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# North Wing FREEDOM 150-190 Wing Manual

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## 1. Introduction

Congratulations on your purchase of a North Wing glider. It's had been our goal to produce the finest gliders using the most current information and design available for the type of glider and use. We have also made it our goal to serve you with all your flying needs, now and many years into the future. Since 1996 we have been designing and producing gliders/wings for both foot launch and powered launch. The hang glider you have purchased is not designed for powered launch or flight. Some powered harnesses may be able to be used on our hang gliders.

Hang gliders are not a registered flying vehicle; there is no requirement to do so with any state or country. As a result, unless you register your glider with us at our web site we will have no list of owners that are flying our equipment and no good way of contacting you directly for service or safety issues. It is also your responsibility to check with your dealer or check our web site periodically for any technical and service bulletins and information pertaining to your glider.

Thank you for choosing to fly a North Wing product. We hope you will be pleased with the product and service you receive from us. Please let us know that you are satisfied with your new glider and write us with a story of good times that you have had with our product. In like, if there is anything that you are not pleased with contact us first and let us take care of any issues with you directly. If then we need to inform other North Wing owners we will do so.

Thank you for joining the growing number of North Wing pilots, and we wish you years of enjoyable and safe flying.

## 2. Disclaimer and Warning

The Federal Aviation Administration does not require a pilot's license to operate a hang glider. Hang gliders and hang gliding equipment are not designed, manufactured, tested or certified to any state or federal government airworthiness standards or requirements. Federal Aviation Regulation Part 103 states in part, "ultralight vehicles are not required meet the airworthiness certification standards specified for aircraft or to have certificates of airworthiness" and "operators of ultralight vehicles are not required to meet any aeronautical knowledge, age, or experience requirements to operate those vehicles or to have airman or medical certificates

The safety of this or any hang glider ultimately rests with you, because hang gliding is an inherently dangerous sport and can induce injury or death even to good pilots flying safe equipment. Because the responsibility of flying and maintaining the glider rests entirely with you, the risks of damage or injury you may cause to others and to yourself also rests entirely with you. We believe that in order to safely practice the sport of hang gliding you need to exercise good pilot skill and knowledge of airmanship and weather. You must also accept this responsibility that hang gliding is dangerous, fly conservatively, and avail yourself of all safety equipment appropriate to the conditions in which you fly.

No glider is totally safe. It is entirely possible to push any hang glider beyond its designed tolerances. This could result in a structural failure, very strong flying conditions may also cause structural failure if flown outside the gliders limits. Aerobatic maneuvers, pitch angles beyond 30° up or down, bank angles exceeding 60°, aggressive stalls, and spins are maneuvers that should never be attempted under any circumstances. We hope to provide you with many hours of enjoyable flying. If you ever need any spare parts or advice do not

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hesitate to contact your nearest North Wing dealer, If they are not available, contact us directly.

North Wing hang gliding and trike products are not covered by product liability insurance.  
From all of us at North Wing: fly smart and fly safe.

### **3. About This Manual**

Most everything the pilot needs to know about the **FREEDOM** from North Wing is contained within this manual. It is recommended that you thoroughly familiarize yourself with the entire manual before you use your new wing for the first time.

It is very important that you become familiar with the set-up procedure for the FREEDOM, or it is possible to damage it. It is best to have a dealer show you how to set up your new wing. Please take the time to look through the appropriate set-up sections before attempting assembly.

Most importantly, you are reminded that this manual is not intended as an instructional device on how to fly our product. Rather, as the purchaser of this product, in the spirit of our self-regulated sport, you are responsible for bringing with you the expertise required to safely operate this vehicle. By purchasing or operating this product, you assume complete liability for its safe operation. North Wing offers this owner's manual simply to assist you with the features particular to this model of hang glider regarding it's unique assembly, flying characteristics, care and maintenance, and technical specifications.

For those looking to advance or refine their particular flying skills, consult the fine line of instructional books dedicated to ultralight weight shift aircraft skill-building written by Dennis Pagen and other authors, also seek out professional instruction. Books do not replace professional instruction, the factory can recommend any number of professional flight training centers.

Please practice safe aviation!

### **4. About the FREEDOM Hang glider**

Congratulations on the purchase of your new North Wing FREEDOM. We believe it to be the finest available high performance recreational flex wing in the market today.

The FREEDOM is a intermediate to advanced hang glider. If you are moving up to a new glider in the sport of hang gliding you should have a minimum of 30 hrs of flight experience in a hang glider along with an instructor's approval before flying the FREEDOM.

The FREEDOM achieves exceptional low speed performance and superb handling for many reasons. It's sail body and cut are composed of a carefully selected and applied and industry proven design of the latest materials that is matched to the leading edge curve. The sail features a leading edge pocket reinforced with a mylar insert sheet. Drag is reduced and performance is increased with a highly refined sail, streamlined tubing, clean hardware and low twist. These features combine to ensure a good usable flight performance and stability.

