

Логотип

# Hangglider

# PHANTOM

## Manual

Kiev, Ukraine  
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## Section 1. GENERAL INFORMATION

### 1.1. Introduction

The Phantom rigid wing is an advanced product of Aeros Ltd and Aerola Ltd. It is aimed at improvement of modern competitive glider with very high performance combined with maximum safety and comfort.

Please read and be sure you thoroughly understand this manual before flying your Phantom. Be sure you are thoroughly familiar with the setup, breakdown, preflight inspection and maintenance procedures as described in this manual.

In case of any doubts or questions contact your local dealer or Aeros.

### 1.2. Main data

The Phantom is a high-performance rigid wing glider designed for foot-launching, soaring and cross-country flights

Table 1.2.

Phantom	
Sail area, sqm.	13.5
Wing span, m	13.2
Aspect ratio	12.9
Nose angle	150
Weight (without bags), kg (lb)	42 (92)
Breakdown length, m	5.8
Min sink rate (max take of weight, m/sec	0,65
Max glide ratio	19.5

### Operation limitations

Table 1.3.

Operation load	+4/-2G
Stall airspeed (straight flight), km/h (mph)	31 (19.2)
Maximum airspeed, km/h (mph)	110(68)
Max hook in weight, kg(lb)	110(243)

After structural, aerodynamic and flight tests, the Phantom has been shown to comply with DHV requirements DHV certificate No.01-0411-05

**ATTENTION !** *We do not recommend to use Phantom for aerobatic flights. Phantom requires a pilot's proficiency not less than Safe pro 4 (club pilot + 60 hours).*

NOTE: manufacturer and \_\_\_\_\_ can in no way be responsible for safety of your flight in case of exceeding operation limitations stated above in the present manual.

### 1.4. Flight tests

Your rigid wing glider Phantom (serial No \_\_\_\_ ) was tested\_\_\_\_\_

*"The rigid wing glider is airworthy according to the present manual".*

Test pilot\_\_\_\_\_ / \_\_\_\_\_ /

## Section 2. SET UP PROCEDURE

The set up procedure should be carried out on a clean, non-abrasive surface.

**ATTENTION:** *After each set up procedure you must perform a preflight inspection of the glider.*

2.1. Take the speedbar out of the bag, spread the uprights. Install the speedbar. Pass the flap's and RVG's ropes through channels in the speedbar and the stoppers. Fix the speedbar using the quick-pins. Hook front wire.



2.2. Rest the glider on the control bar, put the bags inside the D-spar, take the pin of the nose hardware out, spread the wings (don't take the bags off the D-spar ends), remove Velcro tapes.



### 2.3. For one side at a time:

Stand at the leading edge side,

- take the bag off the D-spar end,
- press on the tongues of the tip clamp
- put tip on the hooks
- turn the tongue of the tip clamp to the D-spar wall's side



- unroll the sail, holding both aileron and flap
- put in the tip tube
- open the zipper on the sail's tip and put the tip rib and clamp wall in to the sail, close the zipper
- connect the tip rib to the trailing edge tube



- Do the same for the other wing side



#### 2.4. Nose unit connection

- Put out the keel tube stinger
- Open wings as far as possible – hardware at nose must join. If the nose ear does not match into the nose fork, turn left and right keel beam to adjust position of the ear, corresponding to the fork
- Insert nose pin. To do this, stand at the keel beam side, moving the keel beam slightly



- Insert safety ring into the nose pin. Insert nose tube and secure it with the nose pin ring.



- Put in the keel tube stinger

#### 2.5. Install left and right trailing edge tube on the keel tube



2.6. Fasten root zippers on the upper and lower sail by 1/3 of their way

2.7. Install winglets

- Screw out the head from winglet stud
- Put the winglet on the tip so the stud will go through the hole in the tip
- Screw the head on the stud and tighten it (winglet must not move on the tip)



2.8. Connect the sail to the tip

- fold the tip a little, slip the front and back corner of the sail on the head pins



- press the sail to the tip with clamp wall (be sure there are no wrinkles on the sail between clamp wall and tip)

2.9. Put out the tip tube, fold down the tip strut as much as possible and put the tip strut's free end on the pin on the trailing edge. The tip strut side edge must be under the angle on the tip rib's bracket.



