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Hybrid Tandem Manual



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WARNING

This is not a training manual. It is extremely dangerous to yourself and others to attempt to fly this or any paraglider without first completing a flying course given by a qualified instructor.

Apco Aviation's gliders are carefully manufactured and inspected by the factory. Please use the glider only as described in this manual. Do not make any changes to the glider.

AS WITH ANY SPORT - WITHOUT TAKING THE APPROPRIATE PRECAUTIONS, PARAGLIDING CAN BE DANGEROUS.

1 DISCLAIMER OF LIABILITY

Taking into consideration the inherent risk in paragliding or hang gliding, (free flying and motorized), it must be expressly understood that the manufacturer and seller do not assume any responsibility for accidents, losses and direct or indirect damage following the use or misuse of this product.

APCO Aviation Ltd. is engaged in the manufacture and sale of hang gliding, paragliding, motorized Para/hang gliding and emergency parachute equipment.

This equipment should be used under proper conditions and after proper instruction from a qualified instructor. APCO Aviation Ltd. has no control over the use of this equipment and a person using this equipment assumes all risks of damage or injury.

APCO Aviation Ltd. disclaims any liability or responsibility for injuries or damages resulting from the use of this equipment.

The glider is designed to perform in the frame of the required class as certified.

2 INTRODUCTION

The Hybrid Tandem is based on the original Apco Hybrid solo glider range. It brings all the advantages of the Hybrid to the tandem market. This means, extremely easy inflation and take-off characteristics (better than any other tandem on the market), phenomenal safety and handling in flight as well as a good landing flare, far better than any single surface wing on the market. The wing is suitable for commercial operation, and will make life for the working pilot (especially in alpine conditions, where light / nil / back wind launches are required) a breeze. In addition, the wing has a very low weight and pack volume (similar to that of a solo wing). The Hybrid Tandem can also be flown solo by heavy pilots, solo or tandem with a motor, and solo or tandem with para-trikes, provided one stays within the specified weight ranges. The wing is intended for use by suitably qualified tandem pilots, but it is also the easiest wing for learning to fly tandem on, especially because of its incredibly easy inflation characteristics. The Hybrid Tandem is suitable for winch launching.

3 HYBRID TECHNOLOGY

The Hybrid is a new category of wing in our sport, with unprecedented flying characteristics. This unique design combines a classic double surface profile with a single surface profile, together creating a hybrid profile.

The Hybrid is much more than an exotic wing for special purposes. This version is intended for Tandem Flying. It offers many advantages over single skin.

The Hybrid Tandem is light (~4.3 kg), but not specifically designed to be a "Lightweight" wing.

The absence of bottom surface on the back part of the wing saves weight but is also what makes it fly in such a special way, and the resulting profile from this design gives unparalleled stability in pitch, roll and yaw axis.



Profiles comparison

Classic



Single skin



Hybrid



Top surface 

Bottom surface 

4 TECHNICAL DATA

HYBRID TANDEM / Size	35
Code	38710 / 38810
Cells	48
Area [m²]	35.0
Area (projected) [m²]	29.60
Span (incl. Stabilizer) [m]	13.28
Span (projected) [m]	10.39
Aspect Ratio	5.1
Aspect Ratio (projected)	3.7
Weight Range (all up) Paramotor [kg]	110 - 190
Weight Range (all up) Para-Trike [kg]	110 – 240
Canopy Weight [kg]	4.27
Root Cord m	3.20
Tip Chord [m]	0.57
Length of Lines on B [m]	8.02
Total Length of Lines [m]	402

V-min [km/h] at optimal wing loading*	24
V-trim (closed) [km/h]*	36 - 40
V-trim (open) [km/h]*	43 - 47
Min Sink [m/s] at optimal wing loading**	1.2 m/sec

*All data measured at sea level, using a combination of GPS and Speed Probe, averaged over several runs
**Min Sink Rate is with approx. 25% Brake Applied



CERTIFICATION	
Class	EN-B / LTF-B
Maximum symmetric control travel at maximum weight in flight	80cm
Harness dimensions used during testing	H: 44cm W: 55cm

5 CONSTRUCTION & MATERIALS

The Hybrid Tandem differs from a classic paraglider in design, but in principle, the construction glider is constructed with a top and bottom surface, connected by ribs. One top and bottom panel, together with the connecting ribs is called a cell. Each cell has an opening on the front lower part. The cells fill with air forcing the panels to take the shape dictated by the air-foil (rib) section.

On either side the wing ends in a stabilizer or wing tip, which provides straight-line (Yaw) stability and produces some outward lift to keep the span-wise tension.

The front part of the ribs use APCO's FLEXON batten system to keep the leading edge shaped at high speeds and in turbulent air. They also improve the performance and the launch characteristics of the glider.

The glider is made from tear resistant Ripstop Nylon cloth, which is P.U. coated to zero to give the fabric high resistance to the elements.

Different cloth is used for the top, bottom and ribs due to their different functions.

The lines are made of superaramide and the upper lines are imbedded hook-up points made from Dyneema, imbedded into the bottom surface of the wing for minimal drag and maximum performance.

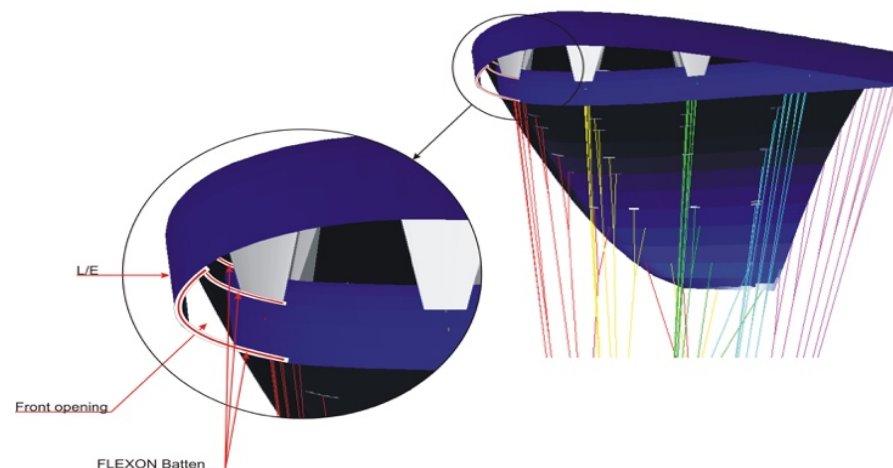
The bottom section of the brake lines is made of polyester because of its better mechanical properties.

The links between the risers and lines are either Dyneema soft links or stainless steel maillon rapide links.

6 FLEXON® Batten system:

New generation FLEXON ® batten system incorporated (see below) in the leading edge of the ribs, insuring perfect profile shape (instead of traditional Mylar reinforcement). FLEXON ® battens reduce the weight of the glider by an additional 500gr. and unlike Mylar reinforcement will guarantee no deterioration in performance or launch.

Additional advantage of FLEXON batten is that it is practically indestructible, safeguarding the performance and launch over the lifespan of the glider.



7 TRIMMING

All Apco gliders are trimmed for optimum performance combined with unsurpassed safety. It is very important not to re-trim or tamper with any of the lines or risers as this may alter the performance and safety. Trimming of the brake line should be done in accordance with this manual and carefully checked before flying.

8 HARNESS

All of Apco's gliders are developed with the use of ABS (Automatic Bracing System) type harnesses without cross bracing. We recommend the use of an ABS harness with all our gliders. All certified harnesses can be used with our gliders. For best safety and performance, we recommend an Apco harness equipped with a Mayday emergency parachute.

CAUTION:

WE RECOMMEND NOT TO USE CROSS BRACING STRAPS.