**FREEDOM SPECIFICATIONS**

	<b>150</b>	<b>170</b>	<b>190</b>
SPAN	30.5	32.6'	34.3'
NOSE ANGLE	125 Deg.	125 Deg.	125
ASPECT RATIO	6.0	6.15	6.3
SAIL AREA	152 Sq/ft	171 Sq/ft	192 Sq/ft
# OF RIBS TOP	13	15	15

**5. Design Information and Placarded Operating Limitations**

Placards bearing test flight information and operating limits are located on the Gliders' left cross-tubes.

We believe the Freedom to be the finest available recreational flex-wing glider on the market today. It achieves an exceptional performance and very good handling for many reasons. Our gliders have a sail cut that is carefully matched to the leading edge bend, floating cross-tube, mylar reinforced leading edge pocket. These features combine to ensure a good usable glide angle, an excellent sink rate and a broad speed range making the FREEDOM both an excellent intermediate soaring wing and a reliable cross country glider.

Like any hang glider, the FREEDOM has been manufactured and tuned to close tolerances and it's performance and safety depend on you maintaining those tolerances. We require that you read this owner's manual thoroughly and follow instructions to the letter when you set up the glider, fly it, break it down for storage or shipping, or perform repairs or maintenance on it. Failure to do so will compromise the safety of your glider.

**This glider must not:**

- a) be flown by more than one person at a time.
- d) be flown inverted or backwards.
- e) be flown with auxiliary power unless designed, installed and tested by the factory.
- f) be towed (unless the towing technique is a proven operation and done with professional instruction).

**Special care should be taken to note the operating limitations, which are clearly stated on the flight operation placard as follows:**

**FLIGHT OPERATIONS** should be limited to non-aerobatic maneuvers--those in which the pitch angle will not exceed:

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- a) 30 degrees nose up to the horizon
- b) 30 degrees nose down to the horizon
- c) Bank angle will not exceed 60 degrees.

**WARNING** -- The owner and operator must understand that, due to the inherent risk involved in flying such a unique vehicle, no warranty is made or implied of any kind against accidents, bodily injury, or death. Operations such as aerobatic maneuvers or erratic pilot technique may ultimately produce equipment failure and are specifically excluded from the warranty. (Reference workmanship warranty described in Section 10 of this manual.)

### Wing loading for Freedom (hook in weight)

	150	170	F190
Usable weight range	130-210 lbs.	160-240 lbs	200-285
Optimal weight range	150-190 lbs.	180-230	220-275
Maximum stall speed	24 mph		
Minimum top speed	41 mph		
VNE (Never exceed)	47 mph		
Recommended USHGA rating		II - V	

### GLIDER TESTING

The FREEDOM glider has undergone extensive testing and has satisfied the standards of the designers and North Wing Inc. as an ultra light glider. The FREEDOM has not been tested to any state or federal airworthiness specification.

A combination of stainless steel trailing edge reflex lines along with airframe geometry provide the most effective positive pitching system known to date. Careful test vehicle pitch experimentation was necessary to determine trailing edge line lengths. Altering those overall dimensions, even to the slightest degree, will decrease your glider's performance, or more importantly, its pitch stability.

You can verify the tested configuration of your FREEDOM by using the compliance verification sheet (Section 7 of this manual).

#### Ultimate Load test- performed at:

Positive (nose up) angle at the speed of	58 mph @ 35 deg
Negative (nose down) angle at the speed of	41 mph @ -30 deg
Negative (tail down) angle at the speed of	29 mph @ -150 deg)

#### Pitch stability test- performed at:

- 20 mph through the pitch range of +35 degs down to -25 degs.
- 32 mph through the pitch range of +25 degs down to -15 degs.
- 47 mph through the pitch range of +10 degs down to -5 degs.

#### Description of stability system on the Freedom

The Freedom uses aerodynamic wing design and physical hardware components that when

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combined give the Freedom positive pitch stability. These are:

- a. The combination of sweep, wing taper and span-wise twist are in the design and for the most part cannot be changed.
- b. The shape of the rib camber and reflex (rebend) put into the root ribs.
- d. Tip wand angle setting
- d. Trailing edge Luff Lines (reflex bridles)

NOTE: Proper reflex bridle height are critical for stability at low angles of attack.

The vehicle test described above has proved the stability system for the Freedom to very effective.

### Results:

3 reflex bridle line per side- length is set and cannot and should not be altered.

The first 3 we have fine-tuned into the Freedom for the best flight characteristics and performance. The glider will not be airworthy with only the first four features. The Freedom must have luff-lines to be pitch positive at the critical low angles of attack. Proper reflex luff-lines on the Freedom is highly important and is directly related to stability and airworthiness.

## 6. Re-Assembly From Shipping Crate

***PICTURES MAY OR MAY NOT BE OF YOUR EXACT MODLE OF WING BUT ARE FOR REPRESENTATION AND PRECEDURE ONLY.***

Carefully undo the crate packing so as not to damage the wing inside. ie: Do not cut into the box.

With the wing out of the box find the Base tube, ribs and rear LE's. Separate the left and right rear LEs. (Leading Edge). Green is right and red is left. With the wing on it's back slide the rear sections into the sail from the tip.



Slide the rear section into the sail. The rear section will now slid into the center section and the locating slots will locate over the pin. Make sure the LE click into place.



