INCH-POUND

MIL-I-49428(CR)
6 November 1989

MILITARY SPECIFICATION

IMAGE INTENSIFIER ASSEMBLY, 18 MM, MICROCHANNEL WAFER MX-10160/AVS-6

This specification is approved for use by USACECOM, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the Image Intensifier Assembly, 18 MM Microchannel Wafer, MX-10160/AVS-6 (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2.h).

SPECIFICATIONS

MILITARY

MIL-P-11268	-	Parts, Materials, and Processes Used in Electronic Equipment
MIL-M-13231	-	Marking of Electronic Items
MIL-B-49030/6	-	Battery, Dry, Type BA 3058/U

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to : HQ, USA Communications-Electronics Command, ATTN: AMSEL-ED-TO, Fort Monmouth, NJ 07703 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A: FSC 5855

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

MIL-A-49425	-	Aviator's Night Vision Imaging System AN/AVS-6(V)1, AN/AVS-6(V)2
MIL-L-49426	-	Lens, Assembly, Objective for Aviator's Night Vision Imaging System, AN/AVS-6(V)1, AN/AVS-6(V)2
MIL-P-49429	-	Power Supply for ANVIS 18 mm Microchannel Wafer
MIL-B-49430/4	-	Battery, Primary, Lithium, Sulfur-Dioxide, BA 5567/U

STANDARDS

MILITARY

MIL-STD-454	-	Standard General Requirements for Electronic Equipment
MIL-STD-781	-	Reliability Testing for Engineering Development, Qualification, and Production
MIL-STD-810	-	Environmental Test Methods

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Naval Publications and Forms Center (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099).

2.1.2 Other Government documents, drawings and publications. The following other Government documents, drawings and specifications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

5002540	-	Monocular Assembly, Aviator's Night Vision Imaging System, AN/AVS-6(V)
5002760	-	Image Intensifier Assembly, 18 mm, MX-10160/AVS-6

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 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 shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Description. The Image Intensifier Assembly, 18 mm Microchannel Wafer, MX-10160/AVS-6 herein referred to as the assembly, shall have a minimum useful photocathode (see 3.11.1) and phosphor screen diameter of no less than 17.5 millimeters (mm). The assembly shall employ a group III-V compound, semi-transparent photocathode produced by metal organic vapor - phase expitaxial (MOVPE) growth techniques and sealed to a glass faceplate forming the input window to the assembly. The assembly shall employ a filmed, microchannel electron multiplier plate (MCP) with proximity focus on the input and output. The image tube shall contain a fiber optic inverter screen as an integral part of the tube envelope. The phosphor screen material shall be type P-20. The assembly shall include the high-voltage multiplier and oscillator and shall be encapsulated within a hard-surface insulating metallized envelope.

3.2 Construction. The MX-10160/AVS-6 is required to meet all physical dimensions of drawing 5002760 and all other associated drawings which affect interface and/or interchangeability of the MX-10160/AVS-6 with the current AN/AVS-6 system. Drawing 5002760 requires modification relevant to housing/contact configuration in order to meet EMI requirements.

3.2.1 Weight. The weight of the assembly shall not exceed 85 grams.

3.3 Qualification. Tubes furnished under this specification shall be products which are authorized by the Government as qualified products (see 3.11.24).

3.3.1 Initial production test (IPT). When specified in the contract the supplier shall furnish and test assemblies as specified in the contract (see 6.2.b).

3.4 Materials, parts, and processes. Materials, parts, and processes shall be as specified herein and as shown on the applicable drawings. Material not specified shall be selected by the contractor, shall be subject to all provisions of this specification, and shall conform to MIL-P-11268. Nonstandard parts lists are required for the power supply assembly, soldering material, wire, and noncorrosive potting material.

3.4.1 Phosphor screen. The phosphor screen shall be type P-20. The phosphor material shall be deposited on a suitably metallized fiber optic inverter.

3.5 Components. The requirements of this paragraph shall be met in the end item produced by this specification.

3.5.1 Power supply assembly. The power supply assembly (Figure 1) shall meet all requirements of MIL-P-49429.

3.5.1.1 Power source. The power source for operating the assembly shall be a battery, BA-5567/U, conforming to MIL-B-49430/4 or BA-3058/U conforming to MIL-B-49030/6.

3.5.2 Fiber optic inverter. The fiber optic inverter shall exhibit the following characteristics.

3.5.2.1 Shear distortion. Shear distortion (see 3.11.3.1) shall not exceed 25 microns over the display area.

3.5.2.2 Gross distortion. Gross distortion (3.11.3.2) shall cause no point on the image of a straight line, through any axis, to be displaced more than ± 30 microns relative to the best-fit straight line (3.11.3.3). The maximum slope of the straight line image shall be less than 15 microns per millimeter across the line image and less than 25 microns per any two millimeters from the best-fit straight line. Distortion shall be measured along the axes which provide the maximum displacement and maximum gradient of the input line. Measurement of two axes may be required. Not more than two slope reversals are permitted on the line image.

3.5.2.3 Image inversion. The fiber optic inverter shall rotate a straight line image 180, ± 1 degree in a clockwise direction when viewed from the display side relative to the end points of the best-fit straight line (3.11.3.3).

3.5.2.4 Chicken wire. When the fiber optic inverter is viewed under 10-power magnification perpendicular to the plano surface, with the output in contact with the phosphor faceplate which is excited by ultraviolet light, or with the output uniformly illuminated by a Lambertian Source, the fiber optic inverter shall meet the chicken wire (see 3.11.4) limits specified in Table I.

NOTE: Those areas in question shall be inspected in such a manner that light is transmitted through the optic and areas in question can be observed and measured in accordance with these requirements and Table I.

TABLE I. Fiber optic inspection.

Number of allowable incidences	Minimum length	Maximum length
Chicken wire (zone 1)		
0	0.090	0.090 or greater
2	0.041	0.089
6	0.020	0.040
Disregard lengths which are not greater than 0.019 inch.		
Chicken wire (zone 2)		
0	0.250	0.250 or greater
5	0.125	0.249
Disregard lengths which are not greater than 0.124 inch		

Zone 1 - 0.295 inch diameter circle in center of optic
Zone 2 - 0.295 to 0.710 inch annulus concentric with Zone 1

3.5.4 Microchannel plate.

3.5.4.1 Ion barrier film quality. There shall be no more than 20 type-B (see 3.11.19) holes over the total useful area of the output screen.

3.6 Operational and environmental.

3.6.1 Photocathode sensitivity. The luminous transmission sensitivity shall be not less than 1,000 microamperes per lumen with a voltage not greater than 800 Vdc applied to the photocathode. The radiant sensitivity shall be not less than 100 milliamperes/watt at 0.830, ± 0.001 micrometer and 60 milliamperes/watt at 0.880, ± 0.001 micrometer with a voltage not greater than 800 Vdc applied to the photocathode.

3.6.2 Burn-in/Environmental Stress Screening (ESS). Each assembly shall withstand the conditioning specified without damage or input current varying more than ± 20 percent as measured prior to and upon completion of the burn-in/ESS test.

3.6.3 Vibration. The assembly with no operating voltage applied shall not be damaged or suffer degradation of performance (see 3.11.9) when subjected to resonance search, resonance dwell, or cycling. The vibration shall be applied both parallel to and perpendicular to the optical axis of the assembly. The vibration double-amplitudes of Figure 2 shall be maintained at the test item mounting point.

3.6.3.1 Resonance search. Resonant frequencies (see 3.11.22) of the assembly shall be determined by varying the frequency of the applied vibration through the range shown in Figure 3.

3.6.3.2 Resonance dwell. The assembly shall be vibrated for 30 minutes parallel to and perpendicular to the optical axis at each of the four most severe resonant frequencies determined during resonance search. If a change in resonant frequency occurs during test, time of occurrence shall be recorded, and immediately the frequency shall be adjusted to maintain peak resonance conditions. The final resonance frequency shall be recorded.

3.6.3.3 Cycling. The assembly shall be vibrated parallel to and perpendicular to the optical axis in accordance with Figure 2. The frequency of vibration shall be swept logarithmically in accordance with Figure 3 over the range 5-2000-5 Hz. The total time of vibration in each direction shall be 3 hours, less the time spent at each of the resonance dwells.

3.6.4 Shock. The operating assembly with no radiation incident on the photocathode shall not be damaged (see 3.11.9) during more than 2 shocks in each direction when subjected to 6 shock impacts parallel to the optical axis and 6 shock impacts perpendicular to the optical axis. Impacts shall be half-sine wave with a minimum peak amplitude of 75 g's (see 3.11.5) and a duration of 6, ± 2 milliseconds measured at the 10 percent amplitude points.

3.6.5 Temperature cycling. The assembly shall not be damaged (see 3.11.9) by four cycles of the temperature profile shown in Figure 4. Input current to the assembly prior to test and at conclusion of test shall not vary by more than ± 20 percent.

3.6.6 Environmental/temperature tests. The assembly shall not be damaged (see 3.11.9) by storage, operation or thermal shock when subjected to the environmental temperature profile specified in Figure 5 and shall meet the following requirements at specified temperatures.

3.6.6.1 Temperature +52°C (+125°F).

a. Input current - not greater than 50 milliamperes.

b. Gain at 2 X 10^{-6} footcandle - not less than 10,000 and not greater than 35,000.

c. Gain at 2 X 10^{-4} footcandle - not less than 3500 and not greater than 10,500.

d. Operational stability:

(1) The output brightness shall not fluctuate more than ± 10 percent from a steady-state condition and shall not drift more than ± 15 percent from a steady-state condition for a period of 2 minutes after an initial 2 seconds of operation time. All fluctuations shall be random after the initial 2 seconds.

(2) If random fluctuations greater than ± 10 percent but less than ± 15 percent occur in the original 2-minute time period, the test shall be continued an additional 2 minutes, during which the requirements of (1) shall be met.

(3) If the output brightness drift is greater than ± 15 percent during the original 2-minute time period, the test shall be continued an additional 2 minutes during which the requirements of (1) shall be met.

e. Rise time - shall be not greater than 7 seconds. Overshoot shall be not greater than 40 percent of steady-state output brightness (see 3.11.18).

3.6.6.2 Temperature -32°C (-26°F).

a. Input current - not greater than 40 milliamperes.

b. Gain at 2 X 10^{-6} footcandle - not less than 10,000 and not greater than 45,000.

c. Gain at 2 X 10^{-4} footcandle - not less than 3,500 and not greater than 10,500.

d. Operational stability:

(1) The output brightness shall not fluctuate more than ± 10 percent from a steady-state condition and shall not drift more than ± 15 percent from a steady-state condition for a period of 2 minutes after an initial 2 seconds of operation time. All fluctuations shall be random after the initial 2 seconds.

(2) If random fluctuations greater than ± 10 percent but less than ± 15 percent occur in the original 2-minute time period, the test shall be continued an additional 2 minutes, during which the requirements of (1) shall be met.

(3) If the output brightness drift is greater than ± 15 percent during the original 2-minute time period, the test shall be continued an additional 2 minutes during which the requirements of (1) shall be met.

e. Rise time - shall be not greater than 7 seconds. Overshoot shall be not greater than 40 percent of steady-state output brightness.

f. After exposure of the assembly to the profile of Figure 5, the room temperature (see 3.11.7) performance shall be as follows:

(1) Gain at 2 X 10^{-6} footcandle - not less than 20,000 and not greater than 35,000.

(2) Gain at 2 X 10^{-4} footcandle - not less than 3,500 and not greater than 10,500.

(3) Operational stability:

(a) The output brightness shall not fluctuate more than ± 10 percent from a steady-state condition and shall not drift more than ± 15 percent from a steady-state condition for a period of 2 minutes after an initial 2 seconds of operation time. All fluctuations shall be random after the initial 2 seconds.

