



Specific Technical Requirements STR-19

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Electrically operated Galley Equipment

1 SCOPE AND PURPOSE

This document prescribes the minimum design requirements and qualification requirements for airplane galley systems.

1.1 Electrically operated equipment and systems, referred to as galley inserts, covered by this document:

- Ovens (Convection and Steam Version)
- Bun- and Plate-Warmer,
- Coffee Makers / Beverage Makers / Water Boilers / Water Heaters
- Rice Cookers / Coffee Warmers / Hot Jugs and Similar Equipment

Inserts receiving NTS certification shall be intended for use in aircraft galleys, as defined by this document. When inserts are certified details are laid down in compliance record sheet.

2 APPLICABLE DOCUMENTS

2.1 RTCA DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment.

2.2 ED14 EUROCAE European Organization for Civil Aviation Electronics

2.3 Joint Aviation Requirements JAR 21 Certification Procedures for Products and Parts.

2.4 Joint Aviation Requirements JAR 25 Airworthiness Standards .

2.5 United States Department of Health and Human Services, Food and Drug Administration, Publication 80-8035, Title 21, Chapter 1, FDA, Part 1030.10.

3 DESIGN REQUIREMENTS

3.1 Applicable Requirements according to Para. 2.4

REQUIREMENT JAR25 Change 15	
Paragraph	Title
JAR 25.301 (a)	Loads
JAR 25.303	Factor of Safety
JAR 25.305 (a)(b)	Strength and Deformation
JAR 25.307 (a) and ACJ 25.307	Proof of Structure...
JAR 25.561 (a)(b)(c) and AMJ25.561 (b)(3)	Emergency Conditions
JAR 25.621	Casting Factors,
JAR 25.625 (a)(b)(c)	Fitting Factors
JAR 25.789 (a)	Retention of Items
JAR 25.853 (a)(c) and ACJ25.853	Compartment Interiors
JAR 25.869 (a) (1)(4)	Fire Protection Systems
JAR 25. Appendix K and JAR 25.1529 Appendix H	Instruction for Continued Airworthiness

3.2 Environment

Galley inserts shall be capable of withstanding repeated exposure to the environmental requirements specified below without failure, malfunction or loss of material properties. Galley inserts shall meet the performance requirements of this STR over the ranges specified below as operating conditions, unless otherwise stated in the equipment specific requirements.

In acc. RTCA DO-160D and additional Aircraft Manufacturer Requirements:

- 3.2.1 Temperature
- 3.2.2 Altitude
- 3.2.3 Humidity
- 3.2.4 Vibration

4 Safety

- 4.1 All corners, which are exposed to crew, formed by two planes and outside corners formed by three planes shall have a minimum radii of 6.35 mm to mm (0.25 and 0.375 inches) respectively.
- 4.2 Fitting and projection design shall consider the risk of potential injury.
- 4.3 Galley insert design shall minimize risk of accidental damage during handling, installation or normal operation.
- 4.4 No single failure shall permit a galley insert to achieve internal temperatures which could generate hazardous quantities of smoke and/or initiate a fire.
- 4.5 No single failure shall permit excessive internal pressure within an insert which could cause the unit to burst.

5 Materials

5.1 General

All Materials used shall be of a type, grade and quality which experience and/or tests have demonstrated to be suitable for the purpose intended. Materials shall be controlled by acceptable specifications.

5.2 Shelf Life

Specifications for perishable materials shall include provisions for storage control, shelf life and retest requirements of properties to assure only acceptable material is used.

5.3 Corrosion Protection

5.3.1 Dissimilar Metals

Selection and finishing of dissimilar metallic surfaces to be placed in contact shall meet the requirements (e.g. MIL-STD-889) .

5.3.2 Finishes

All materials which are not inherently corrosion resistant shall be finished with a protective non-toxic treatment or coating.

5.3.3 Fasteners

All fasteners shall be per an aircraft industry specification. Corrosion protection due to contact of dissimilar metals shall apply to fasteners.

