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Table of Contents

1. About This Manual

Most everything the pilot needs to know about the Reflex series Wings from Evolution Aircraft Inc. is contained within this manual.

It is recommended that you thoroughly familiarize yourself with the entire manual before you use your new wing for the first time.

It is very important that you become familiar with the set-up procedure for the Reflex series wings, or it is possible to damage them. Please take the time to look through the appropriate set-up sections before attempting assembly.

Most importantly, you are reminded that this manual is not intended as an instructional device on how to fly weight-shift control trikes. Rather, as the purchaser of this product, in the spirit of our self-regulated sport, you are responsible for bringing with you the expertise required to safely operate this vehicle. If your trike is a Light Sport aircraft you need the proper Light Sport documentation to fly your Trike legally. By purchasing or operating this product, you assume complete liability for its safe operation. Evolution Aircraft Inc. offers this owner's manual simply to assist you with the features particular to this model of trike wing regarding its unique: assembly, flying characteristics, care and maintenance, and technical specifications.

For those looking to advance or refine their particular flying skills, consult the fine line of instructional books dedicated to knowledge and skill-building published by the FAA (Weight Shift Control Flying Handbook) or other Civil Aviation Authorities (CAA) around the world that have a weight-shift-control or flex-wing micro-light category, or the factory can recommend any number of professional flight training centers.

Please practice safe aviation!

2. About the Reflex Series Trike Wing

The Reflex series trike wings range from a beginner to advanced trike wing depending on the model. You should have a minimum of 30 hrs of flight experience in weight shift trikes with an instructor's approval before flying a Reflex series wing. The Reflex Discovery 13.5 and Sport 12.5 models are better for beginning to intermediate students (with proper instruction) and the Reflex Rival 12.5 and Competition 11 model is suited to more experienced pilots.

Congratulations on the purchase of your new Evolution Aircraft Reflex series wing. We believe it to be the finest available high performance recreational trike flex-wing in the market today.

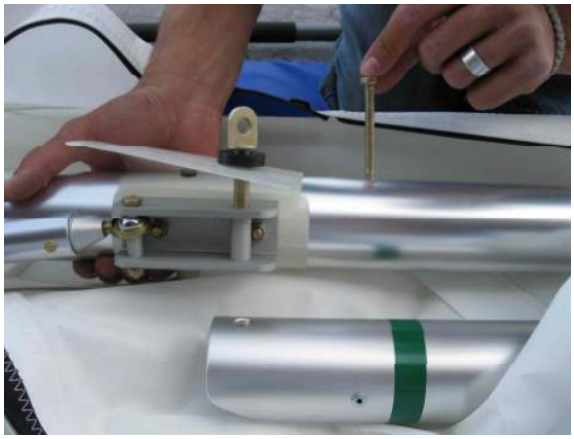
The Reflex series wings achieve exceptional speed range and superb handling for many reasons. The sail and cut are composed of a carefully selected and applied field-proven synthesis of the latest materials that is matched to the leading edge curve. The sail features a leading edge pocket

internally reinforced with a Mylar sheet insert. Drag is reduced with a pair of faired wing struts. Washout is controlled via large diameter, multi-sleeved leading edge tubes and with a PX band that runs span-wise on the top surface of the wing. The trailing edge is also reinforced with a PX sewn in strip. Cordless battens give them a cleaner look (reflex Competiton 11 uses strings) than traditional batten cords scheme. Aerofoil shaped downtubes/uprights also cleans the form further. On some models (not on the Discovery 13.5) you will see vortex generators or rubber turbulators near the leading edge of the wing. These enhance slower speed control and decrease stall speed. Common sense care needs to be taken to make sure that these are not abused when packing or unpacking the sail. On the Reflex Competition 11 model there are winglets supplied that need to be installed properly. Never fly this wing without the winglets. These features combine to ensure a good usable flight performance.

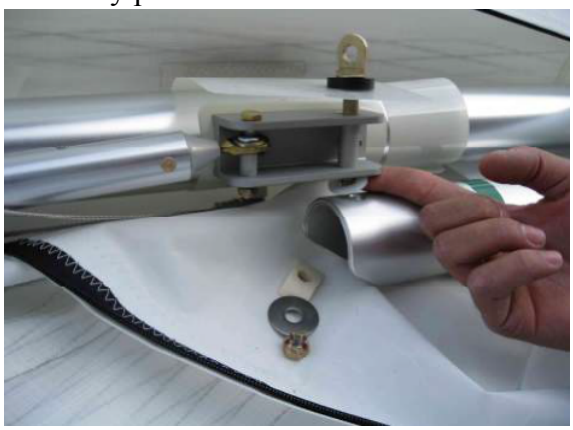
3. Re-Assembly from Shipping Crate (Short Pack)

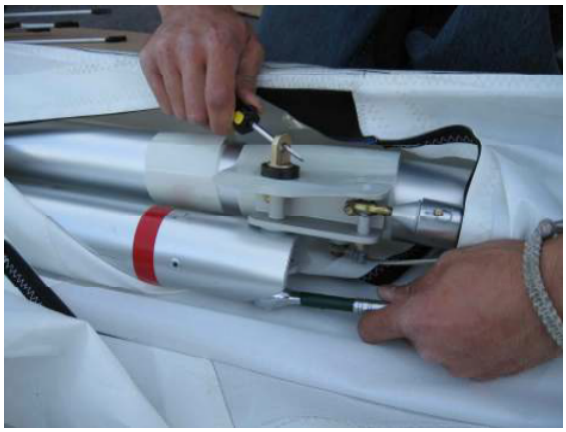
Carefully undo the crate packing so as not to damage the wing inside. ie: Do not cut into the box. With the wing out of the box find the control bar, battens and outer leading edge tubing assemblies. Separate the left (red) and right (green) outer leading edge assemblies.

1. Place the wing on its back slide so the downtubes/uprights are facing upwards.
2. After removing the temporarily installed hardware for the leading edge connection and the rubber caps and from the cross tube and leading edge inside the fabric of the wing, put one of the cap on the outboard leading edge to protect the sail as you slide it into place. Slide the outer leading edge tubing assemblies into the sail from the sail tip carefully and slowly. Note that the notched out end on the leading edge tubes is the side that slides into the existing leading edge tubing present inside the sail. Turn the sprogs so they point towards the wing tips (except on the Rival in which the inboard Sprog must face towards the nose) . Slide the rear section of the leading edge into the front section until the hole lines up. Install bolt from the bottom up (remember the wing is inverted, *see photo below), wrap the mylar protector around the LE and put over the bolt, now thread the nut on over the mylar. Tighten snug. Do not over tighten or you may deform the tube.

