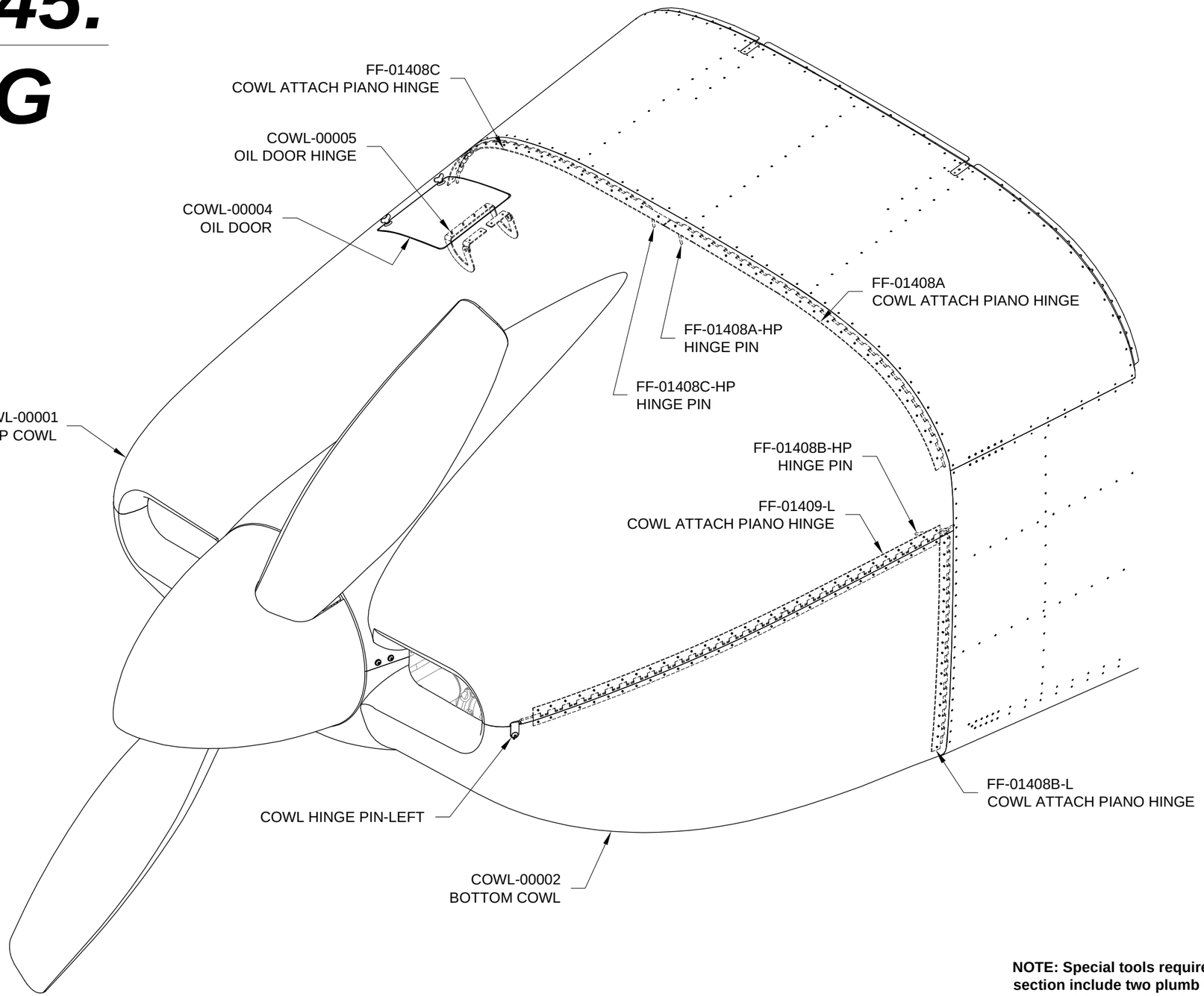
SECTION 45:
COWLING



NOTE: Special tools required to complete this section include two plumb bobs, a long straight sanding block, and a pair of large channellock pliers.

DATE OF COMPLETION: _____
PARTICIPANTS: _____

Step 1: Separate a length of HINGE PIANO 1/8 into two halves by removing the hinge pin. Discard the hinge pin.

Step 2: Fabricate the FF-01408A & C Cowl Attach Piano Hinges from the HINGE PIANO 1/8 halves using the dimensions shown in Figure 1 and Figure 2. Note the orientation of the eyelets when trimming.

Step 3: Fabricate the FF-01408A-HP & C-HP Hinge Pins from SSP-120 Stainless Pin using the dimensions shown in Figure 3 and Figure 4.

Step 4: Grind the end of each hinge pin to an offset point using the dimensions shown in the detail view of Figure 3 and Figure 4. Note the orientation of the offset in relation to the bend direction. Polish the ground end of each hinge pin with a Scotch-Brite wheel.

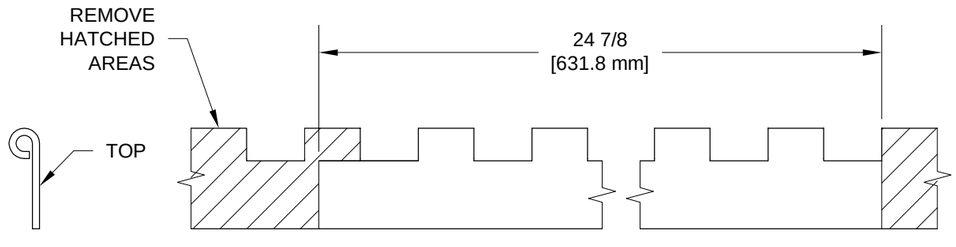


FIGURE 1: FF-01408A
(TOP VIEW)

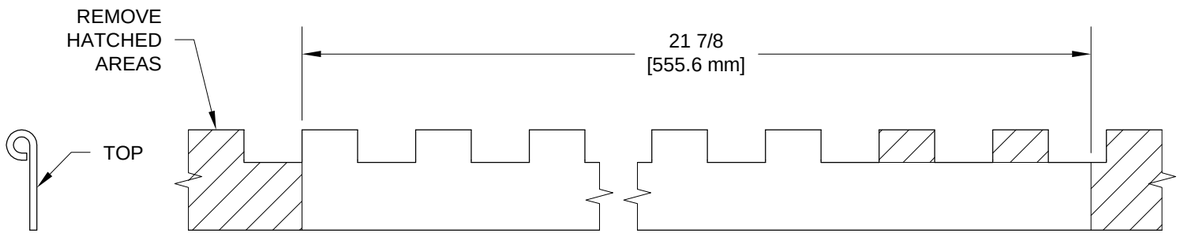


FIGURE 2: FF-01408C
(TOP VIEW)

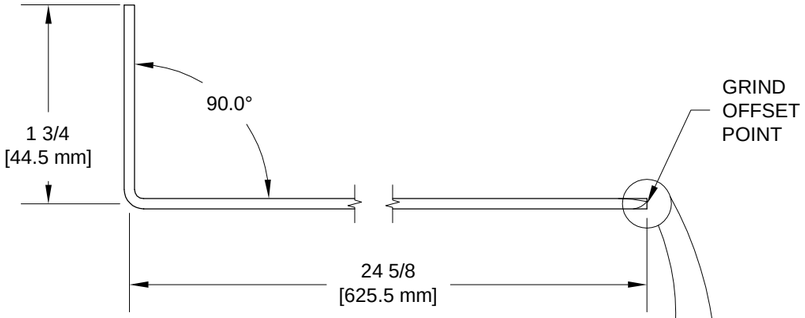


FIGURE 3: FF-01408A-HP

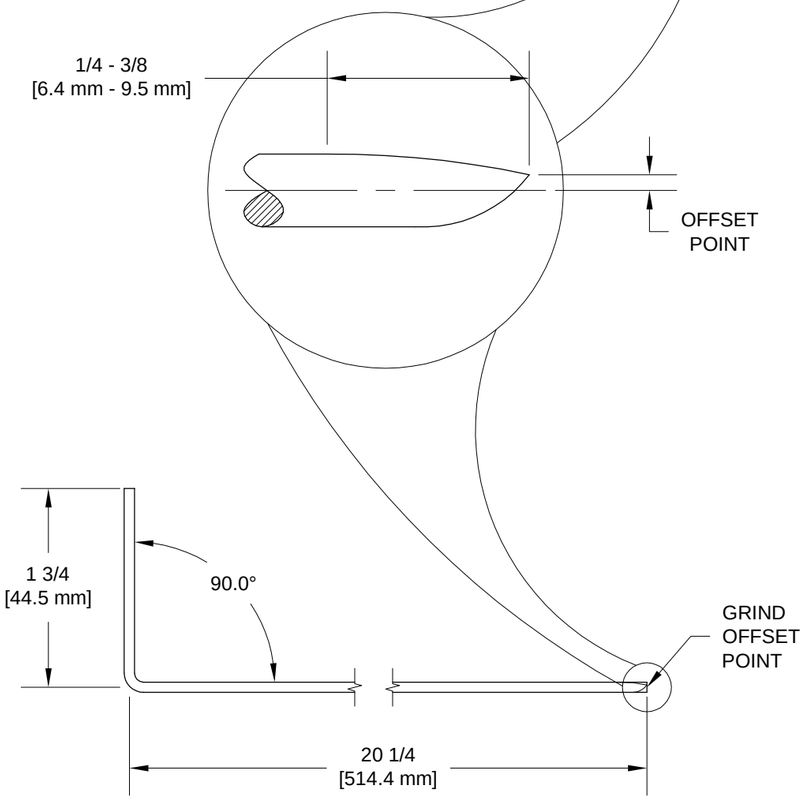


FIGURE 4: FF-01408C-HP

Step 1: Separate a length of HINGE PIANO 1/8 into two halves by removing the hinge pin. Discard the hinge pin.

Step 2: Fabricate the FF-01408B-L & -R Cowl Attach Piano Hinges from the HINGE PIANO 1/8 halves using the dimensions shown in Figure 1.

The FF-01408B-L & -R Cowl Attach Piano Hinges are mirror images of each other. Note the orientation of the eyelets when trimming.

Step 3: Fabricate two FF-01408B-HP Hinge Pins from SSP-120 using the dimensions shown in Figure 2.

Step 4: Grind the end of each hinge pin to a dull point. Polish the ground end of each hinge pin with a Scotch-Brite wheel

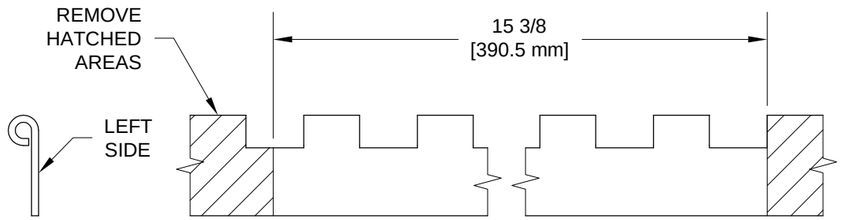


FIGURE 1: FF-01408B-L
(LEFT SIDE VIEW)

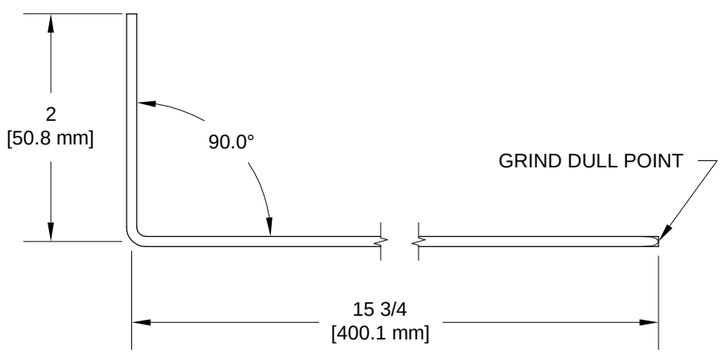


FIGURE 2: FF-01408B-HP

Step 5: Separate a length of AN257-P3 hinge into two halves by removing the hinge pin. Discard the hinge pin.

Step 6: Fabricate the FF-01409-L & -R Cowl Attach Piano Hinges from the AN257-P3 hinge halves using the dimensions shown in Figure 3. At this point, the FF-01409-L & -R Cowl Attach Piano Hinges are identical.

Step 7: Modify the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT as shown in Figure 4. The left and right cowl hinge pins are mirror images of each other.

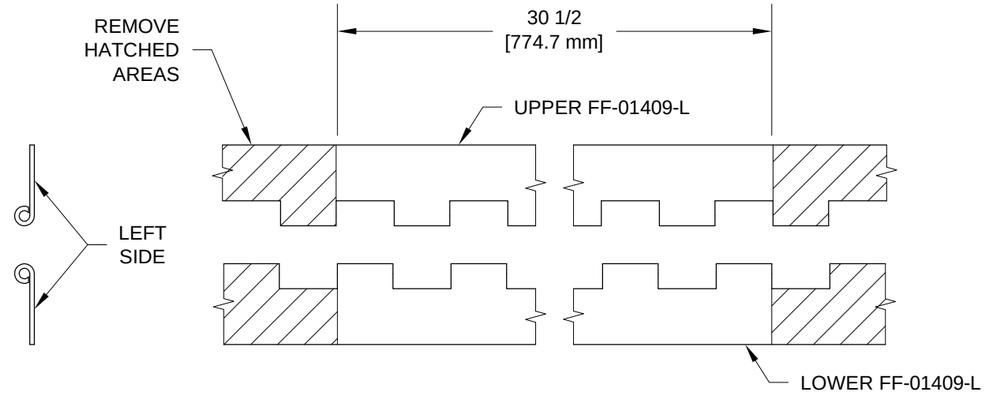


FIGURE 3: FF-01409-L
(LEFT SIDE VIEW)

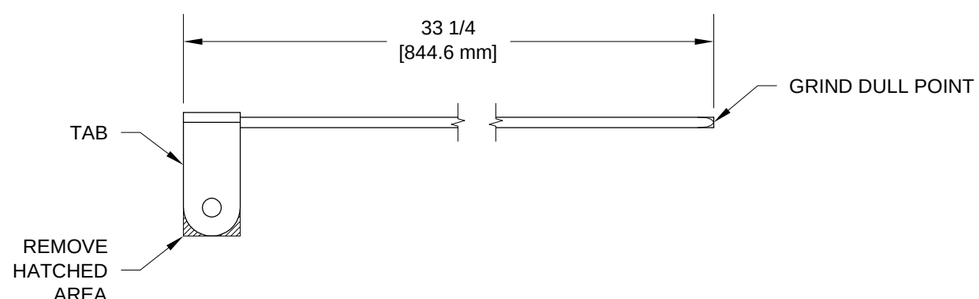


FIGURE 4: COWL HINGE PIN-LEFT

Step 1: Pre-form the FF-01408A & C Cowl Attach Piano Hinges and FF-01408A-HP & C-HP Hinge Pins to their installed shapes. When installed, the bent ends of the hinge pins are secured in the notches of the FF-00005 Cowl Pin Retention Bracket on the firewall as shown in Figure 1.

Step 2: For the more curved portions of the FF-01408A & C Cowl Attach Piano Hinges, bevel the eyelets with a file or small abrasive disc. Likewise, bevel the corresponding eyelets of the FF-00006A & C Cowl Attach Piano Hinge halves. Bevel as required until the hinge halves easily fit together. See the detail view of Figure 1.

Step 3: Coat the FF-01408A-HP & C-HP Hinge Pins with a dry lubricant (e.g. Boelube) to ease insertion and removal. Do this periodically throughout the life of the aircraft.

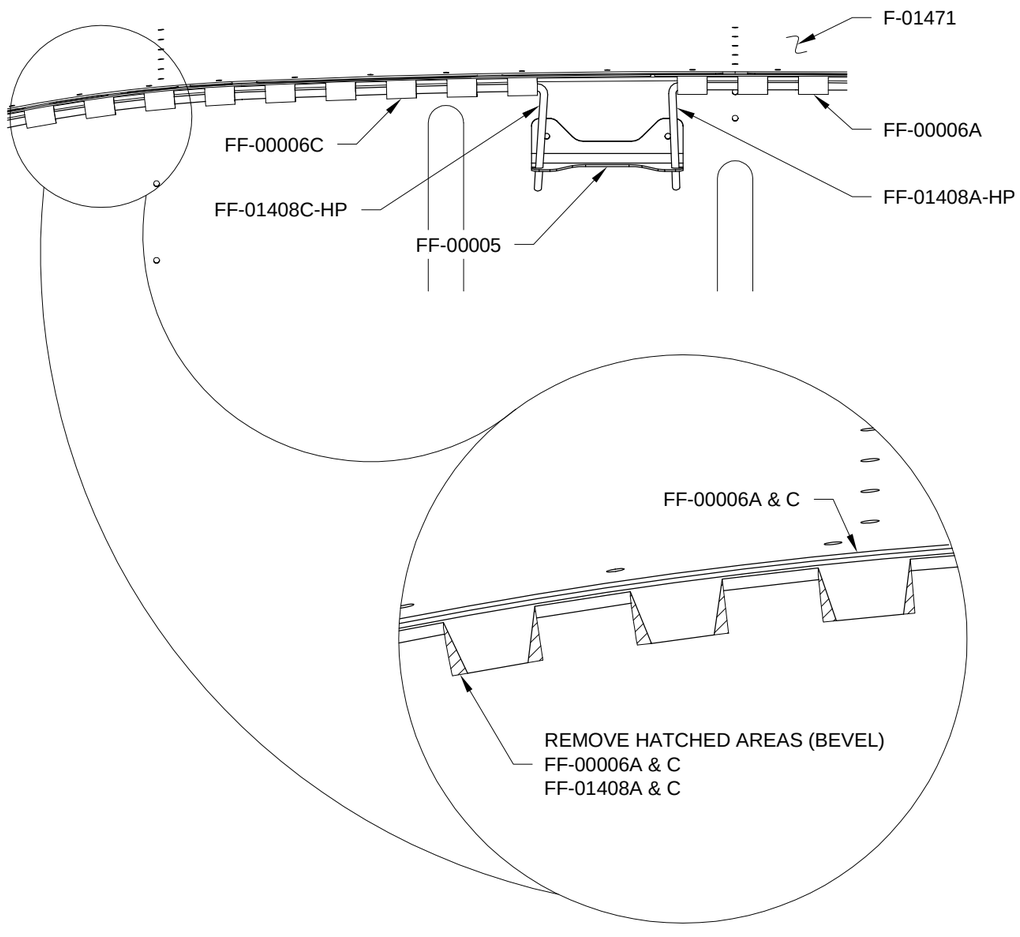


FIGURE 1: HINGE PIN ORIENTATION AND BEVELS
(FRONT VIEW LOOKING AFT, FF-01408A & C NOT SHOWN)

Step 4: Install the FF-01408A & C Cowl Attach Piano Hinges on the fuselage by inserting the hinge pins.

Step 5: Lay a ruler or similar flat item along the forward edge of the F-01471 Forward Top Skin to verify that the hinge halves are aligned along their entire length. See Figure 2.

Step 6: Flute the hinges as required to maintain the curve of the fuselage skin: tighter curves require more fluting. Center the flutes in between the rivets that attach the aft portion of the hinges to the fuselage. If over-fluting occurs, flatten the hinges with pliers or an equivalent tool.

Step 7: Coat the FF-01408B-HP Hinge Pins with a dry lubricant (e.g. Boelube) to ease insertion and removal. Do this periodically throughout the life of the aircraft.

Step 8: Install the FF-01408B-L & -R Cowl Attach Piano Hinges on the fuselage by inserting the hinge pins. See Figure 3.