5.4. Sandwich Panel Stock

5.4.1 Sandwich panel stock shall be controlled by acceptable specifications.

5.4.2 Fasteners and inserts shall be potted or sealed to prevent entry of moisture.

5.4.3 Process specifications shall be supplied for review as part of the NTS presentation.

5.5 Castings

Castings used in load carrying structure shall meet the requirements of e.g. MIL-STD-2175.

5.6 Toxicity

Galley insert construction materials shall be non-toxic.

6 Processes

All manufacturing processes essential to the integrity and reproducibility of the galley insert shall be controlled by acceptable specifications.

7 Maintainability

7.1 Interchangeability

Assemblies bearing the same part number shall be functionally, structurally and physically interchangeable. Any modification to a part affecting its interchangeability shall require a new part number.

7.2 Orientation

Galley inserts shall meet all requirements of this STR in all installable orientations, i.e. facing forward, aft, right or left within the airplane.

8 Structural

Galley inserts shall meet all structural requirements independent of the galley structure, unless intended to be completely enclosed by galley structure during taxi, takeoff, turbulence and landing.

8.1 Design Load Factors

Galley inserts shall withstand the following ultimate load factors:

Forward	9.0 g
Aft	9.0 g
Right	9.0 g
Left	9.0 g
Up	3.0 g
Down	6.0 g

For Special use (e.g. Helicopters) the actual applicable ultimate load factors must be used.

8.2 Fitting Factors

All local attachment fittings shall withstand design loads multiplied by a factor of 1.33.

8.3 Allowable Deformation

Galley insert deformation under the loading conditions of the previous paragraph, as long as the restraint of an item is not compromised and no portion of the insert or insert contents become loose objects.

8.4 Abuse Loads

All galley inserts and their components, e.g. doors, drawers, panel edges and other projections that are easily accessible to passengers or crew shall be capable of withstanding the random direction abuse loads given below, applied at appropriate points as anticipated in service. Pullout tables and drawers shall be in their fully extended position and the load applied at their geometric center.

Pushing		136 kg (300 lbs.)
Pulling	two hands	136 kg (300 lbs.)
	one hand	68 kg (150 lbs.)
Up		68 kg (150 lbs.)
Down		136 kg (300 lbs.)

Load application dimensions of 101 by 101 mm (4" by 4") shall be used for application of all of the loads.

8.5 Retaining Devices

All galley insert doors and drawers shall have independent primary and secondary restraint means. These means may include design to incorporate restraint from the galley structure. Restraints shall satisfy the structural design load and fitting factors under maximum capacity weight of the galley insert.

Inserts that mounts onto rail assemblies shall be securely attached to the rail.

8.6 Loose Objects

Any loose or moveable galley insert item which can, by its motion, cause injury or impede emergency evacuation from the airplane shall have retaining devices.

All loose parts of an insert shall be restrained or be placarded to be stowed during taxi, takeoff, turbulence and landing.

8.7 Interference

No retaining device shall be capable of interfering with another retaining device nor any other surface other than that which it is intended to retain. Turn buttons and other latches shall be designed to fail to the CLOSED position.

8.8 Castings

Castings shall have a minimum casting factor of 1.5, unless a lower casting factor can be justified. Fitting factors shall be applied in addition to the casting factor.

9 Pressure Vessels

9.1 Pressure Relief

All pressure vessels and pressurized systems shall incorporate a pressure relief valve. Secondary pressure relief shall be incorporated according to the following paragraphs:

9.1.1 Closed Systems

Galley inserts that are isolated from the airplane water system through the use of check valves or similar devices are called "closed systems". These systems shall incorporate a secondary means of pressure relief that is not resetting and is functionally different from the primary relief device.

Closed system designs shall undergo an ultimate pressure test to determine that a hazardous condition is not achievable.

9.1.2 Open Systems

Galley inserts that are not isolated from the airplane water system are called "open systems". These pressurized systems do not require secondary pressure relief, but they must be protected from failure of the airplane water systems.

9.2 Proof, burst and Ultimate Pressure Testing

Testing of both open and closed insert water systems is required as follows: Maximum normal operating pressure is defined as the maximum airplane water system pressure or relief valve setting for an insert with an open system or the pressure relief valve setting for an insert with a closed system.

