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PERFORMANCE SPECIFICATION

LIGHTING, EMERGENCY EGRESS, SUBASSEMBLY

This specification is approved for use by the Naval Air Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the Emergency Egress Lighting Subassembly (EELS) requirements for fixed wing, rotary wing, lighter-than-air, and tilt-rotor aircraft and fixed wing or rotary wing aircraft configured as passenger carrying aircraft.

2. APPLICABLE DOCUMENTS.

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to the Naval Air Systems Command (Commander, Naval Air Warfare Center Aircraft Division, Code 491000B120-3, Highway 547, Lakehurst, NJ 08733-5100), or by email to thomas.omara@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-I-8500	-	Interchangeability and Replaceability of Component Parts for Aerospace Vehicles.
MIL-DTL-18307	-	Nomenclature and Identification for Aeronautical Systems including Joint Electronic Type Designated Systems and Associated Support Systems.
MIL-PRF-28800	-	Test Equipment for Use with Electrical and Electronic Equipment, General Specification for.
MIL-L-85762	-	Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-461	-	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.
MIL-STD-704	-	Aircraft Electric Power Characteristics.
MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests.
MIL-STD-882	-	Standard Practice for System Safety.
MIL-STD-1472	-	Human Engineering.

DEPARTMENT OF DEFENSE HANDBOOK

MIL-HDBK-470	-	Designing and Developing Maintainable Products and Systems, Volume I and Volume II.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the 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.

3. REQUIREMENTS.

3.1 Fixed and rotary wing emergency egress lighting system description. The fixed wing and rotary wing emergency egress lighting subassembly shall provide illumination of an aircraft emergency exit to enable rapid location of the exit by crewmembers and passengers inside the aircraft in the event of a crash or emergency landing on land or at sea when the visibility is reduced in the cabin compartment. The fixed wing requirements shall be applicable to lighter-than-air aircraft. The rotary wing requirements shall be applicable to tilt-rotor aircraft. Other aircraft configured to carry only passengers, shall include both requirements. The lighting subassembly shall consist of those components necessary to illuminate designated emergency escape exit(s). The lighting subassembly shall be comprised of light element(s), a control unit with integral power source, cabling, connectors, and mounting hardware. Each lighting subassembly shall operate independently of any other lighting subassembly. However, fixed wing emergency lighting and main lighting systems may share the same source of general cabin illumination. The power supply of the emergency lighting system shall be independent of the main lighting system power supply. The fixed wing emergency lighting system shall also include: Sources of general cabin illumination, interior lighting in emergency exit areas, and floor proximity escape path marking.

3.1.1 Single & multiple light element subassemblies. A single light element subassembly shall be comprised of one light element and a control unit. A multiple light element subassembly shall be comprised of multiple light elements and a control unit.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.3 Light element performance. The light element shall provide illumination during preflight check. The peak chromaticity (relative spectral radiance) of the light elements shall be within a range of 510-575 nanometers. The amount of light energy in the 600-900 nanometer range shall be compatible with the operating characteristics of all in-service night vision goggles.

3.3.1 Rotary wing and tilt-rotor aircraft. The luminance of each light element throughout the duration of operation specified in 3.3 shall be a minimum of 42 foot-lamberts for a projected one-half-inch minimum visible width from any viewing angle within ± 65° of normal. Once actuated, light element output shall be continuous (See 6.3).

3.3.2 Fixed wing and lighter-than-air aircraft.

3.3.2.1 General emergency illumination. White floor light shall be provided as applicable:

a. Illumination provided by the EELS conforming to 3.4.1.2.1.a shall be not less than 0.54 lux (0.05 ft-c).

b. Average illumination provided by the EELS conforming to 3.4.1.2.1.b shall be not less than 0.54 lux (0.05 ft-c) determined from measurements made every 40 in (102 cm) along the center of the main passenger aisle(s) at seat armrest height.

c. Illumination provided by the EELS conforming to 3.4.1.2.1.c shall be not less than 0.22 lux (0.02 ft-c) measured along a line that is within 6 in (15 cm) of and parallel to the floor and centered on the passenger evacuation path.

3.3.2.2 Exit signs. The lighted background-to-letter contrast shall be not less than 10:1. This value is also applicable to symbols, arrows and instructional placards. The background luminance of lighted areas of exit signs conforming to 3.4.1.2.2.2.a. and b. shall be not less than 25 ft lamberts (86 candela (cd)/m^2) and the ratio of maximum to minimum luminance shall be not greater than 3:1. The initial luminance of the exit locator signs per 3.4.1.2.2.2.c. and d shall be not less than 0.38 ft lambert (1.3 cd/m^2). For self-illuminated signs, the nonlighted contrast ratio under ambient light between the intelligence and background shall be not less than 3.0 (see 6.7).

3.3.2.3 Floor proximity escape path marking. The floor proximity emergency escape path marking shall enable each passenger in total darkness to:

a. Visually identify the emergency escape path along the cabin aisle floor to the first exit or pair of exits forward and aft of the seat after leaving the passenger seat.

b. Identify each exit from the emergency escape path by reference only to markings and visual features not more than 4 feet above the cabin floor.

3.3.3 Fixed wing or rotary wing aircraft configured to carry only passengers. The light element performance of aircraft that are fixed or rotary wing aircraft configured used to carry only passengers shall conform to 3.3.1 and 3.3.2.

3.4 Physical characteristics.

3.4.1 Geometry.

3.4.1.1 Rotary wing and tilt-rotor aircraft. The components of the lighting subassembly shall be of minimum size and meet the light element requirements of 3.3. The width of the light element shall be not greater than one inch. All light elements and electrical leads for a single model of aircraft shall be of a standard length to facilitate interchangeability. The length of the light element shall be long enough to enable arrangement in an inverted “U” configuration above the top and along the sides of a single light element emergency escape exit. (See 6.8)

3.4.1.2 Fixed wing and lighter-than-air aircraft.

3.4.1.2.1 General emergency illumination. White floor light shall be provided on passenger and cargo aircraft in the following locations:

a. 25 in (64 cm) above floor at exit door in flight crew station.

b. Along the center of the main passenger aisle(s) and cross aisle(s) between main aisles.

c. The floor of the passageway leading to each floor level passenger emergency exit, between the main aisles and the exit openings.

3.4.1.2.2 Exit signs.

3.4.1.2.2.1 Size. Lettering of the word "EXIT" on exit signs shall be red and not less than 1-1/2 in (38.1 mm) high on illuminated white background. The letter height to stroke width ratio shall be not more than 7:1 and not less than 6:1. The background shall have an area of not less than 21 in^2 (135.4 cm^2) excluding the letters, arrows and symbols.

3.4.1.2.2.2 Location. A sign or signs visible to occupants approaching along the main passenger aisle(s) shall indicate location of each passenger exit.

a. Exit locator signs shall be located above the aisle(s) near each exit and be internally illuminated.

b. An exit marking sign shall be located next to each exit and be internally illuminated.

c. Exit signs shall be located on each bulkhead or divider that obstructs fore and aft vision along the passenger cabin to indicate emergency exits beyond and obscured by the bulkhead or divider.

d. Stairway location shall be indicated by an exit sign visible to passengers approaching the main aisle(s) and be internally illuminated.

3.4.1.2.3 Floor proximity escape path marking. Floor proximity emergency escape path marking shall provide an emergency evacuation path for passengers when all sources of illumination more than 4 feet above the cabin aisle floor are totally obscured.

3.4.1.3 Aircraft configured to carry only passengers. The geometry of lighting subassembly components used in aircraft configured to carry only passengers shall conform to 3.4.1.1 and 3.4.1.2 through 3.4.1.2.3.

3.4.2 Single point failure or fuselage break-up. A single point failure in the EELS or break-up of the fuselage shall not render inoperative more than 25 percent of the required path, cabin illumination, and exit light, not including those directly destroyed by the break or single point failure.

