Designation: ~~F3064/F3064M – 21~~ F3064/F3064M – 24

Standard Specification for Aircraft Powerplant Control, Operation, and Indication[1]

This standard is issued under the fixed designation F3064/F3064M; 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 control, indication, and operational characteristics of propulsion systems. It was developed based on propulsion system installed on aeroplanes, but may be applicable to other applications as well.

1.2 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 Aeroplane Airworthiness regulations (Hereinafter referred to as "the Rules"), refer to ASTM F44 webpage (www.ASTM.org/COMITTEE/F44.htm) which includes CAA website links. Annex A1 maps the Means of Compliance described in this specification to EASA CS-23, amendment 5, or later, and FAA 14 CFR Part 23, amendment 64, or later.

1.3 *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.

1.4 *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 limitations 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]

F3060 Terminology for Aircraft
F3061/F3061M Specification for Systems and Equipment in Aircraft
F3062/F3062M Specification for Aircraft Powerplant Installation
F3063/F3063M Specification for Aircraft Fuel Storage and Delivery
F3116/F3116M Specification for Design Loads and Conditions
F3117/F3117M Specification for Crew Interface in Aircraft
F3233/F3233M Specification for Flight and Navigation Instrumentation in Aircraft

[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 ~~May 1, 2021~~March 1, 2024. Published ~~May 2021~~March 2024. Originally approved in 2015. Last previous edition approved in ~~2020~~2021 as F3064/F3064M~~–20a. DOI: 10.1520/F3064_F3064M-21.~~–21. DOI: 10.1520/F3064_F3064M-24.

[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.

F3367 Practice for Simplified Methods for Addressing High-Intensity Radiated Fields (HIRF) and Indirect Effects of Lightning on Aircraft
F3432 Practice for Powerplant Instruments

2.2 *EASA Standard:*[3]

CS-23 Certification Specifications for Normal-Category Aeroplanes

2.3 *FAA ~~Standard:~~Documents:*[4]

14 CFR Part 23 Airworthiness Standards: Normal Category Airplanes
AC 33.28-1 Compliance Criteria For 14 CFR §33.28, Aircraft Engines, Electrical And Electronic Engine Control Systems
AC 33.28-2 Guidance Material For 14 CFR §33.28, Reciprocating Engines, Electrical And Electronic Engine Control Systems
AC 33.28-3 Guidance Material For 14 CFR §33.28, Engine Control Systems

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 *automatic power reserve (APR) system, n*—the automatic system used only during takeoff, including all devices both mechanical and electrical that sense engine failure, transmit signals, actuate fuel/energy controls or power levers on operating engines, including power sources, to achieve the scheduled power increase and furnish cockpit information on system operation.

3.2.2 *critical time interval, n*—period starting at V_1 minus one second and ending at the intersection of the engine and APR failure flight path line with the minimum performance all engine flight path line. The engine and APR failure flight path line intersects the one-engine-inoperative flight path line at 122 m [400 ft] above the takeoff surface. The engine and APR failure flight path is based on the airplane's performance and must have a positive gradient of at least 0.5 % at 122 m [400 ft] above the takeoff surface. See Fig. 1.

3.2.3 *loss-of-thrust-control/loss of power control (LOTC/LOPC), n*—loss of capability to modulate and maintain thrust or power between flight idle and a specified percent of maximum rated power or thrust, at all operating conditions.

