STANDARD REPAIRS

1. DESCRIPTION

This section outlines specific repairs applicable to composite structural damage that is field repairable. Before beginning any procedure outlined in this Section, the repair technician should read and understand Section 10: Assessing Composite Damage, and Section 20: Composite Repair.

A. Tail Strike

In the event of a tail strike, a visual inspection of the airframe and the components involved must be accomplished to determine the type and extent of damage. The Unscheduled Maintenance Check for Hard/Overweight Landings should be completed. (Refer to 5-50)

Serials 0002 & subs: The Vertical Spar Bond Repair may be used to repair disbonding between the lower vertical spar and empennage skin.

Serials 0821 & subs: The Vertical Spar Patch Repair may be used to replace a damaged portion of the lower vertical spar.

Any damage to the empennage skin is not field repairable and Cirrus Design must be contacted for disposition.

(1) Vertical Spar Bond Repair (See Figure 51-211) - *Serials 0002 & subs*

The Vertical Spar Bond Repair may be used to repair disbonding between lower vertical spar and empennage skin. Bond depressions are filled with filler paste to ensure a smooth layup transition. Glass fabric repair plies are then wet-layed over area where disbonding has occurred.

CAUTION: If extent of damage is such that repair plies would extend into hinge area, then the condition is not field repairable and Cirrus Design must be contacted for disposition.

(a) Determine type and extent of damage. If necessary, contact Cirrus Design for disposition.

(b) Acquire necessary tools, equipment, and supplies.

Description	P/N or Spec.	Supplier	Purpose
Serials 0002 & subs: Tin Plated Copper Tape, 4 Inch	8271-0400-76	Instrument Specialties Euless,TX 76040 817-267-2651	General repair.
Serials 0821 & subs: Expanded Metal Mesh (EMM)	AL060CX	Astro Seal, Inc. 827-B Palmyrita Ave. Riverside, CA 92507 (909) 787-6670	Lightning protection.
Tie Down Bracket	20111-003	Cirrus Design Duluth, MN 55811 218-727-2737	Tie down eye bolt attachment.
Tie Down Eye Bolt	12403-001	Cirrus Design Duluth, MN 55811 218-727-2737	Tie down airplane.

Description	P/N or Spec.	Supplier	Purpose
Nut	50831-375	Cirrus Design Duluth, MN 55811 218-727-2737	Tie down eye bolt attachment.
Isopropyl Alcohol	TT-I-735 Grade A or B	Any Source	General cleaning.
Orbital Sander	39825A12	Any Source	Prepare repair surface.
Angle Grinder	80-grit	Any Source	Remove laminate from vertical spar.
Release Film	WL5200 (Red or Blue)	Airtech Int'l Inc. Huntington Beach, CA 92647 714-899-8100	Protect lay-up surface.
Peel Ply	Stitch Ply G	Airtech Int'l Inc. Huntington Beach, CA 92647 714-899-8100	Makes a smooth and contaminate free repair surface.
Glass Repair Fabric	7781-F16	Hexcel Chicago,IL 60678-3052 740-653-1540	Repair composite structures.
Structural Resin Repair System	MGS L418/418	MGS Stuttgart, Germany D-70309 711-323-081	Bond plies over puncture.
Sandpaper	120-grit or finer	Any Source	Paint and primer removal.
Sandpaper	60 to 80-grit	Any Source	Abrade bonding surfaces.
Aerosil	200	Degussa Ridgefield Park, NJ 07660 201-641-6100	Resin filler.
Sil-Cell	Sil-32	Silbrico Hodgkins, IL 60525 800-323-4287	Resin filler.
Diamond Coated Hole Saw	3/4 inch	Any Source	Drill aft tie down installation hole.

(c) Remove rudder. (Refer to 55-40)
(d) Remove bolts and washers securing upper vertical hinge to empennage.
(e) Remove bolts and washers securing lower vertical hinge to empennage.
(f) Remove nut securing tie down eye bolt to empennage.

(g) Remove bolts and washers securing tie down bracket to empennage.

(h) *Serials 0002 thru 0820:* Remove copper tape from vertical spar.

CAUTION: Never use a grinder for removal of outer surface coats. A grinder will gouge the surface creating more damage. Chemical strippers should not be used as they may become trapped, damage the laminate, or leave a residue.

Note: Multi-action orbital type sanders or simple hand-sanding are the preferred methods of paint removal. Fine-grit paper (120-grit or finer) should be selected to minimize the potential for accidental damage.

(i) Remove paint finish from repair area.

(j) *Serials 0821 & subs:* Remove Expanded Metal Mesh (EMM) lightning protection from repair area.

Note: *Serials 0821 & subs:* Remove lip of aft vertical spar to tangent at least 0.50 inch (1.27 cm) beyond damaged area.

(k) *Serials 0821 & subs:* Carefully trim away lip of aft vertical spar using a small angle grinder with 80-grit or similar disk to remove the laminate from the fuselage skin.

(l) Solvent clean with isopropyl alcohol. (Refer to 20-30)

(m) Mix filler paste. (Refer to 51-20)

Note: At junction between vertical spar and fuselage skin, ensure gap filler does not exceed maximum radius of 0.50 inch (1.27 cm).

(n) Using a clean spatula or wooden applicator, fill bond depressions with filler paste to ensure smooth layup transition.

Note: Ensure plies extend at least 1.0 inch (2.54 cm) beyond disbond.

Ensure each ply overlaps the previous ply by at least 0.5 inch (1.27 cm).

(o) Cut three glass-fiber repair plies at +/- 45°. (Refer to 51-20)

(p) Mix resin. (Refer to 51-20)

(q) Layup glass fabric repair plies (Refer to 51-20)

(r) Cure repair plies. (Refer to 51-20)

(s) *Serials 0821 & subs:* Install Expanded Metal Mesh (EMM) lightning protection. (Refer to 51-20)

(t) Match drill hinge installation holes covered by glass fabric repair layup.

(u) Match drill aft tie down installation hole covered by glass fabric repair layup.

(v) Using 3/4 inch hole saw, cut aft tie down installation hole through skin and centered on BL0.

(w) *Serials 0821 & subs:* From aft tangent of tie down installation hole to aft edge of empennage skin, cut a 0.18 inch (4.6 mm) wide slot centered on BL0.

(x) Prepare the surface for primer and paint. (Refer to 51-30)

(y) Paint repair area. (Refer to 51-30)

(z) *Serials 0002 thru 0820:* Apply copper tape to vertical spar.

Note: Increase bolt length as required to ensure correct grip requirements. Threads not allowed in load bearing structure.

It is permissible to remove up to 0.063 inch at a 45° angle to improve tie down bracket fit.

(aa) Install bolts and washers securing tie down bracket to empennage.

