

FAA-E-2408b
July 31, 2000
SUPERSEDING
FAA-E-2408a dated 10/7/87



U.S. Department Of Transportation

**Federal Aviation Administration
Specification**

LAMPS, PAR-56 Incandescent
AVIATION SERVICE

1.	SCOPE.....	1
1.1	Scope.....	1
1.2	Classification.....	1
2.	APPLICABLE DOCUMENTS.....	1
2.1	FAA documents.....	1
2.1.1	FAA specification.....	1
2.2	Military documents.....	1
2.2.1	Military standards.....	1
2.3	Other standard documents.....	1
2.4	Precedence.....	2
3.	REQUIREMENTS.....	2
3.1	General.....	2
3.2	Functional requirements.....	2
3.3	Equipment to be furnished by the contractor.....	3
3.4	Lamp parameters and performance requirements.....	3
3.4.1	Wattage rating.....	3
3.4.2	Life.....	3
3.4.3	Light maintenance.....	3
3.5	Environmental requirements.....	3
3.5.1	Temperature.....	3
3.5.2	Low pressure altitude.....	3
3.5.3	Humidity.....	3
3.5.4	Salt fog.....	4
3.5.5	Rain.....	4
3.5.6	Thermal shock.....	4
3.5.7	Vibration.....	8
3.5.8	Solar Radiation (Sunshine).....	8
3.5.9	Icing/freezing rain.....	8
3.6	Lamp design and construction.....	8
3.6.1	Fungus-proof materials.....	8
3.6.2	Metals.....	8
3.6.3	Selection of materials.....	8
3.6.4	Mogul end prong and screw terminals.....	8
3.6.5	Optional design.....	9
3.7	Marking.....	9
3.8	Workmanship.....	9
3.8.1	Cleaning.....	9
3.9	Packaging, packing and marking.....	9
4.	QUALITY ASSURANCE PROVISIONS.....	9
4.1	Quality control provisions.....	9
4.2	Test and inspection of production models.....	10
4.3	Test and inspection of production units.....	12
4.3.1	Inspection data.....	13
4.3.2	Acceptance inspection.....	13
4.4	Examinations.....	13
4.4.1	Examination of product.....	13
4.4.2	Preparation for delivery.....	13
4.5	Test methods.....	13

4.5.1	Wattage rating test	13
4.5.10	Low pressure (Altitude) test	16
4.5.11	Salt fog test	17
4.5.12	Rain test	17
4.5.13	Two-hour test	17
4.5.14	Solar Radiation (Sunshine) test	17
4.5.2	Filament motion and shorting of turns test	13
4.5.3	Life test	14
4.5.4	Photometric tests	14
4.5.5	Light maintenance test	14
4.5.6	Thermal shock tests	14
4.5.6.1	Cold water test	14
4.5.6.2	Icing test	15
4.5.7	Temperature Test	15
4.5.7.1	High temperature	15
4.5.7.2	Low temperature	15
4.5.8	Vibration test	15
4.5.8.1	Vibration levels	16
4.5.9	Humidity test	16
4.6	Test performance	17
5.	PREPARATION FOR DELIVERY	17
5.1	General	17
5.2	Packaging	17
5.3	Palletized shipments	18
5.4	Marking	18
6.	NOTES	18
6.1	Acceptance inspection	18
6.2	Government furnished equipment	18
6.3	Test results	18

FIGURES

Figure		Page
1	Lamp, PAR-56 Bulb, Mogul End Prong, Outline Dimensions	4
2	Lamp, PAR-56 Bulb, Screw Terminals, Outline Dimensions	5
3	Typical ALS Flush Lamp Installation	6

TABLES

Table		Page
I	Lamp Design Parameters (Mogul End Prong, Type I)	9
II	Lamp Design Parameters (Screw Terminals, Type II)	10
III	Vibration Test Data	14

1. SCOPE

1.1 Scope.- This specification covers halogen-cycle PAR-56 incandescent aviation service lamps or equivalent used for runway approach lighting systems.

1.2 Classification.- The following types of lamps are covered in this specification:

Type I	Lamp, PAR-56, Mogul End Prong
Type II	Lamp, PAR-56, Screw Terminals

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA documents of the issues in effect on date of invitation for bids or request for proposals, form a part of this specification and are applicable except as modified herein.

2.1.1 FAA specification.

FAA-E-982	PAR-56 Lampholder
-----------	-------------------

2.2 Military documents.- The following military and federal documents of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Military standards.

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-810F	Environmental Test Methods and Engineering Guidelines

2.3 Other standard documents. The following national standards of issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

ANSI/ASQC Z1.4	Sampling Procedure for Inspection by Attributes
ANSI/ASQC-Q9003-1994	Quality Systems, Model for Quality Assurance in final Inspection and Test
ASTM D 3580	Standard Test Method of Vibration (Vertical Sinusoidal Motion) Test Products.
ASTM D 3951	Standard Practice for Commercial Packaging
ASTM D 4169	Standard Practice for Performance Testing of Shipping Containers and Systems
ASTM D 5112	Standard Practice for Testing of Shipping Containers and Systems.