3.4.3 Mounting features. Provisions for mounting to a structural member shall allow for removal and replacement of the light assembly.

3.4.4 Light element configuration. Design of the light element shall be such that failure of a point light source shall not result in the failure of any other point light source within the light element.

3.5 Functional characteristics.

3.5.1 Rotary wing and tilt-rotor aircraft. The lighting subassembly shall be designed for use in emergency situations only. The lighting subassembly shall provide illumination at or above minimum levels as required for not less than10 minutes within one second subsequent to initiation. The lighting assembly shall operate in air or while submerged in fresh or seawater to a depth of 50 feet and shall be deactivated prior to flight in the case of a "lights-out" nighttime mission requirement.

3.5.2 Fixed wing and lighter-than-air aircraft. Emergency illumination shall be maintained at or above the minimum level for not less than 10 minutes at critical ambient conditions after an emergency landing on land or water and shall operate in air or while submerged in fresh or seawater. The lighting assembly shall operate in air or while submerged in fresh or seawater to a depth of 50 feet and shall be deactivated prior to flight in the case of a "lights-out" nighttime mission requirement (see 6.12.1).

3.5.3 Aircraft configured to carry only passengers. The functional characteristics of the EEL configured to carry only passengers shall conform to 3.5.1 and 3.5.2.

3.6 Control unit.

3.6.1 Control unit performance. The control unit shall include a status indicator which provides a visual means to verify that the power source is sufficient for the lighting subassembly to meet the performance requirements of 3.5 and the operational status of each lighting subassembly (function and disable).

3.6.1.1 Rotary wing and tilt rotor aircraft. The control unit for the lighting subassembly shall provide interface for the light element(s). The control assembly shall also provide power, activation and control logic, status indications, test capability and, if applicable, power source charging control for the lighting subassembly.

3.6.1.2 Fixed wing and lighter-than-air aircraft. The emergency lighting system shall provide for manual operation of the lights from the flight crew station and from a location in the passenger compartment that is within reach of an operator seated in an assigned seat. Emergency lighting in the flight deck shall be arranged so as to minimize glare and problems with dark adaptation by the flight crew. There shall be a flight crew warning light that illuminates when main aircraft power is on in the aircraft and the emergency lighting system is not ARMED (see 6.9).

3.6.1.2.1 Cockpit control device. The cockpit control device shall have ON, OFF, and ARMED positions and have means to safeguard against inadvertent operation of the control

device from the ARMED and from the ON positions. When either the cockpit control or the control at the cabin attendant's seat is ON the lights shall remain lighted upon interruption of the aircraft's normal electrical power source, except as noted in 3.4.2. When the cockpit control is in the ARMED position, the lights shall illuminate upon interruption of the aircraft's normal electrical power sources and remain illuminated except as noted in 3.4.2. Operation of the emergency lighting system shall not be dependent upon formal aircraft power.

3.6.1.2.2 Cabin control device. The cabin control device shall provide a means to safeguard against inadvertent operation and turn on the emergency light system, even with the cockpit control device in the OFF or ARMED position.

3.6.1.3 Aircraft configured to carry only passengers. The control unit used in the EEL on aircraft configured to carry only passengers shall conform to 3.6.1 and 3.6.1.1 through 3.6.1.2.2.

3.6.2 Power source. The integral power source in the control unit shall provide power for operation of the complete lighting subassembly. The energy supplied to each emergency lighting unit shall provide the required level of illumination for not less than 10 minutes at the critical ambient conditions after emergency landing (see 6.12.1). Subsequent to satisfactory preflight check and a 1-hour mission during which the power source is charged, the power source shall remain installed without receiving a charge for a period of one week and still provide sufficient power to enable the lighting subassembly to meet the performance requirements stated herein.

3.6.2.1 Shelf life. The power source shall have a minimum shelf life of two years and a minimum service life of two years. Non-emergency operation of the subassembly during its service life shall be limited to the performance of go/no-go power source checks (see 6.11).

3.6.2.2 Rechargeable power sources. If rechargeable power sources are used as the energy supply for the emergency lighting system, recharging of the power sources from the aircraft's main electric power system is permitted in accordance with MIL-STD-704 provided that the charging circuit is designed to preclude inadvertent power source discharge into charging circuit faults. It is desirable that the charging system for the emergency lighting system shall recharge within 1-hour to facilitate aircraft dispatch. However, achievement of this charging rate shall not reduce the system integrity.

3.6.3 Means of activation. The system shall be activated when any of the following events occur: The loss of power, aircraft immersion in water, aircraft inversion or crash. Aircraft operations such as take off and landing, taxi, maintenance or post flight power down, including application of external auxiliary power, shall not activate the EELS.

3.6.3.1 Rotary wing and tilt rotor aircraft. The lighting subassembly shall automatically activate when there is either a loss of power, aircraft immersion in water, aircraft inversion or crash.

3.6.3.2 Fixed wing and lighter-than-air aircraft. When the cockpit control is in the ARMED position, the lights shall illuminate upon interruption of the aircraft's main electrical power system and remain illuminated except as noted in 3.4.2.

3.6.3.3 Aircraft configured to carry only passengers. The EEL system used in aircraft that are configured to carry only passengers shall have means of activation that conform to 3.6.3, 3.6.3.1, and 3.6.3.2.

3.7 Reliability. The lighting subassembly shall be designed and constructed to meet or exceed a reliability of 99.9 percent for a mission (see 6.12.3). Lighting subassembly failure shall be defined as:

a. In the case of point light sources, the loss of capability to illuminate at least 90 percent of the point light sources of each light element to meet the performance characteristics specified in 3.5, such that no more than five point light sources per lighted linear foot are inoperable.

b. For continuous light sources, loss of illumination capability.

c. Inadvertent activation.

3.8 Maintainability.

3.8.1 Maintainability design. The lighting subassembly shall be designed to achieve at least the following maintainability levels:

a. The mean time to repair (MTTR) of the lighting subassembly at the organizational maintenance level shall be not greater than 15 minutes. Ninety percent of all corrective maintenance actions shall be accomplished within 30 minutes, excluding administrative and logistics delay time.

b. The direct maintenance man-hours per flight hour (DMMH/FH) at the organizational level for preventive and corrective maintenance shall be not greater than 0.0025.

3.8.2 Maintenance concept. Non-emergency operation of the subassembly during its service life shall be limited to the performance of go/no-go power source checks at the organizational maintenance level. The design shall facilitate the removal and replacement of failed light elements, control units or power source, as applicable, at the organizational maintenance level. No repair of failed light elements, control units, power source, connectors, or mounting hardware shall be authorized. Power source charging shall be accomplished at the intermediate maintenance level.

3.8.3 Support equipment. Removal and replacement of light elements, control units, or power source at the organizational level shall be performed using common hand tools. Support equipment at the organizational level shall consist of a portable tester which shall verify the operation of either one, or up to nine, installed lighting assemblies in an aircraft without operation of the engines or auxiliary power unit. A charger, used at the intermediate level, shall have charge rates such that the power shall be fully charged in less than ten hours. Design and construction of peculiar support equipment shall comply with MIL-PRF-28800.

3.9 Safety. The lighting subassembly safety sub-program of the systems effectiveness program shall be developed and conducted in accordance with MIL-STD-882. The design of the EELS shall be in accordance with the hazard and safety requirements of MIL-STD-1472.

3.10 Human engineering. The design for user and maintainability requirements shall be in accordance with MIL-STD-1472.

3.11 Dynamic crash loads. The light element(s), control unit, and mounting hardware shall withstand loads occurring in crashes experiencing 20g upward, downward, forward, and backward directions and 10g sidewards.