2.10. Lock the tip strut, connect top and bottom sail each other



2.11. Repeat steps 2.6 through 2.8 for another side

2.12. For one side at a time:

- Set ribs to the trailing edge (don't lock on center yet). Hook rubber of the ribs wire to the ribs wire holding bracket. Make sure that each rib end is properly installed into the trailing edge tube. The tube must be placed between the limiting plates on the rib fork (end)





- Pull aileron rod out of the sail as far as possible



- Attach the arm for rib tensioning to the ribs cable and lock it. Tightening force should appear when the arm is parallel to the keel beam. If the tightening force appears from the very beginning, it means that either the rib tips were not placed on the trailing edge tube or the rib tensioning wire is jammed. It is necessary to check and correct all irregularities, and after that tense the ribs



- 2.13. Repeat steps 2.12 for another side
- 2.14. Connect left and right safety wire each other
- 2.15. Connect flap controls to the flaps.
- 2.11. Attach aileron arms to the ailerons.
- 2.12. SPADD installation:
  - Put it on the pin on the tip rib
  - Put out the tip tube and insert Quick Pin on other end
  - Put in the tip tube.



The pin on SPADD's aileron side must be above the aileron's pick-up bracket

2.12.Side wires connection:

- Insert side wire end plate into the slot at the middle of upright and fix it with Quick Pin
- There must be small slack on side wires with RWG off, if they are tighten too much you must check if side wire freely go through the pulleys or blocked some were

2.13.Install nose and back cover

## Section 3. PREFLIGHT INSPECTION

3.1. Do complete preflight inspection of the glider. Check all parts and all assemblies of the glider. Beginning at the nose go around the glider, check all details of the construction. Finish inspection by checking the keel tube and control frame.

The less you hurry the more you'll inspect!

3.2. Check nose junction.

- The wires must be hooked in and secured.
- All bolts must be screwed and secured.
- The keel's pulley lever must have no bends, the control wire must go through the pulleys, the wire safety brace must have no bents and control wire must do not have possibility to go out from the pulley

3.3. Check the tip area.

- The sail corners must be properly attached at the tip.
- The Velcro around tip strut must be fixed properly. There must be no wrinkles on the sail which do not allow the SPADD's front edge to fit snug to the sail.
- The SPADD must turn easily, it should be impossible to remove the quick pin without pushing the button.

3.4. Check ailerons

- Ailerons must turn easily, without extra efforts (to check this, unhook side wires, turn ailerons holding them by the lever, to avoid damaging them).

3.5. Check aileron rod

- The end of the aileron rod must be secured.
- The quick pin which connects the aileron arm to the aileron should not be removable unless the button is pushed.

3.6 Check the rib N5 junction. Open the zipper at bottom surface.

- The aileron rod must be fixed at the control quadrant (sector) and secured (locked)
- Control wires must go through the sector.
- Control wires must go through the turn pulley in the front part of the rib N5

3.7. Check rib's tips position

Walk along the trailing edge and check rib tips position.

- The trailing edge tube must be supported at tip rib pulleys

3.8. Check the flaps deflection.

- They must turn easily, without extra efforts.
- After unfixing flap control rope flaps must go up easily and quickly.

3.9. Check the root area.

- The trailing edge tube pins must be secured
- The bolt fixing the downtubes to the keel tube must be screwed

Open the bottom and top root zipper by two thirds of its travel.

