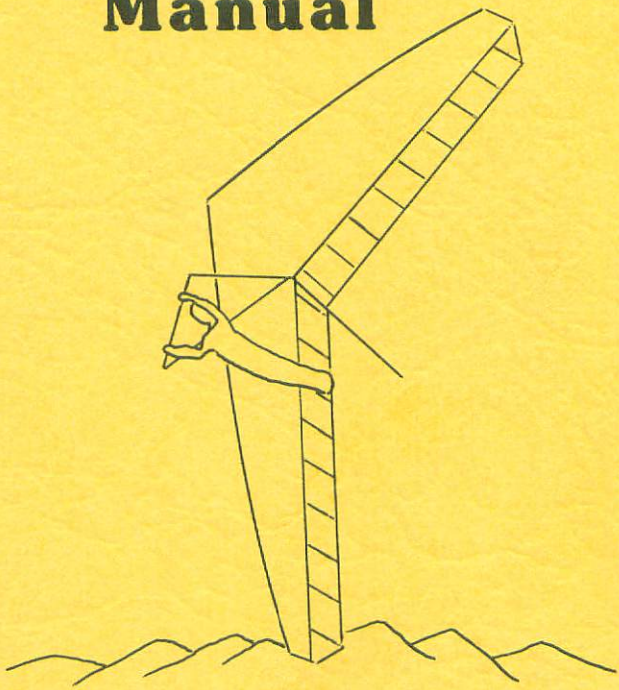
PEARSON 9.85

HP 170
Owner / Service Manual



WILLS WING

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SERIAL NUMBER

PEARSON

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INTRODUCTION

Congratulations! You are now the proud owner of one of the finest footlaunched soaring flex-wings manufactured today. Your WILLS WING HP is the product of an extensive design and development program aimed at optimizing your level of safety and confidence as a pilot, while providing you with a highly competitive level of sink rate and glide ratio performance.

Please read and be sure you thoroughly understand this manual before flying your HP. Hang gliding is an extremely demanding sport requiring exceptional levels of attention, judgement, maturity, and self discipline. It is unlikely that you will be able to participate in it safely unless you make a conscious and continual commitment to your own safety. Hang gliding is a dangerous sport and may result in injury and death even when practiced by a competent pilot using proper equipment. This glider is not covered by product liability insurance, nor has it been designed, manufactured or tested to any federal or state government airworthiness standards or regulations. Do not fly it unless you are willing to assume personally all risks inherent in the sport of hang gliding, and all responsibility for any property damage, injury, or death which may result from your use of this hang glider. Safe operation of this glider requires a pilot proficiency level equivalent to that of a United States Hang Gliding Asssociation Hang IV rating, as well as an equivalent level of knowledge and understanding of those wind and weather conditions which may compromise the pilot's safe control of the hang glider. In particular, be advised that gusty winds or turbulent conditions may interfere with even an expert pilot's ability to safely control the hang glider, and may cause it to crash. Be sure you are thoroughly familiar with the set up, breakdown, preflight, and maintenance procedures as described in this manual. Make sure you follow all appropriate procedures every time you fly.

Never take anything for granted in hang gliding; if you are in doubt about anything, stop and figure it out, consult your manual, your dealer, or Wills Wing, Inc.

We would like to welcome you to the Wills Wing family of pilots, and wish you a safe and enjoyable flying career.

Wills Wing, Inc.

TECHNICAL INFORMATION

The HP has been tested and found to comply with the 1984 HGMA Airworthiness Requirements. These standards require:
An ultimate positve load test at the maximum lift angle of attack at a speed of 65 mph.
An ultimate negative 30 degree angle of attack test at a speed of 46 mph.
An ultimate negative 150 degree angle of attack test at a speed of 32 mph.
Pitching moment tests at speeds of 20 mph, 30 mph and 40 mph which show the glider to be pitch stable over an extended range of angles of attack.
Flight tests which show the glider to be safely controllable and stable over a wide range of normal and abnormal flight modes and conditions.

NOTE: The HP was designed for footlaunched soaring flight. It was not designed to be towed, tethered, motorized, nor flown at angles of bank beyond 60 degrees or angles of pitch beyond 30 degrees. Operation in any of these modes may severely compromise your safety, and we strongly recommend against it. Should you decide to do so anyway, please avail yourself of the experience and expertise of those people who are qualified in that particular area, and please proceed with extreme caution. Please be advised that Wills Wing

can in no way be responsible for the airworthiness or applicability to any specific purpose of any Wills Wing glider, except as described in the HGMA airworthiness standards.

In addition, please understand that flying any hang glider in the presence of turbulence or gusty winds can result in in flight inversion and structural failure of the glider, and in fatal injuries. Do not fly in turbulent or gusty conditions unless you recognize and wish to assume the associated risks.

Stall speed of the HP at maximum recommended wing loading is 25 mph.
Top speed of the HP at minimum recommended wing loading is greater than 35 mph.
Recommended pilot weight, for the HP 170: 150 lbs.- 250 lbs.
(Including all gear)

Flight operation of the HP should be limited to non acrobatic maneuvers, i.e. those in which the pitch angle will not exceed 30 degrees nose up or nose down from the horizon, and in which the bank angle will not exceed 60 degrees. The HP will strongly resist spinning, and will tend to recover quickly from a spin once control pressures are relaxed without entering extreme attitudes and without extreme loss of altitude. Deliberate attempts to spin the glider may result in the glider becoming inverted and suffering a structural failure. No such attempt should ever be made.

The HP should not be flown at speeds in excess of 46 mph. This speed will generally correspond to a prone pilot position where the pilot has pulled forward such that the basetube lies across the midsection, at a position midway between the waist and the middle of the thigh.

A USHGA pilot proficiency level of IV or higher is required to fly the HP safely. Flight operation by unqualified pilots may be dangerous and is prohibited.

HP SET UP PROCEDURE

NOTE: Use of the specific techniques described in this manual will make the set up and break down procedures much easier to perform. Your dealer should go over the set up and break down procedures with you at the time the glider is delivered. The following procedural descriptions are not intended to be a substitute for this orientation process. However, you should read the manual carefully and follow the procedures as described.

1) With the glider in the bag, lay the glider on the ground, nose into the wind, with the bag zipper up. If the wind is more than 10 mph, lay the glider at right angles to the wind direction. (Fig 1)

FIG 1

2) Undo the zipper, and remove the battens from between the rear leading edges as shown. (Fig 2)

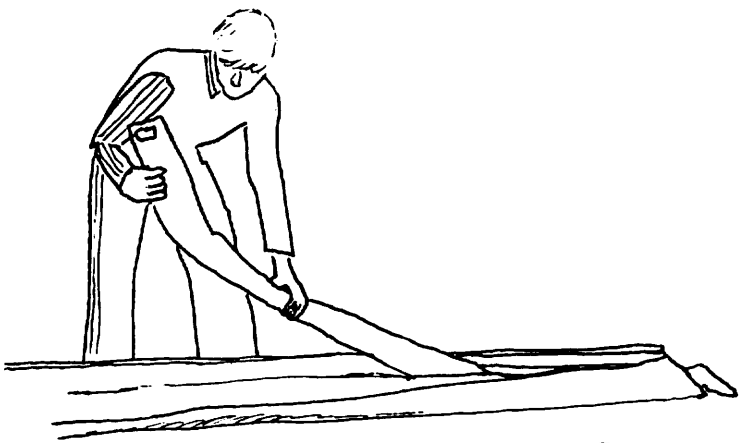


FIG 2

3) Undo the velcro securing the control bar, and fold the bar up and forward. (Fig 3)

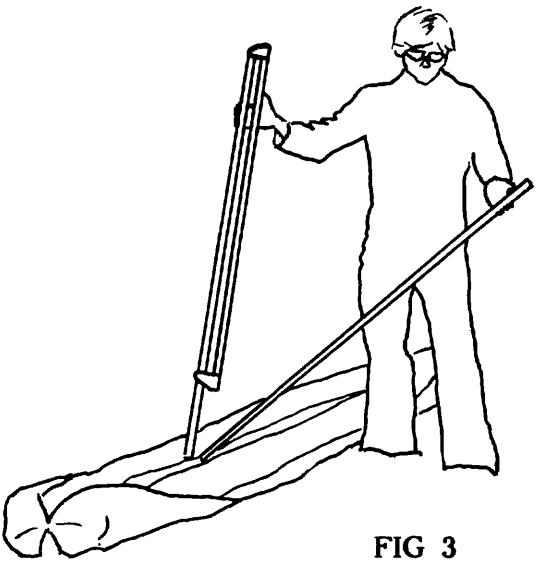


FIG 3

CAUTION: Because of the design of the control bar top "E" bracket, you MUST allow the control bar legs to spread apart as you rotate them upwards from the glider. If you do not, you will bend or break the bolt holding the "U" channel to the keel, strip the nut off this bolt, dent or crush the keel, bend the "U" channel, or all of the above. If any of the above damage should occur, inpspect all of the above named parts and replace any that are damaged.

4) Attach the free end of the base tube to the downtube using the wing nut and safety provided.(fig 4 and 5)
NOTE: If you have streamlined downtubes, the basetube downtube bracket will detach from the basetube, rather than from the downtube as shown.

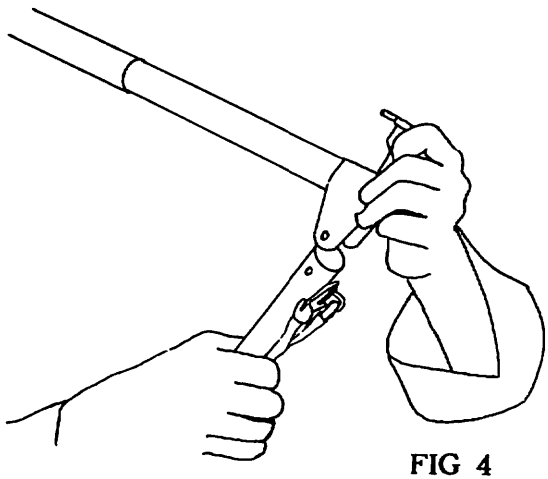


FIG 4

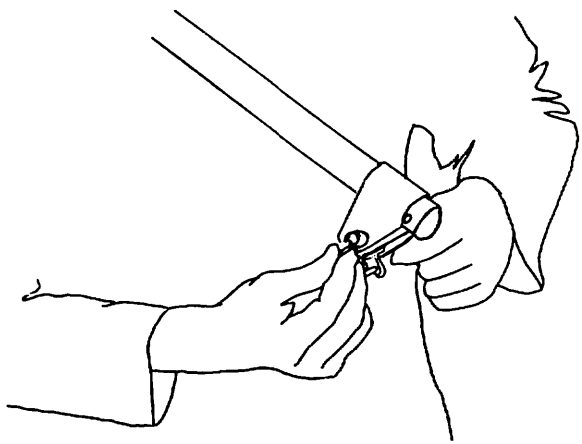


FIG 5

5) Flip the glider upright, holding the front wire to hold control bar forward, and rest the glider on the control bar. The glider should be nose into the wind if the wind is less than 10 mph, or at right angles to the wind if the wind is more than 10 mph.(fig 6 and 7)

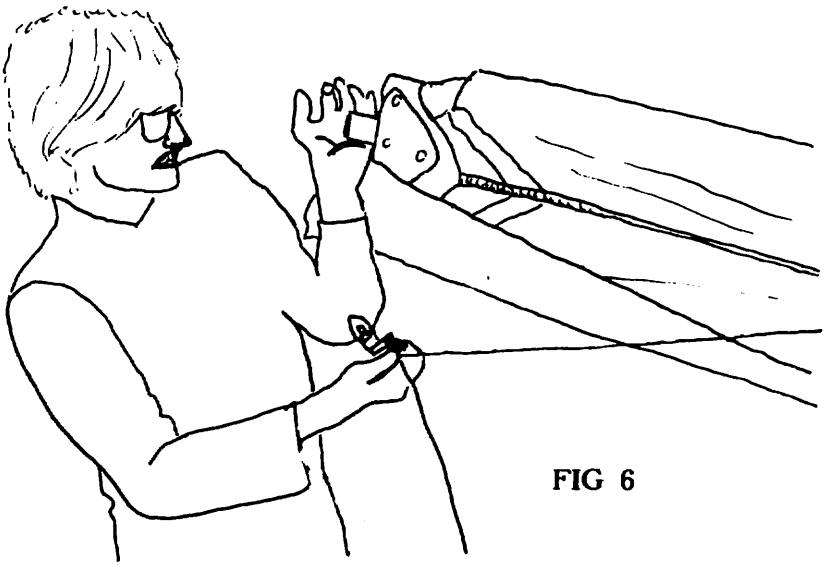


FIG 6

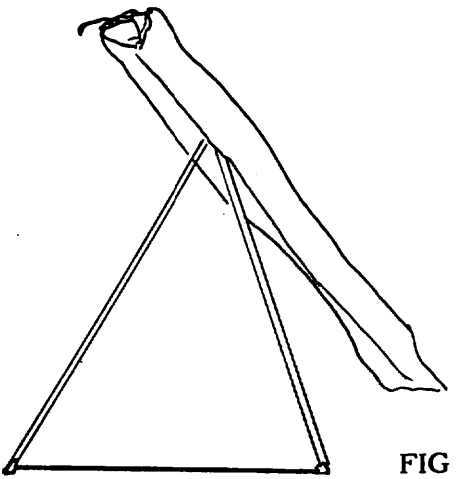


FIG 7

6) Remove the bag and all of the velcro straps. Spread the wings about half way, taking care that the bridles and top side wires are not wrapped around the keel or snagged on the keel hardware.

7) Lift the kingpost, and fit it over the plug on top of the keel, taking care not to pinch the sail in the process. (Fig 8) You must have the keel centered between the partially deployed leading edges in order to install the kingpost. Check that the bridle cables are not twisted or tangled.

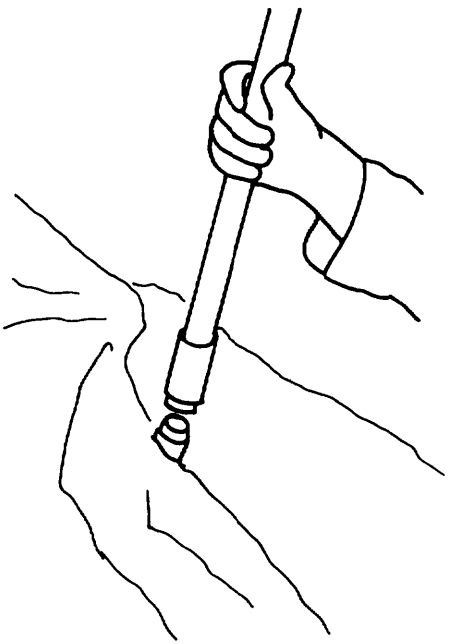


FIG 8

8) Attach the rear kingpost tang to the rearward most bolt on the keel. (Fig 9) Be sure that the tang slides all the way forward on the bolt, and be sure to attach the safety.

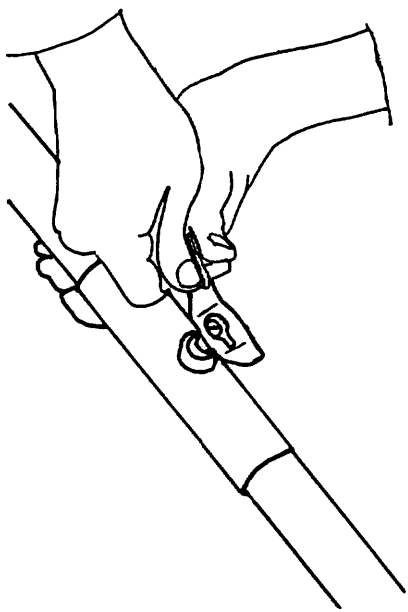


FIG 9

9) Install the washout tips, pushing them into the protruding sleeves until they come up against the clevis pin securing the sleeves in the leading edges. Then rotate the washout tips until you feel them lock into place. (Fig 10) Note: Installation of the washout tips is much easier if done now, before the battens are installed. Also Note: There are two different styles of washout tip and sleeve assemblies used on the HP. On early HP's the tip was secured by two ball bearings which were held captive under a rubber sleeve which fit around the outside of the washout sleeve. On later HP's the washout tip has a spring loaded button inside the tip, which fits into a hole in the sleeve. If you need to order replacement washout tips or sleeves, be sure to specify which type, as they are not interchangeable, except as an assembly.

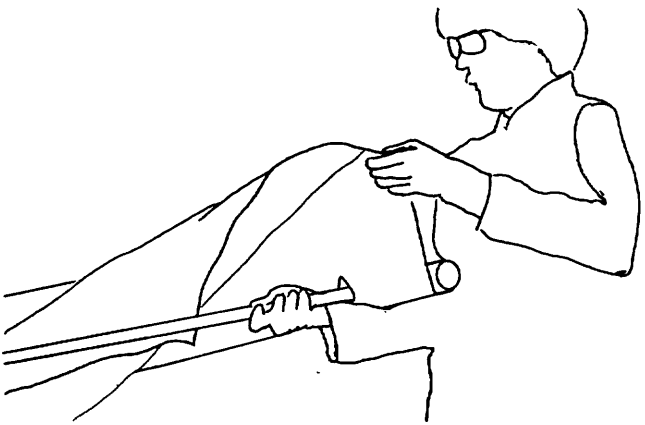


FIG 10

10) Remove the battens from the bag, lay them on the ground, and check them for symmetry, side to side. (Fig 11) Correct any that are assymetric.(See the tuning and maintenance sections of this manual for more information on batten shaping.) Separate the right side battens (those with black tape around the tail end)

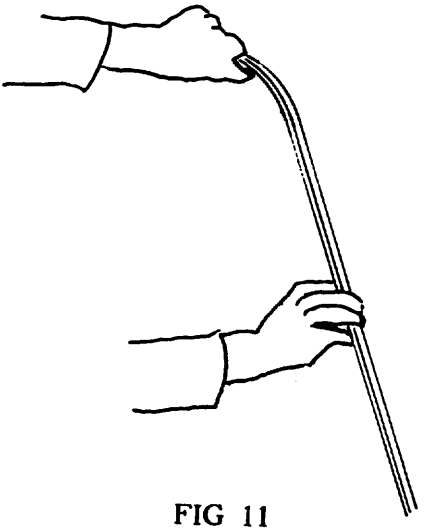


FIG 11

from the left side battens (no tape). Insert the top surface battens into the sail. You should start with the "half battens," the battens which go just outboard of the longest batten. These are inserted from underneath the sail, (Fig 12) and only extend to the rear edge of the bottom surface. They are secured by

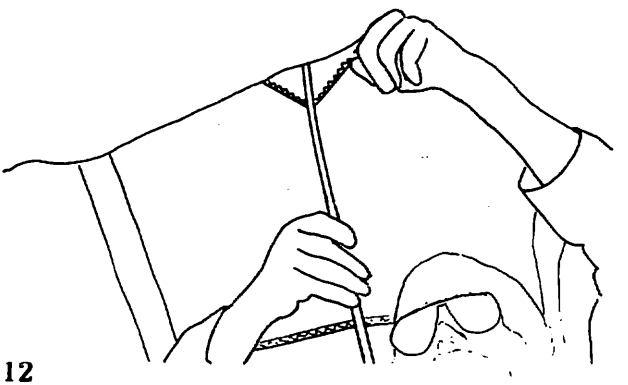
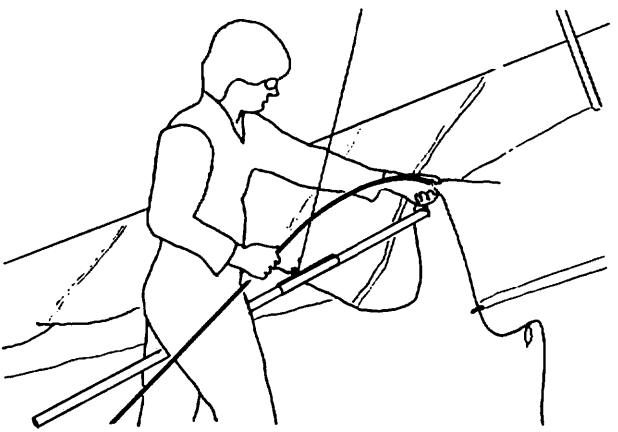


FIG 12

bungee loops, while all the other top surface battens are secured by double purchase leech line. The half battens can be recognized by the fact that they have the full depth of camber of an inboard batten, but are much shorter, and by the fact that the black tape which identifies the right side batten is on the front instead of the rear. On later HP's they also have red tape on the front end of each batten. Order of battens after the half battens is longest to shortest from the root out to the tip. Wills Wing numbers battens from the tip inboard, so that the shortest batten (which is the straight plug on batten), is the number one batten, and the longest batten is the #10 batten. The half battens have no number. When inserting the number 10 battens, you should lift the rear end of the keel and hold it up so that the batten slides in more easily without the rear end scraping the ground. (Fig 13)

Install all the curved top surface battens, but do not install the straight number one battens at this time.



