



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: FIRE PROTECTION: SYSTEMS	Date: 9/9/05 Initiated By: ANM- 100	AC No: 25.869-1 Change:
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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. **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 in Appendix A.

4. **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 25.1739) must include all maintenance actions necessary to ensure that electrical system components maintain their compliance with the requirements of § 25.869 throughout the expected service life of the airplane.
 - 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 as remote as possible from other service points and equipment. 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.

APPENDIX A

§§ 25.863, 25.869, and 25.1701

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

[Amdt. 25–23, 35 FR 5676, Apr. 8, 1970, as amended by Amdt. 25–46, 43 FR 50597, Oct. 30, 1978]

§ 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) 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 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.

(b) The definition in paragraph (a) of this section covers 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 and wire integration units.

(c) Except for the equipment indicated in paragraph (b) 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. Sections of 14 CFR part 25 that prescribe requirements for the design, substantiation, and certification relating to circuit protective devices in transport category airplanes include:

- § 25.863 Flammable fluid fire protection
- § 25.1301 Function and installation
- § 25.1529 Instructions for Continued Airworthiness
- § 25.1701 Definition (of EWIS)
- § 25.1713 Systems and Functions: EWIS.
- § 25.1739 Instructions for Continued Airworthiness: EWIS.

Advisory Circulars.

- 25.17XX Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes

Reports

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