NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
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STRUCTURES

Group Chairman's Factual Report

WPR17LA031

Attachment 2 – Piper Manual Information
(11 pages)

g. Install the washers and locknuts on the machine screws and torque to 15-20 inch pounds.
h. Apply a bead of sealant around the inner collar chamfer and windshield. Remove excess sealant with appropriate sealant removal tool noted in Figure 4-28.
i. Connect the electrical leads from the heated windshield.
j. Install the inside windshield molding and the top cover over the instrument panel.
k. Install the magnetic compass to the windshield center post.
l. Install the windshield wiper arm assembly and secure with the bolt previously removed and safety the bolt. Also install the cotter pin in the pivot bolt.

NOTE

The cabin should not be pressurized for at least 48 hours, to insure adequate time for the sealant to cure around the windshield.

4-42a. WINDSHIELD INSPECTION. See Appendix, Window Inspection and Repair — Standard Practices; Aerofiche Card 6 - Grid 6H1.

4-43. HEATED WINDSHIELD CHECK. The following steps will help in determining if the windshield heating element and timer are functioning properly.

CAUTION

To prevent overheat, and possible damage to windshield, DO NOT leave windshield heat ON longer than necessary to perform the following checks:

a. Connect a 24-volt test light to the positive and negative terminals of the windshield.
b. Set the switch marked WINDSHIELD HEAT to the ON position. The test light should light indicating current is being delivered to the windshield.
c. Place your hand against the windshield to determine that the windshield heating element is operating.
d. The test light should go out before the windshield becomes too hot to hold your hand against it. This indicates that the temperature sensing element is operating properly and has passed through its thermostatic ON-OFF cycle.
e. When check is completed, set the WINDSHIELD HEAT to the OFF position and remove the test light.

4-44. WINDSHIELD WIPER MECHANISM.

4-45. REMOVAL OF WIPER MECHANISM. (Refer to Figures 4-8 and 4-8a.)

a. Remove the access panel on the left side of the nose section. If the copilots wiper is installed, remove the access panel on the right side of the nose section also.
b. Cut the lockwire (5) at the bolt which secures the arm (3) to the serrated converter shaft and remove the bolt.
c. Loosen the adjustment nut (4) and lift the wiper arm (3) off the converter shaft. Refer to Paragraphs 4-48 and 4-49 for wiper blade replacement and adjustment.
d. Remove two screws from seal cover around converter shaft and remove cover and old sealant from shaft.

APPENDIX

WINDOW INSPECTION AND REPAIR — STANDARD PRACTICES

1. **Window Inspection.**

   a. DEFINITIONS. The following apply to all cockpit and cabin windows.

Critical	The viewing area of the windshields used for taxiing, takeoff, climb, cruise, and landing.
Semi-Critical	The viewing area used for general flight vision.
Non-Critical	Viewing areas not normally used for flight operations.
Distortion	Lines in windows or windshields that cause waviness in objects when looking through the window or windshield.
Crack	Critical narrow break, fissure, or separation extending through the entire thickness of the transparent material.
Craze	Fissure on the surface of the transparent material that does not penetrate the full thickness of the material.
Crazing	Mesh of fine hairline cracks that do not penetrate the full thickness of the material, located on the surface or within the structure of the transparent material.
Star Craze	A condition where several fissures radiate from a central point.
Wedge	A condition in a piece of optical glass having a progressive variation in thickness or absorption from one side to the other.
Scratch	An abrasion on the surface of the material caused by contact with rough abrasives or sharp objects.
Hairline Scratch	Visible scratch undetectable when passing a fingernail over the scratch. Considered non-critical other than being an appearance defect.
Light Scratch	A scratch measuring less than 0.010 inch (0.254 mm) deep. Can be detected when passing a fingernail over the scratch. Considered non-critical except for appearance.
Heavy Scratch	A scratch measuring more than 0.010 inch (0.254 mm) deep. Can be detected when passing a fingernail over the scratch. This type of scratch may be accompanied by chipping along the edge. Considered critical when occurring to inner glass ply. Considered semi-critical when occurring to outer glass ply within certain limitations (see inspection criteria). Considered non-critical within certain limitations (see inspection criteria) when occurring to acrylic surfaces.
Chip	A chip is considered a small scratch.
Haze	A foggy appearance located on the surface of the transparent material.
Blemish	Speck, air bubble, or other minor imperfection imbedded in the transparent material.
Mark-Off	An almost nonexistent shallow depression on the surface possessing practically no depth. Discernible only due to a noticeable rim or roughened surface caused by mold surface defects transferred to the surface during the forming operation.
Delamination	Visible evidence of a physical break of the bond between the plastic interlayer and either glass ply. Delamination may be caused by laminating stresses, preload on installation, or excessive heat.