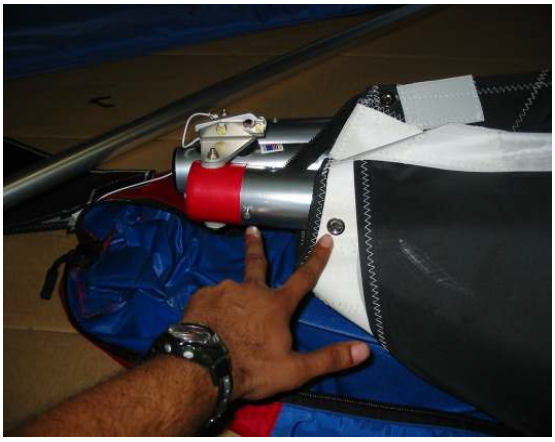


3. Now install the eye bolt through the cross bar channel bracket. Slides the cross bar onto the 3/8" eyebolt with the large Nylon washer between them. Note: the first side will be easy and the second side may require manipulation to line up the holes. To do this, follow the picture. The order from eyebolt head (note the Rival uses a regular bolt in lieu of an eyebolt) is a 1/4" thick plastic spacer, Mylar, channel bracket, white nylon washer (between the bracket and cross tube). On the inside of the cross tube you will have the Half moon plastic spacer, SS fender washers, then a std. small AN washer, then the castle nut and the safety pin. Note line up the hole for the safety pin so it slides in easily, then rotate the entire bolt 180 degrees to latch the safety pin.





4. Install the tip sail strap (yellow) over the end of the trim tip cap. Note: You must take the sail nose screws out of the grommet to make it possible to put the webbing over tip. Make sure that the webbing is in the 1" inch wide shallow slot in the plastic end cap. See picture. After the webbing is over tip run a string from grommet to grommet and around the nose plate and tighten line to pull tension in the leading edge. Or the fabric may fall back off before opening the wing. Secure the white Velcro tabs around the leading edge.



Note: After the wing is completely set up and you have put in the center battens you can reinstall the sail nose screws.

4. Setup Procedure (Long Pack, normal)

1. ASSEMBLE THE CONTROL FRAME or A-FRAME: Place the wing on the ground with its nose pointing 120 degrees to the wind (if the wind is over 5 MPH) and with the zipper facing upward. Unzip the cover bag; remove the battens from the nose area and the side struts. Undo the wing ties and assemble the control frame (if assembling for the first time from a short pack the control bar needs to be installed). Check the lower cable rigging to ensure that it is not tangled kinked or wraped inside the A-frame.

2. ROLL THE WING OVER Stand wing on the control frame (do not attach the lower front control frame wires at this time). Note the assembled A Frame will try to fall over and turn 90 degrees to its proper orientation. Try to limit the amount of stress put on the upper down tube connection FIG.3

3. ATTACH THE FRONT FLYING WIRES Ensure that all the lower rigging is untangled first.

Position the forged hoop on the swan catch; install the bolt, castle nut and safety pin.

4. REMOVE BAG. SPREAD WINGS Ensure that the keel stand "stinger" is in place. If the stinger isn't present the wing can gently be placed on its nose on the ground if the wing struts are installed first. Carefully walk each wing out to 3/4 of it's own approximate flying position. Leave enough slack in the sail so that during the next step the battens may slide in with minimal resistance. If the wing has vortex generators please make sure they align properly through the grommets on the top sail and protrude through properly. Nothing should be forced

5. INSERT INBOARD BATTENS Install all but the last three top curved battens; battens with white front ends go to the right, black to the left. Insert the battens from root to tip with gentle pressure, moving the sail's trailing edge up or down as necessary to help the front of the battens up over the cross tube and leading edge. Keep the rear tip close to the ground so the curved front glides smoothly in the pocket. DO NOT FORCE the battens into place, especially the first two battens (in particular when the sail is new). To put the first battens in, lift the keel off the ground about 20"

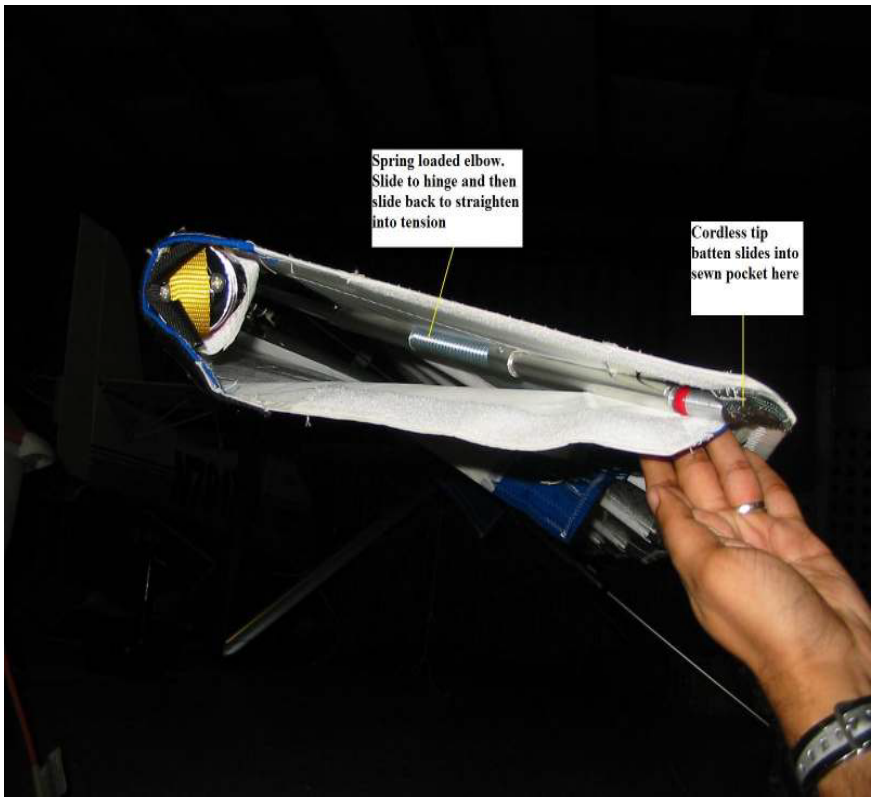
6. PRE-TENSION THE CROSS TUBE Spread the leading edge tubes out the rest of the way before pulling back the cross tube retrieve line. Find the cross tube tensioning Nylon line appearing immediately at the center of the sail. (sometimes the loop of the line needs to be put back through the center hole in the sail) Pull on the nylon line to pull back the cross-tube. Pull back until the nylon rope loop can be hooked into the spring catch on top of the rear keel tube. This opens the wing enough to hook up the side struts. DO NOT FLY THE WING LIKE THIS! You must use the main stainless steel haul-back cable to fly.

6. INSTALL STRUTS Place struts under wing on each side. There is a left and right strut and are marked. The strut also should be marked top. This is the side that has a 5/16" clevis pin. First hook up the lower end of the strut (bolt, castle nut and safety pin) then the top. Make sure you install the safety rings and make sure that the safety rings.


