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141 WING

Refer to section 5 of parts and figure drawings.

WING SPAR ASSEMBLY

1. Clean and debur all 4 wing spars. A grease cutting detergent is recommended.
2. Cleco the FWD and AFT Spar Attach doublers and the FWD and AFT Truss doublers in place.
   a. The two FWD attach doublers go on the inside of the Forward Wing Spar at the wing root.
   b. The FWD Spar Truss Doubler goes on the back side of the Forward Wing Spar.
   c. The AFT Spar Attach doubler is on the backside of the Rear Spar at the wing root.
   d. The AFT Spar Truss doubler is on the forward side of the Rear Spar.
   e. On the FWD Spar FWD Doubler, the notch in the doubler points toward the top of the wing and the doubler contours to the inside of the Forward Wing Spar.
3. If FWD Spar FWD Attach Doubler does not quite set flat on the inside of the Forward Wing Spar, radius the bottom corner until it sets flat.
4. Rivet the doublers in place using the appropriate rivets excluding holes shown in **FIGURE 05-04/141**.
5. Use a 5/16" drill to transfer drill through the FWD Spar Truss Doubler and the Forward Wing Spar where the truss bolts to the spar.

AILERON BELLCRANK ASSEMBLY

1) Press the bearing into the Aileron Bellcrank Pulley. Use the snap ring to hold the bearings in place.
2) Use a 5/8" drill to drill the bellcrank mount tube in which the spindle slides into.
3) Slide the aileron bellcrank spindle through the side of the bellcrank closest to the snap ring. Slide this assembly into the taller tube on the aileron bellcrank mount.
4) Use the appropriate hardware along with Loctite Blue and safety wire to secure the bellcrank assembly.

FLAP BELLCRANK ASSEMBLY

NOTE: The Flap Bellcrank have a left/right orientation.

1) Press the bearing into the Flap Bellcrank. Use the snap ring to hold the bearing in place.

2) Use a 5/8" drill to drill the bellcrank mount tube in which the spindle slides into.

3) See **FIGURE 05A-07/141** for flap bellcrank mount and flap bellcrank orientation. Notice the snap ring is up, the long arm of the bellcrank and bellcrank mount point in the same direction and the short arm of the bellcrank points opposite of the rear spar.

4) Slide the bolt in place from the bottom side of the bellcrank mount. Slide the Flap Bellcrank Spindle over the bolt sticking up and through the bellcrank and mount similarly to the aileron assembly. Place the Aileron Cable Guide and Cover on the top of the flap bellcrank as shown in **FIGURE 05A-07/141**.

NOTE: There is a Left and Right hand Aileron Cable Guide.

5) Do not tighten the bolt until assembled in the wing and the aileron cables are run through the aileron cable guide.

WING RIB / SPAR ASSEMBLY

1. Lay the Forward Wing Spar Assembly on a table with the flange up. Locate the wing truss, lexan wing truss shim, and applicable hardware.
2. Run a 1/4" and a 5/16" drill through the holes in the wing truss where the truss bolts to the front and rear spars to remove the powder coat and allow the bolts to slide freely.
3. Bolt the strut truss fittings to the wing truss. Refer to Lift Strut Assembly for parts listing. The 4 holes are undersized and must be drilled to 1/4".
    a. Drill one of the holes in each fitting to 1/4".
    b. Place one fitting in position on the truss with a bolt through the 1/4" hole and the larger hole that mates with the strut pointing away from the truss.
    c. Carefully line up and drill the opposite hole through the fitting and the truss. Put another bolt in the freshly drilled hole.
    d. Drill out the remaining 2 holes.
    e. The fitting that was just drilled is now matched this particular side of this truss. Mark the fitting and truss so that you know which truss and which side of the truss it goes on.
    f. Repeat with the other 3 fittings in the 3 remaining positions on the trusses and mark accordingly.
    g. Finish bolting the plates to the truss using the appropriate hardware with washers between the truss and the fittings.
4. Debur and soften the edges on the Forward Spar cutouts next to the wing truss to prevent injury when the bolts are inserted to attach the wing truss.
5. Bolt the truss to the Forward Spar using the appropriate hardware and the lexan truss shim between the truss and the Forward Spar.

    NOTE: The nuts and bolts that need to be inserted from the inside of the Forward Spar may be done by reaching into the cutouts in the spar on either side of the truss.
6. Lay the ribs on a flat table with the flanges up and use fluting pliers to straighten the ribs so they lay flat on the table. Bend the flanges on the front and back of the ribs to 90°.
7. Layout the ribs in the proper locations along the front spar. Rib numbering and flange directions are shown in **FIGURE 05B-07/141**.
8. Drill the aileron and flap hinges and hinge arms to 5/16" to allow the bronze bushings to be pressed in. Use a drill press if available. If a drill press is not available, a hand drill may be used.

    IMPORTANT: Care must be taken to stay square to the parts. If there is any play detectable between the bronze bushing and the hole, the damaged hinge must be replaced.

9. Locate and cleco the aileron and flap hinge arms, aileron bellcrank outer rib support, and the flap teleflex and bellcrank mount to the proper ribs. 3 holes are pre-drilled in the ribs and must be used to locate the hinge arms and bellcrank mount doublers.

    NOTE: The flap teleflex mount has no right and left parts. The difference in length needed due to this will be made up in the rod end threading onto the teleflex.

