

Airworthiness requirements for hanggliders and paragliders LTF-2009

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Appendix 1

Program for the execution of hangglider and paraglider test flights.

Appendix 2

Classification of hanggliders and paragliders

1 General

1.1 Validity and definitions

1.1.1 These airworthiness requirements are valid for

Hanggliders with harnesses

Paragliders with harnesses

Hangglider and paraglider rescue systems

Winches and winch tow releases for hanggliders and paragliders

Winch- and microlight-towing launching trolleys

1.1.2 A hangglider per definition of these airworthiness requirements is the aircraft including the attachment loops without harness. The airworthiness requirements (AR) must be fulfilled with all harnesses which have been approved for the hangglider.

1.1.3 Paragliders are aircraft with no rigid primary construction, which are launched and landed on foot, and where the pilot (and passenger) is (are) transported in a harness (harnesses) suspended beneath the glider. The paraglider per definition of this document is the aircraft including steering/brake lines, risers and handgrips for the brake lines without harness, and on tandem/biplane paragliders, the connecting loop between the risers and the attachment loops on the harness. If the harness is incorporated into the paraglider, the AR for harnesses apply. The AR must be fulfilled with all harnesses which have been approved for the paraglider.

- 1.1.4 Harness per definition of this document is the complete harness system including connecting karabiners to the hangglider to the risers of the paraglider. If rescue system containers are integrated in the harness, AR for rescue systems apply to all parts of the harness, that affect the function of the rescue system, without referring to a specific rescue system model.
- 1.1.5 Rescue parachutes are parachutes designed to slow the descent of a pilot in the event of an incident while flying. They are manually deployed and may or may not be steerable. Rescue system per definition of this document is the rescue parachute including connecting belt, inner container, connecting element to the harness and an outer container, with its mounting devices, that is separated from the harness. Should there be an integrated outer container instead, it is regarded as a part of the harness. For all parts of the harness that affect the function of the rescue system, the AR as outlined in this paragraph apply accordingly.
- 1.1.6 Winches per definition of this document are stationary and mobile winches, as well as static line winch systems for hanggliders and/or paragliders, including cutting devices, towing ropes, recoil ropes (recoil protection rope), drogue chutes, weak links, spacers and fork lines, but not including the winch release.
- 1.1.7 Winch release per definition of this document is the connecting element between harness and towing rope. The connection between winch release and a towing ultralight airplane belongs to the airplane.
- 1.1.8 This document is also valid for spare/replacement parts. If accessory parts can affect the safe operation of any equipment mentioned in above paragraphs, the document applies accordingly for these parts.
- 1.1.9 The appendixes and explanations are parts of the AR and are fully valid as interpretations, recommended procedures or additional information.
- 1.1.10 All applicants for type-test certification of equipment or modification to an existing type-test certification, must demonstrate that AR in this document have been fulfilled.
- 1.1.11 Additional documentation, requirements procedures and trials might be required if new materials, new design features, new facts or other circumstances arise that may influence the safe operation of equipment. Results which cannot be gathered through trials for practical purposes, might be verified by other means of validation if the same degree of safety can be ensured. If safety is not affected, some trials and documentations may not be required. If not specifically outlined in the AR, the testing centre will set the according parameters and procedures on an individual basis. Documented fulfilment of requirements from other testing centres within the European Economic Community and Turkey will be accepted as long as they are equal to these AR.

1.2 Design and construction requirements

- 1.2.1 The suitability and fatigue limits of all materials and manufacturing processes used must be verified through the manufacturers experience, or through testing. All construction component materials must be specified and documented.
- 1.2.2 All components have to be properly protected against weakening factors, especially against corrosion, UV radiation, wear from bending and folding, mechanical wear and damage from transport, assembly and operation.
- 1.2.3 Incorrect assembly and dismantling has to be prevented by constructional design. The full functionality of every part has to be guaranteed by the constructional design when the equipment is completely assembled.
- 1.2.4 Couplings, links, locks and other connecting elements have to be secured against unintentional opening. Load bearing ropes and lines need a minimum of 10 cm of slack behind all knots as an additional safeguard.
- 1.2.5 All necessary labels and markings have to be attached in a permanent and functional manner.
- 1.2.6 Adjustment features should only be present when necessary. Constructional design must prevent unintentional changes of adjustment and not allow adjustment limits to be exceeded.
- 1.2.7 All parts have to be accessible for inspection.
- 1.2.8 Potential sources of injury for operators and third parties from construction components must be kept to a minimum.
- 1.2.9 Safe operation must not be impeded by storage temperatures from -30 °C to +70 °C, operating temperatures from -30 °C to +50 °C and variations between 25% and 100% relative humidity.
- 1.2.10 The primary frame structure should be designed in order that dangerous load concentrating areas are avoided.
- 1.2.11 The processing of all parts that are relevant for airworthiness has to be done in an appropriate, functional and durable manner. Seam ends have to be safeguarded properly. Sewing methods, stitch spacing and threads have to be chosen according to the fabric and expected loading.

1.3 Structural strength

- 1.3.1 The tear strength/load capacity has to be verified through testing. The sample has to withstand the test load without any structural damages to materials and/or connecting components. Permanent deformations of components which could have a safety relevance may not occur at loading up to 2/3rds of the test load.

2 Hangglider

2.1 Design and construction requirements

- 2.1.1 There has to be a possibility to fit all hanggliders with wheels on the trapeze to compensate for landing shocks. Tandem hangglider have to be permanently equipped with wheels on the trapeze, and may have an additional wheel at the tail end.
- 2.1.2 It must be ensured that all wire connectors are designed such that assembly cannot only be performed with unsecured connectors.
- 2.1.3 The distance between the attachment point on the hang loop and the trapeze has to be 120cm. The testing centre may allow exceptions if necessary. A second independent backup attachment loop must be present. Each attachment/hang-loop has to hold a minimum load of 1300 daN without breaking.
- 2.1.4 The pilot must be able to trim the hangglider at all allowable take-off weights to fly at a speed between minimum sink speed and best glide speed.

2.2 Static longitudinal stability

- 2.2.1 The pitch moment of a hangglider must be sufficient to ensure static longitudinal stability with a sufficient safety margin at speeds up to 10km/h above the maximum allowable speed (Vmax). Vmax for a hangglider is 90km/h. Testing centres may make exceptions to this ruling, as long as safety is not affected.
- 2.2.2 The pitch moment of a hangglider has to ensure static longitudinal stability with a sufficient safety margin at any flyable speed, regardless of the Vmax.

Notes:

The static longitudinal stability is to be evaluated through measuring (among other things) lift, drag and pitch moment components.

Following measurement and evaluation procedures are suitable:

The glider is to be examined using a special test vehicle at speeds of 40km/, 60km/h, 80km/h and 100km/h. The maximum test speed can be reduced for gliders with a low Vmax. The desired outcome is to find the angle of attack (AoA) at each above mentioned speed that results in a wing loading of -0.5g to +1g range at medium takeoff weight (middle between min and max take-off weight). The readings of all 3 components for each speed are to be determined. The pitch moment is to be calculated for the common center of gravity of glider and pilot. It is to be assumed that the entire pilot mass is applied at the attachment/hang point.

Static longitudinal stability with a sufficient safety margin is given if at any test speed

- a) *the pitch moment between zero lift and a negative lift of -0.5g does not become negative*
- b) *between the AoA of zero lift and an AoA corresponding to the mean value of the AoA of zero lift and the AoA of stable level flight, (total aerodynamic force = mean takeoff weight) at the applicable test speed (named as „medium value“ for further purposes) no moment occurs that is smaller than a line, which reaches at zero lift AoA following limits*
 - *at 40 km/h 50Nm,*
 - *at 60 km/h 100Nm,*
 - *at 80 km/h 150Nm and*
 - *at 100 km/h 200Nm*

and goes to 0 at the point of the medium value.

- c) and between the zero lift AoA and the medium value no positive gradient of the moment curve ($dM/d\alpha > 0$) occurs. Such a positive gradient is only permissible if at any point of the positive gradient the necessary values of the zero moment according to point b) are achieved.

If the maximum test speed should be reduced due to a gliders low Vmax, the results according to points a) - c) have to be achieved up to the newly determined maximum test speed. Limits for intermediate values have to be found out through linear interpolation (example: limit at 60km/h is 100Nm, limit 80km/h is 150Nm, Vmax is 70km/h, limit for 70km/h = $(100+150)/2 = 125\text{Nm}$). The requirement that Vmax is not more than 10 km/h below the maximum tested loading speed remains valid.

2.3 Structural strength

- 2.3.1 The hangglider has to withstand following load factors without any structural damage to material or connections:

- a) positive test load: +6g
- b) negative test load: -3g

Notes:

The load capacity test has to be performed as a simulation of the load factors occurring in flight.

The given mass is the maximum takeoff mass minus half the mass of the glider.

In special cases a static test (sandbag test) can be performed. An elliptic weight loading pattern for positive loads and a rectangular weight loading pattern for negative loads towards the wingtips has to be applied. Towards the chord, the center of the applied load has to be at minimum 35% of chord line no matter if positive or negative loading.

2.4 Handling characteristics

- 2.4.1 The hangglider must be launchable by the pilot without external help. For all certified launch methods, the hangglider must be easily controllable by the pilot. During winch towing the hangglider must not exhibit break-out or oscillatory tendencies which may require extraordinary effort or skills to control by the pilot.
- 2.4.2 The hangglider must be easily landable by the pilot, without special action or undue effort. The glider has to be controllable without any major tendency for sliding or pitching motions. The activation of landing aids, or the change of the pilots position to prepare for landing, must neither cause an large change in steering forces nor influence the manoeuvrability of the glider in a negative way.
- 2.4.3 The hangglider has to be flyable under all approved conditions in all certified configurations over the complete speed range. The pilot must be able to execute all regular manoeuvres without any extraordinary effort and skills.
Flexible parts may not vibrate or oscillate excessively, fixed parts may not vibrate or oscillate at all. Shaking of the hangglider is only acceptable as a means of stall warning. No unexpected sudden wing deformations with aerodynamic consequences, ambiguous flight characteristics or adverse yaw, may occur over the complete speed range.
- 2.4.4 The hangglider has to maintain its trim speed during straight and level flight. Every significant change in speed has to be accompanied by an according change in steering forces. Vice versa the airspeed has to change relative to an according steering input. Steering forces

during a turn may neither in flight direction nor sideways, increase to a level that the pilot has to apply extraordinary effort or skills to maintain control. During a turn it is not permissible that the glider assumes an angle of bank (AoB) that requires extraordinary effort or skills of the pilot to return to level flight. All oscillations that can not be solved without extraordinary effort or skills by the pilot, must be damped over the complete speed range. Tendency to spin is not permissible. The hangglider has to return to normal flight conditions after a stall without any extraordinary effort or skill required by the pilot.