(Copies of this specification and other applicable FAA specifications may be obtained from the Contracting Officer in the office issuing the invitation-for-bids or request-for-proposals. Requests should fully identify material desired, i.e., specification and amendment. Requests should cite the invitation-for-bids, request-for-proposals, or the contract involved, or the use to be made of the requested material.)

(Mail requests for copies of military standards, to DODSSP Customer Services, Standardization Documents Order Desk, 700 Robbins Avenue, building 4D, Philadelphia, PA 19111-5094.)

(ASTM documents may be obtained from American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

(ANSI/ASQC documents may be obtained from ASQC, 611 East Wisconsin Avenue, Milwaukee, Wisconsin 53202

2.4 Precedence.- In case of conflict between this specification and specifications and standards referenced in 2.1.1, 2.2.1, and 2.3, this specification shall govern.

3. REQUIREMENTS

3.1 General.- The lamps covered by this specification are to be used for outdoor operation. All lamps shall have halogen-cycle quartz filament tubes or equivalent sealed in a PAR-56 envelope, consisting of internally coated reflector and a cover glass, as shown in figures 1 and 2. Lamps may be coated with an environmentally protective coating. The coating shall be permanently attached to the lamp. There shall be no air bubbles between the coating and the lens of the lamp. The coating shall retain ninety five percent of the initial visible light transmittance after two years of operation with exposure to sunlight. Lamps with the mogul end prongs (figure 1) shall be for installation in above-ground lamp holders, and lamps with the screw terminals (figure 2) shall be used for installation below the surface in semi-flush approach lighting fixtures. All further references to lamps in 3.2 through 6.1 hereafter, refer to coated lamps and uncoated lamps as described in this section.

Type I lamps are mounted in FAA lamp holders installed in the approach area and on the extended centerline of an airport runway.

Type II lamps are installed in semi-flush light fixtures in the approach area and on the extended centerline of an airport runway, typically as shown in Figure 3.

3.2 Functional requirements.- The lamps, mounted in their lamp holders, normally will be installed in the approach areas to runways extending from the landing threshold outward. The lamps shall function in their lamp holders in continuous or intermittent outdoor service under the environmental conditions specified in 3.5.

3.3 Equipment to be furnished by the contractor.- The contractor shall furnish PAR-56 lamps, meeting all requirements of this specification, in quantities specified in the contract schedule. The lamps shall be identified by their rated wattage, rated current, month and with year manufactured, and by their ordering designations.

3.4 Lamp parameters and performance requirements.- Lamps shall conform to the requirements of Table I or Table II. Filament coils shall not wiggle or swing during operation, thereby shorting out turns and reducing lamp filament resistance (4.5.2 and 4.5.4).

3.4.1 Wattage rating.- The lamp operating at rated current shall meet the wattage rating shown in Table I or Table II, after being burned-in for a period equal to 1 percent of its average life at an ambient temperature of 68 degrees Fahrenheit \pm 20 degrees Fahrenheit (20 degrees Celsius \pm 11 degrees Celsius) (4.5.1).

3.4.2 Life.- The life of a constant current lamp is identified as the number of hours of usage at rated current until failure, or the voltage across the lamp increases by six percent, or until the light output falls below 80 percent of the specified initial light output (4.5.3). The lamp initial light output is the photometric values measured during the Photometric test 4.5.4.

3.4.3 Light maintenance.- The lamp light output at rated life shall be greater than or equal to 80 percent of the initial light output (4.5.5) and (4.5.14).

3.5 Environmental requirements.- The lamps, mounted in standard FAA PAR-56 lamp holders conforming to specification FAA-E-982, shall be designed for outdoor installation and continuous or intermittent operation in driving rain, sleet and snow, and under the following environmental conditions.

