Composite Aircraft Propellers

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SENSENICH TWO BLADE COMPOSITE AIRCRAFT PROPELLER INSTALLATION AND OPERATION INSTRUCTIONS FOR PIPER PA-18-150 AIRCRAFT

PA-18-150_2G0Mx_C82BGF_Installation_Instructions_RevA 06-06-2023

ATTENTION

Failure to follow these instructions will void all warranties, expressed and implied. Mounting difficulties, vibration, and/or failure can result with improper assembly of the propeller blades and hub parts.

CAUTION

Rotating propellers are particularly dangerous. Extreme caution must be exercised to prevent severe bodily injury or death.

Record of Revisions:

Rev#	Page(s) Affected	Description of Changes	Date
0	All	Initial Release	12-23-2020
A	1, 2, 3, 5, 6, 8, 12, 13	Added 2G0M6 and 2G0M7 propeller specs for (I)O-320 installation. Broke out ICA to stand alone document number SICA-G_20220214. Added 150hp and 160hp pitch limits.	06-06-2023

Vertical bars should be placed in the margin of the revised pages to indicate changed material.

TABLE OF CONTENTS

PACKING LIST FOR 2G0Mx
INSTALLATION WITH LYCOMING THREADED FLANGE BUSHINGS

Item	Description	Qty
1	Rear Spinner Bulkhead (if applicable)	1
2	Hub Mount Half	1
3	*** Inner Mount Bolts**	2
4	Propeller Blades	2
5	Clamp Bolts (7/16-20 x 2")	4
6	*** Outer Mount Bolts**	4

Item	Description	Qty
7	Hub Cover Half	1
8	Clamp Bolt Washers (NL11 Nord-lock)	4
9	*** Inner and Outer Mount Bolt Washers**	6
10	Spinner Dome (if applicable)	1
11	A-1608 Pitch Setting Gage (gage numbers 0-7)	3
12	A-1889 75% Airfoil Template	1

