SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS8057

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Minimum Design and Performance of Airplane Galley Insert Equipment, Electrical/Pressurized

RATIONALE

Galley Insert Equipment (GAIN) is electrical equipment, used in conjunction with aircraft food service. GAIN (e.g., beverage maker, oven) is not an integral part of the galley and is removable from the galley without tools or with the use of simple tools. The design and operation of GAIN has a significant impact on cabin service, cabin safety and workload of the crew members. Most types of GAIN have significant electrical power consumption, are connected to the aircraft potable water system, and are controlled by electronic devices. This AS specifies criteria to assure safe GAIN design and function.

FOREWORD

This SAE Aerospace Standard (AS) and the SAE AS8056 “Minimum Design and Performance of Airplane Galley In-Flight Carts, Containers, and Associated Components” establish minimum design and performance requirements for galley insert equipment. The content of both standards is harmonized.

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TABLE OF CONTENTS

1. SCOPE

1.1 General

This SAE Aerospace Standard (AS) establishes minimum design and performance requirements for galley insert equipment with an electrical and/or pressure system, as well as associated components intended for installation in galleys and other areas (e.g., bars) of transport category airplanes.

1.2 Purpose

1.2.1 This standard applies to the following equipment intended for installation in galleys and other areas (e.g., bars) within transport category airplanes, such as but not limited to the following:

a. Ovens (e.g., convection, steam, induction, microwave, bun warmer, plate warmer)

b. Beverage makers (e.g., coffee makers, coffee warmers, water heaters, espresso makers)

c. Beverage cups and jugs (so-called hot cups and jugs)

d. Self contained refrigeration equipment (e.g., refrigerators, freezers, wine chillers, water coolers, air chillers)

e. Trash compactors

f. Rail assemblies

g. Associated components, such as oven racks and trays, beverage servers

1.2.2 This standard does not:

a. Address equipment covered in AS8056 “Minimum Design and Performance of Airplane Galley In-Flight Carts, Containers, and Associated Components”.

b. Fully address design details that provide extended service life and continued airworthiness, since these are a function of: (1) total galley and food/beverage system design, (2) human factors engineering desired by individual operators, (3) techniques of care in servicing, and (4) maintenance philosophy. However, references to these considerations are included as appropriate.

c. Fully address requirements that are covered by national aviation regulations, pertinent U.S. Public Health regulations and/or design details, which should be covered by galley operator/airplane manufacturer specifications for the subject equipment.

d. Fully address requirements for equipment utilizing hydraulic systems (e.g., Trash compactors).

1.2.3 When the term “equipment” is used in this standard, it refers to all of the items identified in the Purpose (1.2) unless specifically identified otherwise.

1.3 Mandating and Recommendation Phrases

a. “Shall”

The word “shall” indicates a mandatory criterion.

b. “Should”

The word “should” indicates a criterion for which an alternative, including non-compliance, may be applied if it is documented and justified.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS-STD-401 Sandwich Constructions and Core Materials; General Test Methods

AMS2175 Castings, Classification and Inspection of

ARP4761 Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment

AS8056 Minimum Design and Performance of Airplane Galley In-Flight Carts, Containers, and Associated Components

AS39029 Contacts, Electrical Connector, General Specification For

AS50881 Wiring Aerospace Vehicle

CAESAR 3-D Anthropometric Database

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM C 273 Standard Test Methods for Shear Properties of Sandwich Core Materials

ASTM C 393 Standard Test Method for Flexural Properties of Sandwich Construction

ASTM D 1781 Standard Test Method for Climbing Drum Peel for Adhesives

2.1.3 Code of Federal Regulations (CFR) and other FAA Publications

Available from US Government Printing Office, Superintendent of Documents, Mail Stop SSOP, Washington, DC 20402-9325.

AC 25-17 Transport Airplane Cabin Interiors Crashworthiness Handbook

AC 25.856-1 Thermal/Acoustic Insulation Flame Propagation Test Method

14 CFR Part 1 Definitions and Abbreviations

14 CFR Part 25 Airworthiness Standards: Transport Category Airplanes

21 CFR Part 1240 Control of Communicable Diseases

21 CFR Part 1250 Interstate Conveyance Sanitation

HF-STD-001 The Human Factors Design Standard

2.1.4 U.S. Government Publications

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, http://assist.daps.dla.mil/quicksearch/.

MIL-STD-889 Dissimilar Metals

2.1.5 U.S. Food and Drug Administration (FDA) Publication

Available at http://www.fda.gov/ora/inspect_ref/igs/icsfatt.html .

Attachment 3 to Guide to Inspections of Interstate Carriers and Support Facilities

2.1.6 National Sanitation Foundation (NSF) Publications

Available from NSF International, P.O. Box 130140, 789 N. Dixboro Road, Ann Arbor, MI 48113-0140, Tel: 734-769-8010, Toll Free (USA): 800-NSF-MARK, www.nsf.org.

NSF/ANSI 51 Food Equipment Materials

2.1.7 American Welding Society (AWS) Publications

Available from American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, Tel: 1-800-443-9353, www.aws.org.

AWS D17.1 Specification for Fusion Welding for Aerospace Applications

2.1.8 National Aeronautics and Space Administration (NASA) Publications

Available from Man-Systems Integration Standard Office, NASA Johnson Space Center, Mail Code SF3, 2101 NASA Road One, Houston, TX 77058-3591, http://msis.jsc.nasa.gov/.

NASA-STD-3000 Man-Systems Integration Standards

2.1.9 RTCA Publications

Available from Radio Technical Commission for Aeronautics Inc., 1828 L Street, NW, Suite 805, Washington, DC 20036-5133, Tel: 202-833-9339, www.rtca.org.

RTCA DO-160 Environmental Conditions and Test Procedures for Airborne Equipment

RTCA DO-178 Software Considerations in Airborne Systems and Equipment Certification

RTCA DO-248 Final Report for Clarification of DO-178B “Software Considerations in Airborne Systems and Equipment Certification”

RTCA DO-254 Design Assurance Guidance for Airborne Electronic Hardware

2.1.10 ISO Publications

Available from International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, www.iso.org.

ISO 3744 Acoustics-Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane

ISO 3745 Acoustics-Determination of sound power levels of noise sources using sound pressure – Precision methods for anechoic and hemi-anechoic rooms

2.2 Definitions

ACCEPTANCE TEST: A test conducted to verify that the operational and safety performance of each production unit conforms to its design and published technical data.

ANALYSIS: Verification by technical/mathematical evaluation using mathematical representations (i.e., models, simulation, and algorithms), charts, graphs, drawings and representative test data. An example means of analysis could be a bit comparison of the actual outputs of the equipment to be qualified with the expected outputs, given a specific set of inputs.

ASSOCIATED COMPONENTS: Defined as both of the following:

1. Items, such as oven racks and trays, as well as beverage servers, that are stowed in or connected with galley insert equipment, but are not part of the equipment part number.

2. Items that need to meet 14 CFR 25 requirements to be included as part of an airplane type design.

BEVERAGE CUP: Cup placed at the galley worktop, and with an electrical connector to a galley receptacle, designed to heat water (similar to household electric kettle).

BEVERAGE JUG: Container with integrated heating element, and with an electrical connector to a galley receptacle, designed to hold hot beverages.

CLOSED SYSTEM: (a) Galley insert equipment for which check valves or similar devices isolate the equipment potable water plumbing from the airplane potable water system or the ambient environment. (b) Self contained refrigeration equipment with a vapor cycle.

CONFIGURATION: Relative arrangement of parts. The figure, contour, and pattern produced by a spatial arrangement of parts, assemblies, or structures.

CONSTANT FREQUENCY (CF): Designates AC equipment intended for use on airplane electrical systems where the primary power is from a constant frequency (400 Hz) AC system.

DETRIMENTAL PERMANENT DEFORMATION: Deformation that could or would allow equipment or its contents to become unrestrained from the stowage compartment, protrude into exit paths, hinder evacuation, and/or prevent equipment stowage.

FAILURE: An event or condition, occurring within an equipment item or system, that prevents the equipment from performing its intended function or endangers passengers and/or crewmembers.

FAIL-SAFE: Provisions that maintain safety even when a failure occurs.

GALLEY INSERT: A mechanical component, used in conjunction with airplane food service, that is not an integral part of the galley and is removable from the galley without tools or with the use of simple tools (e.g., trolleys, standard unit, drawer).

GALLEY INSERT EQUIPMENT (GAIN): Electrical equipment, used in conjunction with airplane food service, which is not an integral part of the galley and is removable from the galley without tools or with the use of simple tools (e.g., beverage maker, oven).

GALLEY INSTALLATION: An equipment/subsystem, used in conjunction with airplane food service, that is integral to the galley (e.g., Galley Potable Water System, Galley Waste Water System).

INDUSTRY SPECIFICATION: A specification that is accepted aerospace- industry wide (e.g., SAE (AS, ARP, and AMS), military (MIL and MS), and National Aerospace Standard (NAS)).

INTENDED FUNCTION: The activity equipment normally executes or provides.

INTERCHANGEABILITY: That quality which allows an assembly or part to substitute or be substituted for another and to meet all physical, functional, and structural requirements of the original. No alterations except designed adjustments are allowed to install the item.

INTERFACE: The fit and functional relationships of equipment with the galley or with other airplane structure.

INTERFACE CONTROL DOCUMENT: A document created for the purpose of communicating interface information.

JOINT: The line of meeting of two or more pieces or parts of equipment.

LATCH: A retaining device (e.g., hand-operated quarter turn or a spring-actuated latch for a door) that secures an item(s) during structural loading.

LOOSE COMPONENTS: Items, such as brew cups, beverage servers or other components not attached to equipment, which are stowed in the equipment and are part of the equipment part number.

LOOSE EQUIPMENT: Galley Insert Equipment that is moveable and stowed in galley compartments when not in use (e.g., toaster, skillet).

MAXIMUM DUTY CYCLE: When operation of equipment is periodic, the maximum length of time for which the equipment is designed to operate at its rated capacity.

MAXIMUM NORMAL OPERATING PRESSURE (MNOP): The maximum attainable pressure of the equipment's pressure system when all the equipment's components are functioning normally. For wet equipment connected and open to the airplane potable water system, the maximum airplane water system pressure determines the MNOP.

OPEN SYSTEM: Galley insert equipment for which the equipment potable water plumbing is not isolated from the airplane potable water system or the ambient environment by any device (e.g., check valves or similar devices).

OPTION: A function capable of being included as part of equipment. It shall be fully developed and able to be incorporated without adverse effects.

PERIODIC TESTING: Testing conducted on each batch of material or product used to determine conformance to the process specification. Note: When consistent conformance has been demonstrated, reduced testing may be implemented in accordance with a quality assurance sampling plan.

POTABLE WATER: Water meeting the requirements of the U.S. Environmental Protection Agency Drinking Water Regulations or the U.S. Food and Drug Administration Bottled Water Regulations and filled into the water storage system of an airplane by an external source, i.e., service truck or filling port at the passenger bridge.

PRESSURE VESSEL: Equipment connected to the pressurized water system of the airplane or that generates pressures by heating elements or mechanical pumping. In general, water heater and beverage maker tanks, as well as refrigeration compressors, are pressure vessels.

PROCESS SPECIFICATION: A specification used by the equipment manufacturer that controls manufacturing processes (such as bonding or welding) or materials (such as sandwich panels) that are dependant on preparation, application, and procedure. These specifications ensure repeatability of the process or material for which it is written.

RAIL ASSEMBLY: A device provided for beverage makers, water heaters and air chillers, that simplifies interfaces between the equipment and the galley and facilitates easy installation and removal.

RESIDUAL WATER: Residual amount of water, after draining the equipment by gravity, under the worst case conditions defined in 3.6.4.

RETAINING DEVICES: A device such as a latch, stop, detent, guide, or other mechanical configuration used to retain items, such as doors, drawers, carts, modules, containers, equipment items, or other movable galley components.

SMOOTH SURFACE: Free of pits, pinholes, cracks, crevices, inclusions, rough edges and other surface imperfections detectable by visual and tactile inspection.

STOWED: Placed and retained in a stowage location, usually associated with taxi, takeoff, landing and turbulence.

THERMAL FUSE: A thermal protector that interrupts power when an overheat condition is met, that cannot be reset, and that must be replaced by maintenance personnel action.

UNIT UNDER TEST (UUT): An equipment article, identical to a production unit, used for tests, or an equipment article that is a modified production unit, provided the modifications do not affect the test results.