3.12 Environmental testing. The lighting subassembly shall operate after exposure to the following environmental conditions or extremes (see 4.5.2).

a. A hot temperature extreme of 71 °C (160 °F).

b. A cold temperature extreme of -39 °C (-39 °F).

c. Concurrent high humidity and temperature extremes of 95 percent and 65 °C (149 °F), respectively.

d. Repeated shock pulses of 11g's for 20 milliseconds.

e. A low atmospheric pressure equivalent to an altitude of 4,569 meters (15,000 feet).

f. Vibration as specified in 4.5.2.6.

g. Salt fog as specified in 4.5.2.5.

h. Conditions conducive to the growth of fungus as specified in 4.5.2.4.

i. Lighting subassembly shall operate in water ranging in temperature from -1 °C to + 40 °C (30 °F to 104 °F).

j. In air ranging in temperature from -1 °C to 71 °C (30 °F to 160 °F).

3.13 Electromagnetic interference (EMI). The subassembly shall comply with the requirements of MIL-STD-461. The lighting subassembly shall be considered susceptible to EMI if the light elements become illuminated when subjected to the susceptibility signal. This requirement shall apply whether the illumination is momentary (transient) or permanent in nature (see 6.10).

3.13.1 Susceptibility limits, The subassembly shall be tested to determine compliance with the following sections of MIL-STD-461.

a. CS114 Conducted Susceptibility, Bulk Cable Injection, 10 KHz to 200 MHz.

b. CS115 Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation.

c. CS116 Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 KHz to 100 MHz.

d. RS103 Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz.

3.14 Nomenclature, nameplate, marking, and decals. Nomenclature assignments and nameplate approval for equipment identification shall be in accordance with MIL-DTL-18307. Labeling shall be in accordance with MIL-STD-1472.

3.15 Interoperability & interchangeability. The lighting subassembly shall be tested to determine compliance with the electrical and mechanical interface requirements of each specific aircraft. Failure to comply shall result in redesign and retest in accordance with first article inspection requirements (see 4.3). Parts and components of the lighting subassembly shall be interchangeable or replaceable in accordance with MIL-I-8500.

3.16 Environmental stress screening. The control unit with integral power source shall continue to function when subjected to the tests of 4.5.9.1 and 4.5.9.2.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Development tests (see 4.2).

b. First article inspections (see 4.3).

c. Conformance inspections (see 4.4).

4.2 Development test program. The development test program shall include, as a minimum, the tests specified in table I, unless otherwise specified in the contract for individual escape exit components. The procuring activity reserves the right to witness developmental testing.

4.3 First article inspection. First article inspection shall consist of the tests specified in table I. The procuring activity reserves the right to witness all first article testing.

4.3.1 Samples. As soon as practicable after the award of either the contract or purchase order, the manufacturer shall submit four lighting subassemblies for test. The samples shall be of the same construction, workmanship, components, and materials to be used during production. The first article inspection samples shall be furnished to the Government as specified in the contract or purchase order (see 6.2.d).

4.4 Conformance inspections. Conformance inspections shall consist of the tests specified in table I. The procuring activity reserves the right to witness conformance tests.

TABLE I. Requirement and inspection matrix.

	Requirement paragraph	Test paragraph		
		Developmental	First article	Conformance
First article	3.2	N/A 1/	4.3	N/A 1/
Light element performance	3.3	4.5.3.1	4.5.3.1 4.5.3.2.1 4.5.3.2.15	N/A 1/
Physical characteristics	3.4	4.5.3.2.2 4.5.3.2.3 4.5.3.2.4	4.5.3.2.2 4.5.3.2.3 4.5.3.2.4	4.5.3.2.2 4.5.6
Functional characteristics	3.5	4.5.3.2.5 4.5.8	4.5.3.2.5 4.5.8	4.5 4.5.7 4.5.8 4.5.9
Control unit performance	3.6	4.5.3.1.3 4.5.3.2.6 4.5.3.2.7	4.5.3.1.3 4.5.3.2.6 4.5.3.2.7	4.5 4.5.3.2.6 4.5.6 4.5.7
Reliability	3.7	N/A 1/	4.5.5	N/A 1/
Maintainability	3.8	N/A 1/	4.5.4	N/A 1/
Safety	3.9	N/A 1/	4.5.3.2.8	N/A 1/
Human engineering	3.10	N/A 1/	4.5.3.2.9	N/A 1/
Dynamic crash loads	3.11	4.5.1	4.5.1	N/A 1/
Environmental testing	3.12	4.5.2.1 through 4.5.2.8	4.5.2.1 through 4.5.2.8	N/A 1/
Electromagnetic interference	3.13	4.5.3.2.10	4.5.3.2.10	N/A 1/
Nomenclature and nameplate	3.14	N/A 1/	4.5.3.2.11	N/A 1/
Markings and decals	3.14	N/A 1/	4.5.3.2.12	4.5.3.2.12
Interchangeability	3.15	N/A 1/	4.5.3.2.13	N/A 1/
Interoperability	3.15	N/A 1/	4.5.3.2.14	N/A 1/
Environmental stress screening	3.16	N/A 1/	4.5.9	N/A 1/

1/ N/A – Not applicable.

4.5 Methods of inspection.

4.5.1 Dynamic crash load tests. The lighting subassembly shall continue to operate when the loads of 3.11 are applied. The lighting subassembly shall be mounted to a rigid test frame through which the crash loads are applied.

4.5.2 Environmental tests. The lighting subassembly shall demonstrate compliance with the requirements of 3.12. The environmental effects and failure criteria of MIL-STD-810 shall apply to all tests in addition to specific failure criteria cited for each test. The laboratory test methods defined in part two of MIL-STD-810 shall be followed for all environmental tests. Standard ambient conditions shall be defined as follows: temperature: 25 °C ± 10 °C (77 °F ± 18 °F); relative humidity: 20 to 80 percent; and atmospheric pressure: site pressure.

4.5.2.1 High temperature test. The lighting subassembly shall be subjected to a high temperature test of MIL-STD-810 Method 501.4 in accordance with the following procedures:

Step 1 - Prepare the lighting subassembly in accordance with the test item configuration requirements of Method 501.4 of MIL-STD-810.

Step 2 - Raise the internal chamber temperature to 49 °C (120 °F).

Step 3 - Maintain internal chamber for 6 hours at 49 °C (120 °F).

Step 4 - Raise the internal chamber temperature to 71 °C (160 °F) within a time period of one hour and then maintain at that temperature for four additional hours.

Step 5 - Lower the internal chamber temperature to 49 °C (120 °F) within a time period of one hour.

Step 6 - Repeat steps 3, 4, and 5 two additional times (making a total of three 12-hour cycles).

Step 7 - Adjust the internal chamber temperature to 50 °C (132 °F) and maintain until temperature stabilization of the lighting subassembly is reached.

Step 8 - Operate the lighting subassembly until it is stabilized or as specified in the equipment specification and obtain results in accordance with test item operation requirements of Method 501.4 of MIL-STD-810.

Step 9 - Return the test item, nonoperating, to standard ambient conditions of 4.5.2 and stabilize.

Step 10- Operate and inspect the lighting subassembly and obtain results in accordance with test item operation and analysis of results requirements of Method 501.4 of MIL-STD-810.

The lighting subassembly shall be tested in the in-flight mode (see 6.12.2). Inadvertent illumination of the lighting subassembly during the high temperature test shall constitute a failure. The highest temperature at which the lighting subassembly shall be tested is

50 °C (132 °F). Operation of the lighting subassembly during the test shall be limited to step 8. The lighting subassembly shall be actuated and provide illumination of the specified intensity (see 3.3) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the high temperature requirement.

4.5.2.2 Low temperature test. The lighting subassembly shall be subjected to the low temperature test of MIL-STD-810, Method 502.4 in accordance with the following procedures:

Step 1 - Prepare the lighting subassembly in accordance with test item configuration requirements of Method 502.4 of MIL-STD-810.