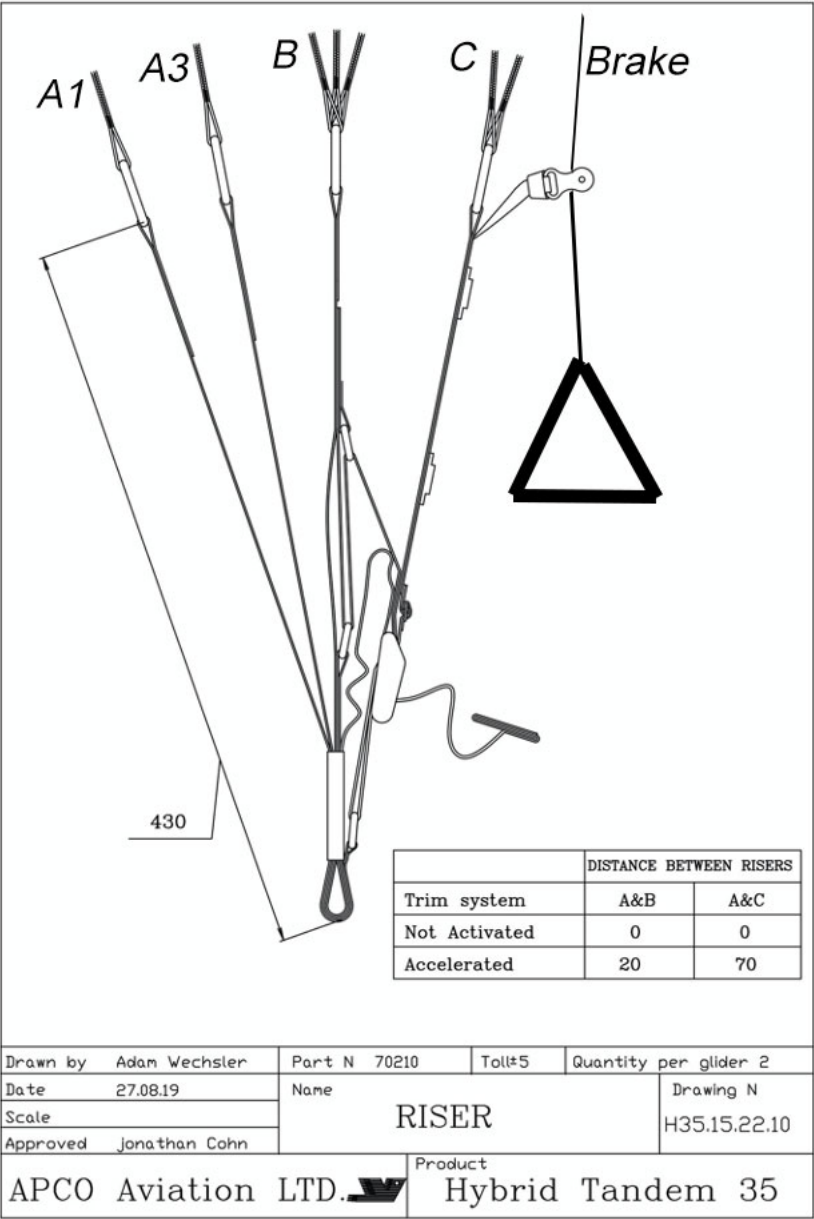
APCO GLIDERS ARE DEVELOPED AND TESTED WITHOUT THE USE OF CROSS BRACING. USING AN ABS HARNESS WITH CHEST STRAP SET AT THE SPECIFIED WIDTH (CHECK THE CERTIFICATION STICKER ON YOUR GLIDER) WILL RESULT IN THE HIGHEST PASSIVE SAFETY ON YOUR GLIDER.

9 EMERGENCY PARACHUTE

It is recommended to use a certified rescue parachute when flying, no matter your intended altitude or flying style. Attaching the rescue parachute should be done in accordance with the recommendations of the harness and reserve parachute manufacturer. When we fly the HYBRID TANDEM, we use the SLT Low, or Split-Leg Low, combined with the Light and compact Mayday SQ Parachute, packed in the matching side mounted reserve container. Always check the reserve handle and locking pins during every pre-flight check.

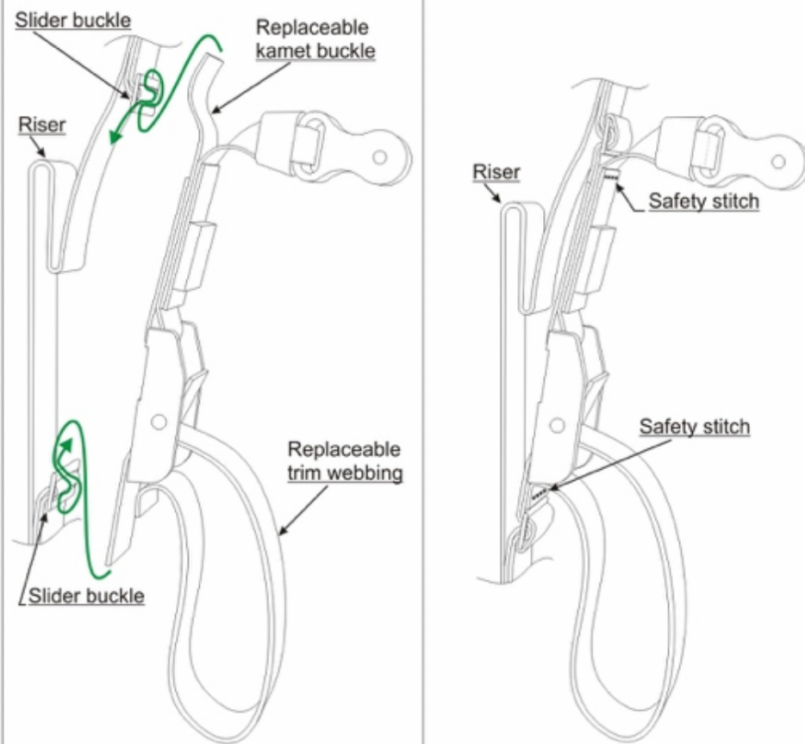
10 RISERS

The HYBRID TANDEM is supplied with risers featuring a split A riser. The 1st A-riser attaches to the central A lines (A1). The second A-riser is attached to the outermost A line (A3). At no time should the pilot change the risers or use risers not intended for this specific glider as this will affect the performance and safety of the glider and void the certification and warranty. The riser is equipped with trimmers, that can be used to accelerate the wing.



Tolerance: +-5mm

Replaceable trimmer system

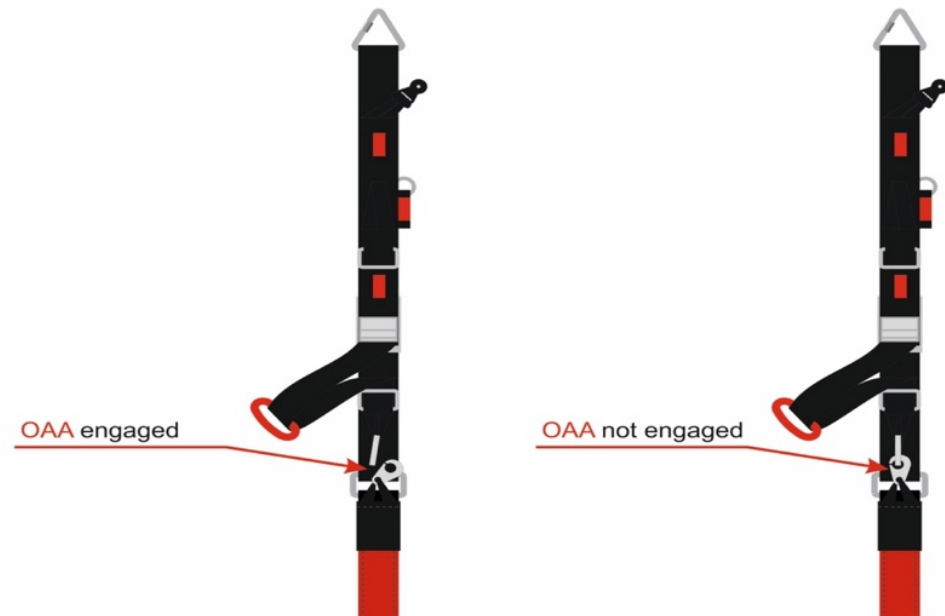


1. Undo the safety stitch of kamet or trim webbing, depending on what requires replacement.
2. Take out the kamet or trim webbing requiring replacement, by removing it from the slider buckle.
3. Replace trim webbing or kamet with new by guiding it back through the slider buckle, verify the trim range is unchanged, on trim speed all the riser branches are at equal height. When kamet fully released it should not retain any load (all the load is on the fully released D branch of the riser).
4. Restitch the safety stitch to lock the configuration of the trim in place.