WASTE BIN LINER: A disposable item, installed in a waste cart, a trash compactor, or galley waste compartment, intended to assist in the easy removal of collected waste.

WIDE VARIABLE FREQENCY (WF): Designates AC equipment intended for use on airplane electrical systems where the primary power is from wide variable frequency (360 to 800 Hz) AC system.

NOTE: Additional definitions are given in reference 2.1.5.

3. REQUIREMENTS

3.1 Introduction

Table 1 identifies applicable requirements for existing galley insert equipment designs. New designs may have additional requirements. To use the table, find the equipment in question along the top row, and then read down that column; the row in which a bullet appears indicates requirements that shall be addressed. A bullet in brackets indicates that the requirements are applicable for only a part of the equipment in question.

TABLE 1 - APPLICABLE REQUIREMENTS

AS Sect.	Requirement	Ovens	Beverage Makers	Beverage Cups/Jugs	Refrigeration Equipment	Trash Compactors	Rail Assemblies	Associated components
3.2	General	•	•	•	•	•	•	•
3.3	Structural	•	•	•	•	•	•	•
3.4	Electrical	•	•	•	•	•	•	
3.5	Thermal Protection/Overheat	•	•	•	•	•		
3.6	Wet Equipment Design Requirement	(•)[1]	•	•			•	
3.6.1	General	(•)[1]	•	•			•	
3.6.2	Wet Equipment Connected with the Airplane Potable Water System	(•)[1]	•				•	
3.6.3	Low Water Sensing	(•)[1]	•					
3.6.4	Self Venting/Self Draining	(•)[1]	•					
3.6.5	Pressure Vessels		•		•			
3.6.6	Pressure Limits	(•)[1]	•		•		•	
3.6.7	Water Taps/Faucets		•	(•)[2]				
3.7	Equipment Ventilation/Exhaust Air	•	•	•	•	•		
3.8	Maximum Temperature Design Requirements	•	•	•	•	•		
3.9	Fire Properties of Materials	•	•	•	•	•	•	•
3.10	Fire Containment					•		
3.11	Placards	•	•	•	•	•	•	•
3.12	Acoustics	•	(•)[3]		•	•		
3.13	Ovens	•						
3.14	Interchangeability / Installation/Removal/Replacement	•	•	•	•	•	•	•
3.15	Software	•	•	•	•	•		
3.16	Electronic Hardware	•	•	•	•	•		
3.17	Environmental Design Requirements	•	•	•	•	•	•	•
3.18	Power Quality – Constant and Wide Frequency Equipment (AC)	•	•	•	•	•		
3.19	Safety Analysis	•	•	•	•	•	•	•

[1] Steam Ovens only
[2] Beverage Jugs only
[3] Beverage Maker with pumps and/or motors (e.g., espresso makers) only

3.2 General

3.2.1 Materials and Materials Control

Materials shall be proven by test to have strength and durability per 14 CFR 25.603 and 25.613.

3.2.1.1 Materials

Materials, including finishes or decorative surfaces applied to the materials, shall be tested periodically (see definition for PERIODIC TESTING) to assure compliance with 3.9.

3.2.1.2 Sandwich Panel

a. The mechanical properties of sandwich panels shall be controlled by process specification and the specification shall require periodic testing (see definition for PERIODIC TESTING) to assure conformance to the specification. At minimum, the specification shall contain requirements for the following, per AMS-STD-401 (or equivalent):

    1. Core Shear or Sandwich Shear (Reference ASTM C 273)

    2. Sandwich Flexure (Reference ASTM C 393)

    3. Sandwich Climbing Drum Peel (Reference ASTM D 1781)

b. Fasteners and inserts installed into or through the core shall be potted or sealed to prevent entry of moisture or water.

c. Aluminum honeycomb core shall be finished for corrosion resistance at the time of core fabrication.

3.2.1.3 Fasteners

Fasteners shall be in accordance with industry specifications.

3.2.1.4 Castings

Castings shall be Class 3 per AMS2175 or equivalent, and shall be clean, sound, and free from blowholes, porosity or surface defects. Imperfections may be removed if strength and serviceability are not impaired as a result.

3.2.1.5 Forgings/Extrusions

Forgings and extrusions shall be of uniform condition, free from blisters, fins, folds, seams, laps, cracks, segregation, and other defects. Imperfections may be removed if strength and serviceability are not impaired as a result.

3.2.1.6 Storage and Shelf Life

Perishable Materials (e.g., prepreg, finishes, sealants, resins, adhesives and potting compounds) shall be controlled by process specification, which shall define minimum strength properties, storage control, shelf life, and re-test requirements of properties to assure that only acceptable material is used.

3.2.1.7 Hazardous Materials

Asbestos or other materials known to be a health or safety hazard shall not be used. Sealants used in food contact areas shall meet the requirements of the National Sanitation Foundation (NSF) Standard 51 or equivalent. Cadmium (e.g., cadmium plated fasteners) shall not be used on or adjacent to compartments, containers, or drawers designed to store ice or unpacked food.

3.2.1.8 Environmental Protection

Components shall be protected against deterioration or loss of strength in service due to environmental causes. Selection and finishing of material (including fasteners), where dissimilar metals may be placed in contact, shall be per MIL-STD-889 or equivalent. Material not inherently corrosion resistant should be finished with a protective treatment or coating. Magnesium alloys shall not be used.

3.2.1.9 Finishes

Finishes (chemical treating, anodizing, powder coating, primer, etc.) shall be controlled by a process specification that includes, but is not limited to, the following:

a. Surface preparation of the area to be finished.

b. Control, preparation, and application of finish.

c. Curing parameters with applicable tolerances.

Finishes at the interface with the galley or stowage unit shall be identified on the Interface Control Document.

3.2.2 General Construction

The methods of fabrication shall produce a consistently sound structure, per 14 CFR 25.605 and 25.613. A fabrication process (e.g., adhesive bonding, spot welding, or heat treating) requiring close control to reach this objective shall be controlled by a process specification.

Per 14 CFR 25.609, each part of the structure shall be suitably protected against deterioration or loss of strength in service due to any cause, including weathering, corrosion, and/or abrasion, and have provisions for ventilation and drainage where necessary for protection.

3.2.2.1 Fastener Installation

Fastener installations shall be controlled by a process specification that includes, but is not limited to, the following:

a. Procedures to ensure thread length is sufficient to fully engage the nut, including any locking feature.

b. Procedures to apply torque.

3.2.2.2 Sealing

The application of sealant shall be controlled by a process specification that includes, but is not limited to, the following:

a. Surface preparation of the area to be sealed.

b. Control, preparation, and application of the sealant.

c. Curing parameters with applicable tolerances.

3.2.2.3 Potting

Process operations for potting used to install inserts or fabricate joints shall be controlled by a process specification. These processes shall include, but are not limited to, the following:

a. Surface preparation of the area to be potted.

b. Control, preparation, and application of the potting compound.

c. Curing parameters with applicable tolerances.

3.2.2.4 Bonding

Bonded joints shall not be loaded primarily in tension. The bonding processes shall be controlled by a process specification that establishes detailed requirements for the following:

a. Surface preparation of areas to be bonded.

b. Control, preparation, and application of adhesives and primers.

c. Maximum mismatch dimensions of parts during assembly, and minimum and maximum bond line thickness dimensions.

d. Curing parameters with applicable tolerances.

3.2.2.5 Welding

Welding shall comply with AWS D17.1 or equivalent.

3.2.3 Construction for Waste Enclosures (e.g., Trash Compactor)

Carts and containers that may be used as waste enclosures shall be fully enclosed (see AS8056, 3.3.6) and constructed of fire resistant materials (see 14 CFR 1.1) capable of containing fire (see 3.10) under the conditions expected to result in service.

3.2.3.1 Wear and Tear

The design of hinges, latches and other moving parts (e.g., springs) shall preclude degradation of fire containment capability due to service wear and tear. Multiple latches shall be used on doors for which fire-induced warp or wear effects may degrade the fire containment capability. These latches may be the same latches used to comply with AS8056, 3.3.6. Hinges shall be durable and provide minimum air gap. Springs, such as those used on waste flaps, necessary to assure fire containment compliance shall have a fatigue life of 300 000 cycles or greater.

3.2.3.2 Unacceptable Features

Features proven by experience to be unreliable shall not be used.

Examples include, but are not be limited to:

- Tape
- Hook and loop type fastening
- Snaps or other attachment means that are easily fouled by waste
- Bonded catch plates
- Hollow core (pop) rivets
- Seals bonded to structure without mechanical attachment or capture
- Seals exposed to tear-out from repetitive insertion/removal of waste
- Plates, doors and panels that exhibit “oil-canning” behavior due to insufficient stiffness

3.2.4 Injury Hazard

Equipment shall not present an injury hazard, whether installed, uninstalled, or due to in-service wear and tear.

3.2.4.1 Edges, Corners, and Protrusions

Equipment shall be constructed without sharp corners, sharp edges, projections or other potential mechanical hazards to minimize injury potential to occupants or damage to the airplane cabin. Equipment design should comply with NASA-STD-3000, Volume I, Section 6.3.

3.2.4.2 Exposed Crushing Components

Trash Compactors shall operate in a manner that minimizes potential injury hazards. All moving components used for the purpose of extending a platen or otherwise crushing frangible trash shall be rendered automatically inoperative when exposed to any personnel and shall automatically remain inoperative until doors, bins, or trash deposit openings are securely closed. Crushing components shall remain inaccessible during operation. Safety switches or mechanical safety devices shall be installed in locations only accessible to maintenance personnel.

3.2.5 Interface Clearances

Interface clearances between equipment and the surrounding galley or structure required for ventilation, heat dissipation, installation, loading, etc. shall be clearly defined on the equipment Interface Control Document and shall account for the equipment and airplane tolerances.

3.2.6 Sanitary Construction

Equipment shall comply with US Food and Drug Administration (FDA) requirements for sanitary construction (21 CFR 1240, 1250) and Attachment 3 “Guidelines for Sanitary Construction of Aircraft Galleys and Galley Equipment” to FDA document “Guide to Inspections of Interstate Carriers and Support Facilities” (Reference 2.1.5).

3.2.7 Identification

a. The following information shall be legibly and permanently marked on equipment:

    1. Manufacturer’s Part Number

    2. Manufacturer’s Serial Number

    3. Date of Manufacture

    4. Manufacturer’s Name and Address

b. For equipment that will be removed from the airplane for maintenance purposes only, the following information should be visible without removal of the equipment (e.g., second placard) to aid maintenance personnel:

    1. Manufacturer’s Part Number

    2. Manufacturer’s Serial Number

    3. Manufacturer’s Name and/or Trademark

c. All loose components shall be legibly and permanently marked with a part number.

3.2.8 Continued Airworthiness

Maintenance instructions that allow equipment to be kept airworthy shall be provided. The maintenance instructions shall account for the detrimental effects of wear and rough handling in typical operation.

3.3 Structural

3.3.1 General

a. Equipment shall be designed for the worst case loading for its intended application, as specified in 4.2.1.

b. Equipment shall meet all structural requirements independently of the galley structure.

3.3.2 Design Load Factors

a. The structure of equipment shall address the most severe load case in each direction and be verified according to 4.2.1.

b. The most severe loading conditions shall be determined by assuming installation of equipment around the z-axis of the airplane (see Figure 1).

c. Equipment and associated retaining devices shall comply with the emergency landing, flight, and ground loading cases defined by 14 CFR 25.301 – 25.307, 25.331 – 25.351, 25.471 – 25.519, 25.561(b), 25.787, and 25.789(a).

d. Failure shall not occur under ultimate load cases and no detrimental permanent deformation shall occur under limit load cases.

NOTE: Flight and ground load cases are typically specified in the airplane manufacturers' specifications.

3.3.3 Local Attachment Factor

A local attachment factor of 1.33 shall be applied in addition to the design load factors for attachments (such as door hinges, latches and retaining devices) likely to deteriorate in service before normal replacement.

3.3.4 Material Strength Properties and Material Variability

In accordance with 14 CFR 25.613, material strength properties shall be based on tests of material meeting industry specifications to establish design values on a statistical basis. Design values shall be chosen to minimize the probability of structural failure due to material variability. The applicable specifications are Metallic Materials Process Development and Standardization (MMPDS, formerly MIL Handbook-5) and MIL Handbook-7.

Analytical substantiation of material strength shall be based on material design values shown to be statistically reliable by repeated structural testing.

