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.

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Standard Specification for Aircraft Powerplant Installation[1]

This standard is issued under the fixed designation F3062/F3062M; 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 minimum requirements for the installation and integration of powerplant system units.

1.2 This specification is applicable to small aeroplanes as defined in the F44 terminology standard. Use of the term airplane is used throughout this specification and will mean "small airplane."

1.3 The applicant for a design approval shall seek the individual guidance to their respective CAA body concerning the use of this standard as part of a certification plan. For information on which CAA regulatory bodies have accepted this standard (in whole or in part) as a means of compliance to their Small Aircraft Airworthiness regulations (Hereinafter referred to as "the Rules"), refer to the ASTM F44 webpage (www.ASTM.org/COMITTEE/F44.htm) which includes CAA website links.

1.4 References within this standard normally refer to documents in United States legal system. Appendix X1 cross references documents in the legal system of other countries of corresponding content.

1.5 *Units*—The values stated are SI units followed by imperial units in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.6 *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.*

1.7 *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]

F2339 Practice for Design and Manufacture of Reciprocating Spark Ignition Engines 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

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

F3060 Terminology for Aircraft

F3063/F3063M Specification for Aircraft Fuel Storage and Delivery

F3066/F3066M Specification for Aircraft Powerplant Installation Hazard Mitigation

F3117/F3117M Specification for Crew Interface in Aircraft

2.2 *Code of Federal Regulations (CFR):*[3]

14 CFR part 23 Airworthiness Standards: Normal Category Airplanes

14 CFR part 33 Airworthiness Standards: Aircraft Engines

14 CFR part 34 Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered Airplanes

14 CFR part 35 Airworthiness Standards: Propellers

2.3 *Federal Aviation Administration (FAA) Publications:*[4]

AC 23-8C Flight Test Guide for Certification of Part 23 Airplanes

CAR 13 Aircraft Engine Airworthiness

TSO-C77 Technical Standard Order – Gas Turbine Auxiliary Power Units

2.4 *JAA Documents:*[5]

JAR-E Engines

JAR-P Propellers

[1] This specification is under the jurisdiction of ASTM Committee F44 on General Aviation Aircraft and is the direct responsibility of Subcommittee F44.40 on Powerplant.

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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 U.S. Government Publishing Office, 732 N. Capitol St., NW, Washington, DC 20401, https://www.gpo.gov.

[4] Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, https://www.faa.gov.

[5] Available from IHS Markit, 15 Inverness Way East, Englewood, CO 80112, http://www.global.ihs.com.

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JAR-22 Sailplanes and Powered Sailplanes

2.5 *EASA Documents:*[6]

CS-22 Certification Specifications for Sailplanes and Powered Sailplanes

CS-23 Normal, Utility, Aerobatic and Commuter Aeroplanes

CS-34 Aircraft Engine Emissions and Fuel Venting

CS-E Certification Specifications for Engines

CS-P Certification Specifications for Propellers

CS-APU Certification Specifications for Auxiliary Power Units

3. Terminology

3.1 The following are a selection of relevant terms. See Terminology F3060 for more definitions and abbreviations.

3.2 *Definitions:*

3.2.1 *powerplant, n*—all units and components necessary for propelling the aircraft or for providing auxiliary power for the aircraft (APU).

3.2.2 *powerplant installation, n*—the installation of an engine or auxiliary power unit including all components that are necessary for propulsion or for providing auxiliary power (APU) and affects the safety of the major propulsive units.

3.2.3 *reciprocating engine, n*—engines with the characteristics of a non-continuous flow piston engines.

3.2.3.1 *Discussion*—For the purpose of this standard the term reciprocating engine does include rotary piston engine due to the similar characteristics.

3.2.4 *supercharger, n*—an air compressor that increases the pressure of air supplied to an engine.

3.2.4.1 *Discussion*—For the purpose of this standard the term supercharger refers to both mechanical and turbine driven superchargers.

3.2.5 *turbine engines, n*—turbopropeller, turbojet and turbofan engines.

3.2.6 *turbocharger, n*—a supercharger driven by a turbine in the exhaust gas stream, short form of turbo supercharger.