- The ribs tensioning wire must be locked and secured properly.
- All control cables must go through the control pulleys
- Control cables must not be jammed.
- The RWG rod on the keel must be fixed and locked
- The RWG rope on the speedbar must easy turn the RVG pulley and after releasing the rope the RVG pulley must turn back
- The stopper rope and rubber on the stopper rope must not be broken.
- Hang-in belt must be secured by the bolt, the nut should be locked, the belt should have no damages

3.10. Check ailerons neutral set up angle

- In neutral position the trailing edge of the ailerons must be on the same level as flap's trailing edge or ~5mm higher

### 3.11. Check side wires attachment.

- The side wires must be connected to the downtubes and should be impossible to remove the quick pin without pushing the button
- The side wire must have slack if the RVG off and must have no slack if the RVG on

### 3.12. Check control system.

Take the glider as before take off, move control frame right and left.

- The control frame must move easily, ailerons and SPADD must move properly.



## Section 4. PERFORMANCE AND FLIGHT CHARACTERISTICS

Check and adjust your harness. We strongly recommend that you hang as low as possible (as close to the speedbar as possible). Be sure that no part of the harness touches the speedbar while pilot moves over the whole range as he or she will move in flight.

### 4.1. Take off

Make sure you are hooked in and check your position hanging in the control bar.

Make the flaps ON by 1/3-1/2 way.

Make sure RWG is OFF. It is not allowed to take off with RWG ON

If the wind is more than 8m/s (18 mph) or is gusty, you have to have at least one wire assistant on the nose wires and side assistant. The Phantom has a slight tail heavy static balance, which does not take effect during take off.

When you hold the glider prior to your take off run, you should keep the nose slightly up and wings level.

The glider takes off easily in zero winds as well as with strong winds and does not require any special methods of handling.

