Laminar

Owner Manual

Congratulations on buying an Icaro 2000 hang glider! We are certain that you have made the right choice!

The new Laminar represents the most important technological breakthrough in the world of free flying in recent years: it has totally transformed the sport of hang gliding.

Icaro 2000 srl is a company that leads the world in the field of hang gliding construction. The results attained in competition and sales put it in first place amongst hang glider manufacturers.
Hang gliders by Icaro 2000 are independently designed and built, using exclusively premium quality raw materials, in the factory premises at Sangiano, in northern Italy.
The success of our gliders stems from the skill and commitment of Manfred Ruhmer, who holds eight World Championship titles (three Cross Country titles, one Speed Gliding title and four Class II titles), it stems from the skill of Christian Ciech (aeronautic engineer, 2 World Championship titles in class 5), as well as from our three decades of experience in hang glider manufacture.
All our hang gliders have German certification, which is acknowledged as being the most stringent in the world as regards the safety parameters demanded from the glider.

You can rest assured that spare parts and service will always be available, no matter where you fly, by means of our worldwide network of distributors. This includes spares for all models, both those in production and earlier designs.

Thank you for choosing our hang gliders and we wish you great flights!

For whatever information or service, please contact the nearest authorized dealer, or the factory direct:

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1. Introduction

During the last twenty years, hang gliders, has become much safer. Accidents have diminished, due to the increased professionalism of flying schools, and increasingly stringent certification procedures. In Switzerland, for example, the insurance risk factor for hang gliding is the same as for winter sports. However, hang gliding is an active sport, in which there is a certain degree of risk.
Your safety can be greatly enhanced by following a few simple rules:

1.1 Keep Risks to a Minimum

- Attend a professional school.
- Fly a glider suited to your skills. In order to fly the new Laminar you should be an advanced pilot with at least 150 hours logged on another hang glider.
- Fly only when weather conditions are suitable.
- Be aware of adverse weather conditions; caution is a mark of intelligence, not of cowardice.
- Keep in continuous contact with your sport. Try to avoid long intervals between one flight and the next. This will also help you to progressively increase your flying skills.
- A new risk may arise when you fly a new type of glider for the first time. The reactions of your new glider may well differ from those of the glider you were used to. In order to minimise this risk, we recommend a gradual process of familiarisation with your new glider. Make your first flight in calm conditions.

1.2 Preliminaries

- Study your manual before your first flight. Practice assembly and disassembly as explained in the manual.
- Always follow the same assembly and pre-flight check routine; **do not allow yourself to be distracted during these procedures!**

1.3 Assembly Check and First Flight

- Every hang glider manufactured by ICARO 2000 is test flown at least once before delivery to the customer. However, if you wish, you can request another test flight from your dealer.
- Your dealer should also help you set up your glider for the first time and see you off on your first flight.
- We strongly recommend speedbar wheels, especially for your first flights.

1.4 First mountain launch

- For your first mountain launch, wait until weather conditions are ideal.
- It is best to fly in a location with which you are familiar, as long as it has a suitable launch site and landing site, in terms of both space and aerological conditions.
- Fly with your habitual harness and instrument.
- Experiment with different VG settings, roll reversals, slow flight, high speed flight and stalls at an altitude of at least 350 m (about 1,000 feet).

2. Fundamental Rules

- After major repairs, after replacing the sail or after a long period without flying, always choose a site to fly from that you are familiar with; and where it is possible to land immediately after take-off.
- Your glider is delivered to you ready to fly.

DO NOT make any adjustments that are not described in this manual.

- Periodically check the trim values shown in the tables (Chapter IX).
- Fly only after having attended a good school, recognized by your hang gliding federation.

- This Owner's Manual does not replace the checks on serviceability performed by an authorized dealer. This is true even for expert pilots. A pilot who is in doubt about any aspect of his/her glider should consult his dealer, or ICARO 2000, for advice.
- Never fly alone.
- Before every take-off, always perform both an assembly check and a pre-flight check.
- Don't push your luck! Fly only in places suited to hang gliding. It is your responsibility to be aware of the limits of your glider, and the limits of your own experience.
- Don't attempt towing of any kind, unless you have attended a recognized towing school. Always fit wheels on your speedbar when towing.

3. Certification and General Restrictions

3.1 Certification

All ICARO 2000 hang gliders have the German certification (DHV). Icaro gliders are rated according to the German DHV as follows:

- **class 1** (beginner pilots) –**RELAX** and **Mars**
- **class 2** (intermediate pilots) – **Laminar EZ, Orbiter**
- **class 2-3** (advanced pilots) - **Orbiter with VG, 12 MastR, 13 MastR**,
- **class 3** (advanced pilots) –**14 MastR**, **12.6 Laminar**, **13.2 Laminar**, **13.7 Laminar**, **14.1 Laminar**, **14.8 Laminar**

3.2 Wind Speed

- When the wind speed is stronger than 30 km/h (~15 knots), launch becomes risky. In these conditions, consult with more experienced pilots before launching. Trust those who advise prudence, and do not be let yourself be influenced by pilots showing excessive self-confidence or brash disregard.

If in doubt, do not fly.

3.3 Turbulence

- In turbulent conditions, gusts of descending air can induce sudden powerful negative forces on the glider; such negative forces must be avoided.
- Never fly on the downwind side of a mountain or ridge. This could be extremely dangerous, even in just a moderate breeze.

3.4 Aerobatic Flying

- Aerobatic flight includes flying with bank angles greater than 60°, pitch angles greater than 30°, whip-stalls, wingovers, loops and spins.

ATTENTION: Aerobatic flight can be fatal. It is, therefore, prohibited by Icaro 2000 and by the German Certification Federation (DHV).

Icaro 2000 wishes to inform its customers that the hang gliders that it manufactures are delivered to customers in a configuration that complies to the requirements specified by the German certification authority DHV.
Any changes that are made with respect to this configuration automatically annul the hang glider's certification, and they can also make its behaviour dangerous in flight.
Customers are therefore strongly advised not to make modifications that are not described in the hang glider's instruction manual, in order not to endanger their own safety and that of other people.

In particular, tips and sprogs should not be lowered, as this adversely affects the hang glider's longitudinal stability.

Icaro 2000 cannot be held responsible in any way in the case that the pilot makes inappropriate modifications to the manufacturer's products, or if they are utilized incorrectly.