3.3 *Abbreviations:*

3.3.1 *APU*—Auxilliary Power Unit

4. General

4.1 *Engines and APU:*

4.1.1 Each engine shall meet the technical requirements of accepted specifications appropriate to the application.

4.1.2 Each APU shall meet the technical requirements of TSO-C77.

4.1.3 Each turbine engine shall meet the applicable requirements of 14 CFR part 34.

4.2 *Powerplant Installation:*

4.2.1 The powerplant installation shall comply with the installation instructions of:

(1) the engine,

(2) the propeller, if applicable,

(3) the APU, if applicable.

4.2.2 Each powerplant installation shall be constructed and arranged to ensure safe operation to the maximum altitude for which approval is requested.

4.2.3 Each turbine engine installation shall be constructed and arranged to result in carcass vibration characteristics that do not exceed those established by the engine manufacturer.

4.2.4 Each powerplant installation shall be constructed and arranged to be accessible for necessary inspections and maintenance.

4.2.4.1 Engine cowls and nacelles shall be easily removable or openable by the pilot to provide adequate access to and exposure of the engine compartment for preflight checks.

5. Air Induction System

5.1 *General:*

5.1.1 The air induction system for each engine and auxiliary power unit and their accessories shall supply the air required by that engine and auxiliary power unit and their accessories under the operating conditions for which certification is requested.

5.2 *Induction Systems of Reciprocating Engine Powered Aeroplanes:*

5.2.1 Each engine installation shall have at least two separate air intake sources.

5.2.2 Primary air intakes may open within the cowling if that part of the cowling is isolated from the engine accessory section by a fire-resistant diaphragm or if there are means to prevent the emergence of backfire flames.

5.2.3 Each alternate air intake shall be located in a sheltered position and may not open within the cowling if the emergence of backfire flames will result in a hazard.

5.2.4 The supplying of air to the engine through the alternate air intake system may not result in a loss of excessive power in addition to the power loss due to the rise in air temperature.

5.2.5 Each automatic alternate air door shall have an override means accessible to the flight crew, or shall comply with 5.2.5.1 and 5.2.5.2.

5.2.5.1 Each automatic alternate air door shall be shown to not freeze shut when exposed to –40 °C [–40 °F] or the lowest ambient temperature expected in flight, at cruise power in visible moisture, and

5.2.5.2 Each automatic alternate air door shall be subject to Instructions for Continued Airworthiness that require periodic opening and inspection for cleanliness of the alternate air door contact surfaces and hinge areas. The time between inspections and cleaning shall be selected to adequately ensure the removal of dirt or other contaminants before accumulating in amounts that are likely to lead to freezing of the alternate air door.

5.2.6 Each automatic alternate air door shall have a means to indicate to the flight crew when it is not closed.

5.3 *Induction Systems of Turbine Engine Powered Aeroplanes:*

5.3.1 There shall be means to prevent quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering the engine intake system that would cause the engine to exceed its operational

[6] Available from EASA European Aviation Safety Agency, Postfach 10 12 53. D-50452 Koeln, Germany, https://www.easa.europa.eu.

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limitations, cause a significant loss of power, or otherwise cause the engine to operate in an unsafe condition.

5.3.2 The airplane shall be designed to prevent water or slush on the runway, taxiway, or other airport operating surfaces from being directed into the engine or auxiliary power unit air intake ducts in quantities that would cause the engine to exceed its operational limitations, cause a significant loss of power, or otherwise cause the engine to operate in an unsafe condition.

5.3.3 The air intake ducts shall be located or protected so as to minimize the hazard of ingestion of foreign matter during takeoff, landing, and taxiing.

5.3.4 Each turbine engine installation shall be constructed and arranged to ensure that the capability of the installed engine to withstand the ingestion of rain, hail, ice, and birds into the engine inlet is not less than the capability established for the engine itself under Specification F3066/F3066M.

5.3.5 The air inlet system shall not, as a result of airflow distortion during normal operation, cause vibration harmful to the engine.

5.4 *Induction System Ducts:*

5.4.1 Each induction system duct shall have a drain to prevent the accumulation of fuel or moisture in the normal ground and flight attitudes. No drain may discharge where it will cause a fire hazard.

5.4.2 Each duct connected to components between which relative motion could exist shall have means for flexibility.

5.4.3 Each flexible induction system duct shall be capable of withstanding the effects of temperature extremes, fuel, oil, water, and solvents to which it is expected to be exposed in service and maintenance without hazardous deterioration or delamination.

