# CHAPTER 3 — TYPICAL PROCESSES AND REPAIR PROCEDURES

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<td>NAS1834 Potted Molded-in, Through-clearance Hole Insert Installation Data</td>
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<td>3-17</td>
<td>NAS1835 Potted Molded-in, Blind, Threaded, Floating Insert Installation Data</td>
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<td>Substitution of Flush Head Rivets</td>
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<td>Drill and Hole Size Limits for Solid and Blind Rivet Installation</td>
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3-1. INTRODUCTION

Many of the repairs for the Bell Helicopter Textron lines of helicopter products are a function of the type of construction to be repaired. Some repairs in fact are similar in nature and may be applicable to various parts of the structure. Those repairs are therefore considered typical for a certain type of construction. This chapter provides “general and typical repairs” for the following types of structure:

- Riveted structures, both aluminum and titanium
- Angles, webs, and skins, both aluminum and titanium
- Resistance (spot) welded assemblies
- Aluminum faced bonded honeycomb panels of various core types with or without fiberglass edging
3-1-1. REPAIR SELECTION GUIDE

As this chapter contains repairs for various types of structures with varying repair methods based on damage type, size, and location, a repair selection guide is included to facilitate the identification of the appropriate repair. The following tables list the different “typical repairs” given in this chapter. These repairs are generic and apply to unrestricted repairable areas of the helicopters. Refer to the model-specific Structural Repair Manual (SRM) and to Chapter 1, Repair Limitations. If the damage is in a restricted area or beyond the limitations given in this chapter, the model-specific SRM may have a suitable generic repair. If the damage cannot be repaired using instructions given in this manual or the model-specific SRM, contact Product Support Engineering.

The repair guide in this chapter is divided in several tables. Each table provides a selection guide based on the type of structure being repaired: titanium, aluminum sheet metal, formed angles or extrusions, or metal-faced bonded panels. Also included are tables for rivet pattern and spotweld pattern discrepancies.

<table>
<thead>
<tr>
<th>Table 3-1. Repair Selection Guide for Titanium Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Structure</strong></td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Titanium</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

1) All dimensions are in inches unless otherwise specified. Values between parentheses are in millimeters (mm) unless otherwise specified.
Table 3-2. Repair Selection Guide for Parts Made from Aluminum Sheet Metal

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Type of Damage</th>
<th>Panel Area</th>
<th>Qty.</th>
<th>Size$^{(1)}$</th>
<th>Depth$^{(1)}$</th>
<th>Length$^{(1)}$</th>
<th>Width$^{(1)}$</th>
<th>Repair Para.</th>
<th>Appl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum sheet metal</td>
<td>Oil can in skin or web</td>
<td></td>
<td></td>
<td>8.00 dia (203.2)</td>
<td></td>
<td></td>
<td></td>
<td>3-6-1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Oil can in bulkhead</td>
<td></td>
<td></td>
<td>1/3.00 (1/76.2)</td>
<td>1/2 ED</td>
<td>4.00 (101.6)</td>
<td>.1875 (4.7)</td>
<td>3-6-3</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Edge tear or crack in skin or web</td>
<td>1</td>
<td></td>
<td>4.00 (101.6)</td>
<td></td>
<td></td>
<td></td>
<td>3-6-3</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Edge tear or crack in flange of skin or web</td>
<td>1</td>
<td></td>
<td>4.00 (101.6)</td>
<td></td>
<td></td>
<td></td>
<td>3-6-3</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Dents, nicks, cracks, gouges, scratches, punctures or deep corrosion</td>
<td>3/16 dia (4.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3-6-6</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.00 dia (50.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3-6-6</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Surface corrosion</td>
<td>20%</td>
<td></td>
<td>25 in² (161.3 cm²)</td>
<td>5.00 (127.0 cm)</td>
<td>5.00 (127.0 cm)</td>
<td></td>
<td>3-6-4</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Edge tear or crack in flange of lightening hole</td>
<td>1</td>
<td></td>
<td>1/3 flange depth</td>
<td>1/2 flange depth</td>
<td></td>
<td></td>
<td>3-6-5</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>Flange depth</td>
<td></td>
<td></td>
<td></td>
<td>3-6-5</td>
<td>B or C</td>
</tr>
<tr>
<td></td>
<td>Pitting corrosion</td>
<td>20%</td>
<td></td>
<td>14 per 1.0 in² (6.5 cm²)</td>
<td>10% of skin thickness</td>
<td>0.060 (1.52)</td>
<td>0.060 (1.52)</td>
<td>3-8-2</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Crevise corrosion</td>
<td>20%</td>
<td></td>
<td>5 rivets</td>
<td>10% of skin thickness</td>
<td></td>
<td></td>
<td>3-8-3</td>
<td>A</td>
</tr>
</tbody>
</table>

1) All dimensions are in inches. Values between parentheses are in millimeters (mm) unless otherwise specified.
## Table 3-3. Repair Selection Guide for Formed Angles and Extrusions

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Type of Damage</th>
<th>Qty.</th>
<th>Length(1)</th>
<th>Width(1)</th>
<th>Repair Para.</th>
<th>Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet metal and extrusion</td>
<td>Edge tears and crack in flange</td>
<td>1</td>
<td>1/3 of flange width</td>
<td>1.00 (25.4)</td>
<td>3-5-1</td>
<td>A</td>
</tr>
<tr>
<td>Sheet metal</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>3-5-1</td>
<td>B</td>
</tr>
<tr>
<td>Sheet metal</td>
<td>Crack in corner of double-formed flange</td>
<td>1</td>
<td>8 times the flange thickness</td>
<td></td>
<td>3-5-4</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>25 times the flange thickness</td>
<td></td>
<td>3-5-4</td>
<td>B</td>
</tr>
<tr>
<td>Sheet metal and extrusion</td>
<td>Extensive damage at end of angle</td>
<td></td>
<td></td>
<td></td>
<td>3-5-2</td>
<td>–</td>
</tr>
<tr>
<td>Sheet metal</td>
<td>Crack in radius</td>
<td>1</td>
<td>25 times the flange thickness</td>
<td></td>
<td>3-5-3</td>
<td>A</td>
</tr>
<tr>
<td>Sheet metal and extrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3-5-3</td>
<td>B</td>
</tr>
</tbody>
</table>

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
| Type of Structure                  | Type of Damage                                      | Panel Area<sup>(1)</sup> | Qty. | Size<sup>(2)</sup> | Depth<sup>(2)</sup> | Length<sup>(2)</sup> | Width<sup>(2)</sup> | Repair Para. | Appl |
|-----------------------------------|-----------------------------------------------------|---------------------------|------|-------------------|------------------|------------------|----------------|--------|
| Metal faced bonded panel          | Small smooth dent and/or void                       | .25 in² void maximum allowed at dent location | 3    | 1.50 dia (38.1)   | 10% of panel thickness or 0.65 inch deep maximum |                   |               | 3-9-1 | A     |
|                                   | Large smooth dent on exterior or interior surface without void | Contact PSE for limit |      | 4.00 dia (101.6)  | 10% of panel thickness or 0.65 inch deep maximum |                   |               | 3-9-1 | B     |
|                                   | Puncture, deep smooth dent, or sharp dent           |                           | 3    | 0.50 dia (12.7)   |                  |                  |               | 3-9-2 | –     |
|                                   |                                                     |                           | 2    | 1.50 dia (38.1)   |                  |                  |               | 3-9-3 | A     |
|                                   | Nicks, cracks, gouges, scratches, surface corrosion, delamination | 25.0 (161.3) or 20% | 2    |                  | 5.00 (127.0)     | 5.00 (127.0)     |               | 3-9-3 | B     |
|                                   | Surface corrosion                                   | 20%                       | 2    | 1.50 dia (38.1)   | 10% of facing skin thickness |                   |               | 3-9-4 | A     |
|                                   | Pitting corrosion                                   | 20%                       | 2    | 14 per 1.0 in² (6.5 cm²) | 10% of facing skin thickness | 0.060 (1.52) | 0.060 (1.52) | 3-8-2 | –     |
|                                   | Crevice corrosion                                   | 20%                       | 5    | rivets            | 10% of facing skin thickness |                   |               | 3-8-3 | A     |

1) All dimensions are in square inches. Values between parentheses are square centimeter (cm²).
2) All dimensions are in inches. Values between parentheses are in millimeters (mm).
### Table 3-4. Repair Selection Guide for Metal-faced Bonded Panels (Cont)

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Type of Damage</th>
<th>Panel Area(1)</th>
<th>Qty.</th>
<th>Size(2)</th>
<th>Depth(2)</th>
<th>Length(2)</th>
<th>Width(2)</th>
<th>Repair Para.</th>
<th>Appl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal faced bonded panel edge</td>
<td>Puncture, edge crack, or tear affecting fiberglass bevel</td>
<td></td>
<td>2</td>
<td></td>
<td>2 rivets or 1.25 (31.8)</td>
<td></td>
<td></td>
<td>3-10-2</td>
<td>–</td>
</tr>
<tr>
<td>Any edge damage in skin only</td>
<td>1/side 2/panel</td>
<td></td>
<td></td>
<td></td>
<td>20%</td>
<td></td>
<td>3.80 (96.5)</td>
<td></td>
<td>3-10-5</td>
</tr>
<tr>
<td>Any edge damage in skin and inner doubler</td>
<td>1/side 2/panel</td>
<td></td>
<td></td>
<td></td>
<td>5.00 (127.0) maximum</td>
<td></td>
<td></td>
<td>3.80 (96.5)</td>
<td></td>
</tr>
<tr>
<td>Any edge damage in skin and inner doubler</td>
<td>1/side 2/panel</td>
<td></td>
<td></td>
<td></td>
<td>5.00 (127.0) maximum</td>
<td></td>
<td></td>
<td>3.80 (96.5)</td>
<td></td>
</tr>
<tr>
<td>Any damage to edging over skin in full thickness core</td>
<td>2/side</td>
<td></td>
<td></td>
<td></td>
<td>1.00 (25.4) maximum</td>
<td></td>
<td></td>
<td></td>
<td>3-10-6</td>
</tr>
</tbody>
</table>

1) All dimensions are in square inches. Values between parentheses are square centimeter (cm²).

2) All dimensions are in inches. Values between parentheses are in millimeters (mm).
Table 3-5. Repair Selection Guide for Rivet Pattern Discrepancy

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Type of Damage</th>
<th>Pattern %</th>
<th>Qty.</th>
<th>Length(1)</th>
<th>Min ED(2)</th>
<th>Min Pitch(2)</th>
<th>Repair Para.</th>
<th>Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet metal</td>
<td>Oversized rivet with low edge distance</td>
<td>50</td>
<td>10</td>
<td>2D</td>
<td>4D</td>
<td>5D</td>
<td>3-4-1</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Low edge distance as applicable to flat edge</td>
<td>50</td>
<td>10</td>
<td>1.5D</td>
<td>4D</td>
<td>5D</td>
<td>3-4-1</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Low edge distance as applicable to bent flange</td>
<td>50</td>
<td>10</td>
<td>2D</td>
<td>4D</td>
<td>5D</td>
<td>3-4-1</td>
<td>D</td>
</tr>
<tr>
<td>Sheet metal</td>
<td>Cracked rivet hole</td>
<td>5</td>
<td>1 / 5</td>
<td>2D</td>
<td>4D</td>
<td>5D</td>
<td>3-4-2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mislocated or cracked hole at flange end fastener</td>
<td></td>
<td></td>
<td>2D</td>
<td>3D</td>
<td>4D</td>
<td>3-4-5</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>5</td>
<td>3/32 dia</td>
<td>3-4-6</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheet metal, metal faced bonded panel, and composites</td>
<td>Nominal rivet with low edge distance</td>
<td>1 / 5</td>
<td></td>
<td>1D</td>
<td>3D</td>
<td>4D</td>
<td>3-4-1</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Elongated, mismatched or oversized hole</td>
<td>50 for 1st oversize 50 for 2nd oversize</td>
<td>1.5D</td>
<td>2D</td>
<td>4D</td>
<td>5D</td>
<td>3-4-3</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>10</td>
<td>2D</td>
<td>3D</td>
<td>4D</td>
<td>3-4-3</td>
<td>B</td>
</tr>
<tr>
<td>Sheet metal and Extrusion</td>
<td>Mislocated hole in flange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3-4-4</td>
<td>-</td>
</tr>
</tbody>
</table>

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).

2) Top value is for protruding head fasteners and bottom value is for flush head fasteners.
**Table 3-6. Repair Selection Guide for Spotweld Pattern Discrepancies**

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Type of Damage</th>
<th>Pattern %</th>
<th>Qty.</th>
<th>Length(^{(1)})</th>
<th>Repair Para.</th>
<th>Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum sheet metal</td>
<td>Pulled or cracked spotweld</td>
<td>15</td>
<td>2 out of any 5</td>
<td>0.188 (4.76)</td>
<td>3-12-1</td>
<td>–</td>
</tr>
<tr>
<td>Titanium or CRES sheet metal</td>
<td>Pulled or cracked spotweld</td>
<td>3</td>
<td>1 out of any 5</td>
<td>0.188 (4.76)</td>
<td>3-12-2</td>
<td>–</td>
</tr>
</tbody>
</table>

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
3-2. COMMON PROCEDURES

3-2-1. COMMON PROCEDURES — GENERAL

**CAUTION**

WEAR APPROPRIATE SAFETY EQUIPMENT (GLOVES, GOWNS, RESPIRATORS, ETC.) WHEN HANDLING OR WORKING WITH MATERIALS AND MAKING REPAIRS. CONSULT MATERIAL SAFETY DATA SHEETS (MSDS) FOR POTENTIAL HAZARDS AND FOLLOW ALL APPLICABLE SAFETY PROCEDURES.

**NOTE**

Determine material and tooling requirements and ensure materials are at hand before proceeding with any repair.

a. Consumable materials and standards: The materials needed to accomplish a particular repair are listed in the “REQUIRED” section of each repair procedure. Each item is accompanied by a description of the material or a numerical code (C-xxx). This code references a consumable item that can be referenced in Chapter 13 of the Standard Practices Manual (BHT-ALL-SPM).

**NOTE**

For field fabricated repair parts, it is acceptable to substitute aluminum 2024-T3 sheet material of two (2) gauges thicker for repair of 7075-T6 aluminum alloy sheet metal less than 0.040 inch (1.02 mm) thick. It is also acceptable to substitute 301 corrosion resistant steel (CRES) half hard per AMS 5518 sheet material of one (1) gauge thicker for repair of commercially pure titanium (CP-1 or CP-2 per MIL-T-9046) sheet metal less than 0.040 inch (1.02 mm) thick. No other material substitution may be accomplished without prior written approval from Product Support Engineering. The fit and function of later installation must not be affected.

CLAD material may be replaced by BARE (non-CLAD) material, but BARE material may not be replaced by CLAD material.

b. Repair material thickness: Unless otherwise indicated in a repair procedure, the thickness of a repair doubler shall be one gauge thicker and of the same material specification as the parent material. A filler is usually as thick as the material it replaces and of the same material specification.
NOTE

Only sheet metal parts may be stop drilled. Do not stop drill bonded panels, castings, forgings, machined parts, or parts made from composite materials.

c. Stop drilling: Stop drilling relieves the stresses in the extremity of a crack. The usual drill size for stop drilling sheet metal material is a #30 drill (3.26 mm). All cracks shall be fluorescent penetrant inspected to determine the extent of the crack prior to stop drilling. Stop drill both ends of the crack except when one extremity relieves itself at a lightening hole, a rivet hole, or runs to the edge of the material. Accomplish another fluorescent penetrant inspection after stop drilling to ensure that the end(s) of the crack does not extend past the stop drill hole(s). If necessary, enlarge the hole(s) to a maximum of 0.25 inch (6.4 mm) diameter.

d. Refinishing: All repairs shall be sealed against moisture intrusion, then finished in accordance with the original finish specifications in accordance with instructions detailed in the Standard Practices Manual (BHT-ALL-SPM).

3-2-2. APPROVED PROCESSES (PROCESS SHEETS)

This section provides instructions to the most common processes used in the repair procedures found in this manual and in the model-specific Structural Repair Manuals. These process sheets cover cleaning, bonding, core splices, dimpling and forming of metal, and insert removal, replacement, and installation. Repair procedures throughout this manual and the model-specific Structural Repair Manuals make reference to the applicable process sheets in the “REQUIRED” section.

The typical repairs in this section and the repairs given in the model-specific Structural Repair Manual are shown for the general cases. Some applicable process sheets are not listed in the “REQUIRED” section as they are not always necessary for a given application such as chemical film application, rivets installed through thin honeycomb panels, aligned rivets, shimming, etc. Even though these process sheets are not listed in the “REQUIRED” section of a repair, they may still apply.

The following processes are covered in this chapter:

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<thead>
<tr>
<th>Subsection</th>
<th>Title and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-2-4 Page 3-21</td>
<td>Cleaning of Honeycomb Core Cavity: Provides a method of cleaning a core cavity in preparation for bonding or core splicing.</td>
</tr>
<tr>
<td>3-2-5 Page 3-22</td>
<td>Preparation of Bonding Surfaces: Provides a method of cleaning faying surfaces of fillers, doublers, and damaged parts in preparation for bonding.</td>
</tr>
<tr>
<td>3-2-6 Page 3-25</td>
<td>Preparation of Core Plug Prior to Bonding: Provides a method of sealing replacement core cells prior to bonding in a panel.</td>
</tr>
<tr>
<td>3-2-7 Page 3-39</td>
<td>Bonding of Flat Stock: Provides a method of bonding flat stock such as fillers and doublers.</td>
</tr>
<tr>
<td>3-2-8 Page 3-41</td>
<td>Wet Layup of Fiberglass: Replaced with process sheet given in Chapter 4, subsection 4-3-3.</td>
</tr>
<tr>
<td>Subsection</td>
<td>Title and Description</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>3-2-9</td>
<td>Fiberglass Edging Replacement: Provides a method for replacing fiberglass edging on bonded panel.</td>
</tr>
<tr>
<td>3-2-10</td>
<td>Core Splicing: Provides a method of bonding a core plug in a panel.</td>
</tr>
<tr>
<td>3-2-11</td>
<td>Potted Inserts — General: Provides general information regarding inserts installation.</td>
</tr>
<tr>
<td>3-2-12</td>
<td>Installation of Potted Inserts: Provides a method of installing commonly used inserts in a panel.</td>
</tr>
<tr>
<td>3-2-13</td>
<td>Removal of Potted Inserts: Provides a method of removing commonly used inserts from a panel.</td>
</tr>
<tr>
<td>3-2-14</td>
<td>Chemical Film Application on Aluminum and Titanium Parts: Provides a method of treating bare aluminum against corrosion.</td>
</tr>
<tr>
<td>3-2-16</td>
<td>Installation of Aligned Rivets in Honeycomb Panels: Provides a method for installing rivets when rivets on a surface of the panel are aligned with the rivets on the other surface of the panel.</td>
</tr>
<tr>
<td>3-2-17</td>
<td>Preparation of Conical Washers: Provides a method for manufacturing conical washers to fill existing countersinks or dimples in a skin to be repaired.</td>
</tr>
<tr>
<td>3-2-18</td>
<td>Dimpling Process for Flush Rivets: Provides a method for installing flush rivets in a skin without countersinking the skin.</td>
</tr>
<tr>
<td>3-2-19</td>
<td>Sealing a Structural Repair Inside a Fuel Cell Cavity or Engine Compartment: Provides a method for sealing a structural repair inside a fuel cell of engine compartment.</td>
</tr>
<tr>
<td>3-2-20</td>
<td>Reserved.</td>
</tr>
<tr>
<td>3-2-21</td>
<td>Reinstallation of Click Bonds: Provides a method for installing click bonds.</td>
</tr>
<tr>
<td>3-2-22</td>
<td>Removal of Click Bonds: Provides a method for removing click bonds.</td>
</tr>
<tr>
<td>3-2-23</td>
<td>Forming of Flat Sheet Metal: Provides general guidelines for forming flat sheet metal at room temperature.</td>
</tr>
<tr>
<td>3-2-24</td>
<td>Shimming of Mating Parts: Provides general guidelines for filling gaps between mating parts with solid shims.</td>
</tr>
<tr>
<td>3-2-25</td>
<td>Preparing and Mixing Two-part Epoxy Resin By Weight: Provides general guidelines for mixing two-part epoxy resins.</td>
</tr>
<tr>
<td>3-2-26</td>
<td>Vacuum Bagging Metallic Repairs: Provides general guidelines for applying bondline pressure to metallic repairs using a vacuum bag.</td>
</tr>
</tbody>
</table>
3-2-3. REMOVAL OF PAINTS AND PRIMERS ON METALLIC PARTS

**CAUTION**

CHEMICAL PAINT STRIPPERS ARE NOT TO BE USED TO REMOVE PAINT FINISHES ON BONDED PARTS OR PANELS. CHEMICAL PAINT STRIPPERS MAY CONTRIBUTE TO CONTAMINATION OF CORE AND/OR DETERIORATE ADHESIVE BOND LINE AND FIBERGLASS EDGING. THIS MAY ULTIMATELY CAUSE PART OR PANEL TO BE REJECTED. TRICHLOROETHYLENE AND VAPOR DEGREASERS ARE NOT TO BE USED TO CLEAN OR STRIP SURFACES ADJACENT TO A DAMAGED AREA FOR THE SAME REASONS.

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAMES. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

ACETONE (C-316), ALIPHATIC NAPHTHA (C-305), ISOPROPYL ALCOHOL (C-385), MEK (C-309), AND TOLUENE (C-306) ARE ACCEPTABLE SOLVENTS FOR REMOVAL OF PAINT FROM ALUMINUM SKINS. HOWEVER, EXCESSIVE APPLICATION OF ACETONE, ALIPHATIC NAPHTHA, ISOPROPYL ALCOHOL, MEK, OR TOLUENE MAY AFFECT ADHESIVES USED IN A BOND. IT IS PREFERABLE TO WIPE SURFACE TO BE STRIPPED USING A MOIST RAG RATHER THAN BY SOAKING. IN SOME CASES, IT MAY BE UNAVOIDABLE THAT ACETONE, ALIPHATIC NAPHTHA, OR MEK COMES IN CONTACT WITH GLASS OR CARBON FIBER REINFORCED COMPOSITES. ALL EFFORTS SHALL BE MADE TO LIMIT EXPOSURE OF COMPOSITE MATERIALS TO THESE SUBSTANCES.

This process sheet establishes the removal of the paint and the primer from a part prior to repairing it.

**APPLICATION A: CONVENTIONAL FINISHES (VARNISHES, ALKYD ENAMELS, ZINC CHROMATE PRIMERS, ETC.)**

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.2 Cheesecloth (C-486).

1.3 Masking tape (C-426).

2.0 PROCEDURE

2.1 Mask around area to be stripped using masking tape specified in 1.3.

2.2 Brush apply cleaner specified in 1.1.
2.3 Remove lifted paint with a stiff fiber bristle brush.

2.4 Accomplish surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 1.1. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.

APPLICATION B: ACRYLIC FINISHES

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.2 Cheesecloth (C-486).

1.3 Masking tape (C-426).

2.0 PROCEDURE

2.1 Mask around area to be stripped using masking tape specified in 1.3.

2.2 Accomplish surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 1.1. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.

APPLICATION C: EPOXY FINISHES

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.2 Cheesecloth (C-486).

1.3 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

1.4 Masking tape (C-426).

2.0 PROCEDURE

2.1 Mask around area to be stripped using masking tape specified in 1.4.

2.2 Remove paint using abrasive paper specified in 1.3.

---

**CAUTION**

DO NOT WET SAND.

DO NOT SAND INTO GLASS OR CARBON FIBERS. PAY SPECIAL ATTENTION NOT TO DAMAGE FIBERS WHEN MULTIPLE SANDING OPERATIONS ARE TO BE PERFORMED, AS EACH STEP MAY SLIGHTLY DAMAGE FIBERS.
2.3 Accomplish surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 1.1. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.
3-2-4. CLEANING OF HONEYCOMB CORE CAVITY

This process sheet establishes the cleaning of a honeycomb core cavity prior to installing a core plug, a skin filler, a potted insert or prior to filling the honeycomb core cavity with adhesive.

NOTE
Sections of core or skin found contaminated by fuel, oil, water, corrosion or debris must be removed.

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Cleaner: MEK (C-309), acetone (C-316), ethyl alcohol (C-339), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.2 Kraft paper (C-254).

1.3 Cheesecloth (C-486).

1.4 Masking tape (C-426).

2.0 PROCEDURE

2.1 Remove all loose debris from cavity.

CAUTION
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

ACETONE, ALIPHATIC NAPHTHA, AND MEK (METHYL-ETHYL-KEYTONE) ARE NOT TO BE USED ON GLASS FIBER REINFORCED COMPOSITES. USE ETHYL ALCOHOL, ISOPROPYL ALCOHOL, OR TOLUENE INSTEAD.

ALIPHATIC NAPHTHA LEAVES AN OILY RESIDUE. IT IS RECOMMENDED TO USE ETHYL ALCOHOL, ISOPROPYL ALCOHOL, OR TOLUENE TO REMOVE THIS RESIDUE.

2.2 Wipe core cavity, do not soak, with a clean cheesecloth moistened with cleaner specified in 1.1. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth or dry immediately using clean, dry, filtered, compressed air.

2.3 Use clean Kraft paper specified in 1.2 or masking tape specified in 1.4 to protect cleaned cavity from contamination until ready for subsequent operation.
3-2-5. PREPARATION OF BONDING SURFACES

This process sheet establishes the surface preparation of a repair part and of a damaged part being repaired prior to bonding.

**CAUTION**

AN EXCELLENT SURFACE PREPARATION IS ESSENTIAL TO ENSURE INTEGRITY AND DURABILITY OF A BONDED JOINT. EXTRA CARE IS TO BE TAKEN TO ENSURE THAT BONDING SURFACES ARE PROPERLY CLEANED AND PROTECTED FROM CONTAMINATION DURING ALL PHASES OF A REPAIR.

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.2 Cheesecloth (C-486).

1.3 Aluminum oxide abrasive paper (C-406) of 200 grit or finer, if required.

1.4 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

1.5 Masking tape (C-426).

1.6 Kraft paper (C-254).

1.7 Deionized or distilled water.

1.8 Spray gun atomizer.

1.9 Process Sheet(s):
Removal of Paints and Primers on Metallic Parts  
(subsection 3-2-3).

2.0 PROCEDURE

2.1 Mask surrounding area using masking tape specified in 1.5.

2.2 If not already accomplished, remove paint, primer, and anodizing using instructions detailed in subsection 3-2-3.
NOTE
For composite bond material (Bell standard 150-021-xxA and 150-021-xxB only), prepare surface to be bonded by first removing peel ply and then sanding lightly with clean abrasive paper specified in 1.3 to remove glaze. No further cleaning of composite bond is required.

Composite bond material shall be bonded within a maximum of 8 hours after surface preparation has been completed.

2.3 Sand surfaces to be bonded with abrasive paper specified in 1.4 to provide a slightly dull surface finish.

CAUTION
BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

ACETONE, ALIPHATIC NAPHTHA, AND MEK ARE NOT TO BE USED ON FIBERGLASS COMPOSITES. USE ETHYL ALCOHOL, ISOPROPYL ALCOHOL, OR TOLUENE INSTEAD.

NOTE
Do not handle clean parts with bare hands. Use of clean cotton gloves is recommended when handling parts. Gloves shall be changed when contaminated with any foreign substance that would adversely affect part quality.

2.4 Wipe surfaces to be bonded with a clean cheesecloth moistened with cleaner specified in 1.1. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.
CAUTION

DO NOT PERFORM WATER BREAK TEST ON ADHESIVE SIDE OF COMPOSITE BOND REPAIR MATERIAL (BELL STANDARD 150-021-XXA AND 150-021-XXB ONLY).

NOTE

Water break test will identify optimum surface preparation for bonding. Result of test may not be accurate when performed on vertical surfaces or on parts that have affected surface at a very steep angle.

2.5 Optionally, bonding surface may be inspected for a water break free surface using procedure described below to ensure surface is clean.

NOTE

Ensure rivet holes and core cavities are masked or sealed to prevent core contamination.

2.5.1 Holding atomizer 10 to 20 inches (254 to 508 mm) away from surfaces to be tested, spray a fine mist of deionized or distilled water for a period of 1 to 10 seconds.

2.5.2 Inspect water film on tested surfaces to ensure that it is thin, continuous, and uniform for a minimum of 30 seconds. If water film is discontinuous or nonuniform, surface is still contaminated. Repeat step 2.4 and step 2.5 as required to obtain a clean surface.

2.5.3 Remove masking or sealing agent used at step 2.5.1.

CAUTION

ENSURE NO WATER REMAINS TO PREVENT CORROSION.

2.5.4 Wipe surfaces to be bonded with a clean cheesecloth moistened with cleaner specified in 1.1. Change cheesecloth often. Wipe dry using a clean cheesecloth.

2.6 Remove masking tape and protect clean surfaces from contamination until ready to bond using clean Kraft paper specified in 1.6 or masking tape specified in 1.5.
3-2-6. PREPARATION OF CORE PLUG PRIOR TO BONDING

This process sheet establishes the means of sealing the core cells in order to provide a better bonding surface and to prevent the adhesive used to bond repair parts from flowing inside the core cells. This process sheet also provides the means to fabricate a thick core plug or a core plug of complex geometry by using two layers of a thinner honeycomb core material.

APPLICATION A: FOR FLAT CORE PLUGS MADE OF A SINGLE LAYER AND OF CONSTANT GEOMETRY

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Honeycomb core of same material, density, and thickness as original core or as defined in repair procedure. Refer to Appendix A-2-4 for appropriate material part number.

1.2 General purpose bonding adhesive (C-317).

1.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.4 Perforated release film (C-477) or non-perforated release film (C-256).

1.5 Cheesecloth (C-486).

1.6 Kraft paper (C-254).

1.7 Process Sheet(s): Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

2.0 PROCEDURE

2.1 Cut core plug to fit section of core removed while allowing a 0.060 inch (1.52 mm) gap for adhesive at edges. Align core ribbon in same direction as that of existing core in panel.

CAUTION
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

2.2 Remove core plug from bulk honeycomb core material panel, wipe with a clean cheesecloth moistened with cleaner specified in 1.3, and dry immediately using clean, dry, filtered, compressed air.
2.3 Lay a piece of release film specified in 1.4 of a size equal to or slightly larger than core plug on a flat surface. Apply a uniform film, 0.020 to 0.030 inch (0.51 to 0.76 mm) thickness, of adhesive specified in 1.2 to surface of release film.

2.4 Place core plug on adhesive covered release film. Apply a uniform pressure from firm contact up to 2.0 PSI (13.8 kPa) on core plug and allow adhesive to cure at room temperature for 24 hours. Refer to Table 3-25 for applicable cure time and temperature.

2.5 Remove release film.

2.6 Trim excess adhesive from core plug.

2.7 If core plug is to be installed on a vertical surface, repeat step 2.3 through step 2.6 to seal opposite surface of core plug.

2.8 Wrap core plug in clean Kraft paper specified in 1.6 to protect it until ready to use.

NOTE
When installing core plug in panel, from above or below, always position core plug with sealed cells facing up to prevent adhesive from flowing inside core cells, as shown in Figure 3-1. In some cases, a core plug with cells sealed on both sides may be required.
Figure 3-1. Single Layer Core Plug — Preparation

ALWAYS INSTALL CORE PLUG IN PANEL WITH SEALED SURFACE FACING UP TO PREVENT ADHESIVE FROM FLOWING DOWN INTO CORE PLUG

ALL-SRM-3-02-06A-1
APPLICATION B: FOR FLAT CORE PLUGS MADE FROM TWO LAYERS OR OF COMPLEX GEOMETRY

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Honeycomb core of same material and density as original core or as defined in repair procedure. Refer to Appendix A-2-4 for appropriate material part number.

1.2 General purpose bonding adhesive (C-317).

1.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.4 Perforated release film (C-477) or non-perforated release film (C-256).

1.5 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

1.6 Cheesecloth (C-486).

1.7 Kraft paper (C-254).

1.8 Process Sheet(s):
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

2.0 PROCEDURE

2.1 Cut two layers of core plug to fit section of core removed while allowing a 0.060 inch (1.52 mm) gap for adhesive at edges. Align core ribbon in same direction as that of existing core in panel.

CAUTION
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

2.2 Remove core plugs from bulk honeycomb core material panel, wipe with a clean cheesecloth moistened with cleaner specified in 1.3, and dry immediately using clean, dry, filtered, compressed air.

2.3 Lay a piece of release film specified in 1.4 in a container of a size slightly larger than two layers of core plug ensuring a sufficient gap between layers. Pour a layer of approximately 0.125 inch (3.18 mm) thickness of adhesive specified in 1.2 to surface of release film.
2.4 Place mating surfaces of two layers of core plug on adhesive covered release film. Apply a uniform pressure from firm contact up to 2.0 PSI (13.8 kPa) on core plugs. Allow adhesive to cure at room temperature for 24 hours. Refer to Table 3-25 for applicable cure time and temperature.

2.5 Remove release film.

2.6 Trim excess adhesive from core plugs and lightly sand adhesive smooth using abrasive paper specified in 1.5 to create a flat surface.

**CAUTION**

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

2.7 Wipe core plugs, do not soak, using cleaner specified in 1.3. Dry immediately using clean, dry, filtered, compressed air.

2.8 Lay a piece of release film specified in 1.4 of a size equal to or slightly larger than core plug on a flat surface.

2.9 Place a layer of core plug on release film with open cells facing down. Apply a uniform film of adhesive specified in 1.2 of approximately 0.006 inch (0.15 mm) thickness to upper surface of core plug, previously sealed in step 2.8, as shown in Figure 3-2. Place second layer of core plug on top of first layer with sealed cells facing first layer of core plug respecting ribbon direction. Apply a uniform pressure from firm contact up to 2.0 PSI (13.8 kPa) on core plugs and allow adhesive to cure at room temperature for 24 hours. Refer to Table 3-25 for applicable cure time and temperature.

2.10 Remove release film.

2.11 Trim excess adhesive from core plug.

2.12 Seal cells of core plug using instructions detailed in Applications A or B.

2.13 Wrap core plug in clean Kraft paper specified in 1.7 to protect it until ready to use.

**NOTE**

When installing core plug in panel, from above or below, always position core plug with sealed cells facing up to prevent adhesive from flowing inside core cells, as shown in Figure 3-2. In some cases, a core plug with cells sealed on both sides may be required.
3-2-6. PREPARATION OF CORE PLUG PRIOR TO BONDING

RELEASE FILM
ADHESIVE SEAL CELLS
CORE PLUG (ONE LAYER)
CONTAINER

ADHESIVE FILLING
NEW ADHESIVE
CORE PLUG (ONE LAYER)

SEAL CELLS OF CORE PLUG PER APPLICATION A OR APPLICATION B

EXPOSED CORE
.25 MIN TYP

.06 GAP TYP

CURED ADHESIVE (SEALED CELLS)

NEW ADHESIVE
EXISTING PANEL

ALWAYS INSTALL CORE PLUG IN PANEL WITH SEALED SURFACE FACING UP TO PREVENT ADHESIVE FROM FLOWING DOWN INTO CORE PLUG

Figure 3-2. Dual Layer Core Plug — Preparation
APPLICATION C: FOR CURVED CORE PLUGS MADE OF A SINGLE LAYER AND OF CONSTANT GEOMETRY

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Honeycomb core of same material and density as original core or as defined in repair procedure. Refer to Appendix A-2-4 for appropriate material part number.

1.2 General purpose bonding adhesive (C-317)

1.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.4 Perforated release film (C-477) or non-perforated release film (C-256).

1.5 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

1.6 Cheesecloth (C-486).

1.7 Kraft paper (C-254).

1.8 Clean aluminum sheet of 0.008 inch (0.20 mm) thick.

1.9 Tube or roll made of metal or thick cardboard of same or slightly undersized diameter as inner diameter of core to be formed.

1.10 Support with same contour as outer diameter of core plug.

1.11 Fiberglass manifold made from 3 to 4 plies of glass fabric (C-404), style 7781.

1.12 Vacuum bag sealant tape (C-259).

1.13 Process Sheet(s):
   Preparing and Mixing Two-part Epoxy Resin by Weight
   Vacuum Bagging Metallic Repairs (paragraph 3-2-25) (paragraph 3-2-26)

2.0 PROCEDURE

2.1 Cut core plug approximately 0.50 inch (12.7 mm) larger in all directions than section of core removed. Align core ribbon in same direction as that of existing core in panel.

**NOTE**
Care shall be taken to prevent crushing core while preforming it to contour.

2.2 Remove core plug from bulk honeycomb core material panel and preform it by hand rolling core between aluminum sheet specified in 1.8 (under core) and tube or roll specified in 1.9 (over core), as shown in Figure 3-3.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

2.3 Wipe with a clean cheesecloth moistened with cleaner specified in 1.3 and dry immediately using clean, dry, filtered, compressed air.

2.4 Lay a piece of release film specified in 1.4 of a size equal to or slightly larger than core plug on support specified in 1.10. Apply a uniform film, 0.02 to 0.03 inch (0.51 to 0.76 mm) thickness, of adhesive specified in 1.2 to surface of release film.

2.5 Place preformed core plug on adhesive covered release film, as shown in Figure 3-3.

2.6 Lay a piece of release film specified in 1.4 of a size equal to or slightly larger than core plug on a workbench. Apply a uniform film, 0.020 to 0.030 inch (0.51 to 0.76 mm) thickness, of adhesive specified in 1.2 to surface of release film.

NOTE
Release film shall be wrinkle free prior to vacuum bagging core plug.

2.7 Place adhesive covered release film on top of core plug, as shown in Figure 3-3.

2.8 Using vacuum bag sealant tape specified in 1.12, create a dam along both sides parallel to core ribbon direction. Dam is to have same thickness as core plug, as shown in Figure 3-3.

2.9 Install fiberglass manifold specified in 1.11 around core plug. Manifold to be 3.0 inches (76.2 mm) wide and located 1.0 inch (25.4 mm) from core plug, as shown in Figure 3-3.

2.10 Vacuum bag core plug using two plies of breather and instructions detailed in paragraph 3-2-26.

2.11 Apply 25 inches (635 mm) Hg minimum vacuum to vacuum bag. Using a gauge, verify vacuum bag for leaks. Vacuum bag must not leak more than 5.0 inches (127 mm) Hg per minute. Rework vacuum bag to plug leaks and repeat this step as required until this condition is met.

2.12 Apply 25 inches (635 mm) Hg minimum vacuum to vacuum bag and allow adhesive to cure at room temperature for 24 hours. Refer to Table 3-25 for applicable cure time and temperature.

2.13 Remove core plug from vacuum bag and remove release films from core plug.
2.14 Trim core plug to fit section of core removed while allowing a 0.060 inch (1.52 mm) gap for adhesive at edges, as shown in Figure 3-3. Align core ribbon in same direction as that of existing core in panel.

2.15 Wrap core plug in clean Kraft paper specified in 1.7 to protect it until ready to use.
3.2-6. PREPARATION OF CORE PLUG PRIOR TO BONDING

1. SUPPORT FOR PRE-FORMING, RADIUS TO MATCH OR BE SLIGHTLY UNDERSIZED.
   USE .008 THICK SHEET TO SUPPORT CORE WHILE PRE-FORMING
   RELEASE FILMS
   CORE TO BE FORMED
   PRE-FORMED CORE PLUG

2. ADHESIVE SEAL CELLS
   SUPPORT TO MAINTAIN CONTOUR
   BAGGING FILM
   VACUUM BAG SEALANT
   INSTALL VACUUM FITTING PER FIGURE 3-32.
   DAM MADE FROM VACUUM BAG SEALANT
   PERFORATED FEP PARTING FILM
   BREATHER

3. FIBERGLASS MANIFOLD
   3.00 WIDE (3-4 PLIES)

Figure 3-3. Single Layer Preformed and Presealed Core Plug — Preparation (Sheet 1 of 2)
4.

5.

Figure 3-3. Single Layer Preformed and Presealed Core Plug — Preparation (Sheet 2 of 2)
APPLICATION D: FOR IN-SITU CURVED CORE PLUGS MADE OF A SINGLE LAYER AND OF CONSTANT GEOMETRY

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Honeycomb core of same material and density as original core or as defined in repair procedure. Refer to Appendix A-2-4 for appropriate material part number.

1.2 General purpose bonding adhesive (C-317).

1.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.4 Perforated release film (C-477) or non-perforated release film (C-256).

1.5 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

1.6 Cheesecloth (C-486).

1.7 Clean aluminum sheet of 0.008 inch (0.20 mm) thick.

1.8 Tube or roll made of metal or thick cardboard of same or slightly undersized diameter as inner diameter of core to be formed.

1.9 Support with same contour as outer diameter of core plug.

1.10 Fiberglass manifold made from three to four plies of glass fabric (C-404), style 7781.

1.11 Vacuum bag sealant tape (C-259) or sealant tape (C-599).

1.12 Process Sheet(s):
Core Splicing (paragraph 3-2-10)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
Vacuum Bagging Metallic Repairs (paragraph 3-2-26)

2.0 PROCEDURE

NOTE
Core forming is to be accomplished in conjunction with core splicing detailed in paragraph 3-2-10.

It is required to repair one surface of panel with damage through both skins and core prior to forming and splicing core plug.

2.1 Cut core plug to fit section of core removed while allowing a 0.060 inch (1.52 mm) gap for adhesive at edges. Align core ribbon in same direction as that of existing core in panel.
NOTE

Care shall be taken to prevent crushing core while preforming it to contour.

2.2 Remove core plug from bulk honeycomb core material panel and preform it by hand rolling core between aluminum sheet specified in 1.7 (under core), and tube or roll specified in 1.9 (over core), as shown in Figure 3-4.

CAUTION

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

2.3 Wipe with a clean cheesecloth moistened with cleaner specified in 1.3 and dry immediately using clean, dry, filtered, compressed air.

2.4 Apply a uniform film, 0.020 to 0.030 inch (0.51 to 0.76 mm) thickness, of adhesive specified in 1.2 to surface at bottom of core cavity on which core plug is to be bonded.

2.5 Place preformed core plug on adhesive covered surface, as shown in Figure 3-4.

2.6 Lay a piece of release film specified in 1.4 of a size equal to or slightly larger than core plug on a workbench. Apply a uniform film, 0.020 to 0.030 inch (0.51 to 0.76 mm) thickness, of adhesive specified in 1.2 to surface of release film.

2.7 Place adhesive covered release film on top of core plug, as shown in Figure 3-4.

2.8 Install fiberglass manifold specified in 1.10 around core plug. Manifold to be 3.0 inches (76.2 mm) wide and located 1.0 inch (25.4 mm) from core plug, as shown in Figure 3-4.

2.9 Vacuum bag core plug using two plies of breather and instructions detailed in paragraph 3-2-26.

2.10 Apply 25 inches (635 mm) $H_G$ minimum vacuum to vacuum bag. Using a gauge, verify vacuum bag for leaks. Vacuum bag must not leak more than 5.0 inches (127 mm) $H_G$ per minute. Rework vacuum bag to plug leaks and repeat this step as required until this condition is met.

2.11 Apply 25 inches (635 mm) $H_G$ minimum vacuum to vacuum bag and allow adhesive to cure at room temperature for 24 hours. Refer to Table 3-25 for applicable cure time and temperature.

2.12 Remove vacuum bag from reworked area and remove release films from core plug.

2.13 Trim excess adhesive from core plug.
3-2-6. PREPARATION OF CORE PLUG PRIOR TO BONDING

1. SUPPORT FOR PRE-FORMING. RADIUS TO MATCH OR BE SLIGHTLY UNDERSIZED.

USE .008 THICK SHEET TO SUPPORT CORE WHILE PRE-FORMING

CORE TO BE FORMED

BAGGING FILM

RELEASE FILM

ADHESIVE SEAL CELLS

VACUUM BAG SEALANT

2. NOTE: INSTALL VACUUM FITTING PER FIGURE 3-32

EXPOSED CORE .25 MIN TYP

.06 GAP TO BE FILLED WITH ADHESIVE TYP

EXISTING PANEL

SUPPORT TO MAINTAIN CONTOUR (OPTIONAL)

CORE SPLICING USING INSTRUCTIONS DETAILED IN SECTION 3-2-10 OF THIS MANUAL TO BE PERFORMED AT SAME TIME

Figure 3-4. Single Layer Preformed Core Plug In-Situ — Preparation
3-2-7. **BONDING OF FLAT STOCK (FILLERS AND DOUBLERS)**

This process sheet establishes the procedure for bonding sheet metal repair parts with at least one flat surface to the parent structure.

**CAUTION**

AN EXCELLENT SURFACE PREPARATION IS ESSENTIAL TO ENSURE INTEGRITY AND DURABILITY OF A BONDED JOINT. EXTRA CARE IS TO BE TAKEN TO ENSURE THAT BONDING SURFACES ARE PROPERLY CLEANED AND PROTECTED FROM CONTAMINATION DURING ALL PHASES OF A REPAIR.

1.0 REQUIRED

1.1 Process Sheet(s):

- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
- Vacuum Bagging Metallic Repairs (paragraph 3-2-26)

2.0 PROCEDURE

**NOTE**

Do not handle clean parts with bare hands. Use of clean cotton gloves is recommended when handling parts. Gloves shall be changed when contaminated with any foreign substance that would adversely affect part quality.

The surfaces of detail parts shall have good contact over entire area to be bonded (without void). Detail parts shall be free of burrs, waves, and other surface imperfections.

When practical surfaces shall be prefitted before surface preparation, unless repair procedure specifies otherwise:

When using composite bond material (Bell standard 150-021-xxB, composite bond on one face only), position composite bond surface against existing structure. Sequence when bonding is to work from existing structure outwards. Do not prebond fillers to doublers unless repair procedure specifies it.

When bonding bare aluminum, bare 301 CRES steel or bare titanium, surface to be bonded must be prepared prior to bonding using instructions detailed in paragraph 3-2-5.

2.1 Prepare required adhesive using instructions detailed in paragraph 3-2-5.

2.2 Using a spatula or other similar tool, coat prepared surface(s) of doubler(s), filler(s), or other part(s) to be bonded with a thin layer (0.003 to 0.015 inch (0.08 to 0.38 mm) thick) of specified adhesive.
NOTE
Use care to ensure proper alignment and to avoid trapping air within bondline.

2.3 Bond components in their respective positions. Install fasteners, if required, while adhesive is still wet. If fasteners cannot be installed at this time, Clecos coated with release agent (i.e., Vaseline) may be used to secure parts.

NOTE
Bondline pressure may be applied using dead weight or vacuum bags. When dead weight is used to apply pressure, ensure part being repaired is properly supported; add weight gradually and ensure there is no visible deformation of part. If possible, try to spread weight uniformly over entire repair area.

Bondline pressure shall be distributed over full bond region throughout cure cycle. If cure at high temperature is used, bondline pressure must be maintained until unit has cooled to 150°F (65.5°C) or below.

2.4 Apply uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used.

2.5 Remove excess adhesive squeeze-out.

2.6 Allow adhesive to cure. Refer to Table 3-25 for applicable cure time and temperature.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

2.7 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.
3-2-8. WET LAYUP OF FIBERGLASS

This process sheet has been replaced with process sheet provided in Chapter 4, paragraph 4-3-3.
3-2-9. FIBERGLASS EDGING REPLACEMENT

This process sheet establishes the procedure for replacing the fiberglass edging on honeycomb bonded panel structure with metallic facings.

**CAUTION**

AN EXCELLENT SURFACE PREPARATION IS ESSENTIAL TO ENSURE INTEGRITY AND DURABILITY OF A BONDED JOINT. EXTRA CARE IS TO BE TAKEN TO ENSURE THAT BONDING SURFACES ARE PROPERLY CLEANED AND PROTECTED FROM CONTAMINATION DURING ALL PHASES OF A REPAIR.

**NOTE**

Cleanliness is to be carefully controlled through all phases of the preparation and bonding operations.

1.0 RESTRICTIONS

1.1 Subject to limitations given in paragraph 1-20 of this manual and in model-specific SRM.

1.2 Not applicable to honeycomb core bonded panels with facings made from glass or carbon fiber composites.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 edging made from glass fabric (C-404), style 7781.

2.2 Cleaner for aluminum skin using MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Cleaner for fiberglass skin or edging using ethyl alcohol (C-339), isopropyl alcohol (C-385), or toluene (C-306).

2.4 Aluminum oxide abrasive paper (C-406) of 100 to 400 grit.

2.5 Wet layup adhesive (C-363) or adhesive (C-512).
2.6 Process Sheet(s) — wet layup bagging process:

- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
- Sanding Glass or Carbon Fiber Composites (paragraph 4-2-3)
- Cutting/Routing Glass or Carbon Fiber Composites (paragraph 4-2-4)
- Removal of Paint, Primer and Sanding Surfacer on Glass or Carbon Fiber (paragraph 4-2-6)
- Surface Preparation for Bonding on Glass or Carbon Fiber Composites (paragraph 4-2-9)
- Drying Composite Parts Prior to Bonding (paragraph 4-2-10)
- Finish Process Following a Composite Repair (paragraph 4-2-11)
- Wet Layup Impregnation Process (paragraph 4-3-3)
- Wet Layup Bagging Process (paragraph 4-3-5)
- Curing Process for Epoxy Resin (paragraph 4-3-6)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**NOTE**

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.2 If applicable, remove paint and primer using instructions detailed in paragraph 3-2-3 for metallic parts, and Chapter 4, paragraph 4-2-6 for fiber reinforced composite parts.

