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PROPELLER DE-ICER INSTALLATION AND MAINTENANCE MANUAL

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REVISIONS

Date	Rev No.	Description of Change	Author	Approval
10/6/97		Initial Release	RLR	DEG
10/9/97	1	Minor text changes	RWP	DEG
11/14/97	2	Minor text changes	WSG	RLR
6/16/00	3	Minor text changes	WSG	RLR
10/12/01	4	Minor text changes	WSG	RLR
8/2/02	5	- Add Warranty page - Add End Item User page	WSG	RLR
12/9/03	6	Revised TOC page, Add page iii, Airworthiness Limitations section, Revise title section 7.3.2, Add Troubleshooting section 8.0, Add Storage section 9.0, Add Accessories: Nylon Bushings, Adhesive Kits	WSG	RLR
7/11/06	7	Update Signature page, Revised First Note Paragraph 5.1, Revised Paragraph 5.5.1, Revised Paragraph 5.6.1, Revised paragraph 5.7.3, Added Section 6.0 Anti-Freeze Feed Shoe, Revised Page number Warranty Section 12.0, Revised page number End Item User Letter Section 13.0	WSG	CDL
9/10/12	8	Updated Format of Title Page, Revisions Page, Signature Page, Header, and Footer to match modern report formats. Updated company logo from SMR Technologies to B/E Aerospace. Removed End Item User Letter to current format. Updated Table of Contents.	ERJ	BDS
6/8/17	9	Revised Section 2.0. Changed Material Safety Data Sheets (MSDS) to Safety Data Sheets (SDS). Removed section 5.4.1. Removed marking centerline on bondside due to contamination concerns. Removed Section 5.4.2. Revised Section 5.5. Added 90 degree leads to de-icers that require filler around lead.	DAT	BDS
4/23/19	10	Replaced B/E Aerospace logo on cover with SMR logo. Removed all mentions of B/E Aerospace.	DBM	DAB
9/11/25	11	Updated Warranty. Updated Section 11.2	DAT	DAB

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.

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1.0 Introduction

This publication contains removal and replacement instructions for SMR Ice Shield Electrothermal Propeller De-Icers, which are used on a variety of aircraft in general and regional aviation. Ice Shield de-icers are designed for specific aircraft and propellers. To determine the correct application for an aircraft and propeller combination, consult the aircraft or propeller manufacturer's manual. This publication's content supplements the aircraft and propeller manufacturers' manuals. In case of any discrepancy, the manufacturer's manuals supersede this publication.

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 Safety Data Sheets (SDS) 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 (Select One – See Section 3.4)

(a) 3M-EC776 – Primer (Ref 3.8 For Instructions)

(b) Bostik 1096M System (Ref 3.9 for Instructions)

  a. 1007 M Primer

  b. 1096 M Adhesive

  c. #9R Boscodur Accelerator

(c) 3M – 1300L Adhesive (Ref. 3.10 For Instructions)

(d) British Bostik 2402 System (Ref 3.11 For Instructions)

  a. 9252 Primer

  b. 2402 Adhesive

3.2 Fillers (Select One – See Section 3.4)

(a) 74-451-100 Goodrich

(b) EC 800 3M

(c) JFM 801 Class B Hutchinson

(d) PRC1422 Courtaulds Aerospace

3.3 Sealers (Select One – See Section 3.4)

(a) 82-076 Goodrich

(b) Sherwin Williams F63B12 Paint – V66V29 Accelerator

(c) Sterling Lacquer

(d) Ault and Wilborg U-1-5-10/U-1-4

3.4 Approved Cement, Filler and Sealer

See Below

Select One			
Prop Manufacturer	**Adhesive System Section 3.1**	**Filler Section 3.2**	**Sealer Section 3.3**
DOWTY ROTOL	(c) – (d)	(a) – (b) (c) – (d)	(a) – (b) (c) – (d)
HARTZELL	(b) – (c) (d)	(a) – (b) (c)	(a) – (b)
HAMILTON STANDARD	(a) – (b)	(a) – (b) (c) – (d)	(a) – (b) (c) – (d)
McCAULEY	(b) – (c) (d)	(a) – (b) (c) – (d)	(a) – (b) (c) – (d)

3.5 Solvents

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

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

3.6 Miscellaneous Materials (See Figure 3.6)

(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 de-icer only)

(e) ½" or 1" masking tape

(f) Plastic spatula (rounded edges)

(g) #320 Silicon carbide sanding paper

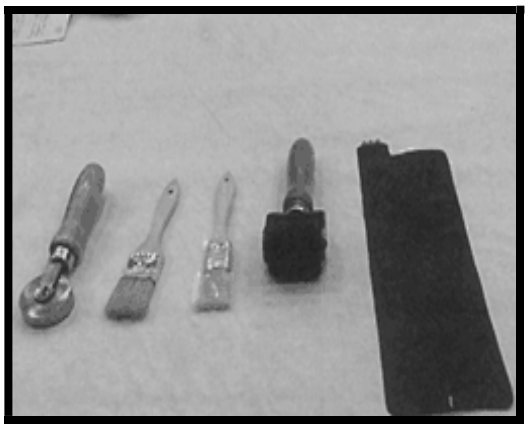


FIGURE 3.6

3.7 De-Icer Adhesive Information (See Section 3.4)

CAUTION: Adhesive coats on the blade and de-icer bond surfaces must be evenly applied. To maximize bond strength, apply adhesive and install de-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.

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

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

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



FIGURE 3.7

3.8 Primer EC776 (3M)

Primer is required on bare propeller blades from Hamilton Standard. Otherwise, refer to Section 3.4 to choose the correct bond adhesive. Drying time of EC776 is 30-40 minutes.