b. CRITICAL AREA INSPECTION - GLASS WINDSHIELDS. A critical area is the area of the laminated glass windshields used for taxiing, takeoff, climb, cruise, and landing.

(1) Cracks could occur in either the inner, outer, or both panes. Cracking in either pane is critical and cause for immediate replacement.

(2) Crazing.

(a) Crazing in the windshields is critical.
(b) Determine depth of craze using a calibrated depth gauge or scale (see Figure 14-APP-1).
(c) A craze of 0.062 inch (1.575 mm) depth is cause for immediate replacement. A craze of 0.031 inch (0.787 mm) depth is cause for replacement at the earliest opportunity.
(d) Crazing in any portion of the windshields requires replacement.

(3) Blemishes.

(a) Blemishes in windshields form in the vinyl plastic interlayer bonding the two glass panes together.
(b) Blemishes in the critical or semi-critical portion of the windshields are not acceptable unless 0.062 inch (1.575 mm) or smaller in circumference, including distorted area.
(c) No more than two blemishes, at least 12 inches (30.48 cm) apart are acceptable in the windshields.
(d) No more than two blemishes within a two inch (5.08 cm) area along the upper portion of the windshields are acceptable.

(4) Haze or foggy appearance on the glass is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.

(5) Scratches.

(a) A scratch, no longer than 0.062 inch (1.575 mm) long and no deeper that 0.020 inch (0.508 mm) is acceptable.
(b) Heavy scratches on either glass ply are cause for immediate windshield replacement.
(c) Hairline scratches may be waxed and buffed out.

(6) Delamination.

(a) Cloudy or milky appearance in the delamination indicates moisture or solvent penetration. Windshields with this condition should be replaced at the earliest opportunity.
(b) Delaminated areas characterized by irregular or jagged boundaries indicate uneven separation of the vinyl and glass. This condition may cause the vinyl to pull chips from the inner glass surface, resulting in failure of the glass ply. Conduct periodic inspections to determine if the damage is progressive or if chipping of the inner glass surface is present.

(7) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.

(8) Distortion. Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).

c. SEMI-CRITICAL AREA INSPECTION - GLASS WINDSHIELD, COCKPIT ACRYLIC WINDOWS. Semi-critical areas are the perimeter of the glass windshield and areas of cockpit acrylic windows used for general flight vision.

(1) Mark-Off of such low intensity that vision quality is not impaired and that is not visible when looking through the windshield is acceptable.

(2) Distortion.

(a) A moderate amount of distortion is acceptable along the lower portion of the windshield if no more than 1.5 inches (3.81 cm) above the windshield retrainer strip.
(b) Distortion may not be so severe that it restricts vision or diverts runway lines or section lines more than 45°.
(c) Slight horizontal distortion is acceptable, if: there are no more than two lines; they do not occupy more than 25 percent of the windshield area, and; they are separated by a minimum of six inches (15.24 cm).