Downtube and control bar make the A-frame
Lower A-frame or control frame to strut junction secured by 5/16" bolt

7. HOOK UP THE CROSS BAR MAIN CABLE Remove pull back nylon line from spring catch. Pull the line all the way back, until you can latch the cable shackle into the spring catch. Make sure the wing tip yellow webbing is completely in the 1" slot on the wing tip cap before tightening the wing with the haul-back cable.

8. INSERT REMAINING BATTENS Remove the tip bags and insert remaining 3 top surface battens towards the wing tips, then lastly the straight spring loaded tip battens onto LE hooks. Cordless battens hook in a bit differently than traditional corded battens. See pictures below.



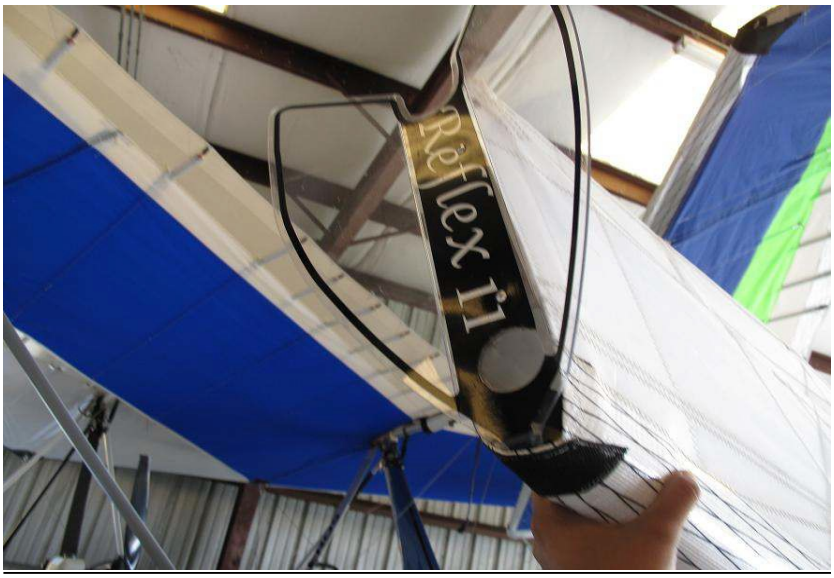
9. LOCATE SPROGS INTO POSITION (If it is light winds you can put the wing on its nose for this). Open the zipper at each sprog location; rotate the four sprogs out to center of the transversal batten. Now put the Velcro loop around the end of the sprogs. Leave Velcro loops slightly loose (aprox. 1/2" gap).

10. UNDER SURFACE BATTENS Install the under surface battens from longest to shortest. Make sure the back ends are inserted back into the slot at the rear.

If your wing is equipped with the optional electric trim system. This is a good time while the center battens are out to install the linear actuator in. Linear actuator is secured at the top nose channel bracket with a ¼" Clevis pin and safety ring as shown in the pictures below. On the top of the keel tube of the wing near the nose where the linear actuator will sit on, it is possible to put a strip sticky industrial Velcro (soft side) and put the other side of the sticky Velcro on the bottom side of the linear actuator so it sits still.

13. POSITION THE NOSE BATTEN AND NOSE CONE Pull the nose down to eye level so you can put the nose rib on the 1/4" stud located front top of keel tube. With nose cone in hand start with the two top Velcro tabs and gently pull the nose cone down and around the nose plate to connect the two bottom Velcro tabs on the nose cone to its corresponding Velcro sewn on the under surface below the keel.

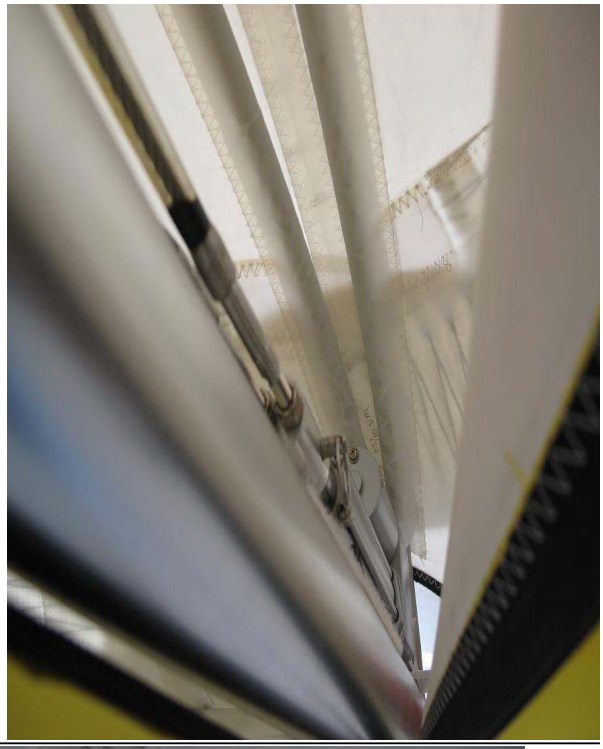
14. INSTALL WINGLETS ON WING TIPS IF APPLICABLE The Reflex Competition (11) wing has winglets made from Lexan that attach to the Velcro sewn in towards the inside of the sail. The winglet in the front (leading edge tube) also has an extension that is inserted between the leading edge sail cloth and the leading edge tubing of the wing. To install the winglet the correct way is to place the front end extension of the winglet towards the "bottom" surface of the wing next to the leading edge tube and then slide the extension "upwards" to get it wedged "between" the leading edge sailcloth and the leading edge tube as shown in the picture below. Then the top and bottom sails can be velcroed onto the winglet wedge tips.

