



MANUAL OPERATION FLAP KIT ASSEMBLY MANUAL

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FLAP OPERATION

The maximum flap extension speed (V_{FE}) is **60 mph**. Do not extend the flaps above this airspeed. Airspeeds higher than this will begin to overstress the airframe and cause serious damage to aircraft.

The flaps have four positions they are 0, 10, 20 and 30 degrees. 0 and 10 degree settings can be used on takeoff. Settings higher than this cause significant drag increases and will reduce the performance of your aircraft. 0, 10, 20 and 30 degree settings can be used during descent and landing. The 30 degree setting will reduce your stall speed by 7-8 mph. The 10 degree setting on takeoff will increase your climb rates by 100-125 fpm. This flap setup has 3 sets of stops that will not allow the flaps to go to a negative angle. The first stop is a through bolt in the flap handle plate. The second stop is the u-bolt extensions preventing the handle from moving to the rear. The third stop is the keel tube. The cross tubes connecting the flaps will push against the keel tube and prevent negative angle settings.

Normal Takeoff with Flaps

- 1) Set flap angle to 10 degrees check to make sure the flap handle is properly seated in the 10 degree hole.**
- 2) Begin normal takeoff, rotate and climb as usual.**
- 3) When desired altitude has been reached return the flaps to the zero degree setting. When returning the flaps to zero you will notice an increase in airspeed and a decrease in lift. Be prepared for small losses in altitude.**

Normal Landing

- 1) Reduce airspeed below 60 mph**
- 2) Increase flap angle in increments of 10 degrees. Be prepared for a ballooning or altitude increase effect that can be corrected by pushing the stick forward.**
- 3) Increase flap angle and adjust power settings until proper approach angle is achieved.**
- 4) Decrease power flare and land.**

Descent angles will be significantly steeper. Care should be taken to maintain enough airspeed to allow for proper flare and touch down. Rotation and flare will be quicker than a no flap scenario. A 30 degree flap setting is similar to landing the aircraft with the engine shutoff. Descents are typically done at 50 - 55mph

Aborted Landing (Go Around)

- 1) Push throttle forward to the full power setting. Be prepared for the nose to rise, forward stick pressure will be required to keep the nose level. It is possible to stall the aircraft if action is not taken to keep the nose down.**
- 2) As airspeed increases reduce flap angle in small increments. Lift will be lost and the aircraft will tend to sink at first. Be sure that you have enough airspeed before retracting the flaps. Too much flap retraction all at once and low airspeed may cause the aircraft to settle to the ground.**
- 3) Continue flap retraction until desired altitude and airspeed are reached.**

Emergency Landing (Engine Out)

If runway surface and length permit do not use flaps. If you are coming into a rough short field use flaps. Use normal descent speeds of 50 – 55 mph. Be prepared for a quick rotation and flare to landing. The combination of a stopped prop and full flaps cause a significant amount of drag and will cause the aircraft to slow quickly in a flare to landing.

PACKING LIST

LOOSE PARTS

Qty.	Part #	Description
10	AN43B-25A	Eyebolt (2) an43-20 on tips with n4s
10	N4	Nut
20	W4	Washer
10	S01-84	Saddle
10	AN3-5A	Bolt
4	AN3-6A	Bolt
4	W3	Washer
4	N3	Nut
10	W3P	Plastic Washer
10	N3S	Shear Nut

ASSEMBLED PARTS

PUSH PULL ROD

Qty.	Part #	Description
1	FL24	Push Pull Rod
2	AN3-7A	3/16" Bolt to go through TC2
2	N3	3/16" Shear Nut
1	N4	1/4" Nut
1	60645K121	Zinc Plated Steel Ball Joint Rod End 1/4-28 Right Hand Male Shank
2	TC2	Tube Threaded Insert

PUSH PULL CABLE ATTACHMENT TO COMPRESSION TUBES

Qty.	Part #	Description
4	W3B	3/16" Fender Washer
4	AN3-24A	Delrin Block Bolts
4	AN3-5A	Strap Clamp 3/16" Bolts
8	W3	3/16" washer
8	N3	3/16" nut
2	3125K11	Push Pull Control Cable Strap Clamp 10-32 End
2	FL20	Delrin Clamp Block
2	FL21	Cable Mount Plate

KEEL TUBE CLAMP U-BOLT

Qty.	Part #	Description
1	3176T39	Vibration Damping U-Bolt with nuts and polymer form

