

OCEAN ENGINEERING DIVISION
UNITED STATES COAST GUARD
WASHINGTON, D. C.

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SPECIFICATION FOR THE 120 VAC,
250 W LAMPCHANGER FOR
MARITIME AIDS TO NAVIGATION

SPECIFICATION G-EOE-266C

1. SCOPE

1.1 Scope. This specification is for a 120 VAC, 250 W, four-place lampchanger for use on U.S. Coast Guard aids to navigation.

2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-E-917 Electrical Power Equipment, Basic Requirements for

MIL-E-16400 Electronic Equipment, Naval Ship and Shore

MIL-E-17555 Electronic and Electrical Equipment Accessories and Repair Parts, Packaging and Packing of

MIL-G-45204 Gold Plating, Electroplating

MIL-R-5757 Relays, General Specifications for

STANDARDS

FEDERAL

FED-STD-595 Colors

MILITARY

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-454 Standard General Requirements for Electronic Equipment

MIL-STD-810 Environmental Test Methods

DRAWINGS

U.S. Coast Guard

EOE-120773 120 VAC, 250 W, 4-Place Lampchanger

EOE-120774 120 VAC, 250 W, 4-Place Lampchanger Focus Fixture and Lamp

In the event of conflict between the detailed requirements of this specification and those of supporting documents, this specification shall govern. Copies of Federal and Military

Specifications and Standards may be obtained from Commanding Officer, U.S. Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120, Attn: (CDS). All requests should include title and identifying number for each publication.

3. REQUIREMENTS

3.1 General. The lampchanger shall support four lamps in a turret. Only the lamp in the operating (uppermost) position shall burn when voltage is applied. The turret shall automatically rotate a new lamp into the operating position when the operating lamp fails and shall complete the electrical power circuit to the new lamps. Power to change lamps shall be provided by an electric motor. Each activation of the stepping mechanism shall allow turret rotation to bring the adjacent lamp into the operating position. The Contractor shall fabricate, assemble, test and deliver the designated four-place lampchanger as defined in this specification.

3.1.1 First Article Qualification. The Contractor shall furnish four preproduction lampchangers for first article tests within 150 days after the contract is awarded. Each of the preproduction lampchangers, first articles, shall pass all the first article tests listed under section 4.2 to the satisfaction of the Contracting Officer. The testing procedures shall be in accordance with section 4.1. The first article tests shall be completed within 30 days after being initiated, and the test records shall be submitted to the Contracting Officer within 40 days after tests are initiated. The Contracting Officer will provide written authority to proceed with the production run within 30 days after the Contractor has furnished complete and detailed records of these tests.

3.1.2 Standardization. The production line lampchanger furnished under this specification shall be a product which has passed the first article qualification tests. The materials, parts, design, and operation, and the manufacturing of the prototypes (first articles) and the production lampchangers shall be identical unless the differences are approved in writing by the Contracting Officer. Within 150 days after the contract is awarded, the Contractor shall furnish a list of proposed differences between the first articles and the production lampchangers for the Contracting Officer's approval. The Contracting Officer will reply within 30 days after receipt of the list. The Contracting Officer may require repetition of any or all of the first article tests on four production lampchangers before the proposed changes are accepted. First article tests on production lampchangers, if required, shall be conducted in accordance with sections 4.1 and 4.2. If subsequent changes of production lampchangers are desired by the Contractor to correct design, the Contracting Officer may require repetition of any or all of the first article tests before the proposed changes are accepted. These tests shall be in accordance with sections 4.1 and 4.2.

3.2 Electrical

3.2.1 Terminals. Three conterminous terminals (with a common boundary) shall be provided, marked and ordered--left to right or top to bottom--as indicated herein. These terminals shall have separate distinctive color insulators and permanent labels that will remain distinguishable for at least 10 years in a marine environment. A label reading "DANGER 120 VAC", in red letters which are 1/2 in. high on a white background, shall be placed beside the terminal. This warning label and the terminal markings and colors shall not deteriorate when the lampchanger is subjected to the first article tests.

<u>Terminal</u>	<u>Function</u>	<u>Color</u>
LAMP	Input 120 VAC, 60 Hz power, line side to lamp circuit	red
MOTOR	Input 120 VAC, 60 Hz power, line side to motor and sensing circuit	black
NEUTRAL	Input 120 VAC, 60 Hz power, common side	white

The LAMP and MOTOR terminals shall be adjacent to each other.

3.2.1.1 Grounding Terminal. A grounding terminal shall be provided on the same surface and side of the lampchanger as the LAMP, MOTOR, and NEUTRAL terminals. The grounding terminal shall electrically connect the lampchanger frame, turret and cover. Insulators need not be used on this terminal. The grounding terminal shall be an 8-32 stainless steel screw with a slotted head. It shall accept a 3/8 in. wide hook-tongue spade lug for a No. 8 stud. This terminal shall be labeled GROUND, and the area about it color green. The green shall correspond to color No. 14109 in FED-STD-595.