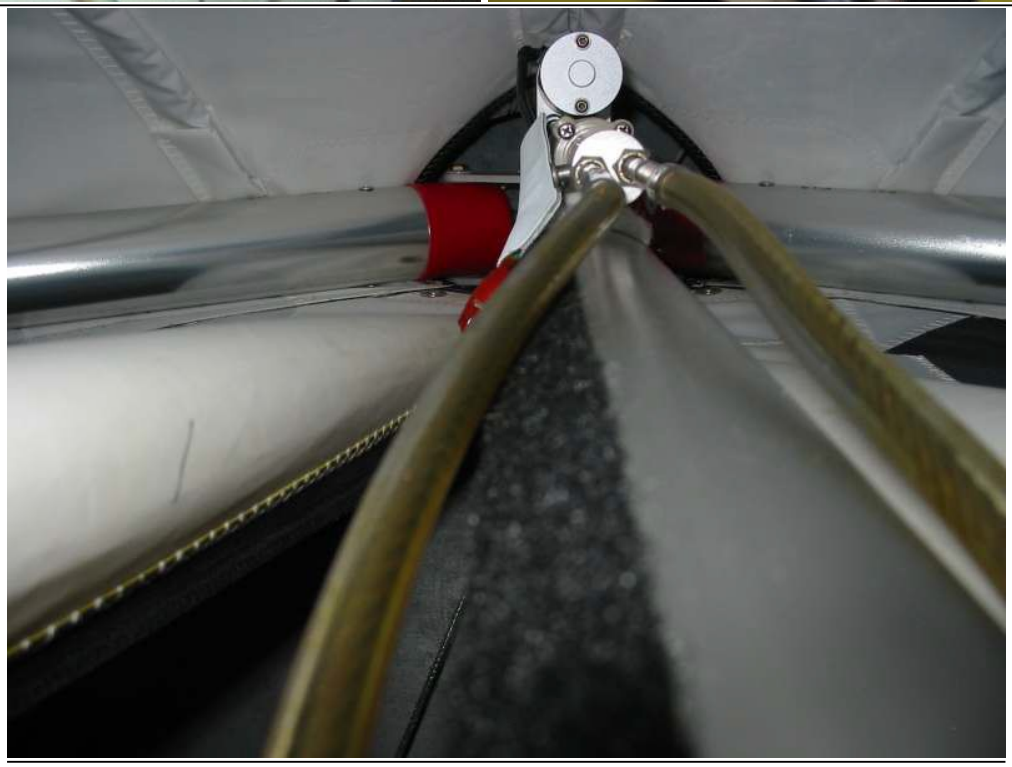


15. CHECK AND CONNECT THE ELECTRIC TRIM SYSTEM IF APPLICABLE The electric trim system consists of a linear electrical actuator with about a 3 or 4 inch stroke, depending on model that sits above the top nose plate and connects with a pin onto a channel bracket above the top nose plate on the wing keel. It connects its stroke arm to a machined cylindrical fitting also via a simple pin. This fitting is tapped to accept threaded ¼" x 28 male studs with crimped on cable assembly that attached to a electric trim plate "slider plate" behind the hang block via AN-4 nuts. The linear actuator can thus be removed easily removing the two pins and undoing its electrical connector around the wing keel tube. Removal of the linear actuator is necessary for folding the wing whether attached to the trike carriage or off the trike carriage or for bagging the wing in its bag. Otherwise the cross tube hinge will impact the linear actuator when the wing is folded and cause damage. Also note that after removing the linear actuator from the wing, the cylindrical barrel that is attached to the cables should be routed through the cross-tube hinge cover assembly that has a black strap loosely tying the cross-tube to the keel. If this is not done you will feel some resistance to folding the wing back. Do not force anything. Take the time to figure things out the first time. If something is not clear, be patient and ask for support from the dealer or factory. Do not do anything without first getting an answer or understanding how to do it.

Note: The electric trim linear actuator MUST be removed when folding the wing pack. This is done by taking the clevis pin out securing the linear actuator to the top nose channel bracket and also the forward pin securing the linear actuator movable shaft to the machined round cylindrical barrel that has two cables screwed into it. Thus linear actuator has to be placed back as upon unfolding by doing the opposite steps. There are no short cuts around this without causing damage.

Note: Also read section 6 regarding linear actuator removal for folding





Slider with cables shown going from behind the hangblock to the linear actuator. Note the transparent hose around the cable keeping it from rubbing directly against any metal in case the slider twsits upwards

16. INSTALLING THE RUBBER VORTEX GENERATORS THROUGH THE TOP SURFACE GROMMET HOLES IF APPLICABLE You can slide the rubber vortex generators now if applicable through the top surface by opening the reaching through the zippers on the bottom surface. You can wet the rubber vortex generators with water to make them easier to slide through the grommets. This is done only on new wings. The rubber grommets can be cleaned with rubbing alcohol when installed and can stay in after first install even when the wing sail is folded without causing any structural sail damage.

Now make sure all zippers are closed after you pre-flight your wing and before you fly.

Cover bag, pads, and ties can fold into one of the bag ends for storage.

Before you attach the wing to the trike be sure to perform a thorough preflight as described on the following pages.

5. Preflight Procedure

A thorough preflight procedure is mandatory with all aircraft. The best technique is a circular walk around. Start at one location, the nose, and check each assembly point available for inspection.

Starting at the nose:

- Sight along both leading edges, checking for similar curves.
- Walk towards the tip, feeling for dents in the leading edge tube.
- Pause at the wing bolts and look into the sail through the zipper inspection access. Check side struts fittings and safety rings.
- Continue to the tip and check the sail tip area for proper seating on the leading edge tube, and sail integrity.
- Verify that the sprog tubes are positioned correctly and velcros are in place.
- Insure that the tip battens are properly seated on the leading edge hooks, and that the tension is set just snug.
- Walk to the keel, checking each of the battens to ensure that they are properly secured.
- Check the haul back cable catch connection.
- Repeat first half inspection as you work your way back around the nose.
- Check the swan catch at the nose.
- Check the nose cone for secure attachment.
- Check all the lower cable rigging for proper routing about the control frame.
- Check that the control frame uprights are straight and that the set up bolt is correctly assembled with castle nut and safety ring through the base bar and forked end fitting
- Check the cross tube center bolt/plates to insure that they are properly attached.
- Make sure you zip up the center zipper after inspection. Flying the wing with the center zipper open (or any zipper) will result in loss of lift and pitch stability and cause dangerous flight handling!!
- Generally site the entire wing for symmetry. If you see something that does not look "right", stop and investigate.

NEVER RUSH A PREFLIGHT PREFLIGHT!

6. Fold Down Procedure

To fold down your Reflex series wing, just follow the reverse set up procedure steps as described in the previous section. Included below are a few guidelines to follow which will save you time and prevent wear areas on your sail.

- If WINGLETS are supplied with your wing, make sure to un-velcro the winglets off the wing tips. • TIP BAGS Remember to remove last 4 battens, install the wing tip bags and un-zip access zippers for upper wing strut before releasing the cross tubes cable.

- FOLDING THE WINGS IN Always fold the wings together symmetrically, bringing both leading edges back together at the same time. An alternative to having someone help bringing in both leading edges at once, is to bring in one a bit, then the other a bit more, in three to four incremental steps. If you meet resistance folding in the wings, check that the cross tube tensioning line or cable are free to run forward through the cable hole center of the sail.

WARNING: Do not fold the wing with optional electric trim linear actuator attached above the keel tube. This can cause damage.
Follow the following steps to take the linear actuator out before folding the wing as usual:

1) Take the Dacron nose cone off and open the bottom zipper.
2) Pull up the nose battens from their pearches on top of the nose plate and take them out towards the front. This should ,make it easy to put your hands in through the front and from the bottom
3) Put your hands in and take the safety ring off for the linear actuator Clevis pin attaching it to the top nose channel and on the cylindrical fitting (attached to cables) in front part of linear actuator (movable shaft side)
4) Disconnect the linear actuator electrical connection and pull the linear actuator out of the wing leaving the cables with the machined cylindrical barrel inside
5) Take the machined cylindrical barrel and cables and guide them "back" through the black loop that keeps the cross-tube hinge and wing keel tube together. To do this you may have to gently lift the cross-tube hinge up by hand just a bit and slide the cables back. See pictures on page 17

Now you are ready to fold the wing. You will be reversing these same steps to install the linear actuator system when unfolding

• FOLDING THE SAIL Once the frame is folded with all of the battens out the wing sail will naturally fall between the keel and the leading edges. The sail must be pulled up and routed outside of the leading edges so that there is little fabric between the leading edges and the keel. The important thing is to get your sail body neatly stowed inside the Mylar reinforced leading edge pocket. Also, some owners prefer to alternate folding, then rolling, their sail to minimize potential permanent creases developing over time.