3.9 Bostik 1096M Adhesive System Mix

(a) Stir Bostik 1007M primer thoroughly. Apply one even brush coat to the masked off area of the blade. 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 de-icer and to the masked off area on the blade.

(c) Allow adhesive to air dry at least one hour.

(d) Apply a second even brush coat of adhesive to the backside of the de-icer (and, if applicable, to long lead strap area) and to the masked off area on the blade. 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.

3.10 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 de-icer and to the masked off area on the blade. Allow to air dry for at least one hour.

(c) Apply a second even brush coat of 1300L to the backside of the de-icer (and, if applicable, to long lead strap area) and to the masked off area on the blade. 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.

3.11 British Bostik 2402 Adhesive System

(a) Apply one coat of 9252 Bostik primer to the blade. 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 de-icer.

(c) If metal strap restrainers are used, apply 2402 Bostik to the de-icer strap up to the projection of the centerline of the strap restrainer and to the affected portion of the blade.

(d) Allow to dry for one hour.

(e) Apply a second even brush coat of 2402 Bostik to the de-icer (and, if applicable, to long lead strap area) and one even brush coat of 2402 Bostik to the masked off area on the blade. Allow to dry until tacky – usually 10-30 minutes.

(f) When adhesive coats feel tacky, proceed to Section 5.4.

4.0 De-Icer Removal

CAUTION: Do not allow solvent to leak into propeller hubs, where it may cause damage to seals.

NOTES: For Hartzell composite blade de-icer removal, see Hartzell Manual #135.

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

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



Figure 4.0

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4.1 Remove Spinner

Disconnect the de-icer lead strap and remove the clamping hardware. Note the location/position of clamping hardware for re-installation after the replacement de-icer is installed.



Figure 4.2

4.2 Scrapped De-Icers

Scrapped de-icers can be removed in strips and pieces as in Figure 4.2. Loosen the inboard strap end of de-icer. Pull or tear off the de-icer with clamps or equivalent locking pliers.

4.3 Remove Adhesive Residue From Blade

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

4.4 Replace Old Parts

Most installations replace an old part with a new part. Save some time – mark the inboard centerline location on the hub, note the type of lead connection (bent tabs or long lead straps), and mark the inboard end of the de-icer position in reference to hub.

5.0 De-Icer Installation

5.1 Blade Preparation

CAUTION: If you choose to make a pattern for marking the blade, trace around the de-icer. Do not use de-icer directly as a cutting pattern. Never use knives or other sharp objects on the new de-icer or propeller blade.

CAUTION: All de-icers on a single propeller must be located the same distance from the hub to maintain rotational balance.

NOTE: Hartzell and McCauley propeller blades have a special protective coating. De-icers should be bonded directly over this protective coating. If bare metal is exposed on Hartzell blades, refer to Hartzell service letter HC-SL-61-234 and Hartzell Aluminum Blade Overhaul Manual 133C (61-13-33) prior to de-icer installation.

NOTE: For convenience, the blade may be held in a padded jaw vise. (See Figure 5.1)

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

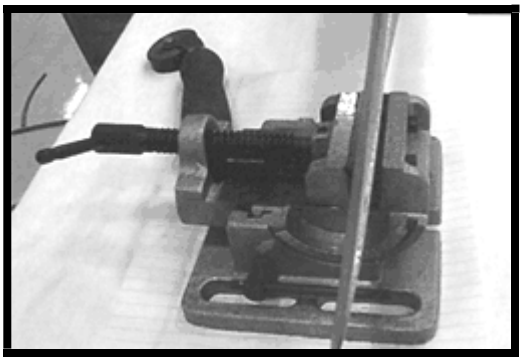


Figure 5.1

5.1.1 Masking Off Blade

Mask off an area approximately ½" beyond each side of the de-icer or pattern and ½" beyond the outboard end. If rubber restrainer straps are used, do not mask in the area where the restrainer strap must be installed. (See Figures 5.1.1A & B)

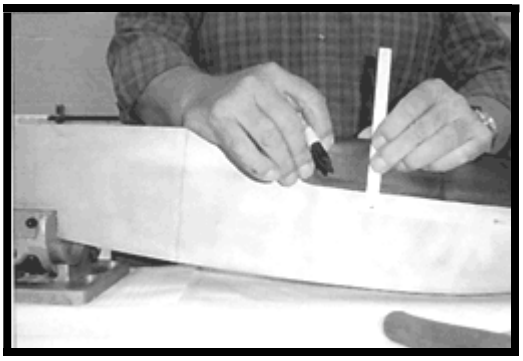


Figure 5.1.1A

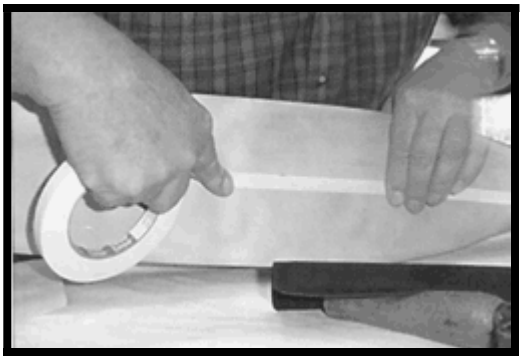


Figure 5.1.1B

5.1.2 Clean the Blade

Remove the de-icer and clean the masked-off area thoroughly with a solvent moistened cloth. If a rubber restrainer strap is used, thoroughly clean around the entire blade about 2" out from the hub. (See Figure 5.1.2)

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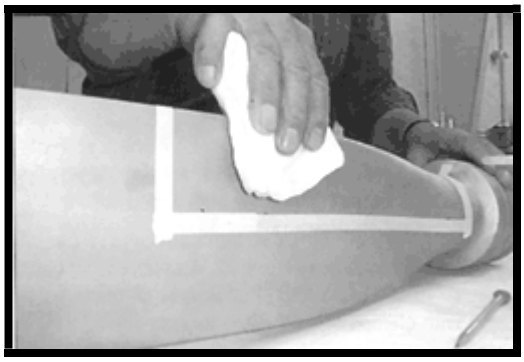


Figure 5.1.2

5.1.3 Mark the Centerline on the Tape

To assist the installer during the installation, mark centerline on tape or blade (use felt tip pen) at inboard and outboard ends.