3.2.2 Modes of Operation. The lampchanger shall have two modes of operation. In the unmonitored mode the LAMP and MOTOR terminals shall be electrically connected by a shorting strap and the lamp out sensing and turret activation shall be accomplished with the same voltage that is applied to the lamp circuit at the LAMP and NEUTRAL terminals. In the monitored mode the LAMP and MOTOR terminals are electrically isolated by at least 10 Megaohms and independent voltages shall be applied at the LAMP and MOTOR terminals with a common NEUTRAL terminal.

3.2.2.1 Unmonitored Mode Electrical Requirements. The lampchanger must perform as specified for all continuous or pulsed voltages between 100 and 130 VAC and for all frequencies between 57 and 63 Hz. For pulsed conditions, the minimum on time per flash is 0.30 sec. and the maximum off time between flashes is 6.00 sec. For continuous conditions, the lamp will burn continuously. The input power, pulsed or continuous, shall be connected to the LAMP and NEUTRAL terminals. The lampchanger

input impedance between the LAMP and NEUTRAL terminals shall be less than 5K ohms at all times, until the last spare lamp fails, to ensure sufficient loading of the power source. There shall be an open circuit, at least 10 Megaohms, between the lampchanger LAMP and NEUTRAL terminals within two revolutions of the turret after all lamps have failed. The lampchanger input impedance between the MOTOR and NEUTRAL terminals shall be at least 10 Megaohms when the motor is not driving the turret (a good lamp is in the operating position or no power is applied to the lampchanger). The motor shall rotate the next lamp into the operating position in less than 1.0 min. after the operating lamp fails.

3.2.2.2 Monitored Mode Electrical Requirements. The lampchanger must perform as specified for all continuous voltages, between 100 and 130 VAC and for all frequencies between 57 and 63 Hz applied to the MOTOR and NEUTRAL terminals and for all pulsed voltages between 100 and 130 VAC and for all frequencies between 57 and 63 Hz applied to the LAMP and NEUTRAL terminals. The frequency for the LAMP and MOTOR terminals shall be the same. The motor shall be driven continuously when the operating lamp fails or when no lamp is in the operating position. The motor shall rotate the next lamp into the operating position in less than 6.0 sec. after the operating lamp fails. The minimum pulsed on time for a lamp in this mode of operation shall be 0.40 sec. The burnout interval shall be estimated to be 0.1 sec which allows 0.3 sec. for the motor to drive the turret on pulsed power. The lampchanger input impedance between the MOTOR and NEUTRAL terminals shall be at least 10 Megaohms when the motor is not driving the turret (a good lamp is in the operating position or no power is applied to the lampchanger). The lampchanger input impedance between the LAMP and NEUTRAL terminals shall be less than 5K ohms at all times, until the last spare lamp fails, to ensure sufficient loading of the power supply. There shall be an open circuit, at least 10 Megaohms, between the lampchanger LAMP and NEUTRAL terminals within two revolutions of turret after all lamps have failed. The maximum off time between flashes for pulsed voltages shall be 1.0 min.

3.2.3 Lamp Out Sensing. The lampchanger shall have a sensor for detecting a failed lamp in the operating position and for activating the turret rotation. Sensing and turret activation shall be accomplished with the available power specified in section 3.2.2.1 and 3.2.2.2. The lamp out sensing shall be accomplished by a lamp current sensing device. A spare lamp shall be rotated into the operating position within 1 min after the operating lamp fails for the unmonitored operation mode and within 6 sec. in the monitored operation mode. Cessation of applied power for any interval of time, as in daylight controlling and power outages, shall not cause turret rotation when the power is off or when the power is restored.

3.2.3.1 TEST Button. A push button, that is labeled TEST, shall be provided that either (1) opens and completes the lamp circuit or (2) controls the electrical signal from the current

sensing device in the lamp circuit which is used for lamp out sensing. If the push button switch is in the lamp circuit, the failure mode of the push button device shall complete the lamp circuit. If the push button switch is not in the lamp circuit, the failure mode of the switch shall not hinder normal operation of the lampchanger. The TEST button shall test all the lamp out sensing logic circuitry and shall not override any logic circuitry. The TEST button shall simulate a lamp filament failure when the button is depressed and be deactivated within 0.20 sec. after the button is released. When the power described in 3.2.2.1 and 3.2.2.2 is applied to the lampchanger terminals depressing the TEST button makes the lampchanger sense a bad lamp and rotates the next adjacent lamp into the operating position. The lamp stops in the operating position and lights if the button is released any time greater than 0.2 sec. before the spare lamp reaches the operating position. The relamping time shall be less than 1 min. for the unmonitored mode of operation and shall be less than 6.0 sec for the monitored mode of operation after the TEST button is depressed. The TEST button shall be placed where the user will not contact the lamps and the power terminals. The TEST button shall not be a hazard to the user. The TEST button when depressed shall override any turret stop mechanism, for example an end of search stop, so the first lamp of the turret can be driven into the operating position by the motor.

