Designation: ~~F2339 – 19~~ F2339 – 19a

Standard Practice for Design and Manufacture of Reciprocating Spark Ignition Engines for Light Sport Aircraft[1]

This standard is issued under the fixed designation F2339; 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 practice covers minimum requirements for the design and manufacture of reciprocating spark ignition engines for light sport aircraft, VFR use.

1.2 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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 limitations prior to use.*

1.4 *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 Standard:*
F3153 Specification for Verification of Avionics Systems
2.2 *RTCA Standards:*[2]
DO-178 Software Considerations in Airborne Systems and Equipment Certification
DO-254 Design Assurance Guidance for Airborne Electronic Hardware

3. Significance and Use

3.1 This practice provides designers and manufacturers of engines for light sport aircraft design references and criteria to use in designing and manufacturing engines.

3.2 Declaration of compliance is based on testing and documentation during the design and testing or flight testing of the engine type by the manufacturer or under the manufacturers' guidance.

4. Engine Model Designation

4.1 *Engine Parts List*—A parts list is required for each engine model qualified in accordance with this specification.

4.2 *New Engine Model Designations:*

4.2.1 Each new engine model must be qualified in accordance with this practice.

4.2.2 Design or configuration changes that impact the installation interface, performance, or operability of the engine require a new engine model designation.

4.3 *Design Changes of Parts*—Each design change of a part or component of an engine model qualified to this specification should be evaluated relative to the requirements of this specification.

5. Data Requirements

5.1 *Retained Data*—The following data and information should be retained on file at the manufacturer's facility for at a minimum of 18 years after production is discontinued.

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[1] This practice is under the jurisdiction of ASTM Committee F37 on Light Sport Aircraft and is the direct responsibility of Subcommittee F37.70 on Cross Cutting.

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[2] Available from RTCA, 1150 18th NW, Suite 910, Washington, DC 20036, https://www.rtca.org.

5.1.1 Drawings that define the engine configuration.
5.1.2 Material and process specifications referenced in the parts drawings.
5.1.3 Engineering analyses and test data prepared for qualification with this specification.

5.2 *Delivered Data*—The following data should be delivered to the airplane manufacturer to support design and operation of the applicable airplane.
5.2.1 An engine performance specification that defines the engine performance under all anticipated operating environments.
5.2.2 An installation manual that defines all functional and physical interface requirements of the engine. This should include an engine outline/installation drawing.
5.2.3 An operating manual that defines normal and abnormal operating procedures and any applicable operating limitations.
5.2.4 A maintenance manual that defines periodic installed maintenance, major inspection, overhaul intervals, and any other maintenance limitations.
5.2.5 An overhaul manual that provides instruction for disassembling the engine to replace or repair, or both, parts as required to return the engine to airworthy condition that is safe for operation until the next major overhaul.

6. Design Criteria

6.1 *Materials*—The materials used in the engine must be adequate for the intended design conditions of the engine.

6.2 *Fire Prevention*—The design and construction of the engine and the materials used must minimize the probability of the occurrence and spread of fire by:
6.2.1 Using fire-resistant lines, fittings, and other components that contain a flammable liquid when supplied with the engine; and
6.2.2 Shielding or locating components to safeguard against the ignition of leaking flammable fluid.

6.3 *Engine Cooling*—The engine design must include provisions for cooling; the installation manual must specify engine and component temperature limitations.

6.4 *Engine Mounting*—Attach points on the engine must have data for the correct design of mounting structures to the airframe. The maximum allowable limit and ultimate loads for the engine mounting attachments and related structure must be specified.

6.5 *Ignition Systems*—Each spark ignition engine must have a dual-ignition system with at least two spark plugs for each cylinder and two separate electric circuits with separate sources of electrical energy, or have an ignition system of equivalent in-flight reliability. System maintenance must be specified under the maintenance manual supplied by the manufacturer.
6.5.1 Engines used in aircraft where the engine is not required for flight, for example, gliders, can be single ignition.
6.5.2 Engines for use in only single seat aircraft may use single ignition.

6.6 *Electronic Engine Controllers (EEC):*
6.6.1 The EEC system must be designed to accommodate single-point failures without significant power reduction.
6.6.2 The functioning of EECs must not be adversely affected by the declared environmental conditions of operation by the manufacturer, including temperature and moisture. The EEC system, inclusive of hardware and software, must be tested to ensure that it safely performs its intended functions, in its specified environments for at least the Engine Overhaul Interval (see 7.4). ~~An acceptable~~See Appendix X1 ~~method for showing compliance is the use of ASTM~~ for study materials ~~F3153, Standard Specification for Verification of Avionics Systems, with the intended functions and test scenarios defined, at minimum, to match specified engine performance and approved operating environments.~~and example of acceptable methods of compliance.
6.6.3 The harnesses or cables in the EEC system must be shielded between components and electrically bonded to a common ground.
6.6.4 The documentation and verification results shall be available for review by the relevant CAA, as required.
6.6.5 The data delivered with the engine (see 5.2) must include appropriate operating limitations and instructions that reflect the limits to which the system has been qualified.

6.7 *Fuel and Induction System:*
6.7.1 *Induction System Icing*—The fuel and air intake passages must be designed to minimize the accretion of ice.
6.7.2 *Filtering*—The type and degree of fuel and air filtering necessary to prevent obstruction of air or fuel flow must be specified.
6.7.3 *Liquid Lock*—Each passage in the induction system that conducts a mixture of fuel and air must be self-draining or demonstrated to not cause damage from hydraulic lock on starting.

6.8 *Lubrication System:*
6.8.1 The lubrication system of the engine must be designed and constructed so that it will function properly in all flight attitudes and atmospheric conditions in which the engine is expected to operate. In wet sump engines, this requirement must be met when only one-half of the maximum lubricant supply is in the engine.
6.8.2 The lubrication system of the engine must be designed and constructed to allow installing a means of cooling the lubricant if required.