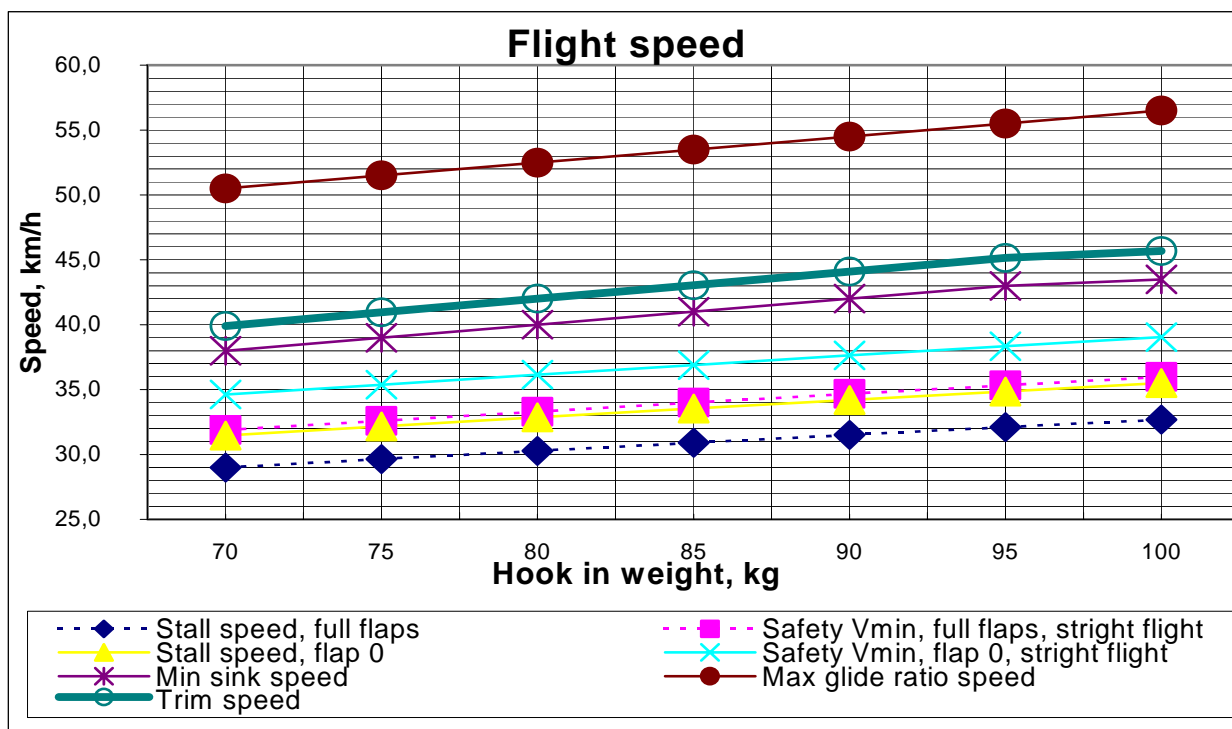
### 4.2. Flying

At first handling performances of the Phantom seem to be different from those inherent in other gliders. The reason is that Phantom handles easily at any speed. Don't worry, you'll soon get used to it. Make your first flight in easy flying conditions.

### 4.3. Flight Speed

Remember that the range of flight speed depends on the wing load. If you have big wing load and you fly at minimum speed for the small wing load, you can get a stall.

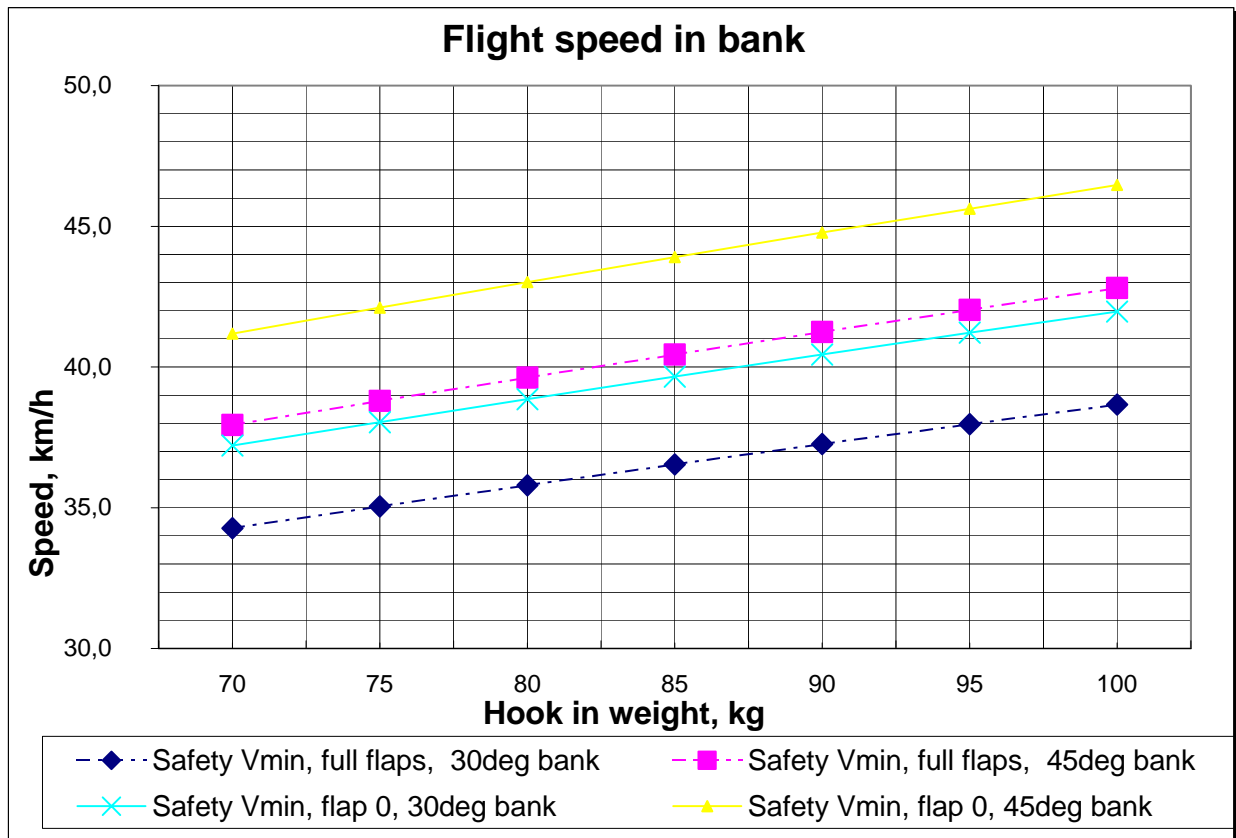
Refer to the diagram below to determine trim speed that corresponds to