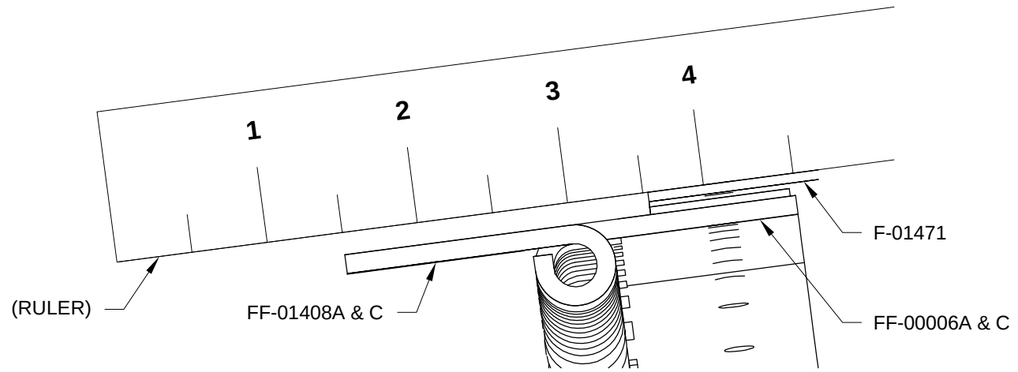


FIGURE 2: ALIGN HINGE HALVES
(LEFT SECTION VIEW)

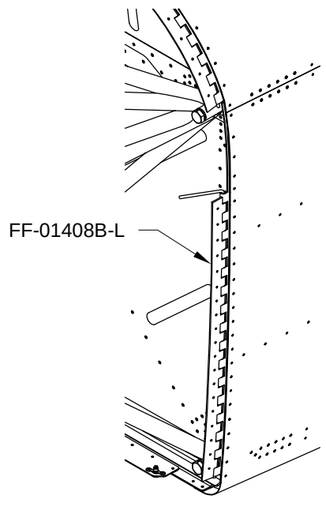


FIGURE 3: INSTALL FF-01408B-L & -R
(TRI-GEAR SHOWN)

NOTE: When trimming to a scribe line, use a cutting disk or die grinder to trim just short of the line and then finish by sanding to the center width of the line with a long (12 [304.8 mm] or more) straight sanding block.

Step 1: Uninstall the S-601-1 Spinner.

NOTE: Refer to Figure 1 and Figure 2 for the following steps:

Step 2: Trace the scribe lines on the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl with a fine point permanent marker. Use a straight edge to reconnect the lines if gaps exist.

DO NOT trace the main gear cutout if you are building a tri-gear aircraft. **DO NOT** trace the nose gear cutouts if you are building a tail dragger aircraft.

Step 3: Trim the top cowl and bottom cowl to the scribe lines around the air inlets and spinner cutout as shown.

Leave a 3/4 [19.1 mm] tall flange on each side of the spinner cutout in the bottom cowl as shown in the detail view.

Step 4: Trim the bottom cowl to the inside corner scribe lines on either side of the spinner cutout as shown in the detail view.

Step 5: Trim the top cowl to the lower edge scribe lines.

Step 6: Trim the top cowl to the oil door cutout can now be used as a hand hold when manipulating the top cowl.)

Step 7: Make a mark on the upper edge of the bottom cowl roughly 3 1/2 inches from the upper outboard corner of the air inlet as shown in the detail view.

Step 8: Trim the bottom cowl to the upper edge scribe line, but only in the region forward of the mark (the portion aft of the mark is trimmed later). See the detail view. Repeat Steps 7-8 for the left side.

Step 9: (Tri-Gear) Trim the bottom cowl to the nose gear cutout scribe line as shown.

Step 10: (Tail Dragger) Trim the bottom cowl to the main gear cutout scribe lines as shown.

Step 11: Trim the top cowl and bottom cowl to their aft edge scribe lines. At this point, the top cowl will barely fit between the S-602-1 Spinner Plate and F-01471 Forward Top Skin.

Step 12: Sand smooth any high or low spots along the inner surfaces of the top cowl and bottom cowl where each of the hinges will be installed. See Page 45-01 for hinge installation locations.

Sand only until the inner surface is uniform to within approximately 0.010 [0.3 mm].

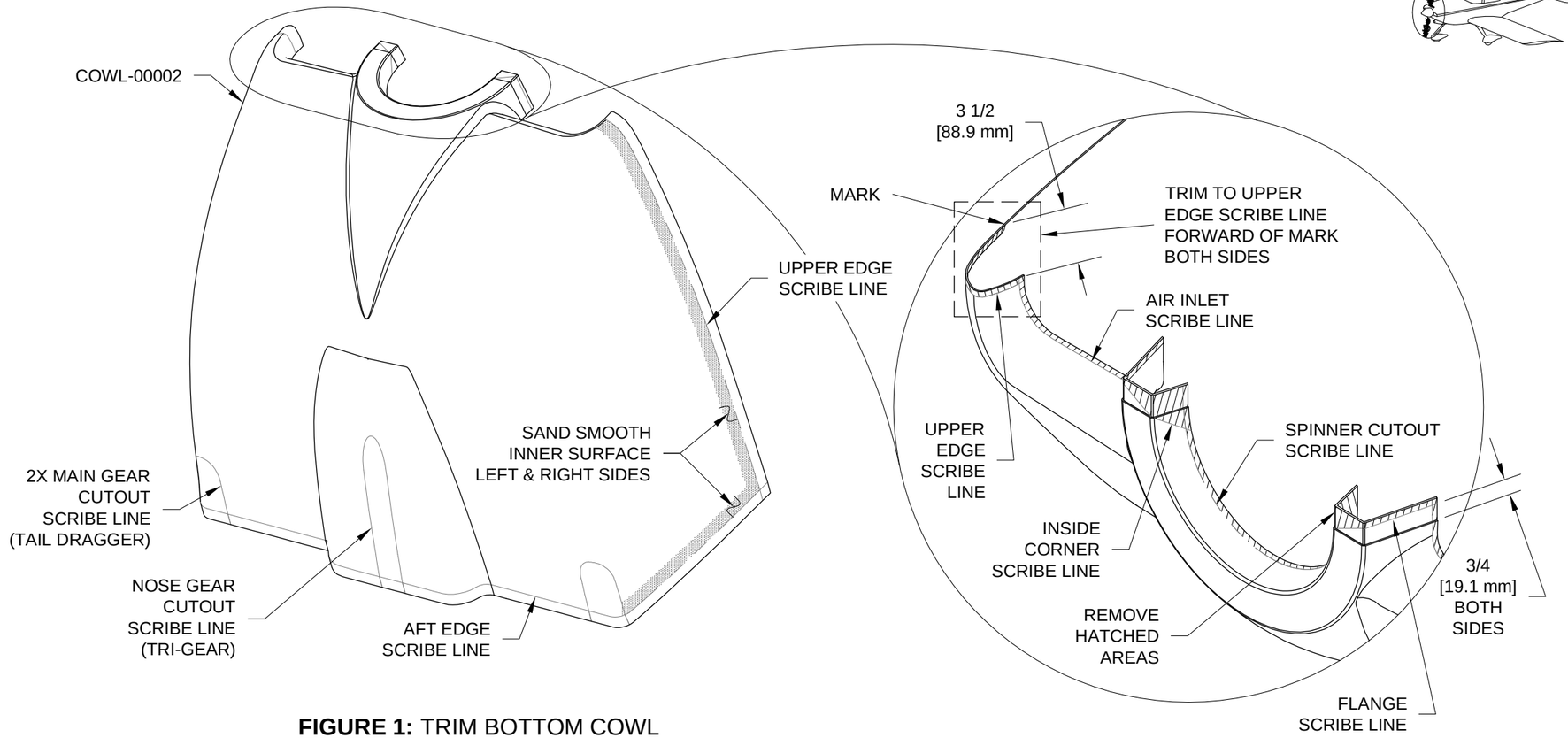


FIGURE 1: TRIM BOTTOM COWL

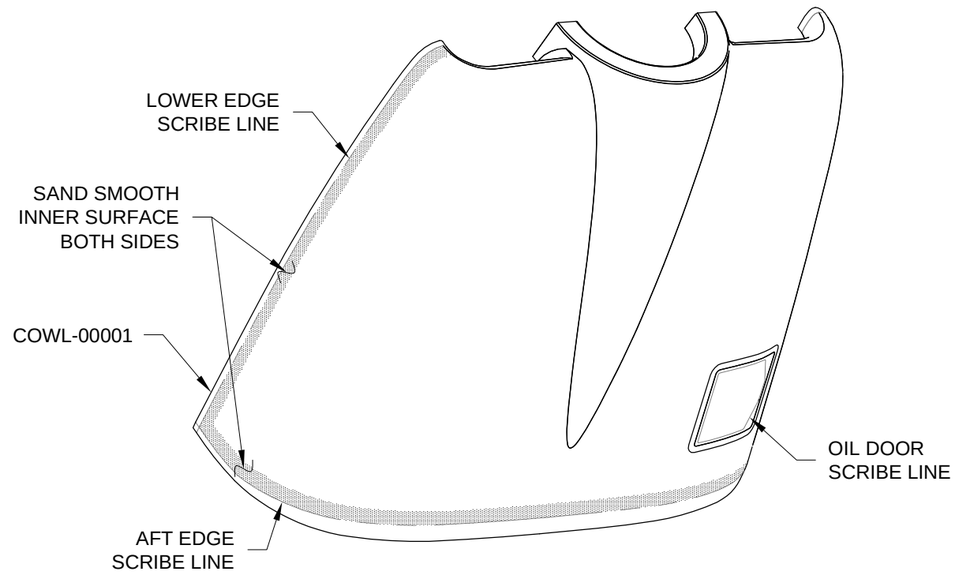


FIGURE 2: TRIM TOP COWL

NOTE: Refer to Figure 1 and Figure 2 for the following steps:

Step 1: Clean up and sharpen the mating surfaces of the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl around the spinner cutout by removing any excess material. Flat surfaces and sharp corners in these areas are critical for proper alignment of the cowling halves.

Step 2: Measure the width of each "step" around the outside of the flanges on the bottom cowl as shown.

Step 3: Remove excess material from the inside surface of the top cowl that correspond to the "steps" on the bottom cowl until the thickness of the top cowl in those areas matches the width of the "steps".

Step 4: Sand flat the inner surface of the flanges in the bottom cowl on both sides of the spinner cutout as required to allow for later installation of nutplates.

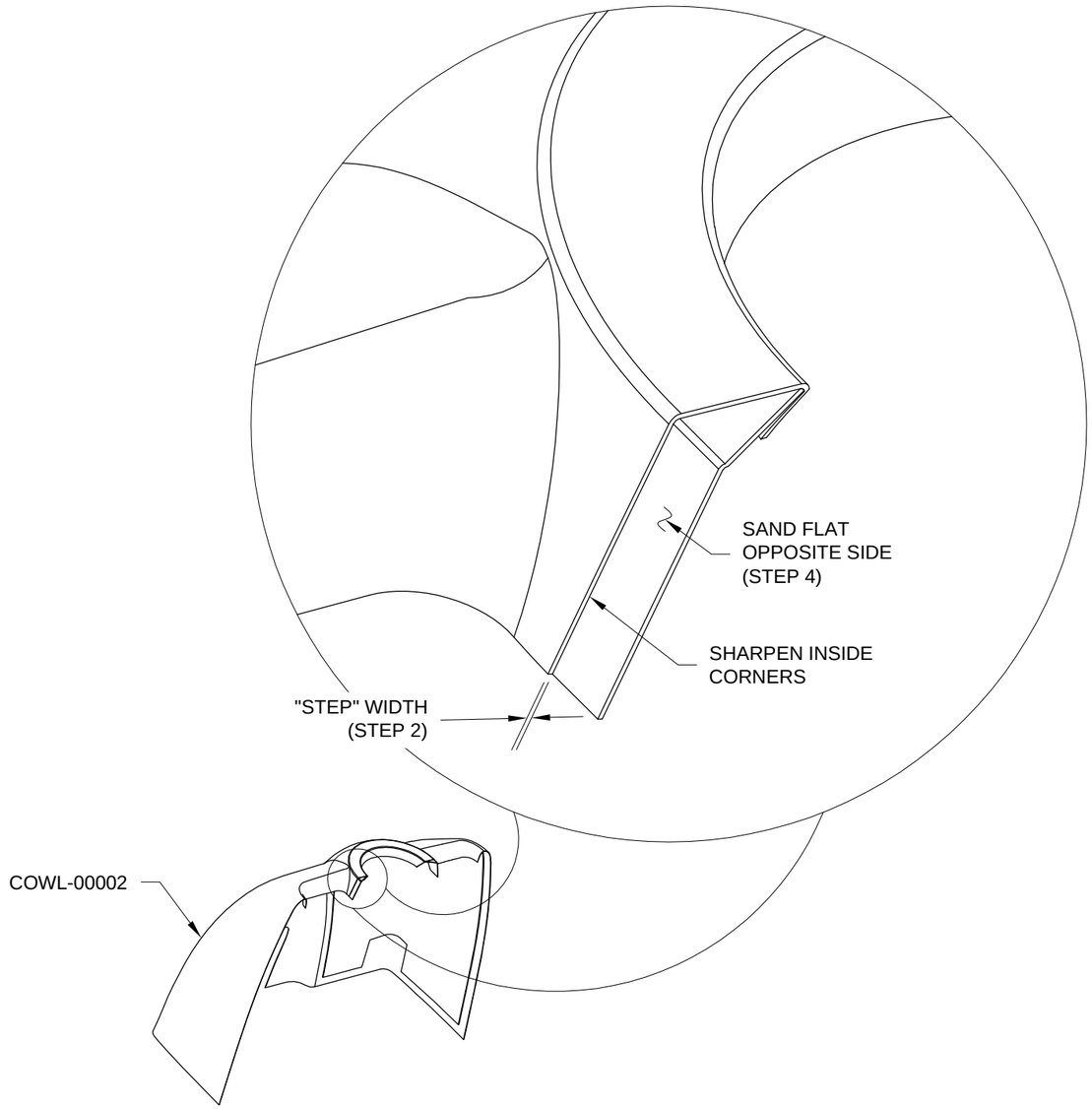


FIGURE 1: CLEAN UP BOTTOM COWL
(TRI-GEAR SHOWN)

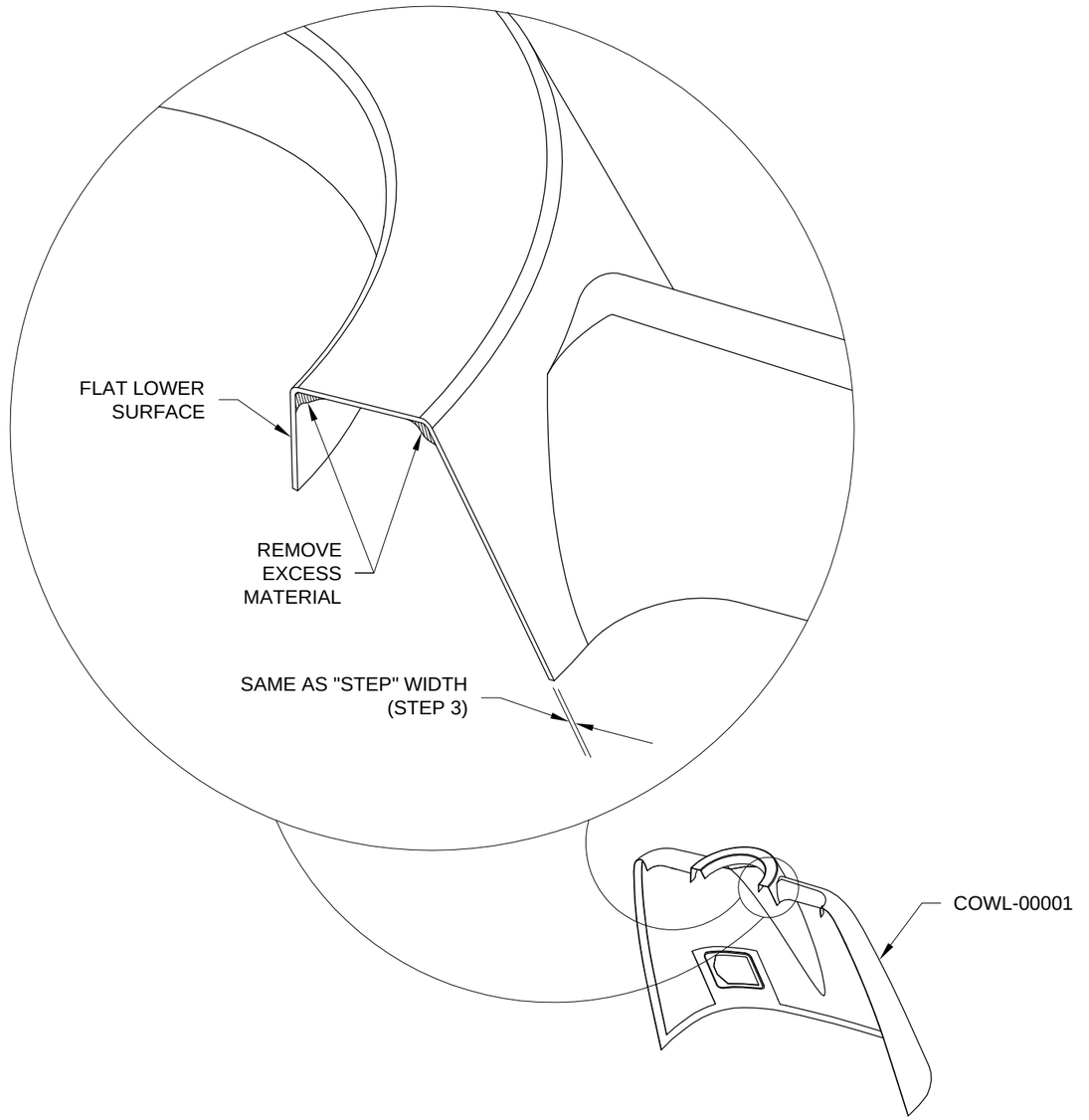


FIGURE 2: CLEAN UP TOP COWL

Step 1: Stand the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl up on their aft edges. Place several wooden spacers of uniform thickness on a level floor. Set the cowl halves on the wooden spacers. The spacers will allow room for the cowl halves to be clamped together.

Step 2: Mate the top cowl to the bottom cowl to verify proper fit around the spinner cutout and air inlets.The flanges and upper edges of the bottom cowl go inside the top cowl.

Step 3: Align the upper edge scribe line (see Page 45-05, Figure 1) of the bottom cowl with the lower edge of the top cowl.

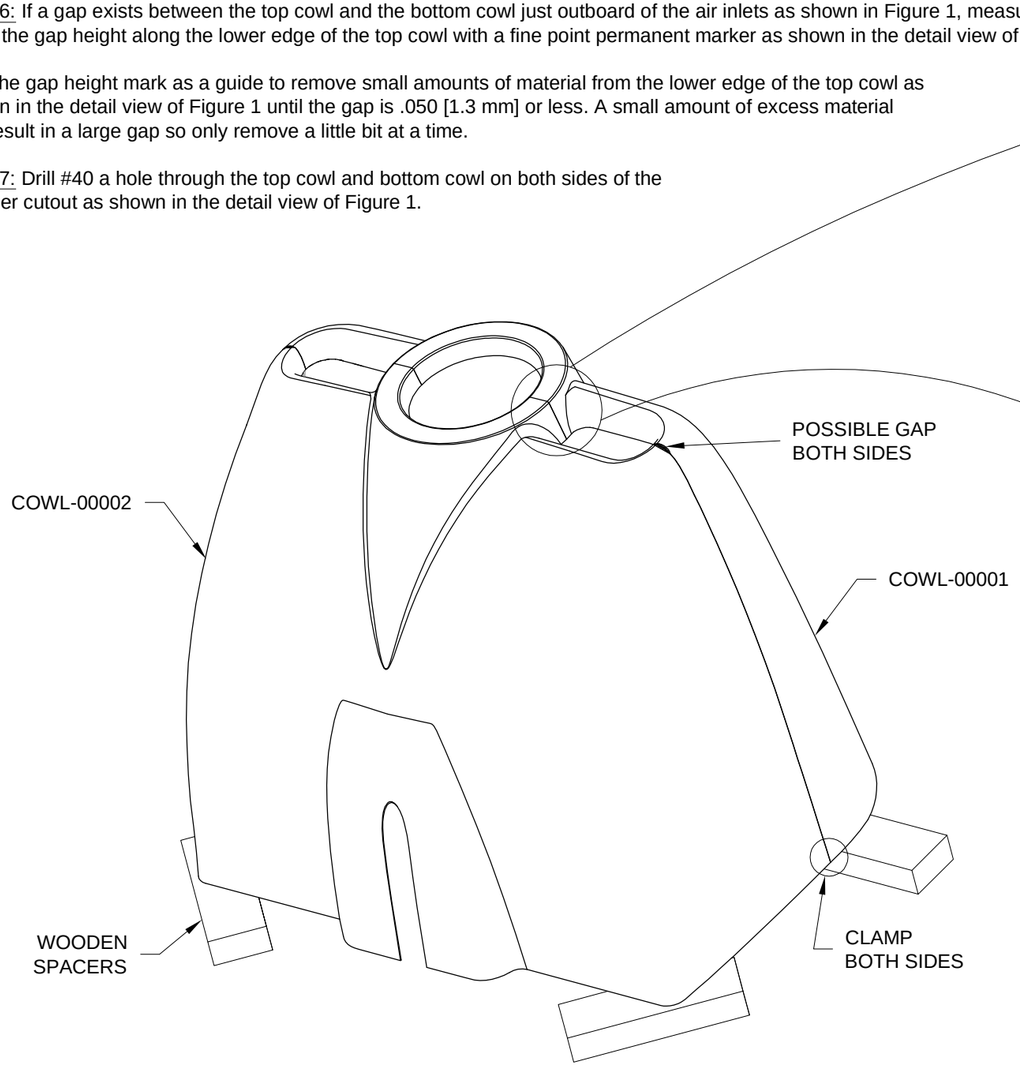
Step 4: Clamp the top cowl to the bottom cowl on both sides at the aft edge near the floor, and at the inboard side of each air inlet aft of the spinner cutout. See Figure 1 and the detail view.

