RIO 15

Owner's Manual

BHPA certificate of air worthiness
number: 0110162

Serial Number

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Before flying your glider please read this manual completely, check all your battens against the batten profile (adjusting them if necessary) and do a thorough pre-flight check.

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CONTENTS

INTRODUCTION

Congratulations on your purchase of an Avian Rio. You are now the owner of a versatile, sport hang glider. We hope that you will experience many enjoyable hours of safe flying on your new Rio.

This manual is designed to help you get the most from your Rio. Please read this manual completely before flying, check all battens against the batten profile (adjusting them if necessary) and do a thorough pre-flight check.

Please make sure your first flight on your new glider is in perfect conditions from a site with which you're familiar. If you are uncertain or have any problems with your glider, **DO NOT FLY**. We have a section on trouble-shooting in this manual that features some of the more common problems that pilots have encountered, and our recommended solutions. If you are still not sure contact your local dealer or the Avian factory.

PLEASE NOTE

Avian Ltd does not have commercial product liability insurance.

Avian hang gliders are built using materials and fittings to the industry standard or better. Avian hang gliders are subject to Avian quality control and testing prior to delivery to the customer.

Once possession of the glider passes to the customer, its maintenance and condition become the responsibility of the owner or pilot. Any concerns or queries about the glider's subsequent air worthiness MUST be referred back to the local dealer or the Avian factory.

Hang gliders must be:

- stored correctly
- treated with respect
- checked before take-off and after heavy landings
- flown within their flight envelopes
- regularly maintained

Failure to do any of these courts disaster.

Look after your aircraft!!

OPERATING LIMITS

1. Minimum pilot rating: Club pilot.

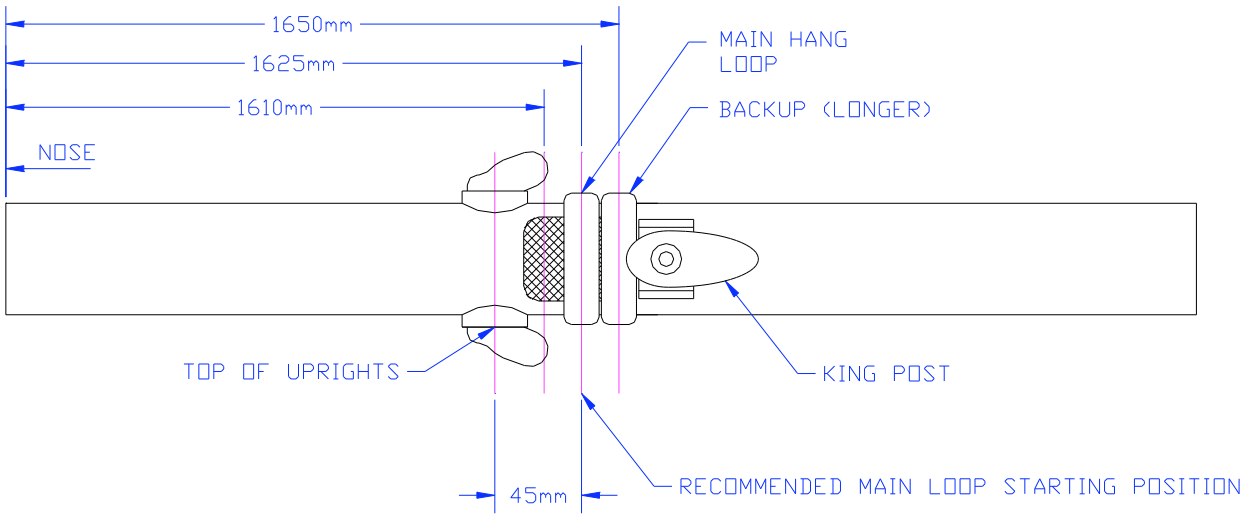
2 Manoeuvres:

1. Aerobatic manoeuvres are not permitted.
2. Pitching the nose up or down more than 30 degrees from the horizontal is not allowed.
3. Do not exceed more than 60 degrees of bank
4. Do not fly the glider inverted or backwards.
5. Do not fly with auxiliary power without factory approval.
6. Do not fly with more than one pilot

3. Hang Glider Payloads:

Pilot Clip in Weight range	Min	Max.
	9.5 stone	15 stone
	134 lb.	210 lb.
	61 kg	95 kg
Pilot + Power unit		110kg

4. Hang Point Position Range (Pitch trim)



The hang loop is attached straight to the keel and should be within the following range:
(Distances measured from the front of the keel *without* plastic bung to centre of hang loop.)

Max. forward position	1610mm
Maximum rearwards position.	1650mm

SPECIFICATIONS

Wing span	30' 10"	9.4 m
Wing area	160 ft^2	15 m^2
Aspect ratio	6:1	
Min sink rate*	190 ft/min	1 m/s
Max. L/D ratio	10	
Speed range**	15 - 50 mph.	24 - 80 km/h
Max. speed (VNE)	50 mph	80 km/h
Normal packed length	19' 2"	5.6 m
Breakdown length	12' 5"	3.8 m
Glider weight rigged	56 lb.	25.5 kg
Glider weight in bag	60 lb.	27.3 kg

*At a wing loading of	1.4 lb./ft^2	6.9kg/m^2

**Speeds measured using Davron 808 vario-ASI system.
VNE Velocity Never Exceed.

RIGGING THE RIO

The glider can be rigged either flat on the ground or with the glider supported on its control frame. The latter should only be attempted in light wind conditions, but is useful in confined spaces or where the terrain is likely to cause soiling or damage to the sail.

Flat rigging

1. Lay the glider on the ground with the nose pointing into wind. Unzip the glider bag, roll the glider so it is the right way up and remove the bag. Take care to keep the inside of the glider bag clean as any dirt will be transferred to the glider when the bag is replaced.

2. Remove the glider ties and take the battens out from on top of the sail.

3. Open the wings slightly, then walk them out to about 3/4 of their full extension. If you are rigging alone, move each wing only a short distance in turn. Due to the geometry of the cross-tubes, attempting to move one wing through a large arc when the wings are nearly parallel exerts high levels of leverage. The increased load in certain areas may cause damage to components. To further prevent damage to the nose plates, ensure that you do not lift either wing tip higher than knee height. If there is any resistance check to see what is causing it and free the problem before continuing. **Do not attempt to force the wings apart**.

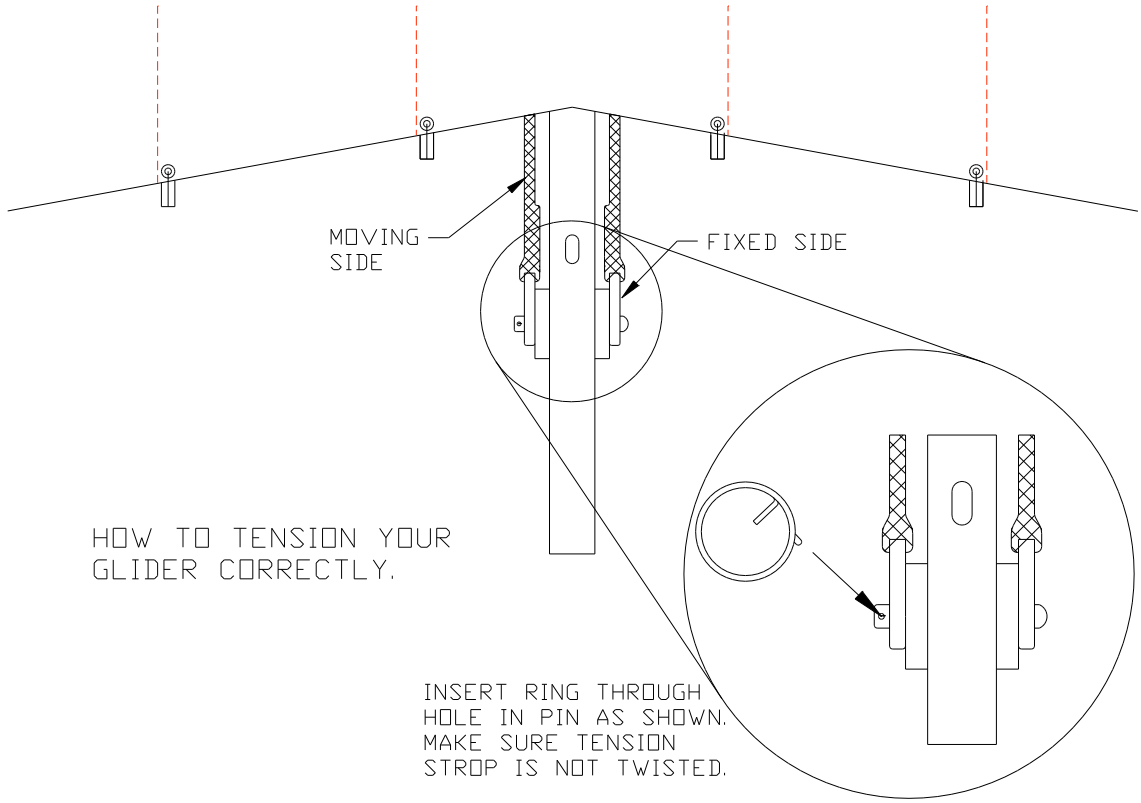
4. Lift the king post into position and connect the tack hook securely, ensure that the 'luff lines aren't twisted or tangled and are free from any fraying *etc*.