(b) If random fluctuations greater than ± 10 percent but less than ± 15 percent occur in the original 2-minute time period, the test shall be continued an additional 2 minutes, during the requirements of (a) shall be met.

(c) If the output brightness drift is greater than ± 15 percent during the original 2-minute time period, the test shall be continued an additional 2 minutes during which the requirements of (a) shall be met.

(d) The variation between the room temperature gain tested prior to high temperature and after low temperature (post test) shall not be greater than ± 15 percent. Room temperature EBI after high and low temperature tests shall be as specified in 3.6.7.

3.6.7 Equivalent background input (EBI). The equivalent background input at room temperature shall not exceed 2.5 x 10^{-11} phot (lumens/square centimeter).

3.6.8 Luminance gain. The assembly shall exhibit a room temperature (see 3.11.7) luminance gain and high light level saturation characteristics per Table II and Figure 6.

TABLE II. Saturation requirements for luminance gain.

Nominal light input (fc)	Minimum allowable gain	Minimum allowable output (fl)	Maximum allowable gain	Maximum allowable output (fl)	Maximum Allowable Input current (mA)
2 x 10^{-6}	20,000	NA	35,000	NA	45
2 x 10^{-4}	3,500	NA	10,500	NA	45
1.0	NA	0.7	NA	2.1	NA
20.0	NA	0.7	NA	2.1	NA

3.6.9 Halo. The halo (see 3.11.8), produced by projecting a spot of light onto the input of the assembly shall be no greater than 1.47 mm in diameter.

3.6.10 Bright source protection. The assembly shall not be damaged (see 3.11.9) when subjected to an input illumination of not less than 50 millilumens concentrated on the photocathode within an area no greater than 1 square millimeter for a time interval not less than 1 minute. There shall be no discernible damage (see 3.11.9) after a nonoperating period of not more than 24 hours, when observed under the test conditions of 4.6.21.

3.6.11 Signal-to-noise ratio. The signal-to-noise ratio shall be not less than 16.2.

3.6.12 Fixed pattern noise.

3.6.12.1 Multi-to-multi pattern variation (see 3.11.10). Multi-to-multi brightness deviations from the mean value shall not exceed ± 10 percent.

3.6.12.2 Multi-boundary pattern noise (see 3.11.11). The average value of the brightness deviations of the multi-boundary intensities shall not deviate from the mean value of the adjacent multi intensities by more than ± 10 percent. The mean value shall be established from the three adjacent multies containing the above multi-boundaries.

3.6.13 Output brightness uniformity. When the photocathode is uniformly illuminated with light at a color temperature of 2856, ± 50K, the output brightness uniformity shall be such that the ratio of the maximum to minimum brightness variation over the useful screen area shall not exceed 3:1. For input illumination of wavelength 0.830, ± 0.001 micrometer, the ratio shall not exceed 4:1. Under the same conditions, when the screen is viewed with a 10-power magnifier, the background shading shall be uniformly graded with no distinct lines of demarcation between the light and dark areas.

3.6.14 Image alignment. A test reticle projected on the photocathode of the assembly concentric with the optical axis shall produce an image on the screen of the assembly such that the center of the reticle's image shall fall within a circle 0.006 inch in diameter concentric with the optical axis of the assembly.

3.6.15 Veiling glare. Using a 10 X magnifier each lot of tube assemblies shall be screened 100% for evidence of chrome which is visible between a cathode and the black glass of the input faceplate. In the event chrome is visible, testing for veiling glare shall be per 3.6.15.1.

3.6.15.1 Veiling glare sampling and rejection critera. Select samples for testing per the contract or purchase order (see 6.2.e) from the assemblies that exhibit maximum exposure of chrome as observed with the unaided eye. Subject these samples to the veiling glare test procedure described in paragraph 4.6.15. In the event that the veiling glare of any of the samples exceeds the measured value of the calibration standard by 10%, then all tubes with chrome exposure shall be screened for acceptance.

3.6.15.2 Veiling glare calibration standards. Veiling glare shall be measured using a calibrated standard. The calibration standard shall consist of an AN/AVS-6 Objective Lens Assembly and an MX-10160 tube assembly which has no chrome visible when viewed through the clear glass portion of the faceplate. The combined veiling glare for standard objective lens/image tube combination shall not exceed 2.13%.

a. The Objective Lens Assembly standard shall meet all the performance requirements including environmental as specified in MIL-L-49426, Lens Assembly Objective.
b. The MX-10160 Tube Assembly Standard using a saturn faceplate with no chrome showing shall meet the following paragraph requirements:

    3.4.1 Phosphor screen
    3.6.7 EBI
    3.6.8 Luminance gain
    3.6.11 Signal-to-noise
    3.6.13 Output brightness uniformity
    3.6.16 Center resolution
    3.6.19 Useful cathode diameter
    3.6.22 Luminance persistence (per phosphor lot)

c. The Objective Lens Assembly and the Tube Assembly shall be identified as the calibration standard using established test procedures.

3.6.15.3 Veiling glare identified standards. The Objective Lens Assembly and the Tube Assembly which are used as the Veiling Glare Standard shall each be identified by serial number.

3.6.16 Resolution

3.6.16.1 Center resolution. The center resolution, referenced to the photocathode, shall not be less than 36 line pairs per millimeter (lp/mm).

3.6.16.2 Peripheral resolution. The peripheral resolution, referenced to the photocathode, shall not be less than 36 line pairs per millimeter (lp/mm). The requirement shall be met at two points separated by 90 degrees spaced on a 14mm diameter circle concentric with the optical axis (see 3.11.15).

3.6.16.3 High light level center resolution. With the entire photocathode of the assembly illuminated with not less than 20 footcandles, the minimum center resolution shall be 5 lp/mm. This requirement shall be performed during Group A and Group D testing only.

3.6.17 System interface. When inserted into an ANVIS monocular assembly, 5002540, the assembly shall operate and allow the objective lens to be focused from 28cm through infinity. There shall be no flashing, flickering, or intermittent operation. This requirement shall be verified only on image intensifier assemblies being purchased as spare parts.

3.6.18 Modulation transfer function (see 3.11.12). With an input illumination of not greater than 8×10^{-4} footcandle, the minimum assembly modulation transfer function (MTF) shall be as follows:

a. 83 percent MTF at 2.5 lp/mm

b. 58 percent MTF at 7.5 lp/mm

c. 28 percent MTF at 15.0 lp/mm

d. 8 percent MTF at 25.0 lp/mm

3.6.19 Useful cathode diameter. The useful cathode diameter shall be not less than 17.5 mm.

3.6.20 Reversed polarity. The assembly shall not be damaged when subjected to a reversed polarity of 3.0 Vdc input voltage for a period of not less than 60 seconds.

3.6.21 Photocathode, microchannel plate, and screen quality. When the screen is viewed with a 10 power magnifier, initially with no light and then with 2×10^{-6} fc incident on the photocathode, there shall be no bright spots or discernible field emission (see 3.11.13) brighter or larger than the background scintillation (see 3.11.14) noise. View the screen with a 10-power magnifier and adjust the radiation level on the photocathode to obtain the best spot contrast. No bright spots shall be allowed except those identified as type B holes per 3.5.4.1.

The dark spots which exceed a contrast of 30 percent of their surrounding areas shall not exceed the sizes and quantities specified in Table III. The areas of noncircular spots shall first be determined and the diameters of equivalent circular spots computed. These diameters shall be used to determine the size of noncircular dark spots when using Table III.
When the distance between two spots is less than the maximum dimension of either spot, the two spots shall be considered as one circular spot whose diameter is equal to the sum of the maximum dimensions of the two spots plus the amount of separation between them. Graininess caused by grainy or "peppery" phosphor screen, channel-to-channel gain variations, or photocathode irregularities (see 3.11.21) shall not be discernible over the useful diameter to the degree that it detracts from normal operation, when viewed with a 10-power magnifier and with the photocathode uniformly illuminated.

TABLE III. Tube assembly dark spots.

Size of spots SS (inches)	Number of spots within 0.22 inch diameter circle	Number of spots sithin annulus bounded by 2 circles 0.22 and 0.59 inch diameter	Number of spots within annulus bounded by circles 0.58 inch diameter and total screen diameter
0.015 or larger	0	0	0
0.012 to 0.015	0	1	2
0.009 to 0.012	0	3	3
0.006 to 0.009	1	6	9
0.003 to 0.006	3	10	14

NOTE: The 0.22- and 0.58-inch circles on the image screen shall be concentric with the optical axis of the assembly.

3.6.22 Luminance persistence. When the light input is gated OFF, output brightness of the assembly shall fall to not greater than 0.15 percent within 300 milliseconds after illumination at a level of 4×10^{-3} footcandle.

3.6.23 Humidity. The unprotected tube assembly pretest values for gain, and input current shall not change greater than $\pm$ 20 percent and the equivalent background input (EBI) shall not increase more than a factor of three.

All parameters must remain within specification limits when subjected to the temperature/humidity profile of MIL-STD-810, Method 507.1, Procedure II.

3.7 Reliability. The assembly shall have a minimum mean time to failure of not less than 7500 hours when operated under the standard reliability conditions. The assembly shall have a mean time to failure of not less than 1500 hours when operated under the accelerated reliability conditions.

3.8 Electromagnetic Interference (EMI). The assembly properly incorporated within an AN/AVS-6 system shall comply with the requirement paragraph 3.6.20 of MIL-A-49425. The required tests are RE02 (Radiated Emission) RS02 (Susceptibility Magnetic Induction Field) and RS03 (Susceptibility Electric Field).

3.9 Identification and marking. Each assembly shall be identified and serialized in accordance with MIL-M-13231. The markings shall include a coded acceptance date. The first two numbers shall be the last two digits of the year. The last two numbers of the code shall be two digits indicating the calendar week of the year (01 through 52). Reading from left to right or top to bottom, the code number shall indicate the year and week of acceptance in that order.

3.10 Workmanship. The assembly shall conform to MIL-STD-454, Requirement 9.

3.11 Technical interpretations. The following technical interpretations are, when referenced in sections 3, 4, or 5, mandatory for this specification.

3.11.1 Photocathode. The glass input window with a galium arsenite substrate bonded to it is referred to as the photocathode.

3.11.2 Phosphor. The phosphor shall be type P-20 as defined commercially.

3.11.3 Distortion. Two types of distortion are important in imaging fiber optics, gross distortion and shear distortion.

3.11.3.1 Shear distortion. Causes the image of a straight line to have a discrete, localized lateral displacement (break). Shear distortion is due to localized misalignment errors in the assembly of fibers or multifibers. Shear distortion in fiber bundles is sometime referred to as incoherences.

3.11.3.2 Gross distortion. Causes the image of a straight line to curve. Gross distortion is caused by a long-range deformation of flow of fibers during fabrication.

3.11.3.3 Best-fit straight line. A straight line intersecting the +8 and -8 millimeter points of the input straight line image. The +8 and -8 millimeter measurements are relative to the projected pattern center point.

3.11.4 Chicken wire. Defined as a predominant pattern of dead fibers which has a diameter not greater than 0.0009 inch (2 single fibers) whose light transmission is so degraded that with light projected through the optic, single fibers in the area in question cannot be distinguished or identified as single fibers with the use of 50-power magnification.

3.11.5 "g". g is defined as an acceleration or deceleration of 32.17 ft/s^2.

3.11.6 Rise time and decay time. The rise time required for the assembly to achieve 50 percent of its steady-state performance after the voltage source is applied to the assembly. The decay time is the time required for the assembly to achieve the screen brightness not greater than 1×10^{-3} footlambert after the voltage source is disconnected.