11 TRIMMERS

The HYBRID TANDEM risers are equipped with trimmers which are replaceable.

The neutral setting is when the A/B/C risers legs are of equal length. For Take-off and landing, the trimmers should be in the closed (minimum trim speed) position. After take-off set them to the neutral position, and close them again before landing. They can also be set asymmetrically to compensate for torque effect. The Trim System of the HYBRID TANDEM is very effective for accelerating the wing on long flights, when staying on bar may not be comfortable. The trim system differs from previous Apco gliders in that it releases the B riser, which gives a clean rotation of the profile, and is very efficient.



12 GENERAL INSPECTION

Pilots, please ensure that your glider has been test flown and fully checked by your dealer before taking it into your possession. Verify that the dealer checked and confirms that the glider is airworthy.

In case of use of the wing in combination with trike:

Due to the very wide assortment of trikes on the market with different set up and design, it is necessary to verify that the specific trike can be successfully coupled with the wing.

Please make sure your dealer performs the following procedures before first flight:

A. It was checked with APCO that the specific trike can be flown with your new wing.

In case the specific combination is not checked by APCO – your dealer must take the following necessary steps :

B. Wing to be fully inspected by the dealer as in the paragraph above

C. Wing to be ground handled and visually checked while inflated.

D. Connection method to the trike is in line with APCO's recommendation according to the sketch below. Pilot can reach both main brake handles and tip steering handles (if available).

E. Before first take-off perform "taxiing" test on the ground slowly rolling with the wing checking all aspects of the set-up without actually taking off. (including roll/yaw stability, pitch stability, stall tendency, brake response etc.)

F. Only once the wing passes the taxiing test – then the next step is to make the actual test flight to make sure trike and wing are correctly coupled and the system is airworthy.

G. Take the wing into your possession only after your dealer confirms that wing is airworthy when coupled with your trike.

13 ANNUAL / PERIODICAL AIRWORTHINESS INSPECTION

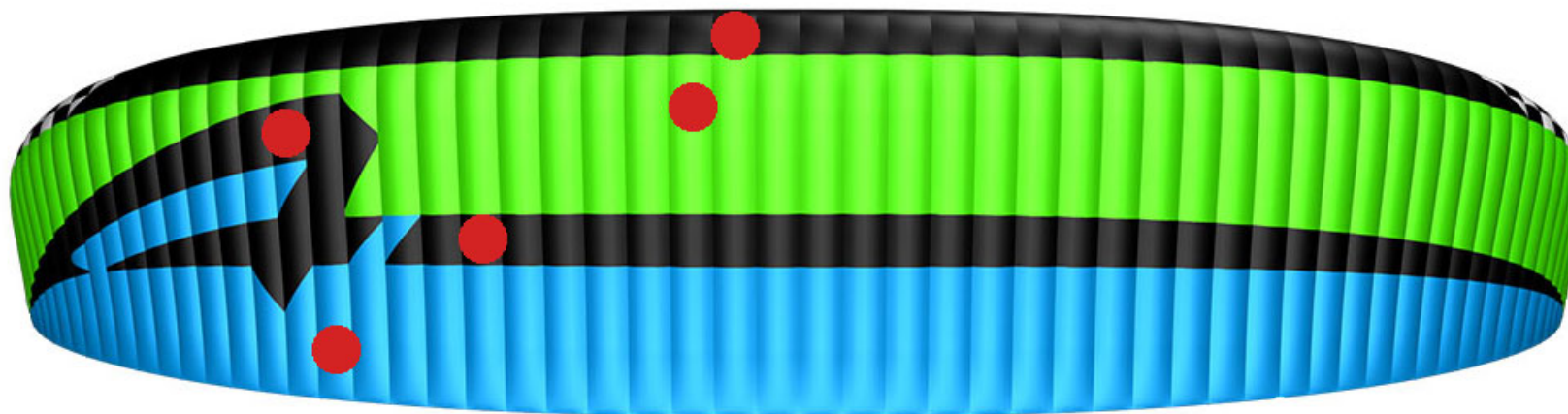
It is highly recommended that your glider (and other equipment), undergo a Periodical Airworthiness Inspection which is to be done by Apco, or an Apco approved / appointed service centre.

This is recommended to be done every 24 months or every 100 hours, whichever comes first.

This recommendation is in line with Israeli regulations, binding in Israel. as an alternative, we suggest for you to follow the regulations set by your national authorities.

POROSITY:

Porosity is measured with a calibrated Porosimeter. It should be measured in at least 5 different places on the upper surface. Below is an example of the sections we test at Apco. The upper surface, at 20-35% chord (from L/E) is most prone to becoming porous, and is thus the most important section to test. It is also important to test the different cloth types, and different colours used.



LINE MAINTENANCE

Superaramide lines are known to be sensitive to the influence of the elements. They must be carefully inspected periodically. In his/her own interest, the pilot must observe the following points to ensure maximum performance and safety from the glider. Avoid sharp bending and squeezing of lines. Take care that people do not step on the lines. Do not pull on the lines if they are caught on rocks or vegetation. Avoid getting the lines wet. If they do get wet, dry them as soon as possible at room temperature and never store them wet.

One line of each line group (a, b, c, upper and lower) must be tested for minimum 50% of the rated strength. If the line fails under the load test or does not return to its specified length all the corresponding lines must be replaced. Never replace lines with different diameter or type of lines as all gliders were flight and load tested for safety in their original configuration. Changing line diameter/strengths can have dangerous / fatal consequences.

Professional use of gliders: towing, tandem, schooling and competition flying requires more frequent line inspection and replacement of A, B, C, D and brake lines. [For replacement lines please refer to our online direct line services.](#)

14 BEFORE THE FIRST FLIGHT



BRAKE SETTING

Before the first flight the pilot / dealer has to inflate the glider in the flight configuration, with Spreader bars if tandem flying, or on the intended frame in the case of motorised flight, to check, and if needed, adjust the brake line length as required. It is important that the brakes are not set too short. If the glider is above your head the brakes should have about 10 cm of free travel in the brake from the brake guide (pulley) on the riser to the activation point of the brakes (See Diagram). If the pilot changes the type of paramotor, please check the brakes again to ensure that the brakes are not too short.

Since there are several hook-up point configurations on paramotors, the Hybrid Tandem comes with longer brake lines to allow for adjustment to your requirements, however, this should only involve lengthening, not shortening. Shortening the brakes (shorter than the factory setting) will cause them to be too short when accelerating the wing, which can be both dangerous, and inefficient. The excess lines should be trimmed or taped or stowed in a safe manner so that they do not increase the chance of the brakes getting pulled through the mesh into the propeller.

15 PARAGLIDING

TAKE OFF

As this is not a training manual, we will not try to teach you launching techniques. We will only briefly go through the different launch techniques to help you get the most out of your glider.

LAYOUT

Pre-flight check should be done before every flight.

Spread the glider on the ground. Spread the lines, dividing them into groups A, B, C and brake lines left and right. Make sure the lines are free and not twisted or knotted. Make sure all the lines are on top of the glider and none are caught on vegetation or rocks under the glider. Lay out the glider in a horseshoe shape. This method ensures that all the lines are equally tensioned on launch, and results in an even inflation. The Flexon rib reinforcements will keep the leading edge open for easy inflation.



