

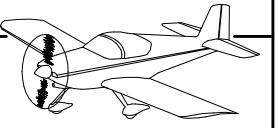
TOTAL PERFORMANCE
VAN'S AIRCRAFT

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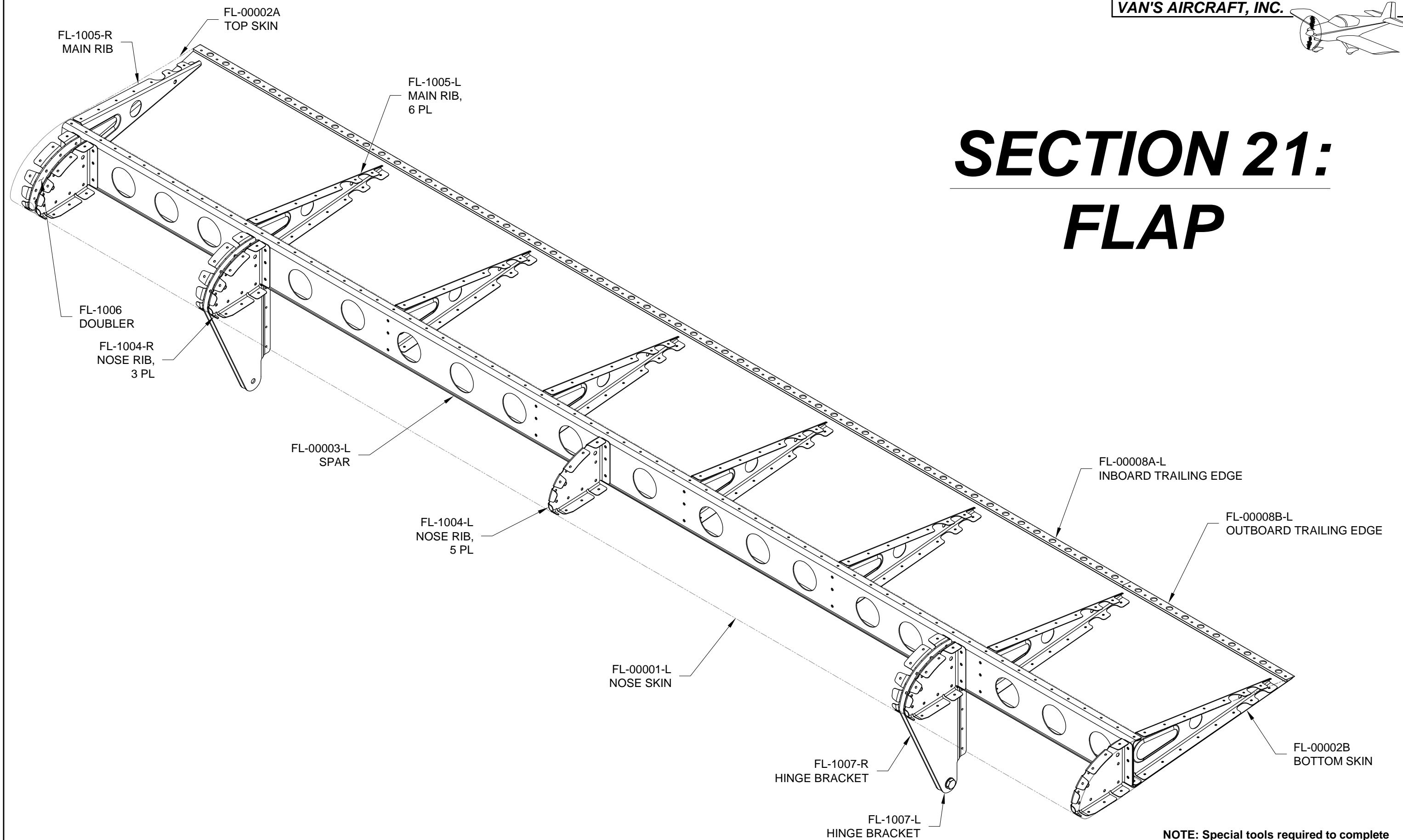
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REVISION DESCRIPTION:

Page: 21-02 MEMO: In Figure 3, "2X 1 3/32 [27.78 mm]" was "2X 1 3/32 [2.75 mm]"



SECTION 21: FLAP



NOTE: Special tools required to complete this section include: #33 6 in. long drill bit, back riveting plate, duck-bill pliers.

DATE OF COMPLETION:	_____		
PARTICIPANTS:	_____		
DATE: 04/15/13	REVISION: 0	RV-14	PAGE 21-01



NOTE: This manual provides building instruction for the left flap only. The right flap is simply the mirror of the left. Unless otherwise specified instructions given for the left flap apply to the right as well. To help prevent mistakes and speed up the construction process assemble both flaps at the same time. A flat work surface is required for constructing a true flap. Two cradles will be needed to hold the flap upright while riveting. Fabricate cradles from the same material supplied for the wing leading edge and tank cradles.

Step 1: Trace the outline of an FL-1004 Nose Rib onto the wood as shown in Figure 1.

Step 2: Cut the cradle out. Cut the nose rib contour slightly oversize to allow for the addition of padding (such as duct tape) to protect the skin's surface. The aft flange of the FL-1004 Nose Rib and the base of the cradle must be parallel as shown.

Step 3: Attach the cradle to a block of wood so that it may be clamped to a table. See Figure 2.

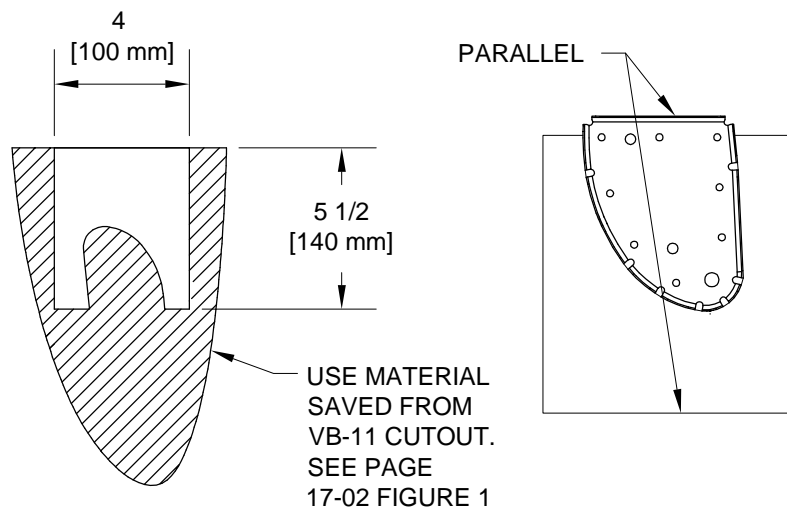


FIGURE 1: CUT CRADLE MATERIAL

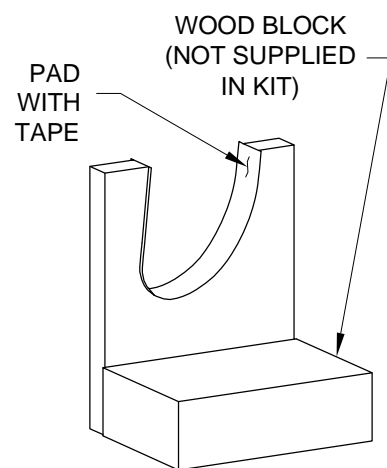


FIGURE 2: BUILD CRADLES

NOTE: Do not drill the joggled portion of the FL-1007-R Hinge Brackets at this time.

Step 4: Adjust the flange of the FL-1007-L and -R Hinge Brackets to be parallel with the part body if/as required. See Figure 3.

Lay-out the four hole pattern on the joggled portion of one FL-1007-L Hinge Bracket as shown in Fig. 3.

Step 5: Drill #40 the four hole pattern from the previous step.

Deburr these holes.

Step 6: Cleco a second FL-1007-L Hinge Bracket to the one just drilled.

Align and clamp the trailing edges.

Match-Drill #40 the second hinge bracket using the drilled hinge bracket as a guide.

Match-Drill #40 the remaining hinge brackets using the drilled hinge bracket as a guide.

Disassemble and deburr.

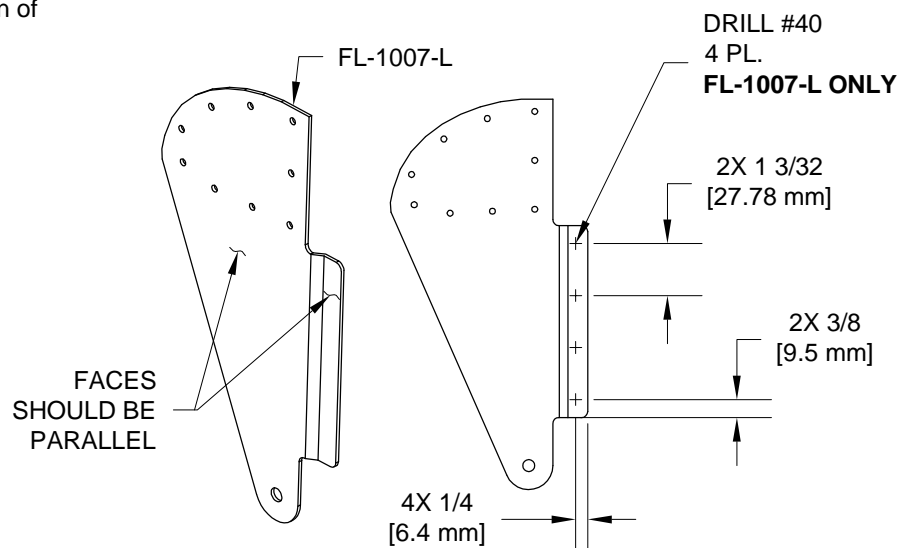


FIGURE 3: DRILL LEFT HINGE BRACKET FLANGES

Step 7: Buff the edges of the FL-1004-L & -R Nose Rib flanges on an abrasive wheel in order to minimize the tendency for them to appear faceted instead of curved. See Figure 4.

Buff the flange faces adjacent to the edges at the flanges nearest the leading edge as indicated by the dashed arrows and the shaded region in the detail. See Section 5.2

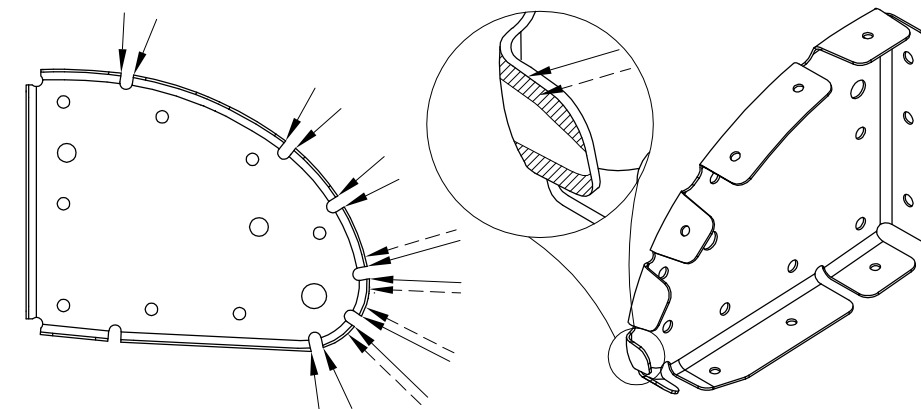


FIGURE 4: BUFF CORNERS

Step 8: Flute and straighten as required the called out flange of the FL-1004-L & -R Nose Ribs. See Figure 5.

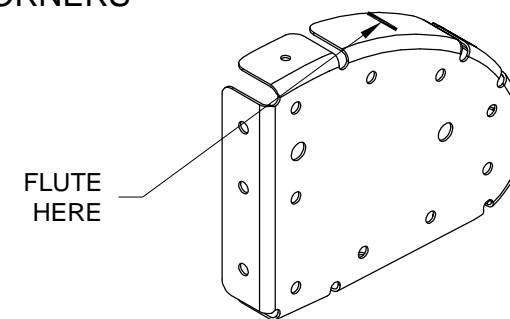


FIGURE 5: FLUTE

Step 9: Deburr all FL-1004-L & -R Nose Ribs.

Step 10: Assemble the Outboard Rod End Rib Subassembly by clecoing the FL-1006 Doublers to the FL-1004-L & -R Nose Ribs. See Figure 6.

Step 11: Match-Drill #40 the two .094 [2.4 mm] doubler holes into the nose rib using the doubler as guide.

Step 12: Final-Drill the 1/4 [6.4 mm] hole in the FL-1006 Doublers and the corresponding #30 hole in the VL-1004-L & -R Ribs. See Figure 6.

Step 13: Machine countersink the #40 holes in the Outboard Rod End Rib Subassemblies. See Figure 6.

Step 14: Disassemble, deburr, clear away chips and cleco together the FL-1006 Doublers and FL-1004-L & -R Ribs. Install the clecos from the rib side.