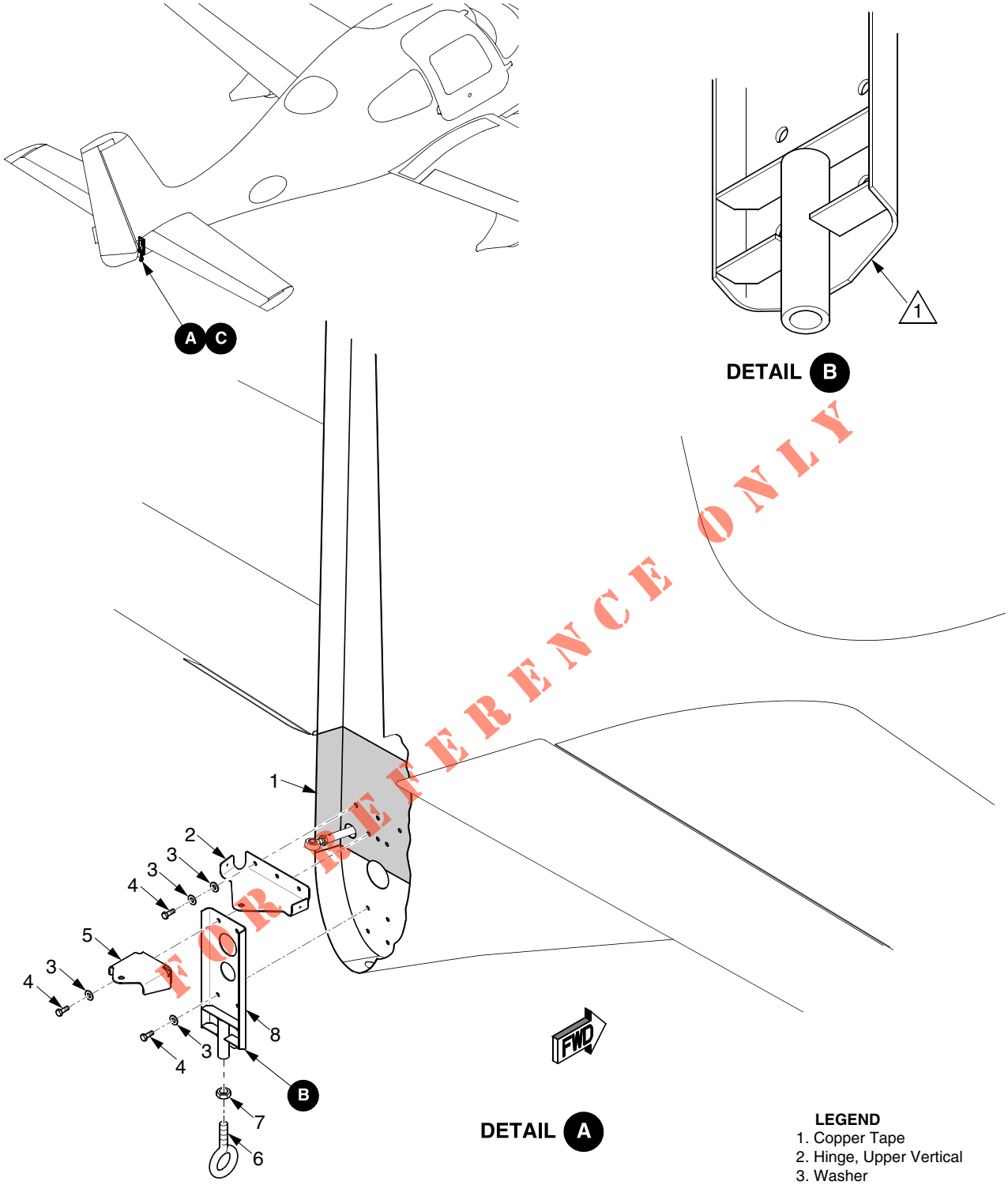
(ab) Install nut securing tie down eye bolt to empennage.

(ac) Install bolts and washers securing lower vertical hinge to empennage.

(ad) *Serials 0821 & subs:* To ensure electrical contact, sand or burnish EMM where sides of upper vertical hinge contact the vertical spar. (Refer to 51-20)

(ae) Install bolts and washers securing upper vertical hinge to empennage.

(af) Install rudder. (Refer to 55-40)



NOTE

1. It is permissible to remove up to 0.063 inches at a 45° angle to improve tie down bracket fit.

LEGEND

1. Copper Tape
2. Hinge, Upper Vertical
3. Washer
4. Bolt
5. Hinge, Lower Vertical
6. Eye Bolt, Tie Down
7. Nut
8. Aft Tie Down

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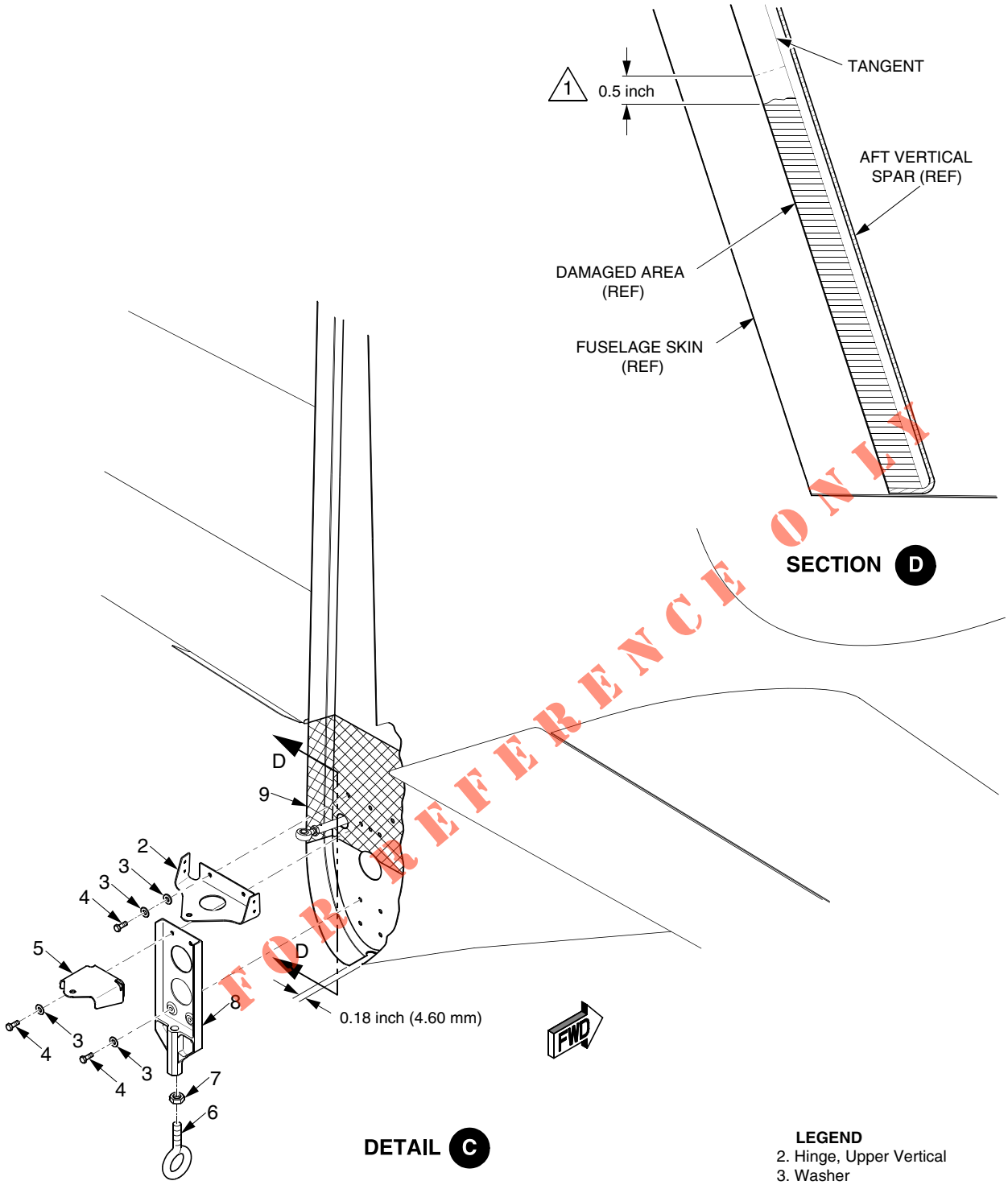
Figure 51-211
Vertical Spar Bond Repair - *Serials 0002 thru 0820* (Sheet 1 of 4)



