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PROPRIETARY INFORMATION

PPS 39.08

PRODUCTION PROCESS STANDARD

REPLACEMENT OF AUTOCLAVE BONDED DE-ICER BOOTS ON DASH 8 COMPOSITE LEADING EDGES

Issue 17
- This standard supersedes PPS 39.08, Issue 16.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS related questions to christie.chung@aero.bombardier.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for replacing autoclave bonded (co-cured) de-icer boots on DASH 8 aircraft composite leading edges.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. do not supersede the procedure or requirements specified in this PPS. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

1.2 Refer to PPS 39.06 and PPS 39.07 for replacement of de-icer boots on the DASH 8 vertical stabilizer and engine air intake, respectively.

2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto Environment, Health and Safety Department.

3 REFERENCES

3.1 BAERD GEN-023 - Contamination Control for Compressed Air.

3.2 PPS 6.05 - Closure of Fluid Lines and Fluid System Components.

3.3 PPS 10.40 - Repairs to Laminates & Sandwich Panels.

3.4 PPS 13.13 - Personal Protective Respiratory Equipment.

3.5 PPS 13.23 - Preparation & Use of DHMS P1.30 Resin.

3.6 PPS 13.26 - General Subcontractor Provisions.

3.7 PPS 13.28 - Storage Life of Adhesives, Sealants, Paints and Composite Products.

3.8 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.9 PPS 15.04 - Use of Markers for Marking Aircraft Parts and Assemblies.

3.10 PPS 20.06 - Ultrasonic Inspection of Fibre Reinforced Composite Parts.

3.11 PPS 21.20 - Mixing and Handling Two-Part Sealants.

3.12 PPS 21.21 - General Sealing Practices.

3.13 PPS 23.02 - Protective Treatment and Decorative Surface Finish Code System.

3.14 PPS 25.63 - Bonding Using DHMS A6.11 Type I Class 2 Adhesive.

3.15 PPS 31.17 - Solvent Usage.

3.16 PPS 32.02 - Manual Application of Chemical Conversion Coatings.

3.17 PPS 34.08 - Application of Epoxy-Polyamide Primer (F19 & F45).

3.18 PPS 34.15 - Application of Anti-Static Polyurethane Enamel (F31 & F34).

3.19 PPS 34.34 - Surface Finishing Compounds (F33).

3.20 PPS 39.06 - Installation of DASH 8 Airframe De-Icer Boots.

3.21 PPS 39.07 - Installation of DASH 8 Air Intake De-Icer Boots.

3.22 PPS 39.09 - Application of Cosmetic Treatment on De-Icer Boots.

3.23 QAMTR 001 - Testing of DHMS S3.01, A1/2, A2, B1/2 and B2 Polysulphide Sealant.

3.24 QAMTR 007 - Testing of Adhesives.

3.25 QDI-15-02 - Shelf Life of Aeronautical Products.

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Abrasive paper, aluminum oxide, 180 - 220 grit size.

4.1.2 DHMS A6.11 Type I Class 2 adhesive.

4.1.3 DHMS S3.01/A1/2 sealant.

4.1.4 DHMS S3.01/B2 sealant.

4.1.5 DHMS S3.01/B1/2 sealant.

4.1.6 DSC 375-1 tack cloths.

4.1.7 Kraft paper.

4.1.8 Lint-free wiping cloth (e.g., DSC 378-3).

4.1.9 Masking tape, 1" width.

4.1.10 Parting Agent 13.

4.1.11 Potting compound, DHMS P1.30 Grade 1.

4.1.12 Scotch-Brite abrasive pad, Type A fine (maroon/brown).

4.2 Equipment

4.2.1 Bristle brush, adhesive application.

4.2.2 De-icer boot peeling tool, Tool Number 85720004-001-216.

4.2.3 Lint-free cotton gloves (e.g., DSC 422-1).

4.2.4 Pressure test rig (e.g., SD5454). Use clean compressed air.

4.2.4.1 Compressed air shall meet the requirements of BAERD GEN-023.

4.2.5 Rubber roller, approximately 3" wide X 2" diameter (e.g., B.F. Goodrich 74-451-74).

4.2.6 Shop vacuum source, capable of maintaining and monitoring a minimum vacuum of 20" Hg.

4.2.7 Suitable spatula.

4.2.8 Trimming knife (e.g., Hyde #K-422-120) or scissors.

4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Critical Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform replacement of the autoclave bonded (co-cured) de-icer boots on DASH 8 aircraft composite leading edges according to this PPS.

4.3.2 Bombardier subcontractors shall direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier Aerospace facilities shall direct requests for approval to the appropriate internal Quality Manager.

4.3.3 Facility approval shall be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report shall detail the materials and equipment to be used, the process sequence to be followed and the laboratory facilities used to show compliance with the requirements of this PPS. Any deviation from the procedure or requirements of this PPS shall be detailed in the facility report. Based upon the facility report, Bombardier Toronto Engineering may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification shall be prepared to demonstrate their capability. Once approved, no changes to subcontractor facilities may be made without prior written approval from Bombardier Toronto Engineering.

4.3.3.1 For approval of subcontractor facilities to perform replacement of the autoclave bonded (co-cured) de-icer boots on DASH 8 aircraft composite leading edges according to this PPS, completion of a test program and submission of suitable test samples representative of production parts may be required. Test samples shall meet the requirements as defined by Bombardier Toronto Engineering.

5 PROCEDURE

5.1 General

5.1.1 For the purposes of this PPS, the term “MRB” (Material Review Board) shall be considered to include Bombardier Toronto MRB and Bombardier Toronto delegated MRB.

5.1.2 The introduction of composite leading edges on the DASH 8 was accompanied by a design change which incorporated the de-icer boot directly into the lay-up of the composite leading edge. This design co-cures the de-icer boot in the outer laminate of the leading edge during autoclave curing to produce a superior bond and aerodynamic smoothness of the completed assembly.

5.1.3 Because this process effectively creates a recess in the outer laminate which is exactly the shape of the original de-icer boot, it is of the utmost importance that the procedures specified herein are closely followed to ensure that the replacement boot is satisfactorily bonded in place and that the original aerodynamic requirements of the leading edge are met.

5.2 Removal of De-Icer Boot

5.2.1 Remove the leading edge from the aircraft and place it on a suitable work bench or trestle that is firmly attached to the floor or otherwise secured.

5.2.2 Remove the lift transducer and stall bar, where fitted, and store until required for re-assembly. Remove stall bars as follows:

Step 1. Remove the attachment bolts, if applicable.

Step 2. Apply the solvent specified in PPS 31.17 to the glue line at one corner of the bar.

Step 3. Peel the bar away from the boot, applying more solvent as required.

5.2.3 Starting at the outboard end of the boot, apply the solvent specified in PPS 31.17 to the glue line at one corner of the boot and peel the boot away from the leading edge, applying more solvent as required (see Figure 1).

5.2.3.1 To aid in peeling, insert the solvent de-bonded outboard end of the boot into the slot in the shank of a de-icer boot peeling tool (see paragraph 4.2.2) and rotate the tool, while applying solvent, to roll the boot back on itself.

5.2.3.2 Any attempt to de-bond DHMS A6.11 Type I Class 2 bonded areas of the boot without using solvent may result in interply delamination of the leading edge itself.

5.2.3.3 If the de-icer boot ends have been cold bonded with DHMS A6.11 Type I Class 2 adhesive after autoclave curing, solvent de-bonding of the de-icer boot is necessary for approximately the last 6" at each end of the boot. If the de-icer boot has been cold bonded overall with DHMS A6.11 Type I Class 2 adhesive, solvent de-bond the entire bonding surface.