3.3 Cut out and remove damaged portion of edging plus a minimum of 0.25 inch (6.4 mm) beyond damage on all sides using instructions detailed in Chapter 4, paragraph 4-2-4 (See Figure 3-5).

3.4 Inspect exposed surfaces of core for evidence of damage, corrosion, or contamination. If damage exists, determine extent of damage and repair using appropriate chapter of this manual or of model-specific Structural Repair Manual before proceeding with edging replacement.

3.5 Prepare faying surfaces of honeycomb panel for bonding using instructions detailed in paragraph 3-2-5 and Chapter 4, paragraph 4-2-7.

3.6 Calculate total repair area, allowing a 0.75 inch (19.1 mm) overlap between end of damage and end of both repair plies.

**NOTE**

Glass fabric has an average cured ply thickness between 0.012 and 0.013 inch (0.30 to 0.33 mm).

3.7 Determine number of plies of damaged edging. Determine required number of repair plies (N) using data from Chapter 4, Table 4-9.
NOTE
Fiber direction of fiberglass edging is such that 0° direction is perpendicular to edge of panel.

3.8 Prepare -1 edging fiberglass fabric repair plies (quantity N plies), as shown in Figure 3-5. When adding two plies, first ply to be oriented at 0° and second ply to be oriented at 45°. When adding three plies, first and second plies to be oriented at 0° and third ply to be oriented at 45°.

3.9 Wet layup -1 edging fiberglass fabric repair plies using instructions detailed in Chapter 4, paragraph 4-3-3.

3.10 Cure -1 edging wet layup using instructions detailed in Chapter 4, paragraph 4-3-6. Vacuum bagging and post-cure are optional.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.11 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.12 Finish repair using instructions detailed in Chapter 4, paragraph 4-2-11.
Figure 3-5. Edging Replacement

- DO NOT DAMAGE SKIN WHEN REMOVING EDGING FROM THIS AREA

- REPAIR PLIES OVERLAP TO HAVE .75 MIN INCREMENTS PER PLY IN EVERY DIRECTIONS, TYP

- END OF DAMAGED AREA
- EOP EXISTING EDGING REF
- R .50 TYP
- EOP NEW PLIES
- EDGING CUTLINE
- .25 MIN

SECTION A-A
3-2-10. CORE SPICING

This process sheet establishes the procedure for splicing a core plug to the parent core of a panel.

NOTE
Cleanliness is to be carefully controlled through all phases of the preparation and bonding operations.

1.0 REQUIRED

1.1 Process Sheet(s):
- Cleaning of Honeycomb Core Cavity (paragraph 3-2-4)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Preparation of Core Plug Prior to Bonding (paragraph 3-2-6)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

2.0 PROCEDURE

NOTE
Do not handle clean parts with bare hands. Use of clean cotton gloves is recommended when handling parts. Gloves shall be changed when contaminated with any foreign substance that would adversely affect part quality.

2.1 Prepare core plug(s) using instructions detailed in paragraph 3-2-6.

2.2 Clean panel in preparation for bonding using instructions detailed in paragraph 3-2-4 and paragraph 3-2-5.

2.3 Apply a light uniform film of specified adhesive to faying surfaces of parent structure, or doubler, or filler and core plug.

NOTE
When installing core plug in panel, from above or below, always position core plug with sealed cells facing up to prevent adhesive from flowing inside core cells, as shown in Figure 3-1 through Figure 3-4. In some cases, a core plug with cells sealed on both sides may be required.

2.4 Bond core plug in place and fill gap between plug and parent core with specified adhesive.

2.5 Proceed with remaining portion of repair while core splice adhesive is wet.
Figure 3-6. Core Splicing
3-2-11. POTTED INSERTS — GENERAL

This process sheet establishes the preparation of the insert and of the panel prior to installing a potted insert into the panel.

1.0 INSERT INSTALLATION TOLERANCES

1.1 Faces of molded-in blind threaded or non-threaded inserts (80-004 and 80-005), dome head inserts (80-007), or of two-piece plug and sleeve type inserts (80-011 and 80-013) shall be flush with panel face(s) within ±0.020 inch (±0.51 mm). Angle of insert axis to panel surface(s) shall be 90° ±2°. For countersunk and dimpled inserts (80-011 and 80-013) and molded-in threaded or non-threaded inserts (NAS1832 through NAS1836), face of insert shall be flush with face of panel within ±0.020 inch (±0.51 mm). When inserts are installed in rigidized skins, face of insert shall be offset from panel face of adjacent high side of diamond pattern of rigidized skin by no more than ±0.020 inch (±0.51 mm).

2.0 PRELIMINARY REQUIREMENTS

2.1 Cleanliness is to be carefully controlled through all phases of preparation and bonding operations.

3.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

3.1 Cleaner: MEK (C-309), acetone (C-316), or isopropyl alcohol (C-385).

3.2 Kraft paper (C-254).

3.3 Masking tape (C-426).

4.0 PREPARATION OF INSERTS

Prior to bonding in panel, inserts shall be prepared as follows:

**CAUTION**

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

4.1 Solvent clean by soaking in cleaner specified in 3.1.

4.2 Air dry for a minimum of 15 minutes.

4.3 Handle clean dry inserts with clean cotton gloves. Do not handle clean parts with bare hands.

4.4 Use clean Kraft paper specified in 3.2 to protect inserts from contamination until ready for subsequent operation.
5.0 HONEYCOMB PANEL PREPARATION

CAUTION

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF SKIN(S) FROM CORE.

5.1 Bonded honeycomb panels shall have proper size hole drilled through skin(s) into core. Refer to Table 3-9 through Table 3-18 for applicable hole size(s).

5.2 In case of blind type inserts, depth of hole in core shall be such that it does not bottom or damage opposite skin.

NOTE

Clean cutting tools to prevent contamination of insert hole during drilling and routing operations.

5.3 Hole in honeycomb core will be enlarged 0.30 to 0.50 inch (7.6 to 12.7 mm) larger than diameter of insert (0.15 to 0.25 inch (3.8 to 6.4 mm) undercut from edge of cutout). Hole shall extend all the way from upper to lower skin.

CAUTION

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

5.4 Clean drilled holes of debris resulting from cutting operation using clean, dry, filtered, compressed air. No further surface preparation of hole is required.

5.5 Use clean Kraft paper specified in 3.2 or masking tape specified in 3.3 to protect cleaned holes from contamination until ready to install inserts.

5.6 After installation of required inserts using instructions detailed in paragraph 3-2-12 is completed, proceed with proof load test procedure as follows:

NOTE

Bolt clearance hole must have 0.063 inch (1.60 mm) larger diameter than nominal diameter of bolt.

5.6.1 Prepare aluminum block as shown in Figure 3-7 or Figure 3-8 as applicable. Deburr all holes and edges.
NOTE

Bolt threads must not engage locking device in insert.

Bolt shank, head, and threads must be lubricated.

5.6.2 Locate aluminum block in position at replacement insert location and secure using adequate hardware. Refer to Figure 3-7 or Figure 3-8, as applicable, and to Table 3-8.

5.6.3 Torque bolt per Table 3-8. All replacement inserts must be capable of withstanding an axial proof load of 250 pounds (1112 N).

CAUTION

PROOF LOADING OF IMPROPERLY/INADEQUATELY INSTALLED INSERTS MAY RESULT IN DAMAGE (DIMPLING) OF BACK SURFACE FACE SHEET.

Table 3-8. Torque Requirement for Insert Proof Load Test

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Torque Inch-pound (Nm)</th>
<th>Tension Load Pound (N)</th>
<th>Washer Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-32</td>
<td>8.5 (0.96)</td>
<td>255 (1134)</td>
<td>NAS1149DN832H</td>
</tr>
<tr>
<td>10-32</td>
<td>9.5 (1.07)</td>
<td>256 (1138)</td>
<td>NAS1149D0363H</td>
</tr>
<tr>
<td>1/4-28</td>
<td>12 (1.36)</td>
<td>258 (1147)</td>
<td>NAS1149D0463H</td>
</tr>
<tr>
<td>5/16-24</td>
<td>15 (1.69)</td>
<td>256 (1138)</td>
<td>NAS1149D0563H</td>
</tr>
</tbody>
</table>
Figure 3-7. Proof Load Test of Threaded Inserts
NOTE: ENSURE THERE ARE NO THREADS WITHIN INSERT DURING TEST.

Figure 3-8. Proof Load Test of Through Type Inserts
3-2-12. INSTALLATION OF POTTED INSERTS

This process sheet establishes the installation procedure for a potted insert into a panel.

APPLICATION A: INSTALLATION OF BLIND TYPE POTTED INSERT, BELL STANDARDS 80-004 AND 80-005

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 General purpose bonding adhesive (C-317).

1.2 Plastic tube using Bell Standard 130-005-2N, M23053/8-002-C, or equivalent (if required).

1.3 Aluminum oxide abrasive paper (C-406) of 360 grit or finer.

1.4 Masking tape (C-426).

1.5 Process Sheet(s):

Potted Inserts — General (paragraph 3-2-11)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

2.0 PROCEDURE

CAUTION

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

NOTE

If thickness of stack up of material where insert is to be installed is thicker than 0.069 inch (1.75 mm), drill insert installation hole in sheet(s) closer to the core approximately 0.100 inch (2.54 mm) larger than diameter A given in Table 3-9 and Table 3-10 to clear head of insert, as shown in Figure 3-10. Hole shall be drilled, whenever possible, prior to installation of mating repair parts. Always install insert in sheet(s) further away from the core.

2.1 Determine position and mark center of insert on panel. Drill hole of appropriate size, for insert type and diameter required, through one skin only. Refer to Table 3-9 or Table 3-10 as applicable.

2.2 Undercut core 0.15 to 0.25 inch (3.8 to 6.4 mm) from edge of insert installation hole or as specified in the applicable repair procedure.
DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.3 If insert used does not have provisions in head for injecting adhesive, drill two opposed 0.078 to 0.093 inch (1.98 to 2.36 mm) injection holes through outer skin at a distance of 0.063 to 0.125 inch (1.60 to 3.18 mm) from edge of insert head to edge of injection holes. Angle the injection holes at 45° down to the center of insert.

2.4 Prepare insert and core cavity using instructions detailed in paragraph 3-2-11.

2.5 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material from core cavity and surface of panel.

NOTE
Care shall be taken to insure proper alignment and to avoid entrapped air or incomplete fill within the potted area.

Blind type potted inserts (Bell standards 80-004 and 80-005) have a serrated shank designed to be torqued into metal face sheets by rotating clockwise while applying light pressure on the insert. By design, the hole in the metal face sheet will be smaller than the serration and top lip of insert. Hole size in the metal face sheet, as specified in Table 3-9 and Table 3-10, shall not be altered. Special installation tools are recommended for this application and are available from the insert manufacturer.

2.6 For inserts installed from top only, fill cavity with a sufficient amount of adhesive specified in 1.1 (minimum 1/4 full) to fill gap between insert and opposite skin in panel.

2.7 Apply adhesive to flange of insert. Press insert in position until it snaps in place and secure in position using masking tape specified in 1.4. Punch through tape at both injection hole locations.

2.8 Using a small tipped syringe inject a slow steady flow of adhesive specified in 1.1 through one hole only. Continue injecting until a steady flow of adhesive emerges out of the opposite hole. If injection is to be accomplished through the lower skin (Figure 3-11), insert a short piece of tube specified in 1.2 in one hole and push until it bottoms against the opposite skin. This allows air to evacuate while adding potting adhesive.

2.9 Clean excess adhesive around insert. Allow adhesive to cure. Refer to Table 3-25 for adhesive curing time and temperature.
CAUTION

DO NOT SAND INTO PANEL OR INTO INSERT WHILE REMOVING EXCESS CURED ADHESIVE.

2.10 Remove tape. Sand surface of insert and adjacent area with abrasive paper specified in 1.3.
3.2-12. INSTALLATION OF POTTED INSERTS

Figure 3-9. Floating Inserts (80-004, 80-005) — Installation

- Installation Hole Size (Table 3-9)
- Undercut Core .15 to .25 TYP
- .063 to .125 TYP
- .078/.093 Inches Injection Holes (QTY 2)
- 180 Degrees Apart
- Potting Adhesive
- Injection Adhesive Into One Hole Until It Flows Out From The Other Hole.
- Fill With Adhesive Ensure No Cap Remains Unfilled Between Insert Bottom and Skin.

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Figure 3-10. Floating Inserts (80-004, 80-005) in Thick Skins — Installation

- Installation of Potted Inserts
- POTTING ADHESIVE TYP
- INJECT ADHESIVE INTO ONE HOLE UNTIL IT FLOWS OUT FROM THE OTHER HOLE.
- FILL WITH ADHESIVE ENSURE NO GAP REMAINS UNFILLED BETWEEN INSERT BOTTOM AND SKIN.
- UNDERCUT CORE .15 TO -.25 TYP
- INSTALLATION HOLES SIZE (+ .100)
- INSTALLATION HOLES SIZE (TABLE 3-9) (TABLE 3-10)

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3.2-12. INSTALLATION OF POTTED INSERTS

Figure 3-11. Inserts from Underside of Panel — Installation
APPLICATION B: INSTALLATION OF PLUG AND SLEEVE TYPE POTTED INSERTS, BELL STANDARDS 80-011 AND 80-013

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 General purpose bonding adhesive (C-317).

1.2 Plastic tube using Bell Standard 130-005-2N, M23053/8-002-C, or equivalent (if required).

1.3 Aluminum oxide abrasive paper (C-406) of 360 grit or finer.

1.4 Process Sheet(s):
   Potted Inserts — General (paragraph 3-2-11)
   Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

2.0 PROCEDURE

**CAUTION**

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.1 Determine position and mark center of insert on panel. Drill hole of appropriate size, for insert type and diameter required, through panel. Refer to Table 3-12 or Table 3-13, as applicable.

2.2 Undercut core 0.15 to 0.25 inch (3.8 to 6.4 mm) from edge of insert installation hole or as specified in the applicable repair procedure.

**CAUTION**

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.3 If insert used does not have provisions in head for injecting adhesive, drill two opposed 0.078 to 0.093 inch (1.98 to 2.36 mm) injection holes through outer skin at a distance of 0.063 to 0.125 inch (1.60 to 3.18 mm) from edge of insert head to edge of injection holes. Angle the injection holes at 45° down to the center of insert.

2.4 If protruding-type insert is to be installed, measure length of fully engaged insert and panel thickness to determine the gap, if any, between head of insert and panel skin. Upon installation of insert, any gap must be closed using a washer made from same material as panel facing and bonded with general purpose bonding adhesive specified in 1.1. If panel facing is made from fiberglass, washer shall be made from any aerospace grade aluminum alloy; for carbon fiber facings, washer shall be made from any corrosion resistant steel (CRES). Washer inner diameter to be same as installation hole size of insert and outer diameter to be same as insert head outer diameter. Washer(s) to be installed between protruding head and panel facing.
2.5 Prepare insert and core cavity using instructions detailed in paragraph 3-2-11.

2.6 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material from core cavity and surface of panel.

2.7 If flush-type insert is to be installed, dimple metal face sheet(s) of 0.032 inch (0.81 mm) thickness or more by using plug or sleeve as a dimpling tool or by countersinking composite face sheet as required.

**NOTE**
A light coat of release agent (i.e., Vaseline) on surfaces of nut, washers, and bolt is recommended to prevent their adhering to insert and panel.

2.8 Coat mating flange and lip of plug and sleeve with a thin layer of adhesive specified in 1.1. Also coat lip underneath heads of plug and sleeve with adhesive specified in 1.1. Insert plug and sleeve from their respective side of panel and press halves together until both halves engage firmly and are seated against panel. Secure insert halves with a nut, washers, and bolt.

2.9 Using a small tipped syringe, inject a slow steady flow of adhesive specified in 1.1 through one hole only. Continue injecting until a steady flow of adhesive emerges out of the opposite hole. If injection is to be accomplished through the lower skin (Figure 3-11), insert a short piece of tube specified in 1.2 in one hole and push until it bottoms against the opposite skin. This allows air to evacuate while adding potting adhesive.

2.10 Clean excess adhesive around insert. Allow adhesive to cure. Refer to Table 3-25 for adhesive curing time and temperature.

**CAUTION**
DO NOT SAND INTO PANEL OR INTO INSERT WHILE REMOVING EXCESS CURED ADHESIVE.

2.11 Remove bolt and ensure that insert bore and threads are free from adhesive. Sand surface of insert and adjacent area, on both sides of panel, with abrasive paper specified in 1.3.
Figure 3-12. Plug and Sleeve (80-011, 80-013) — Installation
APPLICATION C: INSTALLATION OF DOME HEAD TYPE POTTED INSERTS, BELL STANDARD 80-007

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 General purpose bonding adhesive (C-317).

1.2 Plastic tube using Bell Standard 130-005-2N, M23053/8-002-C, or equivalent (if required).

1.3 Aluminum oxide abrasive paper (C-406) of 360 grit or finer.

1.4 Process Sheet(s):
- Potted Inserts — General
- Preparing and Mixing Two-part Epoxy Resin by Weight

2.0 PROCEDURE

---

**CAUTION**

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.1 Determine position and mark center of insert on panel. Drill different diameter holes (K and H) of appropriate size, for insert type and required diameter, through both skins (Table 3-11).

2.2 Undercut core 0.15 to 0.25 inch (3.8 to 6.4 mm) from edge of larger insert installation hole (H) or as specified in the applicable repair procedure.

---

**CAUTION**

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.3 If insert used does not have provisions in head for injecting adhesive, drill two opposed 0.078 to 0.093 inch (1.98 to 2.36 mm) injection holes through outer skin at a distance of 0.063 to 0.125 inch (1.60 to 3.18 mm) from edge of insert head to edge of injection holes. Angle the injection holes at 45° down to the center of insert.

2.4 Prefit insert in panel and using feeler gauge, measure the gap, if any, between head of insert and panel skin. Upon installation of insert, any gap must be closed using washer(s) made from same material as panel facing and bonded with general purpose bonding adhesive specified in 1.1. If panel facing is made from fiberglass, washer shall be made from any aerospace grade aluminum alloy; for carbon fiber facings, washer shall be made from any corrosion resistant steel (CRES). Washer inner diameter to be same as installation hole size of insert and outer diameter to be same as insert head outer diameter. Washer(s) to be installed between protruding head and panel facing.

2.5 Prepare insert and core cavity using instructions detailed in paragraph 3-2-11.
2.6 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material from core cavity and surface of panel.

**NOTE**

A light coat of release agent (i.e., Vaseline) on surfaces of washers and bolt is recommended to prevent their adhering to insert and panel.

2.7 Coat small extremity and lip underneath head of insert with a thin layer of adhesive specified in 1.1. Push insert into panel from one side and press against opposite skin. Secure insert to panel with bolt and washer. Torque bolt sufficiently to ensure insert contacts both skins.

2.8 Using a small tipped syringe inject a slow steady flow of adhesive specified in 1.1 through one hole only. Continue injecting until a steady flow of adhesive emerges out of the opposite hole. If injection is to be accomplished through the lower skin (Figure 3-11), insert a short piece of tube specified in 1.2 in one hole and push until it bottoms against the opposite skin. This allows air to evacuate while adding potting adhesive.

2.9 Clean excess adhesive around insert. Allow adhesive to cure. Refer to Table 3-25 for adhesive curing time and temperature.

**CAUTION**

DO NOT SAND INTO PANEL OR INTO INSERT WHILE REMOVING EXCESS CURED ADHESIVE.

2.10 Remove bolt and washers and ensure that insert threads are free of adhesive. Sand surface of insert and adjacent area, on both sides of panel, with abrasive paper specified in 1.3.
3-2.12. INSTALLATION OF POTTED INSERTS

Figure 3-13. Dome Head Inserts (80-007) — Installation
APPLICATION D: INSTALLATION OF BLIND TYPE POTTED INSERT, NAS1832, NAS1835, AND NAS1836

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 General purpose bonding adhesive (C-317).

1.2 Plastic tube using Bell Standard 130-005-2N, M23053/8-002-C, or equivalent (if required).

1.3 Aluminum oxide abrasive paper (C-406) of 360 grit or finer.

1.4 NAS1837 installation plastic tab, refer to Table 3-14, Table 3-17, or Table 3-18 for appropriate part number. Installation plastic tab is usually supplied with insert.

1.5 Process Sheet(s):

Potted Inserts — General (paragraph 3-2-11)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

2.0 PROCEDURE

CAUTION

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.1 Determine position and mark center of insert on panel. Drill hole of appropriate size, for insert type and diameter required, through one skin only. Refer to Table 3-14, Table 3-17, or Table 3-18 as applicable.

2.2 Undercut core 0.15 to 0.25 inch (3.8 to 6.4 mm) from edge of insert installation hole or as specified in the applicable repair procedure.

CAUTION

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.3 Prepare insert and core cavity using instructions detailed in paragraph 3-2-11.

2.4 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material from core cavity and surface of panel.
NOTE

To prevent adhesive on NAS1837 installation plastic tab from drying, insert must be installed within 15 minutes of removing backing film from plastic tab.

2.5 Install insert as follows:

2.5.1 For inserts installed from top only, fill cavity with a sufficient amount of adhesive specified in 1.1 (minimum 1/4 full) to fill gap between insert and opposite skin in panel.

2.5.2 Remove backing film from NAS1837 installation plastic tab specified in 1.4.

2.5.3 Locate plastic tab on upper surface of insert head taking care to properly align the potting holes in the tab with the potting holes or slots of the insert. Press insert firmly against adhesive side of plastic tab.

2.5.4 Press insert firmly in place in panel. Verify that insert is properly placed by ensuring that plastic tab is firmly attached to surface of panel.

2.6 Using a small tipped syringe inject a slow steady flow of adhesive specified in 1.1 through one hole only. Continue injecting until a steady flow of adhesive emerges out of the opposite hole. If injection is to be accomplished through the lower skin (Figure 3-11), insert a short piece of tube specified in 1.2 in one hole and push until it bottoms against the opposite skin. This allows air to evacuate while adding potting adhesive.

2.7 Clean excess adhesive around insert. Allow adhesive to cure. Refer to Table 3-25 for adhesive curing time and temperature.

CAUTION

DO NOT SAND INTO PANEL OR INTO INSERT WHILE REMOVING EXCESS CURED ADHESIVE.

2.8 Remove plastic tab. Sand surface of insert and adjacent area with abrasive paper specified in 1.3.
3-2-12. INSTALLATION OF POTTED INSERTS

**Figure 3-14. Floating Inserts (NAS1832, NAS1835, NAS1839) — Installation**

- Align potting holes of plastic tab with potting holes of insert.
- Plastic tab.
- Press insert firmly to plastic tab.
- Potting holes.
- Remove plastic tab when adhesive is cured.
- Fill with adhesive; ensure no gap remains unfilled between insert bottom and skin.
- Inject adhesive into one hole until it flows out from the other hole.

**Installation Hole Size**

(Table 3-14)
(Table 3-17)
(Table 3-18)

**Undercut Core**

.15 to .25 TYP
APPLICATION E:  INSTALLATION OF THROUGH-PANEL TYPE POTTED INSERT, NAS1833, AND NAS1834

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 General purpose bonding adhesive (C-317).

1.2 Plastic tube using Bell Standard 130-005-2N, M23053/8-002-C, or equivalent. (if required)

1.3 Aluminum oxide abrasive paper (C-406) of 360 grit or finer.

1.4 NAS1837 installation plastic tab, refer to Table 3-15 or Table 3-16 for appropriate part number. Installation plastic tab is usually supplied with insert.

1.5 Process Sheet(s):
   Potted Inserts — General
   Preparing and Mixing Two-part Epoxy Resin by Weight

2.0 PROCEDURE

CAUTION

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.1 Determine position and mark center of insert on panel. Drill hole of appropriate size, for insert type and diameter required, through panel. Refer to Table 3-15 or Table 3-16 as applicable.

2.2 Undercut core 0.15 to 0.25 inch (3.8 to 6.4 mm) from edge of insert installation hole or as specified in the applicable repair procedure.

CAUTION

DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

2.3 Prepare insert and core cavity using instructions detailed in paragraph 3-2-11.

2.4 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material from core cavity and surface of panel.
NOTE

To prevent adhesive on NAS1837 installation plastic tab from drying, insert must be installed within 15 minutes of removing backing film from plastic tab.

2.5 Install insert as follows:

2.5.1 Remove backing film from NAS1837 installation plastic tab specified in 1.4.

2.5.2 Locate plastic tab on upper surface of insert head taking care to properly align the potting holes in the tab with the potting holes or slots of the insert. Press insert firmly against adhesive side of plastic tab.

2.5.3 Press insert firmly in place in panel. Verify that insert is properly placed by ensuring that plastic tab is firmly attached to surface of panel.

2.6 Using a small tipped syringe, inject a slow steady flow of adhesive specified in 1.1 through one hole only. Continue injecting until a steady flow of adhesive emerges out of the opposite hole. If injection is to be accomplished through the lower skin (Figure 3-11), insert a short piece of tube specified in 1.2 in one hole and push until it bottoms against the opposite skin. This allows air to evacuate while adding potting adhesive.

2.7 Clean excess adhesive around insert. Allow adhesive to cure. Refer to Table 3-25 for adhesive curing time and temperature.

**CAUTION**

DO NOT SAND INTO PANEL OR INTO INSERT WHILE REMOVING EXCESS CURED ADHESIVE.

2.8 Remove plastic tab. Sand both surfaces of insert and adjacent areas with abrasive paper specified in 1.3.
3-2-12. INSTALLATION OF POTTED INSERTS

Figure 3-15. Through-panel Inserts (NAS1833, NAS1834) — Installation

ALIGN POTTING HOLES OF PLASTIC TAB WITH POTTING HOLES OF INSERT

INSTALLATION HOLE SIZE (TABLE 3-15) (TABLE 3-16)

UNDERCUT CORE .15 TO .25 TYP

INSERT

PRESS INSERT FIRMLY TO PLASTIC TAB

PLASTIC TAB

POTTING HOLES

REMOVE PLASTIC TAB WHEN ADHESIVE IS CURED.

POTTING ADHESIVE TYP

INJECT ADHESIVE INTO ONE HOLE UNTIL IT FLOWS OUT FROM THE OTHER HOLE.
3-2-13. REMOVAL OF POTTED INSERTS

This process sheet establishes the removal procedure for a potted insert from a panel.

APPLICATION A: REMOVAL OF BLIND TYPE POTTED INSERT, BELL STANDARDS 80-004 AND 80-005, NAS1832, NAS1835, AND NAS1836

1.0 TOOLS

The following tools are required to accomplish insert removal.

1.1 Piloted hole saw or counterbore of same diameter or slightly smaller than hole in face panel. Pilot shall be the same size as, or slightly smaller diameter than, the threaded portion of insert. Refer to Table 3-9, Table 3-11, Table 3-14, Table 3-17, or Table 3-18 as applicable for insert installation hole size.

NOTE
Routing tool may be locally fabricated from a section of allen key, long end fastened to drill motor.

1.2 Routing tool for removal of potting.

2.0 REQUIRED

2.1 Process Sheet(s):
- Potted Inserts — General
- Installation of Potted Inserts

3.0 PROCEDURE

CAUTION
DO NOT DRILL OR ROUT THROUGH OPPOSITE SKIN IN PANEL.
DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

NOTE
Take care not to damage skins while drilling out body of insert.

3.1 Drill out insert body using hole saw or counterbore, as shown in Figure 3-16.

3.2 Remove remains of insert with use of a pick or by routing. Remove existing potting to expose core.

3.3 Remove all debris and loose material.
3.4 Prepare insert cavity for replacement insert in accordance with instructions detailed in paragraph 3-2-11.

3.5 Install blind insert in accordance with instructions detailed in Application A or Application D of paragraph 3-2-11.
3.2.13. REMOVAL OF POTTED INSERTS

Figure 3-16. Floating Inserts (80-004, 80-005, NAS1832, NAS1835, NAS1836) — Removal
APPLICATION B: REMOVAL OF PLUG AND SLEEVE TYPE POTTED INSERTS, BELL STANDARDS 80-011 AND 80-013, AND THROUGH-CLEARANCE HOLE TYPE INSERTS NAS1833 AND NAS1834

1.0 TOOLS

The following tools are required to accomplish insert removal.

1.1 Piloted hole saw or counterbore of same diameter or slightly smaller than hole in face panel. Pilot shall be the same size as, or slightly smaller diameter than, the threaded portion of insert. Refer to Table 3-12, Table 3-13, Table 3-15, or Table 3-16, as applicable, for applicable insert installation hole size.

NOTE
Routing tool may be locally fabricated from a section of allen key, long end fastened to drill motor.

1.2 Routing tool for removal of potting.

2.0 REQUIRED

2.1 Process Sheet(s):
Potted Inserts — General (paragraph 3-2-11)
Installation of Potted Inserts (paragraph 3-2-12)

3.0 PROCEDURE

CAUTION
DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

NOTE
Take care not to damage skins while drilling out body of insert.

3.1 Drill out insert body using hole saw or counterbore, as shown in Figure 3-17.

3.2 Remove remains of insert with use of a pick or by routing. Remove existing potting to expose core.

3.3 Remove all debris and loose material.

3.4 Prepare insert cavity for replacement insert in accordance with instructions detailed in paragraph 3-2-11.

3.5 Install plug and sleeve type potted insert or through-clearance type insert in accordance with instructions detailed in Application B or Application E of paragraph 3-2-12.
3.2.13. REMOVAL OF POTTED INSERTS

Figure 3-17. Through-panel Inserts (80-011, 80-013, NAS1833, NAS1834) — Removal
APPLICATION C: REMOVAL OF DOME HEAD TYPE POTTED INSERTS, BELL STANDARD 80-007

1.0 TOOLS

The following tools are required to accomplish insert removal.

1.1 Piloted hole saw or counterbore of same diameter or slightly smaller than hole in face panel. Pilot shall be of same size as pilot hole drilled through insert threads. Refer to Table 3-11 for applicable insert installation hole size.

NOTE
Routing tool may be locally fabricated from a section of allen key, long end fastened to drill motor.

1.2 Routing tool for removal of potting.

2.0 REQUIRED

2.1 Process Sheet(s):
Potted Inserts - General
Installation of Potted Inserts

3.0 PROCEDURE

CAUTION
DO NOT DRILL OR ROUT THROUGH OPPOSITE SKIN IN PANEL.
DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

NOTE
Take care not to damage skins while drilling out body of insert.

3.1 Using drill of same diameter as threaded portion and using threads in insert to guide the drill, drill through insert head as shown in Figure 3-18.

NOTE
Take care not to damage skins while drilling out body of insert.

3.2 From head side, using hole drilled in step 3.1 as pilot hole, drill out insert body using hole saw or counterbore.

3.3 Remove remains of insert with use of a pick or by routing. Remove existing potting to expose core.

3.4 Remove all debris and loose material.
3.5 Prepare insert cavity for replacement insert in accordance with instructions detailed in paragraph 3-2-11.

3.6 Install dome head insert in accordance with instructions detailed in Application C of paragraph 3-2-12.
3-2.13. REMOVAL OF POTTED INSERTS

Figure 3-18. Dome Head Inserts (80-007) — Removal

1. PILOT DRILL THROUGH HEAD OF INSERT FROM OPPOSITE SIDE OF PANEL
2. DRILL BODY OF INSERT
3. REMOVE REMAINING SECTION OF INSERT.
4. REMOVE POTTING TO EXPOSE CORE.

CAUTION
DO NOT ENLARGE EXISTING HOLE DIAMETERS THROUGH FACES OF PANEL

USE SAME DIAMETER AS PILOT HOLE DRILLED IN STEP 1.

HOLE "H" SIZE (TABLE 3-11)
HOLE "K" SIZE (TABLE 3-11)
REMOVAL OF POTTED INSERTS

1. Potting holes or slots omitted in -6 thread size.
2. All dimensions are in inches. Values between parentheses are in millimeters (mm).

**Table 3-9. 80-004 Potted, Standard, Self-locking Insert Installation Data**

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<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Thread Type and Size</th>
<th>Head Diameter (A)</th>
<th>Installation Hole Size (mm)</th>
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<tr>
<td>-1</td>
<td>0.1640-32UNJC</td>
<td>0.500 (12.70)</td>
<td>0.469-0.474 (11.91-12.04)</td>
</tr>
<tr>
<td>-2</td>
<td>0.1900-32UNJF</td>
<td>0.500 (12.70)</td>
<td>0.469-0.474 (11.91-12.04)</td>
</tr>
<tr>
<td>-3</td>
<td>0.2500-28UNJF</td>
<td>0.562 (14.27)</td>
<td>0.531-0.534 (13.49-13.56)</td>
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<tr>
<td>-4</td>
<td>0.3125-24UNJF</td>
<td>0.687 (17.45)</td>
<td>0.656-0.659 (16.66-16.74)</td>
</tr>
<tr>
<td>-5</td>
<td>0.3750-24UNJF</td>
<td>0.812 (20.62)</td>
<td>0.781-0.784 (19.84-19.91)</td>
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<tr>
<td>-6(1)</td>
<td>0.1120-40UNJC</td>
<td>0.375 (9.53)</td>
<td>0.344-0.349 (8.74-8.86)</td>
</tr>
<tr>
<td>-7</td>
<td>0.1380-32UNJH</td>
<td>0.437 (11.10)</td>
<td>0.406-0.411 (10.31-10.44)</td>
</tr>
</tbody>
</table>

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<th>2nd DASH No. (insert length)</th>
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<td>-5</td>
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<td>-6</td>
<td>0.335 (8.51)</td>
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<td>-7</td>
<td>0.395 (10.03)</td>
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<td>-10</td>
<td>0.565 (14.35)</td>
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<td>-12</td>
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<tr>
<td>-22</td>
<td>1.305 (33.15)</td>
</tr>
<tr>
<td>-24</td>
<td>1.430 (36.32)</td>
</tr>
</tbody>
</table>

**Panel Skin Thickness**

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

---

1) Potting holes or slots omitted in -6 thread size.
2) All dimensions are in inches. Values between parentheses are in millimeters (mm).
REMoval Of Potted Inserts

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).

Table 3-10. 80-005 Potted, Floating, Self-locking Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Thread Type and Size</th>
<th>Head Diameter(^{(1)}) (A)</th>
<th>Installation Hole Size(^{(1)})</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0.1640-32UNJC</td>
<td>0.593 (15.06)</td>
<td>0.562-0.565 (14.27-14.35)</td>
</tr>
<tr>
<td>-2</td>
<td>0.1900-32UNJF</td>
<td>0.593 (15.06)</td>
<td>0.562-0.565 (14.27-14.35)</td>
</tr>
<tr>
<td>-3</td>
<td>0.2500-28UNJF</td>
<td>0.718 (18.24)</td>
<td>0.687-0.690 (17.45-17.53)</td>
</tr>
<tr>
<td>-4</td>
<td>0.3125-24UNJF</td>
<td>0.843 (21.41)</td>
<td>0.812-0.815 (20.62-20.70)</td>
</tr>
<tr>
<td>-5</td>
<td>0.3750-24UNJF</td>
<td>0.968 (24.59)</td>
<td>0.937-0.940 (23.80-23.88)</td>
</tr>
<tr>
<td>-6</td>
<td>0.1120-40UNJC</td>
<td>0.593 (15.06)</td>
<td>0.562-0.565 (14.27-14.35)</td>
</tr>
<tr>
<td>-7</td>
<td>0.1380-32UNJC</td>
<td>0.593 (15.06)</td>
<td>0.562-0.565 (14.27-14.35)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2nd DASH No. (insert length)</th>
<th>Length(^{(1)}) (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6</td>
<td>0.340 (8.64)</td>
</tr>
<tr>
<td>-8</td>
<td>0.455 (11.66)</td>
</tr>
<tr>
<td>-10</td>
<td>0.565 (14.35)</td>
</tr>
<tr>
<td>-12</td>
<td>0.690 (17.53)</td>
</tr>
<tr>
<td>-14</td>
<td>0.815 (20.70)</td>
</tr>
<tr>
<td>-16</td>
<td>0.935 (23.75)</td>
</tr>
<tr>
<td>-18</td>
<td>1.060 (26.92)</td>
</tr>
<tr>
<td>-20</td>
<td>1.185 (30.10)</td>
</tr>
</tbody>
</table>

Panel Skin Thickness\(^{(1)}\)

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

NOTE

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
Table 3-11. 80-007 Domed Head Insert Installation Data

<table>
<thead>
<tr>
<th>2nd DASH No. (thread size)</th>
<th>Thread Type and Size</th>
<th>Head Diameter(1)</th>
<th>Installation Hole Sizes¹</th>
<th>1st DASH No. (insert length)</th>
<th>Length¹ (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0.1380-32UNJC</td>
<td>0.625 (15.88)</td>
<td>0.323-0.329 (8.20-8.36)</td>
<td>-06</td>
<td>0.375 (9.53)</td>
</tr>
<tr>
<td>-2</td>
<td>0.1640-32UNJC</td>
<td>0.625 (15.88)</td>
<td>0.323-0.329 (8.20-8.36)</td>
<td>-07</td>
<td>0.437 (11.10)</td>
</tr>
<tr>
<td>-3</td>
<td>0.1900-32UNJF</td>
<td>0.687 (17.45)</td>
<td>0.386-0.392 (9.80-9.96)</td>
<td>-08</td>
<td>0.500 (12.70)</td>
</tr>
<tr>
<td>-4</td>
<td>0.2500-28UNJF</td>
<td>0.687 (17.45)</td>
<td>0.386-0.392 (9.80-9.96)</td>
<td>-09</td>
<td>0.562 (14.27)</td>
</tr>
<tr>
<td>-4A</td>
<td>0.2500-28UNJF</td>
<td>0.750 (19.05)</td>
<td>0.453-0.459 (11.51-11.66)</td>
<td>-10</td>
<td>0.625 (15.88)</td>
</tr>
<tr>
<td>-5</td>
<td>0.3125-24UNJF</td>
<td>0.750 (19.05)</td>
<td>0.453-0.459 (11.51-11.66)</td>
<td>-11</td>
<td>0.687 (17.45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-12</td>
<td>0.750 (19.05)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-13</td>
<td>0.812 (20.62)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-14</td>
<td>0.875 (22.23)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-15</td>
<td>0.937 (23.80)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-16</td>
<td>1.000 (25.40)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-17</td>
<td>1.062 (26.97)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-18</td>
<td>1.125 (28.58)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-19</td>
<td>1.187 (30.15)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-20</td>
<td>1.250 (31.75)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-24</td>
<td>1.500 (38.10)</td>
</tr>
</tbody>
</table>

NOTE

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
### Table 3-12. 80-011 Non-threaded Grommet Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH Number</th>
<th>Bolt/Rivet Size</th>
<th>Through Opening Diameter² (A)</th>
<th>Head Diameter² (C)</th>
<th>Installation Hole Size²</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>Bolt .112 (2.84)</td>
<td>0.113-0.119 (2.87-3.02)</td>
<td>0.375 (9.53)</td>
<td>0.228 (5.79)</td>
</tr>
<tr>
<td>-5</td>
<td>Rivet .125 (3.18)</td>
<td>0.130-0.139 (3.30-3.53)</td>
<td>0.500 (12.70)</td>
<td>0.290 (7.37)</td>
</tr>
<tr>
<td>-6</td>
<td>Bolt .138 (3.50)</td>
<td>0.139-0.147 (3.53-3.73)</td>
<td>0.500 (12.70)</td>
<td>0.290 (7.37)</td>
</tr>
<tr>
<td>-7</td>
<td>Rivet .156 (3.96)</td>
<td>0.165-0.172 (4.19-4.37)</td>
<td>0.500 (12.70)</td>
<td>0.290 (7.37)</td>
</tr>
<tr>
<td>-8</td>
<td>Bolt .164 (4.16)</td>
<td>0.165-0.172 (4.19-4.37)</td>
<td>0.500 (12.70)</td>
<td>0.290 (7.37)</td>
</tr>
<tr>
<td>-9</td>
<td>Rivet .187 (4.75)</td>
<td>0.191-0.197 (4.85-5.00)</td>
<td>0.625 (15.88)</td>
<td>0.323 (8.20)</td>
</tr>
<tr>
<td>-10</td>
<td>Bolt .190 (4.82)</td>
<td>0.191-0.197 (4.85-5.00)</td>
<td>0.625 (15.88)</td>
<td>0.323 (8.20)</td>
</tr>
<tr>
<td>-11</td>
<td>Rivet .250 (6.35)</td>
<td>0.253-0.260 (6.43-6.60)</td>
<td>0.750 (19.05)</td>
<td>0.390 (9.91)</td>
</tr>
<tr>
<td>-12</td>
<td>Bolt .250 (6.35)</td>
<td>0.253-0.260 (6.43-6.60)</td>
<td>0.750 (19.05)</td>
<td>0.390 (9.91)</td>
</tr>
<tr>
<td>-13</td>
<td>Rivet .281 (7.14)</td>
<td>0.286-0.293 (7.26-7.44)</td>
<td>0.812 (20.62)</td>
<td>0.421 (10.69)</td>
</tr>
<tr>
<td>-14</td>
<td>Bolt .312 (7.92)</td>
<td>0.315-0.321 (8.00-8.15)</td>
<td>0.875 (22.23)</td>
<td>0.484 (12.29)</td>
</tr>
<tr>
<td>-15</td>
<td>Rivet .312 (7.92)</td>
<td>0.315-0.321 (8.00-8.15)</td>
<td>0.875 (22.23)</td>
<td>0.484 (12.29)</td>
</tr>
<tr>
<td>-16</td>
<td>Bolt .375 (9.52)</td>
<td>0.378-0.384 (9.60-9.75)</td>
<td>1.000 (25.40)</td>
<td>0.640 (16.26)</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1. Available for plug configuration only.
2. All dimensions are in inches. Values between parentheses are in millimeters (mm).
### Table 3-13. 80-013 Threaded Plug and Sleeve Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No.</th>
<th>Thread Type and Size</th>
<th>Diameter(^{(1)}) (A)</th>
<th>Head Diameter(^{(1)}) (C)</th>
<th>Installation Hole Size(^{(1)}) (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0.1380-32UNJC</td>
<td>0.139-0.147 (3.53-3.73)</td>
<td>0.500 (12.70)</td>
<td>0.323 (8.20)</td>
</tr>
<tr>
<td>-2</td>
<td>0.1640-32UNJC</td>
<td>0.165-0.172 (4.19-4.37)</td>
<td>0.500 (12.70)</td>
<td>0.323 (8.20)</td>
</tr>
<tr>
<td>-3</td>
<td>0.1900-32UNJF</td>
<td>0.191-0.197 (4.85-5.00)</td>
<td>0.625 (15.88)</td>
<td>0.358 (9.09)</td>
</tr>
<tr>
<td>-4</td>
<td>0.2500-28UNJF</td>
<td>0.253-0.260 (6.43-6.60)</td>
<td>0.750 (19.05)</td>
<td>0.421 (10.69)</td>
</tr>
<tr>
<td>-5</td>
<td>0.3125-24UNJF</td>
<td>0.315-0.321 (8.00-8.15)</td>
<td>0.875 (22.23)</td>
<td>0.515 (13.08)</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
Table 3-14. NAS1832 Potted Molded-in, Blind, Threaded Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Thread Type and Size</th>
<th>Head Diameter(^{(1)}) ((A))</th>
<th>Installation Hole Size(^{(1)})</th>
<th>NAS1837 Plastic Tab</th>
<th>2nd DASH No. (insert length)</th>
<th>Length(^{(1)}) ((L))</th>
</tr>
</thead>
<tbody>
<tr>
<td>-06</td>
<td>0.1380-32UNJC</td>
<td>0.560 (14.22)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
<td>-2</td>
<td>0.250 (6.35)</td>
</tr>
<tr>
<td>-08</td>
<td>0.1640-32UNJC</td>
<td>0.560 (14.22)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
<td>-3</td>
<td>0.375 (9.53)</td>
</tr>
<tr>
<td>-3</td>
<td>0.1900-32UNJF</td>
<td>0.560 (14.22)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
<td>-4</td>
<td>0.500 (12.70)</td>
</tr>
<tr>
<td>-4</td>
<td>0.2500-28UNJF</td>
<td>0.685 (17.40)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T6</td>
<td>-5</td>
<td>0.625 (15.88)</td>
</tr>
<tr>
<td>-5</td>
<td>0.3125-24UNJF</td>
<td>0.685 (17.40)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T6</td>
<td>-6</td>
<td>0.750 (19.05)</td>
</tr>
<tr>
<td>-6</td>
<td>0.3750-24UNJF</td>
<td>0.841 (21.36)</td>
<td>0.842-0.847 (21.39-21.51)</td>
<td>NAS1837T9</td>
<td>-7</td>
<td>0.875 (22.23)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-8</td>
<td>1.000 (25.40)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-9</td>
<td>1.125 (28.58)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-10</td>
<td>1.250 (31.75)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-11</td>
<td>1.375 (34.93)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-12</td>
<td>1.500 (38.10)</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
### Table 3-15. NAS1833 Potted Molded-in, Through-clearance, Threaded Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Thread Type and Size</th>
<th>Head Diameter$^{(1)}$(A)</th>
<th>Installation Hole Size$^{(1)}$</th>
<th>NAS1837 Plastic Tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>-06</td>
<td>0.1380-32UNJC</td>
<td>0.560 (14.22)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
</tr>
<tr>
<td>-08</td>
<td>0.1640-32UNJC</td>
<td>0.560 (14.22)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
</tr>
<tr>
<td>-3</td>
<td>0.1900-32UNJF</td>
<td>0.560 (14.22)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
</tr>
<tr>
<td>-4</td>
<td>0.2500-28UNJF</td>
<td>0.685 (17.40)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T6</td>
</tr>
<tr>
<td>-5</td>
<td>0.3125-24UNJF</td>
<td>0.685 (17.40)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T6</td>
</tr>
<tr>
<td>-6</td>
<td>0.3750-24UNJF</td>
<td>0.841 (21.36)</td>
<td>0.842-0.847 (21.39-21.51)</td>
<td>NAS1837T9</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).

---

1) For CRES only
Table 3-16. NAS1834 Potted Molded-in, Through-clearance Hole Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Head Diameter(1) (A)</th>
<th>Clearance Hole Diameter(1) (B)</th>
<th>Installation Hole Size(1) (H)</th>
<th>NAS1837 Plastic Tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>-06</td>
<td>0.560 (14.22)</td>
<td>0.139-0.145 (3.53-3.68)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
</tr>
<tr>
<td>-08</td>
<td>0.560 (14.22)</td>
<td>0.168-0.174 (4.27-4.42)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
</tr>
<tr>
<td>-3</td>
<td>0.560 (14.22)</td>
<td>0.195-0.201 (4.95-5.11)</td>
<td>0.561-0.566 (14.25-14.38)</td>
<td>NAS1837T3</td>
</tr>
<tr>
<td>-4</td>
<td>0.685 (17.40)</td>
<td>0.256-0.263 (6.50-6.68)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T6</td>
</tr>
<tr>
<td>-5</td>
<td>0.685 (17.40)</td>
<td>0.315-0.322 (8.00-8.18)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T6</td>
</tr>
<tr>
<td>-6</td>
<td>0.841 (21.36)</td>
<td>0.376-0.383 (9.55-9.73)</td>
<td>0.842-0.847 (21.39-21.51)</td>
<td>NAS1837T9</td>
</tr>
</tbody>
</table>

NOTE

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
### Table 3-17. NAS1835 Potted Molded-in, Blind, Threaded, Floating Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Insert Length (in)</th>
<th>Thread Type and Size</th>
<th>Head Diameter (A) (in)</th>
<th>Installation Hole Size (in)</th>
<th>NAS1837 Plastic Tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>-08</td>
<td>0.37 (9.4)</td>
<td>0.1640-32UNJC</td>
<td>0.685 (17.40)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T7</td>
</tr>
<tr>
<td>-3</td>
<td>0.43 (10.9)</td>
<td>0.1900-32UNJF</td>
<td>0.685 (17.40)</td>
<td>0.686-0.691 (17.42-17.55)</td>
<td>NAS1837T7</td>
</tr>
<tr>
<td>-4</td>
<td>0.56 (14.2)</td>
<td>0.2500-28UNJF</td>
<td>0.748 (19.00)</td>
<td>0.749-0.755 (19.02-19.18)</td>
<td>NAS1837T9</td>
</tr>
<tr>
<td>-5</td>
<td>0.75 (19.1)</td>
<td>0.3125-24UNJF</td>
<td>0.810 (20.57)</td>
<td>0.811-0.817 (20.60-20.75)</td>
<td>NAS1837T10</td>
</tr>
<tr>
<td>-6</td>
<td>0.81 (20.6)</td>
<td>0.3750-24UNJF</td>
<td>0.873 (22.17)</td>
<td>0.874-0.880 (22.20-22.35)</td>
<td>NAS1837T11</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).