3.2.4 Lamp Circuit. The lamp circuit shall consist of the LAMP terminal, operating lamp, NEUTRAL terminal, lamp out current sensing device, and electric wiring and contacts necessary for the operation of the lampchanger. The TEST button contacts may also be in the lamp circuit. The voltage drop in the lamp circuit, excluding the lamp, shall not exceed 0.50 VAC if the TEST button opens the lamp circuit or 0.30 VAC if the TEST button does not open the lamp circuit for 120 VAC applied to the LAMP and NEUTRAL terminals. The current in the lamp circuit must be at least 2.03 A when each voltage is measured. The operating lamp shall be replaced by a 57.0 ohm pure resistive load when these measurements are made. The entire lamp circuit and the entire motor circuit shall be electrically isolated from the lampchanger turret, frame, and housing. The electrical contacts between the turret and the frame shall be housed or located so that they are not exposed and do not present a safety hazard.

3.2.5 Lamp. The lampchanger shall support the 120 VAC, 250 W, single T-4 envelope, tungsten-halogen lamps with double contact, bayonet candelabra bases. Commercially available lamps suitable for use are the General Electric Q250 CL/DC, Sylvania 250 Q/CL/DC, and Westinghouse 250 Q/CL/DC. The Contractor shall supply the lamps required for tests that are required by this specification. The lampchanger shall support the lamp described by U.S. Coast Guard Drawing No. EOE-120774, which is provided as enclosure (1). This drawing describes the "ideal" lamp.

3.2.6 Turret Control Circuit. The motor circuit shall be in parallel with the lamp circuit. The motor circuit shall not

consume more than the equivalent of 10 W of continuous power when the motor is changing lamps. The electrical circuit to control the turret rotation shall be in parallel with the lamp circuit. This control and sensing circuit shall not consume more than the equivalent of 5 W of continuous power when a good lamp is in the operating position. The motor and control circuit shall perform as specified for both and continuous electrical power as stated in sections 3.2.2.1 and 3.2.2.2.

3.3 Mechanical

3.3.1 Lamp Focal Position. The distance from the interface of the lampchanger base and the mounting bracket to the lamp focal position (the filament center of the operating lamp) shall be 6-1/2 in. (16.51 cm). The center of the lamp filament shall be equidistant from the four mounting holes, which described in section 3.3.10 and enclosure (2).

3.3.2 Filament Placement. The center of the filament of an ideal lamp shall be placed at the lamp focal position, with a tolerance of 1/16 in horizontally and 1/16 in (0.1588 cm) vertically for each turret position.

3.3.3 Dimensions. The lampchanger, without lamps, shall fit inside a vertical cylinder which is not more than 5 in. (12.70 cm) in dia. This cylinder shall be coaxial with a vertical line through the lamp focal position. The lampchanger shall rotate the center of each lamp filament in a circle whose radius shall not exceed 2-1/2 in (6.35 cm). The lamp focal position shall be the highest point of this circle. With the specified lamps installed in the lampchanger, it shall be a size, shape, and composition suitable and convenient for use in the following Coast Guard optics: The vented 250 mm lantern (Amerace Corporation), the 300 mm lantern (Tideland Signal Corporation), and the DCB-10 (Crouse-Hinds Company). The maximum dimensions and the configuration of the lampchanger are shown in U.S. Coast Guard Drawing No. EOE-120773, which is provided as enclosure (2).

3.3.3.1 Obstructions. The lampchanger shall be constructed so that any obstruction (excluding the spare lamp envelopes) to light emanating from the operating filament shall be confined to a vertically oriented cone whose apex is at the bottom of the filament of the "ideal" lamp and which has a interior angle at the apex of not more than 74_ measured in a vertical plane. The apex of the 74_ vertical cone shall be the highest point on the cone.