4. Transport

4.1 By Car

Serious damage can be caused to the glider during car transportation; a well-padded roof rack is necessary to avoid damage. For additional safety and support, we strongly suggest you install a front rack on your vehicle.
There are good racks on the market, expressly designed for glider transport; these can be easily assembled on normal roof racks. Ask your dealer or Icaro 2000 for details.

4.2 By Gondola lift or Cable car

To avoid any damage when transporting your glider on a cable car, it is best to supervise the loading and unloading of the glider.

4.3 By Plane

Your glider needs to be well protected if it is to be transported by plane. Use a wooden crate, or a stiff cardboard tube. Your dealer or ICARO 2000 can supply these. Always let the airline know the dimensions and weight of your glider, well in advance.

4.4 Short Packing

It is best to avoid short packing your glider, because it may cause the formation of a marked crease on the leading edge mylar of both wings.

If, however, you have to short pack your glider, it is important to follow these instructions:

- Write notes as you disassemble so that you know exactly how to reassemble the glider afterwards. Where possible, reposition pins, bolts and washers in their correct positions, maintaining the sequence in which they will be reassembled.
- Undo the sail fastening on the end of the leading edge tube.
- Remove the pin holding the compensator cable attached to the swivel tip lever.
- Replace the pin in order not to lose it.
- Press the spring button on the leading edge tube and remove the terminal section.
- Be careful not to wrinkle the LSP leading edge insert too much when you fold the sail; it is possible to remove the insert.
- Wrap the leading edge tube that you have removed with soft fabric.
- At the outer end of the leading edge tube inside the sail, place a suitable form of protection on the end of the tube to prevent it from damaging the sail (for example, a plastic bottle from which you have removed the top half).
- Fold the wingtips as normal (ie in the same way as when you are folding the outer section of the sail), and fold it back onto the shortened wing. In performing this operation, place a cardboard tube (6-10 cm of diameter) on the sail around which to make the fold. This will prevent or reduce damage to the wing and the internal mylar.

Repeat steps 2-8 for the other wing.

To re-assemble your wing, follow the instructions in reverse order.
The reduction of length, removing the outside leading edge, will be as follows:

Laminar	**12.6**	**13.2**	**13.7**	**14.1**	**14.8**

cm / ft	**110 / 3.6**	**103 / 3.4**	**103 / 3.4**	**110 / 3.6**	**110 / 3.6**

When re-assembling the leading edge tube, check that the spring button has popped up and emerged from the tube. Remember to reconnect the compensator cable to the tip, making sure that it is not wound around the wing tip.

5. Assembly

There are two methods of correctly assembling your Laminar:

On the A-frame – this is without doubt the preferable method in most cases, because it prevents direct contact between the sail and the ground, therefore avoiding abrasion and damage caused by stones etc.
On the ground – this method should be used only in the case (best avoided) that you wish to leave the hang glider open for extended periods in high winds.

Note: Hang gliders can fly in one direction only. Left and right should be understood as seen from flying position.

5.1 Assembly on the A-frame

Place the glider on the ground

- In a light breeze, place the glider so that the tail is facing into the wind.
- In a moderate breeze, the keel must be perpendicular to the wind

If the ground where you are assembling the glider is not flat, point the nose of the glider towards the top of the slope.

5.1.1 Starting Point

Important: All the circular-section speed bars manufactured by Icaro 2000 are made with complex curves on several planes. The curves in the horizontal plane create the grips. The curves in the vertical plane are designed in such a way so that when the pilot moves laterally in flight, the distance between pilot and speed bar remains roughly constant.

- Open the cover, remove the Velcro fasteners, lift the two downtubes up together and fix the speed bar into position using the push-pins and the locking plates. **Do not forget the locking plates!** (The competition A-Frame does not have these rings).
- Make sure that the camber of the speedbar faces the nose of the glider. When you turn the glider over, the centre of the speedbar touches the ground first (carbon speedbars can only be assembled the right way), before the extremities of the A-frame.
- Turn the glider over and lean it on the A-frame so it stands stably.
- Remove the glider bag and any remaining Velcro ties.
- Partially open the wings, keeping the tips close to the ground and leaving the tip covers on.
- Remove the Velcro fastener on the sprog joint protector, and let the protector take up its position under the sprog.

- Remove the glider bag and any remaining Velcro ties.
- Position the carbon sprog (basically a large carbon tube braced by a steel wire placed at the crossbar/wing tube junction, which supports battens numbers 6, 7 and 8 on the Laminar 12.6; and battens numbers 7, 8 and 9 on all remaining sizes). In order to position the sprog, you should hold its extremity - the part that is flat and coated – and lift it until it is possible to insert the front part in the adapter.

- Make sure that the sprog wire is free and runs parallel to the sprog: it must not be twisted around the tube! In order to complete the positioning of the sprog, you need to close the zipper beneath it; this should be done **after** having inserted all the battens.
- Repeat the procedure for the other wing.
- Open the wings completely
- Make sure that the VG is totally released and that the wings are open as far as possible

To facilitate assembly of the wing tip tubes, proceed as follows:

- Pull the bungee on the rear part of the keel until you can grasp the handle.
- Then pull the handle until the small plate with the hole into which the bolt locates is close to the bolt itself. Do not fasten the plate onto the bolt.
- If the wind is not excessively strong, the wings should remain open even without locking the crossbar.
- Take the shackle that is attached to the front wires and secure it to the nose hook. In order to do this, you need to force the nose slightly downwards using the handle fitted for this purpose.

Note: On Icaro 2000 hang gliders there is a small safety cord attached to the shackle on the front wires. This has the effect that if the crossbar is not completely opened, it is impossible to hook the front wires in. At the same time, once the front wires are secured, it will be impossible to close the glider even when the crossbar is not locked open. Remember that having secured the front wires

does not necessarily mean that the crossbar is also hooked in. In the event that the crossbar is not hooked in, the safety cord will prevent the wing from closing after take off; but in this case it is essential to head straight for the landing field without making any brusque manoeuvres.