5.2.4 After solvent de-bonding the adhesive bonded area, remove the boot as follows:

Step 1. Peel the boot off the laminate by carefully rolling the boot back onto itself until only the manifold tube prevents complete removal.

Step 2. Carefully cut away the outer layer of the de-icer boot from the manifold so as to expose the manifold tube (see Figure 2-A).

Step 3. If possible, push the manifold tube out of the leading edge to complete the removal of the boot.

Step 4. If the manifold can not be readily pushed out of the leading edge, drill a series of 1/8" diameter holes around the periphery of the manifold. Drill completely through the composite structure and pitch the holes so that each hole touches the next (see Figure 2-B). On completion of drilling the final hole, push the manifold tube out of the leading edge.

Step 5. Discard the old de-icer boot.

5.2.5 After removing the boot, prepare the structure as follows:

Step 1. Undercut the composite structure around the hole to a depth of 0.12" to 0.25" and apply DHMS P1.30 Grade 1 potting compound to the core according to PPS 13.23.

Step 2. If large pieces of the de-icer boot remain on the surface, remove them by carefully peeling the patches off the composite.

Step 3. Remove any adhesive knit carrier fabric by gently pulling it away from the outer surface. The adhesive knit fabric is sometimes used along with the adhesive film to bond the de-icer boot to the leading edge during autoclave curing. The knit fabric can be identified by its fine white mesh weave (compared to the characteristic honey colour of the Kevlar fabric).

Step 4. Remove all residual traces of adhesive from the leading edge surface by solvent cleaning according to PPS 31.17.

Step 5. Use 180 - 220 grit abrasive paper or Scotch-Brite to lightly abrade the entire leading edge de-icer boot bonding surface and remove all residual traces of de-icer boot, rubber, adhesive, small resin ridges, etc. Take care to ensure that the outer surface of the leading edge is not damaged by abrading.

5.2.6 If applicable, fill the depression in the leading edge around the boot manifold hole (resulting from the boot manifold doubler) flush with the surrounding surface as follows:

Step 1. Solvent clean the area around the manifold tube according to PPS 31.17.

Step 2. Fill the depression with DSC 206-2 surface finishing compound, as specified in PPS 34.34, or DHMS P1.49 epoxy resin-gelcoat, as specified in PPS 10.40, to achieve a contour which is approximately aerodynamically flush with the surrounding surface.

Step 3. Allow the finishing compound or resin-gelcoat to fully cure according to the PPS's specified in Step 2.

Step 4. Use 180 - 220 grit abrasive paper to sand the surface finishing compound or gel-coat flush with the leading edge contour and to radius the compound around the manifold hole (see Figure 3).

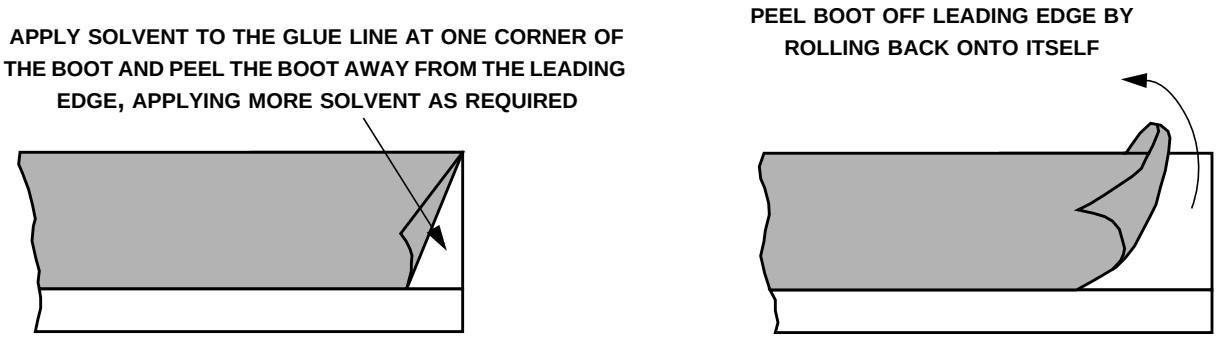


FIGURE 1 - DE-ICER BOOT REMOVAL

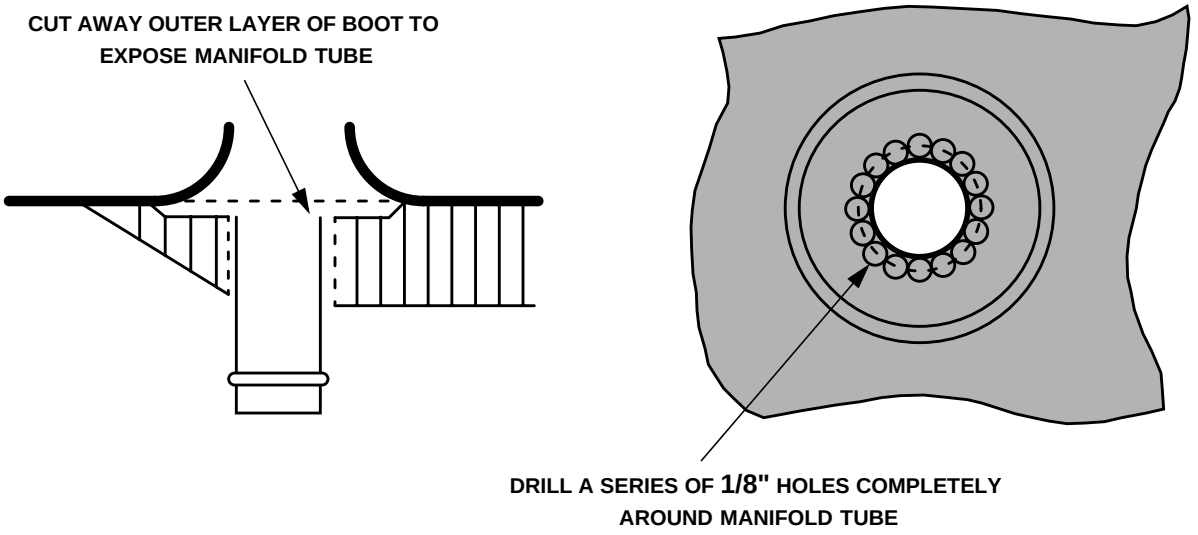


FIGURE 2-A **FIGURE 2-B**

FIGURE 2 - REMOVAL OF MANIFOLD TUBE

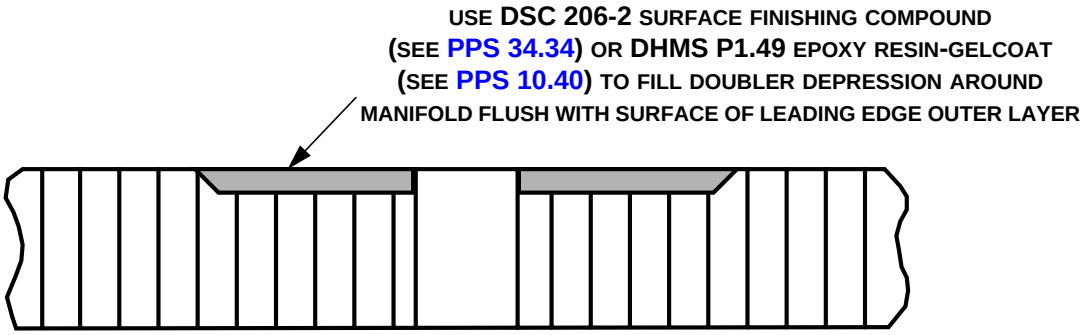


FIGURE 3 - FILLING DOUBLER DEPRESSION

5.3 Intermediate Inspection

5.3.1 After removing the boot and cleaning the leading edge as specified in section 5.2, inspect the outer surface of the composite leading edge to ensure that:

- It is smooth.
- It has a uniform honey colour.
- There are no signs of exposed Kevlar fabric or resin voids.
- Depressions which do not penetrate the outer Kevlar ply are filled with surface finishing compound.

