BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 27.01

PRODUCTION PROCESS STANDARD

REPAIR OF SURFACE DEFECTS IN ALUMINUM ALLOY SHEET

Issue 8
- This standard supersedes PPS 27.01, Issue 7.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS related questions to PPS.Group@aero.bombardier.com or (416) 375-4365.
- This PPS is effective as of the distribution date.

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Table of Contents

1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for classification, disposition and removal of surface defects from bare and clad aluminum alloy sheet.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must 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.

2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) 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 (de Havilland) Environment, Health and Safety Department.

3 REFERENCES

3.1 PPS 13.26 - General Subcontractor Provisions.

3.2 PPS 17.03 - Saturation Shot Peening.

3.3 PPS 27.02 - Edge Finishing Aluminum Alloy Parts.

3.4 PPS 27.06 - Decorative Surface Finishes.

3.5 PPS 31.17 - Solvent Usage.

3.6 PPS 32.02 - Manual Application of C1 Chemical Conversion Coatings.

4 MATERIALS AND EQUIPMENT

4.1 Materials

4.1.1 Sodium hydroxide solution (10% sodium hydroxide, 90% water).

4.1.2 Nitric acid solution (50% nitric acid, 50% water).

4.1.3 Abrasive paper, aluminum oxide, 400 - 600 grit (e.g., 3M Canada Ltd.).

4.2 Equipment

4.2.1 Latex rubber gloves (e.g., DSC 422-2).

5 PROCEDURE

5.1 General

5.1.1 Before any rework, refer all defects on bare or clad aluminum surfaces free of primer, paint or other coatings for classification and disposition according to Table I.

5.1.1.1 Defects which do **not** exceed the limits requiring MRB authority can be repaired without MRB authority (e.g., multiple nicks or scratches that do not penetrate the cladding which are **more** than 6" apart).

5.1.1.2 For defects on parts with applied coatings such as primer, paint, etc. that penetrate the coating and affect the bare or clad aluminum substrate, locally remove the coating in the area of the defect before classification and disposition according to Table I.

5.1.1.3 Refer to MRB for disposition if repair of a defect will result in reducing the part thickness in the defect area below the minimum part thickness specified on the engineering drawing.

5.1.1.4 Refer to MRB for disposition where repair of a defect on a part surface readily visible to passengers and/or crew is believed could have a detrimental effect on final surface appearance.

5.1.1.5 For the purposes of this PPS, the term MRB includes Bombardier Toronto (de Havilland) Material Review Board (MRB) and Bombardier Toronto (de Havilland) delegated Material Review Board.

5.1.1.6 For defects on decorative finished surfaces, repair defects which do not require MRB authorization (as specified in Table I) according to PPS 27.06.

TABLE I - CLASSIFICATION AND DISPOSITION OF DEFECTS

DEFECT TYPE	DESCRIPTION (Note 1)	DEFECTS REQUIRING MRB AUTHORITY FOR REPAIR	REPAIR PROCEDURE
1	Mechanical damage (e.g., nicks, scratches, etc.) that do not penetrate the cladding	• Nicks, scratches, etc. within two hole diameters of any type of fastener (measured from the nearest edge of the hole). • Multiple nicks, scratches, etc. less than 6" apart.	section 5.3
2	Mechanical damage (e.g., nicks, scratches, etc.) that penetrate the cladding	• Nicks, scratches, etc. within two hole diameters of any type of fastener (measured from the nearest edge of the hole). • Multiple nicks, scratches, etc. less than 6" apart. • Nicks, scratches, etc. more than 2" in length. • Nicks, scratches, etc. on the flat surface that are more than 0.010" deep or more than 1/10th the thickness of the sheet (see Figure 1). • Nicks, scratches, etc. on edges or corners more than 0.030" deep (see Figure 2).	section 5.4
3	Mechanical damage (e.g., nicks, scratches, etc.) on non-clad parts		
6	Cladding blisters and inclusions on clad parts	• All cladding blisters or inclusions on clad parts.	section 5.5
7	Corrosion pits, core blisters, heat treat blisters, etc.	• All corrosion pits, core blisters, heat treat blisters, etc.	According to Liaison Engineering instruction
8	Snap mark damage on clad parts around flush head rivets (see Figure 3)	• Snap mark damage more than 0.004" of more than 1/10th the thickness of the sheet. • Any cracks in the base material.	section 5.4
9	Snap mark damage on clad parts around universal head rivets (see Figure 4)	• Snap mark damage more than 0.003" of more than 1/10th the thickness of the sheet. • Any cracks in the base material.	
10	Snap mark damage on non-clad parts	• All snap nark damage on non-clad parts.	According to Liaison Engineering instruction
11	Buckle damage	• All buckling.	
12	Impact damage (e.g., dents)	• All impact damage.	