Attach the black webbing strap to the bottom of the LE at the tip. Install the ¼ clevis pin from the bottom through the webbing grommet into the LE. The pin will go through the small tube inside the LE also. Install safety ring on top.



Install the base tube on the right side (VG side if you have a VG glider) of the control frame. You are now ready to set up your glider. If you have the Fast foil control frame you will put both sides of the Base tube on as you set up.





## SECTION 5: SET-UP AND FOLD DOWN PROCEDURES

**PICTURES MAY OR MAY NOT BE OF YOUR EXACT MODLE OF WING BUT ARE FOR REPRESENTATION AND PRECEDURE ONLY.**

Your **North Wing** hang glider has unique components that were designed to set-up in the simplest, most efficient manner.

The instructions given below provide you with the step-by-step procedure for setting up your glider. By closely following these instructions, you can assure yourself a smooth, quick set-up.

Your North Wing hang glider should always be stored **zipper down** especially during transportation.

The **Freedom** is set up with the control bar set into position at the beginning of the procedure, and it allows the glider to be set up off the ground. This is acceptable in lower wind conditions, and it is effective in keeping the sail clean.

The best value that this chapter can provide the owner is to share some techniques and procedures that other people using the FREEDOM have discovered; things that will minimize wear or even prevent needless damage from occurring. Use this information to extend the life of your wing.

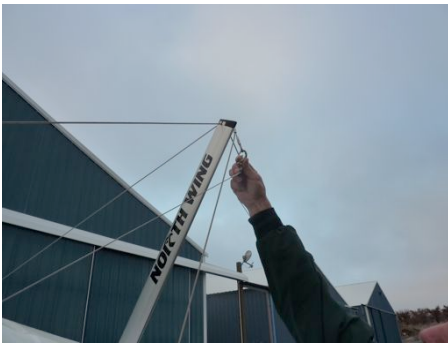
1. ASSEMBLE THE CONTROL FRAME Place the glider on the ground with the nose into the wind or nose pointing 120 degrees to the wind (if the wind is over 5 MPH) and with the zipper facing upward. Remove the ribs from their bag, unzip the cover bag, undo the glider ties and assemble the control frame base tube. NOTE: Check that all the rigging is on the outside of the control frame and check that the bolt, wing nut and safety rings are fully assembled. FIG.1&2



2. ROLL THE WING OVER stand wing on the control frame. Check to make sure the lower side wire cable thimbles have not turned 180 degs and will get kinked if tensioned. (do not attach the lower front wires at this time)



3. REMOVE BAG. SPREAD WINGS carefully walk each wing out to 3/4 of it's own approximate flying position. Leave enough slack in the sail so that during the next step the ribs may slide in with minimal resistance. Set wing cross to the wind to prevent the glider from blowing over.
4. ROTATE KINGPOST UP into position and hook up reflex bridles (luff lines).

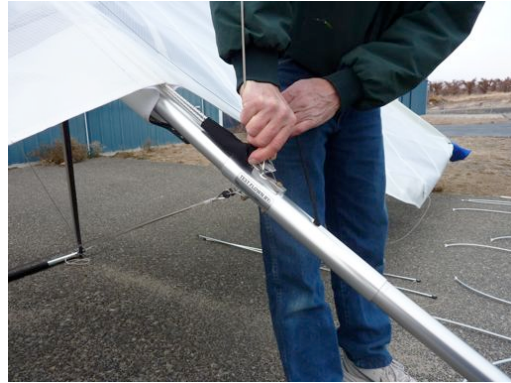


5. SEPARATE WHITE AND BLACK RIBS, white on right black on left. Insert the battens from root to tip with gentle pressure (**do not force the rib to go in**) if the batten meets resistance, lift the sail at trailing edge and gently shake the sail up and down in order to billow it. At the same time push the rib forwards. This enables the rib to go over the cross bar and L.E. tubes. You don't have to tension the ribs with the flip tips at this time. Install all ribs but the last three at the tip and the tip wand.



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6. FIND THE CROSS TUBE TENSION cable retrieve line and pull it through the keel pocket till you can get the black webbing handle. Pull the shackle back and latch into the spring catch.



7. HOOK THE REAR TOP WIRE triangle ring into the same spring catch. **ENSURE THAT THE SPRING IS PROPERLY SEATED so it is pushing up on the top of the latch.**

8. INSTALL THE TIP WAND by opening up the Velcro at tip, slip fiberglass wand into the tip receptor at end of LE tube. Make sure tip wand bottoms out on pin (apx. 4" in). Now hook tip lever socket over end of tip wand and over center lever.



9. INSTALL THE LAST THREE CURVED ribs and secures all the flip tip tension levers at this time.



10. INSTALL THE NOSE BATTENS (tail end first) from the nose of the glider, now seat the front end of the rib on the standoffs just in front of the nose plate. Nose ribs can stay in the glider if you wish by taking them off the stand offs at the nose when packing up.



11. ATTACH THE FRONT FLYING WIRES at the nose plate area by slipping the ring around the nose spring catch. **ENSURE THAT THE SPRING IS PROPERLY SETTED so it is pushing up on the top of the latch.**

12. INSTALL THE GLIDER'S NOSE CONE starting with the two top velcro tabs and gently pulling the shroud down and around the nose plate to connect the two bottom velcros of the nose cone to its corresponding velcro on the under-surface.