Step 5: If the top and bottom cowls do not fit together well in the area shown in the detail view, remove additional material (as described on Page 45-06, Step 1) until a good fit is achieved.

Step 6: If a gap exists between the top cowl and the bottom cowl just outboard of the air inlets as shown in Figure 1, measure the gap height and then mark the gap height along the lower edge of the top cowl with a fine point permanent marker as shown in the detail view of Figure 1.

Use the gap height mark as a guide to remove small amounts of material from the lower edge of the top cowl as shown in the detail view of Figure 1 until the gap is .050 [1.3 mm] or less. A small amount of excess material will result in a large gap so only remove a little bit at a time.

Step 7: Drill #40 a hole through the top cowl and bottom cowl on both sides of the spinner cutout as shown in the detail view of Figure 1.



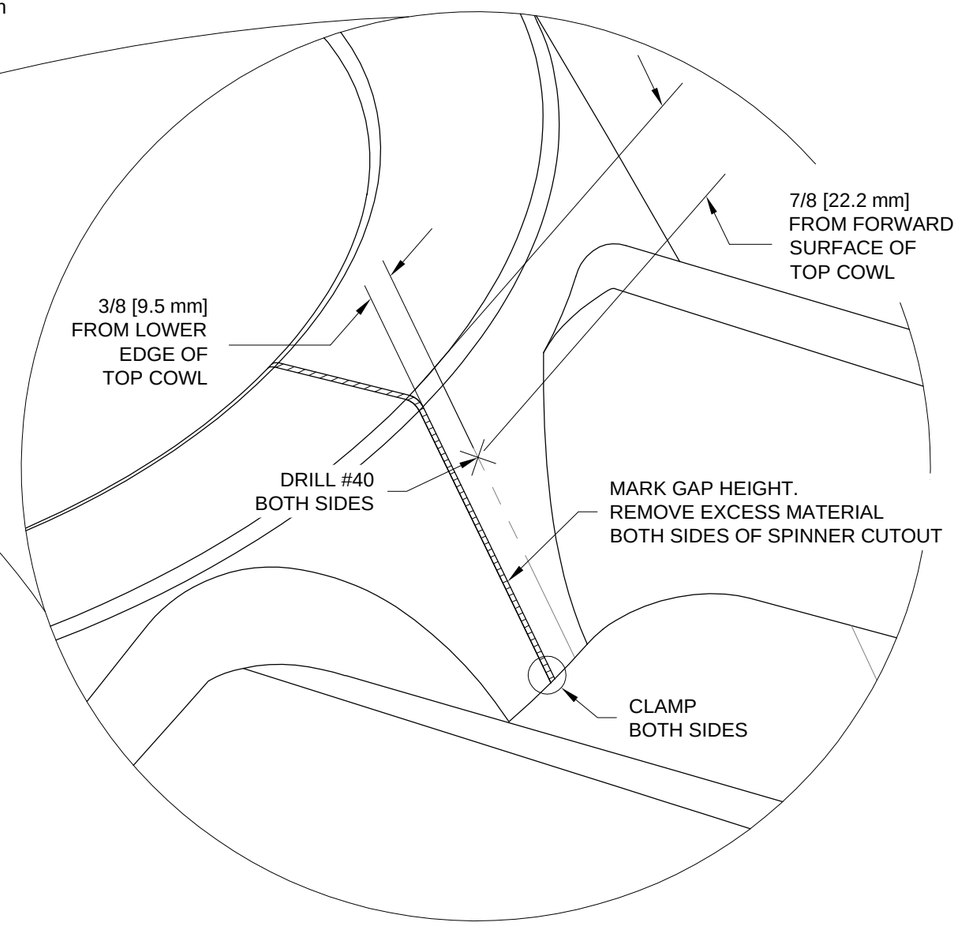


FIGURE 1: FIT COWL HALVES
(TRI-GEAR SHOWN)

NOTE: The COWL -00001 Top Cowl will be used as a reference throughout this section: pay special attention to the alignment of the top cowl.

NOTE: Refer to Figure 1 for the following steps:

Step 1: Verify that the forward face of the S-602-1 Spinner Plate is flat and that any dish shape has been removed (see Section 44).

Step 2: Fabricate an alignment tool out of a piece of aluminum angle (e.g. AA6-063X3/4X3/4) as shown in the detail view.

Step 3: Match-Drill #40 two holes into the top cowl, along the aircraft centerline, using the aluminum angle as a guide.

Step 4: Place one washer under the forward hole in the aluminum angle as shown. Cleco the aluminum angle to the top cowl as shown.

The aluminum angle will rest on top of the S-602-1 Spinner Plate to provide vertical alignment for the top cowl. The vertical offset produced by the washer roughly compensates for the engine settling into its mounts during the first 100 hours of use.

Step 5: Level the aircraft in roll. Use the F-01405F Mid Fuse Brace (i.e. the seat back crossbar) or the F-01440-L & -R Seat Ramps (i.e. the flat portion just aft of the control columns) as a reference.

NOTE: The forward/aft alignment of the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl is less important at the start because the aft edges of the cowls will be trimmed to their final dimensions at the end of this section. At this point, it is more important that there is no strain on the cowls (caused by forcing the cowl between the S-602-1 Spinner Plate and the F-01471 Forward Top Skin) that might distort their shape. It is less important to have perfect edge gaps, however, all edge gaps should be less than .050 [1.3 mm].

Step 6: Place the top cowl on the aircraft and center it behind the S-602-1 Spinner Plate. The top cowl should barely fit between the spinner plate and F-01471 Forward Top Skin.

Step 7: Slide the top cowl forward until it lightly contacts the back of the S-602-1 Spinner Plate.

Step 8: Remove small amounts of excess material from the aft edge of the top cowl where localized interference exists. There should be no strain on the top cowl that might distort its shape. Realign the top cowl per Steps 6-7.

NOTE: Steps 9-15 laterally align (in roll) the aft edge of the top cowl with the fuselage.

Step 9: Place a level on the floor as shown and shim it until it indicates level.

Step 10: Hang plumb bobs from two symmetrical points at the forward edge of the top cowl air inlets so that they touch the level as shown. Mark the cowl and the level with the plumb bob contact points. Remove the plumb bobs.

Step 11: Slide the aft edge of the top cowl left and right until the distances between the pairs of contact points are equal within 1/16 [1.6 mm]. This will laterally align the top cowl.

Step 12: Secure the top cowl to the fuselage with tape. **DO NOT** pull the tape too tight or it will distort the shape of the cowl.

Step 13: Verify that the top cowl is laterally aligned using the pairs of points from Step 10.

Step 14: Verify that the top cowl is centered behind the S-602-1 Spinner Plate.

Step 15: Mark a reference line across the seam between the top cowl and F-01471 Forward Top Skin at the aircraft centerline with a fine point permanent marker as shown. The top cowl will be laterally aligned when the two line segments line up.

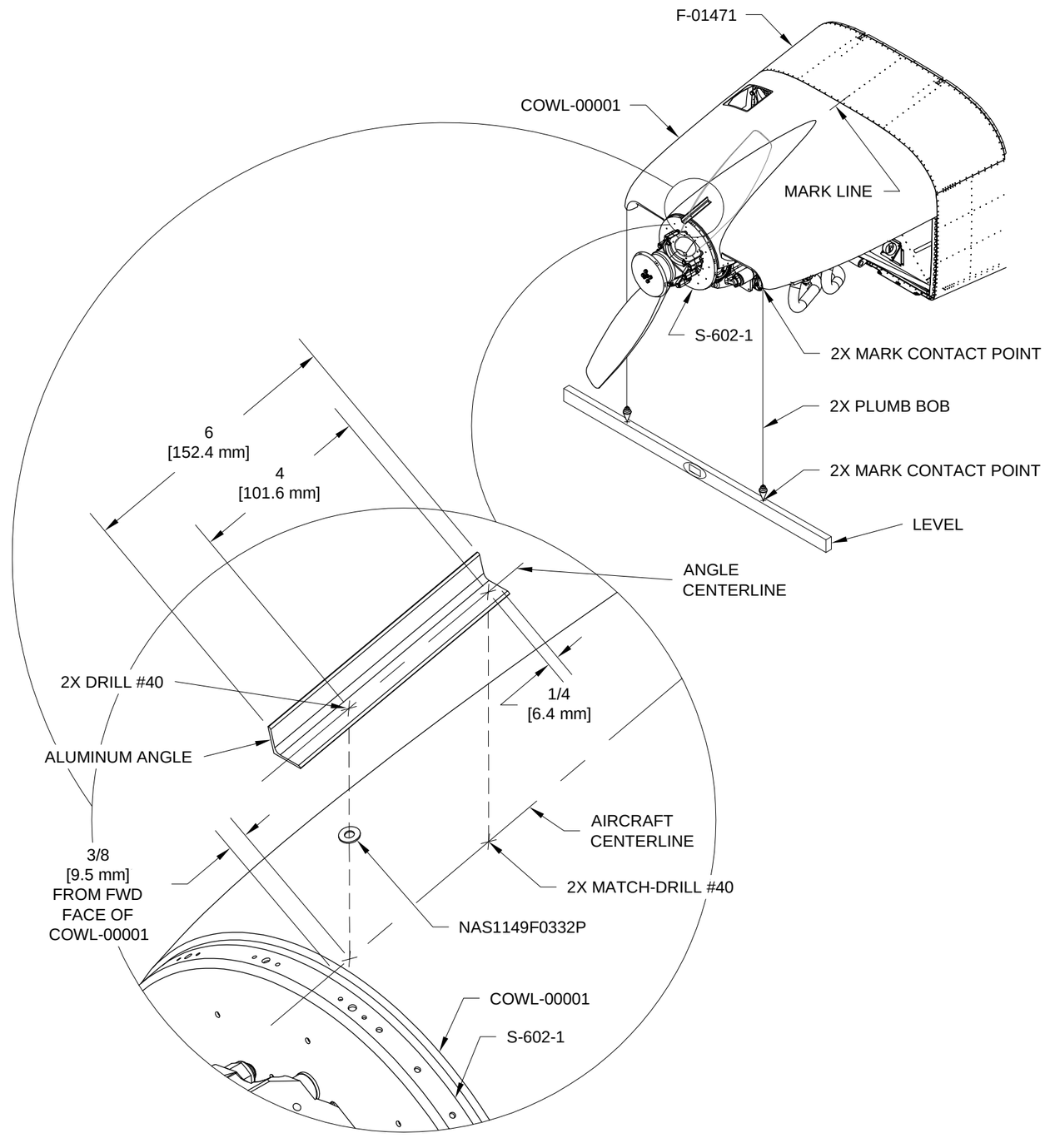


FIGURE 1: LEVEL TOP COWL
(TRI-GEAR SHOWN)

Step 1: Mark a line on the COWL-00001 Top Cowl with a fine point permanent marker 1/8 [3.2 mm] forward from the edge of the F-01471 Forward Top Skin and F-01470-L & -R Fuselage Side Skins. See Figure 1.

Step 2: Remove the top cowl.

NOTE: When trimming the cowl, use a cutting disk or die grinder to trim just short of the desired dimension and then finish by sanding with a long (12 [304.8 mm] or more) straight sanding block.

Step 3: Trim the aft edge of the top cowl to the line marked in Step 1.

Step 4: Place the top cowl on the aircraft.

Step 5: Verify that the top cowl is centered behind the S-602-1 Spinner Plate and is laterally aligned.

Step 6: There should be a 3/16 [4.8 mm] gap between the forward lower edge of the top cowl and the S-602-1 Spinner Plate as shown in Figure 1.

If necessary, the top cowl can be moved forward to achieve the 3/16 gap, but **DO NOT** create a gap in excess of .050 [1.3 mm] between the aft edge of the top cowl and the forward top skin.

Hint: Use a 3/16 diameter bolt to verify the size of the gap as shown in Figure 1.

NOTE: It is normal to have a smaller gap at the top of the S-602-1 Spinner Plate than at the bottom. The engine will settle into its mounts during the first 100 hours of use and the top gap will increase.

Step 7: Secure the top cowl to the fuselage with tape. **DO NOT** pull the tape too tight or it will distort the shape of the cowl.

Step 8: Transfer the rivet locations that are along the forward edge of the F-01471 Forward Top Skin to the top cowl with a fine point permanent marker. **DO NOT** transfer the lowest rivet location on each side.

Transfer the rivet locations forward 11/16 [17.5 mm] from the edge of the forward top skin. See Figure 1.

Step 9: Remove the top cowl.

Step 10: Drill #40 the top cowl at the transferred rivet locations.

Step 11: Place the top cowl on the aircraft.

Step 12: Verify that the top cowl is centered behind the S-602-1 Spinner Plate and is laterally aligned.

Step 13: Verify that there is a 3/16 [4.8 mm] gap between the forward lower edge of the top cowl and the S-602-1 Spinner Plate.

Step 14: Secure the top cowl to the fuselage with tape. **DO NOT** pull the tape too tight or it will distort the shape of the cowl.

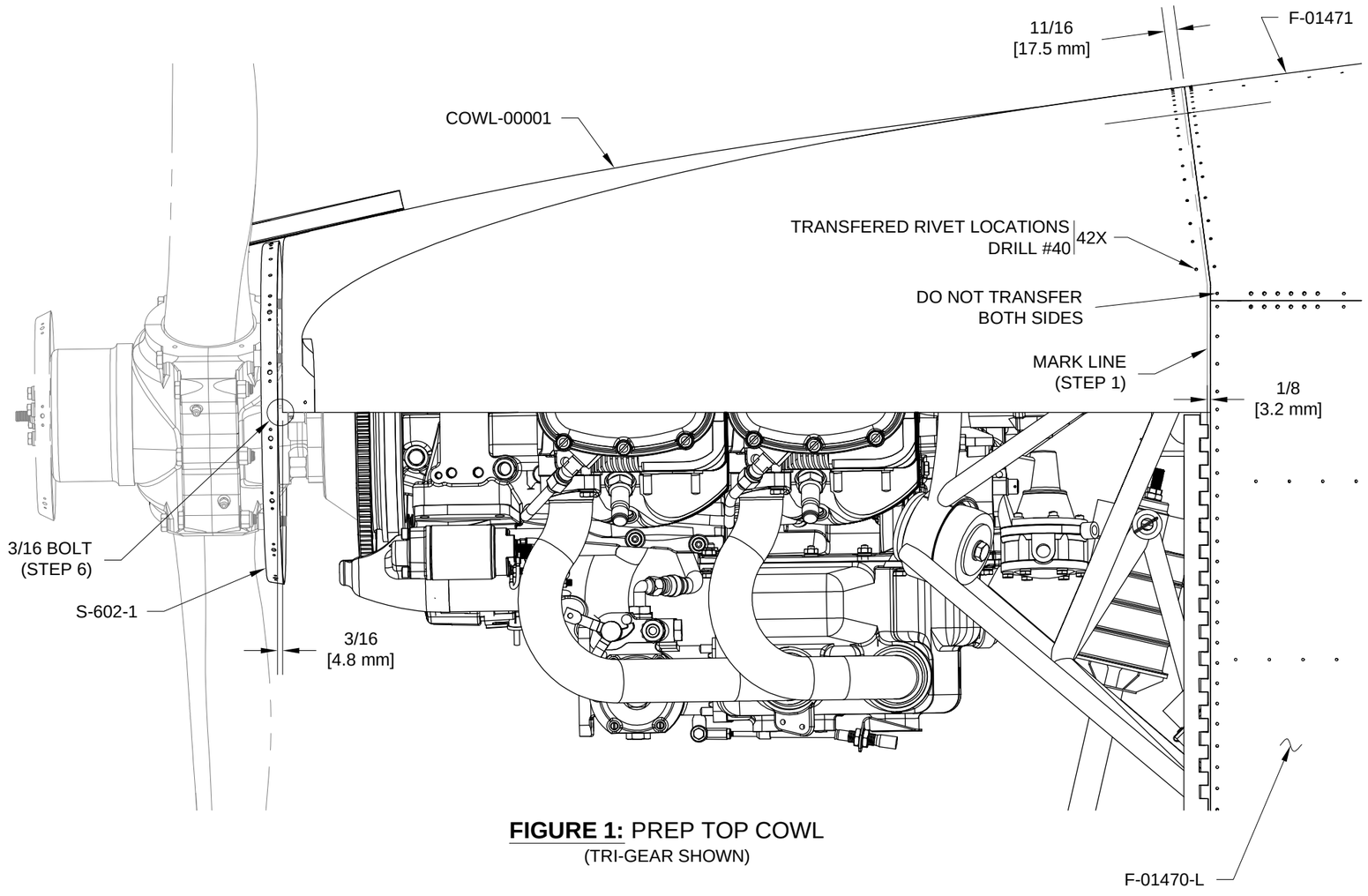


FIGURE 1: PREP TOP COWL
(TRI-GEAR SHOWN)

Step 1: Fabricate a wooden "hinge support block" approximately 1 [25.4 mm] by 2 [50.8 mm] by 4 [101.6 mm] in size.

NOTE: For all drilling operations on this page, keep the drill bit perpendicular to the surface of the cowl. Cleco each drilled hole before drilling the next.

NOTE: Be aware of debris between parts as drilling progresses. Disassemble and clean every few holes or as necessary

Step 2: Match-Drill #40 two holes into the FF-01408A & C Cowl Attach Piano Hinges on either side of the aircraft centerline using the COWL-00001 Top Cowl as a guide. Use a new drill bit.

Press the hinge support block against the FF-01408A & C Cowl Attach Piano Hinges during match-drilling to keep the hinges in contact with the inner surface of the top cowl.

Step 3: Verify that the top cowl remains properly aligned.

If the top cowl is misaligned, reposition the top cowl and match-drill two new holes outboard of the two existing holes.

Step 4: Match-Drill #40 a second set of two holes from the top cowl into the FF-01408A & C Cowl Attach Piano Hinges. Use the holes on either side of the aircraft centerline that are approximately 8 [203.2 mm] outboard of the first set of holes.

Press the hinge support block against the FF-01408A & C Cowl Attach Piano Hinges during match-drilling to keep the hinges in contact with the inner surface of the top cowl.

Step 5: Re-verify that the top cowl remains properly aligned.

If the top cowl is misaligned, reposition the top cowl and match-drill two new holes outboard of the second set of holes.

