

PROPELLER ANTI-ICE - MAINTENANCE PRACTICES

1. General

- A. Propeller anti-ice maintenance practices consist of propeller anti-ice boot removal/installation and electrical components removal/installation.

2. Propeller Anti-Ice Boots (Hartzell) Removal/Installation

- A. Remove Propeller Anti-Ice Boots (Refer to Figure 201).

WARNING: Cement and solvent vapors are toxic and extremely flammable. Use only in a well ventilated area away from sparks and vapors. Excess exposure could cause injury or death. If dizziness or nausea occur, obtain fresh air immediately. Avoid contact with skin or eyes. Use solvent-resistant gloves to minimize skin exposure. Use safety glasses to minimize chance of eye contact. If eye contact occurs, flush eyes with water for 15 minutes and see a physician. If skin contact occurs wash thoroughly with soap and water. If swallowed, do not induce vomiting. See a physician immediately.

- (1) Ensure that airplane electrical power is off.
- (2) Remove all large tie straps (5) securing electrical leads to propeller and hub.
- (3) Remove small tie strap (2) securing the two pin housing (6) and disconnect two pin housing (6) on the anti-ice boot leads.
- (4) To remove or loosen installed anti-ice boots, use Toluol to soften the cement line. Apply a minimum amount of this solvent to the cement line as tension is applied to peel back the boot. The removal should be slow enough to allow the solvent to undercut the cement so that parts will not be damaged.

- B. Install Propeller Anti-Ice Boots (Refer to Figure 201).

- (1) Clean propeller surface to be bonded methyl n-propyl ketone. For final cleaning, wipe solvent film off quickly with a clear, dry cloth before it has time to dry.
- (2) Draw a line on centerline of leading edge of propeller blade.
- (3) Position boot on propeller so bottom of boot is 1.0 inch, +0.031 or -0.031 inch from propeller hub.
- (4) Position boot centerline (boot centerline is indicated by embossed marks 3/8 inch long at each end of the boot on the breeze surface) over propeller leading edge centerline. These marks may be transferred to the boot side using a silver pencil.
- (5) Slide inboard end of boot centerline 0.25 inch toward forward side of prop and mark this dimension.
- (6) Slide outboard end of boot centerline 0.25 inch toward forward side of prop and mark this dimension.
- (7) Draw a line between two marks established in steps 5 and 6. This is the line to be used to center boot on the propeller leading edge centerline.
- (8) Mask off an area 1/2 from each side and outer end of boot and remove boot.
- (9) Mix EC-1300L cement (Minnesota Mining & Mfg. Co.) thoroughly. Surfaces shall be above 60°F prior to applying cement. During periods of high humidity, care shall be taken to prevent moisture condensation due to cooling effect of evaporating solvent. This can be done by warming the area with a heat gun or heat lamp. Apply one even brush coat of EC-1300L cement to cleaned composite surface. Allow to air dry for a minimum of one hour, then apply a second even brush coat of EC-1300L cement.
- (10) Moisten a clean cloth with methyl n-propyl ketone and clean bond surface of boot, changing cloths frequently to avoid contamination of cleaned area.
- (11) Apply one even coat of EC-1300L cement to bond surface of boot. It is not necessary to cement more than half of boot strap.
- (12) Using a silver colored pencil, mark a centerline along leading edge of propeller blade and a corresponding centerline on cemented bond surface of boot.
- (13) Reactivate surface of cement using a clean, lint-free cloth, heavily moistened with Toluol. Avoid excessive rubbing of cement, which would remove cement.
- (14) Position boot centerline on line established in step 7, starting at hub end at the position marked. Tack boot centerline to line established in step 7. If boot is allowed to get off center, pull up with a quick motion and replace properly. Roll firmly along centerline with a rubber roller.

- (15) Gradually tilting roller, work boot carefully over either side of blade contour to avoid trapping air in pockets.
- (16) Roll outwardly from centerline to edges. If excess material at edges tends to form wrinkles, work them out smoothly and carefully with fingers.
- (17) Apply one even coat of EC-539 (Minnesota Mining & Mfg. Co.), mixed per manufacturers instructions, around edges of installed boot.
- (18) Remove masking tape from propeller and clean surface of propeller by wiping with a clean cloth dampened with Toluol.
- (19) Test anti-ice boots for continuity by using an ohmmeter. Connect leads from ohmmeter to anti- ice boot wire connector (6) terminal. There should be a reading between 2.5 and 3.5 ohms.
- (20) Install electrical connectors, wire harness leads, and tie-straps in the following order.
 - (a) Connect anti-ice boot wire connector (6) to slip ring wire connector (3).
 - (b) Install small tie- strap (2) between leads and around assembled connector. (Do not tighten).
 - (c) Install large tie-straps (5) through small tie-strap (2) securing connector and around prop blade clamp. (Do not tighten).
 - (d) Route slip ring wire leads under upper tie-strap (5).
 - (e) Install second small tie- strap (4) securing slip ring wire leads to upper large tie-strap (5).
 - (f) Position connector assembly on hub to eliminate slack in anti-ice boot leads.
 - (g) Install tie-strap (1) around prop blade over anti-ice boot leads.
 - (h) Tighten all tie-straps.

3. Propeller Anti-Ice Boots (McCauley) Removal/Installation

A. Remove Propeller Anti-ice Boots (Refer to Figure 201).

CAUTION: Cushion the jaws of any pulling tool (vise grips, pliers, etc.) to prevent damage to the boot, unless the boot is to be scrapped.

- (1) If boot is to be scrapped, strip from blade without solvent.
- (2) Cut sta-straps (42) and disconnect electrical lead (46).

CAUTION: When removing boots from a complete propeller assembly, care must be taken to prevent solvent from leaking into the propeller hub and causing damage to the seals. The blade being worked on should be pointed down so all excess solvent will run to the outboard tip of the blade. As an extra precautionary measure, the hub and blade area should be masked. Do not use any sharp objects which might scratch the blade when removing the boot.

- (3) Using methyl n-propyl ketone or toluol to soften adhesion line between the anti-ice boot and propeller blade, start at one corner, loosen enough of the boot to grasp with vise grips, pliers, or similar tool.
- (4) Apply a steady pull to remove boot; pull the boot from the blade slowly and carefully while continuing to use a liberal amount of methyl n-propyl ketone or toluol to soften the adhesion line.
- (5) Remove all residual cement from blade. Use solvents with caution as mentioned above.
- (6) Visually inspect propeller blade for damage or deterioration. Check for corrosion, cracks, dents or nicks. If defects are found propeller must be repaired by an authorized propeller repair station.

B. Install Propeller Anti-ice Boots (Refer to Figure 201).

- (1) Outline area to be masked using a red pencil according to dimensions shown in Figure 204. A template or the anti-ice boot may be used. Electrical leads must be aligned with terminal bracket.
- (2) Once the anti-ice boot is positioned, mark an area 1/2 inch outside the boot perimeter. Using masking tape, mask around the outline.
- (3) Clean entire masked area thoroughly with methyl n-propyl ketone or acetone. For final cleaning, quickly wipe off solvent with a clean, dry, lint-free cloth to avoid leaving a film.
- (4) Apply a second layer of masking tape to cover an additional 1/8 inch inside of previously masked area.

