



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: FIRE PROTECTION:
SYSTEMS

Date: 10/22/07

AC No. 25.869-1A

Initiated by: ANM-100

1. PURPOSE. This advisory circular (AC) provides guidance for demonstrating compliance with the transport category airplane certification requirements of § 25.863 *Flammable fluid fire protection* (as applicable to electrical system components) and § 25.869 *Fire protection: systems*.

2. APPLICABILITY.

a. The guidance provided in this document is directed to airplane manufacturers, modifiers, foreign regulatory authorities, Federal Aviation Administration (FAA) transport airplane type certification engineers, and designees.

b. This material is neither mandatory nor regulatory in nature and does not constitute a regulation. It describes acceptable means, but not the only means, for demonstrating compliance with the applicable regulations. We will consider other methods of demonstrating compliance that an applicant may elect to present. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the relevant regulations. On the other hand, if we become aware of circumstances that convince us that following this AC would not result in compliance with the applicable regulations, we will not be bound by the terms of this AC, and we may require additional substantiation as a basis for finding compliance.

c. This material does not change or create any additional regulatory requirements nor does it authorize changes in or permit deviations from existing regulatory requirements

d. Terms such as “shall” or “must” are used in this AC only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described herein is used.

3. CANCELLATION. This AC cancels AC 25.869-1, Electrical System Fire and Smoke Protection, dated March 25, 2004.

4. DEFINITION.

Electrical wiring interconnection systems (EWIS). In part, an EWIS is any wire, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy between two or more intended termination points. The complete regulatory definition of an EWIS is in § 25.1701, which is included in Appendix A of this AC.

5. COMPLIANCE GUIDANCE. Applicants may show compliance with the requirements of § 25.869(a) and those of § 25.863 applicable to electrical equipment by demonstrating the following:

a. Electrical components in areas immediately outside firewalls and in engine pod attachment structures should be made of such materials and installed at such a distance from the firewall that they will not suffer damage that could hazard the airplane if the surface of the firewall adjacent to the fire is heated to 1100° C (2012° F) for 15 minutes.

b. Electrical equipment should be constructed and/or installed so that in the event of failure, no hazardous quantities of toxic or noxious products (for example, smoke) will be distributed in the crew or passenger compartments.

c. Electrical equipment that may come into contact with flammable vapors should be designed and installed to minimize the risk of the vapors exploding under both normal and fault conditions. This can be satisfied by meeting the Explosion Proofness Standards of Radio Technical Commission for Aeronautics (RTCA) Document DO-160/EUROCAE ED-14.

d. Compliance with § 25.1713. Section 25.869(a)(3) requires that EWIS components meet the requirements of § 25.1713. Section 25.1713 contains EWIS-related requirements that were formerly located in § 25.869(a)(1), (a)(2), and (a)(4). The wording in § 25.869(a)(3) is just a reference to 25.1713 stating that EWIS associated with that section of 14 CFR must meet its requirements. Specific guidance for 25.1713 is contained in the subpart H AC.

e. Instructions for Continued Airworthiness. The Instructions for Continued Airworthiness (required by §§ 25.1529 and 25.1729) must include all maintenance actions necessary to ensure that electrical system components maintain their compliance with the requirements of § 25.869.

f. § 25.869(c), Fire Protection for Oxygen Equipment.

(1) High pressure oxygen shut-off valves should be designed to provide effective slow opening and closing to avoid the possible risk of fire or explosion.

(2) Oxygen re-charging systems, if installed, should be provided with means to prevent excessive rates of charging which could result in dangerously high temperatures within the system. The charging system should also provide protection from contamination.

(3) The compartments in which high pressure oxygen system components, including oxygen source(s), are located should have adequate ventilation to ensure the rapid dilution of leaked oxygen. Such compartments should also provide adequate protection against contamination by liquids and other products which could result in the risk of fire.

(4) Where in-situ charging facilities are provided, the compartments in which they are located should be accessible from outside the aircraft and be located far enough from other service points and equipment and ignitable material like grease, fuel vapor, or hydraulic fluid, so that ignition is prevented. Placards should be provided, located adjacent to the servicing point, with adequate instructions covering precautions to be observed when the system is being charged.

(5) The oxygen system should be installed so that components and pipe lines –

(a) Are adequately separated from electrical and fluid systems.

(b) Are routed to minimize joints and sharp bends.

(c) Are clear of moving controls and other mechanisms.

(d) Are protected against grease or other lubricants and are protected against the effects of vibration.

In addition, joints should be assembled dry where possible, but if compounds are used for sealing they should be approved for that purpose.

(6) Where oxygen is supplied from chemical generators, the effects of heat emission during both normal and inadvertent operation, on both the installation and other adjacent equipment, should be taken into account.

(7) § 25.869(c) is applicable to oxygen equipment and lines during all airplane operations.

/s/Ali Bahrami
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APPENDIX A**§§ 25.863, 25.869, and 25.1701**

The text of §§ 25.863, 25.869, and 25.1701 is repeated here for the convenience of the reader.

§ 25.863 Flammable fluid fire protection.

(a) In each area where flammable fluids or vapors might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapors, and the resultant hazards if ignition does occur.

(b) Compliance with paragraph (a) of this section must be shown by analysis or tests, and the following factors must be considered:

(1) Possible sources and paths of fluid leakage, and means of detecting leakage.

(2) Flammability characteristics of fluids, including effects of any combustible or absorbing materials.

(3) Possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices.

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents.