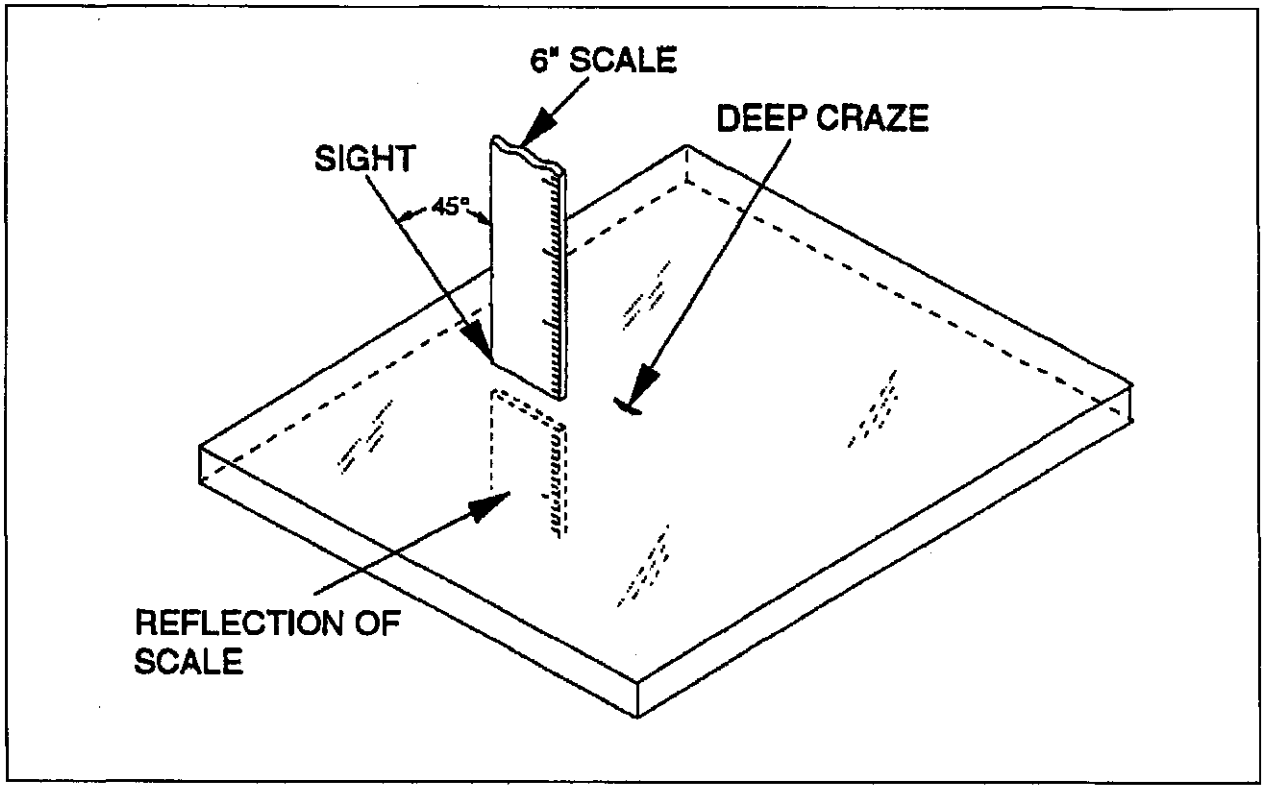

Figure 14-APP-1. Determining Depth of Craze.

(3) Crazing.

(a) Crazing in the windshields is critical.
(b) Determine depth of craze using a calibrated depth gauge or scale (see Figure 14-APP-1).
(c) A craze 0.031 inch (0.787 mm) deep is cause for replacement at the earliest opportunity.
(d) Crazing in any portion of the windshields requires replacement.

(4) Haze or foggy appearance on the glass is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.

(5) Blemishes.

(a) Blemishes in windshields form in the vinyl plastic interlayer bonding the two glass panes together.

(b) Blemishes in the critical or semi-critical portion of the windshields are not acceptable unless 0.062 inch (1.575 mm) or smaller in circumference, including distorted area.

(c) No more than two blemishes, at least 12 inches (30.48 cm) apart are acceptable in the windshields.

(d) No more than two blemishes within a two inch (5.08 cm) area along the upper portion of the windshields are acceptable.

(6) Scratches.

(a) Light scratches in the lower portion of the window and windshield are acceptable if they do not extend more than 1.00 inch (2.54 cm) from the outside windshield retainer and are less than 1.00 inch (2.54 cm) long.