Step 6: Match-Drill #40 the remaining holes from the top cowl into the FF-01408A & C Cowl Attach Piano Hinges. Match-Drill from inboard to outboard, one hole at a time, while alternating left and right sides.

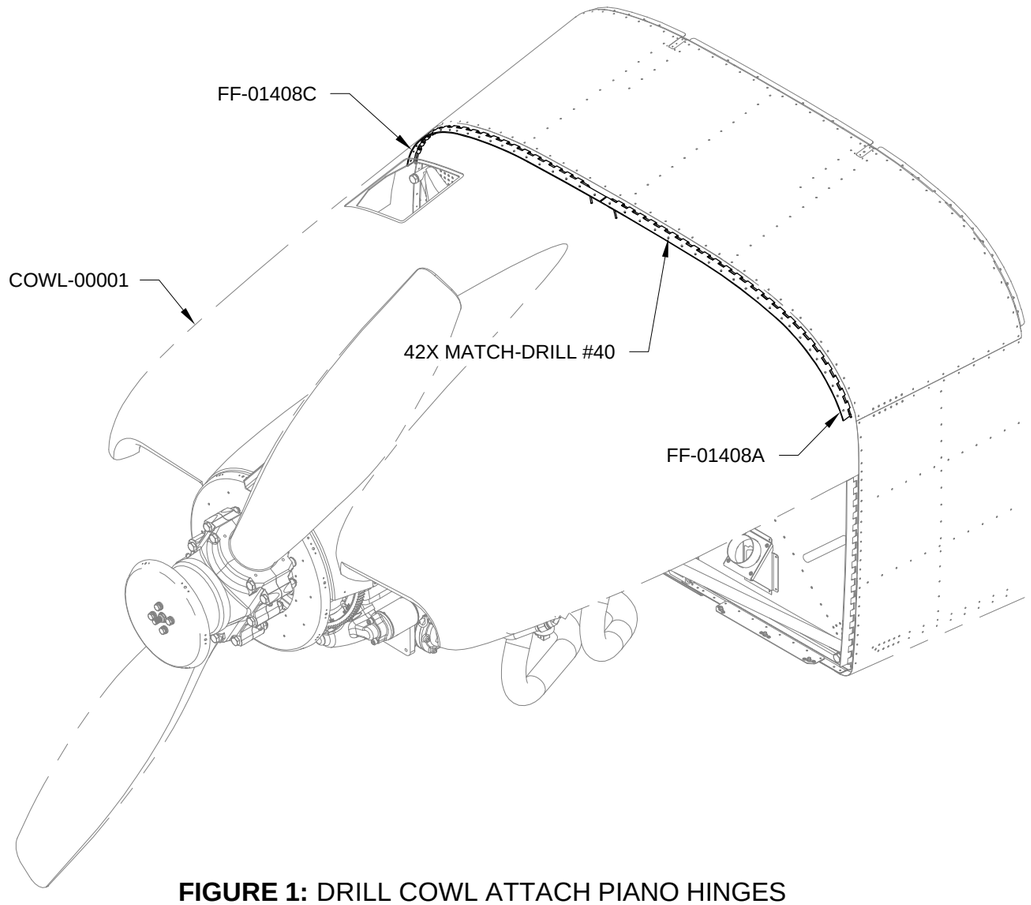


FIGURE 1: DRILL COWL ATTACH PIANO HINGES
(TRI-GEAR SHOWN)

Step 1: Cleco the COWL-00002 Bottom Cowl to the COWL-00001 Top Cowl using the #40 holes that were previously drilled on either side of the spinner cutout. The flange of the bottom cowl fits inside the top cowl. See Figure 1. Support the bottom cowl with a stepladder, sawhorse, or anti-gravity framis.

Step 2: Rotate/lift the bottom cowl into position. The upper edge of the bottom cowl fits inside the top cowl. Slip the sides of the bottom cowl over the lower fuselage and push the bottom cowl up as far as it will go.

Step 3: Trim the aft edge of the bottom cowl until it fits roughly flush against the forward edge of the F-01470-L & -R Fuselage Side Skins and F-01483-L & -R Forward Bottom Skins. Trim such that any gaps are less than .050 [1.3 mm].

Step 4: The bottom cowl is flexible at the lower aft corners. Lift the lower aft corners of the bottom cowl so that the curve of the bottom cowl matches the curve of the lower fuselage.

Step 5: Secure the bottom cowl to the fuselage with tape. **DO NOT** pull the tape too tight or it will distort the shape of the cowl. Verify that the contour of the bottom cowl matches that of the fuselage.

Step 6: Trace the lower edge of the top cowl onto the bottom cowl with a fine point permanent marker. See Figure 1.

Step 7: Trim the upper edge of the bottom cowl to the traced line.

Step 8: Use a sanding block to remove small amounts of material where localized interference exists between the aft edge of the bottom cowl and the fuselage. Forcing the bottom cowl into place will distort the shape of both cowls.

Step 9: Secure the bottom cowl to the fuselage with tape. **DO NOT** pull the tape too tight or it will distort the shape of the cowl.

Step 10: Transfer the rivet locations that are along the forward edges of the F-01470-L & -R Fuselage Side Skins to the bottom cowl with a fine point permanent marker. **DO NOT** transfer the lowest rivet location on each side. See Figure 1.

Transfer the rivet locations forward 11/16 [17.5 mm] from the edge of the F-01470-L & -R Fuselage Side Skins.

Step 11: Remove the bottom cowl.

Step 12: Drill #40 the bottom cowl at the transferred rivet locations.

Step 13: Cleco the bottom cowl to the top cowl at the holes on either side of the spinner cutout. Support the bottom cowl with a stepladder, sawhorse, or repulsorlift.

Step 14: Rotate/lift the bottom cowl into position and align it with the top cowl.

Step 15: Secure the entire aft edge of the bottom cowl to the fuselage with tape. **DO NOT** pull the tape too tight or it will distort the shape of the cowl. **DO NOT** cover the predrilled rivet holes.

Step 16: Uninstall the top cowl by reaching through the oil door cut out and pulling the hinge pins (i.e. leave the FF-01408A & C Cowl Attach Piano Hinge halves clecoed to the top cowl). **DO NOT** disturb the position of the bottom cowl.

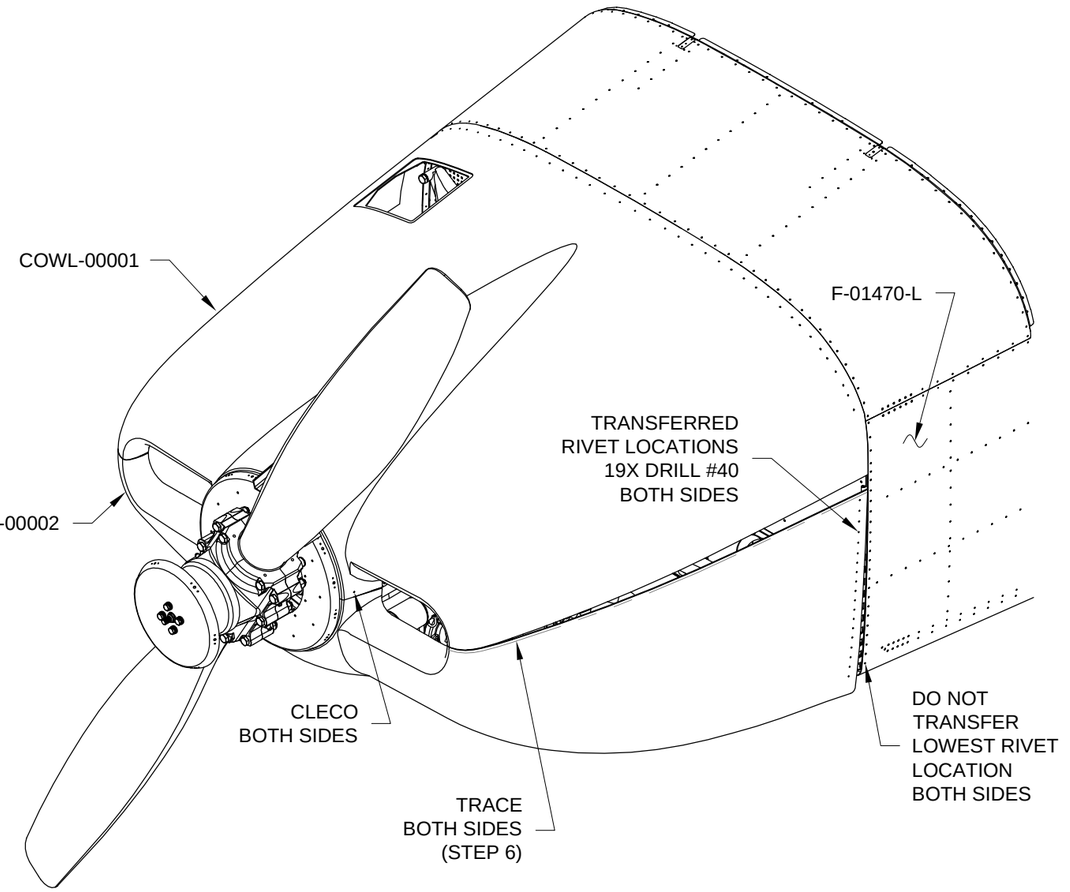


FIGURE 1: PREP BOTTOM COWL

Step 1: Firmly clamp the FF-01408B-L & -R Cowl Attach Piano Hinges to the inside of the COWL-00002 Bottom Cowl. See Figure 1.

NOTE: For all drilling operations on this page, keep the drill bit perpendicular to the surface of the cowl. Cleco each drilled hole before drilling the next.

Step 2: Match-Drill #40 the fourth hole from the bottom in both sides of the bottom cowl into the FF-01408B-L & -R Cowl Attach Piano Hinges. Use a new drill bit.

When match-drilling this hole in each hinge, press the hinge support block against the FF-01408B-L & -R Cowl Attach Piano Hinges to keep the hinges in contact with the inner surface of the bottom cowl.

Step 3: Verify that the bottom cowl remains properly aligned.

Temporarily install the COWL-00001 Top Cowl to check the overall alignment.

If the bottom cowl is misaligned, reposition the bottom cowl and match-drill two new holes.

Step 4: Remove the top cowl.

Step 5: Match-Drill #40 the remaining holes in the sides of the bottom cowl into the FF-01408B-L & -R Cowl Attach Piano Hinges. Match-Drill working upwards from the lowest hole on each side, one hole at a time, while alternating left and right sides.

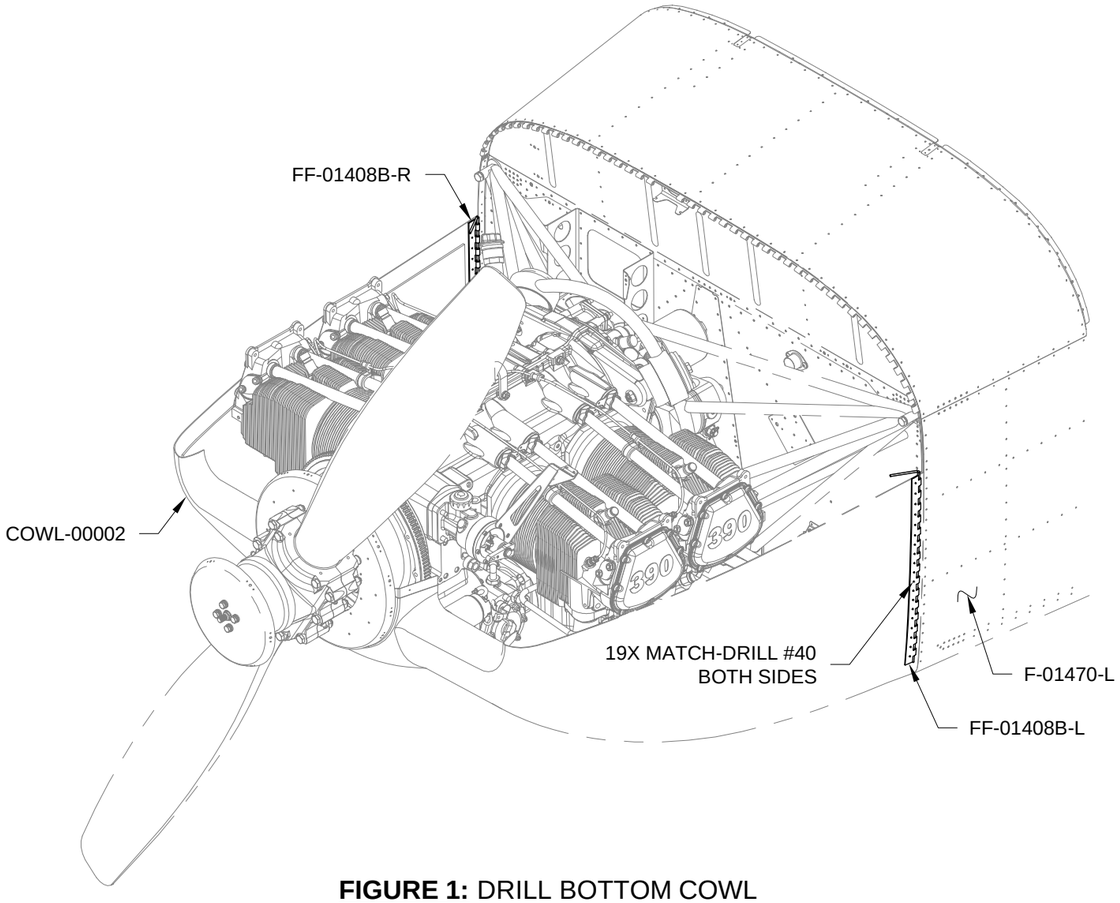


FIGURE 1: DRILL BOTTOM COWL
(TRI-GEAR SHOWN)

Step 1: Firmly clamp the lower halves of the FF-01409-L & -R Cowl Attach Piano Hinges to the inside of the COWL-00002 Bottom Cowl as shown in Figure 1 and Figure 2. The COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT do not need to be installed at this point.

Step 2: Mark the rivet hole locations for the lower FF-01409-L & -R Cowl Attach Piano Hinges on the bottom cowl with a fine point permanent marker as shown in Figure 1.

NOTE: For all drilling operations on this page, keep the drill bit perpendicular to the surface of the cowl. Cleco each drilled hole before drilling the next.

NOTE: Be aware of debris between parts as drilling progresses. Disassemble and clean every few holes or as necessary.

Step 3: Drill #40 the hinge rivet holes into the bottom cowl and lower halves of the FF-01409-L & -R Cowl Attach Piano Hinges. Use a new drill bit.

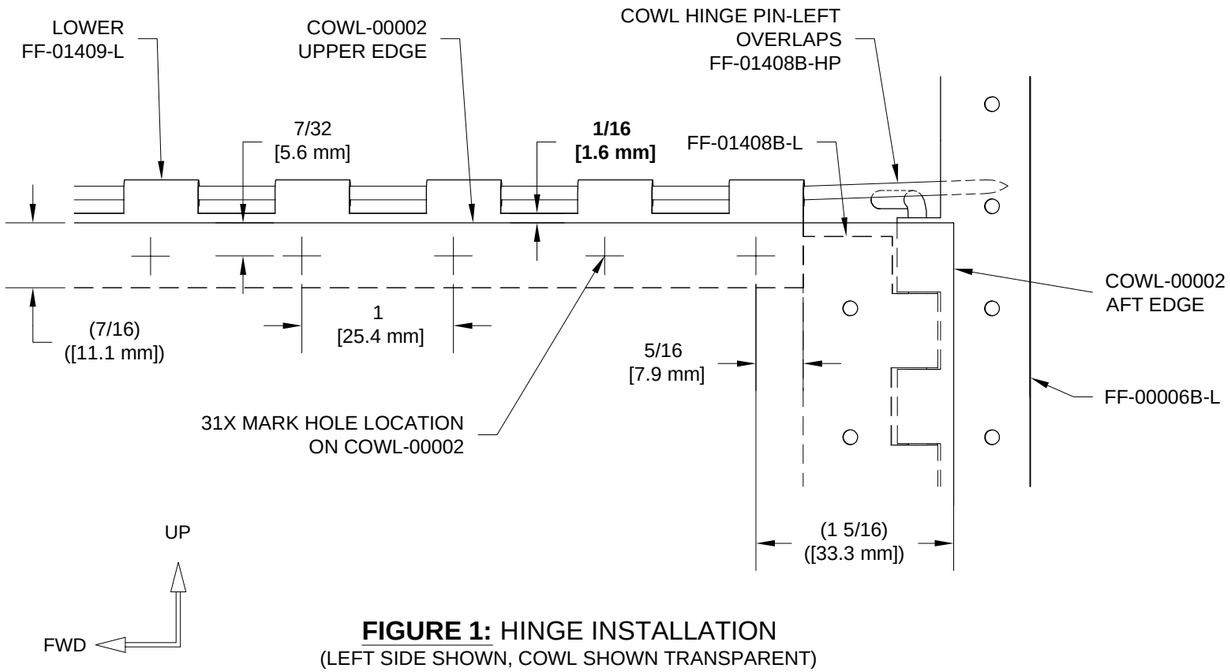


FIGURE 1: HINGE INSTALLATION
(LEFT SIDE SHOWN, COWL SHOWN TRANSPARENT)

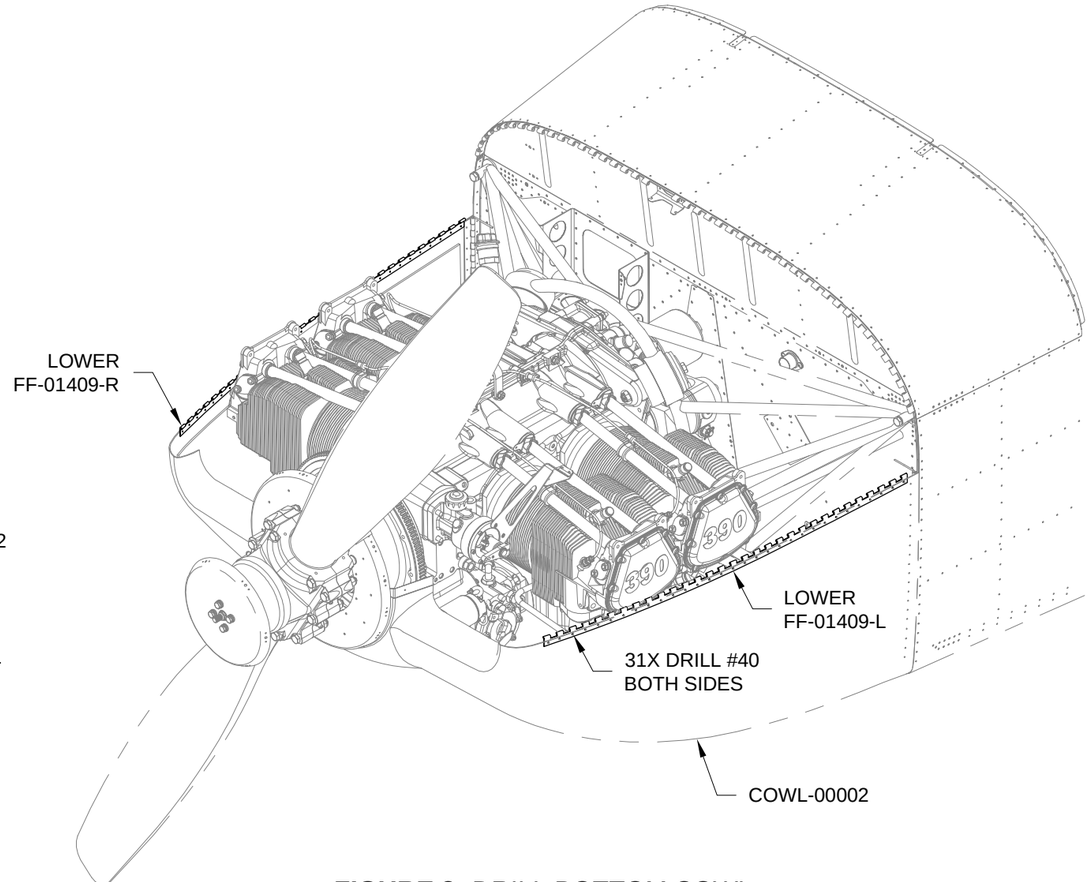


FIGURE 2: DRILL BOTTOM COWL
(TRI-GEAR SHOWN)

Step 1: Coat the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT with a dry lubricant (e.g. Boelube) to ease insertion and removal. Do this periodically throughout the life of the aircraft.