NOTE

1 Remove lip of aft vertical spar to tangent at least 0.5 inch (1.27 cm) beyond damaged area.

LEGEND

2. Hinge, Upper Vertical
3. Washer
4. Bolt
5. Hinge, Lower Vertical
6. Eye Bolt, Tie Down
7. Nut
8. Aft Tie Down
9. EMM

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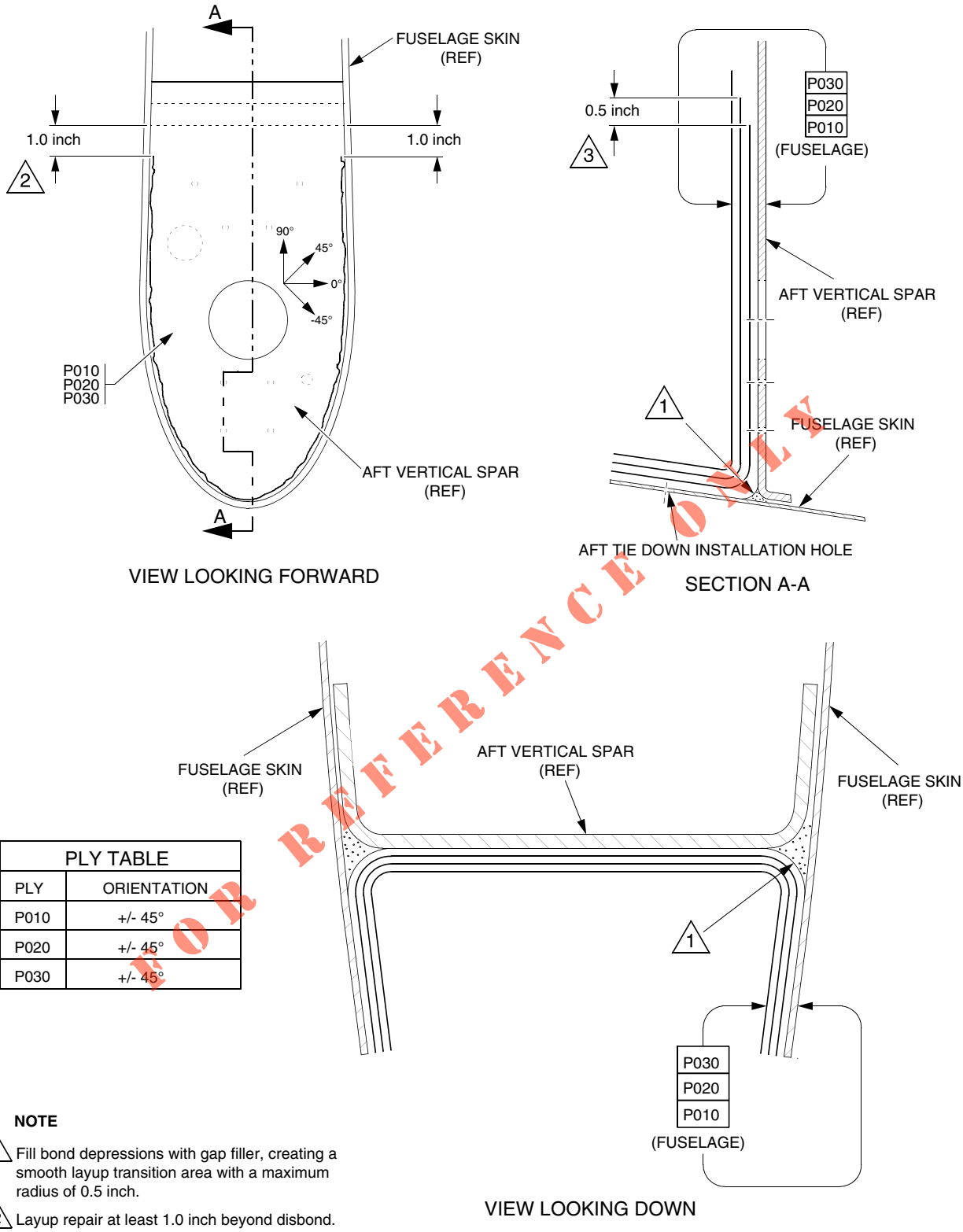
Figure 51-211
Vertical Spar Bond Repair - *Serials 0821 & subs* (Sheet 2 of 4)



PLY TABLE	
PLY	ORIENTATION
P010	+/- 45°
P020	+/- 45°
P030	+/- 45°

NOTE

1. Fill bond depressions with gap filler, creating a smooth layup transition area with a maximum radius of 0.5 inch.
2. Layup repair at least 1.0 inch beyond disbond.
3. Layup each ply so it overlaps previous ply by at least 0.5 inch.