*** Inner Mount Bolt**
2G0M8 (1/2-20 x 2)
2G0M7 (7/16-20 x 2)
2G0M6 (3/8-24 x 2)

*** Outer Mount Bolt**
2G0M8 (1/2-20 x 5)
2G0M7 (7/16-20 x 5)
2G0M6 (3/8-24 x 4-3/4)

*** Mount Bolt Washers**
2G0M8 (NL1/2SP)
2G0M7 (NL11)
2G0M6 (NL3/8SP)

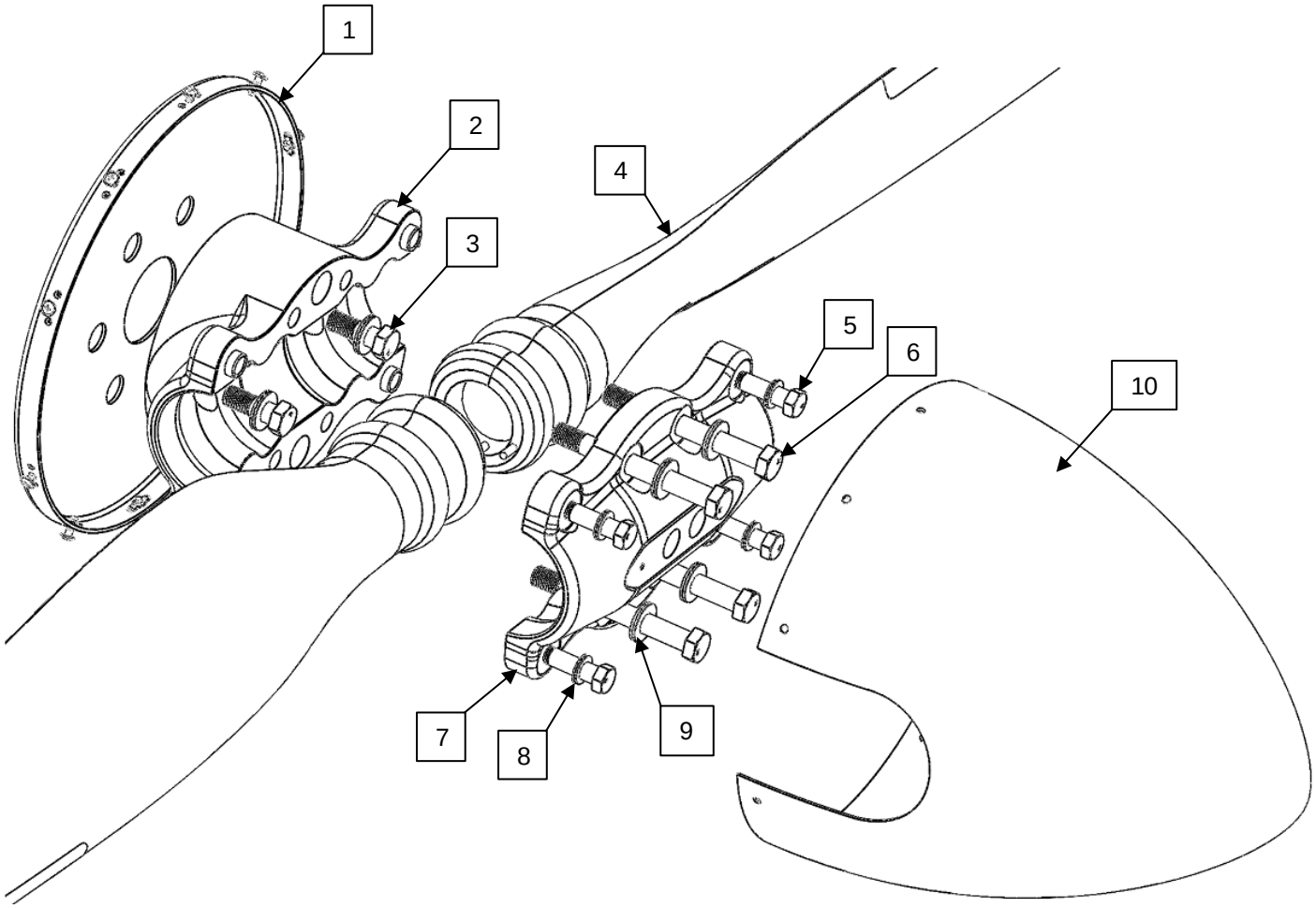


Figure 1: Propeller Assembly
A-1608 and A-1889 not included in Figure 1.

OVERALL DESCRIPTION OF THE PROPELLER AND ITS FEATURES:

Your Sensenich composite propeller was manufactured using aerospace quality materials and processes. Propeller balance was verified before shipment from the factory.

The blades were manufactured by utilizing the latest technology in carbon fiber and glass prepreg materials in a high temperature internal molding process. This yields low inertia propeller with superior performance and durability.

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, providing a smoother finish and a superior bond.

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. The various gages provide six settings of pitch change affording maximum performance within an efficient aerodynamic envelope.

Hub assemblies used for operation on the PA-18-150 aircraft:

- 2G0M6 model hub intended for use with the Lycoming (I)O-320 (SAE#2) engine/flange configuration with 3/8" mounting bolts.
- 2G0M7 model hub intended for use with the Lycoming (I)O-320 (SAE #5) engine/flange configuration with 7/16" mounting bolts.
- 2G0M8 model hub intended for use with the Lycoming (I)O-360 (SAE #6) engine/flange configuration with 1/2" mounting bolts.

REQUIRED TOOLS

Digital level/protractor
Torque wrench
9/16" socket (for 3/8" bolts)
5/8" socket (for 7/16" bolts)
3/4" socket (for 1/2" bolts)

Note: Certain aircraft manufacturers limit total pitch range to comply with aircraft design regulations.

PROPELLER INSTALLATION

1. *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.

2. Zero the level/protractor on the engine flange (If digital level/protractor is being use make sure it does not turn off during the installation process). Place 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.

   Note:
   Bolt breakage *WILL* occur if there is a gap between the propeller hub and the engine flange.

3. 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 (2"), 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 1**.

Table 1: Torque Figures for Specific Bolt

Bolt Size	Recommended Torque
3/8"	350 in-lbs
7/16"	530 in-lbs*
1/2"	770 in-lbs*

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

4. 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.