5.4.4 For reciprocating engine installations, each induction system duct shall be:

5.4.4.1 Strong enough to prevent induction system failures resulting from normal backfire conditions; and

5.4.4.2 Fire resistant in any compartment for which a fire extinguishing system is required.

5.4.5 Each inlet system duct for an auxiliary power unit shall be:

5.4.5.1 Fireproof within the auxiliary power unit compartment;

5.4.5.2 Fireproof for a sufficient distance upstream of the auxiliary power unit compartment to prevent hot gas reverse flow from burning through the duct and entering any other compartment of the airplane in which a hazard would be created by the entry of the hot gases;

5.4.5.3 Constructed of materials suitable to the environmental conditions expected in service, except in those areas requiring fireproof or fire resistant materials; and

5.4.5.4 Constructed of materials that will not absorb or trap hazardous quantities of flammable fluids that could be ignited by a surge or reverse-flow condition.

5.4.6 Induction system ducts that supply air to a cabin pressurization system shall be suitably constructed of material that will not produce hazardous quantities of toxic gases or isolated to prevent hazardous quantities of toxic gases from entering the cabin during a powerplant fire.

5.5 *Induction System Screens:*

5.5.1 Each screen shall be upstream of the carburetor or fuel injection system.

5.5.2 No screen may be in any part of the induction system that is the only passage through which air can reach the engine, unless the available heat rise is at least 56°C [100°F]; and the screen can be deiced by heated air.

5.5.3 No screen may be deiced by alcohol alone.

5.5.4 It shall be impossible for fuel to strike any screen.

5.6 *Induction System Filters:*

5.6.1 If an air filter is used to protect the engine against foreign material particles in the induction air supply:

5.6.1.1 Each air filter shall be capable of withstanding the effects of temperature extremes, rain, fuel, oil, and solvents to which it is expected to be exposed in service and maintenance; and

5.6.1.2 Each air filter shall have a design feature to prevent material separated from the filter media from interfering with proper fuel metering operation.

6. Powerplant Exhaust System

6.1 *General:*

6.1.1 Each exhaust system shall ensure safe disposal of exhaust gases without fire hazard or carbon monoxide contamination in any personnel compartment.

6.1.2 Each exhaust system part with a surface hot enough to ignite flammable fluids or vapors shall be located or shielded so that leakage from any system carrying flammable fluids or vapors will not result in a fire caused by impingement of the fluids or vapors on any part of the exhaust system including shields for the exhaust system.

6.1.3 Each exhaust system shall be separated by fireproof shields from adjacent flammable parts of the airplane that are outside of the engine and auxiliary power unit compartments.

6.1.4 No exhaust gases may discharge dangerously near any fuel or oil system drain.

6.1.5 For aeroplanes certified for night operation no exhaust gases may be discharged where they will cause a glare seriously affecting pilot vision at night.

6.1.6 Each exhaust system component shall be ventilated to prevent points of excessively high temperature.

6.1.7 If significant traps exist, each turbine engine and auxiliary power unit exhaust system shall have drains discharging clear of the airplane, in any normal ground and flight attitude, to prevent fuel accumulation after the failure of an attempted engine or auxiliary power unit start.

6.1.8 Each exhaust heat exchanger shall incorporate means to prevent blockage of the exhaust port after any internal heat exchanger failure.

6.2 *Exhaust System Construction:*

6.2.1 Each exhaust system shall be fireproof and corrosion-resistant, and shall have means to prevent failure due to expansion by operating temperatures.

6.2.2 The suitability and durability of materials used for any exhaust part shall:

6.2.2.1 Be established by experience or test;

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6.2.2.2 Meet approved specifications that ensure their having the strength and other properties assumed in the design data; and

6.2.2.3 Take into account the effects of environmental conditions, such as temperature and humidity, expected in service.

6.2.3 Each exhaust system shall be supported to withstand the vibration and inertia loads to which it may be subjected in operation.

6.2.4 Parts of the system connected to components between which relative motion could exist shall have means for flexibility.

6.3 *Exhaust Heat Exchangers:*

6.3.1 Each exhaust heat exchanger shall be constructed and installed to withstand the vibration, inertia, and other loads that it may be subjected to in normal operation.

