



FENWICK, WV

SMR1461-1

**ENGINE INLET ANTI-ICER
INSTALLATION AND MAINTENANCE MANUAL**

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Revisions

Date	Rev No.	Description of Change	Author	Approval
3/17/04	1	Initial Release	RCL	RLR
8/15/06	2	Removed SMR1990-1 from cover page, Table 1 on page 1, and paragraph 6.1.2, Added Caution to Paragraph 5.4, Added Note to Paragraph 5.4.11, Added Paragraph 5.4.12	RCL	BDS

The latest revision of this maintenance manual can be downloaded from the SMR Technologies website, www.iceshield.com. In the event Internet access is not available, contact the Customer Service office below for inquiry or copy of the latest revision:

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AIRWORTHINESS LIMITATIONS

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

- 2.0** Not applicable.

1.0 Introduction

This publication contains removal and replacement instructions for SMR Ice Shield Engine Inlet Anti-icer. This publication's content supplements the aircraft manufacturers' maintenance manuals. In case of any discrepancy, the manufacturer's manuals supersede this publication. Control and operating information are covered in the aircraft manufactures' operation and maintenance manuals.

For part number applicability, see Table 1.

PART NUMBER	Approved Aircraft
SMR1461-1	(Piper) PA-31T, PA-31T1, PA-31T2

Table 1

2.0 Safety Instructions

WARNING: Both adhesives and solvents along with their vapors are toxic and flammable. Use only in a well-ventilated area, away from sparks or flames. Avoid prolonged breathing of vapors – excessive exposure could cause dizziness or nausea. If this occurs, get 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.

CAUTION: Manufacturer's Material Safety Data Sheets (MSDS) and specifications should be obtained for information on handling and mixing procedures. These are available from the adhesive and solvent suppliers.

3.0 Materials

3.1 Adhesive Systems

- (a) Bostik 1096M System
 - a. 1007 M Primer
 - b. 1096 M Adhesive
 - c. #9R Boscodur Accelerator
- (b) 3M – 1300L Adhesive
- (c) British Bostik 2402 System
 - a. 9252 Primer
- (d) 2402 Adhesive

3.2 Fillers

- (a) EC 800 3M
- (b) JFM 801 Class B Hutchinson
- (c) PRC1422 Courtaulds Aerospace

3.3 Solvents

- (a) MEK – dry time 10 seconds (for removal)

- (b) Toluene – dry time 40 seconds (for cleaning/installation)

3.4 Miscellaneous Materials

- (a) Clean lint-free cloths
- (b) ½" to 2" paint brush (pure china bristle)
- (c) 2" rubber roller – soft durometer
- (d) ¼" to 1/2" wide metal roller (used on edges of anti-icer only)
- (e) ½" or 1" masking tape
- (f) Plastic spatula (rounded edges)
- (g) #320 Silicon carbide sanding paper

3.5 Anti-icer Adhesive Information

CAUTION: Adhesive coats on the inlet and anti-icer bond surfaces must be evenly applied. To maximize bond strength, apply adhesive and install anti-icer at temperatures between 65-75°F with relative humidity less than 75%. When relative humidity ranges from 75-90%, allow additional dry time. If relative humidity exceeds 90%, or temperature is less than 50°F, installation is not recommended.

NOTES: Thoroughly mix all adhesives; follow instructions on container or manufacturer's specifications. (See Figure 3.7)

Thoroughly clean cowling and rubber parts. Clean surfaces provide maximum adhesion.

Just prior to installing the anti-icer on the inlet, the adhesive on both the inlet and the anti-icer should be sticky to the touch, or "tacky".



FIGURE 3.7

3.6 Bostik 1096M Adhesive System Mix

- (a) Stir Bostik 1007M primer thoroughly. Apply one even brush coat to the masked off area of the inlet. Allow Bostik 1007M primer to air dry for at least 30 minutes.
- (b) Mix 9 parts Bostik 1096M with 1 part Boscodur #9R accelerator. Do not prepare excessive amounts, as the mixture begins to gel in 6 to 8 hours. Apply one even brush coat of adhesive to the backside of the anti-icer and to the masked off area on the inlet.
- (c) Allow adhesive to air dry at least one hour.

- (d) Apply a second even brush coat of adhesive to the backside of the anti-icer and to the masked off area on the inlet. Allow to dry until tacky – usually 10 to 30 minutes (depending on temperature and relative humidity).
- (e) When the adhesive becomes tacky, proceed to Section 5.4.

3.7 3M 1300L Adhesive System

- (a) Thoroughly stir 1300L per manufacturer's instructions.
- (b) Apply one even brush coat of 1300L cement to the backside of the anti-icer and to the masked off area on the inlet. Allow to air dry for at least one hour.
- (c) Apply a second even brush coat of 1300L to the backside of the anti-icer and to the masked off area on the inlet. Allow to dry until tacky – usually 5-15 minutes (depending on temperature and relative humidity).
- (d) When the adhesive becomes tacky, proceed to Section 5.4.