The most common reason for a bad launch is a bad layout

FORWARD (ALPINE) LAUNCH

The HYBRID TANDEM has very good launch behaviour in no wind conditions.

For the best results we recommend the use of the following techniques: Lay out the glider and position yourself in the centre of the wing with the lines almost tight.

With a positive and constant force inflate the wing holding only the A-risers, and smoothly increase your running speed. The wing will quickly inflate and settle above your head without the tendency to stick behind.

After you leave the A-risers, apply about 10 - 15% brakes and the HYBRID TANDEM will gently lift you off the ground.

STRONG WIND AND REVERSE LAUNCH

The HYBRID TANDEM behaves better on the ground than single surface wings, with less of a tendency to inflate without input, but as with any wing, care must still be taken once you are connected to the glider.

The Hybrid Tandem is suitable for doing a “Cobra Launch”, which reduces the force compared to a regular inflation.

If using a launch assistant, he or she should let you walk in under the wing on inflation rather than resist the inflation; this reduces the tendency of the glider to lift the pilot prematurely.

TOW OR WINCH LAUNCHING

All APCO gliders are well suited for winching and have no bad tendencies on the winch. With towing it is important to have the wing above your head on launch and not to try and force a stalled wing into the air. This is especially important if the winch operator is using high tension on the winch. Very little brake if any need be applied on launch and during the tow. Directional changes can be made with weight shift rather than brakes. While on tow, the brake pressure will be higher and more force may be needed to make corrections than in normal flight.

FLIGHT TECHNIQUES

The HYBRID TANDEM is an exceptionally easy and forgiving glider, making it ideal for tandem pilots of all levels, and would be an excellent choice for learning to fly tandem on. There are no special procedures or configurations recommended for flying this wing.

FLYING SPEED

Indicated trim speed is dependent on the amount of brake the pilot is using, wing loading, altitude above sea level and the accuracy and make of speed probe. The speeds recorded in technical data were at optimum wing loading at sea level using a Flytec 6030 thus there could be a slight variation in speed range numbers that pilots records.

Speed readings in the flight reports could differ as this was measured during testing using various instruments and is an indication of the difference between trim, stall and top speed. The speed range will be the same but the actual numbers may differ.

- With 0% brake and trimmers at 0 (Neutral) the HYBRID TANDEM will fly at 36-40 km/h with a sink rate of ~1.4m/s.
- Trim closed, and 25% brake the glider will fly at 30-34km/h with minimum sink rate 1.2 m/s.
- The best glide angle is achieved with closed trims and 0% brakes.
- At 80% of the brake range, the glider will fly at about 25km/h and will be close to the stall point at about 24km/h (at optimum weight).

CAUTION:

APART FROM WHEN FLARING AT LANDING THERE SHOULD BE NO REASON TO FLY WITH 70% TO 100% BRAKE. THE SINK RATE OF THE GLIDER WILL BE EXCESSIVE AND THERE WILL BE A POSSIBILITY OF ENTERING A DEEP STALL OR FULL STALL SITUATION. THERE IS ALSO THE RISK OF GOING NEGATIVE OR ENTERING A SPIN WHEN ATTEMPTING TO TURN THE GLIDER NEAR THE STALL SPEED.

WARNING:

The use of the trim system in turbulent conditions or close to the ground is dangerous. While flying with the trims open, the glider has a reduced angle of attack and is therefore more susceptible to turbulence and may collapse or partially deflate. Gliders react faster when accelerated and may turn more. The trims should be closed in turbulent conditions.

THERMAL FLYING

HYBRID TANDEM has high internal pressure and needs very little pilot input even in very turbulent conditions.

In light lift it is advised to make flat turns to keep the glider from banking too much and avoid increasing the sink rate.

In strong lift conditions it is most effective to make small turns in the core with relatively high bank.

For the best climb rate in ridge lift we recommend using about 15% to 20% brake and **trimmers fully closed**.

ASYMMETRIC COLLAPSE

If one side of the glider partially folds or collapses it is important to keep your flying direction by applying weight shift and some brake on the opposite side of the collapse to counter any tendency to turn towards the collapsed side.

The wing should re-inflate on its own without any input from the pilot, however, to help speed up the re-inflation, it is possible to pull some brake on the collapsed side and release immediately.

In the event of a big deflation, i.e. 70%, it is important to apply brake on the inflated side of the wing, but care must be taken not to pull too much as you could stall the flying side.

The glider is very solid and has a strong tendency to re-inflate after a collapse.

CRAVAT

In case a cravat should occur from an asymmetric collapse or other manoeuvres, it is important to keep your flying direction by applying some brake on the opposite side and then it can usually be opened by pulling down on the stabilo line of the affected side while countering the turn with the opposite brake and weight shift.

FRONT COLLAPSE

In the event of a front collapse the glider will normally re-inflate on its own immediately without any change of direction. To speed up re-inflation briefly apply 30%-40% brake (to pump open the leading edge). **Do not hold the brakes down** (to avoid an unwanted stall).

B-STALL

The HYBRID TANDEM has a very clean, stable B stall.

To enter the B stall the pilot has to pull the first 20-cm slowly until the glider loses forward speed and starts to descend vertically.

Then the pilot can pull more on the B until he/she attains a stable 7 to 9 m/s descent rate. The Glider has no tendency to front rosette or become pitch unstable. To exit the B stall the pilot releases the B slowly until the glider has regained its shape and then the **last 15 cm fast** to prevent the glider from entering deep stall.

The HYBRID TANDEM can be controlled directionally in the B stall by pulling more on one B riser than on the other to create a turn in either direction. The B-stall is a safe controlled way of losing altitude fast without any forward speed.

BIG EARS

Big ears manoeuvre is effective means of descent on the HYBRID TANDEM. The risers are equipped with split A risers for this purpose. To induce big ears, reach as high up on the split A risers and pull them down firmly. The tips will open spontaneously when released, so to keep the wing in Big ears, they will have to be held in. It is safe and effective to combine Big Ears with open trimmers to achieve a higher sink rate and forward speed.

DEEP STALL (Parachutal Stall)

Under normal flying conditions the HYBRID TANDEM will have no tendency to enter deep stall. All gliders can however under certain conditions enter and stay in deep stall configuration (as a result of ageing of materials, improper maintenance or pilot induced).

Signs of parachutal stall

- The pilot has very little or no forward airspeed and no wind in his face.
- The glider will be fully open but the cells will be bulging in and not out on the bottom surface.
- You will have an increased vertical descent.

Recovery from parachutal stall

It is important to recognize this situation. Most accidents involving parachutal stall happen because the pilot did not realize that he was in deep stall.

The best way to exit a parachutal stall is to pull all the A risers down to get the wing flying again. The pilot can pull the riser down until the wing starts to fly again. The moment the wing starts to fly the pilot should release the A risers, or the wing might suffer a frontal collapse.

Alternatively, the pilot can release the trimmers to lower the angle of attack and get the wing flying again.

By pulling one or both brakes while in deep stall the pilot can accidentally enter a full stall or spin. (Not recommended).

SPIRAL DIVES

The HYBRID TANDEM has very good behaviour in spiral and has no tendency to stick in the spiral. By progressively applying brake on one side the glider can be put into a spiral dive. Safe high sink rates can be achieved like this. The spiral has to be exited slowly by releasing the brake over one complete turn or the glider may pitch back, and then forward and possibly suffer a collapse.

Care must be taken that the pilot has enough height to exit the spiral safely.

Sink rates in excess of 19m/s can be obtained.

