for damage before further flight. If the inspection reveals one or more of the following listed indications, the propeller should be removed and sent to an Approved Propeller Repair Station for overhaul and or repair.

(i) A blade that tracks more than 3/16" to the other blades.

(j) Loose blades in the hub.

(k) Any noticeable or suspected damage to the blade pitch pins.

(l) Any diameter reduction (tip damage).

(m) Visible major damage to the hub that cannot meet the Minor Hub Repairs criteria. In particular, inspect for cracks in the bolt holes, counterbores, and barrel cavities which clamp the blades.

(n) Visible major damage to a blade that cannot meet the Minor Blade Repairs criteria.

(o) Operating changes, such as vibration or abnormal RPM.

3) **Inspection After Suspected Lightning Strike**

To be accomplished by maintenance personnel appropriately certificated under CFR part 65, and/or appropriately rated Repair Station

Any Sensenich composite blade suspected of lightning strike should be inspected and may require repair or replacement. Lightning strikes usually enter a composite blade through the metal erosion shield. If a lightning strike is present, a darkened area and possible pitting, usually in the proximity of the tip, will be noticeable. If a lightning strike is suspected or detected, consider the blade unairworthy.

4) **Inspection After Overspeed**

To be accomplished by maintenance personnel appropriately certificated under CFR part 65, and/or appropriately rated Repair Station

(a) Perform inspection after suspected impact **SECTION 1E1**
(b) Comply with the engine manufacturers requirements for engine overspeed.

F) TAP TESTING PROCEDURE

1) **Tap Testing Propeller Blade**

(a) Thoroughly clean propeller blade per **SECTION 1D1(a)**

(b) Using a coin or tap hammer (2ounce max), lightly tap along the specified areas of the propeller blade and listen for the acoustic response. A “flat” or “dead” response is indication that there is a delamination or debond. A clear or sharp ringing sound indicates a well-bonded structure.

(i) Tap test areas:

(1) Around the circular shank of the blade just outside of the aluminum hub.

(2) Along the trailing edge of the propeller blade from just outside of the hub to the blade tip. Both the high and low pressure side of the blade.

(3) Along the leading edge of the propeller blade from just outside of the hub to the blade tip. Both high and low pressure side.

(4) The entire surface of the metal erosion shield.

(5) Thoroughly tap across the entire blade high and low pressure surface.

G) NORD-LOCK WASHER INSPECTION

1) **Inside "Ramped" Face Wear Illustrations.**

(a) Washer wear equivalent to the illustrations of **SECTION 1G1(a)** is considered light use with approximately 1-10 installations. Silver coating still prevalent over much of the ramped faces. Re-use of Nord-lock is acceptable.

(b) Washer wear equivalent to the illustrations of **SECTION 1G1b** is considered medium use with approximately 10-40 installations. Minimal silver coating exists around the outer edges of the ramped faces. Re-use of Nord-lock is acceptable. If any doubt exists on washer condition, replace washers.

(c) Washer wear equivalent to or beyond the illustrations of **SECTION 1G1(c)** is considered high use with approximately 50 installations. Minimal silver coating exists. Significant darkening and rounding along the vertical edges. Nord-lock must be retired. If any doubt exists on washer condition, replace washers.

H) TROUBLESHOOTING

NOTE: Always ensure that the aircraft magneto switch is in the “OFF” position and that both magnetos are grounded any time the propeller is handled.

1) **Propeller Vibration**

(a) Improper bolt torque can cause the propeller blades to rotate in the hub or cause the hub to come loose from the engine flange. Check bolt torque following the steps of **SECTION 1C2(o)** of the propeller installation.

(b) Angle variation beyond 0.5° blade to blade can cause aerodynamic vibrations. Check the propeller blade angle following the steps of **SECTION 1C2(o)-1C2(u)**. Repitch the propeller blades if there is an angle variation beyond .5° following the steps of **SECTION 1C3** to repitch the propeller.

(c) Propeller blades that track in excess of 3/16” can cause propeller vibration. Follow the steps of **SECTION 1C4** to ensure blades track within 3/16” blade to blade. If track is out beyond the specified limit, contact Sensenich Wood Propeller Co. for further support.

(d) Tolerance stack up of engine, spacer, spinner, and propeller parts may cause slight vibration even if all parts are correctly installed and within balance tolerances. A dynamic balance can identify and correct the cumulative balance of all parts as an assembly. Alternatively, removing and reinstalling components at different orientations can also mitigate this potential problem.

2) **Improper RPM**

(a) Propeller RPM should fall within established aircraft, engine, and propeller limits. Improper RPM is a result of blades pitched either too low or too high. If you need to increase RPM the blades need to reduce pitch, if you need to decrease RPM the blades need to increase in pitch.

(b) Follow the steps of **SECTION 1C3** to repitch the propeller

Note: 0.5° blade angle change will result in a change of approximately 35-50 static RPM.

I) REMOVAL AND PARTS REPLACEMENT

1) Removal of Spinner Dome and Front Bulkhead

(a) If installation does not include a spinner skip to **SECTION 1I2**.

