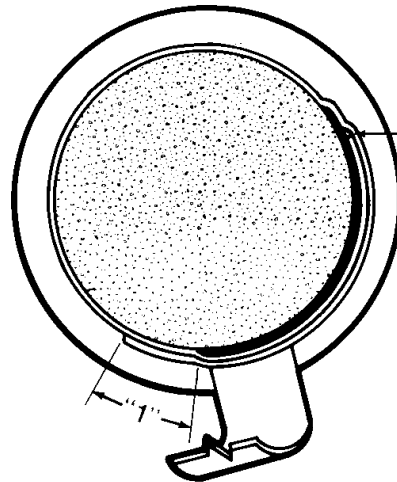
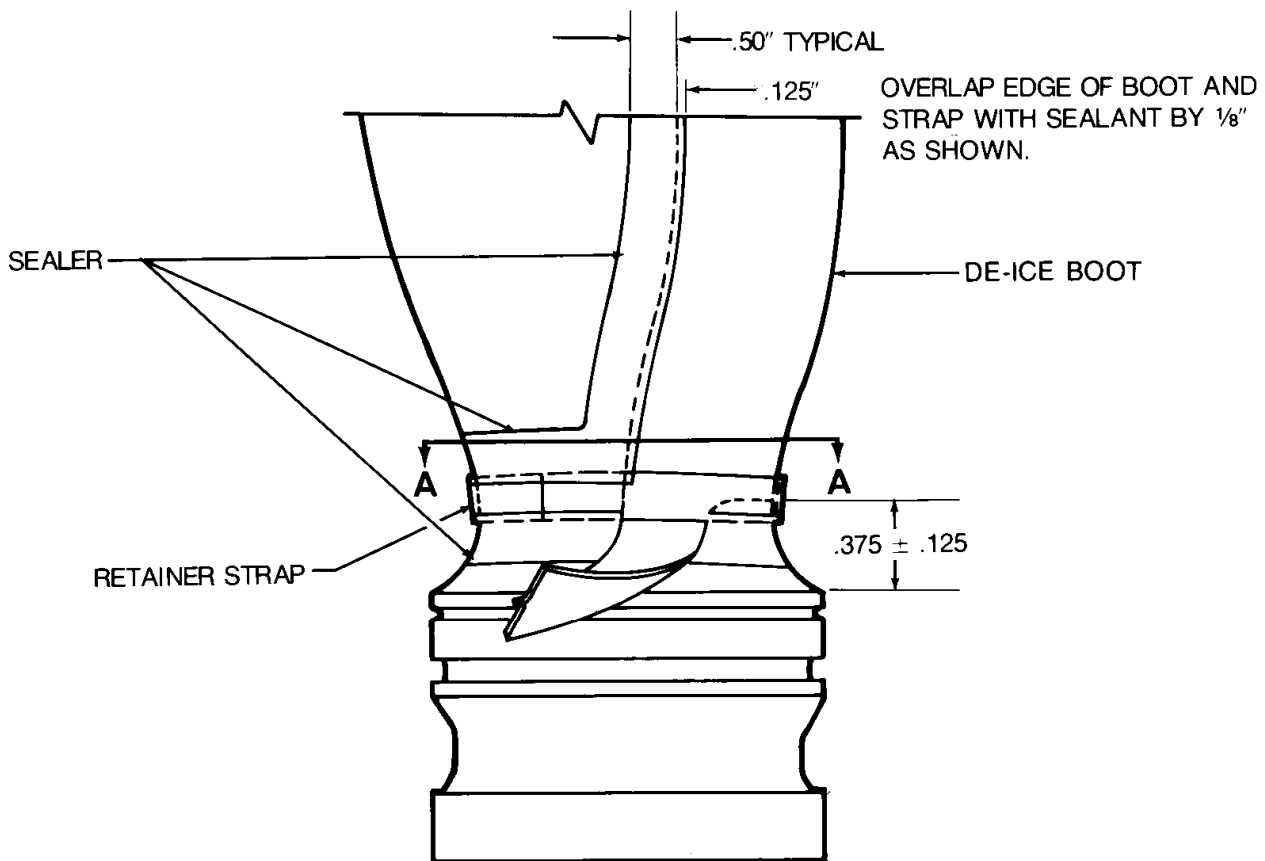


Bonanza Series Maintenance Manual
Propellers - Maintenance Practices



START IN THIS AREA (APPROX. 90° FROM THE DE-ICE BOOT LEAD STRAP) AND WRAP AROUND PROP BLADE SO THAT A DOUBLE THICKNESS WILL COVER THE DE-ICE BOOT LEAD STAP. TRIM RETAINER STRAP SO THAT IT WILL END APPROX. AS SHOWN.

A—A



SEALER

.50" TYPICAL

.125"