5.3.2 Remove excess resin ridges or high points on the leading edge de-icer boot bonding surface by sanding with 180 - 220 grit abrasive paper. Take care not to sand through the resin of the outer ply (i.e., Do not expose the Kevlar fabric).

5.3.3 If an area of surface filler on the leading edge bonding surface shows signs of adhesive or cohesive failure, repair the area as follows:

Step 1. Taking care not to penetrate the outer Kevlar ply, use 180 - 220 grit abrasive paper to sand the area until the surface filler is completely removed.

Step 2. Fill the sanded void with DSC 206-2 surface finishing compound according to PPS 34.34.

5.3.4 If the Kevlar fabric has been exposed, refer the leading edge to MRB for disposition.

5.3.5 If there is visual evidence of cracking of the resin, refer the leading edge to MRB for disposition.

5.3.6 Ultrasonically inspect the entire outer surface of the composite leading edge according to PPS 20.06. Refer leading edges which show evidence of voids, delaminations, inclusions or other structural irregularities to MRB for disposition.

5.4 De-Icer Boot Installation

5.4.1 Preparation of Leading Edge

5.4.1.1 Completely remove the old de-icer boot according to section 5.2 and inspect the leading edge as specified in section 5.3 before installing the replacement boot as follows:

Step 1. Taking care to avoid abrading through the outer resin and exposing the composite fibres, use 180 - 220 grit abrasive paper to lightly scuff the bond surface of the leading edge. Ensure the entire bond surface is abraded, including hard to reach corners or recesses.

Step 2. Solvent clean the bond surface of the leading edge as specified in PPS 31.17. Solvent clean all bond areas twice. Do not touch cleaned areas with bare hands or subject them to any form of contamination. Wear clean lint-free cotton gloves at all times when handling cleaned parts.

Step 3. Visually inspect the bonding surface for evidence of dust, cloth fibres, etc. If necessary, wipe bonding surfaces with a tack cloth to remove loose particles.

Step 4. Place the de-icer boot on the leading edge with the inlet spigot inserted in the manifold hole.

Step 5. Adjust the boot so that it is centrally positioned on top of the original de-icer boot location.

Step 6. With the boot centralized on the original de-icer boot location, fold back the boot at each end and make a mark on the leading edge corresponding to the centreline mark on the replacement boot.

Step 7. Use a permanent type felt tip marker, as specified in PPS 15.04, and a straight edge to draw a straight line on the leading edge which passes through the centreline marks.

Step 8. Mask off the upper and lower recess edges along the entire length of the leading edge with 1" masking tape (see Figure 4).

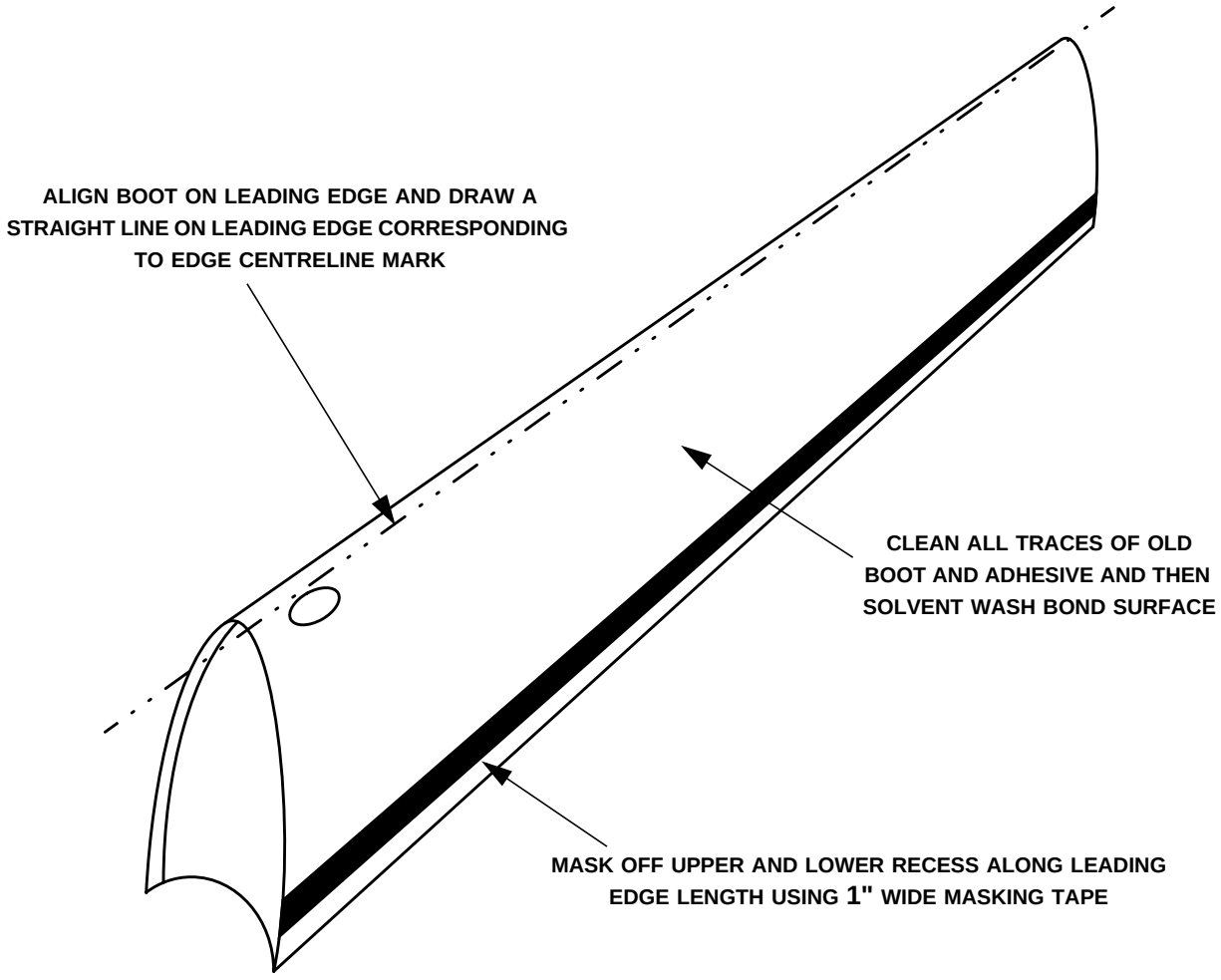


FIGURE 4 - PREPARATION OF LEADING EDGE

5.4.2 Preparation of De-Icer Boot

5.4.2.1 Before installation, submit all de-icer boots for inspection as specified in section 6.1.

5.4.2.2 De-icer boots are inflation tested by the manufacturer. Do not inflate de-icer boots for any reason before installing.

5.4.2.3 It is not necessary to clean the non-bonding surface of the de-icer boot at any time during its installation. If desired, it is acceptable to use a cloth dampened in the solvent specified in PPS 31.17 to remove shop dust or debris from the non-bonding surface.

5.4.2.4 Prepare the de-icer boot as follows:

Step 1. Place the de-icer boot on a clean flat surface with the inner surface (bonding side) up.

Step 2. Solvent clean the entire bonding surface twice according to PPS 31.17. Do not touch cleaned areas with bare hands or subject them to any form of contamination.

Step 3. Visually inspect the bonding surface for evidence of dust, cloth fibres, etc. If necessary, wipe the bonding surface with a tack cloth to remove loose particles.

Step 4. Immediately after cleaning, overlay the de-icer boot with clean Kraft paper until immediately before the application of adhesive.