CAUTION:

SOME GLIDERS CAN BE NEUTRAL IN SPIRAL AND MAY NOT EXIT WITHOUT PILOT INPUT. TO EXIT A NEUTRAL SPIRAL THE PILOT HAS TO LEAN HIS/HER WEIGHT TO THE OUTSIDE OF THE TURN OR APPLY BRAKE INPUT TO TURN OUT OF THE SPIRAL (ON THE OUTSIDE WING). AS SOON AS THE GLIDER STARTS TO SLOW DOWN IN THE SPIRAL THE OUTSIDE BRAKE MUST BE RELEASED.

PILOTS CAN SUFFER BLACK OUTS IN SPIRALS AND THE PILOT HAS TO EXIT THE SPIRAL AS SOON AS he/she FEELS ANY ABNORMAL SYMPTOMS (Black dots in field of vision or light-headedness).

STRONG TURBULENCE

Firstly, If you know its turbulent conditions – DON'T TAKE OFF!!!

If you unexpectedly encounter strong turbulence, fly with **trimmers closed and some brakes applied** to increase angle of attack and reduce forward speed - Land as soon as possible.

STEERING NOT FUNCTIONING

If the pilot cannot reach the brake or steering lines for any reason or if they are not functioning properly, (for example: If they break on a damaged point) the pilot can control the glider by pulling down on the rear risers.

Care must be taken when steering like this, as much less input is needed to turn the wing and the response of the wing is also much slower than when using the brakes.

IF YOU PULL TOO MUCH ON ONE OR BOTH RISERS THE GLIDER WILL SPIN OR STALL.

On the landing flare the pilot should be especially careful not to stall the glider too high.

LANDING

Before landing, the pilot should determine the wind direction, usually by checking a windsock, flags, smoke or checking your drift over the ground while doing one or more 360° turns.

- Always land into the wind.
- At a height of about 50 meters your landing setup should begin. The most commonly used one is to head into the wind and depending on the wind strength the pilot should reach his/her landing point by making s-turns.
- At a height of about 15 meters the final part of your descent should be made at trim speed into the wind.
- At a height between half a meter and one meter you can gently flare the glider by pulling gradually down on the brakes to the stall point. When top-landing it is sometimes not necessary to flare or a much smaller flare may be required, especially in strong ridge conditions.

TREE LANDING

If it is not possible to land in an open area, steer into the wind towards an unobstructed tree and do a normal landing approach as if the tree is your landing spot. Flare as for a normal landing. On impact hold your legs together and protect your face with your arms.

After any tree landing it is very important to check all the lines, line measurements, and the canopy for damage.

WATER LANDING

As you approach landing, open all the buckles of the harness except for one leg. Just before landing, release the remaining buckle. Let the wing pitch completely forward until it hits the water with the leading edge openings; the air inside will then be trapped, forming a big air mattress and giving the pilot more time to escape. Less water will enter the canopy this way, making the recovery much easier. **Get away from the glider and lines as soon as possible**, to avoid entanglement. Remember that a ballast bag can be emptied and then inflated with air for a flotation aid.

The wing should be carefully inspected after a water landing, since it is very easy to cause internal damage to the ribs if the canopy is lifted while containing water. Always lift the canopy by the trailing edge, not by the lines or top or bottom surface fabric.

16 POWERED FLYING

In case of use of the wing in combination with trike:

Due to the very wide assortment of trikes on the market with different set up and design, it is necessary to verify that the specific trike can be successfully coupled with the wing.

Please make sure your dealer performs the following procedures before first flight:

NOTE: Before each start it is necessary to perform a complete check of the paraglider, harness and power unit.

- Never place the power unit downwind of the paraglider.
- Double check that there is no fuel leakage.
- Do you have enough fuel for the flight? It is always better to have too much than too little!
- Check that there is nothing loose in the harness that could possibly contact the propeller in flight.
- Whenever you encounter a problem, fix it **AT ONCE** however small it is!
- Always put on and lock your helmet before getting in the harness.
- Before each launch do a full pre-flight inspection.

In powered flight most of the wing characteristics remain as described above (Chapter 16). Still there is additional information needed, concerning power output, proper matching of the wing/engine/propeller etc.

APCO can try to give advice on some possible tested combinations, but if you contact your nearest APCO dealer or frame manufacturer they will always be ready to help.

FIRST FLIGHTS

In order to get familiar with your wing we recommend flying with trimmers at the 0 position first in stable non-turbulent weather. Once you feel confident with your wing, you can start experimenting with faster trim settings and speed system, taking all necessary precautions. Learn to use all of the additional speed of the HYBRID TANDEM.

Remember: do not exceed the envelope of weather, wing and other parameters to insure safe flying.

TAKE-OFF

FORWARD LAUNCH

Please check wind direction, even when it seems that there is no wind at all, there is always some drift. Therefore, be careful in determining the conditions, since in PPG flying it is most important that the launch and initial climb are performed with a head wind (the danger of losing your airspeed while crossing the wind gradient is greatly reduced). Special attention must be paid to trees, power lines and other obstacles, including the possibility of emerging rotors.

Launch preparation

Lay out the paraglider in an arc, downwind of the power unit, with all suspension lines taut and pointing toward center of the power unit. The risers are to be laid on the ground.

Set the trimmers in 0 positions.

Make sure that you warm up the engine while standing windward of the wing. Stop the engine before clipping in the risers.

Now have quick checks if:

- Helmet is on and fastened.
- The risers are clipped into the carabiners.
- The trimmers are properly set.
- Propeller is clear.
- Speed system is functioning, problem free.
- Steering lines and handles are free and not twisted.
- The engine delivers full power.
- Take off area is clear of approaching traffic, obstacles and free to use.

When you are sure all is OK, you can clip in the wing and execute launch as described in paragraph 17.2.

From now on you should steer / handle the paraglider facing forward, without looking back over your shoulder. If the wing is retreating and behind you at a low angle, do not turn around as there is a danger of falling on your back and damaging the propeller and catching lines in the propeller, so it should be avoided.

During take-off, when you feel the tension on both risers to be equal, make sure the wing is overhead, open up full power and lean back to counter the engine thrust, so that it can push you forward rather than towards the ground.

The best option is not to use the brakes, allowing the paraglider to rise as it was laid out.

If it starts to deviate from its course, pull the opposite riser and run under the centre of the wing while continuing in the initial direction.

If the wind suddenly drops, give a strong pull on the risers.

If the paraglider falls to one side or back too far to lift again - kill the engine, cease launch and check the conditions once again.

As the wing rises, the forces grow lighter and it should stabilize above your head without overshooting.

This is the best moment to check if it is inflated well and the lines are not tangled, **but do not stop or turn.**

Once you feel the forces on the risers decrease, run faster and let go of the risers.

See if there is already any opposition on the brakes and, if necessary, use them to correct direction or to increase lift at take-off.

Remember:

- If the cage of your power unit is not stiff enough, the risers will strain during launch and can deform it to the extent of collision with the propeller. Before applying full throttle, see that the cage does not catch any lines.
- Any brake operation (or steering input in general) should be smooth and gentle.
- Do not try to take off until you have your wing overhead. Hitting power before that can cause dangerous oscillations.
- Do not sit in the harness until you are sure you are flying!
- The faster the trim setting is, the more brake input is required to take off. The HYBRID TANDEM is best with trims fully closed for takeoff and landing

REVERSE LAUNCH (In strong wind)

Reverse launch can be executed holding in one hand both A risers and one brake, with throttle and the second brake in the other hand. A moderate wind is by far the best way.

In weaker wind it is better to prepare for forward launch, as running backwards with an engine on your back is not an easy thing to do.

It is reasonable not to pull the wing up until you are really determined to launch, especially when it is clipped in.

Lay down the paraglider with its trailing edge against the wind.

Unfold the wing enough to find the risers and check that no lines are looped over the leading edge.

Stretch the risers against the wind, separating the right and left one.

We suggest that you lay the risers in the same way as you will be turning during reverse launch, and place one riser over the other, with rear risers on top.

It should be done this way because once you clip in, the cage of your power unit will make turning on your own very difficult.

Now run the pre-launch checklist.