Notes 1. For defects on clad parts, check for cladding penetration according to section 5.2 before repair.

5.1.2 In all cases the blend length must meet the following minimums, as applicable, expressed as a function of the defect depth ”D”:

- For aircraft skin and control surfaces, the blend length must be at least 100 times the defect depth “D” (i.e., 100D).
- For primary structure applications, the blend length must be at least 50 times the defect depth “D” (i.e., 50D).
- For non-primary structure applications, the blend length must be at least 20 times the defect depth “D” (i.e., 20D).

5.1.2.1 If in doubt as to whether the repair application affects primary structure vs non-primary structure, treat as primary structure (i.e., the blend length must be at least 50 times the defect depth “D”).

5.2 Determination of Cladding Penetration

5.2.1 For defects on clad surfaces, perform a determination of cladding penetration as follows:

Step 1. Clean the defect and surrounding area by solvent washing according to PPS 31.17.

Step 2. Using an eye dropper, place one drop of sodium hydroxide solution into the defect and allow it to react for 2 minutes. Take care to prevent the solution from contacting areas other than the defect.

Step 3. Rinse the defect thoroughly with cold water to remove all traces of the sodium hydroxide solution and wipe the area dry with a clean cloth. The presence of a dark residue remaining in the defect indicates that the cladding has been penetrated.

Step 4. Using an eye dropper, place one drop of nitric acid solution in the defect and allow it to react for 2 minutes. Take care to prevent the solution from contacting areas other than the defect.

Step 5. Rinse the defect thoroughly with cold water to remove all traces of the nitric acid solution and wipe the area dry with a clean cloth.