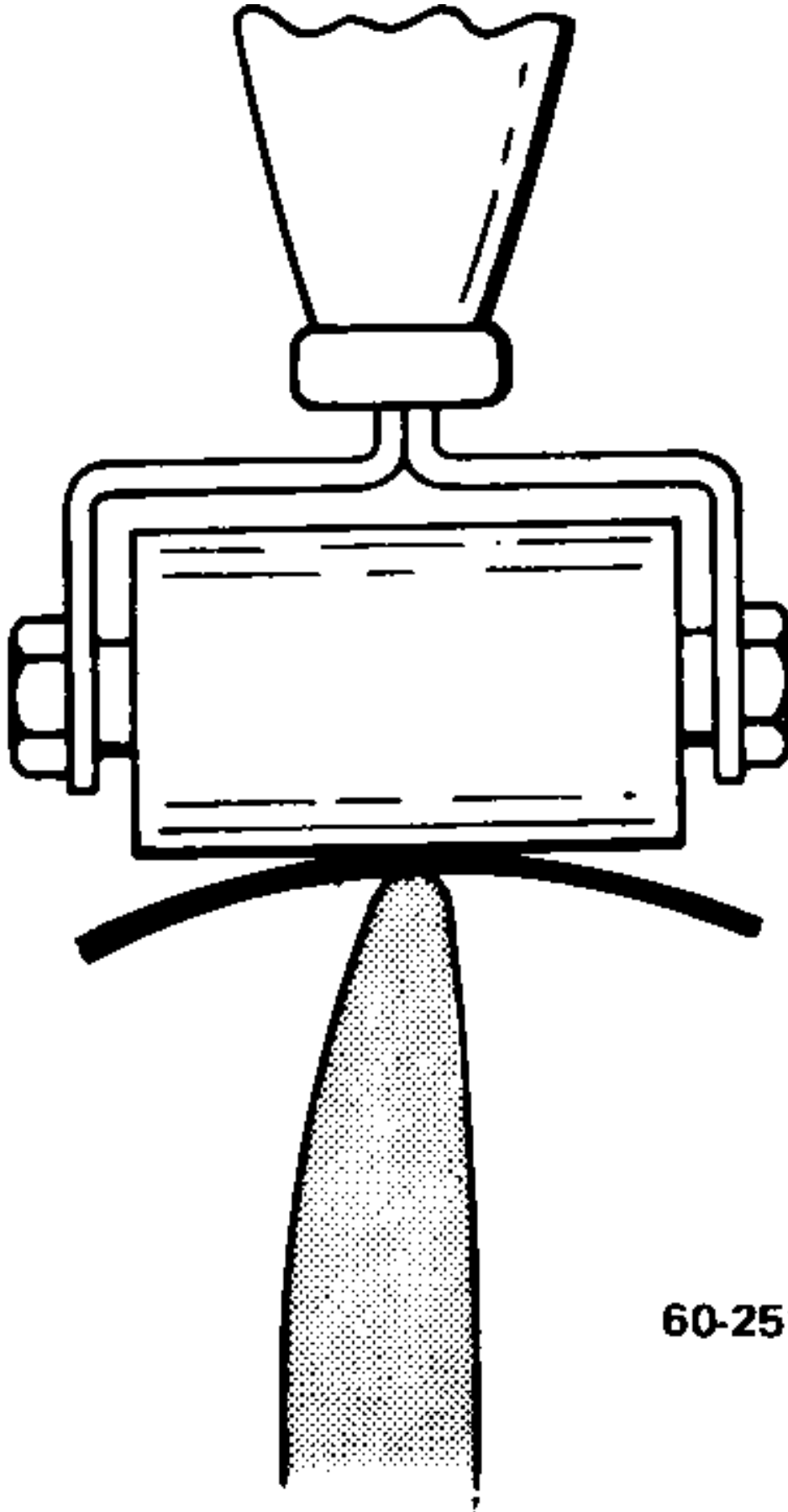
OVERLAP EDGE OF BOOT AND STRAP WITH SEALANT BY 1/8" AS SHOWN.

