

THE
FOIL
C Series
OWNERS MANUAL

designed by

Enterprise Wings.

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INTRODUCTION

Congratulations! You are now the owner of what we believe is the finest flex wing hang glider available.

The FOIL is a new and innovative concept in hang glider design and is instantly recognisable as a glider apart from the rest, in looks, quality, handling and performance.

ENTERPRISE WINGS is confident that you will enjoy many hours of pleasant recreational flying, whilst owning a glider with performance better than most. Your FOIL is also fully certified to Gutesiegal standard so that you are able to enjoy worry-free airtime.

Please do not hesitate to call us and let us know how your FOIL is performing. We welcome your feedback.

Safe and happy flying.

Best Regards,
The Enterprise Wings Team.

DESIGN CONCEPTS & TECHNICAL INFORMATION

The FOIL has been specifically designed to reduce drag, increase performance and improve handling characteristics.

A NEW sail cut, developed by Enterprise Wings, is incorporated in the design. In this cut the sailcloth panels are laid parallel to the leading edge and also the trailing edge. This allows for greater sail tensions with a minimum of stretch. Enterprise Wings is using the latest sailcloths and this, along with the new sail cut, provides years of flutter-free sail life.

The keel is totally enclosed in the double surface, presenting an aerodynamically clean wing. The old dive stick system has been replaced with a swivelling washout strut that is also fully enclosed in the double surface. These two measures clean up the wing and make substantial savings in drag.

The glider has a more positive and connected feel to it by eliminating the keel pocket. This is due to the lack of wing movement relative to the pilot and having the mass of the wing closer to the pilot.

The pilot is now hanging from the aerodynamic centre of the wing, giving much greater pitch and roll authority. The FOIL is able to achieve a much broader speed range with less effort needed to hold high speeds or turn the glider. This, together with the Variable Billow and luff-line compensator system, mean much more enjoyable cross-country flights. You will discover that the FOIL is a joy to thermal.

Finally, its nice to know that at the end of that LONG cross-country flight you are flying the easiest to land high performance wing available.

SPECIFICATIONS

	152	139
Sail Area	14.1m ² (152 ft. ²)	12.9m ² (139ft. ²)
Wing Span	9.86m (32'10")	9.70m (31'4")
Aspect Ratio	7.3	7.3
Nose Angle	130°	130°
Double surface %	85	85
Weight (without bag)	33kg. / 74lb.	31kg. / 68lb.
Pack-up length	5.6m (18'5")	5.55m (17'11")
Breakdown length	3.85m (12'8")	3.85m (12'8")
Recommended hook-in weight limits:	60 - 90kg. / 131 - 198lb.	50 - 75kg. / 109 - 165lb.

OPERATING LIMITS

Utility Class Glider

Flight operation should be limited to non aerobatic manoeuvres, i.e. those in which the pitch angle will not exceed either 30° nose up or down of the horizon and in which the bank angle will not exceed 60°. The FOIL is capable of spins (which is not an approved manoeuvre) but is inherently resistant to them. This glider must not be flown by more than one person at a time or be flown inverted or backwards.

Additional Flight Parameters

Stall speed at max. recommended loading:	31 k.p.h. (19 m.p.h.)
Max. speed at min. recommended loading:	75 k.p.h. (46 m.p.h.)
H.G.F.A. min. required rating (or equiv.)	Intermediate or above
This glider should not be flown in excess of V _{NE}	75 k.p.h. (46 m.p.h.)

Disclaimers

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 aerobatic manoeuvres or erratic pilot technique may ultimately produce equipment failure and are specifically excluded from any warranty.