5. 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:
   Each Nord-lock washer works in pairs with the "ramped" sides facing each other. See Figure 2.

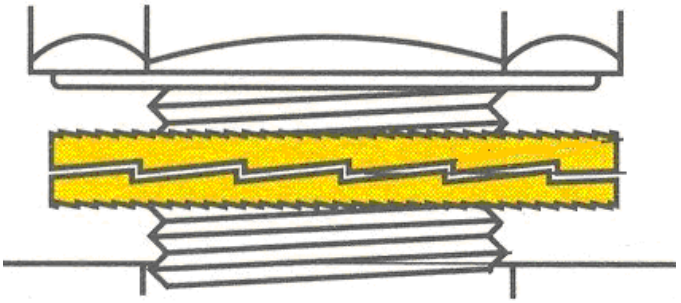


Figure 2: Nord-Lock Lock Washer

6. Place four Nord-Lock mount bolt washers on each of the four outer mount bolts (5" for 1/2" or 7/16" diameter bolts and 4-3/4" for 3/8" diameter bolts) and insert bolts into the four bolt holes along the inboard hub barrel edge of the cover half.

7. 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.

8. Rotate the propeller until it is parallel or level to the ground.

9. Measure 26" 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.**

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

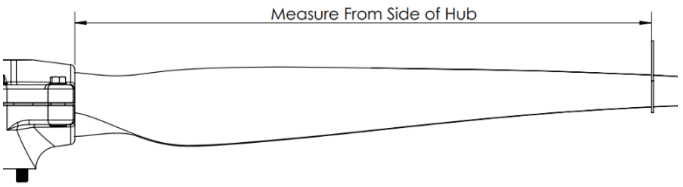


Figure 3: 75% Station Template Location

10. Place the digital level/protractor on the template and then place the template on the round side of the blade at the 75% station mark from step 9. 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 **Figure 4**.

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.

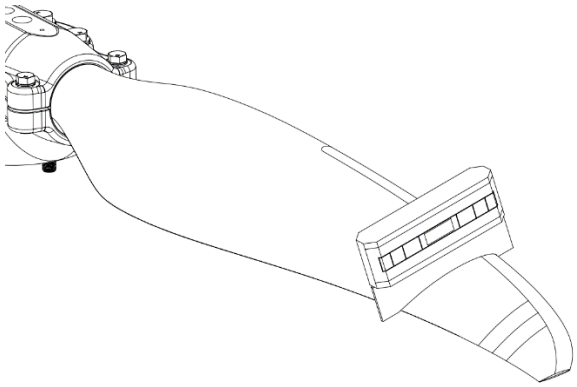


Figure 4: Template and Digital Level/Protractor Positioned on Blade.

11. Rotate the blade until the desired angle is achieved. See **Appendix** for approved angle limits at each propeller diameter for the appropriate installation. 75% blade angles must be set within 0.5° blade to blade.

    Note:

    Blade angle <u>MUST</u> fall within the approved limits for each propeller diameter range. Approved limits for each installation can be found in the Appendix.

12. 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. Stop at to 50% the final torque.

13. 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.

14. Repeat steps 9-12 for the corresponding blade.

15. 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 1** or hub decal for bolt torque values.

16. 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.
    BEFORE ENGINE START:

    Ensure the runup area is clear of debris. Tachometer accuracy is critical for safe operation of the propeller. Refer to the TACHOMETER INSPECTION section for important considerations.

17. 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 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.

18. See **Table 3** for ***<u>Engine / Propeller Combinations and Limitations.</u>***

    CAUTION: YOU SHOULD NEVER EXCEED THE MAXIMUM RPM RATING FOR YOUR ENGINE.

    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. **CAUTION: YOU SHOULD NEVER MASK A POSSIBLE ENGINE PROBLEM WITH A PITCH CHANGE.** If you are unsure, please contact the factory.

    Note:

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

19. Install spinner dome (if used). Refer to **Sensenich Supplemental Instructions for Composite Spinners.**

REPITCHING

1. Ensure that the aircraft magneto switch is in the "OFF" position and that both magnetos are grounded any time the propeller is handled.

