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Standard Specification for Design and Performance of a Light Sport Glider¹

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1. Scope

1.1 This specification covers airworthiness requirements for the design of a powered or non-powered fixed wing light sport aircraft, a “glider.”

1.2 This specification is applicable to the design of a light sport aircraft glider as defined by regulations and limited to day VFR flight.

1.3 A glider for the purposes of this specification is defined as a heavier than air aircraft that remains airborne through the dynamic reaction of the air with a fixed wing and in which the ability to remain aloft in free flight does not depend on the propulsion from a power plant. A powered glider is defined for the purposes of this specification as a glider equipped with a power plant in which the flight characteristics are those of a glider when the power plant is not in operation.

1.4 The values stated in SI units are to be regarded as standard. The values given in parenthesis are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory requirements prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

F2295 Practice for Continued Operational Safety Monitor-

ing of a Light Sport Aircraft (Withdrawn 2019)³

F2316 Specification for Airframe Emergency Parachutes

F2339 Practice for Design and Manufacture of Reciprocating Spark Ignition Engines for Light Sport Aircraft

F2840 Practice for Design and Manufacture of Electric Propulsion Units for Light Sport Aircraft

F2972 Specification for Light Sport Aircraft Manufacturer's Quality Assurance System

2.2 Other Standard:

CS-22 Subpart H Certification Specifications for Sailplanes and Powered Sailplanes⁴

3. Terminology

3.1 Definitions:

3.1.1 *electric propulsion unit, EPU*—any electric motor and all associated devices used to provide thrust for an electric aircraft.

3.1.2 *energy storage device, ESD*—used to store energy as part of a Electric Propulsion Unit (EPU). Typical energy storage devices include but are not limited to batteries, fuel cells or capacitors.

3.1.3 *feathering*—a single action from the cockpit that repositions the propeller blades to low drag configuration when the engine is not operating.

3.1.4 *flaps*—any movable high lift device.

3.1.5 *maximum empty weight, W_E (kg)*—largest empty weight of the glider, including all operational equipment that is installed in the glider: weight of the airframe, powerplant, excluding energy storage device (ESD) for electric propulsion unit when removable, required equipment, optional and specific equipment, fixed ballast, full engine coolant and oil, hydraulic fluid, and the unusable fuel. Hence, the maximum empty weight equals maximum takeoff weight minus minimum useful load: $W_E = W - W_U$.

3.1.6 *minimum useful load, W_U (kg)*—where $W_U = W - W_E$.

3.1.7 The terms “engine” referring to internal combustion engines and “motor” referring to electric motors for propulsion are used interchangeably within this standard.

¹ This specification is under the jurisdiction of ASTM Committee F37 on Light Sport Aircraft and is the direct responsibility of Subcommittee F37.10 on Glider.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from European Union Aviation Safety Agency (EASA), Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, <https://www.easa.europa.eu>.

3.1.8 The term “engine idle” or “throttle closed” when in reference to electric propulsion units shall mean the minimum power or propeller rotational speed condition for the electric motor as defined without electronic braking of the propeller rotational speed.

