

finsterwalder *tunflex*



Stress-free flying, having fun, a pleasure to land
as simple as landing an old Rogallo standard,
yet at the same time flying higher, further and faster
with a performance that was previously reserved for advanced pilots

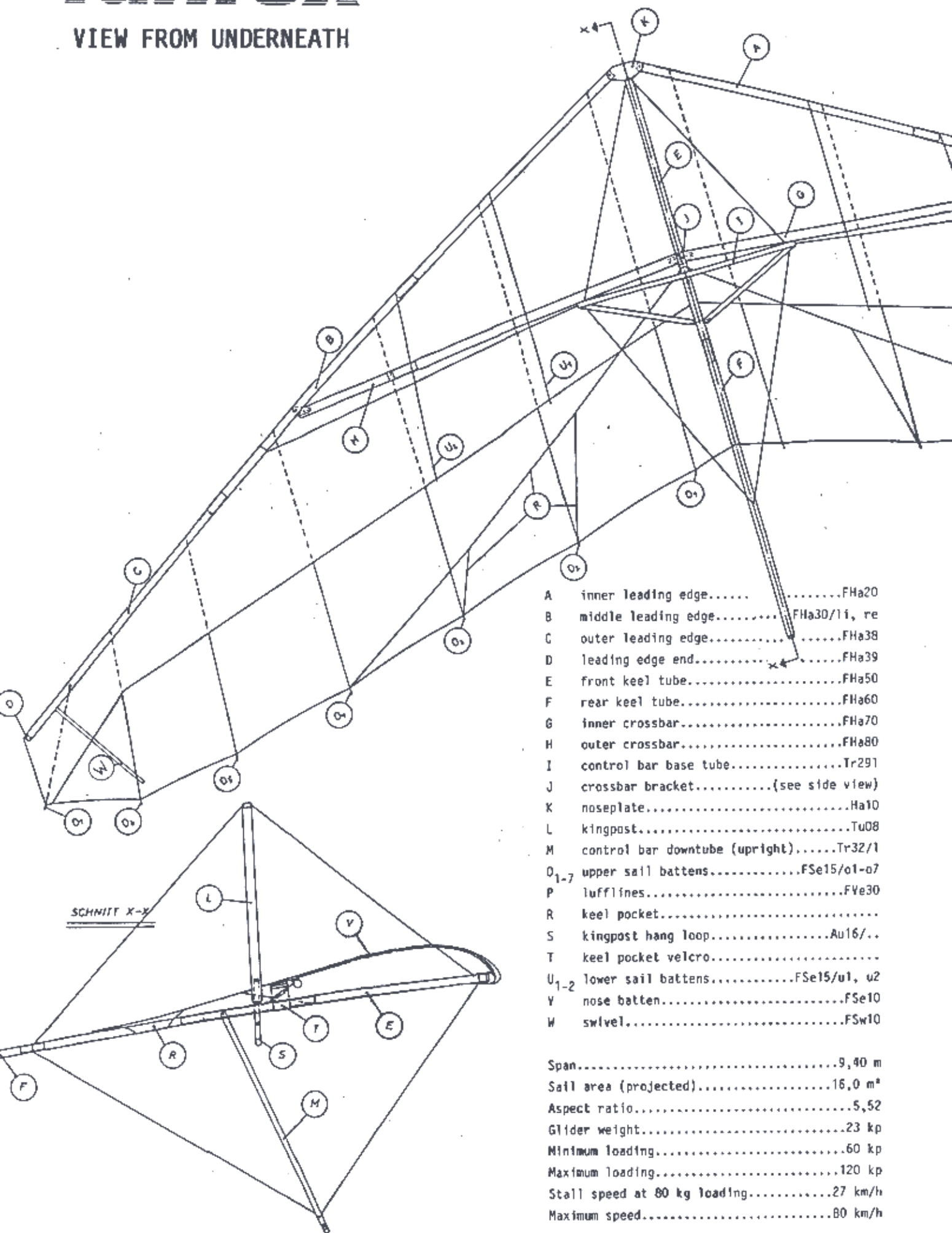
OWNER'S MANUAL

also available in German

funfex



VIEW FROM UNDERNEATH

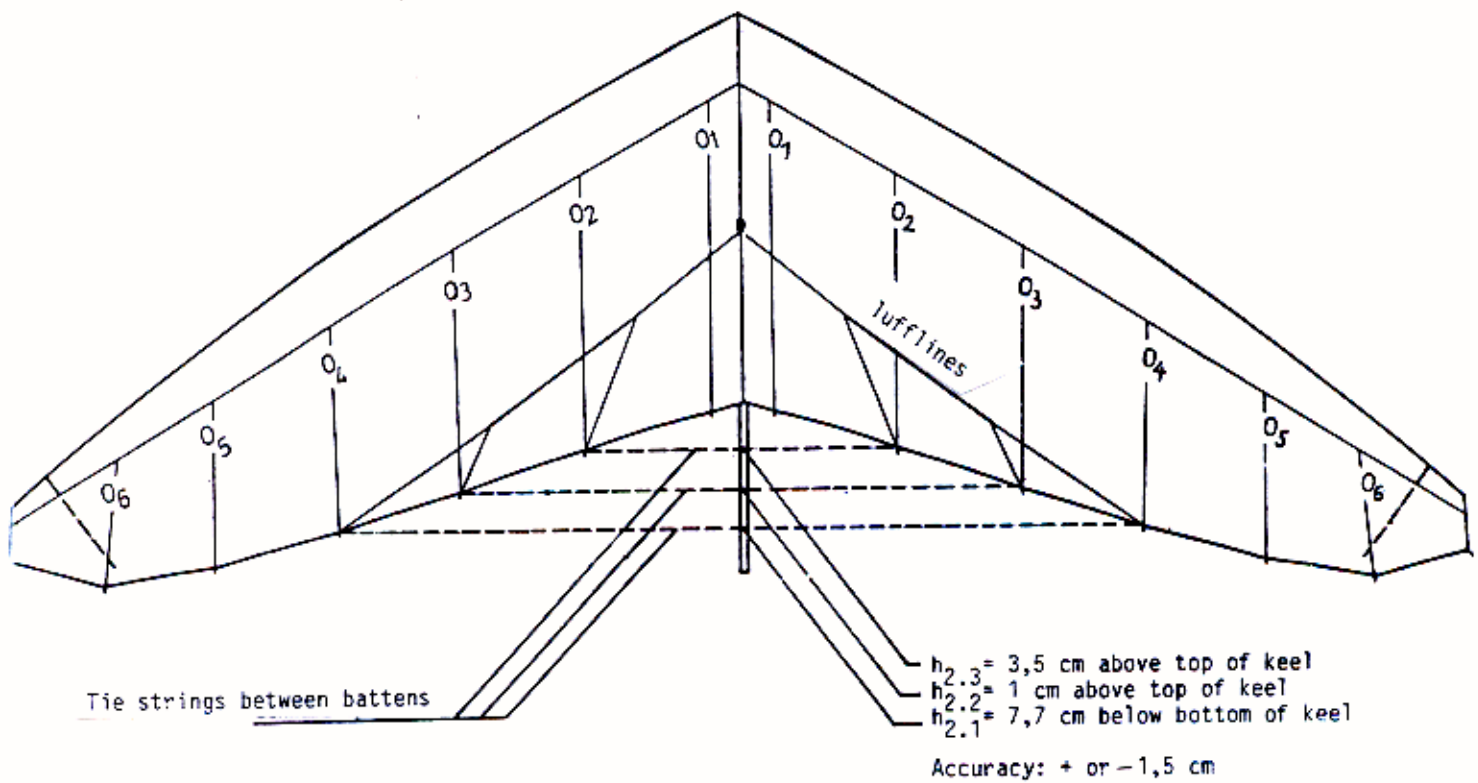


- A inner leading edge.....FHa20
- B middle leading edge.....FHa30/11, re
- C outer leading edge.....FHa38
- D leading edge end.....FHa39
- E front keel tube.....FHa50
- F rear keel tube.....FHa60
- G inner crossbar.....FHa70
- H outer crossbar.....FHa80
- I control bar base tube.....Tr291
- J crossbar bracket.....(see side view)
- K noseplate.....Ha10
- L kingpost.....Tu08
- M control bar downtube (upright).....Tr32/1
- O₁₋₇ upper sail battens.....FSe15/o1-o7
- P lufflines.....FVe30
- R keel pocket.....
- S kingpost hang loop.....Au16/..
- T keel pocket velcro.....
- U₁₋₂ lower sail battens.....FSe15/u1, u2
- V nose batten.....FSe10
- W swivel.....FSw10

Span.....9,40 m
 Sail area (projected).....16,0 m²
 Aspect ratio.....5,52
 Glider weight.....23 kp
 Minimum loading.....60 kp
 Maximum loading.....120 kp
 Stall speed at 80 kg loading.....27 km/h
 Maximum speed.....80 km/h

Adjustment Heights

Check every year !



Forward

The danger in hang gliding lies completely in the hands of the pilot. The hang gliding accident rate is about equal to that of motorcycle riders. Almost all hang gliding accidents could have been avoided with the appropriate precaution. Precaution is a sign of intelligence; not of cowardice!

Prerequisites for safe hang gliding are theoretical and practical knowledge which must be acquired from textbooks and through attending a hang gliding school.

One of the risks of hang gliding is changing gliders. In order to reduce this risk, the pilot should familiarize himself with the new glider step by step in the following manner:

- 1.) Setting up and breaking down (rigging and derigging) the glider according to the owner's manual.

Always carry out the setup and breakdown steps in the same sequence. Conditions at launch are usually governed by stress. You can only set up quickly and safely if you have a system.

- 2.) Setup check, test flight, first flight supervision.

Official Finsterwalder dealers are requested to familiarize each customer with his glider and to test fly each glider before delivery. Make sure that this takes place. Set up your glider without help under the eye of a hang gliding instructor and make your first flight under the supervision of the dealer. If you picked up your glider at the factory, we can recommend you a hang gliding instructor who will perform the setup check, test flight and first flight supervision. Test flight and first flight should be from a grassy hill with a maximum height of 50 m under ideal weather conditions.