- 2.4.5 The pilot must be able to maintain a constant speed without extraordinary effort or skills over the complete speed range. Reversing a turn must not require any extraordinary effort or skills from the pilot.
- 2.4.6 Flight characteristics are to be evaluated through test flights. Necessary pilot abilities / skills for a certain hangglider are to be determined during test flights (see appendix II). The tested hangglider types have to be rated according to these abilities / skills by the testing centre (see appendix II). The test flights have to be documented according to a test flight record, written by the testing centre.

3 Paragliders

3.1 Design and construction requirements

- 3.1.1 Full flying and steering ability has to be demonstrated by all paragliders when used together with a standard harness according to paragraph 4 of this document. Designs which do not use a standard harness are only permissible when used with the harness specifically designated for the design. According labels and notices must be present on the paraglider and in the operating manual.
- 3.1.2 Components which may lead to an irreversible tangling of paraglider lines should not be used.
- 3.1.3 The paraglider has to remain flyable in case of a control line failure. Support and control lines must demonstrate sufficient breaking strengths. Control lines have to be distinguishable from support lines by permanent colour markings.
- 3.1.4 Control loops have to be easily reachable during the entire flight. The position of the control loops should be adjustable for use by pilots of all sizes. The adjustment range has to be clearly marked on the control lines.
- 3.1.5 Any attachment loops on risers have to be permanently closed.
- 3.1.6 Immediate internal pressure distribution within the canopy has to be ensured at all times.

3.2 Structural strength

3.2.1 Shock test.

The paraglider has to withstand a shock test without damage, where an instantaneous loading of all lines according to paraglider take-off weight is to be performed. The shock test is to be performed using a weak link to limit the maximum induced force. The weak link is to be dimensioned according to the following table:

Maximum take-off weight in kg	<120	120-180	180-240	>240
Weak link in daN	800	1000	1200	1400

Note:

Control loops are to be connected normally to the risers, without applying any brake to the canopy.

Shock test cable specifications:

Length: 125m

Diameter: >8mm

Minimum breaking strength: >=50 kN

Elastic cable stretch: <= 0,105% at 10% minimum breaking strength

Shock tests performed according to norm specifications EN 926-1:2006 (D) section 4.4.2 – A are also acceptable.

3.2.2 Load test.

The paraglider has to withstand one of the following load tests without damage ($g=9.81\text{m/s}^2$):

1) a load of $8g \times$ the maximum take-off weight defined by the manufacturer for a period of 3 seconds

2) a load of $10g \times$ maximum take-off weight defined by the manufacturer which must be reached a minimum of 5 times in a single test-run.

Note:

Load tests performed according to norm specifications EN 926-1:2006 (D) section 4.5 are also acceptable.

3.2.3 Line breaking strengths.

Procedures for testing line breaking strengths:

Lines are to be load tested as produced for construction. Before the breaking strength is determined, the lines must be artificially aged by bending 5000 times over 360° at critical points. The bending radius should be equal to the line diameter +/- 0.1mm.

The sum of the breaking strengths of all A- and B- main support lines must be more than $8g \times$ maximum glider take-off weight or a minimum of 800daN; 1200daN for tandem paragliders, whichever is higher ($g=9.81\text{ m/s}$).

The sum of the breaking strength of all other main support must be more than $6g \times$ maximum glider take-off weight or a minimum of 600daN; 800daN for tandem paragliders, whichever is higher ($g=9.81\text{ m/s}$).

The breaking strength sum of all line sections above the main support lines must be greater than the breaking strength of the main support lines.

For tandem paragliders, all connecting components between risers and harnesses must demonstrate sufficient load bearing capacities. Sufficient load bearing capacity is assumed when every individual component has a breaking strength greater than $9 \times$ maximum take-off weight or minimum 1350 daN when loaded for a minimum of 10 seconds.

Note:

Load tests performed according to norm specifications EN 926-1:2006 (D) section 4.6 are also acceptable.

3.3 Handling characteristics

3.3.1 The canopy must be launchable by the pilot without external help. For all certified launch methods, the canopy must be easily controllable by the pilot. The canopy may not demonstrate a tendency for entering deep / parachutal stalls which cannot be easily recovered from by a pilot.

3.3.2 The canopy must be easily landable by the pilot, without special action or undue effort.

- 3.3.3 The canopy must be able to be flown under all certified operating conditions and at all speeds. All normal flying manoeuvres must be able to be performed by the pilot without special action or undue effort.
- 3.3.4 The canopy must fly straight ahead at trim speed. Flying speed must be able to be kept constant by the pilot without special action or undue effort. After an increase in angle of attack, the canopy must return to normal flight without special action or undue effort from the pilot. Undamped oscillation of the canopy should never occur during flight. At minimum take-off weight, the trim speed must be at least 30 km/h.
- 3.3.5 It must be possible to quickly change from flying a curve on one side, to the opposite side without special action or undue effort from the pilot. Speed and course must change appropriately for brake inputs.
- 3.3.6 The canopies stall point must be easily recognisable. Exiting from a deep or parachutal stall must be immediate, with no need to enter a turn and without special action or undue effort from the pilot. Recovery from a full stall should happen once the brakes are released and without special action or undue effort from the pilot. The canopy should self-recover from a spin once the brakes are released.
- 3.3.7 The sink velocity must be able to be controllably increased. Recovering from increased sink velocities must be possible at any time.
- 3.3.8 Handling characteristics are to be tested in flight. Necessary pilot abilities / skills for a certain paraglider are to be determined during test flights (see appendix I). The tested paraglider types are to be classed by the testing centre according to appendix I.
- 3.3.9 Two different test pilots from the testing centre are to perform a complete test program each, one with the manufacturer's minimum recommended and the other with the manufacturer's maximum recommended take-off weight. The maximum recommended take-off weight may not exceed the maximum take-off weight used for the structural strength/load tests according to section 3.2. Should there be a case where the recommended minimum take-off weight is below 65kg and the testing centre cannot provide a light enough test pilot, the tests will be performed with the minimum possible take-off weight that can be provided by the testing centre. The manufacturer has to demonstrate an additional test program with the recommended minimum take-off weight. This program has to be demonstrated to a test pilot from the testing centre and it has to be documented on video.

4 Hangglider and paraglider harnesses

4.1 Design and construction requirements

- 4.1.1 If seat boards are used, special protection of belts, loops, lines etc. against mechanical damage induced by the board has to be ensured. The structural strength of the harness must be ensured should a failure of the seat board occur.
- 4.1.2 Standard harnesses for paragliders have to be equipped with an attachment point on each side (left and right) for the paraglider risers or for the connecting devices of tandem/biplane paragliders. Attachment points are to be between 35 and 65cm above the seat board in flight and they have to be horizontally separated from each other between 35 and 55cm. Attachment points are to be clearly marked with a contrasting colour and be clearly labelled with the maximum allowable load in daN. Other harness designs can only be approved together with a specific paraglider.

- 4.1.3 The harness must distribute all occurring forces in the best possible manner to the pilot's body.
- 4.1.4 In the event of a landing in water, it must be possible for the pilot to quickly and safely separate from the harness.
- 4.1.5 The harness should not impede the pilot when starting or flying such that special action or undue effort is necessary.
- 4.1.6 It must not be possible for the pilot to fall out of the harness under any position. Closing the chest strap on the harness must also ensure that falling out of the harness due to open leg straps is not possible. Alternatively; a load carrying connection to the canopy must only be possible when the leg straps on the harness are closed.
- 4.1.7 Reserve parachute, and reserve parachute connecting straps must be positioned that canopy, harness and reserve parachute can all operate correctly. Connecting straps must be marked with a contrasting colour, and the maximum load in daN.
- 4.1.8 The harness has to be suitable for all kinds of winching operations. Exceptions can be approved by the testing centre. Hangglider harnesses are to be equipped with appropriate attachment points for a winch release. These attachment points have to be clearly marked with a contrasting colour and be clearly marked with the maximum allowable load in daN. A correctly attached winch release must not influence the operation of the rescue system in any way.
- 4.1.9 If the harness is equipped with an integrated rescue system container and this rescue system is to be deployed by hand, the handgrip of the outer container is to be connected to the inner container with a strap loop in a way that it is possible to use the harness with different types of inner containers. The minimum and maximum volume of the rescue container must be clearly labelled in cm³, to indicate the range of compatible rescue systems. Should the harness be fitted with a rescue system which is not to be deployed per hand, then this harness must be tested together with this specific rescue system. The pilot should be suspended in a near upright position once the rescue system has been deployed.

4.2 Structural strength

- 4.2.1 Harnesses must have sufficient load dimensions for all expected flying situations.

Details:

Sufficient load dimensioning can be assumed when the harness can be loaded for a period of 10 seconds without damage at the following values:

- a) *Nine times the maximum pilot mass, minimum 900 daN in normal flight position, connected at riser attachment points.*
- b) *Six times the maximum pilot mass, minimum 600 daN in landing position, connected at riser attachment points.*
- c) *Six times the maximum pilot mass, minimum 600 daN, in an upside-down position, connected at riser attachment points.*
- d) *Three times the maximum pilot mass, minimum 300 daN, in the the towing direction at the tow release points of attachment.*

Loading a) to c) is also to be performed at the reserve parachute attachment points, and at any points which could be used for incorrect attachment of the harness.

- 4.2.2 Proof of loading may also be presented according to European Norm EN 1651 September 1999.

- 4.2.3 Connecting elements according to section 1.1.4 in this document must have proof of durability testing supplied by a suitable testing laboratory.

5 Paraglider harness protectors

- 5.1.1 Paraglider harnesses have to be equipped with a protection device that dampens shocks on the spine during a hard landing (harness protector).

The dampening characteristics have to be proven by shock/impact tests.