2. 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.

3. Follow steps 8-19 from the Propeller Installation section.

REPITCHING: ALTERNATE METHOD

To set pitch with the supplied pitch setting gages, replace steps 8-13 of the Propeller Installation section with the following steps.

NOTE:

Pitch setting gages may be used as a reference but not as the primary means of setting blade angle. If using pitch setting gages, blade angles should be checked with the template and protractor after hub is completely torqued (See step 2 and steps 8-10 of the Propeller Installation section). For a list of reference blade angles at each corresponding pitch setting gage see Table 2.

1. 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, or more "bite".

2. 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 **Figure 5**. 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...

3. 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.

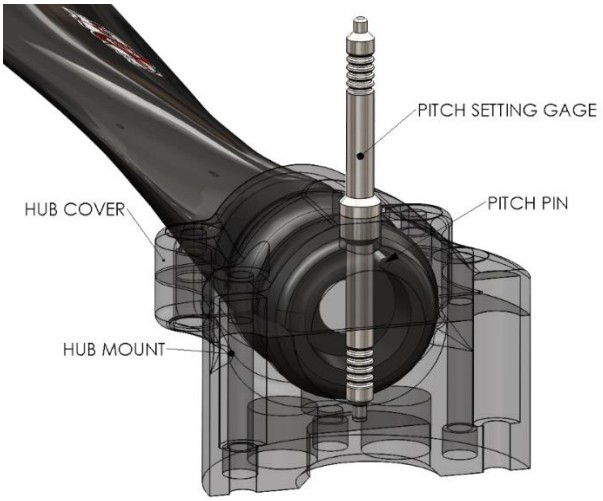


Figure 5: Pitch Setting Gage Detail

4. Remove the pitch setting gage from the hub.

5. Repeat steps 1-5 for the opposite blade.

6. Complete steps 15-19 of the Propeller Installation section.

BEFORE ENGINE START:

Make sure the pitch setting gauges have been removed from the hub and check engine compartment for tools before starting the engine.

Table 2: Pitch Setting Gage and Corresponding Blade Angles

Gage #	Angle (deg)	Pitch (in)
0	11	38
1	11.5	39
2	12	41
3	12.5	43
4	13	45
5	13.5	46
6	14	48
7	14.5	50

NOTE:

Blade angles in Table 2 are for reference only. Gage # is located on end of each gage.

PROPELLER REMOVAL

To remove the propeller, follow the Propeller Installation section in reverse order.

TACHOMETER INSPECTION

Owing to the exceptionally high stresses that may be generated by particular propeller/engine combinations at certain operating ranges, propeller and aircraft manufacturers have established revolutions per minute (RPM) restrictions and maximum RPM limits for some models. An improperly operating tachometer can cause 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.

Table 3: Approved Engine/Propeller/Spacer 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**	**Approved Engine Models**
2G0M6	C82BGF	Tractor	82 / 80.5	20	.46	SAE 2 3/8-24" Bolts	180HP @ 2700 RPM	See STC
2G0M7	C82BGF	Tractor	82 / 80.5	20	.46	SAE 5 7/16-24" Bolts	160HP @ 2700 RPM	See STC
2G0M8	C82BGF	Tractor	82 / 78	20	.46	SAE 6 1/2-20" Bolts	160HP @ 2700 RPM	See STC

Note: Approved models only applies when engine uses appropriate flange and bushings to match hub.

WARNING: Propeller blade failure may occur if maximum propeller RPM is exceeded – resulting in severe bodily injury or death!

PROPELLER PERFORMANCE

In selecting a propeller, keep in mind that both aircraft and engines of the same model may vary in performance, and that operators may want different performance characteristics. For instance, one person may require a high climb rate while another seeks maximum cruising efficiency.

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.

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 particular 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 also recommended for aircraft operating from high density altitude runways.
NOTE: When pitching propeller for a climb pitch, the propeller WILL overspeed in full throttle level flight. Propeller RPM should never exceed the engine manufacturers recommended maximum RPM. Please refer back to Table 3 for limits.