- 3.) High flights

Don't be afraid to put wheels on your base tube for the first flights. Make your first high flights under ideal weather conditions. Learn the steering and stall characteristics with a minimum altitude of 150 m. Determine your personal glide polar using your own instruments.

General Rules

- 1.) Take your glider to the practice hill after major repairs, after putting on a new sail or after significant flying pause.
- 2.) Never change anything on the glider and check tolerances regularly.
- 3.) Fly only after suitable training. The owner's manual is no substitute for the supervision of a flight instructor. This applies to experienced pilots as well.
- 4.) Never fly alone!
- 5.) Increase your concentration before launch and preflight the glider.
- 6.) Fly only at a suitable site under ideal weather conditions.

Register Your Name and Address

When developing our gliders we proceed as carefully as possible. Nevertheless, factory callbacks, flights bans or maintenance bulletins occur or become necessary. It could be in your interest to receive technical developments and other information concerning your glider. Our free information service for glider customers keeps you informed. Please remember to inform us of your moving or upon selling your FINSTERWALDER glider. Write or call us. Tel: (in the FRG) 089/8116528.

Operating Limits

LOADING

Maximum loading: 120 kp

Minimum loading : 60 kp

Maximum permissible airspeed: 80 km/h

In the range above V_{max} strong sail deformation occurs which considerably reduces performance.

Normal airspeed: 30 - 40 km/h

Minimum sink depending on pilot weight: 28 - 35 km/h

Maximum glide ratio at: 33 - 42 km/h

Stall speed : 26 - 32 km/h

WIND CONDITIONS

Launching into a wind of more than 30 km/h airspeed is risky and should be refrained from.

TURBULENCE

Negative loading in flight must be avoided whenever at all possible. That includes holding an airspeed of 40 - 60 km/h in strong turbulence and not exceeding it if possible.

Flying faster under such circumstances is not only pointless, it's dangerous. Furthermore, flights in "Föhn" (leeward) conditions should be avoided right from the beginning.

AEROBATICS

Aerobatics with hang gliders is dangerous and can lead to fatal accidents. Under "aerobatics" we include: turns with more than 60° roll, wingovers, loopings, dives of more than 35° pitch and whip stalls.

RESCUE CHUTE

Wearing a rescue chute is required on all flights of more than 100 m altitude. Wearing a helmet is required on all flights!

Motorizing

Extensive testing and registration procedures are necessary when motorizing your glider. Inquire as to the present situation.

Glider Classification

The FUNFEX is a glider in the intermediate class suitable for novices and recreational pilots with 60 - 90 kp hookin weight. DHVclass: 2

Towing

The FUNFEX may be launched by towing. However, wheels on the base tube and a special pilot's licence are required for this purpose.

Adjustment and Trimming the Glider

- 1.) Careful adjustment of the batten-tensioning cords is the prerequisite for good handling. Too much tension can decrease performance and handling considerably. Loosen the knot on each batten-tensioning cord and move it to the point where it lies exactly 15 mm behind the batten when pulled to the rear.
- 2.) Observe the correct hang loop length. For pleasant handling in turbulent air it's especially important with the FUNFEX to hang as close to the base tube as possible. This also applies when motorizing. Kingpost hang loops between 30 and 60 cm length are available for this purpose. Remember that a slightly longer loop must be tied in as a reserve. Check to insure that primary loop movement is not hindered by the reserve loop.
- 3.) Trim speed: When flying in still air at minimum speed, (ie slightly above stall speed) letting go on the bar should not result in loss of speed. If the glider slows down, insert the kingpost one hole further forward before the next flight - if it speeds up one hole further to the rear. When you've found the correct trim position, tie the reserve security loop into the 2 unused holes. Other existing trimming possibilities include:
 - * by tightening the outer three sail battens, the glider will fly faster, by loosening them, slower.
 - * by fastening the glider cover to the keel inside of the double sail as far forward as possible or by stowing it in your harness.
 - * by slightly tightening the plastic tensioning disc on the forward lower flying wires, the glider will fly faster. However, this possibility should only be used as a last resort.
- 4.) If the glider pulls to one side, compare the battens with the batten template and bend to conform if necessary. To increase bend push the batten against a rounded surface (an automobile tire, f. ex.). To decrease bend push against a flat surface. If the battens are OK and the glider still pulls to the side, increase leading edge tension on the opposite side by pulling out (extending) the leading edge end. If that doesn't suffice, loosen the leading edge tension on the side to which the glider pulls by pushing in (shortening) the leading edge end. Further trimming possibilities include:
 - * by loosening the batten-tensioning cords on the side opposite to that to which the glider pulls
 - * by changing the bend in battens 5 and 6. An increase or decrease of max. 2 cm in the curvature produces an increase or decrease in lift on the corresponding side.

Flying Supine or Sitting

In order to have adequate control it's necessary to coordinate control bar size and position with seat height. For this reason we deliver a smaller control bar (with speedbar and appropriate flying wires) for supine pilots. This control bar is interchangeable with that for prone pilots. The FEX-Supine-Seat should be adjusted in such a way that the base tube is at hip level. To land, stretch the legs forward and let the upper body rise until touching the harness straps and grasp the downtubes somewhat below the middle.

Flight Characteristics

Launch

In contrast to most gliders, which are more or less tailheavy, the FUNFEX is statically neutral and must not be tilted forward with the shoulders. It's best to grasp the downtubes low enough that the shoulders fit between them. In this manner it's possible to change the angle of attack. Maintain high speed during the launch run - it's a safety margin against sudden changes in the wind. Pushing out slightly causes immediate lift off.

Handling

Increase your speed slightly before turning and initiate the turn by pushing the control bar out diagonally. Observe a constant speed when turning.

Stall

A mushy control bar is the sign of an impending stall. The FUNFEX has no tendency to drop a tip when stalling. Every pilot should practise stalling under favorable weather conditions with more than 150 m altitude.

Killing Altitude

For example, before impending thunderstorms: leave the area of lift. If this is no longer possible, fly 360's at high speed: in still air 80 km/h max, in turbulence 60 km/h max.

Landing

The approach should not be too fast and should lie between 32 and 40 km/h. When rising out of the prone position be careful not to inadvertently loose a lot of speed. Be sure to grasp the downtubes high enough; in other words, slightly below the middle. Just before stalling flare diagonally (forward and upward). Novices coming off of Rogallo-type gliders should remember that the FUNFEX requires more time and distance in ground glide before flaring. In other words, approach low and don't flare too early. Your feet should drag on the ground just before flaring. Use air-filled wheels until you've got it!

Assembly Introduction

We basically recommend setting up (rigging) the glider on the ground, from which easy ground handling in strong wind is not the only advantage. It also reduces the chance of damaging the nose-plate, which can occur during set-up on the control bar if the keel rises too high in relation to the leading edge. It is also easier to insert the upper sail battens. As an exception, the FUNFEX can be rigged and de-rigged on the control bar if the ground is dirty.

Pack Length

Long Pack 5,5 m

Important note!: The control bar cannot be folded if the crossbar is tensioned. Always loosen the crossbar first. Always insert and remove the battens by partially loosened crossbar (ideally with the glider on the ground).

ASSEMBLY: Zip open the glider cover, spread the downtubes apart and attach the speedbar. Turn the glider over so that it is lying on the control bar. Set the glider up onto the control bar only if the ground is very dirty. Remove the glider cover. Insert the nose batten and pull the webbed sail nose strap forward over the noseplate and fasten to the stud on the bottom of the noseplate. Check that the sail pins on the ends of the leading edges are correctly inserted. Insert the kingpost by pushing the keel to the side or unhooking the rear kingpost wire. Be sure that the lufflines are correct - they must be hooked onto the kingpost below the rear kingpost wire. Gently spread the leading edges as far apart as they will go without raising them too far off the ground.

* Insert *Swivels*

Insert the battens and tension them with the cords (the knots can only be adjusted when the glider is rigged and the crossbar tensioned). Raise the nose, pull the control bar forward and set the glider onto the control bar, by which you must be careful that the outer battens don't get pushed into the ground. Then fasten the front lower wires onto the noseplate with the self-tensioning safety pin.

To avoid eventual sail abrasion at the wingtips, choose set-up sites where the keel area is higher than the wing area, if possible. Always use the keel extension, also. Tension the crossbar the whole way and insert both safety hooks. Close the keel Velcro! The glider cover can be fastened to the keel. Close the keel zipper with the keel inside.

Medium Pack 3,70 m

Similar to the long pack length except that the outer leading edge must be dismantled. This is easily accomplished by pulling out the sail pins at the wingtips and releasing the outer LE tubes by pressing in the detent buttons, which can be easily reached through the open sail zipper.

