(iii) A battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure. (See AMC 25.1353(c)(6)(ii) and (iii).)

(d) Reserved

(e) Electrical bonding must provide an adequate electrical return path under both normal and fault conditions, on aeroplanes having earthed electrical systems (see CS 25.899).

[Amdt 25/5]
[Amdt 25/18]

AMC 25.1353(a) Electrical equipment and installations

ED Decision 2003/2/RM

The possible sources of interference to be considered should include –

a. Conducted and radiated interference caused by electrical noise generation from apparatus connected to the busbars,

b. Coupling between electrical cables or between cables and aerial feeders,

c. Malfunctioning of electrically-powered apparatus,

d. Parasitic currents and voltages in the electrical distribution and earth systems, including the effects of lightning currents or static discharge,

e. Difference frequencies between generating or other systems, and

f. The requirements of CS 25.1309 should also be satisfied.

AMC 25.1353(c)(6)(ii) and (iii) Electrical equipment and installations

ED Decision 2003/2/RM

Where temperature sensing and over-temperature warning devices are installed to comply with CS 25.1353(c)(6)(ii) or (iii), their correct operations should be verified at agreed maintenance intervals in addition to compliance with CS 25.1309(a) and (b).

CS 25.1355 Distribution system

ED Decision 2016/010/R

(See AMC 25.1355)

(a) The distribution system includes the distribution busses, their associated feeders, and each control protective device.

(b) Reserved.

(c) If two independent sources of electrical power for particular equipment or systems are required for certification, or by operating rules, in the event of the failure of one power source for such equipment or system, another power source (including its separate feeder) must be automatically provided or be manually selectable to maintain equipment or system operation. (See AMC 25.1355(c) and AMC 25.1310(a).)

[Amdt 25/18]

AMC 25.1355(c) Distribution system

ED Decision 2003/2/RM

The arrangement, protection and control of the feeders from the busbars to the distribution points, and the divisions of loads among the feeders, should be such that no single fault occurring in any feeder or associated control circuit will hazard the aeroplane.

CS 25.1357 Circuit protective devices

ED Decision 2016/010/R

(See AMC 25.1357)

(a) Automatic protective devices must be used to minimise distress to the electrical system and hazard to the aeroplane in the event of wiring faults or serious malfunction of the system or connected equipment. (See AMC 25.1357(a).)

(b) The protective and control devices in the generating system must be designed to de-energise and disconnect faulty power sources and power transmission equipment from their associated busses with sufficient rapidity to provide protection from hazardous over-voltage and other malfunctioning.

(c) Each re-settable circuit protective device must be designed so that, when an overload or circuit fault exists, it will open the circuit irrespective of the position of the operating control.

(d) 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 located and identified so that it can be readily reset or replaced in flight. Where fuses are used, there must be spare fuses for use in-flight equal to at least 50% of the number of fuses of each rating required for complete circuit protection.

(e) Each circuit for essential loads must have individual circuit protection. However, individual protection for each circuit in an essential load system (such as each position light circuit in a system) is not required.

(f) For aeroplane systems for which the ability to remove or reset power during normal operations is necessary, the system must be designed so that circuit breakers are not the primary means to remove or reset system power, unless specifically designed for use as a switch. (see AMC 25.1357(f)).

(g) Automatic reset circuit breakers may be used as integral protectors for electrical equipment (such as thermal cutouts) if there is circuit protection to protect the cable to the equipment.

[Amdt 25/5]
[Amdt 25/18]

AMC 25.1357(a) Circuit protective devices

ED Decision 2003/2/RM

No hazard should result from the effects of variations in ambient temperatures on either the protective device or the equipment it protects. See also CS 25.1309.

AMC 25.1357(f) System Power Removal

ED Decision 2008/006/R

1 Subparagraph 25.1357(f) requires that circuit breakers are not used as the primary means to remove or reset system power for those aeroplane systems for which the ability to remove or reset power during normal operation is necessary.

2 It is not the intent of the requirement that every electrically powered system in the aeroplane has a means to remove power other than a circuit breaker. The phrase "normally requiring power removal" is used to distinguish between aeroplane systems normally turned on and off during normal operations, and those systems normally powered at all times, such as flight deck multi-function displays or the flight-management computer. But if, for example, the flight-management computer did require power cycling regularly, for whatever reason, this system would be required to have a means to do this other than using the circuit breakers.