11) Secure the rear end of each top surface batten by first looping one loop of leech line around the notched batten end, and then attaching the second loop, using the extra loop as a handle. (Fig 14) When attaching the leech line loops at the reflex bridle battens, be sure the bridle cable is not caught underneath or wrapped around the leech line.

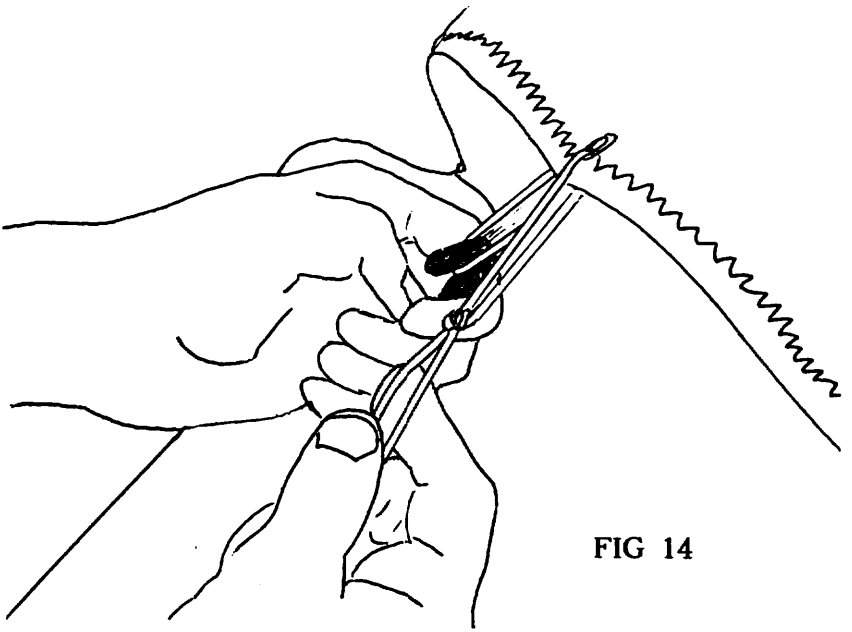


FIG 14

NOTE: The top surface battens must be installed before the crossbar is tensioned. otherwise you will decamber the battens and may ruin the sail. When inserting top surface battens, avoid allowing the batten tip to ride hard against the stitching on the side of the pocket. Batten pocket life will be greatly prolonged if you regularly spray your battens with spray silicone lubricant prior to installation. You may also spray the silicone into the end of the batten pocket, and the batten will distribute it along the length of the pocket.

12) Spread the wings all the way and check all wires for twisted thimbles or tangs. (Fig 15 and 16)

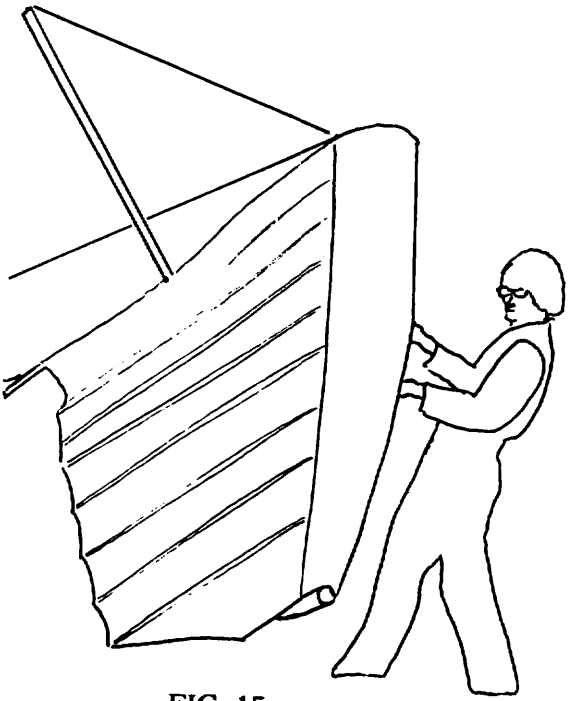


FIG 15

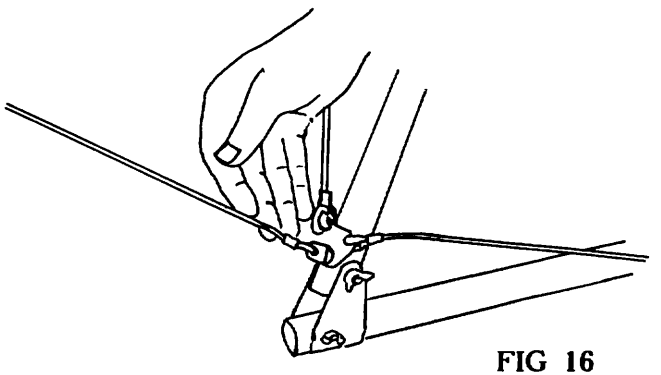


FIG 16

13) Remove the wingnut and safety from the bolt which is secured to the crossbar sweep wire. (The wire attached to the crossbar center.) Insert the free end of the piece of leech line which is attached to the control bar top through the thimble in the shortest of the three wires which make up the crossbar sweep wire. (Fig 17) Then pass the end of the leech line through the grommet in the tang which is bolted to the top of the control bar leg. (Fig 17)

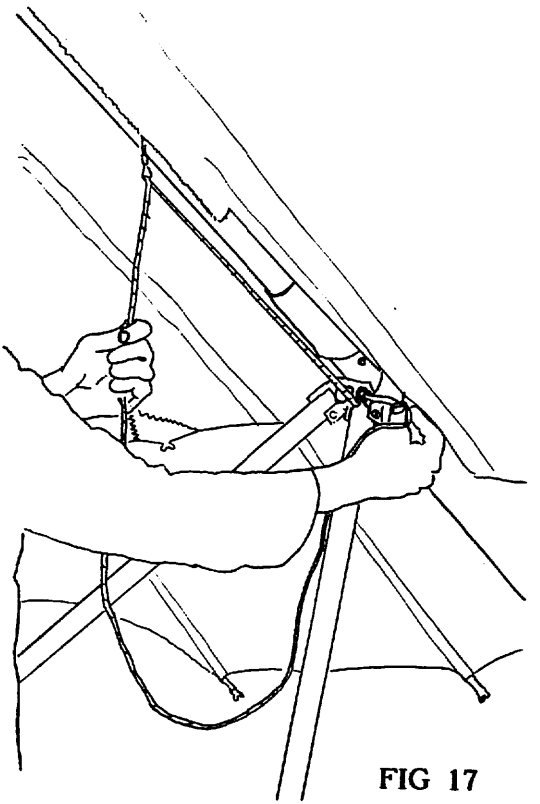


FIG 17

14) Finally, pass the free end of the leech line through the thimble in the crossbar wire a second time, in the same direction as the first time, and pull the leech line tight. (Fig 18).

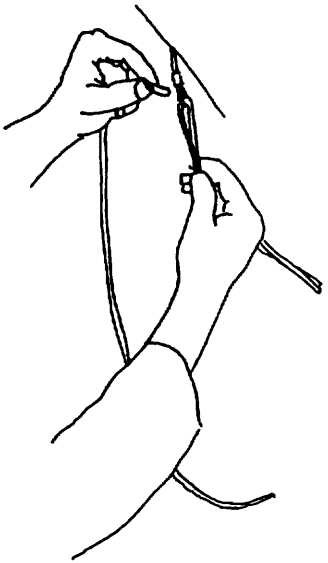


FIG 18

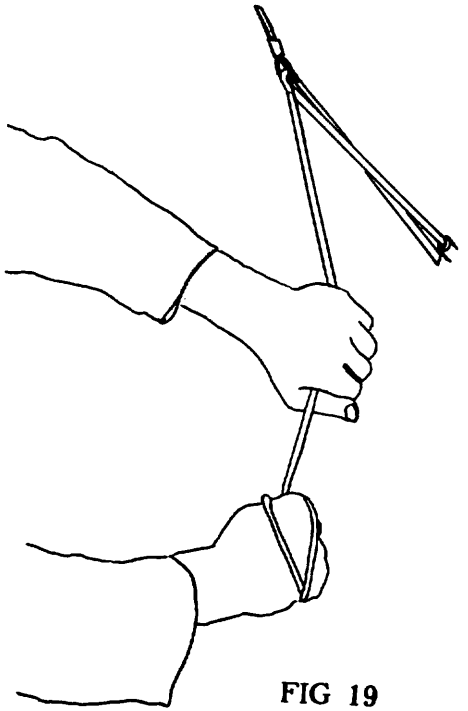


FIG 19

15) Wrap the leech line around your right hand, and push on the line with your left hand while pulling down with your right. This will allow you to pull the crossbar center back far enough so that you can insert the bolt through the hole in the keel, install the other side of the wire, and secure the assembly with the wing nut and safety. (Fig 19, 20, 21 and 22)

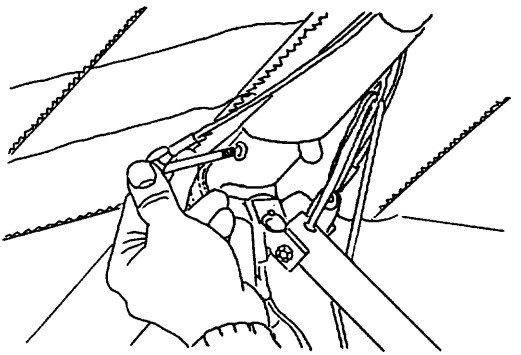


FIG 20

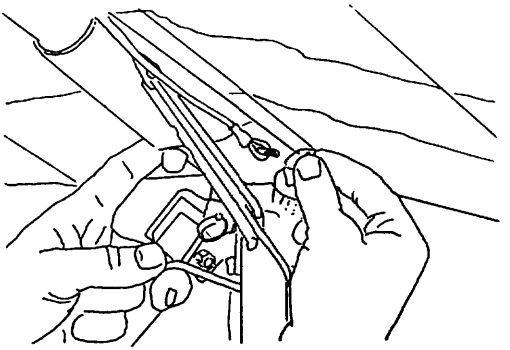


FIG 21

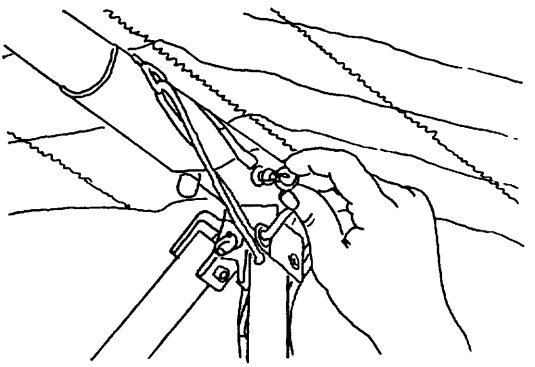


FIG 22

16) Attach the bottom front wires at the nose using the following procedure: First, be sure that the glider is sitting as level as possible, that neither wing tip is resting hard on the ground, and that the control bar base is pulled all the way forward so as to tension the bottom rear wires and put the rear of the keel on the ground. Lift the keyhole tang to the head of the bolt on the bottom of the keel. Press upward on the tang while pulling down on the nose of the glider (Fig 23), and the tang will slide over the bolt and pop into place. Note: Do not try to use the "T" handle on the tang for installing the tang, it is used only for removing the tang. Press instead on the tang itself on either side of the hole. Attach the rubber safety.

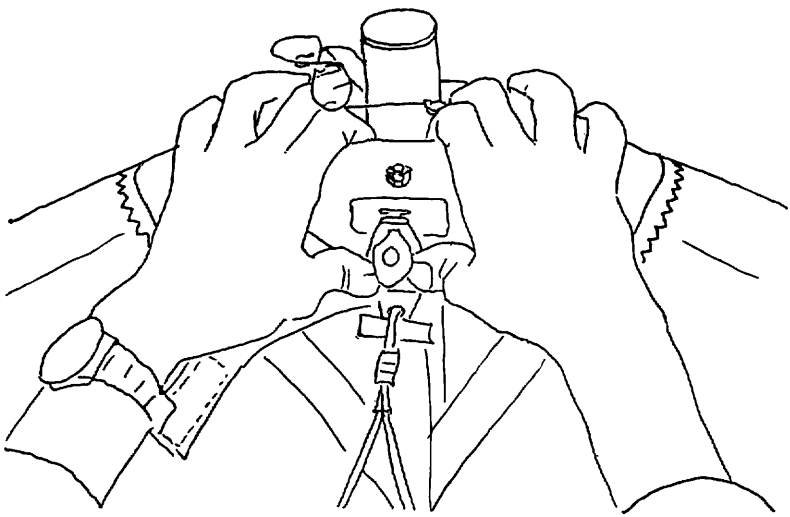


FIG 23

17) Install the bottom surface battens. If the wind is less than 10 mph, this is done most easily by putting the nose down (into the wind.) (Fig 24) The order of the bottom surface battens is longest to shortest, from the root out. When the front of the batten reaches the leading edge seam, you may have to press upward on the batten in order to allow it to clear the seam. Push the batten all the way into the pocket until the rear end is flush with the rear of the pocket. The strings on the rear ends of the bottom surface battens are to facilitate removal of the battens from the sail during beakdown. The bottom surface battens are not secured in the sail. Be sure that the battens go under the leading edge tube, and do not rest on top.

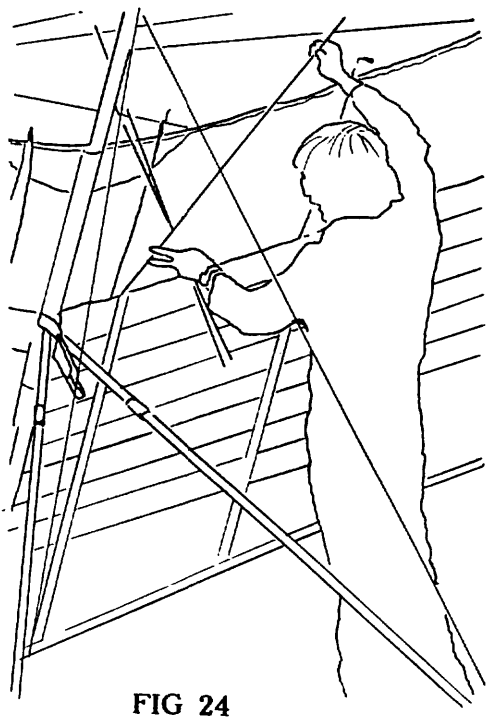


FIG 24

18) Insert the number one battens. On older HP's they will be inserted between the top and bottom surface through the gap in the seam, while on newer HP's they will be inserted through a hole in the bottom surface. (Fig 25)

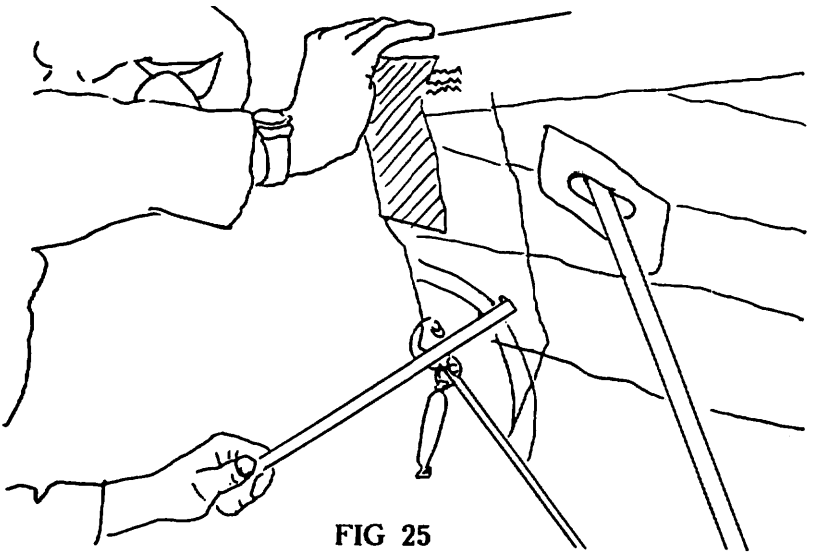


FIG 25

They are never inserted through the washout tube hole. Fit the batten end fork on the front of the batten to the stud on top of the leading edge. (fig 26)

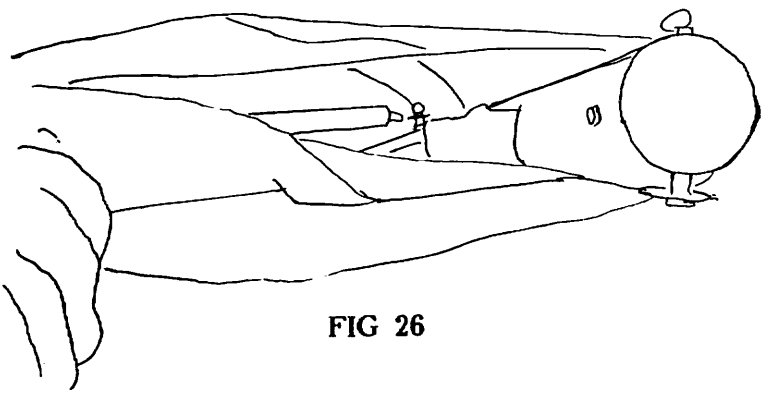


FIG 26

Attach the leech line twice to each batten. You may find it easiest to sit on the ground and place your foot against the leading edge in order to obtain the necessary tension on the batten string. (Fig 27)

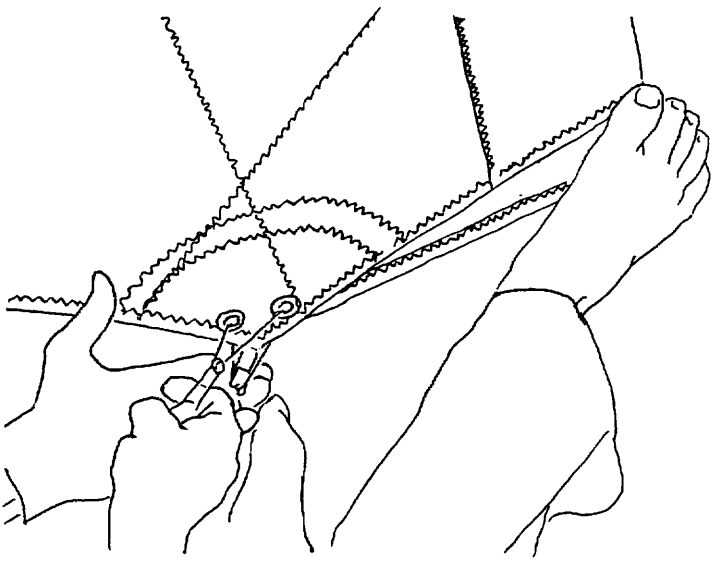


FIG 27

19) Set the glider nose into the wind, and pull the nose down. Grasp the string loop at the front of the nose batten and pull the forked batten end up and over until it sits on top of the keel tube. (Fig 28 and 29)

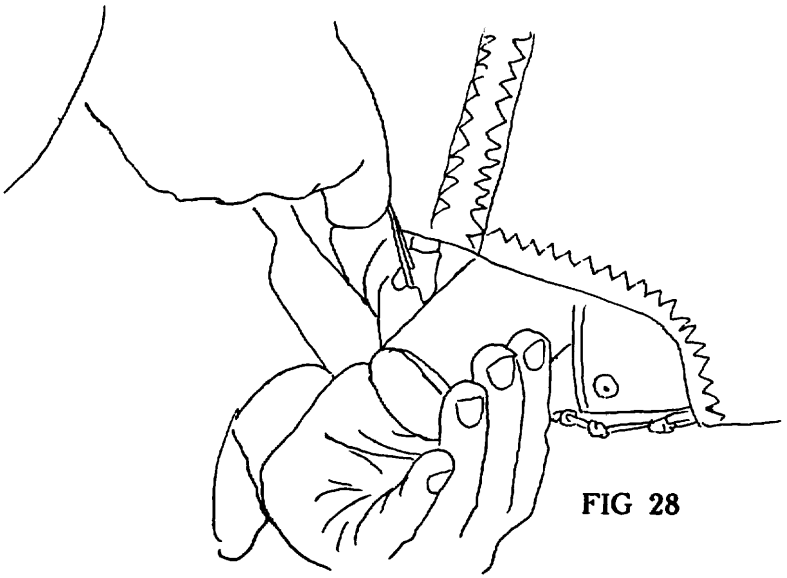


FIG 28

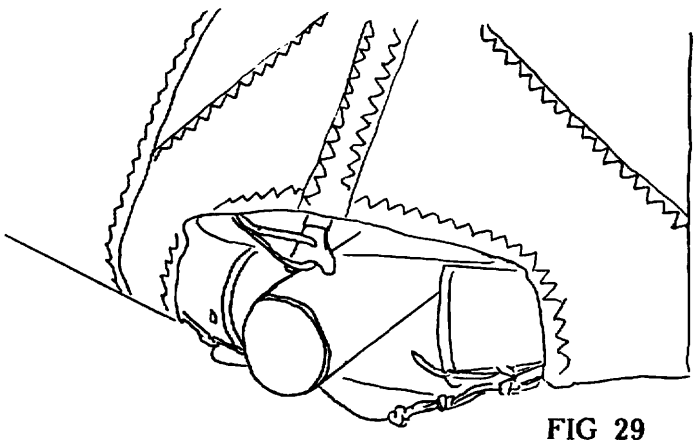


FIG 29

20) Do a complete walk around prefight of the glider. It is your responsibility during this preflight to check every part, component and assembly on the glider.