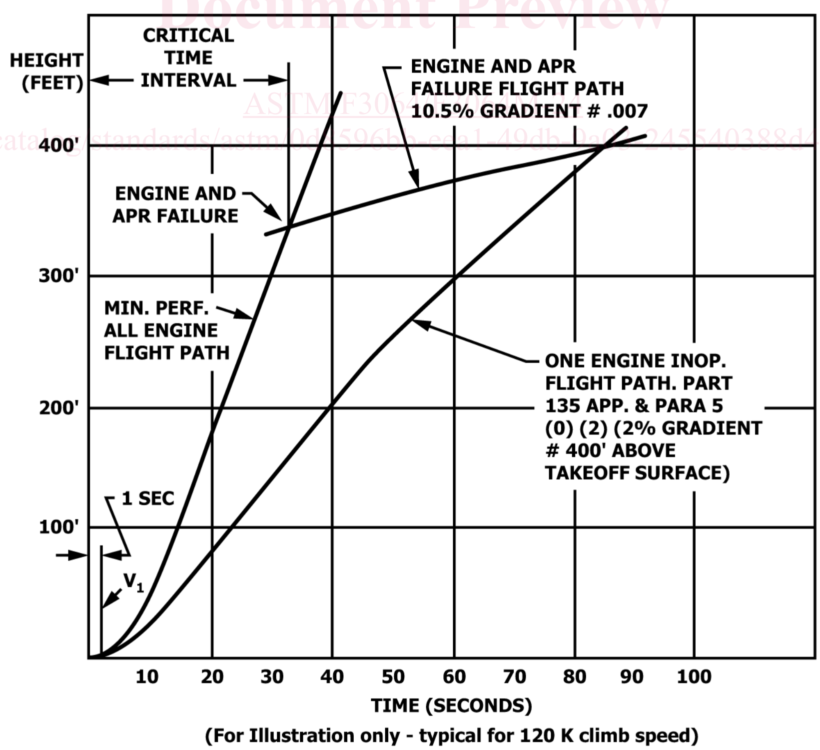

FIG. 1 Critical Time Interval

[3] Available from European Union Aviation Safety Agency (EASA), Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, https://www.easa.europa.eu.
[4] Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov.

3.2.4 *powerplant instrument, n*—the visual presentation of a powerplant (Terminology F3060) parameter, a powerplant installation (Terminology F3060) parameter, a parameter required by the engine manufacturer, or fuel/energy system parameter necessary to provide performance and condition information for the airplane operation.

3.2.5 *selected takeoff power, n*—the power obtained from each initial power setting approved for takeoff.

4. Powerplant Controls

4.1 *General Requirements:*

4.1.1 Powerplant controls must be located and arranged per Specification F3117/F3117M.

4.1.2 Each flexible control must be shown to be suitable for the particular application.

4.1.3 Each control must be able to maintain any necessary position without:

4.1.3.1 Constant attention by flight crew members; or

4.1.3.2 Tendency to creep due to control loads or vibration.

4.1.4 Each control must be able to withstand operating loads without failure or excessive deflection that will impede or negatively affect intended operation.

4.1.5 For turbine engine powered airplanes, no single failure or malfunction, or probable combination thereof, in any powerplant control system may cause the failure of any powerplant function necessary for safety.

4.1.6 The portion of each powerplant control located in the engine compartment that is required to be operated in the event of fire must be at least fire resistant.

4.1.7 Powerplant valve controls located in the cockpit must have:

4.1.7.1 For manual valves, positive stops or in the case of fuel valves suitable index provisions, in the open and closed position; and

4.1.7.2 For power-assisted valves, a means to indicate to the flight crew when the valve is in the fully open or fully closed position; or is moving between the fully open and fully closed position.

4.2 *Ignition Switches:*

4.2.1 Aeroplanes with combustion based engines that utilize spark ignition must have independent ignition switches that must control and shut off each ignition circuit on each engine.

4.3 *Power, Thrust, Supercharger Controls:*

4.3.1 There must be a separate power or thrust control for each engine and a separate control for each supercharger that requires a control.

4.3.2 Each power, thrust, or supercharger control must give a positive and immediate responsive means of controlling its engine or supercharger.

4.3.3 The power, thrust, or supercharger controls for each engine or supercharger must be independent of those for every other engine or supercharger.

4.3.4 For each fluid injection (other than fuel) system and its controls not provided and approved as part of the engine, the applicant must show that the flow of the injection fluid is adequately controlled.