3.8 British Bostik 2402 Adhesive System

- (a) Apply one coat of 9252 Bostik primer to the inlet. Allow one hour drying time.
- (b) Thoroughly stir 2402 Bostik per adhesive manufacturer's instructions and apply one even brush coat to the backside of the anti-icer.
- (c) Allow to dry for one hour.
- (d) Apply a second even brush coat of 2402 Bostik to the anti-icer and one even brush coat of 2402 Bostik to the masked off area on the inlet. Allow to dry until tacky – usually 10-30 minutes.
- (e) When adhesive coats feel tacky, proceed to Section 5.4.

4.0 Anti-Icer Removal

This manual does not cover inlet repair, priming or painting. Consult applicable aircraft manufacturer's manual for specific details prior to proceeding with anti-icer installation.

Typical anti-icer removal tools. (See Figure 4.0)



Figure 4.0

4.1 Scrapped Anti-Icers

Scrapped anti-icers can be removed in strips and pieces. Loosen one end of anti-icer. Pull or tear off the anti-icer with clamps or equivalent locking pliers.

4.2 Remove Adhesive Residue from Inlet

Remove adhesive residue from inlet by placing dampened solvent cloths over the adhesive to soften its bond to the inlet. Wait 10-15 minutes, then rub with the dampened cloths to remove softened adhesive. Repeat as needed to remove all adhesive.

4.3 Replacing Old Parts

Most installations replace an old part with a new part. Save some time – mark the centerline locations on the inlet.

5.0 Anti-Icer Installation

5.1 Inlet Preparation

Inspect repair, prime, and/or paint inlet as required per applicable aircraft manufacturer's manual and FAA regulations before proceeding to anti-icer installation.

5.1.1 Masking Off Inlet

Mask off an area adjacent to and aft of the recessed edge on the inside and outside of the inlet location.

5.1.2 Clean the Inlet

Clean the recessed area with MEK or Acetone and wipe dry immediately using a clean, lint-free, dry cloth. Sand the recessed area and wipe with a clean cloth.

5.2 Anti-Icer Preparation

5.2.1 Clean the Anti-Icer

Clean the bond side (opposite label side) of the anti-icer with a clean cloth moistened with solvent. Change cloths frequently to avoid contamination of the cleaned area.

5.3 Bond Adhesive Application

5.3.1 Select Bond Adhesive

Refer to Section 3.1 for correct bond adhesive system for the aircraft inlet in accordance with the manufacturer's manual.

5.4 Anti-Icer Installation

The anti-icer should be installed to the inlet in the order indicated.

CAUTION: The adhesive coats on the inlet and anti-icer bond surfaces must be evenly applied. To maximize bond strength, apply adhesive and make anti-icer installations at temperatures between 65-75°F with relative humidity less than 75%. If relative humidity is between 75-90%, allow additional dry time. If relative humidity exceeds 90% or temperature is below 50°F, installation is not recommended.

CAUTION: Avoid trapped air under the Anti-icer to prevent potential "hot spots" during operation of the Anti-icer.

Note: If the cement dries beyond the tacky state, it may be necessary to reactivate the cement with a clean cloth slightly dampened with Toluene. Tackify only the cemented sections to be bonded that you intend to work on immediately.

5.4.1 Begin with the Leadwires

Start the installation at the inside surface of the upper lip of the inlet, where the anti-icer ends butt together. Curl the anti-icer so that the cemented surface is facing out then insert the leadwires through the appropriate holes in the inlet.

5.4.2 Dry Fit

Dry fit the anti-icer against the inlet and keep the edge of the anti-icer against the recess edge of the inlet.

5.4.3 Tackify

When satisfied that the alignment of the anti-icer on the inlet is satisfactory, hold the anti-icer in this position and fold back the leadwire end and tackify around the leadwire and also the mating surface of the inlet. Press into position and roll smooth with a rubber roller.

5.4.4 Tackify Inside Radius of Anti-Icer

Now that the anti-icer ends are correctly in position and held, release your hold on the rest of the anti-icer. Tackify approximately 1 inch around the inside lip up from the recess edge and the mating surface on the anti-icer.

5.4.5 Install Inside Radius of Anti-Icer

Install the inside radius first. Keep the anti-icer taut from the leadwire to radius and against the recess edge. Continue to install by dividing each remaining section of anti-icer in half by attaching the midpoint of each remaining section along the inside recessed edge. Work the entire inside edge of the anti-icer into place. Some stretching or crowding of the anti-icer may be necessary.

5.4.6 Install Inside Lip up to Leading Edge

After the inside of the anti-icer is in position along the recess edge, tackify the remaining inside lip surface and the mating surface of the anti-icer up to the leading edge. Roll the installed surface with a rubber roller. Run your hand across the installed surface to check for trapped air, and remove trapped air.

5.4.7 Checking the Trailing Edges

After the inner surface of the anti-icer is installed up to the leading edge, dry fit the anti-icer over the leading edge to estimate the amount of stretching or crowding of the anti-icer that will be needed.