13. YOUR FREEDOM IS NOW READY FOR A PRE-FLIGHT INSPECTION, DESCRIBED NEXT.

### 7. Preflight Procedure

A thorough preflight procedure is mandatory with all aircraft. The best technique is a circular walk around. Start at one location, the nose, and check each assembly point available for inspection.

Starting at the nose:

Sight along both leading edges, checking for similar curves.

Walk towards the tip, feeling for dents in the leading edge tube.

Pause at the cross bar LE junction area and look into the sail through the zipper inspection access. Check all fittings, safety rings and cables.

Continue to the tip and check the sail tip area for proper seating on the leading edge tube, and sail integrity.

Insure that the tip wands are properly seated in the leading edge, and that the tension lever is correctly installed.

Check top of king post, make sure all cables are routed correct and the luff line are not twisted or wrapped around any other cables.

Walk to the keel, checking each of the ribs to ensure that they are properly secured.

Check the cross tube-to-keel cable catch connection.

Repeat first half inspection as you work your way back around the nose.

Check the nose catch.

Check the nose cone for secure attachment.

Check all the lower cable rigging for proper routing about the control frame.

Check that the control frame uprights are straight and that the set up bolt is correctly assembled with speed nut and safety ring through the base bar and forked end fitting

Check the cross tube center bolt/plates to insure that they are properly attached.

Make sure you zip up the center zipper after inspection. Flying the wing with the center zipper open (or any zipper) will result in loss of lift and cause dangerous flight handling!!

Generally site the entire wing for symmetry. If you see something that does not look “right”, stop and investigate.

**NEVER RUSH A PREFLIGHT!**

### Fold Down Procedure

***PICTURES MAY OR MAY NOT BE OF YOUR EXACT MODLE OF WING BUT ARE FOR REPRESENTATION AND PRECEDURE ONLY.***

To fold down your FREEDOM, just follow the reverse set up procedure steps as described in the previous section. Included below are a few guidelines to follow which will save you time and prevent wear areas on your sail.

Such as:

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#1-Take off nose wire #2- take the last #3 ribs out of tip 3- take out tip wand #4- take out #4 rib from tip before rolling tip area makes rolling tip easier.

TIP BAGS Fold sail tip at the end of LE bring the tip lever back so it is by the LE tube area. Now roll the sail to the LE.



FOLDING WINGS IN always fold the wings together symmetrically, bringing both leading edges back together at the same time. An alternative to having someone help bringing in both leading edges at once, is to bring in one a bit, then the other a bit more, in three to four incremental steps. If you meet resistance folding in the wings, check that the cross tube tensioning line or cable are free to run forward through the cable hole center of the sail.

REMEMBER TO INSTALL the upper and lower king post and rear keel pads before you fold the sail up.



FOLDING SAIL The important thing here is to simply get your sail body neatly stowed inside the Mylar reinforced leading edge pocket. Roll the sail neatly from the rear area forwards to nose first, secure with center strap then roll the sail neatly down at the tips. Also, some owners prefer to alternate folding, then rolling, their sail to minimize potential permanent creases developing over time.



ATTACHING SAIL TIES Fasten the first tie just aft of the rear cable (or X-bar latch. By keeping the keel tube outside of the tie, it will make it easier to organize the control bar in this

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area after the wing is flipped over. The forward tie is located splitting the distance between the control frame apex and nose plate. Pull the leading edge pocket up over the top of the wing so the top of the LE mylar pocket is touching and/or overlapped. The third sail tie goes about 2 feet inboard from the leading edge tips.



### 8. About Flying the FREEDOM Wing

*Before launching, hook in to the glider and do a careful hang check. We recommend that you hang as close to the basket as possible - this will give you lighter control pressures and better control in both roll and pitch.*

1. Make sure you have assistant on launch in conditions you are not comfortable with handling the glider's attitudes. This usually occurs at 10 mph wind or more, depending on launch terrain. The angle of attack at which you launch depends on the slope of terrain.

There are two important airspeeds with which all hang glider pilots should be intimately familiar; minimum sink airspeed (hereinafter referred to as MSA) and minimum controllable airspeed (MCA). Minimum sink airspeed is that speed at which your descent rate is the slowest possible. It is the speed to fly when you want to maximize your climb rate in lift, or slow your rate of descent to a minimum in non lifting air. (You would normally not fly at MSA in sinking air; the strategy there is normally to speed up and fly quickly out of the sink. By minimizing your time spent in the sinking air you minimize altitude lost, even though you have momentarily increased your sink rate by speeding up.)

*Minimum controllable airspeed* is that speed below which you begin to rapidly lose effective lateral control of the glider. Recognition of this speed and its implications is a more subtle problem than many pilots realize. We have seen several instances of pilots who were having a lot of trouble flying their gliders simply because they were unknowingly trying to fly them too slowly; below the speed at which the glider responded effectively to lateral control inputs. It is our opinion that a great percentage of hang gliding accidents are caused by inadvertent flight below MCA, and subsequent loss of control of the glider with impact preceding recovery. Such incidents are usually attributed to "stalls," but it is not the stall per se that causes the problem, indeed the glider need not even be "stalled" in the traditional sense.