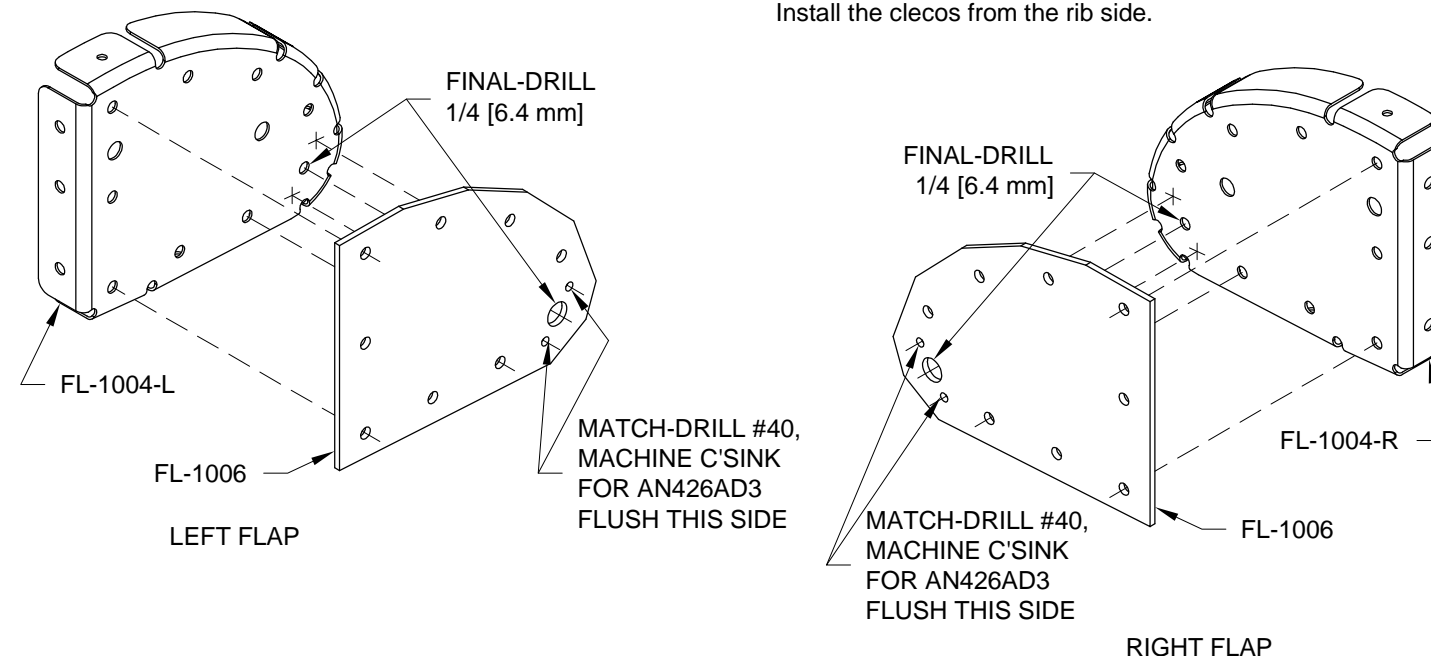
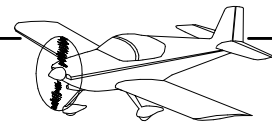


FIGURE 6: MATCH & FINAL-DRILL OUTBOARD ROD END RIB SUBASSEMBLY



Step 1: Assemble the Inboard Rod End Rib Subassembly by clecoing the FL-1006 Doublers to the FL-1004-L & -R Nose Ribs. See Figure 1.

Step 2: Final-Drill the .250 [6.4 mm] hole but ignore the two .094 [2.4 mm] holes shown in Figure 1.

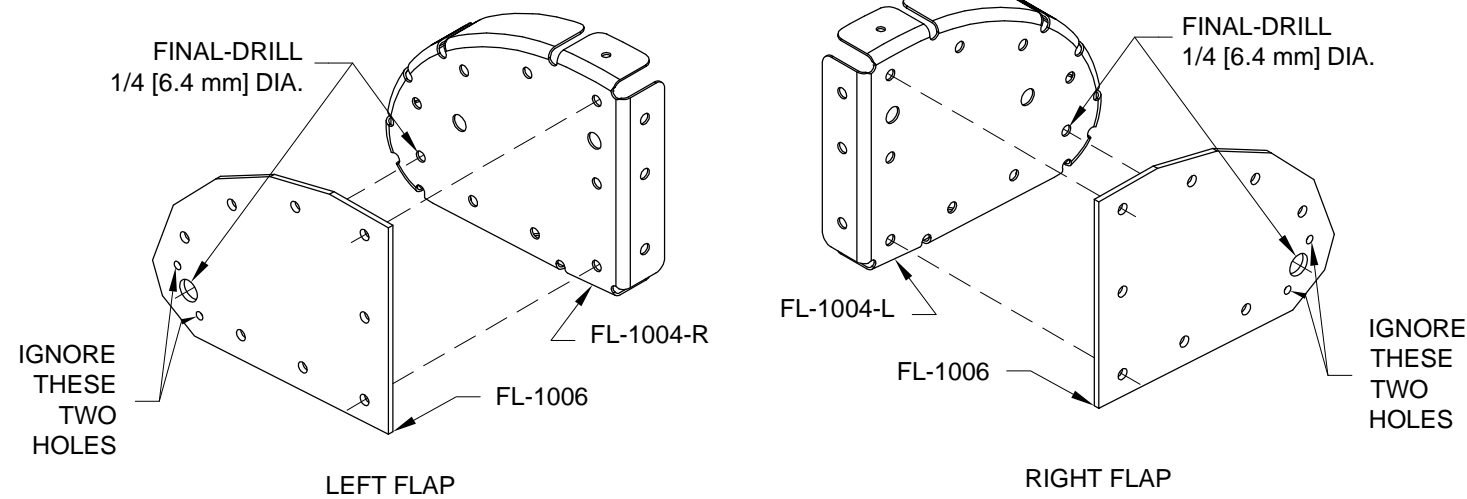


FIGURE 1: FINAL-DRILL

NOTE: Do not drill the joggled portion of the FL-1007-R Hinge Brackets at this time.

Step 6: Assemble the Left Hinge Pair Rib Subassembly by clecoing together the FL-1004-L Nose Rib and FL-1007-L Hinge Brackets as shown in Figure 4. Install clecos from rib side.

Final-Drill #30 the holes common to both parts and the holes in the spar attach flanges of the FL-1004-L Nose Ribs. See Figure 4.

Step 7: Repeat Step 6 for the remaining Left Hinge Pair Rib Subassembly as shown in Figure 4.

Repeat Step 6 for two sets of Right Hinge Pair Rib Subassemblies as Shown in Figure 5.

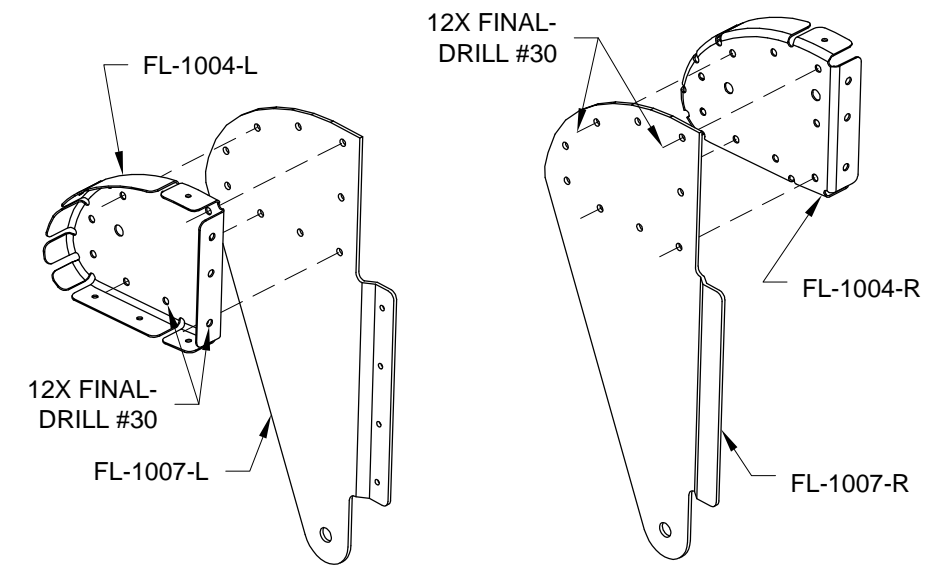


FIGURE 4: LEFT HINGE PAIR RIB SUBASSEMBLY

FIGURE 5: RIGHT HINGE PAIR RIB SUBASSEMBLY

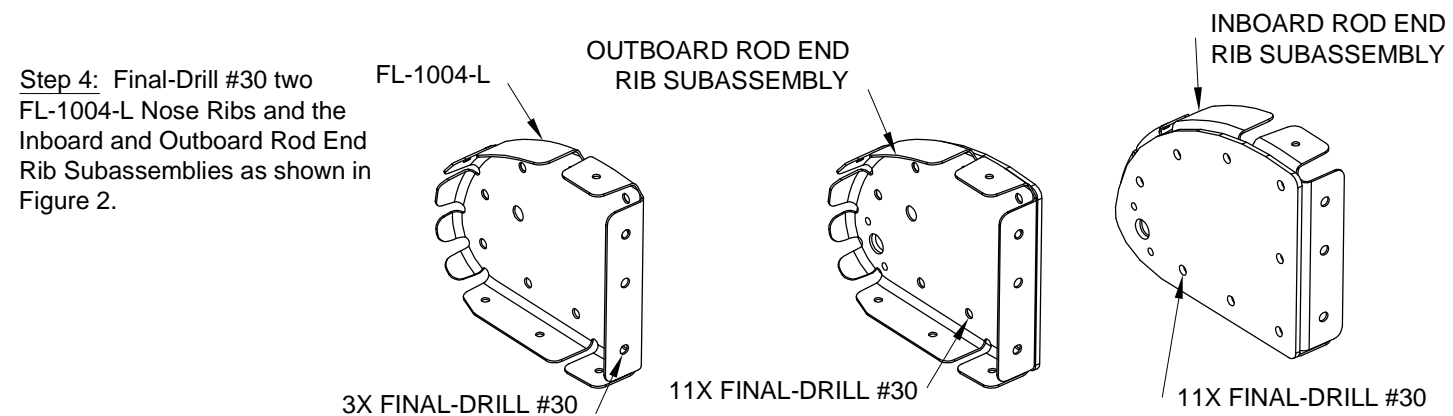


FIGURE 2: FINAL-DRILL NOSE RIBS AND ROD END RIB SUBASSEMBLIES - LEFT FLAP

NOTE: Remaining steps refer to the left flap. As noted earlier the right is a mirror of the left.

Step 8: Remove the small tab with no hole on all FL-1005-L and FL-1005-R Main Ribs as shown in Figure 6. Trim only as deep as the notch.

Step 9: Final-Drill #40 all main ribs per the callouts in Figure 6.

Final-Drill #30 all main ribs per the callouts in Figure 6.