CAUTION: Cleanliness of metal and rubber parts cannot be overemphasized. Only very clean surfaces will ensure maximum adhesion.

- (5) Moisten a clean cloth with methyl n-propyl ketone or acetone. Clean unglazed (back) surface of the anti-ice boot.

Change the cloth frequently to avoid contamination of the clean area.

NOTE: To prevent curling of the anti-ice boot edges, apply masking tape to the edges on the smooth side before applying cement to the fabric impressed side. Remove tape from the anti-ice boot before starting installation.

- (6) Installation should be made at room temperature (60°F-75°F). Apply one even brush coat of cement to the clean, masked surface of the propeller blade and the fabric impressed side of the anti-ice boot.
- (7) Allow cement to air dry for a minimum of one hour at 40°F or above, when the relative humidity is less than 75%. If humidity is 75% to 90%, additional drying time will be required to cure cement. Do not apply cement if relative humidity is higher than 90%.
- (8) After cement is dry (not tacky), apply a second even, brush coat to the anti-ice boot. Then immediately apply an even brush coat of cement to the clean masked off area of the propeller. Timing is important because the cement on both surfaces must reach the tacky stage at the same time.
- (9) When cement is tacky on both surfaces, locate anti-ice boot electrical leads with terminal bracket installed. Tack the anti-ice boot center line to the leading edge of the blade, starting at the inboard end working toward the tip. If cement dries, use methyl n-propyl ketone or toluol as necessary. If boot is allowed to get off center, pull up with a quick motion and re-apply. If cement is removed from either surface, completely remove the boot and re-apply cement, as in step (6) and (7). Use methyl n-propyl ketone or toluol as necessary to re-install boot.
- (10) When correctly positioned, press firmly with rubber or wooden hand roller along full length of the leading edge to form a tight bond.
- (11) Gradually tilt roller over either side of leading edge contour to avoid trapping air. Roll from leading edge of blade toward the tip. Work all excess boot material out to perimeter before moving to the next section. If excess material at boot edges tends to pucker, use fingers to carefully work puckers smooth.
- (12) Remove masking tape applied in step (4).
- (13) Check the electrical resistance between the boot leads, reading should be between 3.60 maximum, 3.26 minimum.
- (14) Check for intermittent open circuits by tensioning the anti-ice boot leads while measuring resistance. Also press lightly on entire boot heating element surface and in area adjacent to leads. Resistance must not fluctuate.
- (15) Mix two parts of Sunbrite 78-U-1003 brushable black enamel with one part enamel catalyst U-1001-C.

CAUTION: It is imperative that the masking steps as described in steps (3) and (4) be followed. This will ensure the sealer will be applied to both the adhesive and 1/8 inch of bare metal. If the adhesion line and sealer line start at the same point water will be allowed to seep underneath the adhesion line, resulting in an ineffective seal.

- (16) Apply one, even, brush coat of sealer to the area around the boot covering the 1/8 inch of bare metal and adhesive along with a masked off area of 1/8 inch of the anti-ice boot. Remove masking tape as sealer is brushed on, otherwise, seal will pull up along with the tape. Allow sealer to dry.
- (17) Allow 12 hours minimum cure time and 24 hours before actually operating the anti-ice system.

4. Slip Ring Assembly (Hartzell) Removal/Rework/Installation

A. Remove Slip Ring Assembly (Refer to Figure 201).

- (1) Ensure that airplane electrical power is off.
- (2) Remove propeller.
- (3) Tag and remove electrical wires from the three terminal strips (16) on spinner bulkhead.
- (4) Remove and retain buttonhead screws (10), beveled washers (9), washers (8), and nuts (7) securing slip ring (18) to spinner bulkhead.
- (5) Remove slip ring (18) carefully working electrical leads through holes in spinner bulkhead.

B. Rework Slip Ring Assembly (Refer to Figure 202).

NOTE: The slip rings can be reworked down to a minimum height of 0.187 inch. If this dimension is exceeded then slip ring assembly will have to be replaced.

- (1) Check slip rings (2) for surface damage (gouges, pits, etc.). If damage exists, proceed with the following steps.
- (2) Tag and remove wires from slip ring assembly (2).
- (3) Check that flatness of mounting surface is within 0.005 inch overall.

- (4) Locate assembly concentrically in a lathe so that runout does not exceed 0.002 inch in 360- degree rotation.
- (5) Using a light cut for a smooth finish (29-35 micro- inches), cut no deeper than required to remove surface damage.
- (6) Ensure that contact surfaces of slip ring (2) is parallel within 0.005 inches and flat within 0.005 inches overall; deviation is not to exceed 0.002 inches in any four inch interval of slip ring travel.
- (7) Undercut epoxy insulation between and around slip rings 0.020 to 0.030 inches as necessary. Outer edge of slip ring holder must be undercut to same dimension as insulation.
- (8) Deburr slip ring edges.
- (9) Check Insulation resistance between slip rings and to metal holder using a mega-ohmmeter. Applying 500 VDC, resistance must be a minimum of 0.5 megohms after one minute.
- (10) Reconnect wires that were removed in step (2).

C. Install Slip Ring Assembly (Refer to Figure 201).

- (1) Insert slip ring electrical leads through holes in spinner bulkhead and align screw holes.
- (2) Install buttonhead screws (10), beveled washers (9), washers (8), and nuts (7).
- (3) Install propeller.

NOTE: Before proceeding with slip ring installation, the following slip ring alignment must be accomplished.

5. Slip Ring Alignment Check (Hartzell)

A. Check Slip Ring Alignment (Refer to Figure 202).

- (1) Securely attach a dial indicator gage to brush block mounting bracket and place pointer on slip ring surface.
- (2) Rotate propeller slowly by hand checking slip ring (2) surfaces to ensure they deviate no more from a true plane than 0.008 TIR (true indicator reading) and 0.002 in any four inch interval of slip ring travel. Vary torque on screws between 40 and 100 inch-pounds to obtain flatness required.

NOTE: Care must be taken to exert a uniform push or pull on propeller to avoid a considerable error in readings.

- (3) If slip ring (2) runout is within limits specified, no corrective action is required. If runout is not within limits specified, slip ring will have to be replaced.

NOTE: Check alignment of brushes (1) in brush block assembly (3) with slip ring assembly (2).

6. Slip Ring Run-Out Test (McCauley)

A. Test Slip Ring Run-Out (Refer to Figure 202).

NOTE: Removal and installation of slip ring assemblies on McCauley propellers for Pratt and Whitney engine installations are limited to authorized FAA approved propeller repair stations or A & P mechanics that have completed the C703 series propeller assembly/disassembly training offered by McCauley and incorporate McCauley Technical Report 722 as revised.

CAUTION: Excessive slip ring runout will result in severe arcing between slip ring and brushes, and cause rapid brush wear. If allowed to continue, this condition will result in rapid deterioration of slip ring and brush contact surfaces, and lead to eventual failure of propeller de-icing system.

- (1) To check this condition, ensure the slip ring face run-out does not exceed 0.008 inches (total indicator reading).
- (2) Securely attach a dial indicator to the brush block mounting bracket and place pointer on slip ring surface.
- (3) Rotate propeller through 360 degrees of rotation observing the dial indicator for a total indicator reading not to exceed 0.008 inches.
- (4) If the reading exceeds 0.008 inches, slip ring assembly must be removed and remachined.