Step 2 - Lower the internal chamber temperature to the storage temperature -57 °C (-79 °F) or as specified in the equipment specification and maintain for a period of 24 hours after stabilization.

Step 3 - Inspect the lighting subassembly in accordance with analysis of results requirements of Method 502.4 of MIL-STD-810.

Step 4 - Adjust the internal chamber temperature to -1 °C (30 °F) under which the lighting subassembly is designed to operate as specified in the equipment specification and maintain until temperature stabilization of the test item is reached.

Step 5 - Operate the test item until the lighting subassembly is stabilized or for the time specified in the equipment specification and obtain results in accordance with test item operation requirements of Method 502.4 of MIL-STD-810.

Step 6 - Return the lighting subassembly, nonoperating, to standard ambient conditions of 4.5.2 and stabilize.

Step 7- Operate and inspect the lighting subassembly and obtain results in accordance with the test item operation and analysis of results requirements of Method 502.4 of MIL-STD-810.

NOTE: The rate of temperature change (steps 2, 4, and 6) shall be not greater than 10 °C (50 °F) per minute.

The lighting subassembly shall be tested in the in-flight mode (See 6.12.2). Inadvertent illumination of the lighting subassembly during the low temperature test shall constitute a failure of the test. The lowest temperature at which the lighting subassembly shall be tested shall be -1 °C (30 °F). Operation of the lighting subassembly shall be limited to step 5 above. It shall be actuated and shall provide illumination of the specified intensity (see 3.3) for a period of 10 minutes. After completion of the test, failure of the lighting subassembly to pass this test shall constitute a failure of the low temperature requirement.

4.5.2.3 Humidity test. The lighting subassembly shall be subjected to the humidity test of MIL-STD-810, Method 507.4 in accordance with the following procedure:

Step 1 - When installing the lighting subassembly in the test chamber, it shall be connected in such a manner that will simulate service use to the maximum extent practical, with test connections made and instruments attached as necessary.

a. To test the effectiveness of protective devices, ensure plugs, covers, and inspection plates used in servicing are in whatever position is appropriate for the test and in their normal (protected or unprotected) mode during operation.

b. Make electrical and mechanical connections normally used in service, but not required for the test being performed (e.g., tests of items not running) with dummy connectors installed (connected and protected as in field/fleet use) so that all portions of the test item will receive a realistic test.

c. If the item to be tested consists of several separate units, these units may be tested separately, provided the functional aspects are maintained as required in section 3 of this document. If units are being tested together and the mechanical, electrical, and RF interfaces permit, position units at least 15 cm (6 inches) from each other or from the test chamber surfaces to allow for realistic air circulation.

d. Protect test items from unrelated environmental contaminants.

Step 2 - With the lighting subassembly installed in the test chamber, adjust the temperature to 23 ± 2 °C (73 ±4 °F) and 50 ± 5 percent relative humidity (RH) and maintain for 24 hours.

Step 3 - Adjust the chamber temperature to 30 °C (86 °F) and the RH to 95 percent.

Step 4 - Expose the lighting subassembly to 5 test cycles (see figure 1). Conduct lighting assembly performance checks during the periods shown.

Step 4a - During temperature change, use a tolerance of not greater than 3 °C (5 °F).

Step 4b - Use a rate of temperature change between 30 and 60 °C of not less than 8 °C per hour.

Step 4c - Do not use a temperature increase in this portion of the curve that is less than 10 °C per hour.

Step 5 - At the end of the required number of cycles, adjust the temperature and humidity conditions to standard ambient conditions of 4.5.2.

Step 6 - In order to prevent drying, within 15 minutes after steps 4, 4a, 4b, and 4c are completed, conduct an operational performance check. If the check cannot be completed within 30 minutes, recondition the lighting subassembly at 30 °C (86 °F) and 95 percent RH for one hour, and then continue the checkout.

Step 7 - Visually examine the lighting subassembly.

Inadvertent illumination of the lighting subassembly during the humidity test shall constitute a failure of the test. Subsequent to the completion of the humidity test, the lighting subassembly shall be removed from the test apparatus and within one hour tested to determine its capability to be actuated and to provide illumination of the specified intensity (see 3.3) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the humidity requirement.

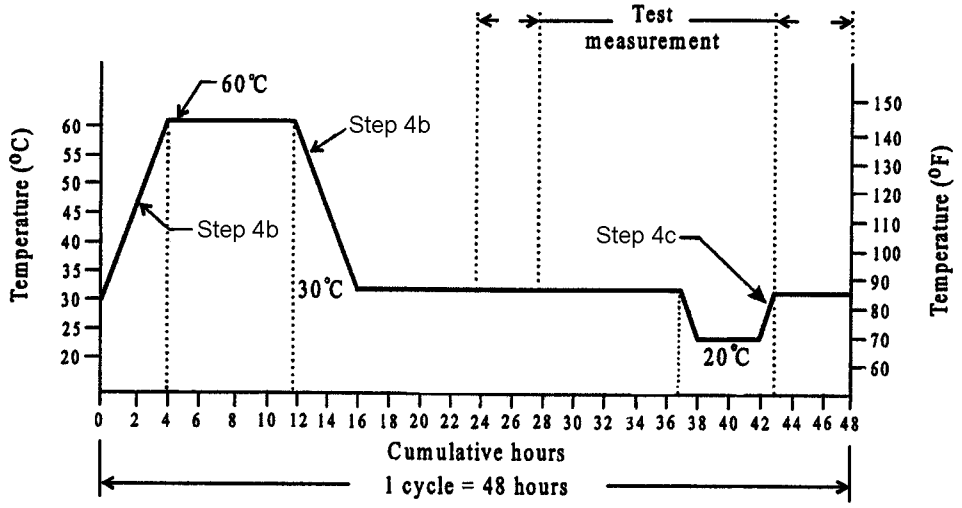

FIGURE 1. Aggravated temperature-humidity cycle.

4.5.2.4 Fungus test. The lighting subassembly shall be subjected to the fungus test of MIL-STD-810, Method 508.5. Fungal growth in or on any component of the lighting subassembly shall constitute a failure. Subsequent to the completion of the fungus test, the lighting subassembly shall be removed from the test apparatus and within one hour tested to determine its capability to be actuated and provide illumination of the specified intensity (see 3.3) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the fungus requirement.

4.5.2.5 Salt fog test. The lighting subassembly shall be subjected to the salt fog test of MIL-STD-810, Method 509.4. The lighting subassembly shall not be actuated during the test. After completion of the salt fog test, the lighting subassembly shall be removed from the test apparatus and shall be tested to determine its capability to be actuated and to provide illumination of the specified intensity (see 3.3) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the salt fog requirement.

4.5.2.6 Vibration test. The lighting subassembly shall be subjected to the vibration test of MIL-STD-810, Method 514.5, Procedure I, as follows:

a. The lighting subassembly shall be vibrated along each axis using the vibration test curves of figures 2, 3, and 4 and a test time per axis of 3 hours. See MIL-STD-810, Method 514.5 for definitions of variables used on figures 2, 3, and 4.

b. The lighting subassembly shall be hard-mounted on the test jig in the manner designed for aircraft installation and shall be tested while in the in-flight mode (See 6.12.2). The lighting subassembly shall not be actuated during the test and illumination of the lighting subassembly during vibration shall constitute a failure of the test. Subsequent to the completion of the vibration test, the lighting subassembly shall be removed from the test apparatus and tested to determine its capability to be actuated and to provide illumination of the specified intensity (see 3.3) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the vibration requirement.