Notes:

Harness protectors are currently available in three different (and partly combinable) groups:

Airbag protectors:

Airflow during flight fills a bag. During impact, a valve construction at the air intake prevents sudden deflation, and the airbag absorbs part of the impact energy in this process.

Rigid foam protectors:

During impact, the rigid foam protector is destroyed and absorbs part of the impact energy in the process.

Soft foam / mousse protectors:

Soft foam contained in an airtight case functions similar to an airbag protector. On impact a defined volume of air is compressed and escapes through the case and its seams, thereby absorbing part of the impact energy.

- 5.1.2 The combination of harness, protector and rescue system may not lead to any circumstances that result in a degraded safety when operating the paraglider. The protector has to be installed into the harness in a way that does not degrade the tested dampening values.

- 5.1.3 The size of the protector has to ensure sufficient safety for the pilot from the middle of the pilot's thigh up to the shoulder line (bottom of neck) over the whole body width. Fixed parts on the harness or protector are only permitted if no injuries of the back or neck area are likely from these parts. Design and material of the protector have to ensure as far as possible that no bending or punctual stress points result in the back or neck area on impact deformation.

- 5.1.4 The protection may not depend on a manual activation prior to impact. Systems that only function correctly after the pilot has undertaken for example, special filling or maintenance measures, are only permitted when the pilot can accomplish this alone. Such systems must be clearly labelled on the harness.

5.2 Limits

The following limits may not be exceeded during a protector test:

Maximum peak 50g

Maximum 38g for a period of 7 milliseconds

Maximum 20g for a period of 25 milliseconds

All three criteria must be fulfilled.

5.3 Test procedures

5.3.1 Test setup

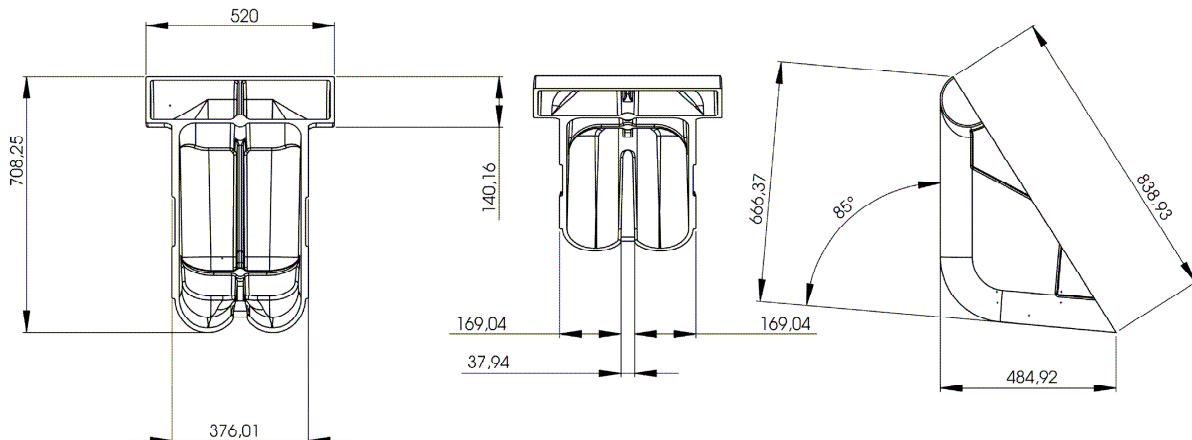
The point of protector impact must be hard and flat.

The protector test should be conducted at a temperature between 20-25 °C. The protector itself should also have a temperature between 20-25 °C.

Should the protector material be particularly temperature sensitive, then impact tests should be performed at both temperatures between -10 - -5 °C and 20-25 °C.

5.3.2 Test dummy

The test dummy must be constructed according to the following diagram. The dummy mass is 50 kg. The harness is to be mounted on the dummy and all connecting elements should be closed. The harness should be mounted such that at least 200N vertical force is applied to the main attachment points.



5.3.2 Release height

The release height for the impact test must be at least 165 cm. The speed on impact must not be less than 3% of the theoretical freefall impact speed from 165cm.

5.3.3 Airbag flight simulation

The airstream used to inflate the airbag should not flow at more than 7 m/s at the harness. The inflation airstream must be stopped for a period of 5 seconds before the harness is released. Direct insertion of the inflation airstream tube in the airbag or any other methods of preventing air leakage from the airbag are not permitted.

5.3.4 Repeat testing

Two identical tests are to be performed on the protector within a time period of 1-2 hours of each other. Airbag tests can be performed immediately after each other. The maximum peak values for the second test may not exceed the maximum peak values for the first test by more than 20% over a 1 millisecond period.

6 Hanglider and paraglider rescue systems

6.1 Design and construction requirements

- 6.1.1 The rescue system should ensure safe rescue of the pilot without injuries in all emergencies, even if the main canopy has not been separated from the pilot.
- 6.1.2 Should the rescue system have any adjustment possibilities then it has to be fully operational/functional over the entire adjustment range.
- 6.1.3 The rescue system has to be fully operational with one main support line broken. The lines have to be bundled at the connector.
- 6.1.4 The connecting strap has to have a minimum load capacity of 2400 daN. The exposed part of the connecting belt has to be protected against environmental factors.
- 6.1.5 The deployment of the rescue system has to be ensured under all circumstances, especially with a damaged glider, under uncontrolled flight or when the connection between harness and glider should fail. The operation must not be influenced by any kind of packing procedures, pressure applied from packing, locking system or any other factors. The pilot has to be able to

deploy the rescue parachute with a single pull out of the outer container, single handed in an anatomically favourable direction. This also applies if the deployment is achieved with the help of any technical device. The action of pulling out the packed chute from the container by hand has to lead directly to a controlled deployment of the rescue system without any changes in direction/plane of motion and without requiring any extraordinary effort or special skills. Inadvertent deployment in flight has to be fairly remote. If deployment is achieved by using a technical device the testing centre may require a backup hand deployment option for the eventual case of failure.

Notes:

Single hand deployment is assumed if the necessary deployment force does not exceed 7 daN.

Unintentional deployment is regarded as impossible if for example a weak link is installed that withstands a minimum load of 2 daN.

- 6.1.6 The opening of the reserve parachute has to be assured for all packing pressures and manufacturer approved packing configurations. The opening has to be also assured regardless of the pilots descent rate and his throwing technique if it happens outside the pilots reach.
- 6.1.7 The outer container has to have suitable attachment points for connection to a harness.
- 6.1.8 The handgrip of the outer container has to be connected to the inner container with a removable loop in a way that it is possible to use the inner container with different types of outer containers. Exceptions may be approved by the testing centre. The connection between handgrip and inner container has to have sufficient load capacity/structural strength in any situation that may arise during normal operation.
Sufficient load capacity/structural strength is assumed if the connection between handgrip and inner container withstands a minimum of 70 daN over a 10 second period.
- 6.1.9 The minimum and maximum volume of the packed rescue parachute in cm³ must be given, to determine compatibility with differing harnesses.
- 6.1.10 Hanggliders have to have an additional connecting element between harness and rescue system. The design has to ensure an additional connection with sufficient load capacity/structural strength independent from the main attachment loop.
Sufficient load capacity/structural strength is assumed at 2400 daN.
- 6.1.11 The pilot must not suffer any major injuries upon touchdown.
*Notes: Major injuries do not usually occur at descent rates of less than 6.8 m/s.
Instead of testing the descent rate at a given load, the according values can also be found by determining the load at a given descent rate with the help of a test vehicle.*
- 6.1.12 The rescue system has to fulfil its purpose even at relatively low altitudes.
*Note:
Low altitude capabilities are assumed if the initial opening shock of the parachute occurs in freefall 30m to 60m after release at zero speed. For this test the parachute should be loaded with 70kg.*
- 6.1.13 The rescue system has to be aerodynamically stable and should not tend to excessive oscillations.
- 6.1.14 Parts with a dampening influence of the opening shock are permissible if a damage of these parts as a result of the dampening function is clearly visible to the pilot as a permanent damage.

- 6.1.15 The rescue system has to withstand a possible shock load of the maximum load capacity, or at least 100kg for paraglider and 120kg for hangglider rescue systems, upon opening.
Dampening devices may be changed in between different tests. Delay devices for the opening are permissible only if their delay timing is not adjustable.

Note:

A suitable procedure is a series of three freefall test deployments on the same test sample from an altitude of 85 m over ground.

- 6.1.16 If the rescue system is equipped with a cut-off function to separate the pilot from the main glider, then it must be assured that no freefall occurs at any point in the deployment.
- 6.1.17 Rescue systems with forward velocity have to be steerable and their flight characteristics have to be similar to a paraglider. Safe flight must be ensured even without pilot input. The testing centre may set limits for speed and glide ratio of the rescue parachute.
- 6.1.18 The rescue system has to be compatible with any harness. The testing centre may limit the operation of a particular rescue system to certain harnesses for safety reasons. Special notes indicating this have to be placed on the rescue system and in the operation manual.
- 6.1.19 Pilots must be able to pack a rescue system using only the accompanying packing instructions, no assistance, special qualifications, extraordinary skills or special tools should be required. A packing record list is to be delivered to the customer with every rescue system.

Note:

Rescue system tests performed according to norm specifications European Standard EN 12491 February 2001 are also acceptable for section 6.1, with exceptions for points 6.1.4 and 6.1.9.

7 Winches for hanggliders and paragliders

7.1 Design and construction requirements

- 7.1.1 A safe towing of the glider has to be assured any time and during any approved mode of operation of the winch.
- 7.1.2 The winch has to withstand the maximum expected loads and stresses during towing without any influence on the operational safety. The cable/rope routing system (reel-system) has to be designed and proportioned to avoid excessive wear of the towing rope/towline. The complete rope with all parts and attachments including connections and repaired portions have to withstand a minimum load of 300 daN, or for towing in excess of 100 daN tension, 400 daN. The testing centre may accept exceptions, insist on weak links or set other limits.
- 7.1.3 Safe anchoring of static winch systems must be ensured. Proper electrical grounding is mandatory due to the possibility of electromagnetic charge accumulation on the rope during towing. Mobile winches and static line systems have to be safely anchored to their towing vehicles.
- 7.1.4 The winch operator has to be protected against injuries from failed ropes by an appropriate safety device that must not hamper his vision. Exhaust gases must be routed away from the operator. A safe seat for the operator has to be provided on mobile systems. Tail gates or similar vehicle parts have to be secured appropriately.
- 7.1.5 Weak links have to be designed to prevent injuries to pilots if they brake or a rope fails. Spacer and fork lines have to be designed to prevent the weak link from recoiling back towards the pilot.