3.11.7 Room temperature. Room temperature is defined as +23°C, +10°C, -2°C for the purposes of this specification.

3.11.8 Halo. Halo is defined as a circular area of brightness evidenced on the assembly output imaging screen occurring as a result of a small bright source input and concentric with the input.

3.11.9 Damage. Damage is defined as:

a. Electrical failure or malfunctioning intermittent or continuous including arcing, corona, flashing, bright spots, flickering, blinking, or unless otherwise specified a change in input current greater than $\pm$ 1.0 mA.

b. Cracks, breakage, deformation, corrosion, or deterioration of any part or finish, and missing or loose components.

c. Degradation of image quality including ion noise, dark spots, or shading.

3.11.10 Multi-to-multi pattern variation. Discernible spatial gain variation between individual multi-patterns or groups of multi-patterns.

3.11.11 Multi-boundary pattern noise. Discernible spatial gain variation between peripheral and interior channels of a multi-pattern or group channels.

3.11.12 Modulation transfer function (MTF). Modulation transfer function is a measure of the degradation of an image as it appears at the output screen of the assembly as correlated to the input pattern which is normalized to 100 percent contrast at a spatial frequency equal to or less than 0.2 lines per millimeter.

3.11.13 Field emission. Discernible field emission is voltage-dependent extraneous emission which appears as bright spots or a pattern that may flicker or appear intermittently on the image screen in one general area. Field emission is voltage-dependent and is best observed with a low level of radiation incident on the photocathode.

3.11.14 Scintillations. Bright spots which occur on the image screen randomly in space and time.

3.11.15 Optical axis. The optical axis of the assembly is defined as the mean centerline of that cylindrical portion of the assembly used to align the assembly in the system housing.

3.11.16 Limiting resolution. Limiting resolution is defined as the smallest resolution pattern which the observer can see and distinguish between the black lines and the clear area between the black lines. The observer must be able to determine the number of line pairs in both the vertical and horizontal test patterns.

3.11.17 Environmental gain computations.

a. G_{htji} High temperature gain

b. G_{ltji} Low temperature gain

c. B_{hji}- High temperature brightness output

d. B_{hoi}- High temperature background brightness output

e. B_{lji}- Low temperature brightness output

f. B_{loi}- Low temperature brightness background output

g. B_{rji}- Room temperature (chamber) brightness output

h. B_{roi}- Room temperature (chamber) background brightness output

3.11.18 Overshoot. The percent amplitude of output brightness above a steady-state condition at turn-on.

3.11.19 Type-B hole defect. A hole in the ion barrier which exists over a series of channels having an area equal to a circle with effective diameter not greater than 125 micrometers.

3.11.20 Useful area. The useful photocathode and phosphor screen area shall comprise a circle of diameter not less than 17.5 millimeters centered on the assembly optical axis.

3.11.21 Photocathode irregularities. Imperfections in the photocathode which lead to significantly degraded image quality: A photocathode grown on a host crystal cut more than 0.5 degree off the proper crystallographic axis, which leads to a terraced crystal surface; and hillocks or craters due to foreign inclusions in the crystal growth.

3.11.22 Resonant frequency. A resonant frequency is defined as any frequency where the response amplitude is greater than or equal to two times the input vibration amplitude at that frequency.

3.11.23 Contrast. Contrast is defined as $\frac{B1 - B2}{B1 + B2}$.

3.11.24 Qualified product. A product which has successfully met all requirements of an IPT or first article witnessed by the procuring activity.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsible for compliance. All items shall meet all requirements of section 3 and 5. The inspection set forth in this specification shall become a part of the Contractor's overall inspection system or quality program. The absence of any inspection requirements in the specifications shall not relieve the Contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Parts and materials inspection. The supplier is responsible for ensuring that the parts and materials used are manufactured, examined, and tested in accordance with referenced specifications, standards, and as specified herein.

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

a. Initial production testing (4.4)
b. Quality conformance inspection (4.5)

4.3 Inspection methods. Unless otherwise specified, all inspections shall be performed in accordance with the test methods specified in 4.6. The Government reserves the right to request clarification, explanation, or justification of any test method used. Further, the Government reserves the right to deem the justification inadequate and to require reassessment of any and all aspects of any test procedure. Unless otherwise specified, all tests shall be made at room temperature 23°C, (+10°C -2°C).

4.4 Initial production testing inspection. Unless otherwise specified, the initial production inspection shall be performed by the contractor.

4.4.1 Initial production testing sample. Unless otherwise specified, the contractor shall furnish 10 sample assemblies as a initial production sample.

4.4.2 Initial production testing . Initial production inspections shall consist of conformance inspections and Group A, B, C, and D tests. The presence of one or more defects at A, B and C tests shall be cause for rejection of that assembly and may be cause for rejection of all IPT assemblies.

Failure of 4 or more assemblies in Group D test shall be cause for rejection of all IPT assemblies. As a part of initial production tests, the Contractor shall supply two (2) additional image tubes, manufactured in the same time period, and complying to A, B and C tests to be installed into a fully acceptable AN/AVS-6 system and EMI tested in accordance with the requirements of the system. Failure to meet the requirements of paragraph 3.8 shall be cause for rejection of the IPT.

4.4.2.1 Group A inspection. Each of the 10 IPT sample assemblies shall be subjected to the inspections/tests specified in Tables IV and V. Failure of any of these tests shall be sufficient grounds to reject a given sample assembly and may be cause for rejection of the IPT.

TABLE IV. Conformance inspection.

Defects	Requirement paragraph
Components and materials missing or not as specified	3.4, 3.5
Weight not as specified	3.2.1
Material not as specified	3.4
Design not as specified	3.2
Chemical and physical properties not as specified	3.2
Dimensions not as specified	3.2
Color not as specified	3.2
Finish not as specified	3.2
Identification or special marking missing or illegible	3.9
Workmanship not as specified	3.10

TABLE V. Group A inspection.

Inspection	Requirement paragraph	Test paragraph
Ion barrier film quality	3.5.4.1	4.6.24
Photocathode sensitivity	3.6.1	4.6.1
Chrome inspection	3.6.15	------
Burn-in(ESS)	3.6.2	4.6.2
EBI	3.6.7	4.6.7
Luminance gain	3.6.8	4.6.8
Photocathode, MCP, and screen quality	3.6.21	4.6.21
Resolution	3.6.16	4.6.16
Signal-to-noise ratio	3.6.11	4.6.11

4.4.2.2 Group B inspection. Ten sample assemblies which have passed all the tests specified in 4.4.2.1 shall be subjected to the tests specified in Table VI. Failure of any one of these tests shall be cause to reject a given sample assembly and may be cause for rejection of the IPT.

TABLE VI. Group B inspection.

Inspection	Requirement paragraph	Test paragraph
Veiling glare	3.6.15.1	4.6.15
Fixed pattern noise	3.6.12	4.6.12
Output brightness uniformity	3.6.13	4.6.13

4.4.2.3 Group C inspection. Ten sample assemblies which have passed all the tests specified in Tables IV, V and VI shall be subjected to the tests specified in Table VII. Failure of any one of these tests shall be cause to reject a given sample assembly and may be cause for rejection of the IPT.

TABLE VII. Group C inspection.

Inspection	Requirement paragraph	Test paragraph
Subgroup I		
Modulation transfer function	3.6.18	4.6.18
Vibration	3.6.3	4.6.3
Shock	3.6.4	4.6.4
Bright source protection	3.6.10	4.6.10
Useful cathode diameter	3.6.19	4.6.19
Environmental/temperature tests	3.6.6	4.6.6
Temperature cycling	3.6.5	4.6.5
Luminance persistence	3.6.22	4.6.22
Image alignment	3.6.14	4.6.14
Halo	3.6.9	4.6.9
Reversed polarity	3.6.20	4.6.20
System interface	3.6.17	4.6.17
Subgroup II		
Humidity	3.6.23	4.6.23

4.4.2.4 Group D inspection. Ten sample assemblies which have passed all the tests in Tables IV, V, VI, and VII shall be subjected to the tests in Table VIII, subgroup 1. Failure of any 4 sample assemblies shall be cause for IPT rejection. Upon completion of the Group D reliability requirement samples shall be subjected to additional reliability testing (for information only) until samples reach end of life or 4000 hours (accelerated) whichever occurs first. Samples and data shall be then shipped to Project Manager for Night Vision and Electro-Optics. For EMI (subgroup 2) tests, the two image tubes selected shall be installed into an AN/AVS-6 system and tested.

TABLE VIII. Group D Inspection.

Inspection	Requirement paragraph	Test paragraph
Subgroup I Reliability	3.7	4.7
Subgroup II Electromagnetic Interference	3.8	4.8

4.5 Quality conformance inspection.

4.5.1 Group A inspection. Each unit supplied under contract shall be inspected for conformance to the inspections specified in Tables IV and V. The inspections listed in Table V shall be performed in any order.

4.5.2 Group B inspection. Sample units which have successfully passed the requirements of Group A inspection shall be formed into lots, and shall be subjected to the tests prescribed in Table VI. Lot size shall be determined by the contractor see paragraph 3.6.15.1 for veiling glare sampling. Sampling plans for Group B inspection shall be as specified in the contract or purchase order (see 6.2.e).

4.5.3 Group C inspection. This inspection shall consist of the tests specified in Table VII and shall be performed on units that have passed Group A inspection. Systems interface test shall be conducted for IPT only. After each environmental test the specified post environmental tests shall be performed. Sample units shall be selected in accordance with 4.5.3.1. Failure of any unit on any test shall constitute failure of that lot.

4.5.3.1 Sampling for Group C inspection. Sample units shall be selected at random for inspections in Table VII, subgroup I from each lot The first samples selected shall be from the first quality conformance inspection lot at the start of the contract. For subgroup II an additional sample tubes may be selected from the lot for humidity testing which can be conducted in parallel to other Group C testing. For luminance persistence tests, each phosphor lot must be certified by conducting tests on a minimum of four representative tubes. Sampling plans shall be as specified in the contract or purchase order (see 6.2.e).

4.5.3.2 Shock and vibration failures. Shock and vibration tests shall be conducted in succession in any order under the Group C inspection. Failure of either of these two tests shall be considered a failure of both attributes.

4.5.3.3 Group C failures. Actions required relative to Group C failures shall be specified in the contract or purchase order (see 6.2.c).

4.5.3.4 Group C order of failure. For the purpose of 4.5.3.3, a failure at a given point in the environmental (extreme) test cycle shall be considered a failure of the given measurement or inspection performed and the measurement and inspections yet to be performed in that test cycle.

Measurements and inspections made before such failure shall be accepted and shall not be subject to 4.5.3.3. In retesting, the samples shall be cycled as shown in Figure 5 except that accepted measurements and inspections shall not be performed.

4.5.3.5 Disposition of Group C samples. Group C samples may be refurbished, pass Group A tests and shipped on the contract.

4.5.4 Group D inspection. This inspection shall consist of the tests specified in Table VIII, and shall be performed on units that have passed Group A inspection. EMI tests shall be conducted per paragraph 4.8.

4.5.4.1 Sampling for reliability testing. For the quality conformance Group D inspections, 2 assemblies shall be selected at random from each months' production from assemblies which have passed Group A inspection. If the production quantity exceeds 200 assemblies in a given month, an additional sample of two will be taken. Samples will be formed into groups of 4 for group D testing.

4.5.4.2 Group D reliability failure. Actions required relative to Group D reliability failures shall be as specified in the contract (see 6.2.c).

4.5.4.3 Disposition of Group D reliability inspection assemblies. Upon completion of the first, third and fifth Group D reliability inspections, the samples shall be subjected to additional reliability testing (for information only) until the samples reach end of life specification (inability to meet the requirements specified in the reliability failure definition) or 4000 hours, whichever comes first. Samples and data shall then be shipped to Project Manager, Night Vision and Electro-Optics, ATTN: AMCPEO-IEW-NVEO, Fort Belvoir, VA 22060-5677. The balance of the Group D reliability samples shall be refurbished, pass Group A inspection and shipped as normal production.