Strength substantiation shown by full scale testing shall impose an overload factor of 1.15 during testing to account for material variability in accordance with 14 CFR 25.619. An overload factor less than 1.15 may be used, provided a comparison of the variability of the material characteristics and fabrication processes, relative to that of conventionally fabricated aluminum, justifies this lower factor. There is no requirement to add the overload factor for material variability to other required factors, e.g., the 1.33 local attachment factor.

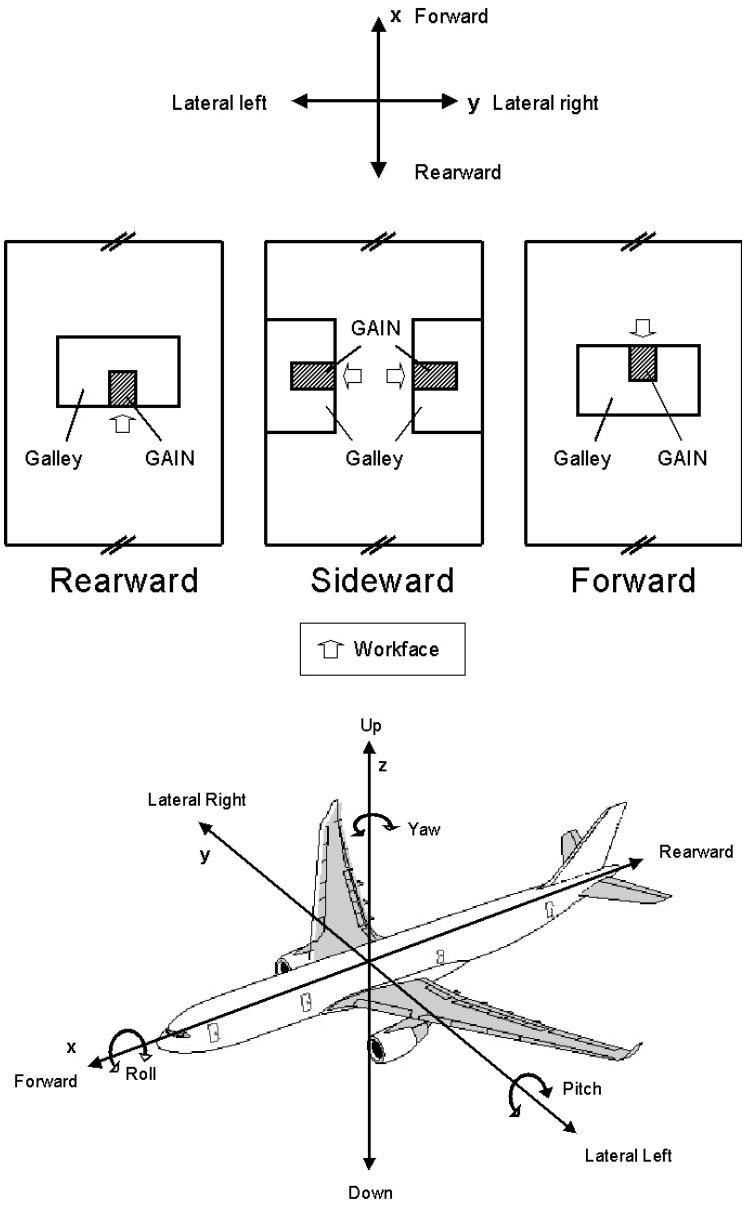


FIGURE 1 - TYPICAL GAIN DIRECTIONS RELATIVE TO AIRPLANE

3.3.5 Retention of Items of Mass

a. Equipment (except loose equipment) shall be designed to allow installation in a compartment without a door.

b. Equipment that mounts onto rail assemblies shall be permanently attached to the rail assembly (which requires a tool for removal) or have dual means of retention.

c. A moveable component (e.g., doors) of equipment, that can, by its motion, cause injury or impede emergency evacuation, shall be secured by dual retaining devices or equivalent.

d. A loose and/or associated component (e.g., beverage server, brew cup) of equipment that can, by its motion, cause injury shall be secured by dual retaining devices, or equivalent, or be placarded to require stowage during taxi, takeoff, turbulence, and landing.

e. Loose and/or associated components of equipment, required to be retained or stowed separately from the equipment during taxi, takeoff, turbulence, and landing, shall be shown and have their stowage requirements defined on the Interface Control Document.

f. Retaining devices for loose and/or associated components and movable components shall be integral to equipment.

g. No retaining device shall be capable of interfering with another retaining device, nor any component other than that which it is intended to retain.

h. Retaining devices shall have a visual indication of full positive engagement, which shall be self-evident by the device design or by integral indicators.

i. Forces generated by hard landings, turbulence, crash, flight loads, ground loads, vibration, or the weight of the retaining device, itself, shall not cause the retaining device to release.

j. Retaining devices should be simple to operate by a single motion.

k. Retaining devices should fail to the secure position.

l. Retaining devices shall operate to permit rapid stowage to minimize content spillage or other potential hazards.

m. Equipment with stowage a compartment (e.g., trash compactors, ovens, refrigerators and freezers, wine chillers) shall be designed such that the stowage compartment completely encloses its contents in accordance with 14 CFR 25.787.

n. For stowage compartments, the strength of doors, hinges, and retaining devices shall be compatible with the maximum contents weight, at the critical load distribution, under ultimate loading conditions (including the local attachment factor in 3.3.3). Under the most critical loading, stowage compartments shall not release their contents due to door deflection.

3.3.6 Weight and Center of Gravity

The following information shall be shown on the Interface Control Document:

a. For ovens, refrigerators, freezers, wine chillers, beverage cups, beverage jugs, and trash compactors:

    1. maximum empty weight, including loose components used for normal operation of the equipment

    2. maximum contents weight, including associated components used for normal operation of the equipment (with the exception of attached hoses, tubes, pipes and/or electrical conduit)

    3. maximum gross weight

    4. center of gravity at maximum gross weight.

b. For beverage makers:

    1. maximum empty weight, including loose components used for normal operation of the equipment

    2. maximum wet weight, including associated components used for normal operation of the equipment (with the exception of attached hoses, tubes, pipes and/or electrical conduit), maximum amount of water in the equipment blumbing system and including water in tank, beverage in server, soaked pillow pack (if applicable)

    3. center of gravity at maximum gross weight.

3.3.7 Doors and Hinges

a. Hinges shall be designed to minimize personnel hazard and offer minimum protrusion in the opened and closed positions.

b. Doors shall have features to hold the door in intermediate open position(s) to avoid the door swinging around.

c. Protrusions (such as latches) on the surfaces of the doors shall be minimized.

3.3.8 Adjacent Equipment Loads

Equipment (e.g., trash compactors) installed in a cart compartment shall meet the strength requirements of AS8056, 3.3.3.

3.3.9 Floor Loads

a. The weight of fully loaded equipment (e.g., trash compactor) installed in a cart compartment shall be uniformly distributed on the airplane/galley floor.

b. The imposed floor loads for fully loaded equipment shall be shown on the Interface Control Document.

3.3.10 Trash Compactor Design Criteria

In addition to the requirements stated in 3.3.9, the trash compactor structure shall not yield during the most severe loading induced by incompressible objects (e.g. bottles on end) contacted during compaction.

3.4 Electrical

3.4.1 Power

a. Equipment shall be designed for primary power of 115 VAC (Constant frequency (CF) or Wide variable frequency (WF)) and/or 28 VDC (nominal)

b. Electrical loads, phase usage and AC power frequency shall be defined on the equipment Interface Control Document.

3.4.2 Protection against Electrical Failure or Overcurrent

Equipment shall be protected against internal electrical failure or overcurrent by a protective device(s) built into the equipment.

3.4.3 Electrical Installation

a. Electrical components and wire bundles shall be protected from exposure to steam, cooking residue, water residue, or water leakage/spillage from inside or outside the equipment.

b. Wire shall conform to industry specifications and be selected according to its intended application (operating potential and current) and environment (ambient temperature).

c. Wire shall be installed and identified per AS50881.

d. Mechanical wire protection (e.g., protective grommets, sleeves, separation) shall be provided at points where chafing is likely to occur.

e. Wiring shall be routed below and/or away from heat sources. Where this is not practical, positive protection (e.g., conduit, tubing) shall be used.

f. Connectors used for wiring shall conform to industry specifications. Only one wire shall be connected to each connector contact. Unused cavities of external connectors shall be sealed.

g. Multiple connectors within equipment shall be dissimilar or separated to prevent misconnection.

h. Equipment designed with more than one external electrical connector shall use dissimilar connectors to prevent misconnection.

i. External connectors shall be environmentally resistant to moisture and should meet AS50881, 3.14.1. Internal connectors used in wet equipment, if not environmentally resistant, shall be protected from moisture by potting/sealing, drip shielding, or equivalent methods.

j. Plugs and receptacles used for equipment wiring should have crimp type contacts per AS39029. Soldered connections shall not be used.

k. Strain relief devices shall be used on the plug side of interface connectors.

l. Components, with mechanical contacts, used in safety related circuits (i.e., as internal switches) should have their contacts de-rated to 70% or less of their maximum rated current to ensure safe function over the life of the equipment.

m. Housing of electrical components and active electronics (e.g., circuit boards) should be fire resistant as defined in 14 CFR 1.1.

n. In wet equipment (e.g., steam ovens, beverage makers), the electrical components should be located above the bottom of the housing to reduce the potential of shorting caused by “pooling” water.

3.4.4 Dielectric Requirements

Dielectric tests shall be performed to qualify the equipment design and to provide an acceptance test on each production unit. The purpose of dielectric tests for qualification is to validate that the equipment is designed to be capable of withstanding over-voltage events without arcing, sparking, smoke or fire. The purpose of the acceptance test on each production unit is to validate that each unit is built without defects that could cause arcing, sparking, smoke or fire. Components (filters, protection diodes) normally not capable of withstanding the dielectric withstanding voltage test without damage may be disconnected or individually disabled (e.g., short circuited) for these tests. The dielectric withstanding voltage test shall be run prior to the insulation resistance test. The tests are:

a. Dielectric Withstanding Voltage Test: A voltage equal to 2.5 times the maximum foreseeable peak voltage level shall be applied for 1 minute between all input connector power and return lines (connected together) and the input connector static ground of the equipment. If the number of terminals is too large to allow them to be tested at once connected together, the test may be performed with several individual tests. The leakage current between any mutually insulated parts of equipment shall not exceed 2.0 mA and there shall be no arcing, sparking, smoke or fire. For equipment without voltage spike protection devices, the test voltage shall be 1500V rms, 50 to 60 Hz, for AC circuits and 1500 V DC for DC circuits. If the equipment includes a device(s) that protects against voltage spikes, the test voltage may be reduced downstream of the device to only 2.5 times the maximum foreseeable voltage spike allowed by the protective device. The leakage current should be measured while the test voltage is applied at a uniform rate not exceeding 500 volts per second until the maximum voltage is reached and held for one minute, before removing the test voltage at a uniform rate not exceeding 500 volts per second

b. Resistance between any mutually insulated parts of equipment shall not be less than 200 MΩ when a DC test voltage is applied. The resistance should be measured while the higher of 500 volts DC or twice the working voltage of the circuitry is applied to each input connector, power, and return wire of the equipment and the connector static ground pin(s).

3.4.5 Grounding and Bonding

a. Equipment shall incorporate an electrical conductive path from any conductive point on the equipment to its designated static ground interface point (e.g., electrical connector).

b. Electrical ground return to the airplane structure should be via the galley interface connector, not the equipment structure; a separate pin in the galley interface electrical connector shall be dedicated for ground return to reduce shock hazards to personnel.

c. Slide-in service connections for beverage makers shall provide an electrical ground for the device. The ground connection (e.g., guide pin) should make connection before the power connections.

d. Bond Resistance: Bonding path resistance shall not exceed 5 mΩ. Note: For a beverage maker/rail assembly combination the requirement is applicable for the combination.

e. Bond Types: Bonding of equipment to the galley structure shall be accomplished through bonding jumpers, guide pins for equipment that mounts onto rail assemblies, or by wiring through the equipment's electrical connector.

3.4.6 Motors

a. Thermal Protection: Motors shall have integral thermal protection unless motor outer surface temperatures cannot exceed 400 °F (204.4 °C) under both normal operation and failure condition.

b. Reset: When integral thermal protection is required to meet 3.4.6 (a) and a re-settable protection device is used, the device shall be manually re-settable and access to the device shall require the use of tools to ensure re-setting is done as a maintenance action only. Note: Automatically-resetting devices can be used in addition to this thermal protective device or when no thermal protection is required.