3.3.4 Turret. No portion of the lampchanger shall be damaged by a 10 lb (44.48 N) rotational force applied in any direction to the bulb of an installed lamp. The turret shall rigidly support the lamps with double-contact bayonet candelabra bases spaced at equal intervals about the turret. The filament of the operating lamp shall be vertical and perpendicular to the base of the lampchanger. The lamp shall be held in a spring-loaded socket by the two base lock pins on the lamp. The lamps shall

be securely held by the sockets under the conditions specified in section 3.4.d. This lamp locking mechanism shall be such that lamps can be easily installed and removed by personnel wearing heavy winter gloves. The entire face of the turret supporting the lamp in the number one position, first operating lamp, shall be colored red. The turret shall be made of metal. Nonmetallic parts of the turret shall function as electrical insulators and shall not be required for structural support or mechanical performance.

3.3.4.1 Rotation. The stepping mechanism shall allow rotation of the adjacent lamp into the operating position to relamp the light whenever the operating lamp fails. The stepping mechanism shall be capable of manual activation by the TEST button described in section 3.2.3.1 to test each lamp in the operating position while AC power is applied. The turret rotation mechanism shall not cause breaking, shift the position in the bulb, or change the shape of filaments in the standby lamps.

3.3.5 Construction. Workmanship shall be in accordance with requirement 9 of MIL-STD-454.

3.3.6 Terminals. There shall be three 8-32 screws terminals on the lampchanger. The terminals shall be convenient for the removal and attachment of hook-up wires when the lampchanger is installed in a lantern. All terminals shall be enclosed in slotted insulators sized to accept two 3/8 in. (0.95 cm) wide, hook tongue spade lugs for a No. 8 stud. The terminal board shall be mounted on a plane surface or convex surface, with the access directions to the slotted unobstructed for a space of 1-1/2 in. along the mounting surface and above the mounting surface when the lampchanger is installed in a 250 mm lantern. The heads of screws and obstructions in this restricted region of the mounting surface shall not project more than 0.62 in (0.157 cm) above the mounting surface. The slotted insulators shall be molded of colored dielectric material, in accordance with the color code of section 3.2.1. With two of the above lugs in place, the top of the terminals screws shall not project above the insulator's top. Terminal screws shall have slotted heads, be made of stainless steel, and have at least 3/8 in. (0.95 cm) of thread. The bottom of the terminal screw head shall fit flush to the terminal board surface when a lug is not in place.

3.3.6.1 Shorting Strap. The lampchanger shall have a shorting strap that electrically connects the LAMP and MOTOR terminals. The shorting strap shall be removable only by removing completely the LAMP and MOTOR terminal screws. The shorting strap shall be insulated where it projects out of the side or over the top of the terminal insulator. The shorting strap shall be capable of carrying 3 A continuously. Each lampchanger shall have a shorting strap installed on the LAMP and MOTOR terminals.

3.3.7 Weight. Each lampchanger shall weigh less than 7 lb (have a mass less than 3.18 kg) without the lamps.

3.3.8 Materials. Materials used shall be galvanically compatible to minimize electrolytic action. Dissimilar metals shall not be used in contact with one another. Dissimilar metals are defined in paragraph 3.5.7.8 of MIL-E-16400 (Navy). Use of stainless steel screws in tinned brass terminals is acceptable. Moving electrical contacts between the frame and turret shall be gold plated, in accordance with MIL-G-45204, and shall be Type II, Grade C, Class 2.

3.3.9 Serial Number. Each lampchanger shall have a unique serial number with up to 10 digits. Four of the digits shall identify the specific lampchanger and the last four digits shall identify the date of manufacture. The Contractor shall request that the Contracting Officer furnish the serial numbers.

3.3.10 Mounting. The lampchanger shall have four holes tapped for 10-32 screws positioned at the corners of a 3 by 5/8 in. (7.620 by 1.588 cm) rectangle centered below the focal point. A line joining the centers of the holes, which are separated by 3 in. (7.620 cm), shall be parallel to the turret's rotational plane. The four holes in the lampchanger base shall be tapped for 10-32 threads. The placement tolerances for the four holes shall be 0.005 in. (0.0127 cm). The lampchanger shall be compatible with the lampchanger support assembly used in the Coast Guard standard lantern with a 250 mm diameter acrylic lens. The assembly is available from Amerace Corporation and can be identified as part number 2101-134. Each of the four holes shall extend through the mounting base. Four 10-32 stainless steel screws, 1/2 in. (1.27 cm) long, shall be supplied with each lampchanger. The base of the lampchanger shall be at least 3/8 in (0.95 cm) thick. The lampchanger need not be usable with the existing mounting brackets used in the 300 mm lantern and the DCB-10.