(5) Ability of airplane components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (e.g., equipment shutdown or actuation of a fire extinguisher) quick acting means must be provided to alert the crew.

(d) Each area where flammable fluids or vapors might escape by leakage of a fluid system must be identified and defined.

§ 25.869 Fire protection: systems.

(a) Electrical system components:

(1) Components of the electrical system must meet the applicable fire and smoke protection requirements of §§25.831(c) and 25.863.

(2) Equipment that is located in designated fire zones and is used during emergency procedures must be at least fire resistant.

(3) EWIS components must meet the requirements of § 25.1713

(4) Insulation on electrical wire and electrical cable installed in any area of the airplane must be self-extinguishing when tested in accordance with the applicable portions of part I, appendix F of this part.

(b) Each vacuum air system line and fitting on the discharge side of the pump that might contain flammable vapors or fluids must meet the requirements of §25.1183 if the line or fitting is in a designated fire zone. Other vacuum air systems components in designated fire zones must be at least fire resistant.

(c) Oxygen equipment and lines must—

(1) Not be located in any designated fire zone,

(2) Be protected from heat that may be generated in, or escape from, any designated fire zone, and

(3) Be installed so that escaping oxygen cannot cause ignition of grease, fluid, or vapor accumulations that are present in normal operation or as a result of failure or malfunction of any system.

§ 25.1701 Definition.

(a) As used in this chapter, electrical wiring interconnection system (EWIS) means any wire, wiring device, or combination of these, including termination devices, installed in any area of the airplane for the purpose of transmitting electrical energy between two or more intended termination points. Except as provided for in paragraph (c) of this section, this includes:

(1) Wires and cables.

(2) Bus bars.

- (3) The termination point on electrical devices, including those on relays, interrupters, switches, contactors, terminal blocks and circuit breakers, and other circuit protection devices.
 - (4) Connectors, including feed-through connectors.
 - (5) Connector accessories.
 - (6) Electrical grounding and bonding devices and their associated connections.
 - (7) Electrical splices.
 - (8) Materials used to provide additional protection for wires, including wire insulation, wire sleeving, and conduits that have electrical termination for the purpose of bonding.
 - (9) Shields or braids.
 - (10) Clamps and other devices used to route and support the wire bundle.
 - (11) Cable tie devices.
 - (12) Labels or other means of identification.
 - (13) Pressure seals.
 - (14) EWIS components inside shelves, panels, racks, junction boxes, distribution panels, and back-planes of equipment racks, including, but not limited to, circuit board back-planes, wire integration units, and external wiring of equipment.
- (b) Except for the equipment indicated in paragraph (a)(14) of this section, EWIS components inside the following equipment, and the external connectors that are part of that equipment, are excluded from the definition in paragraph (a) of this section:
- (1) Electrical equipment or avionics that are qualified to environmental conditions and testing procedures when those conditions and procedures are—
 - (i) appropriate for the intended function and operating environment, and
 - (ii) acceptable to the FAA.
 - (2) Portable electrical devices that are not part of the type design of the airplane. This includes personal entertainment devices and laptop computers.
 - (3) Fiber optics.

APPENDIX B**RELATED REGULATIONS AND DOCUMENTS.**

Regulations. You can download an electronic copy of 14 CFR from the Internet at <http://www.gpoaccess.gov/cfr/>. A paper copy can be ordered by sending a request to the U.S. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-0001, or by calling telephone number (202) 512-1800; or by sending a request by facsimile to (202) 512-2250.

- § 25.863 Flammable fluid fire protection
- § 25.1301 Function and installation
- § 25.1529 Instructions for Continued Airworthiness
- § 25.1701 Definition (of EWIS)
- § 25.1713 Fire Protection: EWIS.
- § 25.1729 Instructions for Continued Airworthiness: EWIS.

Advisory Circulars. You can download an electronic copy of the latest version of the following ACs from the FAA Internet at <http://rgl.faa.gov>.

- 25.1701-1 Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes

Reports. You can download an electronic copy of the following report from the “Final Reports” section of the ATSRAC website: www.mitrecaasd.org/atstrac.

“Task 6 Final Report,” dated October 29, 2002, Aging Transport Systems Rulemaking Advisory Committee.

APPENDIX C

Following is the discussion of § 25.869 published in the *Federal Register* on October 6, 2005 (70 FR 58508) in Notice of Proposed Rulemaking No 05-08, Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety (EAPAS/FTS), at the time this rule was proposed.

Section 25.1713 Fire protection: EWIS.

Proposed § 25.1713 would require that EWIS components meet the applicable fire and smoke protection requirements of § 25.831(c). It would further require that EWIS located in designated fire zones be at least fire resistant. Insulation on electrical wires and cables would also be required to be self-extinguishing when tested in accordance with the applicable portions of Appendix F, Part I, of part 25.

During an emergency situation it is important that airplane systems needed by the flightcrew to effectively deal with the emergency be operative. To help ensure this, § 25.869 requires that electrical systems components meet certain flammability requirements and be designed and installed to minimize probability of ignition of flammable fluids and vapors. Currently, § 25.869(a) is applicable to wiring. The proposal is to move the requirements of § 25.869(a) related to protection of wiring from fire and put them into the proposed § 25.1713. This will allow easy identification of the requirements for fire protection of EWIS, because they will be found in the proposed new subpart H, which is dedicated to EWIS regulations. Requirements of § 25.869 dealing with isolation from flammable fluid lines have been moved to the new § 25.1709 and requirements for allowance for deformation and stretching have been moved to § 25.1703. As a result, we are amending § 25.869 to accommodate this change.