Step 2: Insert the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT into the lower halves of the FF-01409-L & -R Cowl Attach Piano Hinges.

The cowl hinge pins are not identical: note the direction of the tab offset in Figure 1.

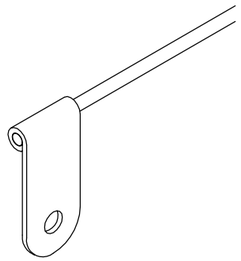


FIGURE 1: COWL HINGE PIN-LEFT

Step 3: Mark the outer surface of the COWL-00002 Bottom Cowl where it intersects with the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT as shown in Figure 2. Use a fine point permanent marker.

Step 4: Bend the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT so that the tabs lay flush on the outer surface of the COWL-00002 Bottom Cowl and the aft edges of tabs touch the marks made in the previous step. See Figure 2.

Step 5: Trace the forward and aft edges of the tabs onto the bottom cowl.

Step 6: Remove the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT from the lower FF-01409-L & -R Cowl Attach Piano Hinges.

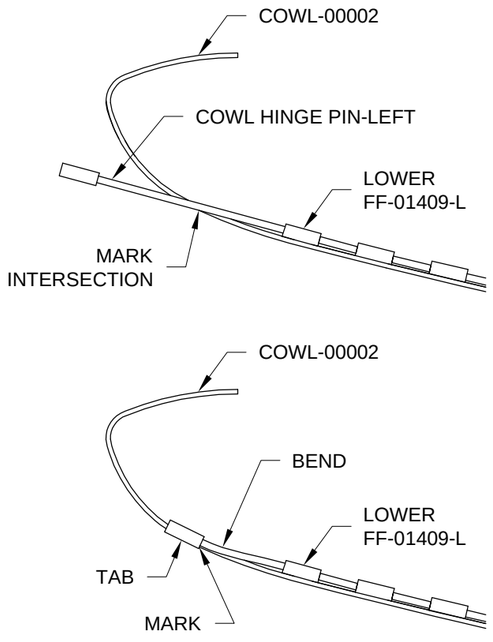


FIGURE 2: BEND HINGE PINS
(TOP VIEW LOOKING DOWN)

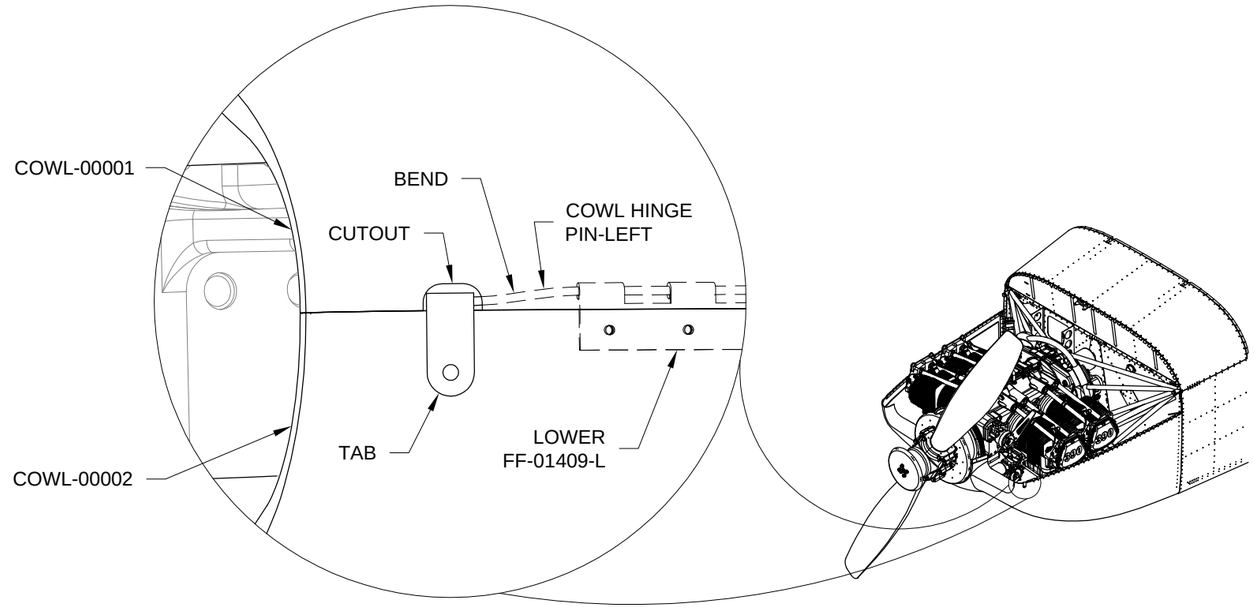
Step 7: Place the COWL-00001 Top Cowl on the aircraft.

Step 8: Transfer the tab edge marks from the bottom cowl to the top cowl with a fine point permanent marker.

Step 9: Remove the top cowl.

Step 10: Create cutouts in the top cowl for the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT tabs as shown in the detail view of Figure 3.

Remove material from the inside aft edge of each cutout to eliminate any interference between the top cowl and the cowl hinge pins. See Figure 4.



(LEFT SIDE SHOWN, VIEW
NORMAL TO TAB SURFACE)

FIGURE 3: COWL HINGE PINS
(TRI-GEAR SHOWN)

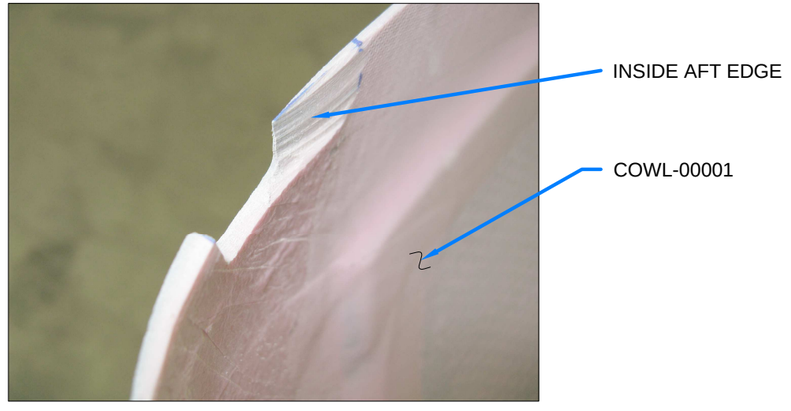


FIGURE 4: TOP COWL TAB CUTOUT
(LEFT SIDE SHOWN, BOTTOM VIEW LOOKING UP)

Step 1: Install the upper halves of the FF-01409-L & -R Cowl Attach Piano Hinges by inserting the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT.

Step 2: Place the COWL-00001 Top Cowl on the aircraft and insert the FF-01408A-HP & C-HP Hinge Pins.

Step 3: Cleco the top cowl to the COWL-00002 Bottom Cowl at the holes on either side of the spinner cutout.

Step 4: Verify that the top cowl and bottom cowl are still properly aligned, pay special attention to the areas just outboard from the air inlets.

Step 5: Transfer the rivet locations from the lower halves of the FF-01409-L & -R Cowl Attach Piano Hinges to the top cowl with a fine point permanent marker. Locate the holes 9/16 [14.3 mm] above the upper edge of the bottom cowl.

Step 6: Remove the top cowl.

Step 7: Drill #40 the marked hinge rivet holes into the top cowl as shown in Figure 1. Keep the drill bit perpendicular to the surface of the top cowl.

Step 8: Place the top cowl on the aircraft and insert the FF-01408A-HP & C-HP Hinge Pins.

Step 9: Cleco the top cowl to the bottom cowl at the holes on either side of the spinner cutout.

Step 10: Verify that the top cowl and bottom cowl are still properly aligned, pay special attention to the areas just outboard from the air inlets.

NOTE: When match-drilling, keep the drill bit perpendicular to the surface of the cowl. Cleco each drilled hole before drilling the next.

NOTE: Be aware of debris between parts as drilling progresses. Disassemble and clean every few holes or as necessary.

Step 11: Match-Drill #40 the hinge rivet holes into the upper halves of the FF-01409-L & -R Cowl Attach Piano Hinges using the top cowl as a guide as shown in Figure 1. Use a new drill bit. Drill the forward most hole on each side first, then move aft one hole at a time while alternating left and right sides.

When match-drilling the forward most holes, reach inside the cowl through the front air inlet and press the hinge support block against the upper half of the hinge to keep the hinge in contact with the inner surface of the top cowl.

When match-drilling the remaining holes, use one hand to pull on the cleco in the lower half of the hinge that is directly below the hole being drilled. This will keep the upper half from pushing inward.

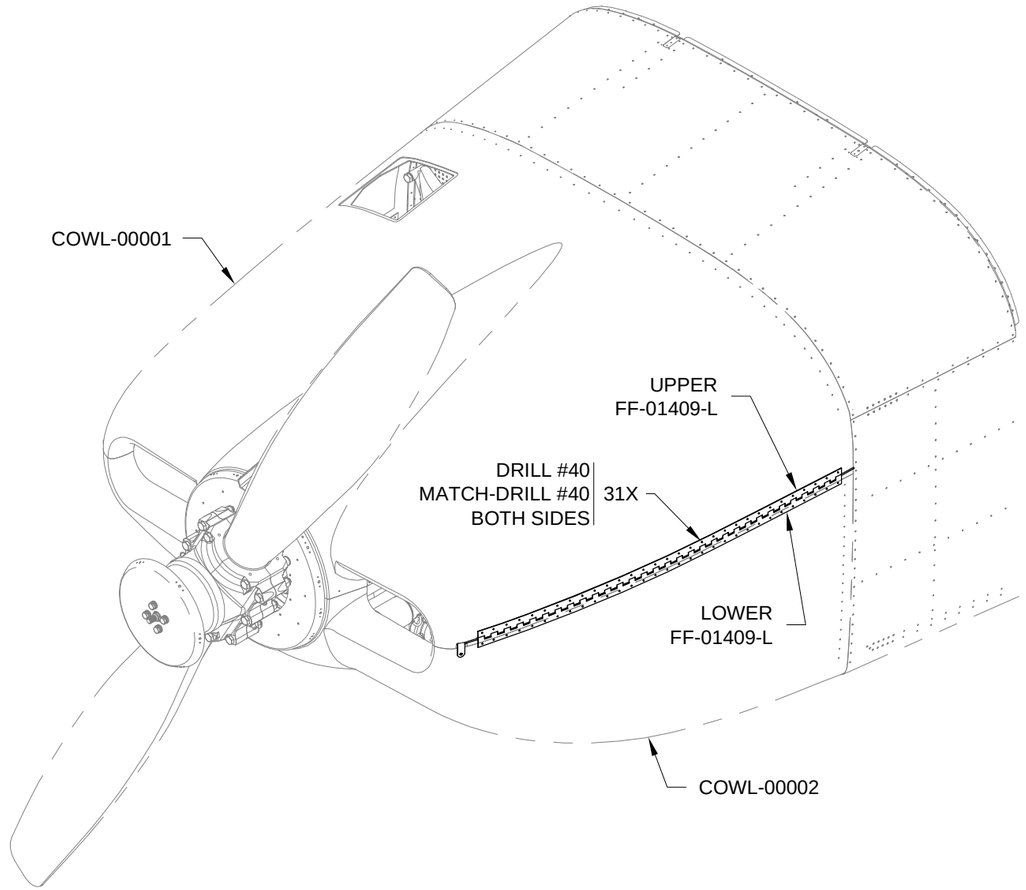


FIGURE 1: DRILL COWL

NOTE: For all drilling operations on this page, keep the drill bit perpendicular to the surface of the cowl.

Step 1: Drill #40 an additional hole through the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl on each side of the spinner cutout as shown in the detail view of Figure 1.

Step 2: Final-Drill #19 the two holes in the top cowl and bottom cowl on each side of the spinner cutout. Drill the forward hole first, insert a #8 screw into the forward hole, drill the aft hole, and then remove the #8 screw.

Step 3: Match-Drill #19 the tab holes in the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT into the bottom cowl. See Figure 1.

Step 4: Uninstall the top cowl and bottom cowl.

Step 5: Label the FF-01408A, B-L & -R, & C and FF-01409-L & -R Cowl Attach Piano Hinges with their part numbers using a fine point permanent marker. See Page 45-01.

Step 6: Uncleco and deburr all of the hinges.

Step 7: Coat the inner surfaces of the top cowl and bottom cowl with a thin layer of epoxy resin. This will make the inside of the cowl impervious to oil and much easier to clean.

Hint: If you're good at washing windows, a plastic bondo spreader can be useful when spreading epoxy resin.

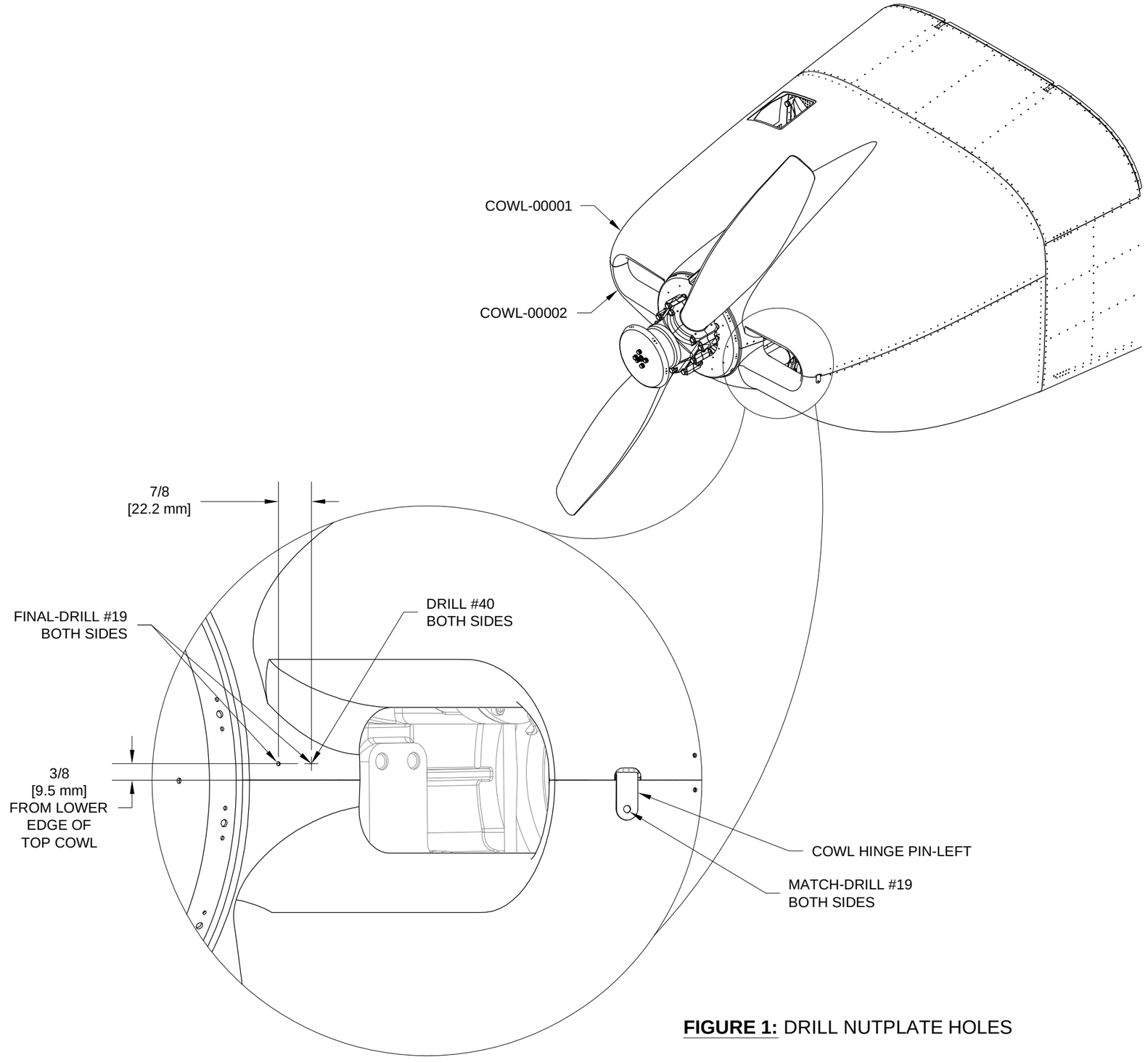


FIGURE 1: DRILL NUTPLATE HOLES

NOTE: When setting solid rivets in fiberglass composites, use soft rivets or do not fully set normal rivets (i.e. make the shop head height approximately 1.2 times the hole diameter).

Step 1: Use #8 screws to temporarily attach nutplates to the inner surface of the COWL-00002 Bottom Cowl flanges on either side of the spinner cutout as shown in Detail A. Tighten the screws finger-tight.

Step 2: Match-Drill #40 the nutplate rivet holes into the flanges of the bottom cowl.

Step 3: Machine countersink the nutplate rivet holes in the bottom cowl as shown in Detail A.

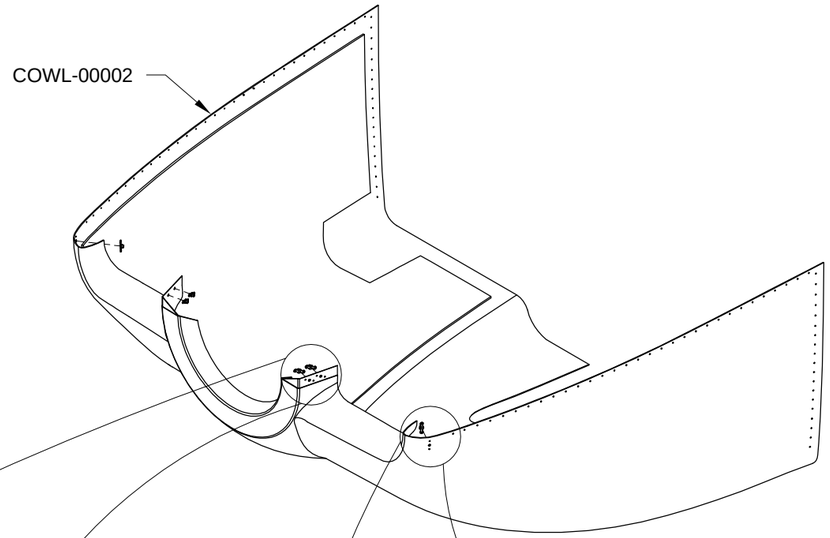
Step 4: Rivet the nutplates to the bottom cowl flange as shown in Detail A.

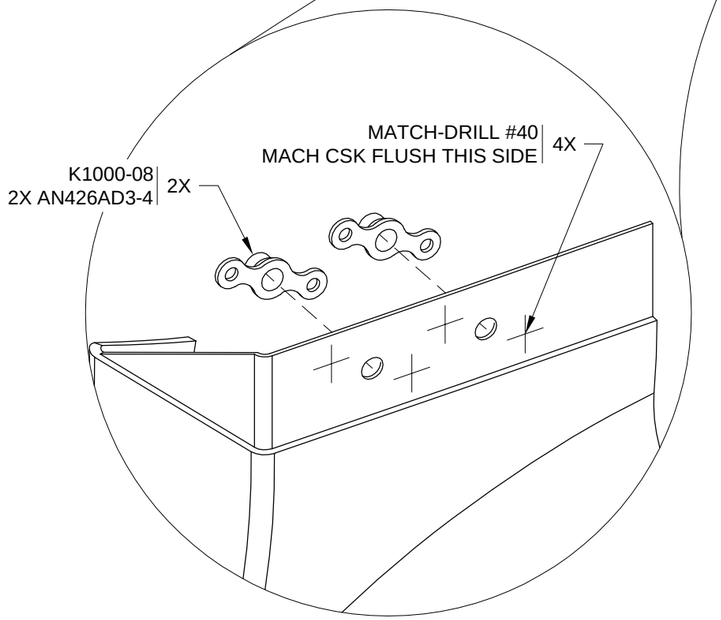
Step 5: Use #8 screws to temporarily attach nutplates to the inner surface of the bottom cowl as shown in Detail B. Tighten the screws finger-tight.