(b) Scratches in acrylic windows may be reworked if:

1) They are less than 0.030 inch (0.762 mm) deep.

2) 0.310 inch (7.874 mm) panes are a minimum of 0.279 inch (7.087 mm) thick after rework.

3) 0.375 inch (9.575 mm) panes are a minimum of 0.338 inch (8.618 mm) thick after rework.

4) 0.380 inch (9.652 mm) panes are a minimum of 0.342 inch (8.687 mm) thick after rework.

5) No vision distortions in critical and semi-critical areas as a result of rework.

(c) Replace acrylic windows with scratches that cannot be reworked in accordance with these standards.

(7) Delamination.

(a) Cloudy or milky appearance in the delamination indicates moisture or solvent penetraton. Windshields with this condition should be replaced at the earliest opportunity.

(b) Delaminated areas characterized by irregular or jagged boundaries indicate uneven separation of the vinyl and glass. This condition may cause the vinyl to pull chips from the inner glass surface, resulting in failure of the glass ply. Conduct periodic inspections to determine if the damage is progressive or if chipping of the inner glass surface is present.

(c) Replace windshield if any of the following condition are noted:

1) Evidence of chipping of inner glass surface.

2) Area of vision required for safe operation is affected (pilot's discretion).

3) Windshield heat system inoperative.

(8) Cracks. Inspect for cracks as directed in paragraph 1e, Crack Inspection - Acrylic Windows.

d. NON-CRITICAL AREA INSPECTION - CABIN WINDOWS. A non-critical area is a portion of a window not used for flight vision.

(1) Mark-Off in moderate amounts is acceptable provided that visibility is not impaired.

(2) Distortion.

(a) Distortion along the sides of the window within 0.5 inches (1.27 cm) or less of the retainer is acceptable.
(b) Distortion along the upper portion of the window is acceptable if distortion does not extend downward more than 2.00 inches (5.08 cm) from the top and does not impair vision.
(c) Distortion of the main body of the side window is acceptable providing the distorted area does not exceed 25 percent of the winddow area.

(3) Crazing.

(a) Crazing in the winddow is critical.
(b) Determine depth of craze using a calibrated depth gauge or scale (see Figure 14-APP-1).
(c) A craze of 0.062 inch (1.575 mm) depth is cause for immediate replacement. A craze 0.031 inch (0.787 mm) deep is cause for replacement at the earliest opportunity.
(d) Crazing in any portion of the winddow requires replacement.

(4) Haze or foggy appearance on the glass is not acceptable if the amount of haze/fog causes an obstruction of vision in the area used for operation of the aircraft.

(5) Cracks. Inspect for cracks as directed in paragraph 1e, Crack Inspection - Acrylic Windows.

e. CRACK INSPECTION - ACRYLIC WINDOWS.

(1) Perform this inspection annually or each 1,000 hours, whichever occurs first.

— Note —

This inspection should also be performed after repainting when any chemical stripping agent was used. Use the prism method described in step (3) to inspect the entire circumference of the window for stripper damage/etching; especially in areas concealed by window frames, retainers, plates, or collars.

(2) Inspect window panes as follows:

(a) Inspect sealant for signs of wear, deterioration, and positive contact with mounting surfaces.
(b) Inspect window frames, retainers, plates, and collars for cracks, loose rivets or screws, corrosion, and structural defects.

(3) Inspect emergency exit and eyebrow window bolt holes as follows, using Window Inspection Kit - P/N 766-294. (A 45° acrylic prism and glycerin may be used if kit not available.)

(a) Clean area to be inspected with soap and water to ensure surface is free of oil, dirt, and wax.

(b) Determine which immersion oil to use: Type A in cold weather; Type B in hot weather.

(c) Apply a small amount of oil to the surface of window adjacent to bolt hole. On initial application, use a small amount of oil applied directly to one 90° face of inspection prism in contact with glass or acrylic (see Figure 14-APP-2).

(d) Press oiled face of prism to glass or acrylic. Slide prism around until a constant film of oil extends across prism face and window surface.

(e) Look into 90° face of prism (see Figure 14-APP-2). The image of an unfractured fastener hole will appear as a frosty cylinder.