---

**Information Only**

Insert Basic Code: NAS1835

Basic Number

- = Carbon Steel
A = Aluminum
C = CRES

Thread Size

- = Passivated
M = Solid Film Lubricant
N = Non Self-locking
P = Cadmium Plated
S = Silver Plated

---

.092–.097 DIA POTTING HOLES OR SLOTS 180° APART

A

THREAD

BASE

LENGTH

THREAD LOCK
### Table 3-18. NAS1836 Potted Molded-in, Blind, Threaded Insert Installation Data

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>Thread Type and Size</th>
<th>Head Diameter(^{(1)}) (A)</th>
<th>Installation Hole Size(^{(1)})</th>
<th>2nd DASH No. (insert length)</th>
<th>Length(^{(1)}) (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-06</td>
<td>0.1380-32UNJC</td>
<td>0.451 (11.46)</td>
<td>0.452-0.457 (11.48-11.61)</td>
<td>-08</td>
<td>0.188 (4.78)</td>
</tr>
<tr>
<td>-08</td>
<td>0.1640-32UNJC</td>
<td>0.451 (11.46)</td>
<td>0.452-0.457 (11.48-11.61)</td>
<td>-07</td>
<td>0.219 (5.56)</td>
</tr>
<tr>
<td>-3</td>
<td>0.1900-32UNJF</td>
<td>0.451 (11.46)</td>
<td>0.452-0.457 (11.48-11.61)</td>
<td>-08</td>
<td>0.250 (6.35)</td>
</tr>
<tr>
<td>-4</td>
<td>0.2500-28UNJF</td>
<td>0.498 (12.65)</td>
<td>0.499-0.504 (12.67-12.80)</td>
<td>-09</td>
<td>0.281 (7.14)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1st DASH No. (thread size)</th>
<th>NAS1837 Plastic Tab</th>
<th></th>
<th></th>
<th>2nd DASH No. (insert length)</th>
<th>Length(^{(1)}) (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-06</td>
<td>NAS1837T2</td>
<td></td>
<td></td>
<td>-10</td>
<td>0.313 (7.95)</td>
</tr>
<tr>
<td>-08</td>
<td>NAS1837T2</td>
<td></td>
<td></td>
<td>-12</td>
<td>0.375 (9.53)</td>
</tr>
<tr>
<td>-3</td>
<td>NAS1837T2</td>
<td></td>
<td></td>
<td>-13</td>
<td>0.406 (10.31)</td>
</tr>
<tr>
<td>-4</td>
<td>NAS1837T4</td>
<td></td>
<td></td>
<td>-14</td>
<td>0.438 (11.13)</td>
</tr>
</tbody>
</table>

**NOTE**

This data is not intended for design or customizing purposes, unless approved by BHT. Refer to the applicable repair procedure or original data for correct replacement insert.

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
This process sheet establishes the application of a chemical film on the bare aluminum or titanium surfaces of a panel or a part using a brush application technique.

The chemical film treatment of aluminum or titanium is a chromate conversion coating that increases the resistance to corrosion and provides a base for organic finishes on all aluminum or titanium alloys. The resulting chemical film coating offers no significant resistance to abrasion.

1.0 RESTRICTION

1.1 Usage of this process sheet is limited to brush treatment of aluminum parts and of titanium parts that will subsequently be primed. No treatment is required for titanium parts that will not be primed.

1.2 Do not apply chemical film to uncovered honeycomb core cells or wherever chemical film material may remain trapped.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Cheesecloth (C-486).

2.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Nylon web abrasive pad (C-407).

2.4 Aluminum wool (C-422).

2.5 Cleaning compound (C-318).

2.6 Chemical film material (C-100).

2.7 Nitric acid (C-432).

2.8 Epoxy polyamide primer (C-204).

2.9 Masking tape (C-426).

2.10 Kraft paper (C-254).

2.11 Deionized or distilled water.

2.12 Process Sheet(s):
Preparation of Bonding Surfaces
3.0 PROCEDURE

CAUTION

ENSURE ALL OPENINGS OF HONEYCOMB CORE BONDED PANELS ARE COVERED WITH TAPE TO PREVENT CONTAMINATION OF HONEYCOMB CORE.

3.1 Protect surrounding area to receive treatment by masking. Use masking tape specified in 2.9 and clean Kraft paper specified in 2.10.

3.2 Clean area to be treated as follows:

3.2.1 Remove oil and grease using a clean cloth specified in 2.1 moistened with cleaner specified in 2.2.

3.2.2 Scrub area to be treated to clean bare metal using a nylon web abrasive pad (preferred) specified in 2.2 or fine aluminum wool specified in 2.4, and cleaning compound specified in 2.5 mixed to 10 to 15% by volume in clean water.

3.2.3 Rinse surface thoroughly using deionized or distilled water.

3.2.4 Inspect for a water break free surface using instructions detailed in step 2.5 of paragraph 3-2-5. Repeat step 3.2.2 and step 3.2.3 as required to obtain a clean surface.

3.3 Allow surface to air dry or force dry using clean, dry, filtered, compressed air and clean and dry cheesecloth specified in 2.1.

3.4 Mix chemical film solution specified in 2.6 as follows:

3.4.1 To 1 U.S. gallon (3.79 L) of distilled, deionized, or demineralized water, add 3.0 ounces (0.85 g) by weight of chemical film material specified in 2.6 and 0.5 fluid ounce (14.8 ml) of nitric acid specified in 2.7 or following chemical film material manufacturer instructions.

NOTE

The treatment should provide a golden iridescent to brown color of continuous and uniform appearance free of powdery or loose film areas to surface of aluminum parts. Streaks and areas with different shades and appearance caused by surface condition of aluminum are acceptable provided that there is chemical film coverage in these areas. No color change can be observed to surface of titanium parts.

3.5 Brush apply chemical film solution (prepared in step 3.4) liberally to area to be treated. Keep area wet with solution for a period of 30 seconds to 1 minute then rinse thoroughly with clean water and allow to dry.

3.6 If required, apply one coat of primer specified in 2.8 to treated surfaces.
3-2-15. INSTALLATION OF RIVETS THROUGH THIN HONEYCOMB PANELS

This process sheet establishes the installation of riveted doublers on thin panels (0.38 inch (9.7 mm) thick core or less) where installation of a blind fastener would damage the opposite skin. This process sheet is also applicable for installation of rivets through panels up to 0.50 inch (12.7 mm) when aligned rivets cannot be installed per instructions detailed in paragraph 3-2-16.

1.0 RESTRICTION

1.1 Usage of this process sheet requires authorization from Product Support Engineering unless specifically authorized by the applicable repair.

1.2 Applicable only to blind rivets.

NOTE
Cleanliness is to be carefully controlled through all phases of the preparation and bonding operations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Fasteners: rivets required by the applicable repair; washers (Table 3-19).

2.2 General purpose bonding adhesive (C-317).

2.3 Aluminum oxide abrasive paper (C-406) of 400 grit or finer.

2.4 Process Sheet(s):
Preparation of Bonding Surfaces (paragraph 3-2-5)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to both sides of panel to be repaired.

3.2 Determine location of fastener holes from doubler(s) and/or part(s) to be installed on panel.

NOTE
Do not drill through opposite skin in panel at this time.

3.3 Drill hole through one face of panel only and core. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Under cut core in panel 0.125 to 0.175 inch (3.18 to 4.45 mm).

3.5 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

NOTE
Carefully air blow honeycomb cavities to remove dirt particles.

3.6 Clean cavity of debris and loose material in preparation for bonding.

3.7 Fill cavity with adhesive specified in 2.2 and allow to cure at room temperature for 24 hours.

3.8 Fair adhesive to contour of panel using abrasive paper specified in 2.3.

3.9 Locate doubler to be installed on panel face and drill hole of appropriate size through adhesive and opposite skin in panel. Refer to Table 3-28 for appropriate rivet hole size.

3.10 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.11 Prepare panel surface for bonding using instructions detailed in paragraph 3-2-5.

NOTE
Installation of washer under shop head of rivet is not required when metal doublers are installed on both faces of panel.

3.12 Bond and rivet doubler or part to be installed in position. Install rivets wet with adhesive or sealant specified in applicable repair, and with washer under rivet shop head while doubler adhesive or sealant is still wet.

Table 3-19. Washer P/N Versus Blind Rivet Diameter

<table>
<thead>
<tr>
<th>Blind Rivet Type</th>
<th>Rivet Diameter</th>
<th>Washer Bell Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal</td>
<td>1/8 = 0.125 inch (3.18 mm)</td>
<td>140-001-1</td>
</tr>
<tr>
<td></td>
<td>5/32 = 0.156 inch (3.96 mm)</td>
<td>140-001-3</td>
</tr>
<tr>
<td></td>
<td>3/16 = 0.187 inch (4.75 mm)</td>
<td>140-001-5</td>
</tr>
<tr>
<td>Oversized</td>
<td>9/64 = 0.141 inch (3.58 mm)</td>
<td>140-029-4</td>
</tr>
<tr>
<td></td>
<td>11/64 = 0.172 inch (4.37 mm)</td>
<td>140-029-5</td>
</tr>
<tr>
<td></td>
<td>13/64 = 0.203 inch (5.16 mm)</td>
<td>140-029-6</td>
</tr>
</tbody>
</table>
CAUTION
DO NOT DAMAGE
OPPOSITE SKIN WHEN
DRILLING FOR RIVET

Rivet
hole size
(TABLE 3-19)

Undercut core
.125 minimum

1. Drill thru one
surface for rivet

2. Undercut core

3. Fill cavity with
adhesive. Allow to
cure & sand flush

4. Drill thru panel
for rivet

5. Install rivet
and washer.

3-2-15. INSTALLATION OF RIVETS THROUGH THIN HONEYCOMB PANELS
3.2-16. INSTALLATION OF ALIGNED RIVETS IN HONEYCOMB PANELS

This process sheet establishes the installation of riveted doublers on both surfaces of a honeycomb core panel or of a single doubler being installed in an area where a repair doubler already exists on the other side of the panel. By aligning the rivet patterns on both sides, the number of locations where the core is affected when installing rivets will be reduced.

1.0 RESTRICTIONS

1.1 Honeycomb core shall have a minimum thickness of 0.50 inch (12.7 mm). For honeycomb core panels of 0.50 inch (12.7 mm) or less, refer to paragraph 3-2-15 (Installation of Rivets Through Thin Honeycomb Panels).

1.2 If the minimum core thickness requirements given in Table 3-20 are not met, an installation interference condition may occur. To prevent this condition, rivets are to be installed through the panel (for core thickness up to 0.50 inch (12.7 mm)) using instructions given in paragraph 3-2-15 or using a staggered pattern to avoid rivet installation interference.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Fasteners: blind rivets required for the applicable repair, grip length to suit.

2.2 General purpose bonding adhesive (C-317).

2.3 Sealant (C-251).

2.4 Process Sheet(s):
   Preparation of Bonding Surfaces
   Preparing and Mixing Two-part Epoxy Resin by Weight

3.0 PROCEDURE

3.1 Gain access to both sides of panel to be repaired.

3.2 If required, drill out rivets of existing repair doubler or existing structure. Record type, size, and location of existing rivets.

3.3 Determine location of fastener holes from doubler(s) and/or part(s) to be installed on panel.

   CAUTION

   DO NOT OVERHEAT SKIN SURFACE(S) DURING DRILLING OPERATION. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN(S) FROM THE CORE.

   NOTE

   Drilled rivet holes to be aligned through panel.

3.4 Drill all rivet holes through repair doubler(s) and part(s). Refer to Table 3-28 for appropriate rivet hole size.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

NOTE
Carefully air blow honeycomb cavities to remove dirt particles.

3.5 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 Clean cavity of debris and loose material in preparation for bonding.

3.7 Prepare panel surface for bonding using instructions detailed in paragraph 3-2-5.

3.8 Locate all parts to be installed in position and bond to parent structure using instructions detailed in paragraph 3-2-7.

NOTE
When filling core cavity at aligned rivet locations with adhesive, always install rivets on lower (under) side first to prevent adhesive from flowing out of rivet holes.

Install all rivets wet with general purpose bonding adhesive while doubler and adhesive filling is still wet.

3.9 Secure part(s) on one side of the panel using rivets required by the applicable repair, grip length to suit. Fill rivet holes cavity in core using general purpose bonding adhesive specified in 2.2 unless specified by applicable repair. Secure part(s) on other side of panel using rivets required by the applicable repair, grip length to suit.

Table 3-20. Minimum Core Thickness Versus Rivet Grip Length

<table>
<thead>
<tr>
<th>Rivet Diameter (D)</th>
<th>Nominal Size Rivet</th>
<th>Oversize Rivet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rivet Grip Length (L)</td>
<td>Minimum Core Thickness</td>
</tr>
<tr>
<td>-4</td>
<td>-01</td>
<td>0.500 (12.70)</td>
</tr>
<tr>
<td></td>
<td>-01 and longer</td>
<td>0.625 (15.88)</td>
</tr>
<tr>
<td>-5</td>
<td>-01 and longer</td>
<td>0.625 (15.88)</td>
</tr>
<tr>
<td>-6</td>
<td>-01 and longer</td>
<td>0.625 (15.88)</td>
</tr>
<tr>
<td></td>
<td>-01 and longer</td>
<td>0.750 (19.05)</td>
</tr>
</tbody>
</table>

Shaded cells indicate that the rivet needs to be pulled as it is inserted.
3.2-16. INSTALLATION OF ALIGNED RIVETS IN HONEYCOMB PANELS

ADDED RIVETS ON SURFACE NEAR SIDE TO BE ALIGNED WITH ADDED RIVETS ON FAR SIDE.

EOP CORE PLUG, REF

CORE CUTLINE, REF

SKIN CUTLINE, REF

ADDED RIVETS ON SURFACE NEAR SIDE ONLY.

EOP REPAIR DOUBLER FAR SIDE REF

EOP REPAIR DOUBLER NEAR SIDE REF

REPAIR DOUBLER, REF

ADDED RIVETS ON BOTH SURFACES ARE TO BE ALIGNED

.50 MIN

FILL CORE WITH ADHESIVE TYPE

REPAIR DOUBLER, REF

Figure 3-20. Aligned Rivets — Installation
3-2-17. PREPARATION OF CONICAL WASHERS

This process sheet establishes the manufacturing of conical washers from regular flush head rivets. These special washers are used to fill the gaps created by the installation of a non-dimpled part over a part that already contains countersinks and/or dimples.

1.0 RESTRICTIONS (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Usage of this process sheet requires authorization from Product Support Engineering unless specifically authorized by the applicable repair.

1.2 No gap can remain unfilled. If this process sheet cannot be used, top sheet or part must be dimpled per instructions detailed in paragraph 3-2-18. Existing countersink or dimple for 3/32 inch (2.4 mm) diameter rivet can be filled with general purpose bonding adhesive (C-317).

2.0 REQUIRED

2.1 Fasteners: solid flush rivet of the same diameter and material as the flush rivet being removed, grip length to suit.

2.2 A strip made from aluminum alloy sheet of a thickness sufficient to receive countersink required for rivet head and prevent distortion of strip while installing rivet.

2.3 Flush rivet of appropriate diameter and of same material as used in surrounding area, unless otherwise specified in applicable repair.

2.4 Process Sheet(s):
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

NOTE
When more than one conical washer of the same size are required, it is possible to reuse the same hole in the strip. The hole must be inspected before reusing it to ensure that it is undamaged (i.e., round and of the appropriate size).

3.1 Drill rivet hole through strip specified in 2.2. Refer to Table 3-28 for appropriate rivet hole size.

3.2 Countersink the hole.

3.3 Remove debris and loose material.

3.4 Install the flush rivet.

NOTE
Ensure rivet is drilled through its center. Use of a center punch may be required to locate center of rivet.

3.5 Drill out shank of rivet far enough so rivet head detaches from strip and starts spinning with drill. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Protect fingers and remove rivet head from drill.
NOTE
Take care not to damage conical washer while removing sharp edges.

3.7 Break all sharp edges in rivet head.

3.8 Repeat step 3.1 through step 3.7 as many times as required to manufacture appropriate quantity of conical washers.

3.9 Locate all conical washers to be installed in position and bond to parent structure using specified adhesive prepared using instructions detailed in paragraph 3-2-25.
Figure 3-21. Conical Washers — Preparation

1. Drill rivet hole thru plate.
2. Counter-sink plate.
3. Install rivet in countersink.
4. Drive rivet.
5. Drill out shank of rivet.
6. Remove conical washer.
7. Retain head of rivet and use as conical washer.
3-2-18. DIMPLING PROCESS FOR FLUSH RIVETS

NOTE

Dimpled holes shall never be used as a replacement for non-dimpled holes except if allowed by a repair procedure in this manual, the model-specific Structural Repair Manual or as approved by Product Support Engineering.

This process sheet establishes requirements for dimpling of aluminum, magnesium, stainless steel, and titanium. Dimpling is a process for forming a controlled contour depression in sheet metal to receive the conical head of a flush type fastener to obtain a flush installation. The dimple is formed by pressure applied to male and female dies with the sheet in between. Coin dimpling utilizes an additional pressurized internal coining ram (Figure 3-22) to produce a well-defined contour on the dimple and restrain expansion of the pilot hole, thereby minimizing cracking tendencies.

1.0 RESTRICTIONS (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Dimpling can be applied to all aluminum alloy sheet materials and magnesium alloy sheet materials in single thickness up to 0.081 inch (2.06 mm) thick regardless of heat treat (temper) condition. The 300 series stainless steel sheet materials up through 1/2 hard condition and all commercially pure titanium can be dimpled up to 0.050 inch (1.27 mm) thick.

1.2 Dimpling requirements depend on the sheet thickness of the part to be dimpled (top sheet) and the sheet thickness of the part underneath (bottom sheet). Refer to Table 3-21 for dimpling and countersink requirements.

1.3 Dimpling may be applied to sheet metal products only. Extruded, cast, forged, or composite products shall not be dimpled.

1.4 Parts to be dimpled shall be clean and free from oil films, grease, chips, and other foreign matter.

1.5 Surface Coating Limitations:

1.5.1 Aluminum alloys may be dimpled when bare, chemical film treated or chromic acid anodized surfaces exist. Dimpling of primed surfaces is also allowed.

1.5.2 Magnesium alloys shall be dimpled with chromate surface treatment (Dow 7, C-212) only. Dimpling of primed surfaces is not allowed.

1.5.3 Titanium alloys shall be dimpled bare. Dimpling of primed surfaces is not allowed.

1.5.4 Hot dimpling shall not be performed on any material having the following surface coatings: temporary strippable protective coatings, enamels, lacquers, epoxy paint, aluminized paint, cadmium or zinc plating.

1.6 Bonded laminated sheets of aluminum alloys, stainless steel alloys, or aluminum alloys or stainless steel alloys bonded to plastic laminates can be dimpled in accordance with this procedure. Dimpling equipment settings shall be those for a single sheet of the applicable metallic material having a thickness of the total stack up of the bonded laminate.

1.7 Redimpling is permitted only to deepen or obtain better definition on a dimple. Redimpling to obtain a larger diameter dimple or to reverse a dimple is not permitted.

1.8 Simultaneous dimpling (dimpling of more than one sheet at one time) is not allowed.
2.0 REQUIRED

2.1 Test strip made of same material and thickness as the parts being coin dimpled.

2.2 Workaid ( pry punch) fabricated locally as per Figure 3-25.

NOTE

The following equipment is recommended. Other brand name equipment may be used provided complete set-up and operation instructions are available.

Pressure, gauges, dwell times, and temperature indicators of dimpling machine shall be calibrated periodically in accordance with ISO 10012-1 or ANSI/NCSL Z540-1.

2.3 Dimpling Machine: Thermo Dimple Control Panel No. ZT2409-G (or equivalent) with portable dimpler No. ZT2427 or ZT2429 (Product of Zephyr Manufacturing Co.).

2.4 Heaters: refer to manufacturer equipment catalogue for heater.

2.5 Punches and dies: refer to manufacturer equipment catalogue for punches and dies.

2.6 A dimpling control log shall be maintained for each dimpling machine. This log shall record the part number and quantity of parts dimpled, the material condition, and the thickness, the date dimpled, the machine operator’s name, and the inspector’s symbol and disposition of the parts (accepted or rejected).

2.7 The approved machine setting required to be used for each applicable material, material condition, thickness and fastener shall be posted at each dimpling machine.

3.0 PROCEDURE

CAUTION

IN DRILLING TITANIUM, IT IS IMPORTANT TO MAINTAIN CORRECT DRILL SPEED AND TO KEEP THE DRILL CUTTING ONCE IT HAS STARTED.

3.1 Drill a pilot hole. The size of pilot holes may vary provided the hole after dimpling meets all the requirements for the specific fastener. Refer to manufacturer’s equipment operation instructions for pilot hole sizes.
NOTE

Coin dimpling on stationary or portable equipment shall be the only acceptable method for forming dimples. When the hole location does not allow sufficient clearance for the coin dimpling dies, the particular dimple may be formed using modified radius dies in stationary or portable equipment. The application of hot or cold dimpling processes shall be as specified in Table 3-22 for the applicable material being dimpled.

3.2 Prepare machine settings as follows:

3.2.1 For dimpling machine set-up instructions, refer to the manufacturer’s operational handbooks applicable to the type of hot dimpling machine being operated and the dimpled material.

3.2.2 Where hot dimpling is specified in Table 3-22, the die and punch temperatures, machine dwell time and dwell pressure shall be as specified in the dimpling equipment manufacturer’s published equipment operation instructions for the material to be dimpled.

3.2.3 Where cold dimpling is specified in Table 3-22, the machine setting shall be in accordance with step 3.2.2 except that the dwell time shall be set at zero and the punch and die shall be cold.

3.2.4 Where optional temperature is specified in Table 3-22, the machine setting can be in accordance with step 3.2.2 or step 3.2.3.

3.3 Dimple hole following instructions given in dimpling machine manufacturer’s operational handbooks. For cold and hot dimpling processes, a test panel or panels shall be dimpled, inspected, and tested whenever the machine settings, or alloy, or material condition (temper), or thickness are changed; refer to paragraph 4.0 (Process Control).

3.4 All cold and hot dimpled parts shall receive 100% inspection for aspects described below. Each individual dimple shall be physically inspected. Aluminum parts dimpled with primed surfaces shall be inspected after dimpling operation to ensure primer has not cracked and/or peeled. If cracked or peeled, primer shall be locally removed as required and all bare metal surfaces reprimed.

Inspection:

3.4.1 Magnifying glass inspection. Inspect (using a 10X magnifying glass) and disposition dimples and dimpled parts with reference to illustrations in Figure 3-23.

3.4.2 Dimensional requirements of finished dimples including the hole size shall be governed by the requirements for the particular fastener for which the dimple was made.

3.4.3 Tolerance on rivet flushness shall be in accordance with normal manufacturing practices.

3.4.4 Single sheet dimpled recesses must be so formed that any number of dimples will nest into other dimples or countersunk holes of the same size. A maximum gap between sheets of 0.015 inch (0.38 mm), but not more than 25% of the outer sheet thickness, is permissible after dimpling.
4.0 PROCESS CONTROL

The test panel or panels shall be of the same material, heat treat condition, and thickness and have the same pilot hole as the material being dimpled. Size of panel or panels shall be 1.00 inch (25.4 mm) in width and of sufficient length to accommodate not less than a total of 10 dimples spaced approximately in 1.00 inch (25.4 mm) increments.

The dimpled test strip shall be physically inspected (using a 10X magnifying glass) for dimple definition, ram flat, gouges, and convexity in accordance with Figure 3-23.

Should the test dimples prove unsatisfactory, the machine operator shall adjust the machine settings until satisfactory dimples are obtained.

One half of the dimples shall be used in the breaking test using the procedure and criteria of Figure 3-24. The balance of the dimples shall be used for the pry test. Of these dimples the inspector shall pry test (Figure 3-25) to failure at least three dimples, leaving two or more dimples untested. If the pry test reveals any unsatisfactory dimples, it shall be considered cause for repeating the test. If the second test fails, the machine shall be shut down until the source of trouble can be found and corrected. In the event of pry test failure, the remaining dimples shall be rejected.
Figure 3-22. Radius Dimpling Versus Coin Dimpling
Table 3-21. Dimpling Requirements

<table>
<thead>
<tr>
<th>Bottom Sheet</th>
<th>Top Sheet .016 Rivet Diameter</th>
<th>Top Sheet .020 Rivet Diameter</th>
<th>Top Sheet .025 Rivet Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>.016</td>
<td>1 1 1 1 1 1 1</td>
<td>1 1 1 1 1 1 1</td>
<td>3 1 1 1 1 1 1</td>
</tr>
<tr>
<td>.020</td>
<td>1 1 1 1 1 1 1</td>
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<th>Bottom Sheet</th>
<th>Top Sheet .032 Rivet Diameter</th>
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<th>Top Sheet .050 Rivet Diameter</th>
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<td>3 3 1 1 1 1 1</td>
</tr>
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<td>3 1 1 1 1 1 1</td>
<td>3 3 1 1 1 1 1</td>
<td>3 3 1 1 1 1 1</td>
</tr>
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<tr>
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<td>3 3 2 2 2 4 4 4</td>
<td>3 3 3 2 2 4 4 4</td>
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<td>3 3 3 2 2 2 2 2</td>
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<td>3 3 3 2 2 2 2 2</td>
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<th>Top Sheet .063 Rivet Diameter</th>
<th>Top Sheet .071 Rivet Diameter</th>
</tr>
</thead>
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<tr>
<td>.025</td>
<td>3 3 3 3 3 1 1</td>
<td>3 3 3 3 3 3 4</td>
</tr>
<tr>
<td>.032</td>
<td>3 3 3 3 3 1 1</td>
<td>3 3 3 3 3 3 4</td>
</tr>
<tr>
<td>.040</td>
<td>3 3 3 3 3 1 1</td>
<td>3 3 3 3 3 3 4</td>
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<tr>
<td>.051</td>
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<td>3 3 3 3 3 3 4</td>
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<tr>
<td>.064</td>
<td>3 3 3 3 3 1 1</td>
<td>3 3 3 3 3 3 4</td>
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<tr>
<td>.072</td>
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<td>3 3 3 3 3 3 4 4 4</td>
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<tr>
<td>.081</td>
<td>3 3 3 3 3 4 4 4</td>
<td>3 3 3 3 3 3 4 4 4</td>
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<tr>
<td>.090</td>
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<td>3 3 3 3 3 3 4 4 4</td>
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<tr>
<td>.102</td>
<td>3 3 3 3 3 2 2 4</td>
<td>3 3 3 3 3 3 3 4</td>
</tr>
<tr>
<td>.125</td>
<td>3 3 3 3 3 2 2 2</td>
<td>3 3 3 3 3 3 3 4</td>
</tr>
</tbody>
</table>

**Notes**

1. Dimple all sheets
2. Dimple top sheet
3. Countersink bottom sheet
4. Do not use. Contact Product Support Engineering for assistance.

All dimensions are in inches.
### Table 3-22. Requirements for Application of Hot or Cold Dimpling

<table>
<thead>
<tr>
<th>Material</th>
<th>Alloy</th>
<th>Heat Treat Condition</th>
<th>Method of Dimpling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>2000 Series</td>
<td>T3(x) or T4(x)</td>
<td>Cold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T6(x), T8(x)</td>
<td>Hot</td>
</tr>
<tr>
<td></td>
<td>6000 Series</td>
<td>T4</td>
<td>Optional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T6</td>
<td>Hot</td>
</tr>
<tr>
<td></td>
<td>7000 Series</td>
<td>T6(x), T7(x)</td>
<td>Hot</td>
</tr>
<tr>
<td>Magnesium</td>
<td>All</td>
<td>All</td>
<td>Hot</td>
</tr>
<tr>
<td>Titanium</td>
<td>Commercially Pure</td>
<td>Annealed</td>
<td>Hot</td>
</tr>
<tr>
<td>CRES</td>
<td>300 series</td>
<td>A, 1/4H, 1/2H</td>
<td>Optional</td>
</tr>
<tr>
<td></td>
<td>All Precipitation</td>
<td>Annealed</td>
<td>Optional</td>
</tr>
<tr>
<td></td>
<td>Hardening Alloys</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(15-5, 15-7, 17-4, 17-7, 455)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Alloy Steel</td>
<td>All</td>
<td>A or N</td>
<td>Optional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hardened</td>
<td>Hot</td>
</tr>
<tr>
<td>CONDITION</td>
<td>ACCEPTABLE LIMITS AND PROBABLE CAUSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. CORRECT DIMPLE</td>
<td>Good ram pressure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No scratches or marks on dimple surface.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No cracks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good definition.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For single sheet dimpling the diameter of ram flat shall be equal to the diameter of the ram itself.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. CIRCUMFERENTIAL CRACK</td>
<td>Insufficient heat in the sheet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sheet re-dimpled in reverse direction to original.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This type of crack is more apt to appear in thin sheet dimpled for large fasteners.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. CRACKS IN DIMPLE FLARE</td>
<td>Dies not properly heated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insufficient ram pressure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inner rams cracked.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pilot holes too small.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This type of crack is more apt to appear in thin sheet dimpled for large fasteners, particularly the screws.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. RAM FLAT TOO SMALL</td>
<td>Insufficient ram pressure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use of insufficient ram pressure will contribute to radial cracking, circumferential tension cracking and some types of internal defects.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restriking the dimple will not correct these faults.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. RINGED RAM FLAT</td>
<td>However, caused by excessive ram pressure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inner ram worn.</td>
<td></td>
<td></td>
</tr>
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</table>

Figure 3-23. Acceptance Limits for Coin Dimples (Sheet 1 of 2)
<table>
<thead>
<tr>
<th>CONDITION</th>
<th>ACCEPTABLE LIMITS AND PROBABLE CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. INTERNAL CIRCUMFERENTIAL TENSION CRACKS</td>
<td><strong>Not Acceptable</strong> – Insufficient heat in the sheet. Dimple formed too fast (speed of operation valve open, etc.) Re-dimpled to reverse a dimple. See Figure 3-24 on how to detect these cracks.</td>
</tr>
<tr>
<td>G. MARKS ON DIMPLE</td>
<td><strong>Acceptable</strong> – Scratches or marks usually indicate scored punches or dies, or foreign matter on tools. Tools shall be kept as clean as possible to avoid this condition. Tools shall be replaced if marks caused by dirty or defective tools.</td>
</tr>
<tr>
<td>H. RINGED DIMPLE</td>
<td><strong>Acceptable</strong> – However, caused by excessive dimpling pressure.</td>
</tr>
<tr>
<td>I. CONVEX SHEET (DUE TO DIMPLING)</td>
<td><strong>Not Acceptable</strong> – Dimpling pressure to be adjusted (too high).</td>
</tr>
<tr>
<td>J. CONCAVE SHEET (DUE TO DIMPLING)</td>
<td><strong>Not Acceptable</strong> – Dimpling pressure to be adjusted (too high).</td>
</tr>
</tbody>
</table>

Figure 3-23. Acceptance Limits for Coin Dimples (Sheet 2 of 2)
Figure 3-24. Breaking Test Strips, Coin Dimples

- **INTERNAL CIRCUMFERENTIAL SHEAR CRACK**
- **CIRCUMFERENTIAL TENSION CRACK**
- **OCCASIONAL BREAK IN THIS MANNER IS CAUSED BY STIFFENING EFFECT OF DIMPLE & SHOULD NOT BE CAUSE FOR REJECTION PROVIDED THERE IS NO TENDENCY OF BREAK TO FOLLOW CIRCUMFERENCE OF DIMPLE. BREAK ADDITIONAL STRIP APPLYING LOAD CLOSER TO CENTERLINE OF DIMPLE.**
- **BREAK ACROSS CENTERLINE OF DIMPLE**
- **A THIN CIRCULAR RING MAY BREAK AWAY FROM THE BOTTOM INNER DIAMETER OF THE DIMPLE. THIS IS A BURR AND SHALL NOT BE CAUSE FOR REJECTION.**
Punches used for pry test shall be of the same nominal diameter as the fastener for which the dimple is made. Prying may be done from either side, however, care shall be taken to see that the end of the punch protrudes through the dimple sufficiently so that the end of the punch does not cut through the dimple. In addition, the tapered part of the punch shall not contact the dimple.

This test is designed primarily to detect internal circumferential shear cracks in the dimple. When present, these cracks will show up during the pry test as follows:

- a. Break out of complete dimple washer pictured.

**NOTE**

In this Figure the internal circumferential shear cracks do not start at the sharp radius at the juncture of the dimple cone and the sheet but slightly down on the dimple cone.

- b. Clean break out of a section of a dimple washer with break in the internal circumferential shear area, as seen in center of figure above.

Failures of the above type denote unsatisfactory dimples and shall cause the machine to be shut down until the cause can be found and corrected.

Good dimples will normally fail radially during the pry test. However, occasionally the failure will start circumferentially in the area at the sharp radius at the juncture of the dimple cone and the sheet but these cracks shall not progress circumferentially around the dimple as seen in RHS of figure above. This failure is not indicative of internal circumferential shear cracks and shall not be cause for rejection of the dimple.

If, during pry testing, several dimples fail initially by radial cracking, but upon reaching the internal circumferential shear area the failure turns into an internal circumferential shear failure, verify the pressure, gauges, dwell times and temperature indicators of dimpling machine and fabricate new test panels.

**Figure 3-25. Pry Testing a Coin Dimple — Internal Circumferential Shear Cracks**
3-2-19. SEALING A STRUCTURAL REPAIR INSIDE A FUEL CELL CAVITY OR ENGINE COMPARTMENT

This process sheet establishes the special requirements for sealing a repair in the area of a fuel cell cavity or inside the engine compartment. This process sheet is not restricted only to repairs accomplished on the inside of a fuel cell cavity or engine compartment, but can apply whenever fasteners common to the inside of a fuel cell cavity are affected.

APPLICATION A: REPAIR IN A FUEL CELL CAVITY

WARNING

PRIOR TO ATTEMPTING REPAIR IN FUME TIGHT AREA, ENSURE ALL FUMES HAVE BEEN DISSIPATED BEFORE USING SWITCHES, OR SPARK AND/OR HEAT PRODUCING TOOLS. THIS MAY REQUIRE VENTING CAVITY FOR A MINIMUM OF 24 HOURS.

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 High corrosion inhibitor sealant (C-251).
1.2 Fuel application sealant (C-308).
1.3 Tape (C-453), No. 472.

2.0 PROCEDURE

2.1 Perform repair as described in this manual, in the model-specific Structural Repair Manual or in Bell Helicopter Textron approved repair. When the specific repair requires sealing and/or riveting, the step where sealing is called in the applicable repair must be replaced with the following step, if not already included:

2.1.1 Seal all edges outside fuel cell areas using high corrosion inhibitor sealant specified in 1.1, allow to dry and then reprime sealant. Ensure that fuel cell areas are sealed and that replaced and/or added rivets in fuel cells are coated with fuel exposure sealant specified in 1.2, allow to dry and then reprime sealant. Cover all rivets and cornered edges of doublers/parts in fuel cell cavities with tape specified in 1.3.
APPLICATION B: REPAIR IN ENGINE COMPARTMENT

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Firewall application sealing compound (C-353).

2.0 PROCEDURE

2.1 Perform repair as described in this manual, in the model-specific Structural Repair Manual or in Bell Helicopter Textron approved repair. When the specific repair requires sealing, the step where sealing is called in the applicable repair must be replaced with the following step, if not already included:

2.1.1 If required, seal all edges of repair area to match surrounding structure using sealant specified in 1.1. Allow to dry.
3-2-21. INSTALLATION OF CLICK BONDS

This process sheet establishes the process for installing click stud, click standoff, and bonded nutplate type fastening systems at existing locations. These bonded fasteners are used where regular studs, standoffs, or nutplates are not practical either because of accessibility issues in case they require to be changed, where dissimilar materials would be a concern, or where the rivets would create low edge distance conditions or fatigue concerns. In no case shall a riveted nutplate be replaced using this procedure.

APPLICATION A: INSTALLATION OF CLICK STUDS/STANDOFFS WITH RIGID PRESSURE APPLICATION FIXTURE

1.0 PRELIMINARY REQUIREMENTS

1.1 Cleanliness is to be carefully controlled through all phases of the preparation and bonding operations.

2.0 DEFINITIONS

2.1 Click stud: stud with external threads bonded to structure using adhesive.

2.2 Click standoff: stud with internal threads bonded to structure using adhesive.

3.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

3.1 Cheesecloth (C-486).

3.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

3.3 Aluminum oxide abrasive paper (C-406) of 120-150 grit.

3.4 Bonding adhesive (C-331) or adhesive (C-317), refer to model-specific SRM for adequate adhesive.

3.5 Kraft paper (C-254).

3.6 Process Sheet(s):
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

4.0 PREPARATION OF CLICK STUD OR STANDOFF

---

DO NOT EXPOSE OR DAMAGE FIBERS ON CLICK STUD/STANDOFF BASE MADE FROM COMPOSITE MATERIAL.

DO NOT USE SCOTCH-BRITE.

4.1 Prepare surface of click stud/standoff for bonding by lightly abrading using abrasive paper specified in 3.3. Use only new clean paper for abrading as old or previously used paper may contaminate surfaces.
CAUTION

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

4.2 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 3.2. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.

4.3 Handle clean dry click studs/standoffs with cotton gloves. Do not handle clean parts with bare hands.

NOTE

Metal details shall be bonded within 2 hours of surface preparation for bonding.

Composite details shall be bonded within 4 hours of surface preparation for bonding.

4.4 Click studs/standoffs that have been prepared for bonding shall be protected by wrapping in clean Kraft paper specified in 3.5 or stored in a container that will protect them from contamination until ready for subsequent operation.

5.0 PREPARATION OF SUBSTRATE

CAUTION

SOME PARTS HAVE SPECIAL SURFACE TREATMENTS SUCH AS SHOT PEENING. EXERCISE CAUTION WHEN HAND ABRADING TO ENSURE AGAINST EXCESSIVE METAL REMOVAL. REMOVE ONLY MINIMAL AMOUNT OF RAISED METAL AROUND SHOT PEEN DIMPLES. BEFORE REINSTALLING CLICK STUD/STANDOFF ON MODEL 429 ROOF BEAM, PLEASE CONTACT PRODUCT SUPPORT ENGINEERING.

5.1 Prepare surface of substrate for bonding by lightly hand abrading using abrasive paper specified in 3.3. Use only new clean paper for abrading as old or previously used paper may contaminate surfaces.
BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

5.2 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 3.2. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.

5.3 Using a felt tip pen, mark centerlines on substrate indicating location of center of click studs/standoffs outside footprint of click studs/standoffs.

6.0 INSTALLATION OF CLICK STUD OR STANDOFF

6.1 Prepare the required adhesive specified in 3.4 using instructions detailed in paragraph 3-2-25.

6.2 Prior to application of adhesive to click stud/standoff base, ensure that base is seated firmly against bottom of center body of plastic pressure application fixture.

CAUTION

CLICK STUD/STANDOFF MUST BE INSTALLED ON SUBSTRATE WITHIN 5 MINUTES OF ADHESIVE APPLICATION. IF CLICK STUD/STANDOFF IS NOT INSTALLED WITHIN 5 MINUTES, REMOVE ALL ADHESIVE FROM FAYING SURFACES, REMIX, AND REAPPLY.

6.3 Using a spatula, syringe, or other similar tool, apply a thin even coat of adhesive to faying surfaces of click stud/standoff and substrate to thoroughly wet-out faying surfaces. Remove excess adhesive and reapply a sufficient amount to click stud/standoff base, approximately 0.030 to 0.040 inch (0.76 to 1.01 mm) thick, to ensure positive squeeze-out around entire perimeter of click stud/standoff base.

NOTE

Use care to ensure proper alignment and to avoid trapping air within the bondline.

6.4 Remove protective paper from adhesive backed foam tabs on bottom of plastic pressure application fixture.
NOTE
If rectangular click studs/standoffs are installed on curved surfaces, ensure that long direction of click stud/standoff is placed in direction of largest radius of curvature.

6.5 Locate fixture on substrate using a template or by aligning index marks with centerline and bond fixture to substrate by pressing firmly down on outer body of fixture.

NOTE
Do not remove excess adhesive squeeze-out.
If geometric constraint prevents utilization of click stud/standoff pressure application fixture to provide bond line pressure, it is permissible to use tape or slightly tightened C-clamp to apply pressure during cure.

6.6 Bond click stud/standoff in position by applying approximately 10 PSI (68.9 kPa) to top of center body of pressure application fixture until it engages and positive squeeze-out flows along entire perimeter of click stud/standoff base. If click stud/standoff fails to engage in fixture after pressure is applied or if there is a gap between click stud/standoff base and bottom of fixture, remove click stud/standoff assembly, clean surfaces and reinstall new click stud/standoff assembly per this process sheet.

6.7 Inspect for positive adhesive squeeze-out around entire perimeter of click stud/standoff base. If squeeze-out is not visible around entire perimeter, remove click stud/standoff assembly, clean surfaces, and reinstall new click stud/standoff assembly per this process sheet.

6.8 Clean any adhesive contaminants from threads of click stud/standoff with a clean cheesecloth moistened with cleaner specified in 3.2.

6.9 Allow to cure at room temperature for 24 hours.

6.10 Remove and discard pressure application fixture.

6.11 Refinish as required.
1. REMOVE PEEL PLY FROM FOAM TAPE PADS AND DISCARD. APPLY ADHESIVE TO FASTENER BASE.

2. LOCATE FIXTURE ON SUBSTRATE USING TEMPLATE OR ALIGNING INDEX MARKS WITH CENTERLINE. PRESS DOWN ON OUTER BOX TO ADHERE FOAM TAPE TO SURFACE.

3. PRESS DOWN ON INNER BOX TO ACTUATE FIXTURE. DO NOT PRESS ON PROTRUDING FASTENER. PLASTIC SPRINGS SQUEEZE OUT ADHESIVE AND HOLD FASTENER IN PLACE WHILE ADHESIVE CURES.

4. AFTER ADHESIVE HAS CURED, REMOVE FIXTURE BY GRASPING WITH PLIERS AND PULLING OFF SUBSTRATE. DISCARD FIXTURE.

Figure 3-26. Click Studs or Coin Standoffs — Installation
APPLICATION B: REINSTALLATION OF BONDED NUTPLATES WITH FLEXIBLE PRESSURE APPLICATION FIXTURE

1.0 PRELIMINARY REQUIREMENTS

1.1 Cleanliness is to be carefully controlled through all phases of the preparation and bonding operations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Cheesecloth (C-486).

2.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Aluminum oxide abrasive paper (C-406) of 200 grit.

2.4 Bonding adhesive (C-331) or adhesive (C-317), refer to model-specific SRM for adequate adhesive.

2.5 Kraft paper (C-254).

2.6 Process Sheet(s):
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PREPARATION OF BONDED NUTPLATE

CAUTION

DO NOT EXPOSE OR DAMAGE FIBERS ON NUTPLATE BASE COVERED WITH COMPOSITE MATERIAL.

DO NOT USE SCOTCH-BRITE.

3.1 Prepare surface of nutplate for bonding by lightly abrading using abrasive cloth specified in 2.3. Use only new clean paper for abrading as old or previously used paper may contaminate surfaces.
CAUTION

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

3.2 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 2.2. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.

3.3 Handle clean dry bonded nutplate with cotton gloves. Do not handle clean parts with bare hands.

NOTE

Metal details shall be bonded within 2 hours of surface preparation for bonding.

Composite details shall be bonded within 4 hours of surface preparation for bonding.

3.4 Nutplate assemblies that have been prepared for bonding shall be protected by wrapping in clean Kraft paper specified in 2.5 or stored in a container that will protect them from contamination until ready for subsequent operation.

4.0 PREPARATION OF SUBSTRATE

CAUTION

SOME PARTS HAVE SPECIAL SURFACE TREATMENTS SUCH AS SHOT PEENING. EXERCISE CAUTION WHEN HAND ABRADING TO ENSURE AGAINST EXCESSIVE METAL REMOVAL. REMOVE ONLY MINIMAL AMOUNT OF RAISED METAL AROUND SHOT PEEN DIMPLES. BEFORE REINSTALLING BONDED NUTPLATE ON MODEL 429 ROOF BEAM, PLEASE CONTACT PRODUCT SUPPORT ENGINEERING.

4.1 Prepare surface of substrate for bonding by lightly hand abrading using abrasive cloth specified in 2.3. Use only new clean paper for abrading.
BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

4.2 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 2.2. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.

5.0 REINSTALLATION OF BONDED NUTPLATE

5.1 Prepare the required adhesive specified in 2.4 using instructions detailed in paragraph 3-2-25.

5.2 Ensure flexible pressure application fixture is nested against faying surface of nutplate base.

CAUTION

NUTPLATE ASSEMBLY MUST BE INSTALLED ON SUBSTRATE WITHIN 5 MINUTES OF ADHESIVE APPLICATION. IF NUTPLATE ASSEMBLY IS NOT INSTALLED WITHIN 5 MINUTES, REMOVE ALL ADHESIVE FROM FAYING SURFACES, REMIX AND REAPPLY.

5.3 Apply adhesive as two linear beads along long axis of nutplate base. One bead shall pass around each side of flexible pressure application fixture. The amount of adhesive in each bead shall be controlled to 0.030 to 0.035 inch (0.76 to 0.89 mm) thick, to ensure positive squeeze-out around entire perimeter of nutplate base.

NOTE

Use care to ensure proper alignment and to avoid trapping air within the bondline.

5.4 Insert appropriate tip of flexible pressure application fixture through hole in substrate.
NOTE

Do not remove excess adhesive squeeze-out.

Do not remove flexible pressure application fixture at this time.

If rectangular bonded nutplate is installed on curved surface, ensure that long direction of bonded nutplate is placed in direction of largest radius of curvature and that additional adhesive is used to ensure adequate seating of nutplate.

5.5 Bond nutplate in position by pulling on flexible pressure application fixture until nutplate is in intimate contact with substrate, and until flexible pressure application fixture engages and positive squeeze-out flows along entire perimeter of nutplate base. Ensure no gap remains between base of nutplate and substrate.

5.6 Inspect for positive adhesive squeeze-out around entire perimeter of click nutplate base. Edge voids are not allowed. If squeeze-out is not visible around entire perimeter, remove nutplate assembly, clean surfaces, and reinstall new nutplate assembly per this process sheet.

5.7 Allow to cure at room temperature for 24 hours.

5.8 Remove and discard flexible pressure application fixture.

5.9 Refinish as required.
1. APPLY ADHESIVE TO BASEPLATE.

2. PULL FIXTURE THROUGH HOLE IN SUBSTRATE.

3. AFTER ADHESIVE HAS CURED, REMOVE FIXTURE FROM NUTPLATE AND DISCARD.

Figure 3-27. Bonded Nutplate — Installation
3-2-22. REMOVAL OF CLICK BONDS

This process sheet establishes the process for removing click stud, click standoff, and bonded nutplates type fastening systems. These bonded fasteners are used where regular studs, standoffs, or nutplates are not practical either because of accessibility issues in case they require to be changed, where dissimilar materials would be a concern or where the rivets would create low edge distance conditions or fatigue concerns.

APPLICATION A: REMOVAL OF CLICK STUD/STANDOFF WITH METALLIC BASE FROM BONDED PANELS, COMPOSITE MATERIAL STRUCTURES, OR THIN/DAMAGED METALLIC STRUCTURES

WARNING

PRIOR TO ATTEMPTING REPAIR IN FUME TIGHT AREA, ENSURE ALL FUMES HAVE BEEN DISSIPATED BEFORE USING SWITCHES, SPARKS, AND/OR HEAT PRODUCING TOOLS.

1.0 DEFINITIONS

1.1 Click stud: stud with external threads bonded to structure using adhesive.

1.2 Click standoff: stud with internal threads bonded to structure using adhesive.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Cheesecloth (C-486).

2.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

2.4 Plastic or wooden scraper with sharp edges radiused out.

3.0 PROCEDURE

3.1 Prepare support plate using wood or aluminum material. Support plate must contain a clearance hole for click stud or standoff to be removed. Clearance hole to be sufficiently large to accommodate tooling required for click stud/standoff removal.

3.2 If required, prepare formed block using wood or aluminum plate.

3.3 Locate support plate and formed block, if required, in position and clamp or hold in position to support structure during removal of click stud/standoff.

3.4 Tape a thermocouple next to bondline of click stud/standoff to be removed and use a temperature controller set to 160°F (71.1°C).
WEAR APPROPRIATE GLOVES TO PREVENT BURNS.

DO NOT OVERHEAT SKIN SURFACE DURING REMOVAL OF CLICK STUD/STANDOFF. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN FROM THE CORE, PLY DELAMINATION OF COMPOSITE PARTS, AND MAY AFFECT MECHANICAL PROPERTIES OF METALLIC PARTS.

NOTE

If pliers do not contact base washer during removal process, stud/standoff shaft may break.

Do not apply excessive force. Take care not to damage substrate while removing click stud or standoff. Controlled heat and moderate bending force is generally all that will be required for removal of click stud/standoff.

3.5 Using a heat gun, apply heat, 140 to 160°F (60.0 to 71.1°C), to bondline of click stud/standoff to be removed.

NEVER FORCE A PUTTY KNIFE OR OTHER SHARP OBJECT UNDER CLICK STUD/STANDOFF BASE TO PRY IT LOOSE AS IT MAY DAMAGE SUBSTRATE.

NOTE

Do not apply excessive force. Take care not to damage substrate while removing click stud/standoff.

3.6 Using pliers, try to remove click stud/standoff from substrate with a rolling pull motion to release bond between substrate and click stud/standoff and discard it. A screw, bolt, or threaded rod may be used to provide better leverage.

3.7 While adhesive and structure is still warm, remove support plate and formed block, if required. Using scraper specified in 2.4, remove remaining adhesive from substrate.
SOME PARTS HAVE SPECIAL SURFACE TREATMENTS SUCH AS SHOT PEENING. EXERCISE CAUTION WHEN HAND ABRADING TO ENSURE AGAINST EXCESSIVE METAL REMOVAL. REMOVE ONLY MINIMAL AMOUNT OF RAISED METAL AROUND SHOT PEEN DIMPLES. BEFORE REMOVING CLICK STUD/STANDOFF ON MODEL 429 ROOF BEAM, PLEASE CONTACT PRODUCT SUPPORT ENGINEERING.