3.3.11 Nameplate. An etched aluminum nameplate, at least 1/32 in. thick and legible for the life of the lampchanger, shall be permanently affixed to the exterior of the lampchanger. At least six screw nails with at least 3/32 in (0.238 cm) of thread shall secure the nameplate to the lampchanger frame. The nameplate shall not deteriorate or become loose when the lampchanger is subjected to the first article tests. The information required is:

COMPONENT	LAMPCHANGER
TYPE	CG4P-120
FEATURE	120 V-4PL
IDENTIFIER	Serial Number (obtained from Contracting Officer)
CONTRACTOR	Coast Guard Manufacturer's Code (obtained from Contracting Officer)
NSN	CG-6250-01-019-6282

Contractor's name and address
Contract Number
U.S. Coast Guard Property

A drawing of the nameplate shall be submitted to the Contracting Officer for approval 60 days after the contract is awarded.

3.4 Environmental. Each lampchanger shall operate as specified and under the following environments (not in a lantern):

- a. Ambient temperature from -30 to +170_F (-34.4 to +76.7_C).
- b. Relative humidity from 5 to 100%.
- c. Continuous salt spray exposure, as specified in section 4.2.8.
- d. Vibrations incident to service on lighted fixed structures and incurred from mailing, as specified in section 4.2.9.
- e. Shock incident to service on lighted fixed structures and in incurred from mailing, as specified in section 4.2.13.

3.5 Instruction Sheet. An instruction sheet shall be packed with each lampchanger. The instruction sheet format must be submitted to the Contracting Officer within 120 days after the contract is awarded for approval. The Contracting Officer will reply within 30 days after receiving the instruction sheet. It shall contain, but need not be limited to, the following information:

- a. Instructions for installing, removing, and testing the lamps.
- b. Instructions for placing the lampchangers on the mounting brackets and installing the assembly on the lantern.
- c. Prominent warnings about the presence of 120 VAC power and the possibility of danger even if the lamps are extinguished because of some failure.
- d. Instructions for positioning and resetting the turret and for testing testing the ratcheting mechanism.

3.6 Relays. All relays and solenoids shall be insulated with IEEE class 200 material, as specified in MIL-E-917. Relays shall meet the general requirement of MIL-R-5757.

3.7 Safety. The lampchanger frame and turret shall be electrically connected to the grounded terminal.

3.8 Materials. The lampchanger frame and turret shall be made of a noncorrosive metal and shall operate in ambient air temperatures between -30 and +170_F (-34.4 and +76.7_C) without warping or otherwise degrading the lampchanger's performance. Nonmetallic parts shall function as insulators and shall not be required for structural support or mechanical performance.

3.9 Warranty. Each lampchanger shall be fully covered by a 1

year warranty for repair or replacement. Warranty is to start when the lampchanger is shipped from the factory. Failed devices will be returned to the Contractor during the guarantee period. The Contractor shall return the repaired lampchanger with 30 days of receipt and the Contracting Officer of the cause for all failures. Return shipping cost shall be paid by the Contractor.

3.9.1 Design Objectives. The design shall emphasize simplicity and maximum reliability consistent with the state of the art and the size and weight limitations. The lampchanger is expected to operate for several years in a marine environment, without ship overhauling. Onsite annual maintenance, if needed, shall be kept to a minimum and must be performable safely by an average person without special or exceptional mechanical aptitude. The lampchanger will be a repairable item and it shall be designed so that mechanical and electrical parts subject to wear and deterioration can easily be replaced without special tools.

3.10 Engineering Drawing and Documentation. The Contractor shall furnish the Contracting Officer full-scale drawings of the lampchanger, to include dimensions and tolerances. These drawings shall be of sufficient accuracy and detail to allow their use in designing interfacing mounting brackets for the lampchanger. They are not intended for use in procuring additional lampchangers. The Contractor shall provide the Contracting Officer with a troubleshooting list and overhauling instructions for shop repairmen. This troubleshooting list shall include possible types of failures, the possible causes of each type of failure, and the remedy for each failure. The overhauling instructions shall include data on the expected frequency of the preventive maintenance and on how to replace and adjust parts. The Contractor shall provide the Contracting Officer with a list of all parts with the manufacturer's part description numbers and with parts (peculiar) and parts (common) identified. Photographs or drawings showing the parts and the manufacturer's part description numbers shall be included with this list. Five draft copies of the engineering drawings, troubleshooting list and overhauling instructions, parts list, and parts illustrations shall be submitted to the Contracting Officer for approval 150 days after the contract is awarded. The Contracting Officer will reply within 30 days after receipt of the drafts. Two Mylar masters of each of these drawings, list, and illustrations shall be delivered to the Contracting Officer when the first lampchangers are accepted.