After warming up the engine put the power unit on, turn to face the wing, go to the risers and clip them in the appropriate carabiners.

Pull on the front and rear risers to open the cells.

It is a good idea to pull up the wing briefly in order to check that the lines are not tangled.

Holding the risers, brakes and throttle as described above, pull the front risers and raise the wing over your head.

On most occasions you won't have to use the brakes.

Once you have it overhead, turn around, open the throttle and take off.

Remember:

- You are launching with your hands crossed. You have to perfect this technique before trying it with a running engine on your back.
- Any brake operation (or steering inputs in general) should be smooth and gentle.
- Do not try to take off until you have your wing overhead, applying the throttle early can cause dangerous oscillations.
- Do not sit in the harness until you are sure you are flying!
- The faster the trim setting is, the more brake input is required to take off.
- When clipping in the crossed risers, you can find proper connection of the speed system particularly hard. Be careful not to confuse the risers!

CLIMBING

Once you are safely airborne, continue heading against the wind, using brakes to correct the direction.

Do not try to climb too steeply.

In powered flight the HYBRID TANDEM behaves more like an airplane than a paraglider, and it is good idea to regard it as such. If there are no obstacles present, it is by far safer to fly level for a while after take-off, clearing the ground gradually, gaining some speed before converting it to height with a brief pull on the brakes.

Another reason not to try climbing too steeply is the risk connected with engine failure at low altitude.

HYBRID TANDEM in a steep climb does not stay behind as much as conventional paragliders.

The HYBRID TANDEM does not have SRS (prevents or delays possible stall), so low speed at low altitude carries inherent danger of stalling

Besides, you should always be able to land safely in case of engine malfunction, so it's better not to take unnecessary risk and always fly with a safe margin of speed and height

Depending on the power unit geometry, it is possible that after take-off you will notice a propeller torque (known as P-factor), which may induce a turn, which increase with amount of power, this can be countered with steering, and asymmetric trimmer settings.

When climbing steeply with slow trim settings and high-power output beware of the possibility of stall.

Due to considerable vertical distance between thrust axis and wing chord - the range of safe power operation is closely connected to your skills and equipment.

Power-unit induced oscillations:

Certain configurations of engine weight, output and propeller diameter can cause oscillations, during which the pilot is being lifted to one side by the torque effect, swings down due to his weight, and then is lifted again and so on.

To avoid this, you can:

- Change the throttle setting,
- Adjust the cross bracing to counteract the torque (if present),
- Shift yourself to the other side of the harness and/or
- Change the trimmer setting.

The best method is to fasten opposite cross-bracing, or apply some weight-shift.

Such oscillations usually occur at full power - the greater the engine output and propeller diameter, the bigger the swings.

In addition, pilot reactions can often be wrong or come too late, increasing the problem instead of solving it.

In this case the safest way to deal with this question is to close the throttle and release the brakes.

Less-experienced pilots especially tend to overreact.

This is called a pilot-induced oscillation, and the proven solution is to **leave the brakes alone**.

LEVEL FLIGHT

If you have a variometer or altimeter – check it regularly.

In level flight it is very easy to start climbing unintentionally.

The instrument will help you optimize speed and fuel economy.

Every flight is affected by the configuration of your gear, but due to HYBRID TANDEM's ability to fly safely without constant piloting, it will let you adjust everything to the best effect.

Good knowledge of weather conditions (e.g. wind at different altitudes) and knowledgeable use of thermals, convergence or other kinds of lift will help you greatly reduce fuel consumption and increase flight range.

Do not hesitate to thermal with the HYBRID TANDEM in order to win some altitude and spare fuel - you will be surprised how efficient it is.

Closing the trimmers will make the climb ratio even better.

TRIMMERS AND SPEED-SYSTEM SETTINGS

You are free to experiment with all possible settings, **as long as you are at safe altitude and watch the weather**. Fully opened trimmers increase the speed of the wing and overall penetration and reflex, **but when trimmers are opened it is highly recommended to use secondary steering only (stabilo steering), using the main brake handles will increase the risk of a collapse**.

As forces on the brakes grow at high speeds, weight shift or steering with STABILO STEERING system becomes increasingly effective.

The TIP STEERING system can be used in all trimmer and speed system settings, also in combination with main brake handles.

At maximum speed bar and fully opened trimmers we **highly recommend** steering with STABILO STEERING system.

Strength needed to initiate the turn will be smaller and there will be no decrease in speed.

On the other hand, slow trimmer settings decreases sink and steering forces, so it is possible to efficiently use the thermals.

Worth noting is the HYBRID TANDEM's impressive speed range -the maximum speed is double the stall speed.

Turns can be much improved by additional use of throttle, speed-system etc. Once you master these techniques, you will be able to execute fully coordinated and effective turns.

REMEMBER:

Trim setting must be part of the pre-start check list!

Taking off with open trims may be dangerous.

Asymmetric adjustment will have an inherent turn.

LANDING

In PPG flying there are two kinds of landing: with and without power.

POWER OFF LANDING

At an altitude of ~50 meters, when set up on a good and safe approach, cut the engine and glide as you would on a conventional paraglider.

It reduces the chances of damage on landing, but on the other hand there is only one attempt possible -so it has to be done right!

POWERED LANDING

Make a flat approach with the engine idling, then level out and lose the speed before final flare.

Immediately on landing, cut the engine.

The main advantage of this procedure is of course the possibility of doing a go around (repeating the approach) if anything goes wrong. Still, if you forget to switch off the ignition before the wing falls down, there is a considerable risk of damaging wing, lines and or propeller, or even suffering injuries connected with falling with your running engine.

Remember:

- Whenever possible, get to know the landing field before taking off.
- Check the wind direction before planning the approach.
- Landing with power off requires much less space.
- In case of any doubt, practice the landing until you feel totally safe
- After landing, continue to maintain the wing's direction straight, as on turning you always risk getting lines in the propeller.
- Turn only if there is danger.

17 PACKING

Spread the wing completely out on the ground. Separate the lines to the left and the right side of the glider. If the risers are removed from the harness, join the two risers together by passing one carabiner loop through the other. This keeps them neatly together and helps to stop line tangles.

Fold the canopy alternately from the right and left sides, working towards the centre, press out the air, working from the rear towards the front. Place the risers at the trailing edge of the folded canopy and use them to finally roll up the canopy.

18 MAINTENANCE & CLEANING

Cleaning should be carried out with water and if necessary, gentle soap. If the glider comes in contact with salt water, clean thoroughly with fresh water. **Do not use solvents of any kind**, as this may remove the protective coatings and destroy the fabric.

19 STORAGE

When the glider is not in use, the glider should be stored in a cool, dry place. A wet glider should first be dried (out of direct sunlight). Protect the glider against sunlight (UV radiation). When on the hill keep the glider covered or in the bag. Never store or transport the glider near paint, petrol or any other chemicals.

Do not leave your paraglider in the trunk of a car or exposed to the sun.

Temperatures on a hot summer's day in a closed environment: car, etc. can easily reach over 60°C

At these temperatures Nylon permanently changes its characteristics which may alter the behaviour and shape of the wing.

It will cause permanent damage to the paraglider, rendering it non-airworthy. APCO's warranty will not be applicable.

20 DAMAGE

Using spinnaker repair tape (for non-siliconized cloth) can repair tears in the wing (up to 5cm). A professional repair facility should repair greater damage.

21 THREE YEAR WARRANTY

The following warranty is granted by APCO Aviation Ltd. with respect to all of its standard Serial Production Wings, manufactured from January 1, 1994, subject to full compliance by the purchaser/owner to its following terms, as hereby detailed:

APCO Aviation Ltd. guarantees the fabric of its wings against porosity to the extent that the wing becomes Unairworthy. The fabric is warranted to retain sufficient air impermeability to fly safely for a period of 250 hours or 3 years, whichever comes first. APCO Aviation Ltd. undertakes at its option to repair or replace the wing, as necessary, at APCO's discretion.