3.4.7 Microwave Ovens

In addition to the requirements of this document, microwave ovens shall meet 21CFR1030.10, Performance Standards for Microwave and Radio Frequency Emitting Products. When the "User" warning label per 21CFR1030.10(iv)(6)(i) is required to be installed, its location shall ensure visibility when the microwave is installed in a five-sided galley compartment.

3.4.8 Electro-Magnetic Interference (EMI)

a. Equipment shall not generate electromagnetic interference that can adversely affect the performance of other equipment on the airplane.

b. Equipment shall not be susceptible to hazard-producing EMI from other airplane systems.

c. Equipment shall meet the electromagnetic interference requirements of RTCA/DO-160F, 3.17. Microwave ovens are allowed to exceed this requirement between 2.4 Ghz and 2.5 Ghz for RF-radiated narrowband emissions up to the limits in 3.4.7. It is recommended that emissions in this band (2.4 to 2.5 Ghz) be as low as is practicable because of potential interference with wireless systems utilized on some airplanes.

3.4.9 Control Elements

a. Control elements should be integrated on the front face of equipment.

b. Hidden installed equipment (e.g., remote water heater, air chiller) may have a separate control module installed on the front of the galley for the following functions:

- Power ON/OFF
- Operating status indication (including failure)
- Operating mode selector

c. Equipment shall have an integrated control element for Power-on/Power-off. Circuit breakers shall not be used for this purpose.

d. Equipment shall have an indicator that shows the device has electrical power applied.

e. Equipment shall have an indicator that shows its readiness to perform.

f. Equipment operated intermittently (e.g., ovens, beverage makers) shall have a control to activate the intended function (e.g., meal preparation process, brew cycle).

g. Equipment operated intermittently shall have an indicator that shows the operating status of the equipment.

h. A safety warning light, if used, shall be of a different color than the power indicator light.

i. Control knobs, switches and indicating lights shall be recessed or otherwise protected from inadvertent operation or damage.

NOTE: Any logical combination of several control functions in one control element is not prohibited (e.g., illuminated Power-On/Power-Off switch that blinks during the initial self test of the equipment and is afterwards permanently illuminated to show that the equipment is ready to execute or provide its intended function.).

3.5 Thermal Protection/Overheat

a. Equipment with heating devices shall incorporate a thermal protector that interrupts power to the heating devices when an overheat condition is met.

b. The overheat protection device shall operate independently from the normal temperature control.

c. The overheat protection device shall incorporate a manual reset or thermal fuse.

d. The manual reset shall be installed in a position such that it can be reset by maintenance personnel action only.

e. Equipment housings should be designed to minimize the amount of smoke released and provide a barrier to any flames that may be generated by internal component faults.

3.6 Wet Equipment Design Requirement

3.6.1 General

a. Materials used in water system design and construction shall conform to applicable sanitary guidelines (e.g., as indicated in 2.1.5).

b. Potable water outlets shall be separated from drains, or other areas where waste water may collect, by a vertical gap of 1.00 inch (25.4 mm) minimum at airplane attitudes from 25 degrees nose up to 15 degrees nose down.

3.6.2 Wet Equipment Connected with the Airplane Potable Water System

a. The complete plumbing interface shall be shown on the Interface Control Document.

b. Equipment shall be connectable/dividable to/from the potable water system without the need for pressure relief in the potable water system and without leakage.

c. The connection of equipment to the potable water system shall guarantee a simple installation/removal without any special tools.

d. Equipment connected to the airplane potable water system shall be supplied water automatically if the system is pressurized.

e. Equipment supplied with potable water shall operate normally when the potable water temperature ranges from 35 °F (1,7 °C) to 158 °F (70 °C).

f. Wet parts of equipment shall be able to withstand five freeze/thaw cycles with residual water inside. After equipment has frozen and been returned to a temperature of 75 °F (24 °C), it shall comply with the proof pressure requirements in 3.6.6.

3.6.3 Low Water Sensing

Equipment, connected to the potable water system of the airplane, that heats and stores water shall incorporate a feature for sensing a low water condition. Indication of low water shall both illuminate a warning light and interrupt power to the equipment heating elements.

3.6.4 Self Venting/Self Draining

a. Equipment connected to the airplane potable water system shall incorporate a self venting device.

b. Equipment connected to the airplane potable water system shall be self-draining.

c. Equipment shall be designed to ensure that water can drain by gravity from wet parts.

d. When water traps are unavoidable, low point drains shall be used that are accessible from the face of the equipment and drained by use of a common hand tool.

e. Drainage by gravity shall be possible for airplane attitudes between 5 degrees nose up and 3 degrees nose down.

3.6.5 Pressure Vessels

3.6.5.1 General

a. No single failure shall result in excessive internal pressure within a pressure vessel that would cause it to burst or result in the uncontrolled release of pressure and /or steam.

b. All pressure vessels shall incorporate fail-safe design features that will release the pressure (fluid) without producing debris, shrapnel, etc.

3.6.5.2 Pressure Relief

a. A pressure relief device for pressure vessels is required.

b. A secondary pressure relief device is required for closed systems. The secondary pressure relief device shall have a higher relief pressure than the primary relief device, shall be functionally different from the primary pressure relief device, and shall not be re-settable. The operation shall be fail-safe.

c. A pressure relief device(s) shall be installed in such a manner that the operation of other valves and devices will not isolate it from the source of pressure.

d. Water and/or steam from pressure relief devices shall be directed away from passengers and crew and be drained into the galley drain system.

e. Pressure relief devices shall be designed and installed such that the accumulation of corrosion or scale is avoided and/or will not affect its function.

f. A gasket shall not be used as a pressure relief device.

3.6.5.3 Pressure Vessel Access

Equipment shall be designed to prevent the user from being able to open pressurized elements other than through accesses (e.g., taps/faucets, spigots, etc.) that enable safe release of the pressurized fluid.

3.6.6 Pressure Limits

Open Systems

a. Equipment shall meet the proof and burst pressure values required by the airplane manufacturer(s). Note: airplane proof and burst pressure values are typically specified in airplane manufacturers' specifications. It is suggested that the equipment be qualified at the maximum proof and burst pressures required by airplane manufacturers to facilitate usage on more than one airplane type

b. The pressure relief device shall activate at a pressure between 70% and 80% of the proof pressure value used for qualification.

Closed Systems

c. Equipment shall be designed for a proof pressure of 1.5 times MNOP and a burst pressure of 3.0 times MNOP.

d. The primary pressure relief device shall activate at a pressure no greater (nominally) than the proof pressure value used for qualification. The secondary pressure relief device shall be per 3.6.5.2. b).

3.6.7 Water Taps/Faucets

a. Water taps/faucets shall be self-venting.

b. Water taps/faucets should be self-closing. A deviation from this requirement is only allowed if the Interface Control Document requires the installation of a sink in the galley monument below the water tap/faucet.

c. Water taps/faucets shall be self-sealing and non-drip.

d. Water taps/faucets shall be designed to avoid sideways spraying or spurting of water caused by pressure “bubbles”.

3.7 Equipment Ventilation/Exhaust Air

a. Equipment shall not depend on an external source of forced cooling air for its operation.

b. Equipment producing discharge air greater than 10 cfm (4.2 l/s) shall have the air inlet and outlet shown on the equipment Interface Control Document. The maximum volume flow shall be stated.

3.8 Maximum Temperature Design Requirements

a. Equipment shall be designed to prevent external surfaces intended to be handled or contacted by personnel in a prolonged manner from exceeding operating temperatures of 120 °F (49 °C) in normal operation.

b. Equipment shall be designed to prevent external surfaces with the possibility of momentary contact, but not intended to be handled or contacted by personnel in a prolonged manner from exceeding operating temperatures of 140 °F (60 °C) in normal operation (refer to MIL-STD-1472F).

c. External surfaces that have to be heated directly to meet the equipment purpose (e.g., toaster slot, skillet surface, heating plates of a sandwich press, warmer pad for beverage server) are excluded from 3.9 a) and 3.9 b). However, the equipment design, its operating concept, and its installation requirements shall minimize the risk of inadvertent contact as much as is practicable.

d. Equipment shall not radiantly heat structure panels of the associated monument such that their surface temperature exceeds 160 °F (71 °C) in normal operation. Equipment shall have the interface clearances required to allow compliance with this requirement. The necessary clearances shall be validated by test and be identified on the equipment Interface Control Document.

e. Equipment, such as beverage cups and jugs, designed for the purpose of heating, holding, and/or transporting hot liquids at temperatures greater than 122 °F (50 °C), shall have means to prevent liquids from spilling and causing injury to passengers or personnel in the airplane. Note: Equipment sealed tightly shall conform to the pressure vessel requirements in 3.6.5.

3.9 Fire Properties of Materials

Materials (including finishes or decorative surfaces applied to the materials) shall comply with the appropriate paragraphs of 14 CFR 25.853 and 14 CFR 25.856(a) App. F, Part VI, at Amendment 25-111 (or higher), as follows:

3.9.1 Flammability

a. Equipment shall comply with the appropriate flammability requirements of 14 CFR 25.853 (a) when tested per appendix F, Part I.

b. Thermal and acoustic insulation material and components (batting, cover foil, foam, etc.) shall comply with the flame propagation requirements of 14 CFR 25.856(a) Appendix F, Part VI, at Amendment 25-111 (or higher). Advisory circular AC 25.856-1 should be consulted for appropriate guidance.

3.9.2 Heat Release and Smoke Density

Exposed surfaces of equipment, when stowed, shall meet the heat release and smoke density requirements of 14 CFR 25.853, when tested per Appendix F, Parts IV and V.

3.10 Fire Containment

a. Equipment dedicated to, or that may be used for, waste stowage (e.g., trash compactors) shall comply with the fire containment requirements of 14 CFR 25.853(h).

b. Trash compactors shall be tested as a waste cart without a waste container installed, with and without a fully extended platen.

3.11 Placards

Per 14 CFR 25.1541 and 25.1557, equipment shall be marked using materials and/or processes that will ensure legibility during its lifespan. Markings shall be conspicuous and worded in mandatory “command” English. Non-English language marking is acceptable, in addition to English. Non-English marking may be used alone when airworthiness requirements are not involved. Marking location, style and wording should be consistent. Weight placards shall include both English and metric units.

The location and wording of placards must be shown on the Interface Control Document.

3.11.1 Placards for Design Limitations

Equipment having inherent design limitations shall be placarded with these limitations.

3.11.2 Placards for Weight

A maximum gross weight placard shall be placed on equipment. An empty weight should also be marked. Refrigerators, freezers, and wine chillers installed in the airplane shall include a maximum capacity placard that is visible to the user.

3.11.3 Placards for Fire Safety

a. Per 14 CFR 25.791, “No Cigarette Disposal” shall be placed on or near each waste receptacle disposal door (e.g., the waste disposal flap of a trash compactor).

b. “No Cigarette Disposal” and “Close When Not In Use” markings shall be visible on manually-operated waste flaps when the flap is open.

c. A graphic symbol for “No Cigarette Disposal”, per AC 25-17, appendix 2, figure 5, may be used in lieu of text.

3.11.4 Placards for Loose Equipment/Loose Components/Associated Components

a. Loose equipment (e.g., toasters and skillets) should be placarded with “This item must be stowed in its compartment for taxi, take off, turbulence, and landing”, or equivalent.

b. Equipment that uses retention devices to hold loose and/or associated components (e.g., beverage server, brew cup) in place during flight and crash conditions shall be placarded with special stowage instructions (e.g.: “Brew handle must be down for taxi, take off, turbulence and landing”).

c. Equipment without provisions to hold loose and/or associated components in place during flight and crash conditions shall be placarded with instructions to stow these components in the galley monument (e.g., “Beverage server must be stowed in the galley for taxi, take off, turbulence, and landing”).

3.12 Acoustics – Noise generated by the Equipment

The maximum A-weighted sound pressure level emitted from equipment during the operating cycle shall not exceed 70 db(A).

3.13 Ovens

a. Heating elements in ovens shall be installed such that spills of food or liquid will not directly contact them.

b. No single failure of a steam oven's water dispensing system shall allow an uncontrolled release of water into the oven's cavity. An uncontrolled release of water could potentially flood the galley work area.

