03 - WING ASSEMBLY

WING ASSEMBLY

WING SPAR ASSEMBLY

The wing spar is mostly assembled as received.

- This work is easily accomplished on two padded sawhorses.
- Check the spar surface for scratches and other damage.
- Use fine sand paper and Scotch-Brite to polish small scratches out.

IMPORTANT:

WING SPARS MUST BE MATCH REAMED TO FUSELAGE SPAR CARRY-THRU !!!

*Refer to **WING SPARS TO CARRY-THRU FIT-UP** in **SECTION 05 – FUSELAGE – CENTER SECTION***

1. Install the Tie Down (KPFU0391). Drill out the two holes in the Wing Spar to #30. Cleco the Tie Down in place (Note orientation). Transfer drill #11 and bolt in place. Reference **Parts Drawing and FIGURES 03-01** & **03-01A**.
2. Install the inner Bellcrank Mount Angles (root side of spar). See **FIGURE 03-01**. ***NOTE:*** *There are left and right parts.* Refer to **BELLCRANK AND PUSH PULL TUBE INSTALLATION** section for details. Drill out the holes on the tip facing flange side to # 11 and cleco Angles to forward side of Wing Spar. Drill the other 2 holes out to # 11 and bolt Angles in place. Note the different length of bolts.
3. Install the outer Bellcrank Mount Angles. See **FIGURE 03-01**. Cleco the 2 Spar Stiffeners to the aft of the Wing Spar. Note orientation of flanges. Drill all holes out to #30 and cleco. Cleco Bellcrank Mount Angles to Spar and Stiffeners. Drill out the 4 angle mounting locations to #11. Rivet Stiffeners and bolt Angles in place.

WING RIB INSTALLATION

- This operation may be performed on two padded sawhorses.
- Clamp the spar in an upright position using a padded clamp. Be sure not to mar the surface of the spar.
- All wing ribs must be straightened. Use fluting pliers at fluted locations. Check on flat table. It is also important that the rib flanges are straight. Use padded pliers to flatten flanges if necessary.
- All parts must have their edges polished smooth before installation to avoid cracking in service.
- If fit is required to move the rib up or down for correct alignment with the spar you can elongate two of the pre-drilled holes in the ribs slightly to allow the movement. Then transfer drill the rest of the holes to finish size.
- Use **FIGURE 01-08 - WING STATIONS** for assistance in positioning ribs.
- ***NOTE:*** *The circled numbers on the parts pages refers to the Wing Station.*

1. Add Stiffeners to the Rear Rib #1 (KPWI0396) as per **Parts Drawing**. There is a short and a long Stiffener for each rib. These are formed as 1 piece and must be cut apart and filed or sanded smooth. ***NOTE:*** *The flange of the Stiffener faces opposite to the Rib flange.* Cleco each Stiffener at the 2 pre-drilled locations and transfer drill all other holes #40. Final size all holes to # 30 and rivet Stiffeners in place.
2. Rivet Wing Rib Gussets (KPWI0444) to 2 each of the left and right Ribs (KPWI0396) with Stiffeners attached. Reference **Parts Drawing.** The Gusset may be formed, if required, to 90-degrees. Form the Rib slightly over 90-degrees so the two parts fit tightly together. Hold the Gusset tight against the Rib when drilling. Transfer drill the 6 holes, #40 through Gusset into Rib. Transfer drill the 2 holes through aft Rib flange into the Gusset. Drill out Gusset and rib to # 30 and rivet with 6 rivets each. Mark 2 ribs each with **Station -1** or **Station -2**.
3. Add Stiffener and Wing Rib Gusset to 1 Rear Rib #1 each (KPWI0396) (**Station-5**) and Rear Rib #2 (KPWI0397) (**Station-7**). Reference **Parts Drawing.** Mark ribs with station #. Be sure to make a Left and Right of each.
4. Modify 2 left and right wing Nose Rib #3 (KPWI0394) as per **FIGURE 03A-04**. The cutouts are needed to clear the Spar at **Stations -6** and **-7**. Mark ribs with station #.

There are many ways to install the ribs. The following describes one.

5. Cleco Nose Rib #1 (KPWI0393) to the Attach Angles at **Stations -1** and **-4**. Reference **Parts Drawing** and **FIGURE 03A-05** for orientation of Rib flanges. Check for level alignment of upper and lower Rib flange with Wing Spar extrusion. A slight misalignment can be corrected by moving the Rib up and down slightly. Check that the Rib is 90-degree to the Spar. Bend flange if required. Transfer drill #40, 3 holes each through Attach Angles on Spar and cleco. Drill out to #30. Transfer drill Rib to Spar to #30 (4 holes per rib). ***IMPORTANT:*** *Use a sharp drill bit when drilling through the Spar and do* ***NOT*** *apply too much pressure. You will not be able to take the Spar apart for deburring.* Take apart and deburr all parts. Rivet each Rib to the Spar. Rivet each Rib to Attach Angles.

6. Install the **Station -1** to **-4** aft Ribs. Reference **Parts Drawing and FIGURE 03A-06**. These Ribs will form the aft step area. You will need the Ribs (KPWI0396) from the previous steps. They should have Stiffeners already installed as described above. ***NOTE:*** *The flanges of all 4 Ribs face to the root.* Start by installing Rib at **Station -4.** Check alignment of Rib flanges to Spar Caps. Correct as required and transfer drill all 7 holes to #30. ***IMPORTANT:*** *An angle drill will be required.* Rivet Rib to Angle as shown. Repeat for Ribs from **Stations -3** to **-1.** Work from tip to root of the Wing.

7. Install aft Rib at **Station -5** (KPWI0396). The rib flange must face to the root. The Rib mounts to the tip side of Attach Angle. ***IMPORTANT:*** *The rivet must be installed with the head inside the tank bay area. File the rivet mandrel flush with the rivet head if needed.*

> ***CAUTION:*** *Do not knock the mandrel back into the rivet. This will weaken the structure and may result in failure.*

8. Install Nose Rib at **Station -5** (KPWI0407). Refer to **Parts Drawing** and **FIGURE 03A-08**. Cleco Rib to tip side of Attach Angle with Rib flanges facing to the root. Adjust Rib position up and down if required. Drill # 30 and cleco. Transfer drill #40, 3 holes each through upper and lower clip. Drill out to #30. Rivet Rib to Angle. Rivet Rib to Clips.