FLAP CONNECTING COMPRESSION TUBES

Qty.	Part #	Description
2	FL23	Belcrank Compression Tubes

4	TC2	Tube Threaded Insert
4	TC1	Tube Insert
4	AN3-12A	Bolt
4	N3	3/16" Shear Nut
1	AN4-12A	Bolt
3	AN4-6A	Bolt

PUSH PULL CBALE MOUNT PLATE ON SEAT BACK

Qty.	Part #	Description
1	FL18	Push Pull Cable Mt. Plate
2	3125K11	Push Pull Control Cable Strap Clamp 10-32 End
7	N3	3/16" nut
11	W3	3/16" washer
4	AN3-5A	3/16" for strap Clamps
3	AN3-15A	Push Pull Cable Mt. Plate 3/16" bolts

PUSH PULL CABLE

Qty.	Part #	Description
2	3125K32	Push Pull Cable
2	60645K311	Zinc Plated Steel Ball Joint Rod End, 10-32 Right Hand Female Shank
2	1583K11	Forged Zinc Plated Steel Threaded Clevis, 10-32 Shank Thread Size
7	ZT	Cable Ties

FLAP CONTROL

Qty.	Part #	Description
1	FL25	Mount Plate
1	FL26	Handle
2	WRUBBER	Rubber Washer
1	AN4-12A	1/4" bolt for pivot
1	W4B	1/4" brass fender washer
2	N4	1/4" nut
1	W4	Washer
1	AN4-10A	1/4" Bolt for position
1	N4S	Shear Nut
1	WRUBBER SM	Small Rubber Washer
1	60645K121	Zinc Plated Steel Ball Joint Rod End 1/4-28 Right Hand Male Shank
1	AN3-17A	3/16" Bolt for stop
1	SPRING	Return Spring
1	W3	3/16" washer
1	W3B	3/16" fender washer
1	N3S	3/16" shear nut

SAIL FABRIC

Qty.	Part #	Description
2	SAIL FABRIC	AILERONS
2	SAIL FABRIC	FLAPS

FLAPS

Qty.	Part #	Description
8	TC3	Tube Connector
8	TC2	Tube Threaded Insert
4	SO1-14	Saddles at Belcrank
4	N3	3/16" nut
4	W3	3/16" washer
4	AN3-13A	3/16 bolt for belcrank
4	FL1 & FL5	Threaded Compression Tube

2	FL22F	Flap Belcrank
2	FL6	Flap Leading Edge
2	FL7	Flap Trailing Edge
4	AN43B-15A	Eyebolt
2	AN4-12A	Compression Tube Bolt

AILERONS

Qty.	Part #	Description
2	FL8	Inner Compression Tube
2	FL9 - FL13	Aileron & Flap Ribs
2	FL14	Aileron Inner Leading Edge
2	FL15	Aileron Outer Leading Edge
2	FL16	Aileron Inner Trailing Edge
2	FL17	Aileron Outer Trailing Edge
4	SO1-14	Saddles at Belcrank
4	TC3	Tube Connector
4	TC2	Tube Threaded Insert
4	AN3-13A	3/16 bolt for belcrank
4	N3	3/16" nut
4	W3	3/16" washer
2	FL22A	Aileron Belcrank
24	PR3L	pop rivet
2	AN43B-15A	Eyebolt (use from existing aileron) Qty 2 Use AN4-13 for shipping
4	AN43B-13A	Eyebolt (use from existing aileron) Qty 4 Use AN4-15 for Shipping
1	AN4-12A	Inner Compression Tube Bolt

FLAP KIT INSTALLATION

STEP 1 – Aileron Removal

Remove existing ailerons and aileron control cables. Save hardware, some of this will be needed later.

STEP 2 – Aileron Belcrank Plate Installation

Clamp FL18 Aileron Belcrank Plate to the right hand seat down tube and the lower fuel tank cross bar. Align lower holes so they are centered on the fuel tank cross bar. Drill (1) 3/16" hole through the seat down tube using the holes provided on FL18. Attach the plate to the seat down tube using (1) AN3-15A, W3 and N3. Drill two 3/16" holes through the fuel tank cross bar using the holes provided on FL18. Attach the plate to the fuel tank cross bar using (2) AN3-15A, W3 and N3.

Install the 10-32 female rod ends on the push pull cables; some adjustment will be required later. Use the nut on the push pull cable to clamp down on the rod end. Clamp the push pull cables to plate FL18 using the strap clamps at the pre-drilled locations. Use AN3-5A bolts, W3 and N3 to attach the strap clamps to the plate. (2) washers will be used with each bolt. One washer will be between the strap and the plate. The other washer will be between the nut and the strap. There are grooves in the push pull cables that the strap clamps must go over to properly lock the cables into place. The grooves are 1/8" wide and about 1/8" deep. They are the largest groove on the cable. Reference Figure 1 to see approximate groove location.

Attach the push pull cables to the existing aileron belcrank using (2) AN3-6A, (2) W3, and the rod ends as shown in the picture. Cable Tie the push pull cables to the upper fuel tank cross bar. Route the cables into the wings through the same sail opening used by the seat down tubes. The cables should cross and route into opposite wings as is shown in Figure 2.