9.2.1 Proof Pressure Tests

Proof pressure tests shall be accomplished as part of the functional testing of the insert, that is, each assembled system manufactured by the insert supplier shall contain, without damage to the unit, pressure equal to 1.5 times the maximum normal operating pressure and held for 5 minutes (as a minimum 8.79 bar / 125 psig).

9.2.2 Burst Pressure Tests

Burst pressure tests shall be accomplished as part of the qualification testing of the insert, that is, the design shall contain pressure equal to 3.0 times of the assembled components (as a minimum 13.22 bar / 188 psig or 3 times Pressure Relief Valve Pressure). Damage is acceptable as long as there is no leakage from the pressurized components.

9.2.3 Ultimate Pressure Tests

Ultimate pressure tests shall be accomplished as part of the qualification testing of the insert when the insert water system is closed as defined by Para. 4.6.6.1 above, that is, the design shall be tested to failure. Damage is acceptable as long as the failure mode is not hazardous to the airplane and its occupants, and can be determined to be repeatable by analysis or subsequent burst tests.

10 Electrical

10.1 Electromagnetic Interference

Galley insert electrical and electronic equipment shall not generate electromagnetic interference that can adversely affect the performance of other equipment on the airplane. Similarly, the galley equipment and inserts shall not be susceptible to EMI from other airplane systems.

Galley inserts shall meet the electromagnetic interference requirements of RTCA DO-160D.

10.2 Control

Galley inserts shall have the following control features or provisions to take these control signals to the galley control panel:

10.2.1 An indicator light which shall illuminate when the equipment is switched on and/or operating (except Plate-, Bun-warmer etc.). When equipment requires both AC and DC power to operate, indication lights shall not illuminate unless both AC and DC are present.

10.2.2 A safety warning indication light , if used , shall be of a different color than the power indicator light. The safety warning indicator light shall be colored amber or red.

10.2.3 Control switches to allow on-off control of all electrical equipment. Circuit breakers shall not be used as control switches.

10.3 Grounding and Bonding

Insert bonding path is defined as the conductive path from any relevant conductive point on a galley insert or its electrical control module to the galley insert designated static ground interface point.

10.3.1 Bonding Resistance

Bonding path resistance shall not exceed 0.005 Ohm.

10.3.2 Bonding Types

Bonding of electrical insert equipment to the galley structure may be accomplished through facing surface bonds, bonding jumpers or by wiring through the insert electrical connector. Slide-in equipment connections for grounding (such as grounding rub strips, rails, etc.) shall be resistant to contamination.

10.3.3 Process Specifications

All bonding procedures shall be controlled by acceptable process specifications.

10.3.4. Insert Doors

Insert doors (such as those on ovens) shall meet all grounding requirements or be electrically isolated from the insert body.

10.4 Wiring

10.4.1 Minimum Size

Minimum wiring size shall be 22 AWG for all applications (except wires for Electronic circuits).

10.4.2 Wire Types

Wire shall be selected according to its intended application and environment:

<u>APPLICATION</u>	<u>MILITARY SPEC</u>	<u>TEMP LIMIT</u>
General Purpose	MIL-W-22759/34	150°C (300°F)
	or	
High Temperature	MIL-W-81381/21	
	or	
	MIL-W-22759/8	260°C (500°F)
	or	
	MIL-W-22759/3	

General purpose is defined as all applications where the ambient temperature does not exceed 54.4°C (130°F) and the operating potential does not exceed 600 V rms.

High voltage is defined as all applications where the operating potential exceeds 600 V rms, but does not exceed 1000 V rms.

High temperature is defined as all applications where the ambient temperature exceeds 54.4°C (130°F) and no combination of ambient temperature and load current will cause the wire temperature to exceed 260.0°C (500°F).

10.5 Installation and Identification

10.5.1 Wire Identification

Wires shall be installed and identified per MIL-W-5088 or color identification shall be per EIA RS-359 standard colors.

10.5.2 Penetrations

Holes for wires or other parts which may be susceptible to wear shall have protective grommets.

10.5.3 Terminations

Installation of wiring and terminations (including splices) shall be controlled by acceptable specifications.

