Transport Canada Transports Canada

# Advisory Circular

**Subject:** **Acceptable Means of Compliance to Chapter 522 of the *Airworthiness Manual* — Gliders and Powered Gliders**

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## 1.0 INTRODUCTION

(1) This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

### 1.1 Purpose

(1) The purpose of this AC is to provide advisory material for demonstrating compliance with the requirements of Chapter 522 of the *Airworthiness Manual* (AWM).

### 1.2 Applicability

(1) This document applies to all Transport Canada Civil Aviation (TCCA) employees, to individuals and organizations when they are exercising privileges granted to them under an External Ministerial Delegation of Authority. This information is also available to the aviation industry for information purposes.

### 1.3 Description of Changes

(1) AC 522-001, Issue 02 is to be used in conjunction with Chapter 522 of the AWM at Change 522-5, published December 30, 2007 and until such time as this AC is later amended. Importantly, Change 522-5 incorporates amendments aligned with Certification Specifications CS-22 (ED No. 2006/13/RM), issued by the European Aviation Safety Agency (EASA).

(2) Correspondingly, Appendices F, G, I, J and K of this AC 522-001 at Issue 01 are now formally included into Chapter 522 of the AWM, as per CS-22 Book 1, and are hence now removed from AC 522-001 at Issue 02.

## 2.0 REFERENCES AND REQUIREMENTS

### 2.1 Reference Documents

(1) It is intended that the following reference materials be used in conjunction with this document:

(a) Part VI, Subpart 2 of the *Canadian Aviation Regulations* (CARs) — *Operating and Flight Rules*;

(b) Chapter 522 of the *Airworthiness Manual* (AWM) — *Gilders and Powered Gilders*;and

(c) Advisory Circular 500-014, Issue 01, 2004-12-01 – *Aircraft Flight Manuals*.

### 2.2 Cancelled Documents

(1) Not applicable.

(2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

## 3.0 BACKGROUND

(1) The airworthiness standards contained in Chapter 522 of the AWM were originally based on the European Joint Aviation Authorities (JAA) “Joint Airworthiness Requirements” JAR 22 “Sailplanes and Powered Sailplanes”. JAR-22 included Advisory Circulars – Joint (ACJs), later called Acceptable Means of Compliance (AMC) and Interpretative/Explanatory Material (IEMs).

(2) On 28 September 2003, the EASA came into force replacing the JAA. The Joint Airworthiness Requirements of JAR-22 were replaced by the EASA Certification Specification CS-22 which were first published on 14 November 2003. CS-22, Book 1, contains the Airworthiness Code; CS-22, Book 2, contains AMC.

(3) The Transport Canada airworthiness standards of Chapter 522 of the AWM are now based on EASA's CS-22, Book 1. This AC is based on EASA's CS-22, Book 2.

## 4.0 ACCEPTABLE MEANS OF COMPLIANCE

### 4.1 Applicability - 522.1(a)

(1) Chapter 522 of the AWM is not applicable to aeroplanes classified as hang-gliders and ultralights or microlights. The definitions of these aeroplanes differ from country to country. However, hang-gliders can be broadly defined as gliders that can take-off and land by using the pilot's muscular energy and potential energy.

(2) Ultralights or microlights can be described as very low-energy aeroplanes, as some of their main characteristics are strictly limited. The following criteria are often used (alone or in combination): stalling speed, weight to surface area ratio, maximum take-off weight, maximum empty weight, fuel quantity, number of seats.

(3) In addition, both hang-gliders and ultralights/microlights are usually not type-certificated, and Chapter 522 of the AWM prescribes minimum standards for the issue of type certificates.

### 4.2 Glider Categories - 522.3

(1) In accordance with Subsection 602.121(1) of the *Canadian Aviation Regulations* (CARs) « No pilot-in-command shall operate an aircraft in IMC in any class of airspace, except in accordance with IFR. », accordingly gliders and powered gliders are not permitted to be used for cloud-flying i.e., refers to the activity of soaring in clouds, which is not Instrument Flight Rule (IFR) flight.

(2) See Appendix F of Chapter 522 of the AWM - *Glossary of Aerobatic Manoeuvres*.

### 4.3 Proof of Compliance - 522.21

(1) Instrumentation for flight test:

- (a) For tests purposes the glider should be equipped with suitable instruments for conducting the required measurements and observations in a simple manner. If reliable results cannot be obtained otherwise, the Authorities may request the installation of special test equipment.
- (b) At an early stage in the program the accuracy of the instruments and their correction curves should be determined, and particular attention should be paid to the position error of the air-speed indication system; the influence of the configuration of the glider should also be accounted for.