• ATTACHING SAIL TIES Fasten the first tie just aft of the rear cable. By keeping the keel tube outside of the tie, it will make it easier to organize the control bar in this area after the wing is flipped over. The forward tie is located splitting the distance between the control frame apex and nose plate. Pull the leading edge pocket up over the top of the wing so the top of the LE Mylar pocket is touching and/or overlapped. The third sail tie goes about 2 feet inboard from the leading edge tips.

7. About Flying the Reflex series Wing

The Reflex series wings like to fly between 55 to 80 MPH at hands off trim for Reflex Discovery model, between 60 to 90 MPH for the Reflex Sport model and between 65 to 90 MPH hands off trim speed for Reflex Competition wing model with winglets and 60-90 MPH on the Reflex Rival. This is where the trim limits are set during the factory test flights. Adjust the trike on the keel to fly the speed of your choosing. At gross load the Reflex series may stall as higher than published based on the tuning of the wing. The takeoff ground roll on pavement for Reflex wings varies greatly based on many factors such as weight, HP, atmospheric conditions and tuning. (please see the REVO POH for performance figures on the REVO carriage). It is important to get to TOSS (Takeoff Safety Speed) before leaving ground effect which is around a bar position no less than 9" from full bar forward. For REVO trike carriages please see the REVO POH. It is advised that as speed builds up the pilot leans forward in the seat with back arched in a nice posture so as to keep a bend in his arms (no locked elbows) and push the bar gently forward all the way to touch the compression strut of the trike carriage prior to lift off speed and then wait for the nose to lift as speed increases. As the nose wheel lifts pull back and relax the control bar to a position of no less than 9" from the compression strut before the trike reaches 24" from the ground.
WARNING: Leaving the bar pushed out after trike starts to take off can cause a possible stall.

The safe operation of this or any trike wing ultimately rests with the pilot in command. Because the responsibility of flying and maintaining the wing rests entirely with you, the risk of damage or injury you may cause to others and to yourself also rests entirely with you. We believe that in order to safely participate and practice the sport of flying, you must maturely accept responsibility for yourself and others. We recommend to fly conservatively, and avail yourself of all safety equipment (i.e.; parachute, strobes……etc.) appropriate to the conditions and terrain you fly in.

No wing on the market is totally infailable. It is entirely possible to push any aircraft beyond its limitations and damage or even break a wing. Very strong weather conditions may also cause structural failure.
WARNING: Aerobatic maneuvers, pitch angles beyond 30 degrees up or down, bank angles exceeding 60 degrees, aggressive stalls, and spins are maneuvers that should never be attempted under any circumstance.

CAUTION:
The speed never to exceed:
Reflex Discovery 13.5 90 MPH
Reflex Sport 12.5 110 MPH
Reflex Competition 11 115 MPH
Reflex Rival 12.5 110 MPH
The Reflex wings, even when flown in their lightest wing loading, can exceed VNe. Structural damage is possible if VNe is exceeded. Respect these limitations.

Your new Reflex wing combines the best blend of low speed performance, rugged construction and easy handling that the art and science of trike wing design allows. Properly maintained and flown within its design limits, it will provide you many years of flying pleasure. But, like any wing, its safety is directly proportional to your diligence in maintaining and repairing it properly, and to your ability to fly it intelligently and conservatively.

We hope your Reflex series wing will provide you with many hours of enjoyable flying. All of us at Evolution Aircraft Inc. would like to welcome you to our growing family of pilots!

8. Flight Limitations

Operations and limitation for the Reflex series wing on the Light Sport Aircraft such as the Revo is available in the POH manual. The wing performance placard bearing test flight information and operating limits is located on the wing's left cross tubes. Special care should be taken to note the operating limitations, which are clearly stated on the flight operation placard. As with any wing, special care should be taken to note the operating limitations, which have been ascertained by careful testing.

Flight operations should not exceed those laid down in the operating limits specified within this manual. No wing is totally infailable; there are inherent risks involved in flying a trike wing. It is quite possible to fly the Reflex wing beyond its operating limits using deliberate flying skills. Do not do this!

The responsibility for safety rests ultimately with the pilot alone who must decide whether the wing they are about to fly has been properly maintained, and is in air worthy condition.

- FLIGHT OPERATIONS: Should be limited to non-aerobatics maneuvers -- those in which the pitch angle will not exceed either 30 degrees nose up or nose down of the horizon and in which the bank will not exceed 60 degrees.

- WARNING: The owner and operator must understand that, due to the inherent risk involved in flying such a unique vehicle, no warranty is made or implied of any kind against accidents, bodily injury, or death. Operations such as aerobatics maneuvers or erratic pilot technique may ultimately produce equipment failure and are strongly discouraged.

- NEVER FLY FASTER THAN VNE: To verify the speeds you are achieving, you should fly with an accurate airspeed indicator. During certification testing, test pilots found that it would be possible to exceed VNE during smooth acceleration. The most typical cause of exceeding VNE is rapid acceleration performing aerobatics maneuvers and steep spiral dives.

9. Wing Tuning

When a wing is new and from time to time it may be necessary to tune the wing to get rid of small turns etc. Flex-wings unlike rigid wings stretch over time or with load and this can happen unevenly over time and turns can develop.
When folding, packing the wing, the operator should note how things were so when the wing is unfolded to get it in its flying format, all things are roughly put back in the same scheme as before. Thus it is invaluable for the operator to take some pictures of different areas at some point when the wing is flying well and keep them handy in case the operator needs to refer back to these pictures for anything.
Tuning of the wing should be done in calm conditions and only one thing should be changed, logged and a test flight be performed to note its proper effect.
This section is by no means a complete primer on tuning. The idea is to give guidance on the most basic tuning for the most common problems. If the wing develops a severe turn all of a sudden or is divergent, the operator needs to think about what happened or changed last? If there was a hard landing or crash, was there a thorough inspection done of the tubing for straightness? What about a sail inspection? After a crash, the sail of the wing could stretch so unevenly that it may not be possible to bring the wing back in tune easily at all without changing to a new sail or getting it back to the manufacturer for testing and tuning.

If any adjustments are made on your glider, we recommend that they be noted in your Maintenance Log or aircraft logbook.
It is then easy to go back and trace occasional problems. Please bear in mind that certain adjustments, like the cross tube sweep setting, are very critical and often create trade-offs in handling, performance, or --more seriously-- safety.