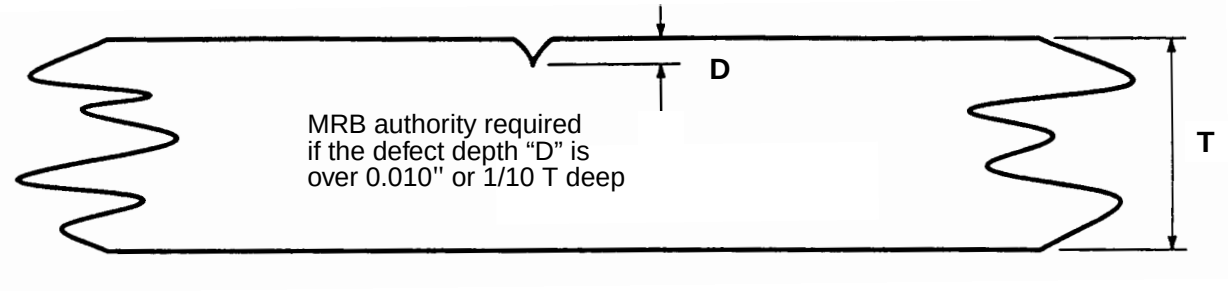

FIGURE 1 - NICKS, SCRATCHES, ETC. ON FLAT SURFACES

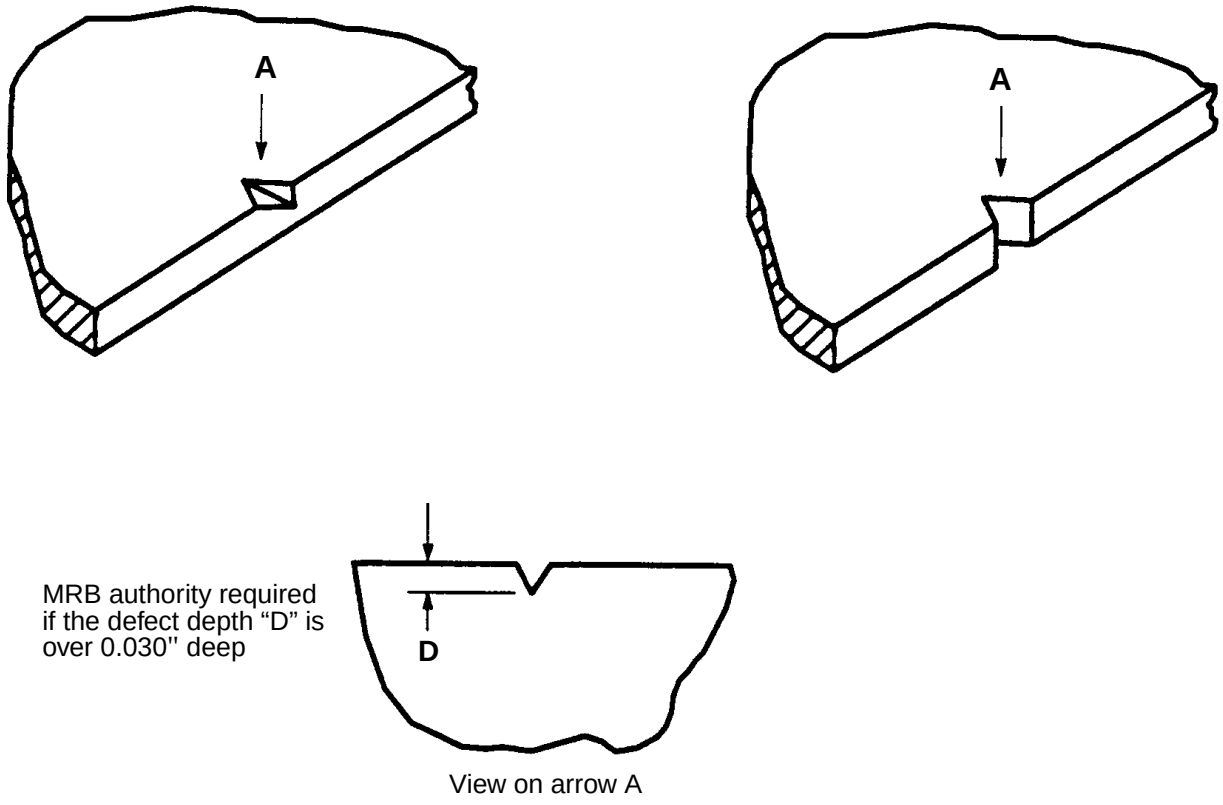

FIGURE 2 - NICKS, SCRATCHES, ETC. ON EDGES OR CORNERS

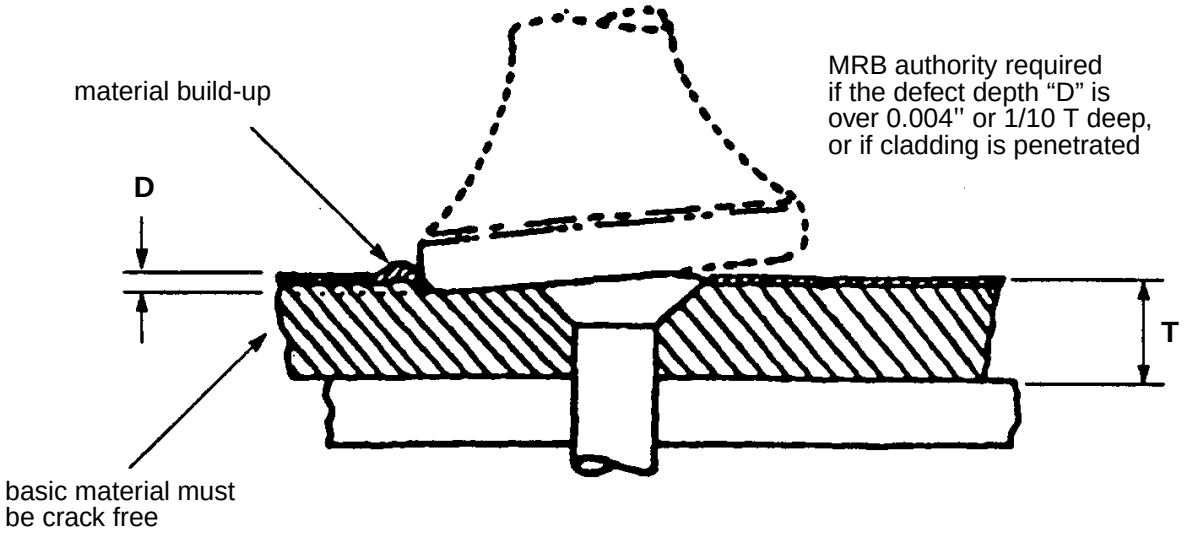

FIGURE 3 - SNAP MARK DAMAGE AROUND FLUSH HEAD FASTENERS

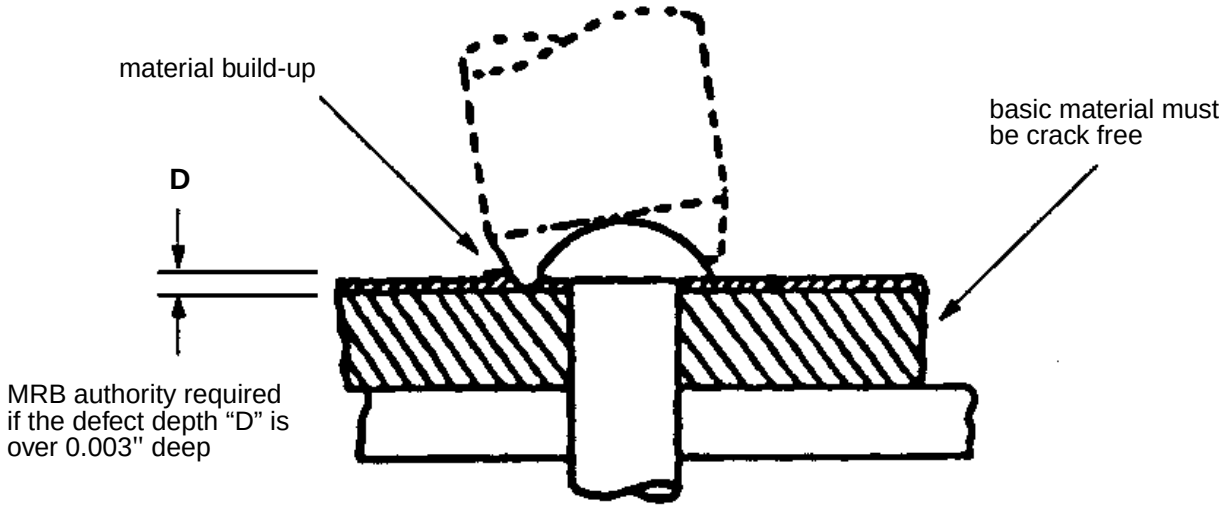

FIGURE 4 - SNAP MARK DAMAGE AROUND UNIVERSAL HEAD RIVETS

5.3 Repair of Type 1 Defects

5.3.1 If permitted by Table I or authorized by MRB, repair Type 1 defects (nicks, scratches, etc. that do not penetrate the cladding) by removing burrs and pile-up using a curved metal scraper, taking care not to remove excess material (see Figure 5).

5.3.1.1 Unless requiring MRB authorization for repair, Type 1 defects on surfaces to be painted do not require repair unless it is believed the defect will be visible after painting.