(2) Prior to flight test, the following measurement ground tests should be conducted:

- (a) control circuit stiffness;
- (b) friction of controls;
- (c) control cable tension of closed control circuits; and
- (d) maximum deflection of control surfaces and wing-flaps.

(3) Functioning tests. Before starting the flight tests all ground functioning tests should be carried out; especially the functioning of the towing hook should be tested in operation for all cable angles and forces, which may occur.

### 4.4 Load Distribution Limits - 522.23

(1) Significant variations of lateral c.g. are only likely to occur on gliders equipped for the carriage of expendable ballast in the wings. Such variations may result from any permitted intentional asymmetric loading or from levels of asymmetric loading which might realistically be expected to

occur unintentionally, particularly if flight is permitted with partly-filled tanks. In this case, the range of lateral c.g. considered shall not be less than the greater of:

(a) any intentional asymmetric loading that is permitted; and

(b) the level of asymmetry that might realistically be expected to occur inadvertently, taking account of the design of the system and the likely accuracy of loading. In the absence of a more rational analysis to establish any greater or lesser value, an asymmetry of 10 litres, or 10% of the combined capacity of each symmetrical pair of tanks, whichever is the greater, may be assumed.

### 4.5 Controllability and Manoeuvrability General - 522.143(a)

(1) Compliance with Subsection 522.143(a) of the AWM should include the extension of airbrakes at speeds up to 1.05 $V_{NE}$. The time to extend airbrakes should not exceed 2 seconds.

### 4.6 Controllability and Manoeuvrability General - 522.143(b)

(1) The characteristics to be noted should include stalling speeds and stalling behaviour.

### 4.7 Aerotowing - 522.151(c)(3)

(1) In demonstrating compliance with this requirement, in addition to the requirements of Subsections 522.21(a) and (b) of the AWM, the effects of at least the following should be investigated:

(a) variations of tow cable length;

(b) variations of pitch trim settings;

(c) acceleration along the longitudinal axis of the glider;

(d) snatch loads on tow; and

(e) wind gradient due to ground boundary layer effects.

### 4.8 Winch-launching and Auto-tow Launching - 522.152

(1) For showing compliance with the winch-launching requirements at least 6 winch-launches should be made, covering the range of speeds up to $V_W$. During these launches a range of release points should be selected along the flight path to cover the normal operating range and the release in emergency.

### 4.9 Static Longitudinal Stability - 522.173(a)(1)

(1) Compliance with this requirement can be assumed, if the slope of the curve, stick force versus speed, is at least 1 N per 10 km/h at all speeds up to $V_{NE}$.

### 4.10 Static Longitudinal Stability - 522.173(b)

(1) In flight demonstration, the glider should be trimmed in steady flight and the speed should be increased by approximately 20% by moving the control column. The force on the column should then be relaxed very slowly, so as to avoid speed oscillation, and the speed at which the glider settles should be noted. The test should be repeated with the speed being decreased by approximately 20%.

(2) Suitable minimum and maximum trimmed speeds are:

(a) wing-flaps neutral (see Section 522.335 of the AWM): 1.3 $V_{S1}$ and the maximum trim speed, but not exceeding 0.84 $V_{NE.}$

(b) wing-flaps in the landing position: 1.3 $V_{SO}$ and the maximum trim speed, but not exceeding 0.84 $V_{FE}$.

(3) Where no in-flight trimming device is fitted, the test should be made at the trimmed speed. In such case, the speed at which the force on the column is relaxed need not exceed $V_{NE}$ or $V_{FE}$ as appropriate, and need not be less than the minimum speed for steady unstalled flight.

## 4.11 Demonstration of Static Longitudinal Stability - 522.175

(1) With air brakes extended, qualitative tests are normally acceptable.

(2) Wing-flap positions should include negative positions, where provided (see Section 522.335 of the AWM).

## 4.12 Wings Level Stall - 522.201(c)

(1) Yawing angles up to 5° should not appreciably change the stalling characteristics.

## 4.13 Wings Level Stall - 522.201(d)

(1) The loss of altitude during the stall is the difference between the altitude at which the stall occurs and that altitude at which level flight is regained.

## 4.14 Stall Warning - 522.207(b)

(1) A visual stall warning alone is not acceptable.