(b) Remove spinner screws around the base of the spinner dome.

(c) Remove spinner dome and place to the side.

(d) If the spinner includes a front bulkhead, remove the AN3-3A bolts and then remove the front bulkhead.

2) Removal of Hub Cover Half and Propeller Blades

(a) Remove the four clamp bolts.

(b) Loosen the four outer mount bolts where they can be turned by hand, do not completely unscrew.

(i) While pressing firmly against the hub cover half to keep it in place over the blade shanks, completely unscrew the four outer mount bolts.

(ii) While keeping pressure on the hub cover half, slide your hands over to the blade shanks and carefully remove both blades and hub cover half in one piece. Carefully place on a flat surface to then remove the blades from the hub cover half.

Note: Removal of hub cover half and propeller blades is significantly easier if completed by two people.

3) Removal of Hub Mount Half, Spacer, and Rear Spinner Bulkhead

(a) After completing **SECTION 1I2**, remove the two inner mount bolts. The hub mount half will only be sitting on the drive bushings at this point; take care not to drop the hub mount half once the inner mount bolts are removed.

(b) Remove the hub mount half and rear spinner bulkhead (if applicable).

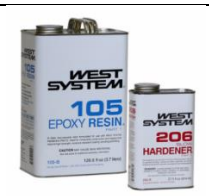
4) Parts Replacement

(a) To replace parts of the propeller assembly, follow the applicable steps of **SECTION 1I1-1I3** to remove all parts up to the part needing replacement.

(b) Follow the appropriate steps of **SECTION 1C** propeller installation to reinstall the replacement parts and removed

J) MINOR REPAIRS

1) Required Minor Repair Tools

	Epoxy-Hardener System: West System 105/206 or equivalent
	Filler Material: West System 406 Colloidal Silica, Cabosil or Equivalent
	220 and 320 grit Sandpaper
	Scotch-Brite “Medium” and “fine” Grade Scouring Pad or Equivalent
	Touch Up Paint: Tempo A150 Flat Black, A152 White, or equivalent
	10x Magnifier
	Fluorescent Penetrant: Per ASTM E 1417 or AMS2647

2) Minor Blade Repairs

(a) Minor impact damage, nicks, and gouges in composite material of blade not to exceed .025 depth and or .5 square inches of surface area: Fill with high strength epoxy resin West System 105/206 or equivalent (NOT 5 minute epoxy) thickened with aerospace filler material, such as Colloidal Silica 406, Cabosil, or equivalent. Sand smooth when dry.

(b) Wear and/or roughness of metal erosion shield on blade leading edge: If metal is not worn through, use 220 grit sandpaper or scouring pad to remove roughness or minor pitting, being careful to not grind through the erosion shield. Polish with fine scouring pad or equivalent to remove scratches.

(c) Paint wear on blade: Touch up paint using Tempo A150 Flat Black, A152 White, or equivalent. Paint mass can cause an out of balance of the rotating assembly. Only apply touch up paint to fill missing or removed paint. Touch up paint not to exceed two coats over a total of 10in^2.

Note: Dynamic balance is recommended after any blade repair.

3) **Minor Hub Repairs**

(a) Any hub or spacer that exceeds what is depicted in Figure 11 for minor repair must be retired from service. The dimensions in Figure 11, other than the radius, are the maximum allowable. A hub can be returned to service with the following limitations:

(b) No more than two (2) repairs in a single barrel half (where the blade touches the hub) for a total of 8 barrel repairs in one (1) complete hub, as long as the repairs do not touch.

(c) The number of minor hub repairs outside the barrel is indefinite, as long as the repairs do not touch.

(d) No repairs over a previous repair.

(e) No repairs on the hub or spinner mounting flange faces.

(f) Clean the area thoroughly, apply an approved fluorescent penetrant (ASTM E 1417 or equivalent), and inspect with a l0X magnifying glass before returning to service.

(g) All corrosion must be removed before a hub can be returned to service. Corrosion removal is considered a minor repair.

(h) Instructions for removing the damage or corrosion spot:

(i) Sand the area with 220 wet-or-dry abrasive paper until all evidence of corrosion is removed. A small, motorized grinding tool may be used.

(ii) Polish the area with 320 grit (or finer) to remove all scratches

(iii) Clean the area thoroughly, apply an approved penetrant (ASTM E 1417 or equivalent), and inspect with a l0X magnifying glass. NOTE: It is extremely important that all corrosion be completely removed. If cavities reappear during penetrant inspection, the repair operation must be repeated.

(iv) Remove penetrant from the affected area.

(i) Touch up finish coating of repaired area with an Alodine or Anodize touch up pen.