DE-ICE BOOT

RETAINER STRAP

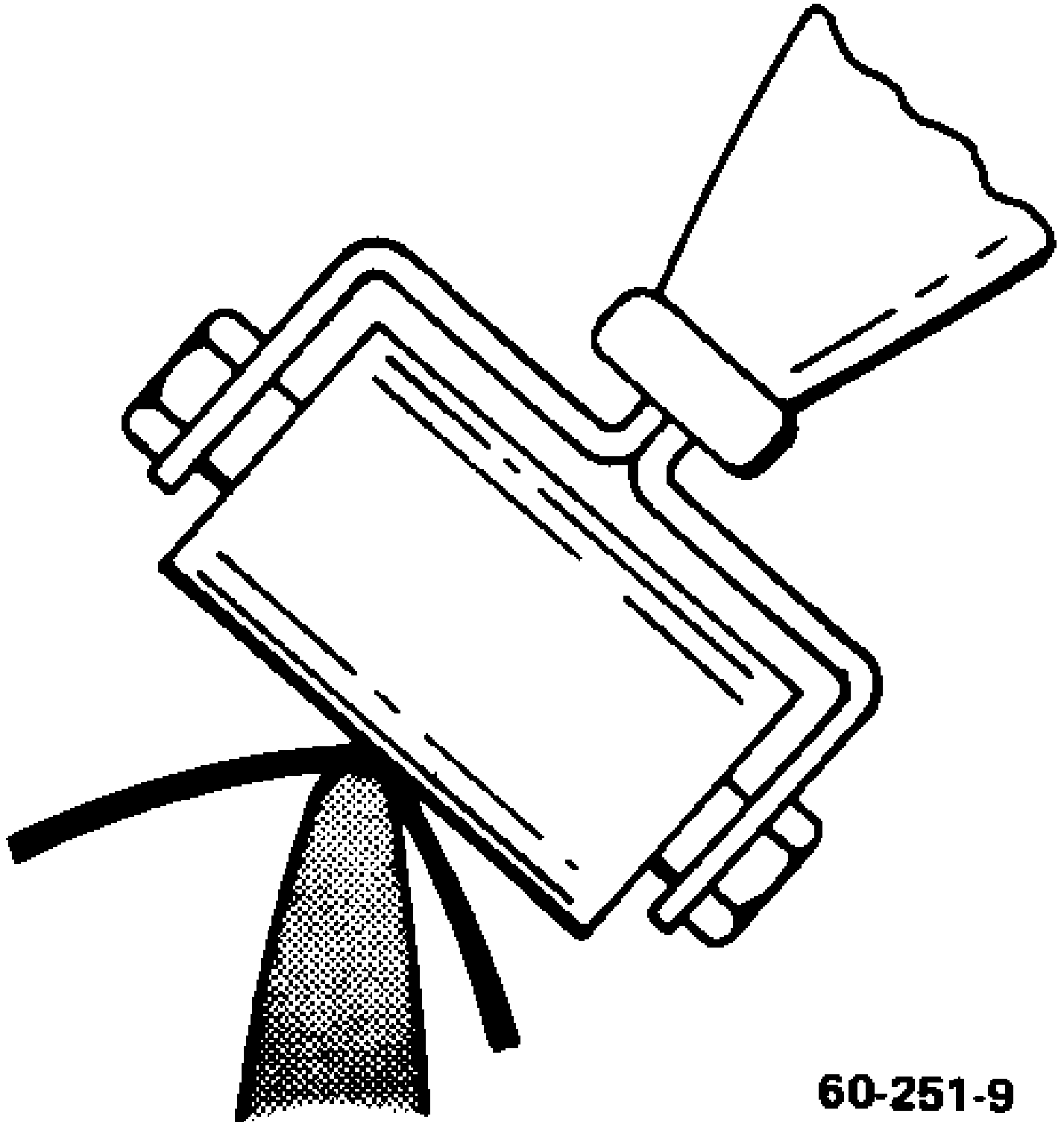
.375 ± .125

Bonanza Series Maintenance Manual
Propellers - Maintenance Practices

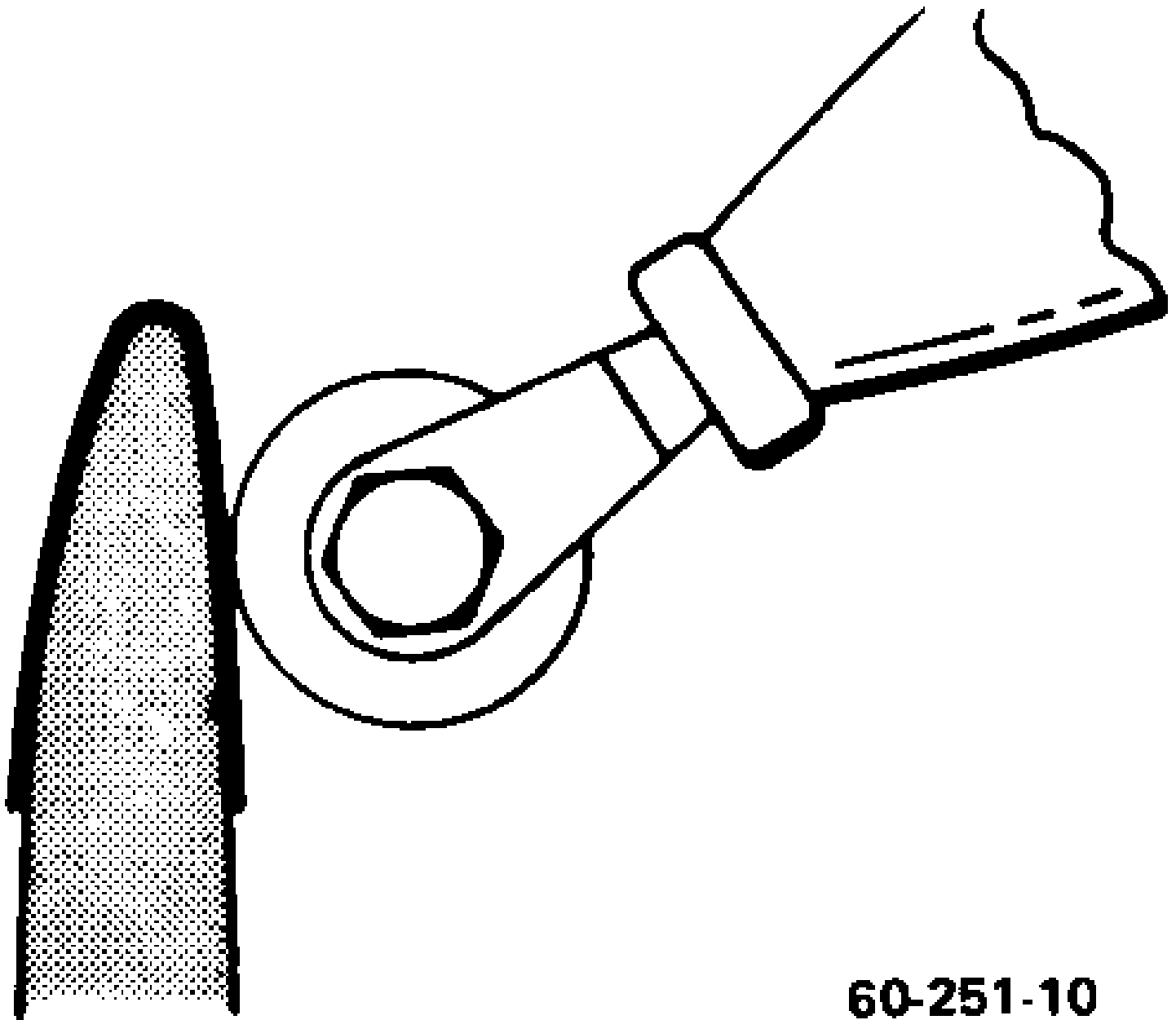


60-251-8

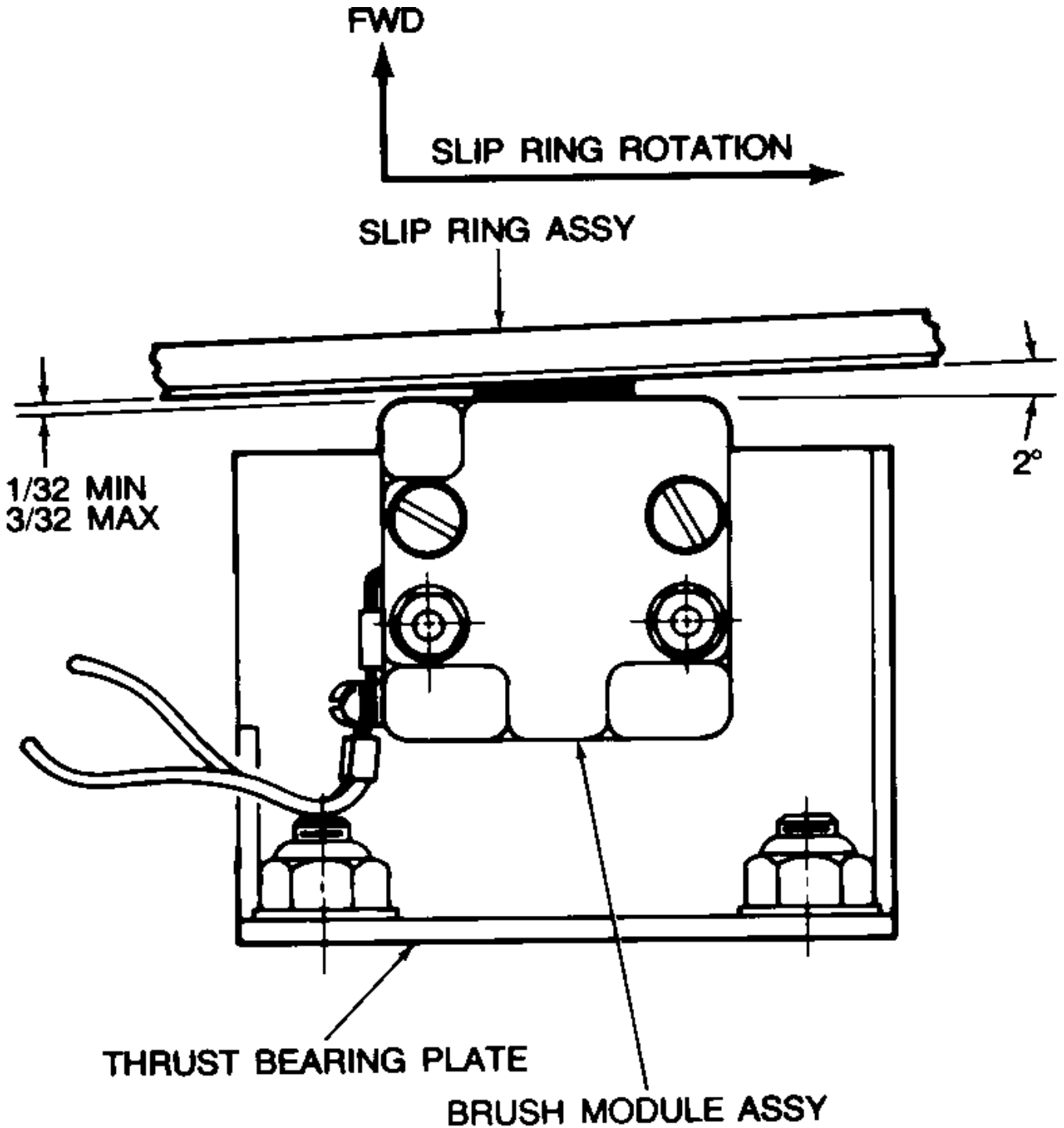
Fig 202 - Center Rolling



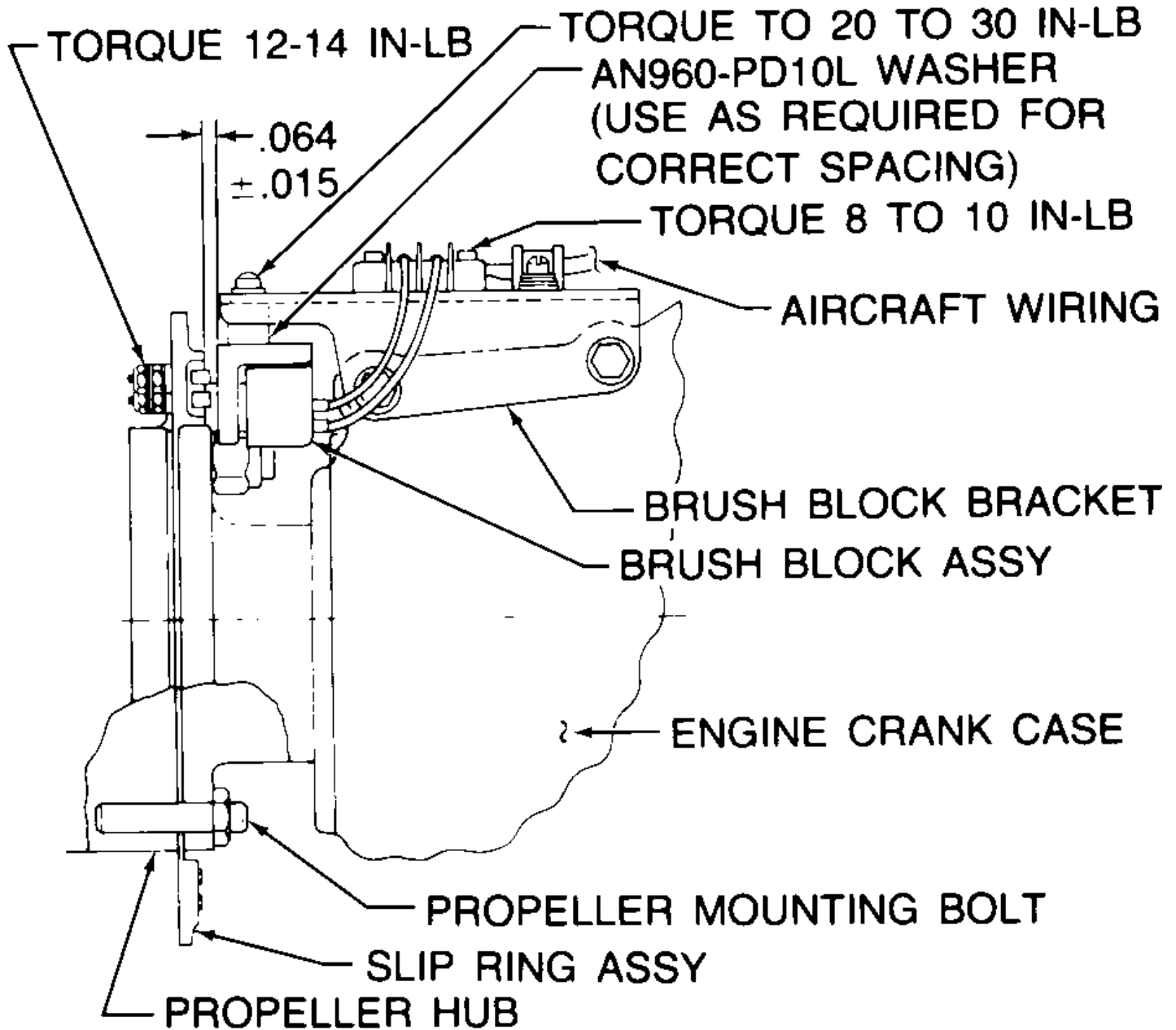
60-251-9



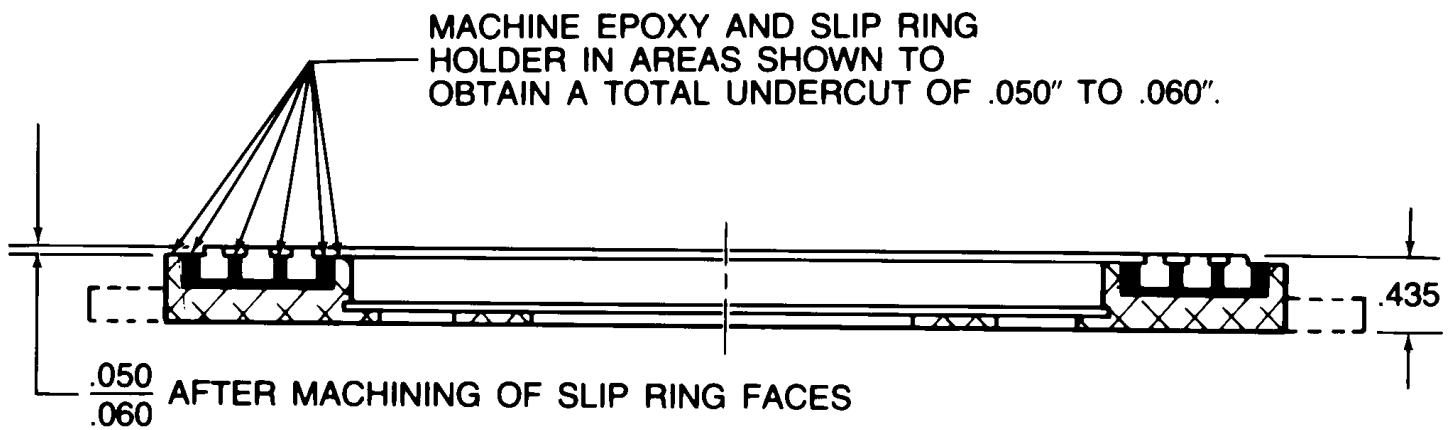
60-251-10



36-240-6



36-251-5



CAUTION

WHEN UNDERCUTTING INSULATION BETWEEN RINGS, DO NOT CUT INSIDE AND OUTSIDE DIAMETERS OF SLIP RINGS MORE THAN .003" PAST THE ORIGINAL UNDERCUT DIAMETERS.

36-251-7

Current as of Jul 1/09

ICE AND RAIN PROTECTION PROPELLERS MAINTENANCE PRACTICES

1. PROPELLERS - MAINTENANCE PRACTICES

A. Propeller Deicer Boot Removal

- (1) Remove the propeller spinner.
- (2) Disconnect the deicer boot leads from the spinner bulkhead and slip ring.