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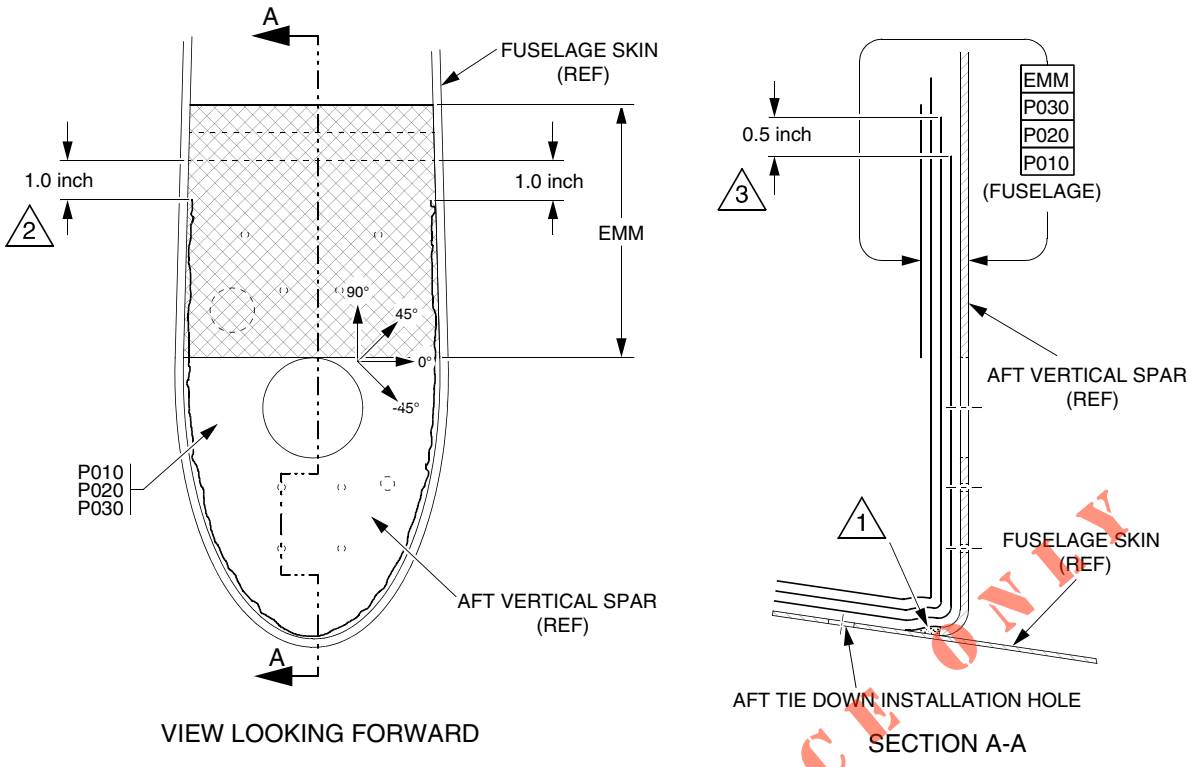
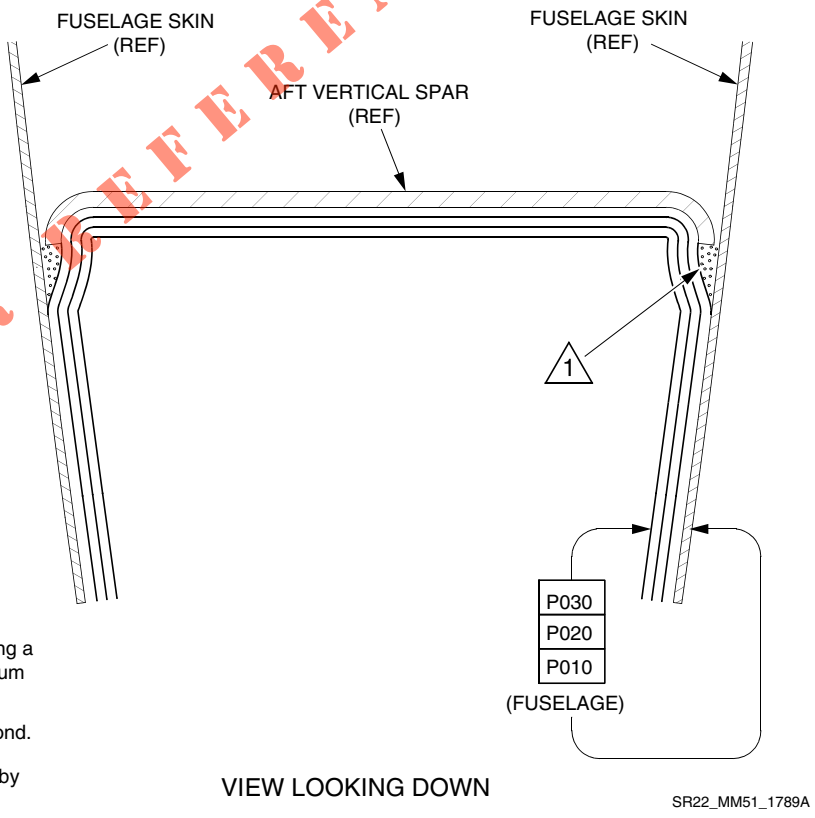
Figure 51-211
Vertical Spar Bond Repair - *Serials 0002 thru 0820* (Sheet 3 of 4)



PLY TABLE	
PLY	ORIENTATION
P010	+/- 45°
P020	+/- 45°
P030	+/- 45°



NOTE

1. Fill bond depressions with gap filler, creating a smooth layup transition area with a maximum radius of 0.5 inch.
2. Layup repair at least 1.0 inch beyond disbond.
3. Layup each ply so it overlaps previous ply by at least 0.5 inch.

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Figure 51-211
Vertical Spar Bond Repair - *Serials 0821 & subs* (Sheet 4 of 4)

(2) Vertical Spar Patch Repair (See Figure 51-212) - *Serials 0821 & subs*

The Vertical Spar Patch Repair may be used to replace a damaged portion of the lower vertical spar. The damaged area of the vertical spar is cut away and removed. A repair patch is created from a replacement vertical spar and bonded over the damaged area. Glass fabric repair plies are then wet-layed over repair patch area.

CAUTION: If damage to vertical spar extends above inspection hole, the airplane is not repairable and Cirrus Design must be contacted for disposition.

(a) Determine type and extent of damage. If necessary, contact Cirrus Design for disposition.

(b) Acquire necessary tools, equipment, and supplies.

Description	P/N or Spec.	Supplier	Purpose
Vertical Spar	20852-001	Cirrus Design Duluth, MN 55811 218-727-2737	Create repair patch for damaged portion of vertical spar.
Lower Vertical Hinge	20104-001	Cirrus Design Duluth, MN 55811 218-727-2737	Rudder attachment.
Tie Down Bracket	20111-003	Cirrus Design Duluth, MN 55811 218-727-2737	Tie down eye bolt attachment.
Tie Down Eye Bolt	12403-001	Cirrus Design Duluth, MN 55811 218-727-2737	Tie down airplane.
Nut	50831-375	Cirrus Design Duluth, MN 55811 218-727-2737	Tie down eye bolt attachment.
Expanded Metal Mesh (EMM)	AL060CX	Astro Seal, Inc. 827-B Palmyrita Ave. Riverside, CA 92507 (909) 787-6670	Lightning protection.
Isopropyl Alcohol	TT-I-735 Grade A or B	Any Source	General cleaning.
Orbital Sander	39825A12	Any Source	Prepare repair surface.
Release Film	WL5200 (Red or Blue)	Airtech Int'l Inc. Huntington Beach,CA 92647 714-899-8100	Protect lay-up surface.
Peel Ply	Stitch Ply G	Airtech Int'l Inc. Huntington Beach,CA 92647 714-899-8100	Makes a smooth and contaminate free repair surface.

Description	P/N or Spec.	Supplier	Purpose
Glass Repair Fabric	7781-F16	Hexcel Chicago,IL 60678-3052 740-653-1540	Repair composite structures.
Structural Resin Repair System	MGS L418/418	MGS Stuttgart, Germany D-70309 711-323-081	Bond plies over puncture.
Sandpaper	120-grit or finer	Any Source	Paint and primer removal.
Sandpaper	60 to 80-grit	Any Source	Abrade bonding surfaces.
Aerosil	200	Degussa Ridgefield Park, NJ 07660 201-641-6100	Resin filler.
Sil-Cell	Sil-32	Silbrico Hodgkins, IL 60525 800-323-4287	Resin filler.
Angle Grinder	80-grit	Any Source	Remove laminate from aft vertical spar.

(c) Remove rudder. (Refer to 55-40)

(d) Remove bolts and washers securing upper vertical hinge to empennage.

(e) Remove bolts and washers securing bottom vertical hinge to empennage.

(f) Remove nut securing tie down eye bolt to empennage.

(g) Remove bolts and washers securing tie down bracket to empennage.

CAUTION: Never use a grinder for removal of outer surface coats. A grinder will gouge the surface creating more damage. Chemical strippers should not be used as they may become trapped, damage the laminate, or leave a residue.

Note: Multi-action orbital type sanders or simple hand-sanding are the preferred methods of paint removal. Fine-grit paper (120-grit or finer) should be selected to minimize the potential for accidental damage.

(h) Remove paint finish from repair area.

(i) Remove Expanded Metal Mesh (EMM) lightning protection from repair area.