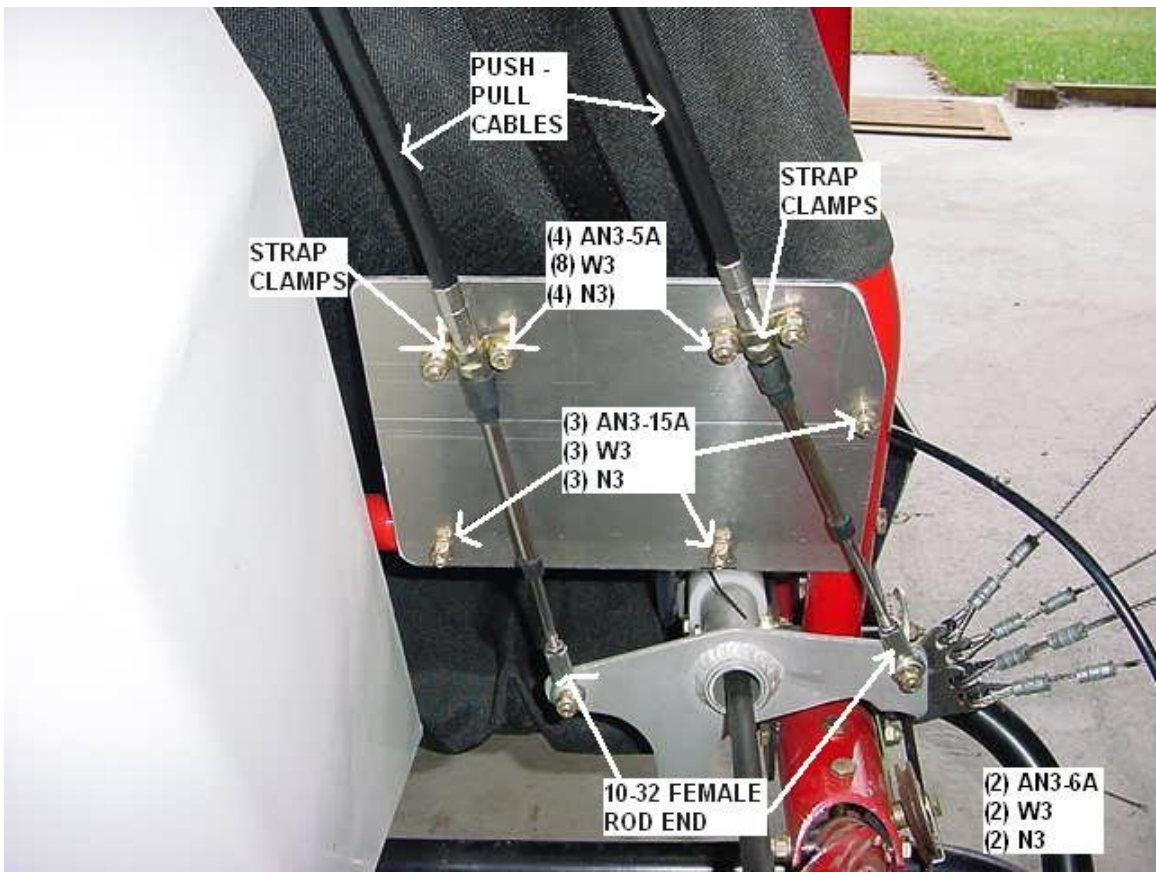


Figure1 – FL18 Aileron Belcrank Plate



Figure 2 – Cable Routing

STEP 3 – Wing Modification

This is the most time consuming portion of the assembly. In order to ensure proper spacing and freedom of movement for the flaps and ailerons, S01-84 Saddles must be between the eyebolt head and wing spar. Some aircraft are already equipped in this manner and will not need modification. If your aircraft is not, you must remove the existing eyebolts in the rear wing spar and replace them with an AN43B-25A Eyebolt as shown in Figure 3. A W4 and N4 washer and nut should be used on the inside of the wing spar to secure the eyebolt into place. Some bolts will require an extra washer. Replacement of the eyebolts that only extend through the wing spar and do not connect to anything else will be the easiest to do. Those that extend through the wing spar and connect to a compression tube will be the most difficult. Utilize the zippers in the wings to gain access to the interior nuts and bolts.