3 Systems requiring power removal during normal operations should be designed so that power is removed from the system as closely as practical to the source of power instead of simply deactivating the outputs of the systems power supplies.

4 A separate, or integrated, power switch may be used to show compliance with CS 25.1357(f). If an integrated switch is used (that is, a switch that controls power to multiple aeroplane systems), then it must be shown that removing or resetting power for those multiple systems will not adversely affect safe flight.

5 A switch-rated circuit breaker can be used if it is shown to be appropriately rated for the number of switch cycles expected to be executed during the service life of the system or of the circuit breaker.

[Amdt 25/5]

CS 25.1360 Precautions against injury

ED Decision 2016/010/R

(See AMC 25.1360)

(a) *Shock*. The electrical system must be designed so as to minimise the risk of electric shock to crew, passengers and servicing personnel and also to maintenance personnel using normal precautions. (See AMC 25.1360(a) and CS 25.899.)

(b) *Burns*. The temperature of any part, which has to be handled during normal operation by the flight crew, must not be such as to cause dangerous inadvertent movement, or injury to the crewmember. (See AMC 25.1360(b).)

[Amdt 25/18]

AMC 25.1360(a) Precaution against injury

ED Decision 2007/010/R

1 Where there may be a hazard during maintenance or servicing, aeroplane panels, etc., carrying voltages of above 50V RMS, should be marked with the voltage.

2 Where socket outlets are provided, these should be labelled as to use and with the output voltage or voltages. Where the output voltage exceeds 100 volts d.c. and/or 50 volts a.c. RMS either the output should be electrically isolated from the aeroplane structure, or means shall be provided to prevent inadvertent contact with live parts.

[Amdt 25/3]

AMC 25.1360(b) Precaution against injury

ED Decision 2007/010/R

1 For equipment which has to be handled during normal operation by the flight or cabin crew, a temperature rise of the order of 25°C, for metal parts, should not be exceeded. For other equipment, mounted in parts of the aeroplane normally accessible to passengers or crew, or which may come into contact with objects such as clothing or paper, the surface temperature should not exceed 100°C, in an ambient temperature of 20°C.

2 The heating surfaces of properly installed cooking apparatus are excluded from these requirements.

3 The provision of guards around hot surfaces is an acceptable method of complying with these requirements.

[Amdt 25/3]

CS 25.1362 Electrical supplies for emergency conditions

ED Decision 2003/2/RM

(See AMC 25.1362)

A suitable supply must be provided to those services, which are required, in order that emergency procedures may be carried out, after an emergency landing or ditching. The circuits for these services must be so designed, protected and installed such that the risk of their causing a fire, under these conditions, is minimised.

AMC 25.1362 Electrical supplies for emergency conditions

ED Decision 2003/2/RM

1 The emergency services which may require a supply include fuel shut-off valves, hydraulic shut-off valves and engine / APU fire extinguisher systems.

2 An appropriate design and/or unambiguous AFM procedures should be provided in order to prevent disconnection of the electrical supply to the required services before the emergency procedures are fully completed.

CS 25.1363 Electrical system tests

ED Decision 2003/2/RM

(See AMC 25.1363)

(a) Tests must be made to determine that the performance of the electrical supply systems meets the requirements of this CS-25 under all the appropriate normal and failure conditions. When laboratory tests of the electrical system are conducted –

(1) The tests must be performed on a mock-up using the same generating equipment used in the aeroplane;

(2) The equipment must simulate the electrical characteristics of the distribution wiring and connected loads to the extent necessary for valid test results; and

(3) Laboratory generator drives must simulate the actual prime movers on the aeroplane with respect to their reaction to generator loading, including loading due to faults.

(b) For each flight condition that cannot be simulated adequately in the laboratory or by ground tests on the aeroplane, flight tests must be made.

AMC 25.1363 Electrical systems tests

ED Decision 2003/2/RM

1 In carrying out the tests due account should be taken of load switching and flight crew operation of the system.

2 *Laboratory or Ground Tests*

2.1 All tests should be carried out with all equipment as representative as possible of the actual aeroplane. In particular, the simulation should include the correct representation of aeroplane cables in size, length and impedance, the correct ground (airframe) impedance and relative ground plane location and their location to other cables or systems that could influence performance. System loads and the generator drive system should also be correctly simulated.