10. Use a #30 drill to match drill and debur the remaining holes.
11. Cleco and rivet the rib AFT attach angles to wing ribs and hinge arms.
12. Rivet the aileron and flap hinge arms, aileron bellcrank outer rib support, and flap teleflex and bellcrank mount to the ribs.
13. Rivet only the bottom holes of the rib AFT attach angles through the rear spar. The top hole is used to rivet the gap seal.
14. Use a 1/4" drill to match drill through the hinge arms, aileron bellcrank outer rib support, and the flap teleflex and bellcrank mount where the bellcrank mounts are bolted to the ribs.
15. Test fit and rivet the attach angle on the front of the inner root rib (rib #1) on the root side of the rib. The flat sided flange is longer and gets riveted to the inner root rib.
16. Cleco the ribs to the Forward Spar.
17. Cleco the tie down angle in place.
18. Cleco the Rear Spar to the ribs. Refer back to **FIGURE 05-04/141** for orientation.
19. Bolt the truss to the rear spar using the appropriate hardware. Use washers, as needed, in between the rear spar truss doubler and the wing truss to make sure the bolts don't pull or push on the rear spar. Sight down the rear spar to check for straightness.
20. Triple check the rib direction and hinge, doubler, and bellcrank locations.
21. Remove the root rib before riveting the rest of the ribs. It will be riveted in place after the fuel tank is in place. Rivet the ribs to the spars excluding locations where the gap seal shares the same holes as shown in **FIGURE 05A-07/141**.
22. Bolt the aileron and flap bellcrank assemblies in place with the lexan shims between the bellcrank mounts and the aluminum doublers. Bolt the smaller arm of the bellcranks to the rear spar. Use Loctite and safety wire as necessary.
23. Route the aileron cable through the rear opening in the ribs down to the aileron bellcrank. Position the bellcrank so that the break in the outside diameter is toward the root of the wing as shown in **FIGURE 05A-07/141**.

    IMPORTANT: The longer side of the aileron cable is on the FORWARD side of the aileron pulley.

24. Use safety wire to secure the aileron cable to the aileron bellcrank pulley as shown in **FIGURE 05A-07/141**.

25. Make sure the aileron cable is untangled and secure it in the aileron cable guide at the flap bellcrank.

26. Insert the flap teleflex into the wing through the same passage as the aileron cables. Slide the groove on the teleflex cable onto the flap bellcrank mount rib support.

27. Position the flap bellcrank so that the longer arm of the bellcrank points toward the root of the wing while the shorter arm points toward the leading edge of the wing.

28. Attach the teleflex to the shorter arm using the appropriate hardware and rod end.

CAUTION:

The rod end must be threaded on at least 10 full turns.

29. Secure the teleflex to the teleflex mount using safety wire as shown in **FIGURE 05A-07/141**.

30. For the left wing only, run the lines for the pitot tube. Use a piece of tape and safety wire as shown in **FIGURE 05B-30/141** to attach the pitot tubes to the top of each rib and prevent rubbing. A #40 hole must be drilled in each rib.

31. Drill a 5/8 hole as shown in **FIGURE 05B-30/141** and insert grommets on ribs 3 to 11. Run any wires needed out to the wing tip. Protect the wires with loom from between ribs 2 and 3 to the inside of the plane. Join the wires with the pitot/static lines and teleflex at rib 2.

WING SKIN INSTALLATION

PRE-SKIN CHECK LIST

- ☐ FWD wing truss doubler is riveted to the front spar.
- ☐ AFT truss doubler is riveted to the rear spar.
- ☐ Wing truss is bolted in the correct orientation using the appropriate hardware and lexan anti-corrosion shims in the front.
- ☐ FWD spar FWD attach doubler is riveted in place.
- ☐ FWD spar AFT attach doubler is riveted in place.
- ☐ Wing ribs are in the proper locations and flanges are orientated the correct directions.
- ☐ All ribs are riveted to the spars (excluding rivets shared with the gap seal on the rear spar and the root rib).
- ☐ All flap hinge arms are in the proper locations and riveted to the ribs.
- ☐ All aileron hinge arms are in the proper locations and riveted to ribs.
- ☐ AFT rib attach angles are in place and upper hole on the spar side is left open for gap seal.
- ☐ Aileron bellcrank outer rib support and the flap bellcrank mount rib support are riveted in place.
- ☐ Aileron bellcrank is assembled and bolted into the wing in the proper location using blue thread lock, safety wire, and lock washers where necessary.
- ☐ Flap bellcrank is assembled and bolted into the wing in the proper location using blue thread lock, safety wire, and lock washers where necessary.
- ☐ Aileron cable is correctly routed, secured through the aileron cable guide, and secured on the aileron pulley using safety wire.
- ☐ Flap teleflex is pressed into the flap bellcrank mount rib support and safety wired in place.
- ☐ Flap teleflex is attached to the bellcrank using rod ends and appropriate hardware. The rod end is threaded on at least 10 turns.
- ☐ Ribs have been fluted properly and they are straight enough that the skin can be clecoed to the ribs with ease. Each rivet hole should be in a high point in the rib. If the rivet is located in a flute or a deformity is higher than the rivet, the skin will wrinkle.
- ☐ Remove any scratches from the skins on the side that will be inaccessible after the skin is riveted to the wing. Use 600 or 800 grit sand paper to sand the area of the scratch until it is no longer visible. For deeper scratches, courser grit can be used and then finish with finer grit.
- ☐ Run wires for the desired wing tip lighting system.
- ☐ Run tubing for the pitot tube.

TOP SKIN

1. Set a couple of 4x4s or similar under each end of the wing spanning from the front and rear spar.
2. Make sure the wing structure is square. Lightly clamp down the wing in a way as to not interfere with the top skin.
3. Place a couple of straight pieces of angle (or other sturdy straight edges) on top of the spars at opposite ends of the wing.
4. Use a level to make sure there is 0° of twist in the wing.
5. If adjustment is needed, add shims under the boards to remove any twist.
6. Place the stringers in place on the wing ribs. Stringers will have to be trimmed and will be cut short of the rib flanges. The stringer flange will point rearward when installed.
7. The wing skins will have the print on opposite sides from each other. This is so that the print can be left on the inside of the skin and won't have to be removed. Select the top skin which puts the print on the inside of the wing.

