INCH-POUND

MIL-PRF-49052G
4 March 1999
Superseding
MIL-I-49052F
21 May 1992

PERFORMANCE SPECIFICATION

IMAGE INTENSIFIER ASSEMBLY, 18 MILLIMETER MICROCHANNEL WAFER, MX-9916/UV

This specification is approved by the U.S. Army Communications-Electronics Command (CECOM), 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-Millimeter Microchannel Wafer, MX-9916/UV (see 6.1).

2. APPLICABLE DOCUMENTS

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

Beneficial comments (recommendations, additions, and 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-LC-LEO-E-EP, Fort Monmouth, NJ 07703-5023, by using the Standardization Document Improvement Proposal (DD Form 1426) or by letter.

AMSC N/A FSC 5855

SPECIFICATIONS

MILITARY

MIL-PRF-49065 - Night Vision Goggles, AN/PVS-5( )

STANDARDS

MILITARY

MIL-STD-461 - Electromagnetic Interference Characteristics For Equipment, Subsystem and System
MIL-STD-462 - Electromagnetic Interference Characteristics, Measurements Of

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robins Avenue, Building No. 4, Section D, Philadelphia, PA 19111-5094.)

2.1.2 Other government documents, drawings, and publications. The following other government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation (see 6.2.e).

DRAWINGS

USA COMMUNICATIONS-ELECTRONICS COMMAND

SM-D-657310 - Image Intensifier, Night Vision and all associated drawings
SM-C-657375 - Mount Assembly, Objective Lens
A3144480 - Objective Lens Assembly, F/1.05
SM-C-657326 - Image Intensifier Module
SM-C-657325 - Power Supply Assembly

(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 takes 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 Millimeter Microchannel Wafer, MX-9916/UV, referred to hereinafter as the assembly, shall have a minimum useful photocathode diameter and phosphor screen diameter of no less than 17.5 millimeters (see 3.12.20). The assembly shall employ an S-20 photocathode with extended red response. The assembly shall include the high voltage multiplier and oscillator and shall be encapsulated within a hard-surface insulating sleeve or boot and assembled into a metal housing. The assembly shall employ a microchannel electron multiplier plate with proximity focus on the input and output, and shall contain an input fiber optic faceplate and an output fiber optic inverter as an integral part of the tube envelope.

3.2 Construction. The assembly shall be constructed to comply with the performance requirements in the contract, drawing SM-D-657310 as applicable, and as specified herein.

3.2.1 Weight. The weight of the assembly shall not be greater than 126 grams.

3.3 First article test inspection. When specified in the contract or purchase order, the contractor shall furnish first article test (FAT) inspection assemblies in accordance with 4.2 (see 6.2.b).

3.4 Parts and materials. The contractor shall select parts and materials fully capable of meeting all operational and environmental requirements specified herein. The materials specified on the applicable drawings are recommended, but not mandatory. Verification that the assembly meets the overall performance requirements shall be the governing acceptance standard.

3.4.1 Phosphor screen. The phosphor screen (see 3.12.2) shall be RCA F2126 (type number 10-52) or a government approved equivalent.

3.5 Components.

3.5.1 Power supply. The power supply (see drawing SM-C-657325) shall electrically and mechanically interface with the image intensifier module (see drawing SM-C-657326). The power supply shall produce the required operational characteristics when powered by a 2.0 to 3.0 volt direct current (Vdc) power source.

3.5.1.1 Reverse polarity. The power supply shall withstand a reverse polarity input voltage of 3.0 Vdc for at least 10 minutes. When the correct polarity of 3.0 Vdc is applied to the power supply, the tube shall function normally.

3.5.2 Fiber optic faceplate/inverter.

3.5.2.1 Shear distortion. Shear distortion (see 3.12.3.1) shall not exceed 25 micrometers (µm) over the display area.

3.5.2.2 Gross distortion. Gross distortion (see 3.12.3.2) shall cause no point on the image of a straight line, through any axis, to be displaced more than ±30 µm relative to the best-fit straight line (see 3.12.3.3). Displacement measurements shall be rounded to the nearest whole µm. The maximum slope of the straight line image shall be less than 15 µm per millimeter (mm) across the line image and less than 25 µm per any 2 mm from the best-fit straight line. Distortion shall be measured along 4 axes which are 45 degrees apart. Distortion measurements shall be initiated from an identifiable reference point located on the fiber optic inverter. The line image cannot have more than two slope reversals. Slope reversals less than ±5 µm shall not be considered as a change in slope.

3.5.2.3 Image inversion. The fiber optic inverter shall rotate a straight line image 180 degrees ± 1 in a clockwise direction when viewed from the display side relative to the end points of the best-fit straight line (see 3.12.3.3). Image inversion measurements shall be rounded off to the nearest tenth of a degree.

3.5.2.4 Chicken wire. When the fiber optic inverter is viewed under 10 power (10X) 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 3.12.4) limits specified in Table I.