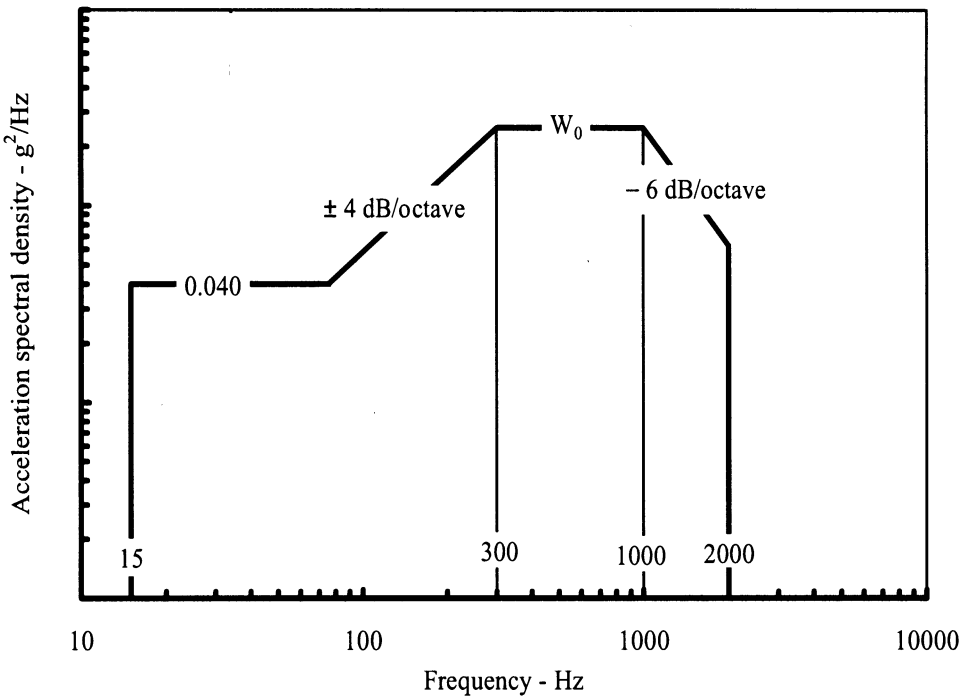

FIGURE 2. Jet aircraft vibration exposure.

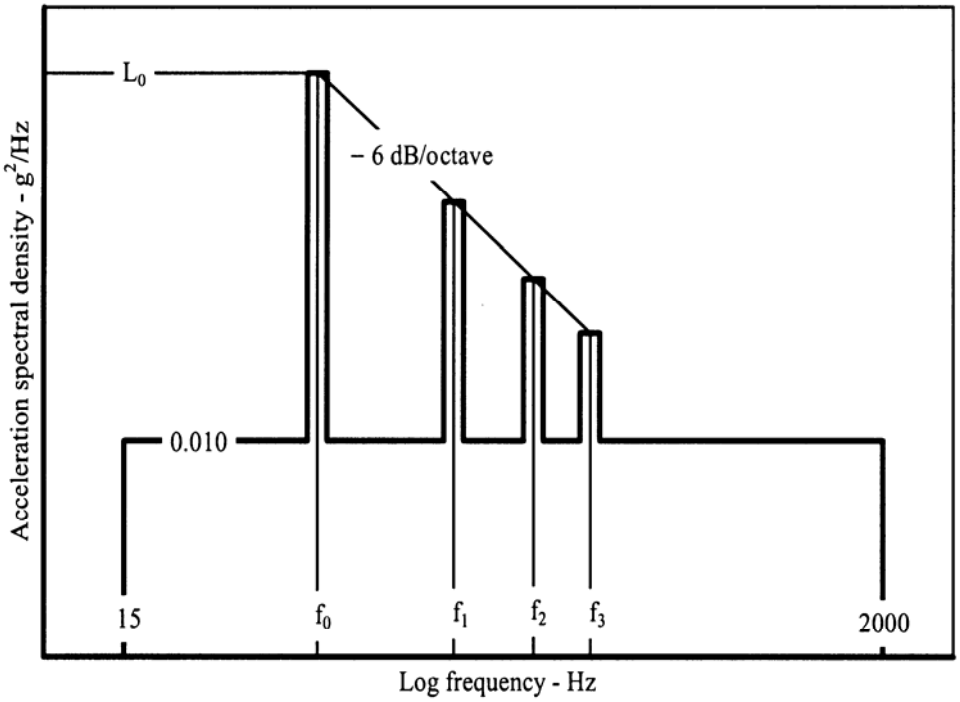

FIGURE 3. Propeller aircraft vibration exposure.

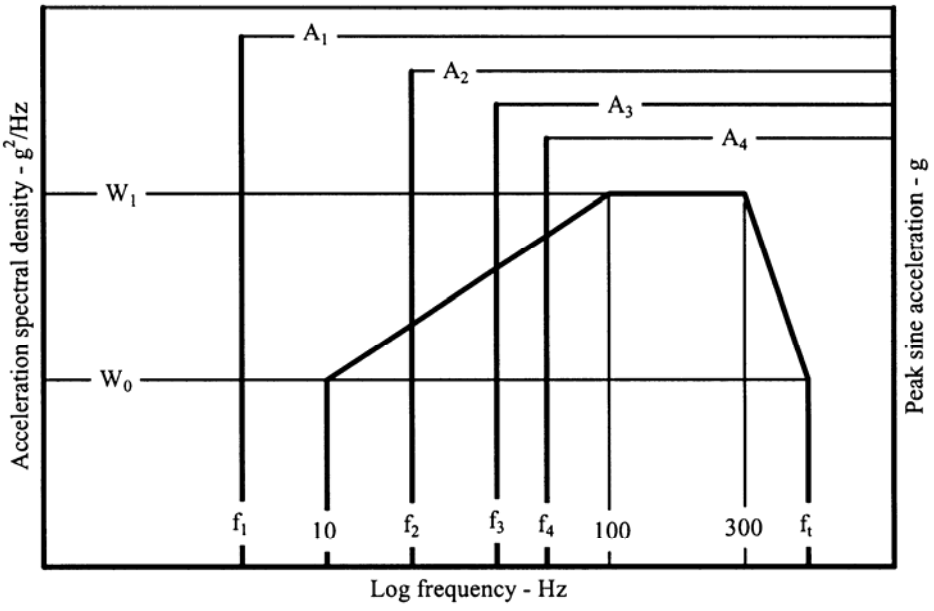

FIGURE 4. Helicopter vibration exposure.

4.5.2.7 Shock test. The lighting subassembly shall be subjected to the shock test of MIL-STD-810, Method 516.5C, Procedure I. The shock pulse shall be in accordance with MIL-STD-810 as shown on figure 5. The test shocks shall be applied with the lighting subassembly hard-mounted in the manner designed for aircraft installation. The lighting subassembly shall be tested in the in-flight mode (see 6.12.2). The lighting subassembly shall not be actuated during the test and illumination of the lighting subassembly during shock application shall constitute a failure. After completion of the shock test, the lighting subassembly shall be removed from the test apparatus and tested to determine its capability to be actuated and to perform as illumination of the specified intensity (see 3.3 and 3.5) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the shock requirement.