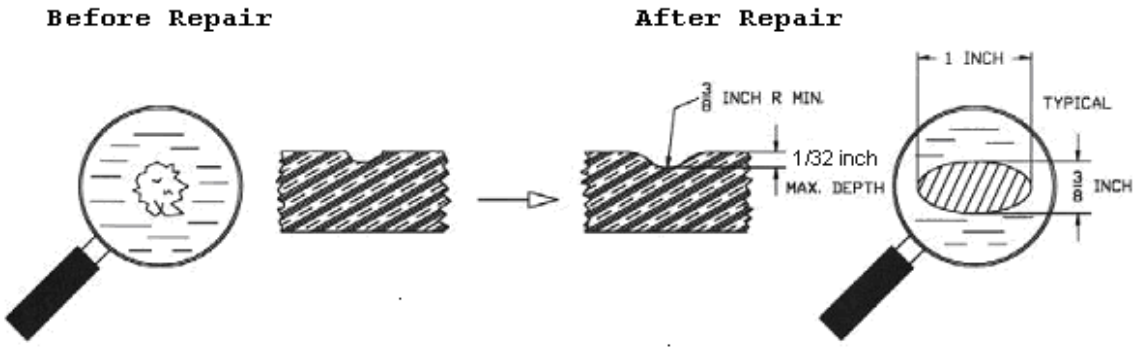


Figure 11: Minor Hub Repair Limits

4) **Minor Spinner Repairs**

(a) The following repairs are directed toward composite spinners supplied by Sensenich Propeller. For repair of composite spinners not supplied by Sensenich please refer the spinner manufacturers repair instructions.

(b) Minor impact damage, nicks, and gouges in composite material of dome or rear bulkhead not to exceed .025 depth and or .5 square inches of surface area: Fill with high strength epoxy resin West System 105/206 or equivalent (NOT 5 minute epoxy) thickened with aerospace filler material, such as Colloidal Silica 406, Cabosil, or equivalent. Sand smooth when dry.

SECTION 2: PROPELLER OVERHAUL

A) REQUIRED OVERHAUL TOOLS

	Digital Level or Protractor
	Calibrated Torque Wrench
	3/8” socket (for AN3 bolts) 9/16” Socket (for 3/8” bolts) 5/8” Socket (for 7/16” bolts) 3/4” Socket (for 1/2” bolts)
	Socket Extension
	Measuring Tape
	Sharpie or Pencil
	Torque Screw Driver
	Propeller Tachometer
	Alcohol and Towel
	Soap and Water

	Mineral Spirits
	Brush
	Fluorescent Penetrant: Per ASTM E 1417 or AMS2647
	Coin or Composite Tap Hammer (Tap Test)

B) OVERHAUL

To be accomplished every 2000 operation hours or 96 calendar months, whichever comes first:

1) Clean propeller.

    (a) Prior to removal, propeller is to be cleaned by hand washing with a rag, standard dish soap, and water. Alcohol may be utilized if there is residue that will not come off with soap and water. Allow propeller to thoroughly dry before applying finish or performing repairs.

2) Remove spinner, hub, propeller blades, and hardware per **SECTION 1I**.

    (a) After propeller removal, metal parts may be cleaned further by hand or in a parts washer with mineral spirits or similar. If necessary, light brushing may be used.

3) Visually inspect clamp bolts, inner mount bolts, outer mount bolts, and lock washers and retire from service. ***BOLTS AND WASHERS MUST BE REPLACED AT OVERHAUL***.

4) Visually inspect for and make note of spinner dome and bulkhead(s) for damage and cracks. If necessary, replace the spinner dome. See spinner repair **SECTION 1J2.**

5) Visually inspect for and make note of hub damage, abrasion, corrosion, and cracks. Perform a fluorescent penetrant inspection per ASTM E 1417(*type I)* and use a 10x magnifying glass to check hub halves for cracks. If any cracks are found, the hub half must be retired from service or repaired with minor repair procedures in **SECTION 1J.**

6) Visually inspect for and make note of blade damage, cracks, dentation, and abrasion. Perform a tap test per **SECTION 1F** to check blades for debonds. If any defects are found, the blade must be retired from service or repaired with minor repair procedures of **SECTION 1J.**

C) RETURN TO SERVICE

If minor repairs are performed on a propeller part, repeat all applicable inspections of the part prior to returning parts to service. Any parts that continue to fail inspection criteria after performing a repair must be retired from service. Make note of overhauls, repairs, and inspection findings in the propeller log.

If propeller will be stored long term prior to a return to service, package propellers for storage to avoid parts colliding during storage or transport. Always store propeller components in a dry environment. Store propeller components between -20 and 120 Fahrenheit.

If propeller is to be reinstalled on the aircraft, use procedures outlined **SECTION 1C** of this document and any additional aircraft specific installation instructions. Installed pitch and operational RPMs must fall within limits established by applicable TCDS, STC, ICA, and installation instructions.

SECTION 3: AIRWORTHINESS LIMITATIONS

A) LIFE LIMITATIONS

NONE

Parts are removed from service when they can no longer meet the Continued Airworthiness Requirements.

The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

DESCRIPTION OF ALL OPERATIONS PERTAINING TO INSPECTIONS AND MAINTENANCE

DATE	TACH TIME	DESCRIPTION OF WORK	SIGNATURE