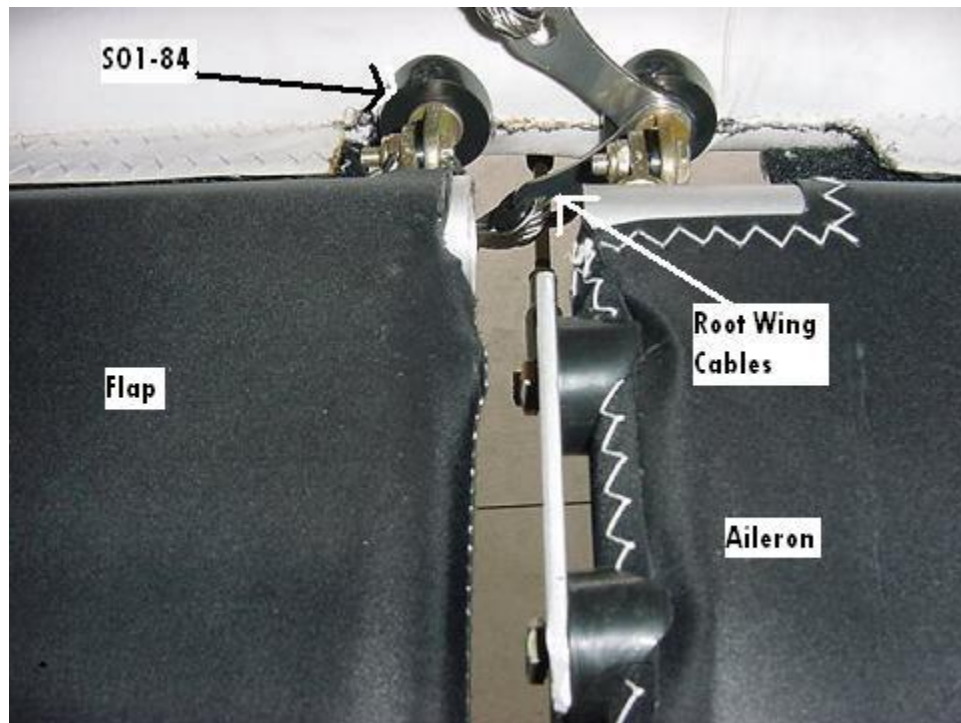


Figure 3 – Inner Wing Cable Attachment Point Eyebolt and Saddle Arrangement

An eyebolt must also be added to the root wing cable connection point. This connection is normally an AN4-25A bolt. To replace this bolt with an eyebolt use the following steps.

- 1) Loosen the sliders on the upper wing cables; be sure to mark their location before sliding them up to the kingpost.

- 2) Disconnect the root wing cables from the wing. Remove both front and rear.
- 3) Remove Wing Ribs. Slide the wing sails back to this point. It is possible to do this without removing the wing sails, but it will be more difficult.
- 4) Remove the aft bolt that holds the compression tube in place.
- 5) Remove the bolt going through the wing spar that is holding the inner wing cables and compression tube bracket in place.
- 6) Insert an AN43B-25A eyebolt through the root wing cables, S01-84 saddle and then through the wing spar. Re-install the compression tube bracket and inner wing cables. Bolt in place with a W4 and N4 washer and nut. Tighten until snug. Do not over tighten and crack the S01-84 Saddle.
- 7) Re-install the compression tube into the compression tube bracket. Wing spars can be spread using a large spreader clamp found in wood working or by using two people pulling on the spars to them apart. This will assist in realigning the compression tube and compression tube bracket holes.
- 8) Before sliding the wing sails back into place check the root eyebolt next to the keel tube. If it does not have an S01-84 saddle, replace the eye bolt with an AN43B-25A eyebolt at this time. Refer to Figure 4. Some aircraft will not have a root compression tube. It is only required if using the folding wing option.
- 9) Repeat previous steps for opposite wing.
- 10) Slide the wing sails back into place reattach all cables and re-tension the wing wires to flying condition.