ASSEMBLY PROCEDURE

It is possible to rig the FOIL in two positions, either lying flat on the ground or standing on the control frame. The second method is acceptable in lower wind conditions and helps keep the sail from getting dirty or suffering tears and scrapes from rocks in the rigging area. The first method, flat on the ground, is useful in higher wind conditions as it reduces the chance of ground looping in the event of a sudden gust of wind. Generally, the first method is preferred and the rigging sequence is as follows:

- 1) Lay the glider on the ground nose into wind with the zip facing upwards. Unzip the bag.
- 2) Spread the control bar sides out and insert the base bar end onto the alloy forging at the base of each upright. Secure with the bolt, nut and safety-pin. Pivot the control frame up briefly to check that all of the rigging wires are outside the control frame.
- 3) Holding the control frame with one hand, flip the glider over so that the control frame is flat on the ground.
- 4) Remove the glider bag and unclip all the sail ties.
- 5) Pivot the king-post up vertically and attach the luff-lines/top rear wire with the spring clip to the thimble on the short wire at the top rear of the king post. It may be necessary to pull back on the king post to attach the clip.
- 6) Open out one wing a few feet then open out the other wing fully. Finally open out the first wing fully. This sequence is necessary to avoid catching the crossbar on the keel as it spreads apart. When opening the leading edges out avoid lifting them too high as this can distort the nose plates.
- 7) Remove the battens from the batten bag and sort into left and right sets (white tips are right side, black tips are left side. Bottom battens and tip struts can go in either side.)
- 8) Insert the tip struts FIRST on each wing. Reach into the sail with one hand to help guide the strut into the swivel mount near the end of the leading edge. It fits with its curve down and has a mitred end to correctly locate on the leading edge. Secure the strut with double elastic cord from the top surface and single elastic cord from the bottom surface. Note: Tip struts are identical and can go in either wing.
- 9) Insert the remaining top surface batten from tip to root using gentle pressure until the batten meets resistance then lift the sail at the trailing edge and gently shake in order to billow out. This enables the batten to be fully inserted over the crossbar. DO NOT FORCE - care taken during insertion and removal of the battens will minimise wear in batten pockets. Secure all the battens with the double looped cords. Finally, insert the nose batten from the front of the glider.

10) Tension the crossbars by pulling back the cord attached to the end of the crossbar retaining strap. This is achieved most easily by lifting the keel on to one's knee whilst pulling on the strap. Locate the steel tang on the end of the retaining strap over the bolt at the rear of the keel. Screw on the nut and locate the safety-pin. NOTE: If difficulty is experienced tensioning the crossbar, check that none of the rigging wires, top or bottom are snagged or kinked. DO NOT FORCE. Check the wires!

11) Insert the lower surface battens carefully as there is a chance of missing the batten pocket as the battens enter the sail. Secure the battens with the elastic cords. NOTE: if wind conditions permit, the lower surface battens can be inserted after the glider has been stood on its control bar, by pivoting the glider to the nose down position.

12) Lift the glider up onto the control bar and ensure that all the lower rigging is untangled.

13) Secure the bottom front wire nose catch onto the bottom nose plate channel and velcro up the nose cone, pulling it tight.

14) Pull the variable billow (V.B.) to maximum tension. Unzip the double surface about two feet and find the clip on the end of the luff-line compensator. (This line is attached to the front top wire). Secure this clip on to the tang on the crossbar centre plates. Release the V.B. again. On the 160, 150 and 140B FOILS the compensator clip also includes a wire minimum setting. It is extremely important that this clip is secured correctly to the tang. Some VB cord is left over when the VB is at the "off" setting. Tie up the extra cord to prevent stepping on it during your take-off run.

This is a critical stage of assembly as the glider is not fully tensioned until the compensator and minimum setting is secured (N.B. 170B FOIL does not have a minimum setting)

15) Remove the padding from the top of the control frame.

16) Pre-flight the glider thoroughly by following the checklist in the next section.

If the glider is rigged standing on the control frame, follow this initial sequence (refer to the previous method for details of each step).

1) Lay glider on the ground, unzip the bag and assemble the control frame.

2) Stand the glider on its control frame and attach the nose catch.

3) Remove the bag and undo all the sail ties.

4) Spread the wings out. IT IS ESSENTIAL THAT THE KEEL AND LEADING EDGES ARE KEPT IN THE SAME PLANE DURING THIS STEP. Damage to the crossbar and nose plates may otherwise result.

5) Attach the top rear wire/luff-lines to the kingpost top.

6) Follow steps 7-17 as per the first method. When rigging this way, always be aware of wind conditions and position the glider accordingly to avoid ground-looping.

PRE-FLIGHT INSPECTION

A thorough pre-flight inspection should be followed before each flight. Do not get distracted by other people during this inspection. The Foil, like other double surface gliders, has many of the airframe checkpoints obscured by the sail, but access zips have been provided to facilitate the inspection.