Beginning at the nose, check the nuts on all the nose bolts, including the safety ring on the top of the rear nose bolt. (Fig 30)

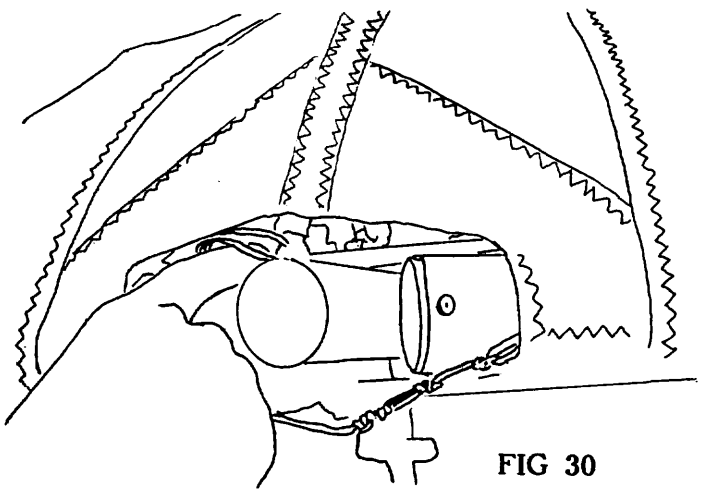


FIG 30

While at the nose, lift up on the edge of the sail above the noseplate and look down each leading edge. (Fig 31) Check for safety rings at the crossbar leading edge junctions. Check that all bottom surface battens are underneath the leading edge tube. Check for any evidence of dents in the leading edges, or bends in the tubes (look for signs of crystalization of the material; a brighter, fuzzy spot on the aluminum).

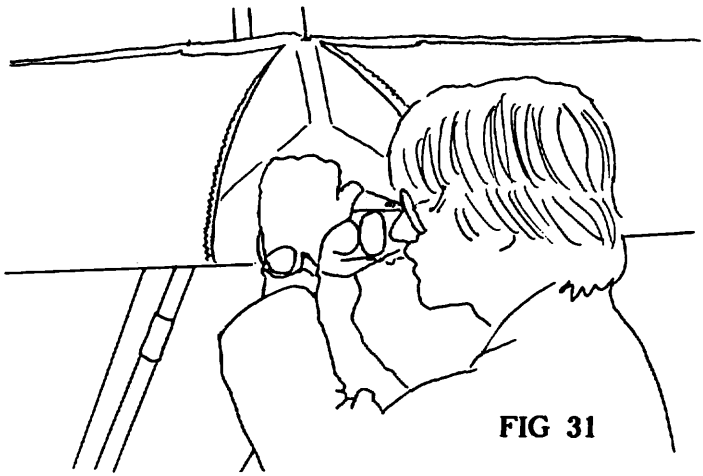


FIG 31

21) Continue the preflight at the control bar apex. Check that the nuts which secure the control bar top bolts are secure. (Fig 32)

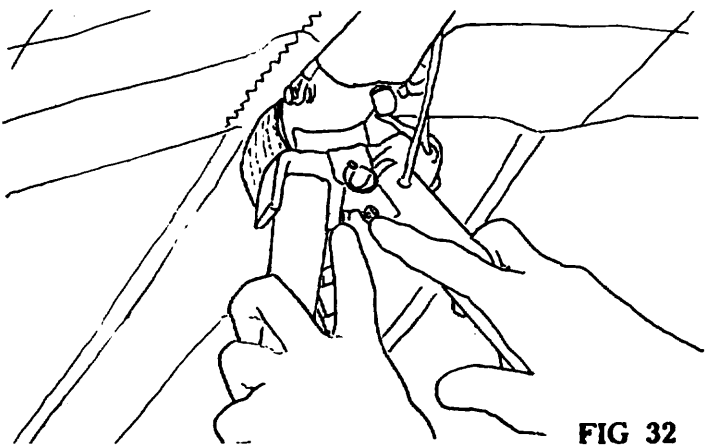


FIG 32

Check that the control bar top clevis pin and the safety on the clevis pin are in place, and that the pin is inserted from the rear so that the safety cannot be caught on the hang loop and pulled out. (Fig 33)

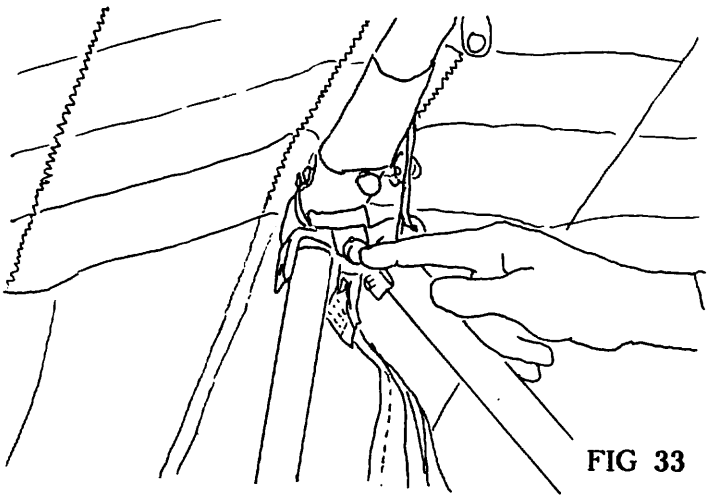


FIG 33

Check that the hang loop is properly bolted in place and check the hang loop itself for signs of wear or broken stitching or improper sewing. (Fig 34 and 35) Check that the flex lock nut which secures the control bar top channel bracket to the keel is secure.

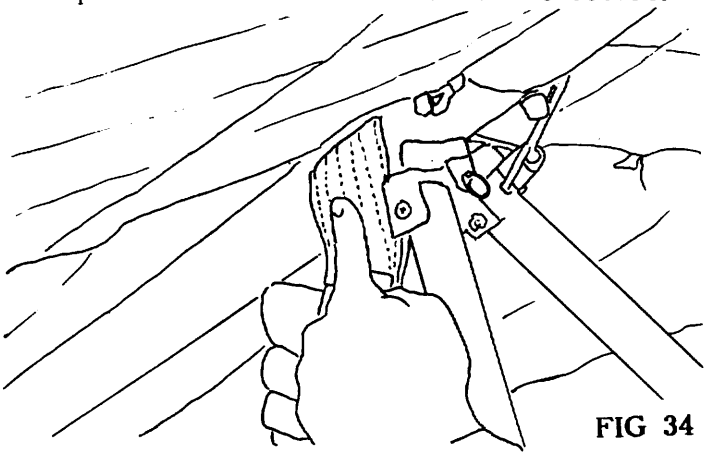


FIG 34

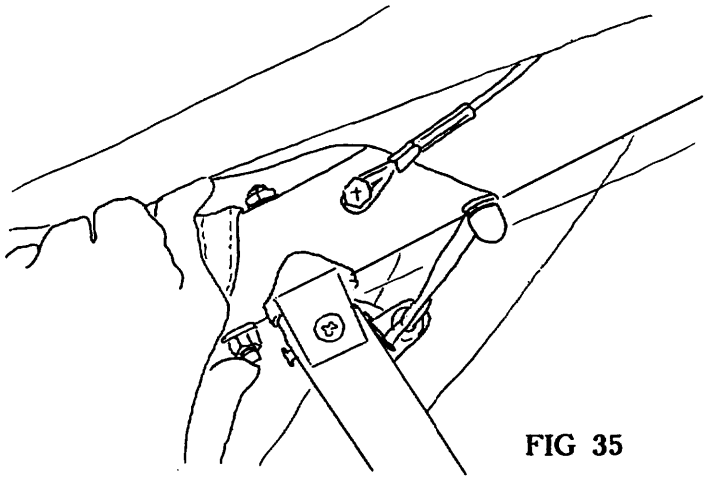


FIG 35

Check that the crossbar sweep wire tang swivels freely, but that the nut which secures it is snug enough that there is no excess play in the tang. Check that the safety ring is in place in the end of the bolt below the nut and tang. (Fig 36)

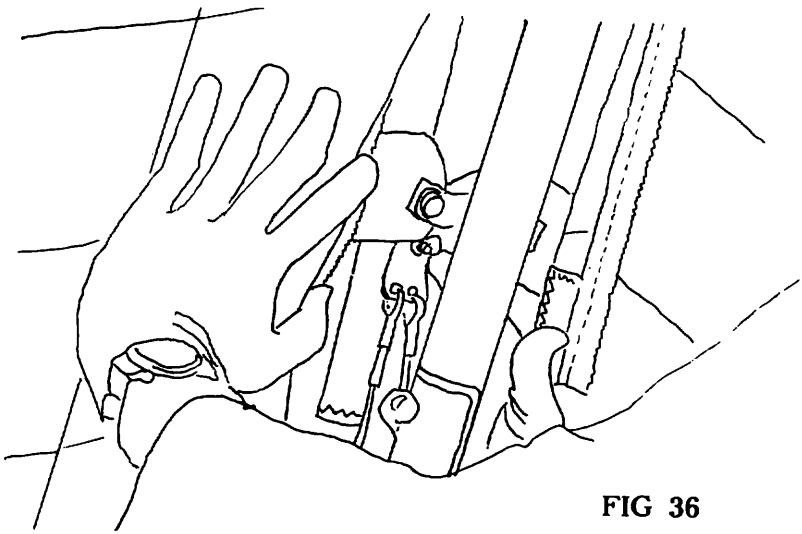


FIG 36

After your inspection in this area is complete, close the zipper by pulling the zipper slider all the way aft (Fig 37)

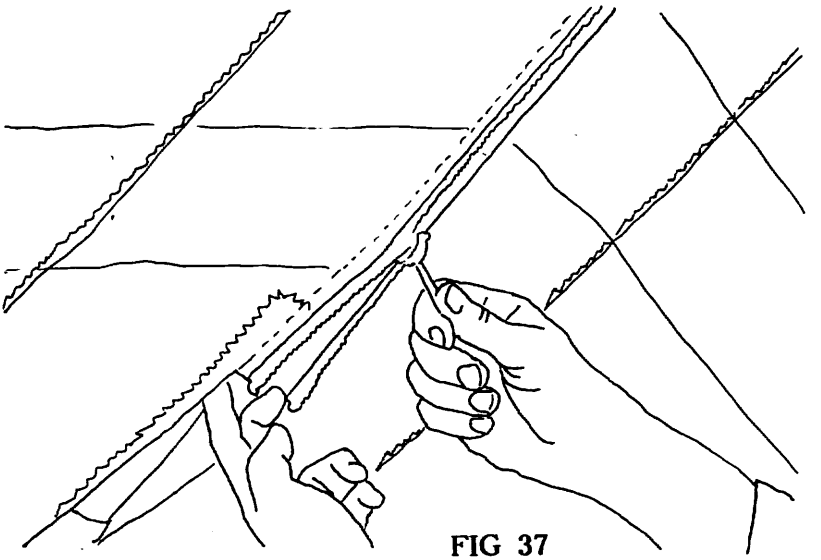


FIG 37

Sight down each downtube and check for bends or kinks. Do not fly with a bent or kinked downtube. (Fig 38)

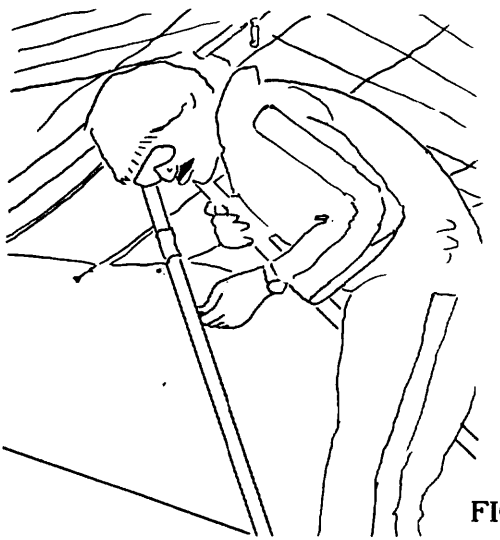


FIG 38

Check the thimble fittings at the control bar corners for any cocked or twisted thimbles. If you find any, detension the crossbar and straighten them out. Prior to retensioning the crossbar check carefully for any kinks in the cable. If you kink a cable, you must replace it, or there is a danger it will fail after repeated loading and unloading.

Check the nylock nuts which secure the side wires to the control bar downtubes, and the nylock nuts, wingnuts and safety rings at the lower control bar corners. (Fig 39)

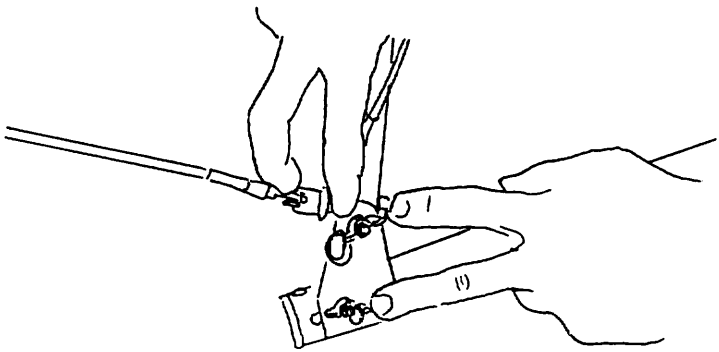


FIG 39

While pressing up on the leading edge, step on each bottom side wire with about 50 pounds of force. (Fig 40) This will test the side wire loop, and show up any fittings which are so loose as to be ready to fall apart, or any wires which are on the verge of breaking.

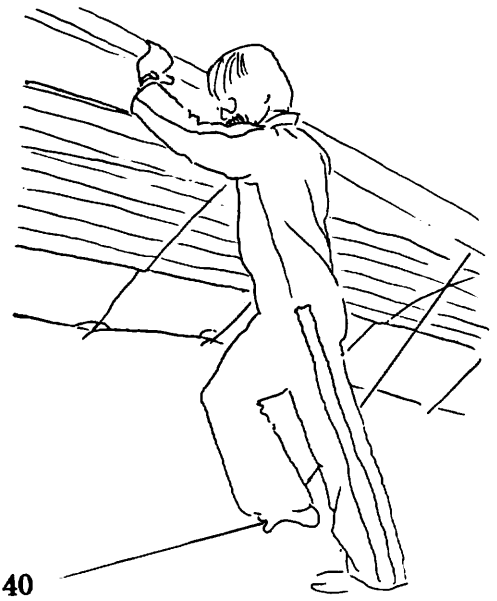


FIG 40

Check the trailing edge for any cuts, tears or broken stitching. (Fig 41)

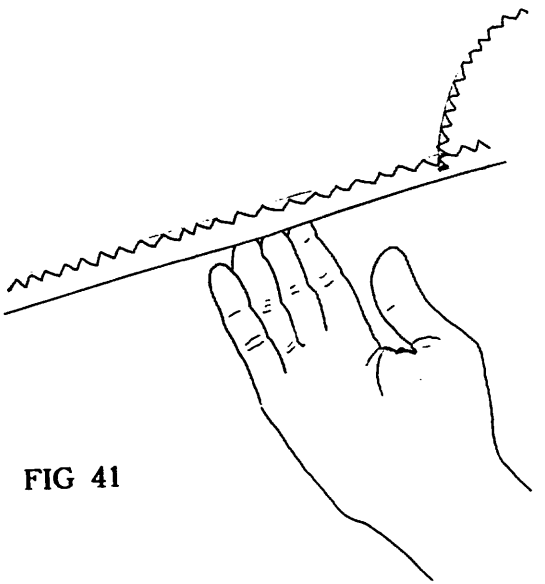


FIG 41

Check that all the battens are secured properly. (The illustration shows the number one battens). (Fig 42)

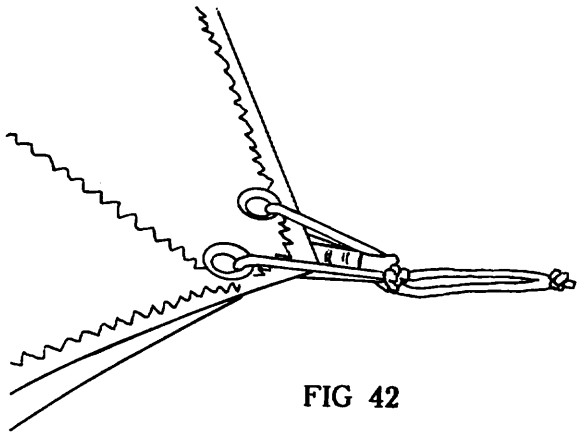


FIG 42

Look into the sail at each wing tip, and check that the number one battens are properly seated, and that the safety rings on top of the washout sleeve and number one anchor stud clevis pins are in place. (Fig 43)

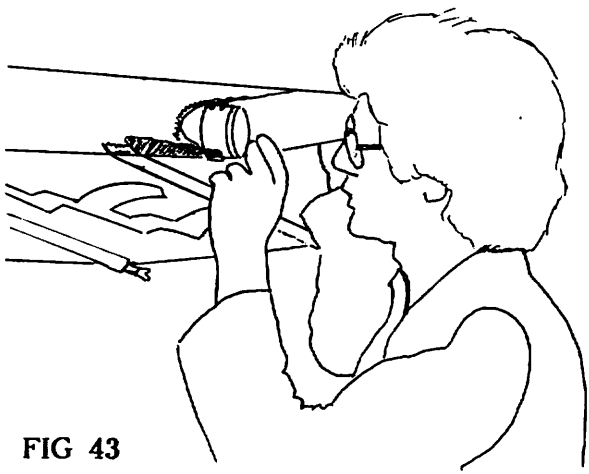


FIG 43

Check that the sail mount plug anchor screw is in place, and that the twist in the plug is properly adjusted so as to provide equal tension to the top and bottom surfaces of the sail when the number one batten is held up about half an inch above the washout tube. (Fig 44)

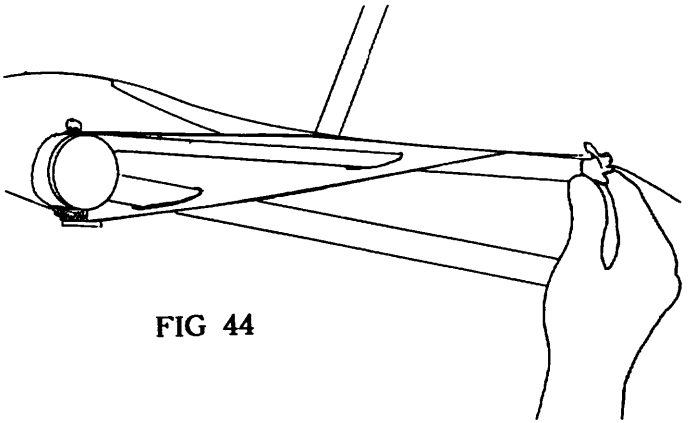


FIG 44

Check that the top rear wire passes behind all of the bridle cables (Fig 45) and not around one of the cables (Fig 46 shows an INCORRECT configuration).

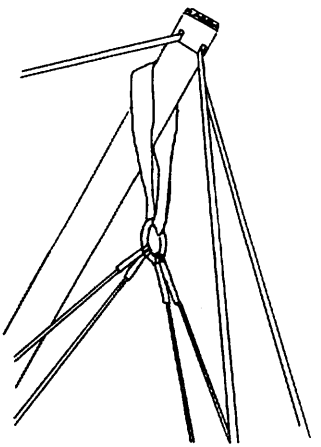


FIG 45

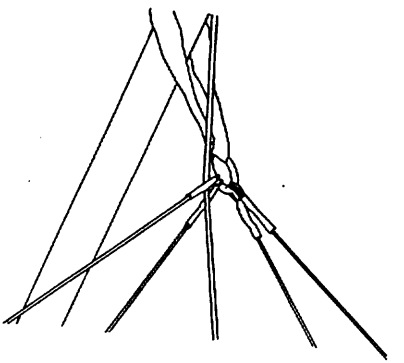


FIG 46

Check that each of the four bridle cables are free of the batten tension leech lines (Fig 47) and that the bridle cable key ring is flush with the bottom of the sail. (Fig 48)

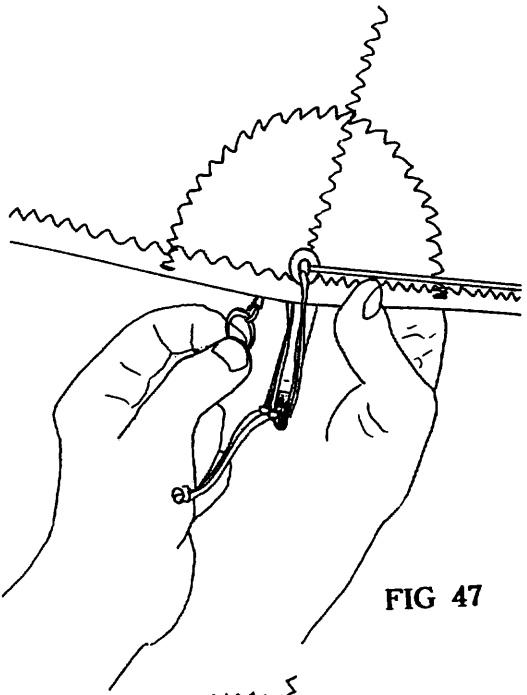


FIG 47

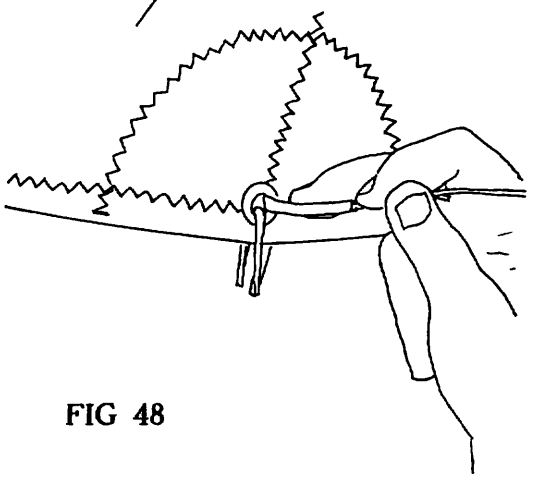


FIG 48

Check that no bridle line is looped underneath a more inboard batten (Fig 49 shows the INCORRECT configuration).