   CAUTION: When working with large pieces of sheet metal such as wing skins, care must be taken to prevent creases or "smiles" from appearing in the sheet metal. If smiles appear, they can be worked out using a large spoon and pressing it against the smile to minimize its visibility.
8. Put the top skin in place on the wing.
9. Use an edge forming tool to roll a slight edge on the leading edge of the skin to prevent pillowing.
10. Cleco the skin to the ribs including the forward most row of rivets right next to the spar.
11. Drill the leading edge holes to the Forward Spar using a #30 drill. Start at the middle and work your way out. Be sure to lightly press down on the skin until it contacts the spar when drilling to ensure a proper hole is created. Insert clecos as you progress across the spar.
12. Remove about 4 rows of clecos from the leading edge.
13. Use a hand squeezer and 120° dimple dies to dimple the holes in the skin leading edge.
14. Use a 120° countersink (preferably a micro stop countersink) to machine countersink the holes in the Forward Spar to accept the dimples in the skin.
15. Lightly lift the leading edge of the skin and debur the holes in the Forward Spar.
16. Insert 4 tank supports and cleco them to the top skin.
17. Rivet the top skin to the wing. Start with the leading edge and work your way rearward one row of rivets at a time. Leave the holes open for the inner root rib (#1). Push the skin to the ribs between the rivet to be pulled and the cleco in the next row to prevent as much pillowing as possible.

18. Stop riveting about 4 rows from the rear spar. Double check that the wing is square and still has 0° of twist. Match drill the holes from the skin into the rear spar using a #30 drill. Start at the middle and work your way out.

19. Remove clecos back to the rivets and lightly lift the trailing edge to allow removal of any burrs or chips in between the skin and the rear spar.

20. Fit the gap seal to the rear spar and slide the top edge underneath the trailing edge of the top skin. Cleco the gap seal along the top of the rear spar. It is critical that the gap seal conforms to the wing airfoil. Check for proper alignment to Wing airfoil profile with a straight edge on top of the wing. Refer to **FIGURE 05C-20/141**. If gap seal needs to be modified, use a wood board as long as the gap seal, to prevent dings and dents. Remove gap seal from wing and place on a tabletop. Press down with the board. Refer to **FIGURE 05C-20A/141.** Re-cleco and check profile. Repeat pressing as needed.After satisfied, use a pair of shears to remove the supports at push-pull tube exit holes and end tabs indicated in **FIGURE 05C-21/141**.

    IMPORTANT: Once the supports are removed, the gap seal will be very fragile and prone to damage. Remove the supports only after the top row of holes is clecoed to the rear spar. If it must be removed for some reason before riveting, use extreme caution.

21. The rest of the top skin can now be riveted using the appropriate rivets.

    NOTE: Do NOT rivet the Inside Root Rib at this time.

22. On the outboard side of the gap seal, three holes in the gap seal do not have matching holes in the spar and need to be transfer drilled using a #30 drill.

23. Rivet the gap seal to the rear spar using the appropriate rivets.

    NOTE: Longer rivets must be used near the truss due to the rear spar truss doubler thickness on the inside of the spar.

24. Assemble the wing jig by screwing 2X2’s or similar, flush with the bottom with 33.5" between the inside edges of the stand pieces as shown in **FIGURE 05C-24/141**.

25. Place the wing stands under each end of the wing and secure the stands to the table. Flip the wing over and place it in the stands with the leading edge of the wing up against the tall side of the stands. Adjust the location of the stands to line up with the ribs on the ends of the wing.

BOTTOM SKIN

1. Use clamps to secure the wing to the front of the jigs and down to the table.
2. Use a level and a piece of straight stock across the spars to insure there is no twist in the wing. If there is, use shims between the table and the stands to remove any twist.
3. Place the stringer in place on the wing ribs. Stringers will have to be trimmed and will be cut short of the rib flanges. The stringer flange will point rearward when installed.
4. The stringer will need a notch cut out of the flange in order to give clearance for the wing truss. Mark its location and use a sanding drum or similar to remove material from the stringer to create a notch.

   NOTE: Smooth any sharp corners, cutting marks, etc. from the stringer to avoid stress concentrations.
5. Place the bottom skin on the wing by lifting the leading edge high and sliding the hinge arms through the slots in the skin before lowering the front and sliding the skin forward. A 3rd person may be helpful to help guide the hinge arms through the skin.

   CAUTION: When working with large pieces of sheet metal such as wing skins, care must be taken to prevent creases or "smiles" from appearing in the sheet metal. If smiles appear, they can be worked out using a large spoon and pressing it against the smile to minimize its visibility.
6. Cleco all inspection rings in place by lifting an edge of the skin and sliding them into place on the inside of the wing. Wait to rivet them until after the skin is riveted on the wing to allow the skin to flex as it bends to the shape of the airfoil.

   IMPORTANT: Orientate the inspection ring for mounting the Pitot/Static System per **FIGURE 05C-30/141**.

   NOTE: Orientate the inspection hole tab ring for the flap bellcrank such that the screws will not interfere with the bellcrank mount. Refer to **FIGURE 05C-30A/141**.
7. Begin by putting a couple clecos in various wing ribs to line up the skin and then in the tank supports. Use an ice pick or similar tool to line up the holes.
8. Begin placing a few clecos in place next to the rear spar. Note the locations of any interference between the bottom skin and the hinge arms. If necessary, remove the skin and widen the slots until the skin does **NOT** rub on the hinge arms.

   NOTE: This clearance varies with twist in the wing so ensure any twist is removed before checking for interference.
9. Cleco the rest of the bottom skin to the wing leaving about 3 rows at the front.
10. Use an edge forming tool to roll a slight edge on the leading edge of the skin to prevent pillowing.