This warranty is subject to the following limitations: a. The original purchaser has properly completed and returned the Warranty Registration Card to APCO Aviation Ltd. b. The wing owner duly records the wing's flight time and use, in an official Log Book, signed by himself and/or an official instructor site supervisor, meet official etc. This Warranty will not be in force for wings without properly registered and logged Flight Records. The wing has undergone its periodical inspections as required in accordance with its users' Manual and Directives of Association, to which the owner is affiliated, and has received its periodical signed Airworthiness Certificates from the owner's local paragliding authority, to this effect. d. The wing has been properly maintained and serviced, exclusively by APCO authorized dealers and their employees, and cleaned, dried, packed and stored in accordance to the manufacturer's instructions. For replacement wings the owner shall be entitled to a discount from the retail price proportionate to the remaining life span of the wing, as covered by this Warranty (pro-rata).

The wing has been flown for recreational use only – high stress applications, including (but not exclusive to) towing, instability manoeuvres, schooling, training and any professional use of the wing, are expressly excluded from the terms of this Warranty.

This warranty does not apply to the following:

- Use outside the specified load limitations.
- Colour fading of the fabric.
- Damage or corrosion caused by solvents, fuel or other chemicals.
- Accidental or flight (take off/landing) related damage.
- Damage caused by emergency parachute deployment.
- Modified wings.
- Any special, indirect, incidental or consequential damages of any nature whatsoever, resulting from the use of the wing, or lack of use and pleasure thereof, other than the cost of the product.

This warranty is transferable.

Your statutory rights are in no way affected by this warranty.

The manufacturer retains the right of final decision regarding any claims made within the framework of this warranty.

RECYCLING / DISPOSAL

Once your wing has reached the end of its life, it must be disposed of in an appropriate and environmentally conscious manner. Always ensure that you comply with the regulations of your country. There are organizations that recycle paragliders into Windsocks, Reusable shopping bags, Backpacks and more, so take the time to find a good solution.

22 GENERAL ADVICE

A qualified person or agent of the company should check the glider every year.

The glider is carefully manufactured and checked by the factory. Never make changes to the wing or the lines. Changes can introduce dangerous flying characteristics and will not improve flying performance.

Do not put the glider in direct sunlight when not necessary. In order to protect the glider during transportation or waiting time we recommend one of our lightweight storage bags.

- Do not fly over water, between trees or power lines and other places where engine failure will leave you helpless, always make sure you have possibility for emergency landing.
- Mind the turbulence caused by other gliders or even by yourself, especially when flying low.
- It is not recommended to let go of the brakes below 100 meters, because a possible power unit malfunction may require immediate attention.
- In general, never trust your engine, as it can stop at any moment. Always fly prepared for engine failure.
- Unless it is absolutely necessary (e.g. collision avoidance), do not execute tight turns against the torque direction. Especially when climbing you can easily enter a stall or negative spin.
- Do not fly with tail wind at low altitudes - it narrows your options!
- Do not wait for the problem to grow - any change of engine sound or a vibration may indicate a problem. You'll never know until you land and check it out!
- Be certain of your navigation
- Remember that not everyone is fond of your engine noise
- Take care not to disturb wildlife, and not to enter the airspace of wildlife sanctuaries, nature reserves or areas where birds are breeding.

If you have any doubts about flying conditions - do not begin.

If you have any questions, please contact your dealer or us.

Lastly, be equipped with a certified emergency parachute and helmet on every flight.

23 CERTIFICATION

The Apco Hybrid Tandem is certified EN-B and LTF-B (926-2 / 926-1)

The Flight, Load and other tests were conducted by Air Turquoise in Switzerland.

The following data represents the test configurations and results.

Maximum symmetric control travel at maximum weight in flight	80cm
Harness dimensions used during testing	H: 44cm W: 55cm

Line and Riser Measurements of flight test Paraglider ⁽¹⁾

Report No. : PG_1453.2019				Sample name: Hybrid Tandem 35				Date measure: 03.07.2020				Place: Villeneuve														
Manufacturer: Apco Aviation				S/N: PRO 0224				Responsible: Claude Thurnheer				Linked: ISO 71.8.1														
Total line length including risers [mm]												Main brake line with diff color than A,B,C main line?												Yes		
		A			B			C			D			E			F			Stab			Brake			+strap
		Manu ⁽²⁾	Sample	Diff	Manu	Sample	Diff	Manu	Sample	Diff	Manu	Sample	Diff	Manu	Sample	Diff	Manu	Sample	Diff	Manu	Sample	Diff	Manu	Sample	Diff	Sample
Center	1	7965	7968	3	7955	7960	6	8050	8057	7	8050	8059	9	8125	8135	10	8195	8204	9	6910	6919	9	8305	8304	-1	
	2	7885	7890	5	7875	7879	4	7820	7823	3	7820	7827	7	7900	7910	10	7970	7979	9	6945	6953	8	8075	8077	2	
	3	7780	7786	6	7780	7782	2	7735	7740	5	7735	7743	8	7810	7822	12	7880	7895	15	6960	6970	10	7850	7854	4	
	4	7755	7760	5	7755	7761	6	7725	7731	6	7725	7737	12	7800	7810	10	7870	7881	11				7755	7757	2	
	5	7765	7772	7	7765	7770	5	7670	7673	3	7670	7673	3	7765	7772	7	7835	7843	8				7675	7675	0	
	6	7790	7795	5	7790	7798	8	7620	7627	7	7620	7626	6	7705	7718	13	7775	7786	11				7705	7701	-4	
	7	7640	7640	0	7630	7643	13	7640	7646	6	7640	7645	5	7725	7738	13	7795	7809	14				7560	7567	7	
	8	7590	7593	3	7580	7590	10	7650	7657	7	7650	7657	7	7715	7716	1	7785	7786	1				7420	7421	1	
	9	7500	7505	5	7500	7502	2	7655	7663	8	7655	7663	8	7700	7706	6	7760	7767	7				7440	7444	4	
	10	7470	7474	4	7470	7472	2	7710	7719	9	7710	7718	8	7700	7710	10	7760	7770	10				7320	7321	1	
	11	7415	7420	5	7370	7377	7	7645	7642	-3	7645	7642	-3	7720	7722	2	7780	7783	3	Stab line to riser:			7265	7265	0	
	12	7400	7405	5	7355	7361	6	7560	7560	0	7560	7559	-1	7660	7663	3	7710	7714	4	B			7235	7233	-2	
	13	7235	7241	6	7235	7243	8	7550	7551	1	7550	7549	-2	7660	7662	2	7710	7713	3							
	14	7005	7012	7	7035	7041	6	7520	7520	0	7520	7519	-1	7600	7599	-1	7650	7650	0							
15							7470	7467	-3	7470	7469	-1	7525	7527	2	7580	7582	2								
16							7485	7487	2	7485	7484	-1	7525	7529	4	7580	7584	4								
17							7440	7444	4	7440	7446	6	7485	7482	-3	7530	7527	-3								
18							7405	7410	5	7405	7409	4	7440	7438	-2	7485	7483	-2								
19							7425	7431	6	7425	7432	7	7435	7439	4	7485	7489	4								
20							7260	7260	0	7260	7261	1	7385	7386	1	7435	7436	1								
21							7170	7170	-1	7170	7169	-2	7270	7269	-1	7305	7306	1								
22							7090	7090	0	7090	7092	2	7185	7187	2	7220	7222	2								
23							6995	7005	10	7090	7092	2				Number Cell:			48							
Wing	24						6955	6962	7	7030	7033	3				Weight of the glider [kg]:			4.28							