5.4.3 Application of Adhesive

5.4.3.1 Do not touch adhesive coated surfaces with bare hands. Wear clean cotton gloves at all times and protect adhesive coated surfaces from contamination.

5.4.3.2 Immediately after cleaning the structure and cleaning or removing the Kraft paper from the boot, apply adhesive as follows:

Step 1. Prepare DHMS A6.11 Type I Class 2 adhesive according to PPS 25.63.

Step 2. After cleaning the boot and leading edge, apply the adhesive to the de-icer boot and leading edge bonding surfaces according to PPS 25.63. Distribute the adhesive evenly and cover all bonding surfaces.

Step 3. Allow the first coat of adhesive to dry for a minimum of one hour. Do not touch the adhesive during this time.

Step 4. If the second coat of adhesive is not going to be applied right away, cover the first coat of adhesive with Kraft paper. Do not wait more than 48 hours between applying the first and second coats of adhesive.

Step 5. If Kraft paper was applied as specified in Step 4, remove the Kraft paper and apply a second coat of adhesive to the de-icer boot and the leading edge bonding surfaces according to PPS 25.63. Distribute the adhesive evenly and cover all bonding surfaces.

Step 6. Before installing the boot, allow the second adhesive coat to dry as follows:

- If the relative humidity is 75% or less and the temperature is 10°C (50°F) or greater, dry for a minimum of 1 hour.
- If the relative humidity is greater than 75% or the temperature is less than 10°C (50°F), dry for a minimum of 2 hours.

Step 7. If the boot is not going to be installed immediately after the initial drying time, cover the adhesive with Kraft paper. Do not wait more than 48 hours between applying the second coat of adhesive and installing the boot.

5.4.4 Bonding of De-Icer Boot

5.4.4.1 When re-activation of the de-icer boot is specified, dampen corresponding areas of the adhesive coating on the boot and structure using a clean cloth or brush moistened with the solvent specified in PPS 31.17. Take care to prevent the solvent from contacting the outer surface of the boot. Avoid rubbing the adhesive coating as this can locally remove the adhesive from the surface of the boot or structure.

5.4.4.1.1 Wait until the re-activated adhesive is tacky (approximately 30 seconds to 1 minute) before unrolling the boot onto the leading edge.

5.4.4.2 Press down firmly to eliminate all air bubbles and, using a rubber roller, roll the boot spanwise to improve the bond (see Figure 5). If necessary, lightly stretch the boot during bonding to eliminate wrinkles.

5.4.4.2.1 Take special care to ensure that boot is firmly pressed down in areas where there is a slight concavity in the leading edge surface, such as the area around the air intake manifold hole.

5.4.4.3 Remove all entrapped air while bonding. Smooth out the affected area by hand or with a rubber roller or slide a thin spatula between the bonded surfaces into the air bubble and press out the bubble while simultaneously removing the spatula. If necessary, use the solvent specified in PPS 31.17 to loosen the adhesive or release the boot as far as the affected area. Re-bond the boot after loosening the adhesive.

5.4.4.4 Bond the de-icer boot as follows:

Step 1. Remove the masking tape applied to the leading edge in Step 8 of section 5.4.1.

Step 2. Place the boot in its correct position on the structure, concentrically locate the boot manifold tube in the leading edge cut-out and align the boot reference centreline with the corresponding leading edge centreline.

Step 3. Connect the boot to a vacuum source of 5" Hg to 8" Hg to maintain the boot under vacuum during installation.

Step 4. Roll the boot back to just beyond the air intake manifold (see Figure 6).

Step 5. Taking care to prevent the solvent from contacting the outer surface of the boot, re-activate the adhesive in the area of the manifold. Use a clean cloth moistened with the solvent specified in PPS 31.17 to dampen corresponding areas of the adhesive coating on the boot and structure. Avoid rubbing the adhesive coating as this can locally remove the adhesive from the surface of the boot or structure.

Step 6. Unroll the boot slightly so that it covers the air intake manifold, superimposing its reference centreline on the leading edge reference centreline, and press the boot down firmly in the bond area. Take care to avoid trapping air in the bond line.

Step 7. Check the concentricity of the manifold tube and, if satisfactory, improve the bond using a rubber roller (see paragraph 4.2.5).

Step 8. Making sure to match the reference centreline markings, progressively unroll the boot along the leading edge, re-activating the adhesive (see paragraph 5.4.4.1) and bonding a small area at a time along the centreline (see Figure 6, sections 2 through 12). Improve the bond of each section by using a rubber roller to firmly roll the bonded strip lengthwise (see Figure 5).

Step 9. Complete bonding both sides of the boot, reactivating in strips 3" to 4" wide (Figure 6, sections 13 to 17) and leaving the last 2" to 3" at the trailing edges unbonded to facilitate trimming as specified in section 5.6.

Step 10. After bonding and before trimming according to section 5.6, check for correct positioning of the installed boot and for evidence of entrapped air in the bond line. If the boot is incorrectly positioned, completely or partially remove it according to section 5.5.

- Remove entrapped air using a thin spatula. Slide the spatula between the bonded surfaces into the air bubble and press out the bubble while simultaneously removing the spatula. If necessary, use solvent to de-bond the adhesive as specified in section 5.5.
- Refer to section 5.5 for solvent de-bonding instructions if complete or partial removal of a boot is necessary.