5. Assemble the 'A' frame, attach the base bar, insert the two stainless pins from the back of the base bar and fit the safety rings. **PUT THE RINGS IN IMMEDIATELY - DO NOT LEAVE THEM UNTIL LATER.**

6. Lay the battens on the ground and pair them up, red with green, checking that corresponding batten pairs have the same profile. This is a good habit to get into as it will reduce the chances of launching on a glider with a turn caused by asymmetric shaped battens. Periodically the battens should be checked against the batten profile.

7. Insert the battens smoothly starting with the first 'normal' batten in from the wing tip, working from the tip towards the centre chord. Insert the batten in the second from the tip batten pocket. (The compression strut sits in the outermost batten pocket and is inserted later in the rigging sequence.) Keeping the trailing edge low and slowly easing the battens into their respective pockets will help increase sail life. (On a new glider a little silicon spray on the batten ends will help them slide in smoothly.)

8. The glider can now be tensioned. Remove the split ring from the special bolt located through the rear of the keel tube. Using the attached elastic cords, pull the cross-tube restraint webbing back. Check that the elastics are not twisted. Locate the stainless tang over the stub of the bolt and replace the split ring. If the tension feels too tight, stop and see what is causing the problem. **DO NOT FORCE IT**. (Consult the trouble-shooting area of this manual for possible causes.)



9. Push the battens home the last little bit. (With a new sail the battens may not go fully home unless pushed.) The batten elastics should be attached double on each batten. The battens nearest the wing tip can only be inserted when the glider has been tensioned. These battens are referred to throughout this manual as compression struts. On the Rio this strut is straight and locates onto a metal hook on the leading edge.

10. The under surface battens should also be inserted when the glider is tensioned. They should be pushed home so that only the rope projects from the batten pocket. Insert the most outboard U/S batten first. The under surface battens can be pushed home with another under surface batten.

11. Insert the nose batten. Some people prefer to put the nose batten in before the wings are moved out at all or to leave the nose batten in the glider when packed. The nose batten will be more prone to becoming misshapen if left in a packed glider, so remember to check its profile against the batten profile.

12. Ensure the wires are not twisted, then stand the glider on its control frame and attach the swan catch at the nose, pip pin and safety washer.

13. Make sure the nose catch is correctly attached, with safety washer in place, then fit the nose cone.

14. The glider is now fully rigged and you should complete a thorough pre-flight check **before** you fly.

If there is a significant wind we suggest that the glider is left flat on the ground, nose into wind and securely weighted or tied down at the nose until you are ready to fly. In light winds the Rio may be left standing on its 'A' frame, tail into wind but be wary of gusts of wind, thermals and dust devils. Keep a close eye on your glider or make sure it is securely tied down.

Rigging on the 'A' frame

This is useful in confined spaces or where the terrain is likely to cause soiling or damage to the sail, but should only be attempted in light-wind conditions.

1. Lay the glider on the ground. If there is any wind the nose should be pointing cross or down wind. Unzip the bag and remove enough ties to assemble the 'A' frame. Attach the base bar and insert the two stainless pins from the back of the base bar and fit the safety rings. **PUT THE RINGS IN IMMEDIATELY - DO NOT LEAVE THEM UNTIL LATER.**

2. If the nose batten was left in the sail move it onto its location - then stand the glider on its 'A' frame. Remove the bag and remaining ties and take the battens from the top of the wing.

3. Open the wings slightly then walk the wings out to about three quarters of their full extension. If you are rigging by yourself move each wing a short distance in turn. NB: Whilst spreading the wings, particularly when the glider is standing on its 'A' frame, it is essential that the leading edges and keel are kept in the same plane to avoid distortion of the nose plates or any other component.

4. Take care to place the tips on a piece of ground that is not likely to cause them damage. Leave the tip socks on for protection. The glider should now be standing on its 'A' frame, wing tips and keel.

5. Lift the king post into position and connect the tack hook securely, ensure that the 'luff lines aren't twisted or tangled and are free from any fraying *etc*.

6. Making sure that the wires are not kinked, attach the nose swan catch, pip pin and safety washer.

7. Lay the battens on the ground and pair them up, red with green, checking that corresponding batten pairs have the same profile. This is a good habit to get into as it will reduce the chances of launching on a glider with a turn caused by asymmetric shaped battens. (Periodically the battens should be checked against the batten profile.)

8. Working from the centre chord towards the tip put all but the last 3 curved battens into their pockets. Keep the trailing edge low and slowly ease the battens into their respective pockets. Leave the tip socks on.

9. Before tensioning the glider make sure you have opened the wings as far as possible. Tensioning will be much easier if you can get someone to lift a wing tip slightly, thus opening out the wings still further. Remove the split ring from the special bolt located through the rear of the keel tube. Using the attached elastic cords, pull the cross-tube restraint webbing back. Check that the elastics are not twisted. Locate the stainless tang over the stub of the bolt and replace the split ring. If the tension feels too tight, stop and see what is causing the problem. **DO NOT FORCE IT**. (Consult the trouble-shooting area of this manual for possible causes.)

10. Remove the tip socks and insert the last battens near the tip. Push all battens fully home. (With a new sail the battens may not go fully home unless pushed.) The batten elastics should be put on double on each batten.

11. Take the compression struts (these are straight) and insert them ensuring that they locate onto their hook on the leading edge.

12. If not already in place, insert the nose batten and locate it on its seat just in front of the nose plate. (Some pilots only remove the nose batten occasionally to check its profile.)

13. The under surface battens are more easily inserted once the glider has been tensioned. They should be pushed home so that only the rope projects from the batten pocket. Put the most outboard U/S batten in first, the battens can be pushed home with another under surface batten.

14. Double check that the nose catch is correctly attached, with the safety washer in place and fit the nose cone.

15. The glider is now fully rigged and you should complete a thorough pre-flight check before you fly.

In light winds the Rio may be left standing on its 'A' frame tail into wind but be wary of gusts of wind, thermals and dust devils. Keep a close eye on your glider or make sure it is securely tied down.

PRE-FLIGHT CHECK-LIST

Detailed pre-flight checks must be carried out during assembly. Always using the same assembly and packing procedure will help to eliminate mistakes. After rigging always carry out a pre-flight check. The following must be checked:

1. All tubes are straight and not dented.

2. Cross-tube hinge, nose plates and 'A' frame fittings OK. All bolts secure.

3. All sail seams intact with no frayed stitching, particularly in high stress areas (*e.g*. wing tips, junction of keel pocket and sail *etc*.)

4. Battens correct shape and undamaged.

5. All nuts and bolts secure.

6. All quick release fittings secure:
(i) cross-tube tensioner
(ii) nose catch (check the clevis pin and split ring as well)
(iii) tip battens correctly located on leading edge
(iv) quick pins and rings secure on bottom bar
(v) outboard leading edge section fully engaged. (Be especially vigilant if the leading edge has been short-packed recently.)