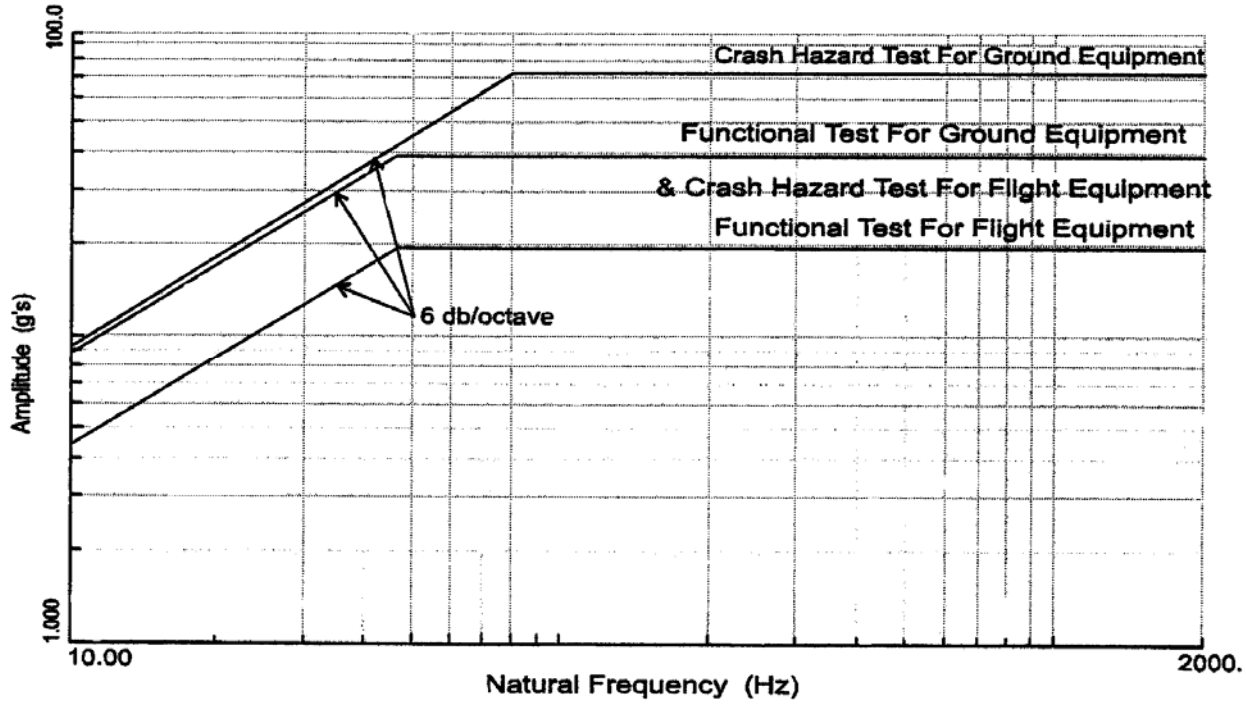

FIGURE 5. Test shock response spectrum (SRS) for use if measured data are not available (for MIL-STD-810, Method 516.5-13, procedure I functional shock and procedure V - crash hazard).

4.5.2.8 Low pressure test. The lighting subassembly shall be subjected to the low pressure (altitude) test of MIL-STD-810, Method 500.4, in accordance with the following procedure:

Step 1 - Prepare the lighting subassembly in accordance with the test item configuration requirement of Method 500.4 of MIL-STD-810 and maintain standard ambient temperature during the entire test (see 4.5.2).

Step 2 - Decrease the chamber pressure to 429.1 millimeters of Hg (16.9 inches of Hg or 15,000 feet above sea level) at a rate not to exceed 2,000 feet per minute and maintain for not less than one hour.

Step 3 - With the lighting subassembly not operating, return the chamber to standard ambient conditions of 4.5.2 at a rate not to exceed 2,000 feet per minutes.

Step 4 - Operate and inspect the lighting subassembly and obtain results in accordance with the test item operation and analysis of results requirements of Method 500.4 of MIL-STD-810.

The lighting subassembly shall be tested in the in-flight mode. Inadvertent illumination during Steps 1 to 3 shall constitute a failure. During step 4, the lighting subassembly shall be actuated and provide illumination of the specified intensity (see 3.3 and 3.5) for a period of 10 minutes. Failure of the lighting subassembly to pass this test shall constitute a failure of the low pressure requirement.

4.5.3 Performance tests.

4.5.3.1 Underwater performance tests. Underwater performance tests shall be conducted to evaluate the operation of the lighting subassembly while immersed in water. The lighting subassembly shall be installed in a manner and configuration using the requirements of 4.5.2.3, step 1.

4.5.3.1.1 Duration of operation. The lighting subassembly's duration of illumination in accordance with 3.5 shall be verified by operational demonstration (see 6.12.4).

4.5.3.1.2 Water operation. The ability of the lighting subassembly to satisfy the requirements of 3.5.1 and 3.5.2 shall be verified by operational demonstration with the lighting subassembly submerged in fresh or seawater at a depth of 50 feet (see 6.12.4).

4.5.3.1.3 Activation functioning. The activation of the lighting subassembly as described in 3.6.3 shall be verified by operational demonstration (see 6.12.4).

4.5.3.2 Land based tests.

4.5.3.2.1 Deactivation capability. The lighting subassembly shall demonstrate the capability of being deactivated prior to flight (see 3.5.1 and 3.5.2).

4.5.3.2.2 Size and location. The size and location of the lighting subassembly shall be measured to determine compliance with 3.4.

4.5.3.2.3 Mounting features. The lighting subassembly mounting feature shall be removed and replaced to determine compliance with 3.4.3.

4.5.3.2.4 Lighting element configuration. The lighting element configuration compliance with 3.4.4 shall be verified by operational demonstration (see 6.12.4).

4.5.3.2.5 Night vision goggle compatibility. Compliance of the lighting element configuration with 3.3 shall be verified using the lighting system night vision imaging system compatible examination requirements of MIL-L-85762.

4.5.3.2.6 Light assembly status indicator. Compliance of the light assembly status indicator performance with the requirements of 3.6.1.1 and 3.6.1.2, shall be verified through operational demonstration (see 6.12.4).

4.5.3.2.7 Means of activation. The activation performance of the lighting subassembly (see 3.6.3.1 and 3.6.3.2) shall be verified through operational demonstration (see 6.12.4).

4.5.3.2.8 Safety. The compliance of the lighting subassembly with 3.9 shall be verified by visual inspection.

4.5.3.2.9 Human engineering. Compliance of the lighting subassembly with 3.10 shall be verified by visual inspection and operational demonstration (see 6.12.4).

4.5.3.2.10 Electromagnetic interference. Compliance of the lighting subassembly with 3.13 shall be verified through operational demonstration (see 6.12.4).

4.5.3.2.11 Nomenclature and nameplates. The lighting subassembly nomenclature and nameplate compliance with 3.14 shall be verified by visual inspection.

4.5.3.2.12 Markings and decals. The lighting subassembly markings and decals compliance with paragraph 3.14 shall be verified by visual inspection.

4.5.3.2.13 Interchangeability. The lighting subassembly interchangeability performance compliance with 3.15 shall be verified by simulation and operational demonstration (see 6.12.4).

4.5.3.2.14 Aircraft resources compatibility. The lighting subassembly electrical and mechanical interface compliance with 3.15 shall be verified by simulation and demonstration.

4.5.3.2.15 Duration of operation. The lighting subassembly's duration of illumination in accordance with 3.5 shall be verified by operational demonstration (see 6.12.4).

4.5.4 Maintainability verification. Compliance of the lighting subassembly with 3.8 shall be verified by demonstration. MIL-HDBK-470, Method 9 may be used as a guide.

4.5.5 Reliability verification. The lighting subassembly shall demonstrate a reliability of 0.999 at the lower 90 percent confidence limit of the mission specified in 3.7. Reliability assessments and the cumulative results of development, demonstration, and operational tests shall be used to verify compliance with this requirement (see 6.2.f).

4.5.6 Visual examinations. The complete lighting subassembly shall be visually inspected (where applicable) to verify it is free from performance affecting defects which are not covered elsewhere in this specification, such as scratches, loose or missing components, obstructions, and other damage.

4.5.7 Quality performance tests. The activation and illumination of the lighting subassembly shall be verified through operational demonstration (see 6.12.4).

4.5.8 Photometric and radiometric tests. Compliance of each lighting subassembly with 3.3 shall be verified through operational demonstration (see 6.12.4).

4.5.9 Environmental stress screening. The control unit with integral power source shall be subjected to environmental stress screening consisting of random vibration and thermal cycling as a part of the assembly's acceptance test.