11. Cleco the remaining rows of the bottom skin to the ribs.
12. Insert and cleco the wing tank supports (KPWI0651) to the bottom skin. The tank supports overlap onto the wing ribs and go on the inside of the ribs flange.
13. Double check to be sure there is 0° of twist in the wing.
14. Match drill the leading edge holes through the D spar using a #30 drill. Start in the middle and work your way out.
15. Remove the front 4 or so rows of clecos.
16. Debur the skin and the Forward Spar.
17. Dimple the leading edge holes in the skin using 120° dimple dies.
18. Countersink and then debur the holes in the Forward Spar.
19. Insert clecos to secure the front of the bottom skin.
20. Use the appropriate rivets to rivet the bottom skin to the wing. Start at the leading edge and work your way rearward. Stop about 4 rows from the trailing edge.

    NOTE: Do **NOT** rivet the Inside Root Rib at this time.
21. Double check to be sure there is 0° of twist in the wing.
22. Match drill the trailing edge holes in the skin to the rear spar using a #30 drill. Start in the middle and work your way out. Lightly lift the edge to clear any burrs or chips.
23. Finish riveting the bottom skin to the wing.

    NOTE: Do **NOT** rivet the Inside Root Rib at this time.
24. Rivet the inspection tab rings that are clecoed to the bottom skin.

PITOT/STATIC SYSTEM

1. Locate Doubler Plate on 5” Inspection Cover using **FIGURE 05C-49/141** as a template. Transfer drill #30 and cleco.
2. Transfer drill 1/4” for the Pitot Tube. Refer to **FIGURE 05C-49/141**. If the Pitot Tube fits too tight, open the hole with a deburring tool or file. Deburr and rivet Doubler to Inspection Cover.
3. Insert Pitot Tube through 1/4” hole in Doubler and Cover. Attach to Angle Bracket with 1/4” Conduit Clamps. Adjust Angle and Clamps to allow 7” of Pitot Tube to extend below the Cover. Forward open end of Pitot Tube should face forward when in flight. Adjust after mounting to Wing Skin as needed.
4. Transfer drill #11 through base of Angle. Angle base should be oriented outboard. Debur and rivet to Cover.
5. Push a Union Elbow over the upper end of the Pitot Tube. Pull on the elbow body while holding the inner sleeve to seal. Connect to Pitot line in wing. Pull on tubing to seal. Attach Pitot Assembly to wing opening.
6. Attach Union Elbow at root of wing to tubing.

7. After attaching wings to fuselage, route line behind Station 3 Closeout down to belly of aircraft. Route forward to firewall, then up and connect to pitot side of instruments with correct connectors.
8. Locate and drill a #30 hole in each Side Boot Cowl Skin per **FIGURE 05C-56/141**.
9. Pull rivet and push center mandrel out of rivet with a click punch or similar tool.
10. Connect tubing to each protruding rivet body, on inside of Boot Cowl, and secure with safety wire. Connect lines together with a Union Tee and connect to static side of instruments with correct connectors.
11. After painting Boot Cowl label each Static Location with a placard reading “STATIC PORT KEEP OPEN”.

WING FUEL TANK ASSEMBLY

1. Using a small piece of aluminum sheet, make a drill guide as shown in **FIGURE 05D-01/141**. The jigs purpose is to locate a small center hole for the center drill in a fly-cutter or hole-saw. Make the screw holes about 1/4" outside of the small existing hole in the tank to keep the jigs size down. If the jig is made too large it will interfere with the fly cutter when the hole for the cap is cut.
2. Screw the drill guide to the top of the tank, covering the center of the hole.
3. Slide the fuel tank into position in the wing.
4. Slide the Inside Root Rib into position and cleco to the front and rear spar. Make sure the wing tank supports (top and bottom) are toward the inside of the flange on the outer rib so that the skin will rest solely on the rib.

   HINT: Slide a nylon string between the skin and the supports to give a gap for the root rib to slide into. Leave the ends accessible so you can get to them once the root rib is in place. Once in place, pull the string out through the exit hole in the inner root rib.
5. Fabricate a sight gauge location tool as shown in **FIGURE 05D-05/141**. Insert the Sight Gauge Location Tool into the sight gauge locations in the Inside Root Rib and use a long #11 bit to create a centering mark.

   NOTE: Drill only deep enough to create a mark and check to see that the hole will be close to the center radius of the depression. Use a long #11 drill bit and drill a pilot hole for the sight gauge. Step drill to 1/2". A 1/2" Unit-bit works well. Refer to **FIGURE 05D-05A/141**.
6. Drill a #30 hole in the drill guide at the center of the hole in the top skin for the cap. Mark the hole in the top skin to the top of the tank using a marker.
7. Remove the tank from the wing.
8. Cut a 3" hole for the wing tank cap using a fly-cutter or hole-saw and the previously drilled hole as a guide.
9. Debur the 3" hole.
10. Set the fuel cap assembly into the hole with the cap pointed forward. Mark a line on the outboard side of the cap assembly that passes through the center of the cap parallel to the spars (front and rear of the tank).
11. Set the cap assembly upside down and place the retaining ring on it. Line up the retaining ring so that the big hole lines up with the line drawn in the previous step on the outboard side. The retaining ring should lay flat and maintain a constant separation from the tapered section on the cap assembly.
12. Carefully (don't scratch the cap assembly) clamp the retaining ring in place and use it as a drill jig to drill #11 holes in the cap assembly. Insert clecos as holes are drilled.