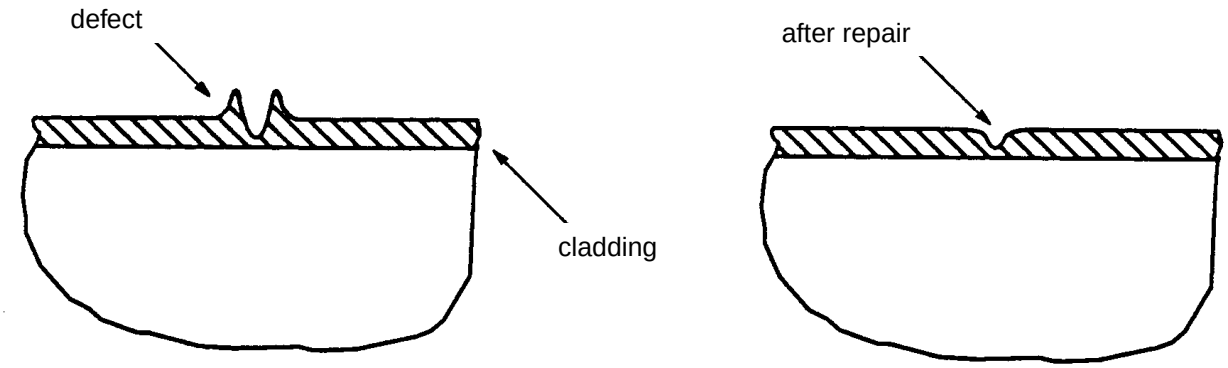

FIGURE 5 - REPAIR OF TYPE 1 DEFECTS

5.4 Rework of Type 2 and Type 3 Defects

5.4.1 If permitted by Table I or authorized by MRB, repair Type 2 defects (nicks, scratches, etc. that penetrate the cladding) and Type 3 defects (nicks, scratches, etc. on non-clad parts) as follows (see Figure 6, Figure 7 and Figure 8):

Step 1. Remove burrs and pile-up using a curved metal scraper, taking care not to remove excess material.

Step 2. Mask off the area surrounding the defect with masking tape to minimize the rework and to protect the surrounding material.

Step 3. Radius and smooth the defect as shown in Figure 6, Figure 7 or Figure 8, as applicable, using 400 - 600 grit abrasive paper wrapped around a suitably shaped rubber sanding block. Remove only sufficient material to ensure complete removal of the defect.

Step 4. Break all sharp edges according to PPS 27.02.

Step 5. Remove the masking tape and clean off all residue by solvent washing according to PPS 31.17.