- (3) Remove the clip securing the lead strap to the spinner bulkhead and the clamp securing it to the propeller hub.

Caution: Place the blade so the solvent will run away from the hub. The solvent may damage the propeller seals.

Note: If the lead strap is retained by a strap rather than a clamp, remove the boot lead strap retaining strap as follows:

- (a) Using solvent (31 or 19, Table 1, 91-00-00) to soften the adhesive of the strap, loosen one corner of the strap sufficiently to grasp it with pliers or similar tool.
 - (b) Apply a slow steady pull to the strap while using the solvent to soften the adhesive.
- (4) If applicable, remove the boot lead strap retaining strap, using methyl ethyl ketone or toluol (31 or 19, Table 1, 91-00-00) to soften the adhesive of the strap, loosen one corner of the strap sufficiently to grasp it with pliers or similar tool.

Caution: Unless the boot being removed is to be scrapped, cushion the jaws of any pulling tool to prevent damaging the boot surface.

- (5) Apply a slow, steady pull to the strap while using the solvent to soften the adhesive.
- (6) Using solvent (31 or 19, Table 1, 91-00-00) to soften the adhesion line between the boot and the blade, loosen one corner of the boot sufficiently to grasp it with vise grip pliers or a similar tool.
- (7) Apply a slow, steady pull on the boot to pull it off the propeller surface while continuing to use the solvent to soften the adhesive.
- (8) Remove the remaining adhesive from the boot and propeller blade with solvent (19 or 31, Table 1, 91-00-00).

B. Propeller Deicer Boot Installation

Note: If a new propeller is installed, the drying time of the adhesive (52, Table 1, 91-00-00) must be extended per B.F. Goodrich Service Bulletin No. E-75-51.