5.1.4 Mark the Centerline at the Hub

Place a center mark at the hub of the propeller blade in line with the blade's leading edge. Determine the location by sighting along the leading edge.

5.1.5 Test Fit the De-Icer

Starting at the hub or at the point specified for your installation in the aircraft or propeller manufacturer's manual, center the de-icer in line with the center mark. Ice Shield de-icers either have centerlines marked on the bond side, or scribed centerline marks at both ends on the breeze side to assist in this location effort. Mark the breeze side with centerline marks as needed. (See Figure 5.1.5)

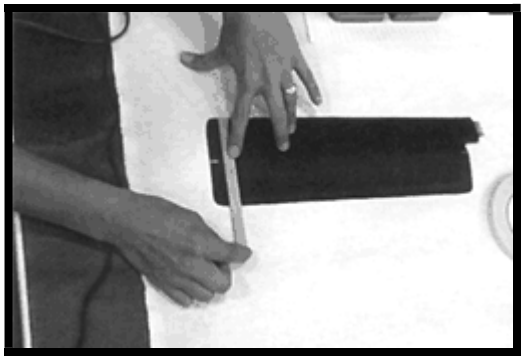


Figure 5.1.5

5.2 De-Icer Preparation

5.2.1 Clean the De-Icer

Clean the bond side (opposite label side) of the de-icer and lead strap with a clean cloth moistened with solvent. (See Figure 5.2.1)

Change cloths frequently to avoid contamination of the cleaned area.



Figure 5.2.1

5.2.2 For Ice Shield De-Icers with Bent Tabs

Locate as follows: Starting at the blade clamp, locate the lead area of the de-icer centrally to the four tapped holes in the side of the blade clamp and shape the de-icer to the leading edge. The inboard end of the de-icer should be located as specified in the applicable aircraft manual, propeller manual or installation drawing.

5.2.3 For Ice Shield De-Icers with Long Lead Strap

Locate the de-icer as described in Section 5.1, then fit the strap clamp or restrainer on the hub. Adjust the de-icer location as necessary to make the lead strap coincide with the strap clamp, unless more specific location details are provided in the aircraft or propeller manufacturer's manual.

5.3 Bond Adhesive Application

5.3.1 Select Bond Adhesive

Refer to Section 3.4 for correct bond adhesive system for the aircraft and propeller blade in accordance with the manufacturer's manual.

5.3.2 See Section 3.7 for Mixing and Drying Times Between Coats.

5.3.3 Bonding Lead Straps

(a) For long lead strap de-icers, apply adhesive to the appropriate length of the de-icer lead strap and blade so that the strap will be bonded to the blade up to the hub.

(b) If metal strap restrainers are used, apply proper adhesive to the de-icer strap up to the centerline projection of restrainer and to the affected portion of the blade.

5.3.4 Restrainer Strap Area Preparation (If Applicable)

Using a clean cloth dampened with solvent, clean both sides of the restrainer strap and the 2" cleaned area of the blade next to the hub. Also, wipe over any part of the de-icer and lead strap located in that 2" area. Apply bond adhesive to those areas.

5.4 De-Icer Installation

CAUTION: The adhesive coats on the blade and de-icer bond surfaces must be evenly applied. To maximize bond strength, apply adhesive and make de-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.

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Note: There are a few applications in which the de-icer centerline is not positioned on the blade centerline. Consult aircraft or propeller manufacturer's manual for proper placement.

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.

5.4.1 Roll Down the Lead Strap and Align the De-Icer

Starting at the hub, or at the point out from the hub specified for your installation in the aircraft or propeller manufacturer's manual, center the de-icer in line with the center mark previously made on the hub. (See Figure 5.4.2)



Figure 5.4.2

5.4.2 Align the De-Icer

While the cement is tacky on both the blade and the de-icer surfaces, position the de-icer over the blade leading edge. Start at the hub end, matching the de-icer centerline to the blade centerline.

5.4.3 Long Lead Strap De-Icers

Verify that the strap falls in the appropriate position.

5.4.4 Press the Centerline Down

Working outward toward the tip, lightly press the de-icer centerline to the blade centerline with your fingertips. (See Figure 5.4.5)

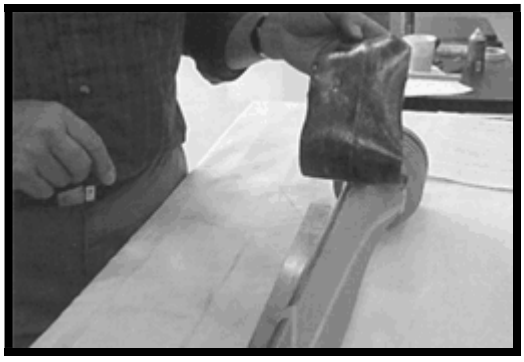


Figure 5.4.5

5.4.5 Correcting Misalignment

If the de-icer centerline moves off the blade centerline, pull up quickly and reapply. If the cement is removed from either surface when the de-icer is pulled up, thoroughly clean the de-icer and the blade and begin the cementing procedure again.