4.5.9.1 Random vibration. Prior to conducting the temperature cycling, random vibration shall be performed on each unit. All the hardware, including cables and connectors, shall be exposed to vibration. The vibration shall be random, or subject to procuring activity approval, pseudo-random or complex waveform vibration, for an accumulated time of 1 hour in the axis most susceptible to vibration excitation. All items being screened shall be hard-mounted (without shock isolators) and subjected to the vibration conditions of figure 6. The control accelerometer shall be located next to one of the mounting points of the lighting subassembly being screened. Equipment having a bandwidth of not greater than 10 Hz for vibration frequencies up to 500 Hz, and 100 Hz for vibration frequencies above 500 Hz shall be used for the control and analysis of the power spectral density. The lighting subassembly being screened shall be energized during vibration, and operationally representative input signals shall be applied. The lighting subassembly shall be visually examined to verify that the output continuously satisfies 3.3. All failures occurring during the process shall be corrected and the screening resumed.

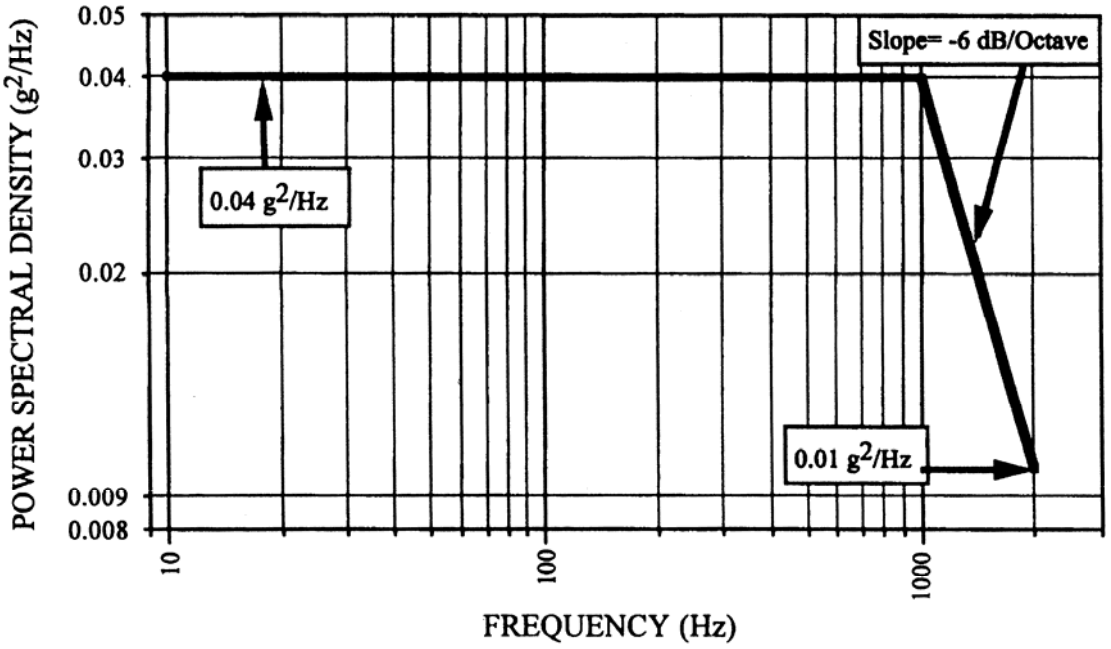

FIGURE 6. Random vibration environmental screening curve.

4.5.9.2 Temperature cycling. Each lighting subassembly shall be subjected to the temperature cycling shown on figure 7. Three temperature cycles are required. The temperature rate of change shall be not less than 5 °C (11 °F) per minute. Equipment power shall be turned

on and off at the points indicated on figure 7. During every temperature cycle the lighting subassembly shall continue to satisfy the requirements of 3.3. The dwell time shall be 80 percent of the time required for the largest electrical or electronic part to become temperature stabilized. Temperature stabilization will have been attained when the temperature of the part of the time being screened considered to have the longest thermal lag reaches a temperature within 2 °C (4 °F) of the specified temperature, except that all circuit boards and lighting elements shall be within 1 °C (2 °F). Exceptions may occur in large items. When changing temperatures, the temperature of the chamber air may be adjusted up to 5 °C (11 °F) beyond the desired end point for a period of up to 1 hour to reduce stabilization time, provided that the stabilization requirements of this paragraph are ultimately attained relative to the specified end point temperature, and provided the extended chamber temperatures will not cause damage to the lighting subassembly being screened. It is permissible to recharge the power source during cycling while the unit is powered off.

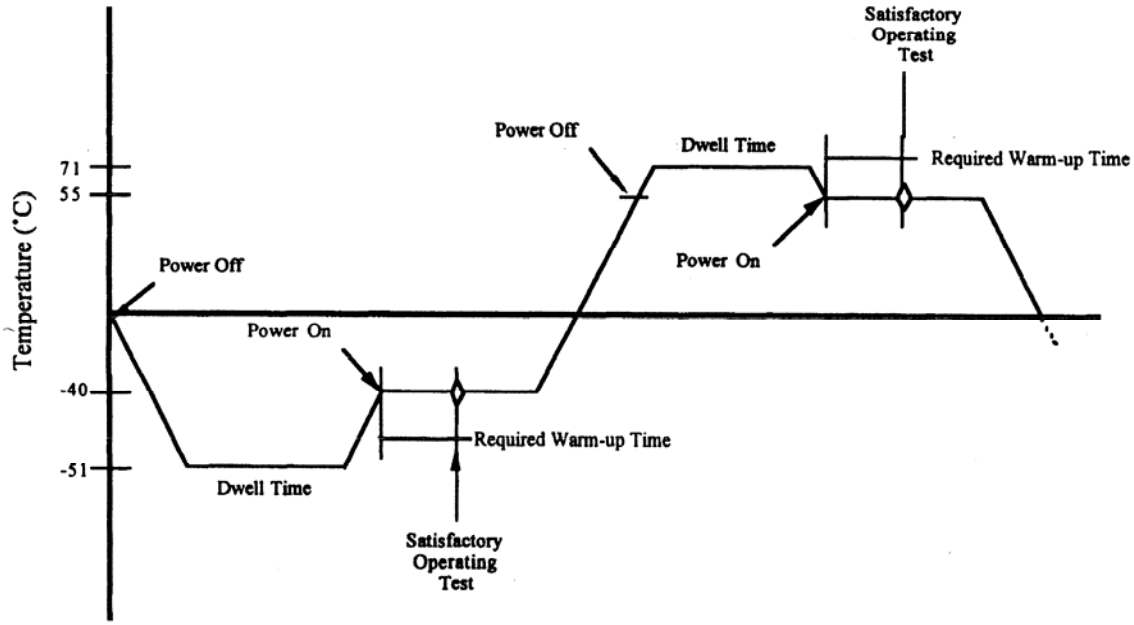

FIGURE 7. One cycle of the temperature screening curve.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory.)

6.1 Intended use. It is intended to install the lighting subassembly in all aircraft in which passengers or crew are not located immediately next to an emergency escape exit or are mobile and may move about the aircraft in flight. Lighting assemblies conforming to this specification are used in military systems subject to extreme environmental conditions. There are no commercial applications for these assemblies.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Drawings.

c. First article (see 4.3).

d. Requirements for furnishing first article samples (see 4.3.1).

e. Data required from contractor for organizational maintenance plans (see 4.5.4).

f. Data required from contractor to evaluate and measure the reliability of the lighting subassembly (see 4.5.5).

g. Packaging requirements (see 5.1).

6.3 Luminance requirement & lumens to foot-lambert conversion. The following calculation shows the relationship between the original requirement stated in lumens and the current foot-lambert requirement. Luminance measurement devices display measured levels in foot lamberts. The 1984 MIL-L-85676 specification (3.3.1.1, Light element performance) stated "2 lumens per lighted linear foot per 3.63 steradians for a projected one-half-inch minimum width from any viewing angle within ± 65 degrees of normal is required." To avoid the need for units conversion, the luminance requirement in this specification is stated in foot lamberts.