3.11 Description Sheet. The Contractor shall Provide the Contracting Officer with a description sheet for the 120 VAC, 250 W lampchanger, in accordance with the Coast Guard Purchase Description for Product Description Sheets (see enclosure (3)). This description sheet shall be submitted to the Contracting Officer for approval within 150 days after the contract is awarded. The Contracting Officer will reply 30 days after receipt.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. The Contractor is responsible for the Performance of all first article tests and production quality control inspection requirements, as specified herein. The Contractor may use his own or any other inspection facilities approved by the Contract Contract Contracting Officer. Inspection records shall be kept complete and made available to the Contracting Officer on request. The Government reserves the right to perform any of the inspections set forth in this specification. The Contracting Officer or his representatives may witness all the first article tests. The Contractor shall submit a first article test plan for the Contracting Officer's approval within 120 days after the contract is awarded and not later than 30 days prior to the first article tests. The Contracting Officer will reply within 30 days after receiving the plan. The Contracting Officer or his representatives may witness the production quality control tests. The Contractor shall submit a production quality control test plan for the Contracting Officer's approval within 150 days after the contract is awarded and not later than 30 days before production assembly begins. The Contracting Officer will reply within 30 days after rec

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plan.

4.1.1 Test Plans. The first article production quality control test plans shall include, but not be limited to, a list of equipment used for each test, the procedures for each test, and the acceptance/rejection criteria for each test.

4.2 First Article Tests. These tests shall be made on each of four prototype lampchangers, unless otherwise stated in this specification. Each of the four lampchanger must pass each test to the satisfaction of the Contracting Officer. Tests shall be performed in the order in which they are listed. These lampchangers shall be part of the procurement and shall be shipped to the Contracting Officer after being refurbished. The failure of any test by any of the four lampchangers shall be the basis for rejecting the first articles. These sample units shall be supplied in addition to the production quantities ordered.

4.2.1 Visual Inspection The lampchanger shall be visually inspected to meet the requirements of sections 3.2.1, 3.2.1.1, 3.2.5, 3.2.3.1, 3.3.3.1, 3.3.4, 3.3.6, 3.3.6.1, 3.3.7, 3.3.8, 3.3.9, 3.3.10, and 3.3.11.

4.2.2 Mechanical Tolerances. The requirements of sections 3.3.1, 3.3.2, and 3.3.4.1 shall be met for the lampchanger.

4.2.3 Isolation. Place 120 VAC, 60 Hz between each ungrounded terminal and the frame for a least 10 sec and note the current flow. The current must be less than 10 A for 50% humidity at

room temperature. As an alternative test, a megger meter may be used to determine if the isolation is at least 12 Megaohms. The megger used shall be equivalent to the Holtzer-Cabot megger, ZM-13A-TSM1, National Stock Number 6625-284-0265. It is rated for 0 to 100 Megaohms and 500 VDC.

4.2.4 Workmanship. Workmanship shall comply with requirement 9 of MIL-STD-454.

4.2.5 Operation Check. Load the turret with the specified lamps and make measurements to verify that the lamp out sensing device and turret rotation mechanism are in accordance with the requirements of sections 3.2.2.1, 3.2.2.2, 3.2.2, 3.2.3.1, and 3.3.4.1 when pulsed and continuous 120 VAC, 60 Hz power is applied to the lampchanger. To test for pulsed conditions, use the following flash characteristics (1) a quick flash with an on time of 0.30 sec and an off time of 2.2 sec, (2) a group flash an on time of 0.6 sec and an off time of 5.4 sec, and (3) a group flash with a period of 5 sec and two 0.4 sec flashes separated by an off time of 0.6 sec. Perform these tests with each lamp in the operating position. For the monitored mode the quick flash pulsed voltage will simulate the minimum on interval for the motor to drive the turret on pulsed power if continuous power is not immediately available when the operating lamp fails.

4.2.5.1 Turret Rotation Mechanism. Simulate lamp failure by removing each operating lamp to ensure that the turret advances the next lamp into the operating position in the time interval allowed in sections 3.2.3 and 3.2.3.1. Verify that the lamps are not damaged by the turret rotation, as described in section 3.3.4.1, and that the circuit between the LAMP and NEUTRAL terminals and the MOTOR and NEUTRAL terminals are opened within the period allowed in section 3.2.2.1 and 3.2.2.2. Use all voltages and frequencies of sections 3.2.2.1 and 3.2.2.2 for these tests.

4.2.5.2 Electrical Power. Measure the electrical power consumed in the turret rotation mechanism and verify that it is in accordance with section 3.2.6. Measure the input impedance of the lampchanger when the operating lamp is burning and with the operating lamp removed and the turret about to or in the act of rotating. The input impedance must be in accordance with sections 3.2.2.1 and 3.2.2.2. Use all voltages and frequencies of sections 3.2.2.1 and 3.2.2.2 for these tests.