WRONG!

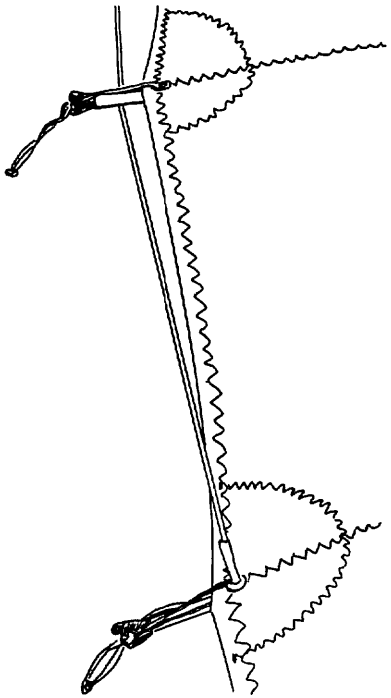


FIG 49

22) Fit the nose cone over the front of the keel (Fig 50) and attach the velcro at the top rear of the nose cone (Fig 51) taking care to line up the nose cone

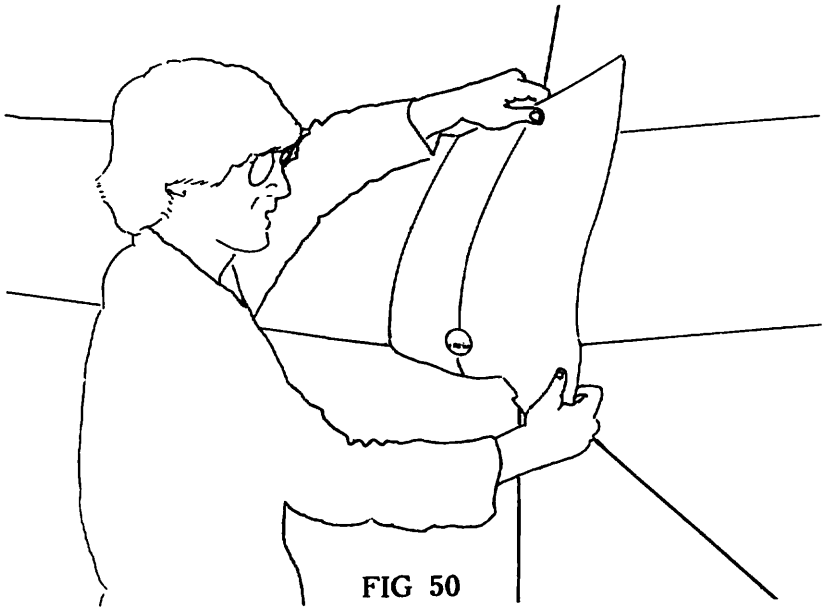


FIG 50

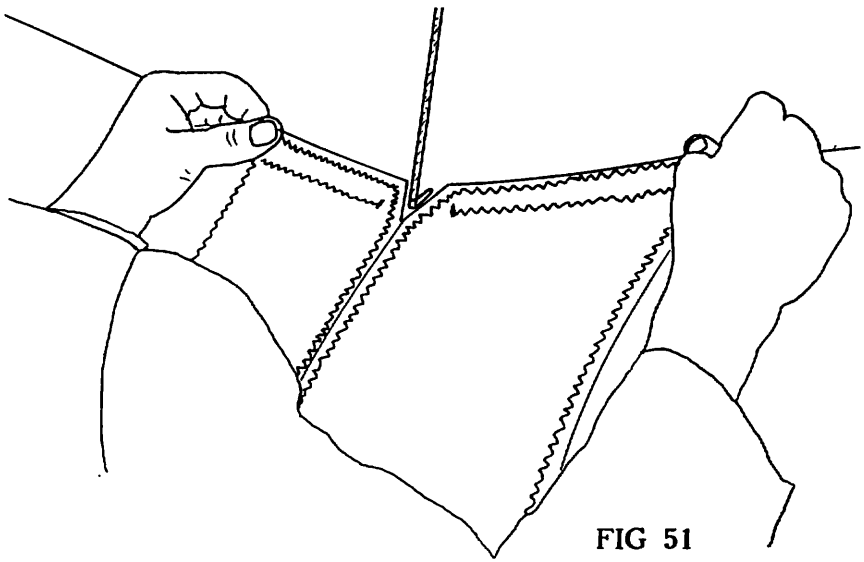


FIG 51

properly. Rest the glider back on its tail and pull the bottom corners of the nose cone back until the nose cone is tight around the nose (Fig 52) and secure the velcro on the bottom of the nose cone.

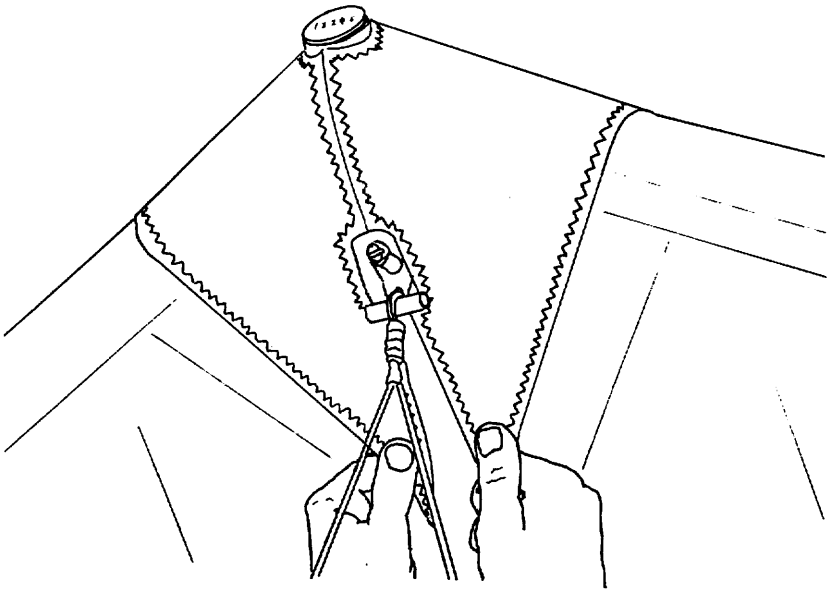
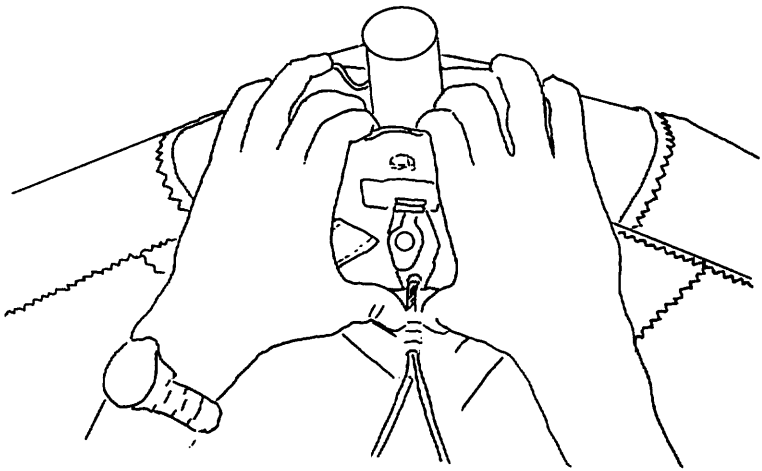


FIG 52

LAYING THE GLIDER FLAT

Once you have the glider set up, you can easily lay it flat on the ground: If there is more than ten miles per hour of wind, however, you should have assistance to do it.

1) Remove the safety from the front bottom nose bolt. Place your thumbs against the "T" handle on the keyhole tang and push up on this handle while pulling down on top of the nose as shown. (Fig 53) This provides the easiest method for removing the keyhole tang from the nose bolt.



4) Lay the glider flat on the ground CAUTION: Be sure to have the nose pointed into the wind when using this procedure and be gentle when laying the glider down and lifting it back up, otherwise you may bend or break the keel.

LAUNCHING THE HP

The HP has a very slightly tail heavy static balance. When you hold the glider prior to your take off run, you should have the nose slightly elevated and the wings level. If the wind is more than ten mph or is gusty, you should have at least one wire assistant, on the nose wires. Make sure all signals are clearly understood beforehand. Make sure all spectators are clear. Make sure you are hooked in and check your position hanging in the control bar.

Give a good aggressive run and ease the bar out for lift-off.

Have a good one!

FLYING THE HP

The HP has flight characteristics which are typical of a very tight sail, very high performance flex wing. Some of the characteristics may be unfamiliar to you, depending on what gliders you are used to flying. Make your first flights from a familiar site in mellow conditions. Give yourself an extra margin of safety in all maneuvers until you are thoroughly familiar with the glider's response characteristics.

There are some special techniques for turn control which will greatly increase your effective control authority once you master them.

TURN INITIATION

Turns are best initiated on the HP with sharp jabs on the control bar, rather than sustained pushes. Because the HP has a tight keel pocket, the pilot attachment point on the keel is not free to float laterally. This results in higher roll bar pressures during smooth, sustained lateral movements, and makes such movements less effective in initiating roll. Also, because of the very tight sail and high batten density of the HP, the wing needs to be loaded in order for the twist to shift during turn initiation. For this reason, pulling in on the control bar prior to moving to the side, which lowers the angle of attack and partially unloads the wing, is not recommended.

HANG POSITION

We strongly recommend that you hang as low as possible (as close to the basetube) in the HP for maximum ease of roll control. The higher you hang off the bar, the shorter your pendulum is, and the higher will be the roll bar pressures. Also, hanging higher makes the lateral component of the force you exert with your arms smaller, and forces you to work harder to achieve the same weight shift. If you are used to hanging fairly high off the bar, you will probably find it uncomfortable at first to hang lower. From our experience, however, you can get used to hanging lower in a relatively short time, and you will be rewarded with substantially better control authority. Make sure that your parachute is secure in your harness, and that it is not in danger of snagging on the basetube.

TURNING IN SMOOTH AIR AND LIGHT LIFT

When flying in smooth air with weak areas of lift, you

can cruise at minimum sink and initiate turns by pushing straight to the side on the control bar. Minimum sink is achieved with the control basetube (straight basetube) between your chin and your eyes. As the glider begins to turn, relax pressure and allow yourself to move back to the center of the bar. This will allow for slow, flat turns without overbanking or the need to high side the bar.

TURNING IN MODERATE TO STRONG THERMAL LIFT AND TURBULENCE

When flying in stronger lift, you should cruise at a high minimum sink or low best L/D speed, with the (straight) basetube between your chin and your chest. Avoid the temptation to pull in prior to moving to the side when initiating a turn, unless you are flying too slowly to begin with. The HP responds best to a sharp lateral push on the bar, in combination with a short, sharp push out. If you find that the glider does not respond, do not hold yourself over on the bar waiting for the glider to come around. It is usually better to return to the center of the bar, neutralize the bar pressures, and repeat the sharp lateral and outwards push.

An alternate turn initiation technique, provided you are flying at well above minimum sink to begin with, is to let the bar out quickly a few inches and then push it sharply to the side.

SPEED TO FLY

Most hang gliders obtain minimum sink rate performance at or near their lowest controllable airspeed. The HP is designed to fly faster than many gliders you may be used to, and yet is controllable at speeds well below that of minimum sink. If you fly the HP as slow as you can while still retaining some lateral control, you will be flying in a partial stall, and you will not be getting your best sink rate.

THERMALLING THE HP

Airspeed control when thermalling is very critical to optimum climb performance on the HP. It is also difficult and takes lots of practice. If you fly your turns too fast, you won't climb as fast as you could because the higher flying speed will increase your sink rate and your minimum turn radius. On the other hand, it is easy to fly the HP too slow in a thermal, and end up flying around with one wing continuously stalled. This also will hurt your sink rate. The reason that this is easy to do on the HP is that the glider is more controllable in a partial stall or mush than most other gliders. If you judge your angle of attack by degree of lateral controllability, and fly as slow as you can in a thermal while still retaining some lateral control, you will probably fly a little too slowly.

These techniques may take many hours to master, even for the most expert pilot. Do not be discouraged if your effective soaring performance during your first hours on your HP is less than it was on your previous glider. Just keep working on your technique, and your performance will continue to improve. Once you master the glider, it will offer you a total performance package that exceeds that of any other glider you can buy. If at anytime you have problems flying the glider, don't hesitate to give us a call here at the factory. We're pilots here, whatever you're going through we've probably been there and we'll do our best to help you figure it out.

FLYING AT HIGH CRUISING SPEEDS

Some pilots find themselves entering a roll/yaw oscillation when flying in the higher speed ranges, with the bar at or below the abdomen. This is caused by the fact that the glider is much more sensitive to pilot control inputs in this speed range, and it is therefore very easy to overcontrol the glider. This

oscillation may not feel like it is pilot induced because the movements you make are so small that you may not be aware of them. You will find, however, if you make a conscious effort to make smaller lateral movements and return sooner to the center of the bar, that the oscillation will dampen out. With a little practice, you will learn to avoid making the lateral movements that set up the oscillation, and you will be able to fly the glider in a straight line at any speed without difficulty.

LANDING THE HP

As with all defined airfoil flex-wings, landings should involve a long straight final approach at faster than best L/D airspeed, straight into the wind. Allow the speed to bleed off slowly, keeping the glider flying wings level, and close to the ground. Expect the HP to fly farther in ground effect than you are used to flying prior to the flare. When it is time to flare, flare agressively and abruptly, and hold the bar out. (Fig 54) A common mistake is flaring too early. Do not

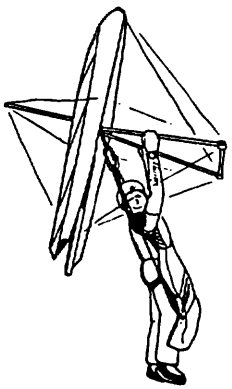


FIG 54

flare until you feel the glider begin to settle and the pitch response become mushy. Another common mistake is to flare too late. Do not fly the glider so far into the mush that your arms are extended and you have nothing left to flare with. Your hands should be positioned high on the downtubes for a good flare. If you cannot hold the downtubes with your hands at shoulder width when your hands are at shoulder height, your harness leg straps are too long for an optimum flare capability. (Fig 55) Your body position prior to flare should be upright, inclined slightly forward, with your feet and legs trailing behind you. (Fig 56) If you try to hold your feet in front of you, it will prevent you from achieving an adequate flare. (Fig 57) With a good sharp flare, the glider will quickly attain a very high angle of attack, and the sudden increase in drag will slow the glider very suddenly. You will then swing forward underneath the glider, your feet will come underneath you, and you will land on your feet with the glider settling nose up on your shoulders. (Fig 54)

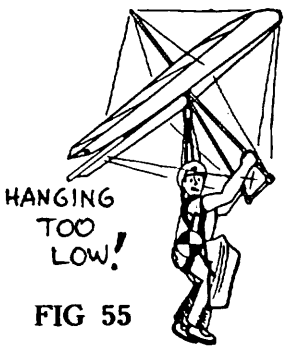


FIG 55

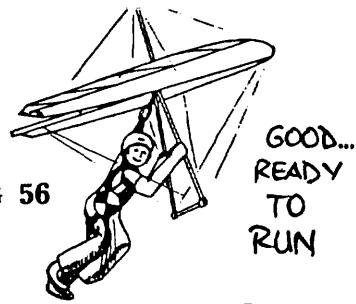


FIG 56

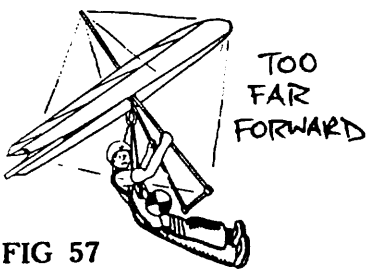


FIG 57

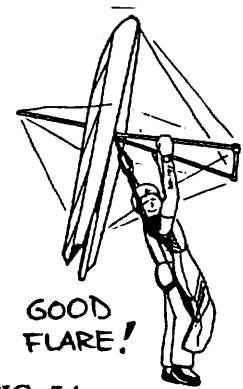


FIG 54

HP BREAKDOWN

Breakdown of the HP is simply the reverse of the set up procedure.

1) Do not remove the nose batten, but dismount the front end from the top of the keel and pull the batten out past the top noseplate.

2) Remove the bottom surface battens. Do not remove the top surface battens at this time! Remove the number one battens now, before you undo the crossbar.

3) Detach the bottom front wires at the noseplate by pressing upwards with your thumbs on the "T" handle while pulling down on the nose. (Fig 58)

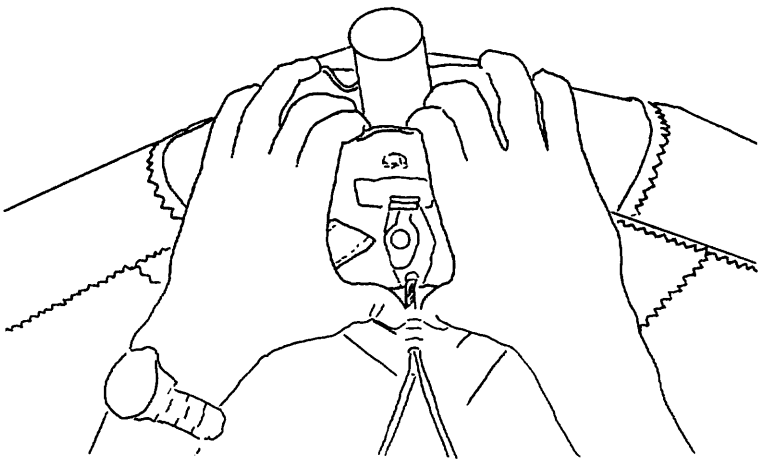


FIG 58

4) Unzip the bottom surface centerline zipper almost all the way. Tension the crossbar slightly with the leech line pull so that you can remove the anchor bolt. Reinstall the bolt through the thimble in the second cable with both cables and the bolt below the keel. Pull the crossbar forward.

NOTE: If the zipper is left closed when you fold the wings in, the sweep wire bolt can catch on the rear of the zipper and tear it loose from the sail.

5) Pull the wings in slightly and remove all the battens. Lift the keel as you remove the #10 battens.

6) Detach the top rear wire keyhole tang from the rear of the keel.

