



Memorandum

U.S. Department
of Transportation

**Federal Aviation
Administration**

Subject: **INFORMATION:** PS-ACE100-2002-005; Proposed Policy Statement; Clarification on Policy on 14 CFR Part 23, § 23.1357(d) Regarding Circuit Breakers and Fuses

Date: DRAFT

From: Manager, Small Airplane Directorate, ACE-100

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Applicability

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This policy statement provides clarification of 14 CFR part 23, § 23.1357(d), for normal, utility, acrobatic, and commuter category airplanes. It is applicable for all installed fuses or circuit breakers, including those used for primary and/or secondary (in-line) circuit protection. This policy statement incorporates, and therefore supersedes, the previously issued policy applicable to this subject contained in Advisory Circular, AC 23-17A.

This policy statement is also applicable to conventional, near-equilibrium, non-rigid airships. These criteria are applicable to airships certificated in the normal category under 14 CFR part 21, § 21.17(b) for special classes of aircraft that have a passenger seating configuration, excluding pilot seats, of nine seats or less. For airships containing larger numbers of passengers, these criteria would require further consideration.

Regulation

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The requirements in 14 CFR part 23, § 23.1357(d), at amendment 23-55 are stated as follows:

“If the ability to reset a circuit breaker or replace a fuse is essential to safety in flight, that circuit breaker or fuse must be so located and identified that it can be readily reset or replaced in flight.”

Summary

The applicability of the above statement from 14 CFR part 23, § 23.1357(d), depends on whether a function is determined to be "essential to safety in flight." There are two criteria, listed below, that are used to determine which functions are “essential to safety in flight,” as required by 14 CFR part 23, § 23.1357(d). They are the following:

- (1) For airplane systems with a certification basis at Amendment 23-40 or earlier: When the function is required by the airworthiness or operational requirements, it is considered “essential to safety in flight;” or
- (2) For airplane systems with a certification basis at Amendment 23-41 or later: When the failure condition of the loss of the function is determined to be “major”, “hazardous”, or “catastrophic” [as per a § 23.1309 and AC 1309-1C safety assessment, which considers both operational and airworthiness requirements], it has a significant impact on safety in flight and is considered “essential to safety in flight.”

The statement "required by the airworthiness or operational requirements" in criteria (1) above refers to equipment required by the current operational rules under which the aircraft is operated (i.e., 14 CFR part 91, 14 CFR part 135).

Background of Existing Policy

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AC 23-17A, “Systems and Equipment Guide for Certification of Part 23 Airplanes,” served to consolidate existing and past policy regarding circuit protective devices into a single document. The AC, which originated in 1968, stated the following under § 23.1357(d):

"The phrase 'essential to safe operation,' as used in part 135, Appendix A, paragraph 64, and the phrase 'essential to flight safety' in § 23.1357(b) have the same meaning as 'essential to safety in flight' in § 23.1357(d) and 'essential to flight safety' in § 23.1357(b). All of these phrases are descriptive of equipment installed to comply with the airworthiness or operational requirements."

Similarly, the words “essential to safety in flight” are also found in CAR 3, CAR 4, and 14 CFR part 25, § 25.1357(d).

In 1989, when the criticality of functions such as oil pressure, oil temperature, and fuel quantity were considered, they were not considered “essential to safety in flight.” AC 23-17A states this position clearly. Also, the following additional statement was included in AC 23-17A:

“The FAA recognizes that some required circuit protection devices are associated with circuits that can have no significant impact on safety in flight. Therefore, the responsible Aircraft Certification Office (ACO), in conjunction with the applicant, should identify which circuits and circuit protection devices are essential to safety in flight. The identified circuits should comply with § 23.1357(d) regarding the pilot’s ability to reset them in flight.”

At that time, no additional guidance was provided to determine what was meant by “no significant impact on safety in flight.” Subsequently, there has been a lack of standardization within the certification authorities. For clarification, the term “no significant impact on safety in

flight” should be interpreted to be equivalent to “no safety effect” or “minor failure” conditions, as described below.