9. Install Nose Rib (KPWI0394) and Skin Stiffener (KPWI0434) at **Station -6**. Refer to **Parts Drawing.** ***NOTE:*** *The Nose Rib flange faces on both wings to the tip, but the Skin Stiffener flange faces on the right wing to the tip and on the left wing to the root.* The Nose Rib should have been modified earlier to clear the spar extrusion. Cleco the parts in place as shown. Drill all holes to #30. ***IMPORTANT:*** *The bottom 6 rivets must be installed with the head inside the tank bay area.* Install rib clips as shown in **Parts Drawing.** ***IMPORTANT:*** *Do* ***NOT*** *rivet through the top 2 holes. This is where the Skin Stiffener (KPWI0434) attaches in a later step.* Refer to FUEL TANK BAY AREA ASSEMBLY.

10. Install nose and aft rib at **Station -7** (KPWI0394/ KPWI0397). Refer to **Parts Drawing** and **FIGURE 03A-10**. The Nose Rib should have been modified earlier to clear the spar extrusion. All rib flanges must face to the tip. Cleco ribs to **pre-drilled** holes in spar. Adjust up and down as required. Drill all holes to # 30. Rivet AAPQ-43 (8). Install rib clips at **Station -7** as shown in **Parts Drawing.**

11. Install nose and aft ribs to **Station**s **-8, -9,** and **-10** (KPWI0394/ KPWI0397). Refer to **Parts Drawing** and **FIGURE 03A-10**. All rib flanges must face towards the tip.

12. Cut Rib Attach Angles (KPWI0387) into 2 pieces per **FIGURE 03A-12**. Install Rib Attach Angles, Nose Ribs (KPWI0395), and aft ribs (KPWI0398) to **Station -11** and **-12**. Reference **Parts Drawing** and **FIGURE 03A-12A**. Cleco ribs and angles to **pre-drilled** holes in tip spar channel. Ribs attach to tip side of angles and all rib flanges must face to the tip. Check fit and alignment. Drill all holes #30. Rivet angles to spar using AAPQ-42 and ribs to angles using AAPQ-41.

13. If Optional Pitot/Static or Strobes are to be installed, check with the respective installation pages before proceeding.

FUEL TANK BAY AREA ASSEMBLY

All wing ribs must be straightened. Use fluting pliers at fluted locations. Check on flat table. It is also important that the rib flanges are straight. Use padded pliers to flatten flanges if necessary. As stated under general, it is very important that all metal edges are smooth. It is recommended to deburr, smoothen, and polish all edges.

1. Install tank bay channel (KPWI0435), tank rib attach angle (KPWI0438) and tank rib (KPWI0436). Reference the **Parts Drawing and FIGURE 03B-04.** Cleco the wing channel with its flanges facing aft toward the 2 each **pre-drilled** holes in the aft ribs at **Station -5** and **-7.** Check alignment of upper and lower channel flanges with rib flanges (use straight edge across parts to check). If required move channel up or down and bend channel flanges for perfect fit. If required to move the channel up or down you can elongate the **pre-drilled** holes in the ribs slightly to allow the movement.
2. Check distance between channel and wing spar web. It should allow the corresponding tank to fit.
3. Transfer drill 7 holes each # 40 through channel into ribs.
4. Cleco tank rib attach angle to back side of wing channel. Transfer drill #40 through the top 2 holes of attach angle, and channel into the skin stiffener. Make sure the skin stiffener is straight and fits with channel flange and rib flanges for flush fit of upper skin (use straight edge to check).
5. Cleco the tank rib to rib attach angle as shown. Check alignment of all parts and tweak as required. Drill all holes out to # 30, take apart, and deburr. Rivet as shown. Pay closed attention to the rivet direction as shown in the parts drawing.
6. If rivet mandrels extend into the tank bay, file them flush with the rivet heads.

CAUTION: *Do not knock the mandrel back into the rivet. This will weaken the structure and may result in failure.*

TRAILING EDGE SPAR ASSEMBLY AND INSTALLATION

1. Cleco and clamp angle reinforcement (KPWI0428) to the root end of the spar. Reference **FIGURE 03C-01**. Verify flush fit of angle - flange to upper spar – flange. Remove cleco if required (hole is not critical) for flush fit. Bend angle flange to fit spar if required as shown.

2. Transfer drill #40 all holes through spar in angle. Cleco as you go and make sure the angle fits perfect.

3. Cleco plates (KPWI0427/ 426) as shown in **FIGURE 03C-03** to angle and spar. Transfer drill all remaining holes through the spar in plate KPWI0427. Do not drill to #30 or rivet at this time.

4. Modify the spar reinforcement plate (KPWI0441) as shown in **FIGURE 03C-04**. One will be used for the right and one for the left spar. ***NOTE:*** *The parts are symmetrical.* Place plate in spar (aft side), center cutout on plate on spar cutout. Bend upper flange to fit spar if required. Transfer drill #40, cleco, drill out to # 30 and cleco. File the cutout to match the cutout in the spar if required. Take apart, deburr, and rivet using AAPQ-42 rivets.

5. Draw a centerline along each lower aft rib flange as shown in **FIGURE 03C-05**. Cleco the trailing edge spar with plates and angle at the root end to the aft ribs. Transfer drill (3 each) lower holes #40 through the spar in the ribs. Use a small wooden block to press the rib flange firmly to the spar when drilling. Reference **FIGURE 03C-05**. ***NOTE:*** *The ribs at station **-1** to **-7** each receive 1 additional rivet at their upper aft flange.* The ribs must be transfer drilled through the spar in these locations. In addition, the ribs at **Station -1** and **-2** each receive 2 additional rivets at their lower aft flange. These holes must be transfer drilled through plate and aft spar.

6. Cut apart the Hinge Support – Aileron & Flap (KPAL0088) per **FIGURE 03C-06**. ***IMPORTANT:*** *Be sure to mark the parts as shown. Do **NOT** loose the individual parts.* Clamp Flap Hinge Support (KPAL0088) in place using a piece of hinge as a spacer as shown in **FIGURE 03C-06A**. Drill and cleco #30.

7. Drill out all holes in aft spar and aft ribs to # 30, Drill out the 3 holes receiving a bolt in plate KPWI0426 to # 11. Double check before drilling that you identified the correct holes. Refer to **FIGURES 03C-06A** and **03C-07**.