PITCH NOTES AND LIMITATIONS

The faster the airplane, the higher the pitch setting that will be required to keep the engine from over-speeding at Wide Open Throttle (WOT).
While the propeller may be structurally operated at any pitch setting within the approved limits (see appendix for approved limits), the take-off RPM at WOT must meet the aircraft manufacturer's recommended limits to ensure safe flight. Although this propeller model has many pitches available, Propeller RPM should never exceed the engine manufacturers recommended maximum RPM. Please refer to **Table 3**.

NOTE:

For each aircraft installation, refer to the applicable pitch limitations section in the Appendix.

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

Refer to Sensenich document number **SICA-G_20220214** for instructions for continued airworthiness.

LIMITED WARRANTY

We hope you enjoy your new composite propeller. We have worked hard to ensure that your propeller will meet or exceed your expectations for years to come.

We offer a one year limited warranty (the “Warranty Period”) on any defect in materials and workmanship.

In the event a unit does not conform to this express warranty during the Warranty Period, Sensenich Composites, Inc. (“Sensenich”), will repair or replace the defective material at it’s place of business at Plant City, FL USA. Sensenich will decide at its sole discretion which remedy, repair or replacement, it will provide. Any replacement of a unit or a part of a unit during the Warranty Period will not extend the Warranty beyond the original duration. The remedy of repair or replacement is exclusive and does not include the cost of shipping, removal, or installation, all of which are the customer's responsibility.

Procedure For Obtaining Warranty Service
Units or parts that are defective must be shipped prepaid to Sensenich at the address listed on page 1. The unit must be accompanied by a copy of the original (Distributor or Dealer) invoice, a Return Authorization Number (which can be obtained by phoning Sensenich), and a brief description of the defect.

Conditions, Exclusions, and Disclaimers
This limited warranty applies only to units that have been installed, used, and maintained properly in strict accordance with our specifications, instructions, and recommendations. It does not cover units that show abuse, alterations, improper installation, improper maintenance or repair, or improper packaging for shipment; and it does not pertain to damage due to object strike, or excessive blade wear due to operation. Racing use of any kind automatically voids this Warranty. The use of units on or with engines or equipment not approved by Sensenich automatically voids this warranty. For purposes of this limited warranty, “engines or equipment not approved by Sensenich” shall mean engines or equipment that are not explicitly consistent with all specifications and instructions applicable to that engine or equipment, including, without limitation, those established by the Federal Aviation Administration, those established by the manufacturers of any component parts used in connection with the units, and/or those established by Sensenich. The purchaser has sole responsibility for ensuring that the use of the units is in compliance with all applicable specifications and instructions, and no conduct by Sensenich shall prevent this Warranty from being voided for failure to comply with the instructions or specifications provided by any third-party.