7. Cross-tube tensioner strop not frayed and twist free.

8. Batten elastics symmetrical on both sides of the glider. They should also be in good condition and engaged over the batten ends.

9. Hang loops in good condition.

10. The glider is symmetrical when viewed from the front.

11. Unzip the under surface and check the centre junction. Check that the cross-tube hinge bolts are secure and webbing loop is in good condition. Sight down the cross-tubes and check they are undamaged.

12. Check the four nose plate bolts are secure.

13. Check that the four bolts at the ends of the uprights are secure. (If you have the aerofoil upright option, check that castings (at the upright ends) are in good condition and that all the screws in the castings are secure.

14. Walking along the length of the leading edges feel with your fingers to check that they are free from dents. Check that there is a similar leading edge curvature when looking down the inside of the wing from the nose to each wing tip.

15. Ensure the webbing is correctly seated into the groove on the plastic end caps at the wing tips.

16. Check through the sail inspection zip to ensure that the wing wire and cross-tube leading edge bolts are secure.

17. All zips done up.

18. Check that the keel is straight and the tensioning strap is secure, correctly fitted and the split ring is in place, as shown in the previous diagram.

19. Ensure the king post is correctly positioned, straight, free from dents and held securely in position via the tack hook.

20. Check the 'luff lines are not twisted or frayed and are securely attached. If the outer 'luff lines become caught under any of the battens this will cause a significant turn in the glider when flying, so always ensure the 'luff lines are free before launching.

21. Check the wires are undamaged. Look for signs of corrosion and fraying. Pay particular attention to inspection of the wing wires, as in normal flight these are the most heavily loaded. **INSPECT BOTH ENDS: THE BASE BAR END AND THE CROSS-TUBE JUNCTION END. REMEMBER: IF IN DOUBT DO NOT FLY- CONSULT AVIAN FOR ADVICE.**

22. Finally, special attention should be paid to quick-release fasteners, check that all are secure. Pay particular attention to the base bar quick pins as it is possible for the safety rings to become detached from the pin. The most likely cause is when rigging and moving the glider in long grass, or from the safety rings contacting the ground. The problem is minimised if you put the pins in from the back of the base bar, so that when the glider is sitting on its keel the head of the pin rather than the safety ring will contact the ground.

FLYING THE RIO

Please note the following is not meant to be an exhaustive flying manual but merely a brief note and should be read with that in mind. It is recommended that your first flight on the Rio is from a site you know well, in suitable flying conditions and using your normal flying gear. Remember: only change one thing at a time.

Take off

Before take-off make sure you've 'pre-flighted' the glider, that you are clipped in and that you have performed a hang check. On take-off the wings should be held level with the nose slightly raised. A strong and committed take-off run is always recommended. Keep the angle of attack low until you are running fast. Once sufficient air speed has been achieved increase the angle of attack gradually to take off. Once settled in flight move your hands, one at a time, to a comfortable position on the base bar.

In Flight

The control in both pitch and roll is light and precise. Accordingly the glider should be flown with moderate and precise inputs. The glider should not be flown too slow or in a semi-stalled condition as the roll response becomes much slower.

Stall

The Rio recovers quickly from stalls but will lose height doing so. A wing close to the stall becomes difficult to control. For both these reasons the glider should be flown with sufficient air speed close to the ground, hill or any other aircraft or obstacle.

Spin

Hang gliders are generally resistant to spin and it is very unlikely that you will ever experience a spin in normal flight. To recover from a spin pull the bar in and increase speed BEFORE applying opposite bank.

Flying when wet

DO NOT TEST YOUR NEW GLIDER IF IT IS WET. Wet gliders do not fly nearly as well as dry gliders because water droplets on the leading edges disturb the airflow over the wing. The result is that the glider does not perform so well and the stall speed is increased. *i.e.* It will not be possible to fly the glider as slowly as if it were dry. A wet glider stalls more easily, takes longer to recover from a stall and is more prone to spinning.

If you get caught in the rain you will notice the above effects increase as the glider gets wetter. You will have to fly faster to avoid stalling and should be especially careful when turning or landing. WE ADVISE THAT, WITH A WET HANG GLIDER, YOU FLY FASTER, ESPECIALLY WHEN DOING ANY MANOEUVRES NEAR THE GROUND OR OTHER AIRCRAFT.

Landing the Rio

The secret of a good landing is good field selection followed by a precise approach with plenty of air speed.

Always plan your landings from high up and make sure you can get your feet out of your harness well before landing. Check the surrounding air for other aircraft preparing to land. Look and check that your approach and over-shoot path have as few obstacles as possible. Never choose to land immediately behind other gliders or obstacles, land to one side, you'll make a lot more friends.

POST FLIGHT INSPECTION

After landing, especially if heavily, the glider should be inspected as outlined in the pre-flight inspection.

DE-RIGGING

De-rigging is largely the reverse of the assembly sequence:

De-rigging the glider flat

1. Lay the glider flat on the ground and into wind. Remove the under-surface battens and the compression struts. If you intend removing the nose batten from the sail, do so before releasing the cross-tube tension.

2. Release the cross-tube tension and swing the wings in a few feet, release the king post and lay it down on the sail.

3. Loosen all batten elastics, remove the remaining battens and place in batten bag. The wings can then be closed further.

4. Place the padding around the tension bolt and bring the leading edges in further. Dismantle the 'A' frame and attach the 'A' frame padding around the bottom of the uprights. When packed, the side wires should emerge from the top of this packing and should not be kinked.

5. Bring the wing tips completely together. The sail should then be rolled and tucked inside the Mylar of the leading edge. One side can be rolled and retained with a tie and tip sock while the other wing is being packed.

6. The battens can be stowed at the front of the glider between the leading edges with the curves over the nose section. Place the ties around the glider holding the leading edges neatly together. Place the glider bag over the glider and then turn the glider on its back.

7. Put the speed bar in its bag and place in the sail near the wing tip. Any remaining ties should be put around the glider. Tuck the nose cone under the tie nearest the nose of the glider.

8. Zip up the bag and store the glider in a cool dry and dark place. Always ensure that your glider is dry before storing.

De-rigging the glider upright on the keel

This is useful in confined spaces or where the terrain is likely to cause soiling or damage to the sail. It is essentially the reverse of rigging the glider on the keel:

1. Put the glider keel down and tail into wind. Remove the under-surface battens. Loosen all the batten elastics and remove the compression struts.

3. With the glider still tensioned, remove the outer battens, say 2 or 3 per side. Roll the wing tips and put on the tip socks before releasing the tension (this keeps the tips covered and protects them.)

4. Release the cross-tube tension and move the wings in slightly. Attach the tension bolt packing. The keel remains on the ground.

5. Release the king post and lay it down onto the sail.

6. Remove all remaining battens except the nose batten.

7. Remove nose cone and release the lower nose wires.

8. Bring the wings closer together pulling the sail between the leading edge and keel so that it is all above the leading edge. Roll the sail carefully and tuck inside the leading edge. One side can be rolled and retained with a tie and tip sock while rolling the other.

9. If you intend to remove the nose batten do so now. Put all the battens into their batten bag.

10. The battens can be stowed at the front of the glider between the leading edges with the curves over the nose section. The ties can then be placed round the glider holding the leading edges neatly together. Remove the ties holding the sail in place and put them around the whole glider in the normal way.

11. Place the glider bag over the glider, turn the glider on its back and lay it on the ground.

12. Dismantle the 'A' frame. Attach the 'A' frame padding around the bottom of the uprights. When packed the side wires should emerge smoothly from the top of the packing.

13. Put the speed bar into its bag and store in the sail near the wing tip. Any remaining ties should be put around the glider. Tuck the nose cone under the tie nearest the nose of the glider.

14. Zip up the bag and store the glider dry in a cool, dry, dark place. Always ensure your glider is dry before storing.

TUNING INSTRUCTIONS

Trim speed

The trim speed is adjustable by moving the hang loop forwards or backwards along the keel. Forward movement will increase the trim speed of the glider, whilst rearward movement will lower the trim speed. Only move the hang loops in small increments of 5 mm maximum. You should not need to move the hang loop further forward than the uprights or further back than the king post.