7) Remove the kingpost from the base by lifting straight up. If you have a streamlined kingpost, install the protective covers over the top and bottom ends. Secure the bottom end to the rear of the keel with the bungee loop at the rear of the keel. (Fig 59)

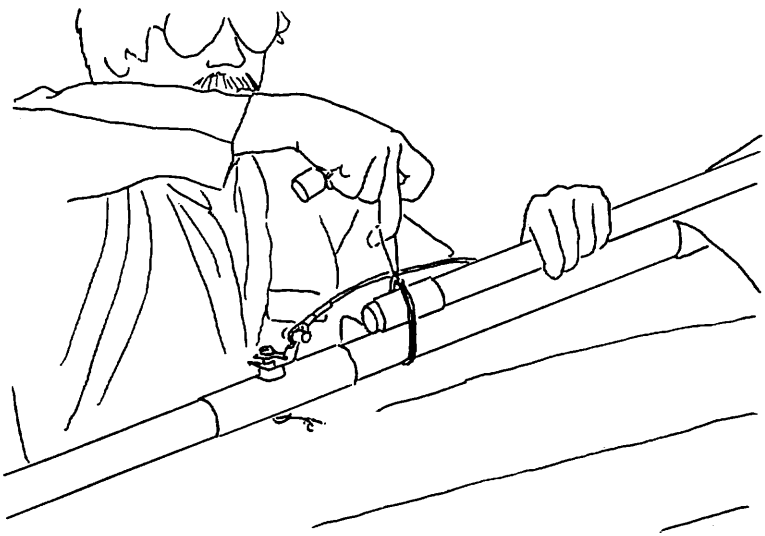


FIG 59

Slide the bungee loop with the rubber cap attached over the top of the kingpost (Fig 60) and attach the rubber cap to the kingpost base. (Fig 61)

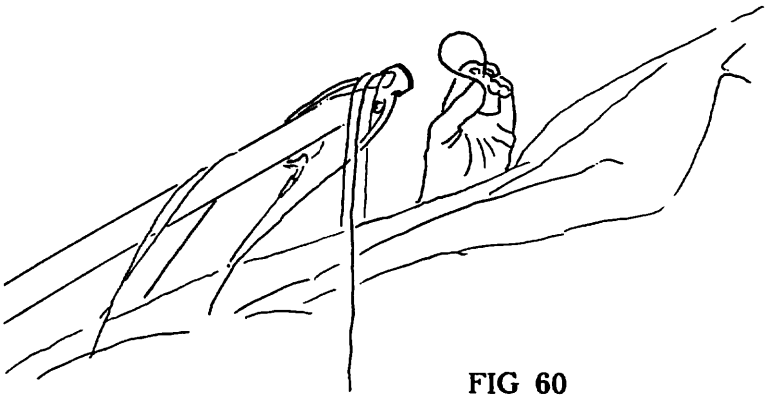


FIG 60

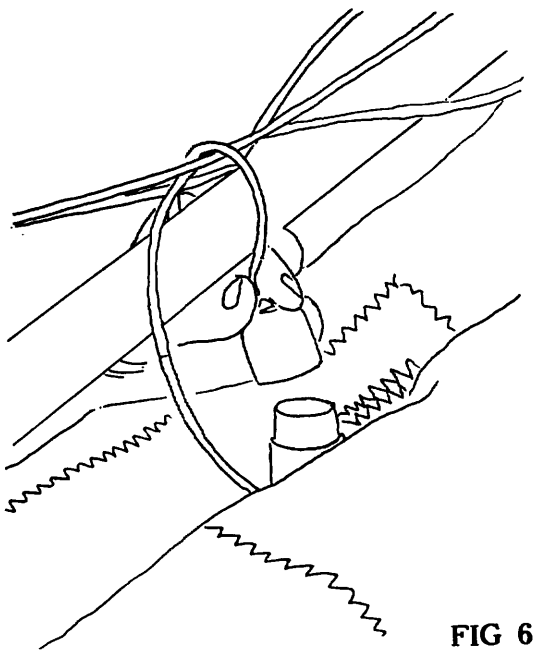


FIG 61

8) Remove the washout tips. Fold the wings in pulling the sail over the top of the leading edges. (Fig 62)

NOTE: If you meet resistance while folding the wings in, stop and check that the crossbar center section is not caught between the keel and front leading edge.

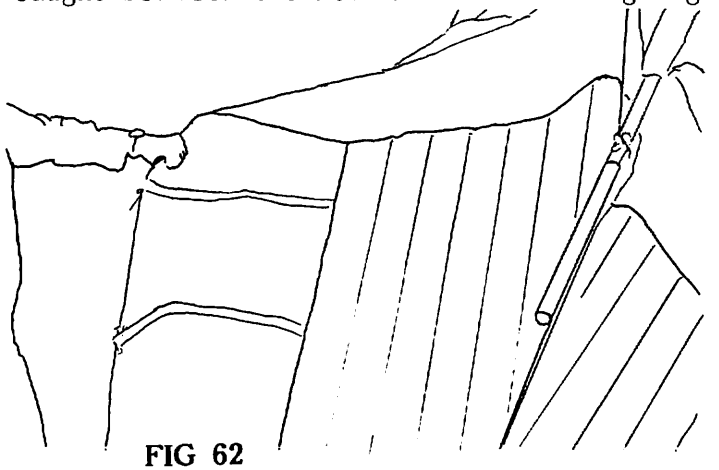


FIG 62

9) Pull the sail out so that both the top and bottom folds of the sail are equally taut, and roll the washout tips and lower surface battens up in the sail. (Fig 63) Do one side first, and pull the mylar pocket up and around the rolled sail (Fig 64) and secure it temporarily with one velcro strap.

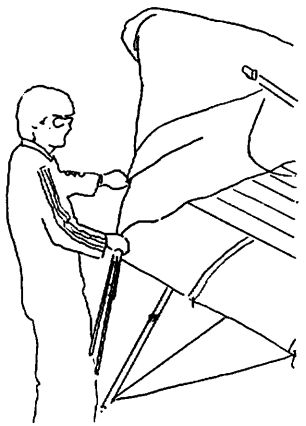


FIG 63

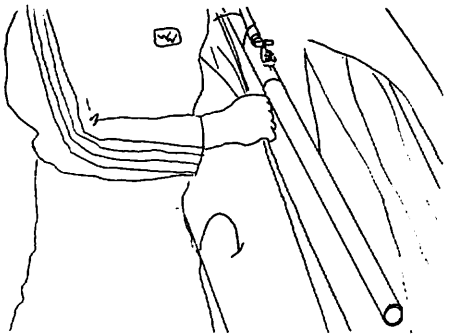


FIG 64

10) Roll the second side, and place one velcro strap OVER the keel and around each leading edge and rolled sail in the vicinity of the leading edge/crossbar junction. (Fig 65) The mylar pocket from one side should be pulled underneath that of the other side, the mylar should sit on top of the leading edges, and lay smooth. do not overtighten the velcro. (Fig 66) Secure

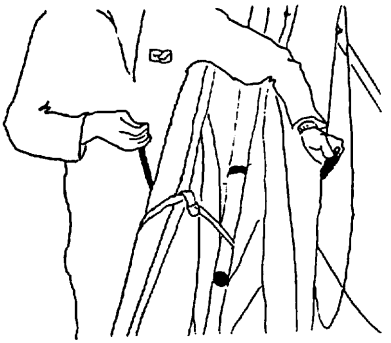


FIG 65

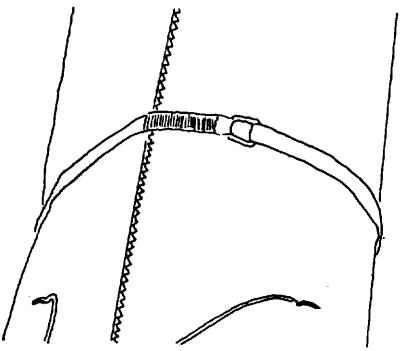


FIG 66

the velcro strap that is attached to the front keel in a like manner, again pulling the mylar pocket on one side up and over the other side. Make sure this strap passes over the top of the keel and supports the leading edges above the control bar top "E" bracket.

If the sail will not fold up cleanly it may be because the restraining string which mounts the sail to the nose is too loose.

NOTE: If you roll up your sail wet, and leave it packed up wet, there is a good chance that the colored dyes in the cloth will bleed from the darker colors onto the lighter colors, staining the sail. If you MUST roll up a wet sail, unroll it and dry it as soon as possible thereafter.

11) Place the last velcro around the sail near the rear end of the leading edges. Place the bag on the glider with the flag at the tail end. Install the protective rubber caps on the washout studs. (Fig 67) Lay the glider on the ground, disassemble the control bar and fold it rearwards.

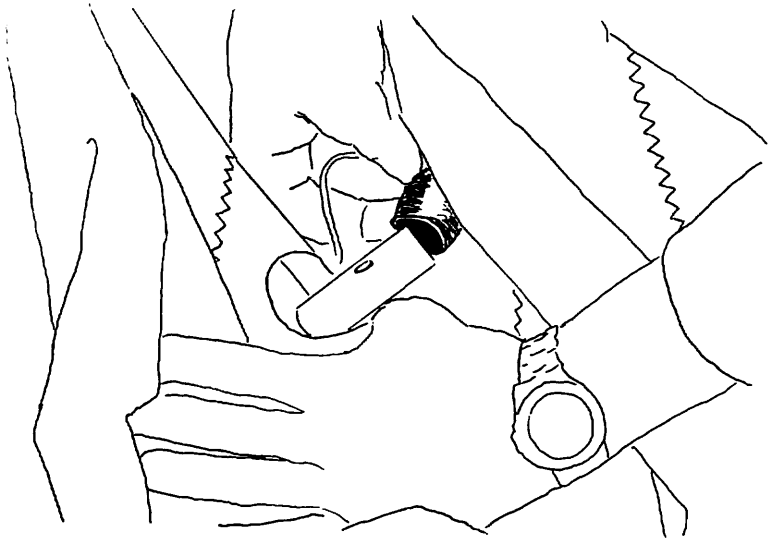


FIG 67

12) Insert the pad underneath the keel, (Fig 68) and between the keel and control bar and secure the velcro

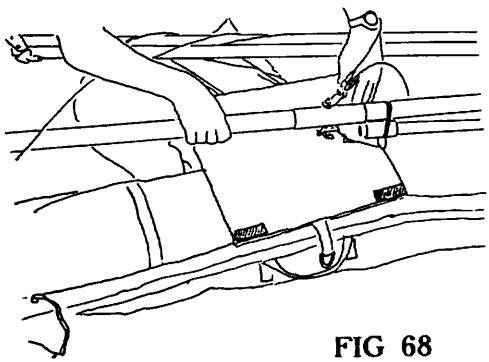


FIG 68

tabs. Install the protective bag over the rear end of the control bar. (Fig 69)

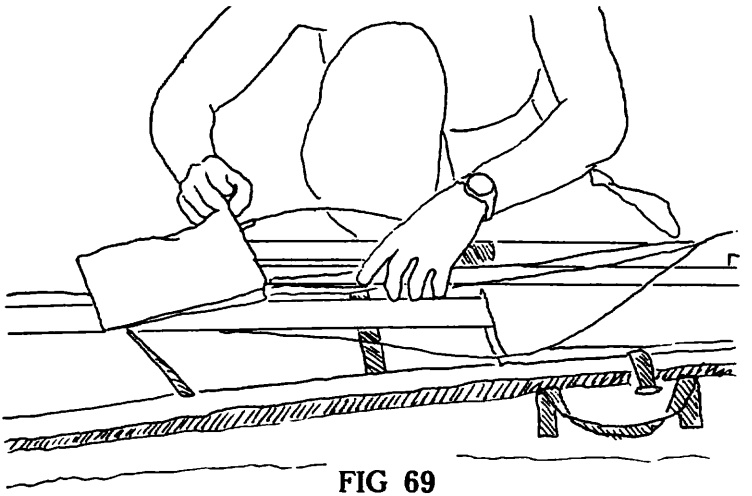


FIG 69

13) Secure the velcro strap around the control bar. (Fig 70)

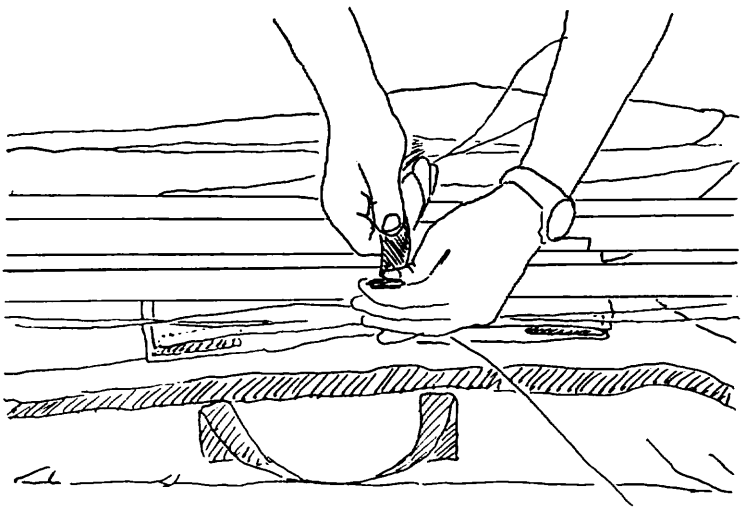


FIG 70

14) Place the battens together carefully and stow them in the batten bag. With the curved end towards the front, stow the battens between the rear leading edges of the glider. (Fig 71)

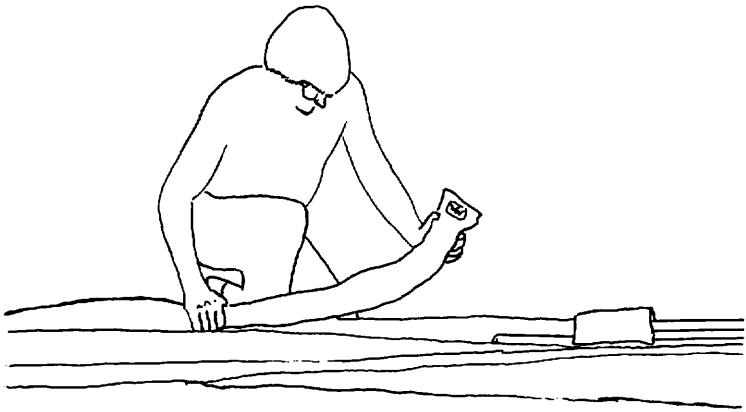


FIG 71

15) Slide the nose cone under the forward most velcro strap. (Fig 72) Zip up the bag.

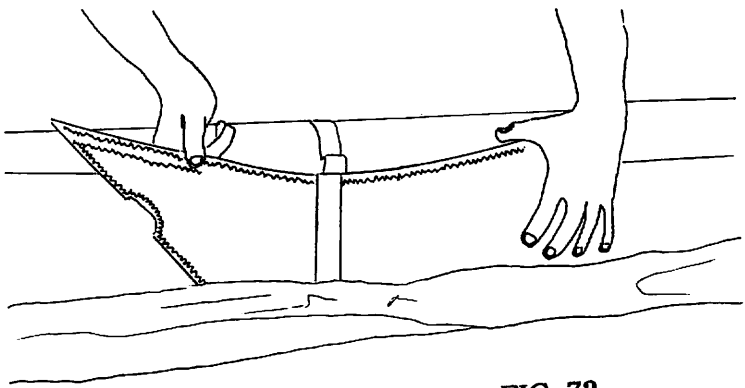


FIG 72

HP TUNING

In the following section, the various adjustments which can be made to tune the HP are summarized. Tuning a hang glider is an operation best performed by an expert pilot experienced with evaluating the effects of various adjustments on the glider's flight characteristics. If you feel qualified to tune your own glider, feel free to experiment with the various adjustments that are outlined in this manual. Prior to doing so, however, you should read carefully the detailed tuning information in the service section of this manual.

LEADING EDGE SAIL MOUNT TENSION

The sail tension along the leading edge affects turn trim, performance and handling characteristics. If the sail is mounted too loose, the glider will not perform as well as it should. If the sail is mounted too tight, the glider will be hard to turn and have a greater tendency to adverse yaw or spin. If the sail is mounted assymetrically the glider will have a turn to one side. See the section on leading edge sail mount tension in the service section of this manual for a detailed explanation of how to adjust the leading edge sail tension.

BATTEN TRUING

You will need to periodically check your battens against the batten diagram provided. The batten diagram must be laid flat on a flat, smooth surface in order to get accurate results. Follow the instructions on the pattern for truing the battens. Improperly shaped battens may affect the glider's handling, turn trim, performance, and safety.

REFLEX SUPPORT BRIDLES

You should periodically check the adjustment of your reflex support bridles. Proper adjustment is achieved when the bridles are just barely slack in normal flight. This can be determined by sighting the shadow of the bridle lines on the sail while flying. Take note that even tight bridles will produce a curved shadow on the curved surface of the sail, so be sure to differentiate between the curve of the sail and the curve of a slightly slack bridle. If the bridles are more than just slightly slack, they are too loose. As a reference measurement, with a tape measure hooked over the top front wire at the kingpost cap, the measurement to the outside edge of the bridle batten seam where it intersects the trailing edge should not be greater than those specifications listed on the compliance verification sheets in section 1 of this manual.

If the bridles are too loose, the glider will not have the level of pitch stability for which it was designed and certified. This lack of stability will only show up outside the normal range of flying angles of attack, however, and therefore is not likely to be apparent to you from flying the glider. It will, however, make the glider less safe to fly, and it is therefore very important that you maintain proper adjustment of the bridles. Bridle adjustment can change as your sail or cables stretch over a period of time, so you have to keep an eye on it.

If the bridles are too tight, they may seriously interfere with your ability to control the glider, especially in turbulence.

TURN TRIM

Turn trim is accomplished by appropriate adjustments of the leading edge sail tension and batten tension. See the service section of this manual for a detailed explanation.

FRONT TO REAR WIRE LOOP TENSION

This may be adjusted with the washers under the bottom rear wire tang. See the service section of the manual for detailed instructions.

HP MAINTENANCE

You should continually maintain your glider in a proper state of tune to insure optimum performance and flight characteristics. In addition, we recommend regular lubricaton with silicone spray for three areas of the glider: the zipper on your glider bag, the zipper in the bottom surface of the sail, and the batten pockets. Periodically spraying the zippers, and spraying silicone lubricant into the ends of the battens pockets, will provide lubrication that will extend the useful life of these components. You should not use any other type of lubrication such as petroleum based lubricants.

Your HP should have a complete maintenance inspection every six months or 30 hours of airtime, whichever comes sooner, or at any time that you have reason to believe that any component may have been damaged.

Maintenance and service should be performed by your Wills Wing dealer.

MINIMUM SERVICE SCHEDULE

EVERY SIX MONTHS

Complete maintenance inspection of sail and airframe (requires removal of sail from frame.) Replace any parts that show signs of wear. Have any tears or wear points in sail repaired by a professional sail maker.

EVERY YEAR

Replace hang loops, harness suspension lines, bridle cables, all airframe support cables including crossbar restraint cable.

SPECIAL CIRCUMSTANCES

Any time you suffer a crash or hard landing you should thoroghly inspect your glider and replace any parts that are bent or broken. Inpspect the sail carefully for tears, especially along the trailing edge, at the rear leading edge attachment points, and at the kingpost cut-out. Have any sail damage repaired by a professional sail maker.

Even a simple ground handling mishap may cause concealed damage, such as bent battens, which could severely affect your glider's flight characteristics. If your glider flips over in the wind, or something similar happens, you should breakdown far enough to remove and inspect your battens, and perform a careful preflight after re-assembly.

If your glider is ever exposed to salt water you must rinse it thoroughly with fresh water, including the insides of all tubes. This will require the removal of all end caps. After rinsing, or any time your glider gets wet, you should dry it thoroughly, remove the endcaps from all tubes, and swab the insides of the tubes with an oil dampened rag.

Your sail should never be washed in anything other than fresh water, as any soap or detergent will likely degrade the cloth and may adversely affect the flying characteristics.

We recommend against the use of ARMORALL or other preservative treatments on your sail. These tend to lubricate the surface of the fabric to the point were seamstick tape will no longer adhere to the cloth. As a result, if your sail is ever damaged, it will be almost impossible to repair.

If you set up or break down your glider in a sandy area, take care not to allow sand to enter your sail or batten pockets. This can best be done by placing something under the wing tips (your glider bag or harness bag) during any time they are resting on the sand, and by not dragging the trailing edge of the sail in the sand during set up or breakdown. Sand inside your sail, especially inside the batten pockets, will rapidly cause premature wear in that area.

IN CLOSING

With proper care and maintenance, your glider will retain for some years a high level of airworthiness. The HP was tested and found to comply with the 1984 HGMA Airworthiness Standards, which represent the best accumulated knowledge of what constitutes airworthiness in a hang glider. There is much that we still do not know, such as what is the effective lifetime for a hang glider before material fatigue and degradation compromise the glider's airworthiness. We do know that

ultraviolet light (contained in sunlight) will cause progressive deterioration of the sail fabric, and we estimate that a sail which has had 200 hours of UV exposure will lose 30% or more of its structural strength. We recommend that you not expose your glider to any more solar radiation than necessary; do not leave it set up for long periods of time in the sun when you are not flying it, and always keep the coverbag on the glider when it is folded up.

We also know that there are forces in nature which can severely compromise your safety regardless of the quality of design or condition of the aircraft you are operating. Your safety is ultimately your responsibility. We strongly recommend that you fly conservatively, both in your choice of the the conditions in which you fly and the safety margins you allow in the manuevers you attempt. We recommend that you fly only with a harness that has been tested for strength by the manufacturer, and that you always fly with an emergency parachute system. Our experience has shown us that pilots who fail to follow these recommendations are often killed or severely injured in accidents that could easily have been prevented.

CAR TOP MOUNTING

Your HP should be mounted on your rack with the control bar bracket (zipper on the bag) facing upwards, and the flag at the rear. Your rack should have at least three support points, spanning at least 13' of the glider. These should be padded and at least 4" wide to distribute the load.

A FEW LAST WORDS

Your Wills Wing HP is a sophisticated high performance glider that will give you years of safe and enjoyable soaring, provided that you treat it properly and always maintain a healthy respect for the demands and potential dangers of flying. Please remember that aviation is always potentially dangerous, and that your safety depends on you. You are reminded that this glider is not covered by product liability insurance, and that you fly a hang glider at your own risk.