3.8 Remove remaining adhesive from substrate by lightly hand abrading using abrasive paper specified in 2.3.

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

3.9 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 2.2. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.
Figure 3-28. Metallic Based Click Stud or Standoff — Removal from Thin Structures
APPLICATION B: REMOVAL OF CLICK STUD/STANDOFF WITH METALLIC BASE FROM THICK METALLIC STRUCTURES

1.0 RESTRICTION

1.1 Not applicable to composite material structures and honeycomb bonded panels.

1.2 Not applicable to metallic structures less than 0.125 inch (3.2 mm) thick.

2.0 DEFINITIONS

2.1 Click stud: stud with external threads bonded to structure using adhesive.

2.2 Click standoff: stud with internal threads bonded to structure using adhesive.

3.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

3.1 Cheesecloth (C-486).

3.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

3.3 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

3.4 Plastic or wooden scraper with sharp edges radiused out.

4.0 PROCEDURE

**CAUTION**

NEVER FORCE A PUTTY KNIFE OR OTHER SHARP OBJECT UNDER CLICK STUD OR STANDOFF BASE TO PRY IT LOOSE AS IT MAY DAMAGE SUBSTRATE.

**NOTE**

If pliers do not contact base washer during removal process, stud or standoff shaft may break.

Do not apply excessive force. Take care not to damage substrate while removing click stud/standoff. Moderate bending force is generally all that will be required for removal of click stud/standoff.

4.1 Using pliers, try to remove click stud/standoff from substrate with a rolling pull motion to release bond between substrate and click stud/standoff and discard it. A screw, bolt, or threaded rod may be used to provide better leverage.

4.2 Using scraper specified in 3.4, remove remaining adhesive from substrate.
CAUTION

SOME PARTS HAVE SPECIAL SURFACE TREATMENTS SUCH AS SHOT PEENING. EXERCISE CAUTION WHEN HAND ABRADING TO ENSURE AGAINST EXCESSIVE METAL REMOVAL. REMOVE ONLY MINIMAL AMOUNT OF RAISED METAL AROUND SHOT PEEN DIMPLES. BEFORE REMOVING CLICK STUD/STANDOFF ON MODEL 429 ROOF BEAM, PLEASE CONTACT PRODUCT SUPPORT ENGINEERING.

4.3 Remove remaining adhesive from substrate by lightly hand abrading using abrasive paper specified in 3.3.

CAUTION

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

4.4 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 3.2. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.
Figure 3-29. Removing Click Stud or Standoff from Thick Metallic Structures
APPLICATION C: REMOVAL OF CLICK STUDS/STANDOFFS WITH COMPOSITE BASE

1.0 DEFINITIONS

1.1 Click stud: stud with external threads bonded to structure using adhesive.

1.2 Click standoff: stud with internal threads bonded to structure using adhesive.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Cheesecloth (C-486).

2.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

2.4 Plastic or wooden scraper with sharp edges radiused out.

3.0 PROCEDURE

3.1 Using a 90° router with a 2.00 inch (50.8 mm) diameter, 120 grit sanding disc, reduce upper fiberglass plies of click stud/standoff base around bottom of metal stud/standoff. Carefully abrade away fiberglass base until metal base is exposed at bottom of threaded stud or standoff.

3.2 Prepare support plate using wood or aluminum material. Support plate must contain a clearance hole for click stud or standoff to be removed. Clearance hole to be sufficiently large to accommodate tooling required for click stud or standoff removal.

3.3 If required, prepare formed block using wood or aluminum plate.

3.4 Locate support plate and formed block, if required, in position and clamp or hold in position to support structure during removal of click stud or standoff.

CAUTION

NEVER FORCE A PUTTY KNIFE OR OTHER SHARP OBJECT UNDER CLICK STUD OR STANDOFF BASE TO PRY IT LOOSE AS IT MAY DAMAGE SUBSTRATE.

NOTE

If pliers do not contact base washer during removal process, stud or standoff shaft may break.

Do not apply excessive force. Take care not to damage substrate while removing click stud/standoff. Moderate bending force is generally all that will be required for removal of click stud/standoff.

3.5 Using a pair of pliers, grasp threaded stud/standoff next to base and try to remove click stud/standoff base from bottom fiberglass plies with a rolling pull motion and discard it.
3.6 Remove support plate and formed block, if required.

3.7 Tape a thermocouple next to bondline of click stud/standoff to be removed and use a temperature controller set to 160°F (71.1°C).

**CAUTION**

WEAR APPROPRIATE GLOVES TO PREVENT BURNS.

DO NOT OVERHEAT SKIN SURFACE DURING REMOVAL OF CLICK STUD OR STANDOFF. OVERHEATING MAY CAUSE SEPARATION OF THE SKIN FROM THE CORE, PLY DELAMINATION OF COMPOSITE PARTS, AND MAY AFFECT MECHANICAL PROPERTIES OF METALLIC PARTS.

3.8 Using a heat gun, apply heat, 140°F to 160°F (60°C to 71.1°C), to remaining adhesive. Using scraper specified in 2.4, remove remaining adhesive from substrate.

**CAUTION**

SOME PARTS HAVE SPECIAL SURFACE TREATMENTS SUCH AS SHOT PEENING. EXERCISE CAUTION WHEN HAND ABRADING TO ENSURE AGAINST EXCESSIVE METAL REMOVAL. REMOVE ONLY MINIMAL AMOUNT OF RAISED METAL AROUND SHOT PEEN DIMPLES. BEFORE REMOVING CLICK STUD/STANDOFF ON MODEL 429 ROOF BEAM, PLEASE CONTACT PRODUCT SUPPORT ENGINEERING.

3.9 Remove remaining adhesive from substrate by lightly hand abrading using abrasive paper specified in 2.3.

**CAUTION**

BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

3.10 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 2.2. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.
3-2-22. REMOVAL OF CLICK BONDS

Figure 3-30. Click Stud or Standoff with Composite Base — Removal

- Use pliers to remove stud or standoff with a rolling pull motion.
- Secure support plate and formed block (if required) to substrate.
- Heat gun temperature not to exceed 160 F.
- Remove remaining adhesive applying heat with heat gun.
- Sand off stud or standoff composite base with router.
APPLICATION D: REMOVAL OF BONDED NUTPLATES

This process sheet establishes the process for removing the base plate of a bonded nutplate from the structure it is bonded to, and is limited to this application only. If the damage is on the nut element of the bonded nutplate, it is possible to replace the nut element without removing the base plate.

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Cheesecloth (C-486).

1.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

1.3 Aluminum oxide abrasive paper (C-406) of 200 grit or finer.

1.4 Locally manufactured plastic wedge.

1.5 Dry ice (to be procured locally).

2.0 PROCEDURE

2.1 Apply dry ice specified in 1.5 for 10 minutes to bonded nutplate assembly.

**NOTE**

Do not apply excessive force. Take extreme care not to damage substrate while removing bonded nutplate. Moderate force is generally all that will be required for removal of bonded nutplate.

2.2 Drive plastic wedge specified in 1.4 gently under one end of bonded nutplate until bondline separation occurs.

2.3 Inspect substrate for damage such as permanent deformation, delamination, or fiber damage. If any damage is found, submit all details to Product Support Engineering for evaluation.

**CAUTION**

SOME PARTS HAVE SPECIAL SURFACE TREATMENTS SUCH AS SHOT PEENING. EXERCISE CAUTION WHEN HAND ABRADING TO ENSURE AGAINST EXCESSIVE METAL REMOVAL. REMOVE ONLY MINIMAL AMOUNT OF RAISED METAL AROUND SHOT PEEN DIMPLES. BEFORE REMOVING BONDED NUTPLATE ON MODEL 429 ROOF BEAM, PLEASE CONTACT PRODUCT SUPPORT ENGINEERING.

2.4 Remove remaining adhesive from substrate by lightly hand abrading using abrasive paper specified in 1.3.
BEFORE HANDLING A SOLVENT, EXTINGUISH ALL FLAMES AND PILOT LIGHTS. KEEP PRODUCT AND ITS VAPORS AWAY FROM HEAT, SPARKS, AND FLAME. DURING APPLICATION AND UNTIL VAPORS HAVE DISSIPATED, AVOID USING SPARK PRODUCING ELECTRICAL EQUIPMENT SUCH AS SWITCHES, APPLIANCES, ETC. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED CONTACT WITH SKIN.

2.5 Accomplish final surface cleaning by wiping with a clean cheesecloth moistened with cleaner specified in 1.2. Change cheesecloth often. Repeat operation until all evidence of residue is removed and wipe dry using a clean cheesecloth.
Figure 3-31. Bonded Nutplate — Removal

- Apply dry ice for 10 mins then pry nutplate off with a plastic wedge.
- Remove remaining adhesive with abrasive cloth or paper.
3-2-23. FORMING OF FLAT SHEET METAL

This process sheet establishes the requirements for forming flat sheet metal material at room temperature. The following forming features are specified below: minimum bend radii, bend relief, and joggles.

1.0 RESTRICTIONS

1.1 Valid for bend angles between 1 and 110° only. For angles over 110°, contact Product Support Engineering.

2.0 DEFINITIONS

2.1 Minimum bend radius: minimum radius of curvature that will consistently produce acceptable formed sheet metal.

2.2 Bend relief: a bend relief is a cutout in a formed sheet of material required to relieve stress concentrations due to presence of bends on two adjacent sides of a part.

2.3 Joggle: a joggle is offset in a flat plane, consisting of two parallel bends in opposite directions at same angle, typically used to allow installation of a part over a step in assembly stack up.

3.0 PROCEDURE FOR BENDING SHEET METAL

CAUTION

ALL TOOLS USED FOR BENDING SHEET METAL MATERIAL MUST BE FREE FROM SCRATCHES, BURRS, DEBRIS, ETC.

AFTER FORMING A PART, IT IS NOT ACCEPTABLE TO REVERSE DIRECTION OF BEND TO CORRECT OVER-BENDING.

NOTE

All sheet metal material must be formed at room temperature.

Whenever a part requires formed flanges on two adjacent sides, a 0.16 inch (4.1 mm) bend relief is required. Bend relief shall be centered on bend tangency lines (Figure 3-32).

3.1 Using a brake/bending machine, bend in a straight line part to be formed to appropriate angle using appropriate bend radius as listed in Table 3-23.
4.0 PROCEDURE FOR JOGGLING FLAT SHEET METAL

CAUTION

ALL TOOLS USED FOR BENDING FLAT SHEET METAL MATERIAL MUST BE FREE FROM SCRATCHES, BURRS, DEBRIS, ETC.

NOTE

The data herein is only applicable to room temperature forming.

Applicable to flat sheet material only (not applicable to formed angle and extrusion).

After forming a part, it is not acceptable to reverse direction of bend to correct over-bending.

It is unacceptable to have fasteners installed in jogged section of a part. Ensure sufficient distance exists between fasteners and joggle to allow adequate seating of fastener head.

4.1 Using a brake/bending machine bend in a straight line part to be jogged to appropriate dimensions as listed in Table 3-24 or as specified in applicable repair. Refer to Table 3-23 for appropriate bend radii.
Figure 3-32. Bend Radius and Bend Relief for Sheet Metal

REFER TO TABLE 3-23 FOR MINIMUM BEND RADIUS.
Table 3-23. Minimum Bend Radii (Room Temperature Formed)

<table>
<thead>
<tr>
<th>Material</th>
<th>Alloy – Temper</th>
<th>Sheet Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.012 (0.30)</td>
</tr>
<tr>
<td>Aluminum</td>
<td>2024-T(xx)</td>
<td>0.03 (0.8)</td>
</tr>
<tr>
<td></td>
<td>6013-T6</td>
<td>0.06 (1.5)</td>
</tr>
<tr>
<td></td>
<td>7075-T(xx)</td>
<td>0.09 (2.3)</td>
</tr>
<tr>
<td>CRES Steel</td>
<td>301 Anealed</td>
<td>0.03 (0.8)</td>
</tr>
<tr>
<td></td>
<td>301 ¼ Hard</td>
<td>0.03 (0.8)</td>
</tr>
<tr>
<td></td>
<td>301 ½ Hard</td>
<td>0.06 (1.5)</td>
</tr>
<tr>
<td>Steel</td>
<td>4130 Anealed</td>
<td>0.06 (1.5)</td>
</tr>
<tr>
<td></td>
<td>and low carbon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4130 Norm.</td>
<td>0.13 (3.3)</td>
</tr>
<tr>
<td>Titanium</td>
<td>CP-1 (Type I, Comp B)</td>
<td>0.03 (0.8)</td>
</tr>
<tr>
<td></td>
<td>CP-2 (Type I, Comp C)</td>
<td>0.03 (0.8)</td>
</tr>
<tr>
<td></td>
<td>AB-1 (6Al-4V)</td>
<td>0.06 (1.5)</td>
</tr>
<tr>
<td></td>
<td>AB-2 (6Al-4V ELI)</td>
<td>0.06 (1.5)</td>
</tr>
</tbody>
</table>

Tolerance = ±0.02 inch (±0.5 mm)

Table 3-24. Length of a Joggle Travel

<table>
<thead>
<tr>
<th>Joggle Depth</th>
<th>Length of Joggle Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 0.020 inch</td>
<td>No joggle required unless otherwise specified in applicable repair.</td>
</tr>
<tr>
<td>0.020 inch to 0.080 inch</td>
<td>4 x Joggle Depth</td>
</tr>
<tr>
<td></td>
<td>Ex: Joggle Depth = 0.040 inch</td>
</tr>
<tr>
<td></td>
<td>Joggle Travel = 4 x 0.040 = 0.160 inch</td>
</tr>
<tr>
<td>More than 0.080 inch</td>
<td>6x Joggle Depth</td>
</tr>
<tr>
<td></td>
<td>Ex: Joggle Depth = 0.100 inch</td>
</tr>
<tr>
<td></td>
<td>Joggle Travel = 6 x 0.100 = 0.600 inch</td>
</tr>
</tbody>
</table>
Figure 3-33. Joggling Sheet Metal
3-2-24. SHIMMING OF MATING PARTS

This process sheet establishes the requirements and restrictions to be used to fill gaps between two mating parts by installing solid shims.

1.0 RESTRICTIONS

1.1 Shimming of structures listed in Chapter 1, paragraph 1-20 is prohibited without prior authorization from Product Support Engineering unless specifically authorized by applicable repair.

1.2 A 0.040 inch (1.01 mm) maximum shim thickness is allowed between forgings, castings, extrusions, bonded panels, and sheet metal parts. Shim is to be tapered in all required directions as necessary to fill gap to a minimum of 0.010 inch (0.254 mm) thickness.

1.3 Not applicable where shims already exist per production configuration or are called in the model-specific Illustrated Parts Book or Illustrated Parts Catalog.

1.4 Installation of shim may not affect fit and/or function, alignment of next assembly, or interchangeability.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Shim made from same material and heat treatment condition as parent structure. Thickness of shim shall be sufficient to fill gap but not exceed restrictions given in step 1.2.

2.2 Adhesives: General purpose bonding adhesive (C-317) for aluminum and CRES parts.

2.3 Firewall application sealing compound (C-353) for titanium parts.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 Epoxy polyamide primer (C-204).

2.6 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
   - Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
   - Preparation of Bonding Surfaces (paragraph 3-2-5)
   - Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Prepare shim specified in 2.1, dimensioned as required to fill gap. If required, shim may contain a constant taper from stock thickness down to 0.010 inch (0.25 mm) minimum thickness.

3.2 Locate shim in position on permanently fixed member. Whenever possible, shim to be attached using a minimum of two existing fasteners. Transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.3 Remove shim. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended. If required, carefully air blow honeycomb cavities to remove dirt particles.

It is permissible to bond shim on lightly abraded primed surfaces.

3.4 Remove dirt, paint, and primer from area to be shimmed and clean for bonding using instructions detailed in paragraph 3-2-3 and paragraph 3-2-5.

NOTE
Shim may be bonded prior to or during accomplishment of a repair.

3.5 Locate shim in position and bond to permanently fixed member using bonding adhesive specified in 2.2 and instructions detailed in paragraph 3-2-7.

3.6 Remove excess adhesive squeeze-out.

3.7 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of shim if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used.

3.8 Prime all bare metal surfaces using material specified in 2.4. Allow to dry.

3.9 Complete installation of parts.

3.10 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.5. Allow to dry. Reprime sealant.

3.11 Refinish as required.
3-2.25. PREPARING AND MIXING TWO-PART EPOXY RESIN BY WEIGHT

This process sheet establishes the requirements to be used to calculate the proper mixing ratio for two-part epoxy resins. Two-part epoxy resins come in separate containers. Part A contains base resin and Part B contains the hardener or curing agent.

1.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

1.1 Use specified epoxy resin and its hardener (Table 3-25).

2.0 PROCEDURE

**WARNING**

USE CARE WHEN HANDLING AND MIXING EPOXY RESIN AND HARDENER. FUMES FROM THESE MATERIALS CAUSE BOTH A HEALTH AND FIRE HAZARD.

HAVE GOOD VENTILATION AND BREATHING PROTECTION. WEAR PROTECTIVE CLOTHING AND EYE SHIELD.

MIXING LARGE QUANTITY OF EPOXY RESIN AND HARDENER CAN YIELD HIGH EXOTHERMIC TEMPERATURE AND ACCELERATED REACTION.

**NOTE**

The mixing ratios in Table 3-25 are expressed as weight of Part A over weight of part B.

2.1 Determine required weight of resin/hardener mix. To prevent excessive heat generation due to exothermic reaction, mix no more than 0.33 pounds (150 grams) at a time.

2.2 Select appropriate mixing ratio for respective resin system (Table 3-25).

2.3 Calculate amount of each part to be added using following formulas:

\[
\text{Part A} = \frac{\text{MRA} \times \text{Required Weight of (Part A + Part B) Mix}}{\text{MRA} + \text{MRB}}
\]

\[
\text{Part B} = \frac{\text{MRB} \times \text{Required Weight of (Part A + Part B) Mix}}{\text{MRA} + \text{MRB}}
\]

where:

MRA: mix ratio of Part A  \hspace{1cm} MRB: mix ratio of Part B

2.4 In separate trays, weigh required amount of Part A and Part B.
NOTE
If containers are in refrigerated storage, allow material to reach room temperature before opening. Ensure material shelf-life is not exceeded.

2.5 Pour hardener (Part B) into base resin (Part A) container.

2.6 Slowly mix epoxy resin and its hardener to minimize amount of trapped air.

3.0 EXAMPLE

3.1 Assuming 0.1 pound (45 grams) of Magnobond 6367 (C-363) is required for a fiberglass wet layup repair. Mix ratio of Magnobond 6367 is 100 parts of A to 44 parts of B by weight.

\[
\text{Part A} = \frac{0.1}{100 + 44} \times 100 = 0.07 \text{ pound} \\
\text{Part A} = \frac{45}{100 + 44} \times 100 = 31.25 \text{ grams}
\]

\[
\text{Part B} = \frac{0.1}{100 + 44} \times 44 = 0.03 \text{ pound} \\
\text{Part B} = \frac{45}{100 + 44} \times 44 = 13.75 \text{ grams}
\]

3.2 Combine 0.07 pound (31.25 grams) of Part A with 0.03 pound (13.75 grams) of Part B to obtain 0.1 pound (45 grams) of Magnobond 6367 required for repair.
### Table 3-25. Adhesive Data

<table>
<thead>
<tr>
<th>Adhesive</th>
<th>Bell Spec.</th>
<th>“C” code</th>
<th>Pot Life Room Temp. (Minutes)</th>
<th>Handling Strength Room Temp.</th>
<th>Full Cure Room Temp. (65-85°F) (18.3-29.4°C)</th>
<th>Alternate Cure</th>
<th>Mixing Ratio Part A/Part B by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysol EA934NA</td>
<td>299-947-100, Type II, Class 2</td>
<td>C-317</td>
<td>30 minutes minimum.</td>
<td>24 hours</td>
<td>180°F (82.2°C), 1 hour</td>
<td></td>
<td>100/33</td>
</tr>
<tr>
<td>Magnobond 6398</td>
<td>299-947-100, Type II, Class 2</td>
<td>C-317</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>150-200°F (65.6-93.3°C) 1 hour or 125-135°F (51.7-57.2°C) 2 hours</td>
<td>100/27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>299-947-359, Type I</td>
<td>C-562</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysol EA956NA</td>
<td>299-947-100, Type II, Class 3</td>
<td>C-363</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>195-205°F (90.6-96.1°C) 1 hour</td>
<td>100/58</td>
<td></td>
</tr>
<tr>
<td>Magnobond 6367</td>
<td>299-947-100, Type II, Class 3</td>
<td>C-363, C-512</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>180-200°F (82.2-93.3°C) 1 hour</td>
<td>100/44</td>
<td></td>
</tr>
<tr>
<td>Hysol EA9309NA</td>
<td>299-947-125, Type I</td>
<td>C-331</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>180°F (82.2°C) 1 hour</td>
<td>100/23</td>
<td></td>
</tr>
<tr>
<td>Hysol EA9320NA</td>
<td>299-947-125, Type II, Class 2</td>
<td>C-397</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>180°F (82.2°C) 1 hour</td>
<td>100/19</td>
<td></td>
</tr>
<tr>
<td>Hysol EA9392</td>
<td>299-947-100, Type II, Class 2</td>
<td>C-317</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>180°F (82.2°C) 1 hour</td>
<td>100/32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>299-947-359, Type I</td>
<td>C-562</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epon 828 DTA</td>
<td>–</td>
<td>C-219, C-220</td>
<td>30 minutes minimum</td>
<td>24 hours</td>
<td>180°F (82.2°C), 1 hour</td>
<td>100/8-12</td>
<td></td>
</tr>
<tr>
<td>Magnobond 120-271</td>
<td>299-947-097, Type II</td>
<td>C-584</td>
<td>20 to 60 minutes</td>
<td>–</td>
<td>24 to 48 hours</td>
<td>100/19</td>
<td></td>
</tr>
<tr>
<td>BH200A/9810</td>
<td>299-947-097, Type II</td>
<td>C-584</td>
<td>20 to 60 minutes</td>
<td>–</td>
<td>24 to 48 hours</td>
<td>100/15</td>
<td></td>
</tr>
</tbody>
</table>

⚠️ Refer to manufacturer’s specifications.
3-2-26. VACUUM BAGGING METALLIC REPAIRS

This process sheet describes the procedures used to vacuum bag the metallic doubler repairs.

**NOTE**

The vacuum bag must not leak more than 5.0 inches (127.00 mm) Hg per minute.

1.0 EQUIPMENT Use as required

1.1 Vacuum fitting.

1.2 Vacuum gauge.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Plastic film masking tape (C-260), if required.

2.2 Bagging film (C-257) or bagging film (C-564).

2.3 Breather felt (C-258) or breather felt (C-565).

2.4 Release film (C-477).

2.5 Release fabric (C-478) (optional).

2.6 Vacuum bag sealant tape (C-259) or sealant tape (C-599).

3.0 PROCEDURE

3.1 Bag repair according to Figure 3-34.

3.2 If required, use plastic film masking tape specified in 2.1 to hold bagging components on vertical surface.
Figure 3-34. Vacuum Bagging
3-3. RIVETED STRUCTURES

3-3-1. RIVET INSTALLATION AND REPLACEMENT — GENERAL

Generally, a replacement fastener shall be of the same type and size as the original fastener removed except when hole damage, repair alteration, or field conditions (e.g., lack of proper equipment or tooling) requires a change within these guidelines.

**CAUTION**

IT IS NOT ACCEPTABLE TO OVERSIZE A FASTENER THAT IS INSTALLED IN A COLD EXPANDED HOLE WITHOUT PRIOR AUTHORIZATION BY PRODUCT SUPPORT ENGINEERING. REFER TO MODEL-SPECIFIC SRM FOR INDICATION OR A LIST OF WHERE COLD EXPANDED RIVET HOLES ARE LOCATED.

1. USE OF NEXT-SIZE SOLID RIVET

**NOTE**

Except when Product Support Engineering or the applicable repair procedure allows otherwise, universal head rivets require a minimum edge distance of 2D (2.5D for fiber reinforced composite parts) be maintained. Countersunk rivets require a minimum edge distance of 2.5D be maintained for both metallic and fiber reinforced composite parts.

It is acceptable to install same type oversize solid rivet providing sufficient material edge distance exists to accommodate the new fastener in all parts. Typically, the repair procedures in this manual require 0.38 inch (9.7 mm) inch minimum edge distance.

2. EDGE DISTANCE

The edge distance (ED) of a fastener is a measure of the proximity of the fastener to the edge of the part. The ED is measured from the center of the fastener hole to the edge of the material.

![Figure 3-35. Rivet Spacing and Edge Distance](image-url)
3. HOLE PREPARATION

Inspect rivet holes to the requirements of Table 3-28 to determine the correct size of rivet to be used. Use a go-no-go gauge or another suitable test instrument to determine the hole size. Never attempt to install a rivet in a hole that is too big for the fastener; rather, drill to the next available size rivet. In the case of fiber reinforced composite parts, the edge of the rivet hole is to be sealed using wet layup adhesive (C-363) prior to rivet installation.

4. RIVET LAYOUT

Where possible, lay out location of fasteners using the same pattern and spacing used in the immediate surrounding structure. When adding universal head rivets or increasing the rivet size in a metallic part, a minimum edge distance (ED) of two times the rivet shank diameter (2D), and a minimum rivet spacing of four times the rivet shank diameter (4D) must be maintained unless otherwise specified. In the case of countersunk rivets installed in a metallic part, a minimum ED of 2.5D and a minimum spacing of 5D must be maintained unless otherwise specified. In the case of rivets installed in fiber reinforced composite parts, a minimum ED of 2.5D and a minimum spacing of 5D must be maintained for protruding and countersunk rivets. Rivet spacing should be between 0.90 to 1.30 inch (22.9 to 33.0 mm) apart, 1.12 inches (28.5 mm) being the desired value.

5. RIVET IDENTIFICATION

Solid rivets are easily recognizable by the distinct markings on the rivet head. Refer to Table 3-30 for information on solid rivet identification. Blind rivets and close tolerance fasteners have a code or part number embossed on the rivet head.

6. RIVET LENGTH

Refer to Table 3-29 for the effective grip lengths for installations using blind rivets.

7. INSTALLATION OF FLUSH RIVET

When a flush rivet needs to be installed, special considerations must be made to ensure an adequate installation of the rivet. Prior to installing the rivet, the rivet hole must be countersunk or dimpled to allow a flush installation of the rivet. Refer to instructions detailed in paragraph 3-2-18 for the sheet thickness requirements before dimpling or countersinking.
3-3.2. RIVET INSTALLATION AND SUBSTITUTION

Solid rivets are the preferred fasteners for most repair conditions. At all times, all efforts shall be made to install or reinstall solid rivets in metallic parts. However, blind rivets may be substituted for solid rivets if one or more of the conditions below prevail. Refer to Table 3-30 for information on solid rivet identification, to Table 3-28 for drill and hole size limits, and to Table 3-29 for blind rivet grip length.

**CAUTION**

SOLID RIVETS ARE NOT TO BE USED IN CARBON OR GLASS FIBER REINFORCED COMPOSITE MATERIAL PARTS UNLESS SPECIFIED IN THE APPLICABLE REPAIR. FOR FASTENING OF FIBER REINFORCED COMPOSITE MATERIAL PARTS, THE PREFERRED FASTENER IS THE BLIND BOLT.

BOLTS OR SCREWS ARE NOT APPROVED AS REPLACEMENT FOR RIVETS UNLESS PREVIOUSLY AUTHORIZED IN WRITING BY PRODUCT SUPPORT ENGINEERING.

**NOTE**

Refer to Table 3-26 and Table 3-27 for allowable rivet alternates and substitution data.

a. Blind rivets are specified in the repair procedure.

b. Only one side of the structure is accessible (in the case of sheet metal structure or edges of bonded panels) preventing installation of a solid rivet.

c. Fastener attaches to the metallic facing of a honeycomb panel.

**APPLICATION A: PROTRUDING HEAD RIVETS**

Use of Table 3-26 is restricted to the following conditions:

a. Protruding head rivets replacement: Table 3-26 applies to rivet diameters of 1/8 inch (3.2 mm) (-4) through 3/16 inch (4.8 mm) (-6).

b. Minimum edge distance (2D for metallic parts and 2.5D for composite parts) must be respected by the new fastener.

c. Meets the thickness restrictions specified as per Note 2 of Table 3-26.

d. Every rivet is to be installed wet with high corrosion inhibitor sealant (C-251) unless otherwise specified in the applicable repair.
### Table 3-26. Substitution of Protruding Head Rivets

<table>
<thead>
<tr>
<th>Existing Rivet Type</th>
<th>1st Oversize Solid Repair Rivet</th>
<th>ALTERNATE BLIND RIVET</th>
<th>Cherry Max (oversize)(^{(1)})</th>
<th>Bulbed Cherry Lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS20470AD(d)-(L)</td>
<td>NAS1242AD(d)-(L)</td>
<td>NAS9304B-(d)-(L)(^{(2)}) or NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20470B(d)-(L)</td>
<td>NAS1242B(d)-(L)</td>
<td>NAS9304B-(d)-(L)(^{(2)}) or NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20470D(d)-(L)</td>
<td>NAS1242D(d)-(L)</td>
<td>NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20470DD(d)-(L)(^{3})</td>
<td>NAS1242DD(d)-(L)</td>
<td>NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20470E(d)-(L)</td>
<td>N/A</td>
<td>NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20600AD(d)W(L)</td>
<td>N/A</td>
<td>CR7771S-(d)-(L)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>MS20600B(d)W(L)</td>
<td>N/A</td>
<td>NAS9304B-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20600M(d)W(L)</td>
<td>N/A</td>
<td>NAS9310M-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20600MP(d)W(L)</td>
<td>N/A</td>
<td>NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20615-(d)M(L)</td>
<td>N/A</td>
<td>NAS9310M-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>MS20615-(d)MP(L)</td>
<td>N/A</td>
<td>NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>NAS1398B-(d)-(L)</td>
<td>N/A</td>
<td>NAS9304B-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>NAS1398M-(d)-(L)</td>
<td>N/A</td>
<td>NAS9310M-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>NAS1398MW-(d)-(L)</td>
<td>N/A</td>
<td>NAS9310ML-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>NAS1738B-(d)-(L)</td>
<td>N/A</td>
<td>NAS9310M-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>NAS1738M-(d)-(L)</td>
<td>N/A</td>
<td>NAS9310M-(d)-(L)</td>
<td>NAS1738MW(d)-(L)</td>
<td></td>
</tr>
<tr>
<td>NAS1738MW-(d)-(L)</td>
<td>N/A</td>
<td>NAS9310ML-(d)-(L)</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**1)** Refer to Appendix A-5.

**2)** In order to maintain the equivalent strength of the joint, the following sheet thickness restrictions exist when using alternate blind rivets. The numbers express the thinnest of all the parts being fastened:
- Do not use -4 dia. alternate blind rivets for sheet thickness below 0.050 inch (1.01 mm), use NAS9310ML-4 rivets instead;
- Do not use -5 dia. alternate blind rivets for sheet thickness below 0.063 inch (1.27 mm), use NAS9310ML-5 rivets instead;
- Do not use -6 dia. alternate blind rivets for sheet thickness below 0.071 inch (1.60 mm), use NAS9310ML-6 rivets instead.

**3)** MS20470DD(d)-(L) nominal size rivet may be replaced with MS20470E(d)-(L) nominal size rivet.

**LEGEND**
- (D) Indicates rivet diameter in 1/32 inch (0.8 mm) increments.
- (L) Indicates rivet length in 1/16 inch (1.6 mm) increments.
APPLICATION B: FLUSH HEAD RIVETS

Use of Table 3-27 is restricted to the following conditions:

- **Flush head rivets replacement:** Table 3-27 applies to rivet diameters of 1/8 inch (3.2 mm) (-4) through 3/16 inch (4.8 mm) (-6). Rivet head to be flush within -0.005/+0.010 inch (-0.12/+0.25 mm) from surface of part for solid rivet, -0.006/+0.006 inch (-0.15/+0.15 mm) for blind rivet and -0.000/+0.005 inch (-0.00/+0.12 mm) for shallow head rivet.

- **Minimum edge distance (2.5D for metallic and composite parts) must be respected by the new fastener.**

- **Minimum sheet thickness required to accommodate countersink is detailed in paragraph 3-2-18 (dimpling process for flush rivets).**

- **Every rivet is to be installed wet with high corrosion inhibitor sealant (C-251) unless otherwise specified in the applicable repair.**

- **Flush head oversized rivets cannot be used to replace nominal size rivets when hole is dimpled. If oversized fasteners are required in such a hole, either replace the affected part(s) and dimple each flush rivet hole using appropriate dies, perform appropriate repair from this manual or model-specific SRM, or contact Product Support Engineering for disposition.**
### Table 3-27. Substitution of Flush Head Rivets

<table>
<thead>
<tr>
<th>Existing Rivet Type</th>
<th>1st Oversize Solid Repair Rivet (4)</th>
<th>ALTERNATE BLIND RIVET</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MS20426AD(d)-(L)</td>
<td>NAS1241AD(d)-(L)</td>
<td>NAS9305B-(d)-(L)(2)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20426B(d)-(L)</td>
<td>NAS1241B(d)-(L)</td>
<td>NAS9305B-(d)-(L)(2)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20426D(d)-(L)</td>
<td>NAS1241D(d)-(L)</td>
<td>NAS9311ML-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20426DD(d)-(L)</td>
<td>NAS1241DD(d)-(L)</td>
<td>NAS9311ML-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20426E(d)-(L)</td>
<td>N/A</td>
<td>NAS9311ML-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20426T(d)-(L)</td>
<td>N/A</td>
<td>CR7770S-(d)-(L)</td>
<td>N/A</td>
</tr>
<tr>
<td>MS20427M(d)-(L)</td>
<td>N/A</td>
<td>NAS9311M-(d)-(L)</td>
<td>NAS1739M-(d)-(L)</td>
</tr>
<tr>
<td>MS20427M(d)-C(L)</td>
<td>N/A</td>
<td>NAS9311ML-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20601AD(d)-W(L)</td>
<td>N/A</td>
<td>NAS9305B-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20601B(d)-W(L)</td>
<td>N/A</td>
<td>NAS9305B-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>MS20601M(d)-W(L)</td>
<td>N/A</td>
<td>NAS9311M-(d)-(L)</td>
<td>NAS1739M-(d)-(L)</td>
</tr>
<tr>
<td>MS20601MP(d)-W(L)</td>
<td>N/A</td>
<td>NAS9311ML-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>NAS1097AD(d)-(L)</td>
<td>N/A</td>
<td>NAS9303B-(d)-(L)</td>
<td>N/A</td>
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<tr>
<td>NAS1200M(d)-(L)</td>
<td>N/A</td>
<td>NAS9309M-(d)-(L)</td>
<td>N/A</td>
</tr>
<tr>
<td>NAS1200M(d)-(L)P</td>
<td>N/A</td>
<td>NAS9309ML-(d)-(L)</td>
<td>N/A</td>
</tr>
<tr>
<td>NAS1399B-(d)-(L)</td>
<td>N/A</td>
<td>NAS9305B-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>NAS1399M-(d)-(L)</td>
<td>N/A</td>
<td>NAS9311M-(d)-(L)</td>
<td>NAS1739M-(d)-(L)</td>
</tr>
<tr>
<td>NAS1399MW-(d)-(L)</td>
<td>N/A</td>
<td>NAS9311ML-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>NAS1739B-(d)-(L)</td>
<td>N/A</td>
<td>NAS9311M-(d)-(L)</td>
<td>NAS1739MW-(d)-(L)</td>
</tr>
<tr>
<td>NAS1739M-(d)-(L)</td>
<td>N/A</td>
<td>NAS9311M-(d)-(L)</td>
<td>N/A</td>
</tr>
<tr>
<td>NAS1739MW-(d)-(L)</td>
<td>N/A</td>
<td>NAS9311ML-(d)-(L)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1) Refer to Appendix A-5.

2) In order to maintain the equivalent strength of the joint, the following sheet thickness restrictions exist when using NAS9305B rivets. The numbers express the thinnest of all the parts being fastened:
   - Do not use NAS9305B-4 rivets for sheet thickness below 0.040 inch (1.01 mm), use NAS9311ML-4 rivets instead;
   - Do not use NAS9305B-5 rivets for sheet thickness below 0.050 inch (1.27 mm), use NAS9311ML-5 rivets instead;
   - Do not use NAS9305B-6 rivets for sheet thickness below 0.063 inch (1.60 mm), use NAS9311ML-6 rivets instead.

3) MS20426DD(d)-(L) nominal size rivet may be replaced with MS20426E(d)-(L) nominal size rivet.

4) Flush head oversized rivets cannot be used to replace nominal size rivets when hole is dimpled.

**LEGEND**
- (d) Indicates rivet diameter in 1/32 inch (0.8 mm) increments.
- (L) Indicates rivet length in 1/16 inch (1.6 mm) increments.
### Table 3-28. Drill and Hole Size Limits for Solid and Blind Rivet Installation

#### NOMINAL SIZE SOLID RIVET

<table>
<thead>
<tr>
<th>Rivet Diameter&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>Drill Size</th>
<th>Standard ED</th>
<th>Hole Size Min/Max&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/32 (2.4) (-3)</td>
<td>No. 40</td>
<td>0.19</td>
<td>0.098-0.102 (2.49-2.59)</td>
</tr>
<tr>
<td>1/8 (3.2) (-4)</td>
<td>No. 30</td>
<td>0.25</td>
<td>0.1285-0.133 (3.26-3.38)</td>
</tr>
<tr>
<td>5/32 (4.0) (-5)</td>
<td>No. 20</td>
<td>0.32</td>
<td>0.161-0.166 (4.094.22)</td>
</tr>
<tr>
<td>3/16 (4.8) (-6)</td>
<td>No. 10</td>
<td>0.38</td>
<td>0.1935-0.199 (4.91-5.05)</td>
</tr>
<tr>
<td>1/4 (6.4) (-8)</td>
<td>F</td>
<td>0.50</td>
<td>0.257-0.262 (6.53-6.65)</td>
</tr>
</tbody>
</table>

#### OVERSIZE SOLID RIVET

<table>
<thead>
<tr>
<th>Rivet Diameter&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>Drill Size</th>
<th>Standard ED</th>
<th>Hole Size Min/Max&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/64 (2.8) (-3)</td>
<td>No. 33</td>
<td>0.22</td>
<td>0.113-0.117 (2.87-2.97)</td>
</tr>
<tr>
<td>9/64 (3.6) (-4)</td>
<td>No. 27</td>
<td>0.29</td>
<td>0.1435-0.148 (3.64-3.76)</td>
</tr>
<tr>
<td>11/64 (4.4) (-5)</td>
<td>No. 16</td>
<td>0.35</td>
<td>0.177-0.182 (4.50-4.62)</td>
</tr>
<tr>
<td>13/64 (5.2) (-6)</td>
<td>No. 1</td>
<td>0.41</td>
<td>0.2255-0.232 (5.72-5.89)</td>
</tr>
<tr>
<td>17/64 (6.7) (-8)</td>
<td>L</td>
<td>0.53</td>
<td>0.288-0.293 (7.32-7.44)</td>
</tr>
</tbody>
</table>

#### NOMINAL SIZE BLIND RIVET

<table>
<thead>
<tr>
<th>Rivet Diameter&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>Drill Size</th>
<th>Standard ED</th>
<th>Hole Size Min/Max&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 (3.2) (-4)</td>
<td>No. 30</td>
<td>0.25</td>
<td>0.129-0.132 (3.28-3.35)</td>
</tr>
<tr>
<td>5/32 (4.0) (-5)</td>
<td>No. 20</td>
<td>0.32</td>
<td>0.160-0.164 (4.06-4.17)</td>
</tr>
<tr>
<td>3/16 (4.8) (-6)</td>
<td>No. 10</td>
<td>0.38</td>
<td>0.192-0.196 (4.88-4.98)</td>
</tr>
</tbody>
</table>

#### OVERSIZE BLIND RIVET

<table>
<thead>
<tr>
<th>Rivet Diameter&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>Drill Size</th>
<th>Standard ED</th>
<th>Hole Size Min/Max&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/64 (3.6) (-4)</td>
<td>No. 27</td>
<td>0.29</td>
<td>0.143-0.146 (3.63-3.71)</td>
</tr>
<tr>
<td>11/64 (4.4) (-5)</td>
<td>No. 16</td>
<td>0.35</td>
<td>0.176-0.180 (4.47-4.57)</td>
</tr>
<tr>
<td>13/64 (5.2) (-6)</td>
<td>No. 5</td>
<td>0.41</td>
<td>0.205-0.209 (5.21-5.31)</td>
</tr>
</tbody>
</table>

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
### Table 3-29. Effective Grip Lengths for Blind Rivets Installation

<table>
<thead>
<tr>
<th>RIVET GRIP</th>
<th>MATERIAL THICKNESS(^{(1)})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PROTRUDING HEAD</td>
</tr>
<tr>
<td></td>
<td>MINIMUM</td>
</tr>
<tr>
<td>-01</td>
<td>See Note 2</td>
</tr>
<tr>
<td>-02</td>
<td>0.063 (1.60)</td>
</tr>
<tr>
<td>-03</td>
<td>0.126 (3.20)</td>
</tr>
<tr>
<td>-04</td>
<td>0.188 (4.78)</td>
</tr>
<tr>
<td>-05</td>
<td>0.251 (6.38)</td>
</tr>
<tr>
<td>-06</td>
<td>0.313 (7.95)</td>
</tr>
<tr>
<td>-07</td>
<td>0.376 (9.55)</td>
</tr>
<tr>
<td>-08</td>
<td>0.438 (11.13)</td>
</tr>
<tr>
<td>-09(^{4})</td>
<td>0.501 (12.73)</td>
</tr>
<tr>
<td>-10</td>
<td>0.563 (14.30)</td>
</tr>
<tr>
<td>-11(^{5})</td>
<td>0.626 (15.90)</td>
</tr>
<tr>
<td>-12(^{6})</td>
<td>0.688 (17.48)</td>
</tr>
</tbody>
</table>

**NOTES:**

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).

2) Do not use protruding head rivets:
   - NAS93xx-4-01 below 0.025 inch (0.64 mm) stackup thickness
   - NAS93xx-5-01 below 0.031 inch (0.79 mm) stackup thickness,
   - NAS93xx-6-01 below 0.037 inch (0.94 mm) stackup thickness.

3) Do not use nominal flush head rivets:
   - NAS9302B-4-02, NAS9303B-4-02, NAS9308M-4-02 below 0.063 inch (1.60 mm) stackup thickness,
   - NAS9302B-5-02, NAS9303B-5-02, NAS9308M-5-02 below 0.065 inch (1.65 mm) stackup thickness,
   - NAS9302B-6-02, NAS9303B-6-02, NAS9308M-6-02 below 0.080 inch (2.03 mm) stackup thickness.
   Do not use oversize flush head rivet:
   - NAS9305B-4-02, NAS9311M-4-02 below 0.045 inch (1.14 mm) stackup thickness,
   - NAS9305B-5-02, NAS9311M-5-02 below 0.063 inch (1.60 mm) stackup thickness,
   - NAS9305B-6-02, NAS9311M-6-02 below 0.073 inch (1.85 mm) stackup thickness.

4) Maximum grip length for all NAS93xx-4 rivets. Maximum grip length for other types of rivets may be different.

5) Maximum grip length for all NAS93xx-5 rivets. Maximum grip length for other types of rivets may be different.

6) Maximum grip length for all NAS93xx-6 rivets. Maximum grip length for other types of rivets may be different.

7) Refer to Appendix A-5.
### Table 3-30. Solid Rivet Identification

<table>
<thead>
<tr>
<th>Head Code</th>
<th>Head Profile</th>
<th>Countersunk Rivet</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>RAISED</td>
<td>MS20426D(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>DIMPLED</td>
<td>MS20426AD(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>RAISED CROSS</td>
<td>MS20426B(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>RAISED DOUBLE DASH</td>
<td>MS20426DD(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>GREEN RAISED</td>
<td>110–174–(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>RECESSED</td>
<td>MS20426E(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>DOUBLE Dimple</td>
<td>MS20427M(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>PLAIN</td>
<td>MS20427F(D)–(L)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Head Code</th>
<th>Head Profile</th>
<th>Protruding Head Rivet</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>RAISED</td>
<td>MS20470D(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>DIMPLED</td>
<td>MS20470AD(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>RAISED CROSS</td>
<td>MS20470B(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>RAISED DOUBLE DASH</td>
<td>MS20470DD(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>GREEN RAISED</td>
<td>110–175–(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>RECESSED</td>
<td>MS20470E(D)–(L)</td>
</tr>
<tr>
<td>○</td>
<td>DOUBLE Dimple</td>
<td>MS20615–(D)M(L)</td>
</tr>
<tr>
<td>○</td>
<td>RECESSED</td>
<td>MS20613–(D)P(L)</td>
</tr>
<tr>
<td>○</td>
<td>PLAIN</td>
<td>MS20613–(D)C(L)</td>
</tr>
</tbody>
</table>

**LEGEND**

- (D) Indicates rivet diameter in 1/32 inch (0.8 mm) increments.
- (L) Indicates rivet length in 1/16 inch (1.6 mm) increments.
3-3-3. INSTALLATION AND REPLACEMENT OF CLOSE TOLERANCE FASTENERS — GENERAL

When replacing a part that is attached with close tolerance fasteners (Hi-Lok and Hi-Shear), it is essential that the hole(s) drilled in the replacement part matches exactly the existing hole(s) in the structure or mating part(s). This must be accomplished without damaging or enlarging the existing hole(s).

**CAUTION**

IT IS NOT ACCEPTABLE TO OVERSIZE A FASTENER THAT IS INSTALLED IN A COLD EXPANDED HOLE WITHOUT PRIOR AUTHORIZATION BY PRODUCT SUPPORT ENGINEERING. REFER TO MODEL-SPECIFIC SRM FOR INDICATION OR A LIST OF WHERE COLD EXPANDED RIVET HOLES ARE LOCATED.

BOLTS OR SCREWS ARE NOT APPROVED AS REPLACEMENT FOR HI-SHEAR OR HI-LOK FASTENERS UNLESS PREVIOUSLY AUTHORIZED IN WRITING BY PRODUCT SUPPORT ENGINEERING.

a. Secure the replacement part in position by clamping or other suitable means.

**CAUTION**

ENSURE THAT THE EXISTING HOLES ARE NOT DAMAGED DURING THE DRILLING PROCESS.

b. Place a drill bushing in one of the existing holes in the mating part and drill a pilot hole through the replacement part. The bushing shall fit snugly in the existing hole to ensure correct positioning of the pilot hole.

**NOTE**

Inspect Hi-Lok and Hi-Shear holes to the requirements of Table 3-33 and Table 3-34 respectively to determine the correct size of Hi-Lok to be used. Bell Helicopter does not generally install Hi-Lok with an interference fit. Use a go-no-go gauge or another suitable test instrument to determine the hole size. Never attempt to install a Hi-Lok in a hole that is too big for the fastener; rather, drill and ream to the next available oversize Hi-Lok ensuring a minimum edge distance of 2D for protruding head Hi-Lok and 2.5D for flush head Hi-Lok is maintained.

c. Remove the drill bushing. Step drill and final ream the hole to the required size. Last step drill to be 0.003 to 0.007 inch (0.08 to 0.18 mm) undersized from the final reamed hole diameter. Deburr and inspect the hole for correct size and possible damage.

d. Insert Hi-Lok in hole and temporarily install collar, but do not apply torque at this time as it will be done later.

e. Repeat step b through step d to install remaining Hi-Loks in pattern.
f. Remove all fasteners. Reinspect all holes for correct size and possible damage.

g. Prepare parts for final assembly. Install all Hi-Lok fasteners in pattern using unreduced epoxy polyamide primer (C-204). Torque collars until the nut drive is fractured.

The following conditions must be met when replacing 5/32 inch (4.0 mm) diameter Hi-Shear fastener with same diameter Hi-Lok fastener due to differences in installation hole size and depth of countersink. Table 3-31 provides the appropriate part numbers and countersink depths while Table 3-33 and Table 3-34 provide the installation hole diameter. In all other cases, Hi-Shear fasteners may be replaced with Hi-Lok fasteners in accordance with Note 1 of Table 3-32.

Table 3-31. Substitution of Shear Type Fasteners with Hi-Loks

<table>
<thead>
<tr>
<th>Fastener Type: Protruding/Flush Pin (Collar)</th>
<th>Depth in Countersink(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi-Shear NAS1054-5-(L) (NAS179 or NAS528)</td>
<td>0.042 (1.07) (NAS1055-5-(L) only)</td>
</tr>
<tr>
<td>Hi-Sheer NAS1055-5-(L) (NAS179 or NAS528)</td>
<td>0.042 (1.07) (NAS1055-5-(L) only)</td>
</tr>
<tr>
<td>Hi-Lok 100-048-5-(L) (30-015 or 30-1392)</td>
<td>0.042 (1.07) (100-076-5-(L) only)</td>
</tr>
<tr>
<td>Hi-Lok 100-076-5-(L) (30-055)</td>
<td>0.042 (1.07) (100-076-5-(L) only)</td>
</tr>
<tr>
<td>Hi-Shear NAS529-(D)-(L)(3) (NAS528)</td>
<td>N/A</td>
</tr>
<tr>
<td>Hi-Lok HL18PB-(D)-(L) (HL94PK-(D))</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
2) Self-aligning (7°) collar assembly.
3) The HL18PB fastener listed in this table is a direct replacement for NAS529 provided the installation hole sizes given in Table 3-33 and Table 3-34 are respected. NAS529 will in no case be used to replace a Hi-Lok fastener.
For replacement with nominal or oversize fasteners, refer to Table 3-32 and Table 3-33.