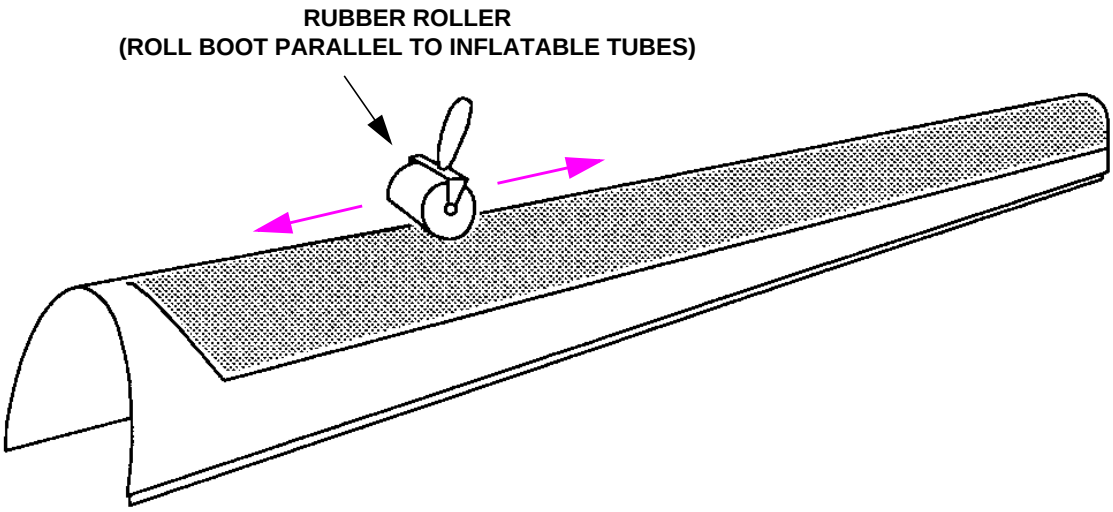


FIGURE 5 - USE OF ROLLERS TO IMPROVE BOND

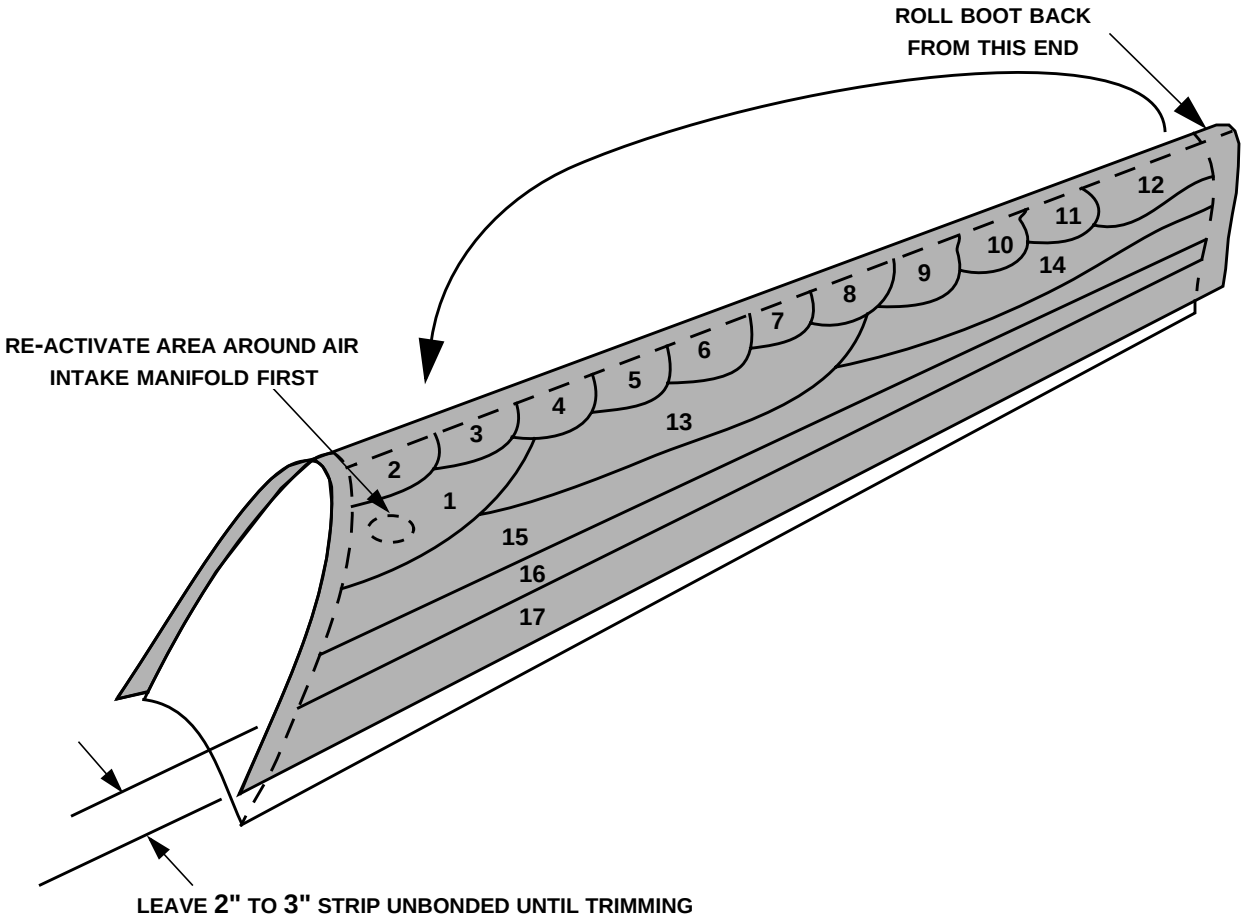


FIGURE 6 - RE-ACTIVATION SEQUENCE FOR BONDING DE-ICER BOOTS

5.5 Removal or Re-Positioning of Bonded Boot

5.5.1 If removing a boot and re-using it, release the bond by applying the solvent specified in PPS 31.17 between the boot and structure as follows:

Step 1. Peel back one section of the boot edge from the structure and apply solvent to the glue line while applying tension to peel the boot back. To aid in peeling, insert the solvent de-bonded boot edge in the shank slot of a de-icer boot peeling tool (see paragraph 4.2.2) and rotate the tool, while applying solvent, to roll the boot back on itself.

Step 2. If re-installing the de-icer within 48 hours of applying the original second adhesive coat, touch-up all bare areas on the bonding surfaces with DHMS A6.11 Type I Class 2. If more than 48 hours has elapsed, remove all traces of adhesive from the boot and leading edge structure, by solvent cleaning according to PPS 31.17, before re-installation.

5.5.2 Any attempt to de-bond DHMS A6.11 Type I Class 2 bonded areas of the boot without using solvent may result in interply delamination of the leading edge itself.

5.5.3 Peel off boots which are to be discarded in sections parallel to the inflatable tubes. Remove adhesive from the leading edge by solvent cleaning according to PPS 31.17.

5.5.4 If partially removing a boot to correct its position or to free entrapped air, release bonds by applying the solvent specified in PPS 31.17 between the boot and leading edge. After making the necessary adjustments, immediately re-bond the boot in place, applying DHMS A6.11 Type I Class 2 adhesive to bare areas before re-bonding.

5.6 Trimming Installed Boot

5.6.1 Before installing the lift transducer, if applicable, cut out the boot area for the lift transducer mounting hole to correspond with the cut-out in the leading edge and fill the edges with DHMS S3.01/B1/2 sealant according to PPS 21.21.

5.6.2 If necessary, use scissors or a knife to trim the trailing edge of the boot so that the trailing edge of the replacement boot ends 1/8" to 1/4" forward of the recess in the leading edge.

5.6.2.1 Take care while trimming the boot to avoid cutting or scoring the outer layer of Kevlar fabric on the leading edge.

5.6.2.2 After trimming, reactivate and bond the trailing edges of the de-icer boot as specified in section 5.4.4.

5.6.3 Trim the inboard and outboard ends of the boot to suit the structure.

5.6.4 Remove excess adhesive from the leading edge structure and de-icer boot surface by solvent cleaning as specified in PPS 31.17. Do not allow solvent to run under the bonded edges.

5.6.5 Allow the adhesive on installed boots to cure for a minimum of 24 hours at room temperature before inflated inspection according to paragraph 6.3.2.

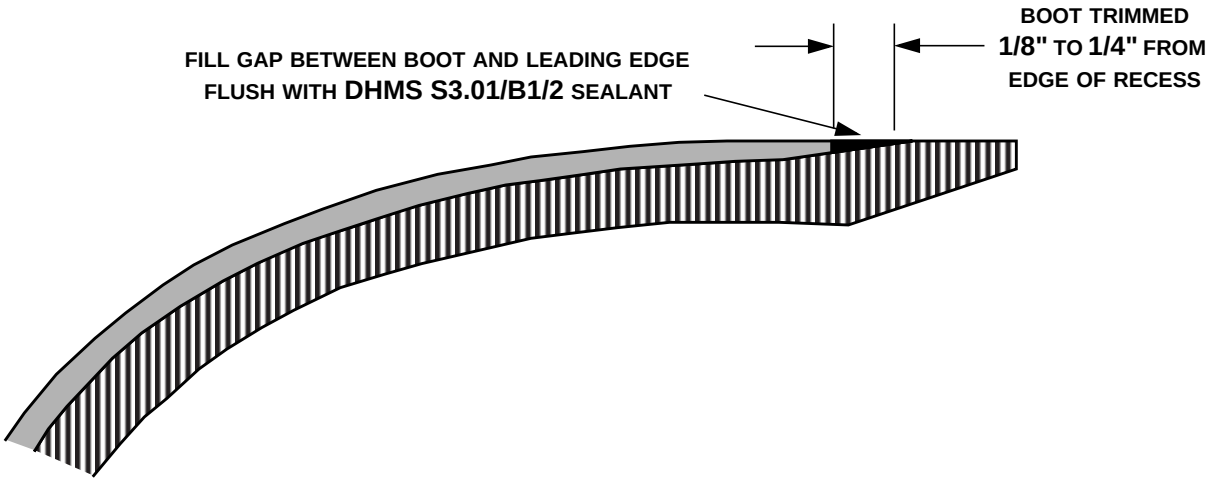


FIGURE 7 - TRIMMING AND SEALING FEATHER EDGE OF BOOT IN AREA OF RECESS

5.7 Sealing Installed De-Icer Boot (See Figure 7)

5.7.1 Fill all gaps between the boot trailing edges and the leading edge recess flush with DHMS S3.01/B1/2 sealant according to PPS 21.21.