4.5.4.4 EMI testing frequencies. EMI shall be tested during IPT as specified in paragraph 3.8 and 4.8. EMI may be required during the contract should process or component changes be made which might affect the interference resistance.

4.6 Operational and environmental tests. Tests shall be conducted in accordance with contractor-prepared, Government-approved test plan and as specified herein. Unless otherwise specified, the following conditions shall apply:

a. The color temperature of the radiation source for the following tests shall meet the correlated tolerance as stated below:

Tolerance: 2856 ± 50K

Test Paragraphs:

3.6.1 Photocathode Sensitivity
3.6.7 EBI
3.6.8 Luminance Gain
3.6.11 Signal-to-Noise

3.6.13 Output Brightness Uniformity
3.6.15 Veiling Glare
3.7 Reliability

Tolerance: 2700K to 2900K

Test Paragraphs:

3.5.4 Ion Barrier Film Quality
3.6.2 Burn-In/ESS
3.6.5 Temperature Cycling
3.6.6 Environmental Temperature Test
3.6.9 Halo
3.6.10 Bright Source Protection
3.6.12 Fixed Pattern Noise
3.6.14 Image Alignment
3.6.16 Center Resolution
3.6.18 MTF
3.6.19 Useful cathode diameter
3.6.21 Photocathode, MCP and Screen Quality
3.6.22 Luminance Persistence
3.8 EMI

b. The photometer used for screen brightness measurements shall be a Pritchard Model 1970, or equal.
c. The photometer used for screen brightness measurements shall be calibrated against a standard source which has a tungsten filament lamp, opal glass or integrating sphere and filters as specified below:

(1) Tungsten filament lamp operated in connection with an opal glass such that the color temperature of the radiation emitted from the opal glass or integrating sphere is 2856, ± 50K.

(2) Corning Spectral Filters, Nos. 3-71 and 4-67, or equal.

(3) Opal glass or integrating sphere to produce a uniform, Lambertian distribution.

(4) Output brightness to be 0.1 to 10.0 footlamberts uniformly distributed over an output aperture of not less than 17 millimeters.

d. The amount of radiation from the source incident on the photocathode for each assembly shall be the amount specified in the test. Tolerances on specified radiation levels shall be ± 20 percent.
e. Meters used for monitoring lamp current and voltage shall have an accuracy of ± 0.25 percent.
f. Tests shall be performed at room temperature unless otherwise specified (see 3.11.7).
g. Neutral density filters used in test equipment shall have transmission characteristics within 10 percent of the nominal filter transmission from 0.35 to 1.0 micrometer.

h. All tests on the assembly shall be performed with the input voltage at 2.7 to 3.0 Vdc unless otherwise specified.
i. All gain and environmental tests except humidity shall be performed in a grounded housing.
j. Tolerances on applied nominal voltages shall be ± 0.05 Vdc.
k. Test chambers used for environmental temperature tests shall maintain the temperature within ± 2°C (3.6°F) of the specified test temperature.

4.6.1 Photocathode sensitivity. The photocathode sensitivity shall be measured prior to assembly of the tube and the power supply. Corrections for leakage and dark current shall be made. The luminous sensitivity shall be measured over a useful 16-millimeter-diameter circle with 0.001 lumen of tungsten lamp radiation and with a photocathode voltage not greater than 800 Vdc. The photocurrent (in microamperes) corrected for leakage and dark current, divided by the actual input (lumens) is the 2856K photocathode sensitivity. With the same dc voltage applied as above, insert an 0.83-or 0.88-micrometer filter between the photocathode and the 2856K tungsten source. The 16-millimeter-diameter area on the photocathode shall be illuminated with the filtered radiation at a level between 1×10^{-6} to 1×10^{-4} watt. Measure the total tube current and subtract the photocathode leakage and dark current. This photocurrent (in microamperes), divided by the actual input radiation (in watts) is the cathode radiant sensitivity at 0.8300 and 0.8800 micrometer ± 0.0010 (in microamperes per watt). The 0.8300- or 0.8800- micrometer filter shall have the following characteristics:

a. Far infrared blocking out to 4 micrometers and ultraviolet (UV) blocking out to 0.3 micrometer.
b. Peak placement wavelength of 0.8300 or 0.8800 micrometer, ± 0.0010 micrometer.
c. Bandwidth at the 10 percent points of 0.0125, ± 0.0015 micrometer.
d. Minimum peak transmission of 50 percent.

Failure to meet requirements of 3.6.1 shall constitute failure of this test.

4.6.2 Burn-in/environmental stress screening (ESS). Each assembly shall undergo 50 continuous cycles consisting of 55 minutes operation and 5 minutes OFF time per cycle. Once during each operating portion of each cycle the photocathode shall be illuminated with 5×10^{-4} footcandle (fc) for 5 seconds then with 5 fc for 3 seconds. The balance of the operating portion shall be without illumination. The brightness gain setting shall not be changed during burn-in or subsequent to completion of the burn-in test. Evidence of damage (see 3.11.9) or change in input current beyond limits (see 3.6.2) shall constitute failure of this test.

4.6.3 Vibration. The operating potential shall not be applied to the assembly during vibration testing. Tolerance on specified frequencies shall be ± 3 percent and tolerance on total excursion shall be ± 5 percent. Mount the assemblies rigidly and singly, or in groups, in the vibration fixture. The vibration shall be applied both parallel to and perpendicular to the optical axis of the assembly. The vibration double-amplitudes of Figure 2 shall be maintained at the test item mounting point.

4.6.3.1 Resonance search. Resonant frequencies of the assembly shall be determined by the varying the frequency of the applied vibration through the range shown in Figure 3 with an acceleration of 1 g.

4.6.3.2 Resonance dwell. The assembly shall be vibrated for 30 minutes parallel to and perpendicular to the optical axis at each of the four most severe resonant frequencies determined during resonance search. If a change in the resonant frequency occurs during the test, its time of occurrence shall be recorded, and immediately the frequency shall be adjusted to maintain peak resonance conditions. The final resonance frequency shall be recorded. The acceleration to be used at each of the resonant frequencies shall be as defined in Figure 2.

4.6.3.3 Cycling. The assembly shall be vibrated parallel to and perpendicular to the optical axis in accordance with Figure 2. The frequency of vibration shall be swept logarithmically in accordance with Figure 3 over the range 5-2000-5 Hz. The total time of vibration in each direction shall be 3 hours, less the time spent at each of the resonance dwells.

4.6.3.4 Post testing/vibration. If shock is conducted first then the post testing for the combined tests is successful compliance with requirements of 3.6.3, 3.6.4, 3.6.7, 3.6.8, 3.6.11, 3.6.16, and 3.6.21.

4.6.4 Shock. This test shall be conducted in a darkened room with no light incident on the photocathode and with the operating potential applied. Apply 6 shock impacts to each axis in such a way as to generate nominal half-sine wave pulses having a minimum peak amplitude of 75 g. The duration of each shock pulse shall be 6, $\pm$ 2 milliseconds, measured between the 10 percent values of peak amplitudes. The after-oscillations shall be not greater than 15 percent of the peak amplitudes of the nominal half-sine wave pulses.

NOTE: There shall be not more than 2 instances of flashing or flickering during the 6 shock impacts on each axis.

a. Mount the assembly with the optical axis in a vertical plane and subject it to 6 shock impacts with the direction of the force applied parallel to the optical axis.
b. Observe the image screen with the unaided eye during application of shock impacts for evidence of flashing, flickering, bright spots, or electrical breakdown.
c. Mount the assembly with the optical axis in a horizontal plane and subject it to 6 shock impacts with the direction of force applied perpendicular to the optical axis.
d. Observe the image screen with the unaided eye during application of shock impacts for evidence of flashing, flickering, bright spots, or electrical breakdown.
e. Horizontal and vertical shocks may be conducted in any order.

4.6.4.1 Post testing/shock. If vibration is conducted first then the post testing for the combined tests is successful compliance with requirements of 3.6.3, 3.6.4, 3.6.7, 3.6.8, 3.6.11, 3.6.16 and 3.6.21.

4.6.5 Temperature cycling. Place the assembly in a test chamber and subject it to four cycles of the temperature profile shown in Figure 4. The variation in luminance gain measured prior to this test and after this test shall not be greater than ± 15 percent. The room temperature EBI shall be not greater than 2.5 x 10^{-11}phot (lumens/square centimeter). Failure to meet requirements of 3.6.5, 3.6.7, 3.6.8, 3.6.11, 3.6.16, and 3.6.21 shall constitute failure of this test.

4.6.6 Environmental/temperature tests. Place the assembly in a test chamber at room temperature and perform the room temperature (+23°C) tests specified in Table IX. A minimum 18.2, ± 0.1mm diameter area of the input window shall be illuminated by the specified input illumination. The test procedure for gain shall be as specified in 4.6.8. Remove the operating potential. Raise the temperature of the test chamber to +71°C and hold at this temperature for a minimum of 2 hours. At the end of the 2-hour stabilizing period, lower the test chamber temperature to +52°C. Maintain this condition for a period of 6 hours. At the end of this 6-hour period, subject the assembly to the high temperature (+52°C) performance tests specified in Table IX. The assembly shall be off not less than 3 minutes prior to performance of the rise time test. The rise time shall be recorded on an X-Y recorder, or equivalent. The operational stability of the assembly shall be verified by viewing the output signal from the photometer with a device that will display the signal for the period specified in 3.6.6.1.d. Adjust the vertical sensitivity to obtain a minimum of 80 percent deflection from a zero reference. Apply the specified operating potential to the assembly, and after not greater than 15 seconds illuminate the photocathode with the specified step pulse of input illumination. The turn-on time of the input light pulse shall be not greater than 700 milli-seconds from zero brightness to 100 percent brightness. After the +52°C tests are completed, remove the operating potential. Raise the temperature of the test chamber to +71°C and hold at this temperature for not less than 30 minutes. Thermal shock the assembly from +71°C to room temperature within 3 minutes or less. Lower the temperature of the test chamber to -32°C and hold at this temperature for a minimum of 1 hour. After the stabilizing period, subject the assembly to the low temperature (-32°C) performance test specified in Table IX. The test procedures for rise time, gain, and operational stability shall be the same as those used at +52°C. At the conclusion of the -32°C tests, remove the operating potential to the assembly. Lower the temperature of the test chamber to -35°C and remain at this temperature for not less than 2 hours. At the end of the 2-hour stabilizing period, thermal shock the assembly from -35°C to room temperature within 3 minutes or less. Hold the assembly at room temperature for a minimum of 4 hours. At the end of the room temperature holding period, subject the assembly to the room temperature (+23°C) tests specified in Table IX. The test procedures for operational stability shall be the same as that used at +52°C, except that the light pulse for illuminating the photocathode shall be applied within 10 seconds after the operating potential has been applied to the assembly. Compute the high temperature luminance gain (G_{htji}):

$$G_{htji} = \frac{B_{hji} - B_{hoi}}{B_{rji} - B_{roi}} \times \text{room temperature gain}$$

Compute the low temperature luminance gain (G_{ltji}):

$$G_{ltji} = \frac{B_{lji} - B_{loi}}{B_{rji} - B_{roi}} \times \text{room temperature gain}$$

Failure to meet requirements of 3.6.6, 3.6.7, 3.6.8, 3.6.11, 3.6.16, and 3.6.21 shall constitute failure of this test.

TABLE IX. Temperature test.