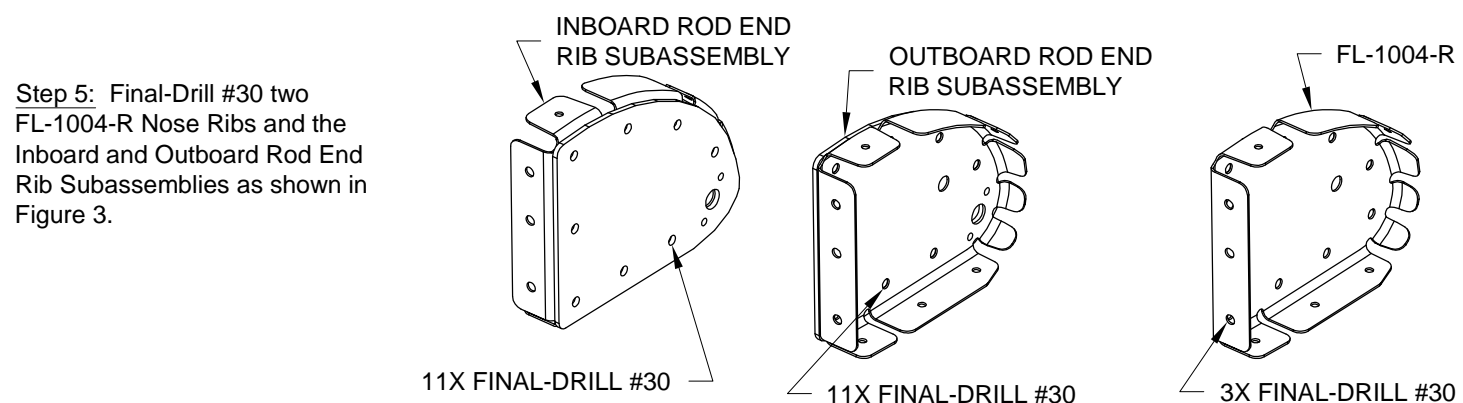


FIGURE 3: FINAL-DRILL NOSE RIBS AND ROD END RIB SUBASSEMBLIES - RIGHT FLAP

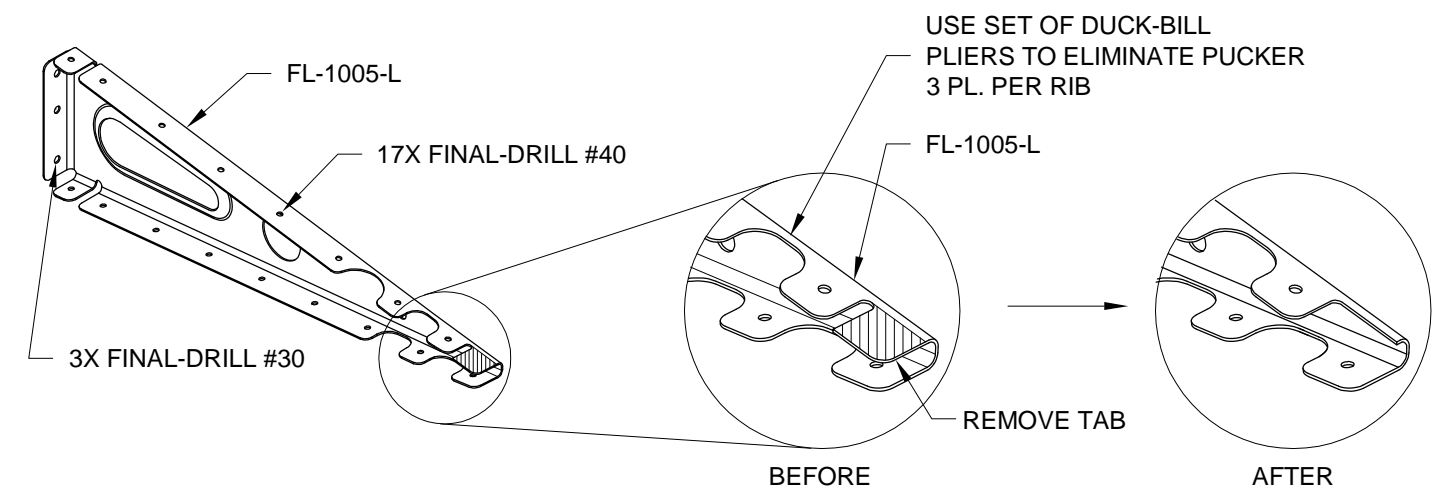
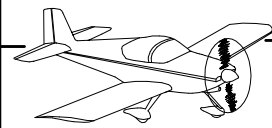


FIGURE 6: MAIN RIB TAB REMOVAL



NOTE: One FL-1005-R Main Rib spar attach flange must be over bent to allow the aft end of the rib to swing inboard. The corresponding holes in the FL-00002B Bottom Skin determine the rib location.

Step 1: Cleco a FL-1005-R Main Rib to the inboard end of the FL-00002B Bottom Skin as shown in Figure 1.

Step 2: Bend the FL-1005-R Rib's spar attach flange until it is parallel to the forward edge of the skin as shown in Figure 2.

Hereafter refer to this rib as the FL-1005-R Modified Main Rib.

NOTE: Make sure all rib flanges face in the directions shown in Figure 3.

Step 3: Cleco the FL-1004-L Nose Ribs, FL-1005-L Main Ribs and FL-1005-R Modified Main Rib, Rod End Rib and Hinge Pair subassemblies to the FL-00003-L Spar as shown in Figure 3.

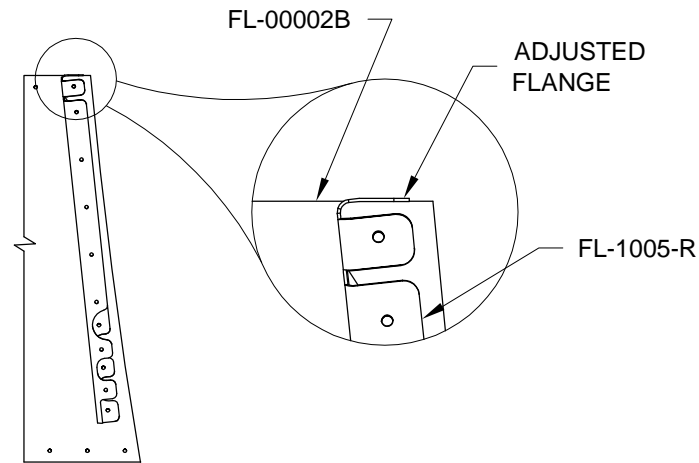


FIGURE 2: BENDING RIB FLANGE

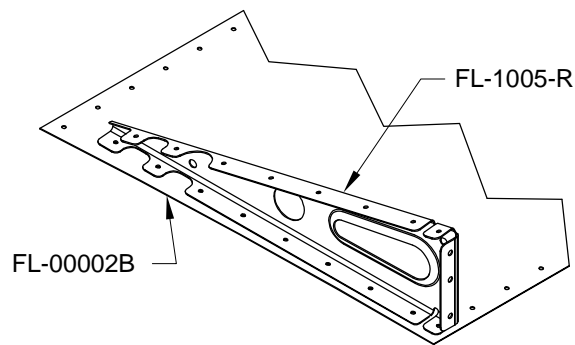


FIGURE 1: CLECO RIB TO SKIN

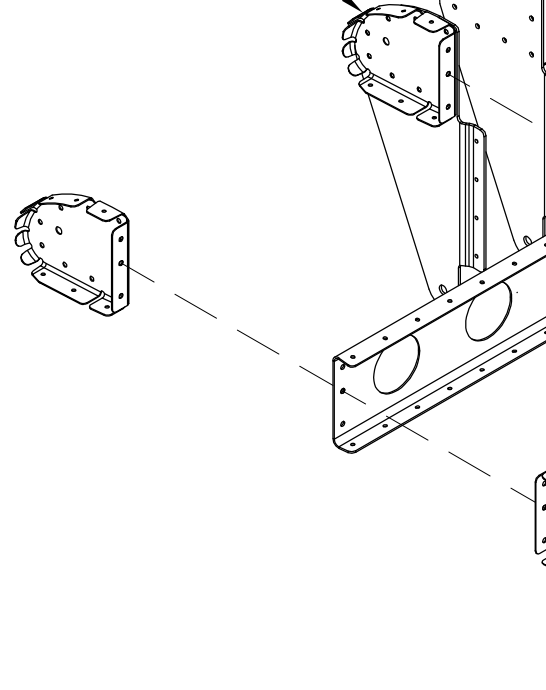
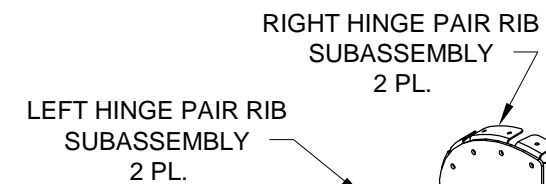
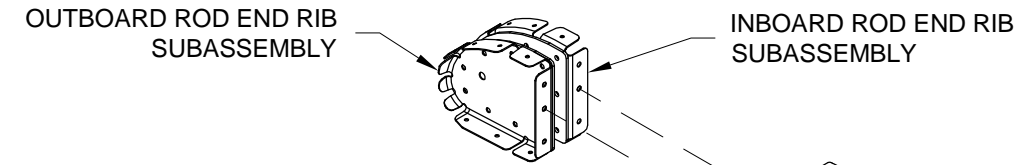


FIGURE 3: CLECO TOGETHER LEFT FLAP SUBSTRUCTURE

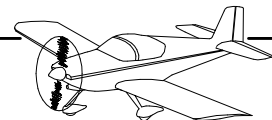


FL-1005-R MODIFIED MAIN RIB

FL-1005-L 7 PL.

FL-1004-L 2 PL.

FL-00003-L



Step 1: Locate the VA-140 Trailing Edge extrusions.

NOTE: The following part will be trimmed again at both ends in the next step.

Fabricate FL-00008B Outboard Trailing Edge from VA-140 Trailing Edge extrusion per the dimensions of Figure 1.

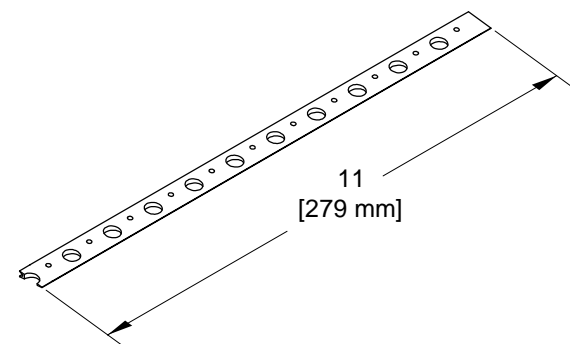


FIGURE 1:
CUT OUTBOARD TRAILING EDGE TO LENGTH

Step 2: Cleco one FL-00008B Outboard Trailing Edge to the FL-00002B Bottom Skin outboard end as shown in Figure 2, Details A and B.

Fabricate one FL-00008A Inboard Trailing Edge by cutting 1/4 [6.4 mm] from one end. See Figure 2, Detail B.

Lay the FL-00008A Inboard Trailing Edge on the skin so that the untrimmed end just overhangs the skin's inboard end as shown in Figure 2, Detail C. Allow the opposite end to run up over the outboard trailing edge.

Cleco the inboard trailing edge to the skin in several places stopping at the last row of rib attach holes before the overlap.

Mark the top of the outboard trailing edge where the two trailing edges overlap. See Detail B.

Mark the underside of the outboard trailing edge where it overhangs the skin. See Detail A.

Mark the underside of the inboard trailing edge where it overhangs the skin. See Detail C.

Remove the trailing edges from the skin, trim and deburr.

Hereafter refer to the trailing edge extrusions as FL-00008A-L Inboard Trailing Edge and FL-00008B-L Outboard Trailing Edge.

Step 3: Bend the called out edges of the FL-00001-L Nose Skin slightly as shown in Figure 3 so they will lie down flush on the FL-00002A Top Skin and FL-00002B Bottom Skin after riveting.

For more information about bending the edges see the "Crimp edges of external skins" detail in Sections 5.4 and 5.9.

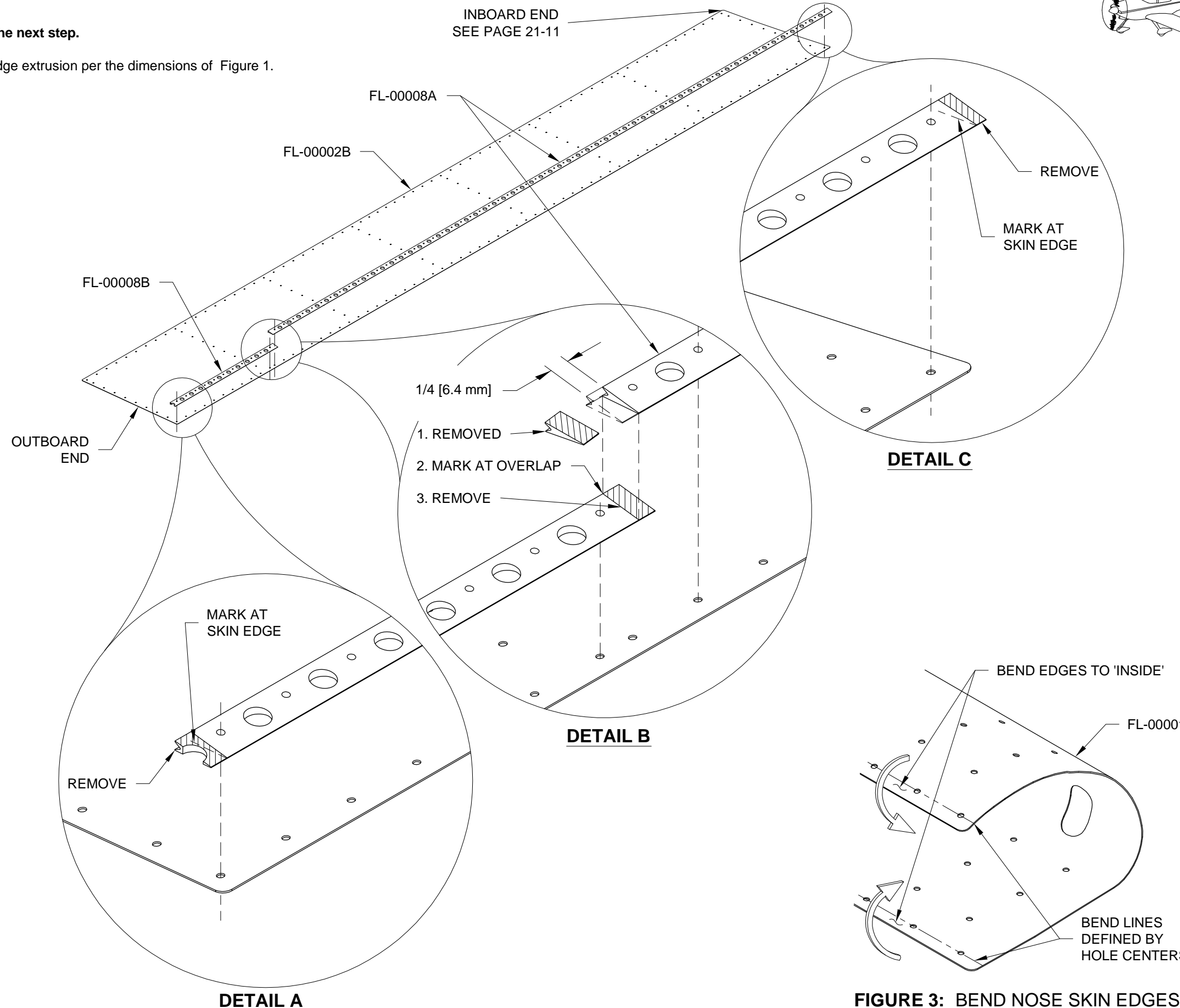


FIGURE 2: FINAL TRIM TRAILING EDGES

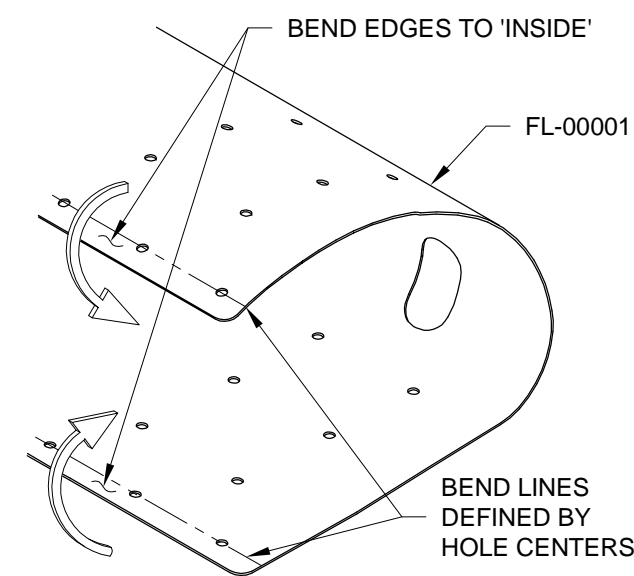
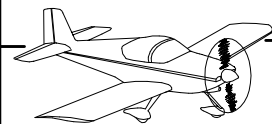