8. Remove aft spar and all root attach parts. Deburr all parts and cleco back in place. Rivet and bolt as required.

BELLCRANK AND PUSH PULL TUBE INSTALLATION

1. Assemble inner and outer bell cranks. Cleco and rivet bell crank and bearing flanges together. Remember to insert the bearings. See **FIGURE 03D-01** for proper part and rivet orientation. ***NOTE:*** *Paired bell cranks are mirror images of each other.* Notice which side of the bell crank each bearing flange is riveted to.
2. Cut the aluminum bushings to 0.53" for proper fit. Be sure that the ends of the bushing are cut square.
3. Assemble inner and outer bell crank assemblies. Install thin washers to remove any gap between the bell crank assemblies and the brackets. Ideally, the bell crank pairs should be parallel to each other when bolted to the rod ends. Reference the parts manual. Refer to **FIGURES 03D-03** and **03D-03A**.
4. Assemble aileron push-pull tubes as per parts manual. ***IMPORTANT:*** *Make sure that you use stainless steel rivets.* Install a rod end, with stop nut, in each end.
5. Fabricate rigging pins as per **FIGURE 03D-03A** from supplied stainless steel rod. Pin inner and outer bell cranks in neutral position. Adjust rod ends evenly at both ends of outer push-pull tube (long one) to fit between inner and outer bell cranks. Lock in place with the stop nuts.

> ***CAUTION:*** *Rod ends must have a* ***minimum of 10 threads engaged*** *into the end fittings.*

6. Check fit, and remove for rib installation. After ribs are installed, control rods can be installed and hardware tightened.

FUEL TANK INSTALLATION

- All protruding rivet mandrels in fuel bay area must be ground flush.

> ***CAUTION:*** *Do not knock the mandrel back into the rivet. This will weaken the structure and may result in failure.*

1. Cut openings in each tank for Pick-Up Tube, Vent Tube, and Drain Fitting. Refer to **FIGURES 03E-01** thru **01B** for locations. ***HINT:*** *A Uni-Bit works very well.* Rinse tanks out with water to remove drillings and foreign matter.
2. Place the tank inside the wing frame. ***HINT:*** *Installation is easiest by rotating in from the bottom*.
3. Check alignment of tank in frame.
   - The tank should be aligned with the wing spar
   - Tank is designed to float within the fuel tank bay. No attachment is required to the spar or fuel tank bay.
   - The top of the tank should be no higher then the top flange of the wing ribs
   - The bottom of the tank should be no lower than the lower rib flange. Clamp multiple straight edges across the two outer ribs to assure this.

INSTALLATION OF FUEL TANK AND FITTING INSTALLATION

4. Make sure that outer ribs are firmly in contact with tank sides. Possibly hold with tape to tank for drilling of wing skins.
5. Cut openings for fuel tank drain and vent tube in lower wing skins. Fabricate templates from clear plastic material or Lexan. ***HINT:*** *Use the Vertical Stab jigs (KPVS0081, KPVS0082) for this.* The templates are used to transfer the hole locations to the bottom skin. Reference **FIGURE 03E-05** and **FIGURE 03E-05A**. ***IMPORTANT:*** *Remove the tanks before drilling the skins.*
6. Before the fuel drain fittings are installed, they must be modified by cutting a slot and drilling out to 3/8” per **FIGURE 03E-06**. Fabricate the tool shown to fit in slot of fitting. ***HINT:*** *It is easier to install the fittings with the tank removed from the Wing.*
7. Modify fuel pickup tube as shown in **FIGURE 03E-07**. ***HINT:*** *Drill #30 first. Final drill #11.*

8. Install fuel pickup tube. Orientation will be as shown in **FIGURE 03E-08**. Use Loctite to secure nuts on fittings. Reference **FIGURE 03E-08A** for installation of fittings into tank. ***NOTE:*** *It is very important that you follow the installation guide for the fuel pick up tube as per* ***FIGURE 03E-08B****.* ***HINT:*** *Hold the steel washer with needle-nose Vise-Grips to prevent the rubber washer from turning and pushing out.*

9. Install drain fitting and vent tube. Modify vent tube per **FIGURE 03E-09** before installation. ***HINT:*** *Hold the steel washer with needle-nose Vise-Grips to prevent the rubber washer from turning and pushing out.*

10. Remove the Rubber Gasket and Plastic Baffle from the Fuel Cap. The Plastic Baffle will “snap” out of the Fuel Cap. A screwdriver works well for the removal. Locate and drill a #30 hole 1/4” from the center of the plastic baffle. Refer to **FIGURE 03E-10**. Drill through the Plastic Baffle and Rubber Gasket. Deburr. Detach the Rubber Gasket from the Baffle. Note the orientation of the Rubber Gasket.

12. Assemble the Bead Chain to the Bead Chain Retainer Sleeve. Install the Bead Chain and Retainer Sleeve through the topside of the Baffle and pull tight. Push the Chain though the drilled hole in the Rubber Gasket. Re-install the Rubber Gasket to the Baffle. Be sure the Chain is pulled tight. “Snap” the Rubber Gasket and Baffle back into the Fuel Cap.

13. Install the Bead Chain End Coupling onto the Bead Chain. Find the center of the Plastic Retainer and drill a #30 hole. Using the 1/8” Small Brass Washer, rivet the Plastic Retainer to the Bead Chain End Coupling.

14. Close filler neck, vent, and pick up tube and pressure test the tank to 1.5 psi. ***CAUTION:*** *Do* ***NOT*** *over pressurize.* Apply soapy water to fittings for leak detection.

15. Temporarily cleco the lower wing skins in place to verify that the cutouts are correct and provide the required clearance to the fittings.

WING SKIN INSTALLATION

- Wing assembly must be performed on a flat work surface. Assembly on a warped surface will result in a warped wing
- Sandbags will be required in parts of the assembly to hold the wing flat to the work surface
- Wipe all parts down with acetone to remove markings before assembly
- All parts must have their edges polished smooth before installation to avoid cracking in service.

SKIN STIFFENERS

1. Modify skin stiffeners (KPWI0439, 0440, 0452) as shown in **FIGURE 03F-01**.
2. Lay your aft skins (KPWI0446, 0450) on a flat table with the inside surfaces facing upward.
3. Position the stiffeners on the wing skins as shown in the **FIGURE 03F-03**.
4. Cleco the stiffeners in place and transfer drill #30.
5. Disassemble, deburr, and reassemble.
6. Rivet together using the rivets called out in the **Parts Drawing.**
7. Leave out rivets closest to the tank bay on the bottom skin to allow for fitting of the tank cover in a later step.