See you in the sky!

Wills Wing, Inc.

COMPLIANCE VERIFICATION SPECIFICATION SHEET

NOTE: THESE SPECIFICATIONS ARE FOR THE PURPOSE OF VERIFYING THAT THE GLIDER IS IN THE CONFIGURATION IN WHICH IT WAS HGMA CERTIFIED. THEY SHOULD NOT BE USED FOR PARTS FABRICATION.

Glider Model: HP 170

1) Glider Weight 70 lbs
(lbs., without bag)
2) Leading Edge Tube
Length, Outside Diameter 231.875, 2
Holes at: .875, 131.875, 136.875, 206.875, 223.875
Keel Tube
Length, Outside Diameter 135, 1.5
Holes at: 3.5, 5.5, 55, 56.75, 58, 59.25, 60.25,101.5
Xbar Tube
Length, Outside Diameter 119.625, 2.25
Holes at: .5, 2.5 each end
Kingpost Tube
Length, Outside Diameter 54, 1.125
Holes at: .25, 1
Control Bar Leg
Length, Outside Diameter 69.5, 1.125 or 1.070 x 2.5 streamline, or .875 x 2.03 streamline steel
Holes at: .5, .875 one end, .5 other end
Control Bar Base
Length, Outside Diameter 57.125, 1.125
Holes at: .5, 1.125, .5 other end
Washout Tips
Length, Outside Diameter 33, .75
Holes at: 1.40625

3) Washout Tip Angle 11 degrees
Control Bar Angle 5.6 degrees

4) Bridle Measurement 86 inches inner, 123.625 inches outer, from top front wire at kingpost cap to batten pencil line at trailing edge

5) Chord at Root + 3' 73
Chord at Tip - 3' 42.75

6) Span of Sail 413

7) Bow In Leading Edge 7 in
Bow In Keel .75 down
Bow In Crossbar none

8) Placard Location keel
Test Fly Sticker Location keel

9) Pilot Weight Range 150 to 250 lbs.
Pilot Proficiency Required IV

Service Section

INTRODUCTION

This section of the manual is intended for the use of Wills Wing dealers performing service on the glider. This manual assumes a high degree of familiarity with hang glider service procedures, the use of appropriate tools, etc. We strongly recommend that all service procedures be performed by a qualified dealer. We know of several serious accidents which were caused by improper assembly of glider components during service procedures done by pilots unfamiliar with general practices of glider design and assembly. When doing service work on a hang glider, please be absolutely sure you know what you are doing; someone's life will depend on it. There are numerous drawings and diagrams in this manual to help you understand the proper assembly of the glider. If you have any questions which you cannot answer after studying the manual, please contact Wills Wing.

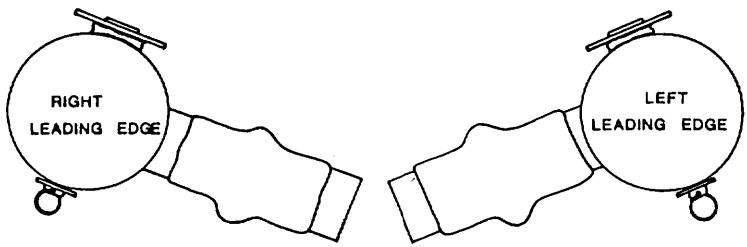
POST SHIPMENT ASSEMBLY

Part of your required service as a Wills Wing dealer is to unpack, assemble, inspect and test fly each glider before you deliver it to the customer. The following instructions cover this pre-delivery procedure.

If the glider has been shipped full length, it requires no assembly other than the normal set up procedure described earlier in the owner section of this manual. Please refer to that section.

If the glider has been broken down for shipment, the rear leading edges will have been removed, and will need to be re-installed.

1) Remove the glider and parts from the shipping tube, unzip the bag, and spread the leading edges slightly. The rear leading edges should be marked to indicate right and left. Remember that with the glider lying on its back, the right leading edge will be on your left, as you look from the tail of the glider. Also notice that each rear leading edge has two 3/16" clevis pins holes in the forward end. This is so each leading edge can be used as either a left or right. It is important that you use the proper clevis pin hole to secure the leading edge in place. When the leading edge is properly installed, the plug in tip sleeve will point up and in, at an angle of **about 11 degrees** from the horizontal. If improperly installed, the sleeve will point either outwards, which would make it impossible to assemble the glider, or in and **down at 11 degrees** from the horizontal, which would **put 11 degrees** of negative twist in the tip and make the glider extremely unsafe to fly. Please note that when the glider is lying on its back (when the zipper on the bag is up) the tip sleeves will point "down" and in when properly installed, since the glider is upside down. The clevis pin should be installed from below the leading edge (from the top with the glider upside down) with the safety ring installed on top of the leading edge.



Installation of Rear Leading Edges

REAR VIEW GLIDER UPSIDE DOWN

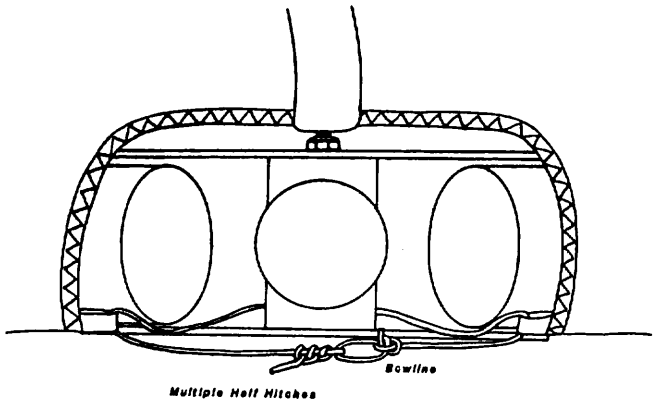
Proper orientation of this clevis pin is shown in the exploded view of the leading edge / crossbar junction in section three of this manual.

2) Once the leading edges are properly installed and secured with the clevis pin and safety, the sail may be mounted to the rear leading edge. Note that the sail is mounted to the bottom of the leading edge (which will be on top if the glider is lying upside down). The diagram of the rear leading edge in section three of this manual shows the proper mounting of the clevis pin, large protective washer, sail anchor webbing, small washer and safety ring. In most cases the sail should be mounted to the middle of the three holes in the sail mount plug. The proper hole in the plug for mounting the sail should be indicated a circle drawn around it in magic marker. It is possible that the sail may not be mounted in the same hole on each side, especially if a shim has been installed on one side for tuning purposes. See the tuning sections on leading edge sail tension and tuning for turn trim for more information on the use of shims and sail mounting adjustments.

Anytime you are mounting or dismounting the sail at the rear leading edge, check the condition of the webbing loop which secures the sail to the clevis pin. If it is worn, have a sailmaker replace it. Also check to see that the sail mount plug is properly aligned and secured with a set screw.

3) When mounting the sail at the rear of the leading edge, you may find it difficult to stretch the sail back far enough to intall the clevis pin. If so, you can dismount the sail at the nose by cutting the string which ties the sail around the nose plate. If you do dismount the sail at the nose, you should remount it immediatley after mounting the rear. Otherwise the sail will slide rearward on the frame at the nose, and when you spread the leading edges during set-up, you will tear the sail. When remounting the sail at the nose, be sure to mount it tight enough so that the string will remain in place when the glider is set up and broken

down again. With the glider set up, the string across the nose will be much looser that with the glider broken down and the leading edges folded in. Therefore, when tying the string with the wings spread, you should make it just slightly slack. When tying the string with the leading edges folded in, you should make it tight. You may not be able to adjust it tight enough if you are tying it off with the leading edges folded in. In this case, readjust the nose string tension after you have the glider set up.



Nose Sail Mounting

SET UP, INPSECTION AND TEST FLIGHT

Following removal of the glider from the tube and installation of the leading edges (if necessary) set up the glider according to the instructions in the owner section of this manual. Before inserting the battens, check them against the pattern and recamber any that may have been altered in shipping.

When installing the battens, check that the batten strings are properly adjusted, and re-adjust any that require it. Proper adjustment of the strings will allow you to pull the string just past, but not more than 1/4" to 3/8" past the end of the batten. If the strings are too loose, particularly on the outboard battens, the sail may flutter at the trailing edge. Batten strings which are attached with a single trailing edge grommet (inboard battens) should be a little looser than the strings which go through two grommets (outboard battens).

Following set-up, perform a complete pre-flight inspection of the glider as described in the owner section of this manual. Make sure to check carefully for proper alignment of the sail mount plugs, and symmetrical tensioning of the sail on the leading edges and symmetrical tensioning of the battens. Refer to the sections in this manual which cover leading edge sail plug adjustment and leading edge sail mount tension adjustment.

During this pre-flight inspection, don't assume that the glider is properly put together just because it came from the factory. At this point in time it becomes your responsibility to make sure that the glider you deliver to your customer is right, in every respect. If you find anything during the inspection that doesn't look right, and if after consulting the appropriate sections of this manual, you can't figure it out, contact Wills Wing.

After you have inspected the glider, the next step is the test flight. You should fly the glider from a familiar site in mellow conditions. During the test flight, perform the following maneuvers:

1)Multiple 360 degree turns at shallow bank angles in both directions. This is the best way to detect a turn in the glider; it will feel mildly roll stable to one side and mildly roll unstable to the other. Properly tuned, the glider will be essentially roll neutral, and will be equally so to both sides.

2)Low speed roll initiation from wings level. This is a test for adverse yaw; the tendency of a glider to resist rolling and yaw in the wrong direction at low speeds. Some degree of adverse yaw may be present at very low speeds, but from trim speed on up, the glider should roll in smoothly with good coordination, and should not require you to pull in on the bar prior to roll initiation.

3)Sustained, pilot full forward dives. The bar pressure in a dive is mild, but should be smooth, progressive and consistent. If it is not, carefully check the bridle settings, the alignment of the sail mount plugs, and the batten camber.

If the glider exhibits any improper flight characteristics, refer to the tuning section of this manual and try to correct the problem. Fly the glider between each adjustment to check on your progress. Do not deliver a glider until it has exibited in flight the proper flying characteristics. Refer to your Wills Wing Dealer Test Pilot's Manual for further information on test flying. If you have a problem you cannot solve, please contact Wills Wing.

The final steps in your glider delivery procedure are to review the set-up, breakdown, and transport procedures, as well as the owner's manual with your customer. Fill out the glider delivery checklist, have your customer initial it, and send it in. Also, please encourage your customer to send in his customer response form.

TUNING

There are a number of things on the glider that are adjustable. We will cover the effects of adjusting each.

BATTENS

The battens will need to be trued to the pattern from time to time. Repeated installation and removal will tend to de-camber the battens. Hard landing and nose-ins may bend the tip battens or induce reflex into the #3, #4 and #5 battens. (Note: Battens are numbered from the tip inboard.) Small variations in batten camber will not have a significant effect on flight characteristics. Excessive camber in the battens will usually make the glider trim faster, have less bar pressure in a dive and be less pitch stable, and be stiffer and slower to roll. Too little camber will reduce the performance of the glider. Battens which are assymetric from left to right will tend to induce a turn in the glider.

The best way to true battens is in the shop on a flat table, using a radiused wooden template. Try to avoid putting sharp kinks in the batten. Unlike structural frame members, battens may be bent and re-bent repeatedly without causing any safety hazard. However, you may find it easier to replace a badly bent batten than to re-true it. When re-shaping a batten the material will tend to spring back after it is bent, so some practice is required to arrive at the proper final bend. We recommend against truing battens to the pattern outside the shop. In the field a bent batten can be trued to it's corresponding batten from the other side. As long as the battens are symmetrical and close to the proper shape, the glider will fly normally. When truing the battens to the pattern, line up each end of the batten underneath the line on the pattern, and check for the deviation along the batten as described on the pattern.

REFLEX SUPPORT BRIDLES

The proper adjustment for the reflex bridles is just slack in normal flight. The dimensions listed on the compliance verification specification sheet in section 1 of this manual give you the normal measurements. However, the "just slack" criterion is the determining factor. This is best determined by flying the glider and sighting the shadow of the bridles on the sail. They should be perceptibly slack, but not more than just slack. Be sure to distinguish between the curved shadow of a straight bridle on the curved surface of the sail, and the shadow of a bridle line which is curved because it is hanging slightly slack. If the bridles are too tight, the handling of the glider will be seriously degraded. If they are too loose, the glider will not have the level of pitch stability for which it was designed and certified, and may not be safe. Loosening the bridles beyond the proper adjustment will not improve either handling or performance.

LEADING EDGE SAIL TENSION

Proper leading edge sail tension is important in determining the performance and flight characteristics of the HP. If the sail is mounted too tightly, the glider will be "stiff;" hard to turn with lots of roll bar pressure, and with a strong tendency to adverse yaw on turn initiation, especially at low speeds. If the sail is too loose, the handling will feel mushy and disconnected, and the glider will not perform as well as it should. The sail will stretch over time, so a new sail which is properly tensioned will eventually become too loose. A good time to consider re-tensioning your sail is after the first 50 hours of air time.

Note: A glider on which the sail is properly mounted will not handle better if the sail is loosened further; it will not get any easier to turn, and the qualitative characteristics will probably deteriorate.

Symmetrical leading edge sail tension is very important on the HP for proper turn trim. This has not been true for previous Wills Wing gliders. An asymmetry of only 1/16" in the leading edge sail tension can put a noticeable turn in an HP. The holes in the sail mount plug are 1/4" apart, and thus by themselves do not provide sufficiently fine adjustment for tuning leading edge sail tension on the HP. (Actually, because they are staggered around the circumference of the tube, the holes are more than 1/4" apart. They are spaced, however, so as to provide 1/4" increments in adjustment of the leading edge sail tension.) The leading edge tension may be increased by moving the sail mount clevis pin to a hole farther aft in the sail plug, or by removing the sail plug from the leading edge, installing a shim over the inner sleeve portion of the plug and then re-installing the sail mount plug. The shim will then space out the plug by the width of the shim, and increase the sail mount tension by that amount.

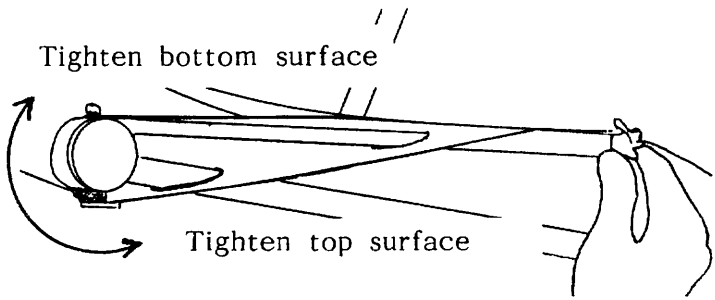
NOTE: Whenever you are changing sail mounting tension, be sure to properly align the sail mount plug with respect to the rotation or twist of the plug, and be sure to properly secure it against rotation. See the following section on Sail Mount Plug Alignment for intructions on this adjustment.

An HP with a sail mounted assymetrically on the leading edges will normally have a turn towards the looser wing. That is, if the left wing is mounted farther forward on the leading edge (looser) the glider will probably have a left turn. It is sometimes difficult to see whether or not the sail is mounted symmetrically. We recommend that you take three measurements: The distance that the hem at the nose rides underneath the noseplate, the distance from the end of the leading edge tube to the V cut at the front of the sail at the tip, and the distance from the washout tube to the corner of the reinforcing patch on the sail. If you find an assymetry and the glider has a turn, correct

the assymetry and see if the turn goes away. The last analysis is in the flight characteristics of the glider; if the glider flies properly, it is tuned properly.
Resist the temptation to draw conclusions about the tuning, the sail tension or the symmetry of the glider based on how high the sail flies above the washout tips. Very small variations in manufacturing tolerances can cause the height of the ends of the washout tips to vary from one glider to another, and from side to side on one glider. It is just as likely that a difference you observe in the height of the sail from the tips in flight will be due to variations in the frame as it is that it will be due to variations in the effective "twist" or angle of attack at which the sail at the tip is flying.
Remember that anytime you change the adjustment of the leading edge sail mount tension you will have to readjust the number one batten strings.

SAIL MOUNT PLUG ALIGNMENT

The leading edge sail mount plug can be rotated to achieve proper tensioning of the top and bottom surfaces of the sail at the tip. This adjustment is not particularly effective in adjusting turn trim, and should not generally be used for that purpose. The proper rotational alignment of the plug is achieved when, with the number one batten supported about one half inch above the washout tube, the top surface and bottom surface of the sail at the tip are equally tensioned.



The plug is secured in position with a set screw which goes through a hole in the leading edge and into a slot in the inner sleeve of the sail mount plug. Make sure that this screw is in place after making any adjustments. If you need to install a shim to adjust the leading edge tension, the hole in the leading edge will no longer line up with the slot in the plug. In this case, drill another hole through the leading edge and into the plug with the plug set at the proper alignment, and install the screw to secure the plug.

HANG LOOP POSITION ADJUSTMENT

The position in which the hang loop is mounted will affect the speed at which the glider tends to fly when control pressures are relaxed. Moving the loop forward on the keel will make the glider trim at a faster speed, while moving it back will lower the trim speed. When the glider is trimmed faster there will be more bar pressure pushing out required to fly at low airspeeds below trim, and less bar pressure required pulling in to fly at speeds faster than trim. Mounting the hang loop too far back will tend to "stiffen" the handling and make the glider harder to turn, primarilly because the pilot will tend to fly the glider where it is trimmed, and the glider responds more slowly to turn initiation when it is flying slowly. When adjusting the trim speed of an HP, keep in mind that the glider is designed to operate at a higher airspeed than many gliders. You can fly it slowly, and you can trim it to fly slowly, but if you fly it too slowly you wil not obtain the best performance or handling from the glider. Unlike many gliders, minimum sink rate on the HP is NOT obtained at the slowest controllable airspeed, because the HP remains controllable at speeds well below that at which the wing first begins to stall.

Earlier HP's came with only one hole in the keel for mounting the hang loop. A second hole may be drilled on such gliders if desired. Newer HP's come with a second hole located one inch aft of the normal hang loop mounting hole. In no case should the hang loop on an HP be mounted farther aft than 57.5" aft of the forward most bolt on the nose plate, nor farther forward than 54.5" aft of the forward most bolt on the noseplate.

SAIL REMOVAL PROCEDURE:

Read ALL of these instructions before starting.

You'll need an unobstucted area six by thirty feet long. Make sure the surface is clean. If it is abrasive, like rough concrete, you should either put down a protective tarp or be extremely careful not to scrape your sail.

1) Lay the glider on its back, unzip and remove the bag and the battens.

2) Cut or untie the string sail mount at the nose then spread the wings slightly and remove the clevis pins securing the sail in the rear. Reinstall the pins in the same holes to remind you of their correct position when assembling the glider.

3) Unbolt the bottom side wires from the control bar. Detach the control bar E bracket from the U channel at the keel. Replace the control bar clevis pin and safety in the U channel. Remove the bottom front to rear wires at the rear keel. Reinstall the keyhole tang bolt through the bottom rear wire tang with the washers in the same relative position as they were on the keel and put the locknut back on finger tight. The position of the washers relative to the tang and the keel affects the front to rear wire tension.

4) Turn the glider over. Unroll the sail until you can reach the bridle attachments at the trailing edge. Detach the bridles by removing the key rings. Remove the screw that holds the kingpost top in place and the screw that secures the kingpost endcap. Remove the kingpost top, then pop the endcap out by tapping a phillips head screwdriver through the hole in the bottom of the cap. This procedure will also release the small white plastic rivet that keeps the top wires in place, inside the cap. Remove the top wires from the cap. Remove the kingpost from the glider and coil the bridle cables.

5) Remove the kingpost base from the keel. It is important to use the proper Phillips head screwdriver on the bolt securing the kingpost base; if you don't, you might strip the head. You need not remove the hang loop. Remove the machine screw anchoring the keel pocket to the keel.

6) Slide the sail off the frame by pulling the frame out the nose of the glider. When you get a foot or two out, you'll have to feed the hang loop out of the front of the keel pocket. Continue sliding the sail off. If you encounter resistance, check to make sure the sail isn't catching on any of the frame hardware; especially the crossbar/ wing junction, the crossbar center junction, the keel pocket, the cables and the washout tip studs. The nose of the sail is very tight as it goes over the crossbar center. Make sure the wings aren't spread too far,and gently work it over the junction.

7) If you need to send your sail in for service, you should remove the mylar. It usually slides out the front of the pocket without binding. If you encounter resistance, it is probably because one edge has wedged close against a seam and is stuck on the seamstick. Gently work the mylar away from the seam until it is free.

ASSEMBLY PROCEDURE:

1) Install the mylar. The easiest procedure is to feed a string through the pocket tied to a bottom surface batten, then have someone help feed the mylar in at the nose while you pull from the rear. Don't pull the mylar too far back in the pocket. Check to make sure that the hole in the mylar is aligned with the top sidewire hole in the sail.

2) Position the sail on the floor with the keel pocket up and the wings folded back over to the rear so that the mylar pockets are exposed and laying flat, next to the side of the keel pocket.