FIGURE 3: BEND NOSE SKIN EDGES



NOTE: For more information regarding riveted trailing edge construction see Section 5.8. Unless otherwise noted see Figure 1 for details.

Step 1: Cleco the FL-00002B Bottom Skin, FL-00002A Top Skin, and FL-00001-L Nose Skin in place in this order.

Step 2: Cleco the FL-00008A-L Inboard Trailing Edge and the FL-00008B-L Outboard Trailing Edge to the bottom skin and top skin.

Step 3: Match-Drill #40 the FL-1004-L & -R Nose Ribs using the FL-00001-L Nose Skin as a guide.

NOTE: When drilling the trailing edge, drill perpendicular (90°) to the centerline of the trailing edge extrusion, not perpendicular to the surface of the top skin. See Figure 2.

Step 4: Final-Drill #40 the trailing edge per Figure 2 detail callout.

Step 5: Install hardware into the FL-1007-L & -R Hinge Brackets as shown on Page 21-12, Figure 2. Use additional washers or the bushing called out on Page 21-12 Figure 1 to fill the gap between the brackets.

Step 6: Match-Drill #40 all FL-1007-R Hinge Bracket flanges using the holes in the FL-1007-L Hinge Bracket flanges as drill guides.

Hereafter refer to these as the Hinge Pair Subassemblies.

Remove the hardware from the hinge brackets when drilling is complete.

Step 7: Mark the Hinge Bracket Pairs for their location on the spar.

Step 8: Disassemble the flap.

Step 9: Machine countersink the holes on both sides of the FL-00008A-L & B-L Trailing Edges for setting rivets double flush.

Step 10: Fabricate the FL-00009 Drill Jig from 3/4X3/4X1/8 [19.1X19.1X3.2 mm] angle extrusion to allow use of a countersink cage when countersinking the hinge brackets. See Figures 3 and 4.

Machine countersink the four holes on the non-mating side of the joggled flanges of each FL-1007-L and FL-1007-R Hinge Bracket for double flush riveting.

Deburr holes in mating surface of the hinge brackets.

Step 11: Deburr the two match-drilled #40 holes in the upper flange of the FL-1004-L & -R Nose Ribs.

NOTE: Holes in skins that will receive MK-319-BS blind rivets will be final-drilled #33 in assembly later, but for now dimple them just as you would to receive AN426AD3 rivets. See Page 21-11, Figures 1 and 3 for their locations.

When dimpled the spar will develop a harmless lengthwise bow.

CAUTION: Be sure to dimple the correct side of the skins.

Step 12: Dimple all holes common to the skins, spar and rib flanges. Use a reduced diameter female die on the curved portion of the nose skin and on the spar flanges.

Step 13: Prime the parts if/as desired.

Mask off the area on the skins where they will contact the FL-00008A-L and B-L Trailing Edges where adhesive will be applied. For this reason, do not prime the trailing edges.

Hereafter refer to the skins as FL-00002A-L Top Skin and FL-00002B-L Bottom Skin.

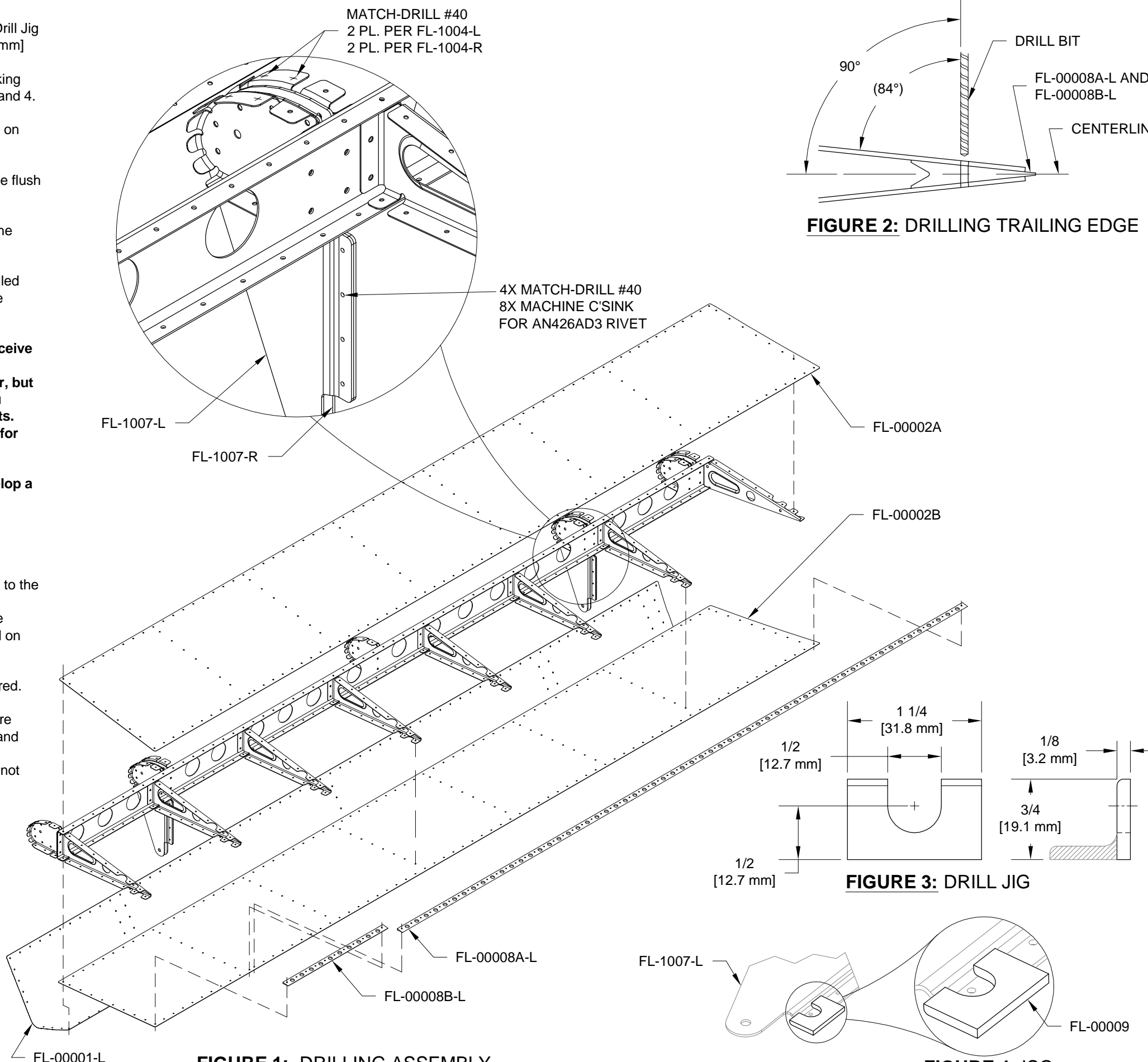
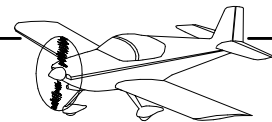


FIGURE 2: DRILLING TRAILING EDGE

FIGURE 3: DRILL JIG

FIGURE 4: ISO



Step 1: Rivet the FL-1004-L Nose Rib and nutplate to the FL-1006 Doubler using the rivets called out in Figure 1.

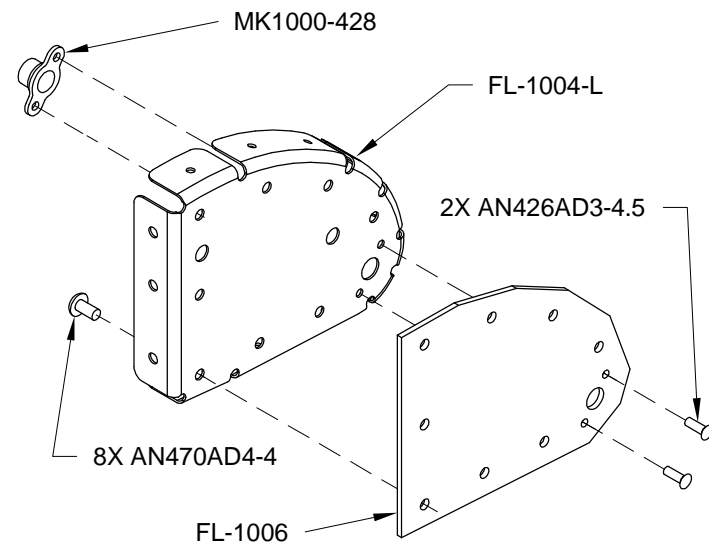


FIGURE 1: RIVET OUTBOARD ROD END RIB SUBASSEMBLY

Step 2: Rivet the FL-1004-R Nose Rib to the FL-1006 Doubler using the rivets called out in Figure 2.

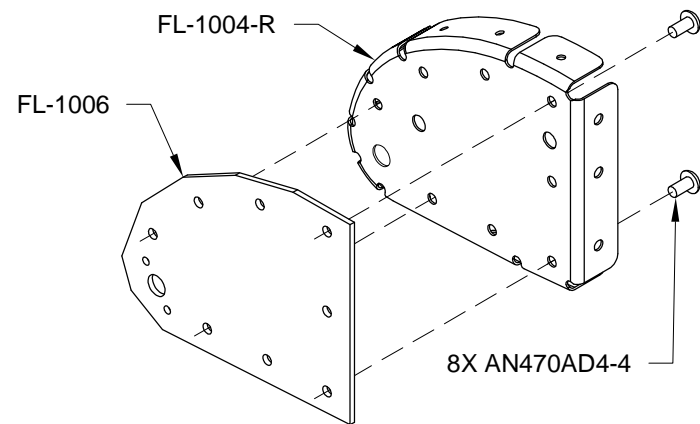


FIGURE 2: RIVET INBOARD ROD END RIB SUBASSEMBLY

Step 3: Rivet together the FL-1004-L Nose Rib and the FL-1007-L Hinge Bracket using the rivets called out in Figure 3.

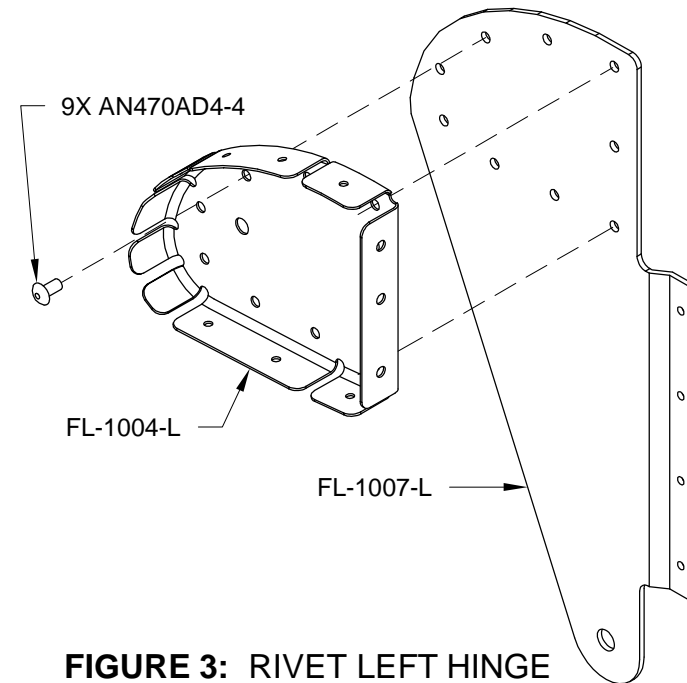


FIGURE 3: RIVET LEFT HINGE PAIR RIB SUBASSEMBLY

Step 4: Rivet together the FL-1004-R Nose Rib and the FL-1007-R Hinge Bracket using the rivets called out in Figure 4.