3.5.1 Temperature.- Any temperature between -67° F (-55° C) and +158° F (+70° C) (4.5.7).

3.5.2 Low pressure altitude.- Any altitude from sea level to 10,000 feet (3,048 meters) above sea level (4.5.10).

3.5.3 Humidity.- Any relative humidity between 10 and 100 percent over the temperature range specified in 3.5.1 (4.5.9).

3.5.4 Salt fog.- Exposure to salt laden atmosphere (4.5.11).

3.5.5 Rain.- Exposure to wind-blown rain (4.5.12). Applicable only to type I lamps.

3.5.6 Thermal shock.- Exposure to a sudden application of cold water and ice (4.5.6 and 4.5.13).

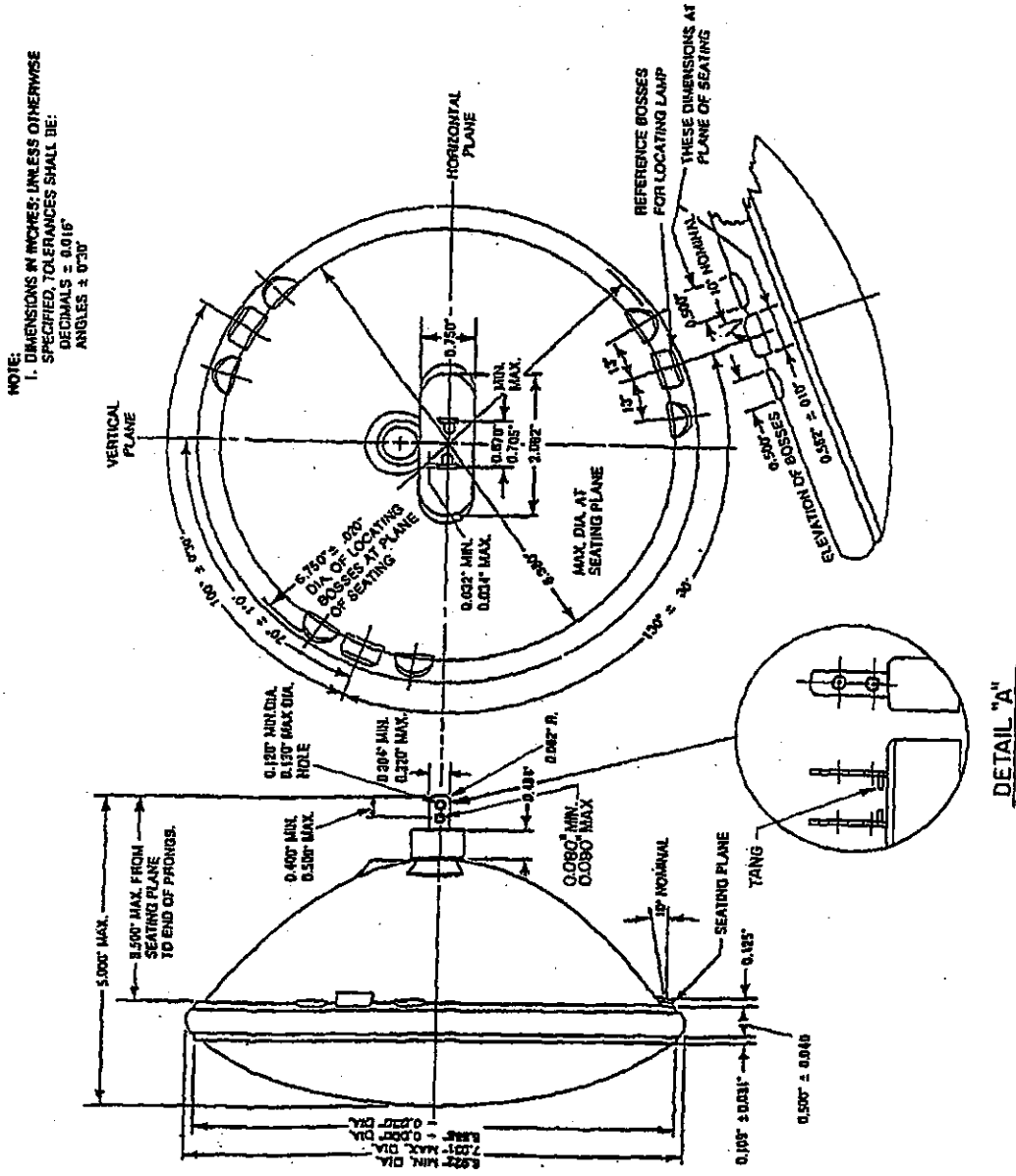


Figure 1. Lamp, PAR-56 Bulb, Mogul End Prong, Outline Dimensions

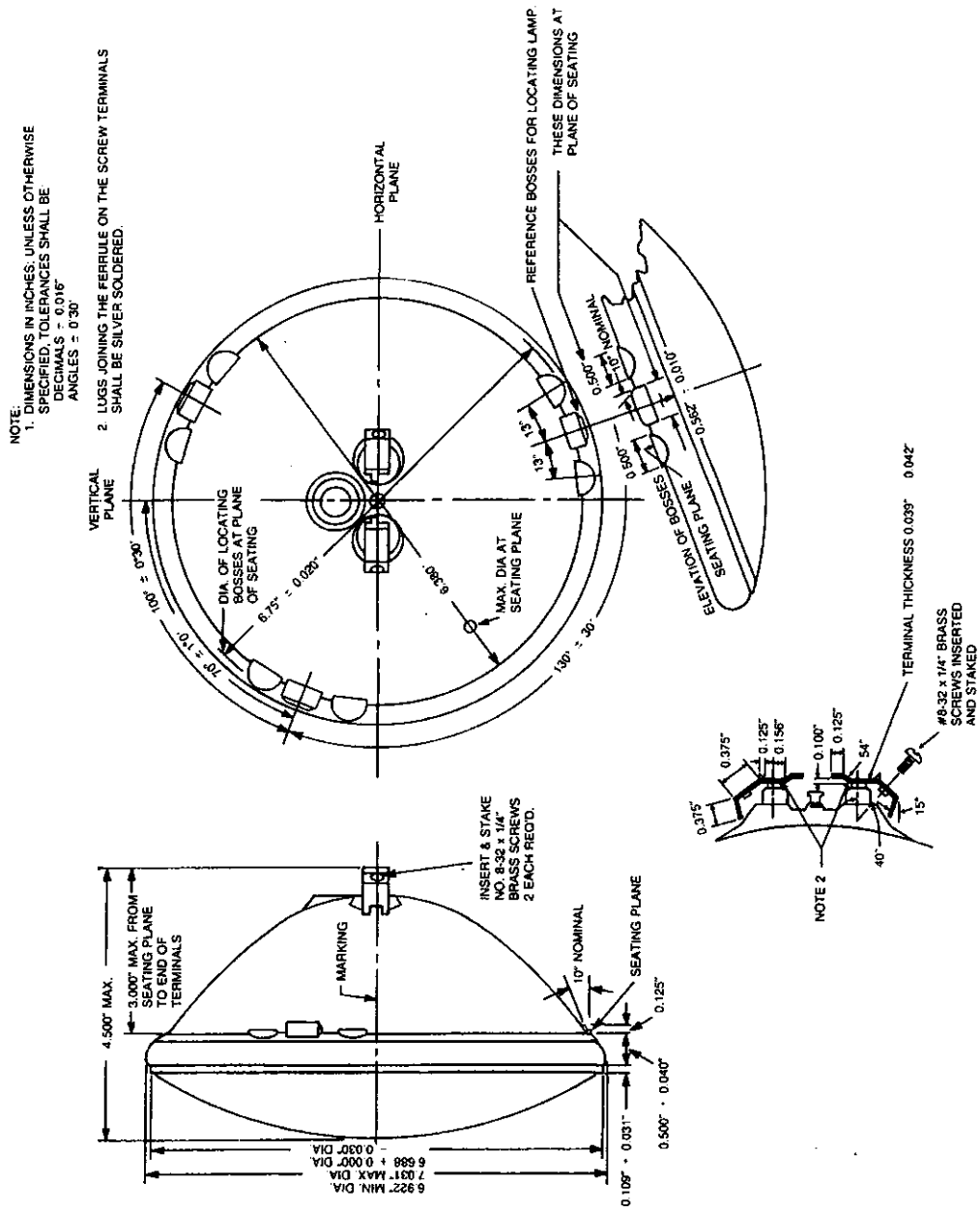
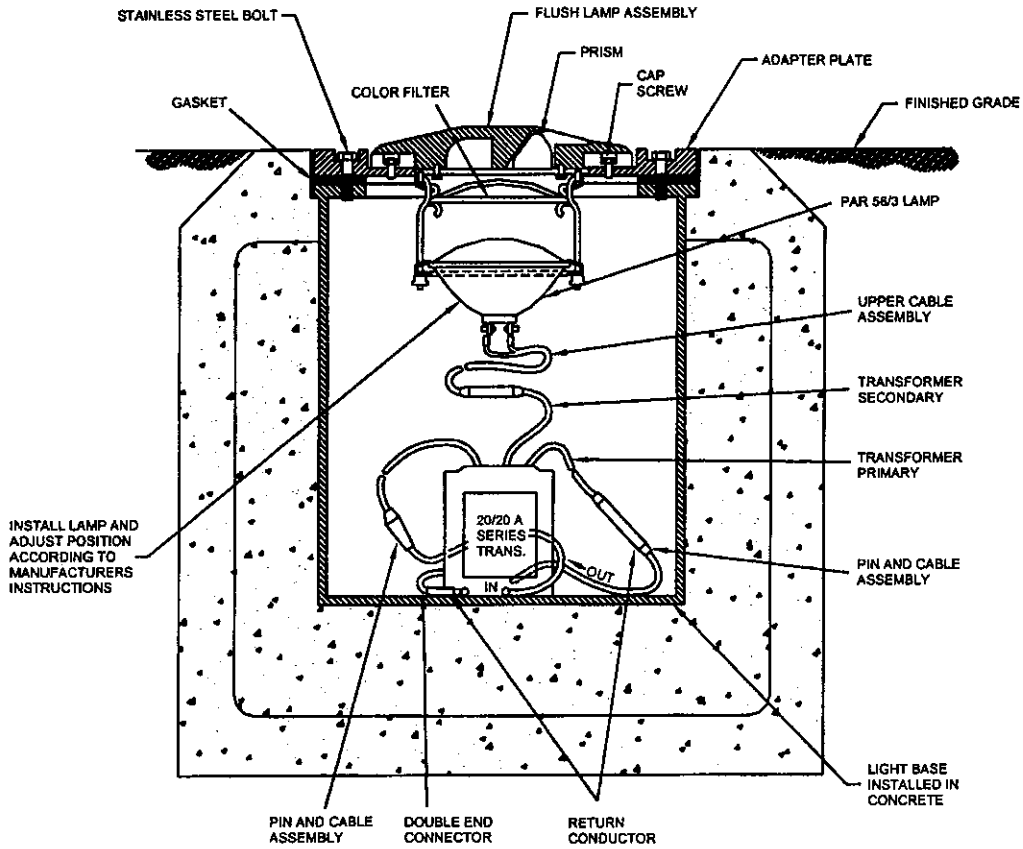


Figure 2. Lamp, PAR-56 Bulb, Screw Terminals, Outline Dimensions



NOTE: NOT ACCEPTABLE FOR CAT II OPERATIONS

Figure 3. Typical ALS Flush Lamp Installation

3.5.7 Vibration.- The equipment installed in a PAR-56 Lampholder, meeting FAA-E-982, shall be capable of withstanding vibrations in three planes (4.5.8) and in the frequency range of 10 to 2,000 hertz, acceleration in gravities (4.5.8.1 Table III).