7. Brush Length Inspection (Hartzell)

A. Inspect Brush Length (Refer to Figure 203).

NOTE: Inspect brushes and clean slip ring in accordance with Inspection Time Limits set forth in Chapter 5.

- (1) Ensure that airplane electrical power is off.
- (2) Remove right nose cap half.

- (3) Remove washers (1) and nuts (2) securing brush block assembly bracket (3) to engine.
- (4) Position brushes (4) so that ends of brushes extend 0.0625 inch from brush block assembly module (5).
- (5) Place marks on a straightened paper clip (6) 0.36 inch from end, and 1.39 inches from end.
- (6) Position paper clip (6) through slot in brush block bracket (3) and into hole in brush block assembly module (5).
NOTE: The brushes (4) may or may not be equipped with rods.
- (7) Observe appropriate mark on paper clip (6), 0.36 inch mark (with rods) or 1.39 inch mark (without rods). If appropriate mark disappears into brush block assembly module (5) brush block assembly module (5) must be replaced.
- (8) Reinstall brush block assembly (5) on engine using washers (1) and nuts (2). Torque 145 to 165 inch- pounds.
- (9) Reinstall right nose cap half.

8. Brush Length Inspection (McCauley)

- A. Inspect Brush Length (Refer to Figure 203).

NOTE: Inspect brushes and clean slip ring in accordance with Inspection Time Limits set forth in Chapter 5.

- (1) Ensure that airplane electrical power is off.
- (2) Remove right nose cap half.
- (3) Remove nuts (2) and washers (3) securing bracket (1) to engine.
- (4) Insert a small diameter feeler gage (5) into the slots provided on the sides of the block holder assembly.
- (5) With the feeler gage inserted, push down on the brush until it bottoms out on the gage (5).
- (6) Measure the distance between the holder and top surface of the brush.
- (7) If brush measures 0.094 inches or less, the brush and brush block assembly (4) should be replaced.
- (8) Reinstall brush block assembly (4) on engine using washers (3) and nuts (2). Torque 145 to 165 inch- pounds.
- (9) Reinstall right nose cap half.

9. Brush Block Removal/Installation (Hartzell)

- A. Remove Brush Block (Refer to Figure 201).

- (1) Ensure that airplane electrical power is off.
- (2) Tag to identify and disconnect electrical wires from brush block (29).
- (3) Remove screws (30), washers (26), and nuts (25) securing brush block (29) to mount (27).
- (4) Remove shim (28) between brush block (29) and mount (27). Remove brush block (29) from airplane.

- B. Install Brush Block (Refer to Figure 201).

NOTE: Before proceeding with brush block installation, ensure that brush block alignment has been accomplished.

- (1) Ensure that airplane electrical power is off.
- (2) Insert shim (28) between brush block (29) and mount (27) then install screws (30), washers (26), and nuts (25).

10. Brush Block Removal/Installation (McCauley)

- A. Remove Brush Block (Refer to Figure 201).

- (1) Ensure that airplane electrical power is off.
- (2) Tag to identify and disconnect electrical leads (54).
- (3) Remove screws (51) washers (52) spacers (60) and shims (59) then remove brush block (58).

- B. Install Brush Block (Refer to Figure 201).

NOTE: Before proceeding with brush block installation, brush block alignment must be accomplished.

- (1) Ensure that airplane electrical power is off.
- (2) Insert screws (51) with washers (52) through bracket (55) then install spacers (60) and shims (59) and screw into brush block (58) but do not tighten.

11. Brush Block Assembly to Slip Ring Alignment (Hartzell)

CAUTION: Ensure that slip ring alignment has been accomplished before attempting to align brushes on slip ring.

- A. Align Brush Block Assembly to Slip Ring Attachment (Refer to Figure 202).

NOTE: Keep brushes retracted in brush block until slip ring and propeller assemblies have been installed. In order to get smooth, efficient and quiet transfer of electric power from brushes to slip ring, brush alignment must be checked and adjusted, to meet the following requirements.

- (1) The clearance between brush block (3) and slip ring (2) must be 0.064 inch, +0.015 or -0.015 inch.
- (2) The brushes are to be lined up with slip ring so that entire face of each brush (1) is in contact with slip ring (2) throughout the full 360 degrees of slip ring rotation.
- (3) The brushes must contact slip ring at an angle of 2 degree from perpendicular to slip ring surface, measured toward the direction of rotation of slip ring.
- (4) Brush projection can be adjusted by loosening hardware attaching the brush block and holding the brushes in desired location while retightening hardware. Slotted holes are provided.
- (5) To center brushes on slip ring, a shim made of a series of laminates is provided and may be peeled for proper alignment. Layers of metal 0.003 inch are used to make up shims which are approximately 0.20 thick overall. Shims may also be fabricated locally.

12. Brush Block Assembly to Slip Ring Alignment (McCauley)

- A. Align Brush Block Assembly to Slip Ring Attachment (Refer to Figure 202).

- (1) Check that brushes are aligned with slip ring. This may be accomplished by adding or removing shims (59).
- (2) Brushes must be lined with slip ring so the entire face of each brush is in contact with the slip ring throughout the full 360 degrees of slip ring rotation.
- (3) This may be accomplished by loosening screws (51) and adjusting in slotted holes in bracket (55).
- (4) At the same time the distance between the face of the brush block assembly and the slip ring must be 0.064 inch, +0.015 or -0.015 inch.
- (5) Torque screws (51) 25 to 30 inch-pounds and safety wire.
- (6) Remove tags and connect electrical leads (54) to terminal block (53).

13. Brush Block/Slip Ring Cleaning

CAUTION: Accumulations of engine oil and carbon dust particles on the slip ring, and brush block can have detrimental effects, and cause accelerated wear.

- A. Cleaning Brush Block and Slip Ring.

- (1) Refer to INTRO - List of Publications, Chapter 30 - Deice for cleaning procedures.

14. Propeller Anti-Ice Timer Removal/Installation

- A. Remove Propeller Anti-Ice Timer (Refer to Figure 201).

- (1) Ensure that airplane electrical power is off.
- (2) Disconnect electrical plug (22) from timer (23).
- (3) Remove two screws (24) securing timer to diagonal brace on aft side of firewall.
- (4) Remove timer from airplane.

- B. Install Propeller Anti-Ice Timer (Refer to Figure 201).

- (1) Ensure that airplane electrical power is off.
- (2) Install timer (23) to nutplates using screws (24).
- (3) Connect electrical plug (22) to timer (23).