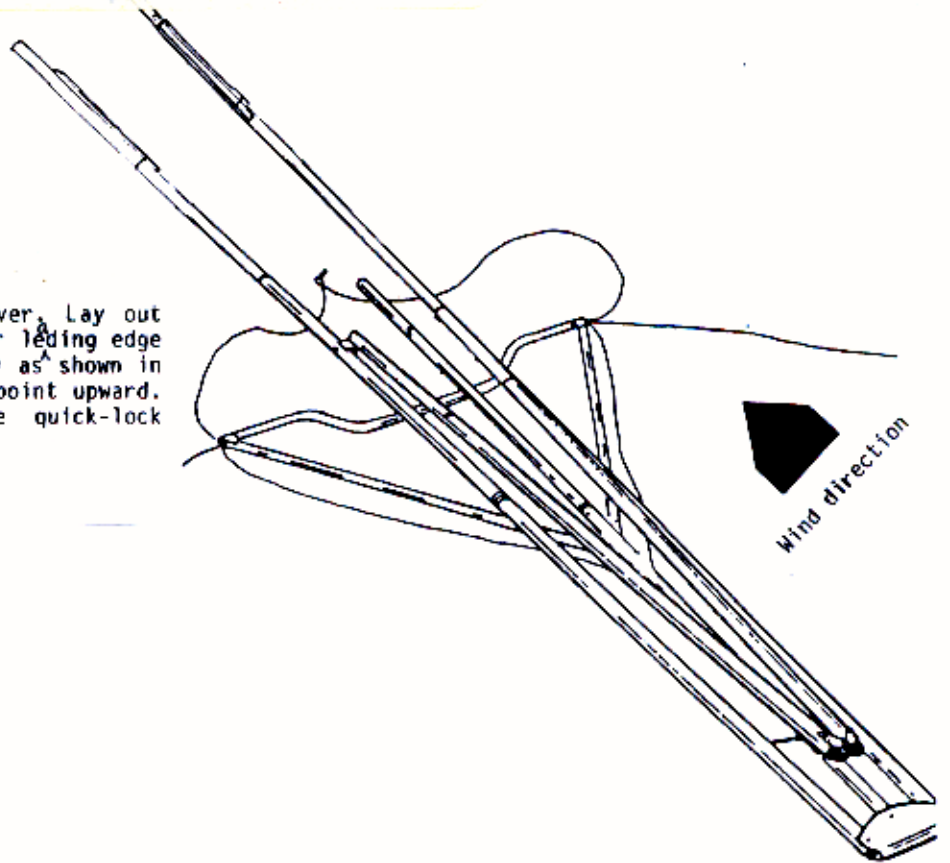
Short Pack 1,95

The sail can be easily pulled off and folded after removing all flying wires by unhooking the bayonet pins, the tangs with anchor pins, the hooks and the self-tensioning safety pin. The leading edge inserts may be left in the sail. The frame consists of 5 parts which are color coded and secured with detent buttons. The long FUNFEX glider cover is designed so that it can also be used for the short pack length. Frame and sail must be put into the cover one after the other, after which the cover must be folded together from the ends and secured with Velcro straps. However, there are no carrying straps or end padding as found on the short FUNFEX glider cover.

Setting Up out of the short package

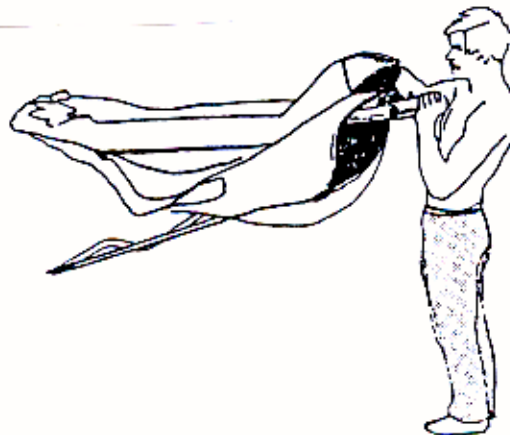
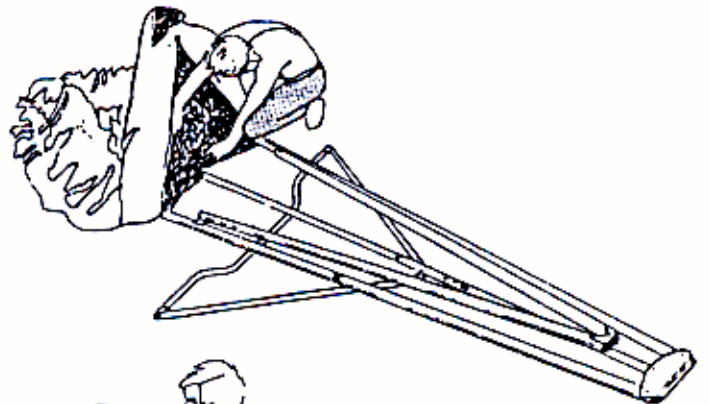
Frame Assembly

Remove all tubes from the glider cover. Lay out the noseplate with front keel and inner leading edge tubes (which normally remain together) as shown in the diagram. The detent buttons must point upward. Assemble the control bar with the quick-lock system.

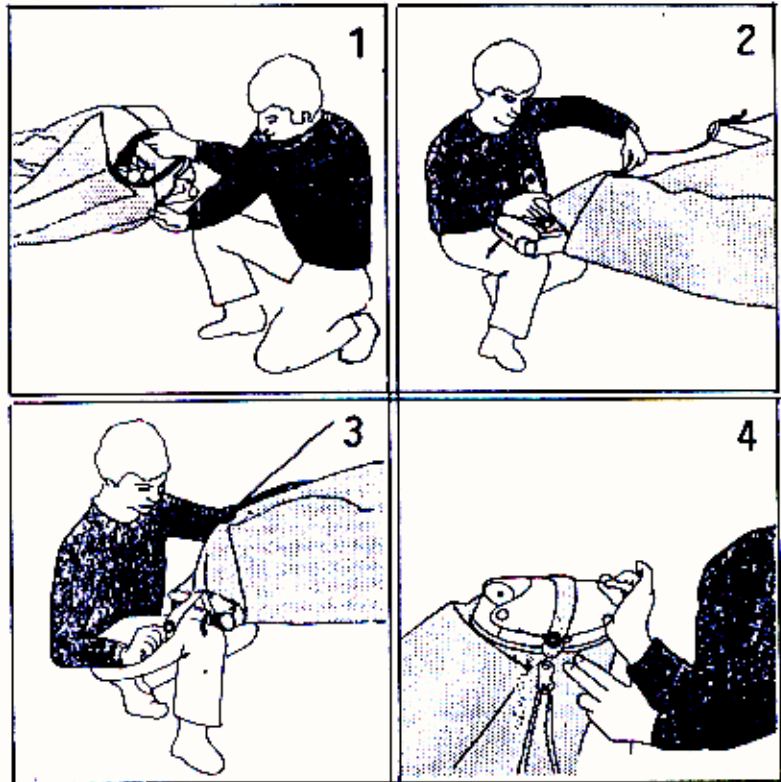


Pull On the Sail

Spread out the sail behind the frame. Insert the leading edges into the double sail to the left and right of the keel pocket and push the keel into the keel pocket. Pull the sail as far forward as possible while simultaneously raising the nose to avoid jamming the sail between the tubes.



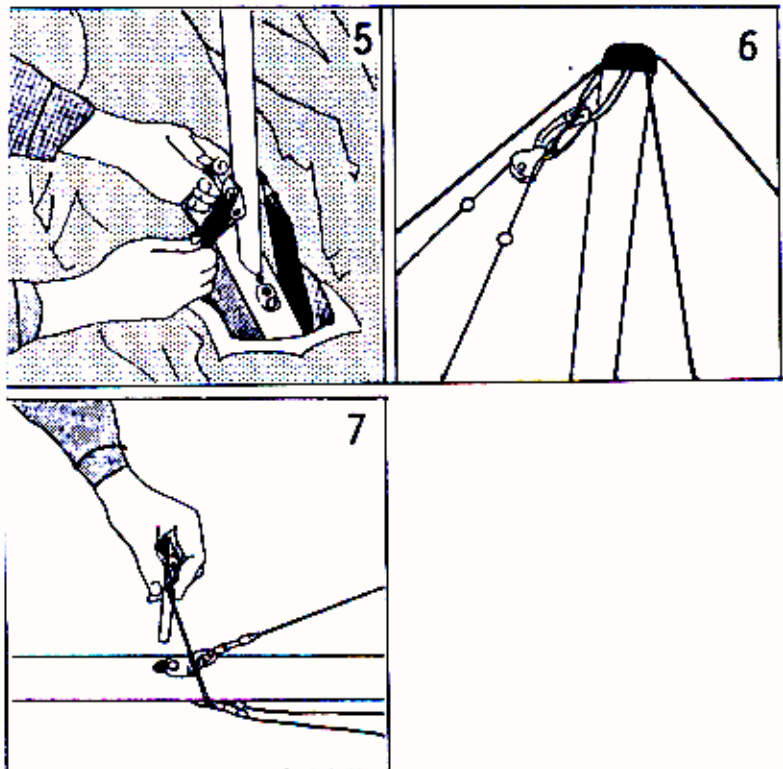
Pull the noseplate through the lower sail and into the nose opening as shown in Figure 1. Pass the forward kingpost wire through the sail opening and hook it into the keyhole in the keel as shown in Fig.2 The safety detent button will snap into place. Insert the nose batten and pull the webbed sail nose strap forward over the noseplate as shown in Figure 3. Secure the nose strap to the bottom of the noseplate with the self tensioning safety pin as shown in Figure 4.



Attach the Kingpost

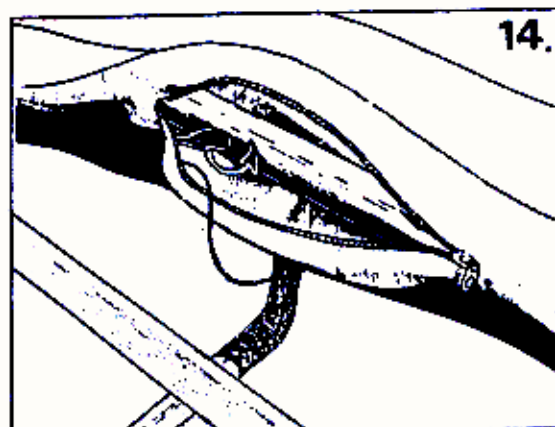
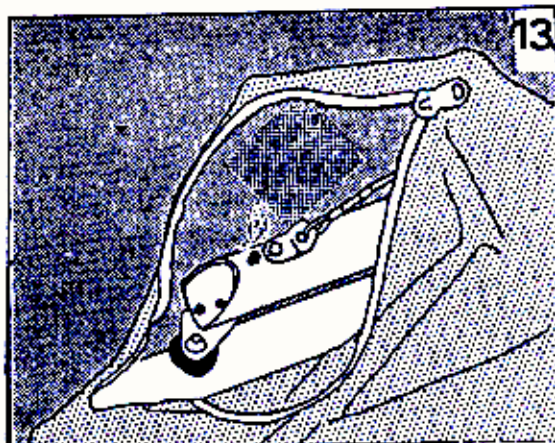
Insert the kingpost into its corresponding opening in the keel tube. Guide the straps of the kingpost hang loop around the keel and fasten them to the kingpost with the quickpin (Figure 5). Hook the luff lines into the safety hook at the top of the kingpost as shown in Figure 6. The rear kingpost wire must run above the luff lines (as opposed to the MINIFEX or TOPFEX). Hook the rear kingpost wire tang and the rear lower flying wire tang into their corresponding keyhole openings in the keel tube and secure them with the aluminium pin (Figure 7).