2.2 The tests may be carried out on representative laboratory rigs or in an actual aeroplane, as appropriate.

2.3 Test procedures should be prepared to cover each test condition in the programme.

3 *Aeroplane Flight Tests*

3.1 If not adequately simulated by laboratory or ground testing, flight tests should be carried out as necessary.

3.2 Temperature tests should be carried out on equipment to establish the adequacy of the cooling media under all ground and flight conditions.

3.3 Measurements should be made to ensure that all equipment, particularly the aeroplane battery, is operating within its specified environmental conditions.

3.4 Test procedures should be prepared to cover the conditions of the tests.

CS 25.1365 Electrical appliances, motors and transformers

ED Decision 2017/015/R

(See AMC 25.1365)

(a) Domestic appliances must be so designed and installed that in the event of failures of the electrical supply or control system, the requirements of CS 25.1309(b) and (c) will be satisfied.

(b) The installation of galleys and cooking appliances must be such as to minimise the risk of overheat, fire, burns, or spilled liquids to the aeroplane, passengers, and crew (See AMC 25.1365(b)).

(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 vapours which may be present during normal operation or as a result of spillage, where such damage or contamination may hazard the aeroplane.

(d) Unless it can be shown that compliance with CS 25.1309(b) is provided by the circuit protective device required by CS 25.1357(a), electric motors and transformers etc. (including those installed in domestic systems, such as galleys and toilet flush systems) must be provided with a suitable thermal protection device if necessary to prevent them overheating such as to create a smoke or fire hazard under normal operation and failure conditions.

[Amdt 25/2]
[Amdt 25/19]

AMC 25.1365 Electrical appliances, motors and transformers

ED Decision 2003/2/RM

1. Heated Domestic Appliances (Galley Equipment)

In showing compliance with CS 25.1365(a), the following should be taken into consideration:

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

An acceptable method of achieving this is by the provision of a means independent of the normal temperature control system, which will automatically interrupt the electrical power supply to the unit in the event of an overheat condition occurring. The means adopted should be such that it cannot be reset in flight.

1.2 The design and installation of microwave ovens should be such that no hazard could be caused to the occupants or the equipment of the aeroplane under either normal operation or single failure conditions.

1.3 Heated liquid containers, e.g. water boilers, coffee makers should, in addition to overheat protection, be provided with an effective means to relieve overpressure, either in the equipment itself or in its installations.

1.4 When considering failures of domestic appliances, the effect of the loss of the water supply to a water heater, with the electrical supply maintained, should be taken into account.

NOTES:

Due account should be taken of the possible effects of lime scale deposit both in the design and maintenance procedures of water heating equipment.

The design of galley and cooking appliance installations should be such as to facilitate cleaning to limit the accumulation of extraneous substances, which may constitute a fire risk.

2. Electric Overheat Protection Equipment

In showing compliance with CS 25.1365(d), the following should be taken into consideration:

a. Failures of any automatic control systems, e.g. automatic timer systems, which may cause the motor to run continuously;

b. Short circuit failures of motor windings or transformer windings to each other or to the motor or transformer frame;

c. Open circuit of one or more phases on multi-phase motors;

d. Motor seizures;

e. The proximity of flammable materials or fluids;

f. The proximity of other aeroplane installations;

g. Spillage of fluids, such as toilet waste;

h. Accumulation of combustible material; and

i. Cooling air discharge under normal operating or failure conditions.

3. Water Systems

3.1 Where water is provided in the aeroplane for consumption, or use by the occupant, the associated system should be designed so as to ensure that no hazard to the aeroplane could result from water coming into contact with electrical or other systems.

3.2 Service connections (filling points) should be of a different type from those used for other services, such that water could not inadvertently be introduced into the systems for other services.

AMC 25.1365(b) Installation of Cooktops

ED Decision 2017/015/R

The following acceptable means of compliance are applicable to cooktops with electrically powered heating elements. Use of other types of heat sources, such as gas, is unlikely to be acceptable. If such a design is desired, EASA should be contacted for advice.