Table 3-32. Oversize Part Number Equivalencies for Hi-Lok Fasteners

<table>
<thead>
<tr>
<th>TENSION HEAD FASTENERS&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>Standard Size Protruding/Flush Pin (Collar)</th>
<th>1/64 inch Oversize Protruding/Flush Pin (Collar)</th>
<th>1/32 inch Oversize Protruding/Flush Pin (Collar)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INCONEL 718 PIN - 210 KSI TENSILE – 125 KSI SHEAR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell Standard No.</td>
<td>100-049</td>
<td>100-059</td>
<td>(30-017)</td>
</tr>
<tr>
<td>Hi-Lok No.</td>
<td>HL646PB&lt;sup&gt;2&lt;/sup&gt;</td>
<td>HL730PB</td>
<td>(HL73)</td>
</tr>
<tr>
<td></td>
<td>HL647PB&lt;sup&gt;2&lt;/sup&gt;</td>
<td>HL731PB</td>
<td>(HL73W)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>431 STAINLESS STEEL PIN – 125 KSI SHEAR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell Standard No.</td>
<td></td>
<td>N/A</td>
<td>(30-015)</td>
</tr>
<tr>
<td>Hi-Lok No.</td>
<td>HL32PB</td>
<td>HL33PB</td>
<td>(HL86KP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ALLOY STEEL PIN - 160-180 KSI TENSILE – 95 KSI SHEAR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell Standard No.</td>
<td>100-048</td>
<td>100-047</td>
<td>(30-015)</td>
</tr>
<tr>
<td>Hi-Lok No.</td>
<td>HL20PB</td>
<td>HL21PB</td>
<td>(HL86KP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SHEAR HEAD FASTENERS&lt;sup&gt;(1)&lt;/sup&gt; (FLUSH FASTENER WITH SHALLOW HEAD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ALLOY STEEL PIN - 160-180 KSI TENSILE - 95 KSI SHEAR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell Standard No.</td>
<td>100-076</td>
<td>(30-055)</td>
<td>N/A</td>
</tr>
<tr>
<td>Hi-Lok No.</td>
<td>HL19PB</td>
<td>(HL94)</td>
<td>(HL94W)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) The 100-048 and 100-076 fasteners listed in this table are direct replacements for NAS1054 and NAS1055 respectively, provided the limitations given in Table 3-31 are met and hole diameters respected. NAS1054 and NAS1055 will in no case be used to replace a Hi-Lok fastener. Refer to Table 3-33 and Table 3-34 for installation hole sizes.

2) Part numbers that are struck-through are no longer used by Bell Helicopter. Contact Product Support Engineering before using these part numbers.
### Table 3-33. Selected Hole Diameters for Hi-Lok Fasteners

<table>
<thead>
<tr>
<th>Shank Diameter</th>
<th>Reamed Hole Diameter Min/Max</th>
<th>Shank Diameter</th>
<th>Reamed Hole Diameter Min/Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/32 Nominal$^1$</td>
<td>0.1635/0.1655</td>
<td>3.97 Nominal$^1$</td>
<td>4.153/4.204</td>
</tr>
<tr>
<td>3/16 Nominal</td>
<td>0.1895/0.1915</td>
<td>4.76 Nominal</td>
<td>4.813/4.864</td>
</tr>
<tr>
<td>3/16 + 1/64 Oversize</td>
<td>0.2026/0.2046</td>
<td>4.76 + 0.40 Oversize</td>
<td>5.146/5.197</td>
</tr>
<tr>
<td>3/16 + 1/32 Oversize</td>
<td>0.2182/0.2202</td>
<td>4.76 + 0.80 Oversize</td>
<td>5.542/5.593</td>
</tr>
<tr>
<td>1/4 Nominal</td>
<td>0.2495/0.2515</td>
<td>6.35 Nominal</td>
<td>6.337/6.388</td>
</tr>
<tr>
<td>1/4 + 1/64 Oversize</td>
<td>0.2651/0.2671</td>
<td>6.35 + 0.40 Oversize</td>
<td>6.734/6.784</td>
</tr>
<tr>
<td>1/4 + 1/32 Oversize</td>
<td>0.2807/0.2827</td>
<td>6.35 + 0.80 Oversize</td>
<td>7.130/7.181</td>
</tr>
<tr>
<td>5/16 Nominal</td>
<td>0.3120/0.3140</td>
<td>7.94 Nominal</td>
<td>7.925/7.976</td>
</tr>
<tr>
<td>5/16 + 1/64 Oversize</td>
<td>0.3276/0.3296</td>
<td>7.94 + 0.40 Oversize</td>
<td>8.321/8.372</td>
</tr>
<tr>
<td>5/16 + 1/32 Oversize</td>
<td>0.3432/0.3452</td>
<td>7.94 + 0.80 Oversize</td>
<td>8.717/8.768</td>
</tr>
</tbody>
</table>

1) No oversize fastener exists for -5 (5/32 inch (4.0 mm) diameter) Hi-Lok: use a -6 nominal (3/16 inch (4.8 mm) diameter) Hi-Lok for next oversize.

### Table 3-34. Selected Hole Diameters for NAS529, NAS1054, and NAS1055 Hi-Shear Fasteners

<table>
<thead>
<tr>
<th>Shank Diameter</th>
<th>Reamed Hole Diameter Min/Max</th>
<th>Shank Diameter</th>
<th>Reamed Hole Diameter Min/Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 Nominal</td>
<td>0.1240/0.1260</td>
<td>3.18 Nominal</td>
<td>3.150/3.200</td>
</tr>
<tr>
<td>5/32 Nominal</td>
<td>0.1560/0.1580</td>
<td>3.97 Nominal</td>
<td>3.962/4.013</td>
</tr>
<tr>
<td>3/16 Nominal</td>
<td>0.1895/0.1915</td>
<td>4.76 Nominal</td>
<td>4.813/4.864</td>
</tr>
<tr>
<td>1/4 Nominal</td>
<td>0.2495/0.2515</td>
<td>6.35 Nominal</td>
<td>6.337/6.388</td>
</tr>
<tr>
<td>5/16 Nominal</td>
<td>0.3120/0.3140</td>
<td>7.94 Nominal</td>
<td>7.925/7.976</td>
</tr>
</tbody>
</table>
3-3-4. INSTALLATION AND REPLACEMENT OF BLIND BOLTS — GENERAL

Generally, replacement Huck blind bolts (MS21140, MS21141, MS90353, MS90354, OSR, etc.) and Cherry Aerospace maxibolts (CR7310, CR7311, CR7340, CR7341, CR7620, CR7621, CR7650, CR7651, etc.) shall be of the same type and size as the original fastener removed except when hole damage, repair alteration, or field conditions (e.g., lack of proper equipment or tooling) require a change within these guidelines.

CAUTION

BOLTS OR SCREWS ARE NOT APPROVED AS REPLACEMENT FOR BLIND BOLT FASTENERS UNLESS PREVIOUSLY AUTHORIZED IN WRITING BY PRODUCT SUPPORT ENGINEERING.

NOTE

Except when Product Support Engineering or the applicable repair procedure allows otherwise, universal head Huck blind bolts and Cherry maxibolts require a minimum edge distance of 2D (2.5D for fiber reinforced composite parts) be maintained. Countersunk Huck blind bolts and Cherry maxibolts require a minimum edge distance of 2.5D be maintained.

a. Installation of blind bolts.

NOTE

A maximum of 0.005 inch (0.13 mm) countersink on blind side of hole is acceptable when deburring blind bolt holes.

Blind bolts are installed in a similar way as other blind rivets. These blind bolts must be placed in a pneumatic single or double action installation gun and the stem is drawn up forcing the sleeve to expand and hold the blind bolt in place.

b. Grip length identification.

NOTE

For MS fasteners that contain a “U” code in part number, always use black side of a grip gauge to determine required fastener length prior to installation. This is necessary to ensure correct installation.

For MS Huck blind bolts and CR maxibolts, the grip length is indicated by a number on the fastener head while the grip length of an OSR Huck rivet is indicated by a letter on the bottom of the rivet pin. For relation between grip length identification numbers and letters, refer to Table 3-37 and Table 3-38.

c. Hole preparation.

Inspect blind bolt holes to the requirements of Table 3-35 to determine the correct size of blind bolt to be used. Use a go-no-go gauge or another suitable test instrument to determine the hole size. Never attempt to install a blind bolt in a hole that is too big for the fastener.
d. Replacing blind bolts with oversized fasteners.

In the case where a blind bolt hole diameter is above the tolerances specified in Table 3-35, it is acceptable to replace the blind bolt with a 1/64 inch (0.40 mm) oversize as shown in Table 3-37 provided that adequate edge distance (2D for protruding head in metallic parts, 2.5D for protruding head in fiber reinforced composite parts, and 2.5D for flush head) and fastener spacing (4D for protruding head in metallic parts, 5D for protruding head in fiber reinforced composite parts, and 5D for flush head) is maintained. Other fastener substitution may be offered by Product Support Engineering but must be considered on a case by case basis.

e. Part number examples.

CR7620S-05-02  CR7620 Cherry maxi bolt, flush head, single action tool required, 5/32 inch (3.97 mm) nominal diameter, 0.094 to 0.157 inch (2.39 to 3.99 mm) grip range.

MS90353S0502  MS90354 Huck blind bolt, flush head, single action tool required, 5/32 inch (3.97 mm) nominal diameter, 0.094 to 0.157 inch (2.39 to 3.99 mm) grip range.

Table 3-35. Selected Hole Diameters for MS Huck Rivets and CR Maxibolts

<table>
<thead>
<tr>
<th>Rivet Part Number</th>
<th>Drill Size (No Reaming Required)</th>
<th>Inch</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Shank Diameter</td>
<td>Hole Diameter Min/Max</td>
</tr>
<tr>
<td>CR7310/CR7311</td>
<td>No. 30¹</td>
<td>1/8</td>
<td>0.129/0.132</td>
</tr>
<tr>
<td>CR7620/CR7621</td>
<td></td>
<td>5/32</td>
<td>0.164/0.167</td>
</tr>
<tr>
<td>CR7770/CR7771</td>
<td>No. 8</td>
<td>3/16</td>
<td>0.199/0.202</td>
</tr>
<tr>
<td>CR7773/CR7774</td>
<td>G</td>
<td>1/4</td>
<td>0.260/0.263</td>
</tr>
<tr>
<td>MS21140/MS21141</td>
<td>5/16</td>
<td>0.312/0.315</td>
<td></td>
</tr>
<tr>
<td>MS90353/MS90354</td>
<td>OSR</td>
<td>1/4</td>
<td>0.271/0.275</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5/16</td>
<td>0.342/0.348</td>
</tr>
</tbody>
</table>

NOTES:

1) Applicable for CR7620, CR7621, CR7770, CR7771, and CR7773 only.

2) Applicable for CR7310, CR7311, CR7620, and CR7621.
### Table 3-36. MS Huck Rivets and CR Maxibolts Equivalency and Oversize

<table>
<thead>
<tr>
<th>PROTRUDING HEAD</th>
<th>FLUSH HEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMINAL</td>
<td>OVERSIZE</td>
</tr>
<tr>
<td>MS</td>
<td>CR</td>
</tr>
<tr>
<td>MS90354</td>
<td>CR7311</td>
</tr>
<tr>
<td>MS21141</td>
<td>CR7621</td>
</tr>
</tbody>
</table>

### Table 3-37. Effective Grip Lengths for MS Huck Rivet and CR Maxibolt Installation

<table>
<thead>
<tr>
<th>MS HUCK RIVET GRIP</th>
<th>MATERIAL THICKNESS(1)</th>
<th>PROTRUDING HEAD</th>
<th>FLUSH HEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MS90354, CR7311, CR7341, CR7621, CR7651, CR7771</td>
<td>MS90353, CR7310, CR7340, CR7620, CR7650, CR7770, CR7774</td>
</tr>
<tr>
<td></td>
<td>MINIMUM</td>
<td>MAXIMUM</td>
<td>MINIMUM</td>
</tr>
<tr>
<td>01², 5</td>
<td>0.031 (0.79)</td>
<td>0.095 (2.41)</td>
<td>N/A</td>
</tr>
<tr>
<td>02³, 5</td>
<td>0.094 (2.39)</td>
<td>0.157 (3.99)</td>
<td>0.094 (2.39)</td>
</tr>
<tr>
<td>03⁵</td>
<td>0.156 (3.96)</td>
<td>0.220 (5.59)</td>
<td>0.156 (3.96)</td>
</tr>
<tr>
<td>04</td>
<td>0.219 (5.56)</td>
<td>0.282 (7.16)</td>
<td>0.219 (5.56)</td>
</tr>
<tr>
<td>05</td>
<td>0.281 (7.14)</td>
<td>0.345 (8.76)</td>
<td>0.281 (7.14)</td>
</tr>
<tr>
<td>06</td>
<td>0.344 (8.74)</td>
<td>0.407 (10.34)</td>
<td>0.344 (8.74)</td>
</tr>
<tr>
<td>07</td>
<td>0.406 (10.31)</td>
<td>0.470 (11.94)</td>
<td>0.406 (10.31)</td>
</tr>
<tr>
<td>08</td>
<td>0.469 (11.91)</td>
<td>0.532 (13.51)</td>
<td>0.469 (11.91)</td>
</tr>
<tr>
<td>09⁶</td>
<td>0.531 (13.49)</td>
<td>0.595 (15.11)</td>
<td>0.531 (13.49)</td>
</tr>
<tr>
<td>10</td>
<td>0.594 (15.09)</td>
<td>0.657 (16.69)</td>
<td>0.594 (15.09)</td>
</tr>
<tr>
<td>11</td>
<td>0.656 (16.66)</td>
<td>0.720 (18.29)</td>
<td>0.656 (16.66)</td>
</tr>
<tr>
<td>12</td>
<td>0.719 (18.26)</td>
<td>0.782 (19.86)</td>
<td>0.719 (18.26)</td>
</tr>
</tbody>
</table>

**NOTES:**

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).

2) Only available for (-04) 1/8 inch (3.2 mm) diameter and (-05) 5/32 inch (4.0 mm) diameter protruding head fasteners.

3) Not available for (-08) 1/4 inch (6.4 mm) diameter and (-10) 5/16 inch (7.9 mm) diameter flush head fasteners.

4) Minimum grip for (-04) 1/8 inch (3.2 mm) diameter is 0.094 inch (2.39 mm), for (-05) 5/32 inch (4.0 mm) diameter is 0.094 inch (2.39 mm), and for (-06) 3/16 inch (4.8 mm) diameter is 0.120 inch (3.05 mm).

5) Not available for (-10) 5/16 inch (7.9 mm) diameter flush head fasteners.

f. Part number example.

OSR-8-C OSR Huck rivet, protruding head, 1/4 inch (6.35 mm) diameter, 0.201 to 0.250 inch (5.11 to 6.35 mm) grip range.

Table 3-38. Effective Grip Lengths for OSR Huck Rivet Installation

<table>
<thead>
<tr>
<th>OSR HUCK RIVET GRIP</th>
<th>MATERIAL THICKNESS(^{(1)})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OSR-8</td>
</tr>
<tr>
<td></td>
<td>MINIMUM</td>
</tr>
<tr>
<td>a</td>
<td>0.051 (1.30)</td>
</tr>
<tr>
<td>A</td>
<td>0.101 (2.57)</td>
</tr>
<tr>
<td>B</td>
<td>0.151 (3.84)</td>
</tr>
<tr>
<td>C</td>
<td>0.201 (5.11)</td>
</tr>
<tr>
<td>D</td>
<td>0.251 (6.38)</td>
</tr>
<tr>
<td>E</td>
<td>0.301 (7.65)</td>
</tr>
<tr>
<td>F</td>
<td>0.351 (8.92)</td>
</tr>
<tr>
<td>G</td>
<td>0.401 (10.19)</td>
</tr>
<tr>
<td>H</td>
<td>0.451 (11.46)</td>
</tr>
<tr>
<td>J</td>
<td>0.501 (12.73)</td>
</tr>
<tr>
<td>K</td>
<td>0.551 (14.00)</td>
</tr>
<tr>
<td>L</td>
<td>0.601 (15.27)</td>
</tr>
<tr>
<td>M</td>
<td>0.651 (16.54)</td>
</tr>
<tr>
<td>N</td>
<td>0.701 (17.81)</td>
</tr>
</tbody>
</table>

**NOTE:**

1) All dimensions are in inches. Values between parentheses are in millimeters (mm).
3-4. RIVET PATTERN DISCREPANCIES

There are cases in repairs when conditions occur that deviate from established standards for fastener installation. Some deviations are required to allow use of parts that otherwise would have to be replaced. This section covers such cases and their respective corrective action. Refer to paragraph 3-4-1 through paragraph 3-4-6 for repairs.

**WARNING**

THE REPAIRS IN THIS SECTION DO NOT APPLY TO COLD EXPANDED HOLES.

**CAUTION**

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

**NOTE**

When repairs specify use of adhesive, the mating surfaces of the parts to be bonded must be prepared and bonded in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-25.

1. NEGLIGIBLE DAMAGE

   • Rivet short edge distance. Refer to Application A of paragraph 3-4-1.

2. REPAIRABLE DAMAGE

   • Rivet short edge distance. Refer to Application B, Application C, and Application D of paragraph 3-4-1 and paragraph 3-4-5.

   • Cracked rivet hole (paragraph 3-4-2 and paragraph 3-4-5).

   • Elongated, mismatched or oversized rivet hole (paragraph 3-4-3).

   • Mislocated rivet hole in flange. Refer to Application C and Application D of paragraph 3-4-1, paragraph 3-4-4, and paragraph 3-4-6.
3-4-1. RIVET SHORT EDGE DISTANCE

APPLICATION A: LOW EDGE DISTANCE FOR ONE OUT OF FIVE RIVETS

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum of one rivet in any five consecutive rivets may be affected.

1.3 For rivet holes not exceeding 0.144 inch (3.66 mm) diameter.

1.4 Condition "X" shown in Figure 3-36 is not permitted.

1.5 A minimum of 0.050 inch (1.27 mm) edge required for flush rivets, as shown in Figure 3-36.

1.6 Rivets to maintain minimum edge distance and spacing in all components of structure to which they are common:

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
<th>Composite Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
<td>Minimum Rivet Spacing</td>
</tr>
<tr>
<td>Protruding</td>
<td>1D</td>
<td>3D</td>
</tr>
<tr>
<td>Flush</td>
<td>1.5D</td>
<td>4D</td>
</tr>
</tbody>
</table>

1.7 Not applicable to close tolerance fasteners (e.g., Hi-Lok, Hi-Shear, etc.).

1.8 Not applicable to forgings, castings, machined parts, or control tubes.

2.0 REQUIRED

2.1 None.

3.0 PROCEDURE

3.1 Use as is.
3.4.1. Rivet Short Edge Distance

Figure 3-36. Rivet Common to Replacement Part Installed with Low Edge Distance — Repair

- No part of rivet head may extend past edge of part.
- Condition 'X' not permitted.
- .050 minimum edge required for flush rivet heads.
- One rivet diameter minimum.

Note: One rivet with minimum edge distance out of five rivets is acceptable.
APPLICATION B: LOW EDGE DISTANCE FOR UP TO 10 CONSECUTIVE RIVETS

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not to exceed 10 consecutive rivet holes or 50% of rivet pattern, whichever is less.

1.3 Condition "X" shown in Figure 3-37 is not permitted.

1.4 A minimum of 0.050 inch (1.27 mm) edge required for flush rivets, as shown in Figure 3-37.

1.5 Added rivets are not to interfere with later installations.

1.6 Not applicable to bonded panels, extrusions, castings, forgings, control tubes, or where close tolerance fasteners are used.

1.7 Added rivets to maintain standard edge distance and spacing in all components of structure to which they are common. If this condition is not met, it may be possible to repair using instructions detailed in Application C or Application D.

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
<th>Composite Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
<td>Minimum Rivet Spacing</td>
</tr>
<tr>
<td>Protruding</td>
<td>2D</td>
<td>4D</td>
</tr>
<tr>
<td>Flush</td>
<td>2.5D</td>
<td>5D</td>
</tr>
</tbody>
</table>

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Same type and size rivets as used in immediate area. Refer to Table 3-30 for rivet identification.

2.2 Epoxy polyamide primer (C-204).

2.3 High corrosion inhibitor sealant (C-251).

2.4 Process Sheet(s):
- Dimpling Process for Flush Rivets (paragraph 3-2-18)
- Drilling Glass or Carbon Fiber Composites (paragraph 4-2-5)

3.0 PROCEDURE

3.1 Drill for new rivets specified in 2.1. Interpitch added rivets of same type and size as original rivets in immediate area, maintaining edge distance and spacing shown in Figure 3-37. Refer to Table 3-28 for appropriate rivet hole size.

3.2 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.3 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.
3.4 Install all new rivets wet with sealant specified in 2.3.

3.5 Apply primer specified in 2.2 to bare metal surfaces. Allow to dry.
Figure 3-37. Oversized Rivet Installed with Low Edge Distance — Repair
APPLICATION C: LOW EDGE DISTANCE OR ELONGATED HOLE FOR UP TO 10 CONSECUTIVE RIVETS WITH SHORT OVERLAP ON FLAT PART

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not to exceed 10 consecutive rivet holes or 50% of rivet pattern, whichever is less.

1.3 Condition “X” shown in Figure 3-38 is not permitted.

1.4 A minimum of 0.050 inch (1.27 mm) edge required for flush rivets, as shown in Figure 3-38.

1.5 Added rivets or doubler are not to interfere with later installations.

1.6 Not applicable to bonded panels, extrusions, castings, forgings, control tubes, fiber reinforced composite parts, or where close tolerance fasteners are used.

1.7 Added rivets to maintain standard edge distance and spacing in all components of structure to which they are common.

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
<td>Minimum</td>
<td>Minimum Doubler Width</td>
</tr>
<tr>
<td>Protruding</td>
<td>2D</td>
<td>4D</td>
<td>8D</td>
</tr>
<tr>
<td>Flush</td>
<td>2.5D</td>
<td>5D</td>
<td>10D</td>
</tr>
</tbody>
</table>

1.8 Replacement oversized rivets shall meet the following requirements. If this condition is not met, part may be repaired by combining this repair with another repair given in paragraph 3-4-1 provided that all restrictions for both repairs are met.

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
<td>Minimum Rivet Spacing</td>
</tr>
<tr>
<td>Protruding</td>
<td>1.5D</td>
<td>4D</td>
</tr>
<tr>
<td>Flush</td>
<td>2D</td>
<td>5D</td>
</tr>
</tbody>
</table>

1.9 Oversize rivets for elongated holes are not applicable where flush rivet holes are dimpled.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than discrepant part. Dimension doubler to extend a minimum of one rivet on either side of discrepant holes pattern plus 0.38 inch (9.7 mm) minimum edge distance, where possible, otherwise a minimum of three rivets of same type and size as existing rivets is required. Width to be dimensioned as shown in Figure 3-38. Refer to Appendix A-2-1 for appropriate material part number.
2.2 If required for elongated holes, replace oversized rivet of same type and material but 1/64 inch (0.4 mm) or 1/32 inch (0.8 mm) larger diameter as rivets removed. Refer to Table 3-30 for rivet identification.

2.3 Same type and size rivets as used in immediate area. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).

2.8 Process Sheet(s):
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Dimpling Process for Flush Rivets (paragraph 3-2-18)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
- Vacuum Bagging Metallic Repairs (paragraph 3-2-26)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Prepare -1 doubler specified in 2.1. If required, extend -1 doubler beyond edge of discrepant area by a maximum of 1D to obtain adequate edge distance.

3.3 Locate -1 doubler in position and drill for fasteners specified in 2.2, and if required 2.3 at existing and new locations, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

NOTE

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove "peel ply" and lightly sand composite bond material prior to bonding.

3.6 Prepare faying surfaces of -1 doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.7 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.
NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.8 Secure -1 doubler using new fasteners specified in 2.2, and if required 2.3, grip length to suit.

3.9 Remove excess adhesive squeeze-out.

3.10 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used (refer to paragraph 3-2-26).

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.11 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.12 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.13 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.14 Refinish as required.

NOTE
Unless flush rivets are absolutely necessary, additional rivets may be protruding head rivets even if affected rivets are flush.
Figure 3-38. Low Edge Distance by Addition of a Flat Doubler — Repair
APPLICATION D: LOW EDGE DISTANCE OR ELONGATED HOLE FOR UP TO 10 CONSECUTIVE RIVETS WITH SHORT OVERLAP ON FLANGED PART

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not to exceed 10 consecutive rivet holes or 50% of rivet pattern, whichever is less.

1.3 Condition “X” shown in Figure 3-38 and Figure 3-39 is not permitted.

1.4 A minimum of 0.050 inch (1.27 mm) edge required for flush rivets, as shown in Figure 3-39.

1.5 Added rivets or doubler are not to interfere with later installations.

1.6 Not applicable to extrusions, castings, forgings, control tubes, fiber reinforced composite parts, or where close tolerance fasteners are used.

1.7 Rivets to maintain standard edge distance and spacing in all components of structure to which they are common.

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
</tr>
<tr>
<td>Protruding</td>
<td>2D</td>
</tr>
<tr>
<td>Flush</td>
<td>2.5D</td>
</tr>
</tbody>
</table>

1.8 Oversize rivets for elongated holes are not applicable where flush rivet holes are dimpled, unless repair doubler is installed (Figure 3-38) and requirements, for new flush countersunk (not dimpled) rivets could be used as indicated in paragraph 3-2-18, are met. Conical washers must be used to fill dimple using instructions detailed in paragraph 3-2-17.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 flanged doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker, of sufficient length to extend a minimum of one rivet on either side of discrepant holes plus 0.38 inch (9.7 mm) edge distance with a minimum of three existing rivets. Width to be dimensioned, as shown in Figure 3-39. Refer to Appendix A-2-1 for appropriate material part number. As an alternate, formed repair angle (Bell standard 151-028) may also be used. Refer to Appendix A-2-2 for appropriate part number.

NOTE

Unless flush rivets are absolutely necessary, added rivets may be protruding head rivet even if affected rivets are flush.

2.2 Same type and size rivets as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).
2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
- Preparation of Bonding Surfaces
- Bonding of Flat Stock
- Dimpling Process for Flush Rivets
- Forming of Flat Sheet Metal
- Preparing and Mixing Two-part Epoxy Resin by Weight

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Prepare -1 doubler specified in 2.1. If required, extend flange of -1 doubler beyond edge of discrepant area by a maximum of 1D to obtain adequate edge distance. If required, form -1 doubler using instructions detailed in paragraph 3-2-23.

3.3 Locate -1 doubler in position and drill for fasteners specified in 2.2 at existing and new locations, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

If applicable, remove “peel ply” and lightly sand composite bond material prior to bonding.

3.6 Prepare faying surfaces of -1 doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.7 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.8 Secure -1 doubler using new fasteners specified in 2.2, grip length to suit.

3.9 Remove excess adhesive squeeze-out.
3.10  Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used (refer to paragraph 3-2-26).

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.11  Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.12  Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.13  If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.14  Refinish as required.
Figure 3-39. Low Edge Distance by Addition of a Flanged Doubler — Repair

- 1 doubler

.38 min ed typ

4d min

1d max flange extension

No part of rivet head may extend past edge of part

Condition 'X' not permitted

.050 minimum edge required for countersunk rivet heads

Thickness "t" plus one gauge

Low edge distance locations

Minimum edge distance refer to restriction 1.7

All-SRM-3-04-01D-1
3-4-2. **CRACKED RIVET HOLE**

This application is for crack in skin or flanged member extending from rivet hole to edge of material.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum of one cracked hole is allowed in every five consecutive holes. Not applicable to close tolerance fastener holes or to cracks entering holes at a tangent.

1.3 Cracked holes may not exceed 5% of rivet pattern.

1.4 Crack may not extend past rivet hole. Refer to paragraph 3-4-5 when crack is at last rivet of a flanged part.

1.5 Maximum material thickness of 0.032 inch (0.81 mm).

1.6 Not applicable to fiber reinforced composite parts.

1.7 Rivets to maintain standard edge distance and spacing in all components of structure to which they are common, as follows:

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
</tr>
<tr>
<td>Protruding</td>
<td>2D</td>
</tr>
<tr>
<td>Flush</td>
<td>2.5D</td>
</tr>
</tbody>
</table>

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker, of sufficient length to extend a minimum of two rivets on either side of crack plus 0.38 inch (9.7 mm) edge distance. Width to extend from bend tangent to edge of part and maintain adequate edge distance (Figure 3-40). Refer to Appendix A-2-1 for appropriate material part number.

2.2 Same type and size rivets as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Prepare -1 doubler specified in 2.1.

3.3 Locate -1 doubler above damaged rivet hole. Pick up at least two rivets on each side of damaged hole.

3.4 Transfer existing fastener holes same size as originals, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.5 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.7 Prepare faying surfaces of -1 doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.8 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive specified in 2.4 while -1 doubler adhesive is still wet.

3.9 Secure -1 doubler using fasteners specified in 2.2, grip length to suit.

3.10 Remove excess adhesive squeeze-out.

3.11 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used (refer to vacuum bagging under paragraph 3-2-26).
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.12 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.13 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.14 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.15 Refinish as required.
Figure 3-40. Cracked Rivet Holes — Repair
3-4-3. ELONGATED, MISMATCHED, OR OVERSIZED RIVET HOLE

APPLICATION A: RIVET PATTERN DISCREPANCY THAT CAN BE REPAIRED WITH AN OVERSIZED RIVET

This application is for elongated, mismatched, or oversized rivet hole in sheet metal and fiber reinforced composite parts that can be cleaned up by drilling through and using oversized rivet.

NOTE

If both rivet edge distance and pitch can be maintained in accordance with paragraph 3-3-1, step 1 and paragraph 3-3-1, step 4 on all affected holes, through all components, then there are no restrictions to the number of fastener holes affected.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum of 50% of the rivet pattern when using 1/64 inch (0.4 mm) or 1/32 inch (0.8 mm) diameter larger than existing rivet pattern, for a maximum of five consecutive holes.

1.3 Maximum of 25% of the rivet pattern when using 1/16 inch (1.6 mm) diameter larger than existing rivet pattern, for a maximum of five consecutive holes.

1.4 Valid for "AD", "B", and "Cherry" aluminum rivets only for metallic and glass fiber reinforced composite parts. Valid for steel blind bolts and "Cherry" monel rivets only for carbon fiber reinforced composite parts.

1.5 Replacement oversized rivets shall meet the following requirements. If this condition is not met, part may be repaired by combining this repair with a repair given in paragraph 3-4-1 provided that all restrictions for both repairs are met.

1.6 Not applicable to extrusions, forgings, castings, and machined parts unless specifically approved by Product Support Engineering.

1.7 Not applicable where close tolerance fasteners are used.

1.8 Not applicable where flush fastener holes are dimpled.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Oversized rivet of same type and material but 1/64 inch (0.4 mm) or 1/32 inch (0.8 mm) larger diameter as rivets removed. Refer to Table 3-30 for rivet identification.

2.2 Epoxy polyamide primer (C-204).
2.3 High corrosion inhibitor sealant (C-251).

2.4 Process Sheet(s):
   Drilling Glass or Carbon Fiber Composites (paragraph 4-2-5)

3.0 PROCEDURE

3.1 Drill for new fasteners specified in 2.1 at existing fastener locations, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.2 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.3 Verify that all holes are round and free of burrs.

3.4 Install all new rivets wet with sealant specified in 2.3.

3.5 Apply primer specified in 2.2 to bare metal surfaces. Allow to dry.
3.4.3. Elongated, Mismatched, or Oversized Rivet Hole

Figure 3-41. Elongated Hole by Oversizing — Repair
APPLICATION B: REPAIR OF MISMATCHED HOLE THAT WOULD REQUIRE ADDITION OF RIVET EXCEEDING 1/16 INCH (1.6 MM) OVERSIZE DIAMETER

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not to exceed 5 consecutive rivet holes or 50% of rivet pattern, whichever is less.

1.3 Added repair rivets shall respect the following requirements. In the case of a pattern with mixed rivet types (flush and protruding), limitations from worse case shall be used.

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Metallic Parts</th>
<th>Composite Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum Edge Distance</td>
<td>Minimum Distance Between Discrepent Hole and Added Rivet</td>
</tr>
<tr>
<td>Protruding</td>
<td>2D</td>
<td>2D</td>
</tr>
<tr>
<td>Flush</td>
<td>2.5D</td>
<td>2.5D</td>
</tr>
</tbody>
</table>

1.4 Added rivets are not to interfere with later installations.

1.5 Not applicable where close tolerance fasteners are used.

1.6 Not applicable to forgings, castings, and machined parts unless specifically approved by Product Support Engineering.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Same type and size rivets as used in immediate area. Refer to Table 3-30 for rivet identification.

2.2 Epoxy polyamide primer (C-204).

2.3 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.4 Process Sheet(s):
   - Dimpling Process for Flush Rivets (paragraph 3-2-18)
   - Drilling Glass or Carbon Fiber Composites (paragraph 4-2-5)

3.0 PROCEDURE

3.1 Drill for new rivets specified in 2.1. Interpitch added rivets of same type and size as original rivets in immediate area, maintaining edge distance and spacing shown in Figure 3-42. Refer to Table 3-28 for appropriate rivet hole size.

3.2 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
3.3 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.4 Verify that all holes are round and free of burrs.

3.5 Install all new rivets wet with sealant specified in 2.3.

3.6 Fill mismatched holes with sealant specified in 2.3. Allow to dry.

3.7 Apply primer specified in 2.2 to bare metal surfaces. Allow to dry.

3.8 Refinish as required.
3-4.3. ELONGATED, MISMATCHED, OR OVERSIZED RIVET HOLE

Figure 3-42. Mismatched Holes Requiring Addition of a Fastener — Repair

FILL MISMATCHED HOLES WITH SEALANT

MINIMUM SPACING BETWEEN ADDED RIVET AND EXISTING RIVET TO BE AS PER RESTRICTION 1.3 (EQUALLY SPACED PROVIDED THAT ABOVE MINIMUM IS MET)

ADDED RIVET OF SAME TYPE AS ORIGINALS

MINIMUM SPACING BETWEEN MISLOCATED HOLE AND ADDED RIVET TO BE AS PER RESTRICTION 1.3
3-4-4. MISLOCATED HOLE IN FLANGE NEAR RADIUS OF FORMED FLANGE

This application is for mislocated hole where fastener would normally ride or interfere with radius or dimension "A" (Figure 3-43).

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not applicable to angles with radius greater than 0.188 inch (4.78 mm) without prior written approval from Product Support Engineering.

1.3 Rivet hole cannot fall in radius of angle.

1.4 Not applicable to forgings, castings, and machined parts unless specifically approved by Product Support Engineering.

1.5 Not applicable to flush rivet holes.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

NOTE

It is acceptable to use a metal radius block, made from an aerospace grade aluminum alloy, on fiberglass material.

Flat stock sheet metal, of appropriate thickness, may be used in lieu of extrusion material.

2.1 -1 radius block of like material. Minimum thickness (T) to be same as bend radius (R) of angle. Length to be sufficient to pick up a minimum of one rivet or fastener plus 0.38 inch (9.7 mm) edge distance on each side of mislocated hole. Radius one corner to match bend radius (R) of angle.

2.2 Same type and size rivets or fasteners as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
   Preparation of Bonding Surfaces (paragraph 3-2-5)
   Bonding of Flat Stock (paragraph 3-2-7)
   Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
3.0 PROCEDURE

3.1 Gain access to discrepant area recording type, size, and location of fasteners removed.

3.2 Prepare -1 radius block specified in 2.1.

3.3 Locate -1 radius block in position over mislocated hole. Pick up a minimum of one fastener plus 0.38 inch (9.7 mm) edge distance on each side of mislocated hole.

3.4 Transfer existing fastener holes same size as originals, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.5 Remove -1 radius block. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.6 Prepare faying surfaces of -1 radius block and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.7 Locate -1 radius block in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 radius block adhesive is still wet.

3.8 Secure -1 radius block using fasteners specified in 2.4, grip length to suit.

3.9 Remove excess adhesive squeeze-out.

3.10 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight or clamps.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.11 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.12 Prime all bare metal surfaces using material specified in 2.4. Allow to dry.

3.13 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.14 Refinish as required.
3.4.4. MISLOCATED HOLE IN FLANGE NEAR RADIUS OF FORMED FLANGE

WHERE "A" ≥ "R" + 0.6 x RIVET HEAD DIAMETER

Figure 3-43. Mislocated Hole in Flange — Repair
3-4-5. SHORT EDGE DISTANCE OR CRACK IN FLANGE AT END RIVET HOLE

This application is for cases where end fastener of bulkhead or frame flange would be installed with a low edge distance condition or cases where a crack extends from end fastener hole to edge of part flange.

APPLICATION A: REPAIR BY INTERPITCHING A NEW RIVET

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Added rivet shall have equal or greater edge distance than removed part and respect the following requirements:

<table>
<thead>
<tr>
<th>Rivet Head Type</th>
<th>Minimum Edge Distance</th>
<th>Minimum Rivet Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protruding</td>
<td>2D</td>
<td>4D</td>
</tr>
<tr>
<td>Flush</td>
<td>2.5D</td>
<td>5D</td>
</tr>
</tbody>
</table>

1.3 Not applicable where close tolerance fasteners are used.

1.4 Maximum flange thickness of 0.100 inch (2.54 mm).

1.5 Applicable only to sheet metal type structure.

1.6 Not applicable to flange ending with a joggle.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Same type and size rivet or fastener as discrepant rivet removed. Refer to Table 3-30 for rivet identification (quantity 2).

2.2 Epoxy polyamide primer (C-204).

2.3 High corrosion inhibitor sealant (C-251).

2.4 Process Sheet(s):
Dimpling Process for Flush Rivets (paragraph 3-2-18)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

CAUTION

DO NOT DAMAGE SURROUNDING STRUCTURE.

3.2 Cut out and remove damaged section of flange. Cutout to remove a minimum of material to provide clearance for fastener head. Ensure cutout does not extend into bend radius of flange and ensure 0.25 inch (6.4 mm) minimum corner radius (Figure 3-44).
3.3 Drill for new rivet specified in 2.1. Interpitch added rivet of same type and size as original rivets in immediate area, maintaining edge distance and spacing given in restriction in 1.2. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 If required, countersink/dimple new hole for installation of added rivet using instructions detailed in paragraph 3-2-18. Dimpling may require removal of part from its permanent location. If part may not be removed, install a radius block using instructions detailed in paragraph 3-4-2.

3.6 Verify that all holes are round and free of burrs.

3.7 Install new rivet wet with sealant specified in 2.3.

3.8 Plug remaining open hole in skin or web at discrepant hole location by installing same type and size rivet as original. Rivet to be installed wet with sealant specified in 2.3.

3.9 Remove excess sealant squeeze-out.

3.10 Prime all bare metal surfaces using material specified in 2.2. Allow to dry.

3.11 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.3. Allow to dry. Reprime sealant.

3.12 Refinish as required.
Figure 3-44. Short Edge Distance or Crack at Flange End Fastener — Repair
APPLICATION B: REPAIR BY REPLACING UNAFFECTED COUNTERSUNK OR PROTRUDING HEAD RIVET WITH OVERSIZED RIVET

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.
1.2 Not applicable where close tolerance fasteners or flush rivets are used.
1.3 Maximum flange thickness of 0.100 inch (2.54 mm).
1.4 Applicable only to sheet metal type structure.
1.5 Not applicable to flange ending with a joggle.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Same type and size rivet or fastener as discrepant rivet removed. Refer to Table 3-30 for rivet identification (Quantity 1).
2.2 Oversized rivets, 1/32 inch (0.8 mm) larger diameter of same type and material as those originally removed. Refer to Table 3-30 for rivet identification (Quantity 2).
2.3 Epoxy polyamide primer (C-204).
2.4 High corrosion inhibitor sealant (C-251).

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

CAUTION

DO NOT DAMAGE SURROUNDING STRUCTURE.

3.2 Cut out and remove damaged section of flange. Cutout to remove a minimum of material to provide clearance for fastener head. Ensure cutout does not extend into bend radius of flange and ensure 0.25 inch (6.4 mm) minimum corner radius (Figure 3-45).
3.3 Drill for two new oversized rivets specified in 2.2 at existing locations, maintaining adequate edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.
3.4 Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
3.5 Verify that all holes are round and free of burrs.
3.6 Install two new rivets specified in 2.2 wet with sealant specified in 2.3.
3.7 Plug remaining open hole in skin or web at discrepant hole location by installing same type and size rivet as original. Rivet to be installed wet with sealant specified in 2.3.
3.8  Remove excess sealant squeeze-out.
3.9  Prime all bare metal surfaces using material specified in 2.3. Allow to dry.
3.10 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.4. Allow to dry. Reprime sealant.
3.11 Refinish as required.
Figure 3-45. Short Edge Distance or Crack at Flange End Fastener — Alternate Repair
3-4-6. MISLOCATED HOLE IN ALUMINUM REPLACEMENT PART

This application is for repairing hole drilled in the wrong location in aluminum replacement part.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum of 50% of the rivet pattern for a maximum of five consecutive holes.

1.3 Applicable to sheet metal type structures excluding extrusions, forgings, castings, and machined parts.

1.4 Applicable only to 3/32 inch (2.4 mm) diameter holes.

1.5 Not applicable to flush rivet hole installed with countersink or dimple in discrepant part.

1.6 Minimum material thickness of 0.020 inch (0.51 mm) for single flush plug rivet and 0.025 inch (0.64 mm) for double flush plug rivet.

1.7 Added rivets are not to interfere with later installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 MS20426A3 rivet, grip length to suit.

2.2 Epoxy polyamide primer (C-204).

2.3 High corrosion inhibitor sealant (C-251).

3.0 PROCEDURE

3.1 Drill new rivet hole(s), maintaining proper edge distance and spacing shown in Figure 3-46. Refer to Table 3-28 for appropriate rivet hole size.

3.2 Touch countersink hole(s) to be plugged in faying surface of part for installation of flush rivet.

NOTE

Ensure a minimum of 0.005 inch (0.13 mm) untouched material remains between touch countersinks.

3.3 Optionally for material thickness of 0.025 inch (0.64 mm) or thicker, touch countersink hole(s) to be plugged in opposite surface of part for installation of double flush rivet.

3.4 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 Plug discrepant hole(s) using material specified in 2.1 wet with sealant specified in 2.3.

3.6 Shave rivet head(s) flush with contour of part.

3.7 Prime all bare metal surfaces using material specified in 2.2. Allow to dry.
Figure 3-46. Mislocated Rivet Hole in Detail Part — Repair

1.5D MIN OF LARGEST DIAMETER
(OPEN HOLE OR EXISTING
ADJACENT FASTENER)

TOUCH COUNTERSINK AND
PLUG HOLE WITH MS20426A3 RIVET.
RIVET TO BE SINGLE OR DOUBLE
FLUSH WITH RIVET HEAD SHAVED
FLUSH TO CONTOUR.
3-5. ANGLE SECTION REPAIRS

This section covers typical repairs of angles. Angles are typically used as stiffeners or frame flanges. Refer to paragraph 3-5-1 through paragraph 3-5-4 for repairs.

CAUTION

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

NOTE

When repairs specify use of adhesive, the mating surfaces of the parts to be bonded must be prepared and bonded in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-25.

1. NEGLIGIBLE DAMAGE
   - N/A

2. REPAIRABLE DAMAGE
   - Flange crack (paragraph 3-5-1 and paragraph 3-5-2).
   - Radius crack (paragraph 3-5-3 and paragraph 3-5-4).
3-5-1. FLANGE DAMAGE TO ANGLES

APPLICATION A: FOR DAMAGE IN ANGLE, NOT EXCEEDING 1/3 OF FLANGE WIDTH AND 1.0 INCH (25.4 MM) IN LENGTH

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Cleanup cannot extend into rivet hole.

1.3 Repair will not interfere with subsequent installations.

1.4 Cleanup not to exceed limits shown (maximum of 1/3 flange width, and length of 1.00 inch maximum) (Figure 3-47).

1.5 Maximum flange thickness of 0.040 inch (1.02 mm).

1.6 Not applicable where close tolerance fasteners are used.

1.7 Not applicable where flush fastener holes are dimpled.

1.8 Applicable to extrusions and formed sheet metal angles.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 strap doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker, of sufficient length to pick up three rivets on either side of damage plus 0.38 inch (9.7 mm) edge distance. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 Rivet of same type and material but one size larger rivets as rivets used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Plug rivet using MS20426A rivet of same diameter as rivet used in immediate area, grip length to suit (if required).

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).

2.8 Process Sheet(s):
Preparation of Bonding Surfaces (paragraph 3-2-5)
Bonding of Flat Stock (paragraph 3-2-7)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of angle using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of crack(s).

3.3 Blend out damage ensuring smooth transition. Maintain 0.13 inch (3.3 mm) minimum corner radii.

3.4 Perform fluorescent penetrant inspection of angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack(s) do not protrude past cleanup.

3.5 Prepare -1 strap doubler specified in 2.1.

3.6 Locate -1 strap doubler in position. Pick up a minimum of three fasteners on each side of blend-out.

**NOTE**

Do not transfer fastener hole adjacent to blendout into -1 strap doubler.

3.7 Transfer existing fastener holes one size larger than originals, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.8 Remove -1 strap doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.9 For angle of 0.025 inch (0.64 mm) or thicker, plug fastener hole adjacent to blendout using instructions described below. Angle or mating part that cannot be plugged with a rivet may be plugged using sealant specified in 2.7 at same time as edges of repair are sealed at step 3.17.

**NOTE**

Ensure a minimum of 0.005 inch (0.13 mm) untouched material remains between touch countersinks.

3.9.1 If applicable, touch countersink both surfaces of existing angle at fastener hole adjacent to blendout.

**NOTE**

Ensure a minimum of 0.005 inch (0.13 mm) untouched material remains between touch countersinks.

3.9.2 If applicable, touch countersink faying surface of mating part at fastener hole adjacent to blendout. Optionally for mating part with material thickness of 0.025 inch (0.64 mm) or more, touch countersink hole to be plugged in both surfaces for installation of double flush rivet. Dimpling may require removal of part from its permanent location.
3.9.3 Plug open fastener hole adjacent to blendout in angle and/or mating part by installing double flush rivet(s) specified in 2.3. Rivet(s) to be installed wet with bonding adhesive specified in 2.5.

3.9.4 If required, shave rivet head(s) flush with contour of part.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.10 Prepare faying surfaces of -1 strap doubler and angle for bonding using instructions detailed in paragraph 3-2-5.

3.11 Locate -1 strap doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 strap doubler adhesive is still wet.

3.12 Secure -1 strap doubler using fasteners specified in 2.2, grip length to suit.

3.13 Remove excess adhesive squeeze-out.

3.14 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight or clamps.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.15 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.16 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.17 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. If required, plug hole into angle and/or mating part thinner than 0.025 inch (0.64 mm) with sealant. Allow to dry. Reprime sealant.

3.18 Refinish as required.
Figure 3-47. Edge Crack in Angle Frame — Strap Doubler Repair

- Plug hole with flush rivet
- Damage not to extend into rivet hole
- 1/3 flange width maximum after cleanup
- Oversized rivets
- Radius cutout to .13 min
- .38 min Ed 2 places
- 1.00 max
- 1.5D min
- Radius

3-5-1. FLANGE DAMAGE TO ANGLES
APPLICATION B: EXTENSIVE FLANGE DAMAGE TO ANGLE

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Limited to angles with rivets installed in one leg only.

1.3 Repair will not interfere with subsequent installations.

1.4 Leg of original angle without rivet holes must be sufficiently wide to provide a minimum edge distance of 1.5 times the rivet diameter (1.5D) for protruding head rivets.

1.5 Maximum flange thickness of 0.032 inch (0.81 mm) thick.

1.6 Not applicable to curved parts.

1.7 Not applicable to extrusions or where close tolerance fasteners are used.

1.8 Applicable to formed sheet metal angles only.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 angle filler made from an angle of same material and thickness as original to replace removed damaged section. As an alternate, formed repair angle (Bell standard 151-028) may be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 -2 splice angle made from same material and one gauge thicker than original angle. Length of splice angle to be sufficient to overlap damaged area by a minimum of four rivets plus 0.38 inch (9.7 mm) edge distance in each flange, on each side of discrepant area. As an alternate, composite bond material (150-021-xxB) may be used, refer to Appendix A-2-1 for appropriate part number, and formed using instructions detailed in paragraph 3-2-23. As another alternate, formed repair angle (Bell standard 151-028) may also be used. Refer to Appendix A-2-2 for appropriate part number.

2.3 Oversized rivet of same type and material but 1/64 inch (0.4 mm) or 1/32 inch (0.8 mm) larger diameter as rivets used in immediate area. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).

2.8 Process Sheet(s):
Preparation of Bonding Surfaces (paragraph 3-2-5)
Bonding of Flat Stock (paragraph 3-2-7)
Forming of Flat Sheet Metal (paragraph 3-2-23)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**CAUTION**

DO NOT DAMAGE SURROUNDING STRUCTURE.