15. Propeller Anti-Ice Ammeter Removal/Installation

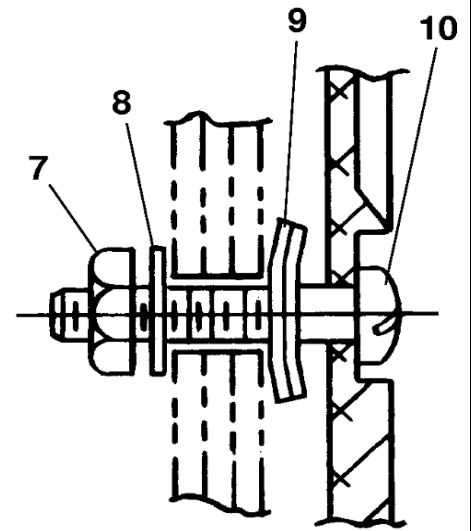
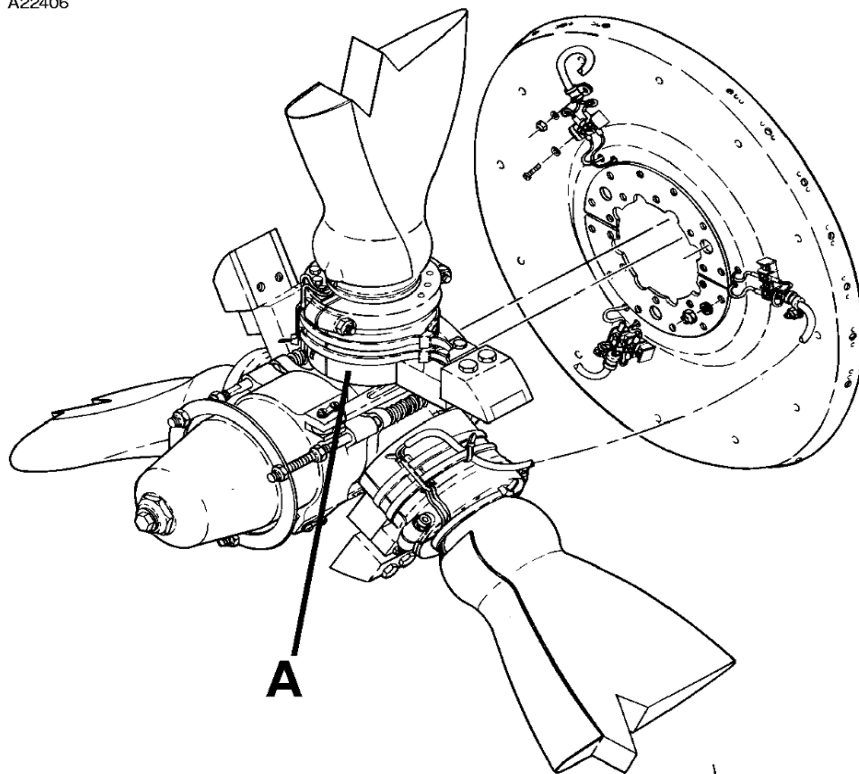
- A. Remove Propeller Anti-Ice Ammeter (Refer to Figure 201).

- (1) Ensure that airplane electrical power is off.
- (2) Unscrew bezel (34) and remove along with O-ring (33).
- (3) Remove body (31) forward out of instrument panel.
- (4) To remove propeller anti- ice ammeter from airplane, unsolder wires from solder lugs on ammeter.

- B. Install Propeller Anti-Ice Ammeter (Refer to Figure 201).
- (1) Solder wires to solder lugs of propeller anti-ice ammeter (31).
 - (2) Insert ammeter body (31) through hole in instrument panel from forward side.
 - (3) Install O-ring (33) and screw bezel (34) onto threads of body (31).

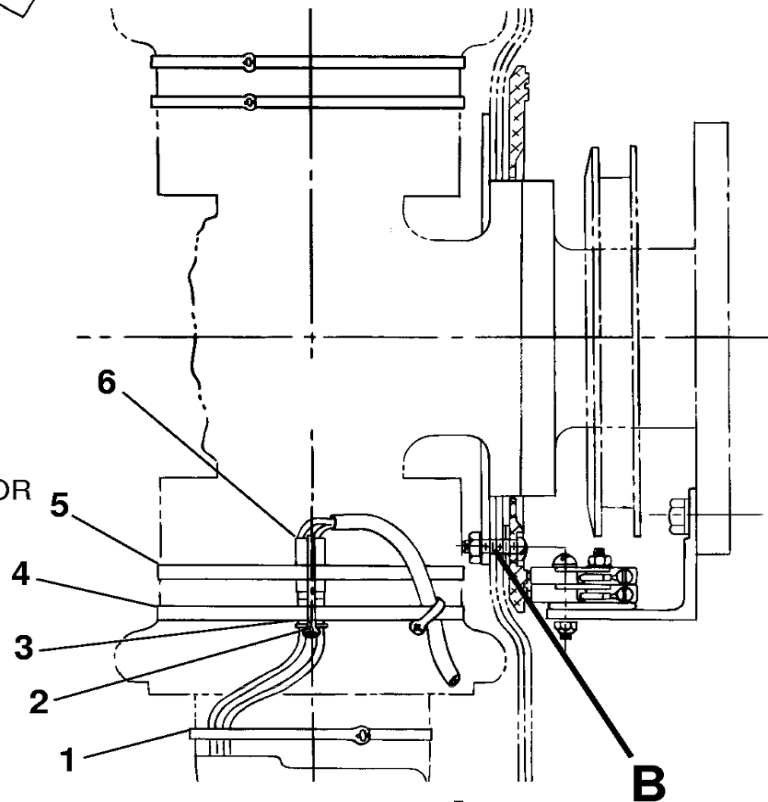
Figure 201 : Sheet 1 : Propeller Anti-Ice Boots Installation

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DETAIL B
(HARTZELL)

1. TIE-STRAP
2. SMALL TIE-STRAP
3. SLIP RING WIRE CONNECTOR
4. SMALL TIE-STRAP
5. LARGE TIE-STRAP
6. ANTI-ICE BOOT WIRE CONNECTOR
7. NUT
8. WASHER
9. BEVELED WASHER
10. BUTTONHEAD SCREW