(f) If hole is countersunk, cylinder will appear to have a cone setting on one end as seen in Figure 14-APP-2.

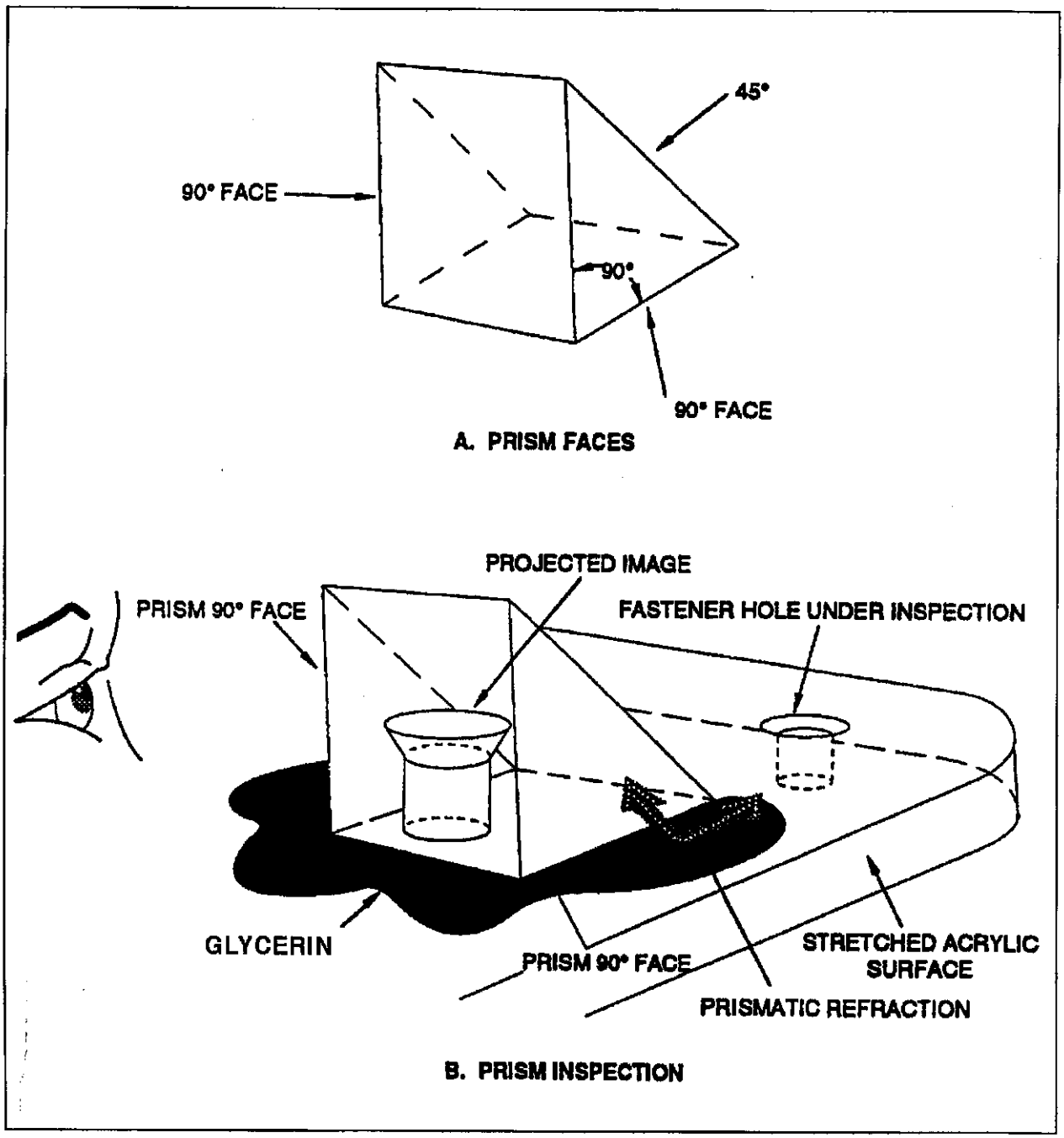

Figure 14-APP-2. Visual Inspection

(g) The image of a cracked hole will appear as a frosty or reflective projection extending from the hole (see detail A-A, Figure 14-APP-3).