Input Voltage	Input Light (fc)	Gain	Input current	Rise Time		Operational stability	
		3.0 Vdc	3.0 Vdc	2.2 Vdc	2.0 Vdc	2.0 Vdc	3.0Vdc
+23°C	2×10^{-6}	*					
	2×10^{-4}	*		*			*
	1					NOTE A	
+52°C	2×10^{-6}	*	*	*			
	2×10^{-4}	*				(*)	(*)
	1					*	(*)
-32°C	2×10^{-6}	*	*		*		
	2×10^{-4}	*				(*)	
	1					*	(*)

* Applicable
(*) Applicable to initial production samples

NOTE A: Test after completion of temperature only.

4.6.7 Equivalent background input (EBI). With the operating potential applied to the assembly and no radiation incident on the photocathode, hold for not less than a one minute and not more than a 15 minute stabilizing period, measure the screen brightness (footlamberts) with a photometer, and record the photometer reading (R_1). Illuminate the photocathode at a level between 3.5 to 7×10^{-11}phot (lumens per square centimeter) uniformly distributed over the full useful diameter centered on the photocathode faceplate. Record the photometer reading (R_2). The angle of incident flux shall not be greater than 2 degrees from perpendicular and the photometer shall be positioned such that acceptance angles covers the full 17 millimeters. Determine the equivalent background input (EBI) by the following formula.

$$EBI = \frac{R_1}{R_2 - R_1} \times \text{actual input illumination}$$

Failure to meet requirements of 3.6.7 shall constitute failure of this test.

4.6.7.1 Equivalent background input (EBI) alternate test method. With the operating potential applied to the intensifier and no radiation incident on the photocathode, hold for a stabilizing period of not less than one (1) minute no more than 15 minutes.

At the end of the stabilizing period, with no radiation incident on the photocathode, measure the screen brightness (footlamberts) with the photometers. Divide this reading by the luminance gain and multiply by 1.076×10^{-3}. An EBI greater than that specified in paragraph 3.6.7 shall constitute failure of this test.

4.6.8 Luminance gain. With no light incident, apply input voltage to the tube assembly and then illuminate the photocathode of the operating assembly with an input light level of approximately 2×10^{-4} fc uniformly distributed over the full useful diameter of the photocathode faceplate. (This level is approximate only and no specific tolerance applies. The level must; however, be high enough to place the tube into the ABC mode of operation). Change the input light level, uniformly distributed over the useful diameter of the photocathode faceplate, in accordance with each of the conditions of 3.6.8 in sequence. Measure the input current and measure the image screen luminance with the photometer in each condition. The acceptance angle of the photometer shall be not greater than 2 degrees. Position the photometer so that the acceptance angle subtends a 17 mm area centered on the phosphor screen. Luminance gain is determined by dividing the screen luminance in footlamberts by the actual input illumination in footcandles. Failure to meet requirements of 3.6.8 shall constitute failure of this test.

4.6.8.1 ABC light level. Exposing the operating tube assembly to a light level resulting in ABC operation prior to measuring low light level gain is necessary to ensure that errors resulting from initial overshoot/undershoot are not incorporated into gain measurement.

4.6.9 Halo. Illuminate the photocathode of the assembly through an aperture followed by a lens having a 40 degree field of view, an f-number equal to f/1.4, a focal length of 26.6, $\pm$ 0.2mm, and a T-number equal to T-1.58. The aperture shall be such as to produce a spot of light 0.350, $\pm$ 0.02mm in diameter on the photocathode faceplate of the assembly. The illumination in that spot shall be not less than 5×10^{-4} footcandle. The illumination incident on the photocathode of the assembly in the region outside of the 0.350 millimeter spot shall not exceed 5×10^{-7} footcandle. Measure the diameter of the halo (see 3.11.8) formed on the output image screen with no less than a 10-power measuring magnifier. Repeat the measurement 3 times and compute an average diameter. Failure to meet requirements of 3.6.9 shall constitute failure of this test.

4.6.9.1 Halo-alternate. Illuminate the photocathode of the assembly through two apertures followed by an AN/AVS-6 objective lens or equivalent. The apertures shall be such as to produce two spots of light 0.350 $\pm$ 0.01mm in diameter with centers displaced by 1.47mm on the photocathode faceplate on the assembly. The illumination of the spots shall be not less than 5×10^{-4} footcandle. The illumination incident of the photocathode of the assembly in the region outside the 0.350 millimeter spots shall not exceed 5×10^{-7} footcandle. The diameter of the halos formed on the output image screen shall not touch or overlap when viewed with no less than 10-power magnifier. Failure to meet requirements of 3.6.9 shall constitute failure of the test.

4.6.10 Bright source protection. Apply the input potential to the assembly. Illuminate the photocathode with a spot of light having an area not greater than 1.0 square millimeter and having an intensity of at least 50 millilumens. Failure to meet requirements of 3.6.10 shall constitute failure of this test.

4.6.11 Signal-to-noise ratio. Using a F = 1.45, ± 5 percent objective lens, image a circular spot no larger than 0.200 millimeter in diameter onto the photocathode of the assembly. The circular spot shall uniformly illuminate the photocathode at a level no greater than 1×10^{-5} footcandle. Focus the signal which is emergent from the assembly on a pinhole 0.200 millimeter or larger in diameter. Align to obtain a maximum signal through the pinhole. Measure the light passing through the pinhole with a low-dark-current photomultiplier tube, EMR Model 541E, or equivalent. After suitable amplification, pass the signal to a Total Technology Pulse Height Analysis or equivalent signal-to-noise measurement set and measure the dc content and the RMS value of the signal over an electronic bandwidth of 10 Hz. The signal-to-noise (S/N) ratio is the ratio of the dc signal to the rms noise:

$$S/N = \frac{S_o - S_{bkd}}{K\,(N_o^2 - N_{bkd}^2)^{1/2}}$$

where

S = dc signal

N = rms noise

S_o = signal output from S/N test set

S_{bkd} = background signal from S/N test set with light input off

N_o = noise output from S/N test set rms meter

N_{bkd} = background noise from S/N test set rms meter with light input off

K = correlation factor to obtain signal-to-noise ratio over an equivalent bandwidth of 10 Hz independent of assembly frequency response; K = 1.19 for a P-20 phosphor.

Failure to meet requirements of 3.6.11 shall constitute failure of this test.

4.6.12 Fixed pattern noise. With the operating potential applied to the assembly, illuminate the entire photocathode uniformly at a level of 1 to 2×10^{-4} footcandle. Observe the phosphor screen with a 10-power magnifier for multi-to-multi pattern variations and multi-boundary noise (webbing). If multi-to-multi pattern variations or multi-boundary pattern noise are observed, perform the following:

a. Choose an area of the image where the multi-to-multi patterns appear most noticeable. Search this area for the most contrasting adjacent multi-bundles and measure each multi-bundle brightness, using a photometer aperture of effective diameter of 1/3 the distance from flat-to-flat for hexagonal multies. Failure to meet requirements of3.6.12.1 shall constitute failure of this test.

b. Choose an area of the image screen where the multi-boundary pattern noise is most noticeable. Scan 3 multies and the corresponding multi-boundaries in this area of the screen with a photometer aperture of 25 micrometers effective diameter. Failure to meet requirements of 3.6.12.2 shall constitute failure of this test.

4.6.13 Output brightness uniformity.

4.6.13.1 Output brightness uniformity (white). Uniformly illuminate the photocathode of the assembly under test at a level between 5 X 10^{-6} and 1 X 10^{-5} footcandle of 2856K light. Observe the phosphor screen with a 10-power magnifier for shading. If shading is observed, perform the following:

Using a photometer whose effective aperture at the output image plane of the assembly is not greater than 2.5mm, make four scans completely across the assembly useful area. Each scan shall pass over the assembly optical axis and shall be rotated 45 degrees from the two adjacent scans. The axis of the scanning aperture shall be parallel to the assembly optical axis for all points along each scan. The brightness of the output image plane shall be measured to within ± 10 percent over each scan, and the brightness values shall be recorded in a suitable storage device. There shall be no compensation made for nonuniformity caused by the output fiber optic.

The four scans shall then be examined as a group, from which the maximum output brightness uniformity ratio shall be determined using the maximum and minimum values of the combined scans. Failure to meet the requirements of 3.6.13 shall constitute failure of this test.

4.6.13.2 Output brightness uniformity (0.8300 microns). Uniformly irradiate the photocathode of the assembly under test with 1 to 3 X 10^{-10} watt of 0.8300-micrometer radiation. Observe the phosphor screen with a 10-power magnifier for shading. If shading is observed repeat the scan procedure specified in 4.6.13.1.

Calculate the maximum-to-minimum output brightness uniformity ratio, using the maximum and minimum values of the combined scans. Failure to meet the requirements of 3.6.13 shall constitute failure of this test.

4.6.14 Image alignment. Perform this test with the same equipment or equivalent, used in 4.6.16. With the operating potential applied, focus a test reticle on the photocathode. The photocathode shall be illuminated to provide a high contrast image of the test reticle. Observe the image of the test reticle formed on the screen of the assembly with a 10-power measuring magnifier containing a circular pattern of 0.006-inch diameter.

When the image of the center of the test reticle is focused on the optical axis of the photocathode, the screen image of the reticle center shall be examined to verify that it falls within the circular pattern. The magnifier shall be aligned with the optical axis of the assembly such that the center of the circular pattern falls on the optical axis. Failure to meet requirements of 3.6.14 shall constitute failure of this test.

4.6.14.1 Image alignment-alternate. Project a 0.056 ± 0.001 inch spot onto the photocathode. This spot shall fall within a 0.062 ± 0.001 inch output aperture. Failure of the 0.056 ± 0.001 inch spot to fall within the 0.062 ± 0.001 inch spot shall constitute failure of this test.

4.6.15 Veiling glare. Use a NiTec veiling glare tester (drawing number SD000646) or equivalent described as follows:

A black-hole target is imaged on the central 14mm of 18mm image tube, which results in a 2mm annulus bright area at the image tube output. The target itself overfills the ANVIS 40 degrees FOV by at least 25 degrees, in order to account for glare resulting from outside FOV light. The output black-hole image thus contains an illumination level proportional to the system's glare. The central 4mm diameter area of the black hole is measured for the glare illumination level. Next, the black hole is covered to present uniform illumination over the full FOV. The 4mm probe then measures the high-light level illumination. Glare is then calculated as follows:

The background illumination level (Bd) shall be measured (or pulled) with no target illumination. The annular target shall be illuminated such that is brightness (B1) is $1.2 \pm 0.2 \times 10^{-4}$ footlamberts outside the dark central, and detector reading (BL) shall be recorded. The dark central area of the annular target shall then be eliminated such the target's brightness is (B2) over the entire FOV and the detector's reading (BH) shall be recorded. The tube assembly veiling glare (VG) shall be calculated as follows:

$$VG = \frac{(BL - Bd)\ B2}{(BH - Bd)\ B1} \times 100\%$$

Failure to meet the requirements of 3.6.15.1 shall constitute failure of the test.

4.6.16 Resolution.

4.6.16.1 Center resolution. Perform this test using:

a. Radiation source as specified in 4.6.
b. A projection system having an F-number not less than 1.2 or not greater than 2.35 to project the test pattern.
c. A resolving power target having black bars on a clear background (1951 Air Force Resolving Power Test Target).
d. A 10- magnifier.

The resolving power test target shall be focused on the photocathode such that the center of the target is aligned with the optical axis. The input radiation shall be adjusted for best image contrast. The image of the resolving power test target formed on the screen of the assembly shall be observed for limiting resolution (see 3.11.16). Failure to meet requirements of 3.6.16.1 shall constitute failure of this test.