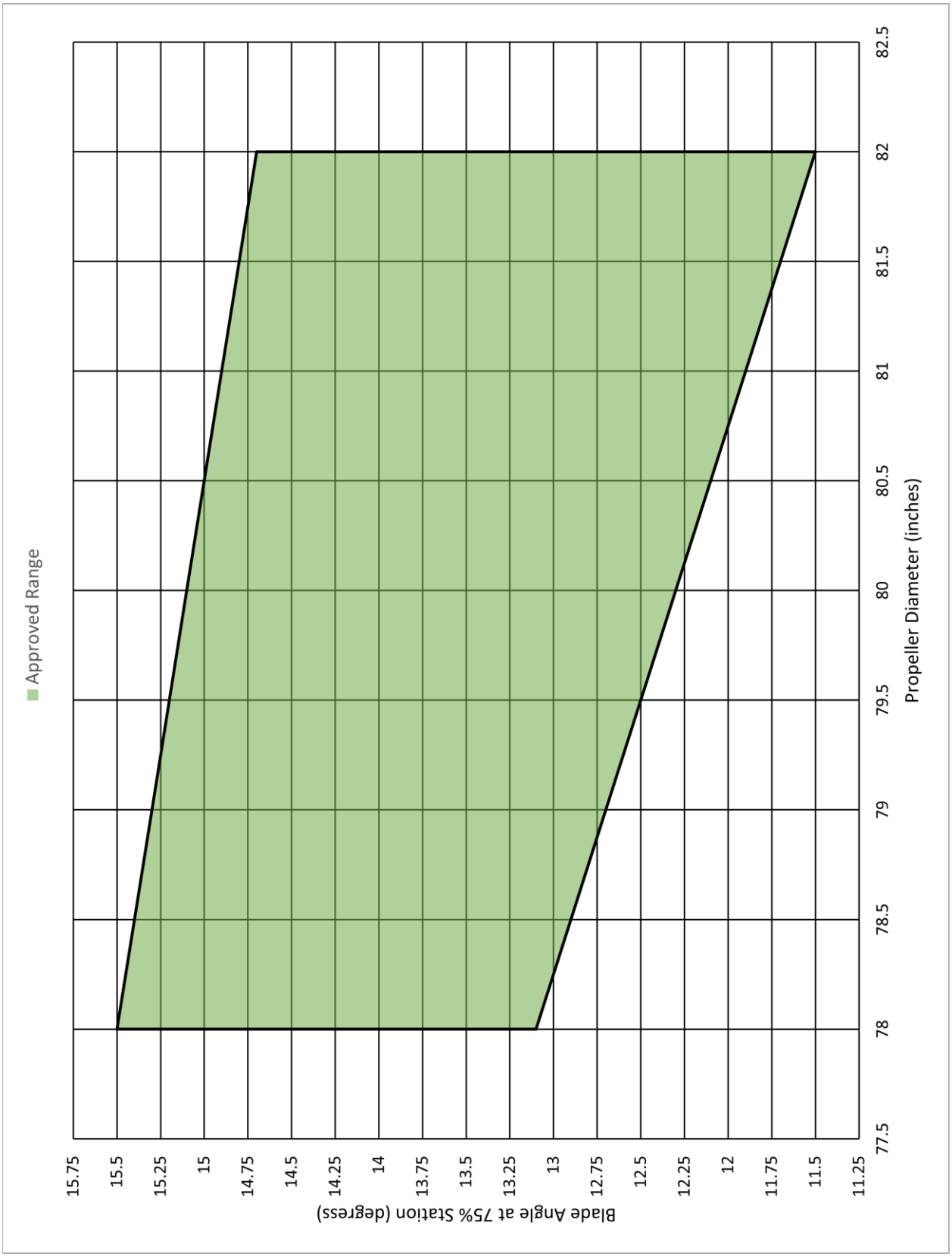
This Limited Warranty is the only warranty provided with respect to covered units, and **THERE ARE NO OTHER WARRANTIES, REPRESENTATIONS, CONDITIONS OR GUARANTEES, EXPRESS OR IMPLIED, WITH RESPECT TO THE COVERED UNITS OR THE MANUFACTURE THEREOF, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**
Repair or replacement of a nonconforming unit or part is the exclusive remedy for breach of this limited warranty, and shall constitute fulfillment of all liabilities of Sensenich to a customer or user, whether based on contract, negligence or otherwise. **IN NO EVENT SHALL SENSENICH BE LIABLE FOR ANY OTHER EXPENSES, CLAIMS OR DAMAGES OF ANY KIND HOWSOEVER CAUSED, INCLUDING (WITHOUT LIMITATION) ANY OTHER PRODUCT REPLACEMENT OR INSTALLATION COSTS AND/OR ANY DIRECT, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES.**

The purchaser of the covered units has read, understood and, by purchasing the units, agrees to be bound by the above terms and conditions.
Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.
This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