your hook in weight, and adjust hook in point in order to achieve this trim speed. Trim speed must be a little higher than minimum sink speed. So, in thermals when you want to fly at min. sink speed, you should push the bar a little.

If you inadvertently slowed down to stall speed, you may get spin. At these mode glider has slow reaction on control input, but entering into turn appears very fast. Pilot can stop spinning at very beginning stage. In that

case glider recovers with intensive gaining of the speed and not too much loosing of the altitude. But if pilot do nothing after 1/4 turn spin begins. There is no much warning by bar pressure have precedence of spin. Recovering occurs after applying standard recovery technique such as move speedbar in middle position and pull 1/4 way back. Recovery takes 1 to 1.5 turns and ~100m of the altitude.



Don't fly in turns at speed less then min. Safe bank speed. See diagram below.

At speed over 90-100km/ in gusty and bump conditions you can get a non-periodical hits on the wing, which appears due to turbulence.

#### 4.4. Handling in turn

Phantom responds quickly to any bar movement, control efforts are small. The glider turns easily and quickly at speed a little higher than the trim speed. As the glider begins to turn, you may push the bar out a little for making the turn faster, and then move it back. **Don't do this at low speed.** You must keep the speed corresponding to the bank angle. Phantom is stable in multiple 360-degree turns in both directions and has no sideslip.

#### 4.5. Using RVG

RVG system is designed for increasing glide ratio at high speed. That system decrease the aileron set up angle on 3deg. Therefore the pitch stability is decreased also and, as result, bar pressure becomes lower. Trim speed with RVG ON becomes higher on 12-14km/h.

- Climbing. RVG mode – OFF(rope is released). Excellent control at low speed, best possibility for finding good climb. Too much bar pressure at high speed.
- Gliding. RVG mode –ON (rope is pulled). Use that mode if you are going to fly for a long time at speed higher than 75-80km/h. Glider has best glide ratio at high speed. Bar pressure do not make you tired during long flight at high speed. That is quite difficult to climb with RVG ON due to high trim speed and not that comfortable handling as with RVG OFF. Also in combination with backward CG position at low speed the pitch stability can be not enough for climbing in turbulent conditions. So do not use that mode for climbing.

#### 4.5. Using flaps

The Phantom has flaps deflection range 0~55deg. After full flaps deflection trim speed is decreased by 8~10 km/h and speedbar moves backward by 150 mm.

The 0 deg. flaps is the best glide ratio and min sink ratio configuration.

The 15-20 deg. flaps is the climbing configuration – glider has best control with good sink ratio

Big flaps deflection angles are not recommended for climbing due to substantial increase in sink speed and decrease in glide ratio. These big angles can be used for landing and quick descent.

#### 4.6. Landing

As the Phantom is a high performance glider, you should land only up the wind and avoid going downhill. Phantom requires thorough handling during landing.

For landing it is recommended to use from half flap up to full flap configuration.

Make sure RWG is OFF. That is not allowed to land with RWG ON.

That is not allowed to do big flare up. In case of big flare there is high possibility to hit the ground with the tip and damage the tip.

Keep the wings level, speed the glider up slightly and fly right down till the altitude is 0,5 - 0,8 m from the ground to the speedbar. At this altitude decrease descent rate by pushing slightly on the control bar. When you feel the glider unresponsive to the bar movement, quickly ease the bar out all the way before your feet touch the ground. With a good sharp final thrust, the sudden increase in drag will slow the glider very suddenly and you will land softly. In zero wind conditions you will make few steps to stop the glider.