5.7.2 Fill all gaps between the boot and the lift transducer flush with DHMS S3.01/B1/2 sealant according to PPS 21.21.

5.7.3 Fill the gap between the honeycomb core/skin and the de-icer boot manifold tube with either DHMS S3.01/B1/2 or DHMS S3.01/B2 sealant (see Figure 8).

5.7.4 If the de-icer boot has been trimmed flush with the end of the leading edge, apply a brush coat of DHMS S3.01/A1/2 sealant to the edge of the boot according to PPS 21.21, overlapping approximately 1/4" onto the closing rib.

5.7.4.1 Allow DHMS S3.01/A1/2 sealant to cure for a minimum of 8 hours at room temperature, and apply two brush coats of parting agent (see paragraph 4.1.10) to the sealant on the rib face. Allow 15 minutes drying time between each coat.

5.7.5 Allow DHMS S3.01 sealant to cure for a minimum of 8 hours at room temperature before inflated inspection according to paragraph 6.3.2 or further working the leading edge assembly.

5.7.6 Allow DHMS S3.01 sealant to cure for a minimum of 24 hours before functional or pressure testing or subjecting the boot to flight conditions.

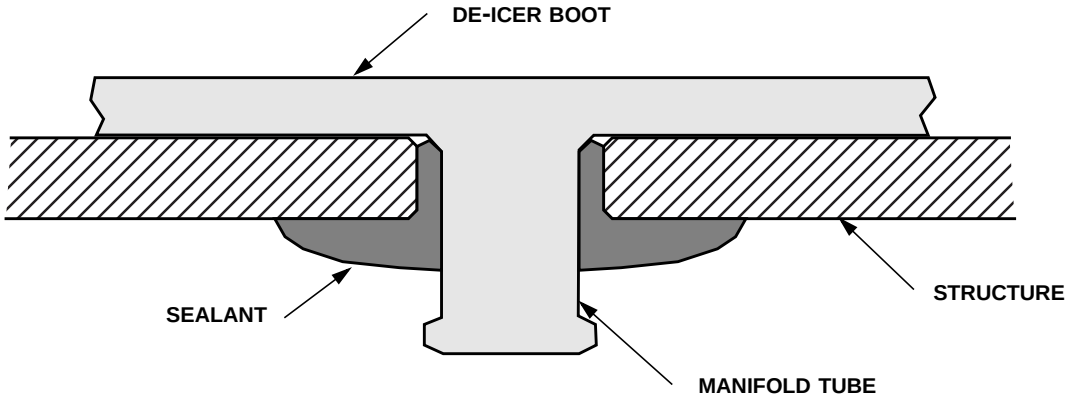


FIGURE 8 - CROSS SECTION OF SEALANT AROUND MANIFOLD TUBE

5.8 Installation of Stall Bar

5.8.1 Install stall bars on a replacement de-icer boot according to PPS 39.06.

5.9 Application of Removable Protective Latex Coating

5.9.1 After inflated inspection according to paragraph 6.3.2, apply protective latex coating to the boot surfaces according to PPS 39.06.

5.10 Application of Conductive Paint Coating

5.10.1 After the protective latex coating has cured, re-paint the de-icer boot/leading edge assembly with F31 black conductive paint according to the engineering drawing and PPS 34.15.

5.10.2 Apply the protective treatment finish code specified on the engineering drawing according to the applicable PPS as specified in PPS 23.02 (e.g., F31 enamel according to PPS 34.15). Take special care to ensure countersinks meet the finish code requirements specified on the engineering drawing.

5.11 Pre-Delivery Procedure

5.11.1 Apply cosmetic treatment to all de-icer boots according to PPS 39.09 immediately before final delivery of the aircraft.

6 REQUIREMENTS

6.1 Inspection of Boot Before Installation

6.1.1 Ensure that the boot has not exceeded the maximum shelf life storage period as specified in QDI-15-02.

6.1.2 Before installation, inspect boots for damage and evidence of deterioration as specified in paragraph 6.1.2.1, paragraph 6.1.2.2 and paragraph 6.1.2.3.

6.1.2.1 With the exception of wrinkle inspection, place the de-icer boot on a clean flat surface and connect the boot to a vacuum source of 5" Hg to 8" Hg and inspect the de-icer boot according to Table I. For wrinkle inspection, inspect for wrinkles according to Table I without applying a vacuum to the de-icer boot. If the defects magnitude exceeds the limits as specified in Table I, reject the boot and take corrective action as specified in paragraph 6.1.3.

6.1.2.2 Reject boots with deformation in the air connection. Check air connectors for cracks by squeezing between the thumb and forefinger.

6.1.2.3 Reject boots having any separation and/or evidence of brittleness.

6.1.3 Return boots which fail to meet all the above requirements to their original boxes and refer to MRB for disposition.

6.1.4 De-icer boots shall be installed within 48 hours of the application of the second coat of adhesive.

6.2 Composite Surfaces

6.2.1 The Kevlar fibres in the composite part to which the boot is being bonded shall not be exposed. The adhesive used to bond the boots in place can damage exposed fibres and compromise the structural integrity of the composite part.

6.2.2 Verify that the Kevlar fibres are not exposed before installation of the boot.

6.3 Inspection of Installed Boots

6.3.1 Immediately after bonding and before any required trimming, the installed boot shall be checked for correct positioning and entrapped air.

6.3.1.1 If complete or partial removal of boots is necessary due to incorrect positioning, refer to section 5.5 for re-positioning instructions.

6.3.1.2 Entrapped air shall be removed by sliding a thin spatula between the bonded surfaces into the air bubble and pressing out the bubble while simultaneously removing the spatula.

6.3.2 After sealing according to section 5.7, the boot shall be checked by Inspection in both the uninflated and inflated conditions for evidence of lack of adhesion and proper inflation.

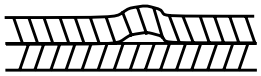
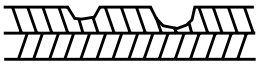
6.3.3 After the sealant has fully cured, use a suitable regulator (see Equipment section, paragraph 4.2.4) to inflate the installed and sealed de-icer boots to 15 psi and hold for 1 minute and visually checking the boots as follows:

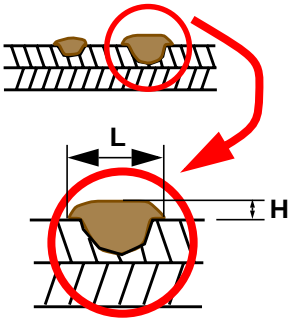
- Inspect boots according to Table I. If the defects magnitude exceeds the limits as specified in Table I, refer the part to MRB for disposition. Perform all removal of the de-icer boot according to section 5.5.
- There shall be no lack of adhesion over the entire bonded area of the de-icer boot.
- The pressure drop during the 15 psi pressure test shall be less than 1 psi/minute. Remove and discard boots with a pressure drop greater than 1 psi/minute according to section 5.5.
- A narrow inflation strip may occur outside the last active inflation tube. The narrow strip is approximately 3/16" wide and is located between the last (upper or lower side) stitch line and the tapered fillet in the de-icer tapered edge. This condition is not a construction defect, does not affect the form, fit or function of the de-icer, and is acceptable.
- Reject boots with deformation in the air connection.
- Reject boots having evidence of brittleness.