10.5.4 Water Protection

Wiring shall be located at least 76.2 mm / 3 inches (typical) or 12.5 mm / 1/2 inches when suitable fixed away from water tubing, above water tubing and unattached to water tubing directly or by bracket or other means; where this is unavoidable water proof sleeving and sealing of terminals shall be accomplished.

Where there is a possibility of water, liquid or condensation traveling down the wire bundles to electrical connectors or terminations, drip loops shall be provided with the loop low point three bundle diameters below the connection, such that the moisture will not drain into the connector or terminal.

10.5.5 Connectors

Connectors for general purpose wiring shall conform to MS 24264 and MS 24266 per MIL-C-26500.

Connectors per MIL-C-5015 may be used within the following voltage limitations:

<u>MS Service Rating</u>	<u>Max. Allowable Voltage</u>
Instrument or better	28 volt
A or Better	28 volt or single phase 115 V AC
D or Better	Multi-Phase 115/200 V AC

Service Connectors for beverage containers etc. shall be made of corrosion resistant materials. Phenolic materials shall not be used.

Only one wire connection shall be made to each connector contact. All unused cavities of environmental connectors shall be sealed.

Multiple connectors within the insert shall prevent inadvertently cross mating. No identical connectors shall be used external of the insert.

10.6. Motor Requirements

10.6.1 Thermal Protection

Thermal protection shall be integrated into motors to prevent a motor, under either normal operation or failure conditions, from becoming a potential ignition source or emitting toxic fumes or smoke. Motor outer surface temperatures shall not exceed 204.4°C (400°F). Failure of the manual or automatic reset protective device shall not remove the requirement for thermal protection of the motor. Thermal protection of the motor may be maintained by installation of a thermal fuse set to open at 204.4°C (400°F) max in line with motor winding leads inside the motor housing.

The thermal protector or thermal protection system shall be designed and rated to provide a minimum of 5,000 interruptions of the maximum current or 25 hours of intermittent or continuous locked rotor protection at rated voltage and frequency as required by MIL-M-79696.

Motors without overheat protection must show that the above requirements can be met in a locked rotor condition.

10.6.2 Motor Speed

Motor housings shall contain all fragments that would result from failure of the rotors.

10.6.3 Motor Power Factor

The steady state full load power factor per single phase shall not be less than 0.75 for motors of 1.47 KW (2 horsepower) or greater and 0.4 minimum for less than 1.47 KW (2 horsepower) motors.

10.7 Power

Galley inserts power quality is defined by RTCA DO-160D. Galley inserts shall meet all power input and voltage spike requirements of RTCA DO-160D.

Primary AC power is 115/200 V, 400 Hz, 3-phase, 4-wire (grounded neutral) Y-connected system. DC power is 28 volt (nominal), two wire supply, negative side grounded to airplane structure via the galley interface connector.

10.8 Safety

All control circuitry shall be designed to revert to a safe condition in the event of a failure of any component.

Equipment operating above 1.25 volts AC and 5 volts DC in hazardous areas where there is potential exposure to large quantities of water or 10 volts AC and 30 volts DC for all other wet areas, require a single case ground unless they are completely contained in non-conductive housings.

The potential between electrical equipment and ground shall be limited to 30 Volts AC or DC in general (dry) areas. Metallic water and drain tubing shall be suitably grounded to the insert structure through metallic clamps, brackets or by bonding jumpers.

10.9 Insulation Materials

Electrical system components shall meet the fire worthiness requirements of JAR Part 25 Appendix F Part I as required by JAR 25.869.

For areas exposed to moisture or other conductive contaminants, sealing or other approved protective design features shall be provided.

Insulating materials shall not react to form corrosive products when subjected to galley operational environments nor emit toxic fumes when subjected to an ignition source hot enough to cause combustion or reaction.

10.10 Dielectric High Potential

Leakage current between any mutually insulated parts shall not exceed 2.0 milli Amperes when a high potential voltage of 1500 volts at 50 or 60 Hz is applied at a uniform rate of 250 - 500 volts per second and maintained for one minute. High voltage sensitive components may be disconnected.