- 7.1.6 Noise and exhaust reduction systems have to be according to current technical standards and should minimize environmental effects to a maximum extent. Combustion engines and hydraulic units have to be equipped with an oil retaining sump.
- 7.1.7 All activation and control equipment necessary for safe operation of the winch has to be within reach and view of the winch operator. Operation must only be possible with a fully functioning rope-cut-off device. Following order of placement is mandatory for all stationary winches:
 - a) Gear and cut-off handle: combined in the center to slightly left; push forward to cut off, pull back for towing
 - b) Tension adjustment lever: far left side
 - c) Brake lever: far right side
 - d) Clutch pedal/switch: center
 - e) Tensiometer: in the field of view in the direction of the towed glider
- 7.1.8 The winch operator has to be able to terminate the towing at any time, reel rope off the drum (brake drum) and cut off the rope. The testing centre may accept exceptions.
- 7.1.9 Tow ropes must be able to be reeled off and on to the winch drum without any trouble. The drum resistance has to be between minimum 2 daN and maximum 5 daN. The rope routing system has to ensure a reeling of the rope at angles up to 90° from the longitudinal axis of the winch. The effective diameter of the main support reels has to be at least 100mm. If a proper reeling of the rope is not ensured, a special reeling/routing device has to be added. It can be manually or automatically actuated. The testing centre may accept exceptions and set the limits of operation.
- 7.1.10 Towing speed has to be adjustable according to glider. The operator must be able to change towing tension from 20 daN to the upper limit smoothly and without any jerks or jolts. Upper limit for tension is minimum 80daN and maximum 130daN. From 80daN upwards it has to be directly adjustable with an automatic constant speed function. When exceeding the maximum tension, the drum has to release the rope automatically by reversing its turn direction. During reverse of turn direction a momentary exceeding of the maximum tension by 20daN is acceptable. The tension applied to the glider has to be indicated to the winch operator. The testing centre may accept exceptions and set the limits of operation.
- 7.1.11 The brake system must be able to stop the drum at any moment. The brake must not completely lock up. If the pulling force is regulated by the brake, it may not differ from the set value by more than 10daN. Winches used for the step tow method need an automatic brake system that may not lead to excessive rope/line wear and can be released by the winch operator at any time. Applied force to release the brake may not exceed 5daN. The testing centre may accept exceptions and set the limits of operation.
- 7.1.12 The winch operator must be able to cut the rope at its thickest portion without any extraordinary effort by the use of the cut-off device that can be activated by two independent systems. The backup system is not required if drum tension is automatically released upon a cut-off attempt.
- 7.1.13 The winch has to be equipped with an yellow rotating beacon light.

8 Winch tow releases for hanggliders and paragliders

8.1 Design and construction requirements

- 8.1.1 Winch tow releases must ensure safe towing of hanggliders and paragliders in all approved modes of operation. Winch tow releases must be able to be simply attached to gliders or harnesses. Winch tow releases may not at any time cause changes to the pilots load distribution which may require special techniques or extraordinary force to release from. The winch tow release must function single-handedly and in a single release direction in all flight modes, without the need for visual contact from the pilot. A successful release must be possible in all flight directions under 150daN loading. Release force must be between minimum 1daN and maximum 7daN. Winch tow releases must not hinder the pilot at any point during towing, flight or landing. Winch tow releases must not hinder the deployment of the reserve system.
- 8.1.2 Winch tow releases must be secured against unintentional opening. Paraglider winch tow releases must have a recoil protection system for the case of tow rope failure.
- 8.1.3 Winch tow releases should not require special connection elements to attach to the towing rope. If this is the case, then these elements must be supplied by the manufacturer and are considered to be part of the tow release system.
- 8.1.4 Winch tow releases must hold a load of 300daN, microlight tow releases must hold a load of 200daN.

9 Launching trolleys

9.1 Design and construction requirements

- 9.1.1 Launching trolleys must ensure safe towing of hanggliders in all approved modes of operation. Loaded trolleys must not have a tendency to veer when towed. Wheels on the trolley may not wobble when loaded. It must be ensured that no part of the hangglider, pilot or harness can foul the trolley and prevent separation. Resting blocks for hangglider keel posts must ensure no fouling can take place and should be adjustable in height. Trapeze resting blocks should be adjustable in width. Trolleys must have a grip rope for pilots.
- 9.1.2 Launching trolleys must demonstrate sufficient load carrying capabilities to ensure safe operation.

Note:

Load carrying capabilities are to be tested by simulating tow launching. Sufficient load carrying capabilities are assumed when the trolley withstands loading to 1.5 times the maximum approved launching load (take-off weight of hangglider). The load should be distributed as in practice on the trolley – ¾ over the front wheels and ¼ over the back wheels.

10 Labeling

10.1 Labels

- a) Following details have to be placed permanently, clearly visible and in German language as a minimum on all tested and certified equipment:
 - 10.1.1 On all equipment
 - a) Kind of equipment
 - b) Type of equipment
 - c) Name and address of the testing centre
 - d) Name and edition of the applied airworthiness requirements (Standard if appl.)
 - e) Name of the test type procedure

- f) Name of the manufacturer
- g) Serial number of the equipment
- h) Production date (year and month)
- i) Date of the type test with manufacturer signature
- j) Service intervals
- k) Following inscription: "this model has been tested according to the applying rules and regulations, it corresponds with the tested sample and is airworthy"
- l) Following warning: "read the operating manual before using this equipment"

10.1.2 Additionally on all hanggliders

- a) Number of seats
- b) Rating of the glider for required pilot skills
- c) Minimum and maximum takeoff weight in kg
- d) Overall weight of the glider (approx.)
- e) Projected wing area (approx.)
- f) Maximum allowable speed (V Max)

10.1.3 Additionally on paragliders

- a) Number of seats
- b) Rating of the glider for required pilot skills
- c) Minimum and maximum takeoff weight in kg
- d) Overall weight of the paraglider (chute, lines, risers) in kg (approx.)
- e) Projected wing area (approx.)
- f) Number of risers
- g) Speed system (yes/no)
- h) Trim system (yes/no)

10.1.4 Additionally on harnesses

- a) Maximum load capacity in kg
- b) Integrated rescue system container (yes/no)
- c) On removable paraglider protectors: name of manufacturer and certifying authority, serial number and number of type test

10.1.5 Additionally on rescue systems

- a) Maximum load capacity in kg
- b) Overall surface area (approx.)
- c) Design type (i.e. umbrella or mattress shaped, centerline...)

10.1.6 Additionally on winches

- a) Maximum tension in kg
- b) Approved types of aircraft (hangglider, paraglider, glider plane)
- c) Step tow suited/approved (yes/no)

10.1.7 Additionally on winch releases

- a) Approved types of aircraft (hangglider, paraglider, glider plane)
- b) Ultra light towing (yes/no)
- c) Step tow suited/approved (yes/no)

10.1.8 Additionally on launching trolleys

- a) maximum approved take-off weight
- b) Launching trolley weight

10.2 Operating manual

The manufacturers operating manual for the owner/operator has to contain all the essential instructions required for safe operation in German language, especially:

10.2.1 For all equipment

- a) Edition and date of the operation manual in the cover
- b) Purpose of usage
- c) Short technical description and a labeled sketch especially for all parts, important for the operation
- d) Limits of all adjustment ranges with principles of function and effects
- e) Type related procedures for single seat, tandem and winching operations
- f) Emergency procedures and special flight conditions
- g) Special interest items (i.e. introduction)
- h) Mandatory illustrated and written information for operation, assembly, dismantling
- i) List of all mandatory checks for assembly and operation (checklist)
- j) Important information for care and storage
- k) For maintenance
 - lifecycle and changing intervals of parts
 - frequency, extent and kind of maintenance work
 - instructions for repair procedures
 - parts list
 - recommendations for cleaning and care
- l) Operating limits
- m) Specifications (data list)
- n) Procedure for regular checks, documentation and check frequency
- o) Environmental information
- p) Recycling instructions

Note :

The above instructions can also be performed according to norm standards EN1651 :1999, EN 12491 :2001 and EN 926-2 :2005

10.2.2 Additionally for hanggliders

- a) Rating of the glider for required pilot skills
- b) Complete batten template over the whole wingspan

10.2.3 Additionally for paragliders

- a) Rating of the glider for required pilot skills
- b) Emergency procedures, especially rapid descent, exiting of a collapse and terminating of a deep stall
- c) Description of the connection between the risers and the harnesses of a biplace/tandem paraglider

10.2.4 Additionally for harnesses

- a) Connection to the rescue system
- b) Reference to the integrated outer container or accordingly instructions for the installation of a rescue system outer container
- c) Information of the compatibility between harness and rescue system, especially assembly, function and check items for the rescue system - harness combination and rescue system activation mechanism
- d) Check interval regulations, procedures and documentation for the rescue system - harness combination
- e) Attachment of winch releases and other equipment necessary for winching operations
- f) Instructions for harness protector installation, function and checks and a separate operation manual if the protector can be used with different types of paragliders

10.2.5 Additionally for rescue systems

- a) Connection with the harness
- b) Information about the accompanying inner container
- c) Information of the compatibility between rescue system and harness, especially assembly, function and check items for the rescue system - harness combination and rescue system activation mechanism
- d) Check interval regulations, procedures and documentation for the rescue system - harness combination

- e) Information about operational checks of the rescue system after installation of a harness protector
- f) Special information for winching operation

10.2.6 Additionally for winches

- a) Information about the tow rope/line

LTF 2009: Appendix 1 – Test flight program and paraglider classification

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- 6. Test protocol

1. Scope

This document specifies requirements and test methods for classifying the flight safety characteristics of paragliders in terms of the demands on pilot flying skills.

2. Terms and definitions

For the purposes of this document, the following terms and definitions apply.

Controls

Primary steering and speed controls which are designated as such by the manufacturer.

Trimmers

Lockable pitch adjustment system, i.e. action by the pilot is required to return it to the initial position.