- (1) On B.F. Goodrich installations position the deicer boot on the propeller blade so that its center line at the inboard end is adjacent to the split in the propeller blade clamp and 1 inch outboard of the clamp, and the center line at the outboard end falls on the blade leading edge. Be sure the lead strap is in the proper position to be clamped to the blade retaining clamp.

Note: On McCauley installations, place the center line of the deicer boot on the leading edge of the propeller. For other McCauley installation dimensions refer to Figure 201, Sheet 1.

Bonanza Series Maintenance Manual
Propellers - Maintenance Practices

- (2) Mask off an area approximately 1/2 inch from the outer end and each side of the boot (Ref. [Figure 201, Sheet 2](#)).

Note: On installations using rubber lead straps mask off an area approximately 1/2 inch from the area which will be occupied by the lead strap retainer strap (around the blade shank).

- (3) Remove the deicer boot and clean the blade in the masked area from the retaining clamp outboard. Clean the area thoroughly with solvent ([31 or 19, Table 1, 91-00-00](#)). For final cleaning, wipe the solvent off quickly with a clean, dry, lint free cloth to avoid leaving a film.

Caution: If the blade is painted with lacquer remove all paint within the masked off area. If the blade is painted with polyurethane, slightly sand within the masked off area, using 400 grit sandpaper.

The metal and rubber parts must be thoroughly clean to assure maximum adhesion.

- (4) Moisten a clean cloth with solvent ([31 or 19, Table 1, 91-00-00](#)) and clean the unglazed surface of the deicer boot and both sides of the rubber retainer strap if applicable, changing the cloth frequently to avoid contamination of the clean area.
- (5) Thoroughly mix the adhesive ([52, Table 1, 91-00-00](#)) and apply one even brush coat to the propeller blade and to the unglazed back side of the boot. Allow the cement to dry for at least one hour at 40° F or above when the relative humidity is less than 75%, or two hours if the humidity is between 75% and 90%. Do not apply the cement if the relative humidity is higher than 90% or the temperature is below 50° F.
- (6) After allowing sufficient drying time, apply a second brush coat of cement to the propeller and to the unglazed surface of the deicer boot. Apply cement to the lead strap as necessary to cement the strap to the propeller, up to the hub. Allow the cement to dry.

Note: When solvent ([31, Table 1, 91-00-00](#)) is used to soften the cement it provides approximately 10 seconds time for deicer application, while solvent ([19, Table 1, 91-00-00](#)) will provide approximately 40 seconds working time.

- (7) Position the deicer boot on the propeller, starting one inch from the blade retaining clamp, making sure the lead strap is in position to clamp to the blade retaining clamp. Moisten the cement lightly with solvent ([31 or 19, Table 1, 91-00-00](#)) and tack the boot center line to the blade leading edge. If the center line of the boot deviates from the blade leading edge, pull up with a quick motion and replace properly. Roll firmly along the center line with a rubber roller (Ref. [Figure 202](#)).

Caution: Never use a metal or wooden roller for this purpose, for they would damage the heating elements in the deicer boot.

- (8) Gradually tilting the roller, work the boot carefully over each side of the blade contour. Avoid trapping air pockets under the boot (Ref. [Figure 203](#)).
- (9) Roll outwardly from the center line to the edges of the boot (Ref. [Figure 204](#)). If excess material at the edges tends to form puckers, work them out smoothly and carefully with the fingers.
- (10) Roll the tapered edges of the boot with a narrow steel stitch roller.
- (11) Clean the blade with a clean cloth moistened with solvent ([19 or 31, Table 1, 91-00-00](#)). Be careful not to let the solvent run into the edge of the boot.
- (12) Apply one even brush coat of sealer around the edges of the boot, allowing 1/16 to 1/8 inch overlap on the boot but extending to the masking tape. Use BFG 82-076-1 and -2 on B.F. Goodrich installations and Sunbrite 78-U-1003 enamel and U-1001-C catalyst on McCauley installations. Remove the masking tape after applying the cement to obtain a neat border.
- (13) Install the clamp securing the lead strap to the propeller blade retaining clamps.

Bonanza Series Maintenance Manual
Propellers - Maintenance Practices

Note: The rubber retainer strap should wrap around the blade shank over the inboard 1/4 inch of the deice boot on B.F. Goodrich or 1/2 inch on McCauley installations.

- (14) Connect the lead terminals and install the clip on the spinner bulkhead. There must be no slack between the terminal and the clip to assure enough slack between the clip and the clamp on the blade to allow full proper travel.

Caution: After deicer boot installation allow at least 12 hours for the adhesive (52, Table 1, 91-00-00) to dry before starting the engine, and 12 hours more before energizing the deicers.

C. Brush Module Replacement (B. F. Goodrich)

The modular brush assembly is made up of two modules, each consisting of a plastic housing with an integral brush and spring. These modular units are stacked with a spacer held together by screws to produce the modular brush assembly.

When a brush wears to where only 3/8 inch of brush material remains, the module containing the brush should be replaced. 1/4 inch of brush remains, the brush module MUST be replaced.

Note: During measurement only 1/16 inch of brush should protrude from the brush module, this being the normal protrusion when the brush is installed on the airplane.