LOWER AFT WING SKIN

8. Place a wing frame assembly upside down on your level work surface.
9. Position 3” wooden blocks under the front and aft spar. Check that the front and aft spars are level with each other. Screw the blocks to the table. ***HINT:*** *Use 6 blocks total; 3 under each spar.*
10. The spars must also be square with each other. There are alignment holes in the forward and aft spars at several places along the length of the spars. A rod placed through these holes from one spar to the other should be exactly 90-degrees from the spars. An easy way to do this is to use the square edges of your table. Align the aft spar with one edge of the table and a rod through the inboard holes with another. You can hang plumb bobs from the rod and trailing edge to marks on the table for greater accuracy. See **FIGURE 03F-10**.
11. Place sand bags over the blocks in places that will not interfere with the placement of the wing skin (i.e. - lightning holes, etc). Clamp or screw the frame to the table.

12. Lay the lower aft skin (KPWI0450) in place on the top of the inverted wing frame with the stiffeners toward the wing frame.
13. Cleco the trailing edge of the wing skin to the trailing edge of the aft spar.
14. The skin should not quite fit up against the joggle on the spar. There should be approx 0.1” gap between the edge of the skin and the joggle.
15. Check that the lines previously drawn on the centerlines of the ribs are visible through the holes in the skin.
16. Transfer drill #40 and cleco in to the ribs starting at the aft spar in the center and working outward in a fan pattern across the skin.
17. Place the tank cover (KPWI0451) in place on the lower skin. If the holes do not line up flip the skin until proper alignment is achieved.
18. Slide lower aft tip skin (KPWI0455) between the aft rib and lower skin at the tip and cleco into place. The wide section with the slot should face aft.
19. Transfer drill and cleco the skins to the ribs #30.
20. Modify hinges as shown in **FIGURES 03F-20** and **03F-20A**.
21. Drill the aft skin to the aft spar #40 and cleco.
22. Draw a centerline on the hinge flanges.
23. Drill a #40 hole, 1/4” from the outboard edge of the flap hinge.
24. Find the hole in the aft spar 54.5” from the outboard edge of the bottom skin. This is the furthest outboard hole of the flap hinge. Cleco through this hole into the hole in the flap hinge. Be sure that the orientation of the hinge is correct.
25. Clamp the hinge in place using cleco clamps. Verify that the centerline drawn on the hinge is visible through the holes in the aft spar.
26. Transfer drill #40 and cleco.
27. You will need to extend the hinge to inboard edge of the spar using a short piece of scrap hinge. To properly align the piece you will need to use another short piece of hinge pinned to both the clecoed flap hinge and the filler piece. Refer back to **FIGURE 03F-20**.
28. Drill a #40 hole, 1/4” from the inboard edge of the inboard aileron hinge.
29. Pin the hinges to the aileron. Double check that the hinges are properly oriented on the aileron.
30. Support the aileron on blocks in the proper location behind the wing.
31. Find the hole in the aft spar 53.1” from the outboard edge of the bottom skin. This is the furthest inboard hole of the inboard aileron hinge. Cleco through this hole into the hole in the aileron hinge. Be sure that the orientation of the hinge is correct.

32. Align the outboard aileron hinge with the holes in the aft spar. Verify that the centerline drawn on the hinge is visible through the holes, transfer drill #40 and cleco.

33. Draw a line on the aileron hinge doublers as shown in **FIGURE 03F-33**. Position aileron hinge doublers as shown.

34. Holding the doubler in place with a small wooden block, transfer drill the hinge to the spar to the doubler #40.

35. Drill all holes in the aft spar and doubler #30 and cleco.

UPPER AFT WING SKIN

36. Remove clamps and screws from the blocks supporting the wing structure.

37. Rotate the wing in place over the table to expose the top of the wing. Before setting the wing down position the blocks under the front and aft spars in a manner to avoid contact with the clecos holding the bottom skin in place. The blocks should be supporting the wing without distorting the bottom skin.

38. Screw the blocks in place. The wing can be kept from shifting on the blocks by drilling through the aft spar into the blocks and pinning in place with clecos.

39. Place sand bags over the blocks in places that will not interfere with the placement of the wing skin (i.e. - Lightning holes, etc.). Clamp or screw the frame to the table.

40. Install wire for fuel sender as shown in **FIGURE 03F-40**.

41. Lay the upper aft skin (KPWI0446) in place on the top of the wing frame with the stiffeners toward the wing frame.

42. Cleco the trailing edge of the wing skin to the trailing edge of the aft spar.

43. The skin should not quite fit up against the joggle on the spar. There should be approx 0.1” gap between the edge of the skin and the joggle.

44. Check that the lines previously drawn on the centerlines of the ribs are visible through the holes in the skin.

45. Transfer drill #40 and cleco in to the ribs starting at the aft spar in the center and working outward in a fan pattern across the skin.

46. Slide upper aft tip skin (KPWI0456) between the aft rib and upper skin at the tip and cleco into place. The narrow section should face aft.

47. Transfer drill and cleco the skins to the ribs and aft spar #30.

LEADING EDGE WING SKIN

48. Draw a straight-line 0.45” from the joggle, on the forward spar, on the top aft skin. This will be a reference line for mounting the leading edge skin.

49. Remove clamps and screws from the blocks supporting the wing structure.

50. Rotate the wing in place over the table to expose the bottom of the wing. Before setting the wing down position the blocks under the front and aft spars in a manner to avoid contact with the clecos holding the top skin in place. The blocks should be supporting the wing with out distorting the top skin. See **FIGURE 03F-50**.

51. Be sure the wing is positioned to allow the leading edge skin to extend over the edge of the table while aligning it to the forward spar.

52. Screw the blocks in place. A wedge may be needed at the aft spar location to keep from stressing this skin where the blocks are located. Also attach stops to the blocks to keep the wing from sliding of the blocks under the front spar. Refer back to **FIGURE 03F-50**.

53. Using a file remove any edges from the forward ribs that may put dimples in the leading edge skin.

54. Draw a straight-line 0.45” from the joggle, on the forward spar, on the bottom aft skin. This will be a reference line for mounting the leading edge skin.