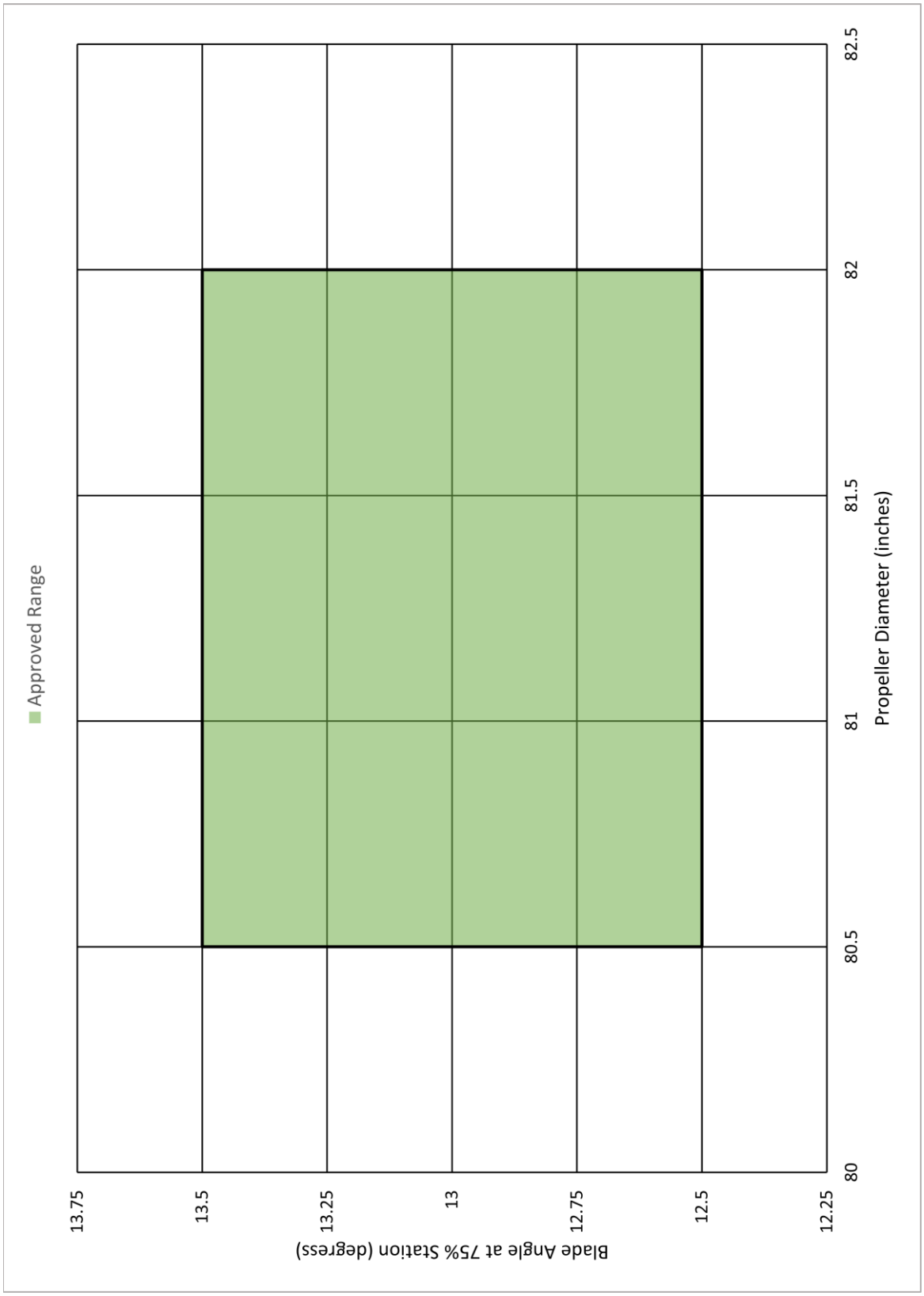
DESCRIPTION OF ALL OPERATIONS PERTAINING TO INSPECTIONS AND MAINTENANCE

DATE	TACH TIME	DESCRIPTION OF WORK	SIGNATURE

APPENDIX A: ***2G0M8 C82BGF*** *pitch limitations when operated on a Piper PA-18-150 with a 180hp Lycoming O-360 or IO-360 Incorporated by STC.*



2G0M6 C82BGF and 2G0M7 C82BGF *pitch limitations when operated on a Piper PA-18-150 with a 160hp Lycoming O-320 or IO-320.*



2G0M6 C82BGF and 2G0M7 C82BGF *pitch limitations when operated on a Piper PA-18-150 with a 150hp Lycoming O-320 or IO-320.*