6.3.3.1 Before and after the inflated boot pressure test as specified in paragraph 6.3.3, with the exception of wrinkle inspection, connect the boot to a vacuum source of 5" Hg to 8" Hg and while maintaining the boot under vacuum, inspect the de-icer boot according to Table I. When performing this test after the inflation test, allow the boot to deflate naturally before connecting the boot to the vacuum source. For wrinkle inspection, inspect for wrinkles according to Table I without applying a vacuum to the de-icer boot, both before and after the inflated boot pressure test as specified in paragraph 6.3.3. If the defects magnitude exceeds the limits as specified in Table I, refer the part to MRB for disposition.

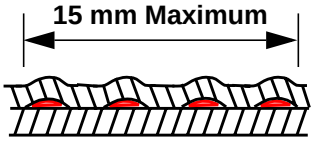
6.3.4 After inflation testing according to paragraph 6.3.3, installed boots shall be checked for compliance with the aerodynamic smoothness requirements of Table II. If the aerodynamic smoothness requirements specified in this PPS conflicts with the engineering drawing, follow the engineering drawing.

TABLE I - DEFECTS IN DE-ICER BOOTS

DEFECT	DESCRIPTION (NOTES 1 AND 2)	ILLUSTRATION
Blisters	• Air pockets • Maximum size of 0.006 square inch (4 mm^2) • No more than 2 such defects per square meter	
Craters, Voids or Impressions (Note 3)	• First ply only • Maximum size of 0.008 square inch (5 mm^2) • Maximum depth of 0.008 inch (0.20 mm) • Density ≤ 0.002 in^2/ft^2 (14 mm^2/m^2)	

Filled Craters, Voids or Impressions	• These are acceptable “filled” craters, voids or impressions performed by the de-icer boot manufacturer not exceeding the following limits:
	  • Length (L) ≤ 0.118 inch (3 mm)
	  • Height (H) ≤ 0.008 inch (0.20 mm)
	  • Density ≤ 5 “filled” reworks (i.e., craters, voids, or impressions) per square meter
		

Cuts	• Refer to MRB for disposition	
Hard Foreign Body (Stationary)	• Unknown embedded impurity (e.g., dirt) slight bump in the outer layer • Height (H) ≤ 0.008 inch (0.20 mm) • Maximum size of 0.003 square inch (2 mm^2) • Density ≤ 0.002 in^2/ft^2 (14 mm^2/m^2)	

	• Embedded “loose weave” from thread (indicated by multiple sequential bumps) in the outer layer is acceptable provided it does not exceed the following limits:
	  • Height (H) ≤ 0.008 inch (0.20 mm)
	  • Maximum size of each bump shall be 0.003 square inch (2 mm^2)
	  • Maximum length of 0.6 inch (15 mm)
		

Foreign Body (Moving)	• Refer to MRB for disposition	
Surface Scratches	• First ply only • Maximum length of 0.39 inch (10 mm) • Maximum depth of 0.004 inch (0.1 mm) • Surface scratches shall not exceed 10% per square foot of boot surface	
Linear Marks	• Protruding hairline marks on the external ply (Note 3) • Linear marks shall not exceed 10% per square foot of boot surface	
Matt Finish	• First ply only • Differences in the shiny appearance of the outer surface, however, first ply is still intact (i.e., no Tear Offs) • Areas of dull finish shall not exceed 10% per square foot of boot surface • Matt finish caused by solvents are unacceptable as a brittle surface will result	

TABLE I - DEFECTS IN DE-ICER BOOTS

DEFECT	DESCRIPTION (NOTES 1 AND 2)	ILLUSTRATION
Stitch	• No more than 1 skipped stitch per single length of stitching • No skipped stitches along the centre line tube stitching • No broken threads • Slight bump caused by "loose thread" (see Note 4) allowed. No more than one "loose thread" bump per single length of stitching allowed	

Tear Offs	• Lack of material in the inner or outer ply
	• Not allowed for outer surface. Refer to MRB for disposition
	• Inner surface, first ply only, is allowed provided that the following limits are not exceeded:
	  • Maximum size of 0.05 square inch (30 mm^2)
	  • Maximum depth of 0.008 inch (0.2 mm). Internal plies shall be intact.
	  • No more than 1 such defect per square meter	

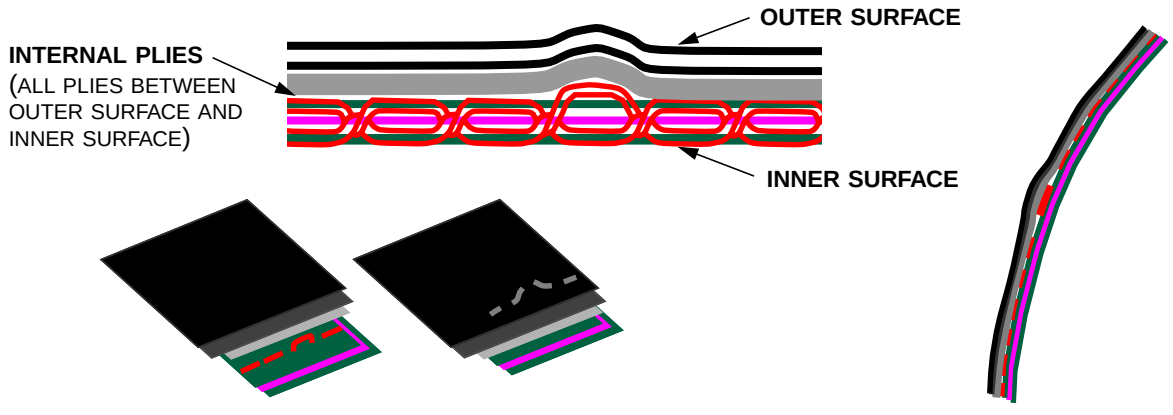
Wrinkles/Waves	• Outer surface (Allowed in De-icing Area B only - see Figure 9)
	  • Maximum length of 0.8 inch (20 mm) per wrinkle/wave
	  • Maximum height of 0.016 inch (0.4 mm) per wrinkle/wave
	  • No more than 3 such defects per each end of the de-icer boot (i.e., maximum of 6 such defects per de-icer boot)
	• Inner surface (Allowed in De-icing Area A and B - see Figure 9)
	  • This is only acceptable prior to bonding the de-icer boot. After bonding, these wrinkles/waves shall not be visible	

Note 1. These are the limitations to which these defects do not require MRB disposition. All defects exceeding the limitations specified shall be referred to MRB for disposition.

Note 2. Any defects which appear at the edges of the de-icer boot where it will be trimmed off after bonding shall not be cause for rejection.

Note 3. During the de-icer boot manufacturing process, dust or hairline scratches on the tool may cause impressions and/or linear marks.

Note 4. See below for depictions of "LOOSE THREAD". During the de-icing boot manufacturing process, the "loose thread" is compressed down and forms a bump under the three plies of protective rubber.