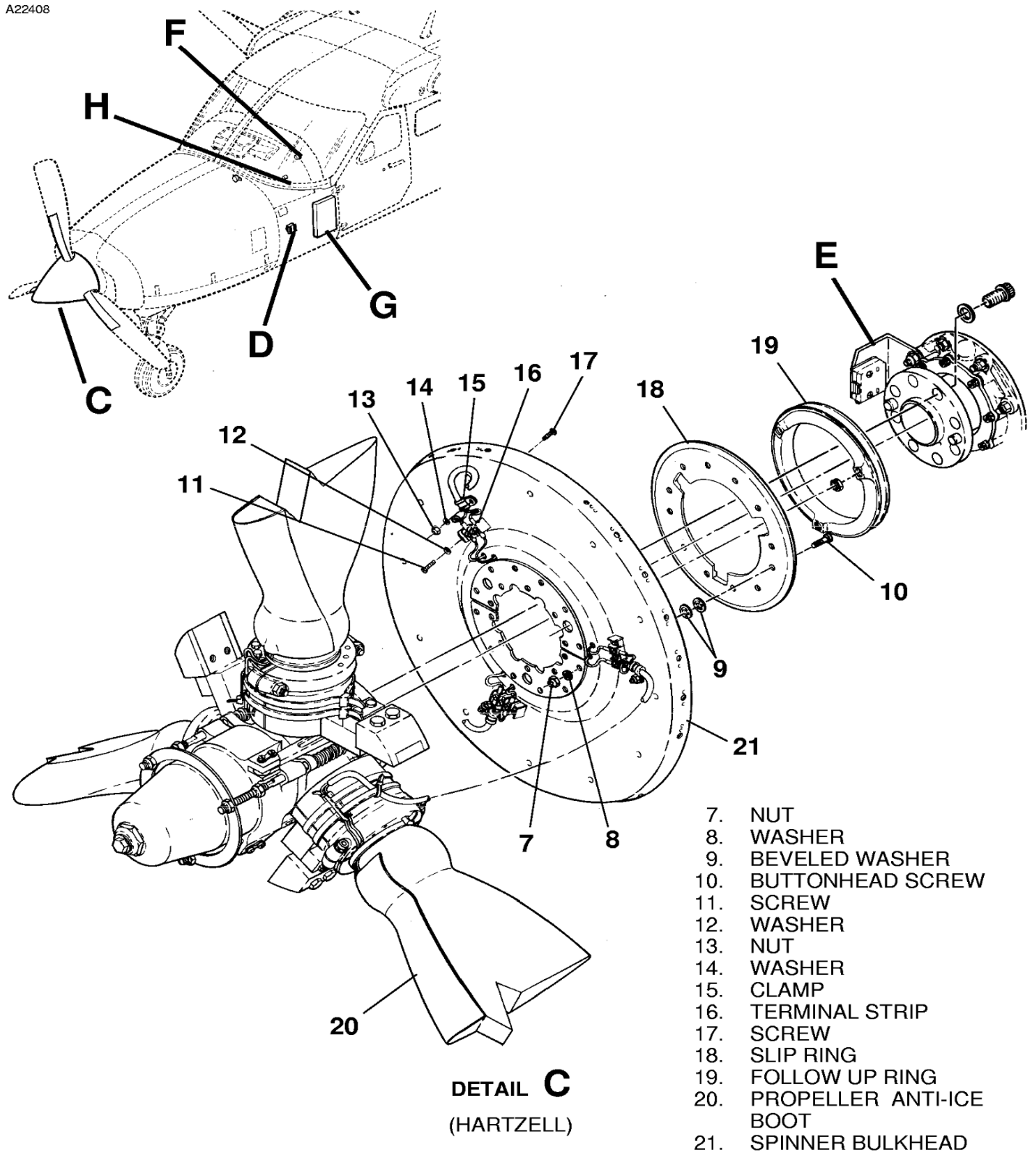


DETAIL A
(HARTZELL)

26142049
A26141073
B26141072

Figure 201 : Sheet 2 : Propeller Anti-Ice Boots Installation

A22408



26141152
C26142049

Figure 201 : Sheet 3 : Propeller Anti-Ice Boots Installation

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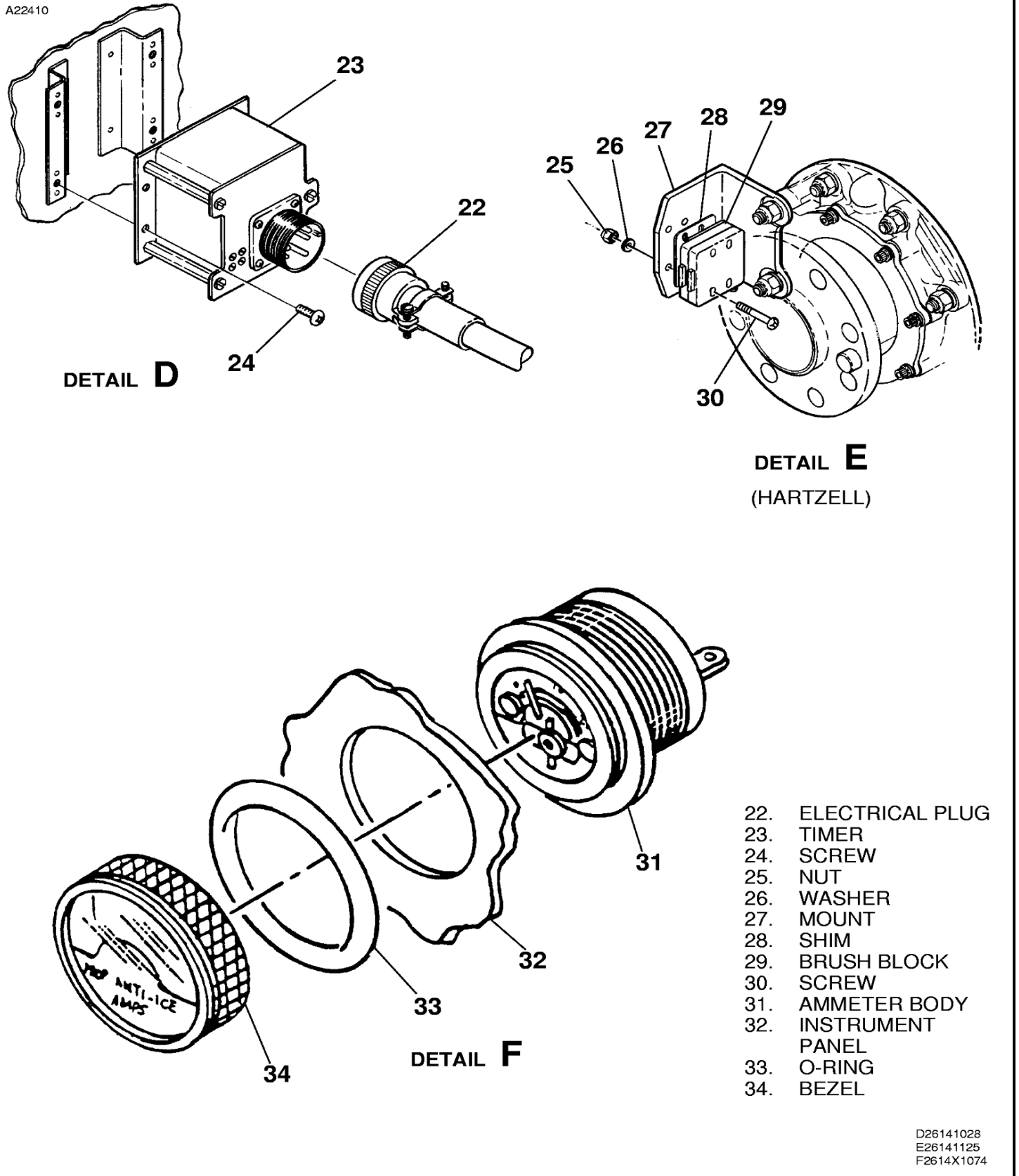