55. Plot a line from the center of the holes along the inboard rib to cross the line drawn parallel to the spar joggle.

56. Drill a #40 hole where these lines cross.

57. Cleco the leading edge skin (KPWI0445) to the wing using this hole. Position the skin so the line drawn in the previous step is visible through the holes along the edge of the skin. Cleco clamp the outboard edge of the skin to the outboard rib.

58. Use masking tape along the trailing edge of the skin to help hold it in place while drilling.

59. Start drilling the leading edge skin through the aft skin and into the spar #40, working inboard to outboard. Use a board to hold the skins flat to the spar and ribs while drilling.

60. Cleco the skin in place as you drill. Check frequently to insure the skin is still on the line while drilling.

61. Position the ribs to make the line drawn on them visible through the holes in the skin. Use masking tape to hold them in place while drilling.

62. Drill #40 and cleco the skin in place working from the spar forward.

63. Drill all of the holes in the leading edge skin, ribs and spar, on the bottom of the wing #30 and cleco.

64. Remove clamps and screws from the blocks supporting the wing structure.

65. Rotate the wing in place over the table to expose the top of the wing. Before setting the wing down position the blocks under the front and aft spars in a manner to avoid contact with the clecos holding the bottom skin in place. The blocks should be supporting the wing with out distorting the bottom skin.

66. Screw the blocks in place. The wing can be kept from shifting on the blocks by drilling through the aft spar in to the blocks and pinning in place with clecos.

67. Use strapping tape attached to the leading edge skin alongside of the pre-drilled rib holes, to pull the skin back into position. Stick the tape strips to the aft skin. Do this in small steps as not to wrinkle the skin. Keep loosening and tensioning the tape until the skin lays flat against the ribs.

68. Once the skin is in place position the ribs until the lines are visible through the holes in the skin. Use tape to hold them in place if necessary.

69. Starting at the middle rib, drill #40 and cleco from the leading edge to the spar. Then drill #40 and cleco along the spar out from the middle rib until you get to the next rib. Then repeat these steps until you reach the ends of the wing.

70. Bend Leading Edge Tip Skin (KPWI0457) per **FIGURE 03F-70**. Slide leading edge tip skin between the forward rib and leading edge skin at the tip and cleco into place.

71. Drill all of the holes in the leading edge skin, ribs and spar, on the top of the wing #30 and cleco.

FUEL TANK SKIN PANEL / TORQUE ANGLE

72. Fabricate torque angle from supplied raw stock angle material. The angle will capture one more rivet outside the skin panel to the aft and 3 rivets to the front of the main spar as shown. The edge distance in either direction should be 0.3”. Refer to **FIGURE 03F-72**. Bend the angle to follow the shape of the lower wing surface using two wooden blocks as shown. Move the point where the pressure is applied on the edge of the wooden block for a smooth bend. Doing that the angle will curve a little sideways. Mark forward side, the required length, cut angle off and modify both angle flanges as shown in **FIGURE 03F-72**.

73. Mark the centerline on the angle as shown in **FIGURE 03F-72**. The angle will be warped a little from forming. Average the error when marking with a straight edge. Try to maintain a 1/4” edge distance.

74. Place the torque angle on the skin panel in the way it is to be installed. Refer to **FIGURES 03F-74** and **03F-74A** to insure proper orientation. Place reference marks on the parts so they can be aligned after removal.

75. Remove fuel tank skin panel. Place angle on outside of panel with centerline centered on pre-drilled holes. Make sure forward side is forward and the angle direction is correct. Transfer drill angle through skin panel.

76. Rivet angle to the outside of skin panel. ***IMPORTANT:*** *Rivets will install from the inside to the outside of the wing*.

77. Cleco skin panel and angle to the wing. Drill the remaining holes in the angle as shown in **FIGURES 03F-74** and **03F-74A**. You will need a #30 hole finder to accomplish this

ACCESS PANELS

There are two types of access panels used.

- The oval shaped panel is screwed in place and can be easily removed for inspection purposes.

- The smaller, round panel is riveted in place and will only have to be removed for repairs.

78. Position the rings and panels on the wing skins as shown in **FIGURE 03F-78**. If the skin is curved at the place where the panel is to be installed, form the ring and panel to match the curve.

79. Cleco the rings in place and transfer drill final size.

80. Disassemble, deburr, and reassemble.

FINAL ASSEMBLY

1. Disassemble wing. Clean and debur all parts.
2. Place the wing frame upside down on the blocks screwed to your table.
3. Install fuel tank. See **INSTALLATION OF FUEL TANK AND FITTING INSTALLATION**
4. Cleco the lower, tank and leading edge skins to the frame.
5. Position the hinges and hinge support brackets and cleco in place.
6. Rivet the skins to the frame using the same fan pattern used to drill them. Refer to **FIGURE 03G-06**. ***IMPORTANT:*** *Do* ***NOT*** *rivet the skins to the tip rib.* This will be done at the installation of the wing tips.
7. Rotate the wing on the table.
8. Cleco the top skin in place. Make sure you have fit the Fuel Scupper in place before final riveting.
9. Use strapping tape to pull the leading edge skin back into place.
10. Cleco leading edge skin in place.
11. Rivet the skins to the frame using the same fan pattern used to drill them. See **FIGURE 03G-11**.

FUEL SCUPPER

12. Position Fuel Scupper centered over Fuel Tank Filler Neck. Mark and trim the Scupper to fit over Filler Neck.
13. Trim upper edge on Scupper to scribe line. ***NOTE:*** *When trimmed the upper edge of the Scupper will fit into the Spacer with 1/8" gap all around.*
14. Cleco Scupper Retainer Ring and Spacer to underside of Wing Skin.
15. Transfer drill #30.
16. Disassemble, deburr, and re-assemble with Scupper sandwiched between Wing Skin and Retainer Ring.
17. Rivet assembly together.
18. Smear sealant between the Scupper and base of Filler Neck. RANS uses DOW 730 Solvent Resistant Sealant