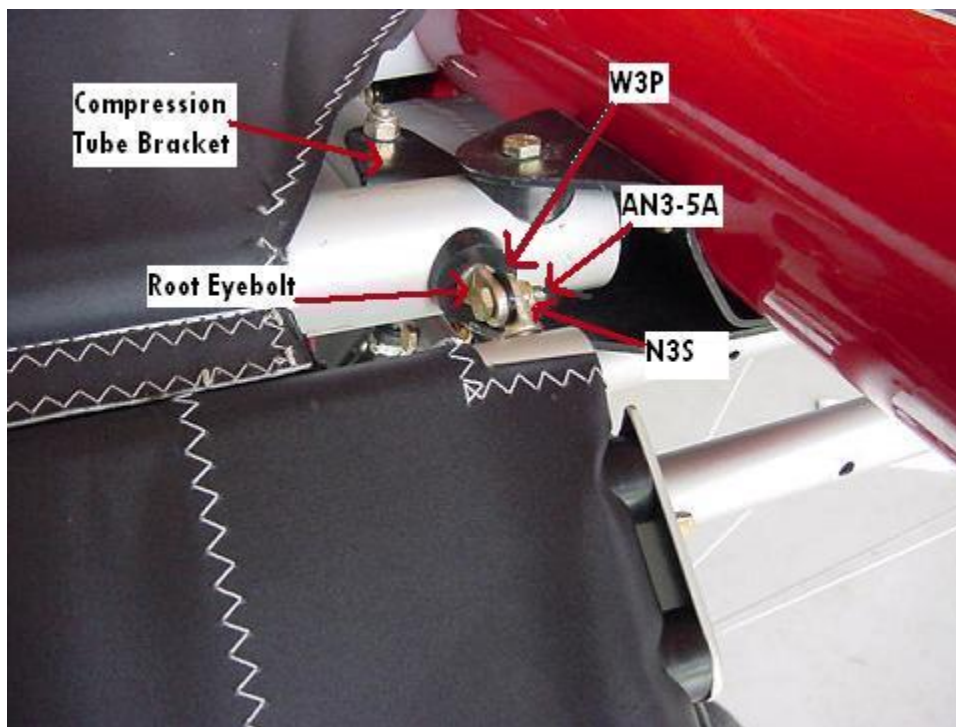


Figure 4 – Root Eyebolt Configuration

Depending on the age of your aircraft and tension of your cables you may need to remove more of the wing cables to reduce the tension. On some aircraft we have found it easiest to support the wings and lower the king post to reduce tension on all the wing wires. This will make it easier to remove and install all the bolts. It is also easiest to reattach wing cables with two people. One person will hold and reposition the wing cables while the other inserts the bolt and gets the nut started on the bolt. The key is to be patient. Once you are past this step everything else is fairly easy.

STEP 4 – Aileron and Flap Installation

Bolt the flaps onto each wing using (1) AN3-5A, (1) W3P and (1) N3S at each eyebolt joint. The plastic W3P should be placed between the two eyebolts. Placement of the flap eyebolts should be as shown in Figures 3 and 4. Flap eyebolts should be to the inside of the wing eyebolts.

For the ailerons you will need three eyebolts from your old ailerons. Remove the (3) outboard eyebolts from each aileron and install them on the new aileron at the same location. Removal of (3) AN4 bolts from the new aileron leading edge will be required. Remove and replace these bolts one at a time. Install the ailerons onto the aircraft using (1) AN3-5A, (1) W3P and (1) N3S at each eyebolt joint. The aileron

eyebolts should be to the inside of the wing eyebolts. Refer to Figures 3 and 4 for bolt placement.

STEP 5 – Flap Connection

The Flaps are controlled by a push pull rod connected to a handle above your head in the cockpit. Connect the flaps using (2) FL23 connecting tubes. Connect FL23 to the Flap Belcranks using (3) AN4-6A and (1) AN4-12A. The push pull rod should also be connected to the Flap Belcrank using the AN4-12A as shown in Figure 5. All bolts should be installed using a thread locker such as LOCTITE.