Start at one point, the nose plate for example, and work around the glider checking components carefully.

- 1) Sight along both leading edges checking for similar curves. Check that the nose battens are located properly on the nose plate.
- 2) Walk towards the wing tip feeling for dents in the leading edge.
- 3) Unzip the inspection panel at the crossbar/leading edge junction and check the wire mounting points.
- 4) Check the sail tension at the tip and twist the ball tip (if fitted) to check for free movement.
- 5) Check the tip struts for proper location. These should curve down.
- 6) Walk to the keel checking all the batten cords, including the bottom surface battens.
- 7) Check the luff-line attachment points at both the trailing edge and king-post top. Ensure that the luff-lines are not caught around the batten ends.
- 8) Check that the crossbar retaining strap is secured on the bolt with the castle-nut and pin and that it is fitted correctly. Make sure the V.B. pulleys are not twisted (look up the rear of the keel pocket).
- 9) Check that the luff-line compensator is attached to the crossbar.
- 10) Repeat steps 2-7 in reverse order for the other wing.
- 11) Check the nose catch.
- 12) Check that the lower rigging is not kinked or caught round the control bar.
- 13) Check that the uprights are straight and that the base bar bolt is correctly assembled with the castle-nut and safety-pin.
- 14) Check the bolts and housing at the top of the control frame.
- 15) Pull the V.B. on full and then release, checking that the compensator line pulls down the top front wire as the V.B. is released and that the pulleys move freely.
- 16) Check that the hang loop and safety loop are in correct trim position and are not worn.
- 17) Check the nose catch, base bar bolt, crossbar strap and compensator line clip AGAIN. These four items are critical for the safe operation of the glider.
- 18) Attach your harness to both loops, checking carabiners carefully. Check the height of the harness above the base bar.
- 19) **DO A HANG CHECK.**
- 20) Set up and switch on your instrumentation.
- 21) **SPECK OUT !**

DE-RIGGING PROCEDURE

This is basically achieved by reversing the sixteen assembly steps. **Remember to unclip the luff-line compensator first**, or the crossbars won't fold when the crossbar strap is released. Pull the V.B. full on to unclip the compensator, then release it again.

Fold the wings into the keel at the same time, otherwise the crossbar may jam between the keel and the leading edge and prevent the glider from being folded properly. To fold the wings at the same time, stand astride the keel facing forward and hold the trailing edge of each wing. Swing the wings inwards, lifting the leading edges slightly off the ground to avoid scraping the sail.

Keep the leading edges and keel in the same plane at all times to avoid damaging the crossbar and nose plates, especially when packing up with the glider standing on the control frame.

Roll the sail up carefully to avoid unnecessary creases and always use the padding provided to prevent sail wear.

Try to make the packed glider as compact as possible as this will reduce wear and tear during travel.

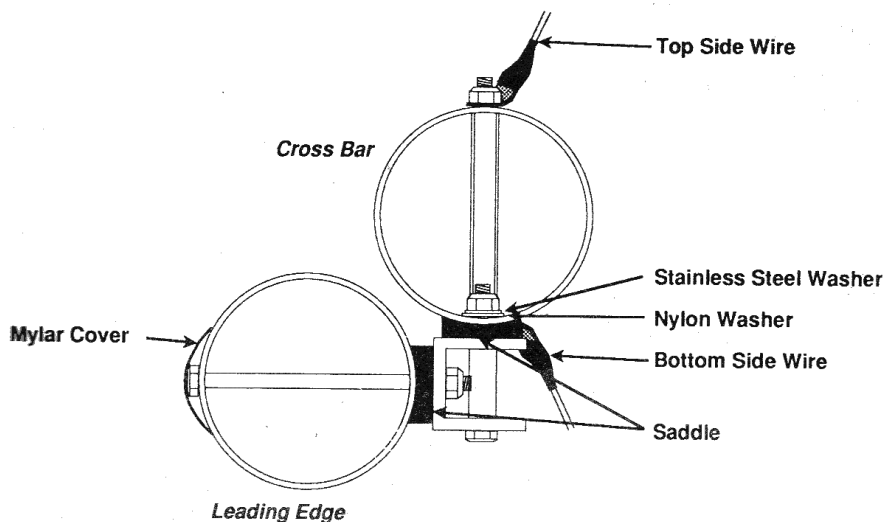
OPTIONAL BREAKDOWN PROCEDURE

The Foil breaks down easily for long distance or overseas travel. The procedure is as follows:-