WING TIPS

19. Trim the wing tips to the trim-line and notch the tips to clear the spars when inserted into the wing allowing for approximately 1/2" extension past the wing skins. ***NOTE:*** *The aft tip should lay flat against the tip extension when properly trimmed.*
20. Open up the trailing edge of the wing to accept the wing tip. Hold a wooden block firmly against the trailing edge and roll a 3/8" tube inside the bend to open it up.
21. To help the fit at the trailing edge you may have to split the trailing edge of the tip to within 3/4" of the outboard edge of the tip. Remove a "V" shaped piece of material to allow the edge to reduce in radius. Stop drill the corner of the "V" to reduce the chance of cracking.
22. Use tape pulled on the bias to pull and hold the tip in position while drilling and clecoing #40. Use a hole-finder to drill for the spar extension.
23. Place a piece of tape along the joggle of the aft tip. Mark a line 1" back from the joggle. This will be used as a reference line for trimming the forward tip.
24. Place the forward tip in position and pull forward into the leading edge until the there are no more gaps at the leading edge. Secure with tape on the bias to hold forward tension on the tip.
25. Drill and cleco #40 starting at the leading edge and working back toward the aft tip. Stop when you are about 8" from the aft tip.
26. Measure 1" forward from the reference line on the aft tip and place a line on the forward tip. This line should be directly above the joggle. Remove tip, trim to the line and replace tip.
27. Continue to drill and cleco in place. Use a hole-finder to locate the holes for the spar extension.
28. Remove tip and trim the edge to 1/2" past the rivet holes.
29. Re-install the tips with the stiffener strips in place. Double stick tape can be used to hold the strips in place until the tip is clecoed into place.
30. Drill and cleco #30.
31. If strobes are to be installed go to **OPTIONAL STROBE INSTALLATION** before riveting.
32. Deburr tips, spar extensions, and wing tips. Re-install and rivet into place.

OPTIONAL PITOT/STATIC SYSTEM INSTALLATION

- All parts must have their edges polished smooth before installation to avoid cracking in service.
- Installation of Pitot/Static Assembly and tubing must be completed before Wing Skin is final installed.

1. Become familiar with the Optional Pitot/Static Mount Installation **Parts Drawings** and collect the parts shown in the drawings. The Optional Pitot/Static System mounts in the Right Hand Wing on the Outer Round Inspection Panel forward of the Fuel Tank.
2. Modify the Mount Plate as shown in **FIGURE 03H-02**.
3. Fabricate Fairing per **FIGURE 03H-03**.
4. Locate Mount Brackets to Fairing per **FIGURE 03H-04**. Transfer drill #11. Bolt Mount Brackets to Fairing. ***NOTE:*** *Do* ***NOT*** *tighten the bolts at this time.*
5. Transfer drill #11 through Mount Brackets and Mount Plate per **FIGURE 03H-05**. Bolt Mount Brackets to Mount Plate.
6. Cut Blue and Black Fuel Line into 1” lengths and slip over the Pitot/Static Assembly per **FIGURE 03H-06**. Slide the Pitot/Static Assembly into the Fairing from the bottom. Make sure the Assembly is inserted no farther than the dimension referred to on **FIGURE 03H-06**. Trim the top end of the tubes per **FIGURE 03H-06** and deburr. Tighten bolts to retain Pitot/Static Assembly in the Fairing.
7. Slip Union Elbows onto top of Pitot/Static Assembly. Route Pitot/Static Line through the Forward Wing Ribs per **FIGURE 03H-07**.
8. Install Pitot/Static System to bottom of Forward Wing Skin with supplied Pan Head Screws. ***IMPORTANT:*** *During final Wing assembly check for clearance between Pitot/Static Assembly and Push-Pull Tube.*

OPTIONAL DYNON PITOT/STATIC SYSTEM INSTALLATION

- All parts must have their edges polished smooth before installation to avoid cracking in service.
- Installation of Pitot Probe Assembly and tubing must be completed before Wing Skin is final installed.

WING

1. Become familiar with the Optional Dynon Pitot/Static Mount Installation **Parts Drawings** and collect the parts shown in the drawings. The Optional Dynon Pitot/AOA Probe mounts in the Right Hand Wing on the Outer Round Inspection Panel forward of the Fuel Tank.
2. Modify the Dynon Probe Mount per **FIGURE 03I-02**. ***IMPORTANT:*** *Use caution when drilling the holes, ensuring that you avoid drilling into the Pitot and AOA pressure lines. As long as you do not penetrate these lines, you may drill all the way through the outer metal without affecting the probe's waterproofing.*
3. Install Dynon Probe Mount to Cover Plate. Install the probe to the Probe Mount and seal gaps with silicone sealant per **FIGURE 03I-03**.
4. Temporarily fit Dynon Probe Assembly to wing. Check for clearance of the Pitot and AOA lines to the aileron push-pull tube. ***NOTE:*** *Lines may be trimmed or bent as needed. Refer to Dynon Installation Instructions for cautions.*
5. Slip Reducer Couplings onto the Pitot and AOA lines. Refer to **FIGURE 03H-07** and route lines through the Forward Wing Ribs.
6. Install Dynon Probe Assembly to bottom of Forward Wing Skin with supplied Pan Head Screws. ***IMPORTANT:*** *During final Wing assembly check for clearance between Pitot and AOA lines and Aileron Push-Pull Tube.* Connect Pitot and AOA lines to flight instrumentation.

FUSELAGE

7. Become familiar with the Optional Dynon Pitot/Static Mount Installation **Parts Drawings** and collect the parts shown in the drawings. The Optional Dynon Static System installs in the Fuselage Tailcone.
8. Find the rivet location shown in **FIGURE 03I-08** and install rivet. Push center mandrel out of rivet with a click-punch or similar tool. Placard as "STATIC PORT - KEEP OPEN".
9. Connect 1/8" Line to protruding rivet body on inside of Tailcone and secure with safety wire. Connect 1/8" Lines together with 1/8" Tee. Route Static Line through Bulkheads using Grommets provided and connect to static side of flight instrumentation. Refer to **FIGURE 03I-08**.

OPTIONAL AVEO STROBE INSTALLATION

- This operation may be performed on two padded sawhorses.
- All parts must have their edges polished smooth before installation to avoid cracking in service.
- Installation of wire must be completed before Wing Skin is final installed.