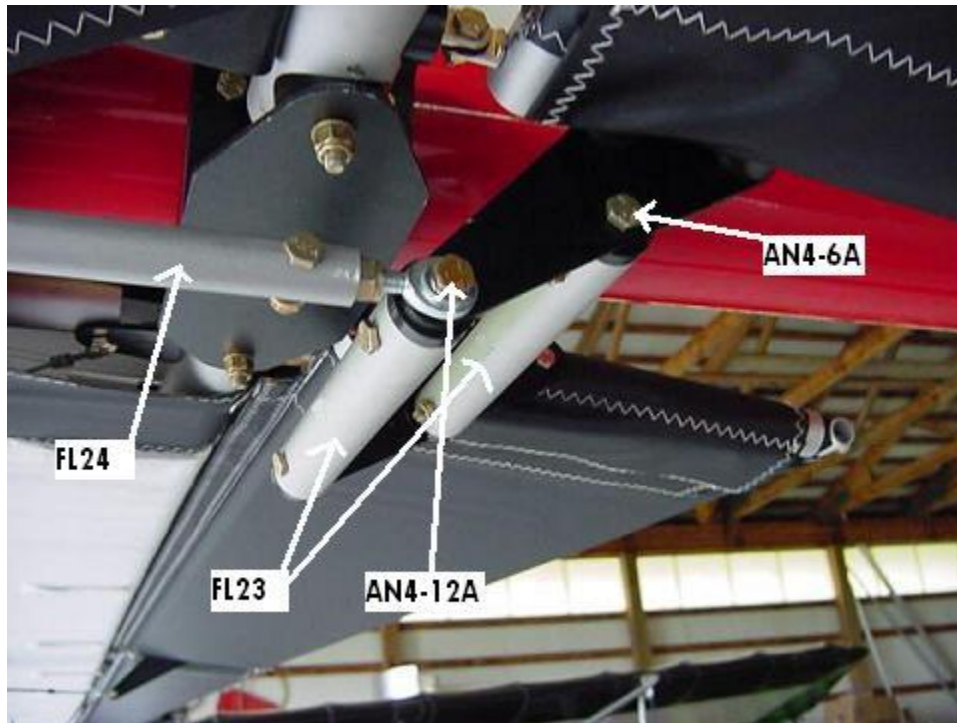


Figure 5 – Flap Connection

STEP 6 – Flap Control Mechanism

Refer to Figure 6 for the following assembly. The flap control mechanism comes preassembled. Remove plastic vibration damper from U-bolt. Install the vibration damper around your keel tube in front of the aileron idler pulley. The damper can be spread apart and slid around the keel tube. This may require you to burn a hole in your sails to ensure proper clearances and fit. A standard soldering iron works well to burn the holes in your sail. Burning the holes prevents the fabric from fraying. Once the plastic vibration damper is around your keel tube re-install the U-bolt around the damper. If you have two piece sails unvelcro the sails and install the U-bolt from the top of the wing. If you have one piece sails install from the bottom of the wing and rotate the damper and U-bolt so the U-bolt threads are facing down.

Once the U-bolt is in place install the Flap Control Plate, FL25. Bolt the plate to the U-bolt using the Nylon Lock Nuts provided with the U-Bolt. Tighten these nuts evenly until the plate feels snug.

Connect the Push Pull Rod to the Flap Handle, FL26 using an AN4-13A and N4. The bolt should be extra long and is used to control the position of the flaps. Set the handle in the rearmost hole which is the zero degree setting. Slide the U-Bolt and Control Plate forward or rearward until the flaps are at an angle of zero degrees. This angle can be set by matching the top of the flap to the top of the wing surface. The angles should be the same. Once this is complete tighten the U-bolt nuts until the U-bolt is locked in place and cannot be slid around.

Climb in the cockpit and test the flap handle. You can adjust the handle movement by adjusting the return spring. To loosen the handle up, loosen the return spring bolt. To tighten the handle up, tighten the return spring bolt. Take care to leave enough compression in the return spring to hold the handle in the flap position holes. The plate should be parallel to the ground. It should not be angled up on one side of the keel tube or the other. Using the handle in flight will take some getting use to. Eventually you will be able to place the flap angle without looking at the flap handle.