3.2 Cut out and remove damaged section of angle.

3.3 Prepare -1 angle filler specified in 2.1.

3.4 Prepare -2 splice angle specified in 2.2. If required, form flange doubler using instructions detailed in paragraph 3-2-23.

3.5 Locate -1 angle filler in position.

3.6 Locate -2 splice angle in position maintaining a minimum edge distance of 1.5D. Pick up a minimum of four fasteners on each side of damaged area on all flanges.

3.7 Drill for new fasteners specified in 2.3 at existing and new locations, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.8 Remove -1 angle filler and -2 splice angle. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**NOTE**

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

If applicable, remove “peel ply” and lightly sand composite bond material prior to bonding.

3.9 Prepare faying surfaces of -1 angle filler, -2 splice doubler, and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.10 Locate -1 angle filler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

3.11 Locate -2 splice angle in position and bond to existing angle and -1 angle filler using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

**NOTE**

Install all rivets wet with adhesive while -1 angle filler and -2 splice angle adhesive is still wet.

3.12 Secure -1 angle filler and -2 splice angle using new and existing fasteners specified in 2.3, grip length to suit.
3.13 Remove excess adhesive squeeze-out.

3.14 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight or clamps.

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.15 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.16 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.17 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.18 Refinish as required.
Figure 3-48. Extensive Damage to Angle Flange — Splice Repair

ATTACHING STRUCTURE

DAMAGED SECTION TO BE REMOVED

1.5D MIN ED TYP

.50 MIN

-1 ANGLE FILLER

DAMAGED ANGLE

4 RIVETS MINIMUM ON EACH SIDE OF DAMAGE IN BOTH FLANGES, TYP

-2 SPLICE ANGLE

.38 MIN ED TYP

PICK UP EXISTING RIVET PATTERN IF POSSIBLE.
3-5-2. EXTENSIVE DAMAGE TO END OF ANGLE

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Repair will not interfere with subsequent installations.

1.3 For fasteners interfering with radius of angle doubler, install radius block in accordance with paragraph 3-4-4.

1.4 Not applicable to angles greater than 0.032 inch (0.81 mm) thick.

1.5 Not applicable where close tolerance fasteners are used in splice overlap pattern.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 splice angle made from same material and thickness as original angle. Length of splice angle to be sufficient to overlap existing angle by a minimum of five rivets plus 0.38 inch (9.7 mm) edge distance in each flange. As an alternate, composite bond material (150-021-xxB) may be used (refer to Appendix A-2-1 for appropriate part number) and formed using instructions detailed in paragraph 3-2-23. As another alternate, formed repair angle (Bell standard 151-028) may also be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 -2 filler blocks, if required, made from same material as existing angle and of sufficient thickness to match existing joggle. As an alternate, composite bond material (150-021-xxB) of same material and thickness may be used. Refer to Appendix A-2-1 for appropriate material part number.

2.3 Oversized rivets of same type and material but 1/64 inch (0.4 mm) or 1/32 inch (0.8 mm) larger diameter as rivets used in immediate area. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).

2.8 Process Sheet(s):

Preparation of Bonding Surfaces (paragraph 3-2-5)
Bonding of Flat Stock (paragraph 3-2-7)
Forming of Flat Sheet Metal (paragraph 3-2-23)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**CAUTION**

DO NOT DAMAGE SURROUNDING STRUCTURE.

3.2 Cut out and remove damaged end of angle.

3.3 Prepare -1 splice angle specified in 2.1. If required, form flange doubler using instructions detailed in paragraph 3-2-23.

**NOTE**

Install -2 filler blocks, if required, to restore in-plane condition. Filler blocks to be bonded and riveted using a minimum of two rivets on end of straight angle and all splice rivets on end of joggled angle.

3.4 If required, prepare -2 filler blocks specified in 2.2.

3.5 Locate -1 splice angle and, if required, -2 filler blocks in position maintaining a minimum edge distance of 1.5D. Pick up a minimum of five fasteners on existing angle on all flanges.

3.6 Drill for new fasteners specified in 2.3 at existing locations, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 splice angle and, if required, -2 filler blocks. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**NOTE**

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

If applicable, remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 splice angle, parent structure and, if required, -2 filler blocks for bonding using instructions detailed in paragraph 3-2-5.

3.9 Locate -1 splice angle and, if required, -2 filler blocks in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

**NOTE**

Install all rivets wet with adhesive while -1 splice angle adhesive is still wet.

3.10 Secure -1 splice angle and, if required, -2 filler blocks using new fasteners specified in 2.3, grip length to suit.
3.11 Remove excess adhesive squeeze-out.

3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight or clamps.

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.14 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.15 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.16 Refinish as required.
Figure 3-49. Angles — Splice Repair
3-5-3. LENGTHWISE CRACK IN BEND RADIUS OF ANGLES

APPLICATION A: FOR CRACK OF 25 TIMES FLANGE THICKNESS (25T) OR LESS ALONG LENGTH OF BEND RADIUS OF FORMED MEMBER

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not applicable where repair doubler would be closer than 3.0 inches (76 mm) from end of member, or end of splice fitting.

1.3 Not applicable to curved angle unless repair angle is made from a section of a new spare part of identical part number or equivalent as approved by Product Support Engineering.

1.4 Repair will not interfere with subsequent installations.

1.5 Crack length not to exceed 25 times the thickness of damaged flange.

1.6 Maximum flange thickness of 0.032 inch (0.81 mm).

1.7 Not applicable to extrusions or where close tolerance fasteners are used.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 angle doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than original angle. Refer to Appendix A-2-1 or appropriate material part number. Length to be sufficient to overlap existing angle by a minimum of two rivets plus 0.38 inch (9.7 mm) edge distance beyond end of crack on each side of damage in both flanges. As an alternate, formed repair angle (Bell standard 151-028) may also be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
Preparation of Bonding Surfaces (paragraph 3-2-5)
Bonding of Flat Stock (paragraph 3-2-7)
Forming of Flat Sheet Metal (paragraph 3-2-23)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.


3.3 Stop drill each end of crack with No. 30 drill.

3.4 Perform fluorescent penetrant inspection of existing angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack(s) do not protrude past stop drill holes.

3.5 Prepare -1 angle doubler specified in 2.1. If required, form flange doubler using instructions detailed in paragraph 3-2-23.

3.6 Locate -1 angle doubler about damaged area. Pick up a minimum of two rivets beyond the end of the crack on each side of damaged area, on each flange, as well as all rivets along the length of the crack.

3.7 Drill for new/existing fasteners specified in 2.2 maintaining proper edge distance and spacing. Transfer existing fastener holes same size as originals. Ensure that rivet installation does not interfere with radius of -1 angle doubler. Refer to Table 3-28 for appropriate rivet hole size.

3.8 Remove -1 angle doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**NOTE**
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.9 Prepare faying surfaces of -1 angle doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.10 Locate -1 angle doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

**NOTE**
Install all rivets wet with adhesive while -1 angle doubler adhesive is still wet.

3.11 Secure -1 angle doubler using fasteners specified in 2.2, grip length to suit.

3.12 Remove excess adhesive squeeze-out.

3.13 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight.
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.14 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.15 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.16 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.17 Refinish as required.
Figure 3-50. Small Longitudinal Crack in Angle — Repair
APPLICATION B: FOR CRACK GREATER THAN 25 TIMES FLANGE THICKNESS (>25T) ALONG LENGTH OF BEND RADIUS OF FORMED MEMBER

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Repair will not interfere with subsequent installations.

1.3 Not applicable to curved angle unless repair angle is made from a section of a new spare part of identical part number or equivalent as approved by Product Support Engineering.

1.4 Maximum flange thickness of 0.032 inch (0.81 mm).

1.5 Not applicable where close tolerance fasteners are used.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 angle made from formed repair angle (Bell standard 151-028) of same material and one gauge thicker than original angle. Refer to Appendix A-2-2 for appropriate part number.

2.2 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Dimpling Process for Flush Rivets (paragraph 3-2-18)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

CAUTION

DO NOT DAMAGE SURROUNDING STRUCTURE.

3.2 Cut off and remove discrepant flange at bend radius, as shown in Figure 3-51. Maintain 2D minimum edge distance with any existing rivet hole(s).

3.3 Prepare -1 angle specified in 2.1.
3.4 Locate -1 formed angle in position and drill for new fasteners specified in 2.2, maintaining proper edge distance and spacing. Transfer existing fastener holes same size as originals. Ensure that rivet installation does not interfere with radius of -1 formed angle. Refer to Table 3-28 for appropriate rivet hole size.

3.5 Remove -1 formed angle. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

**NOTE**
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.7 Prepare faying surfaces of -1 angle and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.8 Locate -1 angle in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

**NOTE**
Install all rivets wet with adhesive while -1 angle adhesive is still wet.

3.9 Secure -1 angle using fasteners specified in 2.2, grip length to suit.

3.10 Remove excess adhesive squeeze-out.

3.11 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight or clamps.

**NOTE**
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.12 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.13 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.14 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.15 Refinish as required.
3-5-3. LENGTHWISE CRACK IN BEND RADIUS OF ANGLES

Figure 3-51. Long Crack in Flange of Formed Member — Repair

NOTES:
1. "X" DIMENSION = "T" + .76 + "R".
2. "W" DIMENSION = CUTOFF WIDTH.
3. LENGTH DETERMINED BY DISCREPANT MEMBER.

ALL-SRM-3-05-03B-1
3-5.4. CRACK IN DOUBLE-FORMED FLANGE

APPLICATION A: FOR REPAIR OF CRACK IN THE CORNER OF A DOUBLE-FORMED FLANGE.

1.0 Restriction

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Crack length not to exceed eight times the thickness (8T) of the damaged flange before cleanup. Crack exceeding 8T in length may be repaired using Application B.

2.0 Required (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Epoxy polyamide primer (C-204).

3.0 Procedure

3.1 Gain access to damaged area recording type, size, and location of fasteners removed, if applicable.

3.2 Perform fluorescent penetrant inspection of angle using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of crack(s).

3.3 Radius out crack with 1/8 inch (3.2 mm) diameter cutter. Cleanup not to exceed end of crack by more than one time the material thickness (1T) for a maximum of nine times the thickness (9T) total.

3.4 Deburr edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 Perform fluorescent penetrant inspection of angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack(s) do not protrude past cleanup.

3.6 Prime all bare metal surfaces using material specified in 2.1. Allow to dry.

3.7 Refinish as required.
3.5.4. Crack in Double-Formed Flange

Figure 3-52. Small Crack in Corner of Double Flanged Member — Repair
APPLICATION B: FOR REPAIR OF CRACK IN THE CORNER OF A DOUBLE-FORMED FLANGE EXCEEDING LIMITATIONS STATED IN APPLICATION A

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Crack length not to exceed 25 times the thickness (25T) of the damaged part or 1.0 inch (25.4 mm), whichever is less.

1.3 Repair will not interfere with subsequent installations.

1.4 Maximum flange thickness of 0.050 inch (1.27 mm).

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 double-formed flange doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than original angle. Refer to Appendix A-2-1 for appropriate material part number. Length of flanges to be sufficient to overlap existing double-formed flange by a minimum of two rivets plus 0.38 inch (9.7 mm) edge distance in both flanges.

2.2 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
   - Preparation of Bonding Surfaces (paragraph 3-2-5)
   - Bonding of Flat Stock (paragraph 3-2-7)
   - Dimpling Process for Flush Rivets (paragraph 3-2-18)
   - Forming of Flat Sheet Metal (paragraph 3-2-23)
   - Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of double-formed flange using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of crack(s).

3.3 Stop drill end of crack with No. 30 drill.

3.4 Perform fluorescent penetrant inspection of double-formed angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack does not protrude past stop drill.
3.5 Prepare -1 double-formed flange doubler specified in 2.1. Form flange doubler using instructions detailed in paragraph 3-2-23.

**NOTE**

If no rivets are present in damaged area, install rivets of same type, size, and pitch as surrounding structure. A minimum of two rivets per surface is required, as shown in Figure 3-53.

3.6 Locate -1 double-formed flange doubler in position and drill for new fasteners specified in 2.2, maintaining proper edge distance and spacing. Transfer existing fastener holes same size as originals. Ensure that rivet installation does not interfere with radius of -1 double-formed flange doubler. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 double-formed flange doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.8 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

**NOTE**

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.9 Prepare faying surfaces of -1 double-formed flange doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.10 Locate -1 double-formed flange doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

**NOTE**

Install all rivets wet with adhesive while -1 double-formed flange doubler adhesive is still wet.

3.11 Secure -1 double-formed flange doubler using fasteners specified in 2.2, grip length to suit.

3.12 Remove excess adhesive squeeze-out.

3.13 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair using dead weight or clamps.
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.14 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.15 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.16 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.17 Refinish as required.
3.5.4. Crack in Double-Formed Flange

Figure 3-53. Cracks Longer Than 8T in Corner of Double Formed Angle — Repair
3-6. WEB AND SKIN REPAIRS

This section covers typical repairs of web and skin. Web and skin are susceptible to a variety of damage, including oil canning, cracks, punctures, and dents. Refer to paragraph 3-6-1 through paragraph 3-6-6 for repairs.

CAUTION

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

NOTE

When repairs specify use of adhesive, the mating surfaces of the parts to be bonded must be prepared and bonded in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-25.

1. NEGLIGIBLE DAMAGE
   • N/A

2. REPAIRABLE DAMAGE
   • Oil canning (paragraph 3-6-1 and paragraph 3-6-2).
   • Cracks in webs and skins (paragraph 3-6-3).
   • Small punctures (paragraph 3-6-4).
   • Cracks at lightening holes (paragraph 3-6-5).
   • Dents (paragraph 3-6-6).
3-6-1. “OIL CAN” CONDITION IN EXTERIOR SKIN OR WEB

This section covers typical repairs for cases where web and unsupported skin create a false contour or “oil can” effect.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum skin thickness of 0.032 inch (0.81 mm).

1.3 Damage not to extend into stiffeners or other supporting structure.

1.4 Applicable only to external skin or web between stringers, stiffeners, frames, and longerons.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 angle made from same material and thickness as adjacent members of sufficient length to span between bulkheads or stringers. Flange width sufficient to allow a minimum of 0.38 inch (9.7 mm) edge distance for rivets. As an alternate, formed repair angle (Bell standard 151-028) may also be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 -2 clips (quantity 2) made from same material and thickness as -1 angle. Length and width to allow a minimum of two rivets per flange plus 0.38 inch (9.7 mm) edge distance. As an alternate, formed repair angle (Bell standard 151-028) may also be used. Refer to Appendix A-2-2 for appropriate part number.

2.3 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 Epoxy polyamide primer (C-204).

2.6 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
   Dimpling Process for Flush Rivets (paragraph 3-2-18)
   Forming of Flat Sheet Metal (paragraph 3-2-23)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Prepare -1 angle specified in 2.1. If required, form angle using instructions detailed in paragraph 3-2-23.

3.3 Prepare -2 clips (quantity 2) specified in 2.2. If required, form clips using instructions detailed in paragraph 3-2-23.
3.4 Locate -1 angle and -2 clips (quantity 2) in position through center of “oil can” area on inner
surface and drill for new fasteners specified in 2.3, maintaining proper edge distance and
spacing. If required, transfer existing fastener holes same size as originals. Refer to Table 3-28
for appropriate rivet hole size.

3.5 Remove -1 angle and -2 clips (quantity 2). Deburr all holes and edges. Deburr not to exceed
0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and
to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for
countersink/dimpled flush rivets installation.

3.7 Prime all bare metal surfaces of -1 angle and -2 clips (quantity 2) using material specified in 2.5.
Allow to dry.

**NOTE**
Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a
moistened rag is recommended.

Do not remove primer from parent structure. Use touch-up primer if required.

3.8 Prepare faying surfaces of -1 angle, -2 clips (quantity 2) and parent structure for sealing by
thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.6. Surfaces shall
be wiped dry with a clean dry cloth before solvent evaporates.

3.9 Locate -1 angle and -2 clips (quantity 2) in position against parent structure using a thin layer
(0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.6. Sealant shall be
uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall
be spread to cover entire surface. Sufficient sealant shall be applied to provide positive
squeeze-out after clamping or fastening.

**NOTE**
Install all rivets wet with sealant while -1 angle and -2 clip(s) sealant is still wet.

3.10 Secure -1 angle and -2 clips (quantity 2) using fasteners specified in 2.3, grip length to suit.

3.11 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm)
minimum width fillet bead along entire joint.

3.12 Allow to cure at room temperature for 24 hours.

3.13 Prime all bare metal surfaces and sealant fillet bead using material specified in 2.5. Allow to dry.

3.14 Refinish as required.
Figure 3-54. Oil Canning of Skin or Web by Addition of a Stiffener — Repair

-2 CLIP (QTY 2) ATTACH TO SUPPORT STRUCTURE AT BOTH ENDS OF -1 ANGLE

.90 TO 1.30
1.12 DESIRED TYP

8D TYP

.62 MIN

.38 MIN ED TYP

-1 ANGLE

SKIN OR WEB, REF

OIL CAN CONDITION

ALL–SRM–3–06–01–1
3-6-2. **“OIL CAN” CONDITION IN BULKHEAD**

This section covers typical repairs for cases where unsupported web of bulkhead create a false contour or “oil can” effect.

**APPLICATION A: REPAIR BY ADDITION OF A DOUBLER**

1. **RESTRICTIONS**

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Minimum rivet edge distance and spacing are available with ends of doubler extending past damaged area by a minimum of 1.50 inches (38.1 mm).

1.3 Minimum rivet edge distance is available to accommodate a single row of rivets around each lightening hole over which the doubler extends.

1.4 Flanges of bulkhead are not buckled or damaged.

1.5 “Oil can” not to exceed 8.0 inches (203 mm) in diameter.

1.6 Consecutive “oil cans” to be separated by a minimum of 4.00 inches (101.6 mm) edge to edge. Consecutive “oil cans” not meeting this restriction are to be considered as one.

1.7 Applicable only to sheet metal type structure.

1.8 Repair will not interfere with subsequent installations.

1.9 No more than two lightening holes in any one bulkhead can be covered by repair doubler.

1.10 Not applicable to repair cracks in bulkheads.

2. **REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)**

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxC) of same material and one gauge thicker than bulkhead. Doubler to match contour of bulkhead and overlap “oil can” condition by a minimum of 1.50 inches (38.1 mm) on either side of damage plus 0.38 inch (9.7 mm) edge distance. If installed on flanged side of lightening holes, provide clearance for hole and bulkhead flange radii in doubler. Refer to Appendix A-2-1 for appropriate material part number.

2.2 Same type and size rivets as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 Epoxy polyamide primer (C-204).

2.5 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.6 Process Sheet(s):
   Dimpling Process for Flush Rivets (paragraph 3-2-18)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed. Remove from bulkhead, clips, rivets, decals, etc. that may interfere with doubler installation.

3.2 Prepare -1 doubler specified in 2.1.

3.3 Locate -1 doubler in position on bulkhead and drill for new fasteners specified in 2.2, maintaining 0.38 inch (9.7 mm) edge distance and 8D spacing. If required, transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.6 Prime all bare metal surfaces of -1 doubler using material specified in 2.4. Allow to dry.

NOTE
Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Do not remove primer from bulkhead. Use touch-up primer if required.

3.7 Prepare faying surfaces of -1 doubler and bulkhead for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.3. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.

3.8 Locate -1 doubler in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.5. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

NOTE
Install all rivets wet with sealant while -1 doubler sealant is still wet.

3.9 Secure -1 doubler using fasteners specified in 2.2, grip length to suit.

3.10 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.

3.11 Allow to cure at room temperature for 24 hours.

3.12 Prime all bare metal surfaces and sealant fillet bead using material specified in 2.4. Allow to dry.

3.13 Reinstall all parts removed in step 3.1 and refinish as required.
NOTE:
NOT APPLICABLE TO REPAIR CRACKS IN BULKHEAD.

OIL CAN CONDITION
8.00 MAX DIA

1.50 MIN OVERLAP TYP

.38 MIN ED TYP

.38 R TYP

1 DOUBLE

.90 TO 1.30
1.12 DESIRED TYP

Figure 3-55. Oil Can Condition in a Bulkhead — Doubler Repair
APPLICATION B: REPAIR BY ADDITION OF A SINGLE STIFFENER (WHENEVER APPLICATION “A” IS NOT PRACTICAL)

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Minimum rivet edge distance and spacing are available with ends of doubler extending past damaged area by a minimum of 1.50 inches (38.1 mm).

1.3 Flanges of bulkhead are not buckled.

1.4 “Oil can” not to exceed 8.0 inches (203 mm) in diameter.

1.5 Consecutive “oil cans” to be separated by a minimum of 4.00 inches (101.6 mm) edge to edge. Consecutive “oil cans” not meeting this restriction are to be considered as one.

1.6 Applicable only to sheet metal type structure.

1.7 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 reinforcing angle made from an angle of same material and thickness as discrepant part. As an alternate, Bell standard 151-028 may be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 Epoxy polyamide primer (C-204).

2.5 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.6 Process Sheet(s):
   Dimpling Process for Flush Rivets
   Forming of Flat Sheet Metal

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed. Remove from bulkhead, clips, rivets, decals, etc. that may interfere with doubler installation.

3.2 Prepare -1 reinforcing angle specified in 2.1. Reinforcing angle to have 0.75 inch (19.1 mm) wide and 0.50 inch (12.7 mm) high flanges. If required, form reinforcing angle using instructions detailed in paragraph 3-2-23.

3.3 Locate -1 reinforcing angle in position through center of “oil can” area and drill for new fasteners specified in 2.2, maintaining proper edge distance and spacing. If required, transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.
3.4 Remove -1 reinforcing angle. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.6 Prime all bare metal surfaces of -1 reinforcing angle using material specified in 2.4. Allow to dry.

**NOTE**

Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Do not remove primer from parent structure. Use touch-up primer if required.

3.7 Prepare faying surfaces of -1 reinforcing angle and parent structure for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.3. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.

3.8 Locate -1 reinforcing angle in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.5. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

**NOTE**

Install all rivets wet with sealant while -1 reinforcing angle sealant is still wet.

3.9 Secure -1 reinforcing angle using new fasteners specified in 2.2, grip length to suit.

3.10 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.

3.11 Allow to cure at room temperature for 24 hours.

3.12 Prime all bare metal surfaces and sealant fillet bead using material specified in 2.4. Allow to dry.

3.13 Reinstall all parts removed in step 3.1 and refinish as required.
Figure 3-56. Oil Canning by Addition of a Stiffener — Repair

NOTE:
-1 REINFORCING ANGLE SHALL NOT EXTEND PAST BEND RADIUS OF BULKHEAD

.50 MAX TYP

.90 TO 1.30
1.12 DESIRED TYP

.38 MIN ED TYP

4.00 MIN

1.50 MIN OVERLAP TYP

OIL CAN CONDITION 8.00 MAX DIA

OIL CAN CONDITION 8.00 MAX DIA

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APPLICATION C: REPAIR BY ADDITION OF STIFFENERS (WHENEVER REQUIREMENTS OF APPLICATION B CANNOT BE MET)

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Minimum rivet edge distance and spacing are available with ends of doubler extending past damaged area by a minimum of 1.50 inches (38.1 mm).

1.3 Flanges of bulkhead are not buckled.

1.4 Applicable only to sheet metal type structure.

1.5 “Oil can” not to exceed 8.0 inch (203 mm) diameter.

1.6 Consecutive “oil cans” to be separated by a minimum of 4.00 inches (101.6 mm) edge to edge. Consecutive “oil cans” not meeting this restriction are to be considered as one.

1.7 A maximum distance of 12.0 inches (305 mm) between stiffeners is authorized for this repair.

1.8 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 reinforcing angles (Qty. 2) made from an angle of same material and thickness as discrepant part. As an alternate, Bell standards 150-021 and 151-028 may be used. Refer to Appendix A-2-1 and Appendix A-2-2 for appropriate part number.

2.2 -2 reinforcing channel made from a channel extrusion of same material and thickness as discrepant part. As an alternate, Bell standards 150-021 and 151-028 may be used. Refer to Appendix A-2-1 and Appendix A-2-2 for appropriate part number.

2.3 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 Epoxy polyamide primer (C-204).

2.6 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
Dimpling Process for Flush Rivets (paragraph 3-2-18)
Forming of Flat Sheet Metal (paragraph 3-2-23)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed. Remove from bulkhead, clips, rivets, decals, etc. that may interfere with doubler installation.

3.2 Prepare -1 reinforcing angles (Qty. 2) specified in 2.1. Reinforcing angles to have 0.75 inch (19.1 mm) wide and 0.50 inch (12.7 mm) high flanges. If required, form reinforcing channel using instructions detailed in paragraph 3-2-23.

3.3 Prepare -2 reinforcing channel specified in 2.2. Reinforcing channel to have 1.50 inches (38.1 mm) wide and 0.50 inch (12.7 mm) high flanges. If required, form reinforcing channel using instructions detailed in paragraph 3-2-23.

3.4 Locate -1 reinforcing angles (Qty. 2) on each side of “oil can” area. Locate -2 reinforcing channel in position through center of “oil can” area and drill for new fasteners specified in 2.3, maintaining proper edge distance and spacing. If required, transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.5 Remove -1 reinforcing angles (Qty. 2) and -2 reinforcing channel. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.7 Prime all bare metal surfaces of -1 reinforcing angles (Qty. 2) and -2 reinforcing channel using material specified in 2.5. Allow to dry.

NOTE
Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Do not remove primer from parent structure. Use touch-up primer if required.

3.8 Prepare faying surfaces of -1 reinforcing angles (Qty. 2), -2 reinforcing channel and parent structure for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.4. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.

3.9 Locate -1 reinforcing angles (Qty. 2) and -2 reinforcing channel in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.6. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

NOTE
Install all rivets wet with sealant while -1 reinforcing angles sealant is still wet.

3.10 Secure -1 reinforcing angles (Qty. 2) and -2 reinforcing channel using new fasteners specified in 2.3, grip length to suit.

3.11 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.
3.12 Allow to cure at room temperature for 24 hours.

3.13 Prime all bare metal surfaces and sealant fillet beads using material specified in 2.5. Allow to dry.

3.14 Reinstall all parts removed in step 3.1 and refinish as required.
Figure 3-57. Oil Canning by Addition of Stiffeners — Repair
3-6-3. EDGE TEAR OR CRACK IN SKIN, WEB, AND PANEL

APPLICATION A: REPAIR OF EDGE TEAR OR CRACK IN SKIN, WEB, OR METALLIC-FACED PANEL NOT GREATER THAN ONE-HALF RIVET EDGE DISTANCE

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Length of tear or crack not to exceed 1/2 of rivet edge distance; for edge tear or crack exceeding 1/2 edge distance in length, refer to Application B or Application C.

1.3 Applicable only to sheet metal type structures and panels with metallic facings. Refer to Chapter 4 of this manual for repairs of panels with fiber reinforced composite facings.

1.4 Not applicable in areas with cold expanded holes or ForceMates.

1.5 Minimum rivet edge distance of 2D for protruding head rivets and 2.5D for flush head rivets must be maintained.

1.6 One repair allowed in any 3.0 inch (76 mm) length at edge of sheet metal structure.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Epoxy polyamide primer (C-204).

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of skin or web using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of tear or crack.

   NOTE
   Take care not to damage surrounding structure while removing damage.

3.3 Blend out damage over a distance of 3 to 4 times the length of tear or crack. Provide a minimum of 0.13 inch (3.3 mm) radius to ensure smooth transition (Figure 3-58).

3.4 Deburrr edges. Deburrr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 Perform fluorescent penetrant inspection of skin or web, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack(s) do not protrude past cleanup.

3.6 Prime all bare metal surfaces using material specified in 2.1. Allow to dry.

3.7 Refinish as required.
3-6.3. Edge Tear or Crack in Skin, Web, and Panel

Figure 3-58. Edge Cracks Shorter than 1/2 Edge Distance — Repair

RADIUS TO .13 MIN

ONE HALF OF RIVET EDGE DISTANCE MAX

BLEND OVER A DISTANCE OF 3 TO 4 TIMES TEAR/Crack LENGTH

REFER TO RESTRICTION 1.5 FOR MIN ED

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APPLICATION B: REPAIR OF EDGE TEAR OR CRACK IN SKIN OR WEB NOT GREATER THAN 3D

This repair has been replaced with repair provided in Application C.

APPLICATION C: REPAIR OF EDGE TEAR OR CRACK IN FLAT SKIN OR WEB GREATER THAN ONE-HALF RIVET EDGE DISTANCE

NOTE
For repair of cracks extending into any flanged area of skin or web, refer to Application D. Repairs to flanged areas previously accomplished in accordance with Application C, prior to release of Application D dated 14 DEC 2010, are acceptable.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Length of tear or crack greater than 1/2 rivet edge distance and less than 4.0 inches (102 mm).

1.3 Applicable only to sheet metal type structure.

1.4 Not applicable for countersunk and dimpled rivet holes.

1.5 One crack or tear allowed per skin at a minimum angle of 60° to edge.

1.6 Not applicable to skin or web thickness greater than 0.032 inch (0.81 mm).

1.7 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Length and width to allow a minimum of two full rows of rivets on all sides of crack plus 0.38 inch (9.7 mm) edge distance. Refer to Appendix A-2-1 for appropriate material part number.

2.2 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
Preparation of Bonding Surfaces (paragraph 3-2-5)
Bonding of Flat Stock (paragraph 3-2-7)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of skin or web using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of tear or crack.

**CAUTION**

DO NOT DAMAGE SURROUNDING STRUCTURE WHILE ROUTING.

3.3 Rout out crack. Rout-out to be 0.1875 inch (4.763 mm) wide along full length of crack.

3.4 Perform fluorescent penetrant inspection of skin or web, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack does not protrude past rout-out.

3.5 Prepare -1 doubler specified in 2.1. Doubler to pick up a minimum of two full rows of rivets on each side of rout-out plus required edge distance (Figure 3-59).

3.6 Locate -1 doubler in position and transfer existing fastener holes same size as originals. Wherever existing rivets are more than 2.0 inches (51 mm) apart, drill (interpitch) for new fasteners specified in 2.2, maintaining proper edge distance and 0.90 inch (22.9 mm) to 1.30 inches (33 mm) spacing, 1.12 inches (28.5 mm) desired. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**NOTE**

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.9 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

**NOTE**

Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.10 Secure -1 doubler using fasteners specified in 2.2, grip length to suit.

3.11 Remove excess adhesive squeeze-out.
3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used, refer to paragraph 3-2-26.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.14 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.15 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.16 Refinish as required.
3-6-3. EDGE TEAR OR CRACK IN SKIN, WEB, AND PANEL

Figure 3-59. Edge Crack Longer Than One-Half Rivet Edge Distance — Flat Doubler Repair

- Align rivet rows
- 1 doubler
- .38 min ed typ
- 1.70 min overlap typ
- R .38 typ
- .90 to 1.30
- 1.12 desired typ
- .50 min typ
- 4.00 max
- Rout out crack .1875 wide along full length of crack. Fill portion common to angle (hatched section) with adhesive.
APPLICATION D: REPAIR OF EDGE TEAR OR CRACK IN FLANGED SKIN OR WEB GREATER THAN ONE-HALF RIVET EDGE DISTANCE

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Length of tear or crack greater than 1/2 rivet edge distance and less than 4.0 inches (102 mm).

1.3 Applicable only to sheet metal type structure.

1.4 Not applicable for countersunk and dimpled rivet holes.

1.5 One crack or tear allowed per skin at a minimum angle of 60° to edge.

1.6 Not applicable to skin or web thickness greater than 0.032 inch (0.81 mm).

1.7 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Length and width to allow a minimum of two full rows of rivets on all sides of crack plus 0.38 inch (9.7 mm) edge distance with a minimum of four rows of rivets in section common to angle. Refer to Appendix A-2-1 for appropriate material part number. As an alternate, formed repair angle (Bell standard 151-028) may be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 Rivets of same type and size as used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353), high corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Forming of Flat Sheet Metal (paragraph 3-2-23)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of skin or web using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of tear or crack.
DO NOT DAMAGE SURROUNDING STRUCTURE WHILE DRILLING.

3.3 Rout out crack. Rout-out to be 0.1875 inch (4.763 mm) wide along full length of crack.

3.4 Perform fluorescent penetrant inspection of skin or web, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack does not protrude past rout-out.

3.5 Prepare -1 doubler specified in 2.1. Doubler to pick up a minimum of four rivets on each side of rout-out plus required edge distance in section common to flange. If required, form -1 doubler using instructions and restrictions detailed in paragraph 3-2-23 (Figure 3-60).

3.6 Locate -1 doubler in position and transfer existing fastener holes same size as originals. Wherever existing rivets are more than 2.0 inches (51 mm) apart, drill (interpitch) for new fasteners specified in 2.2, maintaining proper edge distance and 0.90 inch (22.9 mm) to 1.30 inches (33 mm) spacing, 1.12 inches (28.5 mm) desired. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

NOTE

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

If applicable, remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.9 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE

Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.10 Secure -1 doubler using fasteners specified in 2.2, grip length to suit.

3.11 Remove excess adhesive squeeze-out.

3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used, refer to paragraph 3-2-26.
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.14 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.15 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.16 Refinish as required.
Figure 3-60. Edge Crack Longer Than One-Half Rivet Edge Distance — Angled Doubler Repair
3-6-4. DOUBLER REPAIR OF SKIN AND WEB

This section covers typical repairs for cases where unsupported aluminum web or skin shows signs of damage such as a scratch, gouge, nick, dent, crack, puncture, corrosion, tear, etc.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on skin or web. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of cleanup must be a minimum of 2.0 inches (51 mm) from nearest adjacent structure after cleanup.

1.4 Maximum length of cutout not to exceed 5.0 inches (127 mm) in any direction.

1.5 Total damage area to be a maximum of 25.0 square inches (161.3 cm²) or 20% of bay area, whichever is smaller. Damage smaller than 2.00 inches (50.8 mm) may be repaired using instructions detailed in paragraph 3-6-6.

1.6 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Length and width to allow a minimum of two full rows of rivets on all sides of damage plus 0.38 inch (9.7 mm) edge distance. Doubler may be installed on either side of skin. Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 filler, if required, made from composite bond material (Bell standard 150-021-xxB) of same material and gauge than existing skin. Size of filler to match damage cutout. Refer to Appendix A-2-1 for appropriate material part number.

2.3 Rivets of same type as used in immediate area and 0.125 inch (3.2 mm) minimum diameter. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).
2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).

2.8 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of web or skin. Cutout to be dimensioned to remove a minimum amount of material and provide a smooth rectangular, oval, or circular cleanup area. Maintain 0.50 inch (12.7 mm) minimum corner radius.

3.3 Prepare -1 doubler specified in 2.1 (Figure 3-61).

3.4 Prepare -2 filler, if required, specified in 2.2.

3.5 Locate -1 doubler and, if required, -2 filler in position and drill for new fasteners specified in 2.3 using fastener pattern shown in Figure 3-61, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler and, if required, -2 filler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.7 Prepare faying surfaces of -1 doubler, parent structure and, if required, -2 filler for bonding using instructions detailed in paragraph 3-2-5.

3.8 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

3.9 If required, locate -2 filler in position and bond precured adhesive side of -2 filler against precured adhesive side of -1 doubler using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-5 and paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.10 Secure -1 doubler and, if required, -2 filler using fasteners specified in 2.3, grip length to suit.

3.11 Remove excess adhesive squeeze-out.
3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used, refer to paragraph 3-2-26.

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.14 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.15 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.16 Refinish as required.
Figure 3-61. Skin and Web — Doubler Repair
3-6-5. EDGE TEAR AND CRACK IN BULKHEAD LIGHTENING HOLE

APPLICATION A: REPAIR OF TORN OR CRACKED LIGHTENING HOLE FLANGE IN BULKHEAD

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Damage not to exceed 1/3 of flange depth (D). Length of damage not to exceed 1/2 of flange depth (D/2) after cleanup; for damage exceeding 1/3 of flange depth (D/3) after cleanup, refer to Application B.

1.3 A maximum of one crack or tear allowed in flange of any lightening hole.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Epoxy polyamide primer (C-204).

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of flange of bulkhead lightening hole using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of tear or crack.

3.3 Blend out damage. Provide a minimum of 0.10 inch (2.5 mm) radius to ensure smooth transition (Figure 3-62).

3.4 Deburr edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.5 Perform fluorescent penetrant inspection of flange of bulkhead lightening hole, as second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack(s) do not protrude past cleanup.

3.6 Prime all bare metal surfaces using material specified in 2.1. Allow to dry.

3.7 Refinish as required.
Figure 3-62. Crack in Bulkhead Lightening Hole Flange — Repair
APPLICATION B: REPAIR OF TORN OR CRACKED LIGHTENING HOLE FLANGE IN BULKHEAD EXCEEDING APPLICATION A

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Crack length not to exceed flange depth.

1.3 A maximum of two cracks or tears allowed in flange of same lightening hole.

1.4 Not applicable to bulkhead thickness greater than 0.040 inch (1.02 mm).

1.5 Use of this repair requires prior approval from Product Support Engineering.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Length and width to allow two rows of rivets plus 0.38 inch (9.7 mm) edge distance. Doubler may be installed on either side of skin. Refer to Appendix A-2-1 for appropriate material part number.

2.2 Rivets of 1/8 inch (3.2 mm) minimum diameter and of same type and material as rivets used in immediate area. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
Preparation of Bonding Surfaces (paragraph 3-2-5)
Bonding of Flat Stock (paragraph 3-2-7)
Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of flange of bulkhead lightening hole using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of tear or crack.
DO NOT DAMAGE SURROUNDING STRUCTURE.

3.3 Stop drill end of crack with No. 30 drill.

3.4 Perform fluorescent penetrant inspection of angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack does not protrude past stop drill.

3.5 Prepare -1 doubler specified in 2.1 (Figure 3-63).

3.6 Locate -1 doubler in position and drill for new fasteners specified in 2.2 using fastener pattern shown in Figure 3-63, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.9 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.10 Secure -1 doubler using fasteners specified in 2.2, grip length to suit.

3.11 Remove excess adhesive squeeze-out.

3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used, refer to paragraph 3-2-26.
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.14 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.15 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.16 Refinish as required.
Figure 3-63. Crack in Bulkhead Lightening Hole Flange — Doubler Repair

NOTE: CRACK NOT TO EXTEND INTO BEND RADIUS OF FLANGE
APPLICATION C: ALTERNATE REPAIR OF TORN OR CRACKED LIGHTENING HOLE FLANGE IN BULKHEAD EXCEEDING APPLICATION A

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Crack length not to exceed flange depth.

1.3 A maximum of two cracks or tears allowed in flange of same lightening hole.

1.4 Not applicable to bulkhead thickness greater than 0.032 inch (0.81 mm) made from 2024 and 6013 aluminum alloys.

1.5 Not applicable to bulkhead thickness greater than 0.025 inch (0.64 mm) made from 7075 aluminum alloy.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 ring doubler made from flanged hole repair material (Bell standard 151-032-xx) of one gauge thicker than existing web. Minimum thickness of doubler to be 0.025 inch (0.64 mm). Ring doubler may be installed on either side of web. Refer to Appendix A-2-3 for appropriate material part number.

2.2 Fasteners: MS20470AD4 rivets, grip length to suit.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Epoxy polyamide primer (C-204).

2.6 High corrosion inhibitor sealant (C-251).

2.7 Process Sheet(s):
   Preparation of Bonding Surfaces (paragraph 3-2-5)
   Bonding of Flat Stock (paragraph 3-2-7)
   Dimpling Process for Flush Rivets (paragraph 3-2-18)
   Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of flange of bulkhead lightening hole using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of tear or crack.
DO NOT DAMAGE SURROUNDING STRUCTURE WHILE ROUTING.

3.3 Rout out tear or crack. Rout-out to be 0.1875 inch (4.763 mm) wide along full length of damage.

3.4 Perform fluorescent penetrant inspection of angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack does not protrude past end of rout-out.

3.5 Prepare -1 ring doubler specified in 2.1 (Figure 3-64).

NOTE

Use a minimum of eight equally spaced rivets for flanged hole diameters below 2.00 inches (50.8 mm) or a minimum of 12 equally spaced rivets for flanged hole diameters of 2.00 inches (50.8 mm) and above.

3.6 Locate -1 doubler in position and drill for new fasteners specified in 2.2 using fastener pattern shown in Figure 3-64, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 ring doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.8 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

NOTE

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.9 Prepare faying surfaces of -1 ring doubler and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.10 Locate -1 ring doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE

Install all rivets wet with adhesive while -1 ring doubler adhesive is still wet.

3.11 Secure -1 ring doubler using fasteners specified in 2.2, grip length to suit.

3.12 Remove excess adhesive squeeze-out.

3.13 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H<sub>G</sub> if vacuum bagging is used, refer to paragraph 3-2-26.
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.14 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.15 Prime all bare metal surfaces using material specified in 2.5. Allow to dry.

3.16 Seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Ensure routed-out portion of web is filled with sealant. Reprime sealant.

3.17 Refinish as required.
Figure 3-64. Crack in Bulkhead Lightening Hole Flange — Repair

- **Minimum 8 Equally Spaced Rivets for "D" ≤ 2.00**
- **Minimum 12 Equally Spaced Rivets for "D" ≥ 2.00**
- **1.00 Minimum Overlap Typ**
- **.80 to 1.30 1.12 Desired Typ**
- **.38 Minimum Typ**
- **EXISTING WEB REF**
- **-1 RING DOUBLER**
- **FILL GAP WITH ADHESIVE**
- **EXISTING WEB REF**
- **-1 RING DOUBLER**
- **ROUT OUT DAMAGE .1875 WIDE FILL WITH SEALANT**
- **ADDED MS20470AD4 RIVETS**
- **SECTION ROTATED 30° CCW**

**Fasteners**
3-6-6. SMALL DAMAGE REPAIR OF SKIN AND WEB

This section covers typical repairs for cases where unsupported aluminum web or skin shows signs of damage such as a mislocated hole, scratch, gouge, nick, dent, crack, puncture, corrosion, tear, etc.

APPLICATION A: REPAIR OF MISLOCATED HOLE OR SMALL DAMAGE IN EXTERIOR SKIN UP TO 3/16 INCH (4.8 MM) DIAMETER

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Edge of cleanup must be a minimum of two times diameter of hole from nearest adjacent structure.

1.3 Damage to be a maximum of 3/16 inch (4.8 mm) diameter. Damage larger than 3/16 inch (4.8 mm) in diameter and less than 2.00 inches (50.8 mm) shall be repaired in accordance with instructions detailed in Application B. Damage larger than 2.00 inches (50.8 mm) shall be repaired in accordance with instructions detailed in paragraph 3-6-4.

1.4 Sharp (knife) edge condition in hole after installation of repair rivet is not allowed.

1.5 Applicable only to sheet metal type structure.

1.6 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 MS20470AD, MS20426AD, or NAS1097AD rivet of smallest diameter required to fill cleanup, grip length to suit.

2.2 Washers, if required (refer to Table 3-39 for applicable part number).

2.3 Epoxy polyamide primer (C-204).

2.4 High corrosion inhibitor sealant (C-251).

2.5 Process Sheet(s):
Dimpling Process for Flush Rivets (paragraph 3-2-18)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Drill out damaged portion of skin. Drill hole to smallest diameter rivet that will remove entire damage. Refer to Table 3-28 for appropriate rivet hole size.

3.3 Deburr hole. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.4 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 for dimpling instructions and to Table 3-39 for dimpling/countersinking requirement. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.
3.5 Install rivet specified in 2.1 and washer specified in 2.2, if required, wet with sealant specified in 2.4, grip length to suit.

3.6 Remove excess sealant squeeze-out. Allow sealant to dry.

3.7 Prime all bare metal surfaces using material specified in 2.3. Allow to dry.

3.8 Refinish as required.

Table 3-39. Rivet Hole Diameter

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<thead>
<tr>
<th>Rivet Part Number</th>
<th>Skin Thickness</th>
<th>Rivet Hole Diameter and Washer Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3/32 inch (2.4 mm)</td>
<td>1/8 inch (3.2 mm)</td>
</tr>
<tr>
<td>MS20426AD</td>
<td>0.020 inch (0.51 mm)</td>
<td>Dimple sheet</td>
</tr>
<tr>
<td></td>
<td>0.025 inch (0.64 mm)</td>
<td>Dimple sheet</td>
</tr>
<tr>
<td></td>
<td>0.032 inch (0.81 mm)</td>
<td>Dimple sheet</td>
</tr>
<tr>
<td></td>
<td>0.040 inch (1.02 mm)</td>
<td>Countersink</td>
</tr>
<tr>
<td></td>
<td>0.050 inch (1.27 mm)</td>
<td>Countersink</td>
</tr>
<tr>
<td></td>
<td>0.063 inch (1.60 mm)</td>
<td>Countersink</td>
</tr>
<tr>
<td></td>
<td>0.071 inch (1.80 mm)</td>
<td>Countersink</td>
</tr>
<tr>
<td>NAS1097AD</td>
<td>0.020 inch (0.51 mm)</td>
<td>Not Allowed</td>
</tr>
<tr>
<td></td>
<td>0.025 inch (0.64 mm)</td>
<td>Countersink</td>
</tr>
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<td></td>
<td>0.032 inch (0.81 mm)</td>
<td>Countersink</td>
</tr>
<tr>
<td></td>
<td>0.040 inch (1.02 mm)</td>
<td>Countersink</td>
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<tr>
<td></td>
<td>0.071 inch (1.80 mm)</td>
<td>Countersink</td>
</tr>
</tbody>
</table>
Figure 3-65. Addition of a Fastener — Small Damage Repair

MS20470AD, MS20426AD OR NAS1097AD

$\phi .188$ MAX

WASHER PER TABLE 3-39 (IF REQUIRED)

CORNER SHOWN IN HIDDEN LINES FOR ILLUSTRATION PURPOSES ONLY

ALL-SRM-3-06-06A-1
APPLICATION B: REPAIR OF SMALL DAMAGE IN EXTERIOR SKIN UP TO 2.00 INCH (50.8 MM) DIAMETER

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on skin without prior written approval from Product Support Engineering. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of damage must be a minimum of 2.00 inches (50.8 mm) from nearest adjacent primary structure after cleanup.

1.4 Skin repair cutout to be a minimum of 0.38 inch (9.7 mm) diameter and not to exceed 2.00 inches (50.8 mm) in diameter. Damage larger than 2.00 inches (50.8 mm) shall be repaired in accordance with instructions detailed in paragraph 3-6-4.

1.5 Applicable only to sheet metal type structure.

1.6 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Doubler to be circular or square in shape and dimensioned to allow a minimum of 1.0 inch (25.4 mm) overlap from skin cutout. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Doubler may be installed on either side of skin. Refer to Appendix A-2-1 for appropriate material part number.

   NOTE

   Filler is required if doing internal doubler repair on exterior skin and optional with external doubler.

   Use a minimum of two rivets to attach filler of 1.00 inch (25.4 mm) or less in diameter; three rivets for filler greater than 1.00 inch (25.4 mm) but less than 1.50 inches (38.1 mm) in diameter; and four rivets for filler 1.50 inches (38.1 mm) to 2.00 inches (50.8 mm) in diameter.

2.2 -2 filler, if required, made from composite bond material (Bell standard 150-021-xxB) of same material and gauge than existing skin. Size of filler to match damage cutout. Refer to Appendix A-2-1 for appropriate material part number.

2.3 Same type rivets as used in immediate area and 0.125 inch (3.2 mm) minimum diameter. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).
2.8 Process Sheet(s):
   Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
   Preparation of Bonding Surfaces (paragraph 3-2-5)
   Bonding of Flat Stock (paragraph 3-2-7)
   Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of web or skin. Cutout to be dimensioned to remove a minimum amount of material and provide a smooth rectangular or circular cleanup area. Maintain 0.50 inch (12.7 mm) corner radius.

3.3 Prepare -1 doubler specified in 2.1, maintaining 0.38 inch (9.65 mm) corner radii for rectangular doubler (Figure 3-66).

3.4 Prepare -2 filler, if required, specified in 2.2.

3.5 Locate -1 doubler and, if required, -2 filler in position and drill for eight equally spaced fasteners specified in 2.3 around web or skin cutout, maintaining 0.38 inch (9.7 mm) minimum edge distance. If required, transfer holes for rivets attaching -2 filler and specified in 2.3 into -1 doubler and -2 filler. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler and, if required, -2 filler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.
Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.7 Prepare faying surfaces of -1 doubler, parent structure and, if required, -2 filler for bonding using instructions detailed in paragraph 3-2-5.

3.8 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

3.9 If required, locate -2 filler in position and bond precured adhesive side of -2 filler against precured adhesive side of -1 doubler using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.10 Secure -1 doubler and, if required, -2 filler using fasteners specified in 2.3, grip length to suit.

3.11 Remove excess adhesive squeeze-out.
3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used, refer to paragraph 3-2-26.

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids is allowed. No edge void is allowed.

3.14 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.15 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.16 Refinish as required.
Figure 3-66. Addition of a Doubler — Small Damage Repair
3-7. TITANIUM STRUCTURE REPAIRS

Titanium's physical characteristics and its primary use in the fire and fume tight areas of the engine and fuel systems make titanium structures special. Typical rivet repairs (paragraph 3-4) apply to most titanium structures (monel rivets are required) except that formed sections, webs, and skins require special considerations. Refer to paragraph 3-7-1 through paragraph 3-7-3 for repairs.

**WARNING**

SPECIAL TOOLS MUST BE USED FOR CUTTING AND DRILLING TITANIUM PARTS AND STRUCTURE.