1. Position all parts on the table in the order they appear in the **Parts Drawing**. Become familiar with the parts and the way they go together.
2. Modify all Nose Ribs per **FIGURE 03J-02**. Deburr and install grommets. ***NOTE:*** *The Strobe wires may use the same grommet locations, on some of the ribs, as used for the Pitot/Static lines and Fuel Sender wires.*
3. Modify the Wing Tip Stiffener per **FIGURE 03J-03**. Deburr and attach clamps, but do not tighten until Strobe wires are installed.
4. Locate wire routing hole in Fuselage after fitting up wings. Deburr and install grommet.
5. Route wires in wing and out to tip. Leave extra length to reach through the Wing Tip and Fuselage.
6. Position the Strobe Mount Plates centered inside the flat area of the Wing Tip. Be sure the Strobe will be straight when mounted. Transfer drill and cleco the Mount Plate to the Wing Tip. Refer to **FIGURE 03J-06**.
7. Use a Dremel tool to remove the Wing Tip material inside the Mount Plate for the wires. ***NOTE:*** *Use the Dremel tool as a router to obtain a clean opening.*
8. After painting of Wing Tip, Mount Strobes to Wing Tip and connect wiring. Route wire through Fuselage Grommet when installing Wing to Fuselage.

WING TRANSPORT AND INSTALLATION

WING TRANSPORT RACK

1. When your S-19 Venterra is complete the Wings will need to be transported to the airport.
2. Construct the Wing Transport Racks as shown in **FIGURES 03K-02** thru **03K-02C**.
3. The Transport Racks may be screwed down to a trailers wooden deck as needed for transport to the airport and are even handy to store the wings in until ready for mating to the Fuselage.

WING INSTALLATION

- Wipe all parts down with acetone to remove markings before assembly
- All parts must have their edges polished smooth before installation to avoid cracking in service.

4. Become familiar with the wing installation **Parts Drawings** and collect the parts shown in the drawings.
5. Have several people help you to hold the wing in place.
6. Clean and wipe the mating surfaces of the wing, bolts and fuselage with light oil.
7. Slide the wing into the fuselage being careful not to allow the wing lugs to come in contact with the belly skins.
8. Once the wing is aligned in the proper location, push a bolt in to the top and bottom lug of the main spar to hold the wing in place. ***NOTE:*** *Each wing must be supported until both wings are installed.* Install all main spar hardware.
9. Fabricate the Wing Incidence jigs per **FIGURES 03K-09** thru **03K-09C**.
10. Refer to **FIGURE 03K-10** and set the wing incidence angle. Drill #30 through the Rear Spar Attach Plates. Cleco and double check incidence. Adjust as needed and step drill to final ream size of 0.249”. Install hardware.
11. Connect aileron controls, flap controls, fuel lines, electrical connections, etc. Refer to **SECTION 15 – PREPARATION FOR FLIGHT** for rigging directions.

04 - FLAP AND AILERON ASSEMBLY

FLAP AND AILERON ASSEMBLY

FLAP ASSEMBLY

- Flap assembly must be performed on a flat work surface. Assembly on a warped surface will result in a warped Flap
- Sandbags will be required in parts of the assembly to hold the Flap flat to the work surface
- Wipe all parts down with acetone to remove markings before assembly
- All parts must have their edges polished smooth before installation to avoid cracking in service.

1. Position all parts on the table in the order they appear in the **Parts Drawing**. Become familiar with the parts and the way they go together.
2. ***IMPORTANT:*** *Position the thicker rib to the inboard end of the flap.* The inboard rib is different from the other ribs in that it has odd bends to accommodate the shape of the fuselage.
3. Draw a line on the Hinge centerline as shown in **FIGURE 04-03**. This will be used to align the hinge holes later in the assembly.
4. Align the Flap Hinge on the Spar. Mark and drill the flap hinge material as shown in **FIGURE 04-03**. ***NOTE:*** *Remove the hinge from the spar to drill.*
5. Modify flap horn angle as shown in the **FIGURE 04-05**.
6. Cut apart the Plate Spar Reinforcement as shown in **FIGURE 04-06**.
7. Assemble the parts to the Spar using Clecos.
8. Transfer drill Reinforcement Angle and Doubler to the end Rib and Spar.
9. Place Hinge in its proper location. Space the Hinges off the table using .040" shims. ***HINT:*** *The Hinge stock is .040", so it makes a good shim.* Refer to **FIGURE 04-09**. Align the Hinge flush with the inboard end of the Spar. Trim the inboard edge to match the Spar. Place sand bags on the assembly to hold it flat to the table and transfer drill through the Hinge into the spar # 30. Cleco as you drill.
10. Transfer drill #30, all Ribs and Doublers to the Spar. Remove Clecos and debur all parts. Assemble parts using rivets shown in **Parts Drawing**.
11. Mark all Ribs down their centerline with a thin felt marker. While doing this check the Rib flanges for proper degree of bend by running a straight edge down several Ribs at once. The Rib flanges should lay flat against the edge, if they don't, adjust with soft jaw pliers or your fingers. Do **NOT** be too aggressive doing this. Take care not to damage the aluminum.

12. Roll the top forward edge of the Flap Skin by taping a 1.50" tube to the edge and rolling the tube aft while applying pressure downward as shown in **FIGURE 04-12**. Only roll the Skin far enough to achieve good fit to the forward Ribs.

13. Cleco the Skin to the Spar using the holes provided in the lower flange of the Spar. The Skin should be even with the edge of the Rib at the root end.

14. Lay the assembly flat on the table with the clecos facing upward. Check the bend at the trailing edge. If it is not bent enough you can increase the bend by placing a board on top of the trailing edge and pressing downward. ***IMPORTANT:*** *Do this with the Skin removed from the Spar and Ribs.* If you notice the Ribs creating a high spot at the trailing edge, file the Rib slightly to allow the Skin to lie more smoothly.

15. Starting at one end and working to the other, position the lines on the Ribs with the holes in the Skin. Transfer drill #40 and cleco. Turn the assembly over. Rest the Skin on 2X4 blocks as shown in **FIGURE 04-15**. Position the Skin so the aluminum bends over the trailing edge of the assembly evenly. Place some sand bags on top of the assembly to hold it down solid to the table. Place them on top of the Ribs and the Spar, being careful not to distort the skin. Continue to drill from the trailing edge moving forward and cleco the skin in place. Final size drill #30 and cleco.

16. Remove Skin, deburr, and rivet.

17. Modify Hinge Pins as shown in **FIGURE 04-17**.

18. Drill wing rear spar and secure pin with safety wire as show in **FIGURE 04-18**.

AILERON ASSEMBLY

- Aileron assembly must be performed on a flat work surface. Assembly on a warped surface will result in a warped aileron
- Sandbags will be required in parts of the assembly to hold the aileron flat to the work surface
- Wipe all parts down with acetone to remove markings before assembly
- All parts must have their edges polished smooth before installation to avoid cracking in service.