Figure 201 : Sheet 4 : Propeller Anti-Ice Boots Installation

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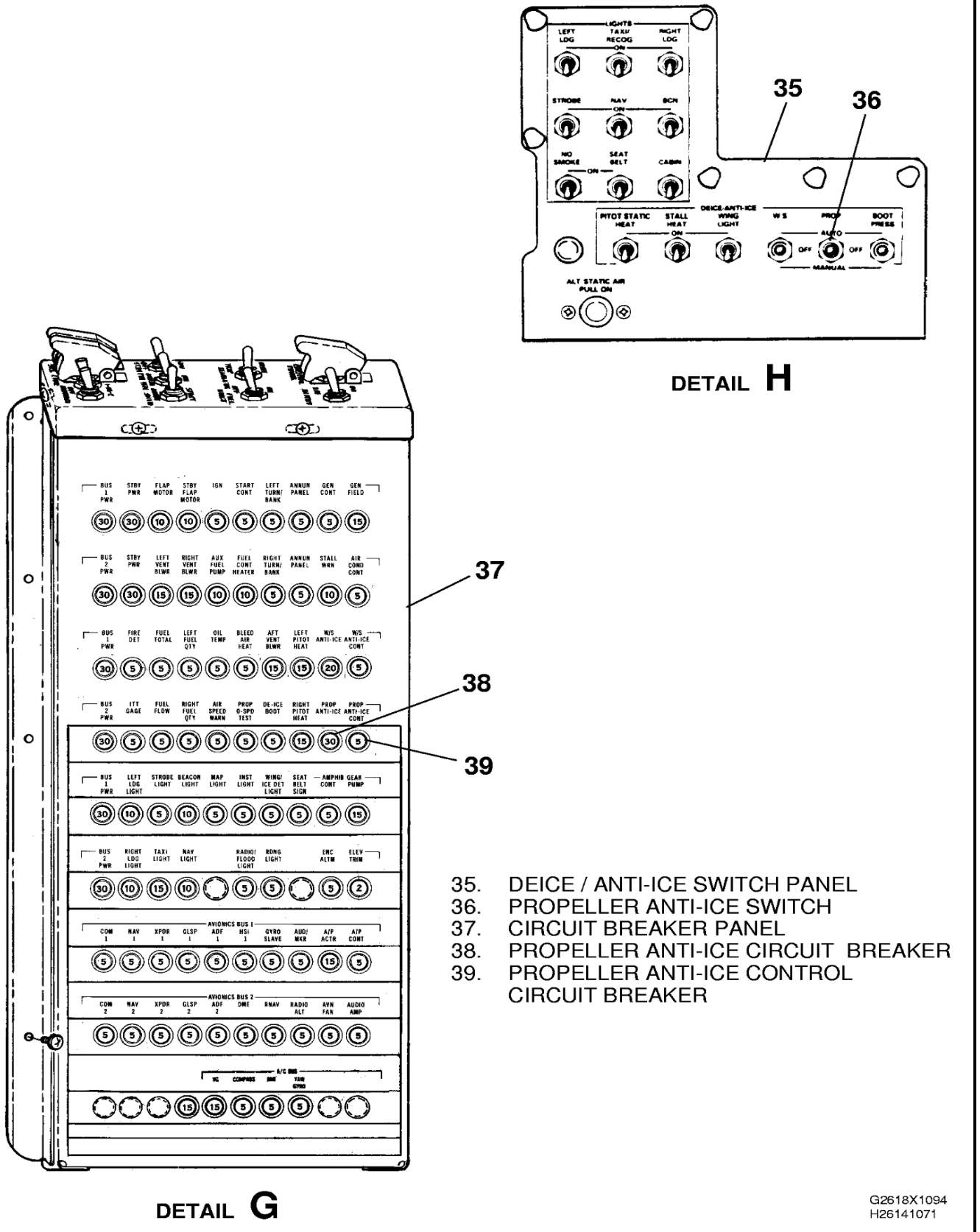


Figure 201 : Sheet 5 : Propeller Anti-Ice Boots Installation

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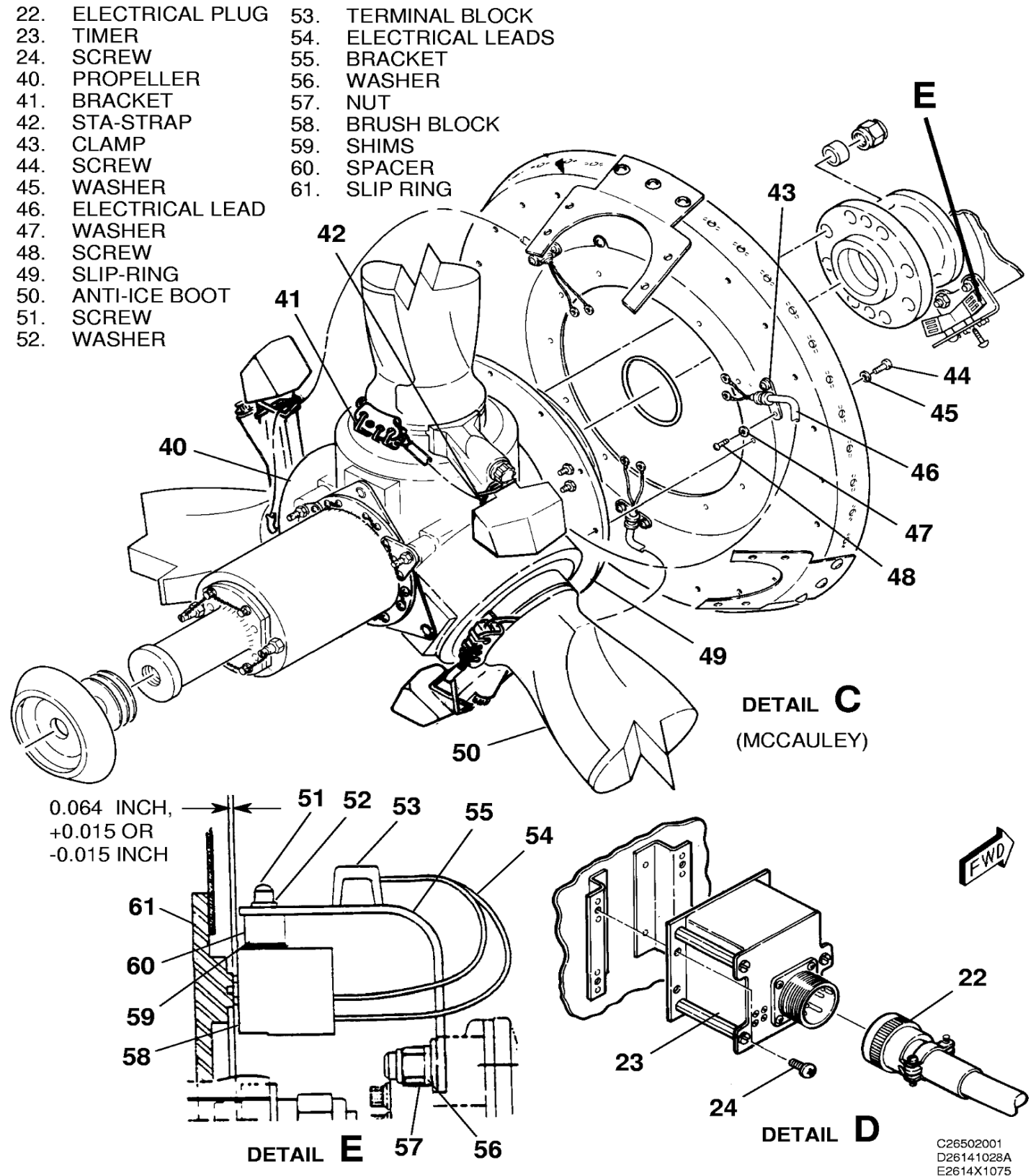