Accelerator

Secondary pitch control mechanism operated by the feet (generally), which automatically returns to the initial position when the action of the pilot stops.

Action of the pilot

Any transfer of weight, action on the controls, the accelerator or on the trimmers.

Normal flight

Flight condition in which the paraglider is fully inflated and is following a trajectory close to straight flight (at a speed close to trim speed) without any action on the part of the pilot. A small number of cells may still be collapsed.

Spontaneous recovery

Without any action on the part of the pilot, the paraglider returns to normal flight.

Front collapse

Front collapse is considered to have occurred when the top surface is visible from the underside of the Paraglider. Deformation of the leading edge is not considered to be a front collapse.

Cascade

Transition from one involuntary abnormal flight condition to another involuntary abnormal flight condition.

Minimum speed

Slowest airspeed maintainable without entering a deep stall or full stall.

Low speed

Airspeed of the paraglider in straight flight with the controls at 50 % of travel between the zero and the symmetric stall position (i.e. 50 % of the symmetric control travel).

Trim speed

Airspeed of the paraglider in straight flight without activating the controls or the accelerator.

Maximum speed

Airspeed of the paraglider in straight flight with the controls in the zero position and the accelerator fully activated.

Maximum speed is only used when referring to gliders equipped with an accelerator.

Weight in flight

Total weight (mass) of the pilot and his entire paragliding equipment (including the glider) ready to fly; rounded to the nearest integer value in kg.

3. Flight tests

3.1. General

The behaviour of the paraglider in the programme of test manoeuvres laid down in 4 is to be demonstrated by a manufacturer's pilot in front of a test pilot of the testing laboratory carrying out the flight tests. If this demonstration is judged satisfactory by the test pilot, two test pilots of the testing laboratory then carry out the test procedure described in 3.5 and 4 of this document.

3.2. Apparatus

3.2.1 Test pilot equipment

The test pilot shall be equipped with:

radio communication system for announcing manoeuvres and comments in flight.
airspeed indicator.

variometer with adjustable acoustic sink alarms. The variometer must fulfil the following specifications: Sensitivity 0.2 m/s, clearly identifiable warning tone at -14 m/s sink velocity. This warning tone must be recognisable in the radio documentation of the test flight.

ballast system for adjusting the load in accordance with the manufacturer's requirements.

type certified emergency parachute.

If the paraglider is tested in two-seater configuration, the passenger shall be equipped with:

ballast system for adjusting the load in accordance with the manufacturer's requirements.

The total weight of the ballast shall not exceed 15 kg or 20 % of the pilot's weight, whichever is larger.

If the paraglider is tested in two-seater configuration, the total weight of the ballast shall not exceed 30 kg or 20 % of the total weight of pilot plus passenger, and should be distributed proportionally to each (see 3.5.7).

3.2.2. Ground equipment

The ground personnel shall be equipped with:
telephoto video camera to review the movements and actions of the pilot and the behaviour of the paraglider;
radio link with the test pilot to record his comments directly on the videotape.

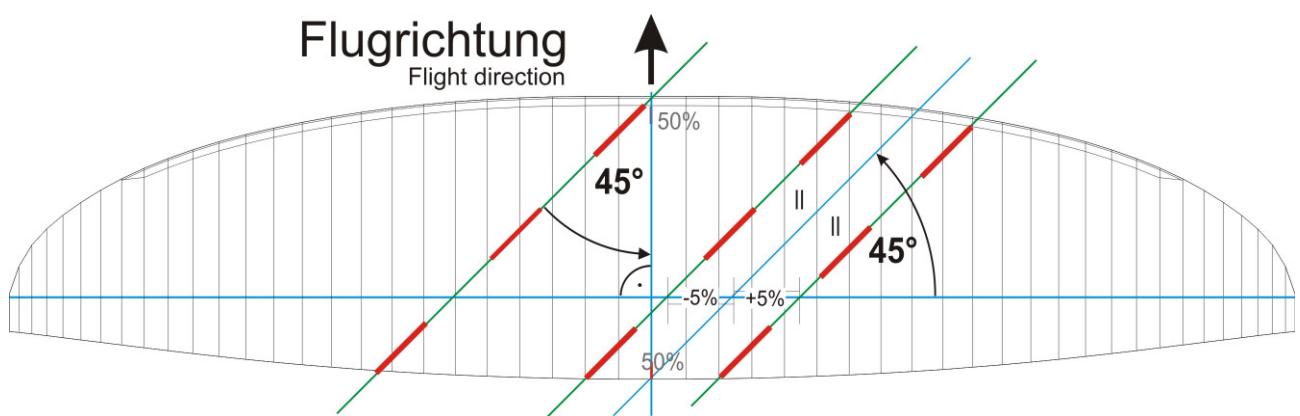
3.3. Test specimen

3.3.1. Selection

A test specimen, complete with the user's manual written in German and present to the testing laboratory, ready to fly and conforming in all points to the production model.

3.3.2 Marking

The test specimen supplied by the manufacturer shall be clearly marked in the following way:



Note: all measurements are given as percentages of the flat span of the paraglider.

Marking for asymmetric collapse manoeuvre 70/75% (4.1.14.)

Marks are to be attached to the canopy along a line from the middle of the trailing edge running at 45° to the leading edge. A tolerance area of +/- 5% of the span should also be marked either side of the main line. Marks should be made from approximately 8cm wide tape, in a contrasting colour to the canopy, and be easily visible from the ground.

Marking for asymmetric collapse manoeuvre 50% (4.1.14.)

Marks are to be attached to the canopy along a line from the middle of the leading edge running at 45° to the trailing edge. No tolerance area is necessary for the 50% asymmetric collapse test. Marks should be made from approximately 8cm wide tape, in a contrasting colour to the canopy, and be easily visible from the ground. After consulting with the testing centre, marks may only be necessary on one side of the canopy.

Markings on control lines

Zero and symmetric stall positions shall be marked.

NOTE: To mark zero and symmetric stall positions, it is recommended that manufacturers attach an additional reference line to each side of the paraglider, running from the B-riser to the seat of the harness, and incorporating elastic to maintain tension. Each reference line should be fitted with 2 adjustable toggles (e.g. tonkas™).

When moving the controls to a position to be marked, the pilot moves both the controls and the appropriate tonkas down. When releasing the controls again, he lets go of the tonkas (refer to the procedure in 4.1.4). If the position of any of these marks obtained at the minimum weight in flight differs noticeably from the position obtained at the maximum weight in flight, the manufacturer is required to provide the test specimen with a second pair of identical control lines or reference lines, one marked for the minimum, the other one for the maximum weight in flight.

Streamer to indicate wind direction

A streamer 1 m long and 5 cm wide should be attached on one riser to help visualise the trajectory.

3.3.3. Folding lines

If due to the geometry of a paraglider's suspension line system any type of deliberate collapse required in this document cannot be achieved in accordance with the procedure description, the manufacturer is required to attach additional lines (folding lines) to the wing of the test specimen enabling the test pilot to perform these manoeuvres.

3.4. Test conditions

Meteorological conditions:

wind less than 20 km/h within the test perimeter;
no turbulence within the test perimeter disturbing the flight tests.

3.5. Test Procedure

3.5.1. General

Any test weight in flight up to 125 kg shall be achieved using 1 pilot.

If any test weight in flight exceeds 125 kg, this weight can be achieved using 1 or 2 pilots.

If any test weight in flight exceeds 155 kg, this weight shall be achieved using 2 pilots.

All weights are subject to an acceptable tolerance of +/-2 kg.

All speeds are subject to an acceptable tolerance of +/-2 km/h.

If a test manoeuvre has not been performed in precise accordance with its procedure in 4, the manoeuvre has to be repeated. (This may be due to an error of the test pilot or due to meteorological influences).

3.5.2. Trimmers

If trimmers are fitted to a paraglider, then the complete test programme is repeated with the trimmers set both to the slowest and to the fastest position.

3.5.3. Other adjustable or removable devices

If the paraglider is equipped with other adjustable or removable devices which are not covered explicitly in this clause and which may influence its flight characteristics or its control, the paraglider shall be tested in the least favourable (symmetric) configuration.

3.5.4. Video documentation

All manoeuvres of the test flight program except 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.16 and 4.1.24 must be filmed per video camera. Should video documentation be explicitly required for manoeuvres 4.1.1 to 4.1.24, then the test pilot must fly at a defined course to the camera at the beginning of the manoeuvre:

Profile course: the pilot must fly a course perpendicular to the camera axis.

Frontal course: the pilot must fly a course parallel towards the camera axis.

Rear course: the pilot must fly a course parallel away from the camera axis.

3.5.5. Radio documentation

Any comments of the pilot in flight shall be recorded on the video. Using the radio connection to the camera:

the test pilot shall announce which manoeuvre is about to follow;