(1) Suitable means, such as conspicuous element 'on' indicators, physical barriers, or handholds, should be installed to minimise the potential of inadvertent personnel contact with hot surfaces of both the cooktop and cookware. Conditions of turbulence should also be considered.

(2) Sufficient design means should be provided to restrain cookware, including their contents, in place on the cooktop against flight loads and turbulence.

(a) Restraints should be provided to preclude hazardous movement of cookware and contents thereof. These restraints should accommodate the cookware that is approved for use with the cooktop.

(b) Restraints should be designed to be easily used and effective in service. The cookware restraint system should also be designed in a way that it may not be easily disabled, thus rendering it unusable.

(c) Appropriate placarding should be installed prohibiting the use of cookware not approved for use with the cooktop.

(3) Appropriate placarding should be installed prohibiting the use of cooktops (i.e. power on any heating surface) during taxiing, take-off, and landing.

(4) Suitable means should be provided to address the possibility of a fire starting on the cooktop or in its immediate vicinity. The following two means are acceptable:

(a) Appropriate placarding should be installed that prohibits any heating surface from being powered when the cooktop is unattended (Note: this would prohibit a single person from cooking on the cooktop and intermittently serving food to passengers while any surface is powered). A fire detector should be installed in the vicinity of the cooktop, which provides a warning audible throughout the passenger cabin; moreover, a fire extinguisher of appropriate size and extinguishing agent should be installed in the immediate vicinity of the cooktop. Access to the extinguisher should not be blocked by a possible fire on or around the cooktop. One of the fire extinguishers required by CS 25.851 may be used to satisfy this requirement if it is located in the vicinity of the cooktop and the total complement of extinguishers remains evenly distributed throughout the cabin. If this is not possible, then the extinguisher in the cooktop area should be additional to those required by CS 25.851; or

(b) An automatic (e.g. thermally activated) system should be installed to extinguish a fire at the cooktop and immediately adjacent surfaces. The agent used in the system should be an approved flooding agent suitable for use in an occupied area. The fire suppression system should have an appropriately located manual activation control. Activation of the fire suppression system (automatic or manual) should also automatically shut off power to the cooktop.

(5) The surfaces of the galley surrounding the cooktop, which would be exposed to a fire on the cooktop surface or in cookware on the cooktop, should be constructed of materials that comply with the flame penetration resistance requirements of Appendix F, Part III. During the selection of all galley materials in the vicinity of the cooktop, consideration should be given to ensure that the flammability resistance characteristics of the materials will not be adversely affected by the use of cleaning agents and utensils used to remove cooking stains.

(6) The cooktop should be ventilated with a system independent of the aeroplane cabin and cargo ventilation system. Maintenance procedures and time intervalsshould be established for inspection and cleaning or replacement of ventilation system components to prevent the accumulation of flammable oils creating a fire hazard. These procedures and time intervals should be included in the instructions for continued airworthiness as required by CS 25.1529. The ventilation system ducting should be protected by a flame arrester (Note: the applicant may find additional useful information in Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) No 85, Revision E, ARP85E 'Air Conditioning Systems for Subsonic Airplanes' of 1 August 1991).

(7) Means should be provided to contain spilled foods or fluids in a manner that will prevent the creation of a slipping hazard to occupants as well as the loss of structural strength due to aeroplane corrosion.

(8) Cooktop installations should provide adequate space for the user to immediately escape a hazardous cooktop condition.

(9) A means to shut off power to the cooktop should be provided at the galley containing the cooktop and in the cockpit. If one (or more) dedicated switch(es) is (are) provided in the cockpit, smoke or fire emergency procedures should be provided in the AFM to cover their use.

(10) The cooktop should have either a lid that will completely enclose the cooking surface, or an appropriately located fire blanket of a size sufficient to completely cover the cooking surface should be provided. If a lid is installed, there should be a means to automatically shut off power to the cooktop when the lid is closed. The fire blanket material should be demonstrated to meet the European Standard (EN) 1869:1997, Fire blankets, or equivalent.

[Amdt 25/19]

LIGHTS

CS 25.1381 Instrument lights

ED Decision 2003/2/RM

(a) The instrument lights must –

(1) Provide sufficient illumination to make each instrument, switch and other device necessary for safe operation easily readable unless sufficient illumination is available from another source; and

(2) Be installed so that –

(i) Their direct rays are shielded from the pilot's eyes; and

(ii) No objectionable reflections are visible to the pilot.