3.2 *Abbreviations:*

- 3.2.1 *AOI*—Aircraft Operating Instructions
- 3.2.2 *AR*—Aspect Ratio = b^2/S
- 3.2.3 *b*—wing span (m)
- 3.2.4 *c*—chord (m)
- 3.2.5 *CAS*—calibrated air speed (m/s, kts)
- 3.2.6 *C_L*—lift coefficient of the aircraft
- 3.2.7 *C_D*—drag coefficient of the aircraft
- 3.2.8 *CG*—center of gravity
- 3.2.9 *C_m*—moment coefficient (*C_m* is with respect to *c*/4 point, positive nose up)
- 3.2.10 *C_{MO}*—zero lift moment coefficient
- 3.2.11 *C_n*—normal coefficient
- 3.2.12 *g*—acceleration as a result of gravity = 9.81 m/s²
- 3.2.13 *IAS*—indicated air speed (m/s, kts)
- 3.2.14 *ICAO*—International Civil Aviation Organization
- 3.2.15 *LSA*—light sport aircraft
- 3.2.16 *n*—load factor
- 3.2.17 *n₁*—glider positive maneuvering limit load factor at *V_A*
- 3.2.18 *n₂*—glider positive maneuvering limit load factor at *V_D*
- 3.2.19 *n₃*—glider negative maneuvering limit load factor at *V_A*
- 3.2.20 *n₄*—glider negative maneuvering limit load factor at *V_D*
- 3.2.21 *q*—dynamic pressure = 0.004823 V^2 kg/m², when *V* is in km/h
- 3.2.22 *S*—wing area (m²)
- 3.2.23 *V*—airspeed (m/s, kts)
- 3.2.24 *V_A*—design maneuvering speed
- 3.2.25 *V_C*—design cruising speed
- 3.2.26 *V_D*—design diving speed
- 3.2.27 *V_{DF}*—demonstrated flight diving speed
- 3.2.28 *V_F*—design flap speed
- 3.2.29 *V_{FE}*—maximum flap extended speed
- 3.2.30 *V_H*—maximum speed in level flight with maximum continuous power (corrected for sea level standard conditions)
- 3.2.31 *V_{LO}*—maximum speed for landing gear extended
- 3.2.32 *V_{NE}*—never exceed speed
- 3.2.33 *V_S*—stalling speed or minimum steady flight speed at which the aircraft is controllable (flaps retracted)
- 3.2.34 *V_{SJ}*—stalling speed, or minimum steady flight speed in a specific configuration

3.2.35 *V_{SO}*—stalling speed or minimum steady flight speed at which the aircraft is controllable in the landing configuration

3.2.36 *V_R*—ground gust speed

3.2.37 *V_T*—maximum aerotow speed

3.2.38 *V_W*—maximum winch tow speed

3.2.39 *V_Y*—speed for best rate of climb

3.2.40 *W*—maximum takeoff or maximum design weight (kg)

3.2.41 *W_E*—maximum empty aircraft weight (kg)

3.2.42 *W_U*—minimum useful load (kg)

3.2.43 *w*—average design surface load (N/m²)

4. Flight

4.1 *Proof of Compliance:*

4.1.1 Each of the following requirements shall be met at the most critical weight and CG configuration. Unless otherwise specified, the speed range from stall to *V_{DF}* or the maximum allowable speed for the configuration being investigated shall be considered.

4.1.1.1 *V_{DF}* shall be less than or equal to *V_D*.

4.1.1.2 If *V_{DF}* chosen is less than *V_D*, *V_{NE}* must be less than or equal to 0.9 *V_{DF}* and greater than or equal to 1.1 *V_C*.

4.1.2 The following tolerances are acceptable during flight testing:

Weight	+5 %, -10 %
Weight, when critical	+5 %, -1 %
CG	±7 % of total travel

4.2 Compliance must be established for all configurations except as otherwise noted. In demonstrating compliance, the powerplant or propeller, if retractable, must be retracted, except as otherwise noted.

4.3 *Load Distribution Limits:*

4.3.1 The maximum weight shall be determined so that it is:

4.3.1.1 Not more than:

- (1) The highest weight selected by the applicant, and
- (2) The design maximum weight, which is the highest weight at which compliance with each applicable structural loading condition and all requirements for flight characteristics is shown.

4.3.1.2 Not less than:

(1) For a single-place glider not less than the empty weight of the glider, plus a weight of the occupant of 80 kg, plus the required minimum equipment, plus, for a powered glider, sufficient energy (fuel or other energy storage) for at least 30 min of flight at maximum continuous power.

(2) For a two-place glider not less than the empty weight of the glider, plus a weight of the occupants of 160 kg, plus the required minimum equipment, plus, for a powered glider, sufficient energy (fuel or other energy storage) for at least 30 min of flight at maximum continuous power.

4.3.2 The design empty weight shall be specified by the manufacturer.

4.3.3 *Empty Weight and Center of Gravity Range:*

4.3.3.1 The CG range within which the glider can be safely operated must be specified by the manufacturer.