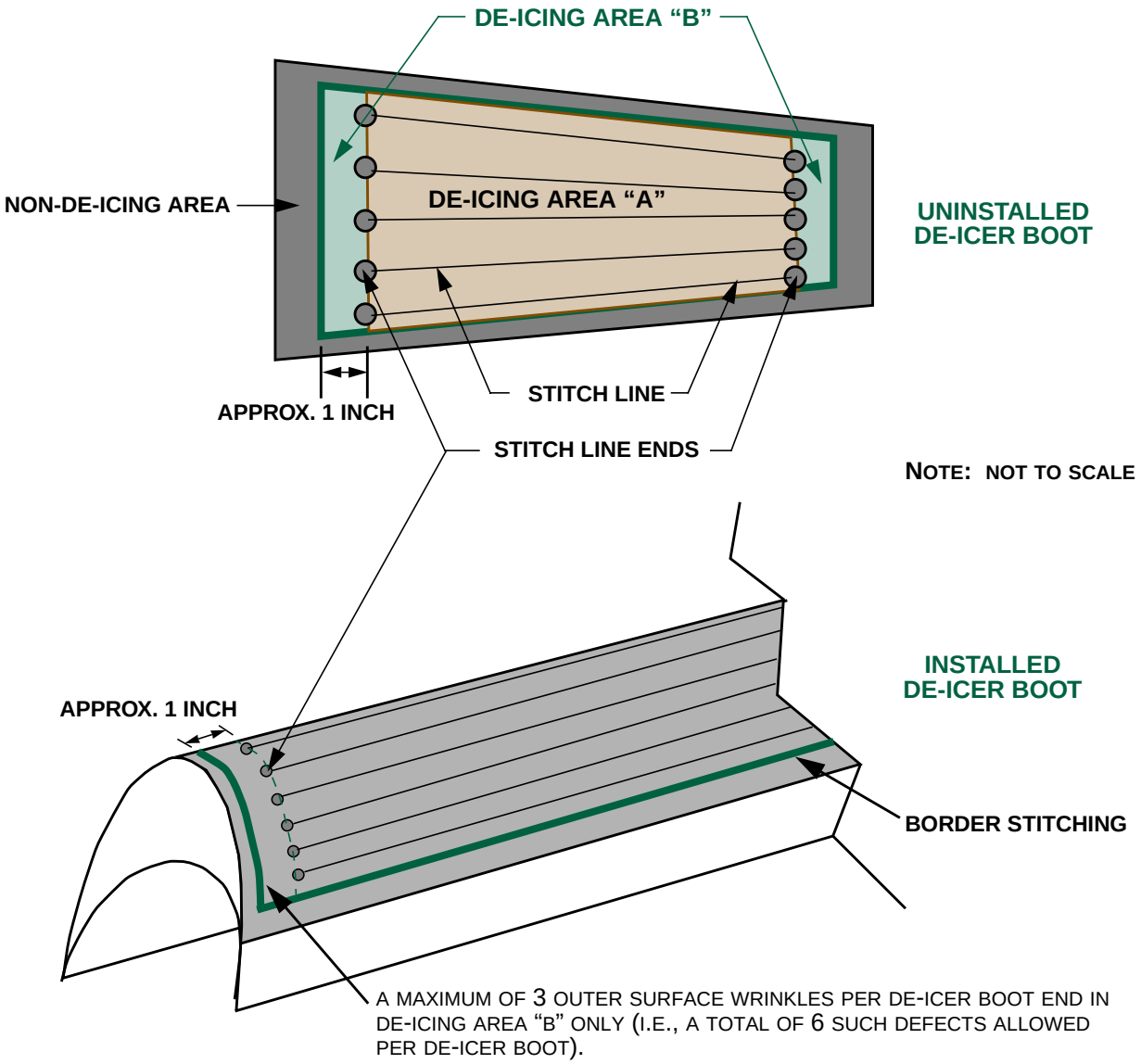


FIGURE 9 - DE-ICING BOOT WRINKLE INSPECTION AREAS

TABLE II - AERODYNAMIC SMOOTHNESS REQUIREMENTS FOR REPLACEMENT BOOTS

SMOOTHNESS CRITERIA	DIRECTION	LIMITS
Steps	Chordwise (Note 1)	0.030" max.
	Spanwise (Note 2)	0.060" max.
Waviness	Chordwise (Note 1)	0.040" or 0.010 × L (Note 3) whichever is greater
	Spanwise (Note 2)	0.080" or 0.020 × L (Note 3) whichever is greater
Contour Deviations (Note 4)	Wing YW47.5 - YW139	± 0.090"
	Wing YW261	± 0.068"
	Wing YW457	± 0.040"
	Horizontal Tailplane	± 0.040"

NOTES:
1. Forward or aft facing trail edge of boot to leading edge.
2. Along length of boot.
3. "L" is the wavelength (i.e., distance between crests).
4. Surface contour shall be maintained within these dimensions regardless of wave height criteria.

6.4 Stall Bars

6.4.1 Stall bars shall be correctly located on the leading edge according to the engineering drawing and shall be visually checked for complete adhesion around the edges.

6.4.1.1 Evidence of lack of adhesion or incorrect location shall be cause to remove the stall bar by loosening the bond with the solvent specified in PPS 31.17, as necessary, and re-bonding according to section 5.4.4.

6.5 F31 Primer

6.5.1 Ensure all countersinks are protected by the finish code requirements specified on the engineering drawing.

6.6 Receipt Testing and Shelf Life Extension

6.6.1 Perform receipt and shelf life extension testing of DHMS A6.11 Type I Class 2 adhesive according to QAMTR 007.

6.6.2 Perform receipt and shelf life extension testing of DHMS S3.01 sealants according to QAMTR 001.

7 SAFETY PRECAUTIONS

7.1 Safety precautions applicable to the materials and procedures specified herein shall be defined by the subcontractor performing the work for Bombardier Toronto.

8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a Controlled Critical Process according to PPS 13.39. Refer to PPS 13.39 for additional personnel requirements. Certified and/or qualified personnel shall have a good working knowledge of the following, as applicable:

- know the function of de-icer boots
- know how de-icer boots work
- know the differences between hot and cold bonding of de-icer boots
- know the advantages and disadvantages of hot bonding and cold bonding
- know why not to inflate de-icer boots before installation
- know the procedure for laying-up, vacuum bagging and curing composite leading edge/de-icer boot assemblies (hot bonding)
- know how to install stall bars
- know the procedure for removal and/or repositioning of de-icer boots
- know how to trim installed boots.
- know how to measure installed boots for aerodynamic smoothness
- know the procedure for sealing de-icer boot ends and edges
- know how to apply protective latex coating to installed de-icer boots
- know how to apply F31 conductive paint coating
- know the procedure for inflated inspection of installed de-icers
- know the Engineering and Quality requirements for de-icer boots, both before and after installation
- know the Engineering and Quality requirements for installed stall bars
- know the safety precautions to observe when installing DASH 8 airframe de-icer boots
- know how to attach de-icers to a vacuum source and hold them under vacuum during installation
- know how to use the 85720013-053/054-248 drill jig to produce fastener holes for stall bar installation
- know how to use rubber rollers to improve de-icer boot bonds

9 STORAGE

9.1 Solvents, Sealants and Adhesives

9.1.1 Store sealant according to PPS 21.20.

9.1.2 Store solvents according to PPS 31.17.

9.1.3 Store DHMS A6.11 Type I Class 2 adhesive according to PPS 25.63.

9.1.4 Clearly mark the contents on all containers of solvents, adhesives and sealants.

9.1.5 Keep containers of solvents, adhesives and sealants tightly closed when not in use.

9.1.6 Always use the oldest adhesive stock first (i.e., first in/first out (FIFO) basis).

9.2 De-Icer Boots

9.2.1 Store de-icer boots according PPS 39.06.

10 MAINTENANCE OF EQUIPMENT

10.1 Solvent clean tools and equipment which have been used in the application of sealants, etc. as specified in PPS 31.17 as soon as possible after using.

11 ADDITIONAL INFORMATION

11.1 If necessary, wash the surfaces of installed de-icer boots with a mild, neutral soap solution and rinse them with water. Do not scrub de-icer boot surfaces.

11.1.1 Remove oil and grease from de-icer boot surfaces by solvent cleaning as specified in PPS 31.17.

11.2 Take care when handling leading edges with installed de-icer boots since the boots will damage or puncture easily.

11.3 Cap the air connectors of installed boots according to PPS 6.05 while not connected.