3.14 Interchangeability / Installation/Removal/Replacement

a. Equipment having the same part number shall be directly and completely interchangeable with respect to fit, form, and function, without any need for adjustment.

b. Any modification to equipment affecting its interchangeability shall require a new part number.

c. Means shall be provided to preclude incorrect installation of equipment and improper engagement of restraint devices.

d. Equipment shall have means for carrying (e.g., handle, grab points, etc.), with the exception of equipment with wheels (e.g., trash compactors).

3.15 Software

a. Software for equipment with a microprocessor(s) shall be designed, developed, and documented according RTCA-DO–178B, Cat. D, or higher, using RTCA-DO-248 for clarification, where applicable.

b. Software shall not be used alone to prevent the occurrence of an unsafe condition that would have an effect on airplane operational capability or crew workload.

3.16 Electronic Hardware

SAE-AS8057-164-1Electronic hardware of equipment with microprocessor(s) shall be designed, developed, and documented according RTCA-DO- 254 Cat. D, or higher.

3.17 Environmental Design Requirements

Equipment shall comply with the environmental conditions and applicable categories in RTCA-DO160F, as listed in Table 2:

TABLE 2 - ENVIRONMENTAL DESIGN REQUIREMENTS

Environmental Requirement	Environmental Test Reference Document	Applicable Category or Guidelines	Remarks	Pass/Fail criteria
Temperature Altitude				
Ground Survival Low Temperature Test and Short-Time Operating Low Temperature	RTCA DO160F, Section 4	A1	Wet equipment shall be tested under drained conditions	(1), (2)
Operating Low Temperature	RTCA DO160F, Section 4	A1	Wet equipment shall be tested under drained conditions	(1), (2)
Ground Survival High Temperature Test and Short-Time Operating High Temperature	RTCA DO160F, Section 4	A1		(1), (2)
Operating High Temperature	RTCA DO160F, Section 4	A1		(1), (2)
In Flight Loss of Cooling	RTCA DO160F, Section 4	N/A	N/A	N/A
Steady State – Altitude	RTCA DO160F, Section 4	A1		(1), (2)
Decompression	RTCA DO160F, Section 4	A1		(1), (2)
Overpressure	RTCA DO160F, Section 4	A1		(2)
Temperature Variation				
	RTCA DO160F, Section 5	C	Wet equipment shall be tested below 35°F (1.7°C) under drained conditions	(1), (2)
Humidity				
	RTCA DO160F, Section 6	A		(1), (2)
Operational Shocks and Crash Safety				
Operational Shock	RTCA DO160F, Section 7	B	To be performed under maximum gross weight conditions	(1), (2)
Crash Safety	RTCA DO160F, Section 7	B	To be performed under maximum gross weight conditions	according RTCA DO160F, Section 7.3
Vibrations				
Operational Vibrations	RTCA DO160F, Section 8	Aircraft type 2 Test Cat: S, Test Curve B3	Standard Random Vibration Test to be performed under maximum gross weight conditions	(1), (2)
Explosive Atmosphere				
	RTCA DO160F, Section 9	N/A		N/A
Waterproofness				
	RTCA DO160F, Section 10	W		Shall pass (1), Should pass (2)

TABLE 2 - ENVIRONMENTAL DESIGN REQUIREMENTS (CONTINUED)

Environmental Requirement	Environmental Test Reference Document	Applicable Category or Guidelines	Remarks	Pass/Fail criteria
Fluid Susceptibility				
	RTCA DO160F, Section 11	F		(2)
Sand and Dust				
	RTCA DO160F, Section 12	N/A		N/A
Fungus Resistance				
	RTCA DO160F, Section 13	F		There shall be no immediate and/or long-term effect(s) due to fungal growth on the physical characteristics of the material.
Salt Fog				
	RTCA DO160F, Section 14	N/A		N/A
Magnetic Effect				
	RTCA DO160F, Section 15	A		The distance for a Deflection of Dc shall be less than 1m.
Power Input				
	RTCA DO160F, Section 16	A(CF) or A(WF) or A	Additional power quality requirements for constant and wide frequency equipment are given in Section 3.18.	According RTCA DO160F ,Section 16 and (2)
Voltage Spike				
	RTCA DO160F, Section 17	A		(2)
Audio Frequency Conducted Susceptibility – Power Inputs				
	RTCA DO160F, Section 18	R(CF) or R(WF) or R		(1), (2)
Induced Signal Susceptibility				
	RTCA DO160F, Section 19	Z		(1), (2)
Radio Frequency (RF) Susceptibility				
RF Conducted Susceptibility	RTCA DO160F, Section 20	R		(1), (2)
RF Radiated Susceptibility	RTCA DO160F, Section 20	R		(1), (2)
Emission of Radio Frequency (RF) Energy				
Conducted RF Emission	RTCA DO160F, Section 21	M		According Section 21 and (2)
Radiated RF Emission	RTCA DO160F, Section 21	M		According Section 21 and (2)
Lightning Induced Transient Susceptibility				
	RTCA DO160F, Section 22	A3C33		(2)
Lightning Direct Effects				
	RTCA DO160F, Section 23	N/A		N/A

TABLE 2 - ENVIRONMENTAL DESIGN REQUIREMENTS (CONTINUED)

Environmental Requirement	Environmental Test Reference Document	Applicable Category or Guidelines	Remarks	Pass/Fail criteria
Icing				
	RTCA DO160F, Section 24	N/A		N/A
Electrostatic Discharge (ESD)				
	RTCA DO160F, Section 25	A		(2)

NOTE: N/A means the test is not applicable to this document.

Pass/Fail criteria:

(1) Equipment shall be operated and shall not present an unsafe condition, during and after the test.
(2) Equipment shall pass the ATP after the test (refer to 4.3).

3.18 Power Quality – Constant and Wide Frequency Equipment (AC)

3.18.1 Power Consumption

The power consumption of the equipment shall be within the limits defined on the equipment Interface Control Document.

3.18.2 Maximum Current Demand / Inrush Current

a. Constant Frequency AC load equipment with a maximum power consumption greater than 500 VA shall be designed such that the maximum current demand, with normal voltage applied to the power input terminals, and for all operating temperatures, shall not exceed 4 times the steady-state full load current (400% of the steady-state full load current).

b. Variable Frequency AC load equipment not incorporating motor controllers and with a maximum power consumption greater than 500 VA, shall be designed such that the maximum current demand, with normal voltage applied to the power input terminals, over a frequency range of 360 to 800 Hz, and for all operating temperatures, shall not exceed 4 times the steady-state full load current (400% of the steady-state full load current).

c. Variable Frequency AC load equipment, incorporating motor controllers, shall exhibit a “soft-start” capability that limits the maximum current demand, with normal voltage applied to the power input terminals, over a frequency range of 360 to 800 Hz, and for all operating temperatures, to 1.1 times the steady-state full load current (110% of the steady-state full load current). The equipment starting (and restarting) inrush current shall be limited, as shown in Figure 2.

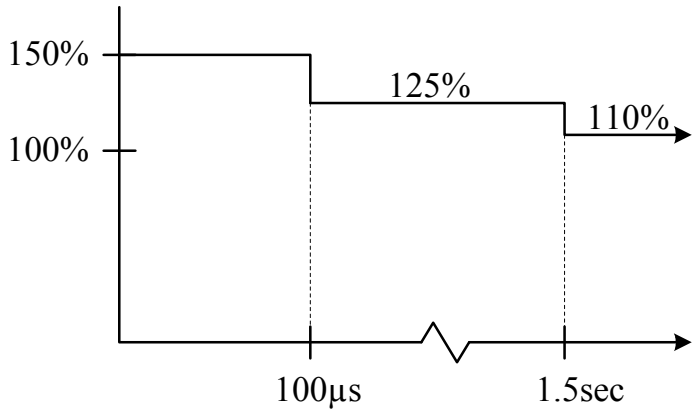


FIGURE 2 - MAXIMUM INRUSH CURRENT FOR AC EQUIPMENT WITH MOTOR CONTROLLERS

NOTE: Maximum current demand includes starting inrush current due to both an initial equipment power-up and equipment restart immediately following a momentary power interruption up to 50 ms in duration.

3.18.3 Load Switching Transients

a. Load equipment shall be designed to operate under transient voltage conditions that are self-generated as a result of load switching.

b. The generation of spike voltage transients due to inductive load switching shall be held within the limits specified by Figure 3.

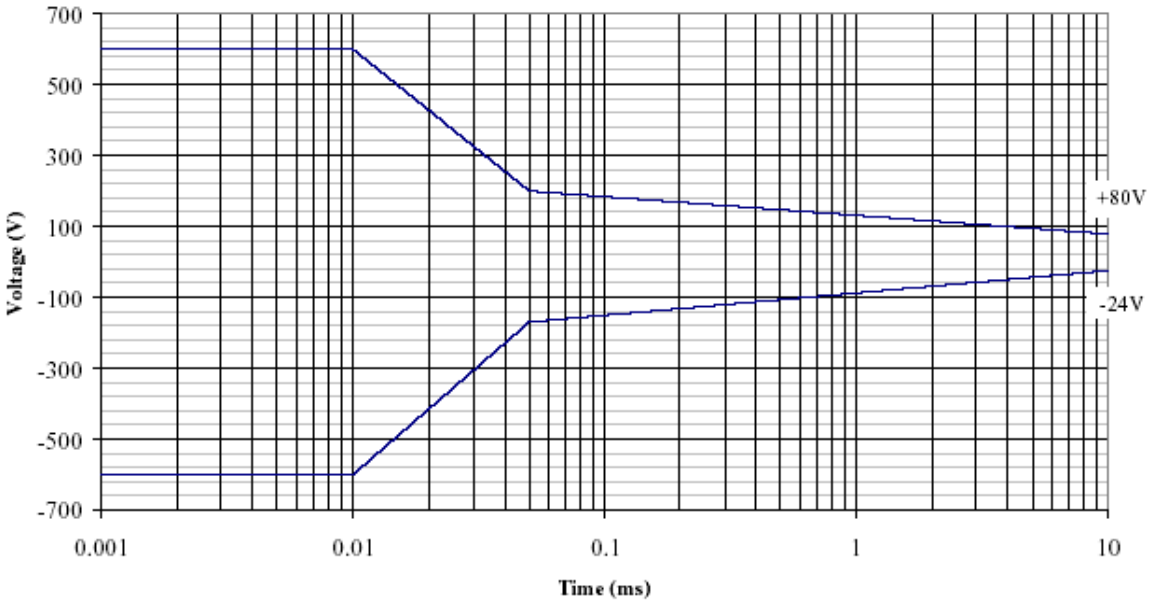


FIGURE 3 - LIMITS FOR THE GENERATION OF SPIKE VOLTAGE TRANSIENT

3.18.4 Input Capacitance

a. The total line-to-neutral input capacitance, including the effects of line-to-line capacitors, shall be less than 2.5 microfarads per kVA, per phase of connected load.

b. For loads less than 200 VA per phase, the total line-to-neutral input capacitance shall not exceed 0.5 microfarads.

c. The total line-to-chassis capacitance for each line shall not exceed 0.02 microfarads.

3.19 Safety Analysis

A Failure Mode and Effects Analysis (FMEA) shall be performed for equipment. The analysis shall include typical and hidden failure modes throughout the entire operating range and include the effects of mishandling.

4. QUALIFICATION AND ACCEPTANCE

4.1 General

Equipment shall be demonstrated by test or analysis to comply with the minimum design requirements in 3. If the equipment is capable of exceeding these requirements, it is suggested that the item be qualified at the maximum level possible to facilitate usage on more than one airplane type.

NOTE: For any of the tests specified in this document, it is acceptable to conduct more severe testing when necessary to meet airplane manufacturers' specifications. It is also acceptable to conduct additional tests according to RTCA DO-160, or equivalent procedures, which are not included in this document but may be required for airplane installation (e.g., DC voltage tests).

Initial qualification of equipment shall be performed by test. Subsequent qualification of equipment design changes may be performed by analysis based on existing qualification test data.

When testing is conducted, the test article shall be a UUT (see definitions).

4.2 Qualification

4.2.1 Structural

a. Structural tests shall be carried out by static loading, using a static test bench (4.2.1.1), or under constant acceleration, using a centrifuge (4.2.1.2).

b. Equipment shall be qualified for structural integrity, using design load factors listed in Table 3.