Step 6: Match-Drill #40 the nutplate rivet holes into the bottom cowl. See Detail B.

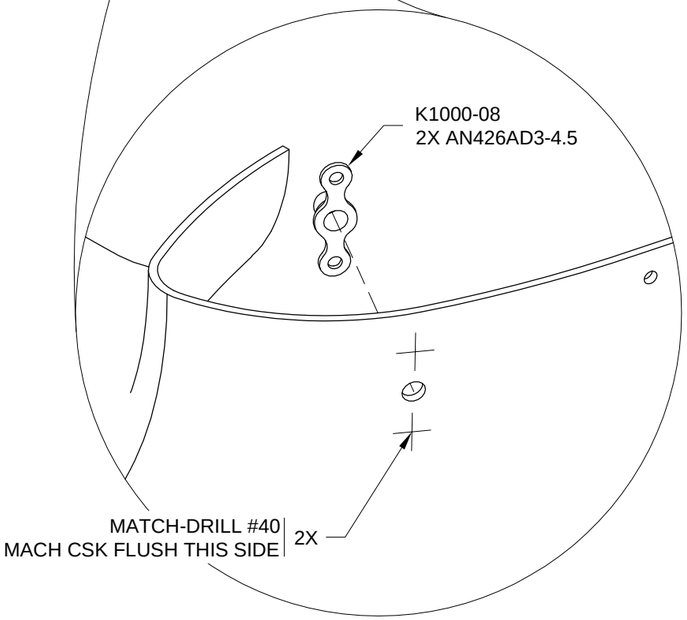
Step 7: Machine countersink the nutplate rivet holes in the bottom cowl as shown in Detail B.

Step 8: Rivet the nutplates to the bottom cowl as shown in Detail B.





DETAIL A



DETAIL B

FIGURE 1: NUTPLATES
(TRI-GEAR SHOWN)

Step 1: Use a #40 drill bit to remove epoxy resin from the hinge rivet holes in the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl as required.

Step 2: Cleco the FF-01408A, B-L & -R, C and FF-01409-L & -R Cowl Attach Piano Hinges to the top cowl and bottom cow. Only cleco every other hole.

Step 3: Machine countersink the hinge rivet holes in the top cowl and bottom cowl that are not clecoed. Leave the hinges clecoed to the cowls during machine countersinking.

NOTE: When setting solid rivets in fiberglass composites, use soft rivets or do not fully set normal rivets (i.e. make the shop head height approximately 1.2 times the hole diameter).

Step 4: Rivet the countersunk holes to join the FF-01408A, B-L & -R, C and FF-01409-L & -R Cowl Attach Piano Hinges to the top cowl and bottom cowl as shown in Figure 1.

Step 5: Remove the clecos.

Step 6: Machine countersink the remaining holes in the top cowl and bottom cowl.

Step 7: Rivet the remaining countersunk holes in the FF-01408A, B-L & -R, C and FF-01409-L & -R Cowl Attach Piano Hinges to the top cowl and bottom cowl as shown in Figure 1.

Step 8: Remove the aluminum angle and washer from the front of the top cowl.

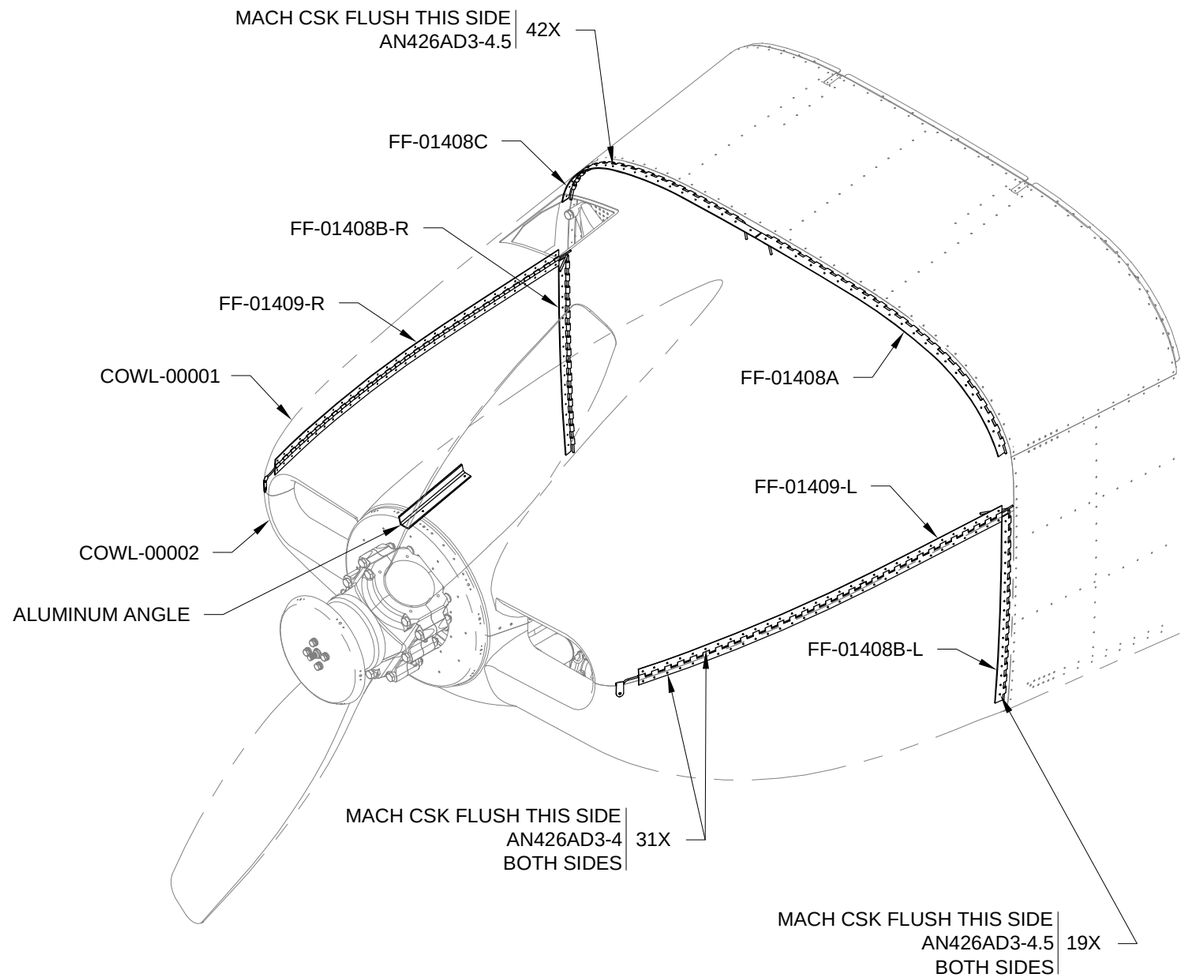


FIGURE 1: RIVET HINGES

NOTE: On this page, except where separate instructions exist for both left and right sides of the aircraft, only the left side parts, assemblies, or installations will be described.

It is the builder's choice as to whether to complete all steps for the left side before repeating those steps for the right side, or to complete each step for both left and right sides before moving to the next step.

Step 1: Trim the COWL-00003-L Inlet Ramp to the edge scribe lines. **DO NOT** trim to the positioning scribe line. See Figure 1.

Step 2: Locate the COWL-00003-L Inlet Ramp on the COWL-00001 Top Cowl as shown in Figure 2. Align the positioning scribe line on the inlet ramp with the aft edge of the left air inlet in the top cowl.

Step 3: The position and thickness of the core material within the top cowl can vary. Remove material from the inlet ramp flange at the forward outboard corner (see Figure 1) as required to achieve a good fit with the top cowl.

Step 4: Remove the inlet ramp from the top cowl.

Step 5: Drill #40 four holes along the aft edge of the inlet ramp as shown in Figure 2. Drill the holes approximately 3/8 [9.5 mm] from the edge.

NOTE: For the following drilling operations on this page, keep the drill bit perpendicular to the surface of the cowl. Cleco each drilled hole before drilling the next.

Step 6: Place the inlet ramp back in position in the top cowl.

Step 7: Match-Drill #40 the four holes in the inlet ramp into the top cowl 1/8 [3.2 mm] deep. **DO NOT** drill all of the way through the top cowl.

Cleco each hole while match-drilling and add a couple of thick washers between each cleco and the inlet ramp to reduce the cleco's pin length.

Step 8: Drill #40 two holes through the air inlet of the top cowl and into the inlet ramp as shown in Figure 2. Locate the holes approximately 3/8 [9.5 mm] from the aft edge of the air inlet.

Step 9: Trace the outline of the inlet ramp onto the top cowl with a fine point permanent marker.

Step 10: If your engine has the propeller governor mounted on the left side, remove the inlet ramp and trim it to the scribe line for the propeller governor. Only the left inlet ramp needs to be trimmed in this manner. See Figure 2.

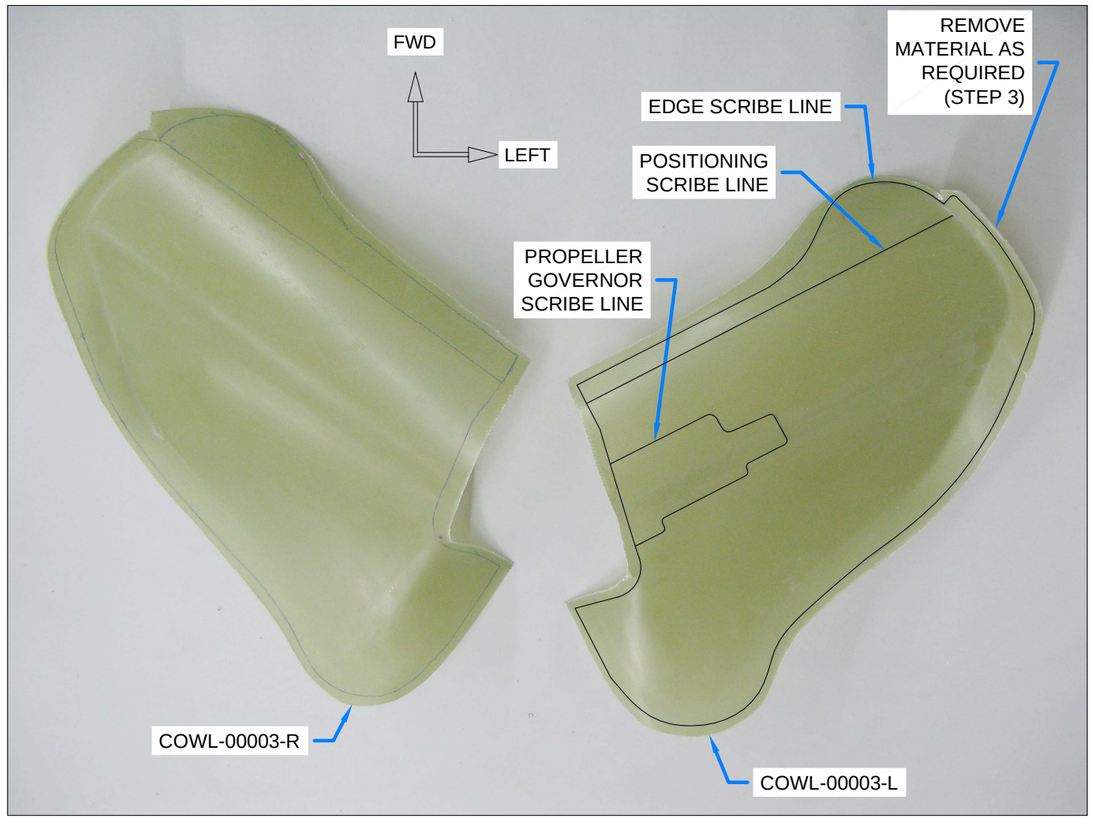


FIGURE 1: TRIM TOP COWL INLET RAMPS

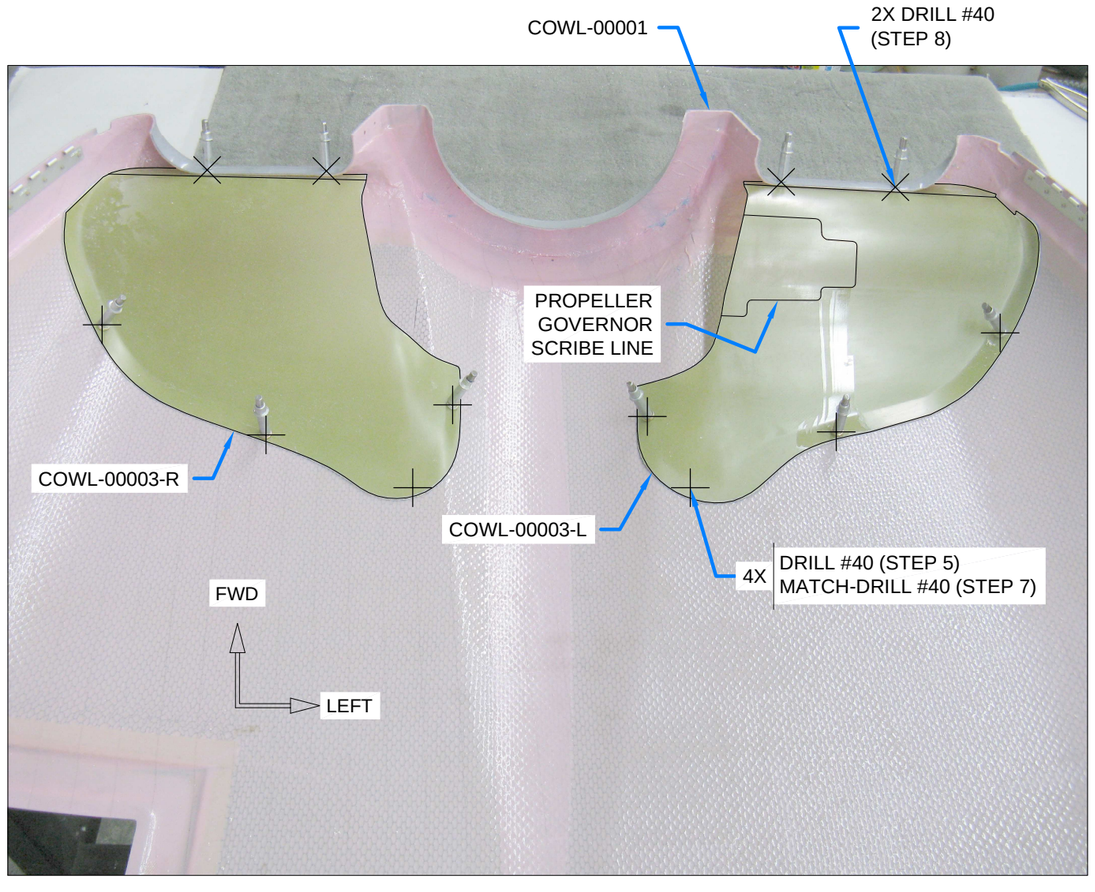


FIGURE 2: DRILL TOP COWL INLET RAMPS

Step 1: Roughen the COWL-00003-L & -R Inlet Ramps and COWL-00001 Top Cowl where they come in contact with each other. Use 80-grit sandpaper. Roughen the inlet ramp contact areas until the glossy surface of the resin is removed.

Step 2: Install the COWL-00002 Bottom Cowl on the aircraft by inserting the hinge pins.

Step 3: Mix cotton flox with epoxy resin. Gradually add flox until the mixture does not move when the container is turned on its side.

Step 4: Bond the roughened areas of the COWL-00003-L & -R Inlet Ramps to the top cowl with a layer of epoxy/flox mixture approximately 1/32 [0.8 mm] thick.

Cleco the inlet ramps to the top cowl. Apply a release agent (e.g. automotive wax) to each cleco to prevent the epoxy/flox mixture from bonding to the cleco.

Remove any excess epoxy/flox mixture from around the perimeter of the inlet ramps.

Install the top cowl on the aircraft by inserting all of the hinge pins. Leave the clecos and top cowl in place until the epoxy/flox mixture has fully cured.

Step 5: Remove the top cowl.

Step 6: Sand the perimeter of the inlet ramps to remove any excess epoxy/flox.

Step 7: Roughen the inlet ramps and top cowl with 80-grit sandpaper in the areas indicated in Figure 1.

Step 8: To provide a continuous surface for the cowl baffle to seal against, blend the edges of the inlet ramps into the inside surface of the top cowl with body filler or with epoxy and micro balloons in the areas indicated in Figure 1.

Sand and blend the areas until there is a smooth, gradual transition between the inlet ramps and top cowl.

Step 9: Fill the inlet ramp cleco holes with body filler or with epoxy and micro balloons and then sand them smooth.

Step 10: Blend the aft edges of the top cowl air inlets into the inlet ramps with body filler or with epoxy and micro balloons in the areas indicated in Figure 1.

Sand and blend the areas until there is a smooth, gradual transition between the air inlets and the inlet ramps.

Step 11: Fill the air inlet cleco holes with body filler or with epoxy and micro balloons and then sand them smooth.

Step 12: Seal the blended/sanded areas with a brush coat of epoxy resin.

Step 13: Fill and sand smooth the two holes in the top cowl that were drilled for the aluminum angle on Page 45-08.

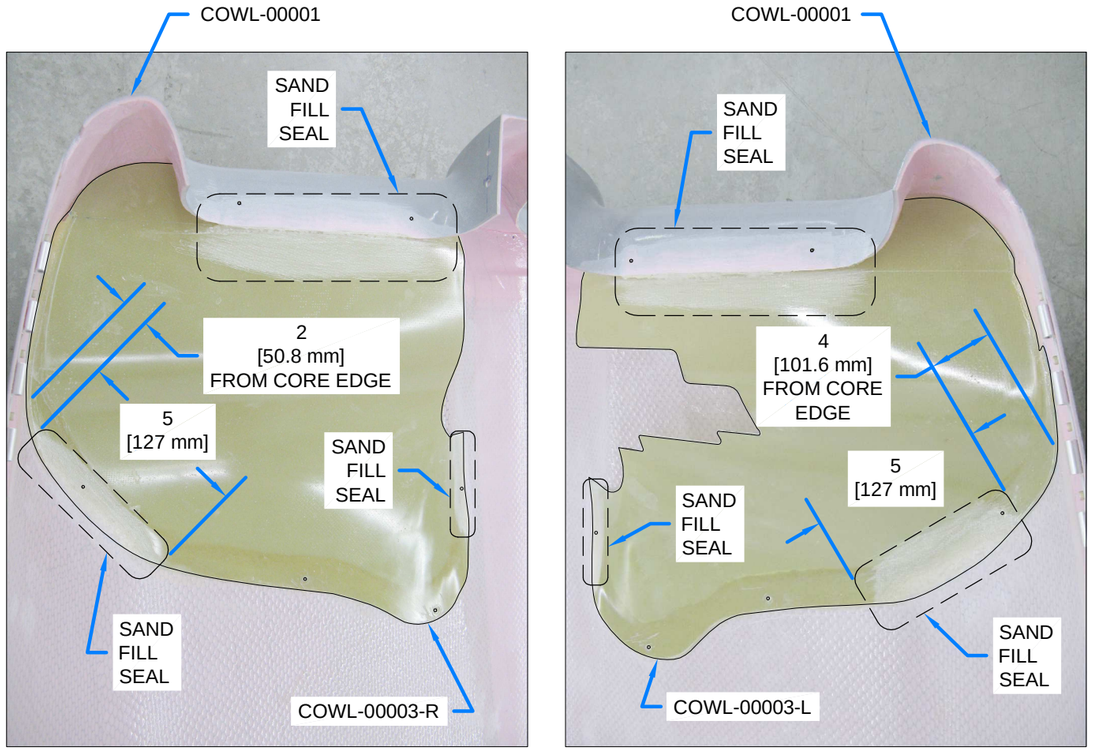
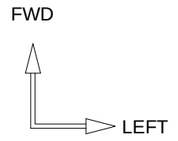


FIGURE 1: INSTALL INLET RAMPS
(SHOWN WITH CUTOUT FOR PROPELLER GOVERNOR)



NOTE: The RTV sealant applied in the following steps will prevent chafing between the hinge pin and the aircraft structure.