***Important Note:** The pin on the bottom of the kingpost is slightly movable through the use of a rubber bearing. However, it is possible to damage the pin if the kingpost is moved too much out of vertical alignment with the keel.



Attaching the Side Wires

Draw each side kingpost wire through its corresponding opening in the upper sail. Reach through the open zipper in the lower sail and attach the side wire tang into the crossbar keyhole. The detent buttons will snap into place for security. Each lower side rigging must be passed through the open zipper in the lower sail, and guided under the leading edge to the opening for the bayonet pin on the inner side, (see sketch 1). The bayonet pin must be inserted and turned 180 degrees until it locks secure. You should hear the safety detent buttons snap into place. Make sure that the bayonet pin is completely inserted before twisting it around into place, and make a habit of pulling on the rigging wire after twisting, to be sure that it is sitting properly.

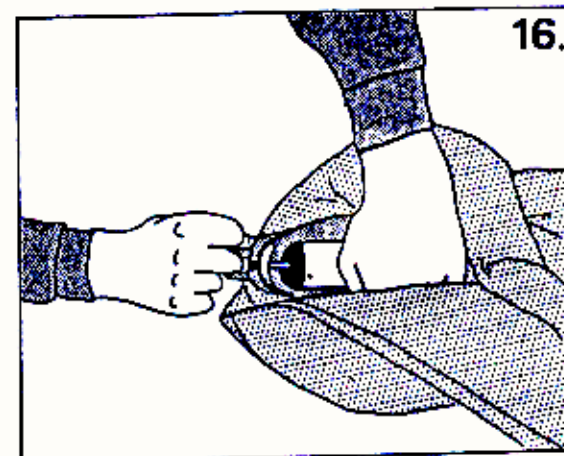


Attaching the Swivel Tips

Push the sail far up the leading edge so that the swiveltips can be inserted into their corresponding sail openings. Pull the sail back to the end of the leading edge tube, and the swiveltip can be slotted into the metal housing where it is held in place by an elastic grip.

Fastening the Sail to the Wingtips

Insert the sail pins into the corresponding openings in the leading edge ends as depicted in the drawing. This may only be undertaken after the sail is attached to the nose, otherwise the leading edges are not under tension and the pins may fall out before the wings can be spread apart.

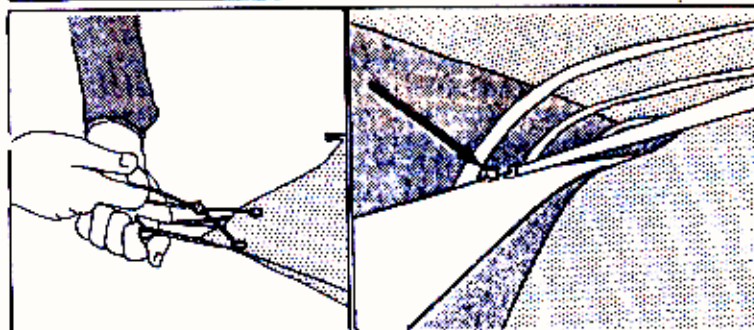
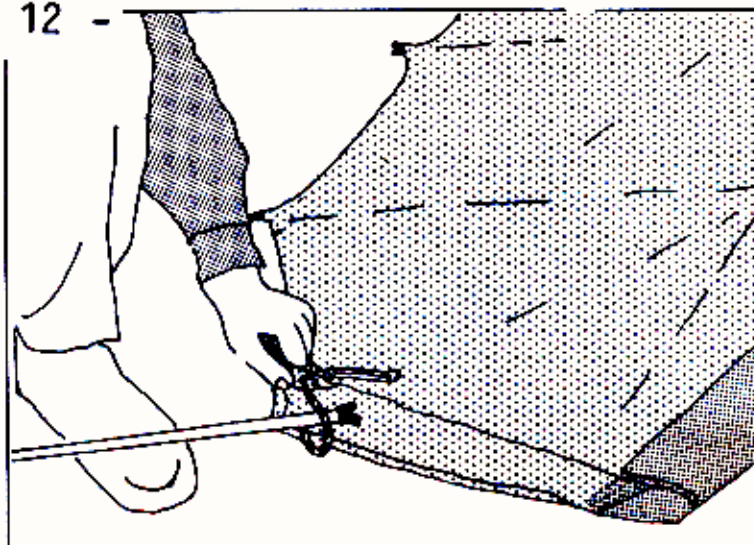


Inserting the Battens

Spread the wings as far apart as the lower side wires allow. The battens are coded red for the left side and green for the right (in the direction of flight). It's best to separate them accordingly. Battens 1, 2 and 3 are in two parts. The rear part consists of: 1-aluminium, 2-fibreglass with marking and 3-fibreglass without marking. Sort the battens on the ground according to length and lay each one behind its corresponding batten pocket in the sail. Then insert and tension the upper sail battens, beginning with the longest.

The upper sail battens may only be inserted and removed when the crossbar is not tensioned. You won't have to wonder about bent battens and damaged batten pockets if you don't follow this rule. The straight outer batten is not housed in a pocket. It must be inserted through the batten-tensioning cord, placed against the knob on the back of the leading edge tube and tensioned into place (see Diagrams 1-3).

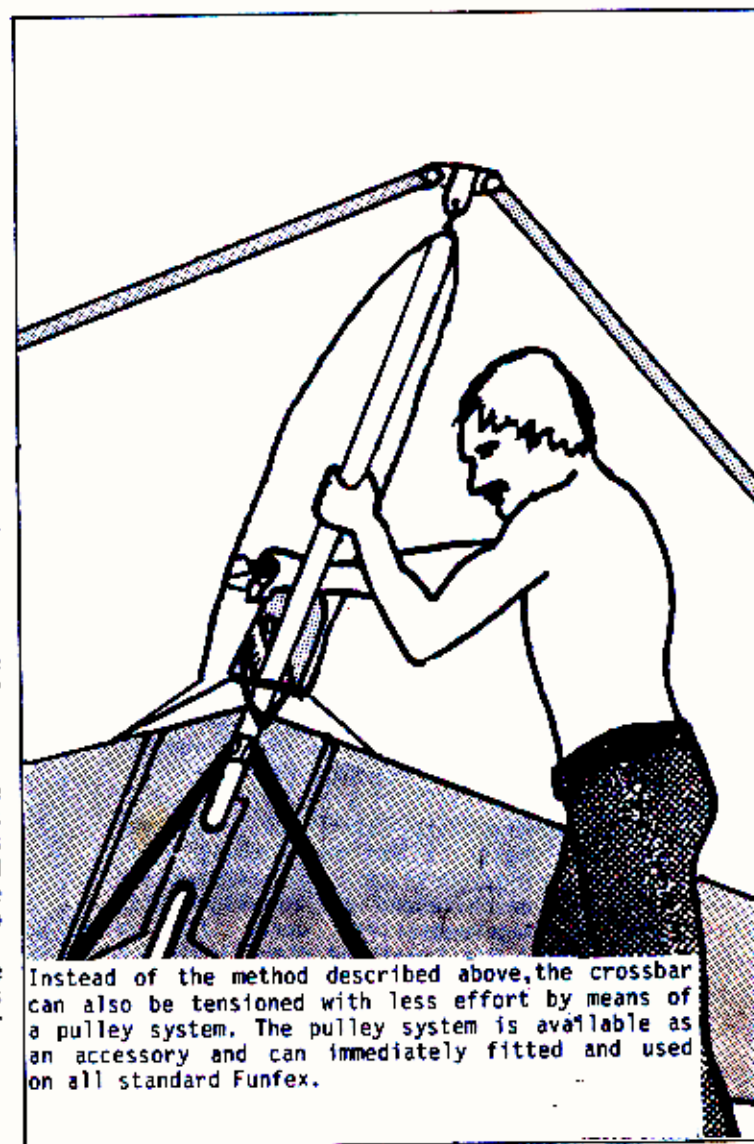
By insertion and tensioning of the two outer sail-battens, care must be taken that they do not twist outwards towards the wingtips; this may lead to a onesided drag in flight !!!!



Tensioning the Crossbar

The FUNFEX crossbar can be easily tensioned with the hand. Raise the glider at the nose and pull the control bar forward. Be careful not to push the glider thereby to the rear, for the outer battens could be pushed into the ground. Hook the tang with the forward flying wires to the noseplate and secure it with the selftensioning safety pin. Then spread the wings apart once again, being careful not to raise them higher than the keel in order to avoid damaging the noseplate. To tension the crossbar by hand, grasp the crossbar bracket from above with one hand and the keel with the other. Push the crossbar to the rear, thereby being careful not to put much pressure on the upper sail or nose batten. Hang both safety hooks into the tang at the base of the kingpost. Be sure that the crossbar safety cable runs over (behind) the Kevlar-cord the floating crossbar.

The Kevlar cord should be tensioned so that the crossbar safety cable is loose. If necessary, shift the knot on the Kevlar cord to the inside. If less responsive handling is desired, the Kevlar cord should be loose and the crossbar fastended to the stainless steel safety cable. The FUNFEX may also be tensioned with the conventional cord and pulley. This method requires less force, but is more troublesome. We'll send you detailed instructions on request. The production FUNFEX is outfitted for the use of cord and pulley.