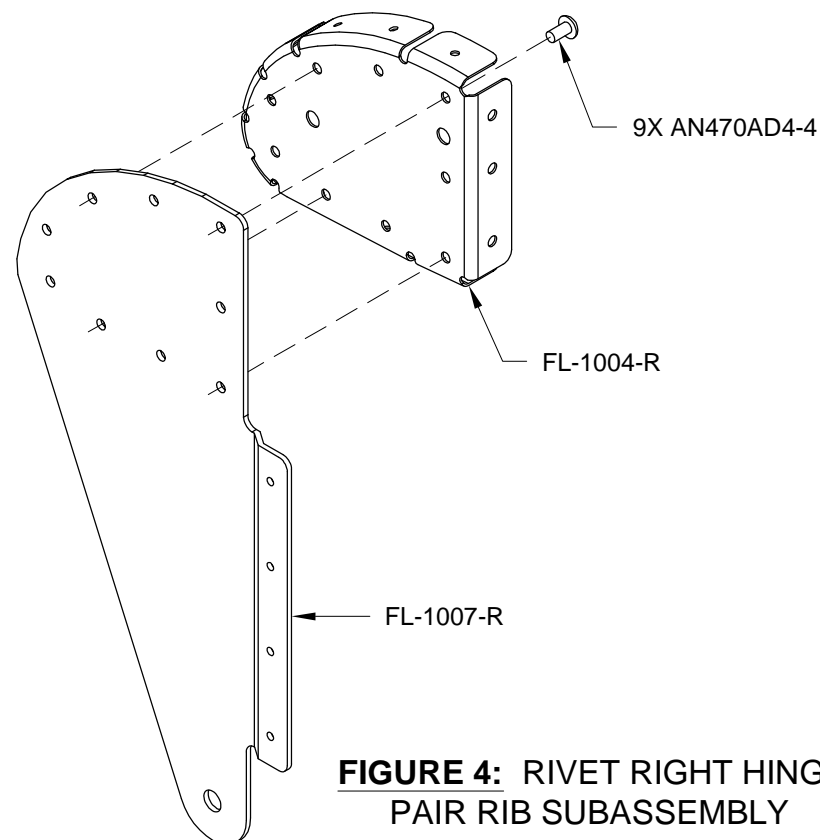


FIGURE 4: RIVET RIGHT HINGE PAIR RIB SUBASSEMBLY

NOTE: For more information on double flush riveting see Section 5.8.

Step 5: Cleco together the Left and Right Hinge Pair Subassemblies as shown in Figure 5.

Step 6: Install the hardware called out on Page 21-12, Figure 1 (for the bushing only) and Figure 2 to maintain the alignment of the .250 [6.4 mm] hole at the bottom of the subassemblies while riveting.

Step 7: Double flush rivet the joggled flanges of the Left and Right Hinge Pair Rib Subassemblies using the rivets called out in Figure 5.

Remove hardware.

Step 8: Repeat Steps 5-7 for the remaining Hinge Pair Rib Subassemblies.

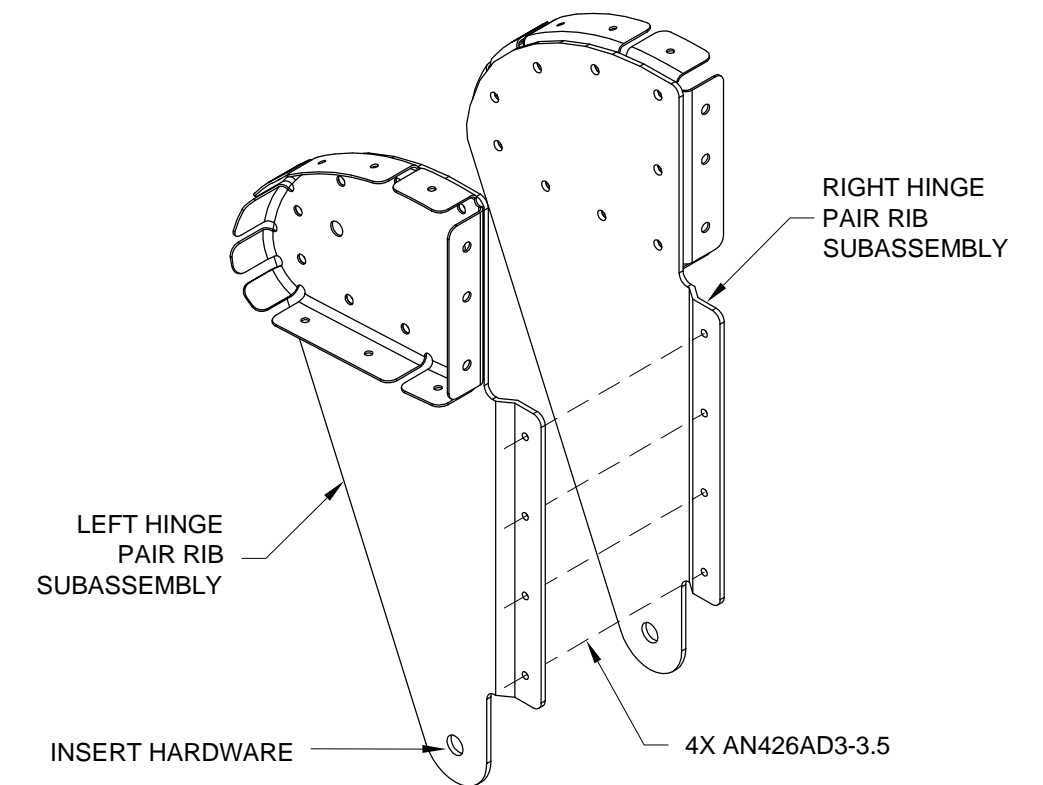


FIGURE 5: RIVET HINGE PAIR SUBASSEMBLIES



NOTE: Make sure all rib flanges face in the directions shown. When necessary, it is acceptable to temporarily bend the FL-1005-L Main Ribs slightly out of position to improve rivet squeezer access. Install the FL-1005-R Modified Main Rib last to improve access to the the Rod End Ribs.

Step 1: Assemble the flap by riveting the FL-1004-L Nose Ribs, FL-1005-L Main Ribs, and FL-1005-R Modified Main Rib, Inboard and Outboard Rod End Ribs, and Hinge Pair Subassemblies to the FL-00003-L Spar using the rivets called out in Figure 1.

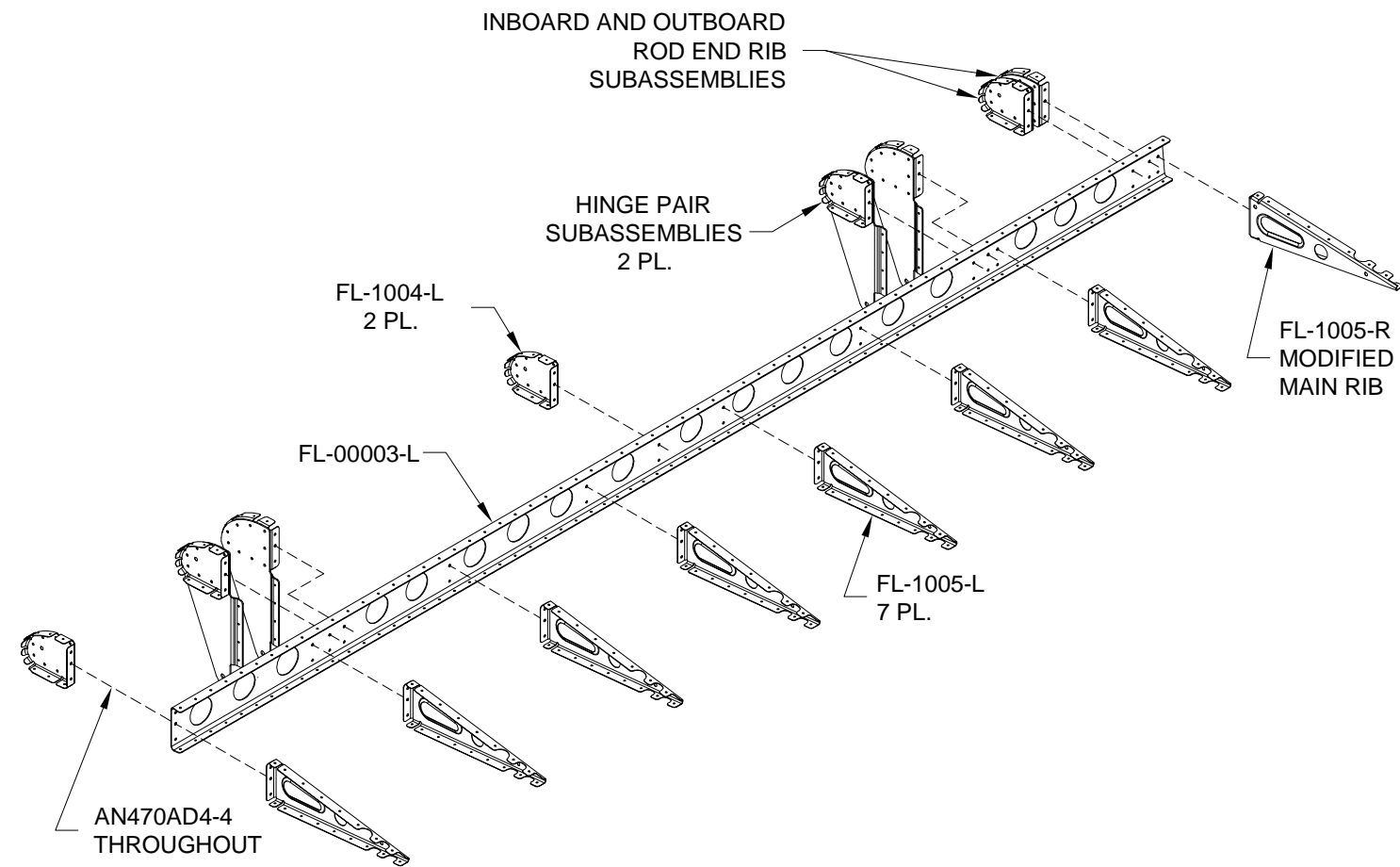


FIGURE 1:
RIVET RIBS AND SUBASSEMBLIES TO SPAR
(ALSO SEE PAGE 21-04, FIGURE 1)

Step 2: Slide the FL-00001-L Nose Skin over the two Hinge Pair Subassemblies and cleco it in place as shown in Figure 2. Use only a few clecos on the top since they will be removed in the next step.

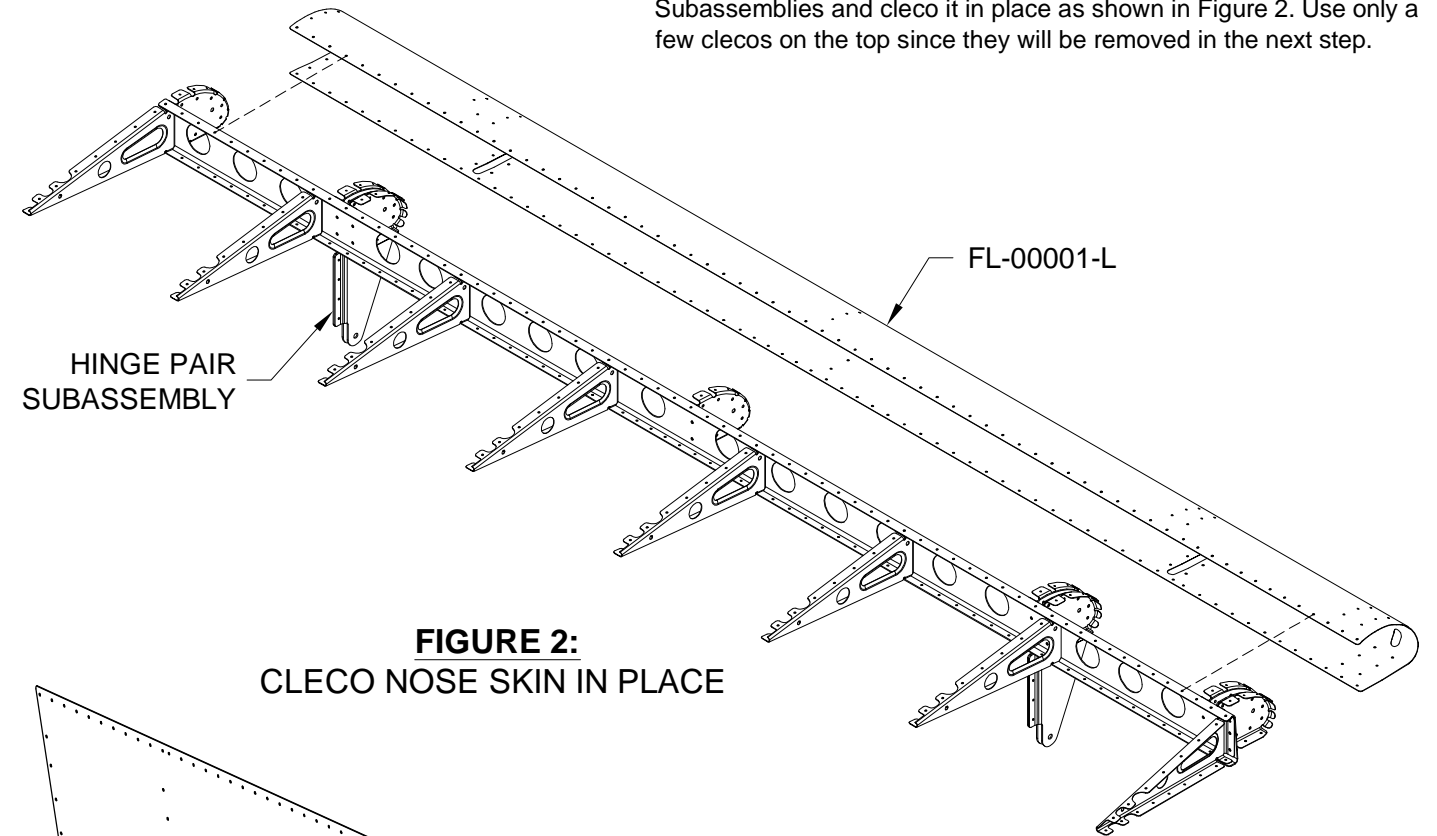


FIGURE 2:
CLECO NOSE SKIN IN PLACE

Step 3: Put the flap in the cradles as shown in Figure 3. Remove the clecos along the top flange of the FL-00003-L Spar, then slip the FL-00002A-L Top Skin into place between the FL-00001-L Nose Skin and the spar's upper flange.