1. Position all parts on the table in the order they appear in the **Parts Drawing**. Become familiar with the parts and the way they go together.
2. ***IMPORTANT:*** *Position the thicker 1/4" ribs to the ends of the aileron.* The end ribs different from the other ribs in that they have an extra #40 hole at the aft tip of the rib.
3. Draw two lines on the spar at the rib locations approx. 10"-11" from each end of the spar as shown in **FIGURE 04A-03**. These will be used to align the hinges later in the assembly.
4. Trim and drill the aileron hinge material as shown in **FIGURE 04A-04 & 04A-04A**. Assemble the parts to the spar using Clecos.
5. Fabricate shim as shown in **FIGURE 04A-05**. Install between outboard forward rib and balance arm.
6. Transfer drill balance arm and doubler to the end rib #30
7. Place hinges in their proper locations. ***IMPORTANT:*** *The rivet spacing is different on the inboard and outboard hinge so take this into consideration.* Space the hinges off the table using .040" shims. ***HINT:*** *The hinge stock is .040", so it makes a good shim.* Align the hinges with the line drawn earlier on the spar. It should be in line with the first hole inboard on the hinges. Place sand bags on the assembly to hold it flat to the table and transfer drill through the hinge into the spar # 30.
8. Transfer drill all ribs and doublers to the spar #30. ***IMPORTANT:*** *Do **NOT** drill the nut plate rivet locations #30, these must remain #40.* Drill #11, the nut plate bolt locations and the nut plate rivet location closest to the bolthole in the doubler. (Drilling this rivet hole will act as a countersink to allow the aileron horn to pass the rivet head.) This is shown in **FIGURE 04A-08**.
9. Remove Clecos and debur all parts. Assemble parts using rivets shown in **Parts Drawing.** Refer to the rivet schedule, **FIGURE 04A-09**, for the Mass Balance end of the Aileron.
10. Install nut plates to spar using rivets shown in **Parts Drawing**.
11. Drill and install aileron horn as shown in **Parts Drawing**. Use a rod through the pivot holes in the aileron horn and the aileron horn plate to align them then transfer drill through the mounting holes in to the end rib. Debur and rivet.

12. Mark all ribs down their centerline with a thin felt marker. While doing this check the rib flanges for proper degree of bend by running a straight edge down several ribs at once. The rib flanges should lay flat against the edge, if they don't they can be adjusted with soft jaw pliers or your fingers. ***IMPORTANT:*** *Do* ***NOT*** *be to aggressive doing this and take care not to damage the aluminum.*

13. Roll the top forward edge of the aileron skin by taping a 1.50" tube to the edge and rolling the tube aft while applying pressure downward. Refer back to **FIGURE 04-13**. Only roll the skin far enough to achieve good fit to the forward ribs.

14. Cleco the skin to the spar using the holes provided in the top of the spar. The skin should be even with the edge of the balance arm at the tip end.

15. Lay the assembly flat on the table with the clecos facing upward. Check the bend at the trailing edge, if it is not bent enough you can increase the bend by placing a board on top of the trailing edge and pressing downward. Do this with the spar and ribs removed.

16. Starting at on end and working to the other, position the lines on the ribs with the holes in the skin. Transfer drill #30 and cleco. Turn the assembly over resting the skin on 2X4 blocks. Refer back to **FIGURE 04-15**. Position the skin so the aluminum bends over the trailing edge of the assembly evenly. Place some sand bags on top of the assembly to hold it down solid to the table. Place them on top of the ribs and the spar being careful not to distort the skin. Continue to drill and cleco the skin in place.

17. Remove skin, debur and rivet. Paint as desired. Balance Aileron per next section.

18. Modify hinge pins as shown in **FIGURE 04A-18**.

19. Drill wing rear spar and secure pin with safety wire as show in **FIGURE 04A-19**.

AILERON MASS BALANCING

- Aileron balancing must be performed on a flat work surface.
- Aileron must be final painted.

WARNING!
LEAD POISONING HAZARD

This aircraft contains Inorganic Lead which is for industrial and commercial use only. Misuse of this product will present a health hazard. Dust or fume created from handling or processing this product may be harmful if inhaled or swallowed. Chronic overexposure to dust and/or fumes may result in severe damage to blood forming, nervous, urinary, and reproductive systems.

Precautions:

- Do not eat, drink, use tobacco products, or apply cosmetics in work areas.
- Wash / shower thoroughly after handling and before eating, drinking, or using tobacco products.
- Dispose of water in compliance with Federal, State, and Local Regulations.
- Do not reuse empty containers.
- Avoid Dust / Fume Inhalation, swallowing of dust and contact with skin and eyes.
- Keep containers and material free of moisture

CAUTION: ***Wear rubber gloves and a particle mask when working with Lead.*** **Lead is a heavy metal and is dangerous for your health. Take care when working with Lead to clean up all shavings and to store Lead products out of reach of children.**

Warning: This requires you to melt Lead to 600+ degrees and pour it into a mold. Please use the appropriate safety equipment when performing this operation.

1. Position all parts on the table in the order they appear in the **Parts Drawing**. Become familiar with the parts and the way they go together.
2. Obtain all tools and material needed for Casting Lead Ballast Weights called out in the General Section of the Text Manual.

3. The mass balance weight may be fabricated by cast molding or layering Lead plates to the size shown in **FIGURE 04B-03**

CASTING LEAD

- Measure the appropriate amount of Lead using an accurate scale.
- Place the Lead in the Crucible on the Hotplate.
- Melt Lead and stir Flux into the Lead using the manufacturer's recommendations.
- Spoon off the slag and place in fireproof moisture-free container.
- Pour Lead into Mold and let stand for 30 min.
- Disassemble Mold and remove flashing from weight.

4. Drill Aileron Balance Horn and Balance Weights per **FIGURE 04B-04**. Temporarily install balance weight and retaining hardware.
5. Set Aileron on a sturdy flat table. Obtain 2 wood blocks and secure short lengths of hinge material to them with wood screws. Attach Aileron and balance. Refer to **FIGURE 04B-05**. If painting the Balance weight, re-check balance after painting.