10.11 Insulation Resistance after High Potential

The resistance of all mutually insulated parts after application of the dielectric high potential shall not be less than 200 meg Ohms at 500 V DC.

11 Equipment Ventilation

All equipment which depends on cooling air supply for its operation shall be self-protecting in the event of failure of the air supply.

12 Temperature

Galley insert equipment, when installed, shall be designed to prevent operating temperatures of all external surfaces not exposed to flight and cabin crew from exceeding 71°C (160°F).

External temperature requirements

Material of Exposed Surface	Maximum Allowable Temperature
Bare or Painted Metal	55°C (131°F)
Porcelain/Enamel	71.1°C (160°F)
Glass/Ceramic	65°C (149°F)
Plastic (includes Plastic with metal) Plating or vinyl covering not less than 0.127 mm (0.005 inch) thick	71.1°C (160°F)

13 Fire Protection

13.1 Fire Protection Procedures:

13.2 Smoke Generation

Material shall meet the requirements of JAR Part 25.853 Appendix F Part V as required.

Toxicity : (additional Requirement)

Material toxicity emission shall meet the applicable requirements

13.3 Heat Release

Material shall meet the requirements of JAR Part 25.853 Appendix F Part IV as required.

13.4 Fire Worthiness

Materials shall be self-extinguishing per JAR Part 25.853 Appendix F Part I as required.

13.5 Exceptions

Materials of small parts which would not contribute significantly to fire propagation or smoke and toxic gas generation may be granted exemption to these requirements if no alternate material is suitable to the application.

13.6 Fire Containment (if applicable)

Galley inserts intended for use as disposal receptacles for trash shall be fully enclosed and have means of containing fires per JAR 25.853 (f).

Fire containment test guidelines are provided in the FAA Aircraft Material Fire Test Handbook.

Special attention must be given to probable conditions of wear, ventilation effects and misalignment expected in service and to maintainability, to ensure that the fire containment capability will not deteriorate during normal use.

14 Placards

Marking as detailed in JAR21 Subpart O.

14.1 General

Operational and warning placards shall be readable from the face of the galley insert or with the insert in the applicable functional position.

14.2 Specific

Placards shall be installed by the insert supplier in accordance with the following requirements:

Items that require special stowage instructions shall be placarded on inserts as required:

Example: "BREW HANDLE MUST BE DOWN FOR TAXI, TAKEOFF, TURBULENT WEATHER AND LANDING" or equivalent, required to restrain coffee pot or brew cup.

14.3 Language

All placards shall be worded in mandatory, i.e. "command" English language or bilingual English and foreign language. Weights shall be in English (LBS) and / or metric (KG) units.

14.4 Location, Lettering and Style

The location, part number, size and wording of all placards shall be identified on the placard installation and / or detail drawing.

14.5 Attachment

All placards shall be fastened with rivets or bonded permanently to the galley insert surface. Riveted placards shall have their edges sealed except when the placard is self adhering. Hollow "blind" rivet heads shall be filled.

15 EQUIPMENT SPECIFIC REQUIREMENTS

This section defines requirements that apply only to specific galley insert types. These requirements, along with the general design requirements define the complete set of requirements for a given insert type.

Specific requirements of this section supersede general design requirements where a conflict exists.

Detailed requirements for specific equipment types see ANNEX A and ANNEX B.

16 Restraint

All insert doors shall require a primary and secondary restraint device capable of restraining the capacity weight of the insert.

Restraint devices are defined as any device such as a latch, stop, or other mechanical device used to retain or restrain items such as doors, drawers, modules, functional equipment items and any other movable or removable item or component.

Dual retaining devices shall be provided to position and retain each loose or movable insert item which can, by its motion, cause injury or which can impede emergency evacuation from the airplane. Inserts without dual retention device may rely on an external restraint device mounted on the galley or removed and stored separately.

No retaining device shall be capable of interfering with another retaining device nor any other surface other than that for which it is intended to retain. Turn buttons and other latches shall be designed to fail to the CLOSED position, that is, the position of the latch that ensures items are secured.

Special attention shall be made to address all loose parts of an insert (such as brew cup, coffee pots) to ensure that all of these items are adequately restrained.