On most hang gliders, MCA and MSA have evolved towards a common value during the design and development of the glider. This is so because if the wing is tuned so tight that minimum controllable airspeed is at a higher speed than minimum sink speed, then effective sink rate performance can be improved by loosening the wing so as to lower the minimum controllable airspeed. Conversely, if minimum controllable airspeed is reached at a speed below that of minimum sink, the wing can usually be tightened so as to improve glide performance without significant sacrifice in other areas. As a result, it is quite easy to fly the glider too slowly for optimum sink rate performance, because control is retained well into a partial stall or "mush." As

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a result, you will often climb more effectively if you speed up a little from your slowest controllable airspeed.

### **Take Off**

The **FREEDOM** has a neutral static balance and is very easy to launch in both calm and windy conditions. When you hold the glider prior to your take off run, you should have the nose slightly elevated and the wings level. **MAKE SURE THAT YOU ARE HOOKED IN!** Run hard and ease the bar out for lift-off.

### **Turns**

The **FREEDOM** has a straight-forward flight characteristic, typical for a defined airfoil flex-wing. The glider can be easily directed into a turn even at low flying speeds with the off to ½ on. At full tight the glider can become very difficult to turn even to the point of uncontrollable if trying to slow the glider at to slow of airspeed.

However, to obtain the best handling characteristics and fast roll rate, it is advisable to pull in for a little extra flying speed, then enter the turn, move to one side and push out slightly. The **FREEDOM** will maintain in a turn of a certain bank angle and radius until the turn is removed. Give yourself an extra margin of safety and **DON'T** fly your glider at the slowest possible airspeed when scratching for lift close to the terrain.

### **Glider trim speed**

Now that we talked about air speed effecting handling, lets determine if your glider is at a proper trim speed. You can make sure you are at a good trim speed by flying your glider in smooth air. Let the control bar go to trim with hands off the bar, the glider should not stall. You should have to push out on the bar from trim at least 3 to 4 inches before stall does occur. (Or slow down 4 to 5 mph)

If you find the glider is flying too slow to do this you will need to move your hang point forwards by one hole at a time till you have proper trim speed.

### **Thermaling**

This is also very straight-forward, the trim speed of the **FREEDOM** should be slightly faster than the speed that will give you the best climb rate in a thermal. In smooth, lighter thermals you can fly a little slower than trim speed. Once you have centered a thermal, push out 2 to 3 inches without stalling. If you are flying in strong thermals (over 1000 fpm and very textured air) you will fly faster than trim. Maintain anywhere from 10 to 35 degree bank angle, depending on the nature and diameter of the thermal. The **FREEDOM** will maintain a certain bank angle and radius without further input in smooth lift. The **FREEDOM** feels very good in turbulence and it doesn't get displaced very easily even by strong turbulence. The **FREEDOMS** handling characteristics have been designed to give you the optimum performance, to achieve your personal longest cross-country flight.

### **Stalls**

When practicing stalls always make sure that you have sufficient altitude. (have at least 300 feet) Push the control bar forwards slowly dropping 1 mph per second till the stall occurs. The stall characteristics of the **FREEDOM** are very straight-forward. The **FREEDOM** will stall without a tendency to drop a wing, the nose will pitch down and the glider will regain flying



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speed. There is not a lot of altitude lost in this type of maneuver. Never stall your glider completely by pushing out quickly and pitched-up very high. This is one of the most uncontrollable and dangerous maneuvers for any tailless aircraft and can result in a tail slide and severe tumble. Stalls in a coordinated turn are difficult to do by mistake. If you push out too much in a turn the glider will turn tighter, unless you are flying very slowly, in which case you may enter a spin (see Spins).

### ***Spins***

The **FREEDOM** will strongly resist spinning. However should you stall one wing in a turn, move your weight forward and the glider will recover quickly from a spin (half a turn) without entering extreme attitudes and without extreme loss of altitude. This is due to the **FREEDOM'S** positive roll-yaw coupling and a neutrally balanced roll characteristic.

### ***Landing***

This is a simple matter. Your final approach should be a straight glide into the wind at faster than best L/D airspeed. Bleed your speed off slowly, wings level, and ground skim onto your chosen landing spot. In light or no wind conditions a full flare is required. When it is time to flare, flare aggressively and abruptly and hold 'A' frame out. The higher the wind the less flair is necessary.

### **Transportation and Storage**

The FREEDOM should always be stored with the zipper facing down, especially during transportation. There are fewer potential "wear points" with the wing riding this way. Additionally, with the zipper down less water will collect inside of the cover bag in case of rain.

Avoid hard spots pressing on the wing during transportation or storage and have as many supports as possible; we recommend using a well padded three-point support system, with less than four feet of unsupported wing extending off either end.

Use flat tie down straps, at least 1" width (available through North Wing) rather than elastic or rope to secure the wing, and tie both ends of the wing to a support or down to the ends of the vehicle in order to prevent the wing from flexing. Take care to not over tighten the wing tie-downs, as this can crimp your Mylar leading edges. A good technique is to squeeze and compress the wing's Mylar, sail, and leading edges into a snug bundle as it gets tied down, rather than using the wing tie-downs to compress the wing within the bag.