**REMEMBER.** Do not ease the bar out with surplus speed! It leads to sudden flare up and falling. It is much better not to move the bar out at all, than move it too early.

## Section 5. BREAKDOWN Procedure

5.1. Remove nose cone

5.2. Unhook side wires

5.3. For one side at time:

- Put out tip tube
- Remove SPADD
- Disconnect winglet
- Unlock tip strut
- Open clamp wall
- Put out top back corner of the sail from head pin
- Fold tip strut as much as possible (tip tube should be removed) and put out it from the pin on the tip rib end
- Fold the tip a little and put out the sail from head pins completely
- Open zipper on the sail, put out the clamp wall from the sail
- Detach ailerons lever from ailerons
- Put aileron rod into the sail and fix it with a rubber ring



5.4. Repeat steps 3.3 for another side

5.5. Detach flap control from the flap

5.6. Ease ribs off

5.7. Detach the trailing edge tube from the keel beam

5.8. Fold ribs down, pulling by the cord at the tip of the ribs wire

5.9. Disconnect keel stinger

5.10. Disconnect nose tube and nose pin.

5.11. Detach the tip rib from the trailing edge tube

5.12. Wrap sail around the D-spar, trying to avoid wrinkles

5.13. Disconnect tips and put covers on the D-cell ends.

5.14. Fasten flaps and ailerons on the D-cell by Velcro.



5.15. Ensure that the zippers in the center are folded correctly and the sliders do not go between the keel beam and the D-cells.



5.16. Put protective covers on the keel beam as follows:

- One big cover – at the place of attachment of the trailing edge tube and ribs wire, wide part backwards;
- Smaller cover – at the place of attachment of rear wires;
- The smallest cover – at the end of tail tube.



5.17. Fold wings in.

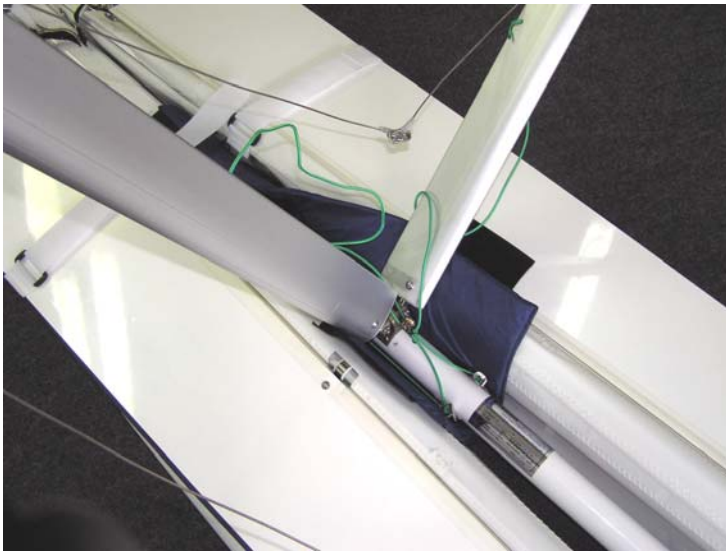
5.18. Hide wingtips into the D-cells.

5.19. Put the glider cover on.

5.20. Put the glider down, upper side down.

5.21. Spread the D-spars a little.

5.21. Disconnect the speedbar, turn each downtube on 180deg, fold them leading edge down, put down tubes along keel slightly turn them to be sure that leading edge does not touch the keel tube.



5.22. Pull the flap rope out so the flap's pulley is out and put protective cover on the downtubes end.

5.23. Always put the packed glider on earth or on the car with the zipper upwards.

## Section 6. Maintenance

### 6.1. Tuning

A correctly tuned glider is comfortable and has good handling in all allowed flight modes. Phantom has a number of adjustment points that can be used for changing its performance.

#### 6.1.1. Hang point.

Trim speed should be different for different hook in weight. The more the weight, the higher speed you'll have (see Flight Speed). Adjust hang point, in order to achieve trim speed corresponding to your weight. If the glider has already been tuned for lower weight, move the hang point backwards for a heavier pilot.