(h) The image of a crack from one hole to another will appear as a frosty or reflective irregular surface (see detail B-B, Figure 14-APP-3).

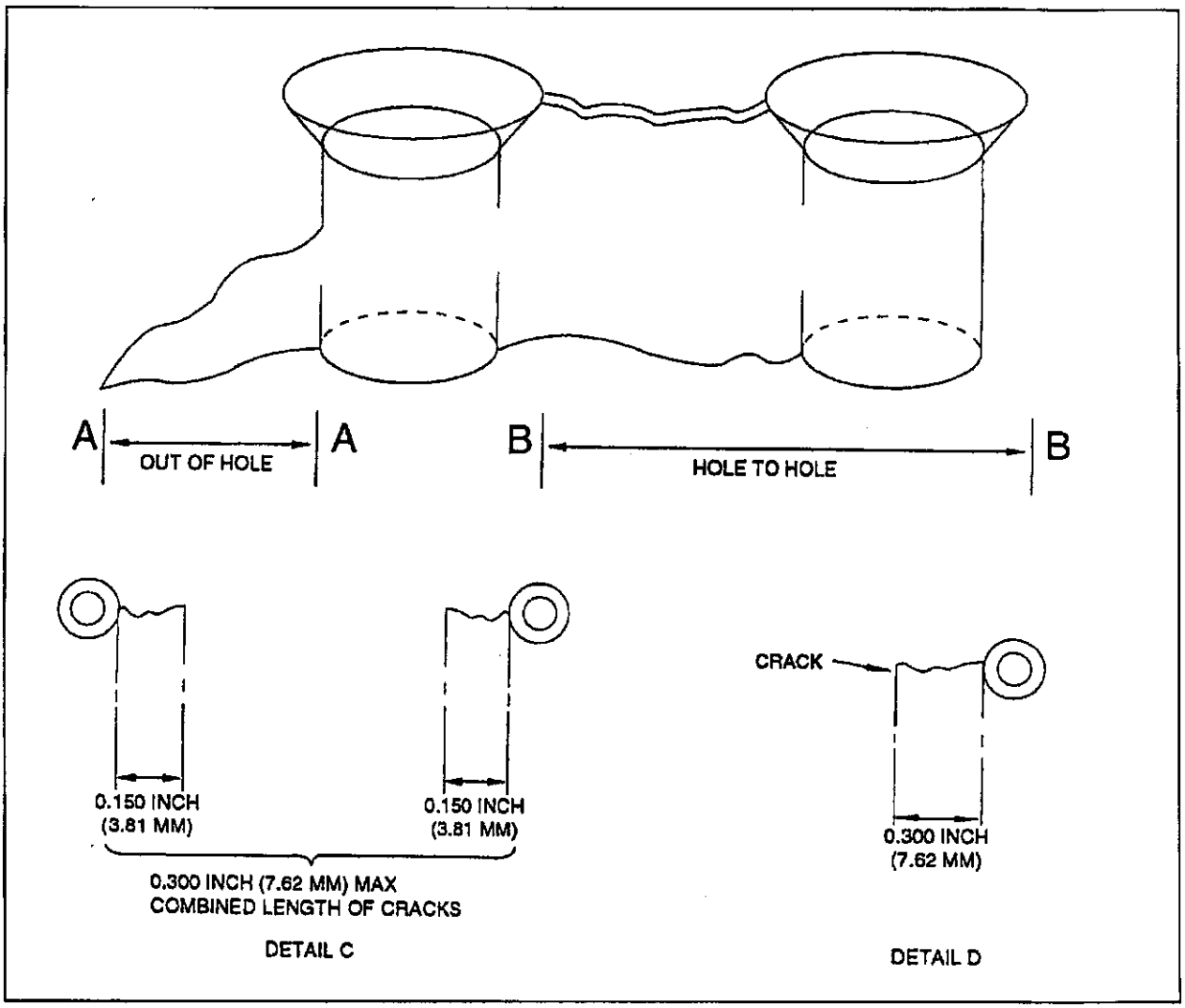

Figure 14-APP-3. Crack Limitations.