(b) Unless undimmed instrument lights are satisfactory under each expected flight condition, there must be a means to control the intensity of illumination.

CS 25.1383 Landing lights

ED Decision 2003/2/RM

(a) Each landing light must be approved, and must be installed so that –

(1) No objectionable glare is visible to the pilot;

(2) The pilot is not adversely affected by halation; and

(3) It provides enough light for night landing.

(b) Except when one switch is used for the lights of a multiple light installation at one location, there must be a separate switch for each light.

(c) There must be a means to indicate to the pilots when the landing lights are extended.

CS 25.1385 Position light system installation

ED Decision 2003/2/RM

(a) *General*. Each part of each position light system must meet the applicable requirements of this paragraph and each system as a whole must meet the requirements of CS 25.1387 to 25.1397.

(b) *Forward position lights*. Forward position lights must consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the aeroplane so that, with the aeroplane in the normal flying position, the red light is on the left side, and the green light is on the right side. Each light must be approved.

(c) *Rear position light.* The rear position light must be a white light mounted as far aft as practicable on the tail or on each wing tip, and must be approved.

(d) *Light covers and colour filters.* Each light cover or colour filter must be at least flame resistant and may not change colour or shape or lose any appreciable light transmission during normal use.

CS 25.1387 Position light system dihedral angles

ED Decision 2003/2/RM

(a) Except as provided in sub-paragraph (e) of this paragraph, each forward and rear position light must, as installed, show unbroken light within the dihedral angles described in this paragraph.

(b) Dihedral angle L (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the aeroplane, and the other at 110° to the left of the first, as viewed when looking forward along the longitudinal axis.

(c) Dihedral angle R (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the aeroplane, and the other at 110° to the right of the first, as viewed when looking forward along the longitudinal axis.

(d) Dihedral angle A (aft) is formed by two intersecting vertical planes making angles of 70 ° to the right and to the left, respectively, to a vertical plane passing through the longitudinal axis, as viewed when looking aft along the longitudinal axis.

(e) If the rear position light when mounted as far aft as practicable in accordance with CS 25.1385(c), cannot show unbroken light within dihedral angle A (as defined in sub-paragraph (d) of this paragraph), a solid angle or angles of obstructed visibility totalling not more than 0·04 steradians is allowable within that dihedral angle, if such solid angle is within a cone whose apex is at the rear position light and whose elements make an angle of 30 ° with a vertical line passing through the rear position light.

CS 25.1389 Position light distribution and intensities

ED Decision 2003/2/RM

(a) *General*. The intensities prescribed in this paragraph must be provided by new equipment with light covers and colour filters in place. Intensities must be determined with the light source operating at a steady value equal to the average luminous output of the source at the normal operating voltage of the aeroplane. The light distribution and intensity of each position light must meet the requirements of sub-paragraph (b) of this paragraph.

(b) *Forward and rear position lights.* The light distribution and intensities of forward and rear position lights must be expressed in terms of minimum intensities in the horizontal plane, minimum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles L, R and A, and must meet the following requirements:

(1) *Intensities in the horizontal plane.* Each intensity in the horizontal plane (the plane containing the longitudinal axis of the aeroplane and perpendicular to the plane of symmetry of the aeroplane) must equal or exceed the values in CS 25.1391.

(2) *Intensities in any vertical plane.* Each intensity in any vertical plane (the plane perpendicular to the horizontal plane) must equal or exceed the appropriate value in CS 25.1393, where I is the minimum intensity prescribed in CS 25.1391 for the corresponding angles in the horizontal plane.

(3) *Intensities in overlaps between adjacent signals.* No intensity in any overlap between adjacent signals may exceed the values given in CS 25.1395, except that higher intensities in overlaps may be used with main beam intensities substantially greater than the minima specified in CS 25.1391 and 25.1393 if the overlap intensities in relation to the main beam intensities do not adversely affect signal clarity. When the peak intensity of the forward position lights is more than 102 cd (100 candles), the maximum overlap intensities between them may exceed the values given in CS 25.1395 if the overlap intensity in Area