Troubleshooting Chart

Symptom	1st	2nd
Tail heaviness (flies too slow)	D, B	I
Nose heaviness (flies too fast)	C, B	
Right Turn	A, B, K	Q, F, I
Left Turn	A, B, K	P, E, I
Yaw unstable (roll response lag)	L	N
Roll, too unstable	A, B, R	T, N
Roll, too stable	A, B, L	O, E
Breaks left in stall	B	J, P
Breaks right in stall	B	K, Q
Trailing edge flutter	A, S	O

The troubleshooting chart offers you a first solution (first action to be taken) and then a second (or more) solution for any possible problems you may encounter.

Please investigate each problem as indicated by the chart. Never make more than one change at a time.
This is a basic rule in test flying, which allows you to keep track of the progress made.

Troubleshooting Chart Action Key

A. Check for proper assembly, crossbar setup cable not fouled on pivot block.All battens secured, check for proper position of sprogs and trailing edge tension.

B. Match all battens to the airfoil maintenance blueprint provided with your wing.

C. Move hang block back (1/2" at a time).

D. Move hang block forward (1/2" at a time).

E. Increase camber on mid span battens by 1/4", or decrease the same on right tip by 1/4".

F. Increase camber on mid span battens by 1/4", or decrease the same on left by 1/4".

G. Decrease camber on last 2-cambered tip ribs on both sides, 1/4" at a time.

H. Increase camber on last 2-cambered tip ribs on both sides, 1/4" at a time.

I. Check leading edges for straightness, and replace if bent. J. Increase the tension of the right leading edge pocket, or loosen the tension of the left leading edge pocket.

K. Increase the tension of the left leading edge pocket, or loosen the tension of the right leading edge pocket.

L. Loosen leading edge pocket on both sides. M. Tighten leading edge pocket on both sides.

N. Loosen batten tension on both sides symmetrically, except for #1 and last 2 ribs.

O. Tighten batten tension on both sides symmetrically, starting at the tips.

P. Tighten batten tension on the left side battens #1-4.

Q. Tighten batten tension on the right side battens #1-4.

R. Loosen tension on battens #2-4, both sides, to remove excess reflex from these ribs.

S. Tighten batten tension in the locality of each problem area.

T. Tighten the haul back cable by using the adjustable tangs on the rear shackle.

U. Loosen the haul back cable by using the adjustable tangs on the rear shackle.

* To modify leading edge tension, slip the tip webbing off the trim tip plug and slide the sail forward. You will need to remove the leading edge screws under the nose cone and fold the wing slightly with the battens removed to get this strap off.
You will see that on the trim tip plug (between the plug and the LE tube there are pieces of tubing cut to 1/8" up to ¼" long, these are shims. These are what you need to put in or take out to change LE tension. Then replace the trim tip plug and the tip webbing.

Make sure the screws are in-line with the mark on the LE when it was removed. The rotation of these caps is very important!

If these strategies do not solve your problem or your problem is not covered in this section, you are requested to contact your dealer or manufacturer via e-mail for support or call 813 810 9262 for our customer support hot line. Always include your name, address, phone number, model of the wing and serial number and date of manufacture of the wing if possible.

10. Transportation and Storage

The Reflex wing should always be stored with the zipper facing down, especially during transportation. There are fewer potential "wear points" with the wing riding this way. Additionally, with the zipper down less water will collect inside of the cover bag in case of rain. Avoid hard spots pressing on the wing during transportation or storage and have as many supports as possible; we recommend using a well padded three-point support system, with less than four feet of unsupported wing extending off either end. Use flat tie down straps, at least 1" width (available through Evolution Trikes) rather than elastic or rope to secure the wing, and tie both ends of the wing to a support or down to the ends of the vehicle in order to prevent the wing from flexing. Take care to not over tighten the wing tie- downs, as this can crimp your Mylar leading edges. A good technique is to squeeze and compress the wing's Mylar, sail, and leading edges into a snug bundle as it gets tied down, rather than using the wing tie-downs to compress the wing within the bag. It is preferable to keep the wing dry. Definitely ensure that it is dry before storing for longer than just overnight. Any contact with salt water, of course, requires immediate rinsing with fresh water to prevent corrosion to hardware, rigging and tubes.

11. Regular Maintenance Schedule

The Reflex series will require very little in the way of maintenance if you care for it properly in your day-to-day use. Following are some general points to follow in maintaining your new wing which will help ensure the safety of your flying and the performance retention of your wing; we suggest you follow this maintenance schedule faithfully -- your ongoing care will pay off in the future. A note on use of silicone spray: This lubricant is useful in that it can minimize friction on zipper pulls. Care must be exhibited, however, in that if you do not wipe off excessive silicon application, the fluid will act essentially as a dust and dirt magnet. Due in particular to the problems associated with silicon attracting foreign material, we recommend against the practice of using silicon on your wing's battens. Clean, dry battens all by themselves are the best ways to prolong the life of the high wear area of the sail batten pockets. Probably the best way to prolong those batten pockets under adverse conditions is to wipe off the battens with a clean dry cloth prior to each insertion.

12. Sail Maintenance

If you must wash the sail, wash it with a light detergent only. Better still; wipe the sail down frequently with a soft, damp cloth keeping detergent washing to a minimum.

Remove dirt with water immediately to avoid stains. Acetone or alcohol can be used sparingly to remove stubborn stains without harming the sail. Rinse very thoroughly with clean water after cleaning.

Because of the acids in their system bug grime should be cleaned immediately to prevent long-term deterioration of the sail.

To renew the luster of Dacron, you can use the product called "Sail Bright" available from marine hardware stores. Use as directed.

Apply sail repair tape to small rips. This will prevent fraying on the edges where the rip is located. Any small rips located at stress points (i.e. the trailing edge or critical seams) should be professionally repaired to insure that the structural integrity of the unit is not compromised. Any rip in the trailing edge seam area is cause for grounding the wing until repaired.

The best thing you can do for your sail is to always use a wing cover (when on the trike), wing bag and pads (when you pack it up). Do not carry your wing on top of a car, even for short distances, without the bag.

Sun and weather cause more deterioration than hours of flying. Keep your Reflex series wings covered when not in use. Wing covers are available.

The very best thing one can do, by way of preventive sail maintenance, is to severely limit the amount of high-G maneuvers.

13. Monthly Inspection

- Check Nose battens against the airfoil maintenance blueprint if any turns or undesirable handling characteristics develop.
- Inspect all batten tensioning cords or flip tips.
- Lubricate the zippers on the sail and cover bag.

14. Twice Yearly Inspection

- Remove the cross tube center junction scuff pad to inspect all cross tube support cable components: tangs, pins, nuts, bolts, cross tube and cable itself. Tighten nuts if loose.
- Check all tubing, especially the control bar frame, for possible damage, which could occur during, set up, fold down, or transportation.
- Closely inspect the sail mounting grommets and webbing at the tips.
- Inspect the sprog cable for wear and/or undue stretch.
- Inspect all rigging and components. Replace any worn or bent bolts or locknuts connecting two moving parts together: cross tube plate junction bolt, cross tube clamp bolt, etc.
- A professional sail maker should mend critical sail tears.