6.3.2 Each exchanger shall be suitable for continued operation at high temperatures and resistant to corrosion from exhaust gases.

6.3.3 There shall be means for inspection of critical parts of each exchanger.

6.3.4 Each exchanger shall have cooling provisions wherever it is subject to contact with exhaust gases.

6.3.5 Each heat exchanger used for heating ventilating air shall be constructed so that exhaust gases may not enter the ventilating air.

6.4 *Induction Air Preheater Design:*

6.4.1 Each exhaust-heated, induction air preheater shall be designed and constructed to:

6.4.1.1 Ensure ventilation of the preheater when the induction air preheater is not being used during engine operation;

6.4.1.2 Allow inspection of the exhaust manifold parts that it surrounds; and

6.4.1.3 Allow inspection of critical parts of the preheater itself.

7. Forced Air Induction and Bleed Air Systems

7.1 *Turbocharger Systems:*

7.1.1 Each turbocharger shall either be approved under the engine type certificate or it shall be shown that the turbocharger system, while in its normal engine installation and operating in the engine environment:

7.1.1.1 Can withstand, without defect, the endurance test specified by the standard to which compliance was shown for the engine; and

7.1.1.2 Will have no adverse effect upon the engine.

7.1.2 Control system malfunctions, vibrations, and abnormal speeds and temperatures expected in service may not damage the turbocharger compressor or turbine.

7.1.3 Each turbocharger case shall be able to contain fragments of a compressor or turbine that fails at the highest speed that is obtainable with normal speed control devices inoperative.

7.1.4 Engine power, cooling characteristics, operating limits, and procedures affected by the turbocharger system installations shall be evaluated.

7.1.5 Turbocharger operating procedures and limitations shall be included in the Airplane Flight Manual.

7.2 *Intercooler Installation:*

7.2.1 The mounting provisions of the intercooler shall be designed to withstand the loads imposed on the system.

7.2.2 It shall be shown that, under the installed vibration environment, the intercooler will not fail in a manner allowing portions of the intercooler to be ingested by the engine.

7.2.3 Airflow through the intercooler shall not discharge directly on any airplane component (for example, windshield) unless such discharge is shown to cause no hazard to the airplane under all operating conditions.

7.3 *Turbocharger Bleed Air System for Cabin Pressurization:*

7.3.1 The cabin air system may not be subject to hazardous contamination following any probable failure of the turbocharger or its lubrication system.

7.3.2 The turbocharger supply air shall be taken from a source where it cannot be contaminated by harmful or hazardous gases or vapors following any probable failure or malfunction of the engine exhaust, hydraulic, fuel, or oil system.

7.4 *Turbine Engine Bleed Air System:*

7.4.1 No hazard may result if duct rupture or failure occurs anywhere between the engine port and the airplane unit served by the bleed air.

7.4.2 The effect on airplane and engine performance of using maximum bleed air shall be established.

7.4.3 Hazardous contamination of cabin air systems may not result from failures of the engine lubricating system.

8. Oil System

8.1 *General:*

8.1.1 For oil systems and components that have been approved under the engine airworthiness requirements and where those requirements are equal to or more severe than the corresponding requirements of this standard, that approval need not be duplicated. Where the requirements of this standard are more severe, substantiation shall be shown to the requirements of this standard.

8.1.2 Each powerplant oil system shall be independent and capable of supplying the powerplant with an appropriate quantity of oil at a temperature not above that safe for continuous operation.

8.1.3 Each oil system shall have a usable capacity adequate for the endurance of the aeroplane.

8.1.3.1 The usable oil tank capacity may not be less than the product of the endurance of the airplane under critical operating conditions and the maximum oil consumption of the engine under the same conditions, plus a suitable margin to ensure adequate circulation and cooling.

8.1.4 For an oil system without an oil transfer system, only the usable oil tank capacity may be considered. The amount of oil in the engine oil lines, the oil radiator, and the feathering reserve, may not be considered.

8.1.5 If an oil transfer system is used, and the transfer pump can pump some of the oil in the transfer lines into the main engine oil tanks, the amount of oil in these lines that can be pumped by the transfer pump may be included in the oil capacity.

8.1.6 Each oil system line shall comply with:

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