3.5.8 Solar Radiation (Sunshine).- Coated lamps shall be able to withstand continuous irradiance intensity of 1120 watts per square meter. The coating shall retain a 95 percent of initial transmittance after two years of solar radiation (4.5.14).

3.5.9 Icing/freezing rain.- The lamp shall operate with one half inch (1/2") (12.7 mm) of glaze ice on the lamp (4.5.6.2). With these icing conditions the lamp shall operate without defect.

3.6 Lamp design and construction.- The lamps shall be of the halogen-cycle type suitable for use in fixtures operated at ambient temperature from -67° F (-55° C) to +158° F (+70° C). The PAR-56 lamp shall meet the dimensions specified in figure 1 or figure 2 as applicable to the lamp type.

3.6.1 Fungus-proof materials.- Whenever practicable, materials that are nutrients for fungi shall not be used. When such materials are used and not hermetically sealed, they shall be treated with a fungicide agent acceptable to the procuring activity. However, if they are used in a hermetically sealed enclosure, fungicide treatment is not necessary.

3.6.2 Metals.- Metals shall be corrosion resistant or suitably treated to resist corrosion caused by fuels, salt spray, or atmospheric conditions that may be encountered in storage or normal service on an airport.

3.6.3 Selection of materials.- Specifications and standards for all materials, parts, and government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected and submitted for approval to the Contracting Officer, or as specified in the contract schedule.

3.6.4 Mogul end prong and screw terminals.- The mogul end prongs for type I lamps shall conform to the physical dimensions shown in figure 1. A minimum 0.430 inch flat prong surface shall be provided for attachment of a lamp connector.

Screw terminal lugs of type II lamps shall be straight and flat. Threads in the lug and on the mating screw shall be free of deformation and burrs.

3.6.5 Optional design.- Design details not specified are optional. The physical appearance of the lamp shown in figures 1 and 2 is preferred; however, minor variations will be permitted, provided

performance requirements are met, the lamp is physically interchangeable with those depicted in figures 1 and 2, and the design is approved by the procuring activity.

3.7 Marking.- Each lamp shall be marked on the back of the reflector body with the ordering designation, rated wattage, rated current, day, month and year of manufacture and the manufacturer's name, logo or trademark or CAGE code. The marking shall be permanent and remain legible for the life of the lamp. The manufacturer's name, logo, or trademark molded into the lamp may be substituted for only that portion of the marking requirement. Stick-on labels are not acceptable (4.4.1).

3.8 Workmanship.- Each lamp shall be free from blemishes and defects. Marking of parts and assemblies shall be clear, legible, and durable. Soldering, welding, brazing, cementing, and wiring shall be thorough. Alignment of parts shall be accurate. The mogul end prongs shall be straight, without bends, twists or burrs. The sealed lamp shall be free of loose internal items and debris.

3.8.1 Cleaning.- Each lamp shall be thoroughly cleaned, and loose, spattered, or excess solder, metal chips, flux, and other foreign material shall be removed during and after final assembly.

3.9 Packaging, packing and marking.- The lamp shall be packaged, packed and marked in accordance with Section 5.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality control provisions.- The contractor shall provide and maintain a quality control program that fulfills the requirements of American National Standards ANSI/ASQC-Q9003-1994. ISO certification is not required. All tests and inspections made by the contractor may be subjected to government inspection. The term "government inspection," as used in this specification, means that an FAA representative will witness the contractor's testing and inspection, and will carry out such visual and other inspection as deemed necessary to assure compliance with contract requirements. Inspection is meant to be separate and distinct from testing and shall be limited to visual and/or observational. Operational shall mean the lamp shall light and shall not be subjected to testing. Inspecting and testing shall be conducted using test procedures prepared in accordance with ANSI/ASQC-Q9003-1994 and approved by the government. The contractor shall prepare the test procedures.

4.2 Test and inspection of production models.- The first five units of production, designated as production models, shall be subjected to the examinations specified in 4.4 and the tests specified in 4.5.1 through 4.5.14. The lamps shall be mounted in PAR-56 lamp holders and shall be operated at rated current during the conduct of tests specified in 4.5.1

Table I. Lamp Design Parameters (Mogul End Prong, Type I)

Ordering Designation	Q6.6A/PAR56/2	Q20A/PAR56/C	Q20A/PAR56/1/C
Wattage Rating	200 ±16	300 ±18	500 ±30
Rated Amperes (RMS)	6.6 ±0.5%	20 ±0.5%	20 ±0.5%
Average Life, Hours	1000	500	500
<u>Minimum Candela Requirements Within Beam Field</u>			
<u>Point Location (degrees from mechanical axis)</u>			
2 up - 13.5 left	10,000		
2 down - 13.5 left	10,000		
2 up - 13.5 right	10,000		
2 down - 13.5 right	10,000		
3.5 up - 13.5 left		7,000	20,000
3.5 down - 13.5 left		7,000	20,000
3.5 up - 13.5 right		7,000	20,000
3.5 down - 13.5 right		7,000	20,000
2.5 up - vertical	10,000		
2.5 down - vertical	10,000		
4 up - vertical		16,000	20,000
4 down - vertical		16,000	20,000
horizontal - 10 left		16,000	
horizontal - 10 right		16,000	
horizontal - 14 left	10,000	7,000	20,000
horizontal - 14 right	10,000	7,000	20,000
Maximum Intensity, Candela (not to be exceeded in any direction)	25,000	48,000	55,000
Cover Glass	Prismatic	Prismatic	Prismatic
Base	All three (3) lamps - Mogul End Prong		
Burning Position	All three (3) lamps - Horizontal to 25° Base Down		