It is preferable to keep the wing dry. Definitely ensure that it is dry before storing for longer than just overnight. Any contact with salt water, of course, requires immediate rinsing with fresh water to prevent corrosion to hardware, rigging and tubes.

## **9. Glider Tuning**

Turns are caused by an asymmetry in the glider frame or sail tension.

### **Airframe**

Check the leading edges for possible bent tubes. Check that the keel is not bent to one side.

Check for symmetrical twist in the leading edges by checking for symmetry in the alignment of

tip wand receptacles.

### **Ribs**

Check the ribs for symmetrical shape.

### **Rib tension**

One of the most effective way of getting a turn out of a glider is to increase tension in the mid area ribs on the side the glider is turning to. Keep the 2 center ribs and the 3 tip ribs tight. Mid span ribs should be loose to moderate in tension. So you can always loosen the ribs n the opposite side if the side you want to tension id already tight.

### **Tip Wand**

You adjust your LE tension by reducing the length or adding length to the tip wand.

To reduce length you will cut of the end of the wand to add length you can add a shim inside the tip wand tube. This change should only be done if instructed by a North Wing dealer or a factory rep.

This is done to gain handling if the LE is too tight or to reduce yaw if the LE is too loose.

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Symptom	1 <sup>st</sup> Adjustment	2 <sup>nd</sup> Adjustment
Tail heaviness (flies too slow)	B	C&D
Nose heaviness (flies too fast)	A	C&D
Right turn	E	K,C
Left turn	F	L,D
Yaw unstable (roll response to fast)	G	I
Roll is unstable (difficult to keep from rolling)	M	O,J
Roll too stable (heavy force required to enter into roll)	I	H
Wing Breaks to left in a stall	K	E
Wing breaks to the right in a stall	L	F
Trailing edge flutter	N	J

**Table 4.2-1: Wing Tuning Diagnostics**

Code	Description of Corrective Adjustments
A	Move king post back (1/2" at a time)
B	Move king post forward (1/2" at a time)
C	Increase camber on the last 3 cambered right tip ribs by 1/4", or decrease the same on left tip by 1/4"
D	Increase camber on the last 3 cambered left tip ribs by 1/4", or decrease the same on right by 1/4"
E**	For a strong turn, increase the tension of the right leading edge pocket by inserting shim on the fiberglass wand or loosen the tension of the left leading edge pocket by cutting down the tip wand. See description below for inserting shims.
F**	For a strong turn, increase the tension of the left leading edge pocket by inserting shim on the fiberglass wand or loosen the tension of the right leading edge pocket by cutting down the tip wand. See description below for inserting shims.
	<b>**If your handling is acceptable - increase LE tension, if your handling could be improved - decrease the LE tension.</b>
G	Tighten leading edge pocket on both sides by adding shims. See description below for inserting shims.
H	Loosen leading edge pocket on both sides by shorter tip wand. See description below for cutting down tip wand.
I	Loosen rib tension on both sides symmetrically except for root rib and the last 3 ribs.
J	Tighten rib tension on both sides symmetrically starting at the tips
K	Tighten rib tension on the Right side ribs #4-8 or loosen Left side. (Root Rib and last 3 tip ribs should be tight) Mid span ribs should be loose to

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	moderate.
L	Tighten rib tension on the Left side ribs #4–8 or loosen Right side. (Root Rib and last 3 tip ribs should be tight) Mid span ribs should be loose to moderate.
M	Loosen tension on ribs #2-4 on both sides to remove excess reflex from these ribs
N	Tighten rib tension in the locality of each problem area
O	Tighten the rigging tension of the cross bar restraining cable using the adjustable tangs on the rear shackle
P	Loosen the rigging tension of the cross bar restraining cable using the adjustable tangs on the rear shackle

**Table 4.2-2: Wing Corrective Adjustments**

The amount of adjustment required is dependent upon the specific problem and varies from wing to wing. Therefore, it is important to make only one change at a time. Make a small change and then test the effect of those changes by flying the wing. It is best if these adjustments are made by someone with wing tuning experience since it takes practice and patience to tune a wing properly.

### 10. Regular Maintenance Schedule

This section contains a recommended schedule of periodic maintenance. None of the items in this section are a substitute for the continual and consistent practice of proper pre-flight inspections and immediate maintenance of any items on the glider which require it. Safety requires that your glider be fully airworthy for every flight. Nuts and bolts must always be secure, safeties must always be in place, and damage to any part that could compromise the airworthiness of the glider cannot be tolerated. If you have a question about the need to repair or replace some part of your glider, feel free to contact your dealer or North Wing directly. It is not always obvious which items require attention and which may not. Minor dents or dings in a non critical location on an airframe tube may not require any repair or maintenance. On the other hand, a wire that has been kinked one time can fail very quickly after that, and should be replaced immediately. A control bar corner fitting that has had a significant landing impact may have a crack that is almost undetectable, but which could cause the part to fail catastrophically at a later time.