TABLE 3 - DESIGN LOAD FACTORS

Load Case[1] (Direction relative to Airplane)	Design Load Factors
Forward	9.0
Aft	9.0[4]
Up	3.0[2]
Down	6.0[2]
Side[3]	9.0[4]

[1] A local attachment factor shall be applied to all loads in accordance with 3.3.3.
[2] Increase these load factors as necessary to meet airplane manufacturers' specifications for flight and ground load cases.
[3] Both left and right sides shall be qualified.
[4] Load factor shall be increased to account for the equipment being stowed in either a forward, aft or side facing orientation in the airplane.
[5] For equipment with a stowage compartment, maximum door deflections shall meet 3.3.5 o.

c. Equipment (e.g., trash compactors) intended to be installed in a cart compartment shall be tested in accordance with AS8056, 4. 2.

d. Equipment and 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 listed in Table 4.

TABLE 4 - ABUSE LOADS

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

4.2.1.1 Static Bench Test

a. Loading shall be conducted by applying a force to simulate test loads or by load weights.

b. The test loads shall be applied independently (as opposed to one combined load) to simulate loads due to contents, empty structure.

c. Test loads shall equal or exceed the maximum gross weight at the respective center of gravity when this weight is multiplied by the factors listed in Table 3.

d. Test loads shall be applied for a minimum of 3 seconds.

4.2.1.2 Centrifuge Test

Centrifuge tests shall be conducted with the non-operating equipment under maximum gross weight conditions fixed at the arm of a centrifuge by increasing the acceleration to the value required over a period greater than 15 s. This state shall be maintained for greater than 3 s. Afterwards, the acceleration shall be decreased to zero over a period of greater than 15 s.

Refer to RTCA DO160F § 7.3.3 and Figure 7-3 for further test definitions.

4.2.2 Electrical

a. Equipment shall be demonstrated to comply with power input and voltage spike requirements identified in 3.17.

b. Equipment shall be demonstrated to comply with all applicable electromagnetic interference requirements identified in 3.17.

c. Compliance with the electrical requirements shall be verified for all normal operating modes of the equipment, including stand-by, maximum duty cycle, and operation with its maximum power demand (if not already covered by the maximum duty cycle). Verification in stand-by-mode-only is not allowed.

4.2.2.1 Grounding and Bonding

A circuit analysis/calculation shall be prepared showing the ground/bond resistance values from any conductive point on the equipment to its designated static ground interface point meets the requirements of 3.4.5.

4.2.3 Wet Equipment

Compliance with wet equipment design requirements shall be verified by tests simulating the corresponding events (refer to Appendix A):

a. Low Water

b. Overheat

c. Operation within the specified potable water supply temperature range and working pressure range

d. Self venting under worst case airplane attitudes

e. Self draining under worst case airplane attitudes

f. Repeated freezing with residual water

4.2.4 Pressure Vessels

a. Proof Pressure Test: The qualification unit and every production unit shall have its pressurized components tested to the required proof pressure; this pressure shall be held for five minutes. The equipment shall not be damaged nor leak as a result of the test.

b. Burst Pressure Test: The qualification unit shall have its pressurized components tested to the required burst pressure; this pressure shall be held for 5 minutes. Deformation of system elements is acceptable; however, all fluids (including gases and vapors) shall be retained. The primary pressure relief valve shall be disabled for the test.

c. Ultimate Pressure Test: The qualification unit of equipment with a closed system shall be pressure tested to failure to demonstrate that the ultimate failure mode will release the pressure (fluid, etc.) without producing debris, shrapnel, etc. Pressure relief devices that can fail latently shall be disabled for the test.

d. Wet equipment and self contained refrigeration equipment shall be tested hydrostatically.

4.2.5 External Temperatures

a. The maximum external surface temperatures of equipment shall be verified according to the test procedure in Appendix A.

b. Equipment shall be tested in a simulated galley compartment.

4.2.6 Fire Properties

4.2.6.1 Flammability

Equipment shall be demonstrated to comply with 3.9.1.

4.2.6.2 Heat Release and Smoke Density

a. Equipment surfaces, that could be exposed when stowed, shall be demonstrated to show compliance with the heat release and smoke density requirements in 3.9.2.

b. The top, sides and front surfaces of equipment shall be tested per 14 CFR 25.853 Appendix F, Parts IV and V.

4.2.7 Fire Containment

Trash compactors used to receive combustible material shall show compliance with the fire containment requirements of 3.11, when substantiated per AS8056, 4.6.

4.2.8 Acoustics - Noise generated by the equipment

The A-weighted sound pressure level emitted from equipment shall be verified according to the test procedure in Appendix A.

4.2.9 Software and Electronic Hardware

a. The performance of software of equipment with a microprocessor(s) shall be verified according RTCA-DO - 178, Section 6.0.

b. The performance of electronic hardware of equipment with a microprocessor(s) shall be verified according RTCA-DO-254, Section 6.0.

4.2.10 Environmental Test Conditions

a. Equipment shall be demonstrated to comply with all applicable requirements identified in 3.17.

b. The Pass/Fail criteria listed in Table 2 shall be used.

4.2.11 Power Quality – Constant and Wide Frequency Equipment (AC)

4.2.11.1 Power Consumption

a. The power consumption of equipment shall be verified by applying the appropriate electrical power to the input terminals of the load equipment in a manner simulating normal airplane operating conditions. The applied electrical power shall comply with the normal characteristics of DO-160F, Section 16.0, except the voltage shall be one of the following, as applicable:

    1. 115 ± 2 Vac at 400 ± 5 Hz (for constant frequency equipment)

    2. 115 ± 2 Vac at 360 +5/-0 Hz (for one test) and 800 +0/-5 Hz (for a second test) (for variable frequency equipment)

    3. 28 ± 0.5 Vdc (For equipment utilizing both ac and dc power)

b. The following parameters shall be recorded at the equipment terminals:

1. Apparent power (volt-ampere);
2. Real power (watt);
3. Reactive power (var);
4. Current AC-DC (ampere);
5. Voltage (volt);
6. Simultaneous current versus time and voltage versus time characteristics for all modes of operation including on-off transients and operating modulation characteristics.

4.2.12 Maximum Current Demand / Inrush Current

a. For constant frequency AC load equipment, the inrush current shall be measured for each of the conditions listed in Table 5. The results shall demonstrate that inrush current remains within the limits specified in 3.18.2.

TABLE 5 - INRUSH CURRENT TEST CONDITIONS FOR CONSTANT FREQUENCY EQUIPMENT

Test Number	Supply Voltage		Supply Frequency	Inrush Test Condition
	Single Phase	Three Phase Average		
1	115 Vrms	115 Vrms	400 Hz	Initial start-up
2	115 Vrms	115 Vrms	400 Hz	50ms power interrupt
3	100 Vrms	101.5 Vrms	400 Hz	Initial start-up
4	122 Vrms	120.5 Vrms	400 Hz	Initial start-up

b. For variable frequency AC load equipment, the inrush current shall be measured for each of the conditions shown in Table 6. The results shall demonstrate that inrush current remains within the limits specified in 3.18.2.

TABLE 6 - INRUSH CURRENT TEST CONDITIONS FOR AC EQUIPMENT

Test Number	Supply Voltage Single-Phase	Supply Voltage Three-Phase	Supply Frequency	Inrush Test Condition
1	115	115	360 Hz	Initial start-up
2	115	115	360 Hz	50 ms power interrupt
3	115	115	400 Hz	Initial start-up
4	115	115	500 Hz	Initial start-up
5	115	115	550 Hz	Initial start-up
6	115	115	600 Hz	Initial start-up
7	115	115	800 Hz	Initial start-up
8	100	101.5	360 Hz	Initial start-up
9	100	101.5	400 Hz	Initial start-up
10	100	101.5	500 Hz	Initial start-up
11	100	101.5	550 Hz	Initial start-up
12	100	101.5	600 Hz	Initial start-up
13	100	101.5	800 Hz	Initial start-up
14	122	120.5	360 Hz	Initial start-up
15	122	120.5	400 Hz	Initial start-up
16	122	120.5	500 Hz	Initial start-up
17	122	120.5	550 Hz	Initial start-up
18	122	120.5	600 Hz	Initial start-up
19	122	120.5	800 Hz	Initial start-up

4.2.13 Load Switching Transients

Equipment shall be demonstrated to comply with the requirements identified in 3.18.3 by measuring the spike voltage transients at the input terminals or on any interconnecting wiring between load assemblies.

4.2.14 Input Capacitance

a. Schematic diagrams of the input EMI filter, power factor correction capacitors (if any), and relevant calculations for the capacitance values shall be provided for equipment.

b. The schematic diagrams shall include the values of capacitors, inductors, resistors and equivalent series resistances of capacitors and inductors of the EMI filter and power factor correction capacitors (if any).

c. Line-to-line capacitance values shall be mathematically converted to equivalent line-to-neutral capacitance values and be included in the total line-to-neutral input capacitance calculations.

d. For multi-stage EMI filter designs, the capacitance values of all filter stages shall be included in the total input capacitance calculations.

4.2.15 Safety Analysis

The FMEA shall be conducted and prepared in accordance with ARP4761.

4.3 Acceptance Test

a. An acceptance test of the qualification unit(s) and of every production unit shall be carried out according to an acceptance test plan (ATP) dedicated to the relevant part number. Except as noted below, the ATP for the qualification unit(s) and the production units is the same.

b. The ATP shall include the following tests as a minimum:

1. General

- Visual Inspection (damages, working marks etc.)

- Means of identification (placards, manufacturers' name plate, identification of embedded software configuration - if applicable; etc.)

- Weight

2. Electrical

- Dielectric withstanding voltage test

- Insulation resistance test

- Grounding and bonding tests to the limits established in 4.2.2.1

- Proper function of control elements

- Proper function of re-settable safety devices such as circuit breakers and thermostats (qualification unit(s) only)

- Maximum power consumption measurement (per phase)

3. Plumbing

- Proof pressure test

- Proper function of drains

- Proper function of valves, including re-settable pressure relief devices

4. Operation:

- Verification of the equipment performance

- Verification that retention devices work properly

- Verification that movable parts and loose components can be operated smoothly

- Verification that the equipment can be operated with the intended associated components

c. Acceptance criteria for all verifications required in this chapter.

5. DATA REQUIREMENTS

5.1 Interface Control Document

a Equipment shall have an Interface Control Document that contains the interface data needed for design and certification of the corresponding galley, or other airplane structure, into which the equipment is intended to be installed, stowed and operated.

b. The Interface Control Document shall include the following information:

1. Part Number of the equipment.

2. Overall (envelope) dimensions (including, when applicable, wheel castor envelope, as well as other dimensions produced by protrusions)

3. The door(s) swing envelope, if applicable.

4. Mounting attachment locations, size, type and part numbers.

5. Weight information according to 3.3.6.

6. Electrical connector part number, potable water connector part number, and part number of any other interface.

7. Flexible tube or cable length, size, material and part number, if applicable.

8. Pin definition for any electrical connector.

9. Electrical loads, phase usage, power factor.

10. Galley mounted electrical circuit breaker requirements.

11. Required minimum gap around the equipment, including the cavity behind.

12. Maximum amount of discharge air emitted by equipment that has to be considered for the galley monument design, if applicable.

13. Location and wording of placards, including the manufacturer nameplate.

14. Loose components of equipment required to be retained or stowed separately from the equipment during taxi, takeoff, turbulence and landing. Retaining methods shall be stated.

15. Brief equipment assembly and installation instruction that clearly defines the steps required for assembling and installing the equipment in the galley monument.

16. MNOP for wet equipment connected to the airplane potable water system. Additionally, the normal operating pressure range should be given.