5.4.6 Roll Leading Edge Centerline

When the de-icer is correctly positioned, roll firmly along the de-icer centerline with the rubber roller. Gradually tilt the roller and carefully work the de-icer over both sides of the blade contour, making sure to avoid trapping air. (See Figure 5.4.7A & B)

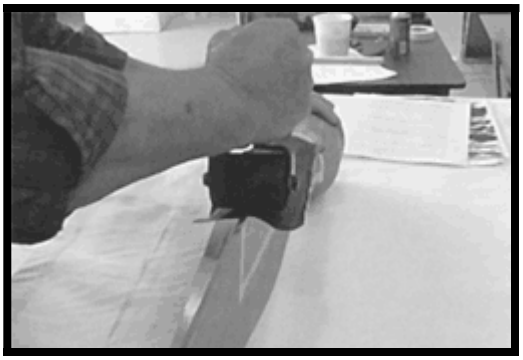


Figure 5.4.7A



Figure 5.4.7B

5.4.7 Roll Down to the Edges

Roll outward from centerline to edges. Be especially careful to work out excess wrinkles at the outboard edge of the de-icer before the edges are completely rolled down. If the edge of the de-icer puckers, work out puckers smoothly and carefully with fingers. (See Figure 5.4.8)



Figure 5.4.8

5.4.8 Roll the Trailing Edges

CAUTION: Do not use metal roller on the body of the de-icer as the de-icer heating element(s) could be damaged.

Roll down the trailing edges of the de-icer, especially the inboard ends, with a metal roller. (See Figure 5.4.9)

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Figure 5.4.9

5.4.9 Installation Clean Up

Remove the masking tape from the blade and clean the excess adhesive with a cloth slightly dampened with solvent. (See Figure 5.4.10)

Be careful not to let solvent run under the edge of the bonded de-icer. For filler and/or sealer installations, allow 30 minutes before application of either filler or sealer.

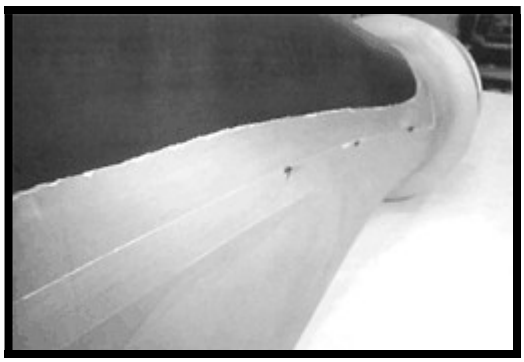


Figure 5.4.10

5.5 Filler Application (Ref. Section 3.4)

Filler is used on all Hartzell and Dowty Rotol propellers, and on McCauley or Hamilton Standard propellers which use MIL-G-23827 or equivalent grease, and on long lead strap de-icers or de-icers that have a 90 degree lead. For all Hartzell installations, refer to Hartzell Manual H-S-2 for filler procedure. For installations not requiring filler, proceed to section 5.6.

5.5.1 Mask Off the Blade Surface

Apply new masking tape to the blade approximately 1/8" beyond the area around the inboard edge of the de-icer and extending approximately 2-1/2" outboard along the trailing edges.

5.5.2 Mask Off the De-Icer Surface

Apply masking tape to the de-icer 1/8" back from the trailing edges, parallel to the masking tape applied in Section 5.5.1, so that the filler will cover 1/8" of the de-icers surface. (See Figure 5.5.2)

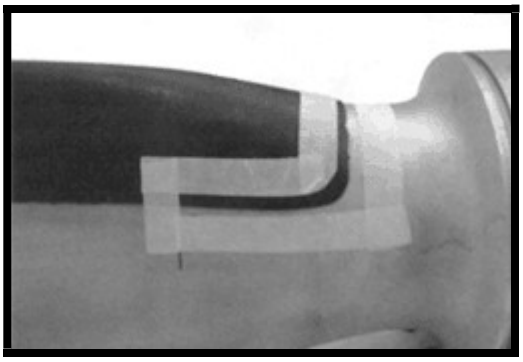


Figure 5.5.2

5.5.3 Apply the Filler

Apply one even coat of filler within the masked-off area. Filler should cover 1/8" of non-cemented blade and about 1/8" of the de-icer edge. (See Figure 5.5.3)

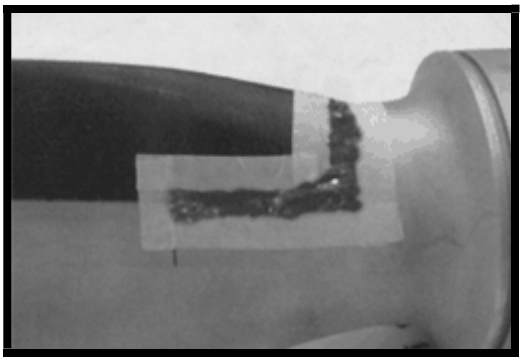


Figure 5.5.3

5.5.4 Clean Up the Filler

Immediately remove masking tape. Allow filler to dry before applying sealer (per manufacturer's technical data sheet).

5.6 Sealer Application (Ref. Section 3.4)

Note: Various Hartzell propeller blades require slightly different sealing procedures. Refer to Hartzell manuals for details.