(j) Remove damaged portion of lower vertical spar. (See Figure 51-212)

Note: A new tiedown backing plate will be attached to the vertical spar repair patch. The damage cutout area in the vertical spar must be large enough to allow insertion of the tiedown backing plate.

1 Use tiedown backing plate to determine size and shape of vertical spar damage cut-out area.

2 Ensure minimum distance of 0.13 inch (3.3 mm) between tiedown backing plate and corners of damage cutout area.

3 Maintain maximum amount of bonding surface possible between damage cutout area and vertical spar radius tangent.

4 Carefully cut and remove damaged portion of lower vertical spar.

(k) If necessary, use sand paper to remove any delaminated, loose, or damaged plies on the vertical spar.

(l) Prepare vertical spar repair patch. (See Figure 51-212)

1 From lower radius of replacement vertical spar, measure 7.4 inch (18.8 cm) up vertical spar and mark horizontal line across face of vertical spar.

2 Cut vertical spar at mark to create repair patch.

3 Remove flange from repair patch by cutting along tangent line +0.0, -0.1 inch (+0.0, -2.5 mm) on all sides.

4 Verify patch does not interfere with upper vertical hinge. If necessary, trim top edge of patch.

5 Bevel outer edges of patch to approximately 60 degrees.

(m) Bond repair patch into position.

1 Solvent clean with isopropyl alcohol. (Refer to 20-30)

2 Mix adhesive. (Refer to 51-20)

3 Using a clean spatula or wooden applicator, apply adhesive to repair area to obtain a bond thickness of 0.005 inch (0.13 mm) to 0.06 inch (1.5 mm).

CAUTION: Movement during cure may cause bond voids. Do not move or pull repair patch away from the vertical spar after squish-out is achieved or voids will form.

4 Place repair patch into position by aligning lower vertical hinge holes in patch with lower vertical hinge holes in existing spar. Secure with fixturing as required to prevent movement during cure.

5 Cure repair patch bond. (Refer to 51-20)

(n) Mix filler paste. (Refer to 51-20)

Note: Ensure gap filler does not exceed maximum radius of 0.50 inch (1.27 cm).

(o) Using a clean spatula or wooden applicator, apply filler paste to corner between repair patch and vertical spar flanges.

(p) Cut three glass-fiber repair plies based on the following criteria:

1 Ply orientation is +/- 45°. (Refer to 51-20)

2 Plies butt to upper edge of repair patch and extend aft to trailing edge of vertical spar on all sides except for bottom.

3 At bottom, plies extend to trailing edge of fuselage skin 1.0 inch (2.54 cm) minimum on either side of BL0.

(q) Mix resin. (Refer to 51-20)

(r) Layup glass fabric repair plies (Refer to 51-20)

(s) Cure repair plies. (Refer to 51-20)

(t) Install Expanded Metal Mesh (EMM) lightning protection over repair area. (Refer to 51-20)

CAUTION: Use caution when drilling tie down bracket installation holes to avoid damage to backing plate nutplates on back of patch.

(u) Match drill tie down bracket installation holes covered by glass fabric repair layup.

(v) Match drill hinge installation holes covered by glass fabric repair layup.

(w) Match drill cable pass through hole covered by glass fabric repair layup.

(x) Match drill inspection hole covered by glass fabric repair layup.

(y) To ensure electrical contact, sand or burnish EMM where sides of upper vertical hinge contact the vertical spar. (Refer to 51-20)

(z) Install bolts and washers securing upper vertical hinge to empennage.

Note: Increase bolt length as required to ensure correct grip requirements. Threads not allowed in load bearing structure.

(aa) Install bolts and washers securing tie down bracket to empennage.

(ab) Install bolts and washers securing lower vertical hinge to empennage.

(ac) Match drill rudder installation hole in lower vertical hinge.

(ad) Trim profile of lower vertical hinge to profile of upper vertical hinge to allow for proper rudder clearance.

(ae) Using 3/4 inch hole saw, cut aft tie down installation hole through skin and centered on BL0.

(af) From aft tangent of tie down installation hole to aft edge of empennage skin, cut a 0.18 inch (4.6 mm) wide slot centered on BL0.

(ag) Prepare the surface for primer and paint. (Refer to 51-30)

(ah) Paint repair area. (Refer to 51-30)

(ai) Install nut securing tie down eye bolt to empennage.

(aj) Install rudder. (Refer to 55-40)