**CAUTION**

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

**NOTE**

When repairs specify use of faying surface sealant, the mating surfaces of the parts to be sealed must be prepared in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-25. The primer must not be removed from parts that are primed. Use touch-up primer if required.

1. NEGLIGIBLE DAMAGE

- A surface scratch and a small smooth dent less than 10% of skin thickness and up to 1.50 inches (38.1 mm) in diameter on skin surfaces that does not penetrate the skin or interfere with mounting surfaces.

- A surface scratch less than 10% of skin or angle thickness and a smooth contoured dent less than 0.025 inch (0.64 mm) deep on angles. A dent must clear spot welds and rivets, and be crack and gouge free.
2. REPAIRABLE DAMAGE

CAUTION

ANY DAMAGE THAT PENETRATES A FIREWALL, SKIN, OR ANY OPENING CREATED BY A REPAIR OR BROKEN SPOT WELD SHALL BE REPAIRED AND SEALED TO ENSURE WATER AND FUME TIGHTNESS.

- A dents that shows evidence of a crack (paragraph 3-7-1 and paragraph 3-7-2).
- A cracks, hole, and tear (paragraph 3-7-2).
- A small hole (paragraph 3-7-3).

3. MATERIAL SUBSTITUTION

- It is acceptable to substitute 301 corrosion resistant steel (CRES) per AMS 5518, half hard, one gauge thicker, for repair of titanium parts contained in this section.
3-7-1. FLANGE DAMAGE TO TITANIUM ANGLES

APPLICATION A: FOR DAMAGE IN TITANIUM ANGLE NOT EXCEEDING 0.20 INCH (5.1 MM) LENGTH AND 0.10 INCH (2.5 MM) WIDTH

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Leg of original angle without rivet holes must be sufficiently wide to provide a minimum edge distance of 1.5 times the rivet diameter (1.5D) for protruding head rivets.

1.3 A maximum of two repairs separated by 2.0 inches (50.8 mm) are permitted; repairs may not overlap or interfere with later installations.

1.4 Maximum flange thickness of 0.032 inch (0.81 mm).

1.5 Cut out to be between 0.30 inch (7.6 mm) to 0.60 inch (15.2 mm) in width, a maximum of 0.25 inch (6.4 mm) in length and a minimum of 0.31 inch (7.9 mm) from existing rivets or spotwelds.

1.6 Repair angle to be located inside existing angle except when part interference requires external installation.

1.7 Maximum width of damage before cleanup to be 0.10 inch (2.5 mm) and maximum depth of damage before cleanup to be 0.20 inch (5.1 mm).

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 angle doubler made from same material and one gauge thicker than original angle. Length of angle to be sufficient to pick up a minimum of two rivets plus 0.38 inch (9.7 mm) edge distance on either side of damage on both flanges and one rivet opposite damage. As an alternate, Bell standard 151-028 may be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 Same type and size, but non-cadmium plated, monel rivets as rivets used in immediate area or MS20615-4M or NAS9307M-4 rivets, grip length to suit, if existing angle is spot welded. Refer to Table 3-30 for rivet identification.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 Epoxy polyamide primer (C-204), if required.

2.5 Firewall application sealing compound (C-353).

2.6 Process Sheet(s):
   1. Dimpling Process for Flush Rivets (paragraph 3-2-18)
   2. Forming of Flat Sheet Metal (paragraph 3-2-23)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Perform fluorescent penetrant inspection of angle using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to determine extent of crack(s).

3.3 Blend out damage, including any cracks resulting from damage and ensuring smooth transition. Refer to Figure 3-67 for limits of blend-out.

3.4 Perform fluorescent penetrant inspection of angle, a second time, using instructions and materials detailed in Chapter 6 of Standard Practices Manual (BHT-ALL-SPM) to ensure crack(s) do not protrude past cleanup.

3.5 Prepare -1 angle doubler specified in 2.1 using instructions detailed in paragraph 3-2-23.

3.6 Locate -1 angle doubler in position. Pick up a minimum of two fasteners on each side of blend-out.

3.7 If existing angle is originally attached with rivets, transfer existing fastener holes into -1 angle doubler, same size as originals, maintaining proper edge distance. If existing angle is originally spot welded, drill for added MS20615-4M or NAS9307M-4 rivets specified in 2.2. Added rivets to be equally spaced between spotwelds, maintaining proper edge distance. Refer to Table 3-28 for appropriate rivet hole size.

3.8 Remove -1 angle doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.9 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.10 If required, prime -1 angle to match surrounding areas using material specified in 2.4. Allow to dry.

NOTE

Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Where applicable, do not remove primer from parent structure and -1 angle. Use touch-up primer if required.

3.11 Prepare faying surfaces of -1 angle doubler and parent structure for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.3. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.

3.12 Locate -1 angle doubler in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.5. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

NOTE
NOTE

Install all rivets wet with sealant while -1 angle doubler sealant is still wet.

3.13 Secure -1 angle doubler using fasteners specified in 2.2, grip length to suit.

3.14 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.

3.15 Allow to cure at room temperature for 24 hours.

3.16 If required, prime all bare metal surfaces and sealant fillet bead using material specified in 2.4. Allow to dry.

3.17 Refinish as required.
Figure 3-67. Flange Damage to Titanium Angle of a Maximum Width of 0.10 Inch (2.5 mm) — Repair

PICK UP EXISTING RIVET PATTERN IF POSSIBLE. IF SPOT WELDS WERE USED IN LIEU OF RIVETS, MS20615-4M OR NAS9307M-4 RIVETS MUST BE EQUALLY SPACED BETWEEN SPOT WELDS.
APPLICATION B: FOR DAMAGE IN TITANIUM ANGLE GREATER THAN 0.20 INCH (5.1 MM) LENGTH AND 0.10 INCH (2.5 MM) WIDTH

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Leg of original angle without rivet holes must be sufficiently wide to provide a minimum edge distance of 1.5 times the rivet diameter (1.5D) for protruding head rivets.

1.3 A maximum of two repairs separated by 8.0 inches (203 mm) are permitted; repairs may not overlap or interfere with later installations.

1.4 Maximum flange thickness of 0.032 inch (0.81 mm).

1.5 Cut out to be between 0.50 inch to 0.75 inch (12.7 to 19.1 mm) in width.

1.6 Repair angle to be located inside existing angle except when part interference requires external installation.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 angle filler made from an angle of same material and thickness as original to replace removed damaged section. As an alternate, Bell standard 151-028 may be used. Refer to Appendix A-2-2 for appropriate part number.

2.2 -2 splice angle made from same material and one gauge thicker than original angle. Length of splice angle to be sufficient to overlap damaged area by a minimum of four rivets plus 0.38 inch (9.7 mm) edge distance in each flange, on each side of discrepant area. As an alternate, Bell standard 151-028 may be used. Refer to Appendix A-2-2 for appropriate part number.

2.3 Same type and size, but non-cadmium plated, monel rivets as rivets used in immediate area or MS20615-4M or NAS9307M-4 rivets, grip length to suit, if existing angle is spot welded. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 Epoxy polyamide primer (C-204), if required.

2.6 Firewall application sealing compound (C-353).

2.7 Process Sheet(s):
   Dimpling Process for Flush Rivets (paragraph 3-2-18)
   Forming of Flat Sheet Metal (paragraph 3-2-23)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**NOTE**
Use a high speed grinder to remove damaged section of existing angle. Do not drill through spot welds. Take care not to overheat angle by allowing sufficient cooling time between cuts.

3.2 Cut out and remove damaged portion of angle including any cracks resulting from damage. Cut out to be within limits shown in Figure 3-68. Maintain 2D minimum edge distance with existing rivet holes.

3.3 Prepare -1 angle filler specified in 2.1 using instructions detailed in paragraph 3-2-23.

3.4 Prepare -2 splice angle specified in 2.2 using instructions detailed in paragraph 3-2-23.

3.5 Locate -1 angle filler in position.

3.6 Locate -2 splice angle in position maintaining a minimum edge distance of 1.5D. Pick up a minimum of four fasteners on each side of damaged area on all flanges and at least one fastener in each flange of -1 angle filler.

3.7 Drill for new fasteners specified in 2.3 at existing and new locations, maintaining proper edge distance and spacing. If existing angle is originally spot welded, drill for added MS20615-4M or NAS9307M-4 rivets specified in 2.3. Added rivets to be equally spaced between spotwelds, maintaining proper edge distance. Refer to Table 3-28 for appropriate rivet hole size.

3.8 Remove -1 angle filler and -2 splice angle. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.9 If required, countersink/dimple holes for installation of flush rivets. Refer to paragraph 3-2-18 and to Table 3-21 for dimpling instructions. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.10 If required, prime -1 angle filler and -2 splice angle to match surrounding areas using material specified in 2.5. Allow to dry.

**NOTE**
Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Where applicable, do not remove primer from parent structure. Use touch-up primer if required.

3.11 Prepare faying surfaces of -1 angle filler, -2 splice doubler, and parent structure for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.4. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.
3.12 Locate -1 angle filler in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.6. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

3.13 Locate -2 splice angle in position against existing angle and -1 angle filler using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.6. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

NOTE
Install all rivets wet with sealant while -1 angle filler and -2 splice angle sealant is still wet.

3.14 Secure -1 angle filler and -2 splice angle using new and existing fasteners specified in 2.3, grip length to suit.

3.15 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.

3.16 Allow to cure at room temperature for 24 hours.

3.17 If required, prime all bare metal surfaces and sealant fillet bead using material specified in 2.5. Allow to dry.

3.18 Refinish as required.
Figure 3-68. Flange Damage to Titanium Angle Wider Than 0.10 Inch (2.5 mm) — Repair

ATTACHING STRUCTURE

DAMAGED SECTION TO BE REMOVED

.75 CUTOUT
.50

1.5D MIN ED TYP

- 1 ANGLE FILLER

DAMAGED ANGLE

.75
.50

4 RIVETS MINIMUM ON EACH SIDE OF DAMAGE IN BOTH FLANGES, TYP

- 2 SPlice ANGLE

.38 MIN ED TYP

PICK UP EXISTING RIVET PATTERN IF POSSIBLE. IF SPOT WELDS ARE USED IN LIEU OF RIVETS, MS20615-4M OR NAS9307M-4 RIVETS MUST BE EQUALLY SPACED BETWEEN SPOT WELDS.
3-7-2. DOUBLER REPAIR TO TITANIUM SKIN OR WEB

This section covers typical repairs for cases where the unsupported titanium web or skin shows signs of damage such as a scratch, gouge, nick, dent, crack, puncture, corrosion, tear, etc.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on skin or web. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of cleanup must be a minimum of 2.0 inches (51 mm) from nearest adjacent structure after cleanup.

1.4 Maximum length of cutout not to exceed 5.0 inches (127 mm) in any direction.

1.5 Total damage area to be a maximum of 25.0 square inches (161.3 cm²) or 20% of bay area, whichever is smaller. Damage smaller than 0.50 inch (12.7 mm) may be repaired using instructions detailed in paragraph 3-7-3.

1.6 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from titanium and one gauge thicker than existing web or skin. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Length and width to allow a minimum of two full rows of rivets on all sides of damage plus 0.38 inch (9.7 mm) edge distance. As an alternate, repair material (Bell standard 150-021-xxC) may be used. Refer to Appendix A-2-1 for appropriate part number.

NOTE

Filler is required if doing internal doubler repair on exterior skin and optional with external doubler.

Use a minimum of two rivets to attach filler of 1.0 inch (25.4 mm) or less in diameter; three rivets for filler greater than 1.0 inch (25.4 mm) but less than 1.50 inches (38.1 mm) in diameter; and four rivets for filler 1.50 inches (38.1 mm) to 2.0 inches (50.8 mm) in diameter. Filler larger than 2.0 inches (50.8 mm) shall be fastened with as many rivets as required provided standard spacing (0.90 to 1.30 inches (22.8 to 33.0 mm)) is maintained.

2.2 -2 filler, if required, made from same material and gauge than existing web. Size of filler to match damage cutout. As an alternate, smooth titanium repair material (Bell standard 150-021-xxC) may be used. Refer to Appendix A-2-1 for appropriate repair material part number.

2.3 Same type and size, but non-cadmium plated, monel rivets as rivets used in immediate area or MS20615-4M or NAS9307M-4 rivets, grip length to suit, if existing angle is spot welded or if repair area is not accessible from the back. Refer to Table 3-30 for rivet identification.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).
2.5 Epoxy polyamide primer (C-204), if required.

2.6 Firewall application sealing compound (C-353).

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of web or skin. Cutout to be dimensioned to remove a minimum amount of material and provide a smooth rectangular, oval, or circular cleanup area. Maintain 0.50 inch (12.7 mm) minimum corner radius.

3.3 Prepare -1 doubler specified in 2.1. Maintain 0.38 inch (9.7 mm) corner radii for rectangular doubler (Figure 3-69).

3.4 Prepare -2 filler, if required, specified in 2.2.

3.5 Locate -1 doubler and, if required, -2 filler in position and drill for new fasteners specified in 2.3 using fastener pattern shown in Figure 3-69, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler and, if required, -2 filler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.7 If required, prime -1 doubler and -2 filler to match surrounding areas using material specified in 2.5. Allow to dry.

NOTE

Do not soak parts to be sealed with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Where applicable, do not remove primer from parent structure, -1 doubler and -2 filler. Use touch-up primer if required.

3.8 Prepare faying surfaces of -1 doubler, parent structure and, if required, -2 filler for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.4. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.

3.9 Locate -1 doubler in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.6. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

3.10 If required, locate -2 filler in position against -1 doubler using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.6. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.
NOTE

Install all rivets wet with sealant while -1 doubler sealant is still wet.

3.11 Secure -1 doubler and, if required, -2 filler using fasteners specified in 2.3, grip length to suit.

3.12 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.

3.13 Allow to cure at room temperature for 24 hours.

3.14 If required, prime all bare metal surfaces and sealant fillet bead using material specified in 2.5. Allow to dry.

3.15 Refinish as required.
Figure 3-69. Titanium Skin or Web — Doubler Repair
3-7-3. SMALL HOLES IN TITANIUM FIREWALLS

APPLICATION A: FOR HOLE IN TITANIUM FIREWALL NOT EXCEEDING 0.375 INCH (9.52 MM) DIAMETER

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 A maximum of two repairs separated by a minimum of 2.00 inches (50.8 mm) are permitted.

1.3 Cutout to be a maximum of 0.375 inch (9.52 mm) diameter.

1.4 Added fastener is not to interfere with later installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Fastener:

<table>
<thead>
<tr>
<th>Discrepant Hole Size</th>
<th>Fastener Part Number(1)</th>
<th>Nut Part Number(3)</th>
<th>Washer Part Number(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000-0.102 (0.00-2.59)</td>
<td>MS20615-3M</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>0.103-0.133 (2.62-3.38)</td>
<td>MS20615-4M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.134-0.164 (3.40-4.17)</td>
<td>MS27039C( ), or MS51957-( )B(2)(4)</td>
<td>MS21043</td>
<td>NAS1149ExxxR, NAS1149CxxxxR, or NAS1149TxxxxL(4)</td>
</tr>
<tr>
<td>0.165-0.375 (4.19-9.52)</td>
<td>MS27039C( ), or MS51958-( )B(2)(4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Grip length to suit.
2) Select screw size to match discrepant hole diameter.
3) To match screw size.
4) Alternate part numbers.

2.2 Firewall application sealing compound (C-353).

3.0 PROCEDURE

3.1 Gain access to damaged area.

3.2 Drill out damage to match diameter required for fastener specified in 2.1. Refer to Table 3-28 for appropriate rivet hole size.

3.3 Deburr hole. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
3.4 For holes larger than 0.132 inch (3.35 mm) diameter, install screw, nut, and washer using instructions given below:

3.4.1 Apply a small amount of sealant specified in 2.2 to outer edge of hole drilled at 3.2 and to shank of screw specified in 2.1.

3.4.2 Plug the hole by installing screw, washer (under head of screw), and nut specified in 2.1.

3.5 For holes smaller than or equal to 0.133 inch (3.38 mm) diameter, install rivet specified in 2.1 wet with sealant specified in 2.2 and using a rivet squeezer, grip length to suit.

3.6 Remove excess sealant squeeze-out.

3.7 Refinish as required.
3.7-3. SMALL HOLES IN TITANIUM FIREWALLS

NOTE:
APPLY SEALANT TO HOLE OUTER EDGE AND TO SHANK OF SCREW.

Figure 3-70. Addition of a Fastener — Small Damage Repair
APPLICATION B: FOR HOLE IN TITANIUM FIREWALL GREATER THAN 0.375 INCH (9.52 MM) DIAMETER AND NOT EXCEEDING 0.5 INCH (12.7 MM)

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 A maximum of two repairs separated by a minimum of 2.00 inches (50.8 mm) are permitted.

1.3 Cutout to be a maximum of 0.50 inch (12.7 mm) diameter.

1.4 Repair is not to interfere with later installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from titanium meeting same specification, or equivalent as per the BHT-ALL-SPM, and of same thickness as firewall material. Doubler to be dimensioned to be a minimum of four times diameter of cutout in firewall. As an alternate, repair material (Bell standard 150-021-xxC) may be used. Refer to Appendix A-2-1 for appropriate part number.

2.2 Fasteners: MS20615-3M rivets, grip length to suit (Quantity 4).

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 Epoxy polyamide primer (C-204), if required.

2.5 Firewall application sealing compound (C-353).

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of web or skin. Cutout to be dimensioned to remove a minimum amount of material and provide a smooth circular cleanup area. Maintain 0.5 inch (12.7 mm) maximum diameter.

3.3 Prepare -1 doubler specified in 2.1 (Figure 3-71).

3.4 Locate -1 doubler in position and drill for new rivets specified in 2.2 using four equally spaced rivets, as shown in Figure 3-71, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.5 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 If required, prime -1 doubler to match surrounding areas using material specified in 2.4. Allow to dry.
3.7 Prepare faying surfaces of -1 doubler and parent structure for sealing by thoroughly cleaning surfaces with a cloth dampened with cleaner specified in 2.3. Surfaces shall be wiped dry with a clean dry cloth before solvent evaporates.

3.8 Locate -1 doubler in position against parent structure using a thin layer (0.006 to 0.010 inch (0.15 to 0.25 mm) thick) of sealant specified in 2.5. Sealant shall be uniformly applied to one faying surface using an extrusion gun, spatula, or brush. Sealant shall be spread to cover entire surface. Sufficient sealant shall be applied to provide positive squeeze-out after clamping or fastening.

NOTE
Install all rivets wet with sealant while -1 doubler sealant is still wet.

3.9 Secure -1 doubler using rivets specified in 2.2, grip length to suit.

3.10 Remove excess sealant squeeze-out by fairing squeeze-out to produce a 0.06 inch (1.5 mm) minimum width fillet bead along entire joint.

3.11 Allow to cure at room temperature for 24 hours.

3.12 If required, prime all bare metal surfaces and sealant fillet bead using material specified in 2.4. Allow to dry.

3.13 Refinish as required.
Figure 3-71. Addition of a Doubler — Small Damage Repair
3-8. CORROSION REPAIRS

Corrosion damage on metal surfaces must be removed by the mildest method available to prevent additional damage to the part being repaired.

NOTE

The Standard Practices Manual (BHT-ALL-SPM) and the Corrosion Control Guide (CSSD-PSE-87-001) provide detailed information on corrosion prevention, protection, and removal.

Evaluate corroded parts before and after rework to determine the depth of the damage, size, location and the number of affected areas. This will determine the type of repair to be accomplished. Refer to paragraph 3-8-1 through paragraph 3-8-4 for repairs.

WARNING

CORROSION DAMAGE ON 7000 SERIES ALUMINUM ALLOY PARTS THAT HAVE HAD SPECIAL TREATMENTS TO PRECLUDE STRESS AND FATIGUE CORROSION, SUCH AS SHOTPEENING OF SURFACES AND STRESS RELIEVING, CANNOT BE REPAIRED EXCEPT AS SHOWN IN THE APPLICABLE MAINTENANCE MANUAL OR COMPONENT REPAIR AND OVERHAUL MANUAL.

CAUTION

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

1. NEGLIGIBLE DAMAGE

   • N/A

2. REPAIRABLE DAMAGE

   • Surface corrosion (paragraph 3-8-1).

   • Surface pitting (paragraph 3-8-2).

   • Crevice corrosion (paragraph 3-8-3).

   • Corrosion between mating parts (paragraph 3-8-4).
3-8-1. SURFACE CORROSION

APPLICATION A: REMOVAL OF SURFACE CORROSION FROM ALUMINUM SHEET METAL PARTS AND EXTRUSIONS

This section covers typical repairs for cases where the aluminum skin, web, angle, bulkhead, and extrusion show signs of limited surface corrosion.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum affected area to be 20% of skin surface area.

1.3 Maximum depth of repair, when combined, to be 10% of part original thickness after cleanup, regardless of how many times the part is repaired. Depth of damage shall always be measured by comparing the minimum remaining material thickness to the thickness of the stock material in adjacent areas that have not been previously reworked.

1.4 No pitting and no penetration allowed.

1.5 Not applicable to forgings, castings, or machined parts.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Aluminum oxide abrasive paper (C-406) of 320 grit or finer.

2.2 Abrasive pad (C-407), grade A, very fine.

2.3 Alcoholic phosphoric acid solution cleaner (C-344). Mix 1 part of alcoholic phosphoric acid solution to 3 parts of demineralized water by volume.

2.4 Chemical film material (C-100).

2.5 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.6 Epoxy polyamide primer (C-204).

2.7 Process Sheet(s):
Brush Chemical Film Application on Aluminum and Titanium Parts (paragraph 3-2-14)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

NOTE

The depth of the repair shall be twice the original depth of the corrosion measured and not to exceed the limitations given above or listed in the applicable Maintenance Manual or Component Repair and Overhaul Manual.

3.2 Remove corrosion by hand sanding with abrasive cloth specified in 2.1.
3.3 Remove sanding residue with cleaner specified in 2.5 or detergent.

3.4 Inspect depth of reworked surface to ensure that it does not exceed restrictions stated above. Refer to Application "B" for damage exceeding limitations.

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**CAUTION**

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

3.5 Clean area by scrubbing with abrasive pad specified in 2.2 and phosphoric acid solution specified in 2.3. Rinse surface of part with distilled water within 30 minutes of application of phosphoric acid solution. Dry using clean, dry, filtered, compressed air.

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**NOTE**

Do not apply chemical film to restricted areas listed in paragraph 3-2-14.

3.6 If applicable, perform chemical film application to all bare metal using material specified in 2.4 and instructions detailed in paragraph 3-2-14.

3.7 Prime all exposed metal surfaces using two coats of primer specified in 2.6. Allow to dry.

3.8 Refinish as required.
APPLICATION B: REMOVAL OF CORROSION IN EXCESS OF LIMITATIONS STATED IN APPLICATION A

This section covers typical repairs for cases where the aluminum skin, web, angle, bulkhead, and extrusion show signs of surface corrosion in excess of the limitations given in Application A.

NOTE

Due to the limited material thickness available in sheet metal details used on Bell Helicopter series helicopters, corrosion damage exceeding 10% of material thickness after cleanup will be treated as mechanical damage. Remove the entire corroded section and repair using the applicable sections of this manual or of the model-specific Structural Repair Manual or replace the affected part(s).

1.0 RESTRICTION

1.1 As directed by the applicable repair procedure stated in this manual or in the model-specific Structural Repair Manual.

2.0 REQUIRED

2.1 As directed by the applicable repair procedure stated in this manual or in the model-specific Structural Repair Manual.

3.0 PROCEDURE

3.1 As directed by the applicable repair procedure stated in this manual or in the model-specific Structural Repair Manual.
3-8-2. SURFACE Pitting

This section covers typical repairs for cases where the aluminum skin, web, angle, bulkhead, and extrusion show signs of limited surface pitting corrosion.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum affected area to be 20% of surface area.

1.3 Pits may not exceed 10% of part original thickness in depth after cleanup, regardless of how many times the part is repaired. Depth of damage shall always be measured by comparing the minimum remaining material thickness to the thickness of the stock material in adjacent areas that have not been previously reworked.

1.4 Pits a maximum of 0.060 inch (1.52 mm) in major dimensions except depth, and separated by a minimum of 0.20 inch (5.1 mm).

1.5 No more than 14 pits per square inch (6.5 cm²).

1.6 Not applicable to forgings, castings, or machined parts.

**NOTE**

If corrosion exceeds restrictions above, it may be possible to repair skin or web using repair instructions given in paragraph 3-6-4, or honeycomb panels using paragraph 3-9-3 or paragraph 3-9-4, as long as restrictions are met.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Aluminum oxide abrasive paper (C-406) of 320 grit or finer.

2.2 Abrasive pad (C-407), grade A, very fine.

2.3 Alcoholic phosphoric acid solution cleaner (C-344). Mix 1 part of alcoholic phosphoric acid solution to 3 parts of demineralized water by volume.

2.4 Chemical film material (C-100).

2.5 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.6 Epoxy polyamide primer (C-204).

2.7 Process Sheet(s):

Brush Chemical Film Application on Aluminum and Titanium Parts

(paragraph 3-2-14)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**NOTE**
The depth of the repair shall be twice the depth of the corrosion and not to exceed the limitations given above or listed in the applicable Maintenance Manual or Component Repair and Overhaul Manual.

3.2 Remove corrosion by hand sanding with abrasive cloth specified in 2.1.

3.3 Remove sanding residue with cleaner specified in 2.5 or detergent.

3.4 Inspect depth of reworked surface to ensure that it does not exceed the restrictions stated above. Damage exceeding limitations may still be repairable, refer to paragraph 3-8-1, Application B for the next step to follow in this case.

**CAUTION**
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

3.5 Clean area by scrubbing with abrasive pad specified in 2.2 and phosphoric acid solution specified in 2.3. Rinse surface of skin with water within 30 minutes of application of phosphoric acid solution. Dry using clean, dry, filtered, compressed air.

**NOTE**
Do not apply chemical film to restricted areas listed in paragraph 3-2-14.

3.6 If applicable, perform chemical film application to all bare metal using material specified in 2.4 and instructions detailed in paragraph 3-2-14.

3.7 Prime all exposed metal surfaces using two coats of primer specified in 2.6. Allow to dry.

3.8 Refinish as required.
3-8-3. CREVICE CORROSION

APPLICATION A: REMOVAL OF CORROSION FROM ALUMINUM SHEET METAL PART OR EXTRUSION AROUND AND UNDER A FASTENER

This section covers typical repairs for cases where the aluminum skin, web, angle, bulkhead, and extrusion show signs of limited surface corrosion located under fastener(s) head.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum affected area to be 20% or a maximum of five fasteners in a pattern, whichever is greater.

NOTE

Except when Product Support Engineering or the repair procedure allows otherwise, protruding head rivets require a minimum edge distance of 2D and flush head rivets require a minimum edge distance of 2.5D.

1.3 Fastener hole corrosion can be removed by drilling hole out to next size fastener and abrading and polishing the surface to a maximum of 10% of the corroded part thickness, regardless of how many times the part is repaired. Depth of damage shall always be measured by comparing the minimum remaining material thickness to the thickness of the stock material in adjacent areas that have not been previously reworked.

1.4 Not applicable in areas with cold expanded holes or ForceMates.

1.5 Not applicable to forgings, castings, or machined parts.

1.6 Not applicable where dimples are used.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Aluminum oxide abrasive paper (C-406) of 320 grit or finer.

2.2 Abrasive pad (C-407), grade A, very fine.

2.3 Alcoholic phosphoric acid solution cleaner (C-344). Mix 1 part of alcoholic phosphoric acid solution to 3 parts of demineralized water by volume.

2.4 Chemical film material (C-100).

2.5 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.6 Epoxy polyamide primer (C-204).

2.7 Rivets of same type and material and one size larger than rivets used in immediate area. Refer to Table 3-30 for rivet identification.

2.8 High corrosion inhibitor sealant (C-251).
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed. Ensure all corroded fasteners are removed.

**NOTE**

The depth of the repair shall be twice the depth of the corrosion and not to exceed the limitations given above or listed in the applicable Maintenance Manual or Component Repair and Overhaul Manual.

3.2 Remove corrosion by hand sanding with abrasive cloth specified in 2.1.

3.3 Remove sanding residue with cleaner specified in 2.5 or detergent.

3.4 Drill for new fasteners specified in 2.7 at existing fastener locations, maintaining proper edge distance and spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.5 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

3.6 Inspect depth of reworked surface to ensure that it does not exceed the restrictions stated above. Damage exceeding limitations may still be repairable, refer to paragraph 3-8-4.

**CAUTION**

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

3.7 Clean area by scrubbing with abrasive pad specified in 2.2 and phosphoric acid solution specified in 2.3. Rinse surface of skin with water within 30 minutes of application of phosphoric acid solution. Dry using clean, dry, filtered, compressed air.

**NOTE**

Do not apply chemical film to restricted areas listed in paragraph 3-2-14.

3.8 If applicable, perform chemical film application to all bare metal using material specified in 2.4 and instructions detailed in paragraph 3-2-14.

3.9 Install all new rivets wet with sealant specified in 2.8.

3.10 Prime all bare metal surfaces using two coats of primer specified in 2.6. Allow to dry.

3.11 Refinish as required.
APPLICATION B: CORROSION BETWEEN MATING SURFACES

This section has been moved to paragraph 3-8-4.
3-8-4.  CORROSION BETWEEN MATING SURFACES

This section covers typical repairs for cases where the aluminum skin, web, angle, bulkhead, and extrusion show signs of corrosion between mating surfaces.

1.0 REstrictions

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Damage on parts that can be separated may be repaired per instructions detailed in paragraph 3-8-1 through paragraph 3-8-3 depending on type of corrosion.

1.3 Damage on parts that cannot be separated or exceed restrictions of repair detailed in paragraph 3-8-1 through paragraph 3-8-3 may be repaired per instructions detailed in other sections of this manual.

2.0 REQUIRED

2.1 None.

3.0 Procedure

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Select part that can be easily separated from its mating unit and remove it. Repair damage to both parts as directed in repair paragraph 3-8-1 through paragraph 3-8-3.

3.3 If necessary, cut out and remove corroded portion of skin on one side of joint. Cutout to be dimensioned to remove a minimum amount of material and provide a smooth rectangular, oval, or circular cleanup area. Maintain 0.50 inch (12.7 mm) corner radius.

3.4 Repair part with cutout made in step 3.3 using typical repair procedures detailed in Chapter 3 of this manual.
3-9. HONEYCOMB PANEL METALLIC FACE REPAIRS

Honeycomb panels are constructed of aluminum or fiber reinforced composite face sheets bonded to aluminum or Nomex honeycomb core. This section covers repairs to the honeycomb panel with at least one aluminum face sheet. All honeycomb panel repairs must be adequately sealed using appropriate sealant (paragraph 3-2-19) and epoxy polyamide primer. Paragraph 3-2-19 is for fuel cells and firewalls only, which require different sealants than basic sealant.

Refer to paragraph 3-9-1 through paragraph 3-9-4 for repairs of panels with metallic face sheet(s) and to Chapter 4 of this manual for repairs of panels with glass or carbon fiber reinforced face sheet(s).

CAUTION

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

NOTE

When repairs specify use of adhesive, the mating surfaces of the parts to be bonded must be prepared and bonded in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-25.

1. NEGLIGIBLE DAMAGE
   • Small dent and void. Refer to Application A of paragraph 3-9-1.

2. REPAIRABLE DAMAGE
   • Large shallow smooth dent. Refer to Applications B and Application C of paragraph 3-9-1.
   • Small, deep, or sharp dent (paragraph 3-9-2).
   • Damage affecting core (paragraph 3-9-3).
   • Damage affecting skin only (paragraph 3-9-4).
3-9-1. PANEL SURFACE REPAIR — SMOOTH DENT AND/OR VOID

APPLICATION A: SMALL SMOOTH DENT AND/OR VOID IN SKIN

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has a small smooth dent in the aluminum facing or void between the aluminum facing and the honeycomb core.

1.0 RESTRICTIONS FOR DENTS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than three dents allowed in panel. Dents closer than 1.00 inch (25.4 mm) edge to edge are to be considered as one large dent.

1.3 A dent may not exceed 1.50 inches (38.1 mm) in diameter and limited to 10% of panel thickness or a maximum of 0.065 inch (1.65 mm) in depth, whichever is less. No void allowed under skin in dented areas.

1.4 Edge of any dent shall be a minimum of 1.00 inch (25.4 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

2.0 RESTRICTIONS FOR VOIDS

2.1 Voids, bondline failure, may not exceed 0.25 square inch (1.61 cm²), i.e., 0.50 x 0.50 inch (12.7 x 12.7 mm).

2.2 No more than two skin voids allowed within a 4.0 inch (102 mm) diameter circle. Voids closer than 1.0 inch (25.4 mm) edge to edge are to be considered one void.

2.3 The edge of any voids must be at least 1.0 inch (25.4 mm) away from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

2.4 No edge separation (delamination) allowed.

3.0 REQUIRED

3.1 Tapping hammer capable of producing a definite sound difference when tapping on a good quality area and on discrepant areas such as Bell P/N T75449-1 (aluminum) and Bell P/N T75449-2 (steel) or equivalent tool.

3.2 Grease pencil or equivalent non-permanent marking device.

4.0 PROCEDURE

4.1 Gain access to damaged area recording type, size, and location of fasteners removed.
4.2 Inspect honeycomb panel for voids or bondline failure. Voids can be detected by tapping. A dead flat sound will be produced if a void exists. Outline voided area(s) with a grease pencil or equivalent non-permanent marking device.

4.3 Damage within limitations given above may be used as is. Optionally, damage may be repaired using instructions detailed in Application B.
Figure 3-72. Smooth Dent — Negligible Damage Repair

IF DEPTH IS LESS THAN "T"/10 OR .065, WHICHEVER IS LESS, NO FURTHER ACTION IS REQUIRED. MAXIMUM 3 DENTS IN PANEL. VOID(S) MUST MEET RESTRICTIONS 2.1 THRU 2.4.
APPLICATION B: LARGE SMOOTH DENT IN SKIN

This section covers typical repairs for cases where honeycomb panel with aluminum facing(s) have large smooth dents.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Smooth dents in one skin only.

1.3 No more than one dent allowed in panel.

1.4 Dents closer than 1.00 inch (25.4 mm) edge to edge are to be considered as one dent.

1.5 Dent may not exceed 4.00 inches (102 mm) in diameter and limited to 10% of panel thickness or a maximum of 0.065 inch (1.65 mm) in depth, whichever is less. No void allowed under skin in dent area.

1.6 Edge of dent shall be a minimum of 1.0 inch (25.4 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

1.7 No other damage allowed within 4.0 inches (102 mm) from edge of dent.

1.8 No other damage permitted to dented portion of skin.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

NOTE

Although -1 doubler is optional, it is recommended to install -1 doubler on exterior structures or interior structures that are exposed to fumes or fluids to increase protection against corrosion.

2.1 -1 doubler made from one ply of glass fabric (C-404), style 7781, 0.125 inch (3.2 mm) smaller than area of removed finish. (optional)

2.2 Cleaner for aluminum skin using MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Cleaner for fiberglass skin or edging using ethyl alcohol (C-339), isopropyl alcohol (C-385), or toluene (C-306).

2.4 Adhesives: General purpose fairing compound (C-372, recommended), Adhesive (C-317, alternate), Wet layup adhesive (C-363, optional).

2.5 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

2.6 Epoxy polyamide primer (C-204).
2.7 Tapping hammer capable of producing a definite sound difference when tapping on a good quality area and on discrepant areas such as Bell P/N T75449-1 (aluminum) and Bell P/N T75449-2 (steel) or equivalent tool.

2.8 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)
- Finish Process Following a Composite Repair (paragraph 4-2-11)
- Wet Layup Impregnation Process (paragraph 4-3-3)
- Wet Layup Bagging Process (paragraph 4-3-5)
- Curing Process for Epoxy Resin (paragraph 4-3-6)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.2 Remove paint and primer from damaged area 1.75 inches (44.4 mm) beyond edge of dent using instructions detailed in paragraph 3-2-3.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.3 Inspect damaged area for evidence of delamination by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. If damage exists, determine extent of damage and repair using appropriate section of this manual or of model-specific Structural Repair Manual.

3.4 Fill dent above contour of panel with general purpose fairing compound specified in 2.4.

3.5 Allow to cure at room temperature for 24 hours.

3.6 Sand cured adhesive to match contour of panel using abrasive paper specified in 2.5.

NOTE
Step 3.7 through step 3.11 inclusively are optional. If the damage being repaired is on a surface frequently exposed to fluids or moisture, it is recommended to proceed with optional fiberglass doubler installation to increase protection against corrosion.

3.7 Prepare faying surfaces of honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.8 Prepare -1 doubler specified in 2.1, as shown in Figure 3-73. Fiber orientation is optional.
3.9 Wet layup -1 doubler repair ply using wet layup adhesive specified in 2.4 and instructions detailed in paragraph 4-3-3.

3.10 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used, or a minimum of 20.4 inches (517 mm) HG if vacuum bagging is used.

NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.11 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.12 Prime repair area using material specified in 2.6. Allow to dry.

3.13 Refinish as required.
Figure 3-73. Large, Shallow, Smooth Dent — Repair
3-9-2. PANEL SURFACE REPAIR — DEEP SMOOTH OR SHARP DENT, CREASE, AND PUNCTURE

This section covers typical repairs for cases where honeycomb panel with aluminum facings have smooth dents deeper than 10% of panel thickness and/or a sharp dent, crease, or small puncture affecting a single skin and the core.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Damage may not exceed 0.50 inch (12.7 mm) diameter after cleanup.

1.3 No more than two damaged areas allowed within a 4.0 inch (102 mm) diameter circle.

1.4 No more than three damaged areas allowed in panel.

1.5 Damaged areas closer than 1.00 inch (25.4 mm) edge to edge are to be considered as one damage and shall be repaired in accordance with instructions detailed in paragraph 3-9-3 or paragraph 3-9-4.

1.6 Edge of cleanup shall be a minimum of 3.0 inches (76 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

   NOTE

   Although -1 doubler is optional, it is recommended to install -1 doubler on exterior structures or interior structures that are exposed to fumes or fluids to increase protection against corrosion.

2.1 -1 doubler made from one ply of glass fabric (C-404), style 7781, 1.00 inch (25.4 mm) larger than area of skin removed (optional).

2.2 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.3 Adhesives: General purpose fairing compound (C-372, recommended), Adhesive (C-317), alternate), Wet layup adhesive (C-363).

2.4 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

2.5 Epoxy polyamide primer (C-204).

2.6 Adhesive aluminum tape (C-439).
2.7 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts
- Preparation of Bonding Surfaces
- Bonding of Flat Stock
- Preparing and Mixing Two-part Epoxy Resin by Weight
- Drying Composite Parts Prior to Bonding
- Finish Process Following a Composite Repair
- Preparation of Molding Tool for Composite Repair
- Wet Layup Impregnation Process
- Wet Layup Bagging Process
- Curing Process for Epoxy Resin

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**NOTE**
Completely remove core taking care not to damage opposite skin.

3.2 Cut out and remove damaged portion of skin and core. Cutout to be circular in shape and a maximum of 0.50 inch (12.7 mm) diameter centered on damage, as shown in Figure 3-74.

3.3 Undercut core 0.25 inch (6.4 mm) minimum from edge of skin cutout. A high speed burr or cutting tool made from an Allen key may be used.

3.4 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**CAUTION**
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

**NOTE**
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.5 If -1 doubler is to be installed, clean and remove organic finish from damaged area 1.25 inches (31.8 mm) beyond edge of skin and core cutout using instructions detailed in paragraph 3-2-3.
NOTE

Tape specified in 2.5 may be used over cutout to maintain adhesive in place using instructions detailed in Chapter 4, paragraph 4-2-12.

If wet layup is to be post-cured, dry damaged area using instructions detailed in Chapter 4, paragraph 4-2-10 prior to filling core cavity with adhesive.

3.6 Fill core cavity above contour of panel with general purpose fairing compound specified in 2.3.

3.7 Allow to cure at room temperature for 24 hours.

3.8 Sand cured adhesive to match contour of panel using abrasive paper specified in 2.4.

NOTE

Step 3.9 through step 3.13 inclusively are optional. If the damage being repaired is on a surface frequently exposed to fluids or moisture, it is recommended to proceed with optional fiberglass doubler installation to increase protection against corrosion and contamination of honeycomb core.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.9 Prepare faying surfaces of honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.10 Prepare -1 doubler specified in 2.1, as shown in Figure 3-74. Fiber orientation is optional.

3.11 Wet layup -1 doubler repair ply using wet layup adhesive specified in 2.3 and instructions detailed in paragraph 4-3-3.

3.12 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) HG if vacuum bagging is used.

NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.13 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.14 Prime repair area using material specified in 2.5. Allow to dry.

3.15 Refinish as required.
Figure 3-74. Small Deep Smooth Dent, Sharp Dent, or Puncture — Repair

- DAMAGE
- CLEANUP
- Ø .50 MAX
- .25 MIN UNDERCUT
- 1.00 MIN OVERLAP, TYP
- -1 DOUBLER (OPTIONAL)
- FILLED AND SAND TO CONTOUR

NOTE: DO NOT DAMAGE OPPOSITE SKIN
3-9-3. REPAIR OF PANEL WITH METAL FACING FOR DAMAGE AFFECTING THE CORE

APPLICATION A: HOLE THROUGH ONE OR BOTH SURFACES OF A PANEL OF 1.50 INCH (38.1 MM) DIAMETER OR LESS AFTER CLEANUP

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has damage exceeding the limitations of the repairs given in paragraph 3-9-1 and paragraph 3-9-2, or a small puncture up to 1.50 inches (38.1 mm) in diameter affecting one or both skin(s) and the core.

NOTE

The repair for honeycomb panels with glass fiber reinforced skin(s) has been replaced with the repairs detailed in Chapter 4 of this manual.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on panel. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of cleanup shall be a minimum of 3.0 inches (76 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout or the panel edge bevel.

1.4 Skin repair cutout not to exceed 1.50 inches (38.1 mm).

1.5 Repair will not interfere with subsequent installations.

1.6 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Doubler to be circular or square (not shown in Figure 3-75 or Figure 3-76) in shape and dimensioned to allow a minimum of 1.00 inch (25.4 mm) overlap from panel skin cutout. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 Fasteners: NAS9304B-4 rivets (Quantity 8), grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).
2.8 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
- Installation of Aligned Rivets in Honeycomb Panels (paragraph 3-2-16)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

NOTE
When only one skin is damaged, completely remove core taking care not to damage opposite skin.

3.2 Cut out and remove damaged portion of skin(s) and core. Cutout to be circular in shape and a maximum of 1.50 inches (38.1 mm) in diameter centered on damage as shown in Figure 3-75 or Figure 3-76, as applicable.

3.3 Undercut core 0.25 inch (6.4 mm) minimum from edge of skin(s) cutout. A high speed burr or cutting tool made from an Allen key may be used.

3.4 Prepare -1 doubler(s) specified in 2.1 (Quantity 1 or 2, as shown in Figure 3-75 or Figure 3-76, as applicable).

NOTE
When repairing both sides of panel, rivets holes are to be drilled and prepared using instructions detailed in paragraph 3-2-15 or paragraph 3-2-16 as applicable.

3.5 Locate -1 doubler(s) in position and drill for eight equally spaced fasteners specified in 2.2, maintaining 0.38 inch (9.7 mm) minimum edge distance. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler(s). Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.7 Remove dirt, paint, and primer from repair area over 1.50 inches (38.1 mm) beyond edge of skin(s) cutout using instructions detailed in paragraph 3-2-3.

NOTE
Tape may be used to maintain adhesive in place.

3.8 Fill core cavity above contour of panel with general purpose bonding adhesive specified in 2.5.

3.9 Allow to cure at room temperature for 24 hours.

3.10 Sand cured adhesive to match contour of panel using abrasive paper specified in 2.4.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.11 Prepare faying surfaces of -1 doubler(s) and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.12 Locate -1 doubler(s) in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler(s) adhesive is still wet.

3.13 Secure -1 doubler(s) using fasteners specified in 2.2, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.14 Remove excess adhesive squeeze-out.
3.15 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used. Refer to paragraph 3-2-26 for vacuum bagging instructions.

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.16 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.17 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.18 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.6. Allow to dry. Reprime sealant.

3.19 Refinish as required.
HOLE THROUGH ONE SURFACE:

HOLE THROUGH SKIN AND CORE

DAMAGE CLEANUP:

SKIN CUTLINE
Ø 1.50 MAX

HOLE TRIMMED AND
CORE REMOVED

.25 MIN
UNDERCUT

NAS9304B-4 RIVETS
8 EQUAL SPACES
INSTALL PER 3-2-15
IF REQUIRED

1 DOUBLE

1.00 MIN
OVERLAP
TYP

.38 MIN
ED TYP

HOLE FILLED WITH ADHESIVE
FLUSH WITH OUTER SKIN

Figure 3-75. Small Hole Through One Surface and Core — Repair
Figure 3-76. Small Hole Through Both Surfaces — Repair

**HOLE THROUGH BOTH SURFACES:**

**HOLE THROUGH PANEL AND CORE**

**DAMAGE CLEANUP:**

**SKIN CUTOFF**

\[ \varnothing \ 1.50 \ \text{MAX} \]

**HOLE TRIMMED AND CORE REMOVED**

**.25 MIN UNDERCUT**

**NAS9304B-4 RIVETS**

8 EQUAL SPACES

INSTALL PER 3-2-15

OR 3-2-16

\[ .38 \ \text{MIN ED TYP} \]

\[ 1.00 \ \text{MIN OVERLAP TYP} \]

**ALIGN RIVETS**

-1 DOUBLERS

2 PLACES

**HOLE FILLED WITH ADHESIVE**

FLUSH WITH OUTER SKINS

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APPLICATION B: HOLE THROUGH ONE OR BOTH SURFACES OF A PANEL GREATER THAN 1.50 INCH (38.1 MM) DIAMETER AFTER CLEANUP

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has damage exceeding the limitations of the repairs given in paragraph 3-9-1 and paragraph 3-9-2, or puncture larger than 1.50 inches (38.1 mm) in diameter and affecting one or both skin(s) and the core.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on panel. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of cleanup must be a minimum of 3.0 inches (76 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

1.4 Maximum length of cleanup not to exceed 5.0 inches (127 mm) in any direction.

1.5 Total damage area to be a maximum of 25.0 square inches (161.3 cm²) or 20% of total panel area, whichever is less.

1.6 Repair will not interfere with subsequent installations.

1.7 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler and, if required, -4 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin(s). Minimum thickness of doubler(s) to be 0.020 inch (0.51 mm). Length and width to allow a minimum of two full rows of rivets on all sides of damage plus 0.38 inch (9.7 mm) edge distance. Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 filler and, if required, -5 filler made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing skin(s). Size of filler(s) to match damage cutout. Filler is not required for 0.008 inch (0.20 mm) thick skin. Refer to Appendix A-2-1 for appropriate material part number.

2.3 -3 core plug made from honeycomb core of same material, density, and thickness as original core. Refer to Appendix A-2-4 for appropriate material part number.

2.4 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.5 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.6 General purpose bonding adhesive (C-317).

2.7 Epoxy polyamide primer (C-204).
2.8 High corrosion inhibitor sealant (C-251).

2.9 Adhesive aluminum tape (C-439).

2.10 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Cleaning of Honeycomb Core Cavity (paragraph 3-2-4)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Preparation of Core Plug Prior to Bonding (paragraph 3-2-6)
- Bonding of Flat Stock (paragraph 3-2-7)
- Core Splicing (paragraph 3-2-10)
- Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
- Installation of Aligned Rivets in Honeycomb Panels (paragraph 3-2-16)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of skin(s). Cutout to allow for a minimum of 0.25 inch (6.4 mm) of exposed core to remain and with 0.50 inch (12.7 mm) corner radii as shown in Figure 3-77 or Figure 3-78, as applicable. Ensure core is not damaged while cutting out skin(s).

3.3 Cut out and remove damaged portion of core leaving a minimum of 0.25 inch (6.4 mm) of exposed core to protrude from skin cutout all around.

3.4 Prepare -1 doubler and, if required, -4 doubler specified in 2.1. See Figure 3-77 or Figure 3-78 as applicable.

3.5 Prepare -2 filler and, if required, -5 filler specified in 2.2. See Figure 3-77 or Figure 3-78 as applicable.

3.6 Prepare -3 core plug specified in 2.3. Ensure that -3 core plug ribbon direction is aligned with ribbon direction of existing core in panel. See Figure 3-77 or Figure 3-78 as applicable.

NOTE
When repairing both sides of panel, rivet holes are to be drilled and prepared using instructions detailed in paragraph 3-2-15 or paragraph 3-2-16, as applicable.

3.7 Locate -1 doubler and, if required, -4 doubler in position and drill for new fasteners specified in 2.4 using fastener pattern shown in Figure 3-77 or Figure 3-78 as applicable, maintaining 0.38 inch (9.7 mm) minimum edge distance in doubler(s) and 0.90 inch to 1.30 inches (22.9 mm to 33.0 mm), 1.12 inches (28.4 mm) desired spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.8 Remove -1 doubler and, if required, -4 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

**NOTE**

Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.9 Remove dirt, paint, and primer from repair area over a minimum of 2.25 inches (57.2 mm) beyond edge of skin(s) cutout using instructions detailed in paragraph 3-2-3.

**NOTE**

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.10 Prepare faying surfaces of doubler(s), filler(s), and parent structure for bonding using instructions detailed in paragraph 3-2-5.

