



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

Advisory Circular

**Subject: ELECTRICAL APPLIANCES,
MOTORS, AND TRANSFORMERS**

Date: 9/9/05

**AC No:
25.1365-1X**

Initiated By: ANM-100 Change: DRAFT

1. **PURPOSE.** This advisory circular (AC) provides guidance for demonstrating compliance with the transport category airplane certification requirements of § 25.1365 *Electrical appliances, motors and transformers.*

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. **DEFINITIONS.**

a. Domestic Appliance. Item placed on the airplane to provide service amenities to passengers. Examples of domestic appliances are cooktops, ovens, microwave ovens, coffee makers, water heaters, refrigerators, and toilet flush systems. In turn, domestic systems are those such as lavatories or galleys that may contain one or more domestic appliances.

b. 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 reproduced in § 25.1701 in Appendix A of this AC.

4. **COMPLIANCE GUIDANCE.**

a. General. Most of section 25.1365 addresses concerns that faulty galley heating equipment (ovens) often cause smoke or fire in the cabin. Circuit protection devices used in motor power supplies for those appliances have not always provided enough protection against failures. Section 25.1365(a) requires that domestic appliances be designed and installed so that the requirements of §§ 25.1309(b), (c), and (d) are satisfied. The intent is to prevent hazards to continued safe flight in the event of any failure. Section 25.1365(b) requires that galley and cooking appliance installations minimize the risk of overheating or fire. Section 25.1365(c) requires that they be installed to prevent damage or contamination of other equipment from fluids or vapors resulting from spillage during use of the appliances. Section 25.1365(d) is broader in scope and requires that all electric motors and transformers, including those on domestic appliances, have a thermal protection device unless the circuit protective device required by § 25.1357(a) would be sufficient to show compliance with the requirements of § 25.1309(b).

b. Heated Domestic Appliances (Galley Equipment).

(1) The design and installation of heated domestic appliances should be such that no single failure (for example, a welded thermostat or contactor or loss of water supply) can result in dangerous overheating and consequent risk of fire, smoke, or injury to occupants.

(2) An acceptable way to achieve this is by providing a means that will automatically interrupt electrical power supply to the unit if an overheat condition occurs. This must be independent of the normal temperature control system. This automatic shutoff means should be designed so that it cannot be reset in flight.

(3) The design and installation of microwave ovens should not pose a hazard to occupants or equipment of the airplane under either normal operation or single failure conditions.

(4) In addition to overheat protection, heated liquid containers (water boilers or coffee makers, for instance) should have an effective means to relieve overpressure, either in the equipment itself or in its installations.

NOTES.

- Design and maintenance procedures should consider the possible effects of lime scale deposit in water-heating equipment.
- The design of galley and cooking appliance installations should facilitate cleaning to limit accumulation of any extraneous substances that may pose a fire risk.

c. Electrical Overheat Protection Equipment. In showing compliance with § 25.1365(d), you should consider the following:

- (1) Failures of any automatic control systems (automatic timer systems for example) which may cause the motor to run continuously.
- (2) Short circuit failures of motor windings or transformer windings to each other or to the motor or transformer frame.
- (3) An open circuit of one or more phases on multi-phase motors.
- (4) Motor seizures.
- (5) Proximity of flammable materials or fluids.
- (6) Proximity of other airplane installations.
- (7) Spillage of fluids, such as toilet waste.
- (8) Accumulations of combustible material.
- (9) Cooling-air discharge under normal operating or failure conditions.

d. Water Systems.

- (1) When water is provided for occupant use or consumption, the associated system should be designed to ensure that no hazard to the airplane can result from water contacting electrical systems or other systems.
- (2) Water service connections (filling points) should be of a different type from those used for other services so that water cannot inadvertently be introduced into other service systems.

e. Compliance with § 25.1719. Section 25.1719(b)(8) requires that EWIS components associated with systems to which § 25.1365 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.

f. Instructions for Continued Airworthiness. 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 § 25.1365 throughout the expected service life of the airplane.

APPENDIX A

§§ 25.1365 and 25.1701

The text of §§ 25.1365 and 25.1701 is repeated here for the convenience of the reader.

§ 25.1365 Electrical appliances, motors, and transformers.

(a) Domestic appliances must be designed and installed so that in the event of failures of the electrical supply or control system, the requirements of § 25.1309(b), (c), and (d) will be satisfied. Domestic appliances are items such as cooktops, ovens, coffee makers, water heaters, refrigerators, and toilet flush systems that are placed on the airplane to provide service amenities to passengers.

(b) Galleys and cooking appliances must be installed in way that minimizes risk of overheat or fire

(c) Domestic appliances, particularly those in galley areas, must be so installed or protected as to prevent damage or contamination of other equipment or systems from fluids or vapors which may be present during normal operation or as a result of spillage, if such damage or contamination may create a hazardous condition.

(d) Unless compliance with § 25.1309(b) is provided by the circuit protective device required by § 25.1357(a), electric motors and transformers, including those installed in domestic systems, must have a suitable thermal protection device to prevent overheating under normal operation and failure conditions, if overheating would create a smoke or fire hazard.

§ 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
- § 25.1307 Miscellaneous equipment
- § 25.1309 Equipment, systems, and installations
- § 25.1351 General
- § 25.1353 Electrical equipment and installations
- § 25.1360 Precautions against injury
- § 25.1529 Instructions for Continued Airworthiness
- § 25.1719 Systems and Functions: 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
- 25-1360-1 Protection Against Injury
- 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.