NOTE: The areas in question shall be inspected in such a manner that light is transmitted through the optic and the areas in question can be observed and measured in accordance with 3.5.2.4 and Table I.

Table I. Fiber optic inspection.

Length of chicken wire in inches	Number of allowable incidences of chicken wire in zone 1	Number of allowable incidences of chicken wire in zone 2
.250 ≤ length	0	0
.125 ≤ length ≤ .249	0	5
.090 ≤ length ≤ .124	0	disregard
.041 ≤ length ≤ .089	2	disregard
.020 ≤ length ≤ .040	6	disregard
length ≤ .019	disregard	disregard
Zone 1 - 0.295 inch diameter circle whose center is coincident with the optical axis of the fiber optic.		
Zone 2 - 0.295 inch to 0.710 inch annulus concentric with zone 1.		

3.6 Operational and environmental characteristics.

3.6.1 Photocathode sensitivity. Luminous sensitivity shall be no less than 260 microamperes (µA) per lumen for radiation with a color temperature of 2856 Kelvin (K) ± 50. Radiant sensitivity shall be no less than .015 ampere per watt at 0.830 µm ± 0.001.

3.6.2 Burn-in (ESS). The assembly shall undergo 50 continuous cycles. Each cycle shall consist of 55 minutes of operating time and 5 minutes of off-time. Once during each operating cycle the photocathode shall be illuminated with 5 x 10^{-4} foot-candle (fc) for 5 seconds and with 5 fc for 3 seconds. The remaining portion of the operating cycle shall be without photocathode illumination. The brightness gain setting shall not be changed during, or subsequent to, burn-in.

3.6.3 Vibration. The assembly, with no operating voltage applied, shall not be damaged (see 3.12.9) or suffer degradation of performance (see 3.12.22) after being subjected to simple harmonic motion parallel to and perpendicular to the optical axis over a frequency range of 5 hertz (Hz) to 55 Hz with an amplitude of not less than 0.100 inch total excursion for a period of 10 minutes in each plane.

3.6.4 Shock. The operating assembly, with no radiation incident on the photocathode, shall not be damaged (see 3.12.9) and there shall be no evidence of arcing, flashing, flickering, corona, bright spots, or other intermittent or continuous failure when subjected to 6 shock impacts parallel to the optical axis and 6 shock impacts perpendicular to the optical axis. The shock impacts shall be half sine wave with a minimum peak amplitude of 75 g (see 3.12.5) and a duration of 6 milliseconds (ms) ± 2 measured at the 10 percent amplitude points.

3.6.5 Temperature (extreme). The assembly shall not be damaged (see 3.12.9) by storage, operation, or the thermal shock temperature profile specified and shall meet the following requirements at the temperature specified. Test profiles shall be as follows:

a. High temperature storage: +65°C for 2 hours.

b. High operating temperature: +45°C for 1 hour.

1. Input current shall not be greater than 20 mA.

2. Gain at 2 x 10^{-6} fc shall not be less than 3,000 and shall not be greater than 15,000.

3. Gain at 2 x 10^{-4} fc shall not be less than 1,500 and shall not be greater than 4,500.

4. Output brightness fluctuation shall be tested at 2.2 Vdc and 2.7 to 3.0 Vdc at 2 x 10^{-4} fc and 1 fc for first article test (FAT). Conformance inspection testing shall be 2.0 Vdc and 1 fc only. The output brightness fluctuation shall not be greater than ±10 percent from a steady state condition and drift shall not be greater than ±15 percent from a steady state condition for a period of 2 minutes after an initial 2 seconds of operating time. All fluctuations shall be random after the initial 2 seconds.

5. 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 3.6.5 b(4) shall be met.

6. If the output brightness drift is greater than ±15 percent during the original 2 minutes time period, the test shall be continued an additional 2 minutes during which the requirements of 3.6.5 b(4) shall be met.

7. Rise time (see 3.12.6) shall not be greater than 7 seconds. Overshoot shall be less than 40 percent of steady state output brightness.

c. Temperature shock: shock from +45°C to +23°C within 3 minutes or less.

d. Low operating temperature: reduce temperature to -51°C, hold for 1 hour.

1. Input current shall not be greater than 19 mA.

2. Gain at 2 x 10^{-6} fc shall not be less than 7,500 and shall not be greater than 30,000.

3. Gain at 2 x 10^{-4} fc shall not be less than 1,500 and shall not be greater than 7,500.

4. Operational stability and rise time testing. Perform same tests as 3.6.5 b.4 through b.7 listed above.

e. Low Temperature storage: maintain temperature at -51°C for 2 hours.

f. Temperature shock: shock from -51°C to +23°C within 3 minutes.

g. After exposure of the assembly(s) to the profiles listed above, perform the following room temperature tests:

1. Gain at 2 x 10^{-6} fc shall not be less than 7,500 and shall not be greater than 15,000.

2. Gain at 2 x 10^{-4} fc shall not be less than 1,500 and shall not be greater than 4,500.

3. Operational stability and rise time testing. Perform same tests as 3.6.5 b.4 through b.7 listed above.

3.6.6 Equivalent background input (EBI). The equivalent background input at room temperature (see 3.12.7) shall not exceed 2.5 x 10^{-11} lumens per square centimeter when tested at 23°C.