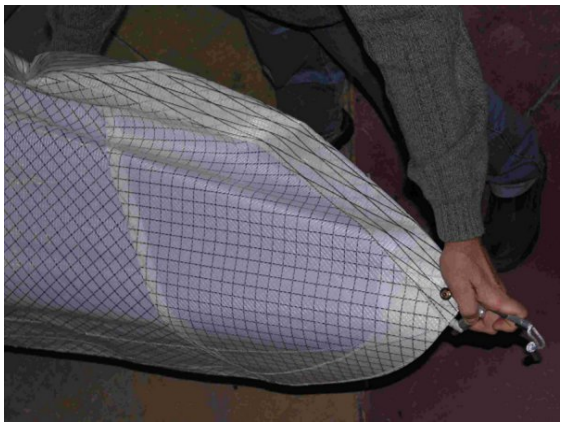
Do not, therefore, omit this point from your pre-flight checklist.
Do not lift the keel at the rear if the crossbar has not been completely opened. If you do so, you risk damaging the nose plates and bolts.

- Place the nose cone. You will only need to secure the lower Velcro strips because on the upper part there is an elastic cord that guides the nose cone into place.
- Move behind the glider again, and, by pulling on the trailing edge of the wing, reduce the wing tension. The wings will not close because they are held open by the safety cable attached to the front cables.
- With the glider in this configuration, in which the wing is not entirely open, it will be easier to assemble the wing tip tubes.
- Again, if the wind is not too strong, you can extract the terminal part of the keel by means of the spring button and rest the hang glider on the keel end. This makes assembly more practical. However, remember that this position is not very stable (it should not be used if wheels are fitted to the speed bar), and the hang glider may topple over and hit the ground with its wings. This is particularly true when wheels are fitted on the speed bar.

5.1.2 Mounting the fibreglass tips

- Remove the glider bag and any remaining Velcro ties.
- Remove the wingtip cover and open the zipper on the end of the sail.
- Insert the shortest straight batten (it is made of carbon on all our hang glider models) into the pocket located inside the sail, parallel to the trailing edge, and secure it with the Velcro strip fastener.

- Remove the glider bag and any remaining Velcro ties.
- Insert the thick end of the fibreglass tip into the aluminium hole at the end of the leading edge tube. Push firmly until you hear the tip hitting the stopper (clack!).
- Standing in front of the glider, hold the leading edge with one hand and the wingtip with the other hand. Bend (do not pull) the thin end of the tip towards the trailing edge and, at the same time, position the tip-lever cap over it.



- Remove the glider bag and any remaining Velcro ties.
- Using the attached cord, push the tip-lever into the sail until it “clicks” against the fibreglass tip. The sail is now tensioned.

IMPORTANT: Watch your fingers while closing the lever!

- Remove the glider bag and any remaining Velcro ties.
- Close the wingtip zipper. At this stage, the sail may not be flat but slightly twisted. If so, twist the end of the sail slightly to make it flat; failing to do this could cause a slight turning tendency in the air.
- Repeat the operation for the other wing.

5.1.3 Positioning the tip

Note: In the pictures shown below you will see the battens already inserted in the sail. Remember that it is important – and better – to position the tip **before** inserting the battens

- Hold the rear part of the tip (not attached to the leading edge tube), located in the outer section of the wing, and rotate it towards the trailing edge until it is inside the sail.

- Make sure that the tip wire is free and running parallel to the tip; it must **NOT** be twisted around it! In order to complete the positioning of the tip, you have to close the zipper on the sail; this should be done after the battens have been inserted.
- Repeat the same procedure for the other wing.

5.1.4 Inserting the Battens

- Remove the glider bag and any remaining Velcro ties.
- The red battens are for the left wing and the green battens are for the right wing. Take them out of the bag and lay them down on the ground on the correct side.
- Start from the centre of the hang glider, begin with the longest one and continue outwards until you have inserted the shortest batten.
- Place each one into its batten pocket and secure it on the trailing edge.
- Then insert the straight battens into their pockets on the double surface.

Note: The number of battens may vary according to the model and size of hang glider.
The nose battens remain in the sail at all times.

5.1.5 Final Steps

- It is now possible to close the tips and the sprogs zippers. Simply closing the zippers will automatically secure the position of the tips and the sprogs, by means of a special ribbon.

- Open the central zipper, which is under the keel and check that the T-junction to which the hang strap is attached is perpendicular to the keel. Close the zipper making sure that both zip pulls are near the nose. By doing this, the crossbar safety cord is almost completely enclosed inside the sail.
- Now place the nose fairing in its final position. All that you have to do is to position the lower Velcro strip fasteners, because the upper part is guided into the correct position by an elastic cord.
- Pass the VG cord through the jam cleat on the speedbar.

Assembly is complete: now perform the assembly check!

5.2 Flat Assembly

Position the hang glider on the ground with the nose into the wind.

5.2.1 Starting Point

- Open the bag, lay down the down tubes and secure the speedbar with the push pins and the safety rings. Do not forget the safety rings! The Competition A-Frame does not have these rings. Make sure that the camber of the speedbar is facing the nose of the hang glider.
- Turn the hang glider over but leave it on the ground.
- Remove the glider bag and the remaining Velcro ties. Open the wings keeping them low with respect to the ground.

Note: follow the same steps as for the “Assembly on the A-frame”; therefore return to page 8.

5.2.2 Final Steps

- Please remember that when you lift the glider onto the A-frame in high winds, it is important never to lift the nose of the hang glider more than required.
- Stand behind the glider, and pull the elastic cord at the rear section of the keel, until you reach the handle used for pulling the cross-bar into position and under tension.
- While lifting the keel slightly, pull the crossbar strap until you reach the fastening plate.
- Hook the plate onto the bolt projecting from the keel while pressing the spring-loaded double pin.

Be very careful when lifting the keel at the rear while the cross-bar has not been brought into position and has been fastened at least by the safety cord. Lifting the hang glider excessively with the cross-bar not fully open could damage the nose plates and the respective bolts.

IMPORTANT: The hang glider is now in a position in which the lateral cables are taut and prevent the hang glider from remaining flat on the ground. It is therefore important to finish assembly rapidly.

- Stand in front of the hang glider, and lift the nose slowly, using the wind to help you raise it level and up to the height at which it can be correctly supported by the A-frame.
- Take the spring clip at the end of the front cables and hook it onto the hang glider’s nose clip. To achieve this, you will have to pull the hang glider nose downwards slightly, using the webbing strap handle.
- Place the nose fairing into position.
- Carefully turn the hang glider so that it is rotated by just over 90° with respect to wind direction.
- Open the central zipper, which is under the keel and check that the T-junction to which the hang strap is attached is perpendicular to the keel. Close the zipper making sure that both zip pulls are near the nose. By doing this, the crossbar safety cord is almost completely enclosed inside the sail.
- Pass the VG cord through the jam cleat on the speedbar.