## 4.15 Spinning General - 522.221(b)

(1) It will normally be sufficient to conduct a number of spins of about two turns in each of the conditions of Subsection 522.221(b) of the AWM and subsequently to conduct spins of five turns in the most adverse cases.

## 4.16 Spinning General - 522.221(c),(d),(e) and (f)

(1) The standard procedure to recover from a spin is as follows:

- (a) Where applicable, close throttle.
- (b) Sequentially:
  - (i) check ailerons neutral;
  - (ii) apply rudder opposite to the direction of the spin;
  - (iii) ease the control column forward until rotation ceases; and
  - (iv) centralize rudder and ease out of the ensuing dive.

## 4.17 Aerobatic Manoeuvres - 522.255(a)

(1) In the case of a powered glider this applies with the engine being operated in an appropriate manner.

## 4.18 Proof of Structure - 522.307(a)

(1) Substantiating load tests made in accordance with Subsection 522.307(a) of the AWM should normally be taken to ultimate design load.

(2) The results obtained from strength tests should be so corrected for departures from the mechanical properties and dimensions assumed in the design calculations as to establish that the possibility of any structure having strength less than the design value, owing to material and dimensional variation, is extremely remote.

## 4.19 Flight Loads General - 522.321(b)

(1) For gliders altitude is not normally critical for flight loads; for powered gliders propeller torque and thrust are normally greatest at sea-level.

## 4.20 Design Air Speeds - 522.335

(1) For flaps, the controls for which are intended to be operated in both high and low speed flight, the term "wing-flaps neutral" in Subsections 522.335(a) and (b) of the AWM is defined (unless a recognized aerofoil profile is adopted which thus defines the neutral position) as that wing-flap

setting which results when one third of the total range of en-route wing-flap settings is subtracted from the most negative setting.

(2) For flaps, the controls for which are intended to be operated during low speed flight only, i.e. slotted flaps, split flaps and other flaps where extension is conventional and only in the positive direction, "wing-flaps neutral" is the retracted or most-upwardly-deflected setting.

### 4.21 Unsymmetrical Flight Conditions - 522.347

(1) The glider is assumed to maintain its attitude after the control surfaces have been activated to initiate roll or yaw until the resulting incremental loads have reached their highest value.

### 4.22 Winglets - 522.375(a)

(1) For the wing the interactive effects between the winglets and the wing should be taken into account as there are:

(a) changes in wing lift distribution;

(b) additional bending and torsion moments at the attachment point of the winglet due to aerodynamic and mass loads on the winglet;

(c) effects of inertia; and

(d) effects of drag on wing torsion.

### 4.23 Secondary Control System - 522.405

(1) Hand and foot loads assumed for design should not be less than the following:

(a) hand loads on small hand-wheels, cranks, etc., applied by finger or wrist-force: P = 15 daN;

(b) hand loads on levers and hand-wheels applied by the force of an unsupported arm without making use of the body weight: P = 35 daN;

(c) hand load on levers and hand-grips applied by the force of a supported arm or by making use of the body weight: P = 60 daN; and

(d) foot loads applied by the pilot when sitting with his back support (e.g. toe-brake operating loads) P = 75 daN.

### 4.24 Control System and Stretch - 522.411(a)

(1) Control systems will normally be accepted as complying with paragraph Subsection 522.411(a) of the AWM, if they meet the following:

(a) Under the application of the loads prescribed in Section 522.395 of the AWM, no part of the control system should stretch or shorten by more than 25%. The stretch percentage is defined as $D_e$ = 100 a/A where:

(i) A = comparable movement of the cockpit controls when the pilot effort is resisted by fixing the control surfaces at their zero settings; and

(ii) A = available positive or negative movement of the cockpit controls (measured from their neutral position) when the control surface and the control mechanism are free.

(2) However, stretch or shortening greater than 25% may be acceptable provided special attention is given to compliance with Sections 522.143 and 522.629 of the AWM in these conditions.

### 4.25 Manoeuvring Loads - 522.423

(1) Method I - The loads should be calculated for instantaneous deflection of the elevator, the following cases being considered:

(a) speed $V_A$, maximum upward deflection;

(b) speed $V_A$, maximum downward deflection;

(c) speed $V_D$, one-third maximum upward deflection; and

(d) speed $V_D$, one-third maximum downward deflection.

(2) The following assumptions should be made:

(a) the glider is initially in level flight, and its attitude and air speed do not change.

(b) the loads are balanced by inertia forces.

(3) The gliders of Category A, initial conditions of both erect and inverted flight should be considered.