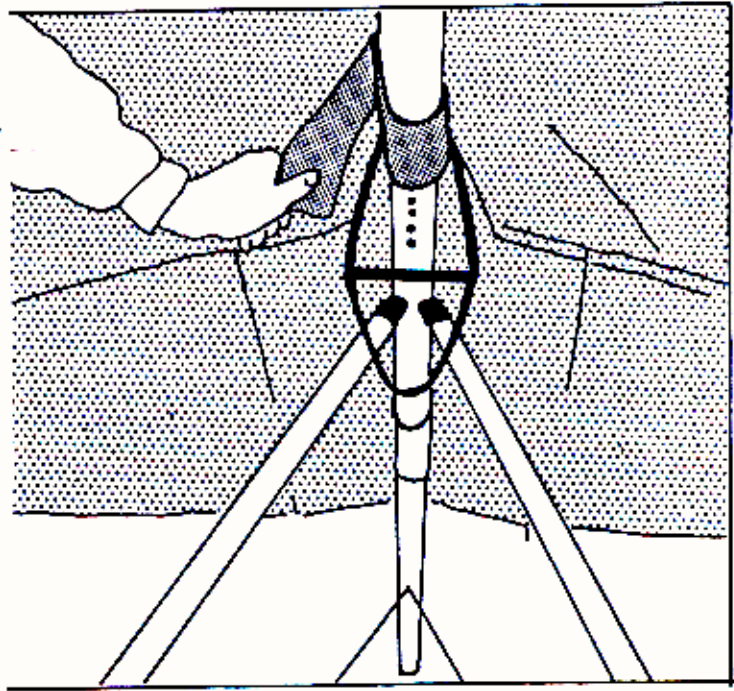


Instead of the method described above, the crossbar can also be tensioned with less effort by means of a pulley system. The pulley system is available as an accessory and can immediately fitted and used on all standard Funfex.

Closing the Keel Pocket Velcro

The keel pocket Velcro has an important function. Should it remain open, the FUNFEX is flyable under normal conditions but without the pitch-up required for certification. Therefore, it's important to always check the Velcro when pre-flying the glider. It must be placed around the keel pocket, pulled through the buckle to the sewed-in mark and fixed. Then close the zipper on the keel pocket, making sure that the keel is within the keel pocket, as opposed to other gliders.

*Note! Never roll up the sail when the glider is wet, since it's possible that the colors in the keel pocket Velcro and kingpost hang loop will run and discolor the sail. To avoid this, it's advisable to impregnate both with a commercially available waterresisting spray. Finally insert the lower sail-battens and attach the nose covering.



Pre-flight Check

Carry Out carefully before every Flight without Fail!

Carry out carefully before every flight without fail!

- 1.) Got the nose of the glider and sight along the keel and leading edges to check the symmetry (right and left the same?).
- 2.) Check the position of the luff-lines and the reserve hang loop.
- 3.) Check the flying wires, particularly their connection to the tubes. Twisted thimbles? Bayonet pins completely inserted?
- 4.) Check crossbar assembly.
- 5.) Keel Velcro closed?
- 6.) Harness and chute OK?
- 7.) Hook in!
- 8.) Perform hang check.
- 9.) Locate chute handle (remember that you have a chute).
- 10.) Weather, wind conditions OK?
- 11.) Raise glider until harness straps are taut and run!

If you should be interrupted during glider check, go back and start again from the beginning.

Break-down (Derigging)

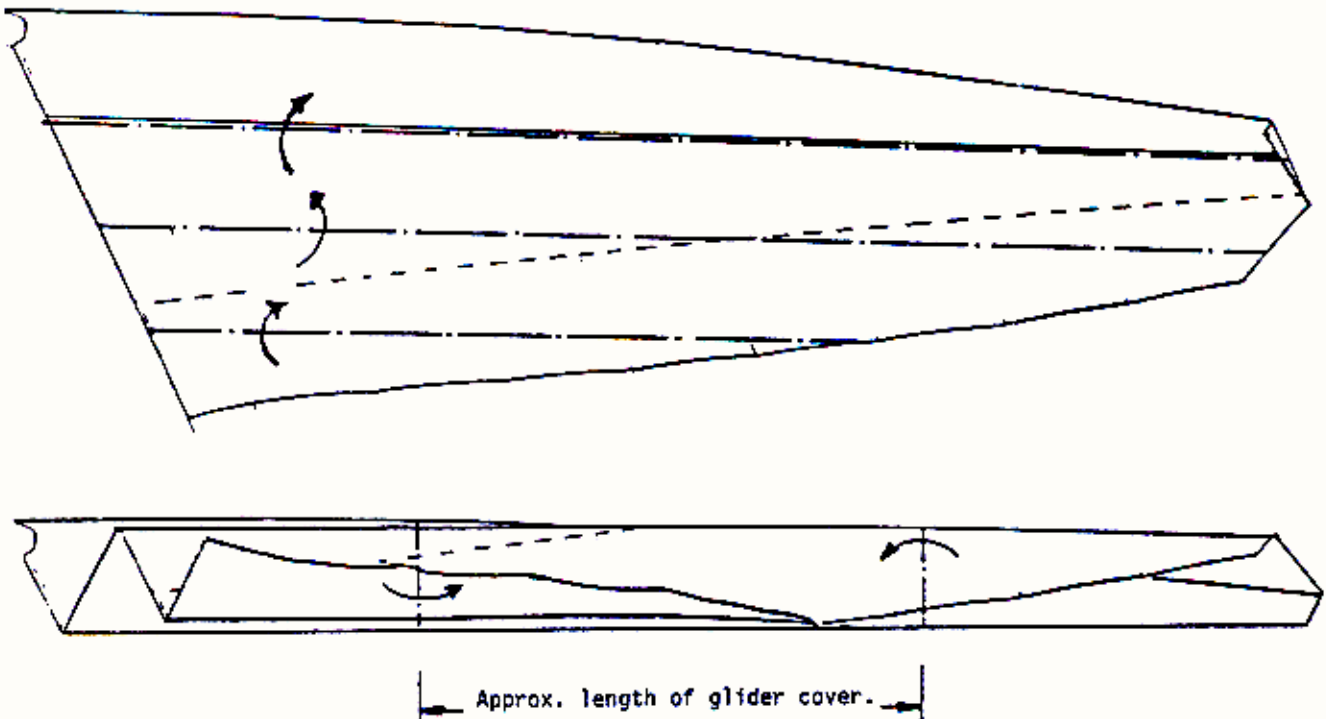
In general, breaking down the FUNFEX is the reverse procedure of setting up. Always remember that the crossbar must be loosened before folding the control bar. Be considerate of the flying wires when packing the glider short. Don't roll up the upper wires or wind them around the kingpost - fasten them to the base of the kingpost using the Velcro. Roll up the control bar wires from outward in to the control bar with a diameter of at least 10 to 12 cm. With every loop the cable ends make one full turn around their own axis. Carelessness when packing the lower wires means long set-up times!

When pulling off the sail, raise the wingtips at regular intervals to insure free sail travel between leading edges and control bar. The tubes use less room in the glider cover when the middle leading edge tubes are inserted into the noseplate between the inner leading edge and forward keel tubes. The rear keel tube fits into the inner crossbar. Gliders with speedbars are easier to pack if the speedbar is detached on both ends. This also simplifies wheel attachment.

Folding the Sail

Approx. length of glider cover.

Folding the Sail



Care and Storage

Never leave the glider in the cover when it is wet. Always spread it out to dry - never hang it up! When handling the sail, always be careful not to stretch it - especially in the trailing edge area! As a rule our sailmaker can eliminate the problem, should your sail flap in the normal speed range. All we need to know is the exact location where it's taking place. It's best to let a sailmaker clean the sail if it should be necessary. Washing reduces the diagonal strength of the sail - it becomes loose. Tears up to 2 cm in the sail can be patched with self-adhesive sailcloth (available from us). Don't repair larger holes your-self. The sailmaker will sew on a patch or a new stripe. Avoid landing in water! If water should find its way into the tubes, the end caps must be removed and the inner tubes sprayed with an aluminium-compatible preservative oil (Delta Boutique Order-No: H01).

Tubes

Humid warmth, as it occurs if wet tubes are put into the glider cover and then stored in a warm area, can lead to dangerous corrosion on the inside of the tubes. For this reason the glider cover should be left open when storing. Many tubes have a small mark on the connecting sleeve which is made visible by the polished tube surface. These marks are not the result of over-loading - they were intentionally produced to facilitate easier insertion of the sleeve into the tube in individual cases. Dents in the tubes are dangerous if they occur at points of high loading and are deeper than 1 mm. Scratches are also dangerous if they are lateral to the tube and longer than 10 mm. Grinding noises in flight can be eliminated by greasing the noseplate reinforcing plates.

Battens

Don't leave the glider standing on the control bar in strong wind - lay it onto the ground. Otherwise the battens could become bent or, at the worst, the keel¹ could break. Check the left/right batten symmetry every time you set up, and bend them so that they are at least equal if you don't have a batten template with you. To increase curvature, press against a rounded surface, to decrease against a flat surface. If frequent batten bending causes a break in flight, it will not affect the glider's ability to fly. crossbar.

Maintenance

At the beginning of every flying day check the flying wires for broken strands, paying special attention to the area around the nico presses. Even stainless steel can rust! That's why it's best to put on new flying wires every 2 or 3 years. Keep an eye on nuts and bolts! Self-locking nuts are never 100% safe. All nut must additionally be glued when motorizing, for which Loctite bolt safety glue is suitable (can be obtained from Finsterwalder Deltaboutique, Order No.Hch100). Other 2-component adhesives which harden without air contact (for example, UHU Endfest 300) may also be used. Nuts on movable parts must be glued on unmotorized gliders, also. Especially important are the following connections: noseplate-leading edge, crossbar bracket, crossbar-leading edge, kingpost hang loop and keel tang for crossbar strap. The following connections must be secured with a safety ring: crossbar-leading edge, crossbar bracket and keel tang for crossbar strap.