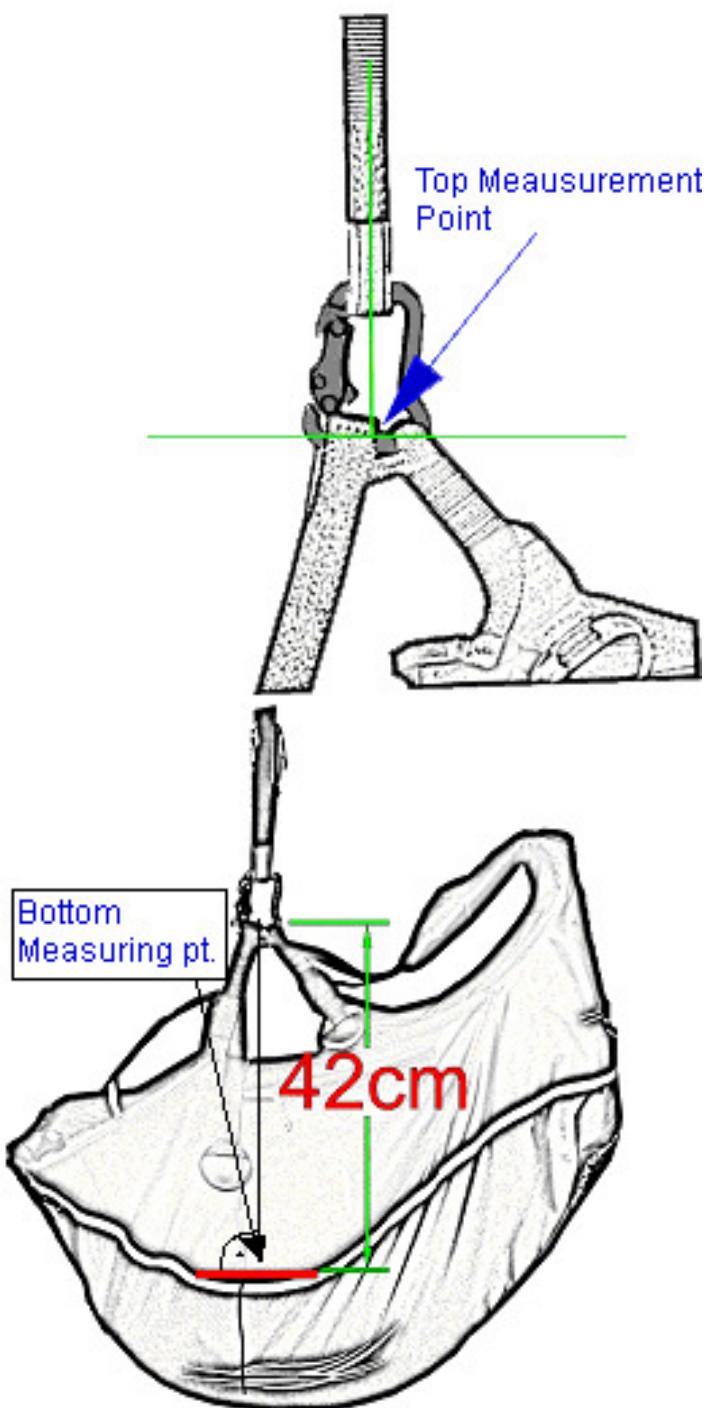
the test pilot shall add any comment helping to evaluate the glider's behaviour (optional);

the test pilot shall announce if he is sure any manoeuvre just performed was not valid for some reason;

the variometer sink alarm at -14m/s during manoeuvre 4.1.22 shall be transmitted.

3.5.6. Harness dimensions

The test pilot (and the passenger when testing in two-seater configuration) shall use a harness with a distance of 42 cm from the paraglider riser (or spreader bar) attachment points (measured from connector centrelines) perpendicular to the seat board top surface



The horizontal distance of the paraglider riser attachment points (measured from connector centrelines) shall be set to 42 cm.

In the case of a pilot's weight of less than 50 kg the horizontal dimension is reduced to 38 cm.

In the case of a pilot's weight of more than 80 kg the horizontal dimension is increased to 46 cm.



When testing in two-seater configuration the horizontal dimension of the passenger's harness is set to the same width as the pilot's harness. The pilot's weight is defined at pilot's bodyweight plus any ballast carried.

3.5.7. Ballast

Any ballast shall be tightly attached to the pilot and positioned as close as possible to the centre of gravity of a pilot sitting in the harness not carrying any ballast.

When testing in two-seater configuration any ballast carried by the passenger shall be attached following the same principles as for the pilot's ballast.

The use of water ballast is recommended for safety reasons.

3.5.8. Sitting position

Unless the test procedure states otherwise, the test pilot should adopt a normal upright sitting position with his feet perpendicularly below his knees.

3.5.9. Controls in hand

Unless the test procedure states otherwise, the controls are always held in the pilot's hands. The term 'releasing the controls' means taking all tension off the control lines.

3.5.10. Wraps

The test pilot should never use wraps unless the test procedure requires this.

3.5.11. Maximum travel of the accelerator

The accelerator is considered to be fully activated when the mechanical limits of the glider are reached and further action on the accelerator does not result in a further decrease of the angle of attack.

3.5.12. Timing when starting test measurements

In test manoeuvres 4.1.11., 4.1.12., 4.1.14., 4.1.20., 4.1.21. timing starts from the instant that the controls reach the zero position after the pilot releases them.

3.5.13. Timing when exiting stalled flight conditions

The glider is considered to have exited tests 4.1.11., 4.1.12. and 4.1.19. when it reaches its furthest forward pitching point.

If there is no noticeable pitching, the glider is considered to have exited any of these tests when the streamer on the riser indicates 45° to the horizon.

3.5.14. Exiting developed spin rotation

The glider is considered to have exited a developed spin when the airflow is reattached over the full span.

3.5.15. Pitch angles

Measurement is of the change of angle. A straight line taken from the leading edge at the centre of the canopy to the pilot's buttocks is compared to the horizon before and after the manoeuvre.

3.5.16. Keeping on course

The paraglider is considered to have kept its course throughout a test if it stays within 15° either side of its original course.

3.5.17. Twist

In test 4.1.14 a twist has occurred, when after 5 s or after a turn of 360° the pilot's position still is rotated more than 180° relative to the glider.

3.5.18. Collapse on the opposite side

In test 4.1.14 a collapse on the opposite side has occurred when less than 50 % of the span of the paraglider's leading edge is affected. If more than 50 % of the span is affected, this is a cascade.

4. Flight testing program and classification scheme

4.1. Manoeuvres and classification

Tests detailed in this section are to be documented with test protocols only. All resulting classification decisions are also to be documented in the protocols.

4.1.1. Inflation/take-off test

The inflation shall take place on a slope between 10 % and 33 %. It shall be carried out in headwinds of less than 8 km/h (measured about 1,5 m above the ground) and shall be repeated twice (to ensure the genuine behaviour is established).

The test pilot uses a normal forward launch technique (controls and A-risers in the hands, the other risers in the elbows, A-lines just tight, constant steady acceleration). If a special take off technique is required for a paraglider then this information shall be contained in the user's manual, and the test pilot shall follow these instructions.

Evaluation

Measurement	Result	Classification
Rising behaviour	Smooth, easy and constant rising	A
	Overshoots, shall be slowed down to avoid a front collapse	C
	Hangs back	D
Special take off technique required	No	A
	Yes	C

4.1.2. Landing

The pilot shall make a normal landing (straight final glide at trim speed) on level ground, into a wind of less than 8 km/h (measured about 1,5 m above the ground), using the controls only.

If a special landing technique is required for a paraglider then this information shall be contained in the user's manual, and the test pilot shall follow these instructions.

Evaluation

Measurement	Result	Classification
Special landing technique required	No	A
	Yes	D

4.1.3. Speeds in straight flight test

Assess the trim speed in 10 s stabilised straight flight and then the minimum speed in 10 s stabilised straight flight.

Evaluation

Measurement	Result	Classification
Trim speed more than 30 km/h	Yes	A
	No	F
Speed range using the controls larger than 10 km/h	Yes	A
	No	D
Minimum speed	Less than 25 km/h	A
	25 km/h to 30 km/h	B
	More than 30 km/h	D

4.1.4. Control forces and travel

Check the zero position and the symmetric stall position reference marks.

The symmetric stall position is checked by stabilising the paraglider in straight flight at trim speed.

Over a period of 5 s gradually lower both controls to the symmetric stall position marks, being careful not to induce pitch oscillations. In this position the paraglider must enter a full stall within 3 seconds.

Assess the control forces throughout the procedure.

Evaluation

Measurement	Result			Classification
Symmetric control pressure	Symmetric control travel			
	Max. weight in flight < 80 kg	Max. weight in flight 80 kg to 100 kg	Max. weight in flight > 100 kg	
Increasing	> 55	> 60	> 65	A
	40 to 55	45 to 60	50 to 65	C
	35 to 40	35 to 45	35 to 50	D
	< 35			F
Approximately constant	> 55	> 60	> 65	B
	40 to 55	45 to 60	50 to 65	C
	35 to 40	35 to 45	35 to 50	F
	< 35			F
Decreasing	> 55	> 60	> 65	F
	40 to 55	45 to 60	50 to 65	F
	35 to 40	35 to 45	35 to 50	F
	< 35			F

4.1.5. Pitch stability exiting accelerated flight

This test is only required for paragliders equipped with an accelerator.

The paraglider should be flown on a straight course at maximum speed. The accelerator should then be released abruptly, and the behaviour of the paraglider assessed.

Camera: profile course.

Evaluation

Measurement	Result	Classification
Dive forward angle on exit	Dive forward <30°	A
	Dive forward 30° to 60°	C
	Dive forward >60°	F
Collapse occurs	No	A
	Yes	F

4.1.6. Pitch stability operating controls during accelerated flight

This test is only required for paragliders equipped with an accelerator.

Activate both controls symmetrically to 25 % of the symmetric control range within 2 s.

Hold that position for 2 s. Then slowly release both controls.

Evaluation

Measurement	Results	Classification
Collapse occurs	No	A
	Yes	F

4.1.7. Roll stability and damping

Induce the maximum possible roll angle achievable by quickly activating and releasing each control in turn to the symmetric stall position marks once without

inducing a stall, spin or collapse. The timing of the control inputs is selected by the test pilot to maximise the roll angle.

Then observe the glider's immediate behaviour.

Evaluation

Measurement	Results	Classification
Oscillations	Reducing	A
	Not reducing	F

4.1.8. Stability in gentle spirals

Stabilise the glider in straight flight at trim speed.

By use of the controls only, direct the paraglider into a gentle spiral between 3 m/s and 5 m/s sink rate, such that the least stable behaviour (least tendency to exit the turn) is established. Maintain this sink rate for one turn.

Then release the controls over a period of 2 s and observe the paraglider's behaviour.

If the turn clearly tightens, the pilot acts to recover the glider. Otherwise the pilot waits for two turns to establish the glider's behaviour.

The pilot shall not counteract inertia effects on his body at any stage.

Evaluation

Measurement	Results	Classification
Tendency to return to straight flight	Spontaneous exit	A
	Turn remains constant	C
	Turn tightens	F

4.1.9. Behaviour in a steeply banked turn

Stabilise the glider in straight flight at trim speed.

Without using a counter-turn, and by steadily activating the inside control, quickly direct the paraglider into the steepest possible spiral dive achievable in two turns (without inducing a spin or a collapse).

Measure the descent rate and document in the test protocol.

The pilot shall not counteract inertia effects on his body at any stage. Any relevant observations e.g. particularly fast acceleration of the glider, must be noted and commented on in the test protocol.