Brush wear is determined by inserting a pin into a hole in the back of the brush module. On all modules having brushes with rods, the brush module should be replaced when the pin can be inserted 15/64 inch and MUST be replaced when the pin can be inserted 19/64 inch. On the rodless brushes, the module should be replaced when the pin can be inserted 1-5/64 inches and MUST be replaced when the pin can be inserted 1-9/64 inches. To replace the brushes, proceed as follows:

- (1) Disconnect the wire harness terminals at the terminal of the modular units that make up the brush block assembly.
- (2) Remove the screws, nuts and washers securing the modular brush assembly to its mounting bracket.
- (3) Remove the assembly retaining screws and separate the modules and spacer.
- (4) Replace each module with another of the same part number. The part number is etched into the surface of the plastic housing.
- (5) Restack the modules and spacers as necessary. If there is interference between adjacent ring terminals, reposition one module with the terminal on the opposite side of the brush module assembly.
- (6) Install the assembly screws so that the screwhead fits in the recess in the spacer, place the flat washer between the star washer and modular housing and install the retaining nut. Make sure the assembly is square before tightening the assembly screws in place.
- (7) Place the modular brush assembly on the mounting bracket and insert the mounting screws through both the block and bracket. One washer fits under the head of the screw and one under the retaining nut.
- (8) Before installing the retainer nuts, make sure that the brushes are aligned with the slip rings such that the entire brush face contacts the copper ring. If the brushes do not align with the slip rings throughout the entire 360 degrees of slip ring rotation, install shims (P/N 1E1157) between the brush module spacer and the mounting bracket until the brushes are properly aligned with the approximate center of the slip ring.
- (9) Install the retaining washers and nuts, making certain that $1/16 \pm 1/32$ inch is maintained between the brush modules and the slip ring surface. To prevent damage to the brushes, the modular brush assembly should be angled so that the brushes contact the slip rings at an angle of approximately two degrees from the perpendicular, as measured toward the direction of slip ring rotation (Ref. Figure 205).
- (10) Reconnect the "B" and "C" terminals of the airplane system wire harness to the same designated terminals of

the modular brush assembly. Ensure that the adjacent ring terminals are not touching.

D. Deicer Timer Check

Experience in the field has indicated that often the timer is considered defective when the source of the trouble lies elsewhere. For this reason, the following test should be performed before the timer is removed as defective:

- (1) With the wiring harness disconnected at the timer and the deicer switch to the ON position, check the voltage from pin B of the harness plug to ground. If no voltage is present, the timer is NOT at fault; however, if system voltage is present at pin B, check the circuit from harness plug pin G to ground with an ohmmeter. If no circuit is indicated, the fault is in the ground lead rather than in the timer. If ground connection is open, the timer step switch will not change position.
- (2) After the ground and power circuits have been checked, connect a jumper wire from pin B of the timer receptacle to terminal B of the connector plug and from pin G of the timer receptacle to ground. With the deicing switch ON, check the voltage to ground from pin B of the timer. The voltmeter should indicate bus voltage. Next check the DC voltage to ground from pin C or pin D on serials D-10404 and after, CE-1024 and after, E-2069 and after, and EA-378 and after; it should indicate bus voltage for 90 seconds, zero volts for 90 seconds, bus voltage for 90 seconds, etc.

E. Heat Test

Before this test can be performed, the jumper wire installed for the timer test must be removed so that the connector plug can be replaced in the timer receptacle. Two men are required to perform this test: one in the cockpit to monitor the ammeter; the other outside by the prop to check the deicer boots. The man in the cockpit turns the deicer system ON while the man outside feels the deicer boots to see if they are heating properly. The man in the cabin observes the ammeter for the proper readings (2 bladed: 8 - 12 amps, 3 bladed: 14 - 80 amps) throughout the timing sequence. The ammeter needle should deflect every 90 seconds in response to the switching action of the timer. Each time this occurs, the man in the cockpit must notify the man inspecting the propeller deicer boots so that the latter can check the proper heating sequence of the propeller deicer boots (the entire boot will either heat or cool, depending on the timer sequence). If any irregularities are detected, a continuity check should be performed on the wiring from the timer to the brush module holder and the propeller deicer terminal connections.

Caution: *While following the instructions of the HEAT TEST, move the propeller back and forth to prevent arcing between the brushes and slip ring.*

Warning: *Before moving the propeller, make certain that the ignition switch is off and that the engine has cooled completely. There is always some danger of a cylinder firing when the propeller is moved.*

F. Brush Module Resistance Check (B. F. Goodrich)

To check for a short circuit, or high resistance in the brush module, measure the resistance from the face of the brush to its terminal studs or receptacle pin with a low range ohmmeter. If this resistance measures over 0.013 ohm, locate and repair the cause of excessive resistance. If the resistance measures zero, locate and correct the open circuit or replace the module. Check the resistance between the terminal studs or receptacle pins. This resistance should not be less than 0.5 meg-ohm.

G. Slip Ring Alignment (B. F. Goodrich)

The slip rings are properly aligned when they run in a true plane relative to the brush module. This condition may be checked by attaching a dial indicator gage to the front of the engine crankshaft housing in such a manner that a reading of the slip ring wobble may be obtained. To avoid error in readings, rotate the slip rings slowly while pushing in on the propeller to take the play out of the thrust bearings. If the total run out over 360 degrees of rotation exceeds 0.005 inch, or 0.002 inch for any 4 inch arc, the slip rings should be aligned as follows:

- (1) Approximately a 0.012 inch adjustment may be made to correct the slip ring wobble by varying the torque on

Bonanza Series Maintenance Manual
Propellers - Maintenance Practices

the attachment bolts. Using the dial indicator to follow the points of maximum deviation, adjust the slip ring assembly to the prescribed run out limits by varying the torque of the mounting bolts as required within a range of 40 to 100 inch-pounds.

- (2) If more than 0.012 inch of adjustment is required for alignment, the slip ring assembly may be shimmed to within the prescribed limits for true running by the addition of AN960C416L washers on the mounting bolts between the slip ring assembly and the spinner bulkhead. If necessary, fabricate thinner shims to the AN960 size. Again the torque may be varied as in step (1).

Note: The above adjustments may affect the clearance between the brush module and slip rings; consequently, after slip ring alignment, a check should be made to ascertain that a distance of from 1/32 to 3/32 inch is maintained between the brush module and slip ring surface (Ref. Figure 205).