Bolts on movable parts (for example, crossbar bracket) should be checked for looseness. Use Loctite or 2-component adhesive to eliminate the problem. In case of abrasion replace Kevlar cord with respective pulley for crossbar, otherwise the handling may suffer. Also check the kingpost hang loop for abrasion and compare the battens with the batten template. As a rule never bend anything straight (except the battens!), replace it with original replacement parts. Spray the inside of the tubes once a year with an acid-free aluminium preservative oil (Delta Boutique Order No.H01). The oil also works its way into the space between the tubereinforcing walls. After 5 years at the latest, the tubes must be examined at the factory for inner corrosion.

Repairs

If you must change a downtube, you can remove the upper and lower adapters and re-use them. The end caps for the Aero-Safe downtubes may be removed by pressing in on the ends and simultaneously lifting the protrusions over the nuts/bolts with a screwdriver. When changing the front or rear lower wires, check carefully as to whether the bolt was inserted through the thimble! Always pull to check!

Although the speedbar passed a loading test of 980 kg without deformation, it is exposed to changing bending forces in flight. For this reason the possibility of a break exists if the material is defect or damaged. This possibility can be eliminated by drawing a safety cable through the speedbar and securing it with the bolts for the speedbar. You can order this cable already cut to the right length from the Finsterwalder Delta Boutique. A thin cord or wire can be used to draw it through the speedbar.

Recommended Replacement Parts

- 1 Loctite bolt safety glue
- 3 Downtubes
- 1 Base tube
- 2 Control bar corners
- 1 Control bar bolt
- 1 Noseplate
- 1 Self-tensioning safety pin with wire
- 1 Nose Batten
- 1 No. 6 batten

The Polar

Since we know that most readers assume that our gliders have such a bad polar that we're afraid to print it, we'd like to take the trouble to say a few words about this subject. We claim that there is no one polar for flexwing hang gliders. Such a polar (a graphed curve which plots sink speed in relation to airspeed) would be a very useful thing. It's the basis for the speed indication according to McCready, with which maximum glide angle can be flown with regard to wind and thermal activity. In addition, the performance of the different glider models can be ideally compared, which makes the decision easier, which glider to buy. The problem with the hang glider polar is that it depends on so many factors that a satisfactory accuracy (± 1 glide angle) cannot be reached.

Even when tests are run in very still air, the sink rate error can still reach $\pm 5\%$. If the measurements are made by instruments attached to the glider and not from the ground, add another 20%. Differences in air pressure can mean another 3%. And we still have to consider the performance difference under different gliders of the same series. For the different available sailcloths alone one would have to calculate different polars. And differences in humidity can cause stretch differences in Dacron sailcloth of up to 5 cm per glider side. And finally, sail age and condition can play such a crucial role, that polar differences of $\pm 8\%$ can occur. The aerodynamic qualities of the different harnesses can mean another 2% difference, the suspension angle of the pilot $\pm .5\%$, the differences in pilot weight $\pm 8\%$ and the frame geometry, different downtube diameters, kingpost fairings, speedbars and instrument drag, etc., another 3%. If the possible sources of error are added together for better or for worse, a polar for everything between a paraglider and a sailplane can be drawn. Not even the use of measurement standards would make a usable polar possible.

Seen from this standpoint, the polars depend on the manufacturer's willingness to exaggerate.

Even if one thought it possible to use the results from DHV test vehicle runs to compute usable polars, he is still the victim of an illusion. Also included in the test vehicle measurements of lift, drag, pitch moment, speed and angle of attack are the influences of such variables as wind gusts and pot holes. An accurate analysis of the measured values would take an enormous amount of time. From this alone a polar difference of 10% can mean a glide angle difference between 1:6 and 1:12! For example, test vehicle runs with 6 different SUPERFEX gliders resulted in glide angles between 1:6.5 and 1:11. Yet it was almost impossible in flight to determine differences in performance between these 6 gliders. The DHV measurements should only be intended to establish the safety of the glider, and for this purpose it suffices to use the lowest measured values.

Is the Mc-Cready ring at all meaningful for a hang glider?

Experienced XC professionals say yes. However, they determine the polar for their own glider using their own instruments. Most of the above-mentioned sources of inaccuracy can be eliminated through very conscientious measurement-taking. For the recreational pilot it's questionable as to whether or not it's worth all the trouble. For him it should suffice to remember: "In lift as slow as possible, into a headwind fast and into a headwind with high sink very fast". A commercially-available McCready ring calibrated to the polar of an average hang glider tells you no more than this, anyway.

REPLACEMENT PART LIST

PLEASE NOTE

We sell 6 glider models and stock over 1000 replacement parts, including 5 different sizes of downtubes. Please help us to avoid wrong deliveries and spare you money and irritation. For this reason always state article number and description without fail.

We reserve the right to change prices!

FRAME

Art.No. Discription

Bda Owner's manual

FHa20 leading edge tube, inner (right or left)

FHa30 leading edge tube, middle (right or left)

FHa38 leading edge tube, outer

(right or left, without LE end)

FHa39 leading edge end (for outer LE, right or left)

FSw10 Swiveltip

FHa50 keel tube, front

FHa60 keel tube, rear (without keel end)

FHa62 keel end /for rear keel tube), short

FHa63 keel end (for rear keel tube), long

FHa80 crossbar, outer (left or right, without brackets)

FHa70 crossbar, inner (left or right)

FHa75 crossbar bracket bolt

FHa78 crossbar safety cable

Ha73 Senk washer

Ha73M Senk washer for nut

Ha74 Brass or plastic washer, diameter 10.5/22

Ha72/1 Joint bracket for crossbar outer right or left

Ha72/2 Joint bracket for crossbar middle right or left

Ha100 noseplate

Ha11/o Reinforcing plate, upper, for Ha10

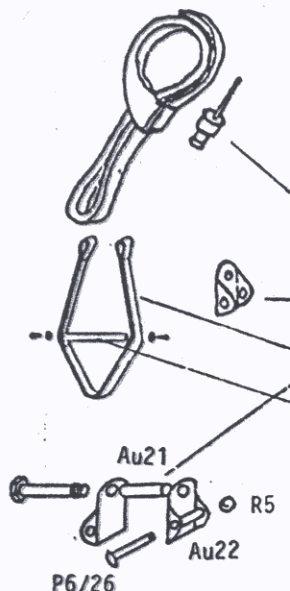
Ha11/u Reinforcing plate, lower, for Ha10

Ha110/vo Bushing for noseplate

Ha12 Glider label

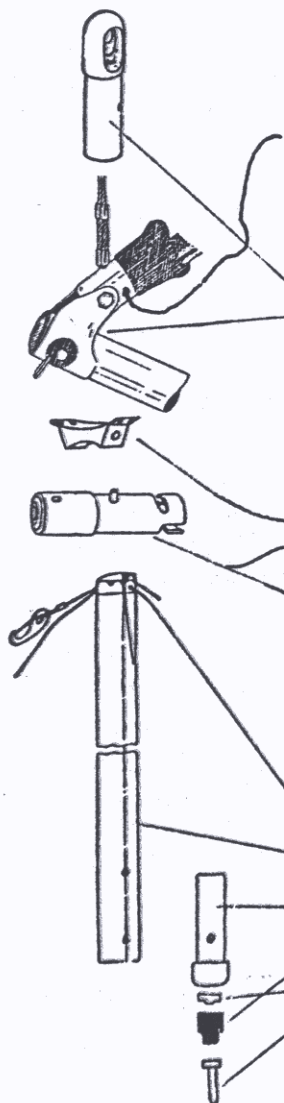
SUSPENSION SYSTEM (Pilot attachment)

Art.No. Discription



- Au10/25 Pilot hang loop, stretched length 20,25,30 oder 35 cm
- Au10/45 Pilot hang loop, stretched length 40,45 oder 50 cm
- Au10/60 Pilot hang loop, stretched length 60, 65 oder 70 cm
- Au15 Knob without rivet
- Au22 Aluminium sleeve for kingpost hang loop
- Au21 Brass sleeve for kingpost hang loop
- Au20 V2A bracket for kingpost hang loop
- Au16/35 Wepped loop for kingpost attachment L=30, 35, 40 oder 45 cm
- Au16/55 Webbed loop for kingpost attachment L= 50, 55 oder 60 cm
- Tu08 Complete hardware for kingpost hang loop (without loop)
- Au18 Spreader for kingpost hang loop (with screws)

A-Frame



- Tr32 FUNFEX lightweight downtube, dia. 32, prone/supine
- Tr28 FUNFEX downtube, dia. 28, prone/supine
- Tr22M2 AERO-SAFE downtube, prone/supine, without adapters
- Tr1/15 Lower adapter for downtube/upright
- Tr320 Adapter for round tube, 32 down to 22 (for Aero-Safe)
- Tr321 Adapter for round tube, 28 down to 22 (for Aero-Safe)
- Tr550 Upper adapter for downtube/upright
- Tr290 FUNFEX control bar corner for base tube, dia. 28
- Tr28B Base tube, dia. 28, prone
- Tr29s Speedbar (supine) for ,with safety cable f.speedb.
- Tr291 Speedbar (prone) f.,with safety cable for speedb.
- Tr560 Control bar (upper) bracket
- Tr570/1 Base tube attachment, left, w/o corner, detent button or rivet
- Tr570/r Base tube attachment, right, w/o corner, detent button or rivet

KINGPOST

- KTU5 Aerofoil faired kingpost head
- Tu08 Aerofoil kingpost bracket, complete
- Tu02 Faired kingpost tube length 1.22 m
- Tu12 Aerofoil kingpost base complete
- Tu120 Kingpost base reinforcing tube, 80 mm
- Tu121 Kingpost reinforcing tube for hang loop, 250 mm
- Tu122 Rubber grommet for kingpost base
- Tu123 Plastic disc for kingpost base
- Tu124 V2A-Stickpin for kingpost base