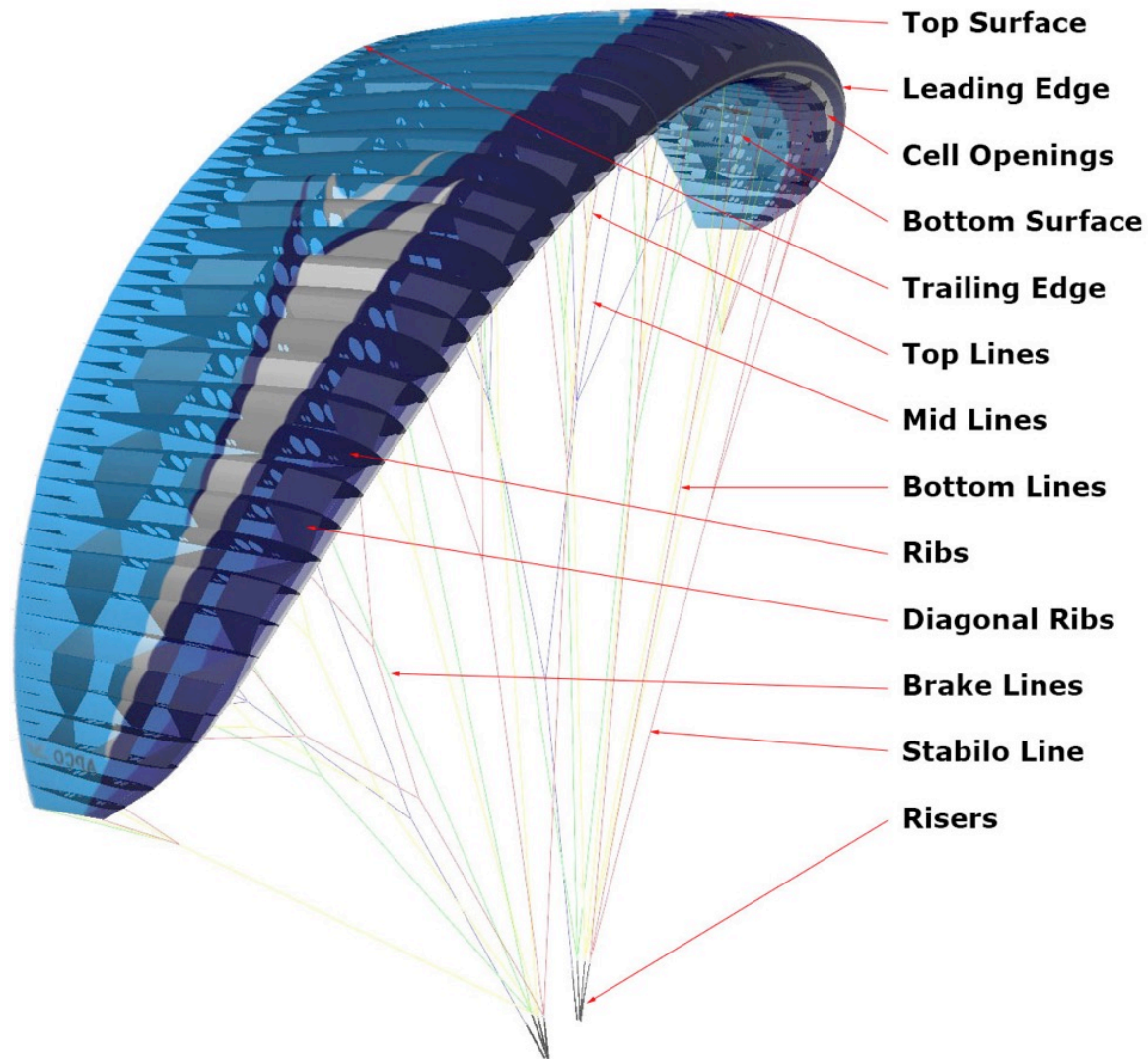
✓ Vous pouvez

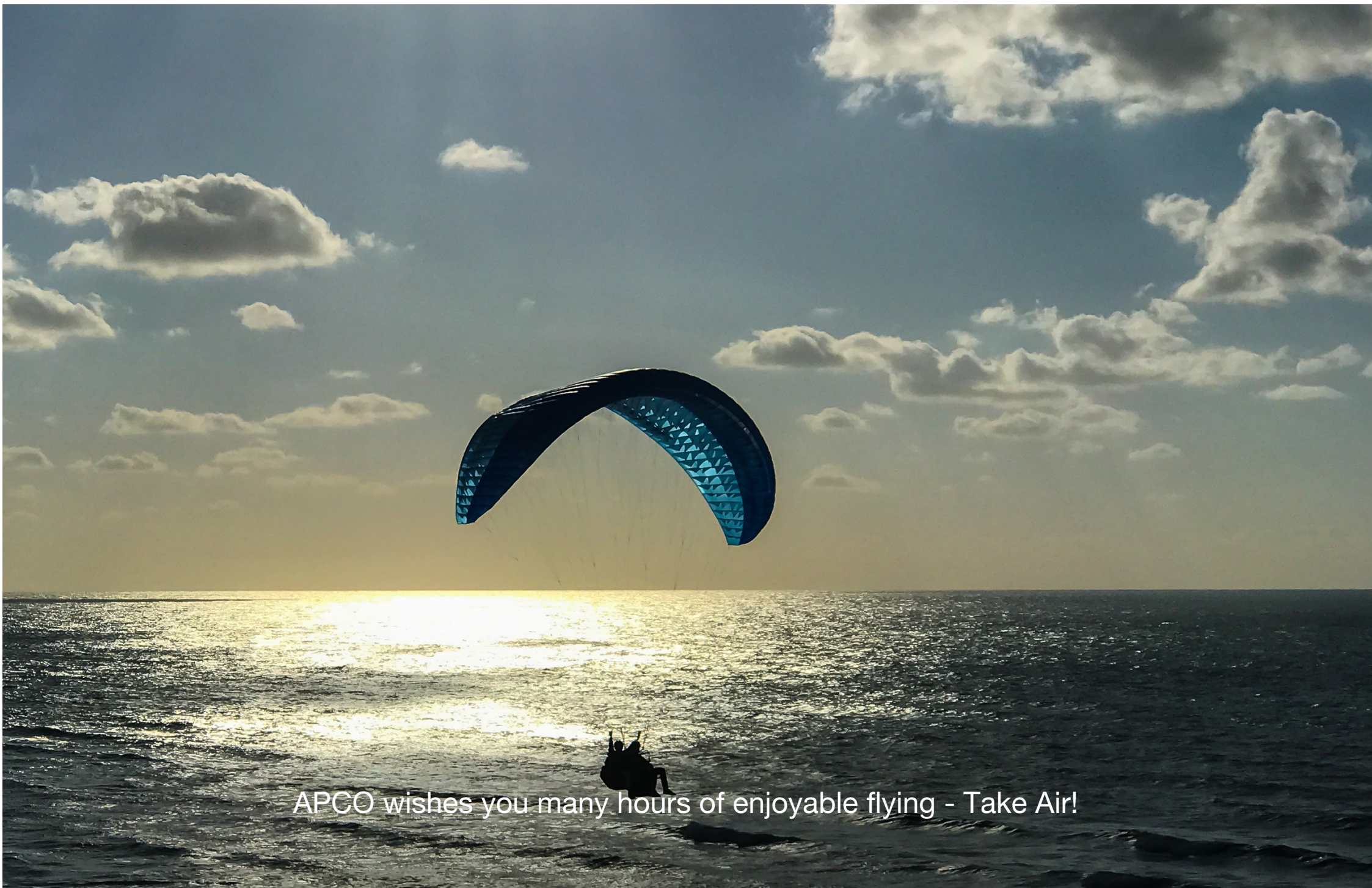
✓ Vous pouvez

Compliance of the test samples suspension lines, control lines and risers with the dimensions given in this manual was checked by the testing laboratory after the test flights were completed.

Line lengths specified are measured under a tension of 50 N, this tension being slowly and gradually applied before taking the measurement. Line measurement tolerance is up to +-10mm.

25 PARTS OF A PARAGLIDER





APCO wishes you many hours of enjoyable flying - Take Air!