4.2.5.3 Turret Contacts. With the turret loaded with lamps and steady 120 VAC, 60 Hz power applied to the LAMP and NEUTRAL terminals, activate the turret rotation mechanism through all four lamp positions for each lampchanger. Repeat this procedure 30 times. Examine the electrical contacts between the turret and the frame for excessive wear and deterioration. Do not use the TEST button of section 3.2.3.1 for these tests.

4.2.5.4 Lamp Out Sensing Test. With 130 VAC, 60 Hz continuous power applied to the LAMP and NEUTRAL terminal and no power

applied to the MOTOR terminal depress the TEST button 100 times at intervals exceeding 5 sec. Examine the TEST button mechanism and its contacts for wear and deterioration. Verify that the TEST button function as required in section 3.2.3.1 and that the voltage drop in the lamp circuit is in accordance with section 3.2.4. With the above power applied to the LAMP and NEUTRAL terminal in the unmonitored mode of operation, depress the TEST button for 5 min at 70_F (21.1_C) and verify that the lampchanger still performs as specified after this test.

4.2.6 Lamp Position. The Contractor shall demonstrate that, on rotation to the operating position by the motor, each lamp is positioned with the horizontal and vertical tolerances specified in section 3.3.2. The manufacturer shall make four focus fixtures with a double contact candelabra bayonet base and a light center length of 1.625 0.016 in. (4.1275 0.04064 cm). This focus fixture shall be used in measuring the tolerance for the lamp focal position. The light center length shall be measured from the top of the base lock pin to the end of a nipple at the top of the focus fixture. The nipple shall be 0.125 0.016 in. (0.3175 0.04064 cm) in dia. The focus fixture shall be made of metal, glass, ceramics, and a durable plastic. The double electrical contacts shall have an open circuit between them, and the exposed parts of the installed four focus fixtures shall be Coast Guard property and be delivered to the Contracting Officer after all the lampchangers are accepted. Requirements for the focus fixture are shown in U.S. Coast Guard Drawing No. EOE-120774, which is provided as enclosure (1). The Contractor shall submit the focus fixtures for the Contracting Officer's approval 30 days before the first article test start.

4.2.6.1 Warpage. Heat each lampchanger in a chamber at a temperature of +170_F (+76.7_C) for 24 hr, with the turret lamped and 120 VAC, 60 Hz power applied to the LAMP and NEUTRAL terminals. Make the measurements specified in section 4.2.6 while the lampchanger turret and frame are within 5_F (2.8_C) of the highest temperature reached in the chamber. Cool two lampchangers in a chamber at -35_F (-31.0_C) for 24 hr with no power applied. Make the measurements specified in section 4.2.6 while the lampchanger turret and frame are less than -30_F (-34.4_C). The LAMP and the MOTOR terminals shall be electrical connected by the shorting strap for these tests.

4.2.7 Humidity. The lampchanger shall be tested in accordance with MIL-STD-810, method 507, procedure IV. During exposure, the lampchanger shall not be energized nor shall lamps be installed. The drying period shall be 4 hr. Verify that lamps burn in all sockets at the operating position and that the lampout sensing device and ratcheting mechanism function for each turret position. Do not clean, recondition, or adjust the lampchanger until all quality assurance tests are completed. Perform test 4.2.3 to verify the isolation of LAMP and MOTOR terminals from ground.

4.2.8 Corrosion Resistance. The lampchanger shall be tested without installed lamps in accordance with MIL-STD-810, method

509. The lampchanger shall be exposed to air for 48 hr after the test is finished before it is examined for evidence of corrosion. Verify that lamps burn in all sockets at the operating position and that the lamp out sensing device and ratcheting mechanism function for each turret position. Do not recondition or adjust the lampchanger until all quality assurance tests are completed. Salt deposits can be cleaned off of the electrical contacts and exterior surfaces of the lampchanger when the lampchanger is being examined for evidence of corrosion, before the electrical and ratcheting tests are conducted.

4.2.9 Vibration. The lampchanger shall be tested in accordance with MIL-STD-810, method 514 (procedure XI with curve AB). The test item shall be attached by its normal mounting means directly to the vibration table or by means of a rigid fixture capable of transmitting the vibration conditions to the test item. The vibration shall be applied parallel to and perpendicular to the axis of the turret rotation. As an additional test, vibrations shall be applied along the axis of each solenoid used in the lampchanger. The test item shall be operated throughout the testing so that functional effects caused by these tests may be evaluated. Operation shall consist of the turret being in the number three position with all lamps installed and a voltage of 120 VAC, 60 Hz applied between the LAMP and NEUTRAL terminals. Extinguishing or dimming of the operating lamp, or the turret changing position during the test, will be a basis for rejection. Upon completion of the vibration test, the test item shall be subjected to the operational check of section 4.2.5 to ensure proper operation. The LAMP and MOTOR terminals shall be electrically connected by the shorting strap during the vibration tests.