(4) Method II - The loads should be calculated for instantaneous deflection of the elevator such as to cause the normal acceleration to change from an initial value to a final value, the following cases being considered (see Figure 1).

**Category U and A**

| Speed | Initial Condition | Final Condition | Load Factor Increment |
|---|---|---|---|
| $V_A$ | $A_1$<br>A<br>$A_1$<br>G | A<br>$A_1$<br>G<br>$A_1$ | $n_1 – 1$<br>$1 - n_1$<br>$n_4 – 1$<br>$1 - n_4$ |
| $V_D$ | $D_1$<br>D<br>$D_1$<br>E | D<br>$D_1$<br>E<br>$D_1$ | $n_2 – 1$<br>$1 - n_2$<br>$n_3 – 1$<br>$1 - n_3$ |

**Category A - Additional Cases**

| Speed | Initial Condition | Final Condition | Load Factor Increment |
|---|---|---|---|
| $V_A$ | $A_{-1}$<br>A<br>$A_{-1}$<br>G | A<br>$A_{-1}$<br>G<br>$A_{-1}$ | $n_1 + 1$<br>$-(1 + n_1)$<br>$n_4 + 1$<br>$-(1 + n_4)$ |
| $V_D$ | $D_{-1}$<br>D<br>$D_{-1}$<br>E | D<br>$D_{-1}$<br>E<br>$D_{-1}$ | $n_2 + 1$<br>$-(1 + n_2)$<br>$n_3 + 1$<br>$-(1 + n_3)$ |

(5) For the purpose of this section the difference in air speed between $V_A$ and the value corresponding to point G on the manoeuvring envelope should be ignored.

(6) The following assumptions should be made:

(a) the glider is initially in level flight, and its attitude and air speed do not change.

(b) the loads are balanced by inertia forces;

(c) the aerodynamic tail load increment is given by:

$$\Delta P = \Delta n\, mg \left[ \frac{x_{cg}}{l_t} - \frac{S_t}{S} \frac{a_h}{a} \left( 1 - \frac{d_\varepsilon}{d_\alpha} \right) - \frac{\rho_o}{2} \left( \frac{S_t\, a_h\, l_t}{m} \right) \right]$$

where:

| | | | |
|---|---|---|---|
| (i) | $\Delta P$ | = | horizontal tail load increment, positive upwards (N); |
| (ii) | $\Delta n$ | = | load factor increment; |
| (iii) | m | = | mass of the glider (kg); |
| (iv) | g | = | acceleration due to gravity ($m/s^2$); |
| (v) | $x_{cg}$ | = | longitudinal distance of glider c.g. aft of aerodynamic centre of glider less horizontal tail (m); |
| (vi) | $S_t$ | = | horizontal tail area ($m^2$); |
| (vii) | $a_h$ | = | slope of horizontal tail lift curve per radian; |
| (viii) | $\frac{d\varepsilon}{d\alpha}$ | = | rate of change of downwash angle with angle of attack; |
| (ix) | $\rho_o$ | = | density of air at sea-level ($kg/m^3$); |
| (x) | $l_t$ | = | tail arm (m); |
| (xi) | S | = | wing area ($m^2$); and |
| (xii) | a | = | slope of wing lift curve per radian. |

**Category U and A** **Category A – Additional Cases**

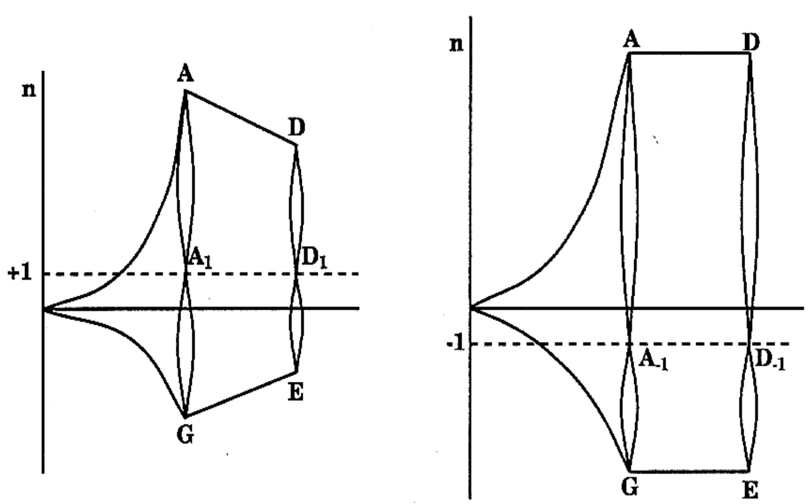



**Figure 1: Pitching Manoeuvres**

## 4.26 Vertical Tail Surfaces Manoeuvring Loads - 522.441

(1) For gliders where the horizontal tail is supported by the vertical tail, the tail surfaces and their supporting structure including the rear portion of the fuselage should be designed to withstand the prescribed loadings on the vertical tail and the rolling moment induced by the horizontal tail acting in the same direction.