4.3.5 If a power, thrust, or a fuel control (other than a mixture control) incorporates a fuel shutoff feature, the control must have a means to prevent the inadvertent movement of the control into the shutoff position. This means must:

4.3.5.1 Have a positive lock or stop at the idle position; and

4.3.5.2 Require a separate and distinct operation to place the control in the shutoff position.

4.3.6 Each power or thrust control must be designed so that if a control separates at the engine fuel/energy metering device, the airplane is capable of continued safe flight and landing.

4.4 *Fuel/Energy Mixture Controls:*

4.4.1 If there are mixture controls, each engine must have a separate control.

4.4.2 Aeroplanes with a manual engine mixture control must be designed so that, if the control separates at the engine fuel/energy metering device, the airplane is capable of continued safe flight and landing.

4.5 *Propeller Speed Pitch and Feathering Controls:*

4.5.1 If there are propeller speed or pitch controls, they must:

4.5.1.1 Allow separate control of each propeller.

4.5.1.2 Allow ready synchronization of all propellers on multiengine airplanes.

4.5.2 If there are propeller feathering controls installed:

4.5.2.1 It must be possible to feather each propeller separately.

4.5.2.2 Each control must have a means to prevent inadvertent operation.

4.6 *Reverse Thrust and Propeller Pitch Settings:*

4.6.1 For turbine engine installations, each control for reverse thrust and for propeller pitch settings below the flight regime must have means to prevent its inadvertent operation that includes:

4.6.1.1 A positive lock or stop at the flight idle position.

4.6.1.2 A separate and distinct operation by the crew to displace the control from the flight regime (forward thrust regime for turbojet powered airplanes).

4.7 *Carburetor Air Temperature Controls:*

4.7.1 For carburetor equipped airplanes there must be a separate carburetor air temperature control for each engine.

4.8 *Auxiliary Power Unit Controls:*

4.8.1 Means must be provided on the flight deck for the starting, stopping, monitoring, and emergency shutdown of each installed auxiliary power unit.

4.9 *Powered Operated Valves:*

4.9.1 Power Operated valves must have a means to:

4.9.1.1 Indicate to the flight crew when the valve has reached the selected position; and

4.9.1.2 Not move from the selected position under vibration conditions likely to exist at the valve location.

4.10 *Fuel Valves and Energy Controls:*

4.10.1 There must be a means to allow appropriate flight crew members to rapidly shut off, in flight, the supply of fuel/energy to each engine individually.

4.10.2 No shutoff valve may be on the engine side of any firewall. In addition, there must be means to:

4.10.2.1 Guard against inadvertent operation of each shutoff valve; and

4.10.2.2 Allow appropriate flight crew members to reopen each valve rapidly after it has been closed.

4.10.3 Each valve and fuel system control must be supported so that loads resulting from its operation or from accelerated flight conditions are not transmitted to the lines connected to the valve.

4.10.4 Each valve and fuel system control must be installed so that gravity and vibration will not affect the selected position.

4.10.5 Each shutoff valve handle and its connections to the valve mechanism must have design features that minimize the possibility of incorrect installation.

4.10.6 Fuel tank selector valves must:

4.10.6.1 Have a separate and distinct action to place the selector in the "OFF" position; and

4.10.6.2 Have the tank selector positions located in such a manner that it is impossible for the selector to pass through the "OFF" position when changing from one tank to another.

4.11 *Electronic Engine Control (EECS):*

4.11.1 For electronic engine control system (EECS) (Terminology F3060) installations, no single failure or malfunction or foreseeable combinations of failures of EECS components shall have an effect on the installed system that causes the probability of loss-of-thrust-control/loss of power control (LOTC/LOPC) to exceed that which was required in the engine certification.

NOTE 1—The term "foreseeable" in this context is defined as those failures or failure combinations which could occur a few times when considering the entire operational life of all airplanes of one type. A qualitative assessment is required for each EECS installation considering all foreseeable events that may not have been considered in the part 33 EECS safety assessment which may invalidate the approved LOTC/LOPC rates (reference AC33.28-1 (paragraph 6-3(a)(2), AC33.28-2 tables 5-1 and 5-2, and AC33.28-3 paragraph 62(d)).