- 1) If the glider is packed, undo all the sail ties.
- 2) Spread the leading edges until they are about three feet apart at the ends.
- 3) If the sail is secured to the leading edge tips by ball tips, undo these by simply reaching into the sail at the tip with one hand and grasping the leading edge firmly. Hold the ball with your other hand (!) and "pop it" out of the socket.
- 4) Slide the outboard leading edge tube away from the inboard section then pad the ends of the sleeves with rags etc.
- 7) Fold the outer sail sections back towards the front and secure with a tie.
- 8) Lie the outer leading edge sections alongside the glider and secure with sail ties.
- 9) Fold the excess bag length over the glider, then zip up the bag.

Simply reverse these steps for reassembly, ensuring that the outboard section is locked securely in place around the clevis locating pin and that the sail is fixed securely with the ball tips.

Leading Edge - Crossbar assembly



FLYING TECHNIQUES

TAKE OFF

The FOIL has a neutral static balance and is very easy to launch in both calm and windy conditions. Have the nose slightly lower than you would normally and the wings level. Run hard till the glider lifts you off the ground.

TURN

The FOIL has a light roll rate even at very low flying speeds. To get the best handling characteristics in turns move to one side and push out slightly. Adjust the bank angle with a combination of pitch input and lateral weight shift. The FOIL will sit at the desired bank angle until the turn is removed. Give yourself an extra margin of safety and DON'T fly at the slowest possible airspeed when scratching for lift close to the terrain.

STALLS

The stall characteristics of the FOIL are very straightforward. If you push out slowly it is hardly possible to stall the glider at all and the glider will "mush" without a tendency to drop a wing. The sinkrate is more than doubled in this "mush" mode.

If you push out harder the nose of the glider will come up a little higher. This is followed by a gentle pitch down and the glider will regain flying speed. There is not a lot of altitude lost with this manoeuvre.

NEVER stall the glider completely with the nose pitched up very high. This is one of the most uncontrollable and dangerous manoeuvres for any hang glider, and can result in a tailslide and severe tumble.

Stalls in a co-ordinated turn are difficult to do by mistake. If you push out too much in a turn the glider will merely turn tighter, unless you are flying very very slowly, in which case you may tip stall. In this case move your weight forward and the glider will quickly recover.

SPINS

The FOIL will strongly resist spinning except with maximum V.B. on. However, if you do stall a wing in a turn and enter the initial stages of a spin, move your weight forwards and the glider will quickly recover without entering extreme attitudes and without great loss of altitude.

LANDING

This is easy in a FOIL. Your final approach should be a straight glide into wind at just faster than best L/D speed. Bleed your speed off slowly, wings level, as you enter ground effect. In light or no-wind conditions a full, hard flare is required with the control frame held out. In stronger winds, a gentler

flare will suffice. If you flare too early and start to gain height, don't pull in again - just keep the bar held right out.

It is possible to do a "parachute" or "mush" approach, but this should only be done in steady smooth winds and it is not recommended that the FOIL be mushed all the way to the ground.

The VARIABLE BILLOW (V.B.) SYSTEM

This provides the best of all worlds by making take-offs and landings easy in the slack setting, gives great handling on medium settings and a superb glide angle on maximum setting.

To use the V.B. simply pull on the rope and hold it with the cleat when the desired setting is reached. You may like to mark the rope with a marker pen at the full-off, full-on and medium position that works best for you in general flying. Generally, about 50% V.B. is a good all-round position. To release the V.B., flick the rope out of the cleat and let it run through.

Note: On maximum V.B. setting, glide angle and sink rate are best, roll rate is slower and spinning/tip-stalling may be possible. Always land with the V.B. off as corrections are light and easy in this setting.

TUNING INSTRUCTIONS

Your FOIL has been test flown by factory authorized pilots to check that the trim and handling characteristics are normal.