Assembly is now complete: now perform the assembly check!

6. Check list

Before every flight it is obligatory to perform a systematic check of the glider.

6.1 Assembly Check

Start at the nose. Proceed counter-clockwise around the glider checking all listed locations, opening and closing zippers where necessary in order to perform inspections. Finish by checking the centre and the A-frame.
The following points need to be checked thoroughly:

Nose

- Nose wire is attached and the hook is properly closed by the spring clip.
- Nuts and bolts on the nose plate are screwed down tightly.
- Nose fairing fits the leading edge properly, and it is properly fixed by the Velcro strip fasteners.

Crossbar/Left Leading Edge Junction

- Crossbar/leading edge junction is properly secured by the nut and bolt.
- The nut and bolt on the sprog cable are firmly tightened.
- The pin and the ring securing the sprog are in position.
- Side wire is in perfect condition and runs in the right direction.
- The sprog is in the right position and the cable is not twisted around it; the zipper is completely closed.
- Crossbar is not damaged.

- The zip is completely closed.

Left Wingtip

- Tip-lever is fully tensioned. The end zipper is closed
- End of the sail is flat.
- The mylar sheet inside the leading edge is correctly positioned, and does not cause any distortion to the wing profile.
- The tip compensation wire is unobstructed and slides freely.
- The tip is mounted and the cable is not twisted around it.
- The zipper is completely closed.

Left Wing Battens

- All upper battens are inserted and properly secured at the trailing edge.
- All lower battens are inserted and properly secured.

Rear Keel

- All nuts and bolts on the rear section of the keel are firmly tightened.
- The crossbar tension plate is secured in place by the spring buttons.
- Tension strap is in good order.
- VG pulleys are in good condition and the cord is not twisted.
- Lower rear wires are in perfect condition.
- Detachable rear section of the keel is inserted into the main keel and held in position by the spring button.

Right Wing Battens

- see above : ”Left Wing Battens "

Right Wingtip

- see above: "Left Wingtip"

Crossbar/Leading Edge Right Junction

- see above: "Crossbar/Leading Edge Left Junction"

Central Section

- The hang strap is not damaged, and it is properly secured by means of its bolt.
- The hang strap T-junction is perpendicular to the keel.
- Look inside the sail to make sure that the main tubes are in perfect condition and that all nuts and bolts on the central plate of the crossbar are tight.
- The nut and bolt that fix the A-frame to the keel are tight and the bolt is not bent.
- Check that the central zipper is completely closed.

A-frame - Lower Corners

- Speedbar is properly attached.
- Speedbar pushpins and their safety rings are in place.
- Both socket head bolts which secure the speedbar are tight and do not protrude from the nylon block.
- The wires attached to the A-frame are not twisted or caught around the A-frame corners.

Symmetry

With the VG totally slackened (zero VG), stand behind the glider while holding the keel up and check the glider’s symmetry, comparing the right and left wings. Verify that the twist on both wings is identical; the twist should increase outwards, on both sides.
Perform the same check with VG full on.
If, when changing VG tension, there are marked differences in symmetry, the first thing to check is the tip compensation cable, making sure that it has not caught somewhere.

6.2 Equipment check

Harness

- Parachute is in place and the handle is secured.
- Zippers are unobstructed and run freely.
- Hook in and perform a hang check.

To reduce the risk of taking off without having hooked in, it is a good idea to hook the harness to the hang glider before putting on the harness. Today, nearly all harnesses open at the front, and so they are easy to put on even when the harness is attached to the glider. If you have to leave the glider after having hooked in, it is best to take off the harness while leaving it attached to the hang glider. The possibility of being surprised and overturned by a gust of wind while you are waiting at the launch site, generally involves less risks than those consequent to taking off without having hooked in.

- Leg-straps are in place and buckles are secured.
- During the hang check, the centre of the speedbar deforms about 5 cm (~2 inches) upwards, when compared to its position in flight. Bear this in mind when evaluating your height from the bar; on the ground you should leave a gap of at least 5 cm (~2 inches) in order to have a distance of 10 cm (~4 inches) in flight. This position is generally the one that is most comfortable.
  The airfoil section speedbar does not deform on flat ground because it does not have the “ox-horn curve”.

Helmet

- Make sure that the outer shell has not been damaged (take care not to sit on your harness pack when the helmet is inside, which can damage the helmet. It was not designed for this sort of function).
- Strap is fastened.

6.3 Pre-Flight Check

- **HOOKED IN.**
- Strength and direction of the wind are safe.
- Nose angle is correct
- Wings are leveled.
- Take-off area and glider are clear.
- Airspace is clear from others aircrafts

7. Disassembly

The disassembly of the hang glider is carried out in the opposite sequence with respect to assembly; therefore you have to follow the procedure detailed below:

7.1 On the A-Frame

In high winds, turn the hang glider so that it is facing a direction about 90° from wind direction.

7.1.1 Starting point

- Position the hang glider with the rear extremity of the keel facing into the wind.
- Make sure that the VG is completely loose.

Note: make sure that the sail is loose before removing the battens, the tips, the sprogs and the fibreglass tips.

This can be achieved by detaching the crossbar tensioning strap from the bolt projecting from the keel and leaving the wing open, as it is held in that position by the safety cable attached to the front cables.

- In a light wind, you can extract the rearmost extremity of the keel, by pushing the spring button and pulling it out. This part remains attached to the glider by a bungee.

- Rest the glider on the rearmost part of the keel as shown in the photograph.

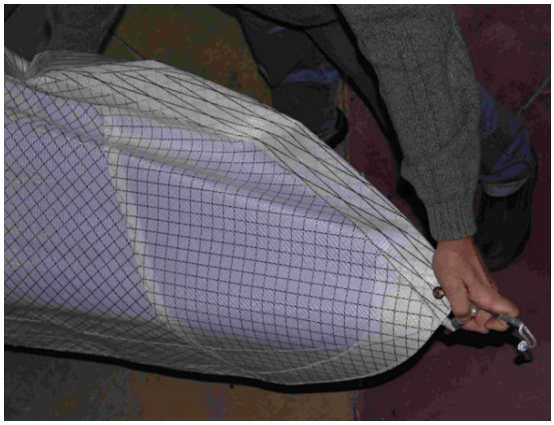
- Open the sprog and tip zippers.