Figure 202 : Sheet 1 : Brush Face Alignment

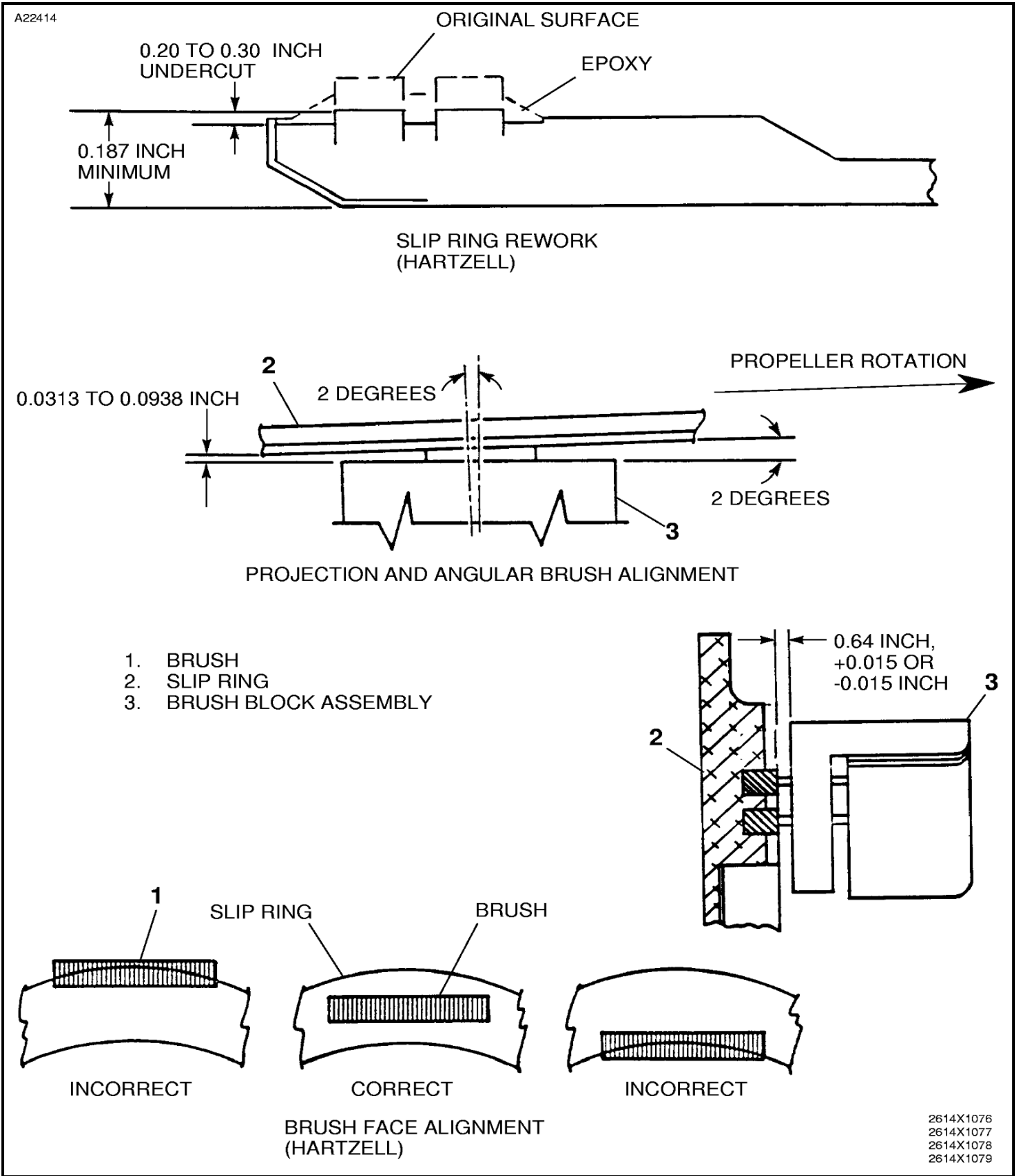


Figure 202 : Sheet 2 : Brush Face Alignment

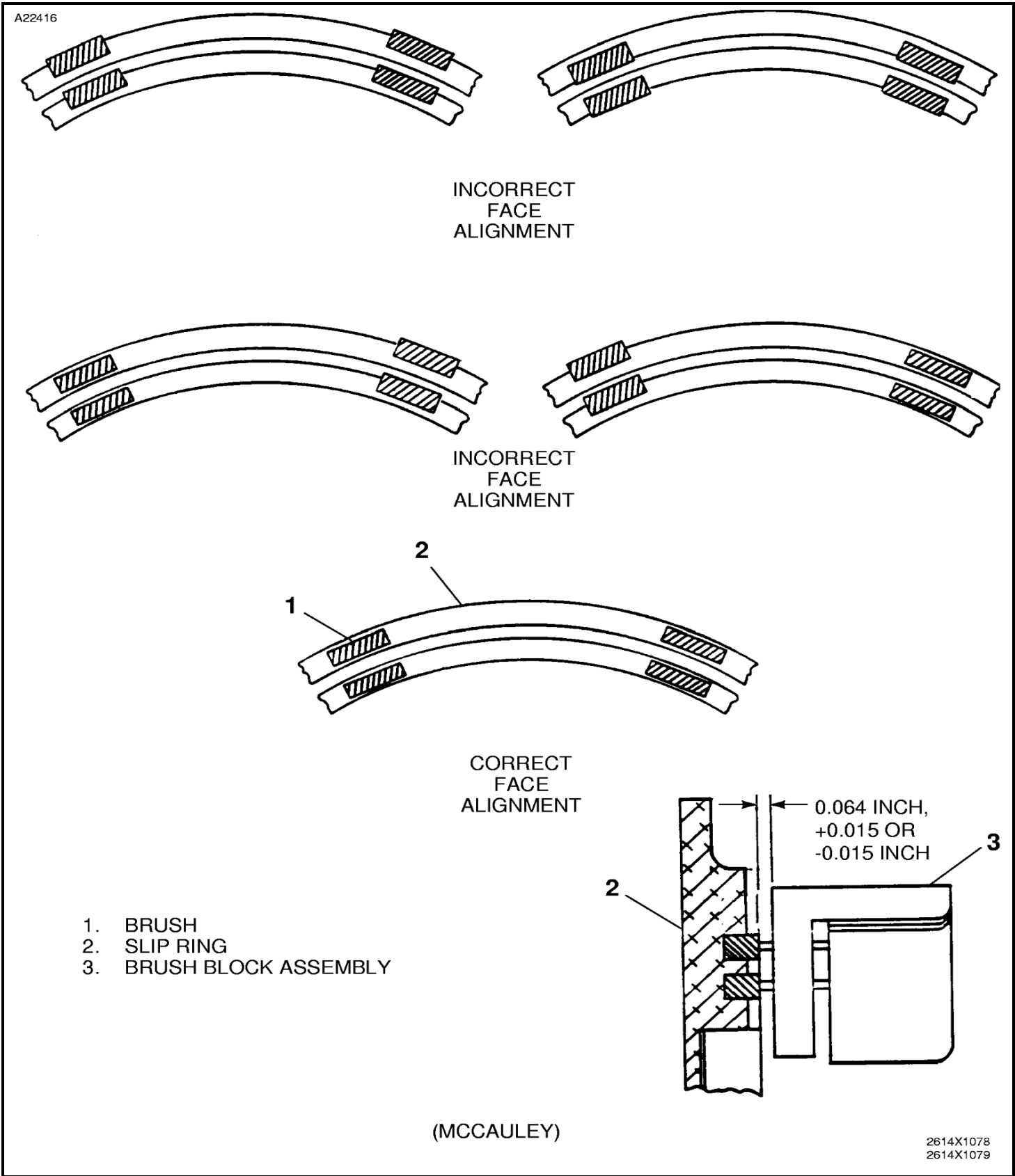


Figure 203 : Sheet 1 : Brush Length Inspection

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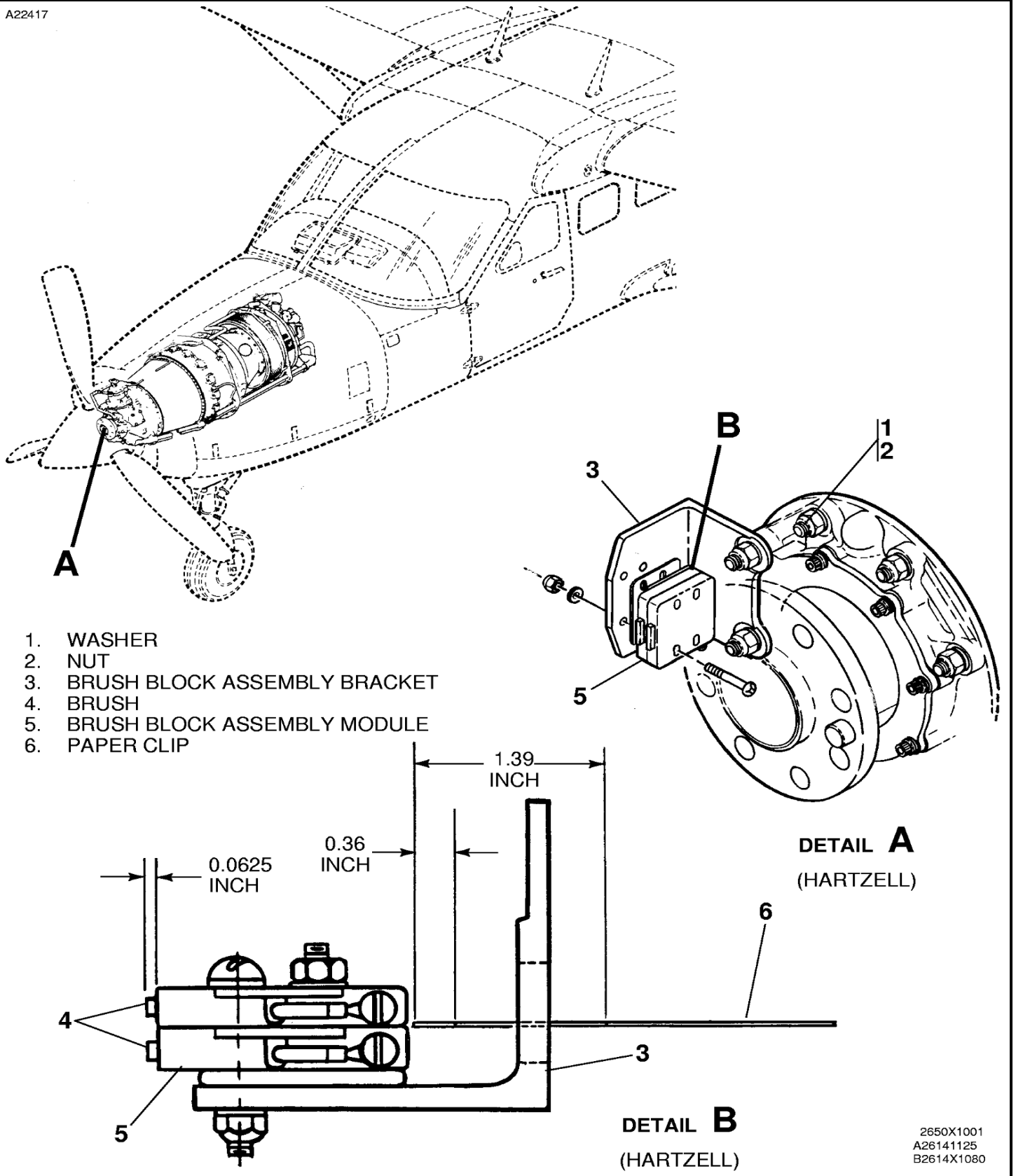
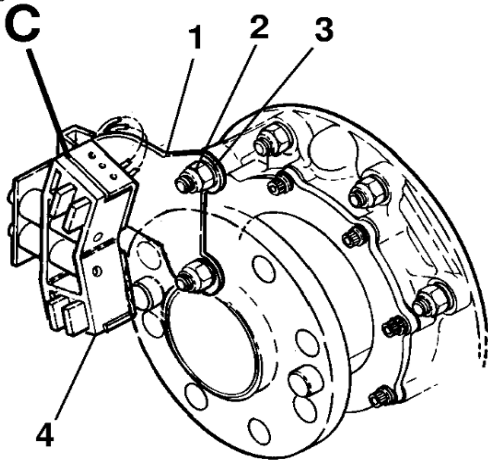
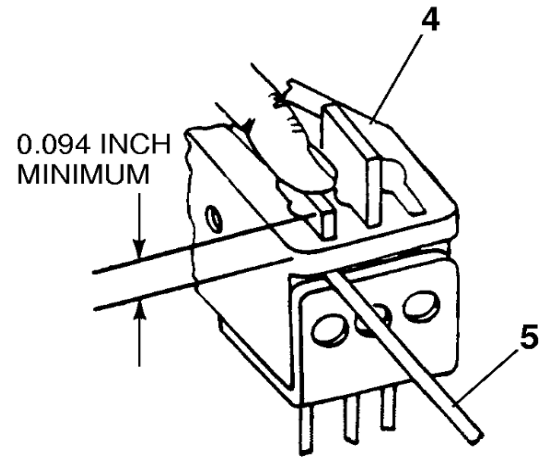


