Designation: F3062/F3062M – 15

StandardSpecification for Installation of Powerplant Systems[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 must 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 may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

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
F3066/F3066M Specification for Powerplant Systems Specific Hazard Mitigation

2.2 *Code of Federal Regulations (CFR):*[3]
14 CFR part 33 Airworthiness Standards: Aircraft Engines
14 CFR part 35 Airworthiness Standards: Propellers
14 CFR part 34 Fuel Venting and Exhaust Emission Requirements for Turbine Powered Airplanes

2.3 *Federal Aviation Administration (FAA) Publications:*[4]
AC 23-8C Flight Test Guide for certification of part 23 airplanes
CAR 13 Aircraft Engines Airworthiness
TSO C77 Technical Standard Order – Gas Turbine Auxiliary Power Units

2.4 *JAA Documents:*[5]
JAR-E Engines
JAR-P Propellers
JAR-22 Gliders and Powered Gliders

2.5 *EASA Documents:*[6]
CS-22 Certification Specifications for Gliders and Powered Gliders
CS-E Certification Specifications for Engines
CS-P Certification Specifications for Propellers
CS-APU Certification Specifications for Auxiliary Power Units

[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.

Current edition approved June 1, 2015. Published August 2015. DOI: 10.1520/F3062_F3062M-15.

[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 Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, www.access.gpo.gov.

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

[5] Available from Global Engineering Documents, 15 Inverness Way, East Englewood, CO 80112-5704, global.ihs.com.

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

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

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

3.3 *Abbreviations:*

3.3.1 *APU*—Auxilliary Power Unit

4. General

4.1 *Engines and APU:*

4.1.1 Each engine must either:

4.1.1.1 Meet the technical requirements of 14 CFR Part 33, or

4.1.1.2 If accepted by the authority, meet the technical requirements of CS-22 Subpart H.

4.1.2 Each APU must meet the technical requirements of TSO C77.

4.1.3 Each turbine engine must meet the applicable requirements of 14 CFR Part 34.

4.2 *Powerplant Installation:*

4.2.1 The powerplant installation must comply with the installation instructions of the engine, the propeller and the APU.

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

4.2.3 Each turbine engine installation must 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 must be constructed and arranged to be accessible for necessary inspections and maintenance.

4.2.4.1 Engine cowls and nacelles must 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 must 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 Installation must 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 must 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 must have an override means accessible to the flight crew.

5.2.6 Each automatic alternate air door must 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 must be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering the engine intake system.

5.3.2 The airplane must 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 hazardous quantities.

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

5.3.4 For turbine engines certified to 14 CFR part 33, each turbine engine installation must 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 For turbine engines certified to CS-E or JAR-E, each turbine engine installation must be constructed and arranged to provide continued safe operation without a hazardous loss of power or thrust while being operated in rain for at least 3 min with the rate of water ingestion being not less than 4% by weight, of the engine induction airflow rate at the maximum installed power or thrust approved for take-off and at flight idle.

5.4 *Induction System Ducts:*

5.4.1 Each induction system duct must 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 must have means for flexibility.

5.4.3 Each flexible induction system duct must 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 must 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 must 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 must 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 must 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 preheat 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 must 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 must 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 must 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 must 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 must 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 must 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 must 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 must 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 must be fireproof and corrosion-resistant, and must 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 must:

6.2.2.1 Be established by experience or tests;

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 must 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 must have means for flexibility.

6.3 *Exhaust Heat Exchangers:*

6.3.1 Each exhaust heat exchanger must 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 must be suitable for continued operation at high temperatures and resistant to corrosion from exhaust gases.

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

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

6.3.5 Each heat exchanger used for heating ventilating air must 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 must 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 must either be approved under the engine type certificate or it must 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 must 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 must be evaluated.

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

7.2 *Intercooler Installation:*

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

7.2.2 It must 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 must 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 must 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 must 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 must be shown to the requirements of this standard.

8.1.2 Each powerplant oil system must 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 must 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 must comply with 11.1.

8.1.7 If an engine depends upon a fuel/oil mixture for lubrication, then a reliable means of providing it with the appropriate mixture must be established.

8.1.7.1 In assessing the reliance that can be placed upon the means for providing the appropriate fuel/oil mixture to the engine to prevent a hazardous condition, account should be taken of, for example:

(a) The tolerance of the engine to fuel/oil mixture ratios other than the optimum;

(b) The procedure established for refuelling and introducing the appropriate amount of oil; and

(c) The means by which the pilot may check that the fuel contains an adequate mixture of oil.

8.2 *Oil Tanks:*

8.2.1 *Installation:*

8.2.1.1 Each oil tank must be installed to withstand any vibration, inertia, and fluid loads expected in operation.

8.2.1.2 Each oil tank must be supported so that tank loads are not concentrated.