Table II. Lamp Design Parameters (Screw Terminals, Type II)

Ordering Designation	Q20A/PAR56/2	Q20A/PAR56/3
Wattage Rating	300 ±18	503 ±30
Rated Amperes (RMS)	20 ±0.5%	20 ±0.5%
Average Life, (hours)	500	500
<u>Minimum Candela Requirements Within Beam Field</u>		
<u>Point Location (degrees from mechanical axis)</u>		
1.5 up - vertical	87,500	180,000
1.5 down - vertical	87,500	180,000
horizontal - 3 left	87,500	
horizontal - 3 right	87,500	
horizontal - 2 left		180,000
horizontal - 2 right		180,000
Minimum Peak Intensity (Candela)	175,000	300,000
Cover Glass	clear	clear
Base	Screw Terminal	Screw Terminal
Burning Position	Horizontal to Base Down	Horizontal to Base Down

through 4.5.14. The humidity test (4.5.9) shall precede the thermal shock test (4.5.6), and both tests shall be conducted on the production models.

4.3 Test and inspection of production units. - Testing of the production unit shall start after acceptance of the production models. All of the production units shall be examined as specified in 4.4 and tested as described in 4.5.1, 4.5.2, 4.5.4, and 4.5.13. During inspection after production tests, if 10 percent of the preselected number of production

units fail the test, as specified in 4.3.2, then all production units shall be retested. Any cracking, fading, or failure of the lamps to operate shall be cause for rejection.

4.3.1 Inspection data.- The contractor shall prepare and submit a list of tests, acceptance test procedures, and test data forms to the Contracting Officer.

4.3.2 Acceptance inspection.- Acceptance shall be made on a sampling basis in accordance with ANSI/ASQCZ1.4-1993, using Special Inspection Level S-3, AQL 4.0 and a single sampling plan for normal inspection as per Table II-A page 11.

4.4 Examinations

4.4.1 Examination of product.- The lamp shall be inspected to determine compliance with the requirements specified herein with respect to materials, workmanship, and marking. The lamp shall be inspected to determine that outline dimensions meet the dimensions given in Figure 1 and Figure 2 as applicable. Lamp prongs shall be flat, any curvature in design shall be cause for rejection.

4.4.2 Preparation for delivery.- The preservation, packaging, packing, and marking shall be examined for conformance to 5.

4.5 Test methods.- Testing of the system shall be performed as follows:

4.5.1 Wattage rating test.- Prior to the wattage rating test all lamps to be tested shall be burned-in as specified in 3.4.1. The production model lamp shall be tested at the end of burn-in and prior to turn off to verify that the lamp wattage rating is within the range specified in 3.4. The production unit lamps, after being burned-in, shall be energized for 10 minutes, then while energized tested to verify that the lamp wattage rating is within the range specified in 3.4. The wattage rating shall be measured as follows: Operate the lamp as specified in 3.4.1 at full rated current ± 0.05 Amps and measure the voltage directly at the lamp prongs with a true RMS voltmeter. Rating is then calculated using $P(\text{Watts}) = V(\text{Volts}) \times I(\text{Amperes})$. The type of or use of a lamp holder during this test is at the discretion of the contractor.

4.5.2 Filament motion and shorting of turns test.- Measure the voltage across the lamp during the conduct of the life test (4.5.3) and the 2-hour test (4.5.13) to verify that no voltage step change occurs after the lamp has been energized. With a constant current input into the lamp terminals, any step change of ± 0.5 volts observed across the lamp terminals by the voltage measuring equipment shall be cause for rejection. The voltage measurement shall be recorded at 15, 30, 60, and subsequently at 120-minute intervals using the technique describe in 4.5.1.

4.5.3 Life test. - The lamp shall be tested and results of the test verified to determine that the life of the lamp conforms to the life requirements specified in 3.4.2, when the lamp is operating in a PAR-56 Lamp holder on an open, vibration-free rack.

4.5.4 Photometric tests. - Photometric tests shall be conducted to demonstrate compliance with the intensity and beam dimension requirements of Table I or Table II, as applicable. A photometric range shall be 30 feet or greater. The lamp shall be measured for rating and photometric output simultaneously with a minimum 2.5 minutes and maximum of 3.5 minutes burn time. Light output for photometry and light maintenance will be simultaneous.

4.5.5 Light maintenance test. - The lamps shall be tested to determine that at rated life, the light output shall not fall below 80 percent of the specified initial output or until the voltage drop across the lamp falls below 6 percent of the initial voltage or fails to light. Unless otherwise specified, beam lumens or total lumens, depending upon the type of lamp being tested, may be used as a criterion of light output. However, the test procedure for determining the change in light output before and after burning shall be the same for any one lamp.