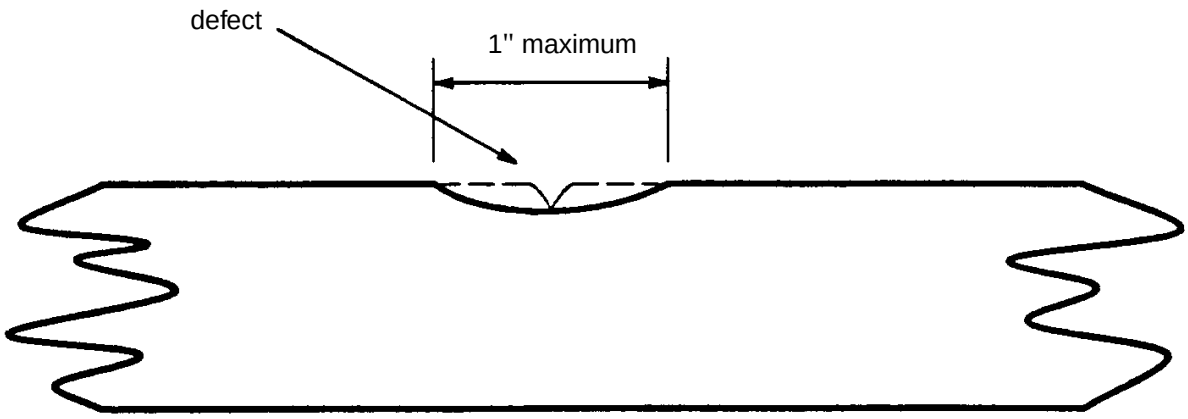

FIGURE 6 - REPAIR OF TYPE 2 AND TYPE 3 DEFECTS ON FLAT SURFACES

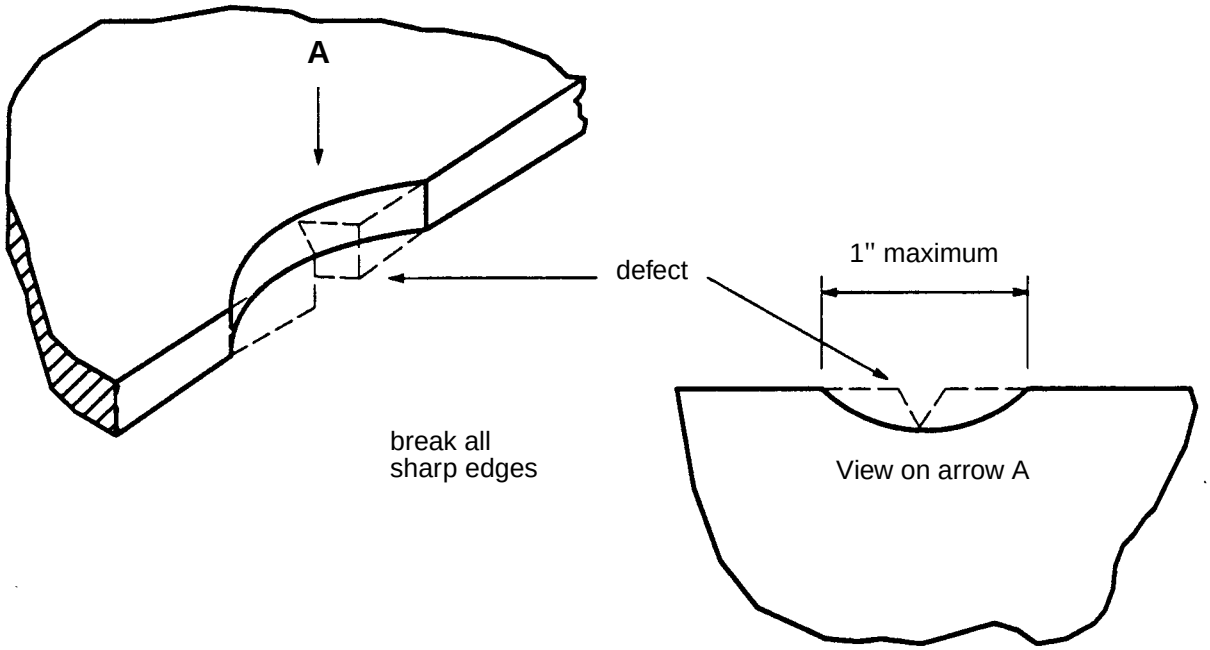

FIGURE 7 - REPAIR OF TYPE 2 AND TYPE 3 DEFECTS ON EDGES

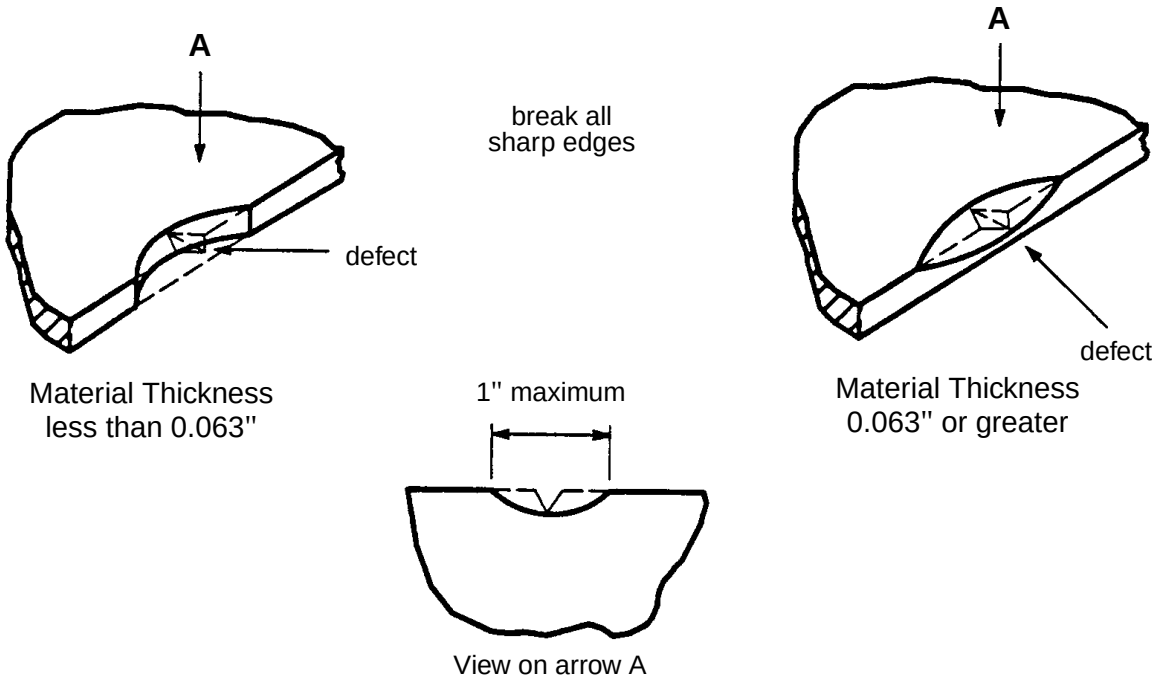

FIGURE 8 - REPAIR OF TYPE 2 AND TYPE 3 DEFECTS ON CORNERS

5.5 Repair of Type 6 Defects

5.5.1 If authorized by MRB, repair Type 6 defects (cladding blisters and inclusions on clad parts) by removing the defect with a curved metal scraper or 400 - 600 grit abrasive paper wrapped around a suitably shaped rubber sanding block (see Figure 9).