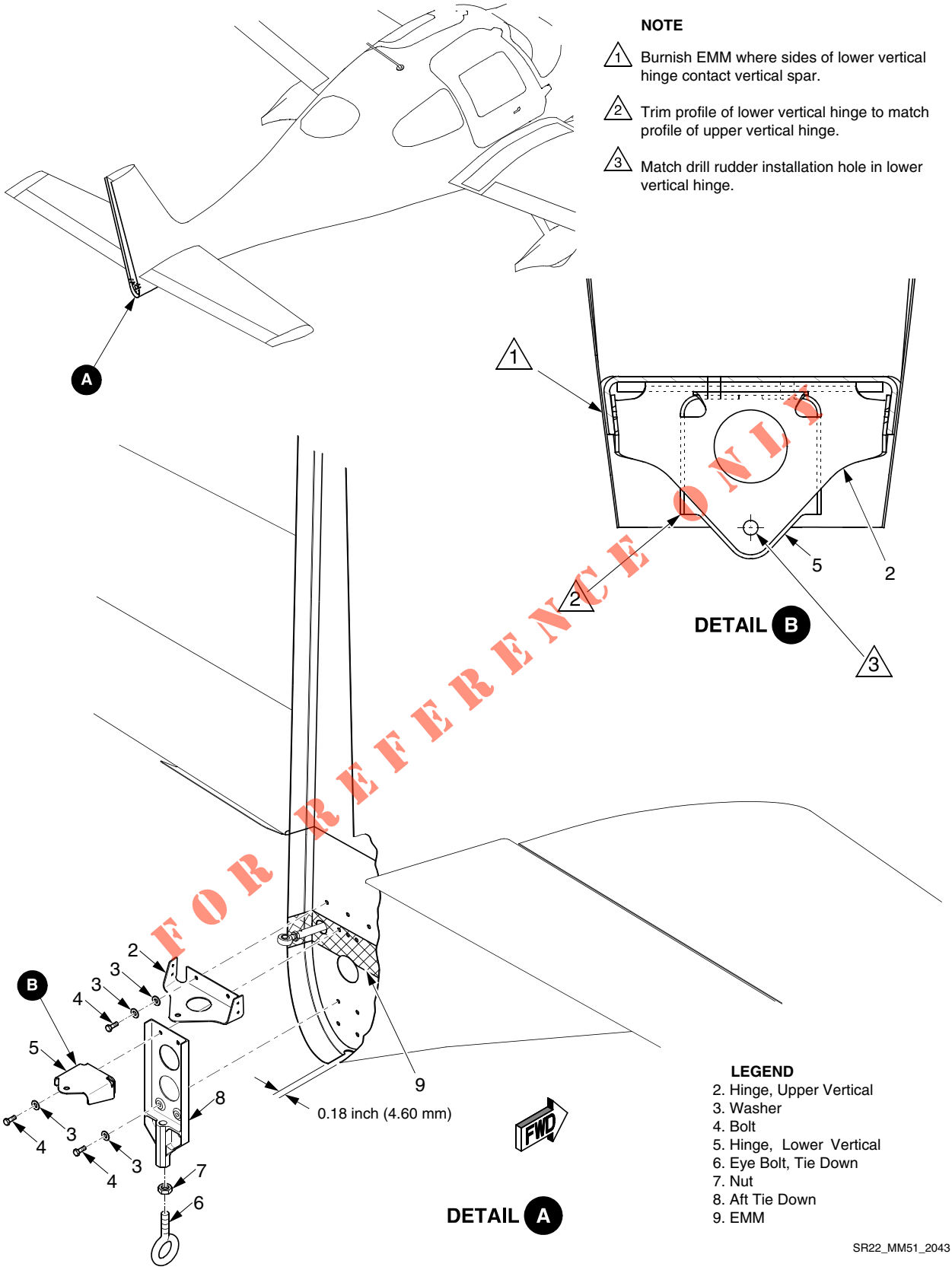
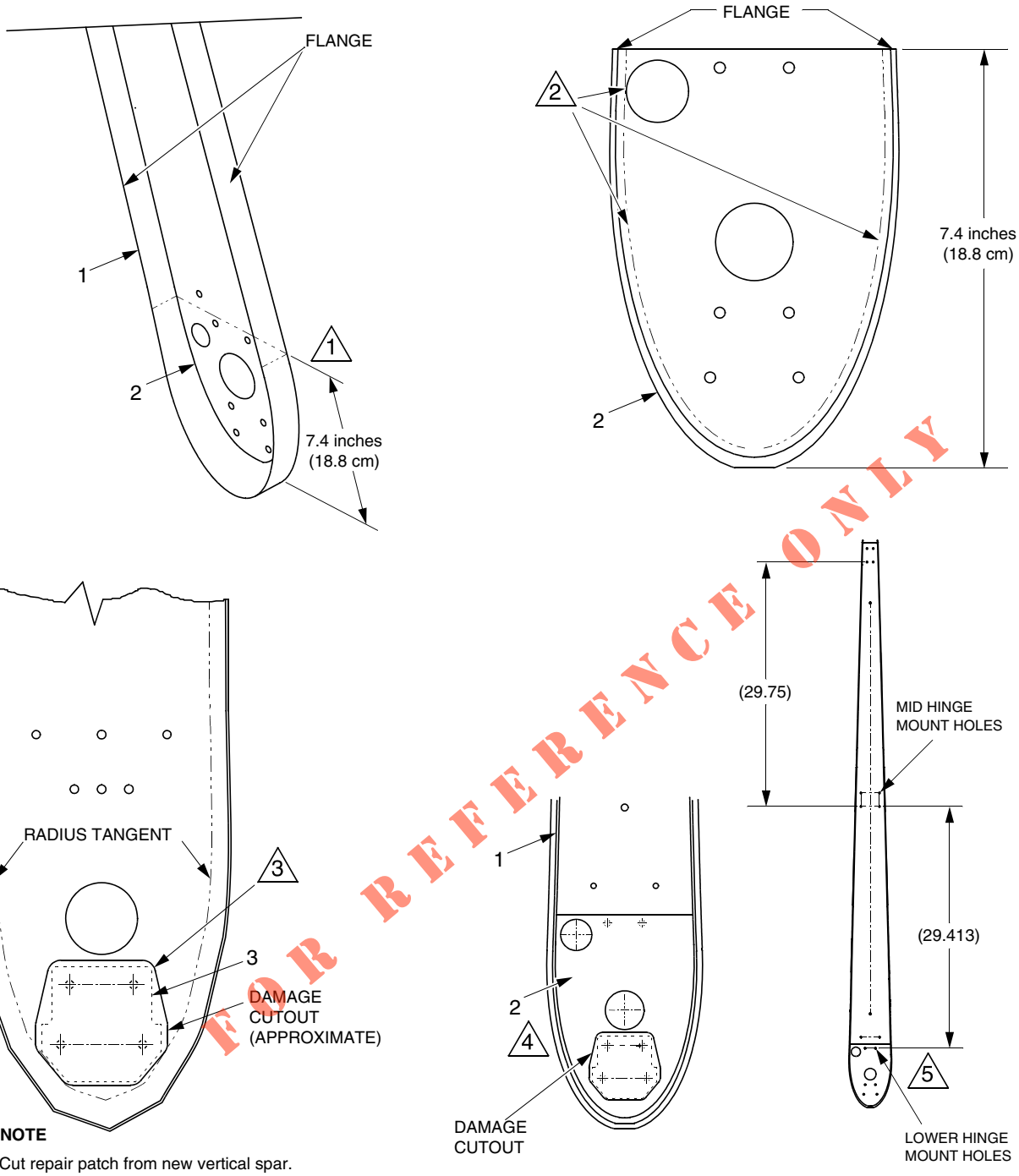


Figure 51-212
Vertical Spar Patch Repair (Sheet 1 of 3)



NOTE

1. Cut repair patch from new vertical spar.
2. Remove flange from repair patch by cutting along tangent line +0.0, -0.1 inch (+0.0, -2.54 mm) on all sides.
3. Remove damaged portion of lower vertical spar. Ensure minimum distance of 0.13 inch (3.3 mm) between tiedown backing plate and corner of damage cutout.
4. Bond repair patch to vertical spar.
5. After repair plies have cured, match drill lower vertical hinge installation holes.

LEGEND

1. Vertical Spar
2. Repair Patch
3. Tiedown Backing Plate

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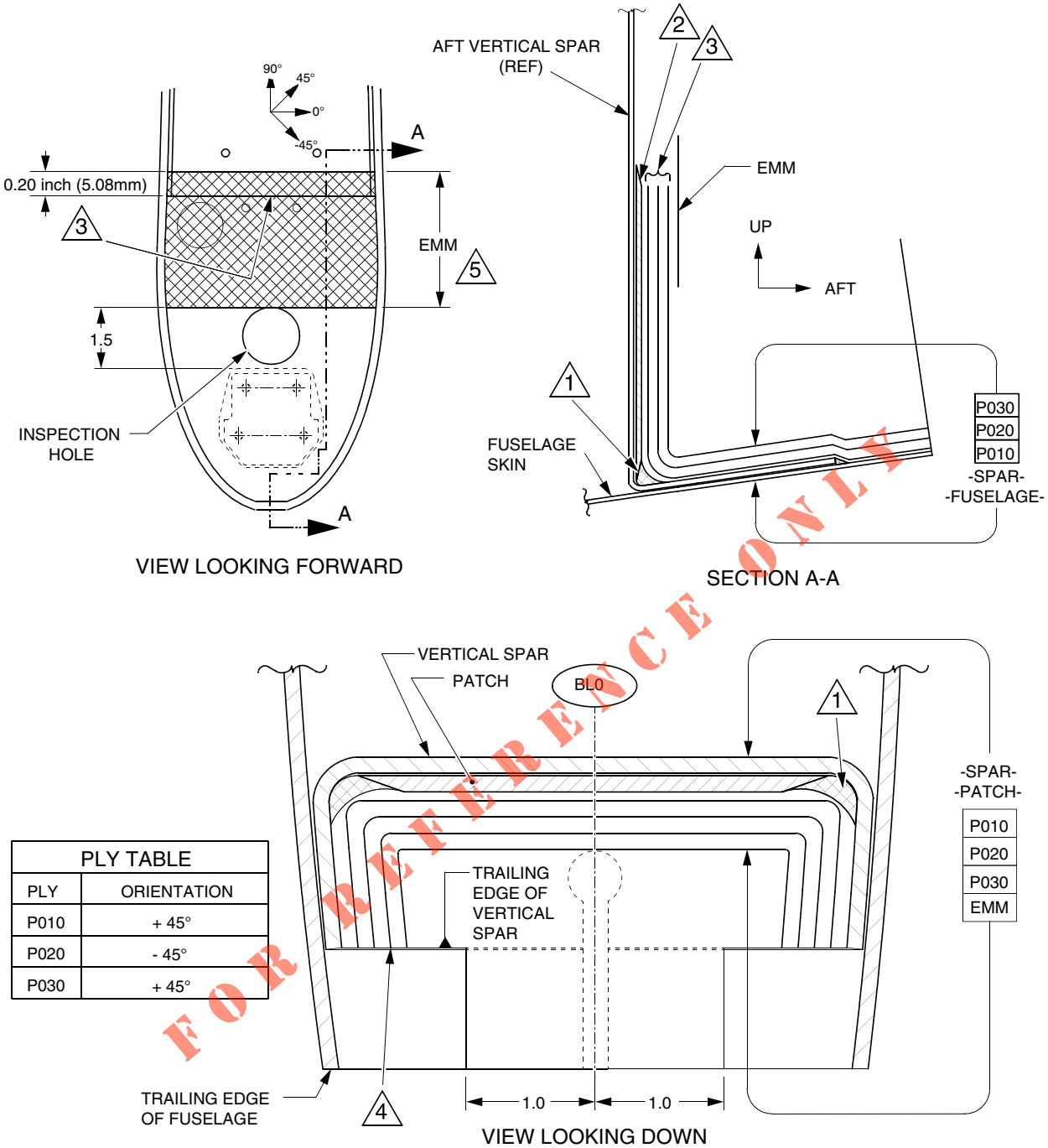
Figure 51-212
Vertical Spar Patch Repair (Sheet 2 of 3)