17. Maximum load factors and load directions for which the equipment is qualified.

18. Quantity and allowable loading areas for external retaining devices (e.g., galley latches), if applicable (e.g., trash compactor)

19. Wheel contact area and maximum floor loads imposed, if applicable (e.g., trash compactor)

20. Results shall be given in both English and metric units.

5.2 Qualification Documentation

a. A qualification test plan shall be prepared prior to the beginning of the qualification tests.

b. The qualification test plan shall include the following:

    1. List of requirements to be verified with reference documents and the applicable category

    2. Means of compliance of the requirements (test, analysis, similarity, etc.)

    3. Verification test to determine compliance with the equipment performance standards to be performed before and after tests (e.g., acceptance test)

    4. Test schedule

    5. Quantity of qualification units to be used

    6. Order of tests (if more than one qualification unit, test sequence on each unit)

    7. List of test laboratories (name; tests that will be performed by the laboratory)

    8. Pass/fail criteria

    9. Tests malfunctions policy

    10. Assurance that the qualification unit is representative of a series production unit

    11. Hardware/Software modification policy in case of change after the completion of the qualification tests

c. Qualification test procedures prepared prior to the qualification test for each requirement to be verified.

d. Qualification test procedures describing the test procedures (installation of the test unit, specific tools used for the test, test sequences) in accordance with those defined in the reference documents listed in the qualification test plan.

e. The qualification test procedures shall include a test log sheet template for each test with following minimum content:

    1. Type of test

    2. Serial number of the UUT

    3. Date and time of test

    4. Test result (passed / failed)

    5. Examiner

f. A qualification test report shall summarize the test results.

g. The qualification test report shall include the following:

1. Update of the information given in the qualification test plan
2. List of all requirements verified by test with an indication if the test was passed or failed
3. Test log sheet for each test performed
4. Detailed test results

h. FMEA.

6. COMPLIANCE MATRIX

TABLE 7 - COMPLIANCE MATRIX

AS	Requirement	Compliance Method	Note
3.2.1	Materials and Materials Control	Drawing and Process Specification Review	
3.2.1.1	Materials	Drawing and Process Specification Review	
3.2.1.2	Sandwich Panel	Drawing and Process Specification Review	
3.2.1.3	Fasteners	Drawing Review	
3.2.1.4	Castings	Drawing and Process Specification Review	
3.2.1.5	Forgings/Extrusions	Drawing and Process Specification Review	
3.2.1.6	Storage and Shelf Life	Drawing and Process Specification Review	
3.2.1.7	Hazardous Materials	Drawing and Process Specification Review	
3.2.1.8	Environmental Protection	Drawing Review	
3.2.1.9	Finishes	Drawing and Process Specification Review	
3.2.2	General Construction	Drawing and Process Specification Review	
3.2.2.1	Fastener Installation	Drawing and Process Specification Review	
3.2.2.2	Sealing	Drawing and Process Specification Review	
3.2.2.3	Potting	Drawing and Process Specification Review	
3.2.2.4	Bonding	Drawing and Process Specification Review	
3.2.2.5	Welding	Drawing and Process Specification Review	
3.2.3	Construction for Waste Enclosures (e.g., Trash Compactor)	Drawing Review	
3.2.3.1	Wear and Tear	Drawing Review	
3.2.3.2	Unacceptable Features	Drawing Review	
3.2.4	Injury Hazard	Drawing Review	
3.2.4.1	Edges, Corners, and Protrusions	Drawing Review	
3.2.4.2	Exposed Crushing Components	Drawing Review	
3.2.5	Interface Clearances	Drawing Review	
3.2.6	Sanitary Construction	Drawing Review	

TABLE 7 - COMPLIANCE MATRIX (CONTINUED)

AS	Requirement	Compliance Method	Note
3.2.7	Identification	Drawing Review	
3.2.8	Continued Airworthiness	Document Review	
3.3	Structural		
3.3.1	General	Test or Analysis Drawing Review	
3.3.2	Design Load Factors	Test or Analysis Drawing Review	
3.3.3	Local Attachment Factor	Test or Analysis Drawing Review	
3.3.4	Material Strength Properties and Material Variability	Test or Analysis Drawing Review	
3.3.5	Retention of Items of Mass	Test or Analysis Drawing Review	
3.3.6	Weight and Center of Gravity	Test or Analysis Drawing Review	
3.3.7	Doors and Hinges	Test or Analysis Drawing Review	
3.3.8	Adjacent Equipment Loads	Test or Analysis Drawing Review	
3.3.9	Floor Loads	Test or Analysis Drawing Review	
3.3.10	Trash Compactor Design Criteria	Test or Analysis Drawing Review	
3.4	Electrical		
3.4.1	Power	Test or Analysis Drawing Review	
3.4.2	Protection against Electrical Failure or Overcurrent	Drawing Review	
3.4.3	Electrical Installation	Drawing Review	
3.4.4	Dielectric Requirements	Acceptance Test	
3.4.5	Grounding and Bonding	Drawing Review, Analysis Acceptance Test	
3.4.6	Motors	Test or Analysis Drawing Review	
3.4.8	Electro-Magnetic Interference (EMI)	Test or Analysis	
3.4.9	Control Elements	Drawing Review	
3.5	Thermal Protection/Overheat	Test or Analysis Drawing Review	
3.6	Wet Equipment Design Requirement		
3.6.1	General	Drawing Review	
3.6.2	Wet Equipment Connected with the Airplane Potable Water System	Test or Analysis Drawing Review	
3.6.3	Low Water Sensing	Test or Analysis Drawing Review	
3.6.4	Self Venting/Self Draining	Test or Analysis Drawing Review	
3.6.5	Pressure Vessels		
3.6.5.1	General	Test or Analysis Drawing Review	
3.6.5.2	Pressure Relief	Test or Analysis Drawing Review	
3.6.5.3	Pressure Vessel Access	Test or Analysis Drawing Review	

TABLE 7 - COMPLIANCE MATRIX (CONTINUED)

AS	Requirement	Compliance Method	Note
3.6.6	Pressure Limits	Test or Analysis Drawing Review	
3.6.7	Water Taps/Faucets	Test or Analysis Drawing Review	
3.7	Equipment Ventilation/Exhaust Air	Drawing Review	
3.8	Maximum Temperature Design Requirements	Test or Analysis Drawing Review	
3.9	Fire Properties of Materials		
3.9.1	Flammability	Test or Analysis Drawing Review	
3.9.2	Heat Release and Smoke Density	Test or Analysis Drawing Review	
3.10	Fire Containment	Test or Analysis Drawing Review	
3.11	Placards	Drawing Review	
3.11.1	Placards for Design Limitations	Drawing Review	
3.11.2	Placards for Weight	Drawing Review	
3.11.3	Placards for Fire Safety	Drawing Review	
3.11.4	Placards for Loose Equipment/Loose Components	Drawing Review	
3.12	Acoustics	Test or Analysis Drawing Review	
3.13	Ovens	Drawing Review	
3.14	Interchangeability / Installation/Removal/Replacement	Drawing Review	
3.15	Software	Refer to RTCA-DO-178, Section 6	
3.16	Electronic Hardware	Refer to RTCA-DO-254, Section 6	
3.17	Environmental Design Requirements	Test or Analysis Drawing Review	
3.18	Power Quality – Constant and Wide Frequency Equipment (AC)	Test or Analysis Drawing Review	
3.19	Safety Analysis	Document Review	

7. NOTES

7.1 A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

APPENDIX A - ADDITIONAL VERIFICATION REQUIREMENTS

Acoustic – Noise generated by the equipment

Purpose: To verify the equipment meets the requirements in 3.12.

Test equipment:

a. An hemi-anechoic room, or room with no reflecting surfaces other than the floor and a ceiling closer than 5 meters from the UUT. The floor shall have a hard surface

b. Microphone connected to a sound level meter.

c. Pressurized source of water (25 to 45 PSIG), if applicable

d. Power supply

Test setup:

a. Ambient conditions according to RTCA-DO160F, Section 3.5

b. The test shall be performed under free field conditions

c. The sound pressure measurements shall be performed at accuracy grade 1 or 2, in accordance with ISO 3744 or ISO 3745. The standard used may be chosen depending on the test facilities and equipment available.

d. UUT placed on the floor of the test facility.

e. UUT connected to the power supply.

f. UUT connected to the pressurized source of water and filled with water (if applicable).

Test procedure:

a. Verify configuration of the test.

b. Record UUT part number and serial number.

c. Record ambient/background noise level.

d. Set equipment timer to maximum duration.

e. Energize UUT and start operating cycle.

f. Measure and record the sound pressure level in a distance of 20 in (51 cm) from the front side of the UUT surface.

Pass/Fail criteria: The UUT shall meet the requirement in 3.12.

Low Water

Purpose: To verify the equipment meets the requirements in 3.6.3.

Test equipment:

a. Pressurized source of water (25 to 45 PSIG)

b. Power supply

Test setup:

a. Ambient conditions according to RTCA-DO160F, Section 3.5

b. UUT connected to the power supply

c. UUT connected to the pressurized source of water and filled with water

Test procedure:

a. Verify configuration of the test.

b. Record UUT part number and serial number.

c. Establish and record ambient conditions.

d. Energize UUT.

e. Operate the UUT in a normal water-consuming mode (e.g., brew mode for coffee maker, hot water withdrawal for water heater, steam mode for steam ovens).

f. During operation decrease the water pressure of the source of water to 0 PSIG.

g. Confirm that the UUT halts operation automatically and indicates the low water condition. Steam ovens may switch over from steam mode to convection mode automatically.

h. Increase the water pressure of the source of water to 25 to 45 PSIG.

i. Confirm that the low water indication extinguishes.

Pass/Fail Criteria: The UUT shall halt normal operation if the pressure of the source of water is 0 PSIG and indicate the low water condition. Steam ovens may switch over from steam mode to convection mode automatically. The UUT shall resume normal operation if the pressure of the source of water returns to the normal operating pressure range.

Operation within the specified potable water supply temperature range

Purpose: To verify the equipment meets the requirements in 3.6.2.

Test equipment:

a. Pressurized source of water (25 to 45 PSIG)

b. Power supply

Test setup:

a. Ambient temperature: min 35 °F (1.7 °C) ; max 75 °F (23.9 °C)

b. Other ambient conditions acc. RTCA-DO160F, Section 3.5

c. UUT connected to the power supply

d. UUT connected to the pressurized source of water with a water temperature of max: 35 °F (1.7 °C)

Test procedure:

a. Verify configuration of the test.

b. Record UUT part number and serial number.

c. Establish and record ambient conditions and water temperature.

d. Energize UUT and fill the UUT with water.

e. Operate the UUT in a normal water-consuming mode (e.g., brew mode for coffee maker, hot water withdrawal for water heater, steam mode for steam ovens).

f. Determine compliance with the applicable equipment performance standards.

g. De-energize the UUT and disconnect the water supply.

h. Allow the UUT to drain by gravity.

i. Drain residual water manually (e.g., by manual opening of a drain valve).

j. Connect the UUT to the pressurized source of water (25 to 45 PSIG) with a water temperature of min: 158 °F (70 °C).

k. Energize UUT and fill the UUT with water.

l. Operate the UUT in a normal water-consuming mode (e.g., brew mode for coffee maker, hot water withdrawal for water heater, steam mode for steam ovens).

m. Determine compliance with the applicable equipment performance standards.

Pass/Fail Criteria: The UUT shall operate without any failure during Step e) and Step l).

Self venting /Self draining under worst case airplane attitudes

Purpose: To verify the equipment meets the requirements in 3.6.4.

Test equipment:

a. Pressurized source of water (25 to 45 PSIG)

b. Power supply

Test setup:

a. Ambient conditions according to RTCA-DO160F, Section 3.5.

b. UUT connected to the power supply

c. UUT connected to the pressurized source of water

d. UUT inclined at a 3 degree angle minimum in an orientation that will represent the worst case condition in terms of venting

Test procedure:

a. Verify configuration of the test.

b. Record UUT part number and serial number.

c. Establish and record ambient conditions.

d. Energize UUT and fill the UUT with water.

e. Do not operate the water faucet, if applicable

f. Confirm that the UUT is completely filled with water.

g. Operate the UUT in a normal water-consuming mode (e.g., brew mode for coffee makers, hot water withdrawal for water heater, steam mode for steam ovens).

h. If the normal duty cycle is finished de-energize the UUT.

i. Incline the UUT at a 5 degree angle minimum in an orientation that will represent the worst case condition in terms of draining.

j. Disconnect the water supply.

k. Allow the UUT to drain by gravity.

l. Determine and record the locations and the amount of residual water inside the UUT.

Pass / Fail Criteria: The UUT shall operate without any failure during Step g) (Self venting).The amount of residual water shall be less than 5% of the equipment capacity (Self draining).

Repeated freezing with residual water (3.6.2)

Purpose: To verify the equipment withstands five (5) Freeze/Thaw cycles without failure.