3) Make sure that the side wires are pulled forward from the crossbar/ leading edge junction and aren't wrapped around the frame. Wrap some padding around the washout tip studs to protect the sail.

4) Start sliding the frame into the nose of the glider. When the frame is about three feet in, you'll have to spread the sail a little to make sure that the rear leading edges are routed properly and don't get caught near the rear of the bottom surface at the root. Continue feeding the sail in while periodically checking to make sure none of the hardware is snagging the sail. When the frame is about eight feet into the sail, feed the keel into the keel pocket. When you get to the crossbar center junction, the nose of the sail will be very tight. Gently work it over the crossbar plates and continue.

5) When the frame is installed, mount the rear with the clevis pins. At the nose, tie the sail forward, around the nose plate, with a piece of leech line.

6) The most difficult part of the assembly is fishing the wires though the sail. There are two ways to get them through:

a) Whe you are taking the glider apart, before the wires are pulled through the sail, tie a long piece of line to each of the top and bottom side wires. Untie the lines after the frame is removed leaving the lines running through the side wire holes in the sail. Before you feed the frame back into the sail, retie the lines to the cables. When the frame is installed, pull the cables back through the holes.

b) If you have to remove the mylar from the sail, the strings can't stay in the sail to guide the wires. You can either fish the strings back through before you put the frame in or construct a tool to fish the wires out through the sail holes with the frame installed. The best tool is a No. "0" grommet riveted onto a 18" long piece of 3/8" aluminum tubing. A long piece of coat hanger with a hook bent on the end would probably work fine.

When you are pulling the wires through the sail, be careful not to pull too hard. It is possible to kink the cable or tear the sail.

7) After the cables are pulled out, bolt the bottom flying wires to the keel. Bolt the side wires through the front to rear wire tang and to the control bar. Check to make sure that the trapezoidal tang is installed properly with the wide end nearest the top of the control bar. Attach the control bar to the keel. Attach the front wires to the nose plate. Flip the glider up onto the control bar.

7) Install the kingpost base.

8) Push the top front wire through the sail. Assemble the top wires in the kingpost cap. Install the white plastic rivet in the cap oriented such that the ears grap the side of the hole and hold the wires in place. Install the kingpost endcap and the kingpost cap into the kingpost. Put the screws in.

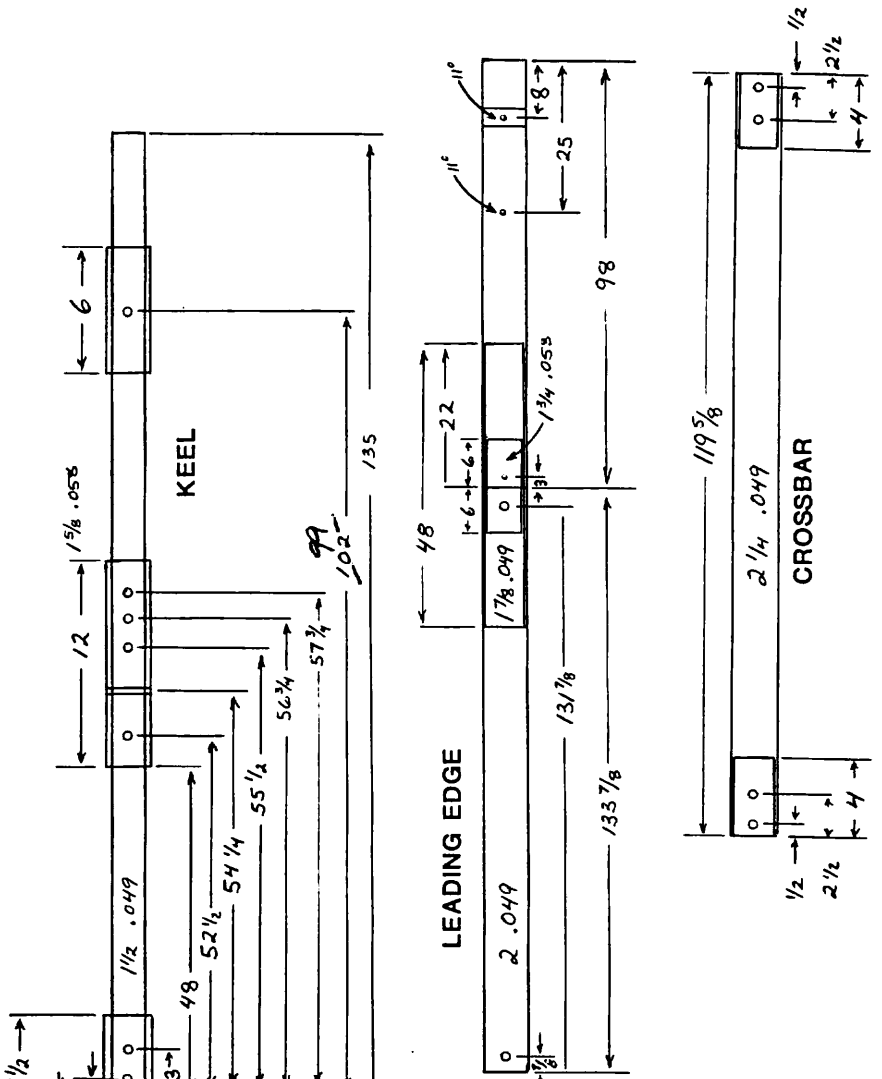
9) Spread the wings slowly, checking frequently to make sure that the sail doesn't bind of catch any of the hardware at the noseplate. Put the kingpost on the base, attach the top rear wire and attach the bridles to the sail.

10) Pull the keel pocket anchor webbing back with a piece of leach line tied around the rear wire bolt, then install the anchor screw.

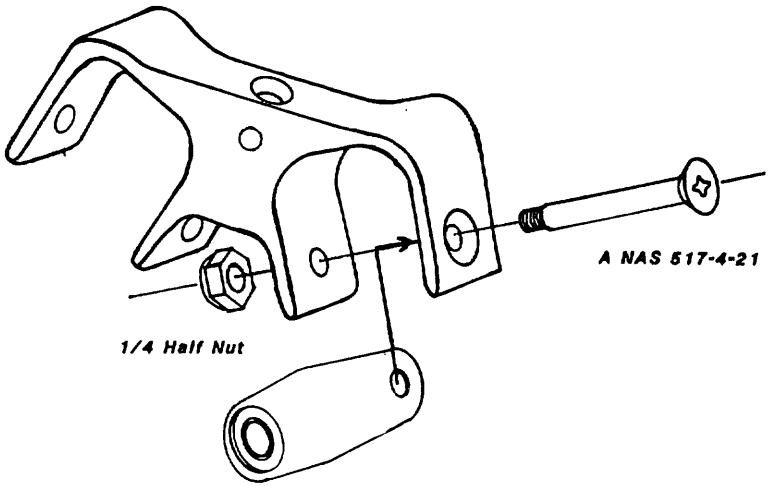
11) Finish assembly and preflight of the glider using normal procedure.

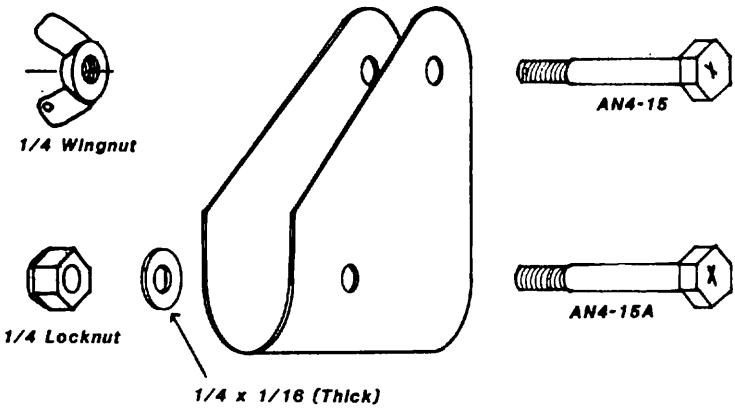
12) Retie the leech line sail anchor at the nose so it is just slightly slack.

HP 170 FRAME PLANS

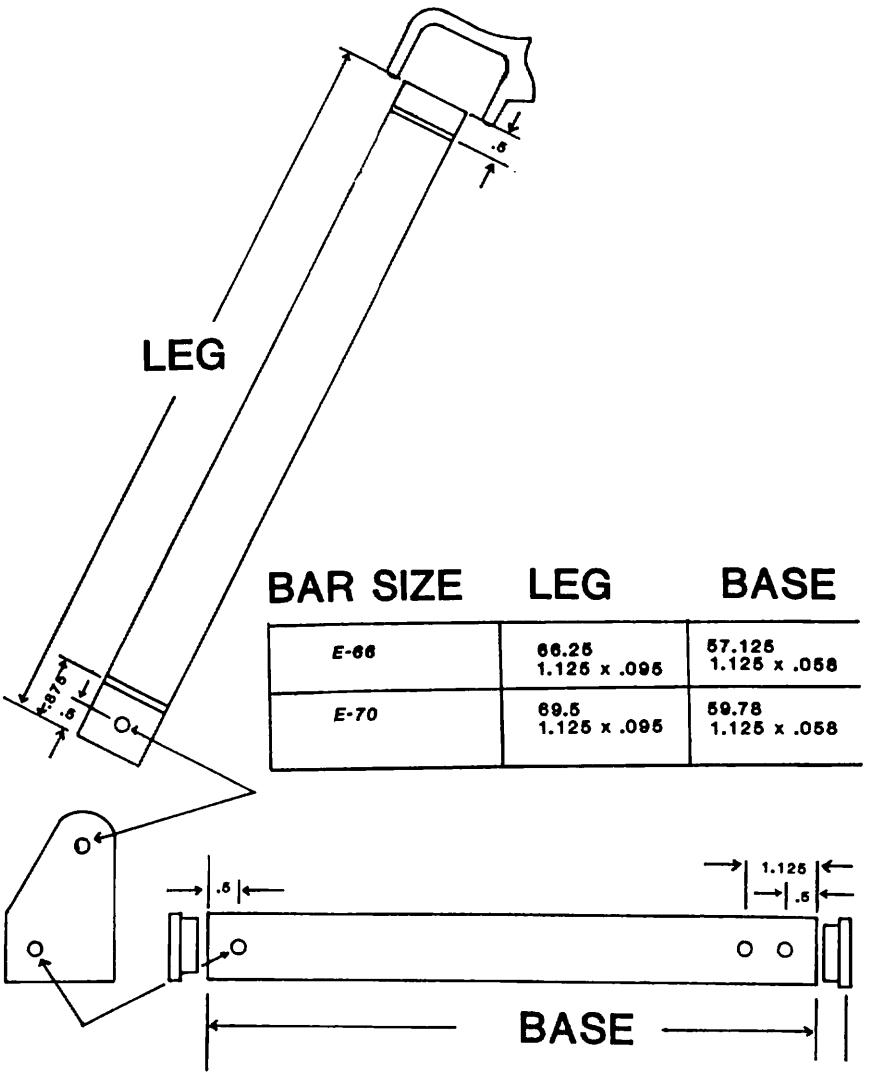


CONTROL BAR

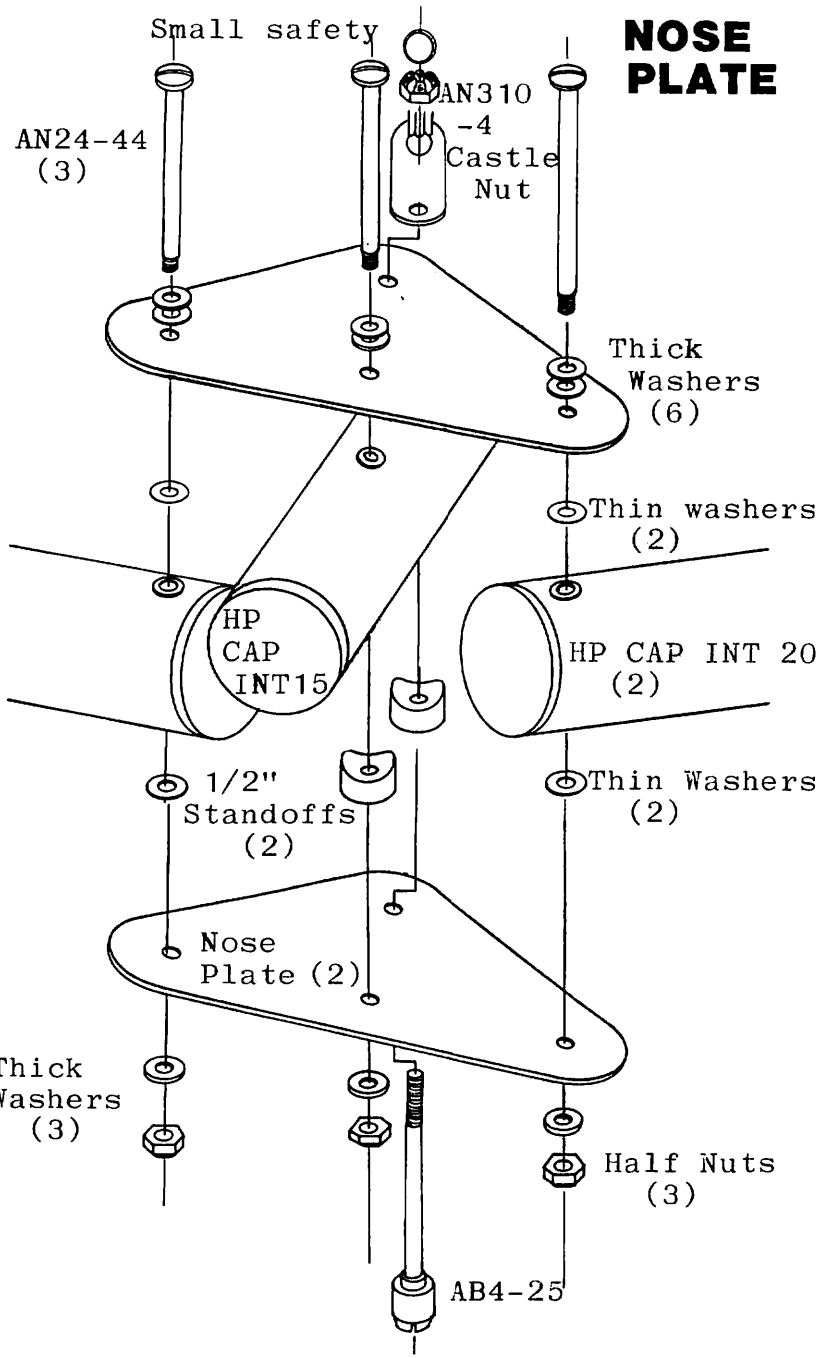

A NAS 517-4-21
1/4 Half Nut

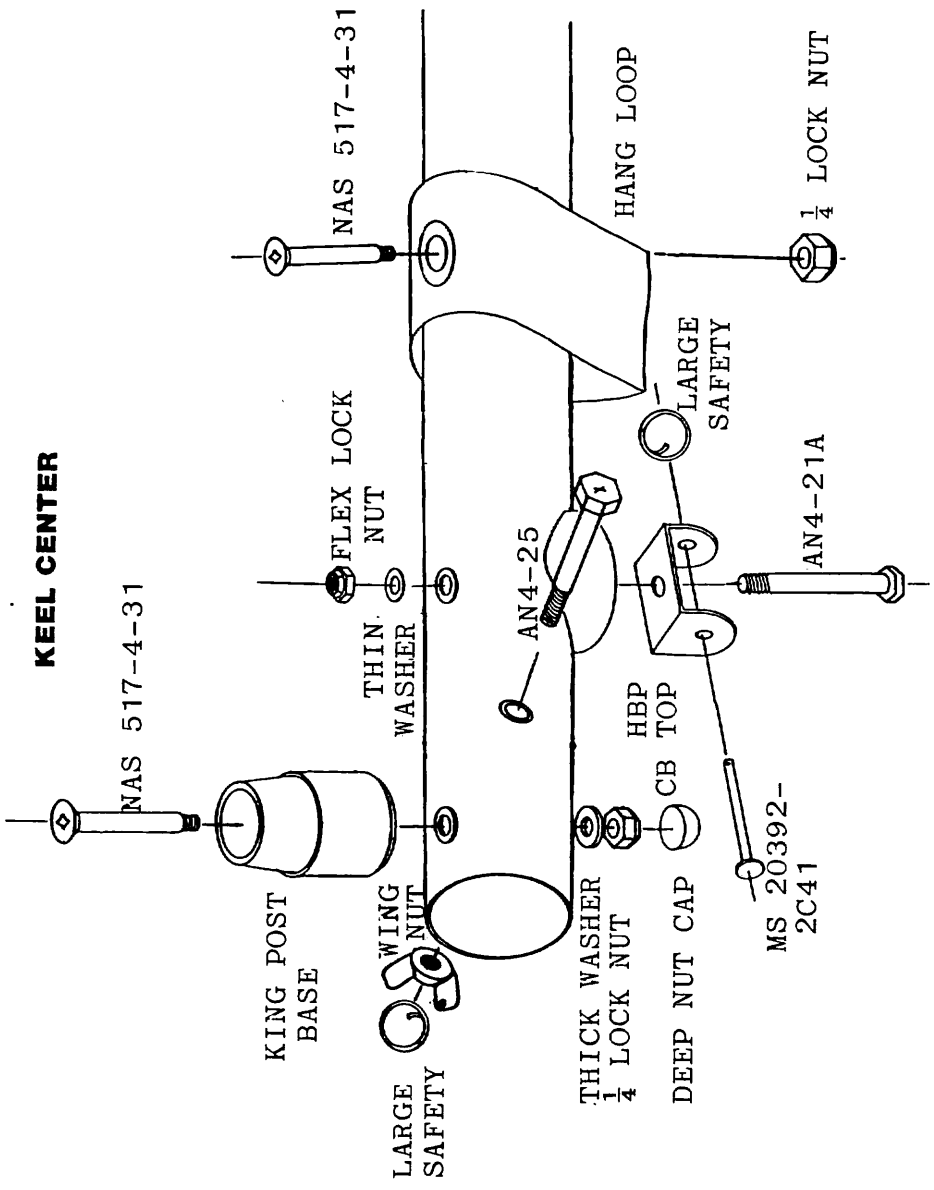

1/4 Wingnut
AN4-15
1/4 Locknut
AN4-15A
1/4 x 1/16 (Thick)

CONTROL BARS

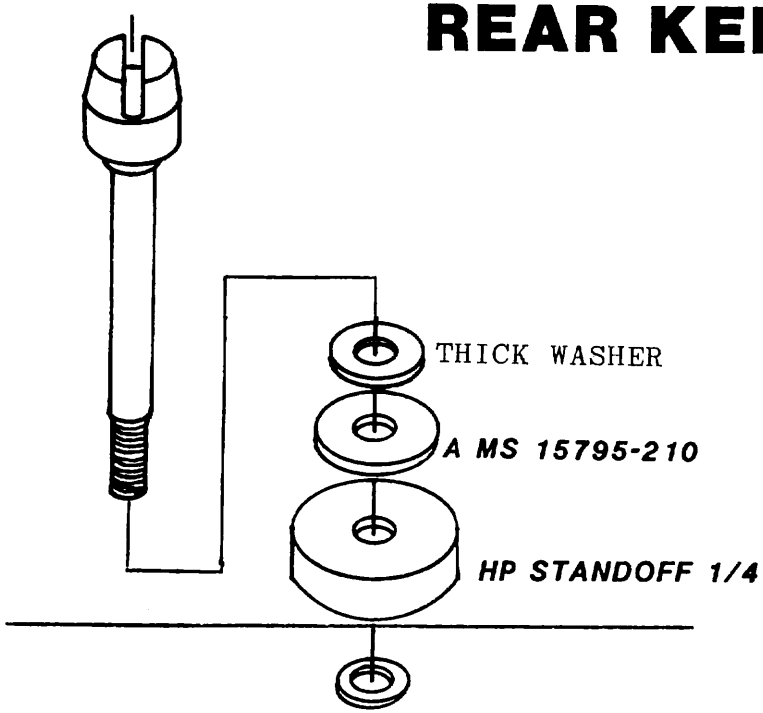


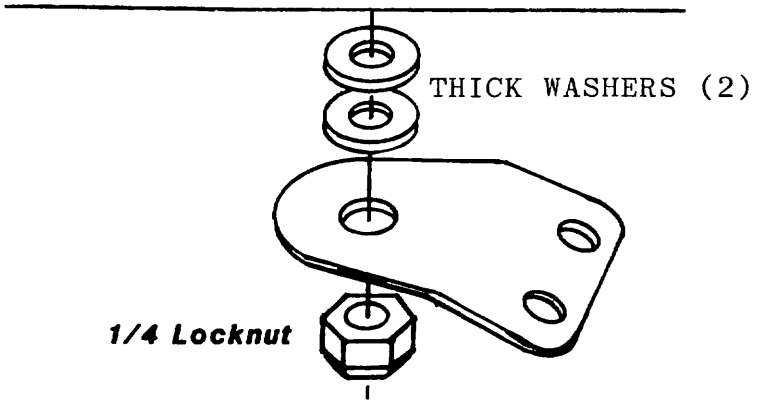
BAR SIZE	LEG	BASE
E-66	66.25 1.125 x .095	57.125 1.125 x .058
E-70	69.5 1.125 x .095	59.78 1.125 x .058