Figure 203 : Sheet 2 : Brush Length Inspection

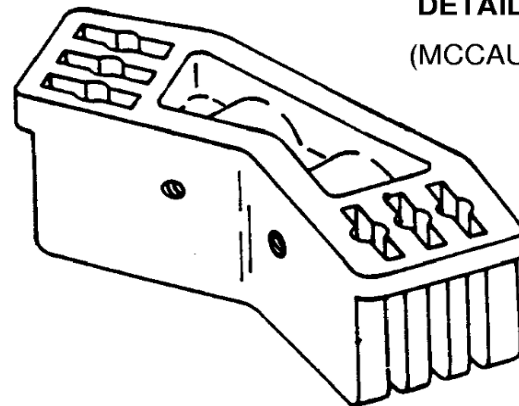
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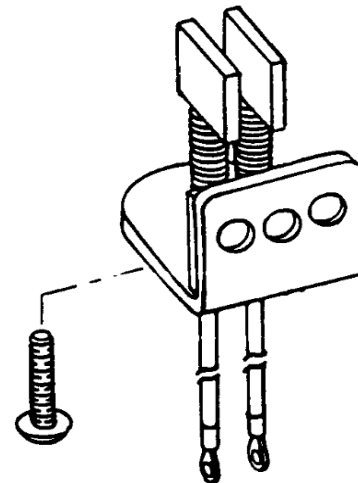
DETAIL A
(MCCAULEY)



DETAIL C
(MCCAULEY)



1. BRACKET
2. NUT
3. WASHER
4. BRUSH BLOCK ASSEMBLY
5. FEELER GAGE



A26141125A
C2614X1081

Figure 204 : Sheet 1 : Anti-Ice Boot Location