Cleco the nose skin and the top skin to the spar and FL-1005-L Main Ribs and FL-1005-R Modified Main Rib.

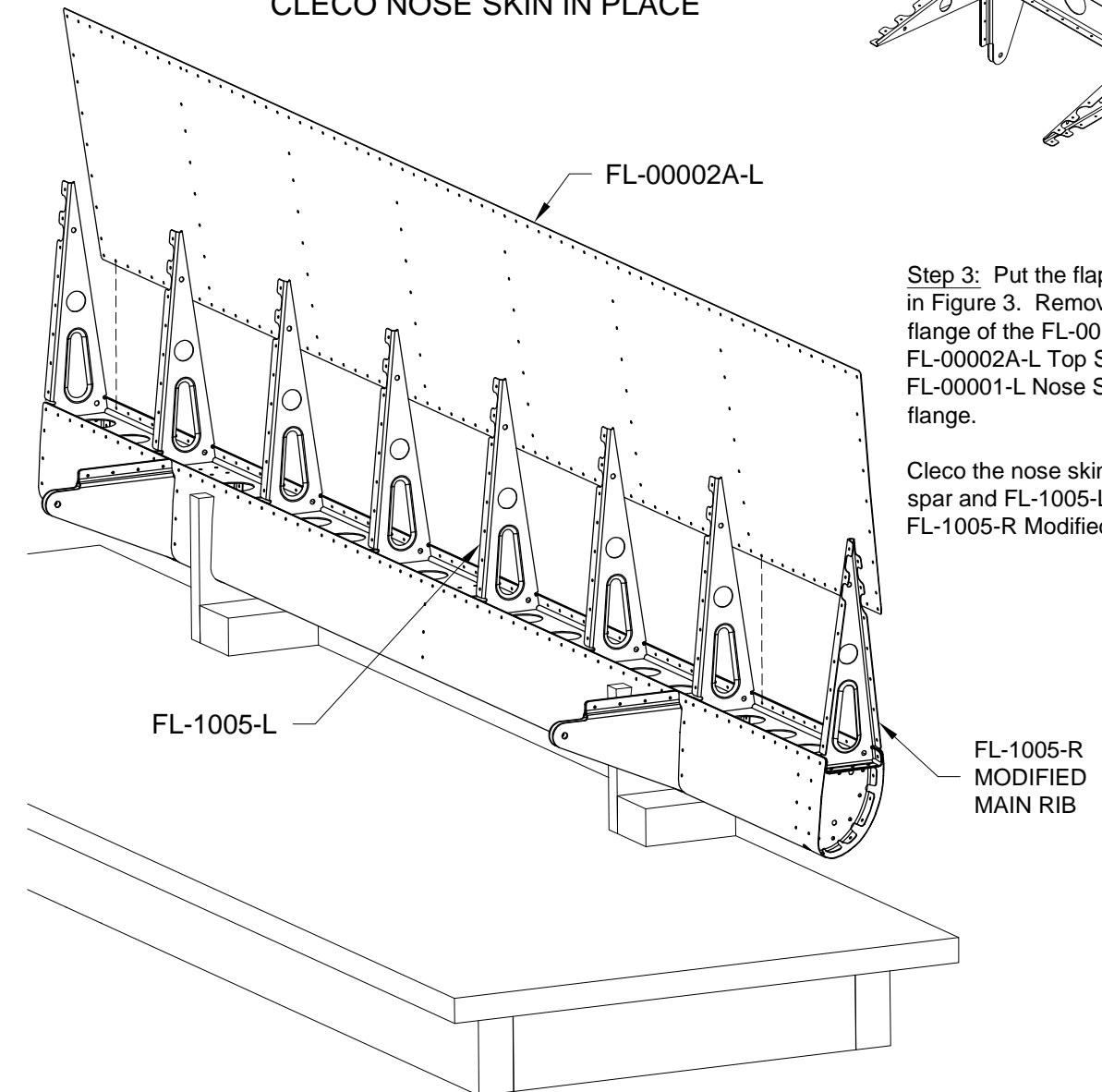
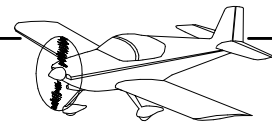


FIGURE 3: INSERTING TOP SKIN



NOTE: Refer to Page 21-11 for all skin to flap (substructure) rivets.

Step 1: Rivet the FL-00001-L Nose Skin, FL-00002A-L Top Skin and the small tab at the top front of the FL-1005-L Main Ribs and FL-1005-R Modified Main Rib to the top flange of the FL-00003-L Spar as shown in Figures 1 and 2.

NOTE: Do not install the two aft-most AN426AD3-3 rivets in the main ribs at this time.

Rivet the top skin to the main ribs and to the modified main rib using the rivet locations called out in Figure 2.

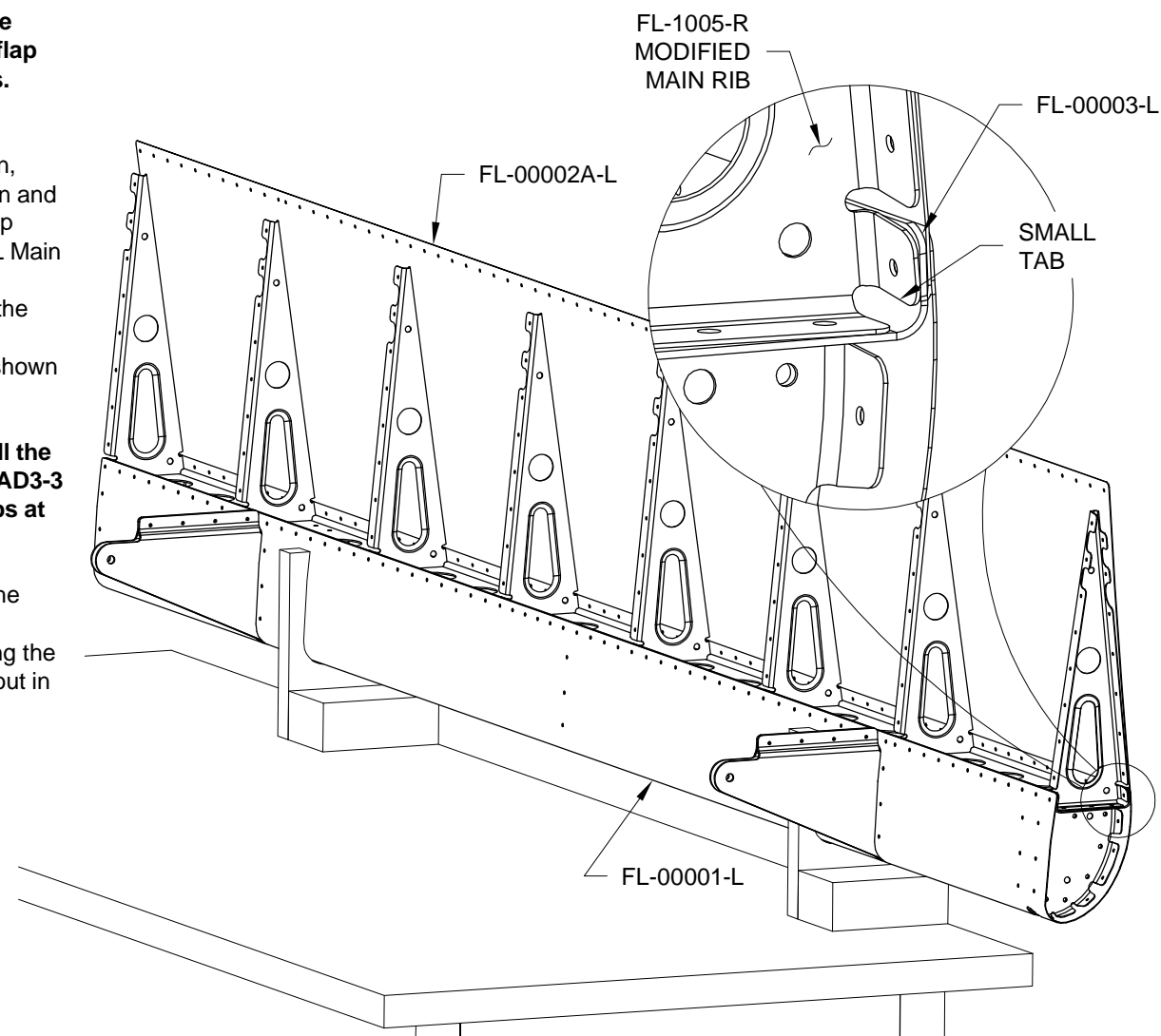


FIGURE 1: RIVETING NOSE AND TOP SKIN

NOTE: A back riveting plate is required for completing the trailing edge. Steel is preferred with minimum dimensions 3/8 [9.5 mm] X 6 [152 mm] X 12 [305 mm]. If using a plate smaller than the flap, spacers with the same thickness as the plate will be needed to provide a flat surface a little larger than the top skin.

Step 2: Remove the flap from the cradles and lay it top side down on a back riveting plate letting the nose rib clecos hang over the edge of the table.

Back rivet the two aft most rivets in the top flange of the FL-1005 Main Ribs to the FL-00002A Top Skin as shown in Figure 3.