(4) Crack Limitation.

(a) The maximum acceptable length of a crack from any single screw hole is 0.300 inch (7.62mm).

(b) The maximum combined length of multiple cracks into the space between two adjacent bolt holes is 0.300 inch (7.62mm) (see Figure 14-APP-3).

(c) If a crack less than 0.300 inch (7.62mm) is left unrepaired, reinspect the window each additional 25 hours of aircraft operation.

(d) A maximum of three bolt holes with cracks less that 0.299 inch (7.59mm) long are acceptable in any one window pane before that window pane must be replaced.

(e) Replace window pane if a single crack or combination of adjacent facing cracks exceed 0.300 inch (7.62mm) in length.

(5) Chips, Scratches, and Crazing Limitations.

(a) Scratches in acrylic windows may be reworked if:

1) They are less than 0.030 inch (0.762 mm) deep.
2) 0.310 inch (7.874 mm) panes are a minimum of 0.279 inch (7.087 mm) thick after rework.
3) 0.375 inch (9.575 mm) panes are a minimum of 0.338 inch (8.618 mm) thick after rework.
4) 0.380 inch (9.652 mm) panes are a minimum of 0.342 inch (8.687 mm) thick after rework.
5) No vision distortions in critical and semi-critical areas as a result of rework.

(b) Replace acrylic windows with scratches that cannot be reworked in accordance with these standards.

2. **Window Repair / Rework Procedure (Side Acrylic Windows Only).** The following methods should be used for repairs:

a. AREAS WITH SMALL SCRATCHES:

(1) Clean the window, using generous amounts of water and a mild detergent.

(2) Polish the window with an approved compound and soft cloth.

(3) Clean and wax the polished area.

b. AREAS WITH LARGE SCRATCHES, GOUGES AND NICKS: Areas with damages exceeding .003 of an inch depth or those with less than .003 of an inch in depth, having sharp edges which cause hanging of fingernail should be locally rounded out or buffed.

(1) Clean the window using generous amounts of water and a mild detergent.

(2) Use a scratch removal kit, such as the type supplied by Micro-Surface Finishing Products Inc., P.O. Box 456, Wilton, Iowa, to remove the defective area, blend and buff.

(3) Using 400A wet or dry abrasive paper wrapped around a smooth rubber block and generous amounts of water, lightly sand over and around the defected area in a circular motion, extending in a diameter equal to two or three times the defected area.

(4) Continue sanding until the initial defect is no longer apparent. Thoroughly flush the area with water.

(5) Using 600A wet or dry abrasive paper, repeat step (3). Continue sanding only until the hairline scratches caused by the coarse sanding are no longer apparent. Sand a larger area than that covered by the original sanding operation. Thoroughly wash the area.

(6) Finish the repair using instructions given in Method a.

CAUTION

Any acrylic window which may have been damaged by paint thinner, paint remover or other softening agent must be replaced. NO repair is permitted for this type of damage.

SERIAL NUMBER	REGISTRATION NUMBER	ENGINE SERIAL NO.	PROPELLER SERIAL NO.
		Left:	Left:
		Right:	Right:

EVENT 1 (cont.)

CAUTION

Prior to applying power to the system, check continuity of system wiring to verify that shorts or opens do not exist. (Refer to appopriate SAS schematic in Piper service manual, section IV.) This check is very important as shorts or opens will destroy certain computer functions.