5.6.1 Mask Off the Blade and De-Icer

Apply masking tape on blade about ¼" beyond the edge of the de-icer (1/8" beyond filler, if used). Apply masking tape about ¼" back from the edge of the de-icer (except around the restraint strap, if used). (See Figure 5.6.1)

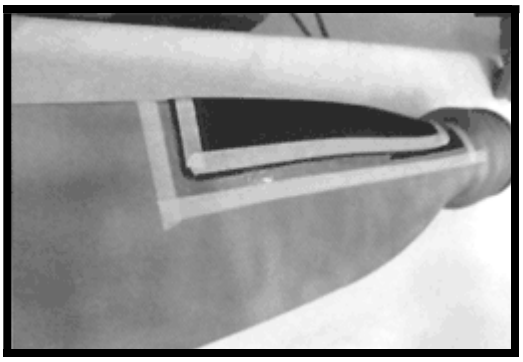


Figure 5.6.1

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5.6.2 If Using Ault & Wilborg Sealer on Dowty Rotol Propellers

Lightly abrade surface of de-icer with grade 320 silicon carbide paper.

5.6.3 Apply Sealer

Apply one even brush coat of the sealer to the masked area around the de-icer. Sealer should cover the ¼" area of the blade (or 1/8" if filler is used) in addition to the area around the de-icer. It should also overlap approximately ¼" onto the de-icer surface. (See Figure 5.6.3)

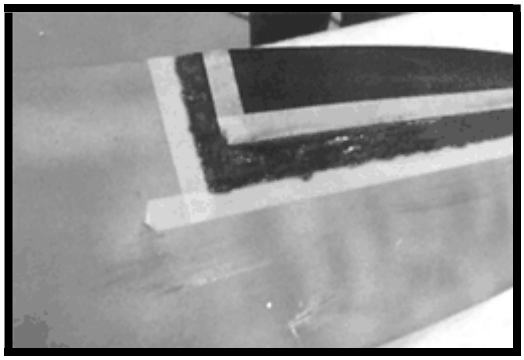


Figure 5.6.3

5.6.4 Long Lead Strap De-Icers

Make sure the sealer completely covers the filled area between the lead strap and blade.

5.6.5 Clean Up

Immediately remove the masking tape. Pull tapes directly up or across the sealer to get a straight edge cutoff. (See Figures 5.6.5A & B)

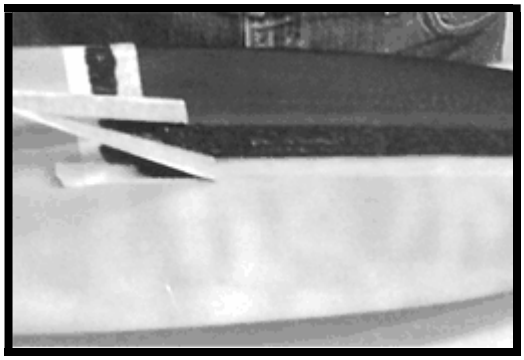


Figure 5.6.5A

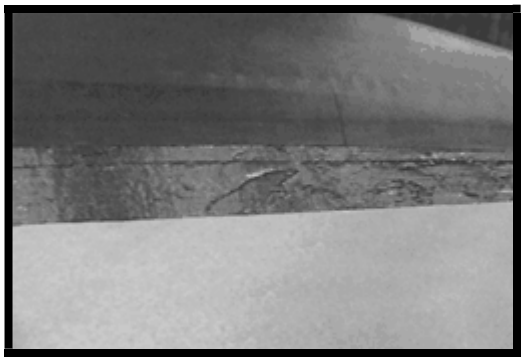


Figure 5.6.5B

5.7 Restrainer Strap Installation (When Applicable)

5.7.1 Mask Off the Area

Using a solvent moistened cloth and masking tape, clean and mask off a 2" wide area around the propeller blade where the restrainer strap is located.

5.7.2 Clean and Wipe Down

With a solvent moistened cloth, clean both sides of the restrainer strap and the 2" area masked off on the propeller.

5.7.3 Apply Adhesive Coats

Apply two adhesive coats per standard procedures to the cleaned area on the propeller and the restrainer strap. Allow approximately one hour dry time between coats.

5.7.4 Install the Restrainer Strap

When second adhesive coat is "tacky" on the blade, de-icer and restrainer strap, position the strap as shown in Figure 5.7.4A, B & C or per the manufacturer's instructions. Roll firmly in place with rubber roller.

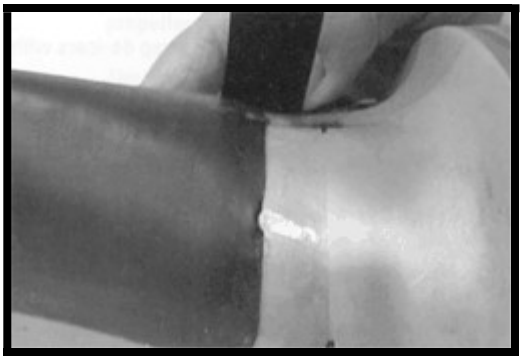


Figure 5.7.4A

The restrainer strap should be centered over the inboard edge of the de-icer.

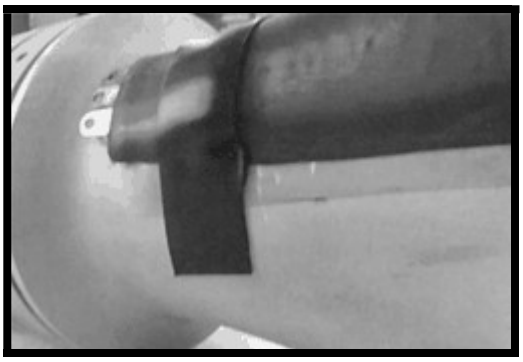


Figure 5.7.4B

The strap should begin about 90° to one side from the lead strap (adhesive not shown).