3.11 If required, locate -5 filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.6 and instructions detailed in paragraph 3-2-7.

**NOTE**

Tape specified in 2.9 may be used to maintain -4 doubler in place until rivets are installed.

3.12 If required, locate -4 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.6 and instructions detailed in paragraph 3-2-7.

3.13 Locate -3 core plug in position and bond to parent structure using general purpose bonding adhesive specified in 2.6 and instructions detailed in paragraph 3-2-10. Ensure that -3 core plug ribbon direction is aligned with ribbon direction of existing core in panel.

3.14 Locate -2 filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.6 and instructions detailed in paragraph 3-2-7.

3.15 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.6 and instructions detailed in paragraph 3-2-7.
NOTE
Install all rivets wet with adhesive while doubler(s) adhesive is still wet.

3.16 Secure doubler(s) using fasteners specified in 2.4, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.17 Remove excess adhesive squeeze-out.

3.18 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) H_G if vacuum bagging is used. Refer to paragraph 3-2-26 for vacuum bagging instructions.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.19 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm^2) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.20 Prime all bare metal surfaces using material specified in 2.7. Allow to dry.

3.21 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.8. Allow to dry. Reprime sealant.

3.22 Refinish as required.
3-9-3. REPAIR OF PANEL WITH METAL FACING FOR DAMAGE AFFECTING THE CORE

Figure 3-77. Repair of Hole Through One Surface And Core
Figure 3-78. Repair of Hole Through Both Surfaces

- Align rivet rows
- 1 doubler
- 4 doubler
- 2 filler
- 5 filler
- Damaged area 25.0 sq. in max
- Exposed core .25 min typ
- 3 core plug
- .06 gap between existing core and -3 core plug. Fill with adhesive.

NAS9301B-4 rivets install per 3-2-15 or 3-2-16

1.70 min overlap typ

.38 min ed typ

.90 to 1.30
1.12 desired typ

R .38 typ

R .50 typ

5.00 max

2 filler

5.00 max

-2 filler

.25 min typ

-3 core plug

-3 core plug
APPLICATION C: FIBERGLASS FACED PANEL

This repair has been replaced with the repairs detailed in Chapter 4 of this manual.
3-9-4. REPAIR OF PANEL WITH METAL FACING FOR DAMAGE ON SKIN ONLY

APPLICATION A: DELAMINATION OR CORROSION DAMAGE AFFECTING ONE SKIN OF A PANEL OF 1.50 INCHES (38.1 MM) IN DIAMETER OR LESS AFTER CLEANUP

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has a void exceeding the limitations of the repair given in Application A of paragraph 3-9-1, or corrosion damage up to 1.50 inches (38.1 mm) in diameter affecting one skin.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on panel. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of cleanup shall be a minimum of 3.0 inches (76.2 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

1.4 Skin repair cutout not to exceed 1.50 inches (38.1 mm).

1.5 Repair will not interfere with subsequent installations.

1.6 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Doubler to be circular or square in shape and dimensioned to allow a minimum of 1.00 inch (25.4 mm) overlap from panel skin cutout. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 filler, if required, made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing skin(s). Size of filler to match damage cutout. Filler is not required for 0.008 inch (0.20 mm) thick skin. Refer to Appendix A-2-1 for appropriate material part number.

2.3 Fasteners: NAS9304B-4 rivets, grip length to suit (quantity 8). Refer to Appendix A-5 for vendor part numbers.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of skin. Cutout to be circular in shape and a maximum of 1.50 inches (38.1 mm) in diameter centered on damage as shown in Figure 3-79. Ensure core is not damaged while cutting out skin.

3.3 Prepare -1 doubler specified in 2.1 as shown in Figure 3-79.

3.4 Prepare -2 filler, if required, specified in 2.1 (Figure 3-79).

3.5 Locate -1 doubler in position and drill for new fasteners specified in 2.3, maintaining 0.38 inch (9.7 mm) minimum edge distance. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.7 Remove dirt, paint, and primer from repair area over a minimum of 1.50 inches (38.1 mm) beyond edge of skin(s) cutout using instructions detailed in paragraph 3-2-3.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 doubler, parent structure and, if required, -2 filler for bonding using instructions detailed in paragraph 3-2-5.
3.9 If required, locate -2 filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

3.10 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

**NOTE**
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.11 Secure -1 doubler using fasteners specified in 2.3, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.12 Remove excess adhesive squeeze-out.

3.13 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used. Refer to paragraph 3-2-26 for vacuum bagging instructions.

**NOTE**
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.14 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.15 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.16 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.17 Refinish as required.
3-9.4. Repair of Panel with Metal Facing for Damage on Skin Only

Damage Through One Surface Only:

Damage Cleanup:

Skint Cutline

$\varnothing$ 1.50 Max

-1 Doubler

1.00 Min Overlap TYP

.38 Min Ed Typ

-2 Filler (IF Required)

Figure 3-79. Small Damage Affecting One Skin — Repair

ALL-SRM-3-09-04A-1
APPLICATION B: DELAMINATION OR CORROSION DAMAGE AFFECTING ONE SKIN OF A PANEL GREATER THEN 1.50 INCHES (38.1 MM) IN DIAMETER AFTER CLEANUP

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has a void exceeding the limitations of the repair given in Application A of paragraph 3-9-1, or for corrosion damage greater than 1.50 inches (38.1 mm) in diameter affecting one skin only.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 No more than two repairs allowed on panel. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.3 Edge of cleanup must be a minimum of 3.0 inches (76.2 mm) from any attachment point or insert attaching a structural member (as defined in the model-specific SRM), fitting, control support, a cutout, or the panel edge bevel.

1.4 Maximum length of cleanup not to exceed 5.0 inches (127 mm) in any direction.

1.5 Total damage area to be a maximum of 25.0 square inches (161.3 cm²) or 20% of total panel area, whichever is smaller.

1.6 Repair will not interfere with subsequent installations.

1.7 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Minimum thickness of doubler to be 0.02 inch (0.51 mm). Length and width to allow a minimum of two full rows of rivets on all sides of damage plus 0.38 inch (9.7 mm) edge distance. Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 filler, if required, made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing skin. Filler to be dimensioned to fit skin cutout. Filler is not required for 0.008 inch (0.20 mm) thick skin. Refer to Appendix A-2-1 for appropriate material part number.

2.3 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).

2.7 High corrosion inhibitor sealant (C-251).
2.8 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

3.2 Cut out and remove damaged portion of skin. Maintain 0.50 inch (12.7 mm) corner radii as shown in Figure 3-80. Ensure core is not damaged while cutting out skin(s).

3.3 Prepare -1 doubler specified in 2.1 (Figure 3-80).

3.4 Prepare -2 filler, if required, specified in 2.2 (Figure 3-80).

3.5 Locate -1 doubler in position and drill for new fasteners specified in 2.3 using fastener pattern shown in Figure 3-80, maintaining 0.38 inch (9.7 mm) minimum edge distance in doubler(s) and 0.90 to 1.30 inches (22.9 to 33.0 mm), 1.12 inches (28.4 mm) desired spacing. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**CAUTION**

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

**NOTE**

Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.7 Remove dirt, paint, and primer from repair area over a minimum of 2.25 inches (57.2 mm) beyond edge of skin cutout using instructions detailed in paragraph 3-2-3.
NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 doubler, parent structure and, if required, -2 filler for bonding using instructions detailed in paragraph 3-2-5.

3.9 If required, locate -2 filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-5.

3.10 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.11 Secure -1 doubler using fasteners specified in 2.3, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.12 Remove excess adhesive squeeze-out.

3.13 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used. Refer to paragraph 3-2-26 for vacuum bagging instructions.

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.14 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.15 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.16 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.17 Refinish as required.
3.9.4. Repair of Panel with Metal Facing for Damage on Skin Only

Figure 3-80. Large Damage Affecting One Skin — Repair

- Align rivet rows
- 1 doubler
- 1.70 min overlap typ
- .90 to 1.30
- 1.12 desired typ
- .38 min ed typ
- 5.00 max
- R .50 typ
- 5.00 max
- 2 filler (if required)
- Damaged area 25.0 sq. in max
- R .50 typ
- NAS9301B-4 rivets install per 3-2-15
- If required

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3-10. HONEYCOMB PANEL EDGE REPAIRS

Most honeycomb panels are tapered near the edges to provide a thin flat surface that permits a solid attachment to frames, bulkheads, and beams. The tapered edge of core is usually covered with metal or fiberglass cloth to seal it. All honeycomb panel repairs must be adequately sealed using appropriate sealant (paragraph 3-2-19) and protected using epoxy polyamide primer (C-204). Paragraph 3-2-19 is for fuel cells and firewalls only, which require different sealants than basic sealant.

Refer to paragraph 3-10-1 through paragraph 3-10-6 for repairs.

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**WARNING**

WEAR BREATHING MASK, FACE SHIELD, AND PERSONAL PROTECTION EQUIPMENT WHEN WORKING ON COMPOSITES. FUMES AND RESIDUE CAN CAUSE IRRITATION TO THE EYES, SKIN, AND LUNGS.

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**CAUTION**

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1, PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

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**NOTE**

When repairs specify use of adhesive, the mating surfaces of the parts to be bonded must be prepared and bonded in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-25.

1. NEGLIGIBLE DAMAGE

   • Small damage to edging common to skin over basic thickness of core (paragraph 3-10-6).

2. REPAIRABLE DAMAGE

   • Core bevel damage, various panel constructions (paragraph 3-10-1 through paragraph 3-10-4).

   • Damage to skin and edging, various panel constructions (paragraph 3-10-5).
3-10-1. PANEL EDGE REPAIR — FIBERGLASS OR CARBON BEVEL EDGING DAMAGE

This repair has been moved with other fiber reinforced composite repairs given in Chapter 4 of this manual and separated by type of construction as follows:

- For honeycomb sandwich panels with metallic facings and glass fiber reinforced composite edging, refer to Chapter 4, paragraph 4-4-13.

- For honeycomb sandwich panels with glass fiber reinforced composite skin(s), refer to Chapter 4, paragraph 4-4-11 and paragraph 4-4-12.

- For honeycomb sandwich panels with carbon fiber reinforced composite skin(s), refer to Chapter 4, paragraph 4-5-10.
3-10-2. PANEL EDGE REPAIR — FIBERGLASS BEVEL EDGING, METAL SKIN, AND EDGE DOUBLER DAMAGE

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has punctured damage affecting metal skin(s), edge doubler, core, and fiberglass edging.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Damage to the skin(s), core, and edge doubler does not extend more than 0.50 inch (12.7 mm) inside the inboard edge of the bevel after cleanup.

1.3 No more than two repairs allowed on panel. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.4 Maximum length of cleanup along edge of panel not to exceed two fasteners plus edge distance or 1.25 inches (31.8 mm) maximum, whichever is smaller.

1.5 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

1.6 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than combined thickness of existing skin and edge doubler. Doubler to extend from edge of panel to 1.70 inch (43.2 mm) minimum beyond repair cutout on the three remaining sides. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.3 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.4 General purpose bonding adhesive (C-317).

2.5 Aluminum oxide abrasive paper (C-406) of 240 grit or finer.

2.6 Epoxy polyamide primer (C-204).

2.7 Sealants (as required by application): fuel application sealant (C-308), high corrosion inhibitor sealant (C-251).

2.8 Adhesive aluminum tape (C-439).

2.9 Petrolatum (C-008)
3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

NOTE
Do not cut out undamaged skin when only one side of panel is affected.

Completely remove core taking care not to damage opposite skin.

3.2 Cut out and remove damaged portion of skin(s), core, and fiberglass edging. Cutout to have 0.50 inch (12.7 mm) corner radii as shown in Figure 3-81. Maintain 0.38 inch minimum edge distance with existing fasteners.

3.3 Undercut core 0.25 inch (6.4 mm) minimum from edge of skin cutout. A high speed burr or cutting tool made from an Allen key may be used.

3.4 Prepare -1 doubler specified in 2.1 (Figure 3-81).

3.5 Locate -1 doubler in position and drill for new fasteners specified in 2.2 using fastener pattern shown in Figure 3-81, maintaining 0.38 inch (9.7 mm) minimum edge distance in doubler and 0.90 to 1.30 inches (22.9 to 33.0 mm), 1.12 inches (28.4 mm) desired spacing. Transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.6 Remove -1 doubler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

CAUTION
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.7 Remove dirt, paint, and primer from repair area over a minimum of 2.25 inches (57.2 mm) beyond edge of skin cutout using instructions detailed in paragraph 3-2-3.
NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.8 Prepare faying surfaces of -1 doubler and honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.9 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.4 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

Do not install rivets common to fiberglass edging replacement at this time. Clecos lightly coated with release agent (i.e., petrolatum (C-008)) may be used to secure -1 doubler.

3.10 Secure -1 doubler using fasteners specified in 2.4, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

NOTE
Tape specified in 2.8 may be used to maintain adhesive in place.

3.11 Fill core cavity above contour of panel with general purpose bonding adhesive specified in 2.4.

3.12 Remove excess adhesive squeeze-out.

3.13 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used (paragraph 3-2-26).

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.14 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.
DO NOT SAND INTO FIBERGLASS.

DO NOT CLEAN WITH SOLVENT AREA FROM WHICH FINISH WAS REMOVED. REMOVE PAINT BY SANDING. USE 240 GRIT OR FINER PAPER AND CLEAN PANEL SURFACE WITH DRY, CLEAN SHOP AIR.

3.15 Sand cured adhesive to match contour of panel using abrasive paper specified in 2.5.

3.16 Perform repair of damaged edging using instructions detailed in paragraph 3-2-9.

NOTE

Install all rivets wet with adhesive.

3.17 Install remaining fasteners specified in 2.2 wet with general purpose bonding adhesive specified in 2.4, grip length to suit.

3.18 Remove excess adhesive squeeze-out.

3.19 Prime repair area using material specified in 2.6. Allow to dry.

3.20 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.21 Refinish as required.
Figure 3-81. Fiberglass Edging and Edge Doubler — Repair

- Damage through panel edge:
  - Cleanup:
  - Undercut core .25 min typ
  - R .50 typ
  - .50 max damage past core bevel
  - Edging repair plies per section 3-2-9

- Existing skins
- Existing panel inner edge doubler
- Adhesive fill
- -1 doubler

- .90 to 1.30
  - 1.12 desired typ
- .38 min ed typ
  - R .38 typ
  - Align rivet rows

- .25 core undercut
- 1.25 max
- 1.70 min overlap typ
- Panel cutline
- .38 min ed typ

- NAS9301B-4 rivets.
  - Install per 3-2-15 if required.

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3-10.2. Panel edge repair — fiberglass bevel edging, metal skin, and edge doubler damage

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3-10-3. PANEL EDGE REPAIR — ALL METAL BEVEL EDGING AND EDGE DOUBLER DAMAGE

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) and edge bevel edging has puncture damage affecting metal skin(s), edge doubler, core, and aluminum edging.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Damage to the skin(s), core, and edge doubler, which does not extend more than 0.50 inch (12.7 mm) inside the inboard edge of the bevel after cleanup.

1.3 No more than two repairs allowed on panel. The edges of each repair doubler must be separated by a minimum of 5.0 inches (127 mm).

1.4 Maximum length of cleanup along edge of panel not to exceed two fasteners plus edge distance or 1.25 inches (31.8 mm) maximum, whichever is smaller.

1.5 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

1.6 Repair will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than combined thickness of existing skin and edge doubler. Doubler to extend from edge of panel to 1.70 inches (43.2 mm) minimum beyond repair cutout on the three remaining sides. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 edging made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than highest thickness material between inner skin and existing edging. Edging to extend from edge of panel to 1.70 inches (43.2 mm) minimum beyond repair cutout on the three remaining sides. Minimum thickness of edging to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.3 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Aluminum oxide abrasive paper (C-406) of 320 grit or finer.

2.7 Epoxy polyamide primer (C-204).

2.8 High corrosion inhibitor sealant (C-251).
2.9 Process Sheet(s):

- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
- Installation of Aligned Rivets in Honeycomb Panels (paragraph 3-2-16)
- Forming of Flat Sheet Metal (paragraph 3-2-23)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**NOTE**
Do not cut out undamaged skin when only one side of panel is affected.

Completely remove core taking care not to damage opposite skin.

3.2 Cut out and remove damaged portion of skin(s), core, and edging. Cutout to have 0.50 inch (12.7 mm) corner radii as shown in Figure 3-82. Maintain 0.38 inch minimum edge distance with existing fasteners.

3.3 Undercut core 0.25 inch (6.4 mm) minimum from edge of skin cutout. A high speed burr or cutting tool made from an Allen key may be used.

3.4 Prepare -1 doubler specified in 2.1 (Figure 3-82).

3.5 Prepare -2 edging specified in 2.2. Form -2 edging to match contour of panel using instructions detailed in paragraph 3-2-23 (Figure 3-82).

**NOTE**
Rivets installed in repair parts on opposite sides of panel are to be aligned per instructions detailed in paragraph 3-2-16 unless rivets are installed through panel using instructions detailed in paragraph 3-2-15.

3.6 Locate -1 doubler and -2 edging in position and drill for new fasteners specified in 2.3 using fastener pattern shown in Figure 3-82, maintaining 0.38 inch (9.7 mm) minimum edge distance in -1 doubler and -2 edging and 0.90 to 1.30 inches (22.9 to 33.0 mm), 1.12 inches (28.5 mm) desired spacing. Transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 doubler and -2 edging. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.8 Remove dirt, paint, and primer from repair area over a minimum of 2.25 inches (57.2 mm) beyond edge of skin cutout using instructions detailed in paragraph 3-2-3.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.9 Prepare faying surfaces of part to be installed on under side of honeycomb panel (either -1 doubler or -2 edging) and honeycomb panel for bonding using instructions detailed in paragraph 3-2-5. Preference is to be given to part installed on under side.

3.10 Locate -1 doubler or -2 edging, as determined at step 3.9, in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler or -2 edging adhesive is still wet.

If applicable, do not install rivets through thin panel per instructions detailed in paragraph 3-2-15 at this time; secure with Clecos only.

3.11 Secure -1 doubler or -2 edging using fasteners specified in 2.3, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.12 Remove excess adhesive squeeze-out.

3.13 Fill core cavity above contour of panel with general purpose bonding adhesive specified in 2.5.

3.14 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of -1 doubler or -2 edging if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used (paragraph 3-2-26).
NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.15 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm$^2$) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.16 Sand cured adhesive to match contour of panel using abrasive paper specified in 2.6.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.17 Prepare faying surfaces of part to be installed on upper side of honeycomb panel (either -2 edging or -1 doubler) and honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.18 Locate remaining -2 edging or -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -2 edging or -1 doubler adhesive is still wet.

3.19 Secure -2 edging or -1 doubler using fasteners specified in 2.3, grip length to suit.

3.20 Remove excess adhesive squeeze-out.

3.21 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of repair if dead weight is used or a minimum of 20.4 inches (517 mm) $H_{\text{e}}$ if vacuum bagging is used (paragraph 3-2-26).

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.22 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm$^2$) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.23 Prime all bare metal surfaces using material specified in 2.7. Allow to dry.
3.24 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.8. Allow to dry. Reprime sealant.

3.25 Refinish as required.
Figure 3-82. All Metal Bevel Edging — Repair

- Undercut core: 0.25 MIN TYP
- 1.70 MIN OVERLAP TYP
- 0.90 TO 1.30
  1.12 DESIRED TYP
- 0.38 MIN ED TYP
- 0.25 CORE UNDERCUT
- 1.25 MAX
- 1.70 MIN OVERLAP TYP
- PANEL CUTLINE
- EXISTING METAL EDGING
- -2 EDGING
- .50 MAX DAMAGE PAST CORE BEVEL
- EXISTING PANEL INNER EDGE DOUBLER
- ADHESIVE FILL
- -1 DOUBLER
- ALIGN RIVET ROWS
- R .38 TYP
- .38 MIN ED TYP
- NAS9301B-4 RIVETS.
  INSTALL PER 3-2-15 IF REQUIRED.

TC/FAA APPROVED

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3-10.4. PANEL EDGE REPAIR — ALL FIBERGLASS PANEL CONSTRUCTION (WITH OR WITHOUT METAL EDGE DOUBLER)

This repair has been moved with the fiber reinforced composite repairs given in Chapter 4, paragraph 4-4-12 for honeycomb sandwich panels with glass fiber reinforced skin(s).
3-10-5. PANEL EDGE REPAIR — OUTER SKIN DAMAGE ON METAL-FACED PANEL

APPLICATION A: DAMAGE TO OUTER SKIN ONLY

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) has delamination and/or corrosion damage between aluminum outer skin and edge doubler affecting outer skin only.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Applicable to panel skin of 0.025 inch (0.64 mm) or less.

1.3 Disbond shall not extend into panel further than 3.80 inches (96.5 mm) from edge of panel.

1.4 No corrosion or contamination permitted in core. Corrosion limited to outer skin only.

1.5 No more than two repairs allowed on panel with a maximum of one repair per side.

1.6 Maximum length of cleanup not to exceed 20% of length of side being repaired or 5.00 inches (127 mm) maximum, whichever is smaller.

1.7 Doubler to pick up a minimum of five existing rivets in pattern including rivets within damaged area.

1.8 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

1.9 Repair will not overlap or interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than existing skin. Doubler to extend from edge of panel to 1.70 inches (43.2 mm) minimum beyond repair cutout on the three remaining sides. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 filler made from composite bond material (Bell standard 150-021-xxB) of same material and gauge than existing skin. Size of filler to match damage cutout. Refer to Appendix A-2-1 for appropriate material part number.

2.3 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.4 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.5 General purpose bonding adhesive (C-317).

2.6 Epoxy polyamide primer (C-204).
2.7 High corrosion inhibitor sealant (C-251).

2.8 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

**NOTE**
Take care not to damage edge doubler and core while cutting out damaged section of skin.

3.2 Cut out and remove damaged portion of skin. Cutout to have 0.50 inch (12.7 mm) corner radii as shown in Figure 3-83. Maintain 0.38 inch minimum edge distance with existing fasteners.

3.3 Inspect exposed area of edge doubler for corrosion, damage, or delamination. If such damage exists, it may be possible to repair panel using instructions detailed in Application B or Application C.

3.4 Prepare -1 doubler specified in 2.1 (Figure 3-83).

3.5 Prepare -2 filler specified in 2.1 (Figure 3-83).

3.6 Locate -1 doubler and -2 filler in position and drill for new fasteners specified in 2.3 using fastener pattern shown in Figure 3-83, maintaining 0.38 inch (9.7 mm) minimum edge distance in -1 doubler, 0.25 inch (6.4 mm) edge distance in edge doubler, and 0.90 to 1.30 inches (22.9 to 33.0 mm), 1.12 inches (28.5 mm) desired spacing. Transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.7 Remove -1 doubler and -2 filler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.
WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.8 Remove dirt, paint, and primer from repair area over a minimum of 2.25 inches (57.2 mm) beyond edge of skin cutout using instructions detailed in paragraph 3-2-3.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.9 Prepare faying surfaces of -1 doubler, -2 filler, and honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.10 Locate -2 filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

3.11 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.5 and instructions detailed in paragraph 3-2-7.

NOTE
Install all rivets wet with adhesive while -1 doubler adhesive is still wet.

3.12 Secure -1 doubler and -2 filler using fasteners specified in 2.3, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.13 Remove excess adhesive squeeze-out.

3.14 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of -1 doubler or -2 edging if dead weight is used or a minimum of 20.4 inches (517 mm) Hg if vacuum bagging is used (paragraph 3-2-26).
NOTE

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.15 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.16 Prime all bare metal surfaces using material specified in 2.6. Allow to dry.

3.17 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.7. Allow to dry. Reprime sealant.

3.18 Refinish as required.
Figure 3-83. Outer Skin on Metal-faced Panels — Repair of Outer Skin Only
APPLICATION B: DAMAGE TO OUTER SKIN AND EDGE DOUBLER WHERE OUTER SKIN IS THICKER THAN EDGE DOUBLER

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) and edge bevel edging has delamination and/or corrosion damage between aluminum outer skin and edge doubler, between edge doubler and core, or both. Repair of the panel with outer skin thickness equal or less than thickness of edge doubler may be accomplished using instructions detailed in Application C.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Applicable to panel skin of 0.025 inch (0.64 mm) or less.

1.3 Disbond shall not extend into panel further than 3.80 inches (96.5 mm) from edge of panel.

1.4 No corrosion or contamination permitted in core. Corrosion to be limited to outer skin and/or edge doubler.

1.5 No more than two repairs allowed on panel with a maximum of one repair per side.

1.6 Maximum length of cleanup not to exceed 20% of length of side being repaired or 5.00 inches (127 mm) maximum, whichever is smaller.

1.7 Doubler to pick up a minimum of nine existing rivets in pattern including rivets within damaged area.

1.8 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

1.9 Repair will not overlap or interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than thickness of existing skin. Doubler to extend from edge of panel to 1.70 inches (43.2 mm) minimum beyond skin cutout on the three remaining sides. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 skin filler made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing skin. Size of skin filler to match damage cutout in skin. Refer to Appendix A-2-1 for appropriate material part number.

2.3 -3 edge doubler filler made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing edge doubler. Size of edge doubler filler to match damage cutout in edge doubler. Refer to Appendix A-2-1 or appropriate material part number.

2.4 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.5 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).
2.6 General purpose bonding adhesive (C-317).

2.7 Epoxy polyamide primer (C-204).

2.8 High corrosion inhibitor sealant (C-251).

2.9 Process Sheet(s):
   - Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
   - Preparation of Bonding Surfaces (paragraph 3-2-5)
   - Bonding of Flat Stock (paragraph 3-2-7)
   - Fiberglass Edging Replacement (paragraph 3-2-9)
   - Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
   - Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

NOTE
Take care not to damage edge doubler and core while cutting out damaged section of skin.

3.2 Cut out and remove damaged portion of skin. Cutout to extend by a minimum of two fasteners on both sides of damaged section of edge doubler to be cut, and to have 0.50 inch (12.7 mm) corner radii as shown in Figure 3-84. Maintain 0.38 inch minimum edge distance with existing fasteners.

NOTE
Take care not to damage core while cutting out damaged section of edge doubler.

3.3 Cut out and remove damaged portion of edge doubler as shown in Figure 3-84. Maintain 0.38 inch minimum edge distance with existing fasteners. Unless full width of edge doubler is cut, cutout to have 0.50 inch (12.7 mm) corner radii.

3.4 If required, adjust skin cutout to suit amount of edge doubler removed. Maintain 0.38 inch minimum edge distance with existing fasteners.

3.5 Cut out and remove portion of fiberglass edging common to edge doubler cutout as shown in Figure 3-84, and using instructions detailed in paragraph 3-2-9.

3.6 Prepare -1 doubler specified in 2.1 (Figure 3-84).

3.7 Prepare -2 skin filler specified in 2.2 (Figure 3-84).

3.8 Prepare -3 edge doubler filler specified in 2.3 (Figure 3-84).

3.9 Locate -1 doubler, -2 skin filler and -3 edge doubler filler in position and drill for new fasteners specified in 2.4 using fastener pattern shown in Figure 3-84, maintaining 0.38 inch (9.7 mm) minimum edge distance in -1 doubler, 0.25 inch (6.4 mm) edge distance in -3 edge doubler filler, and 0.90 to 1.30 inches (22.9 to 33.0 mm), 1.12 inches (28.5 mm) desired spacing. Transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.
3.10 Remove -1 doubler, -2 skin filler, and -3 edge doubler filler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

CAUTION

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE

Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.11 Remove dirt, paint, and primer from repair area over a minimum of 2.25 inches (57.2 mm) beyond edge of skin cutout using instructions detailed in paragraph 3-2-3.

NOTE

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.12 Prepare faying surfaces of -1 doubler, -2 skin filler, -3 edge doubler filler, and honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.13 Locate -3 edge doubler filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.6 using instructions detailed in paragraph 3-2-7.

3.14 Locate -2 skin filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.6 using instructions detailed in paragraph 3-2-7.

3.15 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.6 using instructions detailed in paragraph 3-2-7.

NOTE

Install all rivets wet with adhesive while -1 doubler, -2 skin filler, and -3 edge doubler filler adhesive is still wet.

3.16 Secure -1 doubler, -2 skin filler, and -3 edge doubler filler using fasteners specified in 2.4, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.17 Remove excess adhesive squeeze-out.
3.18  Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of -1 doubler or -2 edging if dead weight is used or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used (paragraph 3-2-26).

**NOTE**

If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.19  Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.20  Repair damaged fiberglass edging using instructions detailed in paragraph 3-2-9.

3.21  Prime all bare metal surfaces using material specified in 2.7. Allow to dry.

3.22  If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.8. Allow to dry. Reprime sealant.

3.23  Refinish as required.
3-10.5. PANEL EDGE REPAIR — OUTER SKIN DAMAGE ON METAL-FACED PANEL

Figure 3-84. Outer Skin (Thicker than Edge Doubler) on Metal-faced Panels — Repair
APPLICATION C: DAMAGE TO OUTER SKIN AND EDGE DOUBLER WHERE OUTER SKIN IS NOT THICKER THAN EDGE DOUBLER

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) and edge bevel edging has delamination and/or corrosion damage between metal outer skin and edge doubler, between edge doubler and core, or both. Repairs of the panel with outer skin thickness greater than edge doubler thickness may be accomplished using instructions detailed in Application B.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Applicable to panel skins of 0.025 inch (0.64 mm) or less.

1.3 Disbond shall not extend into panel further than 3.80 inches (96.5 mm) from edge of panel.

1.4 No corrosion or contamination permitted in core. Corrosion to be limited to outer skin and/or edge doubler.

1.5 No more than two repairs allowed on panel with a maximum of one repair per side.

1.6 Maximum length of cleanup not to exceed 20% of length of side being repaired or 5.00 inches (127 mm) maximum, whichever is smaller.

1.7 Doubler to pick up a minimum of seven existing rivets in pattern including rivets within damaged area.

1.8 The panel shall be a minimum of 0.38 inch (9.7 mm) thick to allow installation of blind fasteners. If access is available on both sides of panel, repair of panel thickness less than 0.38 inch (9.7 mm) is possible using instructions detailed in paragraph 3-2-15.

1.9 Repair will not overlap or interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 -1 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than thickness of existing skin. Doubler to extend from edge of panel to 1.7 inches (43.2 mm) minimum beyond repair cutout and a minimum of three rivet rows beyond repair cutout on the two remaining sides along edge of panel. Minimum thickness of doubler to be 0.020 inch (0.51 mm). Refer to Appendix A-2-1 for appropriate material part number.

2.2 -2 doubler made from composite bond material (Bell standard 150-021-xxB) of same material and one gauge thicker than thickness of existing edge doubler. Doubler to extend from edge of panel to 0.75 inch (19.1 mm) minimum beyond repair cutout and a minimum of two rivet rows on the two remaining sides along edge of panel. Refer to Appendix A-2-1 for appropriate material part number.

2.3 -3 skin filler made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing skin. Size of skin filler to match damage cutout in skin. Refer to Appendix A-2-1 for appropriate material part number.
2.4 -4 edge doubler filler, if required, made from composite bond material (Bell standard 150-021-xxB) of same material and gauge as existing edge doubler. Size of edge doubler filler to match damage cutout in edge doubler. Refer to Appendix A-2-1 for appropriate material part number.

2.5 Fasteners: NAS9301B-4 rivets, grip length to suit. Refer to Appendix A-5 for vendor part numbers.

2.6 Cleaner: MEK (C-309), acetone (C-316), isopropyl alcohol (C-385), aliphatic naphtha (C-305), or toluene (C-306).

2.7 General purpose adhesive (C-317).

2.8 Epoxy polyamide primer (C-204).

2.9 High corrosion inhibitor sealant (C-251).

2.10 Process Sheet(s):
- Removal of Paints and Primers on Metallic Parts (paragraph 3-2-3)
- Preparation of Bonding Surfaces (paragraph 3-2-5)
- Bonding of Flat Stock (paragraph 3-2-7)
- Fiberglass Edging Replacement (paragraph 3-2-9)
- Installation of Rivets Through Thin Honeycomb Panels (paragraph 3-2-15)
- Preparing and Mixing Two-part Epoxy Resin by Weight (paragraph 3-2-25)

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

NOTE
Take care not to damage core while cutting out damaged section of skin and edge doubler.

3.2 Cut out and remove damaged portion of skin and edge doubler. Cutout to have 0.50 inch (12.7 mm) corner radii in skin as shown in Figure 3-85. Maintain 0.38 inch minimum edge distance with existing fasteners.

3.3 Cut out and remove portion of fiberglass edging common to edge doubler cutout, and using instructions detailed in paragraph 3-2-9.

3.4 Prepare -1 doubler specified in 2.1 (Figure 3-85).

3.5 Prepare -2 doubler specified in 2.2 (Figure 3-85).

3.6 Prepare -3 skin filler specified in 2.3 (Figure 3-85).

3.7 Prepare -4 edge doubler filler specified in 2.4 (Figure 3-85).
3.8 Locate -1 and -2 doublers, -3 skin filler, and -4 edge doubler filler in position and drill for new fasteners specified in 2.5 using fastener pattern shown in Figure 3-85, maintaining 0.38 inch (9.7 mm) minimum edge distance in -1 and -2 doublers, 0.25 inch (6.4 mm) edge distance in -4 edge doubler filler, and 0.90 to 1.30 inches (22.9 to 33.0 mm), 1.12 inches (28.5 mm) desired spacing. Transfer existing fastener holes same size as originals. Refer to Table 3-28 for appropriate rivet hole size.

3.9 Remove -1 and -2 doublers, -3 skin filler, and -4 edge doubler filler. Deburr all holes and edges. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

WEAR PROTECTION FOR EYES AND HANDS. AIR PRESSURE NOT TO EXCEED 30 PSI (207 KPA).

DO NOT ALLOW ANY SOLVENT TO CONTAMINATE CORE PORTION OR EDGE OF HONEYCOMB PANEL.

NOTE
Carefully air blow honeycomb cavity to remove dirt particles.

Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

3.10 Remove dirt, paint, and primer from repair area over a minimum of 3.00 inches (76.2 mm) beyond edge of skin cutout using instructions detailed in paragraph 3-2-3.

NOTE
Do not soak parts to be bonded with cleaner (MEK, acetone, etc.). Use of a moistened rag is recommended.

Remove “peel ply” and lightly sand composite bond material prior to bonding.

3.11 Prepare faying surfaces of -1 and -2 doublers, -3 skin filler, -4 edge doubler filler, and honeycomb panel for bonding using instructions detailed in paragraph 3-2-5.

3.12 Locate -4 edge doubler filler in position with composite bond material facing core and bond to parent structure using general bonding adhesive specified in 2.7 using instructions detailed in paragraph 3-2-7.

3.13 Locate -3 skin filler in position with composite bond material facing core and bond to parent structure using general purpose bonding adhesive specified in 2.7 using instructions detailed in paragraph 3-2-7.

3.14 Locate -1 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.7 using instructions detailed in paragraph 3-2-7.

3.15 Locate -2 doubler in position and bond to parent structure using general purpose bonding adhesive specified in 2.7 using instructions detailed in paragraph 3-2-7.
NOTE
Install all rivets wet with adhesive while -1 and -2 doublers, -3 skin filler, and -4 edge doubler filler adhesive is still wet.

3.16 Secure -1 and -2 doubler, -3 skin filler, and -4 edge doubler filler using fasteners specified in 2.5, grip length to suit. If panel thickness is less than 0.38 inch (9.7 mm) and access is available on both sides, install rivets using instructions detailed in paragraph 3-2-15.

3.17 Remove excess adhesive squeeze-out.

3.18 Allow to cure at room temperature for 24 hours while applying a uniform bondline pressure of 0.5 to 1.0 PSI (3.45 to 68.95 kPa) to surface of -1 doubler or -2 edging if dead weight is used or a minimum of 20.4 inches (517 mm) H₂O if vacuum bagging is used (paragraph 3-2-26).

NOTE
If the ultrasonic inspection method is to be used, please contact Product Support Engineering for procedural information.

3.19 Inspect for voids or unbonded areas by performing a tap test inspection, ultrasonic inspection, or any suitable inspection approved by Bell Helicopter Textron. Voids shall not exceed 10% of total bonded area. No one void shall exceed 0.25 square inch (161 mm²) in area. A maximum of two voids within a 6.0 inch (152 mm) diameter circle is allowed. No edge void is allowed.

3.20 Repair damaged fiberglass edging using instructions detailed in paragraph 3-2-9.

3.21 Prime all bare metal surfaces using material specified in 2.8. Allow to dry.

3.22 If required, seal all edges of repair area to match surrounding structure using sealant specified in 2.9. Allow to dry. Reprime sealant.

3.23 Refinish as required.
Figure 3-85. Outer Skin (Not Thicker than Edge Doubler) on Metal-faced Panel — Repair
3-10-6. PANEL EDGE REPAIR — FIBERGLASS EDGING COMMON TO SKIN OVER HONEYCOMB CORE

This section covers typical repairs for cases where the honeycomb panel with aluminum facing(s) and edge bevel edging has damage affecting fiberglass edging section common to metallic skin over full thickness section of honeycomb core.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Not applicable if panel skin and core are affected.

1.3 Damage limited to section of edging common to metallic skin over basic thickness of honeycomb core and to a maximum length of 1.00 inch (25.4 mm) along edge of panel.

1.4 No more than two damages per side of panel. The edge of each damage must be separated by a minimum of 5.0 inches (127 mm) after cleanup.

1.5 Maximum length of cleanup not to exceed 1.50 inches (38.1 mm).

1.6 Damage cleanup not to extend down into honeycomb core bevel.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Epoxy polyamide primer (C-204).

2.2 Process Sheet(s):
   Sanding Glass or Carbon Fiber Composites
   Cutting/Routing Glass or Carbon Fiber Composites

3.0 PROCEDURE

3.1 Gain access to damaged area recording type, size, and location of fasteners removed.

   **NOTE**
   Take care not to damage skin while cutting out damaged section of edging.
   Do not expose core cells.

3.2 Cut out and remove damaged portion of edging plus a minimum of 0.25 inch (6.4 mm) beyond damage on all sides using instructions detailed in paragraph 4-2-4 (Figure 3-86).

3.3 Inspect exposed surfaces of skin and edging for evidence of damage, corrosion, or unbonded areas. If damage exists, determine extent of damage and repair using appropriate section of this manual or of model-specific Structural Repair Manual before proceeding with edging replacement.

3.4 Finish repair using instructions detailed in paragraph 4-2-11.

3.5 Prime all bare metal surfaces using material specified in 2.1. Allow to dry.

3.6 Refinish as required.
NOTE:
THERE SHALL BE NO
DAMAGE TO SKIN OR
CORE.

EOP EXISTING
EDGING, REF

.25
TYP

R .25
TYP

1.00 MAX
DAMAGE

1.50 MAX
CLEANUP

CORE BEVEL
REF

EDGING CUTLINE

EOP SKIN, REF

MAX
CUTOUT

Figure 3-86. Fiberglass Edging Common to Skin Over Honeycomb Core — Repair
3-11. UNSUPPORTED COMPOSITE SKIN REPAIRS

This section has been moved to Chapter 4 of this manual.

3-11-1. UNSUPPORTED COMPOSITE SKIN REPAIRS — FRACTURED PLYES RESULTING FROM IMPACT DAMAGE

This section has been moved to Chapter 4 of this manual and separated as follows: paragraph 4-4-1 and paragraph 4-4-2 for glass fiber reinforced composites, and paragraph 4-5-1 and paragraph 4-5-2 for carbon fiber reinforced composites.
UNSUPPORTED COMPOSITE SKIN REPAIRS — PUNCTURE DAMAGE

This section has been moved to Chapter 4, paragraph 4-4-3 for glass fiber reinforced composites, and to paragraph 4-5-3 for carbon fiber reinforced composites.
3-12. SPOTWELD PATTERN DISCREPANCIES

Sometimes, assembled parts are held together with resistance (spot) welds rather than rivets. The failure modes for this fastening method being different than those of riveted assemblies, different repair methods need to be used. This section provides the different repair methods to be used on spot welded assemblies.

Refer to paragraph 3-12-1 through paragraph 3-12-2 for repairs.

THE TYPICAL REPAIRS IN THIS SECTION ARE SUBJECT TO THE LIMITATIONS OF SPECIFIED REPAIRS IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL. THESE TYPICAL REPAIRS MAY NOT BE APPLIED TO RESTRICTED AREAS IDENTIFIED IN CHAPTER 1 PARAGRAPH 1-20 UNLESS SPECIFICALLY DIRECTED IN THE MODEL-SPECIFIC STRUCTURAL REPAIR MANUAL.

NOTE

When repairs specify use of adhesive, the mating surfaces of the parts to be bonded must be prepared and bonded in accordance with instructions given in paragraph 3-2-3, paragraph 3-2-5, paragraph 3-2-7, and paragraph 3-2-26.

1. NEGLIGIBLE DAMAGE

   • None

2. REPAIRABLE DAMAGE

   • Defective spotwelds in aluminum assemblies (paragraph 3-12-1).
   • Defective spotwelds in stainless steel and titanium assemblies (paragraph 3-12-2).
3-12-1. REPAIR OF DAMAGED SPOTWELD IN ALUMINUM PARTS

This section covers typical repairs for cases where spotwelded aluminum assembly shows signs of damage such as a spotweld pulled-out through the material of a part (i.e., the nugget is torn out (partial or complete) of one sheet of material and an indentation is left in the other sheet) or a cracked spotweld.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum of 15% of the spotweld in a joined assembly large pattern.

1.3 A maximum of two spotwelds in a group of five.

1.4 Maximum material thickness of 0.040 inch (1.02 mm).

1.5 Minimum material thickness of 0.025 inch (0.64 mm) for flush rivets.

1.6 Maximum acceptable diameter of repair rivet is 0.188 inch (4.76 mm).

1.7 Repair rivets will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Fasteners: MS20470AD( ) or NAS1097AD( ) rivets as required by part/location being repaired.

<table>
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<th>Thickness of Thinnest Outer Sheet (inch (mm))</th>
<th>Minimum Edge Distance (inch (mm))</th>
<th>Minimum MS20470AD( ) Protruding Head Rivet Diameter (inch (mm))</th>
<th>Maximum NAS1097AD( ) Flush Head Rivet Diameter (inch (mm))</th>
</tr>
</thead>
<tbody>
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<td>0.012 (0.30)</td>
<td>0.15 (3.8)</td>
<td>3/32 (2.4)</td>
<td>-</td>
</tr>
<tr>
<td>0.016 (0.41)</td>
<td>0.19 (4.8)</td>
<td>3/32 (2.4)</td>
<td>-</td>
</tr>
<tr>
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<td>-</td>
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<td>0.28 (7.1)</td>
<td>1/8 (3.2)</td>
<td>1/8 (3.2)</td>
</tr>
</tbody>
</table>

2.2 Epoxy polyamide primer (C-204).

2.3 High corrosion inhibitor sealant (C-251).

2.4 Chemical film material (C-100).

2.5 Process Sheet(s):

Brush Chemical Film Application on Aluminum and Titanium Parts (paragraph 3-2-14)
3.0 PROCEDURE

3.1 Gain access to damaged area.

3.2 Drill through each pulled-out spotweld to clean out defect. Cleanout diameter to be a maximum of 0.188 inch (4.76 mm).

3.3 Drill for new fasteners (two per defective spotweld) specified in 2.1. One hole to be drilled on each side of discrepant spotweld removed at step 3.2, maintaining proper edge distance and equally spaced between spotwelds. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

**NOTE**
Flush rivets shall be used on all surfaces where assembly operation requires a flat surface.

3.5 If required, countersink new holes (two per defective spotweld) for installation of added flush rivets using restrictions from paragraph 3-2-18 and Table 3-21. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.6 Install rivets (two per defective spotweld) specified in 2.1 wet with sealant specified in 2.3, grip length to suit.

3.7 Remove excess sealant squeeze-out.

3.8 Brush apply chemical film material specified in 2.4 to reworked area using instructions detailed in paragraph 3-2-14.

3.9 Prime all bare metal surfaces using material specified in 2.2. Allow to dry.

3.10 Fill open hole at discrepant spotweld location using sealant specified in 2.3. Allow to dry. Reprime sealant. Alternatively, it is acceptable to plug discrepant spotweld using rivet specified in 2.1 wet with sealant specified in 2.3, grip length to suit.

3.11 Refinish as required.
Figure 3-87. Pulled-out Spotweld in Aluminum Parts — Repair

**Damage:**
- Spotweld torn out of top sheet
- Spotweld spacing "X"

**Damage Cleanup:**
- Drill hole to clean out defect. Ø .188 max
- 1/2 "X"
- Drill holes to accommodate rivets

**Repair:**
- Install rivets in new holes
- Fill hole with sealant
3-12-2. REPAIR OF DAMAGED SPOTWELD IN STAINLESS STEEL OR TITANIUM PARTS

This section covers typical repairs for cases where spotwelded stainless steel or titanium assembly shows signs of damage such as a spotweld pulled-out through the material of a part (i.e., the nugget is torn out (partial or complete) of one sheet of material and an indentation is left in the other sheet) or a cracked spotweld.

1.0 RESTRICTIONS

1.1 Subject to limitations given in Chapter 1, paragraph 1-20.

1.2 Maximum of 3% of the spotweld in a joined assembly large pattern.

1.3 A maximum of one spotweld in a group of five.

1.4 Maximum material thickness of 0.040 inch (1.02 mm).

1.5 Minimum material thickness of 0.032 inch (0.81 mm) for flush rivets.

1.6 Maximum acceptable diameter of repair rivet is 0.188 inch (4.76 mm).

1.7 Repair rivets will not interfere with subsequent installations.

2.0 REQUIRED (Refer to BHT-ALL-SPM for C-xxx consumable materials.)

2.1 Fasteners: MS20615-( )M or NAS1200M( ) rivets as required by part/location being repaired.

<table>
<thead>
<tr>
<th>Thickness of Thinnest Outer Sheet (inch (mm))</th>
<th>Minimum Edge Distance (inch (mm))</th>
<th>Minimum MS20615-( )M Protruding Head Rivet Diameter (inch (mm))</th>
<th>Maximum NAS1200M( ) Flush Head Rivet Diameter (inch (mm))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.012 (0.30)</td>
<td>0.15 (3.8)</td>
<td>3/32 (2.4)</td>
<td>-</td>
</tr>
<tr>
<td>0.016 (0.41)</td>
<td>0.19 (4.8)</td>
<td>1/8 (3.2)</td>
<td>-</td>
</tr>
<tr>
<td>0.020 (0.51)</td>
<td>0.19 (4.8)</td>
<td>1/8 (3.2)</td>
<td>-</td>
</tr>
<tr>
<td>0.025 (0.64)</td>
<td>0.22 (5.6)</td>
<td>1/8 (3.2)</td>
<td>-</td>
</tr>
<tr>
<td>0.032 (0.81)</td>
<td>0.25 (6.4)</td>
<td>1/8 (3.2)</td>
<td>1/8 (3.2)</td>
</tr>
<tr>
<td>0.040 (1.02)</td>
<td>0.28 (7.1)</td>
<td>1/8 (3.2)</td>
<td>1/8 (3.2)</td>
</tr>
</tbody>
</table>

2.2 Epoxy polyamide primer (C-204), if required.

2.3 Sealants (as required by application): fuel application sealant (C-308), firewall application sealing compound (C-353).

2.4 Chemical film material (C-100), if required.

2.5 Process Sheet(s):
Brush Chemical Film Application on Aluminum and Titanium Parts (paragraph 3-2-14)
3.0 PROCEDURE

3.1 Gain access to damaged area.

3.2 Drill through each pulled-out spotweld to clean out defect. Cleanout diameter to be a maximum of 0.188 inch (4.76 mm).

3.3 Drill for new fasteners (two per defective spotweld) specified in 2.1. One hole to be drilled on each side of discrepant spotweld removed at step 3.2, maintaining proper edge distance and equally spaced between spotwelds. Refer to Table 3-28 for appropriate rivet hole size.

3.4 Deburr all holes. Deburr not to exceed 0.005 inch (0.13 mm) depth. Remove debris and loose material.

NOTE
Flush rivets shall be used on all surfaces where assembly operation requires a flat surface.

3.5 If required, countersink new and existing holes (three per defective spotweld) for installation of added flush rivets using restrictions from paragraph 3-2-18 and Table 3-21. Refer to paragraph 3-3-2 and to Table 3-29 for countersink/dimpled flush rivets installation.

3.6 Install rivets (three per defective spotweld) specified in 2.1 wet with sealant specified in 2.3, grip length to suit.

3.7 Remove excess sealant squeeze-out.

NOTE
Chemical film treatment is required only for titanium parts that are primed or painted. Do not apply chemical film to stainless steel parts.

3.8 If required, brush apply chemical film material specified in 2.4 to reworked area using instructions detailed in paragraph 3-2-14.

3.9 If required, prime all bare metal surfaces using material specified in 2.2 to match surrounding areas. Allow to dry.

3.10 Refinish as required.
3-12.2. Repair of Damaged Spotweld in Stainless Steel or Titanium Parts

**Damage:**

- Spotweld torn out of top sheet
- Spotweld spacing "X"

**Damage Cleanup:**

- Drill hole to clean out defect. Ø 188 max
- 1/2 "X"
- Drill holes to accommodate rivets

**Repair:**

- Install rivets in new holes
- Install rivet in new hole at discrepant spotweld location

Figure 3-88. Pulled-out Spotweld — Repair