Turns

A turn in the Rio is unusual. If your glider previously flew straight then the most likely explanation is that you have damaged your glider. If a turn is detected first check the battens. Check them against each other (making sure that they are the same on both sides) and then against the profile. Next check that the batten elastic tension is the same on both sides of the glider. If there is still a turn check that the leading edges are straight and undamaged.

A slight turn may be tuned out using the tip adjusters, but before any adjustment is made locate the reference mark on the outer leading edge and note its position relative to the black plastic end-cap. If there is no reference mark on the leading edge ensure that you mark the starting position of the end-cap before any alterations are made. To make an adjustment, loosen the 2 self-tapping screws no more than 3 turns and then rotate the black plastic cap slightly. It is possible that the screws may stand 'proud' of the end-cap when they have been unscrewed and you will need to exert sufficient pressure to push them inwards so that they are flush with the surround. You should then be able to rotate the end cap and adjust the washout. The wing that is lifting should have the washout increased (*i.e.* trailing edge lifted) while the wing dropping should have the washout reduced (*i.e.* trailing edge lowered). **ONLY ALTER THE WASHOUT AT THE TIP IN SMALL INCREMENTS**. (MAXIMUM 3mm at a time.) The total movement should **NOT** exceed 10mm each side of the reference line. **DON'T FORGET TO TIGHTEN THE SELF-TAPPING SCREWS AFTER ADJUSTMENT.**

Washout at the tips

The washout at the tips can be altered symmetrically, *i.e*. increase or reduce the washout on both wings. Only small changes are needed and large changes are counterproductive. A small reduction in the washout (2-3mm) will make the glider feel slightly lighter in pitch and show perhaps a slight increase in glide performance. In smooth air the glider handling will probably appear much the same but if a wing is lifted it will be more difficult to get down.

Adjustment in the opposite direction will have the opposite effect. However it should be emphasised that large movements are not beneficial.

Please note: washout is factory set and under normal circumstances should not need altering, if in doubt refer to your Avian dealer or contact the Avian factory.

Batten Bungees

The tension of these bungees does make a difference to the handling of the glider.

Recommended set up:

Battens number 1 can be relatively tight.
Batten number 6 can be relatively tight but increasing tightness reduces handling.
The remaining battens, apart from the compression strut should be of medium to light tension.
The compression strut should be tighter than the other battens, but increasing tightness reduces handling.

Note: The battens are numbered from 1 at the keel to 6 near the tip. The outer most batten or compression strut is number 7.

Other tuning should NOT be carried out without reference to Avian Ltd., or an approved dealer.

BATTENS AND BATTEN PROFILE

The Rio battens should be maintained in the correct profile. Failure to do this could result in adverse flying characteristics.

Batten Material

The nose batten and compression struts are made from 1/2" OD 6082 aluminium alloy tubing. This is soft and relatively easy to bend. All other battens are normally made from the same material, but 10.8mm OD 7075 aluminium alloy tubing is optional. This is a harder alloy than 6082, more difficult to bend and more brittle but it holds its shape much better and is therefore recommended for winch launching.

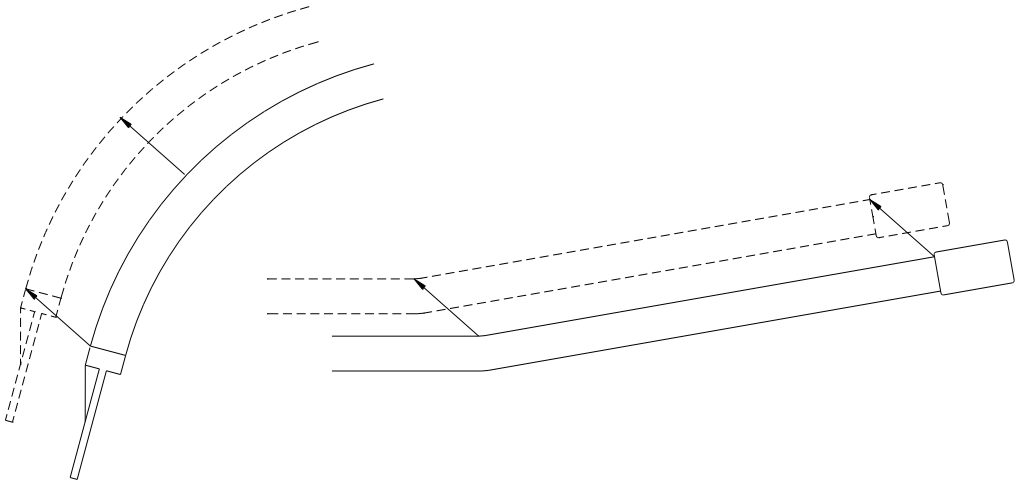
How often should your battens be checked?

Initially check your battens regularly, this will give you some idea of how fast they are changing profile. Battens made from 7075 aluminium alloy tend to hold their shape well. The nose batten and compression struts are made from a softer alloy, 6082, these will tend to harden and hold their shape better once they have been re-profiled a few times. On the Rio the batten most likely to require re-profiling is the nose batten.

Don't forget: If you don't know how the glider has been treated while it is out of your care (for instance if it has been sent by carrier or on an aeroplane) check the battens against the profile and do a very thorough pre-flight check **BEFORE** flying.

Batten Profile

The batten profile is printed with the profile or shape of the battens. The length of the battens may not exactly match the profile due to inaccuracies in the printing process.



Move the batten over the profile as shown above

Checking the profile

The best place to check the profile of your battens is at home on a flat surface. (It is very difficult to do on the hill with no flat surfaces and the wind blowing the paper profile away.)

The printed profile should be rolled out flat and a book placed at either end to hold it down. The battens can then be compared to the profile by laying them on the profile and viewing from above:

Place green (right) number 1 batten against number 1 on the profile. Place the front end of the batten against the profile and check that it matches the profile along its entire length. If it does not match the profile see where it deviates and adjust the batten accordingly in that area (see below.) Continue this process until the batten matches the profile. Repeat the procedure for red number 1 batten and check that both number 1 battens are exactly the same shape. It is more important that the battens are symmetrical than that they are a perfect copy of the profile. Asymmetrical battens could cause a turn in your glider.

Repeat for batten number 2 and so on until you have checked all the battens. Do not forget to check that the compression strut and the under surface battens are straight.

Nose batten

The nose batten profile should not be under-cambered but can be a little over-cambered because the cut of the sail will tend to flatten the batten if it is over-cambered. The objective with the nose batten is to get the sail to fit tightly around the nose area.

How to alter the shape of the batten

The aim is to get a smoothly curved batten but it is not quite as easy as it looks. It is very difficult to bend the batten very close to its front end. Do not attempt to alter the profile over the first 3-5cm of the batten. If your battens need profiling practice with the softer 6082 battens first as they are much easier.

To increase the curve in the batten hold the batten either side of where you want to increase the curve and run the batten over your knee or leg exerting a gentle pressure. (It helps if you are wearing something slippery.) Compare with the profile and repeat if necessary. Try to avoid point bends and make sure that the bends are all in the same plane. (Extra care should be taken when re-profiling any battens made from the harder 7075 aluminium alloy to avoid broken battens.) To reduce the curve, do the opposite of the above either over your knee or preferably by pressing on a flat surface. If you have a point bend try and remove it.

MAINTENANCE

Annual strip down and factory inspection

Avian recommend that the Rio has a factory inspection every year or 100 flying hours which ever is the sooner. This is a sensible precaution and is offered by Avian at special prices in the months of December and January. An additional benefit of the strip down is that the latest upgrades can be fitted, sometimes free of charge.

General

Careful attention to the rigging and de-rigging sequence will reduce the risk of accidental damage. Repairs should only be undertaken by the Avian factory or an approved dealer using genuine Avian spares.

The correct storage of your glider will also greatly influence its life. The glider should always be stored:

- **well packed**
- **completely dry**
- **well supported**
- **in a dark, cool and dry place.**

Airframe Maintenance

Apart from damage caused by over stressing the glider *i.e.* crashing *etc*. the major wear and tear on the glider occurs in transit.