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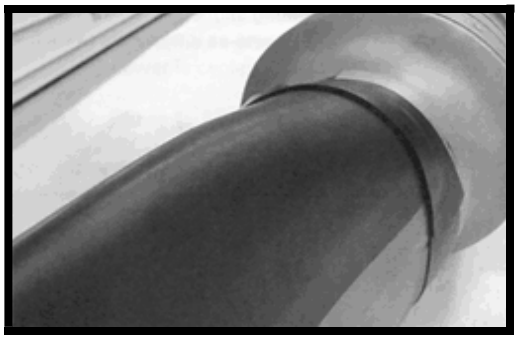


Figure 5.7.4C

The restrainer strap overlaps itself for half the propeller circumference, ending 180° from its start point and providing two layers over the lead strap.

5.7.5 Apply Sealer

Apply one even brush coat of sealer over the restrainer strap and cemented areas.

5.7.6 If Metal Strap Restrainers are Used

The lead strap should be cemented to the blade/hub up to the middle of the strap restrainer.

5.8 Balance Weights, Restraining and Attachment Hardware and Marking

5.8.1 Reinstall Components

Install balance weights, restraining and attachment hardware as previously installed in accordance with aircraft or propeller manufacturer's manuals.

5.8.2 Marking for Hartzell Propellers

Hartzell has established a method for marking the blades; follow blade-marking instructions in Hartzell Manual 133 or 135.

6.0 Anti-Freeze Feed Shoe Installation

6.1 SMR Anti-Freeze Feed Shoe systems remove propeller ice accumulation during flight by distributing anti-freeze liquid over potential icing areas on propeller blades. The liquid is directed onto the grooved propeller shoe and distributed along the blade's leading edge. (Figure 6.1)

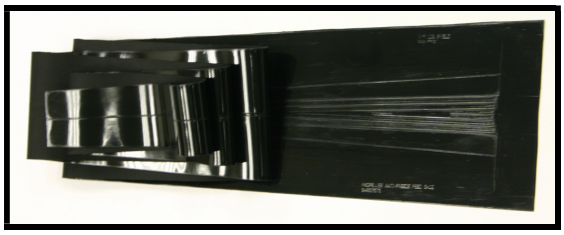


FIGURE 6.1

NOTE: Feed shoes are approximately 52 inches in length and are trimmed as required.

6.2 Verify propeller shoe length from the applicable aircraft maintenance manual prior to installation.

6.3 After trimming the shoe to the specified length, round both corners of the trimmed end to a ½ inch radius. (See Figure 6.3)

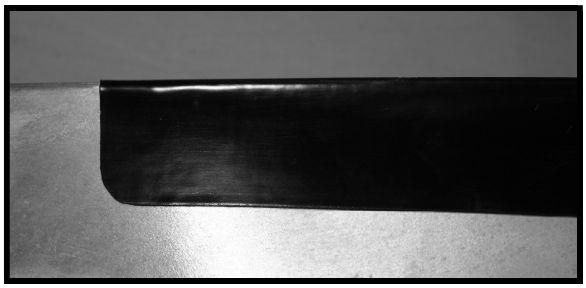


FIGURE 6.3

NOTE: Refer to De-icer Removal section 4.0 and Installation section 5.0 for the adhesive applications and the installation procedures.

6.4 Maintain one inch space between hub end of the blade and wider end of shoe. (See Figure 6.4)

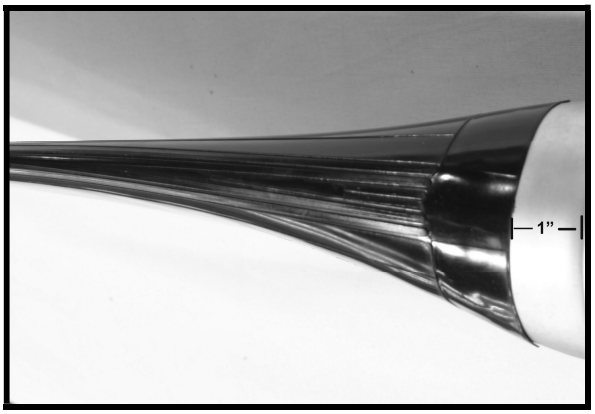


FIGURE 6.4

7.0 Checkout

7.1 Off-Aircraft Checkout

7.1.1 Adequate Slack in the Leads

CAUTION: Ensure that the propeller blades can be moved throughout the entire pitch range without placing the de-icer leads or straps in tension.

7.1.2 Terminals and Resistance

Check that all terminals are tightened per the appropriate aircraft or propeller manuals. Verify the electrical resistance between terminals or between the slip rings. Check resistance (See SMR Technologies, Inc. Report #97-33-068, Propeller De-Icer Installation Resistance Values) between common ground and either of the other terminals when the de-icer terminals are attached to proper studs. Compare with minimum and maximum values in the resistance table for the applicable part number.

7.2 On-Aircraft Checkout

7.2.1 Repeat steps 1 and 2 of Off-Aircraft Checkout

7.2.2 Electrically Isolate the Propeller De-Icer Circuits

Electrically isolate the propeller de-icer circuits from the aircraft wiring before proceeding to the next step. To electrically isolate the de-icer, either remove the brush assembly, or disconnect the wire harness at the brush assembly, terminal strip, or firewall connector plug.

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7.2.3 Resistance Checks

Check for intermittent shorted or open circuits by moving the de-icer straps while measuring resistance. Also, press lightly on the entire de-icer heating surface and in the area adjacent to the clamp. Resistance should not fluctuate; if resistance changes during this exercise, it may indicate a short or open circuit condition. Thoroughly check the connection.

7.2.4 Reconnect Circuits as Required

7.3 Minimum Installation Dry Times

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

7.3.1 Before Flying the Aircraft

Allow 12 hours for short lead strap de-icers with wire harnesses.

Allow 24 hours for long lead strap de-icer installations.

7.3.2 Before Operating the De-Icers

Allow 24 hours for all installations.