Step 1: (Tri-Gear) Locate the areas where the FF-01408B-HP Hinge Pins contact the firewall.

Apply RTV sealant to each area. See Detail A.

Step 2: (Tail Dragger) Locate the areas where the FF-01408B-HP Hinge Pins contact the engine mount.

Apply RTV sealant to each area. See Detail B.

NOTE: For all drilling operations on this page, keep the drill bit perpendicular to the surface of the cowl.

Step 3: Locate the F-14133/F-14133-1 Cowl Attach Plate drill template that was supplied with the Finish Kit.

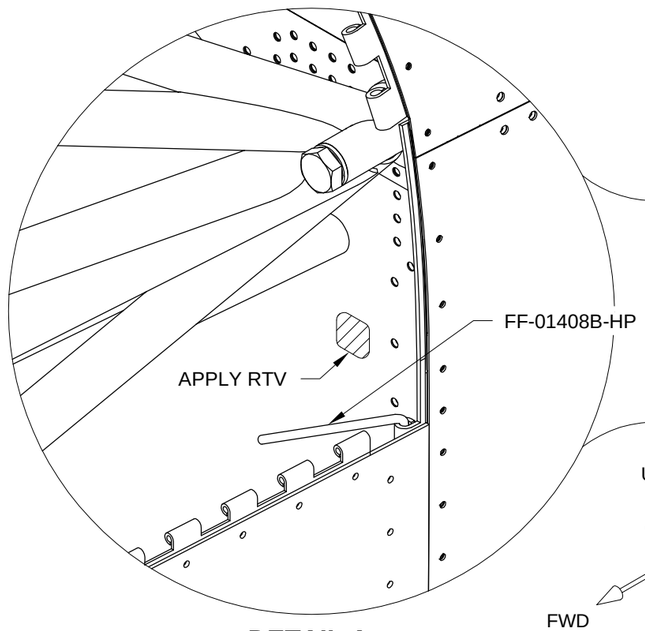
Step 4: Align the rivet holes in the drill template with the rivets in the F-01483-L & -R Forward Bottom Skins as shown in Details C and D. Use the dimples in the rivet heads to center the holes.

Step 5: Secure the drill template to the bottom cowl with tape.

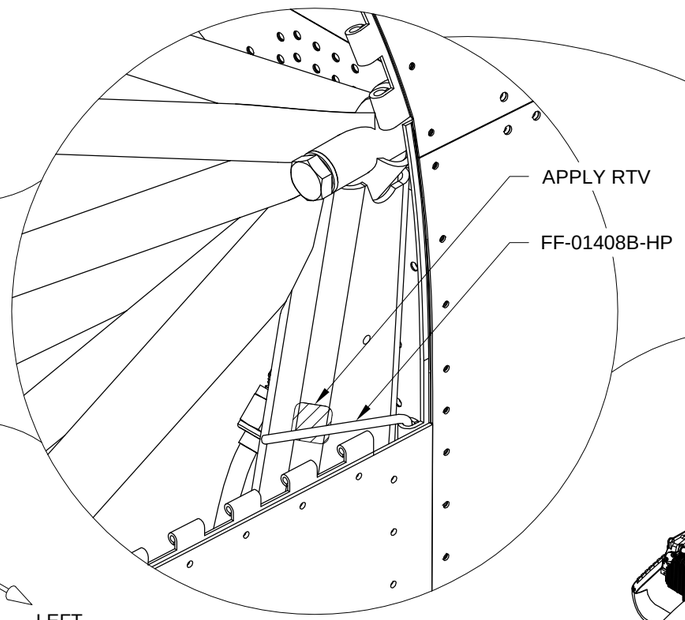
Step 6: Match-Drill #19 the three nutplate screw holes into the COWL-00002 Bottom Cowl using the drill template as a guide. See Details C and D.

Only match-drill the bottom cowl: match-drilling too deep can damage the nutplates.

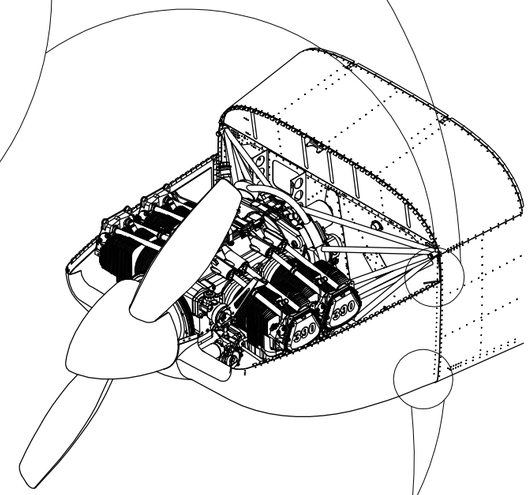
Step 7: Repeat Steps 4-6 for the right side of the bottom cowl.

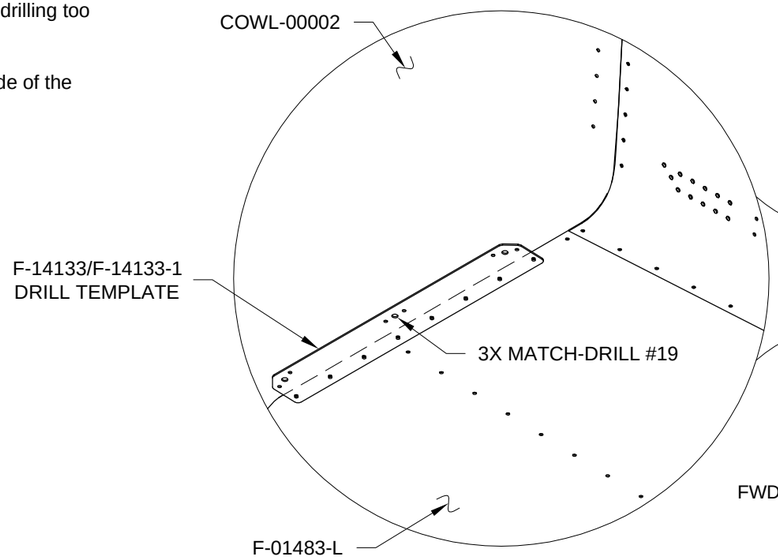


DETAIL A
(TRI-GEAR)

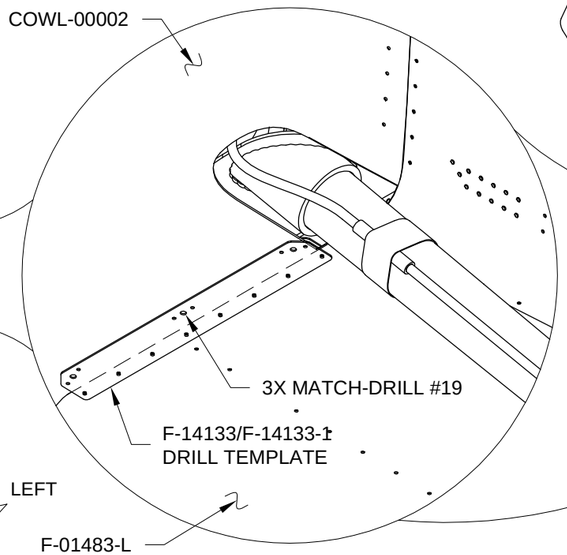


DETAIL B
(TAIL DRAGGER)





DETAIL C
(TRI-GEAR)



DETAIL D
(TAIL DRAGGER)

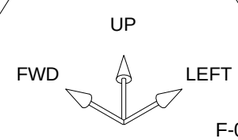


FIGURE 1: RTV AND DRILL

Step 1: Separate the COWL-00004 Oil Door and COWL-00005 Oil Door Hinge as shown in Figure 1 and Figure 2.

Deburr the parts.

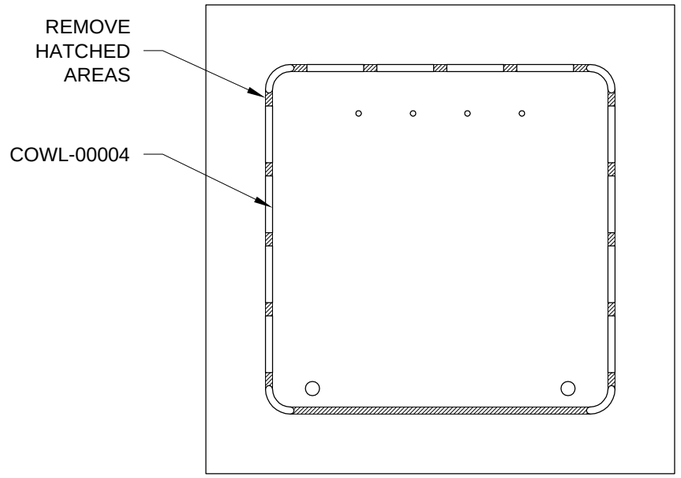


FIGURE 1: SEPARATE THE OIL DOOR

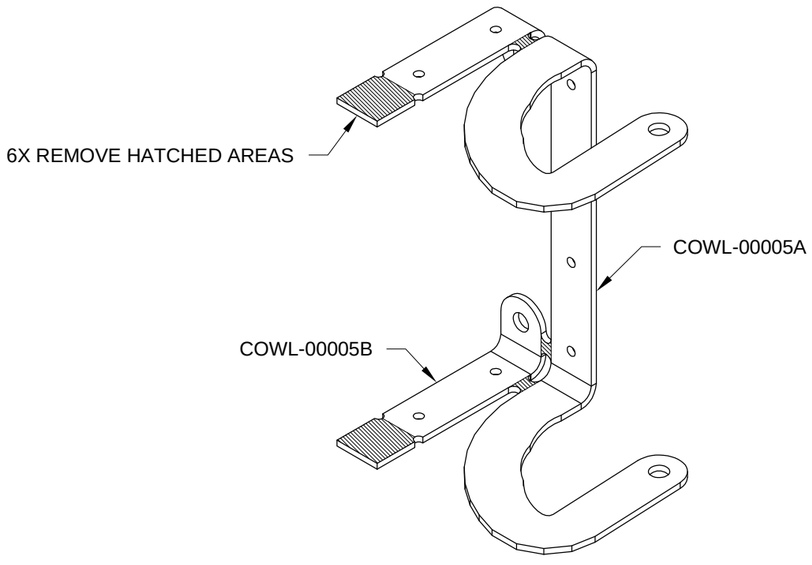


FIGURE 2: SEPARATE THE OIL DOOR HINGE

Step 2: Position the oil door at the opening in the COWL-00001 Top Cowl such that a uniform gap exists around the perimeter of the oil door. See Figure 3.

Step 3: Adjust the curvature of the oil door to match the curvature of the top cowl.

Hint: Make a simple bend fixture to adjust the curvature of the oil door. Fabricate two spacers that are at least .063 [1.6 mm] thick. Align the spacers along the edge of a work table and place them apart the width of the oil door. Over the spacers, clamp an aluminum angle (i.e. AA6-063X3X3/4X3/4) that is approximately 8 1/ 2 [215.9 mm] long. Slide the oil door into the gap between the work table and the angle. Apply pressure to the oil door to induce a bend at the edge of the table.

Step 4: Machine countersink the rivet holes in the COWL-00004 Oil Door as called out in Figure 3.

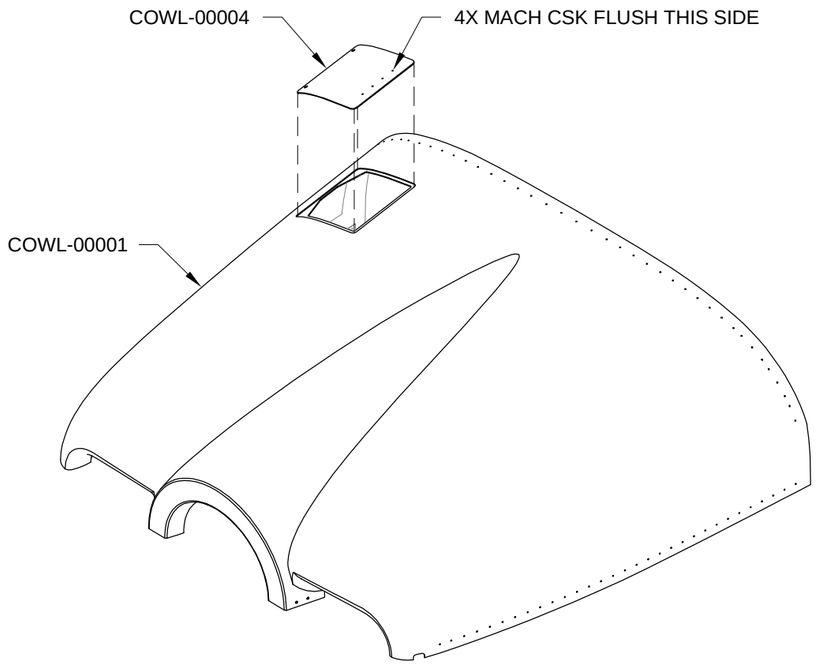


FIGURE 3: POSITION OIL DOOR

Step 1: Place the COWL-00004 Oil Door over the opening in the COWL-00001 Top Cowl. Adjust the position of the oil door until a uniform gap exists around its perimeter. Fix the oil door in place by securely taping it to the top cowl. See Figure 1.

Step 2: Use a step drill to match-drill 1/4 the two camloc holes into the top cowl using the oil door as a guide. See Figure 1.

Step 3: Remove the oil door from the top cowl.

Step 4: Insert a camloc fastener into each camloc hole in the top cowl. Place one or more washers between the camloc fasteners and the top cowl to create a tighter grip. **DO NOT** install the camloc retaining washers at this time. Compress the camloc fasteners in order to insert them. See Figure 2.

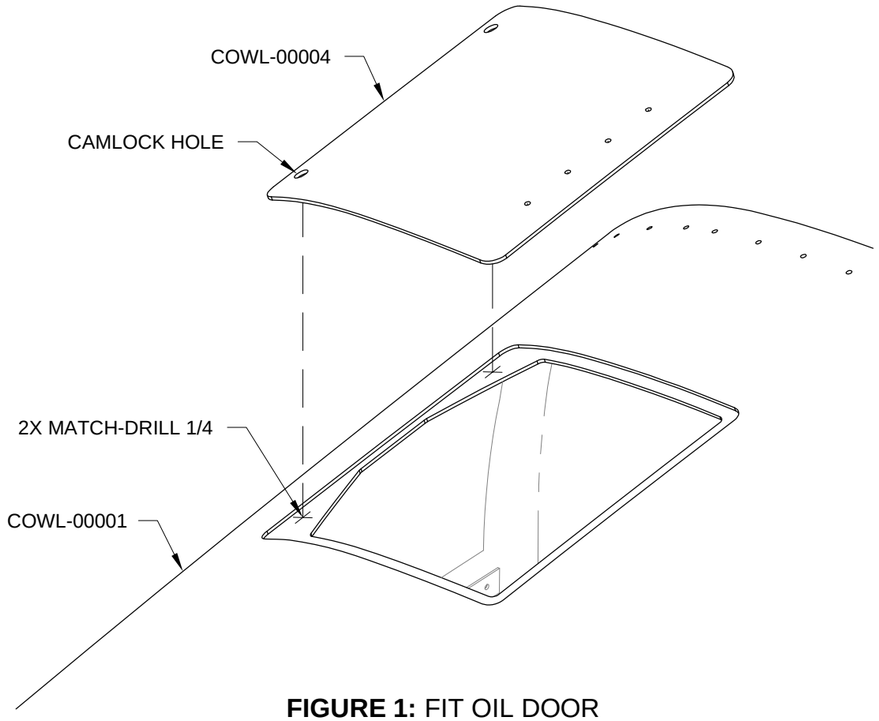


FIGURE 1: FIT OIL DOOR

Step 5: Secure the camloc receptacles to the top cowl using the camloc fasteners.

Step 6: Rotate the camloc fasteners until the wings of the camloc fasteners are parallel to the edge of the oil door recess.

Step 7: Match-Drill #40 the camloc receptacle attach holes into the top cowl.

To maintain the alignment of each receptacle, insert a rivet into the first hole before match-drilling the second hole.

Step 8: Remove the camloc fasteners and receptacles from the top cowl.

Step 9: Machine countersink the camloc receptacle rivet holes in the top cowl as shown in Figure 2.

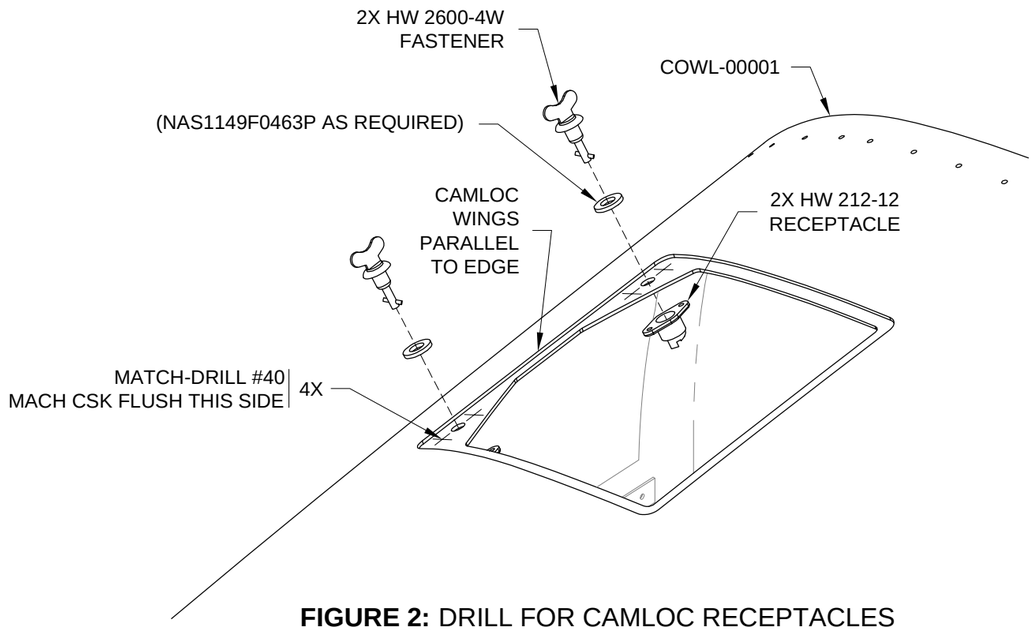


FIGURE 2: DRILL FOR CAMLOC RECEPTACLES

Step 1: Mark cross hairs across the 1/4 camloc holes in the COWL-00001 Top Cowl with a fine point permanent marker as shown in Figure 1.

Step 2: Use a step drill to enlarge the 1/4 camloc holes in the top cowl to 1/2. **DO NOT** enlarge the holes in the COWL-00004 Oil Door. Prevent the step drill from wandering: keep it centered on the cross hairs marked in the previous step.

Step 3: Rivet the camloc receptacles to the top cowl as shown in Figure 1.

Step 4: Attach the camloc fasteners to the COWL-00004 Oil Door. The camloc retaining washers can be squeezed in-place using a deep 11/32 socket and a pair of large channel lock pliers. See Figure 1.

If the cowl will be painted, delay installation of the camloc retaining washers until after the cowl has been painted.

Step 5: Attach the COWL-00005B Oil Door Hinge lugs to the COWL-00005A Oil Door Hinge gooseneck with the hardware shown in Figure 2. **DO NOT** insert the cotter pins at this time.

Step 6: Cleco the COWL-00005A Oil Door Hinge gooseneck to the oil door.

Step 7: Attach the oil door to the top cowl using the camloc fasteners.

Step 8: Rotate the COWL-00005B Oil Door Hinge lugs until they lie flush with the inner surface of the top cowl. See Figure 1.