Aluminium Tubing

Care and consideration in de-rigging and transportation will pay dividends in airframe life. Damage to any one of the structural members is serious and the only remedy is replacement. Insufficient care during ground handling or transportation can lead to tube abrasion or indentation. The former accelerates fatigue fracture and the latter reduces the strength of a component. Keep a regular watch for tell-tale hair-line cracks, which are most likely to occur in high stress areas such as around bolt holes. If you bend, dent or damage the tubular members in any way, seek immediate professional advice before flying again and have replacement parts fitted.

Fasteners

Any fasteners (*i.e.* nuts, bolts *etc*.) which are bent or show signs of wear or corrosion should be replaced immediately. Nyloc nuts should only be used ONCE. One clear thread of the bolt should stick out beyond the end of the Nyloc. Nuts should be tightened only so that they are snug. In most applications on a hang glider the nut is only there to stop the bolt from falling out. DO NOT OVER-TIGHTEN NUTS AND BOLTS. Over-tightening can crush the tubes and damage the hang glider.

Rigging Cables

The main danger with the rigging lies in kinking the cable. This is usually caused by careless rigging and de-rigging or by over tightening the bolts that attach the tangs to the airframe. (It should be possible to swivel the tangs with light thumb pressure.) Once a cable has a kink the strands are damaged and replacement is the only cure. The side cables are particularly important and should receive a frequent detailed inspection. Check for cable damage along the length paying special attention to the area immediately adjacent to the swaged fitting as this is the main failure area. Look carefully for signs of strand fracture at this position. Corrosion shows itself as a white powdery deposit. Corrosion cannot be cured and the only answer, again, is replacement. Even apparently undamaged rigging wires should be replaced every 100 hours.

Cross-tube tensioner

The stitching on the cross-tube tensioner is easy to see and should be inspected frequently. The rest of the tensioner strop is hidden in the sail and keel pocket so that any damage is more difficult to see. Take time to inspect this area thoroughly, particularly the cross-tube centre junction, also ensure the shackle bolt is tight. If the strop is found to be damaged (*e.g*. fraying, abrasions, cuts or wear to the stitching) replace it before flying.

Wing fabric maintenance

Any cuts or tears at critical areas such as the trailing edge, sail fixing points or similar high load areas, must be repaired at either the Avian factory or an Avian approved workshop. Small damage to panels, leading edge covers *etc*., can be repaired with proprietary self adhesive tape. 'Small damage' is defined as abraded holes no more than 10mm diameter and small cuts no longer than 15mm. Anything larger should be inspected by Avian approved personnel.

Stitching Damage

Thread damage never gets better and eventually runs. If you abrade a seam or damage the stitching in any way, have the damage repaired before it gets worse. Small, non load-bearing areas can often be repaired *in situ* by the tedious but effective method of hand sewing back through the original stitch holes. Use a needle and only the correct thread: available from Avian or a good sail maker.

Wing-fabric cleaning

It is, without doubt, better to keep the wing clean than to try and clean it, once it becomes dirty some dirt never comes off completely. With a new glider avoid getting it dirty in the first place by careful rigging and de-rigging. If you decide you do need to wash your wing, then select a dry day and have access to a good hose and clean water supply. Never use bleaches, strong soaps or detergents, the soap residue can react with ultra violet light and degrade the fabric. We recommend a very mild liquid soap (washing-up liquid) and a soft sponge. Gently wash the fully rigged wing, frequently hosing clean. Copious amounts of clean water will not harm the wing and can be very beneficial in removing sand and grit which may get trapped inside the sail (usually in the nose or wing tip areas.) Removing stains from stitching is difficult, resist the temptation to scrub with a stiff brush as it may do more harm than good. Ensure that the wing is completely dry before de-rigging and storing.

Battens

Battens form the wing shape and substantially influence the performance of the wing and need to be treated with care. As they are subject to constant stress both during flight and rigging they may lose their shape and it is therefore essential that they are checked against the template at frequent intervals and re-profiled if necessary. (See Section: Battens and Batten profile.)

REPAIR

The Rio airframe is deceptively simple, but like all aircraft requires skilled and qualified attention. We do not recommend self repair or re-assembly by other than Avian or Avian nominated repair agents. No replacement parts should be fitted unless they are factory supplied and identified as such. When ordering spares always quote your glider serial number (make a note of it if you have to replace your keel. It should be recorded on the front of this manual). Bent aluminium tubes must never be straightened, always replaced. Frayed cables and cables with damaged or twisted thimbles must always be replaced.

To help you identify components some of the main assemblies are shown in the appendix of this manual.

RECOMMENDED COMPONENT LIFE

The safe working life of the structural components of the Rio is dictated by the environment in which the aircraft is used and the care taken during day to day operations. Inspection, therefore, is an essential tool in deciding the continued use of most components, particularly the sail. UV exposure shortens the life of the sail, so it should not be left needlessly exposed to sunlight or any other source of UV radiation. Due to the nature of their material, construction and position within the structure, certain components have a critical fatigue life and it is mandatory that these components are replaced within the time stated below.

Cross-tubes	1000 hours
Leading Edges	1000 hours
Control frame / fittings	1000 hours
Keel	1000 hours
Tension strop	200 hours
Rigging wires	100 hours
Factory inspection	100 hours or 1 year (see maintenance)

TRANSPORTATION BY CAR

The wing must always be transported inside its bag, well packed and with all the protective padding in place. The zip on the bag can be placed underneath to prevent entry of rainwater. During transportation, or when stored on slings, the wing must be supported at its centre and at two points not more than one metre from each end. Supports should be padded and relative movement between glider and supports must be avoided at all times. (If travelling abroad pay attention to the legal requirements for both glider overhang and coloured flags *etc*.)

SHORT PACKING

It is sometimes useful to short pack your glider especially for transportation by air. It is unusual to be able to take the glider full length on an aeroplane and is always best to short pack it.

Tools:

You will need a large, cross-headed screwdriver.

The Rio leading edge has been specially designed in two main sections, the inner (nose to outboard of the cross-tube/leading edge junction) and the outer (tip section of the leading edge). These sections can be separated for short packing - useful for transport overseas or storage.

Removal of the outer leading edge

The outer leading edge section slides inside the inner leading edge and locates on a bolt which stops it rotating. The outer section can be removed without undoing this bolt and we recommend that you do not remove this 'locator' bolt. (The outers must be replaced in the correct sides of the glider. See: **Assembly Drawings** at the back of this book.)

If you have a Rio with a detachable keel and want to reduce the packed length to the absolute minimum you may remove the sleeve section from the inner leading edge by undoing the 2 bolts (the locator bolt and one other) which hold it in place. The heads of these bolts are located beneath a protective Mylar patch which will need to be replaced when the bolts are re-inserted. When replacing the bolts be extremely careful not to over-tighten them. (We recommend that you **do not** undertake this procedure.)

To remove the outer section:

1. Unzip the glider bag and remove the sail ties. Release the leading edge tension at the nose by unscrewing the cross-headed, self-tapping screws at the **NOSE**. The sail can then be disconnected from the wing tips by slipping off the webbing straps from around the end caps. (Do **not** loosen the screws in the tip caps.)

2. The leading edge outer can now be pulled out. Before removing them mark them 'left' and 'right' with a felt pen.

3. Remove the leading edges and place a padded bag over the end of the inner leading edge to prevent it damaging the sail.

4. Place a cylindrical object (cardboard roll 4" diameter, roll of bubble wrap or plastic bottle *etc*.) alongside the sail and bend the tips round. (Take care not to crease the Mylar or damage the sail on the end of the inner leading edge or by bending it round too sharply.)

5. Wrap and pack the leading edge outers so that they will not damage your sail.

Re-assembly of the glider

This is basically the reverse of removal of the leading edges:

1. Open the sail out and remove padding from the end of the inner leading edge.

2. IMPORTANT: Check that you have your outer leading edges in the correct sides. (CHECK THE MARKS THAT YOU PUT ON THEM) When the glider is rigged the location for the compression strut should be on the top front of the leading edge. (See: **Assembly Drawings** at the back of this book.)