8.0 Maintenance

8.1 Electrical De-Icer System Description

8.1.1 Single Element De-Icers

Each single element de-icer has one electrothermal element. A typical heating interval is 90 seconds. Heating sequences for single element de-icer systems are listed below.

(a) Single Engine Aircraft

When the de-icing system is operating, power is cycled in the following manner:

Phase 1: All de-icer power is "on" for 90 seconds.

Phase 2: All de-icer power is "off" for 90 seconds.

The cycle may begin at Phase 1 or Phase 2, but the alternating sequence remains the same and continues as long as the system is operating.

(b) Twin Engine Aircraft

When the de-icing system is operated, power is cycled in the following manner:

Phase 1: All de-icers on the first propeller assembly are "on" for 90 seconds.

Phase 2: All de-icers on the second propeller assembly are "on" for 90 seconds.

The cycle may begin at Phase 1 or Phase 2, but the alternating sequence remains the same and continues as long as the system is operated.

8.1.2 Dual Element De-Icers

Each dual element de-icer has two electrothermal elements: inboard and outboard. Most dual element de-icers operate on a heating cycle of 34 seconds, although there are exceptions. Check the aircraft manual for the applicable interval time. Heating sequences for dual element de-icer systems are listed below:

(a) Single Engine Aircraft

When the de-icing system is operating, power is cycled in the following manner:

Phase 1: All outboard de-icer elements are "on" for the specified interval.

Phase 2: All inboard de-icer elements are "on" for the specified interval.

The cycle may begin at Phase 1 or Phase 2, but the alternating sequence remains the same and continues as long as the system is operating.

(b) Twin Engine Aircraft

Note: Some twin engine aircraft have two independent timers which cycle power to the de-icers on each propeller assembly separately, essentially operating as if there were two single engine systems.

When the de-icing system is operated, power is cycled in the following manner:

Phase 1: All outboard de-icer elements on the first propeller assembly are "on" for the required interval.

Phase 2: All inboard de-icer elements on the first propeller assembly are "on" for the required interval.

Phase 3: All outboard de-icer elements on the second propeller assembly are "on" for the required interval.

Phase 4: All inboard de-icer elements on the second propeller assembly are "on" for the required interval.

The cycle may begin at Phase 1 or Phase 2, but the alternating sequence remains the same and continues as long as the system is operated.

(c) Multi-Engine Aircraft

Check the applicable aircraft manual for operational information on aircraft with three or more engines.

8.2 Current Drain

The type and number of de-icers determine the de-icing system current drain. Therefore, only the components specified for a particular aircraft can be used on that aircraft without adversely affecting de-icing system operation.

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8.3 Required Inspection

Caution: Do not operate the de-icers continuously for more than 5 minutes when ambient temperature exceeds 100°F. Also, allow them to cool down completely between operations.

When checking systems operation, use an auxiliary power supply. If an auxiliary power unit (APU) is not available, conduct a continuity check in place of the inspection steps that require power.

8.3.1 50 Hour Inspection

A properly calibrated ammeter is required for this procedure.

Remove the spinner dome and open access doors as required.

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, including the de-icer, wire harness and slip ring leads, and the firewall electrical connectors. Changes (other than normal flicker from cycling of certain timers) indicate a short or open circuit. Locate the problem by monitoring system continuity while flexing and prodding the suspected area. Correct as required.

Perform the following De-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 Sections 7.1.1 & 7.1.2. Feel the de-icer area that is under power during each phase of the cycle. Hot spots indicate surface damage or poor bonds that require de-icer replacement or rebonding. (Some timers may cause the ammeter needle to flicker when the timer cycles each phase.) Reinstall the spinner dome as required.

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.)

8.3.2 100 Hour/Annual Inspection

If aircraft is equipped with constant speed propellers, feather the propellers. Remove the spinner dome and open access doors as required. (Do not operate the engine with the spinner dome removed.)

Examine the de-icers for wrinkled, loose, or torn areas, particularly around the outboard end and where the de-icer or wire harness leads pass under the strap clamp or restrainer. Look for abrasion or cuts, especially along the leading edge and the propeller thrust face. Confirm that the lead strap and terminal clamps, tie straps or restrainers are secure and properly installed.

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

Confirm that the de-icer or wire harness leads are not in tension. If tension exists, redistribute the slack between the lead clip and terminal studs, or between the lead strap clamp or restrainer and the de-icer. If there is no slack, or when tension still exists after redistributing the slack, confirm the de-icer location dimension in the aircraft or propeller manufacturer's manual or drawing, and confirm the de-icer part number in the aircraft manual and SMR Replacement Parts List. If the de-icer location is incorrect, remove the de-icer and reposition. (All de-icers on a propeller assembly must be located an equal distance from the hub to maintain rotational balance.) If the wrong de-icer part number is installed, replace it with the correct part number.

When de-icer wire harnesses are required, confirm that the terminals and terminal studs are not shorting out to each other or to the propeller hub. Inspect the wire harnesses for damage or shorting. Remove any source of chafing as required, and replace the wire harnesses as required. Confirm that the lead clips or terminal screw assemblies are in good condition.

Perform the De-Icer Heat Test described in the 50-Hour inspection to confirm de-icer system performance.

9.0 Troubleshooting

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

10.0 Storage

The life of an uninstalled de-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.

10.1 Packaging

Each de-icer is sealed in shrink-wrap with cardboard backing and boxed prior to shipment. Store the de-icer in its original sealed packaging in an area free from sunlight, harmful fumes and excessive dust.