- ☐ 10. Remove access panels within nose baggage compartment; inspect plugs and harnesses of SAS system for corrosion, condition, and security (refer to pages 61 - 65 for location of access plates and panels) (PA-31T only).
- ☐ 11. Inspect bulkheads and stringers for damage, condition, and corrosion.
- ☐ 12. Inspect left and right pitot mast heater operation and security of mounting.
- ☐ 13. Inspect heater and heater fuel pump for fuel or fume leaks (Piper service manual, section XIII).
- ☐ 14. Inspect heater fuel lines and valve for leaks.
- ☐ 15. Check recommended time for overhaul of heater. (Refer to 100-Hour Special Inspection.)
- ☐ 16. Inspect hydraulic power pack fluid level (fill as required) (Piper service manual, section II).
- ☐ 17. Inspect hydraulic power pack, flexible control cable and lines for damage and leaks (Piper service manual, section VI).
- ☐ 18. Inspect security and condition of all hydraulic lines.
- ☐ 19. Inspect air conditioning system for freon leaks (Piper service manual, section XIII).

NOTE

Item 20 must be performed with the system in operation.

- ☐ 20. Inspect freon level in system through sight gauge in receiver-dryer (Piper service manual, section XIII).
- ☐ 21. Inspect landing and taxi lights for broken lenses and operation. Replace as required.
- ☐ 22. Inspect external skins for condition, damage and corrosion.
- ☐ 23. Lubricate per Piper service manual, section II.
- ☐ 24. Reinstall inspection plates and panels and close radome.

FUSELAGE MAIN, DETAILED

- ☐ 1. Remove inspection plates, panels and floor panels.
- ☐ 2. Inspect external skin for condition, damage and corrosion.
- ☐ 3. Inspect windshield and all windows for cracks and condition.
- ☐ 4. Inspect windshield wipers for security of mounting, condition and operation (do not operate on dry windshield).
- ☐ 5. Inspect fuel lines and crossfeed valve for damage and operation.
- ☐ 6. Inspect all fuel, hydraulic and pressurization lines for security.
- ☐ 7. Inspect all flight control cables and pulleys for damage and tension (Piper service manual, section V).
- ☐ 8. Inspect all electrical wiring for security.
- ☐ 9. Inspect antenna mounts and connections for security and corrosion.

SERIAL NUMBER	REGISTRATION NUMBER	ENGINE SERIAL NO.	PROPELLER SERIAL NO.
		Left	Left
		Right	Right

EVENT 2 (cont.)

FUSELAGE FORWARD, ROUTINE

- ☐ 1. Inspect baggage door latch and hinges for damage and operation; door ajar switch and compartment light operation.
- ☐ 2. Check fluid in brake reservoir (fill as required).
- ☐ 3. Check battery box and cables for corrosion and security. (Check at least every 30 days and clean as required per Piper service manual, section XI.)
- ☐ 4. Lubricate per Piper service manual, section II.
- ☐ 5. Inspect hydraulic power pack fluid level. (Fill as required per Piper service manual, section VI.)
- ☐ 6. Check condition of skin for visible damage.
- ☐ 7. Inspect heater for fumes and leaks.
- ☐ 8. Inspect SAS angle of attack vane for condition, security and heater operation in accordance with Piper service manual, section XI (PA-31T only).

CAUTION

Prior to applying power to the system, check continuity of system wiring to verify shorts or opens do not exist. (Refer to appropriate SAS schematic in Piper service Manual, Section IV.) This check is very important as shorts or opens will destroy certain computer functions.

- ☐ 9. Inspect hydraulic power pack for leak, security of linkage, and leaks.

FUSELAGE MAIN, ROUTINE

- ☐ 1. Inspect external skin for condition, damage,and corrosion.
- ☐ 2. Check all windows and windshield for condition and cleanness.
- ☐ 3. Check antennas for security.
- ☐ 4. Lubricate per Piper service manual, section II.

CABIN COCKPIT, ROUTINE

- ☐ 1. Check pilot's seat for operation and damage.
- ☐ 2. Check copilot's seat for operation and damage.
- ☐ 3. Check condition of oxygen mask in accordance with Piper service manual, section XIV.
- ☐ 4. Check instrument lights for operation.
- ☐ 5. Check control wheel for operation. (See Special Inspection.)
- ☐ 6. Lubricate per Piper service manual, section II.
- ☐ 7. Check pilot and copilot seat belts and shoulder harnesses for proper security, operation, and condition.
- ☐ 8. Inspect SAS emergency override CO_2 bottle cover for security and proper safetying (PA-31T only).