NOSE PLATE
Small safety
AN310 -4 Castle Nut
AN24-44 (3)
Thick Washers (6)
Thin washers (2)
HP CAP INT15
HP CAP INT 20 (2)
1/2" Standoffs (2)
Thin Washers (2)
Nose Plate (2)
Thick Washers (3)
Half Nuts (3)
AB4-25

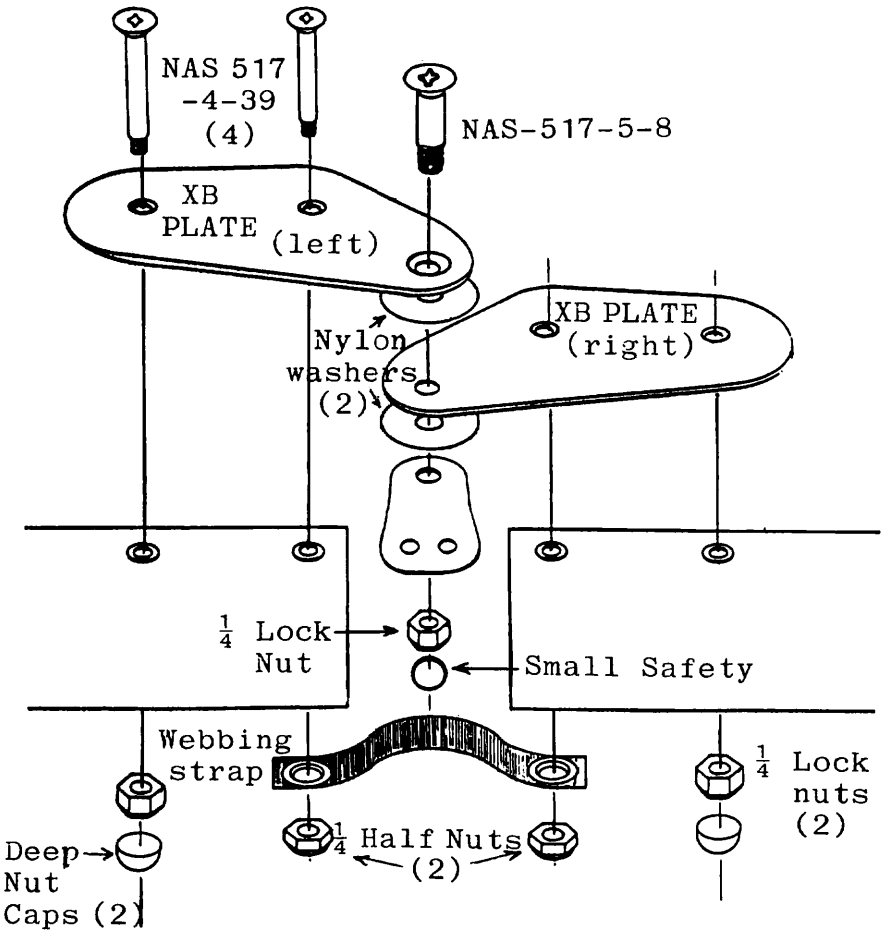

KEEL CENTER
NAS 517-4-31
NAS 517-4-31
FLEX LOCK NUT
THIN WASHER
AN4-25
HANG LOOP
1/4 LOCK NUT
LARGE SAFETY
AN4-21A
KING POST BASE
WING NUT
LARGE SAFETY
THICK WASHER
1/4 LOCK NUT
HBP TOP
CB TOP
DEEP NUT CAP
MS 20392-2C41

REAR KEEL

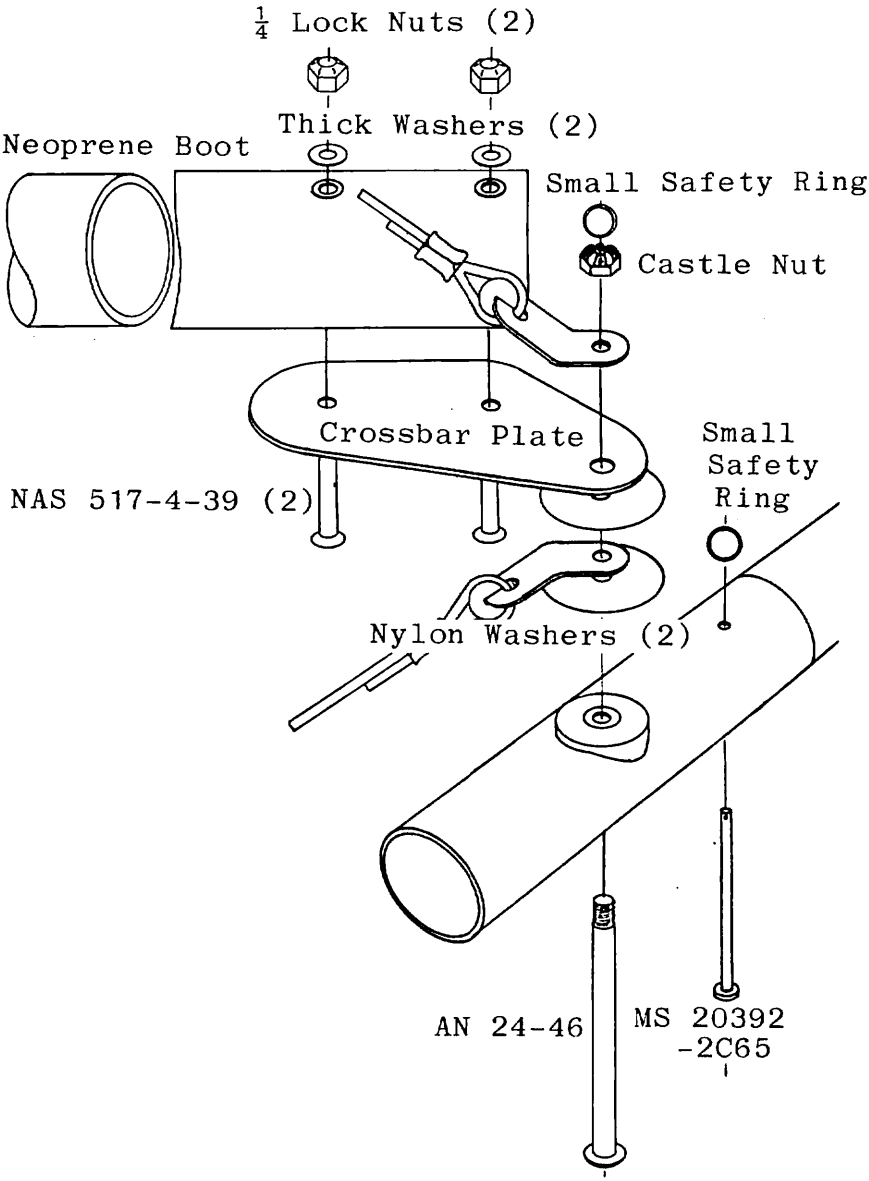

THICK WASHER
A MS 15795-210
HP STANDOFF 1/4

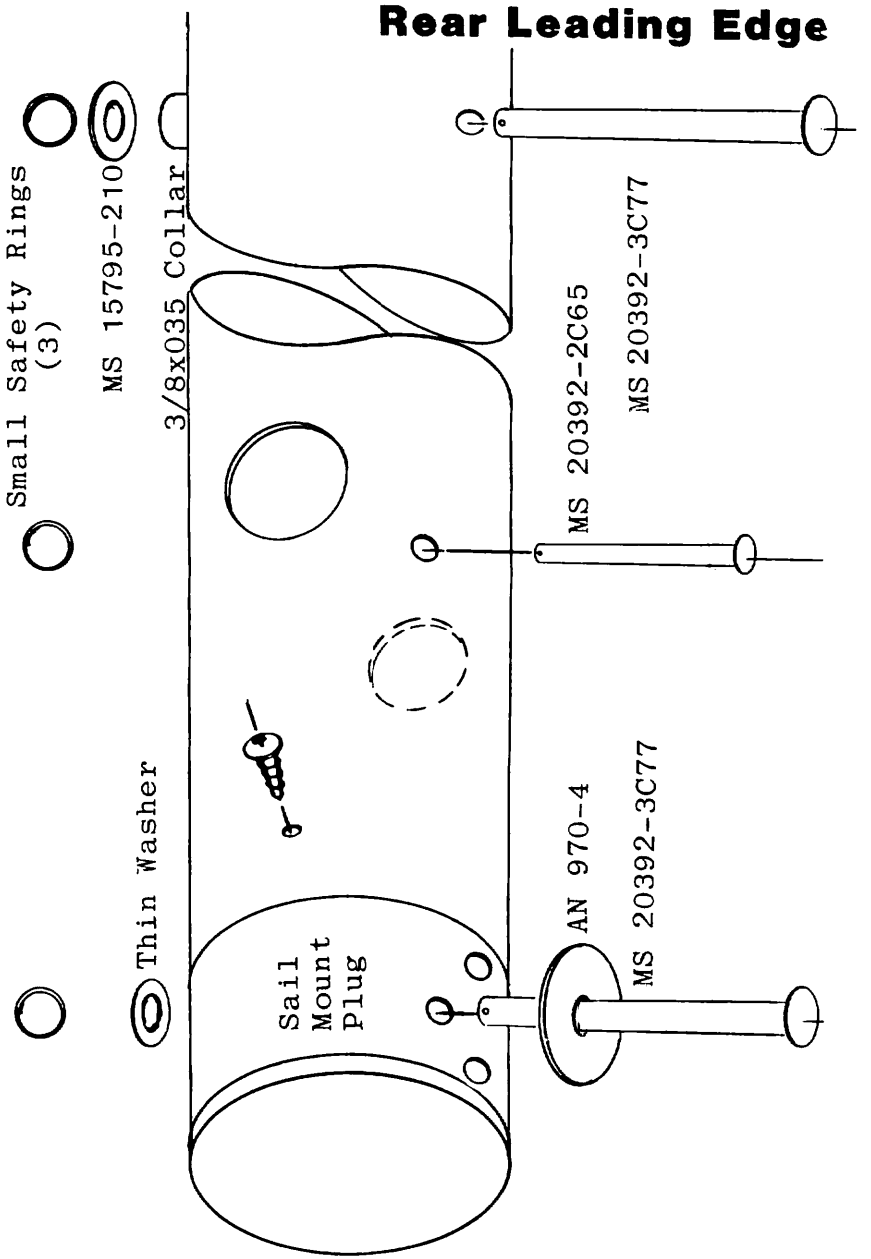

THICK WASHERS (2)
1/4 Locknut

XBAR CENTER

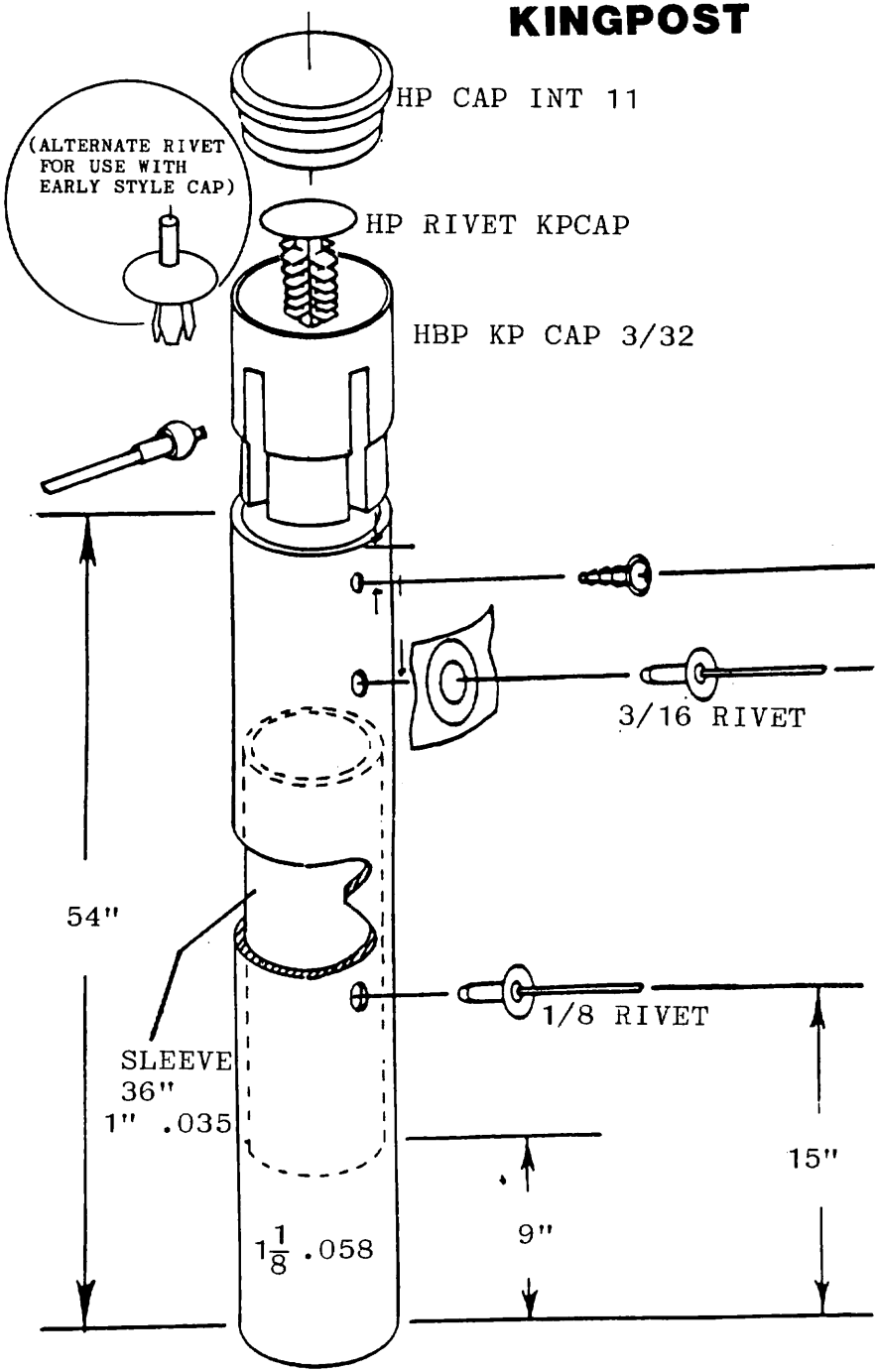

NAS 517
-4-39
(4)
NAS-517-5-8
XB
PLATE (left)
XB PLATE
(right)
Nylon
washers
(2)
¼ Lock
Nut
Small Safety
Webbing
strap
¼ Lock
nuts
(2)
¼ Half Nuts
(2)
Deep
Nut
Caps (2)

XBAR/LEADING EDGE

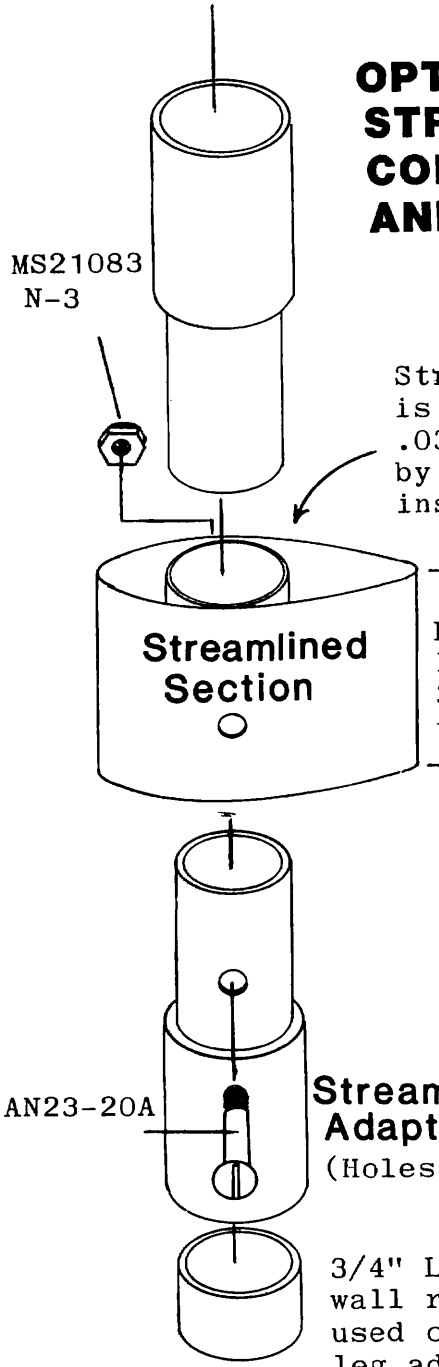



Rear Leading Edge
Small Safety Rings (3)
MS 15795-210
3/8x035 Collar
MS 20392-2C65
MS 20392-3C77
Thin Washer
Sail Mount Plug
AN 970-4
MS 20392-3C77

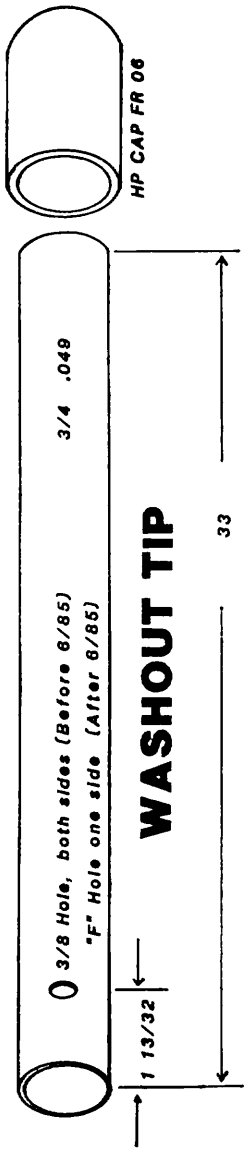
KINGPOST

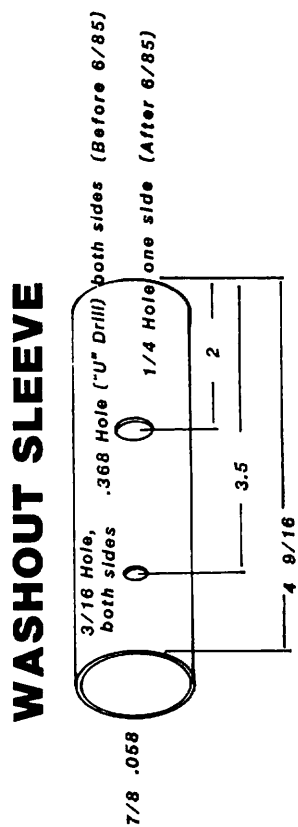

HP CAP INT 11
(ALTERNATE RIVET FOR USE WITH EARLY STYLE CAP)
HP RIVET KPCAP
HBP KP CAP 3/32
3/16 RIVET
54"
1/8 RIVET
SLEEVE
36"
1" .035
15"
9"
1 1/8 .058

OPTIONAL STREAMLINED CONTROL BAR AND KINGPOST

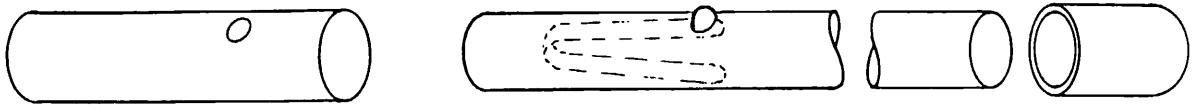


WASHOUT TIP

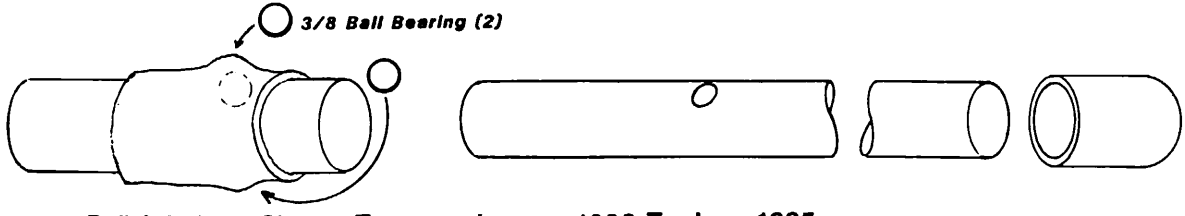

HP CAP FR 06
3/8 Hole, both sides (Before 6/85)
"F" Hole one side (After 6/85)
3/4 .049
WASHOUT TIP
33
1 13/32


WASHOUT SLEEVE
3/16 Hole, both sides
.368 Hole ("U" Drill) both sides (Before 6/85)
1/4 Hole one side (After 6/85)
7/8 .058
2
3.5
4 9/16

Washout Sleeves & Tips



Button Spring Type June 1985 & After



Ball & Rubber Sleeve Type January 1982 To June 1985

WASHOUT TIP