- Remove the lower battens and then the upper battens starting from the outer extremity of the wing and moving towards the centre.
- Hold the end of the tip and rotate it towards the centre of the wing until it rests alongside and parallel to the leading edge (the tip remains on the outside of the double surface).

Note: In the pictures below you will see the battens still inserted in the sail, but the tip should be rotated only after all battens have been removed.

- Open the wingtip zipper and take out the transversal carbon batten.

- Grasp the tip-lever by the cord and pull it towards the outside.
- Unhook the tip lever with the cord and pull it towards the outer side.



- Stand in front of the glider at the wingtip, and hold the end of the leading edge tube with one hand and the fibreglass tip lever with the other. Bend (not pull) the tip towards the trailing edge and, at the same time, rotate the lever cap outwards removing it from the tip.
- Remove the fibreglass tip and the short straight carbon batten, put them together with the other straight battens.
- Rotate the tip-lever inwards and close the zipper.

7.1.2 Folding the sail Wingtips

- With one tip bag in your pocket, stand in front of the leading edge.
- Hold the extremity of the wing by grasping the tip lever bolt, pull it towards the nose and put it along the lower side of the leading edge. The wingtip will be between you and the leading edge.

- Holding the extremity of the wing in this position, take the sail by the trailing edge and lift it upwards until it is tight and from this position roll in the sail, starting from the trailing edge.

- Wrap up the entire wing section with the tip that you kept between you and the leading edge.

- Holding the rolled sail, slip the bag over the tip.
- Repeat the same steps on the other wing.

7.1.3 Final Steps

- Put the battens and the fibreglass tips into their bag.
- Return the extremity of the keel to its closed position.

- Remove the nose fairing.
- Unhook the nose wires. To do this you have to pull the nose downwards slightly. Pull the nose ribbon so the nose's hook safety system will open automatically and you can remove the front wire shackle.
- Completely release crossbar tension.
- Partially close the wings. To perform this operation, stand behind the sail and at the centre, grip the trailing edges of both sides of the wing and pull them upwards and towards you.
- Remove the sprog from its adapter by raising the rear part, which is free. Take it out of its adapter and place it parallel to the leading edge.

- Attach the Velcro fastener on the sprog joint protector.

- Complete the wing-closure procedure by manually bringing one and then the other inwards towards the keel. Keep the wing tips close to the ground while moving the wing inwards.
- The sail tends to become trapped between the leading edge and the keel. Pull it upwards and outwards so that the sail is hanging down outside the spars.
- Make sure that the T-junction of the hang strap runs parallel to the keel.
- Roll up the sail and fasten with Velcro ties. Make sure that where the leading edge joins the downtubes, it is curved inwards in order to avoid damaging the leading edge mylar.

- Put the glider bag onto the hang glider.
- Turn the hang glider over and lay it carefully on the ground.
- Unhook the speedbar and place the protection over the downtube tips. This protects the sail from damage.
- While lowering the downtubes, make sure that all the wires pass between the downtubes and are not tangled. Also check that the hang strap is not twisted under the downtubes.

- Place the downtubes between the leading edges, inside the sail.
- Place the battens and the speedbar into the rear part of the glider cover. To do this, you will have to undo one or more Velcro ties and then refasten them.
- Close the zipper and load the glider onto the car; drive carefully ☺

7.2 Flat Disassembly

In order to ensure that this manual is truly complete, the procedure for disassembling the hang glider on the ground is detailed below. However we would like to remind you that this method of disassembly is not recommended, because of the risk of wear and damage to the sail as mentioned above. Even in high winds, it is preferable to disassemble the hang glider while supported on the A-frame.

7.2.1 Starting Point

- Position the hang glider with the nose into the wind.
- Remove the nose fairing and unhook the nose wires.
- Lower the hang glider down on the ground by pulling it towards you.

Important: The hang glider is now in a position in which the lateral cables are taut and prevent the hang glider from remaining correctly positioned on the ground. Therefore it is important to finish disassembly as quickly as possible.

- Release crossbar tension by pushing the spring buttons and releasing the tension plate; let it slide into the sail.

Note: make sure that the sail is loose. Now proceed in the same order as indicated for “Disassembly on the A-frame”, therefore return to page 13.

8. Hints and Tips

8.1 Variable Geometry

The Laminar is fitted with a very efficient variable geometry (VG) system.
Pulling the VG cord moves the crossbar backwards. Thereby it increases the nose angle, tightens the sail and substantially changes twist (washout) and airfoil geometry. Pulling the variable geometry improves sink rate and gliding angle. Therefore VG should be tight in all those conditions in which maximum efficiency and speed is required.
When VG is loose, handling improves. VG should therefore be totally or partially released in all those conditions in which maximum handling sensitivity is required, such as when near the ground, at take off if turbulent conditions are likely just after launch, in thermals, and when landing.
In order to further improve handling, all Laminar’s are fitted with “swivel tips”. This is a special system that links both outer tips, allowing them to move asymmetrically during turns, making it easier to fly the glider.

On all **Laminar** gliders, **especially on those with LSP sails**, the range of the VG has been increased in both directions, meaning that it is possible to increase and reduce **the nose angle much more than in any other glider**.
To get the maximum performance from your hang glider you can use your VG intensively throughout the flight, to increase or decrease the sail tension.

8.2 Take Off

For take off you can pull the VG in by about 50 cm (~20 inches), which improves ground handling and tightens the lower wires. If the conditions around take off are very buoyant, it is better to leave VG totally released.

Although the launch characteristics of the Laminar are sufficiently forgiving to permit minor errors during taking off, such as the nose angle a little too high or takeoff speed a little too slow, always keep the nose down (~15°) and run hard.

IMPORTANT: Do not take off with a wet sail!!! If your glider has got wet during set up, dry it before take off. A wet sail will stall at higher speeds, making take off and landing considerably more difficult.

8.3 Flight

The Laminar is one of the few high performance hang gliders that is also very easy to fly. Thanks to the efficiency of its VG system, each pilot can adjust the glider to his\her own needs. Moreover, the Laminar is pleasant to fly at any speed.

Below you will find some suggestions. These will help you increase the enjoyment and safety of your flying.
In any case, it is important to consider these suggestions, particularly if you are going to fly the highest performance version, in this case the Laminar with LSP sail.