4.6.16.2 Peripheral resolution. Determine the peripheral resolution with the same or equivalent test equipment used in 4.6.16.1. The resolving power target shall be focused on the photocathode such that the group and element representing 36 line pairs per millimeter of the target is positioned 7mm from the optical center of the photocathode. Input radiation shall be adjusted for the best image contrast. Failure to meet the requirements of 3.6.16.2 shall constitute failure of this test.

4.6.16.3 High light level center resolution. The resolving power test target shall be focused on the photocathode such that the center of the target is aligned with the optical axis. The input radiation shall be adjusted to no less than twenty (20) footcandles. The image of the resolving power target found on the screen of the assembly shall be observed for the limiting resolution (3.11.16). Resolution less than that specified in 3.6.16.3 shall constitute failure of this test.

4.6.17 System interface. Insert the assembly into an ANVIS monocular and apply 3.0 Vdc. The objective lens must be able to focus an image in combination with the assembly at 28 cm and through infinity. View the output of the tube for flashing, flickering or intermittent operation. Failure to meet requirements of 3.6.17 shall constitute failure of this test.

4.6.18 Modulation transfer function (MTF). Equipment used to measure modulation transfer function must satisfy the following, requirements, or equivalent, subject to Government approval.

a. A sine wave analyzer capable of, but not limited to, direct readout for spatial frequencies within one line pair of the following: 2.5 lp/mm, 7.5 lp/mm, 15 lp/mm, and 25 lp/mm such that MTF determined at each frequency shall be within $\pm$ 2 percent of the standard value.

b. The analyzing slit must be 10 micrometers or less in width by 1 mm or more in length.

c. The limiting aperture in the plane of the test pattern shall be a minimum of 2.5mm in width referred to the phosphor screen of the assembly.

d. The test system calibration frequency shall be 0.2 lp/mm or less.

e. The test system MTF shall be greater than 95 percent at 2.5 lp/mm.

f. Input illumination measured at the assembly photocathode shall be not greater than 8×10^{-4} fc.

The zero MTF level shall be determined by blocking the light from the phosphor screen while the system is running at calibration frequency. When unblocked, the calibration reading is normalized to 100 percent MTF. Assembly MTF is determined by dividing MTF of the measuring system with the assembly in place by MTF of the measuring system without the assembly. Failure to meet requirements of 3.6.18 shall constitute failure of this test.

4.6.19 Useful cathode diameter. With the operating potential applied to the assembly, focus the test reticle on the photocathode such that it is centered on the assembly's optical axis. The test reticle shall consist of equally spaced lines from the center to the edge of the reticle in four directions 90^{o} apart. Spacing between a large graduation and a small graduation shall be 0.5 millimeter $\pm$ 0.03 millimeter, and spacing between two large graduation shall be 1.0 millimeter $\pm$ 0.03 millimeter. All line, letters and numbers shall be high contrast black on a clear glass substrate. Adjust the input radiation level for best image contrast. The output screen shall be viewed with a 10- power magnifier. Useful cathode diameter is determined by the number of millimeter graduations visible on the screen of the assembly and shall be determined in both vertical and horizontal directions. Failure to meet requirements of 3.6.19 in both vertical and horizontal directions shall constitute failure of this test.

4.6.20 Reversed polarity. With no light on the photocathode, the assembly shall be operated with a reversed polarity input voltage for a period of not less than 60 seconds. Failure to meet requirements of 3.6.20 shall constitute failure of this test.

4.6.21 Photocathode, microchannel plate, and screen quality. With the operating potential applied and no radiation incident of the photocathode, observe image screen with a 10-power magnifier. With an input light level adjusted for best spot contrast, the image screen shall be observed for opaque or dark spots that exceed the size or quantity specified in Table III. With an input light level of 2×10^{-6} fc, observe the screen for field emission, bright spots, and graininess. If chicken wire is present to a degree that it detracts from normal performance, refer to the requirements of 3.5.2 and determine if minimum requirements are met. Failure to meet requirements of 3.6.21 (and 3.5.2.4) shall constitute failure of this test.

4.6.22 Luminance persistence. Illuminate the central part of the photocathode with a 1/8 inch spot of light at 4×10^{-3} fc, $\pm$10 percent for 1 minute. Let B_s represent the screen brightness. Gate the light OFF within 1 millisecond (ms) and observe the output screen brightness, $B_d(t)$, where t is the time after gating the light OFF. The persistence $(B_d(t)/B_s) \times 100$ percent at t = 300 ms shall be not greater than the value specified in 3.6.22. Failure to meet requirements of 3.6.22 shall constitute failure of this test.

4.6.23 Humidity test. Subject the unprotected assemblies to the temperature/humidity profile of MIL-STD-810, Method 507.1, Procedure II as modified below. Failure to meet the requirements of paragraph 3.6.23 shall constitute failure of this test.

Procedure II - Ground and airborne electronic equipment.

Step 1 - delete
Step 2 - delete
Step 3 - delete
Step 4 - Take initial measurements of gain, input current, center resolution and EBI. Gain shall be run at 2×10^{-6} fc.

NOTE: No readjustment shall be permitted throughout the test period and no repairs or replacement of parts shall be permitted.

Step 5 - No Change
Step 6 - Subject the test items to five continuous 48 hour cycles in accordance with Figure 507.1-2. Take measurements in accordance with Step 4 at the last two hour period of the third (3rd) cycle (sixth day). Prior to measurement accumulated moisture may be removed. Wiping is permitted.
Step 7 - At the end of five continuous 48 hours cycle, cool the assemblies to room temperature and hold at room temperature for a maximum of four hours.
Step 8 - At the end of the room temperature holding period, subject the assemblies to the measurements specified in Step 4.
Step 9 - Delete

4.6.24 Ion barrier film quality. The ion barrier film quality shall be tested prior to assembly with the power supply. When the photocathode is uniformly illuminated with not less than 1×10^{-1} footcandles, apply potentials V_2 and V_3. Adjust V_1 between 1 volt and 8 volts for best contrast while observing the phosphor screen with a 10-power eyepiece or microscope of sufficient power to resolve the holes with a dark-adapted eye. V_2 and V_3 shall be those selected nominal operating voltages for that particular tube under test to obtain a luminance gain of 20,000 FL/FC for 2×10^{-6} footcandles illumination on the photocathode. Photograph the output screen with not less than 1×10^{-1} footcandles illumination on the photocathode. This photograph shall be of sufficient quality to be representative of the holes as viewed with a 10 power eyepiece and a dark-adapted eye. Failure to meet the requirements of 3.5.4.1 shall constitute failure of this test.

4.7 Reliability. The test shall be in accordance with Table X and as specified herein. Sufficient instrumentation shall be provided to ensure immediate recognition of a catastrophic failure as well as a change in relative output brightness. Assembly parameters: luminance gain; EBI; signal-to-noise; center and high light resolution; useful cathode diameter; photocathode, microchannel plate, and screen quality; and output brightness uniformity shall be tested at room temperature as specified herein not less than once each 200 $\pm$ 50 hours of operating time. Reliability test assemblies shall be removed from test conditions for not more than 15 hours at any given time for measurement of assembly parameters. At other times, assemblies shall be cycled continuously on a 24 hour basis. A failure shall be presumed to have occurred immediately after the last successful measurement or inspection. Failed assemblies which have been removed from test shall not be replaced. A failed assembly repaired and returned to test shall be for information only. The requirements of MIL-STD-781 shall apply.

TABLE X. Reliability test environmental conditions.

Parameter	Environmental conditions
Temperature	40°C, ± 5°C
Temperature cycling	Not applicable
Vibration	2.2 g, ± 10% peak acceleration at any resonant frequency between 20 and 60 Hz, measured at the mounting points on the equipment. The duration of vibration shall be at least 10 minutes during each period of equipment ON time when performing standard reliability. The duration of vibration shall be at least 2 minutes per period of equipment ON time during accelerated reliability testing.

4.7.1 Standard reliability test. ON-OFF cycling shall consist of 55 minutes of operation (ON time) followed by 5 minutes OFF. Input voltage to the assembly shall be 2.7 to 3.0 Vdc. The initial brightness gain shall be between 20,000 and 35,000. Acceptable limits of brightness gain during and at the completion of the test shall be 10,000 to 35,000.
No gain adjustments shall be allowed during the test or inspections. Signal-to-noise shall be not less than 13.60 during this test or any inspection. During operation each assembly shall be illuminated with not less than 1×10^{-5} fc. Once during each hour of operation the illumination of each assembly shall be increased to 5×10^{-4} fc for 5 seconds, reduced to 1×10^{-5} fc for not less than 5 minutes, and then increased to 5fc for 3 seconds. See 4.7.4 for failure definition.

4.7.2 Accelerated reliability test. ON-OFF cycling shall consist of 11 minutes of operation (ON time) followed by 1 minute OFF. Input voltage to the assembly shall be 2.7 to 3.0Vdc. The initial brightness gain of each assembly shall be between 20,000 and 35,000. Acceptable limits of brightness gain during and at the completion of the test shall be 10,000 to 35,000. No gain adjustments shall be allowed during this test or inspection. Signal-to-noise shall be not less than 13.60 during the test or any inspection.
During operation each assembly shall be illuminated with not less than 5×10^{-5} fc. Once during each 11 minutes of operation the illumination of each assembly shall be increased to 5×10^{-4} fc for 5 seconds, reduced to 5×10^{-5} fc for not less than 5 minutes and then increased to 5 fc for not less than 3 seconds. See 4.7.4 for failure definition.

4.7.3 Accept/reject criteria.

4.7.3.1 Initial production test reliability inspection. The accept/reject determination shall be made upon either the accumulation of 7500 hours operating time (1500 hours accelerated) on each of the ten assemblies or the occurrence of four assembly failures.

Four or more assembly failures shall constitute failure of the equipment to meet the reliability inspection requirement. Three or less assembly failures shall constitute acceptance of the reliability requirement.

4.7.3.2 Quality conformance reliability inspection. The accept/reject determination shall be made upon either the accumulation of 7500 hours operating time (1500 hours accelerated) on each of the four assemblies or the occurrence of two assembly failures. Two or more assembly failures shall constitute failure of the equipment to meet the reliability inspection requirement. One or less assembly failures shall constitute acceptance of the reliability requirement.

4.7.4 Failure definition. A failure is defined as the inability of the assembly to pass the tests of paragraphs 4.7.1 and 4.7.2 as applicable, and failure to meet the requirements of 3.6.7, 3.6.13, 3.6.16, 3.6.19, 3.6.21, and 3.7. Failures attributed to the power supply are relevant.

4.8 Electromagnetic interference. The AN/AVS-6 system under test shall consist of a binocular assembly and battery pack mounted to an SPH-4 helmet. With testing to be conducted in accordance with paragraph 4.6.20 of MIL-A-49425.

5. PACKAGING

5.1 Packaging requirements. The packaging requirements for the desired level(s) of protection shall be as specified by the acquisition activity (see 6.2).

6. NOTES

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

6.1 Intended use. The assembly is intended for use in the AN/AVS-6(V) Aviator's Night Vision Imaging System, an electro-optical viewing device capable of intensifying low light levels such that a visible image is presented for viewing and flying purposes.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number and date of this specification.
b. Time frame required for submission of IPT number of assemblies required and disposition of IPT samples (see 4.4).
c. Necessary action by contractor in event of Group C or D failures.
d. Qualification - If a product is not qualified at time of award the contract must require qualification prior to first delivery.
e. Sampling plans for Group B and Group C inspections. As guidance, unless otherwise specified, sampling shall be conducted per the requirements of MIL-STD-105.
f. MIL-STD-810C shall be used for environmental test of section 4.
g. Issue of DODISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.1.2).