TRIM SPEED

The trim speed is the speed at which the glider flies "hands off", i.e. when the centre of gravity and centre of pressure of the glider are at the same point. The trim speed can be altered by moving the hang loop forwards or backwards along the keel, to suit individual preferences. An aeroclamp holds the hangloop in position. Simply loosen the hang loop retaining clamp, move as required and retighten the clamp to hold the loop in its new position.

LUFF LINES

Do not alter the luff-lines from the original specifications under any circumstances.

TURN

If your glider develops a turn, check the following:-

- 1) Check that all the battens are correctly profiled and symmetrical on each side.
- 2) Check the ball tips (if fitted) - sometimes grit gets into the socket and restricts movement. Clean out sockets and reinsert the balls.
- 3) Check that the leading edge sail tension is the same each side - pull on the sail at the tip when glider is de-rigged to check the "give" in the sail.
- 4) Check the leading edge spars for straightness. To do this properly, the leading edges should be removed and rolled on trestles or with one end on the ground while looking along their length. If you cannot find a bent leading edge, it is still possible that one of the leading edges has been stressed in a hard landing - this results in slightly different bending characteristics in each leading edge. This is not always critical and the turn can be tuned out by batten bending.

If none of the above checks has cured the turn, it can be tuned out by changing the batten cambers slightly. The only two battens that should be changed in either wing are the two last curved battens near the tip (not the tip strut).

For example, if your glider has a right hand turn, the two battens on the right hand wing tip need to have their camber increased by about 1/2" (10mm). (This will increase the lift at the tip). If the right turn still persists, reduce the camber in the two left tip battens by about 1/2" .

Batten recambering is a delicate adjustment and should be carried out by an experienced flier.

Tightening the batten cords has the same effect as increasing the camber.

Generally speaking, having the batten cords slacker improves the handling, possibly at the expense of glide angle.

LEADING EDGE TENSION

Generally this should be left at the factory setting. Increasing the tension with shims will flatten the tips and may marginally improve the performance but will make the glider harder to roll.

The VARIABLE BILLOW SYSTEM

The Variable Billow (V.B.) system works by pulling the crossbar back (via a system of pulley blocks giving a total mechanical advantage of 12:1. The system allows the sail to be tightened to maximise your glide angle and sink rate, or loosened for easier handling in rough conditions.

If the V.B. sticks in any position it is usually because of friction between rope and pulleys. Avoid getting grit into the pulley blocks at sandy sites and test for free movement during your pre-flight checks.

If the V.B. does stick in flight, pull about two feet of rope loose through the cleat and gently jiggle the control bar backwards and forwards (conditions allowing). This will free the V.B.

See the "Flying Techniques" section for more detailed information on V.B. use.

TRANSPORTATION AND STORAGE

Much of the wear and damage that affects hang gliders occurs during the transportation of the wing to the launch site, especially if rough access roads are involved.

With this in mind, use thick padding on the racks (old carpet pieces are good), avoid hard spots pressing on the glider, and support the glider in at least three places to keep the overhang at each end as short as possible and to minimise flexing. Use flat webbing straps rather than elastic cords to secure the glider to the racks as this is much kinder to the leading edge mylar inserts, which are vulnerable to creasing.

The glider can easily be broken down if desired, for long distance or overseas travel. The detailed procedure is described in the previous "Optional Breakdown Procedure" section.

Ensure the glider is dry before storage and air the glider every few months, otherwise the sail may get mouldy or mildewy.

MAINTENANCE SCHEDULE

Your new FOIL will require very little in the way of maintenance if you care for it properly in your day to day use. The schedule that follows and the general information below it provide a guide to the proper care of your glider.

EVERY 10 hours:-

Check the top and bottom surface batten shapes using the batten template sheet provided.

EVERY 50 hours:-

- 1) Inspect all crossbar tensioning strap components for wear/distortion. This includes the webbing strap, brackets, bolts, nuts, crossbar plates and limiting wire (uncoated wire running from the nose plate to the king post base).
- 2) Inspect luff-lines, attachment points, compensator line, pulleys and carabiner.
- 3) Inspect all the batten elastic cord retainers for wear and that the tension is the same for each side.
- 4) Check all tubing for possible wear damage from rigging, de-rigging or transportation.
- 5) Inspect all sail mounting points.