Rigging and accessories

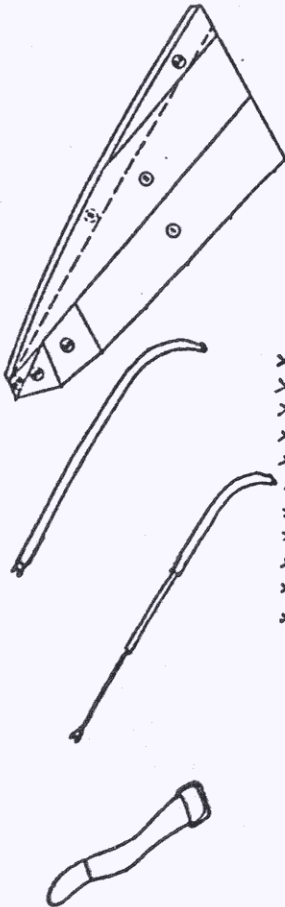
- FVe10 * FUNFEX kingpost wire, side
- FVe20 * FUNFEX kingpost wire, front and rear
- FVe30 * FUNFEX lufflines
- FVe50 * FUNFEX lower rigging wires, front, prone or supine
- FVe60 * FUNFEX lower rigging wires, rear, prone or supine
- FVe70 * FUNFEX lower rigging wires, side (incl. bayonet pin) prone or supine
- FVe31 wire for kingpost head hook
- * or PERFEX

Art.No. Description



- Ve10 Aluminum alloy tang, anodized, with diff. borehole dia.
- Ve15 Stainless steel tang without thimble
- Ve18 Never-King thimble insert
- Ve20/2 Thimble V2A for 2 - 3 mm wire
- Ve30/1,0 Nico-Press 1,0 NT 271 B
- Ve30/1,5 Nico-Press 1,5 28-11-B4
- Ve30/2,0 Nico-Press 2,0 NT 281 C
- Ve30/2,5 Nico-Press 2,5 NT 282 G
- Ve40/1 Stainless steel wire 1 mm
- Ve40/1,5 Stainless steel wire 1,5 mm
- Ve40/2 Stainless steel wire 2 mm
- Ve40/2,5 Stainless steel wire 2,5 mm
- Ve70 PVC tubing
- Ve72 Plastic tensioning disc for forward lower wires

SAIL AND BATTENS



- FSe100 FUNFEX sail, complete, incl. Mylar inserts, not incl. lufflines or battens
- FSe101 FUNFEX nose cover
- FSe95 FUNFEX Mylar leading edge inserts, per side
- FSe105 FUNFEX sail bag
- Se35 Plastic washer for wingtip
- Se36 Swivel pin for wingtip
- x FSe10 FUNFEX nose batten
- x FSe/o1 FUNFEX upper sail batten No. 1 front part
- x FSe/o11 FUNFEX upper sail batten No. 1 rear part
- x FSe/o2 FUNFEX upper sail batten No. 2 front part
- x FSe/o22 FUNFEX upper sail batten No. 2 rear part
- x FSe/o3 FUNFEX upper sail batten No. 3 front part
- x FSe/o33 FUNFEX upper sail batten No. 3 rear part
- x FSe/o4 FUNFEX upper sail batten No. 4
- x FSe/o5 FUNFEX upper sail batten No. 5
- x FSe/o6 FUNFEX upper sail batten No. 6
- x FSe/o7 FUNFEX upper sail batten No. 7 (with coil spring)
- FSe/u1 Lower sail batten No. 1
- FS3/u Lower sail batten No. 2
- HK17 Velcro tie with buckle 18 x 2,5 cm, for bundling battens
- HK18 Velcro tie with buckle 25 x 2,5 cm, for bundling battens
- HK1180 Velcro tie with buckle 35x2,5 cm, for tying sail
- HK11800 Velcro tie with buckle 75x3 cm for tying sail
- HK1181 Velcro tie with buckle 100x4 cm for tying sail
- HK182 Velcro tie with buckle 135x4 cm for tying sail

STD Hourly labour charge for factory repairs

x or Perfex

BOLTS, NUTS & RIVETS

Art No.

Discription






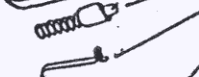
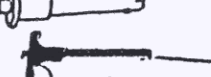

P5/25	Bolt 5mm w. semicircular borehole, stainless steel head, eff. length 26 mm
P5/47	Bolt 5 mm w. semicircular borehole, stainless, steel head, eff. length 47 mm
P5/54	Bolt 5 mm semicircular borehole, stainless steel head, eff. length 54 mm
P6/26	Bolt 5 mm with borehole, flat head, effective length 26 mm
P6/33	Bolt 5 mm with boreh., rounded head, effecti. length 33 mm
R5	Safety ring 1,0 x 11 mm
R6	Safety ring 1,5 x 17 mm

4/16IV	Inbus screw M4 x 16 stainless steel
4/25IV	Inbus screw M4 x 25 stainless steel
4/30IV	Inbus screw M4 x 30 stainless steel
4/35IV	Inbus screw M4 x 35 stainless steel
4/45IV	Inbus screw M4 x 45 stainless steel
5/12ISV	Counter sunk-Inbus screw M 5 x 12 VA DIN 7991
5/30IV	Inbus screw M5 x 32 stainless steel (for AERO-SAFE)
5/40SChv	Castle screw M5 x 60 stainless steel
6/16SV	Hexagonal-head screw M6 x 16 V2A
6/20SV	Hexagonal-head screw M6 x 20 V2A
6/35SV	Hexagonal-head screw M6 x 35 V2A
6/35SVS	Spezial-Hexagonal-head screw M6 x 35 V2A (for kingpost hang loop)
6/35SZ	Hexagonal-head screw M6 x 35 cadmium-plated
6/40SV	Hexagonal-head screw M6 x 40 V2A
6/40SVS	Spezial-Hexagonal-head screw M6 x 40 V2A
6/45SV	Hexagonal-head screw M6 x 45 V2A
6/55SV	Hexagonal-head screw M6 x 55 V2A
6/60SV	Hexagonal-head screw M6 x 60 V2A
6/60SVS	Spezial-Hexagonal-head screw M6 x 60 V2A
6/65SV	Hexagonal-head screw M6 x 65 V2A flat head
6/70SV	Hexagonal-head screw M6 x 70 V2A
6/75SV	Hexagonal-head screw M6 x 75 V2A
6/80ISV	Counter sunk Inbus screw M6 x 80 VA (for crossbar bracket)
6/80SV	Hexagonal-head screw M6 x 80 V2A
6/80SVF	Hexagonal-head screw M6 x 80 V2A flat head
8/10IV	Inbus screw M8 x 10 stainless steel
8/110SV	Heartbolt M8 x 110 V2A (for Bergfex)
8/115SV1	Heartbolt bushing (for Superfex)
8/120SV	Heartbolt (for Superfex)
8/25IV	Inbus screw M8 x 25 VA DIN 912
8/55IZ	Inbus screw M8 x 55 with borehole safety ring
8/65SV	Heartbolt M8 x 65 V2A (for Windfex)
8/70IV	Heartbolt M8 x 70 V2A (for Funfex)
8/75SVS	Spezial-Hexagonal-head screw M8 x 75 V2A

M3Z	Self-tightening nut M3 galvanized
M4V	Self-tightening nut M4 stainless steel
M5V	Self-tightening nut M5 stainless steel
M6Kap	Plastic protective cap for M6
M6V	Self-tightening nut M6 stainless steel
M8V	Self-tightening nut M8 stainless steel

N2,8	Pop-rivet 2,8 length 2,3 mm
N3,2	Pop-rivet 3,2 length 3,1 or 7,2 mm
N4,0	Pop-rivet 4,0 length to 4,1 mm
N4,8	Pop-rivet 4,8 length 5,1 or 8,7 mm
N6,4	Pop-rivet 6,4 length to 7,6 mm

Glider-fittings

	Be09	Coil spring for self-tensioning safety pin
	Be10	Self-tensioning safety pin, without wire
	Be10/S	Self-tensioning safety pin, complete
	Be20	Stainless steel safety hook approx. 200 kp
	Be29	Rapid link Ø 4 mm stainless steel ca. 500 kp
	Be30	Rapid link Ø 5 mm ca. 800 kp
	Be31	Rapid link Ø 7 mm ca. 2.500 kp
	Be300	Rapid link Ø 5 mm ca. 500 kp
	Be40	Connecting pin, noseplate
	Be43	Connecting pin, upper noseplate, Minifex & Topfex
	Be45/125	Connecting pin, Ø 13 mm, crossbar Superfex
	Be45/46	Connecting pin, usable length 46 mm, keel, Topfex, Motor-Windfex
	Be45/50	Connecting pin, Windfex keel or Windfex crossbar 45 mm
	Be45/55	Connecting pin, usable length 55 mm, Superfex keel or Windfex crossbar 52 mm
	Be46/47	Bayonet locking pin, usable length 47 mm
	Be46/52	Bayonet locking pin, usable length 52 mm
	Be46/54	Bayonet locking pin, usable length 54 mm
	Be46/60	Bayonet locking pin, usable length 60 mm
	Be47	Metal plate for bayonet lock
	Be49	Eye bolt V2A Wichard M6 inner Ø 12 mm
	Be5	Shackle V2A tempered, opening 13 mm, inner length 28, appx. 1600 kp
	Be50	Fender eye, stainless steel
	Be500	Shackle, Niro, flat steel, tensile strength 500 kp
	Be52	Plastic hook to fit Fender eye
	Be53	Plastic hook, Holt Allen
	Be54	Mini-pulley for crossbar tensioner
	Be55	Clam cleat Ø 2,58 mm
	Be59	Detent button with coil spring
	Be61	Detent button with flat spring
	Be64	Quickpin special lengths
	Be64/22	Quickpin 22 mm effective length
	Be64/33	Quickpin 33 mm effective length
	Be64/38	Quickpin 38 mm effective length
	Be64/50	Quickpin 50 mm effective length
	Be64/70	Quickpin 70 mm effective length
	Be64T	Quickpin with T-grip 8 x 54 mm, V2A
	Be65	Rectangular ring for Quickpin
	Be70	Patent hook of cast aluminum, tensile strength apx. 700 kg