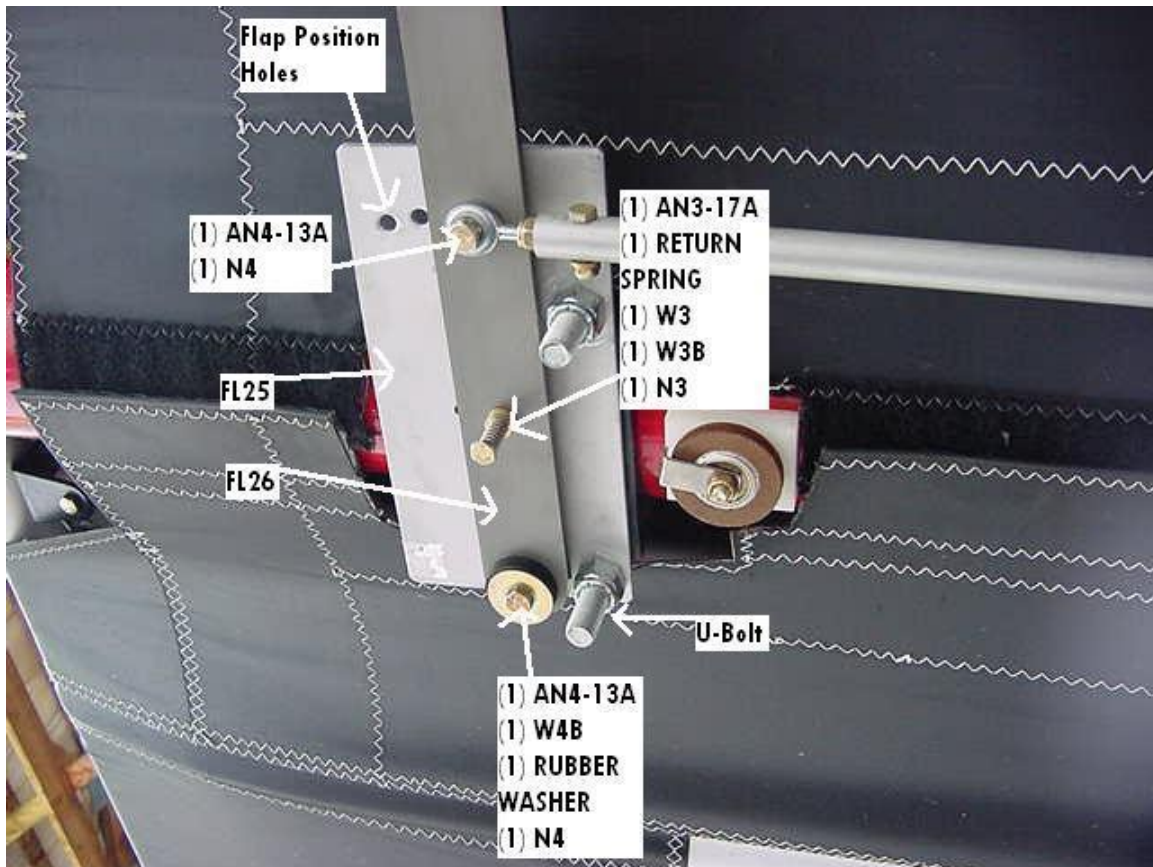


Figure 6 – Flap Control Mechanism

STEP 7 – Connecting the Aileron Cables

The push pull cables for the ailerons exit the interior of the wing by the outside edge of the inboard wing zipper. This will be the zipper aligning itself with the aileron belcrank. Two holes will need to be burned into your wing sales to allow the cable and mounting bracket to exit the interior of the wing. Use a soldering iron to burn the holes. Keep the holes as small as possible and check fits and locations before burning the holes. Figure 7 shows the approximate location of the holes for each wing. Some aircraft will be different depending on the age of the sails. All holes are burned on the underside of the wing.

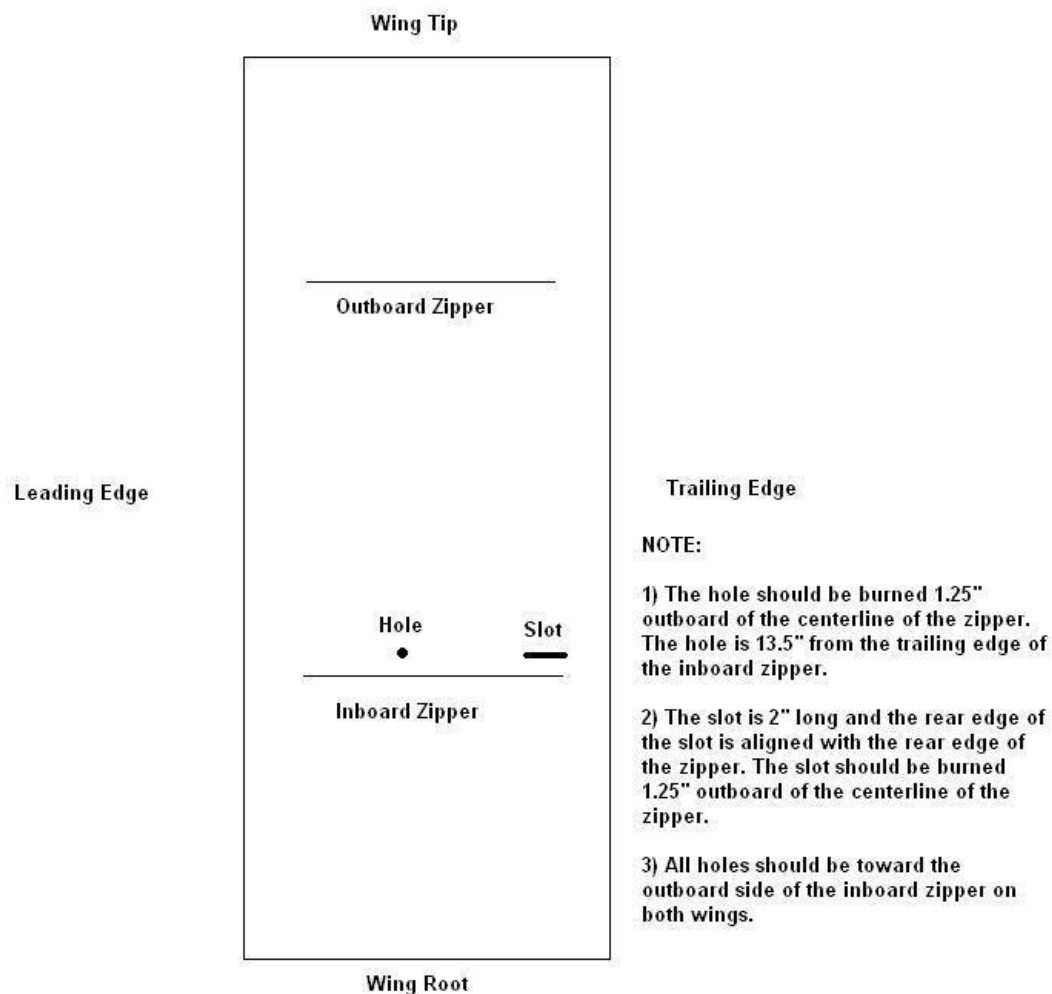


Figure 7 – Burn Hole Locations

Attach FL20, Delrin Clamp Block to the inner compression tube. At the same time attach FL21, Cable Mount Plate to FL20. The mount plate should be attached such that it extends through the rear slot that was burned in the sails. Use AN3-24A, W3B and N3 to bolt the clamp block in place as is shown in Figure 8. Tighten bolts until the block