(2) For T-tails, in the absence of a more rational analysis, the rolling moment induced by side-slip or deflection of the vertical rudder may be computed as follows:

$$M_r = 0.4\, s_t \frac{\rho_o}{2} \beta V^2 b_v$$

(3) Where:

(a) $M_r$ = induced rolling moment at horizontal tail (Nm);

(b) $b_v$ = span of vertical tail, measured from the bottom of the fuselage; and

(c) $\beta$ = side-slip angle (radian).

(4) This formula is only valid for vertical tail aspect ratios between 1 and 1.8 (with span and area measured from the bottom of the fuselage) and horizontal tail with no dihedral and aspect ratio 6 or less. For configurations in excess of these limits more detailed rational analysis will be required.

### 4.27 Vertical Tail Surfaces Gust Loads - 522.443

(1) For gliders where the horizontal tail is supported by the vertical tail, the tail surfaces and their supporting structure including the rear portion of the fuselage should be designed to withstand the prescribed loadings on the vertical tail and the rolling moment induced by the horizontal tail acting in the same direction.

(2) For T-tails in the absence of a more rational analysis, the rolling moment induced by gust load may be computed as follows:

$$M_r = o.4\, S_t \frac{\rho_o}{2} V\, U\, b_v\, k$$

(3) Where:

(a) $M_r$ = induced rolling moment at horizontal tail (Nm); and

(b) $b_v$ = span of vertical tail, measured from the bottom of the fuselage.

(4) This formula is only valid for vertical tail aspect ratios between 1 and 1.8 (with span and area measured from the bottom of the fuselage) and horizontal tail with no dihedral and aspect ratio 6 or less. For configurations in excess of these limits more detailed rational analysis will be required.

### 4.28 Combined Loads On Tail Surfaces - 522.447(a)

(1) In the absence of rational data the unsymmetrical distribution shall be obtained by multiplying the air load on one side of the plane of symmetry by (1 + x) and on the other side by (1 - x).

(2) For point A of the V-n envelope, the value of x shall be 0.34 and in the case of an aerobatic category glider certificated for flick manoeuvres, x shall be 0.5. For point D the value of x shall be 0.15.

(3) The unsymmetrical horizontal tail load shall not be combined with the induced rolling moment at the T-tail.

### 4.29 Landing Gear Arrangement - 522.477

(1) For the purpose of these requirements landing gears are considered conventional if they consist of:

(a) A single wheel or twin coaxial wheels at the bottom of the fuselage or two laterally separated single wheels (with or without shock absorbers) located directly, or nearly so, below the c.g. of the glider, together with a nose wheel or with auxiliary skids attached to the bottom of the fuselage, one auxiliary skid running from the main wheel (or wheels) forward to the nose and the other running aft to a point approximately below the wing trailing edge. The rear skid may be replaced or supplemented by a suitable tail skid. Both skids may be replaced by suitable reinforcements of the fuselage structure.

(b) A single elastic main skid at the bottom of the fuselage extending from the nose to a point approximately below the wing trailing edge. This skid may be supplemented by a tail skid or wheel.

(c) Wing-tip skids.

### 4.30 Tail-down Landing conditions - 522.481

(1) Where $i_y$ cannot be determined by more rational means, a value of $i_y = 0.255\ L_R$ may be used:

$L_R$ in this case to be taken as the overall length of the fuselage without rudder.

(2) In designing the tailskid, side loads should be accounted for in addition to the vertical load determined as above.

### 4.31 Accessibility - 522.611

(1) The provision of access panels suitably located and in sufficient numbers to enable the proper inspection of structural elements, to allow inspection, adjustment and lubrication of critical parts of the control system, as necessary for continued airworthiness, and the replacement of parts as required, is an acceptable interpretation of, and means of compliance with Section 522.611 of the AWM. ‘Inspection’ is meant to include daily and other periodic checks.

(2) Where it is impracticable to provide means for direct visual inspection, non destructive inspection aids or special inspection methods may be used to inspect structural elements, when the inspection can be shown to be effective, if such inspection aids are easily obtainable.