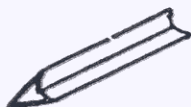
Tubes

A10	Service charge per tube cut
R06GFK	Glass rod, Ø 6 mm, L = 6 m
R08GFK	Glass rod, L = Ø 8 mm, 6 m
R10E	Tube 10 x 1,0 anodized 80 g/m F38 L=5m
R10GFK	Tube 10 x 1 GFK L=6m
R12/0.45	Tube 12 x 0,45 46g/m F60 L= 4,8 m
R12/0.45E	Tube 12 x 0,45 mm anodized 46g/m F60 L= 4,8 m
R13	Tube 13,3 x 0,6 mm unanodized 67g/m F60 L= 4,8 m
R13E	Tube 13,3 x 0,6 mm anodized 67g/m F60 L= 4,8m
R16E	Tube 16 x 0,9 mm anodized 120g/m F60 Perunal L= 6m
R17	Tube 17,3 x 0,6 mm unanodized 87g/m F38 L= 6 m
R17E	Tube 17,3 x 0,6 mm anodized 87g/m F38 L= 6 m
R20E	Tube 20 x 0,9 mm anodized 152g/m F60 Perunal L= 5,2
R22E	22 x 1 mm anodized 220g/m F38 L=0,82m 1m 1,25m oder 5m
R22EM	Reinforcing tube anodized incl. fitting
R22EP	Tube 22 x 1,25 mm anodized 220g/m F60 Perunal L= 5 m
R25/2E	Tube 25 x 2 mm anodized 405g/m F38 Avional L= 6 m
R25/3E	Tube 25 x 3 mm anodized 580g/m F38 L= ca. 5 m
R28	Tube 28,5 x 1,7 unanodized 400g/m F38 Avional L= 6,32 m
R28E	Tube 28,5 x 1,7 mm anodized 400g/m F38 Avional L= 6,32 m
R30E	Tube 30,5 x 1 mm anodized 309g/m F38 L= 2 m
R32/0,9	Tube 32,4 x 0,9 mm unanodized 245g/m F38 L= 6 m
R32/0,9E	Tube 32,4 x 0,9 mm anodized 245g/m F38 L= 6 m
R32/0,9PE	Tube 32,4 x 0,9 mm polished-anodized 245g/m F28 L= 2 m

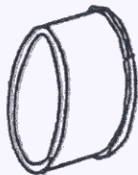
Art.No. Discription

R38E	Tube 38,3 x 1,05 mm anodized 343g/m F38 L= 4,8 m
R40PE	Tube 40 x 0,85 polished-anodized 295g/m F60 L= 3,5 m
R44E	Tube 43,8 x 0,9 mm anodized 340g/m F60 L=13,8 m
R45	Tube 45,6 x 0,85 mm unanodized 330g/m F60 L= 6 m
R45E	Tube 45,6 x 0,85 mm anodized 330g/m F60 L= 6 m
R45PE	Tube 45,6 x 0,8 polished-anodized 330g/m F60 L= 1,5 u. 2m
R47/0,65	Tube 47,1 x 0,65 mm unanodized 260g/m F60 L= 5,75m
R47/0,65PE	Tube 47,1 x 0,65 mm polished-anodized 260g/m F60 L=1,92 m
R47	Tube 47,3 x 0,8 mm unanodized 330g/m F60 L= 5,75 m
R47PE	Tube 47,3x0,8 polished-anodized,330 gr/m F=60,L=1,5 u.2m
R50E	Tube 50 x 0,9 mm anodized 390g/m F60 L= ca. 2 m
R52	Tube 52 x 0,9 mm unanodized 390g/m F60 L= 5,8 m
R52PE	Tube 52 x 0,9 mm polished-anodized 390g/m F60 L= 1,92 m
R54	Tube 54 x 0,9 mm unanodized 420g/m F60 L= 5,9 m
R54PE	Tube 54 x 0,9 mm polished-anodized 420g/m F60 L= 1,99 m
R60	Tube 60 x 0,9 mm unanodized 470g/m F60 L= 6,25
R60PE	Tube 60 x 0,9 mm polished-anodized 470g/m F60 L= ca. 2 m
R62	Tube 62 x 0,9 mm unanodized 485g/m F60 L= 6 m
R62PE	Tube 62 x 0,9 mm polished-anodized 485g/m F60 L= 2 m

Tubes and Accessories



RP29	Rubber trailing edge for RP21E and for gluing to control bar tubes
RP31	Adhesive for rubber trailing edge



KK26	Tube tip caps for inner Ø 25, outer Ø 28 mm
KK36	Tube tip caps for inner Ø 36, outer Ø 38 mm
KK38	Tube tip caps for inner Ø 38, outer Ø 40 mm
KK44	Tube tip caps for inner Ø 44, outer Ø 45 mm
KK48	Tube tip caps for inner Ø 48, outer Ø 50 mm
KK50	Tube tip caps for inner Ø 50, outer Ø 52 mm
KK58	Tube tip caps for inner Ø 58, outer Ø 60 mm
KS w	Pointed tip caps for inner Ø 30,5 und Außen-Ø 32 mm



KA22	Plastic stiffening plugs inner-Ø 22 mm
KA30,5	Plastic stiffening plugs inner-Ø 30,5 mm
KA36	Plastic stiffening plugs inner-Ø 36 mm
KA42	Plastic stiffening plugs inner-Ø 42 mm
KA44	Plastic stiffening plugs inner-Ø 44 mm
KA50	Plastic stiffening plugs inner-Ø 50 mm



KD44	Detent button insert for inner-Ø 44 mm
KD48	Detent button insert for inner-Ø 48 mm
KD50	Detent button insert for inner-Ø 50 mm



KS32	Saddle for tube 30-35 mm
KS40/1	Saddle, small for tube 40-44 mm
KS40/2	Saddle, large for tube 40-44 mm
KS47	Sattel, nylon for tube 45-50 mm



KSLE	Batten tip plugs for inner-16mm
KSLE06	Batten tip plugs for GFK 6 mm
KSLE08	Batten tip plugs for inner-Ø 8 mm
KSLE11	Batten tip plugs for inner- Ø 11 mm
KSLE12	Batten tip plugs for inner- Ø 12 mm



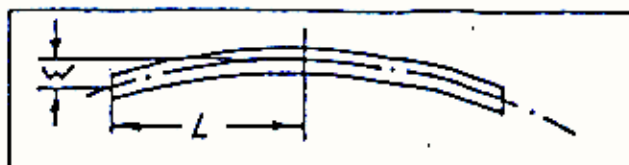
KSLS	Batten tip plugs for inner-Ø 16 mm
KSLS08	Batten tip plugs for inner-Ø 8 mm
KSLS10	Batten tip plugs for inner-Ø 10 mm
KSLS11	Batten tip plugs for inner-Ø 11 mm
KSLS12	Batten tip plugs for inner-Ø 12 mm



Se22	Adapter, 6mm GFK rod into batten with inner-Ø 11 mm
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DATE: 5/31 BY: JAC

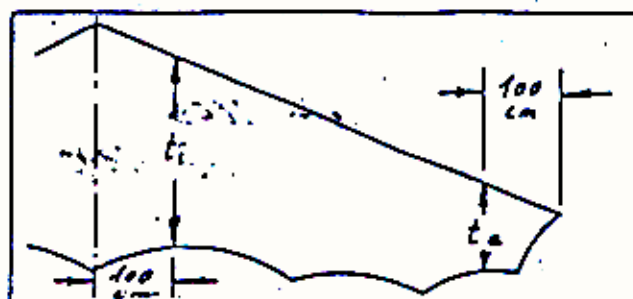
3. Rohrwölbung (mm)		W \downarrow		W \rightarrow	
Bezeichnung	L (m)	min	max	min	max
Seitenrohr	2,72	0	40	130	150
Querrohr	1,27	0	20	0	20
Kielrohr	1,20	0	30	0	5



waagrecht zur projizierten Flügelfläche
senkrecht zur projizierten Flügelfläche
gemessen am horizontalen Flügel

4. Profiltiefen (cm)

Profil innen $t_i = 225$
Profil außen $t_a = 114$

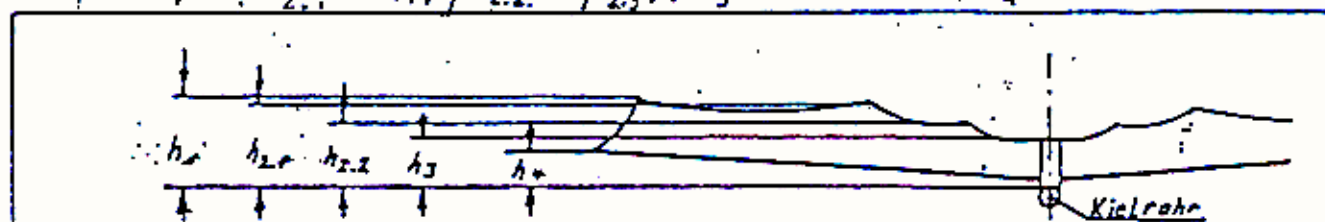


5. Einstellhöhen (cm)

Höhe h gemessen zwischen Kielrohroberkante und Segelhinterkante

Schrägung | Hochgezogene Hinterkante | Kieltaschenhöhe | V-Form

$h_1 = -34$ | $h_{2,1} = -7,7$ | $h_{2,2} = +7$ | $h_{2,3} = 35$ | $h_3 = 0$ | $h_4 = -59$ Ki - 51 Tu.



6. Sonstige besondere Merkmale

(z. B. bei vorgeformten Segellatten die Profilkordinaten)

Für das Mustergerät wurde das Lufttuchtigkeitszeugnis erteilt. Änderungen genehmigt:

Ort, Datum Regensburg 25.3.92

Unterschrift/Stempel Gütesiegelstelle

S.C.C.

Das oben beschriebene Gerät ist identisch mit dem Mustergerät unter Berücksichtigung der nebenstehenden Änderungen

Ort, Datum München 25.3.92

Unterschrift/Stempel Hersteller

finsterwalder
Finsterwald GmbH

FLUGZEUGBAUWERKZEUGE • D-8090 MÜNCHEN 90 • ☎ (0 89) 511 05 26