



Designation: F2245 – 23

Standard Specification for Design and Performance of a Light Sport Airplane¹

This standard is issued under the fixed designation F2245; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers airworthiness requirements for the design of powered fixed wing light sport aircraft, an “airplane.”

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

1.3 *Units*—The values given in this standard are in SI units and are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound (or other) units that are provided for information only and are not considered standard. The values stated in each system may not be exact equivalents. Where it may not be clear, some equations provide the units of the result directly following the equation.

1.4 *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.*

1.5 *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

D910 Specification for Leaded Aviation Gasolines

D4814 Specification for Automotive Spark-Ignition Engine Fuel

D7547 Specification for Hydrocarbon Unleaded Aviation Gasoline

F2316 Specification for Airframe Emergency Parachutes

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

F2483 Practice for Maintenance and the Development of Maintenance Manuals for Light Sport Aircraft

F2506 Specification for Design and Testing of Light Sport Aircraft Propellers

F2538 Practice for Design and Manufacture of Reciprocating Compression Ignition Engines for Light Sport Aircraft

F2564 Specification for Design and Performance of a Light Sport Glider

F2746 Specification for Pilot’s Operating Handbook (POH) for Light Sport Airplane

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

F3619 Specification for Aeroelasticity Requirements for a Light Sport Airplane

2.2 Federal Aviation Regulations and Advisory Circulars:³

14 CFR Part 33 Airworthiness Standards: Aircraft Engines

14 CFR Part 35 Airworthiness Standards: Propellers

AC 23 Powerplant Guide for Certification of Part 23 Airplanes and Airships

AC 23.1521-2 Type Certification of Oxygenates and Oxygenated Gasoline Fuels in Part 23 Airplanes with Reciprocating Engines

2.3 EASA Requirements:⁴

CS-22 Sailplanes and Powered Sailplanes

CS-E Engines

CS-P Propellers

2.4 Other Standards:

EN 228 Automotive Fuels - Unleaded Petrol - Requirements and Test Methods⁵

GAMA Specification No. 1 Specification for Pilot’s Operating Handbook⁶

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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 Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov> or <http://www.gpo.gov>.

⁴ Available from EASA European Aviation Safety Agency, Postfach 10 12 53, D-50452 Cologne, Germany, <http://easa.europa.eu>.

⁵ Available from Deutsches Institut für Normung e.V.(DIN), Am DIN-Platz, Burggrafenstrasse 6, 10787 Berlin, Germany, <http://www.din.de>.

⁶ Available from the General Aviation Manufacturers Association (GAMA), 1400 K Street NW, Suite 801, Washington, DC 20005-2485, <http://www.gama.aero/>.

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 *flaps*—any movable high lift device.

3.1.4 *maximum empty weight, W_E (N)*—largest empty weight of the airplane, including all operational equipment that is installed in the airplane: weight of the airframe, powerplant, Energy Storage Device (ESD) as part of an Electric Propulsion Unit (EPU), 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: $W_E = W - W_U$.

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

3.1.6 *night*—hours between the end of evening civil twilight and the beginning of morning civil twilight.

3.1.6.1 *Discussion*—Civil twilight ends in the evening when the center of the sun's disc is 6° below the horizon, and begins in the morning when the center of the sun's disc is 6° below the horizon.

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

3.1.8 The term “engine idle,” 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.

3.1.9 The term “vapor lock,” when used in reference to liquid fuel systems, shall mean that the liquid fuel, while still in the fuel delivery system, changes state from liquid to gas (that is, vaporizes), that either causes fuel feed pressure to the propulsion unit to decrease below manufacturers' specifications, transient loss of power, or complete stalling of the propulsion unit.

3.2 Abbreviations:

3.2.1 *AR*—aspect ratio $= \frac{b^2}{S}$

3.2.2 *b*—wing span (m)

3.2.3 *c*—chord (m)

3.2.4 *CAS*—calibrated air speed (m/s, kts)

3.2.5 *C_L* —lift coefficient of the airplane

3.2.6 *C_D* —drag coefficient of the airplane

3.2.7 *CG*—center of gravity

3.2.8 *C_m* —moment coefficient (C_m is with respect to $c/4$ point, positive nose up)

3.2.9 *C_{MO}* —zero lift moment coefficient

3.2.10 *C_n* —normal coefficient

3.2.11 *g*—acceleration as a result of gravity = 9.81 m/s^2

3.2.12 *IAS*—indicated air speed (m/s, kts)

3.2.13 *ICAO*—International Civil Aviation Organization

3.2.14 *LSA*—Light Sport Aircraft

3.2.15 *MAC*—mean aerodynamic chord (m)

3.2.16 *n*—load factor

3.2.17 *n_1* —airplane positive maneuvering limit load factor

3.2.18 *n_2* —airplane negative maneuvering limit load factor

3.2.19 *n_3* —load factor on wheels

3.2.20 *P*—power, (kW)

3.2.21 *ρ* —air density (kg/m^3) = 1.225 at sea level standard conditions

3.2.22 *POH*—Pilot Operating Handbook

3.2.23 *q*—dynamic pressure (N/m^2) $= \frac{1}{2} \rho V^2$

3.2.24 *RC*—climb rate (m/s)

3.2.25 *S*—wing area (m^2)

3.2.26 *V*—airspeed (m/s)

3.2.26.1 *V_A* —design maneuvering speed

3.2.26.2 *V_C* —design cruising speed

3.2.26.3 *V_D* —design diving speed

3.2.26.4 *V_{DF}* —demonstrated flight diving speed

3.2.26.5 *V_F* —design flap speed

3.2.26.6 *V_{FE}* —maximum flap extended speed

3.2.26.7 *V_H* —maximum speed in level flight with maximum continuous power (corrected for sea level standard conditions)

3.2.26.8 *V_{NE}* —never exceed speed

3.2.26.9 *V_O* —operating maneuvering speed

3.2.26.10 *V_S* —stalling speed or minimum steady flight speed at which the airplane is controllable (flaps retracted)

3.2.26.11 *V_{SI}* —stalling speed or minimum steady flight speed at which the aircraft is controllable in a specific configuration

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

3.2.26.13 *V_R* —ground gust speed

3.2.26.14 *V_X* —speed for best angle of climb

3.2.26.15 *V_Y* —speed for best rate of climb

3.2.27 *w*—average design surface load (N/m^2)

3.2.28 *W*—maximum takeoff or maximum design weight (N)

3.2.29 *W_E* —maximum empty airplane weight (N)

3.2.30 *W_U* —minimum useful load (N)

3.2.31 *W_{ZWF}* —maximum zero wing fuel weight (N)

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