First of all you have to remember that this wing is designed for **Advanced Pilots**, who are familiar with different weather conditions and who can anticipate, with a limited margin of error, any possible

situations of danger that may arise during flight.
Having said this, you must consider that the more performance you demand from an aircraft, the more attention you have to pay to flying speed. Thanks to its versatility, the Laminar **LSP**, allows you to face a wide range of conditions in maximum safety, as long as you always follow these simple rules:

- In steady thermals, it is possible to fly with a minimum of VG applied. This guarantees a better climb rate.
- In general, however, use the VG in proportion to the speed at which you are flying: the faster you want to fly, the more tension you can give to your sail.

IMPORTANT: when flying LSP Laminar models, when the VG has been pulled full on, the reduction of washout is such as to offer excellent gliding performance, with maximum speeds well above the VNE as established by DHV. However, we recommend not exceeding this speed. As a result of the increased performance attained in recent years, even hang glider pilots must learn to "think aeronautically". Please follow the simple rules described in this manual.

- With VG completely on and at low speed, the glider's stall happens more quickly and in a stronger manner than with VG loose. This means that the pilot has to act quickly (fast responses), and that a higher vertical distance is needed to regain normal flight.

ATTENTION: Always avoid flying near the ground with the VG fully on, no matter which hang glider you are flying.

- Use the VG according to the weather conditions you are flying in: in turbulent conditions the tension of your sail should not be so low as to excessively reduce the wing's performance, neither should it be so high as to reduce its handling.

8.4 Landing

Stall behaviour is best with less twist (the tighter the VG, the less twist on your wing). Close to the ground though, you should not have more than ⅓ VG on in order to ensure a fast response time for your glider.
When landing in turbulent conditions, it is better to leave the VG off.

- After the approach, fly your final leg into the wind at a medium-high speed.
- When you are close to the ground slow down smoothly, flying parallel to the ground and gradually easing up the speedbar.
- As soon as you feel that the glider is about to stall, flare! With less wind you should flare harder. If the wind speed on the ground is greater than 15 km/h, the final stall does not have to be so energetic. The greater the wind at ground level, the less pronounced your stall will be.

9. Trim

When the glider is assembled, the sail must be placed on the frame in such a way that the tension is perfectly symmetric.
The sail's tension may be modified by adjusting the fibreglass tip lever tension or the pressure exerted on the batten tips at the trailing edge.
On all Icaro's wings you can also adjust wingtip sail tension by means of the plate with multiple holes that permits leading edge tension to be modified.
Unless absolutely necessary, we strongly suggest that you leave the sail tension as when delivered from the factory.

9.1 Turn tendency:

First of all you must determine if the turn tendency occurs with VG tight or loose.

9.1.1 Turn tendency with no VG:

- Check that the leading edge and all other tubes are undamaged.
- Verify the batten profile using the supplied batten plans.
- Make sure that the tips' compensating/connecting cables are running freely and are not generating asymmetrical twist.
- Check that the sail tension on the left wingtip is equal to that of the right wingtip. If there is a difference, fix the sail at a different hole so that tension is properly balanced.
- Check that the sail tension on the left fibreglass tip is the same as on the right fibreglass tip. If they are different, fix the lever to a different hole in order to restore symmetrical tension (available only for 12.6 size).
- Check that the tube holding the fibreglass tips (at the end of the leading edge) is not damaged, and that the tips are held correctly inside it.
- Check that the eccentric Nylon caps, holding the above-mentioned tubes, are symmetrical.

If the glider still has a turn tendency:

- Turn the nylon cap not more than 5 mm at a time (measured around the circumference of the tube holding the Nylon cup), so that the end of the fibreglass tip rises. Make sure you raise the tip opposite to the turn direction, i.e. if the glider has a left turn tendency, raise the right tip.

This adjustment should be made as follows:

- Mark the position of the cam with respect to the tube by using a felt-tip pen to make a small mark on the tube.
- Using a crosshead screwdriver, unscrew the screw on the top of the head by about 3 or 4 rotations, so that the cam can rotate freely.

Do not unscrew the screw completely, because otherwise the internal section will slip out, and you will have to remove the sail fastening pin to recover it.

- Then knock the head of the screw gently with a hammer, as if it were a nail, in order to overcome the friction created by the internal section.
- Remove the smaller screw at the side of the tube.

- Using a pair of needle-nose pliers pushed into the two holes in the head of the cam, rotate the cam to the degree desired. In the example described above, the cam will have to be rotated 5 mm anticlockwise.

It should never be necessary to have to apply a correction greater than 15 mm rotation. If it should be necessary, contact your dealer or Icaro 2000.

To fasten the cam in the new position, screw down the screw on the head of the cam, tightening it well.

To ensure safety, you can reposition the smaller screw on the side of the tube. To perform this, you will have to drill a new 1.7 mm hole in the cam, centered on the centre of the hole that is already present in the tube at the wingtip.

9.1.2 Turn tendency with the VG tight:

- Make sure that you weren't flying with the sprog or aluminium tip cable twisted.
- Check that the sprogs are at the same height.
- Check that the aluminium tips are at the same height.
- Check that the cord on the trailing edge is symmetrical.

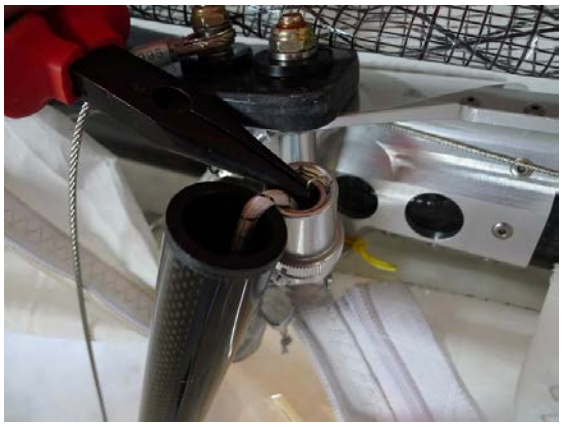
Before doing this, test the sail by pushing downwards where the sprogs and the tips are closest to the sail (near the trailing edge). It is important to do this test in a symmetrical manner on both wings. If you push with different strength on the two wings, it may appear that the tips or the sprogs are not symmetrical.