6.3 Definitions. See 3.11.

6.4 Subject term keyword listing.
Image Intensifier
18mm Microchannel
Tubes

Custodian:
Army - CR

Preparing Activity:
Army - CR

PROJECT 5855-A305

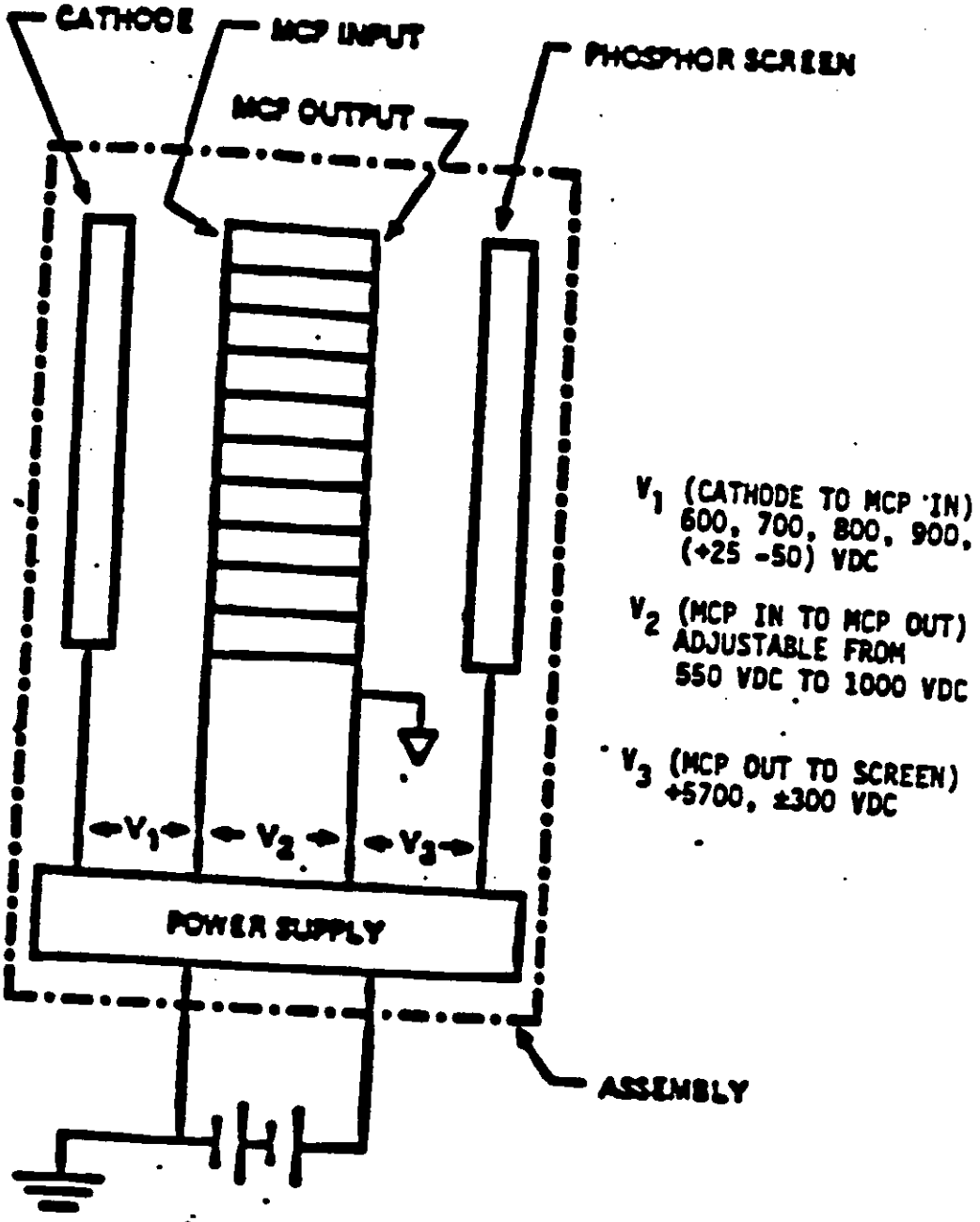

Figure 1. Power Supply/Image Tube Interface

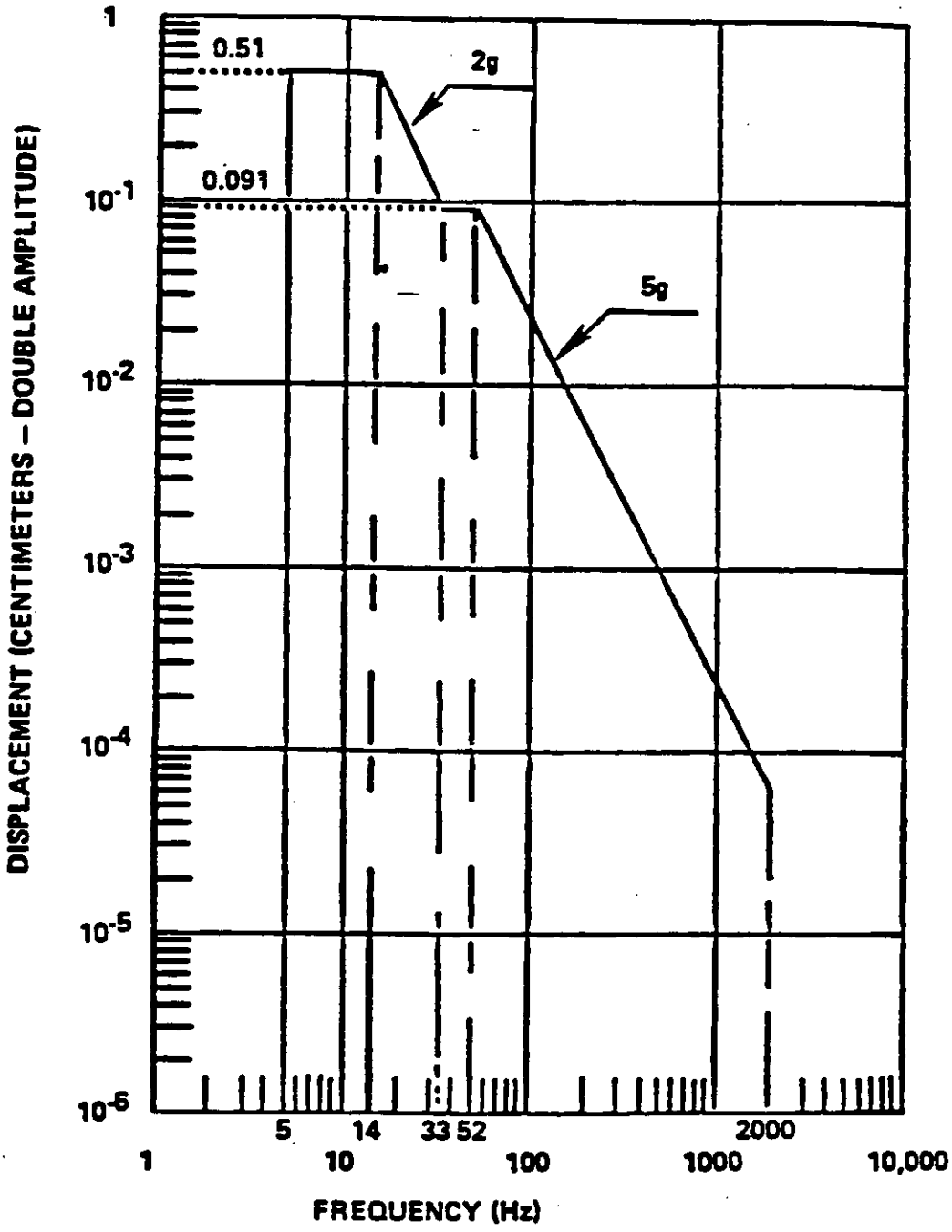

FIGURE 2. Vibration test profile.

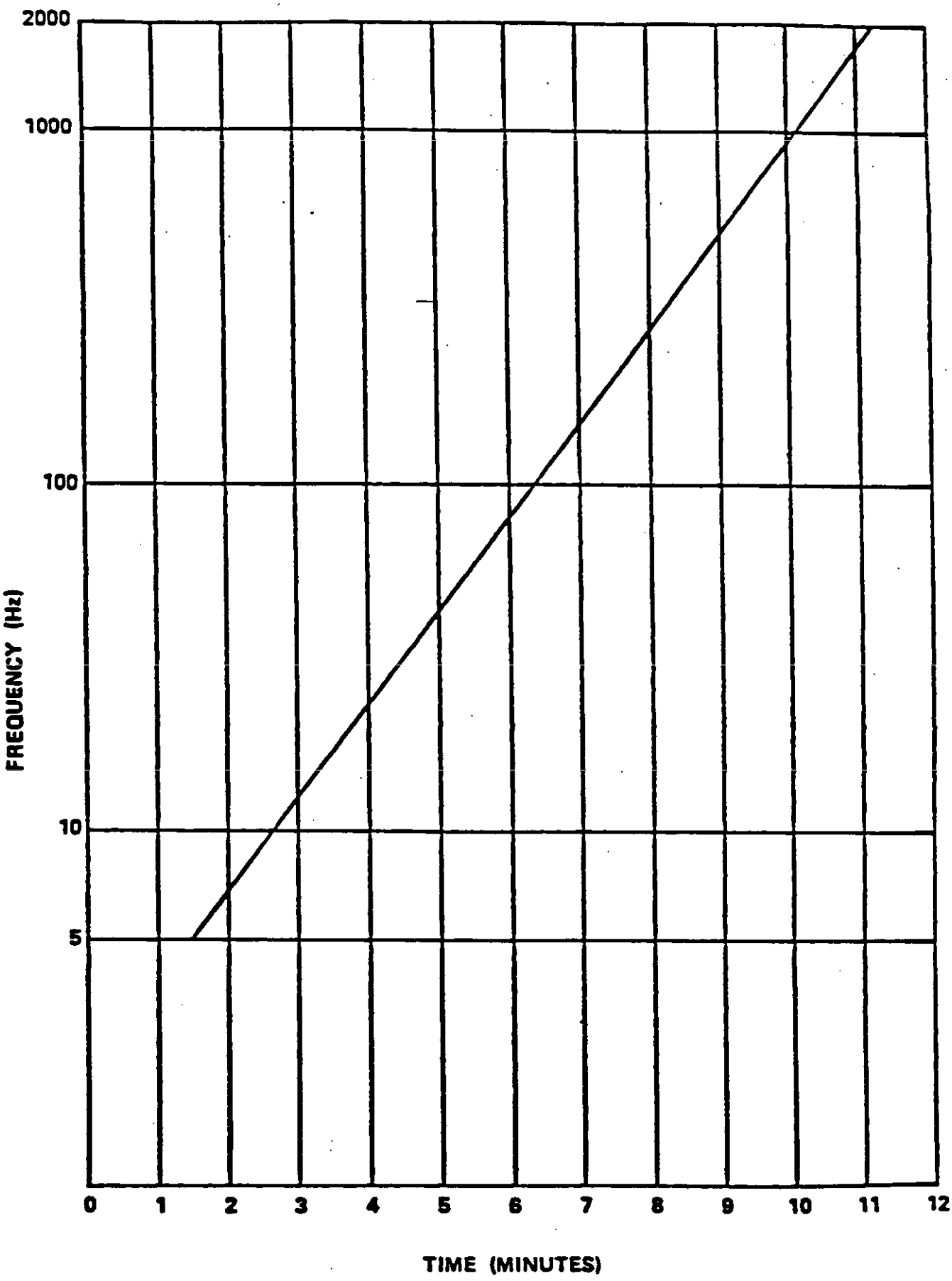

FIGURE 3. Vibration frequency-time profile.