### 6.2. Regular inspections of the glider

It is necessary to check your glider regularly for damages, possible structural deformations, operational depreciation, tuning. You have to inspect frame (D-spars, ribs, keel, trapeze), wires, all hinges and fittings, bolt connections, sail, control system tuning.

#### 6.2.1. Instruments and facilities

- Four supporting struts for proper setting up the glider relatively to the ground level
- Electronic inclinometer for measurement aileron setting up angle and angle of the control surfaces deflection
- Lamp or lighter for searching cracks in D-spars
- Ruler and slide caliper
- Set of spanner and other bench tools

#### 6.2.2. Inspection intervals

- Before the first use;
- After each rough landing, in order to find any possible structural deformations;
- After every 100 hours of flight or annually, whatever comes earlier.

#### 6.2.3. Frame inspection

- Inspect D-cells with the view to find any distortions, damage, cracks, especially at root fitting area, spar belt area. If you found some cracks on the outer surface of the D-spar skin, use the lamp for checking if this crack exists on the outer skin – light the crack zone and look inside the D-spar, if you see the light inside the D-spar, that mean you have a crack on the outer skin. If any D-cell damage detected, seek advice and assistance in its repair from your local dealer. Don't make repair yourself, unless you have experience with repair of carbon plastic structures.
- Inspect control frame wires and all control system wires, looking for broken threads, tear and signs of corrosion and replace them if you found any.
- Check all bolting. Bolts should be tightened and locked. Where self-locking nuts are used, not less than 2 thread coils should be visible.
- Check the keel beam and ribs, looking for permanent deformation, dimples, signs of corrosion, cracks, especially near bolts and rivets.
- Check rib hinges. Axial play must not allow the rib end to move more than 3mm. If the rib end moves more, you have to bush the hinge hole for preventing such axial play.

6.2.4. Check the wing anhedral angle. Put the glider on the supporting struts – One strut on the nose, another on the keel near rear wire fixing point, other two on the left and right side of the wing at the middle of the D-spar span. Align the keel tube with the horizon level. Measure the anhedral angle by electronic inclinometer. Put it on the top D-spar's surface, align with the spar. Anhedral has to be  $-0.4 \div -0.6^\circ$

6.2.5. Check the aileron position. Measure the ailerons neutral setting up angle. Make measurement at Rib N5 point. In neutral position they have to be placed on 0.5-0.7 deg up from the keel level.

6.2.6. Check the ailerons deflection angle. Maximum deflection angle up is 33deg, down – 16deg.

6.2.7. Check sweep back angle. Pass the line between very end points of the plastic parts of the wing tips. The distance from that line to the front edge of the bottom D-spars connection plate should be 2150-2170mm

6.2.8. Check the hooking strap for wear. Replace it if discovering even the slightest symptom of wear.

6.2.9. Inspect the sail.

Thoroughly inspect the sail, looking for tears, torn threads at the seams, especially along the rear edge and in the root part of the wing. Contact your local dealer or the manufacturer if the sail is damaged, and you'll get professional repair.

### 6.3. Maintenance

You should keep your glider in good condition, to ensure it has optimum performance for a long time.

Don't put the glider in the cover down on an uneven surface with sharp edges. This can cause damage to the D-cells.

Don't transport your glider in a car without soft pads on the roof rack. This can cause damage to the D-cells.

It is not recommended to leave your glider under the sun longer than it is necessary.

Don't leave the glider resting on the control frame long when strong wind is blowing. This decreases lifetime of the sail.

Don't pack the glider if its sail is wet. If necessary, spread the sail and let it dry as soon as possible.

It is allowed to wash the sail with pure water only, without any soap or washing-powder.

When setting up and breaking down the glider, take care not to allow sand or dirt into the glider bag.

Keep the telescopic connections thoroughly clean, as their dirtying will make set up and break down difficult or impossible.