3. Slide the outer into the inner leading edge. When almost home the leading edge should be twisted slightly until the slot engages with the clevis pin. They should then be pushed fully home. Light tapping with a mallet or something soft might be needed to completely slide home the outer.

4. Remove the self tapping screws at the nose.

5. Ensure that the sail webbing is correctly seated into the end-cap groove at the wing tips and re-attach the internal velcro strap around the leading edge.

6. Rig the glider as per this manual. **TAKE GREAT CARE TO PULL THE SAIL TOWARDS THE NOSE WHEN OPENING THE WINGS OUT. THIS IS ESSENTIAL! FAILURE TO DO SO WILL RESULT IN VERY SERIOUS SAIL DAMAGE.**

7. When fully rigged the tapping screws at the nose can be replaced. The holes should line up. If not, thread a thin cord through the holes, pull the sail into position, replace the screws and remove the cord.

8. In your pre-flight check, check all the fasteners especially those that have been removed.

TRANSPORTATION BY AIR

Remember, your glider has to be loaded on and off the plane and get past the baggage handlers at both airports. It also has to make the return journey.

The object is to:

- Make the glider as short as possible.
- Protect the glider so that it will not get damaged in transit.
- Make the package as light as possible with handles so it is easy for the baggage handlers to move. (If they can't lift it they'll probably use a fork lift.)
- Minimise the damage to the sail caused by packing the glider.
- Make the whole operation simple, so that you can easily repeat the procedure for your trip home.

The type of damage you are trying to protect against:

- Damage caused by dragging one end of the glider across the floor. Protect the ends with thick cardboard or something that will not wear through too quickly.
- Damage to the glider from being dropped onto an edge such as a railing or the edge of a container truck. (If the whole package has some padding this helps prevent damage. Bubble wrap seems to help but is difficult to unpack and re-pack. You will need lots of sticky tape including some for the return journey.)
- Dirt: Airports and aeroplane-hold's seem to be dirty places. If you've got a nice clean glider bag it won't be after a trip on the plane, so if possible use an old glider bag or some other suitable covering.
- Finally, a cover that shows damage is useful *i.e.* if you pack your glider in a cardboard box and somebody drives a 747 over it at least you'll be able to see the tyre marks on the box and look out for damage inside!

If you are lucky you may have a purpose made box or bag. (Avian make, and recommend an armoured short-pack glider bag.) This will speed-up the process of short packing and also provide good protection for your glider.

STORAGE

The correct storage of your glider will greatly influence its life. The glider should always be stored:

- **well packed**
- **completely dry**
- **well supported**
- **in a dark, cool and dry place.**

Ensuring that your glider is stored dry is important. The sail is made from anti-mould treated cloth but extended storage whilst wet might nevertheless encourage mildew. Wet storage will also greatly encourage corrosion of the airframe wires and fasteners. Salt water will of course be many times more damaging. After flying on the coast the glider should be washed with fresh water. If the glider is wet, leave the bag open and try and open out the glider to dry properly as soon as possible. It is important to keep the glider out of the sun when not in use as exposure to UV radiation damages the sail. Always try and store your glider inside. Use the thick bag supplied and if at all possible store in the dark.

TROUBLE SHOOTING

The tension strop gets caught

When rigging the glider and spreading the wings the tension strop should appear through the keel-pocket. If it does not, stop and check to see where it is caught rather than force it. Check for any damage to the tension strop before flying. To stop this getting caught again, make sure that the elastic attached to the strop is tight enough so that it disappears into the keel when fully rigged. Also check that the strop has no twists in it and that the elastic loop is on the outside of the stainless tang (*i.e.* not next to the keel) when the tension is released.

The tension strop is difficult to pull on

1. The tension strop might be twisted around the cross-tube centre junction. When freed, inspect the strop for damage and replace if necessary. Try and keep the strop twist free.

2. The side wire is caught:

a) The side wire is caught behind a batten end or wrapped around the control frame: release the wire, check for damage and replace if necessary.

b) The side wire is twisted at the junction with the leading edge, (the wire is kinked over the tang): release the wire, check for damage and replace if necessary. (This kinking is more likely if the tang is very loose. The tang should offer some resistance to movement with light thumb pressure.)

The wings are difficult to close when de-rigging the glider

1. When de-rigging on the keel the weight of the wings is transferred to the keel, this stops the cross-tube junction from sliding so easily on the keel when the tension is released (see above.) The easy remedy is to unzip the under surface and pull the cross-tube junction forwards. The wings can then easily be moved inwards.

2. When the tension strop is released it should be pushed towards the keel pocket to feed some slack into it, this allows the wings to move together more easily. It is possible for the tension strop to get caught. If this happens, find the obstruction and release the tension strop then continue to move the wings inboard.

The glider has a turn

Check for crash damage then see tuning instructions.

The glider has become more difficult to turn

1. This can be caused by an incorrect but symmetrical batten profile. (Asymmetrical battens tend to cause turns.) The glider handling will deteriorate significantly if battens are out of profile. Check the battens (don't forget the nose batten) against the profile more regularly.

2. This may also be caused by an incorrect trim position (the position of the hang loop.) The glider might be trimmed too slow "hands off" and be flying in a semi-stalled condition. See tuning instructions.

3. This can also be caused by foreign bodies in the cross-tube junction area. Check, and if present remove.

The glider is heavy or "strange" in pitch

The glider is heavy or handling badly despite the hang point apparently being in the correct position. The backup hang loop might be caught in such a way that it interferes with the main loop when moving the bar (in or out depending on the position of the backup loop relative to the main loop.) Free the backup loop so that it is loose at any flying speed. Always fly with a backup loop.

The glider appears to be trimmed too fast despite having the hang loop at its furthest rearward position

1. If you are new to the glider and have previously flown a glider which has a heavier pitch response you may actually be pulling the bar in without realising. On a smooth day, when you have a safe ground clearance and are clear of all other aircraft, slowly release your grip on the base bar and check the bar position and trim speed without putting any load on the speed bar.

2. As above, this might also be caused by a backup loop that is caught and interfering with the main loop when flying. Free the loop so that you are sure it is loose in flight.

The short under surface batten has been put in the long under surface batten pocket

You can sometimes do this accidentally if rigging quickly. If you have pushed the batten in a long way, you may have to totally de-rig to remove it.

In future always work in from the tip with the under surface battens *i.e.* put the shorter battens in first. In this way if you get the wrong batten it will be too long and easy to remove from the pocket.

The nose cone is lost

YOU SHOULD NEVER FLY WITHOUT A NOSE CONE. Check that the nose cone is not down the leading edge pocket of the glider. Hold the leading edge up to the light and look for the silhouette of the nose cone.

The leading edge pocket appears to have black marks or other dirt on the inside

This is usually grass or other debris which has found its way into the leading edge pocket. Try and remove any debris as best you can. The problem is usually caused by storing the battens in the leading edge pocket which tends to fill the pockets with debris and encourages mildew. **DO NOT STORE YOUR BATTENS IN THE LEADING EDGE POCKET.**

OWNERSHIP

Please notify Avian Ltd. of change of ownership and change of address. This is important so we can let you know about upgrades or in the unlikely event, recall components or gliders.