13. Remove the retaining ring and place the cap assembly in place on the tank. Line up the outboard mark on the tank with the outboard mark on the cap assembly. Center the cap assembly in the circle drawn on the tank. Transfer drill the holes in the cap assembly through the tank using a #11 drill. Remove the cap assembly and debur the tank and cap assembly.
14. Drill the outboard hole to 3/8” for the fuel tank vent.
15. Countersink the #11 holes in the cap to accept the countersunk bolts.
16. Locate and pilot drill the hole for the AFT fuel withdrawal fitting as shown in **FIGURE 05D-05A/141.** Step drill to 3/4". A 3/4” Uni-bit works well.
17. Debur all holes and thoroughly clean any debris from the inside of the tank. A shop vacuum works well.
18. Insert a long piece of wire through the inside of the 3/4” Bulkhead Fitting. Slide the O-ring over the wire and onto the Bulkhead Fitting. Refer to **FIGURE 05D-16/141**.
19. Fish the wire through the hole at the rear of the tank for the AFT fuel withdrawal. Pull the Bulkhead Fitting through the tank and into place.
20. Install the rubber washer, 3/4" thick washer, and Reverse Thread Nut. Use blue thread lock on the threads. DO **NOT** OVERTIGHTEN THE NUT. If the rubber washer deforms past the washer, the fitting will leak.

    IMPORTANT: Do not allow the fitting or thick washer to rotate while tightening or leaks may occur. **HINT:** Prevent the thick washer from turning by holding with needle-nose Vise-Grips. Carefully remove the wire.
21. Repeat this process for the sight gauges using the appropriate hardware and blue thread lock.
22. Let the thread lock set up for at least an hour before installing the withdrawal and sight gauge parts. Do **NOT** allow the fittings to rotate
23. Use thread sealant on pipe thread connections. Orientate the 90° withdrawal fittings for the sight gauge to point towards each other.
24. Install the 90° and fuel line on the AFT fuel withdrawal. Cut the fuel line to length for:
    a. Right wing - 85"
    b. Left wing - 65"
25. Locate, Drill, countersink, and flush rivet the nut plates to the fuel cap retaining ring.
26. Ensure everything is ready to go on the fuel cap. Apply a thin layer of ProSeal to the underside of the flange on the fuel cap. Set the cap aside.
27. Use the gap in the retaining ring to insert it into the tank.
28. While holdinging the retaining ring inside the tank, flip the cap flange right side up and put it in place.

29. Reach in through the cap flange with a finger and move around or hold up the retaining ring as needed to start inserting bolts. It may be necessary to start with a longer bolt for the first one or two bolts. Replace the longer bolts after others are started.
30. Bolt the fuel cap assembly to the tank using the appropriate hardware. Install the fuel tank vent into the 3/8" hole in the cap with the hole facing the leading edge of the wing. Only tighten the bolts until the ProSeal starts to squeeze out from underneath the cap. Wait at least 24 hrs to finish tightening the bolts.
31. The tank needs to be leak tested before assembled into the wing. Slide the tube for the sight gauge on (barely press them on, no clamps needed). Either plug the fuel vent hole or place your finger over it. Apply a small amount of air pressure to the AFT withdrawal fuel line. 1 PSI is enough. Do not apply enough to deform the tank. Spray soapy water on the tank fittings and cap assembly to find any leaks.
32. Once checked, and any leaks are fixed, remove the sight gauge tubes.
33. Re-install the tank in the wing.
34. Thread the wire, cables, teleflex, and fuel line through the hole in the Inside Root Rib and slide rib into position and cleco. Make sure the wing tank supports (top and bottom) are toward the inside of the flange on the outer rib so that the skin will rest solely on the rib.

    HINT: Slide a nylon string between the skin and the supports to give a gap for the root rib to slide into. Leave the ends accessible so you can get to them once the root rib is in place. Once in place, pull the string out through the exit hole in the Inside Root Rib.
35. Install the sight gauge tube and hose clamps.
36. Rivet the Inside Root Rib to the skin and spars.

    NOTE: The top aft end of the Inside Root Rib is bolted in place rather than riveted.

(AFTER WING IS PAINTED)

37. Apply ProSeal to the gap between the fuel tank cap and the wing skin. Dip a finger in water and make a nice fillet all the way around the cap. The purpose of this is to prevent fuel from entering the wing when the tank is over filled.

FLAP ASSEMBLY

1. Remove the bend guides as shown in **FIGURE 05E-01/141.** Carefully use a pair of snips to cut them off close and finish with a file.
2. Remove the attach tabs of the Flap Hinge - Part Assembly to make individual Flap Hinges. Trim off close and finish with a file. Refer to **FIGURE 05E-02/141**.
3. Lay the flap skin on a table.
4. Lay out the ribs, hinges and doublers in the proper locations.
5. The hinges should have been drilled during wing rib/spar assembly to accept the bronze bushings.
6. Double check the location and orientation of the ribs, hinges, and Push-Pull Tube Attach and rivet the hinges and Push-Pull Tube Attach to the appropriate ribs.
7. Determine which side of the hinges to press in the bronze bushing. Refer to **FIGURE 05E-06/141** for typical orientation. Use a bench vice or similar to press in the bronze bushings.

   NOTE: If any of the bronze bushing don't stay pressed into the hole, set them aside and wait until assembling the aileron to the wing. Once in place on the wing the bushings will be retained by the hinge bolts. Green Loctite may be used to retain the bronze bushings.

   IMPORTANT: Check for play between the bronze bushings and the hinges. If play is present, the hinges must be replaced.
8. Cleco the ribs in place. Use a 2X4 or similar to space the aileron off the table and prevent damage due to resting on the clecos. Flip the flap as needed to cleco both top and bottom.
9. The hinges must not contact the skin. Enlarge the slots in the aileron skin if needed.
10. Slide the flap spar into place from either side.
11. Place the flap right side up on the 2X4s.
12. Check for twist and fixture or weight the flap to the table if necessary to remove any twist.
13. Rivet the **TOP** side using the appropriate rivets. Start at the AFT edge and work your way forward one row at a time.
14. Flip the flap over and check for twist before riveting. Start at the trailing edge and work forward.
15. Match drill and debur the spar using the holes in the skin and a #30 drill.
16. Finish riveting the skin to the spar.