### 4.32 Material Strength Properties and Design Values - 522.613(b)

(1) Material specifications should be those contained in documents accepted either specifically by the Authority or by having been prepared by an organization or person, which the Authority accepts, has the necessary capabilities. In defining design properties these material specification values should be modified and/or extended as necessary by the constructor or take account of manufacturing practices (for example method of construction, forming, machining and subsequent heat treatment).

### 4.33 Material Strength Properties and Design Values - 522.613(c)

(1) Temperatures up to 54°C are considered to correspond to normal operating conditions.

### 4.34 Special Factors - 522.619(a)

(1) Appropriate combinations of the special factors should include all those of the following appropriate to the part:

(a) the casting factor derived in accordance with Section 522.621 of the AWM;

(b) the highest pertinent special factor prescribed in Sections 522.623, 522.625, 522.657, and 522.693 of the AWM, or Subsection 522.619(b) of the AWM; and

(c) the two-hinge factor prescribed in Subsection 522.625(e) of the AWM.

### 4.35 Control system Details - 522.685(d)

(1) An automatic connection device in each part of the primary pitch control system, which is connected during the rigging of the glider, is an acceptable means of compliance with this requirement. Means should be provided to guarantee the proper functioning of the primary pitch control system. Normally, this should be provided by visual inspection.

(2) For the other control systems it should be shown that no hazardous situation can occur, due to restrictive movement or jamming of the control system, when a part of the control system is not connected during the rigging of the glider.

### 4.36 Cable Systems - 522.689(b)

(1) The inside diameter of the pulley groove should not be less than 300 times the diameter of each elemental strand.

### 4.37 Shock Absorption Test - 522.723

(1) Where the shock absorption characteristics are not essentially affected by the rate of compression, static tests may be used, but where the characteristics are so affected dynamic tests should be done.

### 4.38 Cockpit View - 522.773(b)

(1) Compliance with Subsection 522.773(b) of the AWM may be provided by the canopy having a suitable opening.

### 4.39 Windshields and Windows - 522.775(a)

(1) Windshields and windows made of synthetic resins are accepted as complying with this requirement.

### 4.40 Cockpit Control - 522.777(a)

(1) The preferred arrangement of the powerplant controls is, from left to right, carburettor heat or alternate air control (if required), power, propeller, and mixture control.

### 4.41 Cockpit Controls - 522.777(c)

(1) The need for a dual trim control may be waived when it is demonstrated that, with the trimmer in the most adverse position, the elevator control forces are sufficiently small and that there is no difficulty in control.

### 4.42 Cockpit Controls - 522.777(d)

(1) Throttle control systems which have been demonstrated to have inherently constant friction levels throughout their life such as Bowden type push/pull cables, are accepted as providing an equivalent level of safety to that of a ‘means of adjusting the freedom of operation of the throttle control in flight’.

### 4.43 Colour Marking and Arrangement of Cockpit Controls - 522.780

(1) When two controls are necessary to jettison the canopy and one of those is also used as the normal canopy opening control, its colour should be white with a red ring or band around the handle.

### 4.44 Cockpit Control Knob Shape - 522.781

(1) The control should take the form of a T-shaped handle.

### 4.45 Seats and Safety Harnesses - 522.785(f)

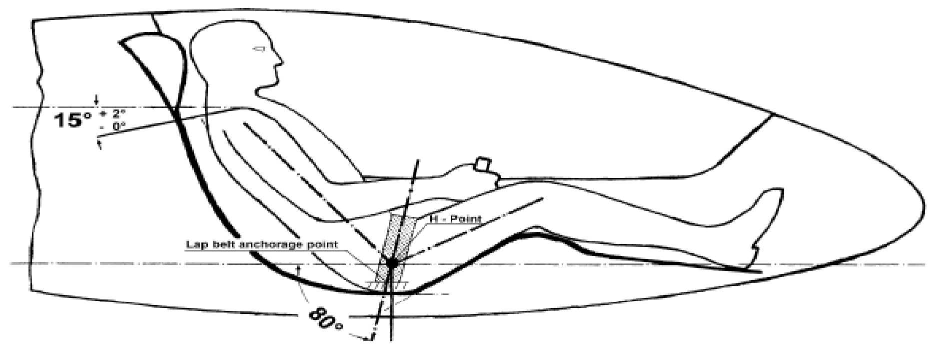
(1) The arrangement of the safety harness installation should minimise the probability of the occupant’s body from either sliding underneath the belts or sliding laterally when subjected to inertia loads acting in the forward or sideward direction, respectively.