5.4.8 Installing the Outside Radius

Begin again at the butt splice end of the anti-icer, tackify and install over the leading edge. Keep the butt splice together. Tackify and install the flat surfaces first and then stretch the anti-icer over the radius ends.

5.4.9 Roll the Anti-Icer

Rubber roll the entire anti-icer surface and again check for trapped air.

5.4.10 Trimming the Anti-Icer

Use a hook trim knife to trim any excess material. Use ¼ steel stitcher to roll the recessed edges firmly into place.

5.4.11 Clean Up the Installation

Note: Be careful not to let solvent run under the edge of the bonded anti-icer. Allow 30 minutes before application of either filler or sealer.

Immediately remove masking tape and clean up excessive cement with MEK.

5.4.12 Mask Anti-Icer and Inlet for Filler and/or Edge Sealer

Apply one even coat of edge sealer or filler, if necessary, within the masked-off area. Remove tape immediately before sealer sets up. Pull tape directly up or across the sealer to get a straight edge cutoff.

6.0 Checkout

6.1 Off-Aircraft Checkout

6.1.1 Resistance Check

Check resistance between common ground and the other leadwires of the anti-icer. Compare with minimum and maximum values in the resistance tables.

6.1.2 Resistance Table

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(Wire C) Shedding Area (SAI) -- 1.87 – 2.07 Ohms

(Wire B) Parting Strip (PS) -- 1.85 – 2.05 Ohms

(Wire D) Shedding Area (SAII) -- 2.11 – 2.33 Ohms

6.2 On-Aircraft Checkout

6.2.1 Repeat the Off-Aircraft Checkout

6.2.2 Resistance Checks

Check for intermittent shorts or open circuits by moving the leadwires while measuring resistance. Also, press lightly on the entire anti-icer heating surface. Resistance should not fluctuate; if resistance changes during this exercise, it may indicate a short or open circuit condition. Thoroughly check the connection.

6.3 Minimum Installation Dry Times

Note: The dry times specified for filler and sealer count toward minimum cement dry times.

6.3.1 Before Flying the Aircraft

Allow 12 hours for all installations.

6.3.2 Before Operating the Anti-Icer

Allow 24 hours for all installations.

7.0 Maintenance

Refer to the aircraft manufacturer's maintenance manual for any specific information not mentioned here.

7.1 100 Hour/Annual Inspection

Examine the anti-icers for wrinkled, loose, or torn areas. Look for abrasion or cuts, especially along the leading edge. Confirm that any lead wire tie straps or restrainers are secure and properly installed.

Search for cracks or other damage. Check that screws are safety-wired.

Confirm that the anti-icer wire leads are not in tension. If tension exists, redistribute the slack between the wire retainers and the wire connectors.

Inspect the lead wires for damage or shorting. Remove any source of chafing as required, and replace the lead wire as required. Confirm that the lead clips or terminal screw assemblies are in good condition.

When the system has no ammeter, connect a temporary test ammeter in the timer power input line. Check the aircraft manual for the operating characteristic of the de-icing system. Have an assistance observe the ammeter with the de-icing system activated, and then flex the accessible wiring. Locate any problems by monitoring system continuity while flexing and prodding any suspected areas. Correct as required.

Perform the following Anti-icer Heat Test to confirm proper heating sequence: Have an assistant activate the system, record the ammeter reading, and call out each phase to verify the sequence as given in the aircraft maintenance manual. Feel the anti-icer area that is under power during each phase of the cycle. Hot spots indicate surface damage or poor bonds that require anti-icer replacement or rebonding. (Some timers may cause the ammeter needle to flicker when the timer cycles each phase.)

Lock the brakes and operate the engine at near take-off power. Operate the de-icing system and observe the ammeter for approximately 2 minutes. The needle should rest within the green, or normal operating range, throughout the complete cycle. (Certain timers may cause the ammeter needle to flicker out of the shaded area as the timer cycles each phase.)

8.0 Troubleshooting

Refer to the aircraft manufacturer's maintenance manual for specific information on probable malfunctions and remedial actions to be taken.

9.0 Storage

The life of an uninstalled anti-icer may be decreased by improper storage conditions. The following conditions should be maintained for the best service life. Where the ideal conditions are not attainable, attempt to approach them as closely as possible.

9.1 Packaging

Store the anti-icer in its original sealed packaging in an area free from sunlight, harmful fumes and excessive dust.

9.2 Harmful Substances

Do not store petroleum products, solvents, hydraulic fluids or other substances that may be injurious to rubber in close proximity to the anti-icers.

9.3 Ozone

NEVER store anti-icers near electric motors or other sources of ozone.

9.4 Temperature

Store in a space protected from extreme temperatures. Ideal storage temperature is between 40° and 80°F (5 to 27°C).

9.5 Stresses

Never store anti-icers under mechanical stresses that could cause kinking, wrinkling, or creasing.

END OF DOCUMENT