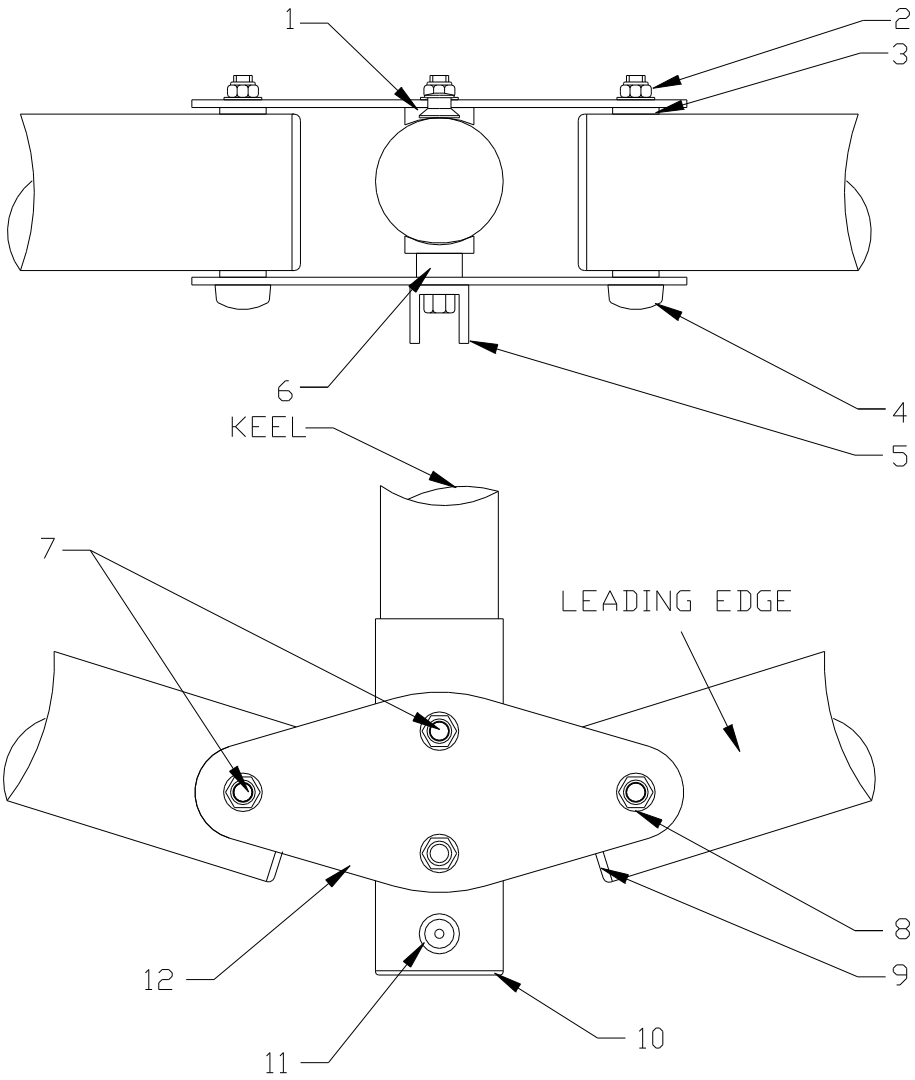
- Please keep a record of all work done on your hang glider.

- Please let us know of any ideas for changes that you think would improve our handbook, hang gliders or service. We are interested and would also like to hear if you have any complaints about the gliders or our service.

- We would be most grateful to receive any interesting photographs of our gliders.