4.2.10 Unmonitored Mode Electrical Performance. Verify that the lamp will operate. Simulate lamp failure by removing the operating lamp and verify that the stepping mechanism performs as specified for both pulsed and continuous 100 VAC and 130 VAC power applied to the LAMP and NEUTRAL terminals. For the pulsed condition, use a quick flash with a 0.3 sec on time and 2.2 sec off time. Check all lamps and ensure that each is energized when in the operating lamp position. These tests shall be made with ambient air temperatures of +170_F, +70_F, and -30_F (+76.7_C, +21.1_C, and -34.4_C). Verify that the lamp filaments were not broken or bent by the rotation. Each lampchanger shall be lamped and operated from 130 VAC power for 24 hr at the temperatures of +170_F (+76.7_C) and +70_F (+21.1_C) before tests are conducted at these respective temperatures. Additionally, each lampchanger shall be unpowered for 24 hr at -30_F (-34.4_C) before being tested at this temperature. The tests at -30_F (-34.4_C) with pulsed power shall be performed before the tests with steady power. If a lamp fails during any test, the entire test shall be repeated for the specific temperature at which the lamp failed. If a lamp fails during a repeated test, the lampchanger shall be rejected.

4.2.10.1 Monitored Mode Performance. Repeat the tests of

section 4.2.10 at -30_F (-34.4_C) with the specified pulsed voltage to the LAMP terminal and specified continuous voltage to the MOTOR terminal. For the pulsed voltages use a quick flash with a 0.3 sec on time and 2.2 sec off time. This simulates the effective 0.3 sec available for the motor to drive the turret on pulsed power if continuous power is not immediately available to the motor when the operating lamp fails.

4.2.11 Stepping Mechanism. With the turret loaded with the specified lamps, apply a 10 lb (44.48 N) force to the bulb of the operating lamp in an attempt to rotate the turret. Apply the force in a line directed through the center of the lamp filament. Perform this test with both the number one lamp and the last spare lamp in the operating position. The torque shall be applied in the clockwise and counterclockwise directions and be perpendicular to the plane of rotation. Repeat tests of sections 4.2.5, 4.2.5.1, 4.2.5.2, and 4.2.6 to ensure that the lampchanger was not deformed and that the required tolerances for the lamp focal position are met.

4.2.12 Lamp Circuit. Measure the voltage drop between the lamp contacts in the turret and the respective LAMP and NEUTRAL terminals on the lampchanger. The sum of the two measured voltages, excluding the voltage drop in the lamp, shall be less than that required by section 3.2.4 when 120 VAC (0.1%) is applied at the LAMP and NEUTRAL terminals.

4.2.13 Shock. The lampchanger shall be tested in accordance with MIL-STD-810, method 516, procedure I, with a half sine shock pulse. The shock duration is 11 msec and the amplitude is 30 times the gravitational force. The shocks shall be applied parallel to and perpendicular to the axis of the turret rotation. The test item shall be rigidly mounted to the shock machine by its normal mounting means. The lampchanger shall be nonoperating and shall not have lamps installed during test. The turret position shall be changed between each shock. Upon completion of the shock test, the test item shall be subjected to the operation check of section 4.2.5. Failure to provide the performance specified will be basis for rejection.

4.2.14 Mechanical Conformance. Verify that the requirements of sections 3.3.1 and 3.3.2 are met.

4.3 Production Quality Control Tests. These tests shall be made on each lampchanger. Each lampchanger must pass each test to the satisfaction of the Contracting Officer. Production tests shall include the tests of section 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.5.1, 4.2.5.2, 4.2.6, and 4.2.12.

5. PACKAGING

5.1 Preservation, Packaging and Packing. Each lampchanger shall be individually packed. Preservation and packaging shall be in accordance with level C, method III of MIL-E-17555. Packing shall be in accordance with level B of MIL-E-17555.

5.2 Marking. The interior and exterior containers shall be marked in accordance with MIL-STD-129. Precautions necessary for full protection of lampchangers shall be prominently located as specified in MIL-STD-129. Each lampchanger container shall be labeled CG4P-250 and shall include the National Stock Number, CG-6250-01-019-6282.

5.3 Material Inspection and Receiving Report (Form DD-250). The Contractor shall use Form DD-250 for inspection and shipping. The Contractor shall furnish with each shipment case under contract 11 copies of Form DD-250. One copy shall accompany this shipment case and 10 copies shall be supplied to the Government Inspector assigned to the contract. On this list shall appear every item included in the shipment case--fully described and showing serial numbers. The copy which accompanies the shipment shall be enclosed in a heavy envelope and attached to the outside of the shipping case.