



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

Advisory Circular

**Subject: PROTECTION AGAINST
INJURY**

**Date: 9/9/05
Initiated By:**

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Change: DRAFT**

1. **PURPOSE.** This advisory circular (AC) provides guidance for demonstrating compliance with the transport category airplane certification requirements of § 25.1360 *Protection against injury.*
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 and is reproduced in Appendix A of this AC.

4. COMPLIANCE GUIDANCE.

Applicants may show compliance with the requirements § 25.1360(a) and (b) by demonstrating the following:

a. Section 25.1360(a)

(1) **Voltage level warning.** Where there may be a hazard during maintenance or servicing, airplane panels and equipment carrying voltages of above 50 V RMS should be marked with the voltage.

(2) **Electrical outlet marking.** Socket outlets should be labeled with output voltage or voltages and intended use. Examples are outlets for electric razors in lavatories and outlets that are part of a power supply system for portable electronic devices (PSS for PED). When the output voltage exceeds 100 volts DC and/or 50 volts AC RMS, that output should either be electrically isolated from the airplane structure or prevented in some way from making inadvertent contact with electrically live parts.

(3) **Vulnerability of wire and components in the passenger cabin.** Power supply systems for PED or similar system wire bundles and components are present throughout the passenger cabin and exposed in some cases. The potential for system faults is increased by the wide exposure to varying hazards such as pinched wires in the seat track, passengers stepping on or kicking the seat electronic box, and spilled liquid. Because these systems have greater exposure to hazards, potential for shock hazards to people is also increased. To guard against damage to PSS cable assemblies installed in the seat itself, seat-mounted wiring should have appropriate protection means. Conduits are one way to provide such protection. Engineering data that controls the installation of PSS wiring and equipment should contain specific, unambiguous requirements for routing, supporting, and protecting all PSS wiring and equipment, and should identify all parts necessary to accomplish those installations.

(4) **Hazards to occupants from PSS for PED outlets.** A fault of the circuit associated with the PSS in the cabin interior or system short circuits could lead to system overloads or fire/smoke hazards and shock hazards to people. Such faults could be caused by spilled liquids or by conductive objects inserted into outlets. The design of the PSS socket installation should prevent

fluid from reaching electrical circuitry or power sockets. The design should also minimize the possibility of conductive objects being inserted into power sockets. If not, the applicant should show a design means in place to mitigate the hazard of those situations. An example of such mitigation would be a design where output power is present at the PSS socket only when the PED connector is correctly mated with the socket.

(5) Electrical component installations such as wiring in the galley and lavatory area should be protected and inaccessible to passengers and crew members.

b. Section 25.1360(b)

(1) Parts on equipment that may be handled by the flight or cabin crew during normal operation should not exceed a temperature rise on the order of 25 degrees Celsius above ambient. For other equipment mounted in parts of the airplane normally accessible to passengers or crew, or which may come into contact with objects such as clothing or paper, surface temperature should not exceed 100 degrees Celsius in an ambient temperature of 20 degrees Celsius. The rule states that items handled by the crewmember must not be so hot that they cause dangerous inadvertent movement or injury to the crewmember. This means that the surface temperature of the part being touched should not be so hot as to cause a reflexive action on the part of the crewmember that could cause injury to the crewmember. Nor should it be so hot that it causes burns to the crewmember.

(2) Interior lighting installation systems are not excluded from the requirements of § 25.1360(b). Reading light lamp surfaces, push button control switches, dimmer controllers, lamp holders, and lighting ballasts must not overheat to the point that their exterior surfaces can cause burns to people.

(3) Providing guards around hot surfaces, such as properly installed cooking apparatus or lighting fixtures, is an acceptable way to comply with these requirements if they prevent crew members from inadvertently contacting the hot surfaces.

c. Compliance with § 25.1719. Section 25.1719(b)(6) requires that components of EWIS associated with systems to which § 25.1360 is applicable be considered an integral part of that system or systems and must be considered in showing compliance with the applicable requirements for that system.

d. Instructions for Continued Airworthiness. Instructions for Continued Airworthiness (required by §§ 25.1529 and 25.1739) must include all maintenance actions necessary to maintain the airplane systems covered by § 25.1360 so that the

shock and burn protection is ensured throughout the expected service life of the airplane or of the system.

APPENDIX A

§§ 25.1360 and 25.1701

The text of §§ 25.1360 and 25.1701 is repeated here for the convenience of the reader.

§ 25.1360 Precautions against injury.

(a) Shock. The electrical system must be designed to minimize risk of electric shock to crew, passengers, and servicing personnel and to maintenance personnel using normal precautions.

(b) Burns. The temperature of any part that may be handled by a crewmember during normal operations must not cause dangerous inadvertent movement by the crewmember, or injury to the crewmember.

§ 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 design, substantiation, and certification relating to circuit protective devices in transport category airplanes include:

- § 25.1301 Function and installation.
- § 25.1309 Equipment, systems, and installations.
- § 25.1353 Electrical equipment and installations
- § 25.1365 Electrical appliance, motors, and transformers
- § 25.1529 Instructions for Continued Airworthiness
- § 25.1701 Definition (of EWIS)
- § 25.1721 Circuit protective devices: EWIS.
- § 25.1739 Instructions for Continued Airworthiness: EWIS

Advisory Circulars

- 25-10 Guidance for Installation of Miscellaneous, Nonrequired Electrical Equipment
- 25-16 Electrical Fault and Fire Protection and Prevention
- 25.1309-1A System Design and Analysis
- 25.1353-1 Electrical Requirement and Installations
- 25.1365-1 Electrical Appliances, Motors, and Transformers

Policy Memorandums

- PS-ANM100-2000-00105 Interim Policy Guidance for Certification of In-Flight Entertainment Systems on Title 14 CFR Part 25 Aircraft
- PS-ANM100-2001-00113 Interim Summary of Policy and Advisory Material Available for Use in the Certification of Cabin Mounted Video Camera Systems with flight Deck Displays on Title 14 CFR Part 25 Aircraft

Reports

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