Test equipment:

a. Pressurized source of water (25 to 45 PSIG)

b. Climate Chamber

c. Power supply

Test Setup:

a. Ambient conditions according to RTCA-DO160F, Section 3.5 and 3.6

b. The UUT placed in a climate chamber

c. The UUT connected to the power supply

d. The UUT connected to the pressurized source of water

Test procedure:

a. Verify configuration of the test.

b. Record UUT part number and serial number.

c. Establish and record ambient conditions.

d. Energize UUT and fill the UUT with water.

e. Operate the UUT in a normal water-consuming mode (e.g., brew mode for coffee maker, hot water withdrawal for water heater, steam mode for steam ovens).

f. If the normal duty cycle is finished de-energize the UUT.

g. Incline the UUT at a 5 degree angle minimum in an orientation that will represent the worst case condition in terms of draining.

h. Disconnect the water supply.

i. Allow the UUT to drain by gravity.

j. Once drained, the residual water in the plumbing system of the UUT shall not be removed (e.g., by manual opening of a drain valve).

k. Close the door of the climate chamber.

l. Lower the temperature to 5 °F (-15 °C ± 3 °C).

m. Hold the temperature for 4 hours.

n. Return the temperature to ambient and hold for another 4 hours.

NOTE: Steps l) – n) constitute one Freeze / Thaw Cycle.

o. Repeat Step l) – n) four (4) times.

Pass / Fail Criteria: After the completion of the last Freeze/ Thaw cycle determine compliance with the applicable equipment performance standards by performing the acceptance test procedure.

External Surface Temperature

Purpose: To verify the equipment meets the requirements in 3.8

Test equipment:

a. Simulated galley compartment:

- Panel construction shall be a 0.40 inch minimum thickness nonmetallic composite panel. An acceptable panel could have a one-ply woven fiberglass phenolic or epoxy prepeg face sheet on each side bonded to a nomex paper honeycomb core.
- Panels shall be bonded with a two-part epoxy using tongue and groove construction.
- Supporting aluminum bonding angles may be used on the outside of the compartment.
- Two ovens in adjacent compartments with an intervening panel shall be tested. The oven adjacent to the oven being substantiated shall have equivalent or worse characteristics.

b. Instrumentation:

- At least 15 thermocouples distributed on the unit (see Appendix A, Figure A1, Figure A2 and Table A1 for preferred locations). Additional thermocouples are required on metallic controls.
- Additional thermocouples shall be placed at the center of the interior walls of the simulated galley compartment.
- Also, additional thermocouples shall be required on metal/ceramic surfaces that are components of non-metallic touchable surfaces.
- Recording device capable of one minute resolution or better.

c. Pressurized source of water (25 to 45 PSIG), if applicable

d. Power supply

Test setup:

a. Ambient temperature: 75 °F ± 5 °F (24 °C ± 3 °C)

b. All other ambient conditions according to RTCA-DO160F, Section 3.5

c. UUT installed in a simulated galley compartment. The minimum air gaps per Interface Control Document shall be sustained

d. Forced airflow is not allowed

e. Thermocouples placed at the locations designated in Figure A1 or Figure A2 and Table A1

f. UUT connected to the power supply

g. UUT connected to the pressurized source of water, if applicable

h. Oven loaded with one quarter of a complement of frozen entrees or equivalent

i. Coffee maker, water heater or server filled with liquid at nominal operating temperature

Test procedure:

a. Verify configuration of the test.

b. Record UUT part number and serial number.

c. Record contents of the UUT.

d. Establish and record ambient conditions.

e. Energize UUT.

f. Set equipment timer to maximum duration.

g. Set equipment temperature control to maximum.

h. Start operation cycle and begin recording temperatures. Data recording interval shall be 1 minute. Note on data chart the start time of test.

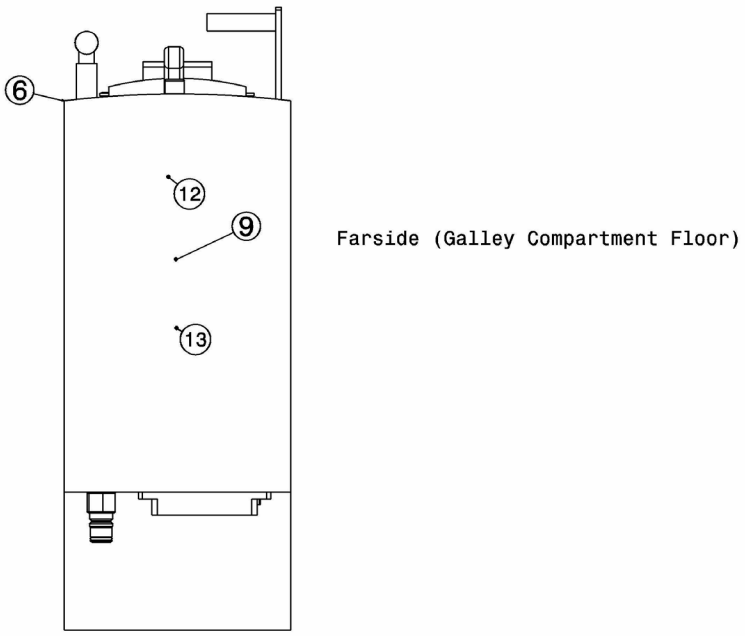
i. Test shall be conducted until all instrumented surfaces have reached a steady state. This may require multiple heating cycles to demonstrate that either a steady state is attained or a maximum temperature is determined.

j. Conclude test by noting on data chart the finish time of the test.

Pass/Fail criteria: The UUT shall meet the external surface temperature requirements in 3.8a), 3.8b) and shall fulfill 3.8d).

TABLE A1 - STANDARD THERMOCOUPLE LOCATION FOR EXTERNAL TEMPERATURE TEST

Thermocouple No.	Beverage Maker (Figure A1)	Ovens (Figure A2)
1	Ambient	Ambient
2	Brew Cup Handle	Oven Door Handle
3	Secondary Restraint (if Used)	Secondary Door Restraint
4	Top Edge	Top Edge
5	Bottom Edge	Bottom Edge
6	Side Edge (Either Side)	Side Edge (Near Door Handle)
7	Beverage Server	Center of Door
8	Hot Water Spigot Handle	Steam Vent
9	Underside of UUT, Central to Panel	Underside of UUT, Central to Panel
10	Side of UUT, Central to Panel	Side of UUT, Central to Panel
11	Side of UUT, Central to Panel	Side of UUT, Central to Panel
12	Top of UUT, Front Half of Panel	Top of UUT, Front Half of Panel
13	Top of UUT, Rear Half of Panel	Top of UUT, Rear Half of Panel
14	Rear of UUT, Upper Half of Panel	Rear of UUT, Upper Half of Panel
15	Brew Cup Lowering Handle	Rear of UUT, Lower Half of Panel



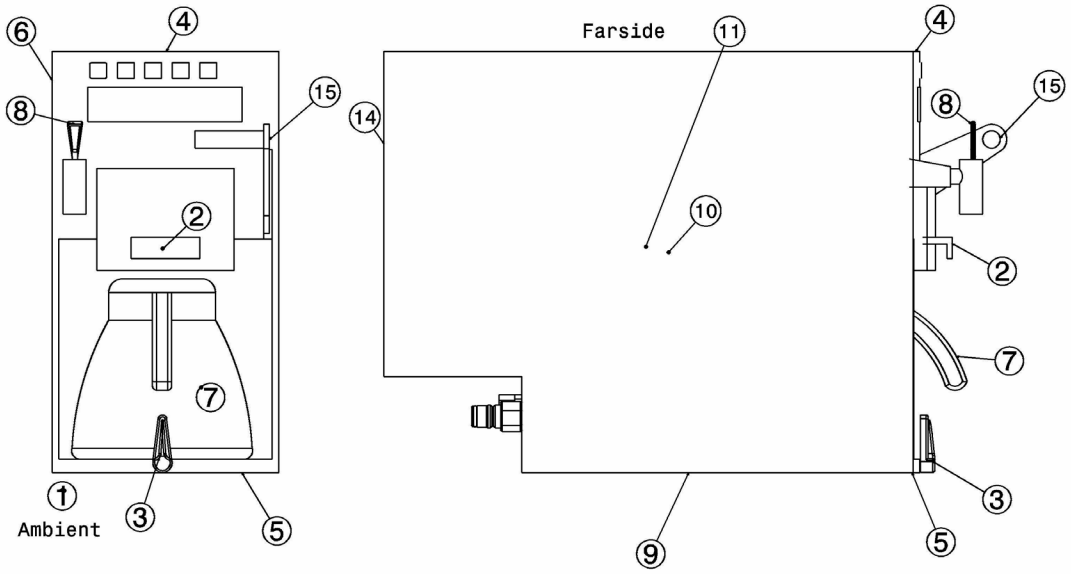


FIGURE A1 - THERMOCOUPLE LOCATION BEVERAGE MAKERS

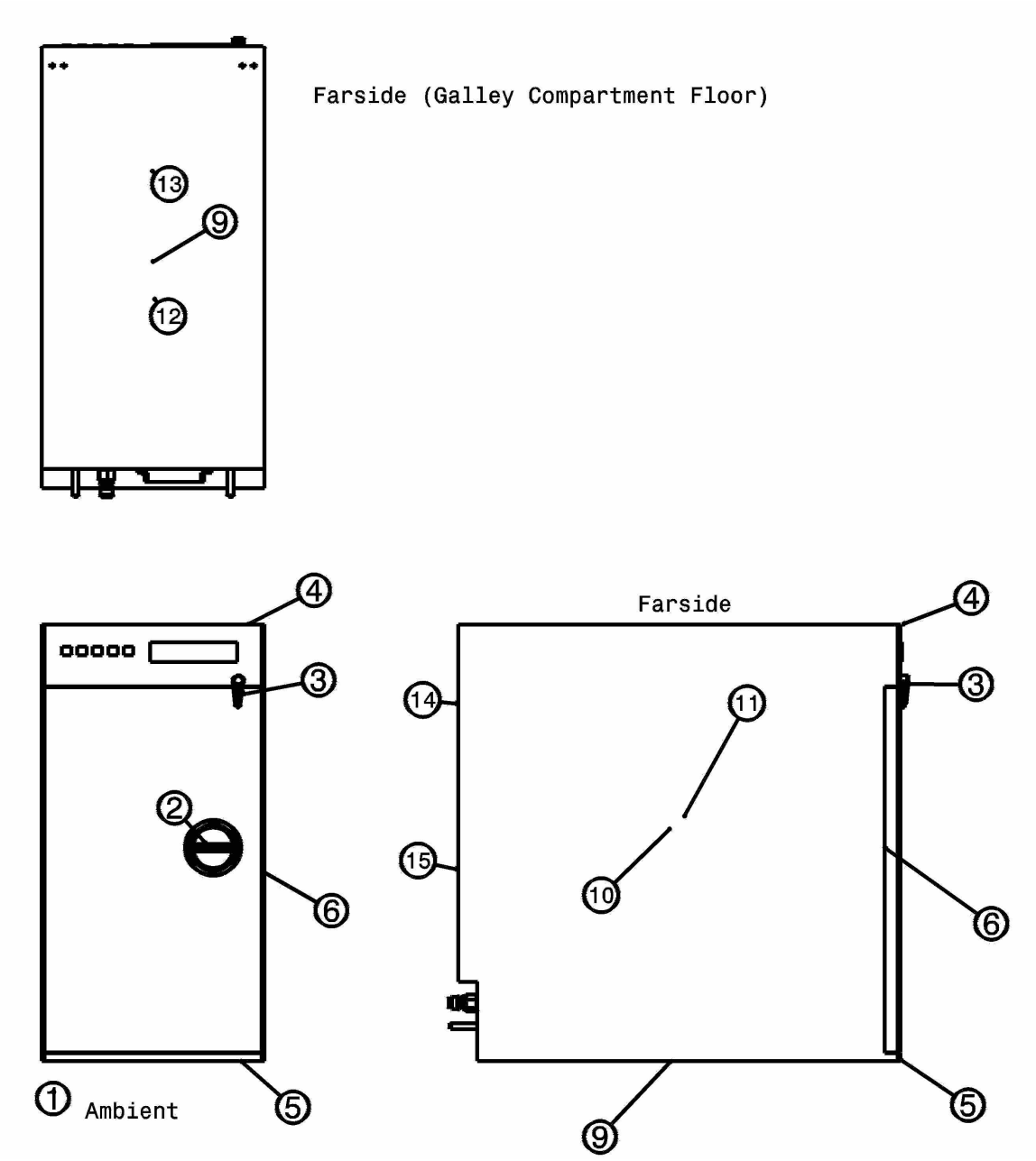


FIGURE A2 - THERMOCOUPLE LOCATION OVENS