15. Annual Inspection

The only way to thoroughly and completely inspect all of the components of your wing is to completely remove the sail from the frame, to allow visual and physical access to everything. Even if yours is the best-kept Reflex series wing, you should have the sail removed for a complete inspection at least once every three (3) years or 500 hours whichever comes first and then every 250 hours or 2 years thereafter. This should be done by an authorized service center, or a qualified mechanic.

With the sail off the airframe, you can more thoroughly perform all of the inspection points listed for the six-month inspection.

Additionally, you should inspect inside the tubes for corrosion. If discoloration indicating that corrosion is present, you will need to arrest this process immediately. We have tested and approved boiled linseed oil (commonly found in most hardware stores) as an effective coating/film to apply on the inside wall surface of the tubes. Clean the tubes first, allow to dry, and then apply the linseed oil.

Inspect the entire inner sail body, and in particular examine the batten pockets for wear points, especially at their stops at the front of each pocket.

Mark “P” for pass or “F” fail at each line _____

WING INSPECTION

Cable System

The cables must be checked for broken/kincked wires (frays), corrosion, niko and thimble condition. If any defect is observed, no matter how small, the cable in question MUST BE REPLACED. It is recommended that the entire cable system be replaced once every eight (5) years or 500 hours irrespective of service conditions except backup cabling. Cables can be obtained from the wing manufacturer or assembled by a repair station with proper expertise and equipment. Alternately they can be assembled to custom lengths and thicknesses by aviation supply stores such as Aircraft Spruce

A NOTE ABOUT CABLES AND CABLE MAINTENANCE

The cables which support the wing's airframe are critical components of the wing's structure, and must be maintained in an air worthy condition. It is a general practice in the design of aircraft structures to design to an ultimate strength of 1.5 times the highest expected load in normal service. Cables, like other structural components on the wing, are typically designed with a structural safety factor of only about 50% above the expected maximum load. No significant loss in cable strength can be tolerated.

A cable with even a single broken strand must be replaced before the wing is flown again. A cable which has been bent sharply enough to have taken a permanent set must also be replaced immediately.

Some degree of fatigue due to repeated bending of cables is almost unavoidable in an aircraft that is assembled and disassembled with every flight.

Sail Check-Up

Checking the sail surface and seams

There should be no cuts, ruptures, threadbare holes and torn seams on the sail. Any torn seams should be re-stitched. Cuts and ruptures on the leading edge and bottom surface (BS) of the sail that are not longer than 1.25" (30 mm) can be patched up with self-adhesive Dacron sail appropriately. The Dacron must be of a weight of not less than 100 g/m. Larger cuts and ruptures are to be repaired by stitching on a reinforcing piece of the same fabric (stitched along the edges). Any rupture shorter than 8" can be repaired in this manner, but more complicated repairs and all cuts near the trailing edge should be carried out in an approved and authorized manner or via the manufacturer of the aircraft.

Sail Strength

An annual Bettsometer test with a 0.045 - 0.047 inch diameter needle (1 to 1.2 mm), with wing sails fitted and tensioned for flight is to be conducted Upper & lower surface: 3 lbs or 1360 gm. There are test panels sewn on the top surface of Reflex wings where this test can be conducted Stitches: 3 lbs or 1360 gm using a 0.045 - 0.047 inch (1 to 1.2 mm) diameter hook, pull upwards.

Besides the annual check there are several criteria for testing of sails dependent on the conditions that the sail fabric is exposed to. The pilot/operator of the aircraft is responsible for determining the level of exposure that the sail experiences. UV is the killer of sail cloth and is to be avoided as much as possible.
Annual testing is adequate except in cases where a more harsh and exposed environment warrants more frequent testing. In such cases every 200 operating hours regardless of time (annual or not), the Bettsometer testing should be conducted to see if sail and stitch passes.
Keep an eye on the sail grommets/eyelets and all areas of the sail that are subject to extra stress, especially the wing keel section, the nose section of leading edge and the outer tip section of leading edge. There are test panels sewn on the top surface of the Reflex wings and if there is any question or doubt, these panels can be cut out and sent to the factory for testing strength of the sail material for airworthiness.

Tubing and Structure

Check all nuts, bolts, safety pins, and hardware on the wing.
Check all tubing visually for corrosion, straightness, dings cracks etc. If there is absolutely any doubt, check the tubing as described below in full tubing inspection. Check all brackets and connections in the structure for cracks etc.

Full tubing inspection (at 500 hours since new and then every 250 hours thereafter)
At 500 hours and then every 250 hours thereafter or if it is known that the wing has had hard landing or the trike has flipped over due to adverse weather conditions when outside, it is imperative that tubing and brackets be inspected fully with sail-off in the following manner:
To check the condition of the wing tubes the sail should be removed from the wing frame by unlocking all the fasteners that secures outside cabling and/or struts to the wing structure, removing the hang block plates or hang block as applicable so the keel pocket can slide through the keel tube, close the wing in so its in packed position and snaking the fabric off the structure. Then the tubes should be detached at the joints. The tubes are to be inspected visually. When there is suspicion of damage, the points in question should be inspected using a magnifying glass of (5-10) X magnification. A straight edge may be used on the tubing to ascertain straightness. There should be no trace of corrosion, cracks, bends or dents

Take all battens out, loosen all fasteners, struts, cabling and cross tube and leading edge junction, hardware, straps and hang block elements that hinder the sail from coming off the tube structure

After closing the wing, the frame can
now be snaked out through the nose of the sail.

Fasteners

Check all fasteners (bolts, screws, rollers, nuts, splint pins etc.) for corrosion. Any corroded/rusted fasteners should be replaced. Bolts should not be worn and/or bent. Key bolts should be checked most thoroughly for cracks between the head and the bolt body. These are the bolts at the control bar side and bottom joints, the cross tube tensioning cable attach point and the rear cable attachment point on the keel tube. If any cracks are observed – REPLACE IMMEDIATELY!

Battens/Ribs and Batten Tips and Trailing Edge Tips or Cords

The batten profiles should be checked if the user complains of a turn against the template and the bends should be adjusted if necessary to the template. Check all the plastic batten heads and tails and replace if necessary. Batten templates can be ordered from the manufacturer. Only those battens that are known to be bent beyond the original template for wing tuning purposes and logged in aircraft maintenance log as such should be allowed to deviate from the manufacturer batten template.

If any of the batten tightening cords or cordless tips are torn or heavily worn they must be replaced. The cord is 400 pounds spear fishing line available at many scuba shops or can be ordered from the factory. Any batten trailing edge tips that are worn should be replaced if applicable and can be ordered from the factory

WHEN REPLACING PARTS OR INSPECTING, NEVER REUSE A NYLOCK NUT

16. Wing Retirement

With proper care and maintenance, the Reflex series wing will remain for some years at a high level of airworthiness. Each Reflex series wing has a patch sewn into the sail at the top center for UV testing. Simply cut out the panel and have a test performed.
There is much that we still don't know about trike wing longevity; such as what exactly is the effective lifetime of a trike wing before material fatigue and degradation compromise the airworthiness of that wing. We do know that there are forces in nature which can severely compromise the airworthiness of that wing, regardless of the quality of design or condition of the wing you are operating. Your safety is ultimately your own responsibility.