PLY TABLE	
PLY	ORIENTATION
P010	+ 45°
P020	- 45°
P030	+ 45°

NOTE

1. Fill bond depressions with gap filler, creating a smooth layup transition area with a maximun radius of 0.5 inch.
2. Bevel repair patch edges to 60 degrees.
3. Extend plies to top edge of repair patch.
4. Extend plies to trailing edge of vertical spar.
5. Apply EMM from upper tangent of inspection hole to 0.20 inch (5.08mm) beyond upper edge of repair patch.

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Figure 51-212
Vertical Spar Patch Repair (Sheet 3 of 3)

B. Belly Burn

Belly burn is defined as burn damage that occurs to the fuselage belly due to incorrect adjustment of the exhaust system. The affected area lies just aft of the tail pipe and occurs when the tail pipe is positioned too close to the fuselage. Visually inspect for discoloration and perform a coin tap test to determine the type and extent of damage. The fuselage skin may be restored using standard composite repair techniques.

(1) Belly Burn Repair (See Figure 51-213)

(a) Remove belly fire shield. (Refer to 52-30)

(b) Determine type and extent of damage. If necessary, contact Cirrus Design for disposition.

(c) Acquire necessary tools, equipment, and supplies.

Description	P/N or Spec.	Supplier	Purpose
Compressed Air (contaminate free)	-	Any Source	General repair.
Liquid Dish Soap	-	Any Source	General cleaning.
Isopropyl Alcohol	TT-I-735 Grade A or B	Any Source	General cleaning.
Orbital Sander	39825A12	Any Source	Prepare repair surface.
Masking Tape	2-inch	Any Source	Limit repair area.
Permanent Marker	Sanford Ink Co.	Any Source	Identify repair area.
Release Film	WL5200 (Red or Blue)	Airtech Int'l Inc. Huntington Beach,CA 92647 714-899-8100	Protect lay-up surface.
Peel Ply	Stitch Ply G	Airtech Int'l Inc. Huntington Beach,CA 92647 714-899-8100	Makes a smooth and contaminate free repair surface.
Glass Repair Fabric	7781-F16	Hexcel Chicago,IL 60678-3052 740-653-1540	Repair composite structures.
Plastic Sheet	N/A	Any Source	Make Template of Repair Ply
Structural Resin Repair System	MGS L418/418	MGS Stuttgart, Germany D-70309 711-323-081	Bond plies over puncture.
Sandpaper	120-grit or finer	Any Source	Paint and primer removal.

Description	P/N or Spec.	Supplier	Purpose
Sandpaper	60 to 80-grit	Any Source	Abrade bonding surfaces.
Rigid Closed Cell Foam	HT70	Divinycell Desoto, TX 75115 972-228-7600	Stiffen laminate.
Aerosil	200	Degussa Ridgefield Park, NJ 07660 201-641-6100	Resin filler.
Sil-Cell	Sil-32	Silbrico Hodgkins, IL 60525 800-323-4287	Resin filler.

(d) To prevent water from contaminating composite, cover damaged area with plastic sheet and seal edges with tape.

(e) Clean the area surrounding the damage with hot soapy water. Rinse with clean water and dry. Remove plastic sheet from damaged area.

(f) Solvent clean damaged area with isopropyl alcohol. (Refer to 20-30)

(g) Determine repair area through visible inspection and coin tap test. (Refer to 51-10)

(h) Mark perimeter of repair area.

(i) Determine and mark 0^{o} axis.

(j) Carefully trim away damaged laminate using a small angle grinder with 80-grit. Grind edge of damaged laminate to a 50:1 taper.

(k) Remove paint, primer, and body filler from area surrounding damage.

(l) Perform core replacement repair. (Refer to 51-20)

Note: Ensure each ply overlaps the previous ply by at least 0.5 inch (1.27 cm).

(m) Cut two glass-fiber repair plies at +/- 45°. (Refer to 51-20)

(n) Mix resin. (Refer to 51-20)

(o) Layup glass fabric repair plies (Refer to 51-20)

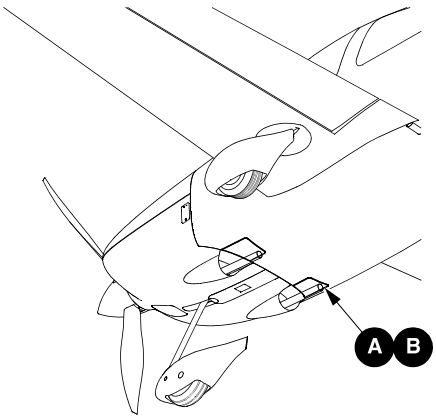
(p) Cure repair plies. (Refer to 51-20)