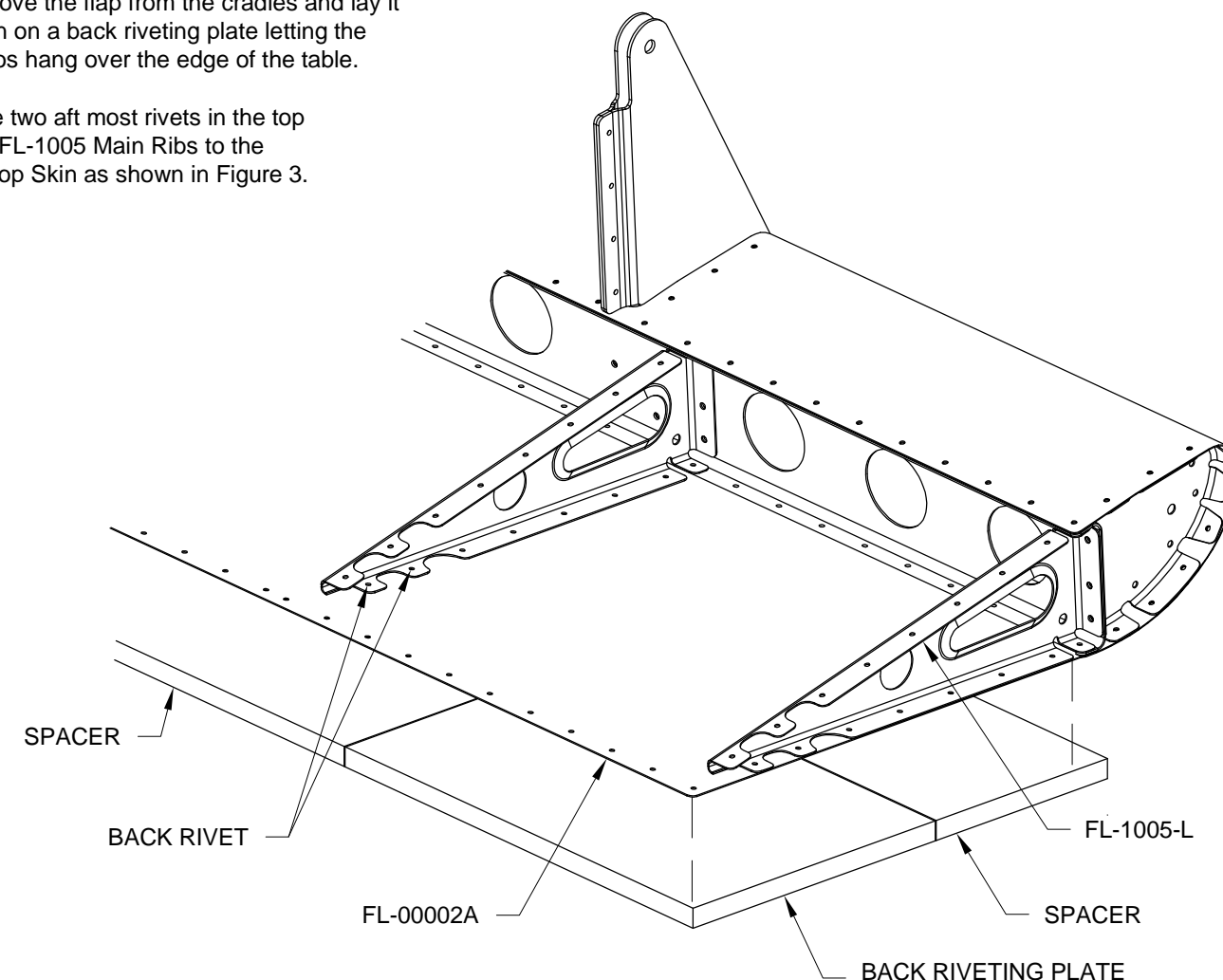


FIGURE 3: BACK RIVETING TOP SKIN TO MAIN RIBS

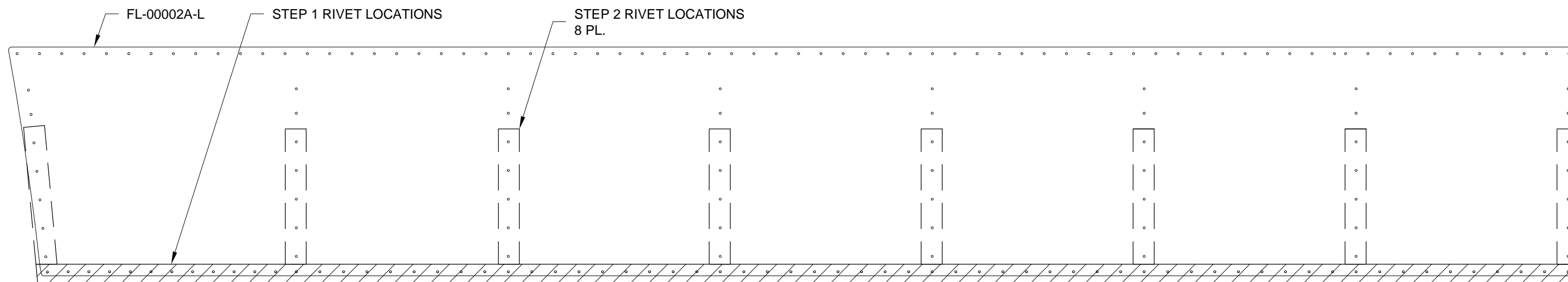


FIGURE 2: TOP SKIN RIVET LOCATIONS
SHOWN ROTATED 180°



Step 1: Reposition the cradles on the bench as shown in Figure 1.

Step 2: Place the flap back into the cradles.

NOTE: Closing the 'D' shaped cell formed by the nose skin and spar will set the torsional alignment of the flap. Follow **Step 3** closely to avoid flap twist.

Step 3: Remove clecos from the bottom flange of the FL-00003-L Spar.

Insert the FL-00002B-L Bottom Skin between the FL-00001-L Nose Skin and the spar's lower flange.

Cleco the bottom skin and nose skins to the spar only.

Check for unwanted twist by measuring the angle of each Hinge Pair Subassembly using a digital level. See Figure 1. If necessary twist the flap to match the angles. When the angles match the flap is true.

Rivet the bottom and nose skins only to the spar using rivets called out on Page 21-11, Figure 3. Rivet every 10th hole, then randomly rivet the remaining holes.

NOTE: In order to clear the hinge brackets when drilling #33, a six inch long drill bit is required.

Step 4: Final-Drill #33 the underside of the FL-00001-L Nose Skin to FL-1004-L and -R Nose Rib holes only at the blind rivet locations. See Page 21-11, Figure 1.

Step 4: (continued)

Blind rivet the underside of the nose skin to the nose ribs using the rivets called out on Page 21-11, Figure 1.

Squeeze solid rivets on the underside of the nose skin at the inboard and outboard ends.

Remove the flap from the cradles.

Step 5: Final-Drill #33 the top side of the FL-00001-L Nose Skin to FL-1004-L and -R Nose Rib holes.

Blind rivet the top side of the nose skin to the nose ribs using the rivets called out on Page 21-11, Figure 1.

Squeeze solid rivets on the top side of the nose skin at the inboard and outboard ends.

Step 6: Lay the flap top side down on a very flat surface as shown in Figure 2.

NOTE: Parts which form the trailing edge need to be cleaned in preparation for applying adhesive which will bond the trailing edge together before riveting to help produce a straighter trailing edge after riveting.

Step 7: Clean FL-00008A Inboard and FL-00008B Outboard Trailing Edges as well as FL-00002A-L Top Skin and FL-00002B-L Bottom Skin trailing edge contact area. See directions for cleaning fuel tank components in Section 5.17.

Refer to Section 5.8 for instruction/technique on how to complete riveted trailing edges.

Apply adhesive to both surfaces of the inboard and outboard trailing edges.

CAUTION: Do not cleco the aft most main rib hole in order to avoid denting the top skin since the cleco tip is longer than the trailing edge is deep.

Cleco the trailing edges to the top skin and the bottom skin as shown in Figure 2.

Cleco the bottom skin to the FL-1005-L Main Ribs and the FL-1005-R Modified Main Rib.

Weight the flap down to a FLAT work table to keep it flat until the adhesive has cured.

NOTE: Refer to Page 21-11, Figure 3 for the remaining rivet callouts.

Step 8: Final-Drill #33 the FL-00002B Bottom Skin to the FL-1005-L Main Ribs and -R Modified Main Rib.

Blind rivet the bottom skin to the main ribs.

Squeeze solid rivets to attach the main and modified main ribs at the ends of the flap.

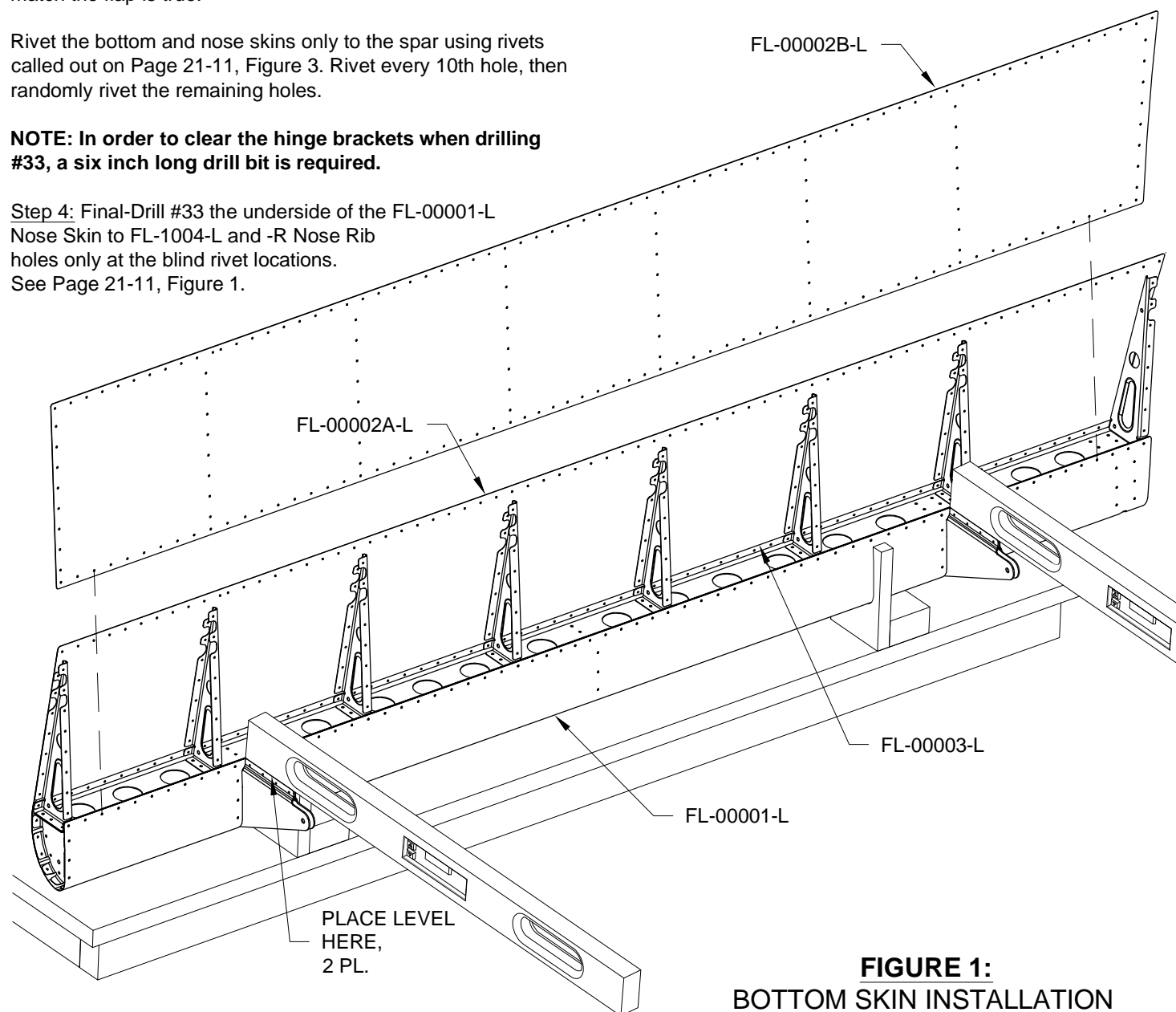


FIGURE 1:
BOTTOM SKIN INSTALLATION

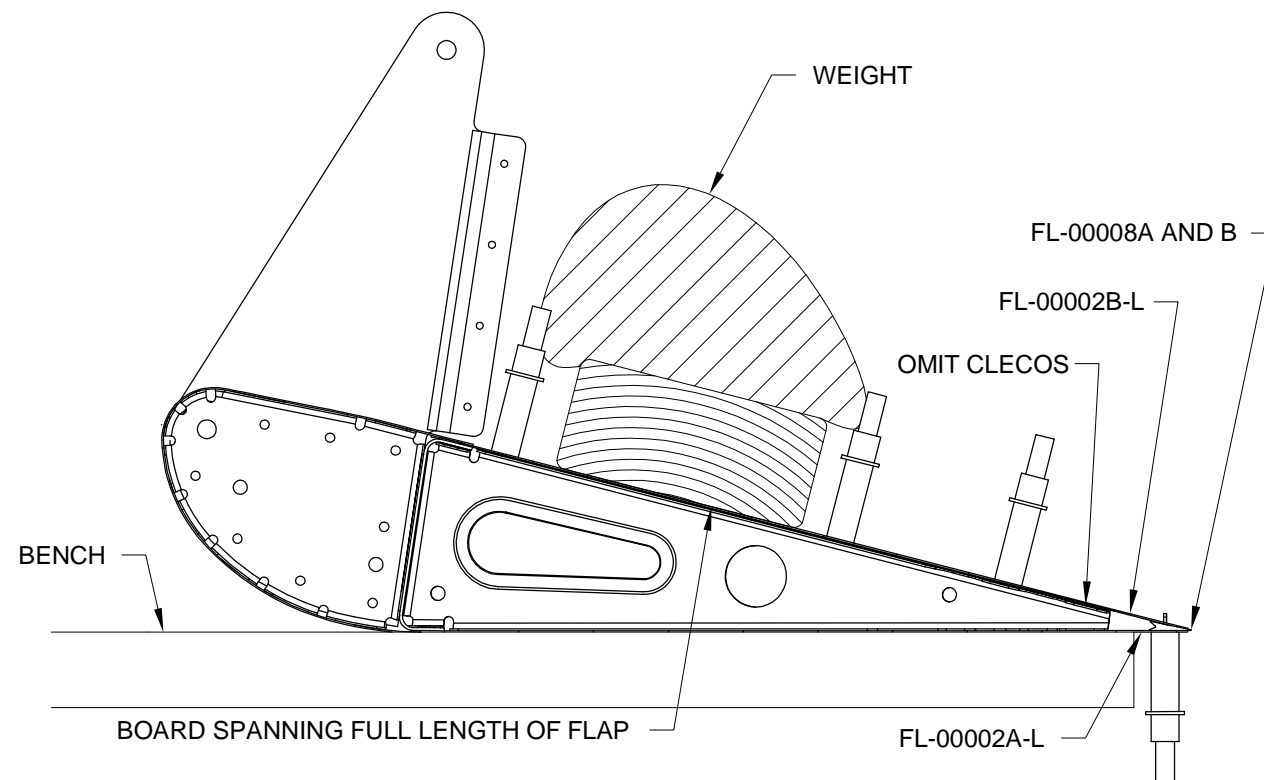
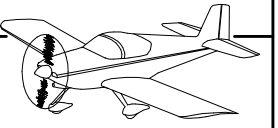


FIGURE 2: RIVETING BOTTOM SKIN



NOTE: Due to their close proximity to the hinge brackets these rivets require a long shank rivet set. The blind rivets called out are an acceptable alternative.