4.5.6 Thermal shock tests. - Thermal shock tests shall be conducted on the lamps as specified in the subparagraphs below. At the completion of each test, the lamps shall be thoroughly examined for defects. The lamps are of acceptable quality if the reflector coating does not peel, discolor, crack, or fade; the glass does not crack or break; the cover glass does not leak or separate from the reflector body; and the terminal seals and solder joints on the terminals do not break.

4.5.6.1 Cold water test (lamps in table I only). - The lamp shall be mounted in a standard FAA PAR-56 lamp holder, fitted with a green filter (use green filter only with 500W lamp), with its longitudinal mechanical axes tilted 25° upward, and operated with rated current in a +100° F (38° C) environment until the glass temperature stabilizes for (1) minute. The lamp shall then be sprayed with water having a temperature of +40° F (+4.4° C), from a nozzle at 45° to the mechanical axis of the lamp (20° from vertical) such that the spray impinges upon the front cover glass. The water spray shall simulate a rainfall of 4 inches (10.16 cm) per hour with the size of droplets not less than 2 millimeters. The spray shall be maintained for at least 15 minutes. At the conclusion of the test, the lamp shall be de-energized, removed from its environment, and examined for defects. In addition, when there is a coating on the lens cover, cut a one inch square into the surface coating, adhesive tape, commercial item A-A-883 (NSN 7510-010031-3129) shall be placed over the square on the surface of the lens and removed after five minutes. The adhesive tape shall be of sufficient length to allow removal with the removing force applied at right angles to the surface. Any peeling of the lens protective coating, from the area under the tape, or visible anywhere on the lens surface, shall constitute failure of the test.

4.5.6.2 Icing test.- This test shall be performed on both type I and type II lamps. The icing test shall be conducted in accordance with Procedure I, Method 521.2 of MIL-STD-810F. The lamp shall be placed in an environment of $+23^{\circ} F \pm 2^{\circ} F$, ($-5^{\circ} C \pm 1.1^{\circ} C$) until cooled to this temperature. Water shall then be introduced by suitable means to cause a layer of ice to form on the lamp covering, the reflector and the cover lens to a thickness of at least 1/2 inch (12.7mm). After the required thickness of ice has formed, the lamp shall be retained in the $+23^{\circ} F$ ($-5^{\circ} C$) environment for an additional period of at least 30 minutes. With the longitudinal axis of the lamp tilted 25° upward, the lamp shall then be energized with rated current and allowed to operate until the ice melts and breaks free. The lamp shall be de-energized, removed from its environment, and examined for defects. In addition, when there is a coating on the lens cover, adhesive tape, commercial item A-A-883 (NSN 7510-010031-3129) shall be placed on the surface (center) of the lens and removed after five minutes. The adhesive tape shall be of sufficient length to allow removal with the removing force applied at right angles to the surface. Any peeling of the lens protective coating, from the area under the tape, or visible anywhere on the lens surface, shall constitute failure of the test.

4.5.7 Temperature Tests.

4.5.7.1 High temperature.- The high temperature test shall be conducted in accordance with Procedure II, Method 501.4, extreme induced conditions, of MIL-STD-810F, except the temperature shall be constant, $158^{\circ} F (+70^{\circ} C)$, and maintained for a period of 6 hours minimum duration. The temperature sensors shall be installed around the production model in the test chamber. This test shall be run concurrently with the low temperature and pressure tests.

4.5.7.2 Low temperature.- The low temperature test shall be conducted in accordance with Procedure II, Method 502.4 of MIL-STD-810F. The temperature shall be constant. The type I lamps shall be tested at $-67^{\circ} F (-55^{\circ} C)$ and maintained for a period of 6 hours minimum duration. The type II lamps shall be tested at $-40^{\circ} F (-40^{\circ} C)$. The test chamber temperature shall be maintained for a period of six hours prior to energizing the lamp. The temperature sensors shall be installed around the production model in the test chamber. This test shall be run concurrently with the high temperature and pressure tests.

4.5.8 Vibration test.- The PAR-56 lamp shall be installed and operating at rated amperes in a standard FAA PAR-56 lamp holder and the assembly shall be vibrated in the following three planes:

- (a) A plane perpendicular to the vibration table (vertically)
- (b) A plane parallel to the light beam axis (horizontally)
- (c) A plane horizontally at right angles to the light beam axis (side)

4.5.8.1 Vibration levels.- The vibration levels are shown in Table III. The duration of each sweep shall be 10 minutes. A sweep is the vibration of a unit throughout a given frequency range. At the conclusion of the test the lamp shall be thoroughly examined. Failure of the lamp to operate during the test, and any mechanical failure observed on the lamp after the test shall be cause for rejection.

Table III. Vibration Test Data

Acceleration in Gravities	Frequency, Hertz
0.020 inch double amplitude (displacement)	10-70
1	70-200
1	200-500
1	500-2,000

4.5.9 Humidity test.- The humidity test shall be in accordance with Procedure II, Method 507.4, of MIL-STD-810F, except that a total of three complete 24 hour cycles (72 hours) shall be required (Table 507, 3-I (cycle 5)). The high temperature shall be +70°C (158°F) and the highest relative humidity shall be 100 percent instead of 75 percent.