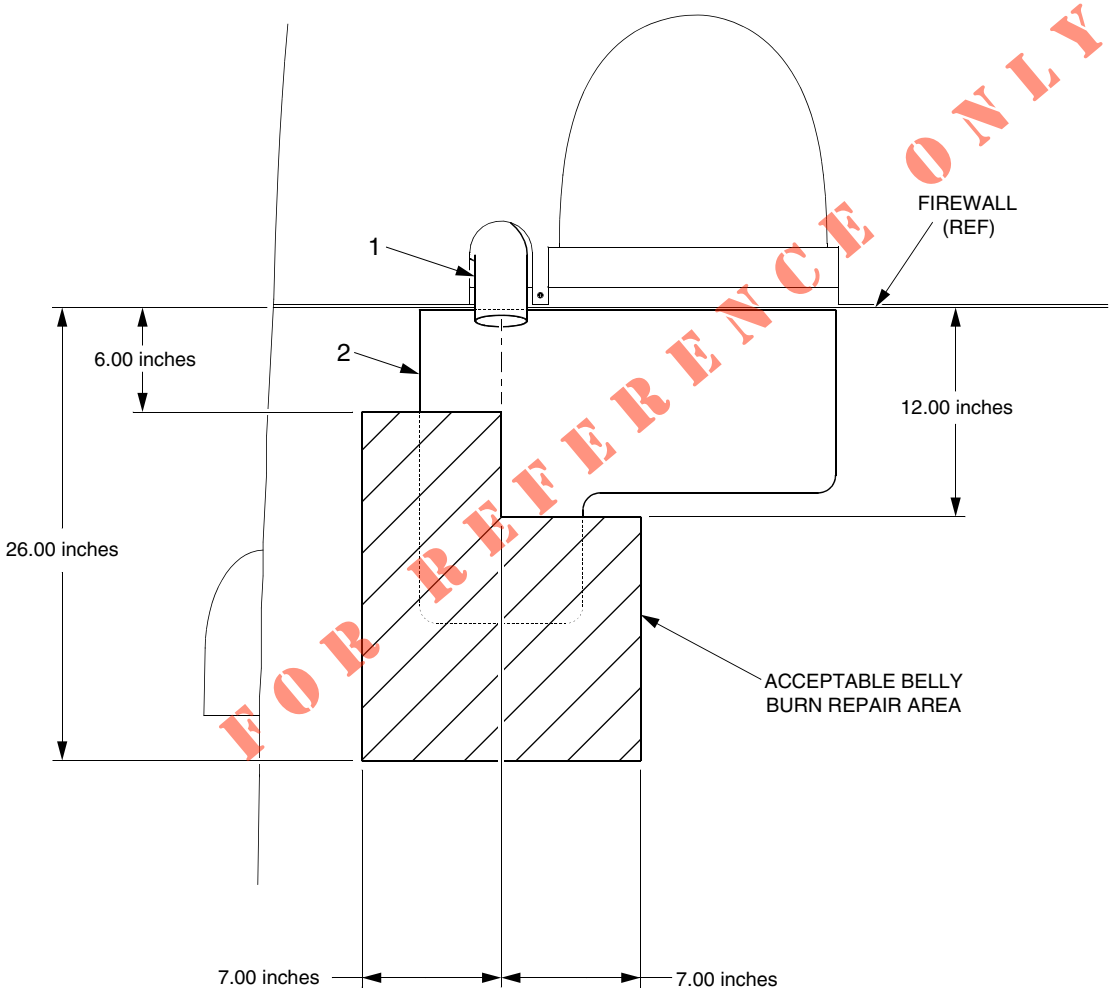
(q) Prepare the surface for primer and paint. (Refer to 51-30)

(r) Paint repair area. (Refer to 51-30)

(s) Install belly fire shield. (Refer to 51-30)

(t) Perform Adjustment/Test - Forward Ball Joints to ensure correct tail pipe orientation. (Refer to 78-20)





LEGEND
1. Tail Pipe
2. Belly Fire Shield

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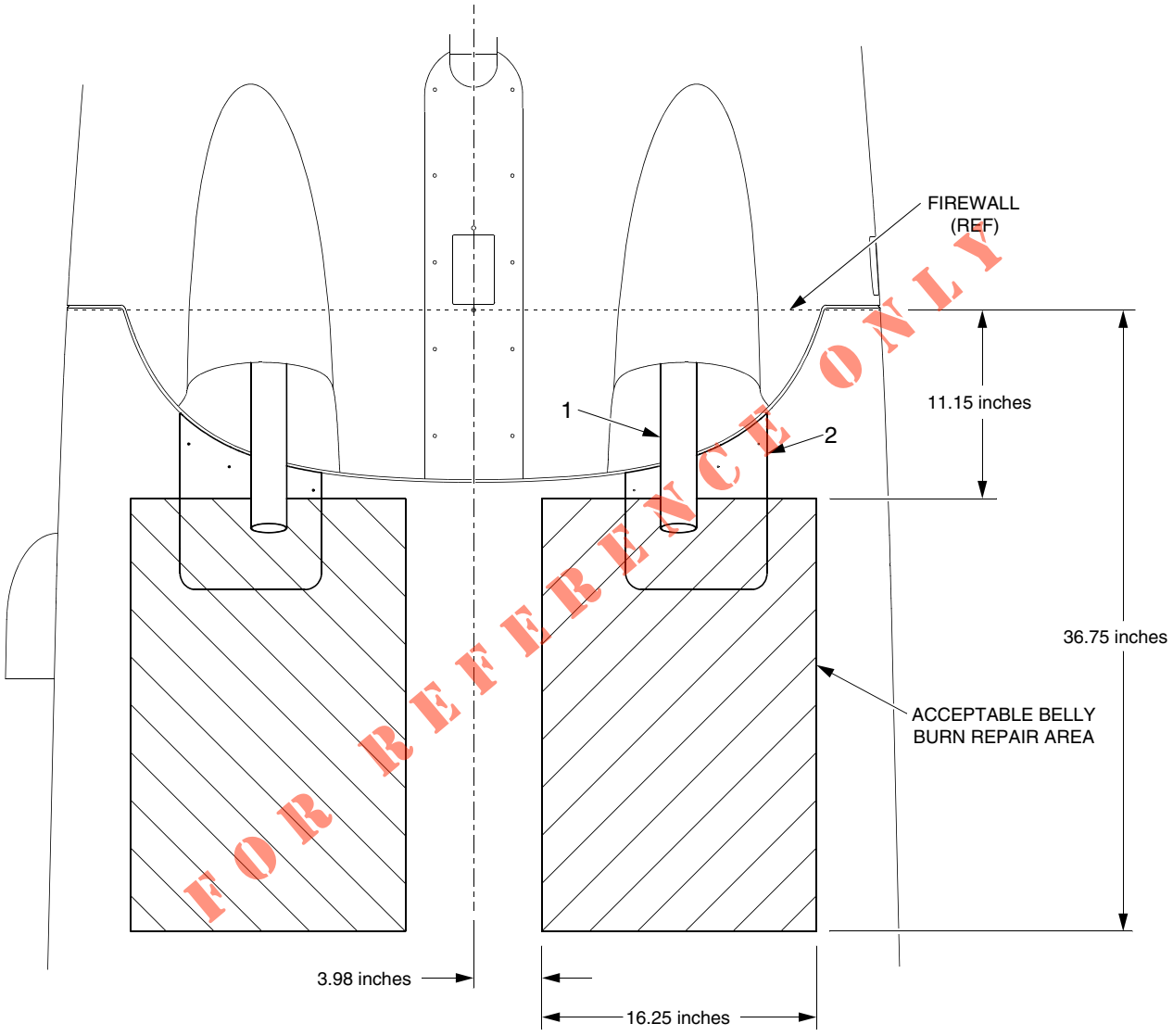
DETAIL A

Figure 51-213
Belly Burn Repair - *Serials 0002 thru 0820* (Sheet 1 of 2)



LEGEND
1. Tail Pipe
2. Belly Fire Shield

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DETAIL B

Figure 51-213
Belly Burn Repair - *Serials 0821 & subs* (Sheet 2 of 2)