(2) For semi-reclined seating positions the anchorage points of the lap belt should be located well below and behind the H-Point at an angle between 80 ± 10 degrees to the datum line through the H-Point parallel to the longitudinal axis of the glider.

(3) The H-Point (Hip-point) is the pivot between the torso centre line and the thigh centre line of the occupant.

(4) The determination of the H-Point, or the anchorage point of the lap belt, should be made by a rational method. An acceptable means is contained in Appendix J of Chapter 522 of the AWM.

(5) The anchorage points of the shoulder belts should be located below and behind the pilots shoulders at an angle of 15° +2°/-0° to a line parallel to the longitudinal axis of the glider for a 50 percentile male. The lateral separation should be not more than 200 mm.




#### 4.46 Headrests - 522.788

(1) If possible, the structure of the headrest should be integrated into the backrest of each seat.

(2) Each headrest should be so designed that protection from injuries referred to in Subsection 522.788(a) of the AWM is ensured for each occupant irrespective of whether or not a parachute is worn.

#### 4.47 Water Ballast - 522.895(a)

(1) Depending on the complexity of the water ballast system it would normally be necessary to carry out failure modes and effects analysis, which should include likely dormant failure modes.

(2) If water ballast is carried in more than one tank:

(a) simultaneous release of water ballast should be achieved by a single lever operation;

(b) the rate of jettison of water ballast shall not result in the centre of gravity moving outside the limitations established under Section 522.23 of the AWM.

#### 4.48 Firewalls - 522.1191(c)

(1) The following materials are accepted as fireproof, when used in firewalls or shrouds, without being tested:

(a) stainless steel sheet, 0.38 mm thick;

(b) mild steel sheet coated with aluminum or otherwise protected against corrosion) 0.5 mm thick; and

(c) steel or copper base allow firewall fittings.

#### 4.49 Function and Installation - 522.1301(a)(4)

(1) The correct functioning should not be impaired by icing, heavy rain or high humidity.

(2) When Air Traffic Control (ATC) equipment is installed it should be shown that the electrical system is such that the operation of this equipment is not adversely affected.

#### 4.50 Power Plant Instruments - 522.1305(i)

(1) If a special pre-flight procedure is established, it should be furnished as required by Subsection 522.1585(l) and Section 522.1541 of the AWM.

### 4.51 Arrangement and Visibility - 522.1321

(1) In order to comply with this requirement, duplication of the flight instruments may be necessary for gliders and powered gliders with dual control.

### 4.52 Electric Cables and Equipment - 522.1365(c)

(1) This is normally achieved by limiting unprotected battery to master switch cables, of an adequate capacity, to a maximum length of 0.5 m.

(2) In any event the capacities of protected cables should be such that no hazardous damage will occur to the powered glider, nor ill effects to the occupants from the generation of noxious fumes, due to electrical overloading of cables before a circuit protective device will operate.

### 4.53 Air Speed Limitations - 522.1505(a)

(1) Speeds Equivalent Airspeed (EAS) determined from structural limitations should be suitably converted.

### 4.54 Air Speed Indicator - 522.1545(a)

(1) A placard located close to, or suitable markings on the face of, the airspeed indicator, giving reductions of $V_{NE}$ with altitude, are acceptable means of compliance with the second sentence of this paragraph.

### 4.55 Air Speed Indicator - 522.1545

(1) An example of the presentation of an air-speed indicator complying with this requirement is shown in Figure 2.