AILERON ASSEMBLY

1. Remove the bend guides on the aileron skin as shown in **FIGURE 05F-01/141.** Carefully use a pair of snips to cut them off close and finish with a file.
2. Cleco and rivet the inspection tab rings to the aileron skin.
3. Lay the aileron skin on a flat table.
4. Lay out the ribs, hinges, and Push-Pull Tube Attach in the proper locations as shown in **FIGURE 05F-01/141**.
5. Drill the aileron and flap hinges and hinge arms using a 5/16" drill to allow the bronze bushings to be pressed in. Use a drill press if available. If a drill press is not available, a hand drill may be used, but care must be taken to stay square to the parts. If there is any play detectable between the bronze bushing and the hole, the damaged hinge must be replaced.
6. Double check the location and orientation of the ribs, hinges, and Push-Pull Tube Attach and rivet the hinges and Push-Pull Attach to the appropriate ribs.

   NOTE: The hole at the top rear of the Push-Pull Tube Attach is used to bolt the PPT to the rib and must be left open.
7. Determine which side of the hinges to press in the bronze bushing. Refer back to **FIGURE 05E-06/141** for typical orientation. Use a bench vice or similar to press in the bronze bushings.

   NOTE: If any of the bronze bushing don't stay pressed into the hole, set them aside and wait until assembling the aileron to the wing. Once in place on the wing the bushings will be retained by the hinge bolts. Green Loctite may be used to retain the bronze bushings in the hinges.

   IMPORTANT: Check for play between the bronze bushings and the hinges. If play is present, the hinges must be replaced.
8. Cleco the ribs in place. Use a short 2X4 or similar to space the aileron off the table and prevent damage due to resting on the clecos. Flip the aileron as needed to cleco both the top and bottom sides.
9. The hinges must not contact the skin. Enlarge the slots in the aileron skin if needed.
10. Slide the aileron spar into place from either side and cleco the bottom leading edge row to the spar.
11. Place the aileron bottom side up on the 2X4s.
12. Check for twist and fixture or weight the aileron to the table if necessary to remove any twist.
13. Rivet the bottom side using the appropriate rivets. Start at the trailing edge and work your way forward one row at a time.
14. Flip the aileron over and check for twist before riveting. Start at the trailing edge and work forward.

15. Match drill and debur the spar using the holes in the skin and a #30 drill.
16. Finish riveting the skin to the spar.

AILERON BALANCING

The plugs for the mass balance are created using spray expanding foam.

1. With the aileron flat on a table, insert the tube on the can of expanding foam at least 14 inches inside the root side of the aileron spar. This will require use of an extension tube or other means. Spray just enough to create a plug.
2. Let the foam set up for at least 8 hours.
3. Place the aileron on a flat table and allow it to rotate on the bottom of the hinges.
4. Add Lead shot or BB's to the root end of the spar until the aileron balances on the hinges when the bottom surface is level.
5. Use expanding foam to create an end plug and isolate the balance weight in the spar. If the foam expands beyond the end of the spar, wait until it completely dries and cut it off flush with the end of the spar.

   IMPORTANT: If the aileron is painted after it is balanced, it will need to be re-balanced. Weight can be added by creating a cavity in the foam plug using a drill or other means, adding BBs to balance, and sealing them in with more expanding foam.

AILERON AND FLAP ATTACHMENT

1. Make sure all the bronze bushings are in place on the hinges as well as the hinge arms.
2. With the wing upside down, the control surfaces can hinge all the way around and lay flat on the bottom wing skin. This makes assembly easy. Place a pad or towel on the bottom of the wing by the trailing edge to keep from making scratches with the aileron and flap. Place the control surface on the wing in the correct orientation and slide the hinges over the hinge arms. Make sure the bronze bushings stay in place.
3. Place the bolts through the hinges. Lightly tighten the bolts. Leave the bolts just loose enough that the control surfaces move freely.

   NOTE: For multiple reasons, we use AN364 nuts here. Drilled bolts, castle nuts, and cotter pins may be used if the builder prefers.
4. Rotate the control surfaces into place one at a time and attach the push-pull tubes using the appropriate hardware. The bushing on the aileron Push-Pull Tube Attach will need to be cut to length. Make 2 (one for each side) out of the supplied tube. Put the nuts on finger tight. The control surfaces will have to be rigged once attached to the fuselage.

   CAUTION: Make sure the rod ends are threaded on at least 10 turns.
5. Check clearances between the bolts and the gap seal. Enlarge the holes in the gap seal if needed.

LIFT STRUT ASSEMBLY

1. The Lift Struts are cut to length and the attach holes pre-drilled at the factory. Smooth the ends of each Lift Strut with fine sand paper and debur.
2. Mark a straight line between the attach holes at either end of the strut. Use a straight edge or a piece of string. Only marking inside the holes by 8" or so is needed.
3. Place a strut doubler on the strut with a bolt in the attach hole. Align the rest of the holes with the line on the strut. Transfer drill the #30 holes from the doubler to the strut. Cleco the first hole to hold the doubler in place before continuing to drill.
4. Repeat for the remaining 3 strut doubler plates.
5. Slide the Strut Fitting Doublers inside the ends of the strut and cleco in place. Drill the #30 holes out to #11. Rivet the doublers to the strut using the appropriate rivets.
6. Use a 5/16” drill to drill the bolt holes out to final size on the strut/doublers and the strut attach tangs on the cage..

7. The lower strut fitting can be bolted to the bottom of the strut. The side with the generous radius is bolted to the tangs on the cage. Leave the bolt loose enough that the lower attach fitting can swivel freely.

   NOTE: The welds between the strut tangs may prevent the fitting from sliding all the way in. Use a file or sander to radius the corner on the lower strut attach fitting just enough to allow it to be inserted until the bolt holes to line up.