LUMINANCE

.29 ft-lamberts = 1 lumen/sq meter/steradian

.29 ft-lamberts = .0929 lumens/sq foot/steradian

1.0 ft-lambert = .32 lumens/sq foot/steradian

Considering the minimum width of one-half inch, the conversion from lumens to foot-lamberts is as shown.

The area of the light element is:

A = (12in)(.5in)

= 6 sq in

Luminance for a light element which has an area of 6 square inches in 1 linear foot

= 2 lumens/(6 sq in/144 sq in)/3.63 steradian

= 13.43 lumens/sq ft/steradian

[1 ft-lambert = .318 lumens/sq ft/steradian]

therefore, luminance = 42.25 ft-lamberts

6.4 Smoke considerations.

6.4.1 Considerations for smoke below four feet. There is concern regarding the possible condition of obscuring smoke below the 4 foot level, since certain possible scenarios result in smoke at the floor level. For example, on opening exits, the cabin effectively becomes a chimney, smoke becoming distributed from ceiling to floor. Research and development since issuance of new FAA requirements for floor proximity emergency lighting have resulted in new devices and systems that provide emergency egress lighting under such conditions that is helpful, FAA Advisory Circular AC 25.812-1A. Copies of FAA Advisory Council AC 25.812-1A are available at http://www.faa.gov/library/online_libraries. The following recommendations can be made:

a. A narrow beam of bright light has greater visibility range through an optically dense medium than a bright spherically emissive or planar source of light; this is because a narrow beam can result in single scattering, whereas a large cone angle beam can result in multiple scattering.

b. Large foreground and background scattering of light compromise the contrast ratio of a source relative to its surroundings, in turn compromising its utility as a marker.

c. Point sources of light, such as highly intense incandescent filaments, if properly spaced to allow visual discrimination between each successive light against the scattered background, can be used beneficially to mark the edges of the aisle.

d. Point sources of light with narrow beams, such as LEDs, can similarly be used to mark the edges of the aisle, and in a dense smoke exhibit a minimum of scattered light with a maximum contrast ratio, thereby having a helpful visibility range.

e. Planar sources, such as small electroluminescent strips, are also useful if properly spaced to overcome compromising foreground glare, thereby improving visual discrimination of each successive marker panel.

f. It is the visibility of the light source itself that is to be exploited, rather than any reflected light, for drastically adverse optical conditions; the brightly glowing filament or chip may be all that remains visible in a dense smoke condition.

The recommendations above for floor proximity lighting below 4 ft for a smoke condition apply also to signs. Many aircraft at exit doors and overwing exits have very little space for signs. The indicators for such exits become dictated by such constraints to whatever is practical, such as a change of color. An important consideration is that signs with letters spelled out by beamed point sources of light have greater visibility and legibility range through smoke than back or front lighted signs for the reasons summarized above (see 3.3.2.2).

6.4.2 Recommendations for a compliant floor proximity system. For designing a complying floor proximity emergency escape path marking system, additional guidance is given here. The FAA Advisory Circular AC 25.812-1A provides a detailed summary of what is needed to demonstrate compliance with this rule. It also lists some acceptable working devices and systems (see 6.4.1).

6.4.2.1 General recommendations.

a. Strobe lights are not recommended for use, but modulating between high and moderate levels of brightness at an exit is a good attention-getter and exit indicator.

b. No directional sequencing indicators to specific exits should be used except where a particular exit needs such an indicator.

c. Indicators of nearby exits can be by color difference.

d. Sufficient illumination should be provided at the exits, cross aisles and longitudinal aisles.

e. Spacing of the light elements should be determined by their capability to illuminate their area of the aisle.

f. Allowances should be defined for minimum equipment list operating requirements.

g. Ready accessibility for ease of replacement must be provided.

h. Remotely controlled devices must not interfere with, nor be interfered with, by other aircraft systems.

i. Handles and methods for opening emergency exits should be illuminated to allow for identification when EELS is active.

6.4.2.2 Specific recommendations for seat and floor mounted systems. Each system must be designed for the following:

a. Be sufficiently resistant to damage by equipment.

b. Not have visibility obstructed by equipment.

c. Not be damaged by passenger's footwear, or cleaning.

d. Not have wiring vulnerable to damage by seating installation changes.

e. Not have any protrusions that can interfere with passenger traverse, especially when crossing.

f. Not compromise the sealing of nontextile floor covering to the floor when mounting path markers on the floor.

g. Not compromise the energy attenuation systems of the seating systems.

6.5 High temperature, low temperature, and humidity verification testing.

a. During temperature change, use a tolerance of not greater than 3 °C (5 °F).

b. Maintain the relative humidity at 95 ± 4 percent at all times except that during the descending temperature periods the relative humidity may drop to as low as 85 percent.

c. Use a rate of temperature change between 30 and 60 °C (86 and 140 °F) of not less than 8 °C (15 °F) per hour during the step 4b portion of the curve on figure 1.

d. Do not use a temperature increase during the step 4c portion of the curve on figure 1 that is less than 10 °C per hour.

6.6 Sharing of general cabin illumination sources. While each lighting subassembly is required to operate independently of other lighting subassemblies, fixed wing emergency lighting and main lighting systems may share the same source of general cabin illumination (see 3.1).

6.7 Exit sign colors. If an exit sign is self-illuminated by other than electrical means, the colors may be reversed (see 3.3.2.2).

6.8 Light element geometry for rotary wing and tilt-rotor aircraft. In addition to using a "U" configuration specified in 3.4.1.1, the light element assembly may be comprised of a left, right, and top light element or continuous U shape. (See 3.4.1.1)

6.9 Emergency lighting system activation. The design of the emergency lighting system should only allow the activation of the flight deck emergency lighting system when main aircraft is off (see 3.6.1.2).

6.10 Causes of EMI variations. MIL-STD-461 requirements are dependent on numerous variables including, but not limited to, the power supplied to the lighting subassembly, the system design, and even mission requirements of the aircraft on which the lighting subassembly is installed (see 3.13).

6.11 Shelf life. This specification covers items where shelf life is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order. The shelf-life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from *DoD 4140.27-M; Shelf-life Management Manual,* or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points (ICPs), and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: http://www.shelflife.hq.dla.mil/.

6.12 Definitions.

6.12.1 Critical ambient conditions. The most extreme environment the system is expected to see during service, as defined in the aircraft detail specification.

6.12.2 In-flight mode. When the system is armed by the crew and charge voltage is present. Charge voltage is present when the permanent magnet generator is turning and supplies power for charging the battery contained within the lighting subassembly.

6.12.3 Mission. A four-hour flight with operation in the inflight mode (operational standby) and on/off cycling followed by successful operation under the conditions specified in 3.5.1 or 3.5.2 with the performance characteristics of 3.3.

6.12.4 Operational demonstration. Testing done to simulate conditions that the EEL system or its components will face in aircraft applications. For further information see test set-up requirements of MIL-STD-810.

6.13 International standardization agreement implementation. This specification implements STANAG-3870.2, “Emergency Escape/Evacuation Lighting.” When amendment, revision, or cancellation of this specification is proposed, the preparing activity must coordinate the action with the U.S. National Point of Contact for the international standardization agreement, as identified in the ASSIST database at http://assist.daps.dla.mil.

6.14 Subject term (key word) listing.

Control unit
Escape path marking
Fixed wing aircraft
General cabin illumination
Illumination
Integral power source
Passenger carrying aircraft
Rotary wing aircraft

6.15 Changes from previous issues. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Preparing activity:

Navy - AS
(Project 6220-2006-002)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.