will not rotate or slide. Take care not to over tighten and crush the compression tube. Slide the push pull cable through the recently burned hole in the wing sails. Clamp the push pull cables to plate FL20 using the strap clamps at the pre-drilled locations. Use AN3-5A bolts, W3 and N3 to attach the strap clamps to the plate. (2) washers will be used with each bolt. One washer will be between the strap and the plate. The other washer will be between the nut and the strap. There are grooves in the push pull cables that the strap clamps must go over to properly lock the cables into place. The grooves are 1/8" wide and about 1/8" deep. They are the largest groove on the cable. Reference Figure 1 to see approximate groove location. The Push Pull cable should be bolted on the side of FL20 that best aligns it with the Aileron Belcrank. Refer to Figure 9 for installation picture.

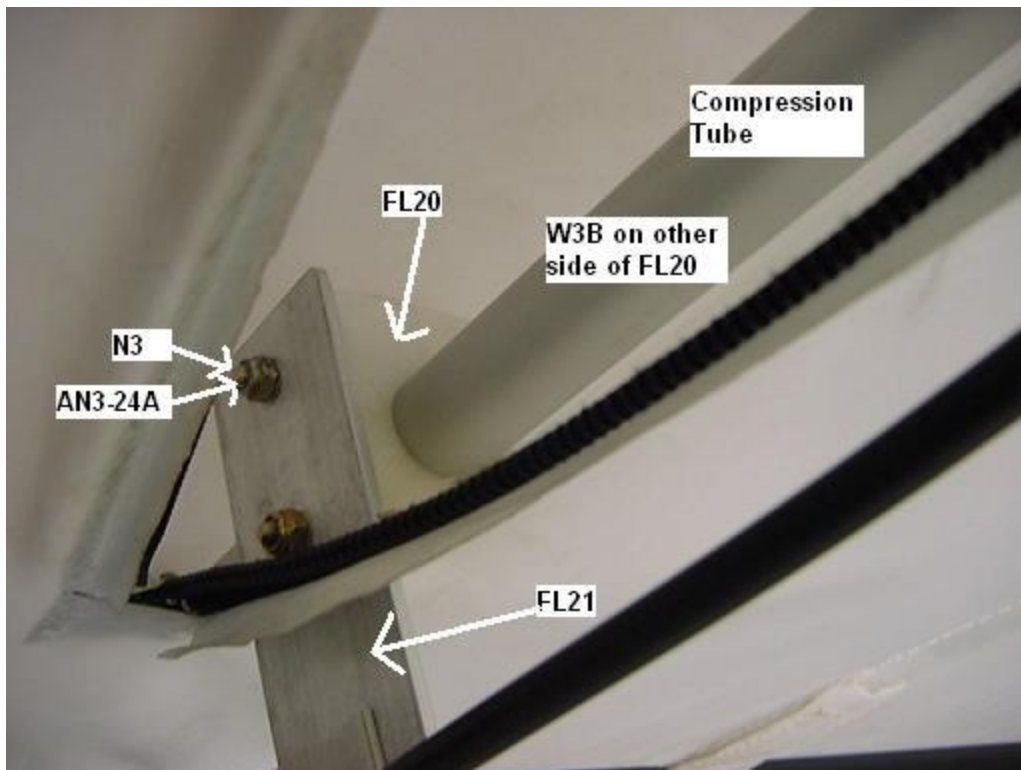


Figure 8 – Cable Clamp Block



Figure 9 – Cable Installation

Bolt the push pull cable to the Aileron belcrank using the forked clevis and (1) AN3-6A, and (1) N3. Zip tie the cable to the compression tube and the inner wing wires. Check security and operation of the ailerons. Adjustment in aileron angle are made 3 ways. The first is to slide the clamp block forward and aft until the desired angle is achieved. The desired angle is zero aileron angle with the control stick in the halfway or neutral position. Adjustments may also be made by adjusting the location of the forked clevis or rod end on the control cable. Loctite the clevis and rod ends onto the aileron cables. Make sure you have sufficient thread into the clevis and rod end. There should be 3/8" to 1/2" of thread going into the rod end or celvis. Repeat this installation for the other wing.

As always if you have any questions feel free to call the factory at 269-271-4568 or email at epederson@phantomaero.com