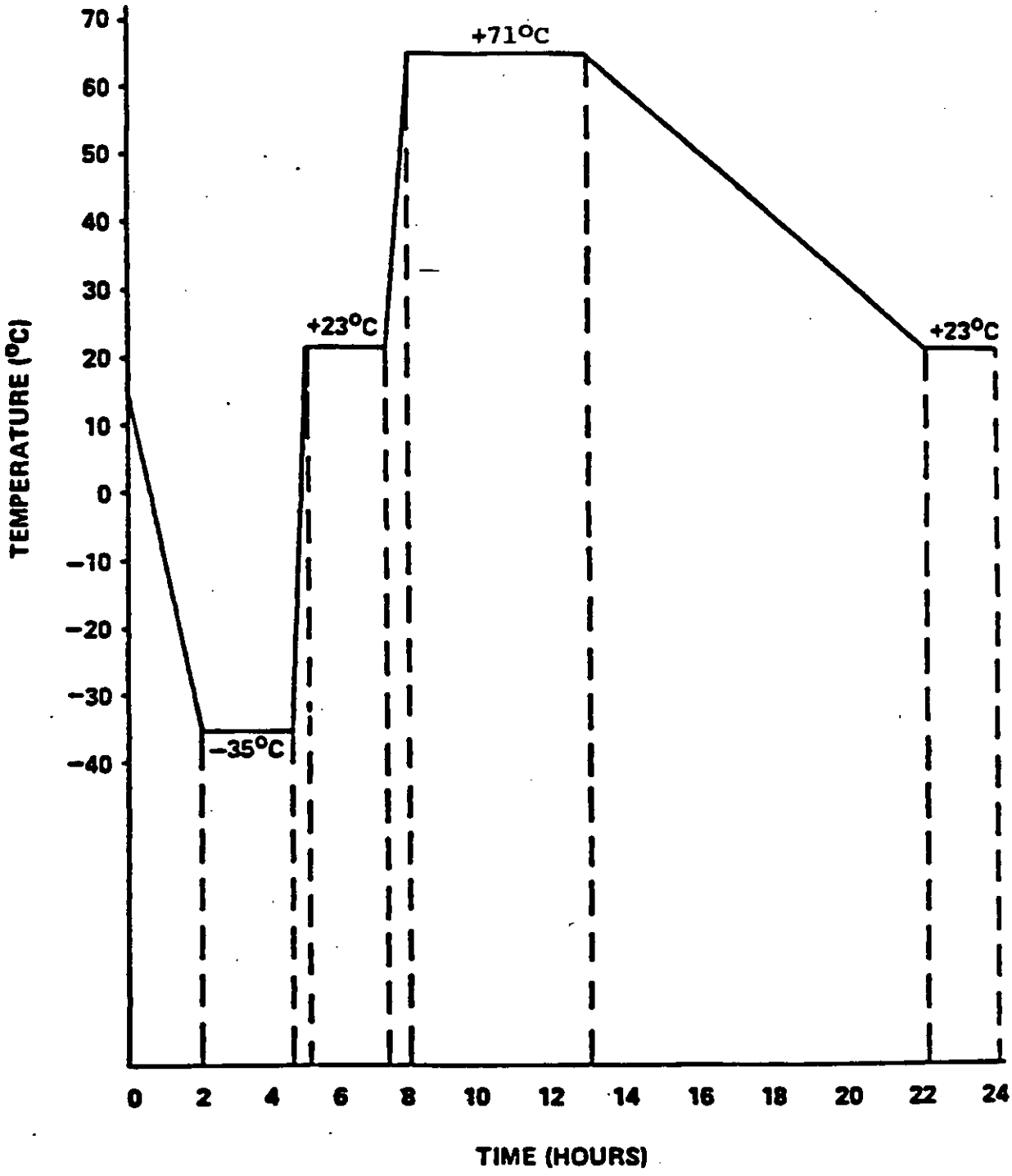

FIGURE 4. Temperature cycle.

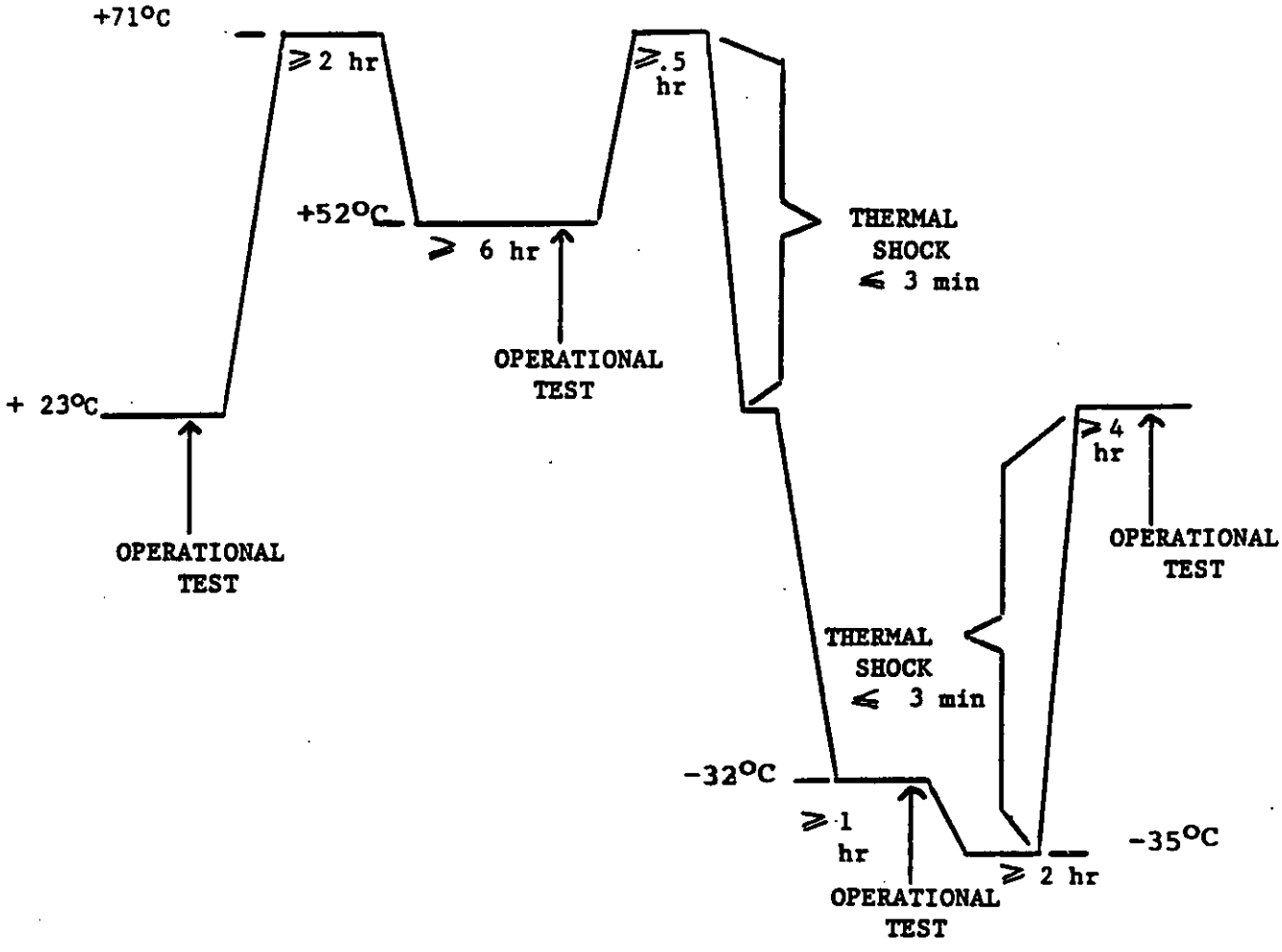

FIGURE 5 Environmental Temperature Profile

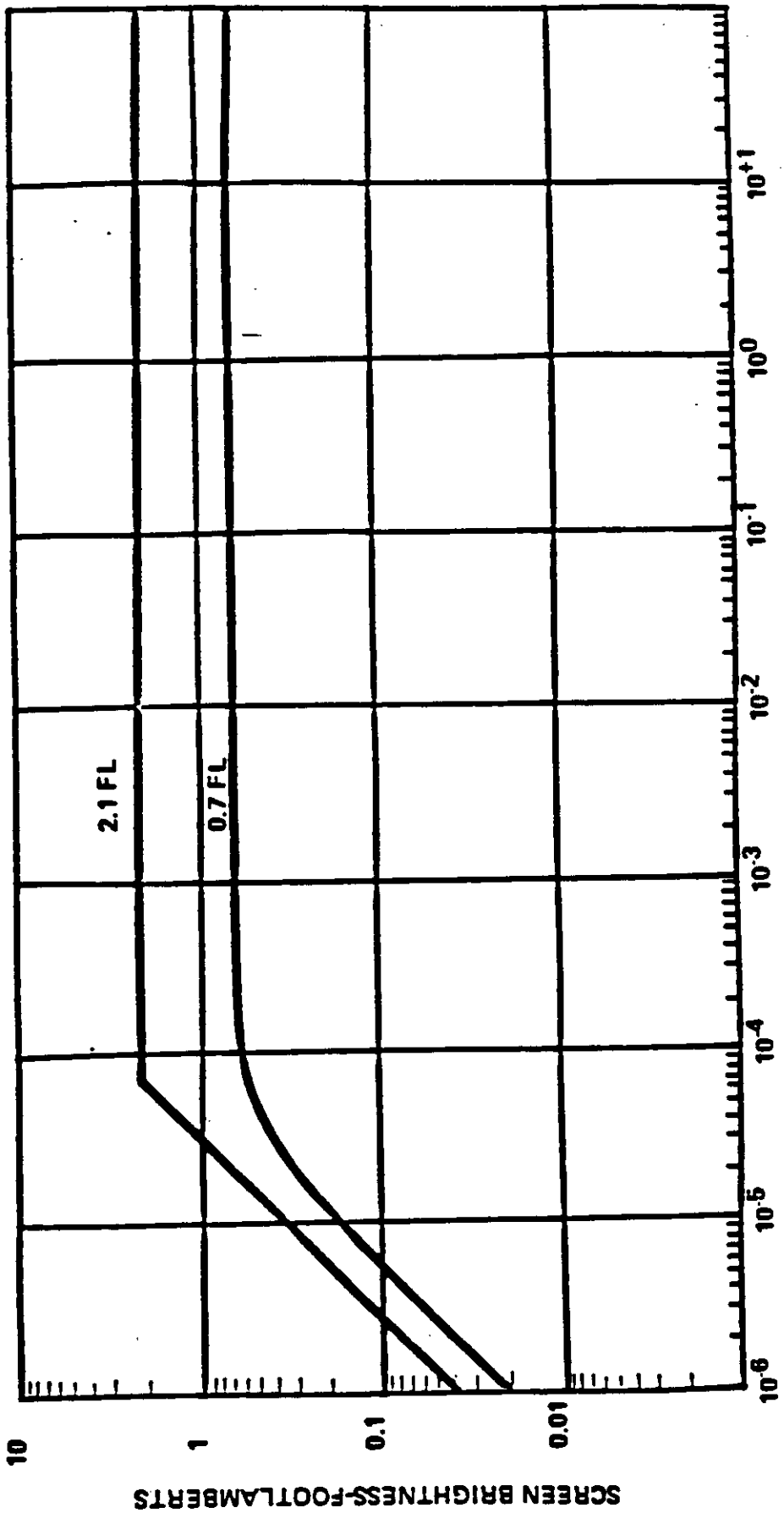

FIGURE 6. Gain/saturation requirement.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12062 WASHINGTON D. C.
POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

Commander
U.S. Army Communications-Electronics Command
ATTN: AMSEL-ED-TO
Fort Monmouth, NJ 07703-5000

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-I-49428(CR)	IMAGE INTENSIFIER ASSEMBLY, 18MM MICROCHANNEL WAFER MX-10160/AVS6

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.