If, after all these checks, your glider still has a turn tendency, try raising the tip or the sprog slightly on the side opposite the turn. You should adjust them only by rotating (no more than half a turn at a time)

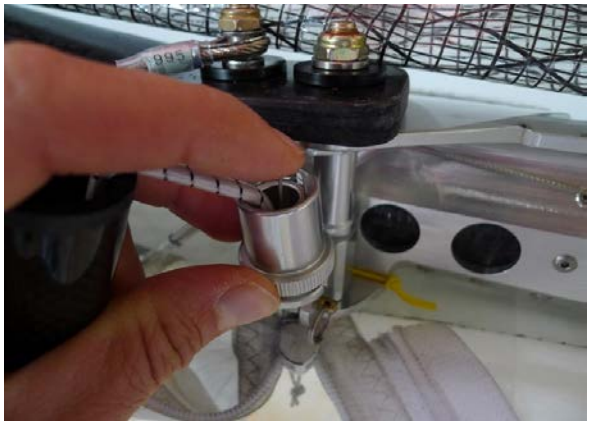
the threaded parts onto which the tip and/or sprog are inserted.

To perform this adjustment, the locking pin has to be removed by means of a pair of narrow-tip pliers. It is a good idea to mark the thread on the collar (for example, with a felt-tip pen) so as to leave an indication of the original point of adjustment.

- Once the pin has been removed, the collar can be rotated anti-clockwise a ½ rotation at a time (the minimum possible regulation is a ¼ rotation).



- After having rotated the collar as required, line up at least one of the four slots on the external collar with the slot on the internal threaded joint.
- Then insert the locking pin that locks the collar and prevents its rotation.



9.2 Trim Speed

- It is possible to regulate trim speed by changing the hang point amongst the holes on the keel.

- By moving the hang point forward, the glider will fly faster (and vice versa).
- With a higher trim speed, the glider tends to drop the wing less during turns.
- An excessively low trim speed considerably reduces manoeuvrability

IMPORTANT: move the hook-in point forwards or backwards just one hole at a time. The maximum degree of forwards/backwards movement depends on the sail and NOT on the number of holes on the keel. In fact in some models, the same keel is used for different sail sizes, which have different centre points. This is why there are more holes than can actually be used.

10. Reflex and Dihedral

Since your Laminar doesn't have any luff lines, the internal sprogs, the tips, fibreglass tips and the wing profile are the elements that provide its pitch stability. If the profile is modified, the wing requires a corresponding twist setting in order to restore the glider's original stability characteristics. For this reason it is very important to check the profile periodically, and/or after a crash.
Below we describe how to check your glider's reflex and dihedral. This should be done with the glider completely set up.
There are three positions that should be checked:

- Positions 1 and 2 are the positions at which the reflex should be checked by measuring the location of two specific battens with reference to the keel (see table below). The battens are numbered from the keel outwards.

ATTENTION: This check (positions 1, 2 and 3) must be done with full VG on, with the keel in a horizontal position, and the side wires fully tensioned.

- Position number 3 covers the outer section of the leading edge where the fibreglass tip is inserted; here you check the glider's dihedral.

For each test, take a length of nylon fishing line, and stretch it tightly between the corresponding points on each wing. Measure the vertical distance from the line to the top edge of the keel. In each case, the measurement must be within the tolerances shown in the following tables:

10.1 Swivel tip and sprogs height

	12.6 LAMINAR Carbon Battens		13.2 LAMINAR Carbon Battens	13.7 LAMINAR Carbon Battens

	Batten	Height mm	Batten	Height mm	Height mm
Position 1	# 7	+59 ± 5	# 8	-80 ± 10	-53 ± 10
Position 2	# 9	+70 ± 5	# 10	-93 ± 10	-68 ± 10
Position 3	Wing Tip	-190 ± 10	Wing Tip	-267 ± 10	-263 ± 10

		13.2 LAMINAR RF Carbon Battens	13.7 LAMINAR RF Carbon Battens
	Batten	Height mm	Height mm
Position 1	# 8	-60 ± 10	-30 ± 10
Position 2	# 10	-70 ± 10	-45 ± 10
Position 3	Wing Tip	-248 ± 10	-248 ± 10

		14.1 LAMINAR Carbon Battens	14.8 LAMINAR Carbon Battens
	Batten	Height mm	Height mm
Position 1	# 8	-50 ± 10	-50 ± 10
Position 2	# 10	-77 ± 10	-77 ± 10
Position 3	Wing Tip	-248 ± 10	-248 ± 10

		12.6 LAMINAR Aluminum Battens		13.2 LAMINAR Aluminum Battens	13.7 LAMINAR Aluminum Battens
	Batten	Height mm	Batten	Height mm	Height mm
Position 1	# 7	+75 ± 10	# 8	-65 ± 10	-38 ± 10
Position 2	# 9	+85 ± 10	# 10	-78 ± 10	-53 ± 10

Position 3	Wing Tip	- 180 ± 10	# 10	-262 ± 10	-256 ± 10

		14.1 LAMINAR Aluminum Battens	14.8 LAMINAR Aluminum Battens
	Batten	Height mm	Height mm
Position 1	# 9	-35 ± 10	-35 ± 10
Position 2	# 11	-62 ± 10	-62 ± 10
Position 3	Wing Tip	-240 ± 10	-240 ± 10

Crossbar cable length that these measurements should refer to:

The above reflex measurements refer to very precise nose angles. For every different nose angle, the wing should have a corresponding reflex. The maximum nose angle attainable with VG full on is determined by the crossbar cable (running parallel to the crossbar). Therefore, the measurements given above are **only** valid for the following crossbar cable measurements:

Model	Crossbar Cable Length
12.6 LAMINAR	705 mm
13.2 LAMINAR / 13.2 LAMINAR RF	730 / 720 mm
13.7 LAMINAR / 13.7 LAMINAR RF	730 / 720 mm
14.1 LAMINAR	800
14.8 LAMINAR	800

Note: the negative measurements (for example position 1 on the **Laminar 13.2 Dacron**) indicate that the Nylon cord should be **65 mm** beneath the upper part of the keel.
The same side of the keel is used for all measurements. Even for position 3 you must measure from the upper side of the keel.

If your glider measurements do not comply with those above, you must take your glider to an authorized dealer or directly to the Icaro 2000 factory for the necessary adjustments.

WARNING: Do not adjust the sprogs or tips, above all DO NOT lower them. Such an adjustment not only invalidates your glider's DHV certification, but it could also make the glider's behaviour dangerous.
Only qualified personnel should work on the glider. Beware that any adjustment carried out by non qualified personnel will automatically invalidate DHV certification.