8. Cut Anti-Slip Tape into two equal pieces approximately 48" in length. Anti-Slip Tape must be 1" wide. Round the ends of each tape. Remove liner and apply, centered on the airfoil camber, in respect to the bottom edge of Lift Strut. The Anti-Slip Tape will help to prevent strut vibration due to airflow.

OPTIONAL LIFT STRUT FAIRING INSTALLATION

(AFTER ATTACHMENT OF WING TO FUSELAGE)

1. Trim base of fairing to allow a slight flange edge where it mates to the wing. See **FIGURE 05G-05/141**.
2. Cut out opening to fit snugly over Lift Strut. Refer to **FIGURE 05G-06/141** for a template. Cut small and trim to fit.
3. Locate the dimples in the base of the fairing and drill to #30. Slip fairing over upper end of lift strut.

   NOTE: The fairing may be split to the cut-out at the top to aid in removal without removing the strut. If this is the case you may want to install an additional rivet nut on either side of the cut-out to retain.

4. Slide fairing up against bottom wing skin. Transfer drill #30. Slide fairing away from wing. Drill #30 holes in wing to 1/4”. Drill fairing to #11.
5. Install Rivet Nuts into bottom wing skin. See **FIGURE 05G-09/141**.
6. During Final Assembly, slide fairing into to place and secure with Truss Head Screws.

WING TIP

Mounting Plate for strobes may be installed before or after fit up of wing tip

ASSEMBLY

1. Cut the round end off the trailing edge of the support rib at the point where it transfers from the round end to the rib.

   NOTE: Use a pair of hand shears or a Dremel with a cutoff wheel. Debur as needed.

2. Trim the support rib down to a flange length of ¾" from the face of the rib. Cut out all the rib pockets to ¾" flange as well.

3. The flat side of the support rib will bolt to the rib on the end of the wing and the flange will extend into the wing tip when assembled. As such, the very aft section of the support rib must be tapered to fit inside the wing tip when assembled. Taper the flange length down to 1/8" at the very rear to 3/4" where the aft most rib support starts.

4. Trim the wing tip to the molded in trim line. Use a sharpie or masking tape and highlight the trim line for ease of seeing the line.

5. Place a masking tape edge around the wing on the very outside edge. Carefully stick the tape down with the very edge of the tape to the very edge of the skin of your wing. This tape can be ¾" or wider tape. Note the width of the tape. It will be used for a measuring reference where the wingtip overlaps the wing during fit up.

6. Position the wing tip on the wing and closely match the profiles. Minimize the overlap but let the tip overlap onto the wing if necessary. Tape in place.

7. Use the edge of the tape as a reference to measure and mark the end of the wing onto the wingtip. Make a series of marks to produce a new trim line. Pay close attention to any areas that holds the wing tip away from the skin and spar. If the spar sticks out slightly from the rib, trim around these spots as well. Take your time and trim precisely.

8. Once trimmed hold the tip back up to the wing and verify fit. Repeat the process until you are satisfied with how the wingtip mates to the wing.

9. Debur all the edges of the wing tip and wing tip support rib. Sandpaper works great.

10. The wing tip and wing tip support rib can now be glued together. Create a fixture out of a piece of 3/4" MDF or plywood.

    a. Lay the support rib on the MDF or plywood and mark the outside perimeter.

    b. Cut out the profile saving the material outside of the profile. A hole can be cut in the inside of the profile for access or it can be cut in half at the ends of the profile and reconstituted with a piece of material. Set the fixture aside.

c. Place the support rib on the table with the flange up and use .050 thick material to shim the wing tip support rib off the table.

d. Weight the rib in place with sand bags or weights of some sort.

e. Test fit the wingtip, support rib, and fixture set up before applying glue.

f. Apply ABS or PVC glue on the wing tip and wing tip rib where the two will mate. Place the wing tip over the support rib and slide the jig over the wing tip compressing the wingtip to the support rib at the bottom.

g. Place weights on top of the wing tip and let the glue cure.

INSTALLATION

11. Position the tip on the wing and tape in place. Ensure a proper fit as this will be the wing tips final location.

12. Access through the inspection holes in the bottom wing skin to transfer drill the #11 holes in the wing rib to the wing tip support rib. Cleco as you go.

13. Remove the wing tip and install nut plates into the wing tip support rib.

14. The wing tips are now ready to paint.

15. Now is a good time to paint the wing, ailerons, and flaps. It is up to the builder to decide when to paint the airplane. Some people will prefer to fly phase 1 before painting. Others will want to paint now before final assembly of the wing. Others may decide to stop at this point and finish the fuselage to ready to paint and paint the wings, fuselage, and tails at the same time.

OPTIONAL STROBES INSTALLATION

1. Route wires in wing and out to the tip through the grommets in the wing ribs. Leave extra length to reach through the wing tip and fuselage.

2. Position the Strobe Light Mount centered inside the flat area of the Wing Tip. Be sure the strobe will be straight when mounted. Transfer drill #40 through the aft set of nut plate rivet holes. Cleco in place. Transfer drill #11 though the center hole for the nut plate. Rivet a nut plate to the Mount inside the Wing Tip.

3. Use a Dremel tool to remove Wing Tip material inside the Mount for the wires and strobe retaining pin.

   NOTE: Use the Dremel tool as a router to obtain a clean opening.

4. After painting of Wing Tip, mount Strobes to Wing Tip and connect wiring. Route wire into fuselage when installing Wing to Fuselage.

OPTIONAL TAXI / LANDING / RECOGNITION (TLR) LIGHT INSTALLATION

1. Route wires in wing and out to the tip through the grommets in the wing ribs. Leave extra length to reach through the wing tip and fuselage.
2. Position the Light Mount inside the lower side of the wing tip. Locate the hole for the mounting bolt about 2” outboard of the wing frame and 7” aft of the leading edge. Angle the mount several degrees inboard. Transfer drill #40 through the forward set of nut plate rivet holes. Cleco in place. Transfer drill #11 though the center hole for the nut plate. Rivet a nut plate to the Mount inside the Wing Tip.
3. Use a Dremel tool to remove Wing Tip material inside the Mount for the wires.