We recommend that you have all maintenance work done by your North Wing dealer

The FREEDOM will require very little in the way of maintenance if you care for it properly in your day-to-day use. Following are some general points to follow in maintaining your new wing which will help ensure the safety of your flying and the performance retention of your wing; we suggest you follow this maintenance schedule faithfully -- your ongoing care will pay off in the future.

#### Sail

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The best thing you can do for your sail is to always pack up your glider in the glider bag as soon as you are done flying. Do not carry your wing on top of a car without the bag, even for short distances.

Sun and weather cause more deterioration than hours of flying. Keep your FREEDOM covered when not in use.

### **Sail Tears Less than 1" Long**

**Skill Level:** *Owner or higher*

**Tools:** Scissors

**Parts:** Adhesive sail repair cloth from sail repair shop or aviation materials supplier

#### **Task Description:**

Sail tears up to 1" in length can be repaired using an adhesive sail repair cloth provided the tear is NOT within 1" of a seam or an edge of sail. Most sail color can be reasonably matched or coordinated. The patch should extend at least 1" in all directions from the tear.

Follow these steps:

1. Prepare the surface where the patch will be applied by washing it with a damp cloth and letting it dry thoroughly. If the patch area feels contaminated with any substance, try a mild detergent followed by thorough rinsing with clean water and drying. You can also use alcohol or acetone to clean the area.
2. Cut the patch material to the required size. Since this task is only approved for tears up to 1" long, the maximum patch size should be 2" wide by 3" long. Rounding the corners of the patch will reduce the tendency of the patch to peel off or snag on something.
3. Remove the backing from the patch and apply patch to torn area.
4. Using a smooth hard material as a backer board under the patch area, roll the patch with a small roller such as a wall paper seam roller.

The wing can be flown immediately after applying an adhesive patch.

### **Sail Tears Greater Than 1" Long**

**Skill Level:** Factory Repair or North Wing Approved Sail Repair Shop

**Tools:** Not applicable

**Materials:** Dacron sail material in several colors

### **Task Description:**

Sail tears longer than 1", or tears that are within 1" of an edge or seam must be repaired by a certified sail repair shop or returned to North Wing for repair. In most cases, the sail must be removed from the frame and shipped to the sail repair shop.

### **Wing Cleaning**

**Skill Level:** Owner and higher

**Tools:** Damp cloth, pail, soft brush

**Materials:** Water and possibly mild detergent, aluminum polish/cleaner, WD40

### **Task Description:**

The sail fabric should be cleaned regularly with a soft damp cloth. If the wing is exceptionally dirty, it can be washed with a mild detergent only. Keep detergent washing to a minimum. Acetone or alcohol can be used to remove stubborn stains without harming the sail. However, rinse thoroughly with water after cleaning with these chemicals. Because of the acid in their system, bug grime should be removed immediately to prevent long term deterioration of the sail.

All cables can be cleaned with a soft damp cloth. The plastic coating on the wing cables can be cleaned with WD40 or household cleaner if necessary.

Other exposed aluminum tubes, keel tube, cross bars, down tubes, base tube, leading edges, and ribs can be cleaned with a soft damp cloth or a mild detergent. In some cases it may be desirable to polish these tubes with a mild aluminum polishing cloth and compound.

## **11. Twice Yearly Inspection**

Remove the cross tube center junction scuff pad to inspect all cross tube support cable components: tangs, pins, nuts, bolts, cross tube and cable itself. Tighten nuts if loose.

Check all tubing, especially the control bar frame, for possible damage, which could occur during, set up, fold down, or transportation.

Closely inspect the sail mounting grommets and webbing at the tips.

Inspect all rigging and components. Replace any worn or bent bolts or locknuts connecting two moving parts together: cross tube plate junction bolt, cross tube clamp bolt, etc.

A professional sail maker should mend critical sail tears.

### 12. Annual Inspection

The only way to thoroughly and completely inspect all of the components of your wing is to completely remove the sail from the frame, to allow visual and physical access to everything. Even if yours is the best-kept FREEDOM, you should have the sail removed for a complete inspection at least once a year. This should be done by an authorized service center.

With the sail off the airframe, you can more thoroughly perform all of the inspection points listed for the six-month inspection.

Additionally, you should inspect inside the tubes for corrosion. If discoloration indicating that corrosion is present, you will need to arrest this process immediately. We have tested and approved boiled linseed oil (commonly found in most hardware stores) as an effective coating/film to apply on the inside wall surface of the tubes. Clean the tube first, allow it to dry, then apply the linseed oil.

Inspect the entire inner sail body, and in particular examine the rib pockets for wear points, especially at their stops at the front of each pocket.

It is recommended that you annually replace the lower cables.

WHEN REPLACING PARTS OR INSPECTING PARTS THAT REQUIRE REMOVING NUTS.....NEVER REUSE A NYLOCK NUT.

### **13. Wing Retirement**

With proper care and maintenance, the FREEDOM will remain for some years at a high level of airworthiness. Each FREEDOM has a patch sewn into the sail at the top center for UV testing. Simply cut out the panel and have a test performed.