H. Slip Ring Machining (B. F. Goodrich)

Slip rings which have roughened or damaged surfaces, but which are structurally sound, can be machined and restored to serviceability. Remove the slip ring assembly from the airplane and mount it in a lathe. Position it concentrically in the lathe, with not over 0.002 inch wobble or run out over 360 degrees rotation. Take light cuts for a smooth finish and cut no deeper than required to remove surface damage. The contact surfaces of the slip rings must be parallel within 0.005 inch and flat within 0.005 inch overall. Deviation from flat is not to exceed 0.002 inch over a 4 inch arc. If necessary, undercut the insulation between the slip rings to a depth of 0.020 to 0.030 inch below the contact surface of the slip rings. In this operation, width of the slip ring MUST NOT be reduced more than 0.005 inch. Contact surfaces of the slip rings must have a finish of 29 - 35 microinches. Deburr the slip ring edges and reinstall in the airplane and align.

Note: If in machining, the solder or braze connection on the underside of the slip ring is exposed, replacement of the slip ring assembly will be necessary.

I. Brush Wear Limits (McCauley)

The brushes may be checked for wear by one of the following methods.

(1) On the Airplane

- (a) Insert a thin stiff feeler gage into the slot on the side of the brush block (Ref. Figure 206).
- (b) If it goes past the back of the brushes, the brushes need replacing.

(2) Removed from the Airplane

- (a) Insert a thin stiff feeler gage into the slot on the side of the brush block past the back of the brushes (Ref. Figure 206).
- (b) Gently push the brushes into the brush block.
- (c) If any brush has 0.094 inch brush or less remaining outside the brush block, that brush assembly needs replacing.

J. Brush Replacement (McCauley)

- (1) Remove the brush block from the engine as indicated in BRUSH BLOCK REMOVAL.
- (2) Remove the two screws in the back of the brush block (Ref. Figure 206).
- (3) Pull the brush holder and brushes from the brush block. Discard the brush holder and brushes.
- (4) Replace the brushes and brush holder by first sliding the brushes into the slots of the brush block, then sliding the brush holder into place.

Bonanza Series Maintenance Manual
Propellers - Maintenance Practices

- (5) Install the two screws which hold the holders in place. Torque the screws to 20 to 24 inch-pounds.
- (6) Push the brushes back into the brush block to ensure that they spring back freely.
- (7) If the brushes bind, loosen the screws and reposition the brush holders so the brushes ride freely in the slots. Torque the screws to 20 to 24 inch-pounds.
- (8) Install the brush block as indicated in [BRUSH BLOCK INSTALLATION](#).

K. Brush Block Removal (McCauley)

- (1) Disconnect the lead wires from the terminal strip.
- (2) Disconnect the brush block mounting screws and remove the brush block from the engine.

L. Brush Block Installation (McCauley)

- (1) Install the brush block on the engine with the two screws, but do not tighten the screws.
- (2) Add or remove shims (Ref. [Figure 207](#)) to the brush block mounting screws until each entire brush is in contact with its slip ring through 360° of rotation.
- (3) Position the brush block on the mounting bracket so that the distance between the brush block and the face of the slip rings is 0.064 ± 0.015 inch.
- (4) Tighten the screws.

M. Slip Ring (McCauley)

On these slip rings the mounting bolts cannot be retorqued or shims added to correct wobble or non concentric rotation. Wear or slight wobble may be removed by machining.

Note: Friction from the brushes will cause a concave wear pattern on the slip rings. This does not necessitate replacement or machining unless rapid brush wear is encountered. When a new brush assembly is installed on slip rings with normal wear, the brushes will rapidly seat without degradation of operation or service life.

(1) Slip Ring Alignment (McCauley)

If a chattering or screeching noise is heard coming from the brush block/slip ring area, the probable cause is improper brush block-to-slip ring alignment. A chattering or screeching detected while turning the propeller (in the normal direction of rotation) by hand should be corrected immediately. If the chattering or screeching is heard above idling engine noise; the problem is severe. Repositioning the brush block (Ref. [Figure 206](#)) should correct the problem.

(2) Slip Ring or Brush Block Cleaning (McCauley)

The slip rings and brush block may be cleaned with a clean cloth dampened with methyl ethyl ketone.

(3) Slip Ring Machining (McCauley)

Structurally sound slip rings with damaged surfaces may be machined to restore serviceability.

- (a) Clean the slip ring assembly with methyl ethyl ketone before machining.
- (b) Check the assembly mounting surface flatness. It must be flat within 0.005 inch overall.
- (c) Locate the assembly concentrically in a lathe so that there is no more than 0.002 inch wobble or run out over 360° of rotation. The assembly should be fixed in the lathe in the same manner as it was attached to

Bonanza Series Maintenance Manual
Propellers - Maintenance Practices

the propeller assembly. This will ensure that run out held while machining the assembly will be transferred when it is mounted on the propeller.

(d) Take a light cut for a smooth finish (25 to 20 microinches).

Note: The spindle speed should be 500 rpm or greater. If machine vibration is noticed, it must be corrected. Machine vibration which is not corrected will result in a chattered finish. Feed rate is to be 0.002 inch or less with a final pass of 0.005 inch to 0.010 inch.

(e) Ensure that the face surface of the slip rings are parallel and flat within 0.008 inch overall.

(f) The slip ring holder face and insulation around and between the slip rings must be undercut to 0.050 inch to 0.060 inch (Ref. [Figure 208](#)).

Caution: When undercutting the insulation between the slip rings, do not cut the inside diameters or the outside diameters of the slip rings more than 0.003 inch past the original diameters.

(g) Deburr the slip ring edges.

(h) Polish the ring faces with crocus cloth to obtain a finish of 16 to 22 microinches.

(i) Check the electrical resistance between each ring and the holder and between each ring. The resistance should be a minimum of 50K ohms.