4.5.10 Low pressure (Altitude) test.- The low pressure test shall be conducted in accordance with MIL-STD-810F, Method 500.4, Procedure II. The lamp shall be tested at atmospheric pressures corresponding to sea level and 10,000 feet (3,048 meters) altitude. The type I lamp shall be tested at both -67°F (-55°C) and +158°F (+70°). The type II lamp shall be tested at -40°F (-40°C) and +158°F (+70°). Lamps shall be tested for six cycles at rated current and power, with a power off interval. A cycle is defined as operation for one hour at rated current and power, followed by one-half hour off. This test shall be run concurrently with the low and high temperature tests.

4.5.11 Salt fog test.- The salt fog test shall be performed in accordance with Procedure I, Method 509.4, of MIL-STD-810F. The equipment shall be exposed for a period of 86 hours, consisting of four consecutive periods of twelve (12) hours wet and twelve (12) hours dry, followed by a 48-hour drying period. At the conclusion of the test, salt buildup or film may be removed with tap water.

4.5.12 Rain test.- The rain test shall be performed in accordance with Procedure I, Method 506.4, of MIL-STD-810F. The wind velocity shall be 18 m/s (40 mph), and the rainfall rate shall be 10cm/h (4in/h). The test item temperature shall be at least 10° ± 3°C (50° ± 37° F) higher than the rain temperature at the beginning.

4.5.13 Two-hour test.- Production units selected in accordance with paragraph 4.3.2 shall be tested. Production model and production units shall be mounted in standard FAA PAR-56 lamp holders (green filters are required on 500 watt lamps only) and operated for 2 hours at rated current and ambient temperature of $86^{\circ}\text{F} \pm 18^{\circ}\text{F}$ ($30^{\circ}\text{C} \pm 10^{\circ}\text{C}$). After one hour of continuous operation, the lamps shall be subjected to the test described in 4.5.6.1, except that the water spray shall be maintained for five seconds, and repeated every 15 minutes.

4.5.14 Solar Radiation (Sunshine) test.- The solar radiation (sunshine) test shall be performed in accordance with Procedure II, Method 505.4, of MIL-STD-810F. An irradiance intensity of 1120 watts per square meter shall be applied to the lamp coating for six hundred and thirty days. At the end of the test the lamp coating transmittance shall be ninety five percent of the initial transmittance, and the lamp at rated life shall meet the eighty percent light maintenance requirement (3.4.3).

4.6 Test performance.- All tests described above shall be performed by the contractor, at the contractor's facility, or at a FAA approved independent testing laboratory. A FAA representative may witness tests. Tests shall be conducted on the production model and on production units as outlined above to provide compliance with this specification.

5. PREPARATION FOR DELIVERY

5.1 General.- Lamps shall be packaged for extended warehouse storage and reshipment. Packaging shall be in accordance with ASTM D 3951 and testing or validation shall be in accordance with ASTM D 4169, Assurance level II, Distribution cycles 18.

5.2 Packaging.- Each lamp, with one inch cushioning, shall be packaged in an individual unit package fiberboard container. Unit packages shall be over packed in intermediate containers with 12 unit packages per container. Intermediate packaging and shipping containers shall be capable of multiple handling and storage under favorable conditions, such as enclosed facilities, for a minimum of one year.

5.3 Palletized shipments.- All palletized shipments shall be made on disposable pallets with maximum outside dimensions of forty seven and one-half inches ($47 \frac{1}{2}$ inches) by forty inches (40 inches). Overall height of the pallet and contents shall not exceed forty seven inches (47 inches). Fork entry of the pallet shall be on the long sides of the pallet. No portion of the load shall overhang or extend beyond any pallet edge. Shrink wrapping to secure intermediate containers is encouraged.

5.4 Marking.- Unit and intermediate packages and exterior shipping containers shall be marked in accordance with MIL-STD-129, M, 4.2.1. Bar code is required and shall be in accordance with MIL-STD-129L, appendix H, 20.1, 20.7, 20.8, 20.9 and 20.10. Each intermediate package and each shipping container shall be durably marked with the following information: (example in parentheses)

Bar Code
National Stock Number:
Cage Code or Manufacturer's Part Number:
Item Description: (PAR-56 Lamp, Watts, Amperes)
Specification:
Quantity and Unit of Issue:
Contract/Purchase Order Number:
Level of Protection and Date Packed:
Manufacturer's Name and Trade Mark:

6. NOTES. The contents of the subparagraphs below are only for the information of the Contracting Officer. They are not contract requirements, and are not binding on either the Government or the contractor except to the extent that they may be specified elsewhere in the contract as such. Any reliance placed by the contractor on the information is wholly at the contractor's own risk.

6.1 Acceptance inspection.- The contract should identify the location of the final acceptance inspection as origin or destination. The Contract shall provide final acceptance inspection requirements.

6.2 Government furnished equipment.- It is recommended that the contract include PAR-56 lamp holders and green filters as needed, to be provided as government furnished equipment.

6.3 Test results.- It is recommended that for coated lamps the bidder be required to submit with the bid the test results proving that the lamp meets the requirements of the specification (3.1), (3.5.8) and (4.5.14).