EVERY 100 hours:-

A complete inspection and strip-down of your glider is recommended (see next section for strip-down guidelines). Contact your local Enterprise Wings dealer or the factory for the glider's annual inspection if you do not feel confident in performing the work.

SPARS

Examine your spars (tubes) for dents, wear spots, bolt-hole elongation or distortion, corrosion and bends. Replace if at all suspect.

HARDWARE & BOLTS

For all practical purposes the hardware in the FOIL is virtually indestructible in hang gliding flight applications. Aircraft bolts, however, can bend and should be checked periodically or after crash landings. Check especially where sliding movement occurs, e.g. at the crossbar plates and at the crossbar/leading edge junctions. Replace any suspect bolts and lock nuts.

CABLES

- 1) Any frays or kinks in the cables should be examined with great care and any frayed cables replaced immediately.
- 2) Inspect all thimbles for elongation.
- 3) Many expert pilots replace their side flying wires every 100 hours, regardless of wear. This is certainly worth considering.
- 4) Each cable has a breaking strength in excess of 400kg. Actual non-aerobatic inflight loads seldom exceed 150kg even in rough thermal conditions.

5) If you regularly set up and pack up your glider in rough rocky areas you will need to replace your cables more frequently than someone who flies at grassy sites. Use your best judgement - those cables hold the frame together.

SAIL

1) If you must wash the sail, use a light detergent only ("Softly" wool washing powder gives excellent results). ALWAYS rinse thoroughly.

2) Acetone or methylated spirits can be used to remove stubborn stains without harming the sail. Avoid using solvents on the mylar sail sections (e.g. tips). Rinse well.

3) Check the sail for tears and abrasion. Apply sail repair cloth ("stickyback") to minor tears and holes in the sail. Have any major sail damage repaired by a professional sailmaker especially if it is in a critical area such as the trailing edge or tip sections.

4) Inspect all the eyelets in the sail.

5) The best thing you can do for your sail is to always use the bag. Do not carry your glider on top of a car, even for short distances, without the bag. Sun and weather cause more deterioration than hours of flying. Keep your FOIL covered when not in use - do not leave it rigged for hours in sunlight unnecessarily.

With proper care and maintenance your FOIL should last you for several years of flying. There is, however, much that is still not known regarding the effective lifetime of a hang glider before material fatigue and degradation compromise the airworthiness of the aircraft. This is why it is important to carry out the maintenance as outlined above.

STRIPDOWN GUIDELINES

1) With the glider upside-down but folded, remove the control frame from the keel. Remove the rigging from the control frame.

2) Turn the glider over and undo the screws holding the sail to the nose, tips, and end of keel

3) Slide the sail up each leading edge to expose the crossbar junction (refer to "Breakdown Procedure" for details). Undo the top side wires. Slide the sail back.

4) Undo the king post base bolt and luff-line compensator cord from the front top wire. Remove the crossbar limiting wire from the large shackle at the king post base.

5) Undo the two bolts holding the keel to the nose plates and remove the top rigging and kingpost together.

6) Undo the tensioning strap retrieval cord. Pull the restraining strap right out from the other side.

7) The keel can now be carefully removed out of the front of the sail.

8) Pull the rest of the glider frame forwards out of the sail through the double surface opening, making sure that nothing catches and that the wires pull through their holes in the sail.

9) Pull out the mylar inserts from the sail.

A FEW LAST WORDS

Your FOIL is a sophisticated high performance hang glider that will give you years of safe and enjoyable soaring provided that you look after it properly and always maintain a healthy respect for the demands and potential dangers of flying.

The FOIL has been tested to internationally accepted airworthiness standards. There are, however, forces in nature which can severely compromise your safety regardless of the quality of design or condition of the aircraft you are operating. You are reminded that you fly a hang glider at your own risk and that your safety is ultimately your responsibility. We strongly recommend that you fly conservatively, allowing safety margins in both the conditions in which you choose to fly and the manoeuvres you attempt.

Have fun, fly safe and see you in the sky !

MAINTENANCE RECORD SHEET

Note down any repairs or changes you make to your FOIL here. You will find it very useful as a reference, showing what was done and when.

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