In case of any doubts, please contact your authorized dealer or Icaro 2000.

11. Maintenance and Periodic Inspections

Every year, or after 100 hours (MANDATORY):

- Replace the side wires.
- Compare your batten profile with the supplied batten plan.
- Check reflex and dihedral as described in the previous chapter.

Every 2 years:

- Have a complete check performed by an authorized dealer or directly by Icaro 2000.
- Remove the sail and carefully check the frame for bends, dents, corrosion or other damage.
- Check that all bolts are tight and not damaged.

Every 5 years or after 500 hours (MANDATORY):

- Replace the sail must and all damaged or worn parts.
- Replace all wires

This check, performed by qualified personnel, is mandatory in Germany.

After a crash or heavy landing

- Carefully check the whole glider. Sometimes the impact energy is absorbed by parts of the frame that did not come in contact with the obstacle (commonly called “whip lash” damage).
- Thoroughly check the parts of the glider that were directly affected by the crash. But…

…by way of example, remember the following:

  - If the nose hits the ground violently in a landing, this may cause the partial or complete fracture of the leading edge tube, even if the leading edge itself did not hit the ground. Partial damage may be very difficult to see without removing the sail.
  - If control bar strikes the ground violently, for example in a landing in which the pilot has stalled too soon and the glider has descended vertically, damage may be caused to the keel, in the area in contact with the crossbar slider and the top A-frame bolt may also undergo damage. As in the previous case, the absence of visible damage (usually the downtubes do not break) does not mean that there is no damage at all.

- Replace damaged parts with exclusively original parts. If you have any doubts about the damaged parts, call an authorized dealer, or our factory. We will be pleased to give you any necessary advice.
- When replacing spare parts, make sure to note exactly how each component is connected or placed. Never rush a repair job; by taking your time, you are far less likely to make a mistake in re-assembly.

In brief, your glider will last much longer when treated with care.

General Advice:

- The wires must be periodically checked for kinks or broken strands.
- Dirty parts must be rinsed with warm water.
- A wet glider must be dried before storage.
  Don’t leave your glider wet for more than one day: mildew and corrosion may result.
- Salt water causes corrosion on all metallic parts. If you land in the sea and survive, you must disassemble the entire glider and wash all tubes, bolts, wires and the sail thoroughly with fresh water.
- If you fly regularly at coastal sites in windy conditions, be aware that evaporated seawater can have the same effect.
- Disassemble your hang glider after a certain number of flights and make a special check for corrosion.

Spare Parts

If you need any spare parts, you may contact your Icaro 2000 dealer or our factory directly. If you should ever place an order (by phone, fax or e-mail), keep the following information in mind so we may enhance the quality of our service (fast and accurate) and to avoid ordering the wrong part:

- The exact model of the glider.
- The glider's serial number.
- The name of the part you need or its exact description.
- The reference number of the spare part.

The serial number is located on the adhesive label on the rear part of the keel, close to the cable junction.
The name of the parts may be found on the drawings in this manual or in our website.
The reference number of the parts may be found on the labels on each part or on the drawings in this manual or on the drawings in our website.

12. Technical Data

Recommended pilot + harness weight (Min/Max).
This is the range of pilot + harness weights (hook-in weight) ideal for the respective hang glider.
DHV certification weight (Min/Max).
This figure is the total recommended take-off weight (hang glider + pilot + equipment).
The minimum weight value is the weight that ensures sufficient pilot control of the glider according to DHV standards.
The maximum value is the maximum weight that can be safely borne by the hang glider and equipment, considering a loading factor of +6/-3 g.

Laminar

	UoM		12.6 LAMINAR		13.2 LAMINAR	
Wing Surface	sq m	sq ft	12.52	134.8	13.24	142.5
Nose Angle	deg		132		132	
Wing Span	m	ft	9.61	31.5	10.05	33.0
Aspect Ratio			7.38		7.63	
Double Surface	%		96%		96%	
Battens (upper + lower)	n		22+4		24+6	
Weight (without glider bag)	kg	lb	28.5	63	31	68
Hook-in Pilot Weight (min / max)	kg	lb	55 / 75	121 / 165	75 / 90	165 / 198
DHV Certification Weight (Min/Max)	kg	lb	80 / 115	181 / 254	80 / 120	176 / 265
Packed Length	m	ft	4.75	15.6	4.98	16.3
Short Packed Length	m	ft	3.35	11.0	3.90	12.8
CERTIFICATION			01-0446-09		01-0441-09	

	UoM		13.7 LAMINAR		14.1 LAMINAR	
Wing Surface	sq m	sq ft	13.88	149.4	14.16	152.4
Nose Angle	deg		132		134	
Wing Span	m	ft	10.05	33.0	10.54	34.6
Aspect Ratio			7.28		7.85	
Double Surface	%		94%		96%	
Battens (upper + lower)	n		24+6		26+6	
Weight (without glider bag)	kg	lb	31	68	32.5	72
Hook-in Pilot Weight (min / max)	kg	lb	80 / 95	176 / 209	90 / 100	198 / 220
DHV Certification Weight (Min/Max)	kg	lb	90 / 125	198 / 276	105 / 134	231 / 295
Packed Length	m	ft	4.98	16.3	5.20	17.1

Short Packed Length	m	ft	3.90	12.8	4.10	13.5
CERTIFICATION			01-0437-08		01-0435-08	

	UoM		14.8 LAMINAR	
Wing Surface	sq m	sq ft	14.82	159.5
Nose Angle	deg		134	
Wing Span	m	ft	10.54	34.6
Aspect Ratio			7.50	
Double Surface	%		94%	
Battens (upper + lower)	n		26+6	
Weight (without glider bag)	kg	lb	33	73
Hook-in Pilot Weight (min / max)	kg	lb	100 / 110	220 / 243
DHV Certification Weight (Min/Max)	kg	lb		
Packed Length	m	ft	5.20	17.1
Short Packed Length	m	ft	4.10	13.5
CERTIFICATION				

13. Maintenance Log

Details of any modifications or repairs made to your glider should be entered here.

Date	Modifications or Repairs

Notes:

14. Owner's Log

This log provides a history of the glider's ownership. Please make sure details are correct when you sell the glider.

Purchase Date	Name	Phone	Address

Notes:			