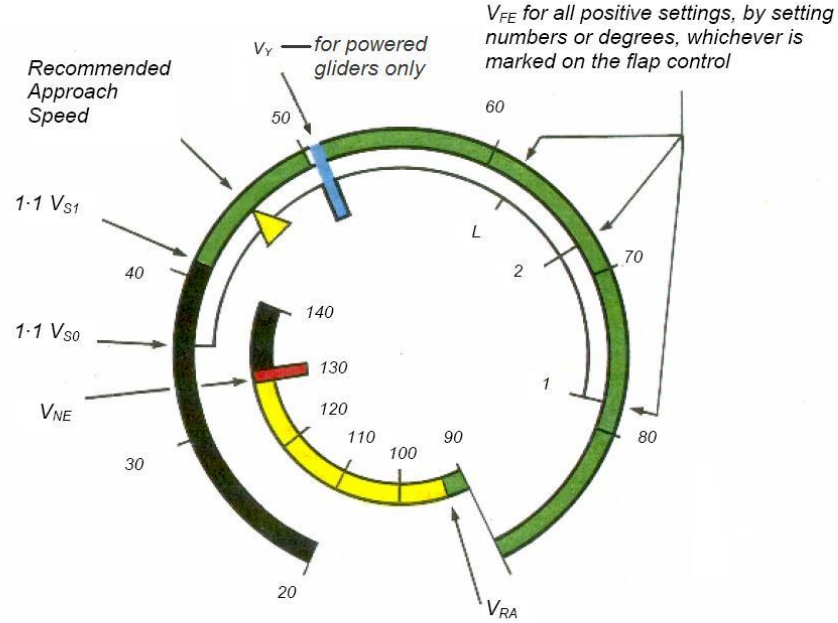



**Figure 2: Example of Airspeed Indicator Markings**

### 4.56 Power Plant Instruments - 522.1549(d)

(1) In the case of digital solid-state displays the required red line should be represented by a steady red light near or on the instrument, or by blinking of the whole display. The precautionary range should be indicated near or on the instrument. All instruments indications in that range should be designed to obtain the attention of the pilot. In addition, the operating range data should be placarded near the display using the colours described in Subsections 522.1549(a), (b) and (c) of the AWM.

(2) Oil temperature, oil pressure and cylinder head temperature indications will be acceptable if achieved by means of warning lights instead of analogue or digital indications if:

(a) the required red line is represented by a steady red light;

(b) the normal operating range is represented by a steady green light;

(c) the precautionary range is represented by a steady yellow light; and

(d) a "press to test" facility is provided for the warning light displays.

### 4.57 Control Markings - 522.1555(a)

(1) Identification of the controls should consist of easily understandable and commonly used symbols, such as those shown in Appendix G of Chapter 522 of the AWM, in preference to placards.

### 4.58 Flight Manual General - 522.1581

(1) A possible format for a Flight Manual is given on the EASA website: http://www.easa.eu.int/ws_prod/g/doc/Agency_Mesures/Certification_Spec/decision_ED_2003_13_RM.pdf , but applicants should also refer to AC 500-014 to ensure that all requirements are met.

### 4.59 Operating limitations - 522.1583(a)

(1) For the purpose of explaining the significance of $V_{RA}$, all air movements in lee-wave rotors, thunderclouds, visible whirlwinds, or over mountain crests, are to be understood as rough air.

### 4.60 Operating data and procedures - 522.1585(f)

(1) Slip characteristic description should include:

(a) qualitative effectiveness of the manoeuvre;

(b) speed range above the recommended approach speed (see Subsection 522.1545(e) of the AWM) within which the manoeuvre can be safely performed;

(c) the appropriate pilot action in response to a control force decrease or reversal;

(d) degradation, if any, in the airspeed system accuracy during the slip; and

(e) the effect of a partial water-ballast.

### 4.61 Applicability - 522.1801

(1) When spark ignition is provided a single ignition system is acceptable.

(2) Engines certificated as aircraft engines are accepted as complying with this Subchapter H.

### 4.62 Engine mounting attachments and structure - 522.1823(a)

(1) In choosing the maximum allowable loads, the applicant should take account of the flight and ground loads and the emergency alighting loads specified in Chapter 522 of the AWM for the glider as a whole.

### 4.63 Vibration test - 522.1843

(1) The propeller should be so chosen that the prescribed maximum rotational speed is obtained at full throttle or at the desired maximum permissible manifold pressure, whichever is appropriate.

### 4.64 Applicability - 522.1901

(1) Propellers certificated as aircraft propellers are accepted as complying with this Subpart J.

### 4.65 Appendix K paragraph 1.1

(1) For the proof of compliance with the requirements of CS-22, Book 1, Subpart B during the aero-towing of gliders by powered gliders, tests with at least three different representative gliders types

covering the whole permissible range of aerotowed gliders should be conducted. During these tests, the weights of the aerotowing powered gliders and of the gliders, the aerodynamic characteristics, speed range and ground handling characteristics should be combined appropriately so as to obtain conservative results.

## 5.0 CONTACT OFFICE

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Suggestions for amendment to this document are invited and should be submitted via the Transport Canada Civil Aviation Issues Reporting System (CAIRS) at the following Internet address:

http://www.tc.gc.ca/Cairs

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[original signed by]

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Transport Canada

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*Transport Canada documents or intranet pages mentioned in this document are available upon request.*