4.11.2 Electronic engine control system installations shall be evaluated for environmental and atmospheric conditions, including lightning and HIRF (Terminology F3060) as follows:

4.11.2.1 The EECS lightning and HIRF effects that result in LOTC/LOPC shall be analyzed utilizing the threat levels associated with a catastrophic failure.

4.11.2.2 The EECS as installed in the aircraft shall be shown to meet the requirements of Specification F3061/F3061M for Indirect Effects of Lightning and High Intensity Radiated Fields (HIRF) protection.

4.11.2.3 If Practice F3367 is used, single reciprocating engine installations shall meet the requirements defined for airplane assessment level I or higher for HIRF and airplane assessment level II or higher for indirect effects of lightning.

4.11.3 The components of the installation shall be constructed, arranged, and installed to ensure their continued safe operation between normal inspections or overhauls.

4.11.4 Functions incorporated into any electronic engine control system that make it part of any equipment, systems, or installation whose functions are beyond that of basic engine control, and which could also introduce system failures and malfunctions, are not exempt from normal category airplane system safety certification requirements and shall be shown to meet normal category airplane certification levels of safety as derived from those requirements. Engine certification data, if applicable, is acceptable to support compliance with any normal category airplane certification requirements.

NOTE 2—If engine certification data is to be used to support substantiation of compliance with normal category airplane certification requirements, then the normal category airplane certification applicant should be able to provide this data to support their showing of compliance.

5. Powerplant Operational Characteristics and Installation

5.1 *Powerplant Operating Characteristics:*

5.1.1 Turbine engine powerplant operating characteristics must:

5.1.1.1 Be investigated in flight to determine that no adverse characteristics (such as stall, surge, or flameout) are present, to a hazardous degree, during normal and emergency operations within the range of operating limitations of the airplane and of the engine.

5.1.2 Forced air induction engine operating characteristics must be investigated in flight to assure that no adverse characteristics, as a result of an inadvertent overboost, surge, flooding, or vapor lock, are present during normal or emergency operation of the engine(s) throughout the range of operating limitations of both airplane and engine.

5.2 *Negative Acceleration:*

5.2.1 No hazardous malfunction of an engine, an auxiliary power unit approved for use in flight, or any component or system associated with the powerplant or auxiliary power unit may occur when the airplane is operated at the negative accelerations within the flight envelopes prescribed in Specification F3116/F3116M. This must be shown for the greatest value and duration of the acceleration expected in service.

5.3 *Cooling—General:*

5.3.1 The powerplant and auxiliary power unit cooling provisions must:

5.3.1.1 Maintain the temperatures of powerplant components and engine fluids, and auxiliary power unit components and fluids within the limits established for those components and fluids under the most adverse ground, and water conditions; and

5.3.1.2 Demonstrate flight operations to the maximum altitude and maximum ambient atmospheric temperature conditions for which approval is requested, including after normal engine and auxiliary power unit shutdown.

5.4 *Cooling Tests—Correction Factors:*

5.4.1 *General*—Compliance with 5.3 must be shown on the basis of tests, for which the following apply:

5.4.1.1 If the tests are conducted under ambient atmospheric temperature conditions deviating from the maximum for which approval is requested, the recorded powerplant temperatures must be corrected under 5.4.3 and 5.4.4, unless a more rational correction method is applicable.

5.4.1.2 No corrected temperature determined under 5.4.1.1 of this standard may exceed established limits.

5.4.1.3 The fuel used during the cooling tests must be of the minimum grade approved for the engine.

5.4.1.4 For turbocharged engines, each turbocharger must be operated through that part of the climb profile for which operation with the turbocharger is requested.

5.4.1.5 For a reciprocating engine, the mixture settings must be the leanest recommended for climb.

5.4.2 *Maximum Ambient Atmospheric Temperature*—A maximum ambient atmospheric temperature corresponding to sea level conditions of at least 38 °C [100 °F] must be established. The assumed temperature lapse rate is 2 °C per 305 meter [3.6 °F per