Items that require special stowage instructions shall be placarded adjacent to, or on, inserts as required .

17 QUALITY ASSURANCE PROVISIONS

The manufacturer shall perform, or cause to be performed, the qualification tests required by Appendix 1 for a given type of galley insert. Any of these required tests that have been performed on similar units may be omitted, provided the manufacturer submits proof of qualification by similarity.

If reworking of the galley insert is required to complete any of the tests required by this STR, the manufacturer shall repeat all tests or certify that the rework does not affect prior test results. Specific tests are not called out in this STR to cover every galley insert requirement nor are functional test procedures defined. This omission does not release the manufacturer from the responsibility of furnishing a galley insert that meets all the requirements of this STR.

17.1 Electromagnetic Compatibility

Electromagnetic Compatibility shall be tested per RTCA DO-160D for audio frequency conducted susceptibility – power inputs, induced signal susceptibility, radio frequency susceptibility and emission of radio frequency energy.

17.2 Environment

Temperature, humidity and pressure requirements shall be tested in addition per MIL-STD-810.

17.3 Vibration

Vibration requirements shall be tested per RTCA DO-160D .

Annex A

Equipment Specific Requirements for Ovens / Bun and Plate Warmers

1. Self Cleaning Oven - Surface Temperature

The temperature of external surfaces of ovens with a self-cleaning cycle shall not exceed 82°C (180°F) during the self-cleaning cycle. Self cleaning cycle operation shall be limited to ground use only.

2. Overheat Temperature

An overheat device, separate from the control thermostat, shall be incorporated to limit the temperatures achieved due to any failure. A failure in any other component in the oven shall not affect the operation of the overheat device. The overheat device shall be wired in series with the power source and the heating elements.

3. Fan Motor

The fan motor overheat control shall remove power from the heating elements during a motor overheat condition.

Annex B

Equipment Specific Requirements for Water Boiler / Coffee Maker / Steam-Ovens / Beverage Makers / Rice Cookers etc.

1. Pressure Relief

The pressure relief valve shall be installed in a manner that will not allow isolation of the valve due to operation of other valves or improper plumbing installation. Water and / or steam from the pressure relief valve discharge tube shall vent at a location which is not exposed to personnel or electrical connections. Attention shall be given to valve materials with regard to corrosion. Valve design shall account for the accumulation of scale.

2. Overheat Control of Inserts

An overheat device shall be incorporated to limit the temperature achieved due to any failure. A failure in any other component in the inserts shall not affect the operation of the overheat device. The overheat device shall be in series with the power source and the heating elements.

3. Personnel Safety

The design of the inserts shall not allow the operator to open the vessel when pressurized.

4. Drain Provisions

Water shall drain by gravity from all parts of the plumbing system. All inserts with integral sumps shall contain and or drain all drainage at flight attitudes of 3° nose up to 2° nose down.

5. Sanitation

The drain system shall not come in direct contact with the potable water (supply) system. There shall be a minimum 25.4 mm (1.0 inch) vertical gap between relief valve openings or water supply faucets and the drain.

6. Materials

Materials shall be resistant to corrosive action of super-chlorinated water, detergents and solvents. Materials shall be non-absorbent and not retain residue from cleaning or disinfecting agents.

Appendix 1: Qualification Testing Requirements

	Oven Convection	Oven Steam	Coffee Maker, Water Boilers and Similar	Bun-and Plate-Warmer
Fire Properties	Qualification	Qualification	Qualification	Qualification
Electromagnetic Compliance.	Qualification	Qualification	Qualification	Qualification
Environment	Qualification	Qualification	Qualification	N/A
Structural	Qualification	Qualification	Qualification	Qualification
Electrical System	Functional	Functional	Functional	Functional
Electrical Ground & Bonding	Functional	Functional	Functional	Functional
Plumbing	N/A	Functional	Functional	N/A
Temperature	Functional	Functional	Functional	Functional
Proof Pressure	N/A	Functional	Functional	N/A
Burst Pressure	N/A	Functional	Functional	N/A
Mechanical Operation	Functional	Functional	Functional	Functional