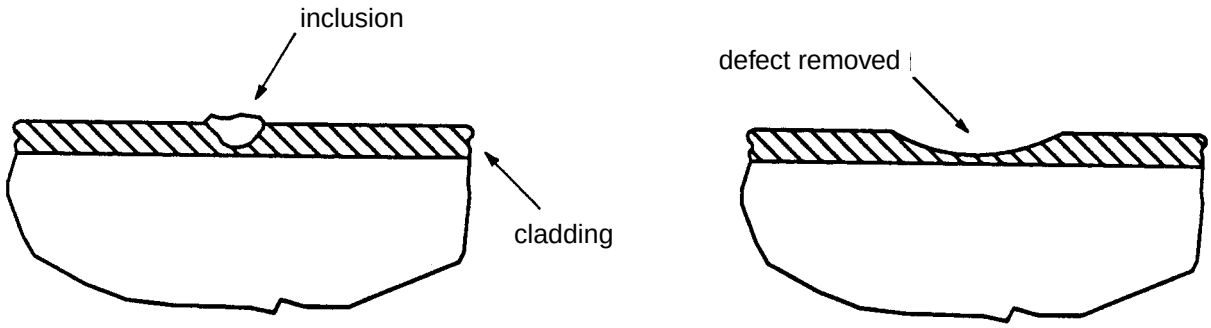

FIGURE 9 - REPAIR OF TYPE 6 DEFECTS

5.6 Repair of Type 7, Type 10, Type 11 and Type 12 Defects

5.6.1 If authorized by MRB, repair Type 7 defects (corrosion pits, core blisters, heat treat blisters, etc.), Type 10 defects (snap mark damage on non-clad parts), Type 11 defects (buckle damage) and Type 12 defects (impact damage) according to Liaison Engineering instructions.

5.7 Repair of Type 8 and Type 9 Defects

5.7.1 If permitted by Table I or authorized by MRB, repair Type 8 defects (snap mark damage on clad parts around flush rivets) and Type 9 defects (snap mark damage on clad parts around universal head rivets) as follows:

Step 1. Remove material pile-up using a curved metal scraper, taking care not to remove excess material.

Step 2. Mask off the area surrounding the defect with masking tape to minimize the rework area and to protect the surrounding material.

Step 3. Radius and smooth the defect using 400 - 600 grit abrasive paper wrapped around a suitably shaped rubber sanding block. Remove only sufficient material to ensure complete removal of the defect.

Step 4. Break all sharp edges according to PPS 27.02.

Step 5. Remove the masking tape and clean off all residue by solvent washing according to PPS 31.17.

5.8 Finishing

5.8.1 If part defects are found in the detail stage before any finish had been applied, repair the defects before finishing the part to the detail drawing requirements.

5.8.2 If part defects are found after the part has been chemical conversion coated or anodized, manually apply chemical conversion coating to the reworked area according to PPS 32.02 after repairing the defect.

5.8.3 If part defects are found after the part has been painted or primed, after repairing the defect, manually apply chemical conversion coating to the reworked area according to PPS 32.02, prime and finish coat as originally specified by the engineering drawing.

5.8.4 For repaired saturation shot peened surfaces, re-shot peen the repaired surface locally according to PPS 17.03 to the Almen intensity originally specified by the engineering drawing.

6 REQUIREMENTS

6.1 Unless otherwise specified by MRB, defects must be repaired as specified herein.

7 SAFETY PRECAUTIONS

7.1 Refer to PPS 31.17 for the safety precautions regarding the handling and use of solvents.

7.2 Avoid skin contact with sodium hydroxide and nitric acid solution. If skin contact does occur, wash the contact area thoroughly with warm water.

8 PERSONNEL REQUIREMENTS

8.1 Personnel responsible for repair of surface defects in aluminum alloy sheet must have a basic understanding of the procedure and requirements as specified herein and shall have exhibited their familiarity to their supervisor.

8.2 Determination of cladding penetration may only be performed by personnel who have been instructed how to perform the procedure specified herein.