RIVET LEGEND

- ▽ AN426AD3-3
- △ AN426AD3-3.5
- ◇ AN426AD3-4.5
- ⊗ MK-319-BS

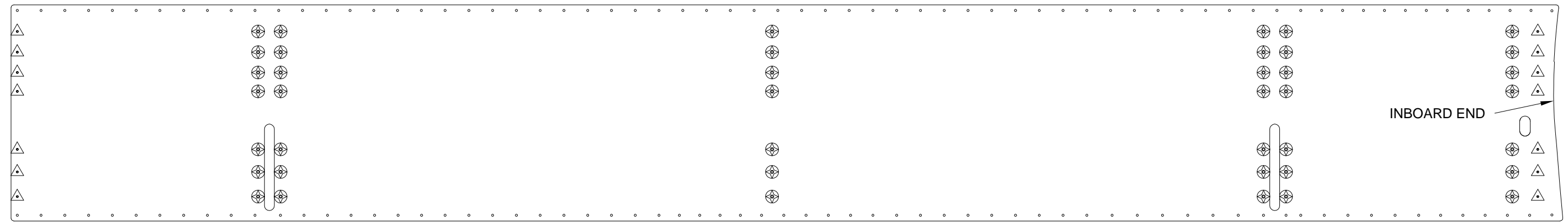


FIGURE 1: FL-00001-L NOSE SKIN RIVETS

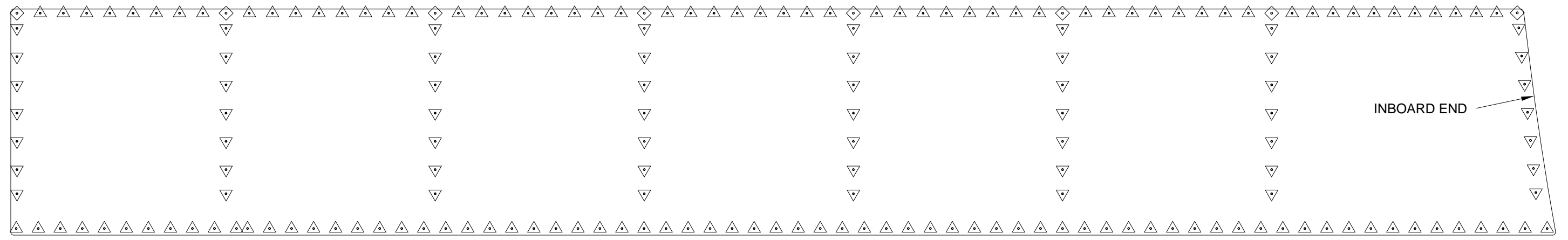


FIGURE 2: FL-00002A-L TOP SKIN RIVETS

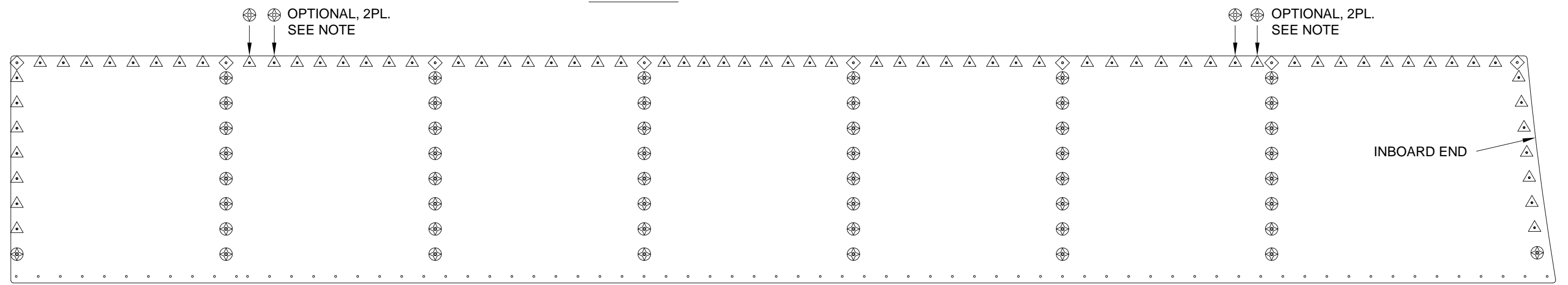


FIGURE 3: FL-00002B-L BOTTOM SKIN RIVETS

Step 1: Press fit the called out bushing into the flap attach hole in each of the W-1025A Flap Hinge Brackets using a c-clamp and a small socket. See Figure 1.

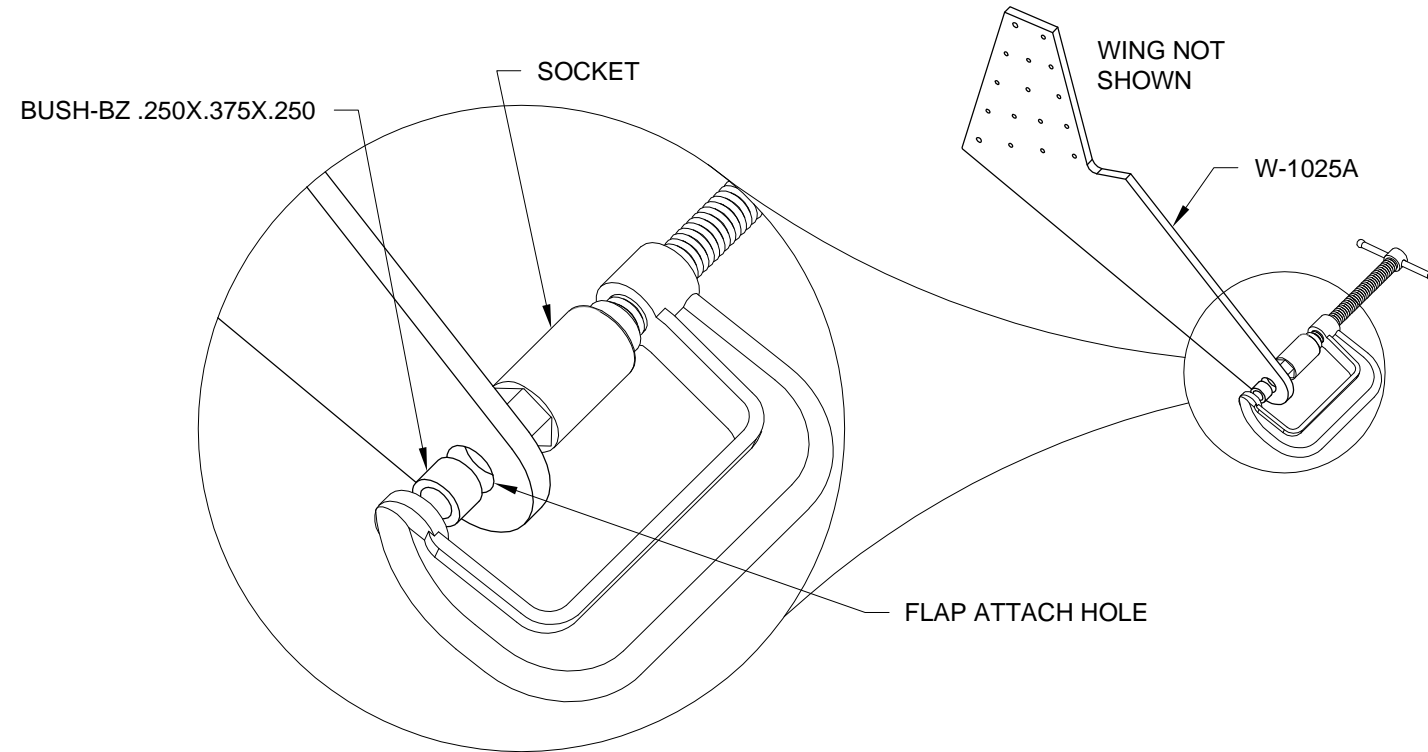


FIGURE 1: PRESS FIT BUSHING

The bushing should protrude the same distance out either side of the flap hinge bracket. See Figure 2.

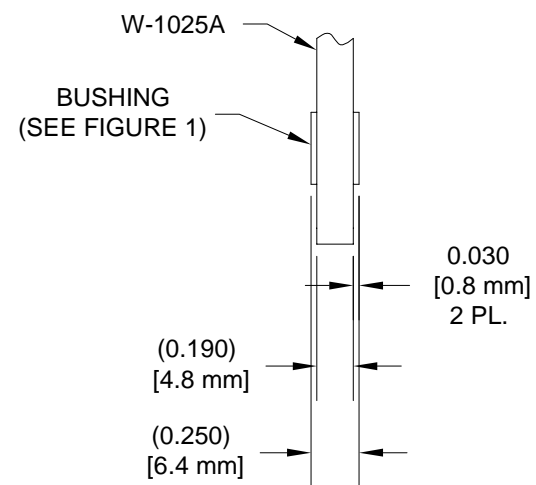


FIGURE 2: CORRECTLY INSTALLED BUSHING

NOTE: The following steps may be delayed until after painting.

Step 2: Attach the CM-4M rod end to the flap's inboard end using the hardware shown in Figure 3.

NOTE: Attachment of the flap to the wing will be addressed in Section 41. At that time proceed to Step 3.

Step 3: Attach the flap to the W-1025A Flap Hinge Brackets using the hardware called out in Figure 3.

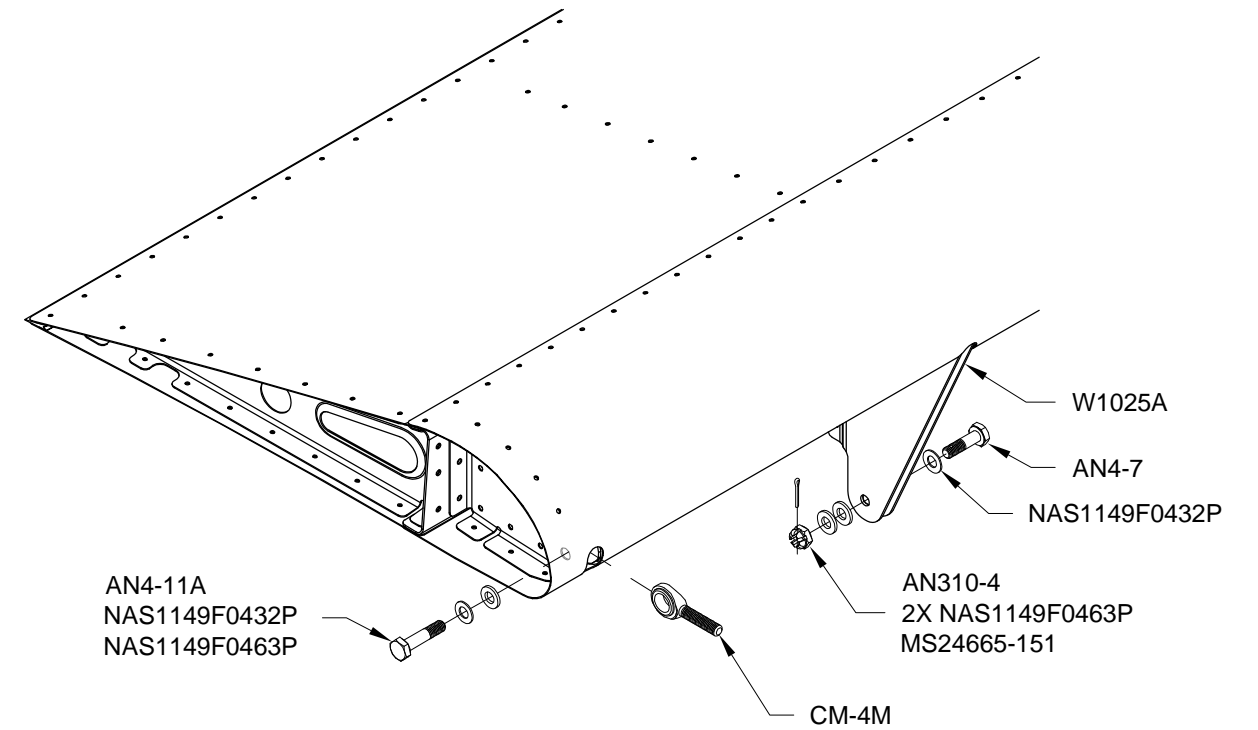


FIGURE 3: ATTACHING ROD END