10.2 Harmful Substances

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

10.3 Ozone

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

10.4 Temperature

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

10.5 Stresses

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

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Appendix A

11.0 Accessories

11.1 Install Kit

P/N 2MA1414-01



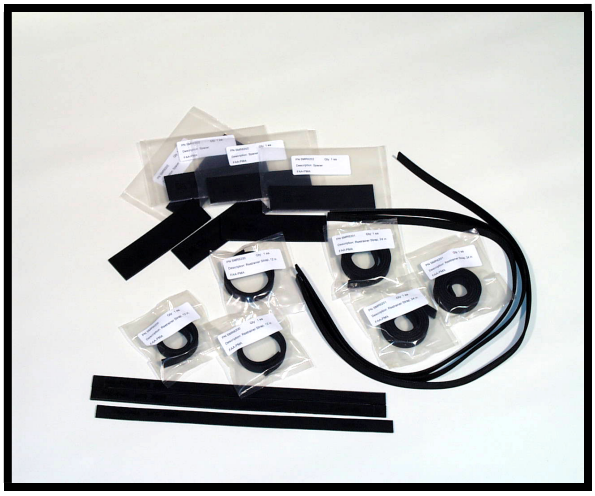
11.2 SMR Ice Inhibitor

P/N SMRPROTECT



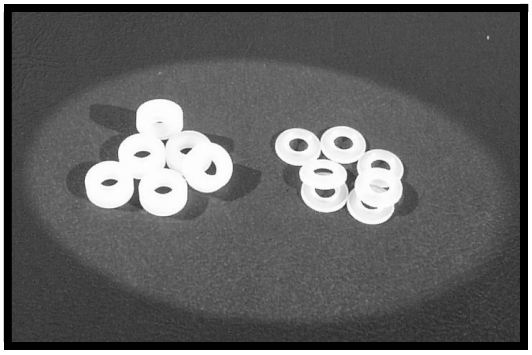
11.3 Restrainer Straps

P/N SMR6200-01 Restrainer Strap, 12 in.
P/N SMR6201-01 Restrainer Strap, 24 in.
P/N SMR6202-01 Restrainer Strap, 4.6 in.



11.4 Bushing, Nylon

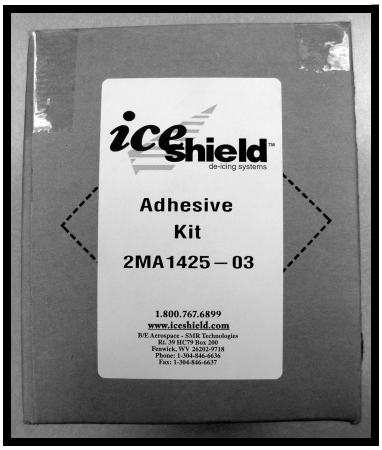
P/N 4MA2043-1
P/N 4MA2181-1



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11.5 Adhesive Kits Contents



Kit, Adhesive P/N 2MA1425-03

Description	Qty
Adhesive, 1300L, 3M	1ea Qt



Kit, Adhesive P/N 2MA1425-04

Description	Qty
Adhesive, 1300L, 3M	1 ea Qt
Brush, Bristle 3 in. wide	1 ea
Stick, Stir	2 ea
Swab, Sewn	2 ea

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12.0 Warranty

All Ice Shield Pneumatic De-Icers are warranted to be free from material and workmanship defects for five (5) years or 4,000 flight hours from the date of installation, whichever occurs first, but not beyond 120 months from date of manufacture.

All Ice Shield™ Propeller De-Icers are warranted to be free from material and workmanship defects for eighteen (18) months or 2,000 flight hours from the date of installation, whichever occurs first, but not beyond 120 months from date of manufacture.

All Ice Shield™ Engine Inlet De-Icers are warranted to be free from material and workmanship defects for two (2) years or 3,000 flight hours from the date of installation, whichever first occurs, but not beyond 84 months from date of manufacture.

All Ice Shield™ Hardware products are warranted to be free from material and workmanship defects for twenty-four (24) months from date of sale to the end user.

The foregoing warranties are exclusive and are accepted by the buyer in lieu of any and all other warranties, expressed or implied, including without limitation, the implied warranties of merchantability and fitness for a particular purpose. Buyers sole remedy in the event of a breach of the foregoing warranties is the repair or replacement of the affected product by SMR Technologies, Inc. (SMR) upon return of the product, transportation charges prepaid to (SMR) and after, a charge to buyer for use of the product prior to its return. Buyer agrees that in no event will (SMR) liability under any theory of contract, negligence, strict liability, other tort or otherwise, exceed buyer's net purchase price, nor will (SMR) be liable for any special, incidental, consequential, or exemplary damages.

(SMR) assumes no liability whatsoever, whether contractual, warranty, tort or otherwise, for any federal aviation administration sanctions, product malfunctions, property damage, personal injuries, or similar incidents occurring after any substitution of parts not manufactured by (SMR) or any alteration of (SMR) manufactured parts not authorized by (SMR) manuals or other written procedures issued by (SMR).

The foregoing warranties will continue in effect for so long as the product is serviced and maintained in accordance with (SMR) instructions and with genuine (SMR) manufactured replacement parts. These warranties may not be altered or amended except by a written instrument signed by buyer and a duly authorized officer of (SMR).

12.1 Repairs and Returns

To return any parts for warranty consideration, you must first request a Return Goods (RG) Authorization number. To receive the number, simply contact a Sales & Service Representative (SSR) at:

Toll Free: 1.800.767.6899
Phone: 1.304.846.6636
Fax: 1.304.846.6268

The SSR will provide you with a return address. Please do not ship any returned parts without the RG number as this number allows SMR to track the part and the resolution of the claim.

The warranty is limited to returns for the following reasons:

1. Wrong items shipped
2. Wrong items ordered
3. Any return for credit
4. Items damaged in shipment
5. Warranted defects

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