Evaluation

Measurement	Results	Classification
Sink velocity after two turns	< 12 m/s	A
	12 m/s to 14 m/s	A
	> 14 m/s	B

4.1.10. Symmetric front collapse test

Stabilise the glider in straight flight at trim speed.

Release the controls and attach them to the risers (however, for safety reasons, the controls may be kept in the hands if the front collapse is achievable without significantly affecting the trailing edge).

Then by abruptly pulling the appropriate lines or risers, induce a symmetric front collapse over the entire leading edge with as little as possible, but at least 40 % of centre chord affected. As soon as the collapse is achieved, let go of the lines/risers. If the paraglider has not recovered spontaneously after 5 s or after 180° of turn (which ever happens first), the pilot acts on the controls to recover (without inducing a deliberate stall).

If the return to normal flight is not easily recognisable, and visible on the video documentation (marked forward pitching or acceleration) , then the test pilot should activate one control to 50% after 3-5 seconds in order to indicate if normal flight has been restored.

If the paraglider is equipped with an accelerator then the following additional test is required:

Stabilise the glider in straight flight at maximum speed.

Release the controls and attach them to the risers (however, for safety reasons, the controls may be kept in the hands if the front collapse is achievable without significantly affecting the trailing edge).

Then by abruptly pulling the appropriate lines or risers, induce a symmetric front collapse over the entire leading edge. As soon as the collapse is achieved, let go of the accelerator and the lines/risers.

If the paraglider has not recovered spontaneously after 5 s or after 180° of turn (which ever happens first), the pilot acts on the controls to recover (without inducing a deliberate stall). If the return to normal flight is not easily recognisable, and visible on the video documentation (marked forward pitching or acceleration) , then the test pilot should activate one control to 50% after 3-5 seconds in order to indicate if normal flight has been restored.

Camera: Profile course

Evaluation

Measurement	Results	Classification
Entry	Rocking back <45°	A
	Rocking back > 45°	C
Recovery	Spontaneous in <3 s	A
	Spontaneous in 3 s to 5 s	B
	Recovery through pilot action in less than a further 3 s	D
	Recovery through pilot action in a further 3 – 5 s	D
	Recovery through pilot action in more than a further 5 s	F

Measurement	Results		Classification
Dive forward angle and/or entering a turn on exit	Dive forward 0° to 30°	Stays on course	A
	Dive forward 0° to 30°	Enters a turn <90°	A
	Dive forward 0° to 30°	Enters a turn 90°-180°	C
	Dive forward 30° to 60°	Stays on course	B
	Dive forward 30° to 60°	Enters a turn <90°	B
	Dive forward 30° to 60°	Enters a turn 90°-180°	C
	Dive forward 60° to 90°	Stays on course	D
	Dive forward 60° to 90°	Enters a turn <90°	D
	Dive forward 60° to 90°	Enters a turn 90°-180°	F
	Dive forward >90°	Stays on course	F
	Dive forward >90°	Enters a turn <90°	F
	Dive forward >90°	Enters a turn 90°-180°	F
Cascade occurs	No		A
	Yes		F

4.1.11. Exiting deep stall (parachutal stall)

Slow down the paraglider using the controls to obtain a trajectory as close as possible to the vertical without significantly changing the shape of the wing (deep stall). If a deep stall cannot be achieved due to a very long control travel, the pilot takes wraps to shorten the control lines.

If a deep stall is achieved, maintain it for 3 s.

Then release the controls smoothly and gradually (in about 2 s) to the zero position.

If the glider does not recover in 5 s then intervene in accordance with the user's manual.

Camera: Profile course.

Evaluation

Measurement	Results	Classification
Deep stall achieved	Yes	A
	No	A
Recovery	Spontaneous in <3 s	A
	Spontaneous in 3 s to 5 s	C
	Recovery through pilot action in less than a further 5 s	D
	Recovery through pilot action in more than a further 5 s	F
Dive forward angle on recovery	Dive forward 0° to 30°	A
	Dive forward 30° to 60°	B
	Dive forward 60° to 90°	D
	Dive forward >90°	F
Change of course	Changing course less than 45°	A
	Changing course more than 45°	C
Cascade occurs	No	A
	Yes	F

4.1.12. High angle of attack recovery

Attain a trajectory as close as possible to the vertical (deep stall), without activating the controls or the accelerator, and with the minimum amount of deformation of the canopy (usually by using the minimum necessary pull-down of the B-risers). Maintain this exacting condition for 3 s.

Then release the risers over a 3 s period, symmetrically and continuously. If the return to normal flight is not easily recognisable, and visible on the video documentation (marked forward pitching or acceleration) , then the test pilot should activate one control to 50% after 3-5 seconds in order to indicate if normal flight has been restored.

Camera: Profile course

Evaluation

Measurement	Results	Classification
Recovery	Spontaneous in <3 s	A
	Spontaneous in 3 s to 5 s	C
	Recovery through pilot action in less than a further 3 s	D
	Recovery through pilot action in more than a further 3 s	F
Cascade occurs	No	A
	Yes	F

4.1.13. Recovery from a developed full stall test

Stabilise the glider in straight flight at minimum speed. Fully apply the controls and hold that position until the paraglider is in a maintained full stall. If a full stall cannot be achieved due to a very long control travel, the pilot takes wraps to shorten the control lines. Release the controls slowly and symmetrically, until the canopy has approximately regained its inflated span. Then quickly and symmetrically fully release the controls in a period of 1 s.

If an asymmetric collapse occurs, it is assumed that the release has not been sufficiently symmetrical, and the test manoeuvre should be repeated.
If any pitch oscillations don't die out, the controls are to be fully released when the canopy, rocking forward, arrives above the pilot.
Camera: profile course

Evaluation

Measurement	Results	Classification
Dive forward angle on exit	Dive forward 0° to 30°	A
	Dive forward 30° to 60°	B
	Dive forward 60° to 90°	C
	Dive forward >90°	F
Collapse	No collapse	A
	Symmetric collapse	C
Cascade occurs (other than collapses)	No	A
	Yes	F
Rocking back on entry	<45°	A
	>45°	C
Line tension	Most lines tight	A
	Many visibly slack lines	F

4.1.14. Asymmetric collapse

Stabilise the glider in straight flight at trim speed. Release the control handle on the side to be collapsed and attach it to the riser. Pull down the appropriate lines on one

side as fast as possible to collapse the canopy asymmetrically at 50 % of the span at an angle of approximately 45° relative to the longitudinal axis. As soon as the collapse is achieved, release the lines quickly.

The pilot shall take no further action and remains passive until the glider either recovers, or changes course by more than 360°, or 5 s elapses. If the glider has not recovered, the pilot acts to recover the glider.

The test is repeated with a collapse of 70 % to 75 %. The folding line at the maximum collapse point must be within the marked tolerance area on the glider.

If the paraglider is equipped with an accelerator, the whole procedure (50 %, 70 % to 75 %) shall be repeated with the accelerator fully activated.

The accelerator shall be released at the same time as the lines are released. To document that the collapse was achieved within the tolerance area, video must be recorded from camera frontal course and camera rear course positions. Rear course video recordings must show that the trailing edge has been collapsed to within the tolerance area.

Camera frontal course, rear course.

Evaluation

Measurement	Results	Classification
Course change angle until recovery	<90°	Dive forward or roll angle 0° to 15°
		Dive forward or roll angle 15° to 45°
		Dive forward or roll angle 45° to 60°
		Dive forward or roll angle 60° to 90°
		Dive forward or roll angle > 90°
	90° to 180°	Dive forward or roll angle 0° to 15°
		Dive forward or roll angle 15° to 45°
		Dive forward or roll angle 45° to 60°
		Dive forward or roll angle 60° to 90°
		Dive forward or roll angle > 90°
> 360°	180° to 360°	Dive forward or roll angle 0° to 15°
		Dive forward or roll angle 15° to 45°
		Dive forward or roll angle 45° to 60°
		Dive forward or roll angle 60° to 90°
		Dive forward or roll angle > 90°
	> 360°	Dive forward or roll angle 0° to 15°
		Dive forward or roll angle 15° to 45°
		Dive forward or roll angle 45° to 60°
		Dive forward or roll angle 60° to 90°
		Dive forward or roll angle > 90°
Recovery	Spontaneous Re-inflation	A
	Re-inflation in <3 s after pilot action	C
	Re-inflation in 3 s to 5 s after pilot action	D
	No Re-inflation within a further 5 s	F
Change of course	<360°	A
	> 360°	C
Collapse occurs on opposite side	No	A
	Yes, without course change	C
	Yes, with course change	D
Twist occurs	No	A
	Yes	F
Cascade occurs	No	A
	Yes	F

4.1.15. Directional control with a maintained asymmetric collapse

Stabilise the glider in straight flight at trim speed. Release the control handle on the side to be collapsed and attach it to the riser. Pull down the appropriate lines on one side as fast as possible to collapse the canopy asymmetrically at 50 % of the span at an angle of approximately 45° relative to the longitudinal axis and hold the collapse. Then the pilot attempts to keep course for a period of 3 s, using the control on the inflated side if necessary. From straight flight the pilot further uses this control to turn 180° to the inflated side in a period of 10 s without involuntarily entering an abnormal flight condition. The pilot assesses the position of the control relative to the symmetric stall position mark.

Collapse the glider as described above. From straight flight the pilot further uses this control to establish the minimum amount of control input required to induce a stall or spin. This amount of control shall be applied in a period of 1 s. The pilot assesses the position of the control relative to the symmetric stall position mark.

The pilot shall not counteract inertia effects on his body at any stage.

Camera: frontal course

Evaluation

Measurement	Results	Classification
Able to keep course	Yes	A
	No	F
180° turn away from the collapsed side possible in 10 s	Yes	A
	No	F
Amount of control range for 180° turn without stall or spin	More than 50 % of the symmetric control travel	A
	25 % to 50 % of the symmetric control travel	C
	Less than 25 % of the symmetric control travel	D

4.1.16. Trim speed spin tendency

Stabilise the glider in straight flight at trim speed. Then over a period of 2 s activate one control to 25% of the symmetric control range. Wait 20 s or until the glider has turned 360°, then over a period of 2 s further activate the same control to 50 % of the remaining range, and wait 20 s or until the glider has turned another 360°, or the glider has obviously entered a spin.