Step 9: If required, fabricate and insert a 3 3/8 [85.7 mm] by 1/2 [12.7 mm] match-drilled aluminum spacer between the COWL-00005A Oil Door Hinge gooseneck and the COWL-00004 Oil Door as shown in Figure 1. Adjust the thickness of the spacer until the COWL-00005B Oil Door Hinge lugs lie flush with the inner surface of the top cowl.

Step 10: Match-Drill #40 the holes in the COWL-00005B Oil Door Hinge lugs into the top cowl. Cleco each hole as it is drilled.

Step 11: Remove the clecos and machine countersink the holes in the top cowl.

Step 12: Remove the hardware from the oil door hinge gooseneck and lugs.

Step 13: Cleco, then rivet the COWL-00005B Oil Door Hinge lugs to the top cowl as shown in Figure 1.

Step 14: Rivet the COWL-00005A Oil Door Hinge gooseneck (and spacer) to the oil door as shown in Figure 1.

Step 15: Trim BUSHING TFI-0304-04 to 3/16" as shown in Figure 2.

Step 16: Attach the COWL-00005A Oil Door Hinge gooseneck to the COWL-00005B Oil Door Hinge lugs with the hardware shown in Figure 3.

Tighten the oil door hardware until the oil door will stay open on its own. Install the cotter pins.

Step 17: Verify that there is no interference with the top cowl when opening and closing the oil door.

If interference exists, trim or bevel the outside edge of the oil door to provide a minimum clearance of 1/32 [0.8 mm] all the way around and/or sand small gooseneck reliefs in the top cowl oil door recess.

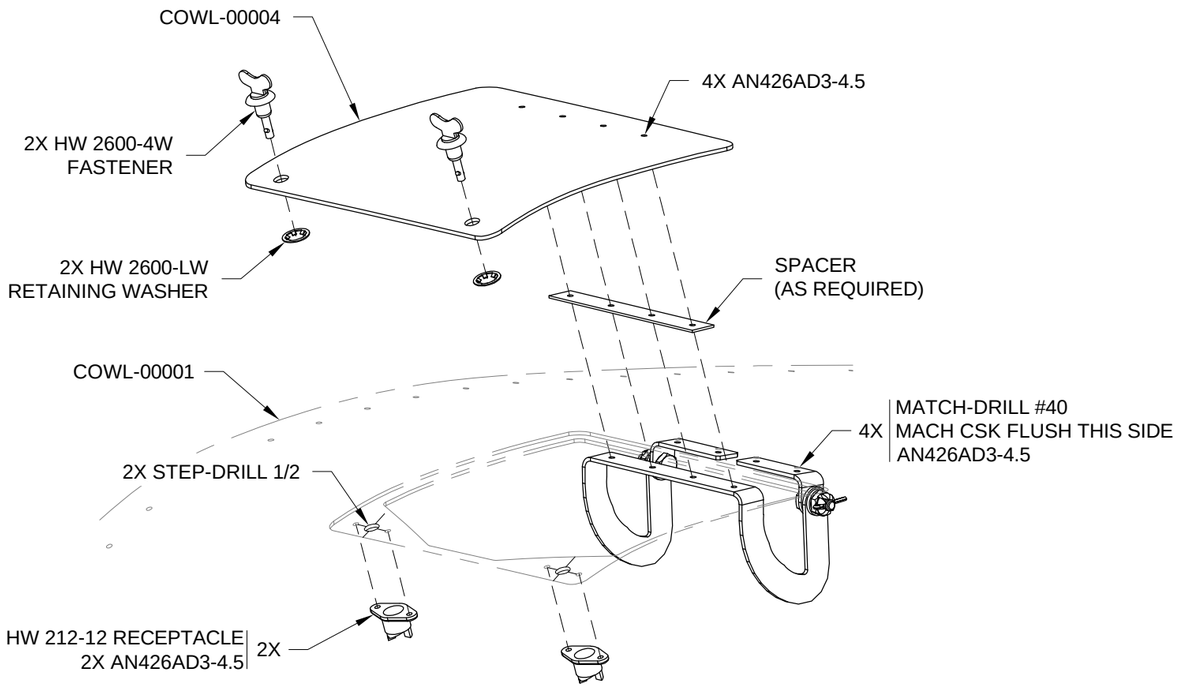


FIGURE 1: OIL DOOR HINGE
(COWL-00001 SHOWN TRANSPARENT)

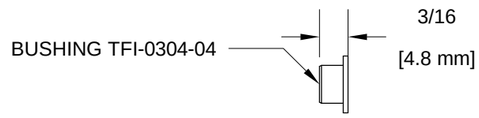


FIGURE 2: BUSHING LENGTH

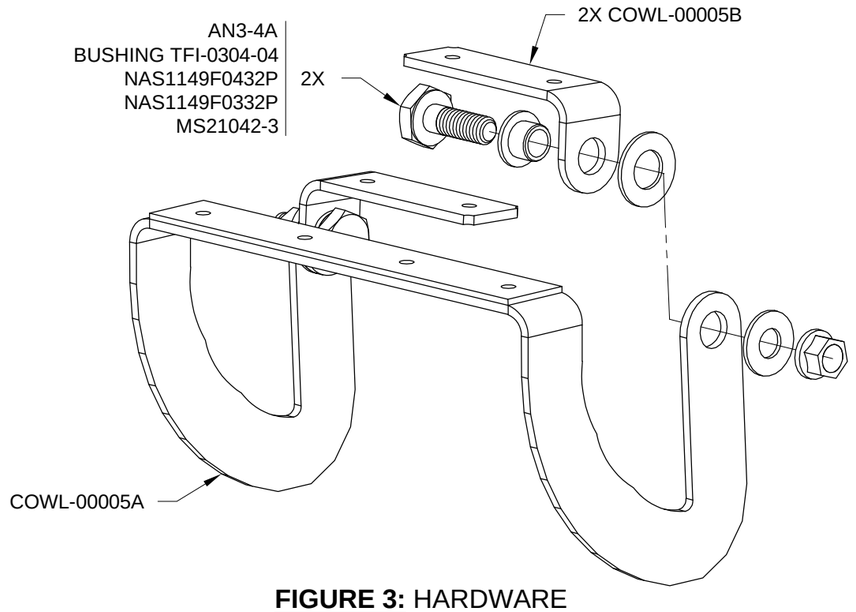


FIGURE 3: HARDWARE

NOTE: In the following steps, the COWL-00001 Top Cowl and COWL-00002 Bottom Cowl will be trimmed to create a uniform gap that will allow for the accumulation of primer/paint. A uniform (equal) gap between components is more aesthetically pleasing than a wavy or angled gap.

Step 1: With both cowl halves installed on the fuselage, mark a line on each side of the top cowl .050 [1.3 mm] above the upper edge of the bottom cowl with a fine point permanent marker. See Figure 1.

Mark a line on the top cowl .050 [1.3 mm] forward from the edges of the F-01471 Forward Top Skin and F-01470-L & -R Fuselage Side Skins.

Step 2: Mark a line on the bottom cowl .050 [1.3 mm] forward from the edges of the F-01470-L & -R Fuselage Side Skins and F-01483-L & -R Forward Bottom Skins. See Figure 1.

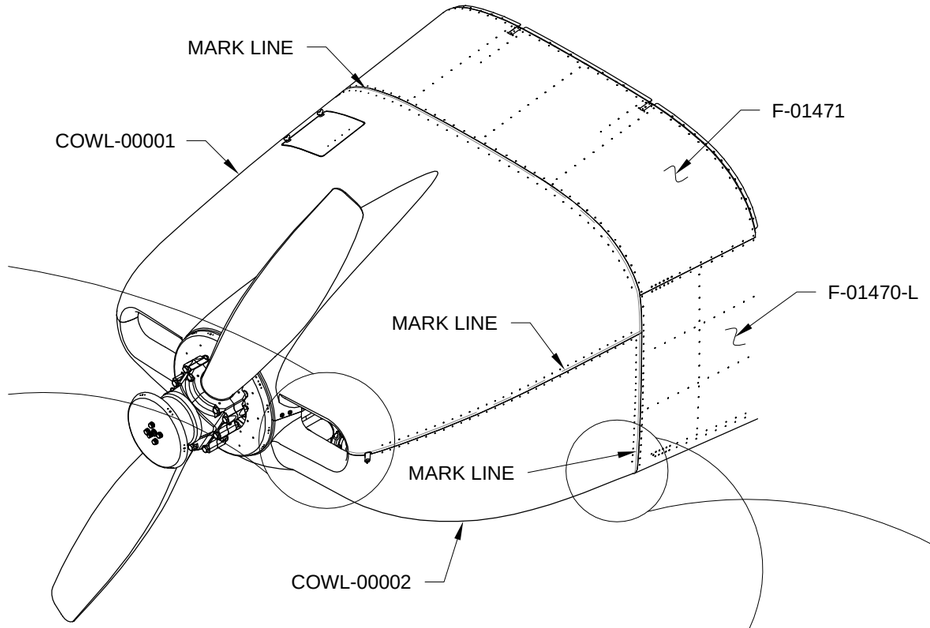
Step 3: Sand the edges of the top and bottom cowls to the lines marked in Steps 1 and 2.

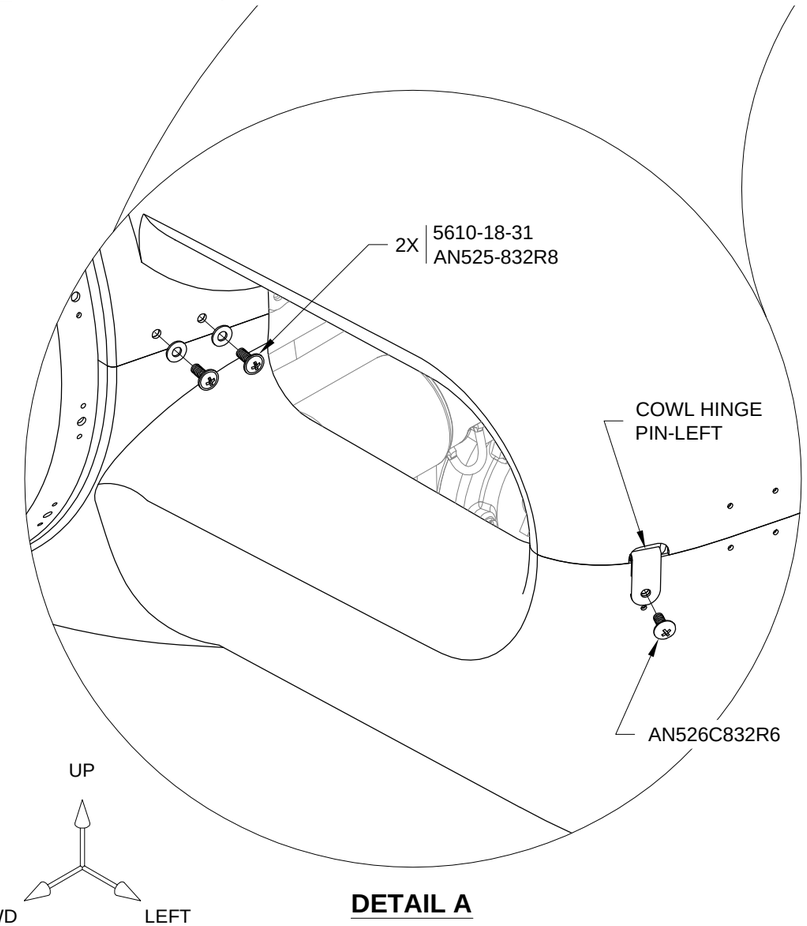
Step 4: Secure the top cowl to the bottom cowl on each side of the spinner cutout using the hardware shown in Detail A.

Step 5: Attach the COWL HINGE PIN-LEFT and COWL HINGE PIN-RIGHT to the bottom cowl using the hardware shown in Detail A.

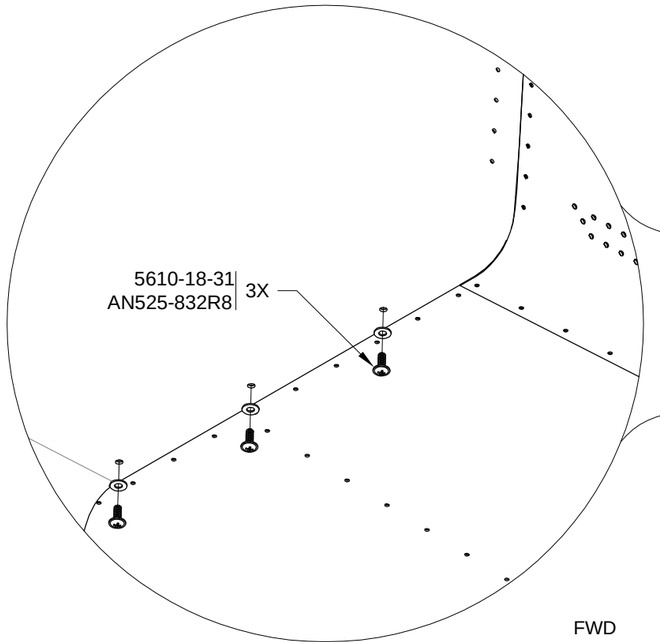
Step 6: Secure the bottom cowl to the lower fuselage using the hardware shown in Detail B or Detail C.

Step 7: Reinstall the S-601-1 Spinner.

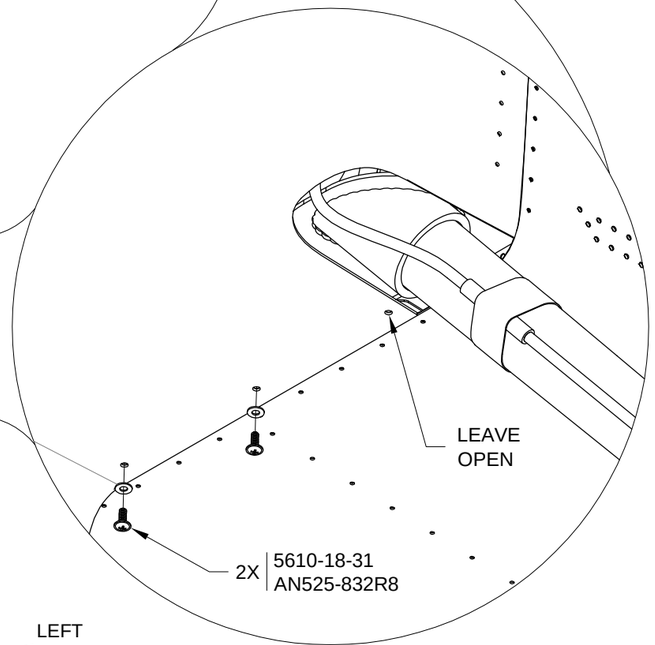




DETAIL A



DETAIL B
(TRI-GEAR)



DETAIL C
(TAIL DRAGGER)

FIGURE 1: SECURE COWL

Step 1: Cut two 12 [304.8 mm] lengths of EA EXHST/COWL SHIELD. Heat shield is supplied 30 [762.0 mm] wide.

Step 2: Apply the 12 [304.8 mm] lengths of shield to the left and right sides of the COWL-00002 Bottom Cowl as shown in Figure 1. Dimensions shown are from the aft edges of the cowl to the corners of the shield.

Align the edge of each shield with the upper outboard edge of the bottom cowl and work the shield slowly inboard and downward.

Remove the adhesive backing as you go (not all at once). The shield will conform to the shape of the bottom cowl and will naturally angle aft.

When large wrinkles form, cut the shield to half the width along the wrinkle such that the shield overlaps onto itself.

Step 3: Trim the shields to where the cowl honeycomb core ends as shown in Figure 1.

Step 4: Cut one 24 [609.6 mm] length of EA EXHST/COWL SHIELD. Heat shield is supplied 30 [762.0 mm] wide.

Step 5: Apply the 24 [609.6 mm] length of EA EXHST/COWL SHIELD to the center of the bottom cowl as shown in Figure 1. Use the technique described above.

Step 6: Trim the center shield as shown in Figure 1.

Step 7: Rub all of the shields with a stiff plastic squeegee or hard roller to work the inevitable wrinkles and bubbles to an edge. Stubborn bubbles can be popped with a needle.

Step 8: Apply a thin layer of epoxy resin to the shield edges, even where the shields overlap. The epoxy should cover approximately 1/4 [6.4 mm] on either side of the edges.

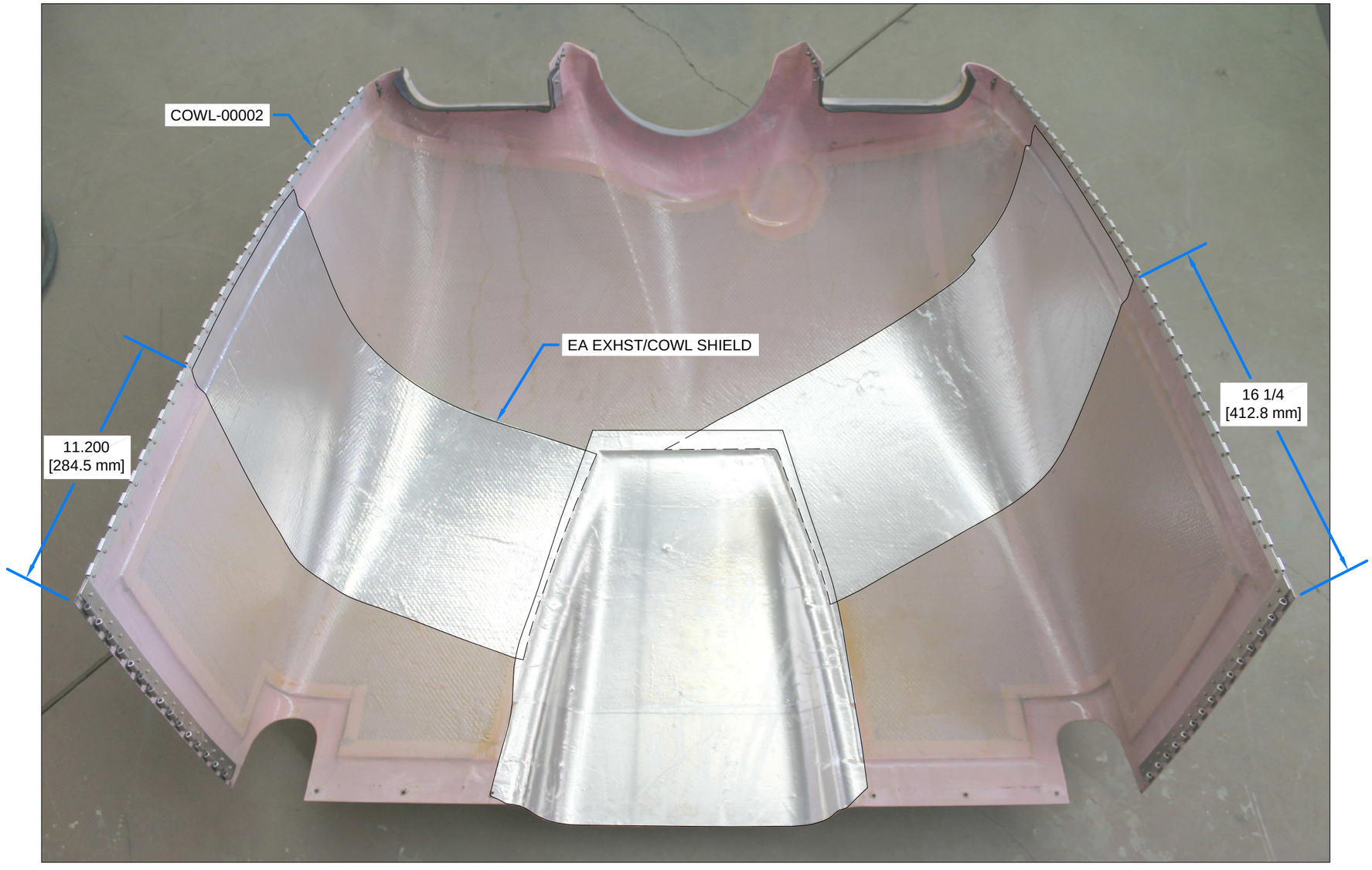


FIGURE 1: BOTTOM COWL HEAT SHIELD
(TAIL DRAGGER SHOWN)