However, there is one subject in particular which needs to be addressed at this point--and this is wing retirement. There comes a time when the sail of any trike wing simply becomes too suspect to feel safe while flying it. Ultraviolet degradation will inevitably dictate the retirement of your wing. Judging when this occurs to your wing is best verified by an authorized service center.

All of us, as responsible and caring human beings, owe it to one another to do the responsible thing and remove any over-used equipment from the skies. We at Evolution Aircraft Inc. abhor those whose method of dealing with a wing due for retirement consists of simply passing their problem along to an unsuspecting pilot in the used wing market place. The mature thing to do, at the appropriate time, is to destroy very old gliders to ensure that they cannot endanger an unknowing pilot.

Along these same lines, because wings do change hands, we feel that it is quite important to keep accurate records of tuning changes, and especially of repairs, in the maintenance log of this manual. Please consider the needs and safety of those other pilots down the road who may stand to gain from these records.

17. Limitation of Liability

The owner and operator of this trike wing must understand that, due to the inherent risk involved in flying such a unique vehicle, no warranty is made or implied of any kind against accidents, bodily injury, or death. By purchasing this wing, the owner and operator of this Trike wing assumes complete responsibility for their use of this equipment, and specifically, agrees to release Evolution Aircraft Inc. and/or their agents, from any and all liability.

18. Technical Specifications

Note: These specifications are intended only as a guideline for determining whether or not a given wing conforms to current production specifications, and whether it is in a configuration as originally designed.

SPECIFICATIONS FOR REFLEX DISCOVERY(13) WING

* Cruise Speed: 55 – 80 mph (48 - 69 Knots)
* Max Speed: 90 mph (78 Knots)
* Stall Speed at Gross: 38 mph (33 Knots)
* Max TakeOff Weight: 1060 lbs (481.8 kg)
* Rate Of Climb (912ULS): 1065 ft/min (5.4 m/sec)
* Takeoff Distance to clear 50 foot obstacle (912ULS): 855 feet (260 meters)
* Landing Distance over 50 foot obstacle : 800 feet (244 meters)
* Descent Rate at 481.8 kg gross loading: 460 feet/min (2.337 m/sec) @ 56 mph (48 knots)
* Glide Ratio (Tested on Revo): 10.7:1
* Ultimate Strength: +6g, -3g
* Maneuverable Loading: +4g, -0g
* Wingspan: 31.5 feet (9.6 meters)
* Style: Topless wing
* Aspect Ratio: 6.7
* Wing Area: 145 sq. ft (13.5 sq. meters)
* Wing weight: 120 lbs (54.5 kg)
* Light in center and pressure increases as steeper bank angles in roll are achieved. Very docile
* Optional electric trim (makes it easy to go slower than trim)

Note: All performance figures are obtained on a Revo trike

SPECIFICATIONS FOR REFLEX SPORT(12) WING

* Cruise Speed: 60 – 92 mph (52 - 80 Knots)
* Max Speed: 110 mph (96 Knots)
* Stall Speed at Gross: 39 mph (34 Knots)
* Max TakeOff Weight: 1060 lbs (482 kg)
* Rate Of Climb (912ULS): 1000 ft/min (5 m/sec)
* Takeoff Distance to clear 50 foot obstacle (912ULS): 902 feet (275 meters)
* Landing Distance over 50 foot obstacle : 800 feet (244 meters)
* Descent Rate at 472.5 kg gross loading: 525 feet/min (2.67 m/sec) @ 55 mph (48 knots)
* Glide Ratio (Tested on Revo): 10.5:1
* Ultimate Strength: +6g, -3g
* Maneuverable Loading: +4g, -0g
* Wingspan: 31.5 feet (9.6 meters)
* Style: Topless wing
* Aspect Ratio: 7.37
* Wing Area: 134.5 sq. ft (12.5 sq. meters)
* Wing weight: 118 lbs (53.5 kg)
* Light but positive roll pressure
* High roll rate
* Optional electric trim (set hands off speed in flight)

Note: All performance figures are obtained on a Revo trike

SPECIFICATIONS FOR REFLEX COMPETITION(11) WING

* Cruise Speed: 65 – 90 mph (56 - 79 Knots)
* Max Speed: 115 mph (100 Knots)
* Stall Speed at Gross: 43 mph (37 Knots)
* Max TakeOff Weight: 1040 lbs (472.5 kg)
* Rate Of Climb (912ULS): 1000 ft/min (5 m/sec)
* Takeoff Distance to clear 50 foot obstacle (912ULS): 951 feet (290 meters)
* Landing Distance over 50 foot obstacle : 800 feet (244 meters)
* Descent Rate at 472.5 kg gross loading: 560 feet/min (2.845 m/sec) @ 58 mph (50 knots)
* Glide Ratio (Tested on Revo): 9.0:1
* Ultimate Strength: +6g, -3g
* Maneuverable Loading: +4g, -0g
* Wingspan: 27 feet (8.23 meters)
* Style: Topless wing
* Aspect Ratio: 6.075
* Wing Area: 118 sq. ft (10.9 sq. meters)
* Wing weight: 114 lbs (51.5 kg)
* Light but positive roll pressure
* High roll rate
* Optional electric trim (set hands off speed in flight)

Note: All performance figures are obtained on a Revo trike

SPECIFICATIONS FOR REFLEX RIVAL (12.5) WING

* Cruise Speed: 65 – 90 mph (56 - 79 Knots)
* Max Speed: 110 mph (Knots)
* Stall Speed at Gross: 43 mph (37 Knots)
* Max Takeoff Weight: 1060 lbs (482 kg)
* Rate Of Climb (912ULS): 1000 ft/min (5 m/sec)
* Takeoff Distance to clear 50 foot obstacle (912ULS): 920 feet (282 meters)
* Landing Distance over 50 foot obstacle : 800 feet (244 meters)
* Descent Rate at 482 kg gross loading: 500 feet/min
* Glide Ratio (Tested on Revo): 9.5:1
* Ultimate Strength: +6g, -3g
* Maneuverable Loading: +4g, -0g
* Wingspan: 29.5 feet (9 meters)
* Style: Topless wing
* Aspect Ratio: 6.2
* Wing Area: 134 sq. ft (12.4 sq. meters)
* Wing weight: 116 lbs (52 kg)
* Light but positive roll pressure
* High roll rate
* Optional electric trim (set hands off speed in flight)

Note: All performance figures are obtained on a Revo trike

Owner's Maintenance Log

DATE WORK PERFORMED