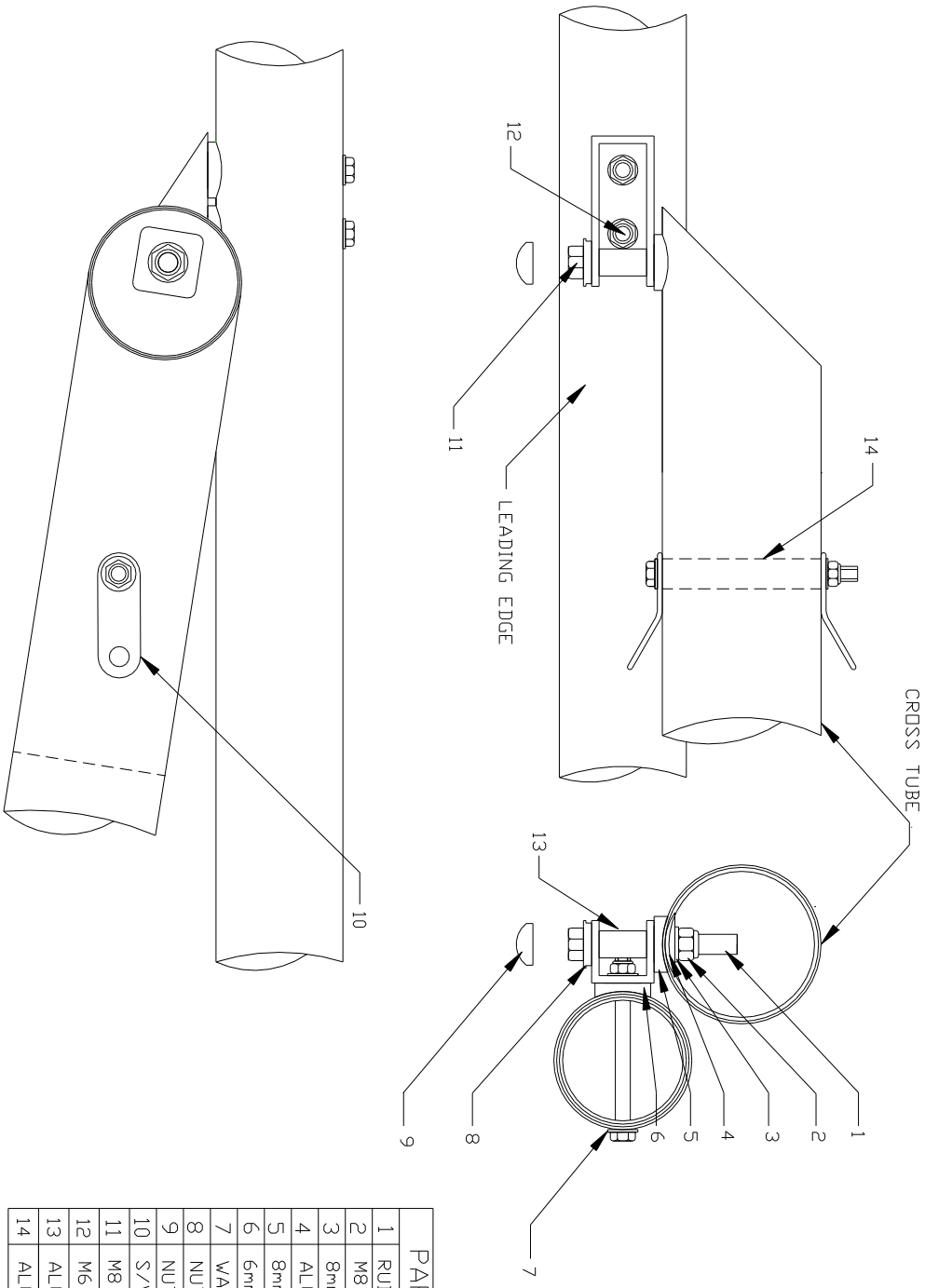
Appendix
ASSEMBLY DRAWINGS

NOSE ASSEMBLY



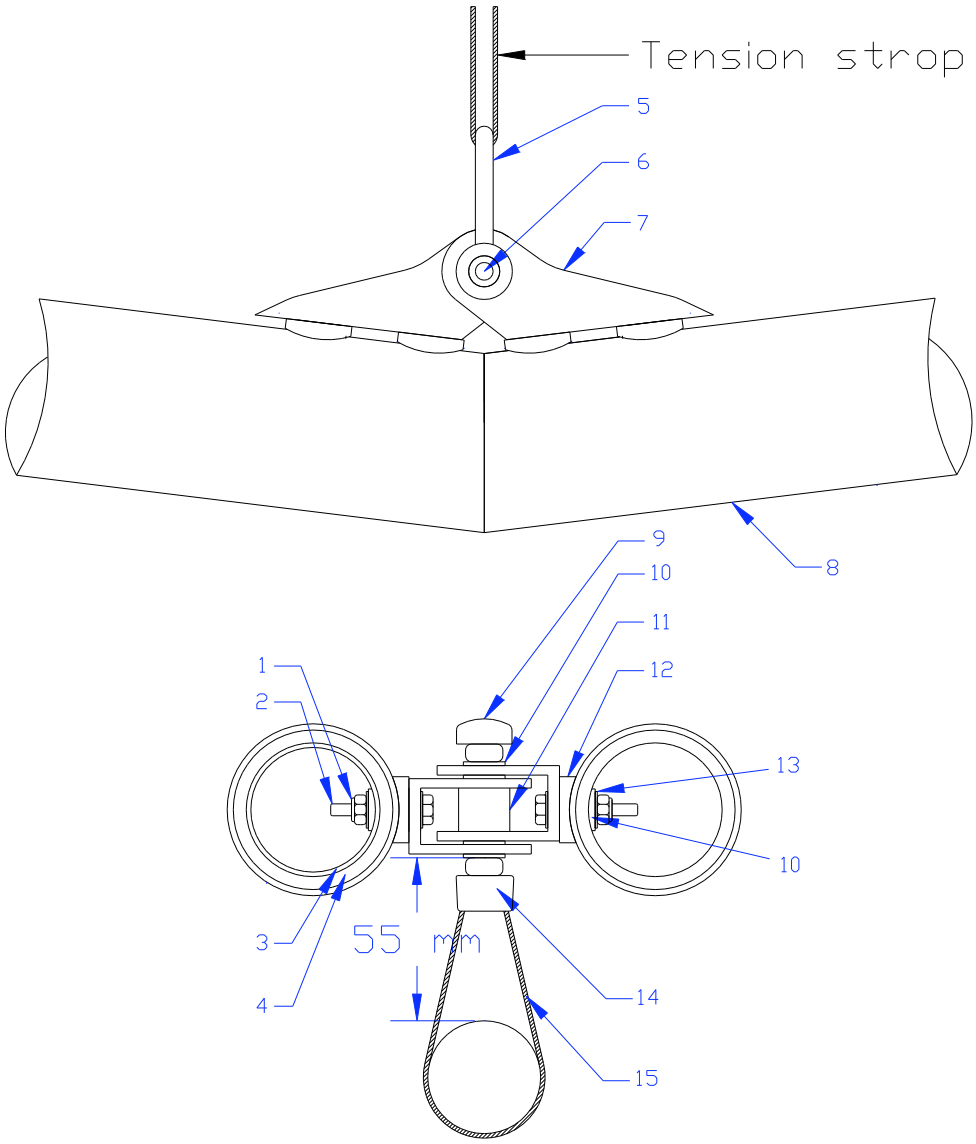
PARTS LIST	
1	6mm SADDLE
2	M6 NYLOCK NUT
3	NYLON INSERT
4	6mm NUT CAP
5	NOSE CHANNEL
6	SPACER
7	NOSE BOLTS
8	6mm S/S WASHER
9	2" BUNG
10	1 1/2" BUNG
11	BATTEN LOCATION
12	NOSE PLATE

CROSS-TUBE / LEADING EDGE JUNCTION



PARTS LIST	
1	RUBBER CAP
2	M8 NUT
3	8mm NYLON WASHER
4	ALU. H/R'ND SECTION
5	8mm SADDLE
6	6mm SADDLE
7	WASHER (STAINLESS)
8	NUT CAP (BOTTOM)
9	NUT CAP (TOP)
10	S/WIRE TANG
11	M8 BOLT (ST'LESS)
12	M6 BOLT (ST'LESS)
13	ALUMINIUM SPACER
14	ALUMINIUM BUSH

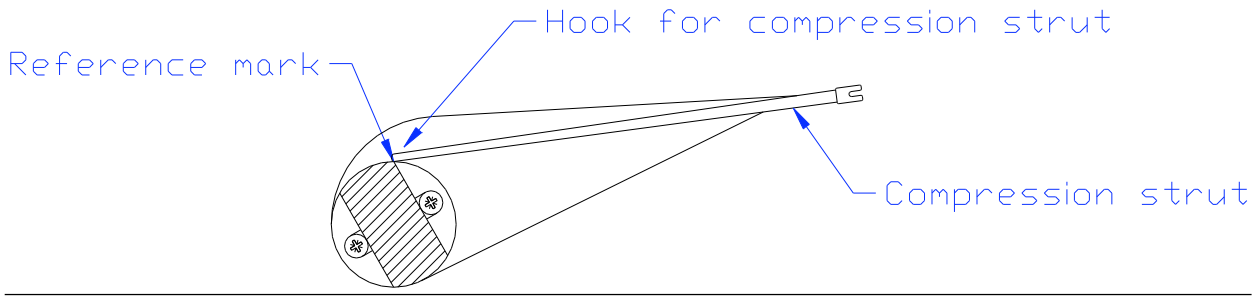
CROSS-TUBE CENTRE JUNCTION



PARTS LIST	
1	M6 nyloc nut 5
2	M6 * 25 bolt 4
3	Location sleeve
4	Thick sleeve
5	Shackle (long)
6	Centre screw head
7	Offset hinge 2
8	Cross tube
9	Nut cap
10	M6 Nylon washer 8
11	Nylon spacer 2
12	M6 * 2 1/8" Saddle 4
13	M6 S-steel washer 8
14	Rubber foot
15	Hold down loop

OUTER LEADING EDGE AND WING TIP ORIENTATION

Left hand wing tip



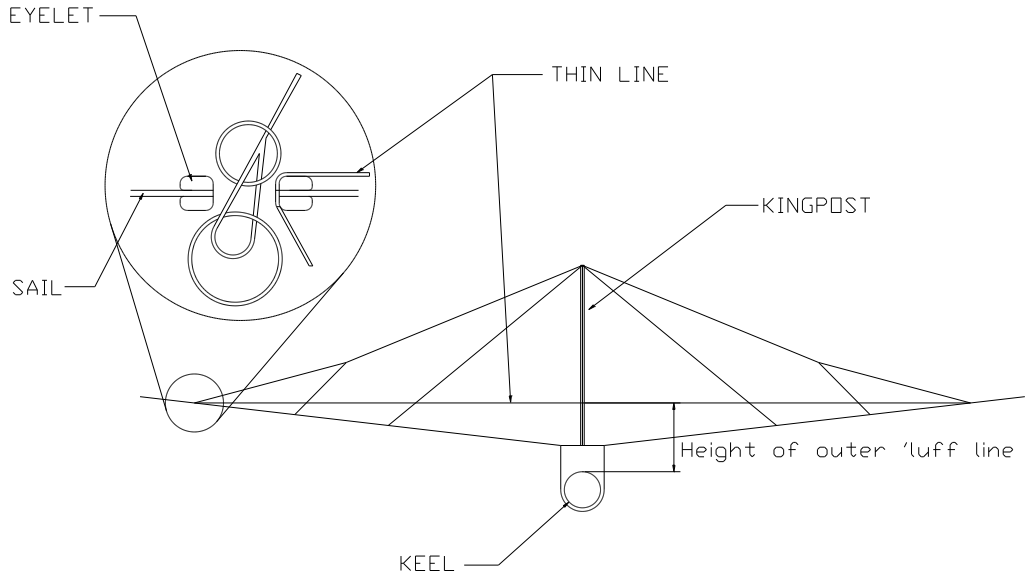
If the leading edges of your glider have been removed, for what ever reason it is very important to make sure that you put them back correctly. The best procedure is to mark the leading edges, 'left' and 'right' before you remove them. When you put them back check the markings and assemble accordingly. Also make sure that the hook for the compression strut batten is on the top of the leading edge. Make sure that the webbing is correctly seated in the tip cap and check the orientation of the tip cap. When the glider is fully rigged check that the Velcro that helps to keep the webbing correctly located at the wing tip is done up securely. If you are uncertain do not fly. Contact Avian for further clarification before flying.

You should not **loosen the screws in the wing tip caps as the cap will then rotate freely in the wing tip. (The angle of the tip cap is factory set and will effect the way your glider flies if altered. See tuning instructions.)**

Right hand wing tip

Appendix

CHECKING 'LUFF LINE HEIGHTS:



'Luff line heights of Rio 15m:

Rio 15	Inner	Middle	Outer
Maximum Height	115 mm	166 mm	160 mm
Nominal Height	105 mm	156 mm	150 mm
Minimum Height (test heights)	96 mm	150 mm	142 mm

The heights should be measured in still air with the hang glider fully rigged standing on its speed bar and with the keel horizontal.

NB. For this check to be effective the keel must be straight. (A damaged keel must be replaced prior to this check.)

Method of checking

Run a thin line (e.g. fishing line) tightly from the 'luff line eyelet (top surface of the sail) over the keel to the other eyelet. Measure the perpendicular height above keel and compare with the chart. IF THE HEIGHTS ARE BELOW THE MINIMUM HEIGHTS THE GLIDER SHOULD NOT BE FLOWN UNTIL THIS HAS BEEN RECTIFIED.