Evaluation

Measurement	Results	Classification
Spin occurs	No	A
	Yes	F

4.1.17. Low speed spin tendency test

Stabilise the glider in straight flight at low speed. Then over a period of 2 s further activate one control to 50 % of the remaining range (i.e. to 75 % of the symmetric control travel) without releasing the other, and wait until the glider has turned 360°, or the glider has obviously entered a spin. If the glider does not turn, or turns only slowly, then the pilot should hold this position for a further 20 s.

Evaluation

Measurement	Results	Classification
Spin occurs	No	A
	Yes	D

4.1.18. Recovery from a developed spin

Stabilise the glider in straight flight at low speed. Induce a spin with as little pitch and roll as possible by rapidly lowering one control to its maximum range whilst releasing the other. Release the inside control while the glider is above the pilot after about one turn of spin rotation, inducing as little pitch and roll as possible. Assess the behaviour.

Evaluation

Measurement	Results	Classification
Spin rotation angle after release	Stops spinning in <90°	A
	Stops spinning in 90° to 180°	C
	Stops spinning in 180° to 360°	D
	Does not stop spinning within 360°	F
Cascade occurs	No	A
	Yes	F

4.1.19. B-line stall

This manoeuvre is not required should the manufacturer exclude it in the glider handbook, and the B-risers are explicitly marked to indicate this.

Stabilise the glider in straight flight at trim speed. Quickly pull down the B-riser maillons symmetrically until the maillons reach the main connectors, or until a mechanical limit (e.g. interference with the accelerator or other risers) is reached. Wait 5 s, then quickly and symmetrically fully release the risers in a period of not more than 1 s. If a special technique for entry is required then this information shall be contained in the user's manual, and the test pilot shall follow these instructions.
Camera: profile course

Evaluation

Measurement	Results	Classification
Change of course before release	<45°	A
	>45°	C
Behaviour before release	Remains Stable, with straight span	A
	Remains stable without straight span	C
	Unstable	D
Recovery	Spontaneous in <3 s	A
	Spontaneous in 3 s to 5 s	B
	Recovery through pilot action in less than a further 3 s	D
	Recovery through pilot action between a further 3 s to 5 s	D
	Recovery through pilot action in more than a further 5 s	F
Dive forward angle on exit	Dive forward 0° to 30°	A
	Dive forward 30° to 60°	A
	Dive forward 60° to 90°	C
	Dive forward >90°	F
Cascade occurs	No	A
	Yes	F

4.1.20. Big ears

This manoeuvre is not required should the manufacturer exclude it in the glider handbook, and the A-risers are explicitly marked to indicate this.

Stabilise the glider in straight flight at trim speed. Collapse approximately 30 % of the span at each tip by twisting down the appropriate lines simultaneously. Note the glider's behaviour. After at least 10 s let go of both ears simultaneously. The pilot shall take no further action and remains passive until the glider either recovers, or 5 s elapses. If the glider has not recovered spontaneously, the pilot acts to recover the glider. If the glider is equipped with special big ears handles or if special entry or exit techniques are required, then this information shall be contained in the user's manual, and the test pilot shall follow these instructions.

Camera: Profile course

Evaluation

Measurement	Results	Classification
Entry procedure	Dedicated controls	A
	Standard technique	A
	No dedicated controls and non-standard technique	C
Behaviour during big ears	Stable flight	A
	Unstable flight	C
	Deep stall occurs	F
Recovery	Spontaneous in <3 s	A
	Spontaneous in 3 s to 5 s	B
	Recovery through pilot action in less than a further 3 s	B
	Recovery through pilot action between a further 3 s to 5 s	D
	Recovery through pilot action in more than a further 5 s	F
Dive forward angle on exit	Dive forward 0° to 30°	A
	Dive forward 30° to 60°	D
	Dive forward 60° to 90°	F
	Dive forward >90°	F

4.1.21. Big ears in accelerated flight

This test is only required for paragliders equipped with an accelerator.

This manoeuvre is not required should the manufacturer exclude it in the glider handbook, and the A-risers are explicitly marked to indicate this.

Stabilise the glider in straight flight at trim speed. Collapse approximately 30 % of the span at each tip by twisting down the appropriate lines simultaneously. Fully apply the accelerator and note the glider's behaviour. After at least 10 s release the accelerator quickly, and immediately let go both ears simultaneously. The pilot shall take no further action and remains passive until the glider either recovers, or 5 s elapses.

If the glider has not recovered spontaneously, the pilot acts to recover the glider.

To evaluate the behaviour of the glider when releasing the accelerator while maintaining big ears, collapse approximately 30 % of the span at each tip by twisting down the appropriate lines simultaneously. Fully apply the accelerator. After at least 10 s release the accelerator quickly and note the glider's behaviour while maintaining the big ears. If the glider is equipped with special big ears handles or if special entry or exit techniques are required, then this information shall be contained in the user's manual, and the test pilot shall follow these instructions.

Camera: Profile course

Evaluation

Measurement	Results	Classification
Entry procedure	Dedicated controls	A
	Standard technique	A
	No dedicated controls and non-standard technique	C
Behaviour during big ears	Stable flight	A
	Unstable flight	C
	Deep stall occurs	F
Behaviour during big ears	Spontaneous in <3 s	A
	Spontaneous in 3 s to 5 s	A
	Recovery through pilot action in less than a further 3 s	B
	Recovery through pilot action between a further 3 s to 5 s	D
	Recovery through pilot action in more than a further 5 s	F
Dive forward angle on exit	Dive forward 0° to 30°	A
	Dive forward 30° to 60°	D
	Dive forward 60° to 90°	F
	Dive forward >90°	F
Behaviour immediately after releasing the accelerator while maintaining big ears	Stable flight	A
	Unstable flight	C
	Deep stall occurs	F

4.1.22. Behaviour exiting a steep spiral

Stabilise the glider in straight flight at trim speed. By initial use of one control only, direct the paraglider into a spiral. By use of the controls the glider is accelerated until a sink rate of 14 m/s is achieved. (If 14 m/s cannot be obtained then evaluate at the highest possible sink rate). Then release the controls over a period of 2 s and observe the paraglider's behaviour. If the turn clearly tightens, the pilot acts to recover the glider. Otherwise the pilot waits for three turns to establish the glider's behaviour.

The pilot shall not counteract inertia effects on his body at any stage.

Any relevant observations e.g. particularly fast acceleration of the glider, must be noted and commented on in the test protocol. The sink velocity at which the spiral stability is evaluated must be recorded in the documentation.

Evaluation

Measurement	Results	Classification
Tendency to return to straight flight	Spontaneous exit	A
	Turn remains constant	D
	Turn tightens	F
Turn angle required to recover to normal flight	Less than 720°, spontaneous recovery	A
	720° to 1080°, spontaneous recovery	C
	With pilot action	D
Sink rate when evaluating spiral stability [m/s]	Value rounded to 1 m/s	---

4.1.23. Alternative means of directional control

Stabilise the glider in straight flight at trim speed. Apply the alternative control method recommended in the user's manual without affecting the primary controls and perform a 180° turn.

Wait for 20 s or until the turn is completed.

Evaluation

Measurement	Results	Classification
180° turn achievable in 20 s	Yes	A
	No	F
Stall or spin occurs	No	A
	Yes	F

4.1.24. Any other flight procedure and/or configuration described in the user's manual

Check whether every other flight procedure and/or configuration described in the user's manual but not covered in tests 4.1.1. to 4.1.23, can be flown safely.

This requirement may be satisfied by the manufacturer producing suitable and acceptable evidence (e.g. video).

Evaluation.

Measurement	Results	Classification
Procedure works as described	Yes	A
	No	F
Procedure suitable for novice pilots	Yes	A
	No	C
Cascade occurs	No	A
	Yes	F

4.2. Failure

The glider has failed the test procedure if either:

a) as a consequence of tests 4.1.1. to 4.1.24 any failure of any part or component occurs;

b) the results of any of the tests 4.1.1. to 4.1.24. are not classified A, B, C or D.

NOTE In the classification tables in 4.1.1. to 4.1.24. the letter "F" (failed) is used to identify unacceptable behaviour.

5. Paraglider classes

When testing in accordance with the procedures 4.1.1. to 4.1.24, various aspects of the paraglider's behaviour are measured. These measurements are classified according to 4.1.1. to 4.1.24.

The class of a paraglider according to this document is determined by the highest classification obtained. The class is intended to give pilots a guideline whether a paraglider is suitable for their levels of skills.

Class	Description of flight characteristics	Description of pilot skills required
A	Paragliders with maximum passive safety and extremely forgiving flying characteristics. Gliders with good resistance to departures from normal flight.	Designed for all pilots including pilots under all levels of training.
B	Paragliders with good passive safety and forgiving flying characteristics. Gliders with some resistance to departures from normal flight.	Designed for all pilots including pilots under all levels of training.
C	Paragliders with moderate passive safety and with potentially dynamic reactions to turbulence and pilot errors. Recovery to normal flight may require precise pilot input.	Designed for pilots familiar with recovery techniques, who fly "actively" and regularly, and understand the implications of flying a glider with reduced passive safety.
D	Paragliders with demanding flying characteristics and potentially violent reactions to turbulence and pilot errors. Recovery to normal flight requires precise pilot input.	Designed for pilots well practised in recovery techniques, who fly very actively, have significant experience of flying in turbulent conditions, and who accept the implications of flying such a wing.

e = Special instruction necessary, e.g. due to unusual steering.

g = This paraglider has been tested together with a particular harness, and may only be used with this harness. Failing to do so negates the airworthiness of the paraglider.

e and **g** are additional qualifiers to the classification scheme.

Classes cannot be mixed or averaged, e.g. class A-B is not a valid classification.

6. Test report

The test report shall include:

- a) name and address of the manufacturer;
- b) name and address of the person or company presenting the paraglider for testing (if different from manufacturer);
- c) model and reference of the paraglider tested;
- d) class of the paraglider tested;
- e) results of each test programme according to 4.1.1 to 4.1.24;
- f) name and address of the testing laboratory;
- g) Unique reference number of the testing centre for the type-test example;
- h) names of the test pilots;

The following items shall accompany the test report and be filed by the testing laboratory:

- i) Test protocol according to section 4;
- j) video cassette of the tests according to section 4;
- k) user's manual;
- l) manufacturing record;
- m) Type-test example of the paraglider that has undergone testing.