There is much that we still don't know about hang glider longevity; such as what exactly is the effective lifetime of a hang glider before material fatigue and degradation compromise the airworthiness of that wing. We do know that there are forces in nature that can severely compromise the airworthiness of that wing, regardless of the quality of design or condition of the wing you are operating. Your safety is ultimately your own responsibility.

However, there is one subject in particular which needs to be addressed at this point--and this is wing retirement. There comes a time when the sail of any hang glider simply becomes too suspect to feel safe while flying it. Ultraviolet degradation will inevitably dictate the retirement of your wing. Judging when this occurs to your wing is best verified by an authorized service center.

All of us, as responsible and caring human beings, owe it to one another to do the responsible thing and remove any over-used equipment from the skies. We at North Wing abhor those whose method of dealing with a wing due for retirement consists of simply passing their problem along to an unsuspecting pilot in the used wing market place. The mature thing to do, at the appropriate time, is to destroy very old gliders to ensure that they cannot endanger an unknowing pilot.

Along these same lines, because wings do change hands, we feel that it is quite important to keep accurate records of tuning changes, and especially of repairs, in the maintenance log of this manual. Please consider the needs and safety of those other pilots down the road who may stand to gain from these records.

### **14. Limitation of Liability**

The owner and operator of this hang glider must understand that, due to the inherent risk involved in flying such a unique vehicle, no warranty is made or implied of any kind against accidents, bodily injury, or death. Practiced even under the best circumstances, flying aircraft of any kind is a high-risk sport or activity. By purchasing this wing, the owner and operator of this



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Hang glider assumes complete responsibility for their use of this equipment, and specifically, agrees to release North Wing and/or their agents, from any and all liability.

### 15. Technical Specifications/ Compliance Verification Sheet

Wing Model: FREEDOM

Manufactured by: North Wing Design

Note: These specifications are intended only as a guideline for determining whether or not a given wing conforms to current production specifications, and whether it is in a configuration as originally designed.

Be aware, however, that no set of specifications, however detailed, can guarantee the ability to determine whether a glider is the same model as was designed, or is in the same configuration in which it was designed, or has those performance, stability, and structural characteristics required by the compliance standards.

#### **SPECIFICATIONS for 150**

Glider, Weight, without cover bags	51 Lbs.
Leading Edge tube	
A. Distance from the nose plate anchor hole to:	
1. Cross tube attachment hole	114.25"
2. Rear most sail attachment point	186.5" +- .50"
B. Outside Diameter at:	
1. Nose	50 mm
2. Cross tube	52 mm
3. Rear sail attachment point	50 mm
Cross tube	
A. "Pin to Pin"	103" + -.25"
B. Outside diameter	52mm"
Keel tube - least and greatest distance from Front of keel:	
A. Cross tube Hinge pin plates (Must be resting on keel)	45.5" + - 1.5"
B. Hang point (for front of keel)	65" + - 1.5"
Sail chord length	
A. 3' from root	78.5"
B. 3' from tip	43.00"
Total span	32.5' +- 2"
Placard and test flight sticker location:	On Left X-Bar
Recommended pilot "flying" weight range	120 - 200 Lbs
Bridle measurements - inner	
center	
outer.	

**SPECIFICATIONS for 170**

Glider, Weight, without cover bags	56 Lbs.
Leading Edge tube	
A. Distance from the nose plate anchor hole to:	
1. Cross tube attachment hole	130.5"
2. Rear most sail attachment point	202.75" +- .50"
B. Outside Diameter at:	
1. Nose	2.125"
2. Cross tube	2.25"
3. Rear sail attachment point	50mm"
Cross tube	
A. "Pin to Pin"	115.375" + -.25"
B. Outside diameter	52mm"
Keel tube - least and greatest distance from Front of keel:	
A. Cross tube Hinge pin plates (Must be resting on keel)	45.5" +- 1.5"
B. Hang point (for front of keel)	65" +- 1.5"
Sail chord length	
A. 3' from root	78.5"
B. 3' from tip	43.00"
Total span	32.5' +- 2"
Placard and test flight sticker location:	On Left X-Bar
Recommended pilot "flying" weight range	160 - 240 Lbs
Bridle measurements - inner	72.75"
center	94.25"
outer	122.75"

**SPECIFICATIONS for 190**

Glider, Weight, without cover bags	61 Lbs.
Leading Edge tube	
A. Distance from the nose plate anchor hole to:	
1. Cross tube attachment hole	146.5"
2. Rear most sail attachment point	218.5" +- .50"
B. Outside Diameter at:	
1. Nose	2.125"
2. Cross tube	2.25"
3. Rear sail attachment point	50mm
Cross tube	
A. "Pin to Pin"	129" +- .25"
B. Outside diameter	62mm"
Keel tube - least and greatest distance from Front of keel:	
A. Cross tube Hinge pin plates (Must be resting on keel)	51.5" +- 1.5"
B. Hang point (for front of keel)	66.5" +- 1.5"
Sail chord length	
A. 3' from root	78.5"
B. 3' from tip	43.00"
Total span	32.5' +- 2"
Placard and test flight sticker location:	On Left X-Bar
Recommended pilot "flying" weight range	210 -290Lbs
Bridle measurements -	inner
	center
	outer.