   NOTE: Use the Dremel tool as a router to obtain a clean opening.
4. After painting of Wing Tip, mount Lights to Wing Tip and connect wiring. Route wire into fuselage when installing Wing to Fuselage.

WING INSTALLATION

Please read the entire section before you continue with Wing Installation.

We recommend having all assemblies and installations related to the Wing completed before the Wings are final installed to the airplane. It is NOT necessary to trial-fit the Wings to the Fuselage at an earlier assembly stage.

The following items should be completed at this stage:

- ❑ Final check of all rivets, hardware, safety wire. Make sure all rivets in the skins have been pulled. If any mandrels are sticking out they must be filed off.
- ❑ Ailerons and Flaps installed
- ❑ Wing Tips installed
- ❑ Wings are painted
- ❑ Fuel Sight Gauges installed to Wing root
- ❑ Lift struts assembled

It is recommended to hang both Wings at the same time (one at a time). You will need at least one helper. However, it is more comfortable to have two helpers.

1. Set the wing on saw horses next to the fuselage so that it can be lifted straight up and into place.
2. Place the AN5 bolt through the AFT attach fitting. Slide the AFT attach fitting and spacers into place on the rear spar. Install the bolt, washers, and nut. Leave the nut loose enough that the fitting can rotate.
3. Follow the following procedures to trim the T-bone on the Fuselage to fit the wing:
   a) On the wing, Measure from the AFT side of the Forward Spar to the center of the 5/16" bolt on the aft attach fitting.
   b) Add 3/8" to measurement to account for Forward Spar and doubler.
   c) On the fuselage, measure from the centerline of the hole for the 5/16" bolt on the AFT attach fitting to the AFT side of the T-bone. Mark the distance previously measured plus the 3/8" allowance.
   d) Cut the bushing to the mark. Keep as square as possible.
   e) Measure the inside distance of the Forward Spar.
   f) Mark this measurement from the AFT side of the T-bone to the forward side.
   g) Cut off the FWD side of the T-bone at the mark. Keep as square as possible.
   h) Debur both cuts.

IMPORTANT: It is recommended to apply some corrosion protective primer to the bare metal.

4. Drill through the Forward Spar and FWD Spar AFT Attach Doubler from the back side through the hole for the attach bolt using a 3/8" drill.
5. Have one person lift at the wing tip and one person lift at the root. Be sure not to use the wingtip itself to lift the wing. Instead lift on the wing rib.
6. Walk the wing over to the fuselage and slide all the cables and wires through the appropriate place on the fuselage. Then slide the AFT attach fitting bolt through the hole in the fuselage and start a nut on the inboard side.
7. Walk the tip forward slowly to slide the Forward Spar over the T-bone. Insert a 3/8" bolt into the hole in the AFT side of the Forward Spar to temporarily hold it in place.
8. With someone still holding the wing tip up, slide the lower attach fitting on the strut assembly into the tangs on the fuselage. Lift the lift strut up and slide it into place between the wing truss/strut attach doublers. Install bolt with nut finger tight. The wing is now attached to the fuselage and no longer needs to be supported.
9. Match drill through the front of the Forward Spar through the T-bone using a 3/8" drill.
10. Insert the correct bolt through the front of the spar and push out the 3/8" bolt used to temporarily hold the wing in place.
11. All of the correct hardware should now be in place and can now be tightened.

    NOTE: For the 5/16" bolt on the AFT attach fitting, use a flathead screw driver or similar to keep the bolt head from spinning while tightening the nut. Do not damage the AFT attach fitting while tightening the nut.
12. Once all the hardware is tightened, the second hole in the AFT attach fitting can be drilled and bolted.
13. Refer to **AILERON CABLE SYSTEM INSTALLATION** in **SECTION 002C.** Connect the Aileron Cable as shown.
14. Refer to **RIGGING** for information about Bell Crank position and cable tension.
15. Use a 1/4” bolt through the vertical tube on the Aileron Bellcrank Mount as a lock to place the Aileron Bellcrank Pulley in neutral position. Adjust the Push-Pull Tube with the Control Stick centered for the correct Aileron neutral position as per **RIGGING** instructions.
16. Adjust the 1/4” Plain Bolts on the Control Stick Torque Tube to obtain Aileron Deflection per **RIGGING** instructions. Lock bolts with the plain nuts.
17. Route the Flap Teleflex Cable inside the Fuselage. Route both Flap Teleflex Cables aft of Station 3 down the side of the fuselage and forward through the wire loops welded to the fuselage frame at Station 2A. Both Teleflex Cables route forward and connect to the Flap Handle. Secure Teleflex cables mid-way up on Station 3 with Cushion Clamps.

18. For adjustment of the Flaps, refer to **RIGGING**.
19. Fabricate the Fuel Lines to connect the Wing Fuel System to the Fuselage Fuel System. Refer to **FUEL LINE INSTALLATION - FUSELAGE**.
20. Refer to **FIGURE 05I-19/141.** Position the Wing Root Bottom Gap Seal on the bottom side of the Wing so that the flange is tight against the Fuselage frame. Mark and drill #30. Remove gap Seal. Drill Wing Bottom Skin to #11. Install Tinnermans on Bottom Wing Skin.
21. Paint Gap Seal. During final assembly, attach the 1/2” Black Foam Tape to the flange that will rest against the fuselage frame. Attach the gap seal to the wing with the screws provided.
22. Installation of Flap Fillet will be done after **WINDSHIELD INSTALLATION**.

    NOTE: The fillet flap is installed to the Baggage Window Trim Frame and closes the gap between Fuselage and Flap.
23. Connect Pitot line to Union Elbow connector in the wing.