Function Criticality and Applicability of § 23.1357

With the enactment of Amendment 23-41, the approval of more advanced and complex system designs under § 23.1309 was addressed by advocating the use of a safety assessment process to assign a level of criticality to each system function. This allowed more latitude during certification of various complex system architectures in part 23 airplanes. AC 23.1309-1C, “Equipment, Systems, and Installations in Part 23 Airplanes,” was written to document the safety assessment process used to classify the failure condition for the loss of each given function in a system.

According to AC 23.1309-1C, if the failure condition is considered “major,” “hazardous,” or “catastrophic,” the circuit providing the function must have a circuit breaker or fuse that is readily accessible to be reset or replaced in flight. Therefore, the terms of § 23.1357(d) would apply.

In contrast, the requirement of § 23.1357(d) would not apply for failure conditions only classified as “minor” or “no safety effect” under the terms of a safety assessment according to AC 23.1309-1C. Also, if there are several functions combined on one display and integrated under one protective device, then the total loss of all affected functions should be considered in the safety assessment process to determine the level of criticality for that system failure.

Example Configurations

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An example of applying this policy follows:

For an airplane that has two electronic Primary Flight Displays (PFD), plus a Multi-Function Display (MFD) installed strictly to meet part 23 powerplant monitoring requirements, the PFDs would display the required flight critical parameters. These include altitude, airspeed, attitude, and others.

It is assumed the classification for the loss of attitude on one PFD in this case is “major,” and the loss of altitude or airspeed is “minor.” For this system, the requirement of § 23.1357(d) applies because of the classification the loss of attitude. Also, both PFDs would be required to meet the airworthiness requirements of § 23.1311(a)(5).

If the MFD is used to display the powerplant parameters required by § 23.1305, potential MFD failure conditions resulting in the loss of several powerplant functions at once should be addressed in the safety assessment. However, if the intended function of the MFD is to display functions that are not required by the airworthiness or operational rules and only information for situational awareness, such as traffic, weather or terrain, then § 23.1357(d) would not apply to the MFD circuit protection devices.

On the other hand, for a system with two independent PFDs with an MFD that is also capable of displaying required independent flight critical parameters through a reversionary mode, the loss of attitude information on one PFD would be of a lower consequence. This is because there would still be two independent sources available to display the critical flight parameters. In this case, the requirement of § 23.1357(d) may not apply for some flight parameters. However, a safety assessment would be needed to address other parameters that may or may not be displayed on the MFD in a reversionary mode, such as the powerplant parameters.

Equivalent Level of Safety or Exemption to § 23.1357 for Internal Circuit Protection Devices

If an internal circuit breaker or fuse is installed, and a lack of access to that circuit breaker or fuse would result in a failure classification of “major” or worse, the circuit protection devices and equipment installation should meet the appropriate § 23.1309 failure probability requirements (as defined in AC 23.1309-1C). Also, in this situation, all the appropriate environmental test conditions, such as indirect effects of lightning and High Intensity Radiated Fields (HIRF) standards, should be addressed for the installation. To allow approval of these kinds of installations, an equivalent level of safety or exemption to § 23.1357 would be needed.

Conclusion

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There are two criteria that can be used to determine the applicability of 14 CFR part 23, § 23.1357(d) for a given system. They are related to the interpretation of the meaning of the phrase “essential to the safety in flight.” (1) If the function is required by the airworthiness or operational requirements, or (2) If the failure condition for the loss of function is “major,” “hazardous,” or “catastrophic” according to a § 23.1309 safety assessment. If the above criteria indicate that the requirement of § 23.1357(d) applies to a given circuit protection device, it must be able to be readily reset or replaced in flight.

If the above criteria indicate that the requirement of § 23.1357(d) applies, and if the circuit protection devices are internal circuit breakers or fuses that cannot be reset by the pilot, then an equivalent level of safety or an exemption is required.

For questions and assistance regarding this policy, please contact Mr. Wes Ryan by telephone at (816) 329-4127, by fax at (816) 329-4090, or by e-mail at wes.ryan@faa.gov.

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