3.6.7 Luminance gain. The assembly shall have a room temperature luminance gain and high light level saturation characteristics as specified in Table II. The input current at room temperature shall not exceed 16 mA at the light level specified.

Table II. Saturation requirements for luminance gain.

Nominal input light level (fc)[1]	Minimum allowable gain	Minimum allowable output (fL)[2]	Maximum allowable gain	Maximum allowable output (fL)[2]	Input Current (mA)
2×10^{-6}	7,500	N/A	15,000	N/A	16
2×10^{-4}	1,500	N/A	4,500	N/A	16
1.0	N/A	0.3	N/A	0.9	N/A
20.0	N/A	0.3	N/A	0.9	N/A

[1]in units of foot-candles (fc)
[2]in units of foot-lamberts (fL)

3.6.8 Halo. The halo (see 3.12.8) produced by projecting a spot of light onto the input of the assembly shall be no greater than 1.37 millimeters (mm) in diameter.

3.6.9 Bright source protection. The assembly shall not be damaged (see 3.12.9) when subjected to an input illumination of not less than 50 millilumens concentrated on the photocathode within an area not greater than 1 mm^2 for a time interval of not less than 1 minute. Additionally, the assembly shall have luminance gain saturation characteristics throughout the applied illumination period such that the light output is not greater than 3 millilumens or not less than 0.37 millilumen. This requirement shall be met within 1 second after the input illumination is applied. There shall be no discernible damage after a non-operating period of not more than 24 hours.

3.6.10 Signal-to-noise ratio. The signal-to-noise ratio of the assembly shall not be less than 4.5.

3.6.11 Fixed pattern noise.

3.6.11.1 Multi-to-multi pattern variation (see 3.12.10). Multi-to-multi brightness deviations from the mean value shall not exceed ±10 percent.

3.6.11.2 Multi-boundary pattern noise (see 3.12.11). 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.

3.6.12 Output brightness uniformity. When the photocathode is uniformly illuminated with light at a color temperature of 2856 K ± 50, 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 µm ± 0.001, the ratio shall not exceed 4:1. Under the same conditions, when the screen is viewed with a 10 power (10X) magnifier, the background shading shall be uniformly graded with no distinct lines of demarcation between the light and dark areas.

3.6.13 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 an ellipse of 0.012 inch major axis and 0.006 inch minor axis. The ellipse shall be concentric with the optical axis of the assembly and the major axis of the ellipse shall be horizontal when the alignment slot of the assembly is displaced 75 degrees ± 0.5 from the horizontal in a counterclockwise direction, when viewed from the screen end of the assembly.

3.6.14 Lens interface. The assembly shall show no evidence of intermittent operation, arcing, flashing, flickering, corona, or bright spots beyond that allowed in 3.6.19, and the input current of the operating assembly shall not increase when coupled with an F/1.4 objective lens assembly conforming to drawing SM-C-657375 and, also, with an F/1.05 objective lens assembly conforming to drawing A3144480.

3.6.15 Resolution.

3.6.15.1 Center resolution. The center resolution, referenced to the photocathode, shall not be less than 32 line pairs per millimeter (lp/mm). Disagreement concerning compliance shall be resolved by performing the modulation transfer function test in accordance with paragraph 3.6.17.

3.6.15.2 Peripheral resolution. The peripheral resolution, referenced to the photocathode, shall not be less than 32 lp/mm. This requirement shall be met at two points separated by 90 degrees spaced on a 14 mm diameter circle concentric with the optical axis (see 3.12.15).

3.6.16 Peripheral illumination stability. There shall be no flashing, flickering, or other intermittent operation when the input fiber optic is illuminated outside the 19.5 mm diameter with 20 fc for a period of 20 minutes. The input current deviation from the steady state value shall not be greater than ±2.0 mA.

3.6.17 Modulation transfer function (MTF). The MTF values (see 3.12.12) of the assembly shall not be less than those specified in Table III.

Table III. Modulation transfer function.

Orientation	**Spatial Frequency**[1]		
	2.5 lp/mm	**7.5 lp/mm**	**15.0 lp/mm**
on-axis	86%	58%	20%

[1]in units of line pairs per millimeter (lp/mm)

3.6.18 Useful cathode diameter. The useful cathode diameter shall not be less than 17.5 mm (see 3.12.20).

3.6.19 Photocathode, microchannel plate, and screen quality. When the screen is viewed with a 10X or greater magnifier, with no light, then with 2 x 10^{-6} fc incident on the photocathode, there shall be no bright spots. There also shall be no discernible field emission (see 3.12.13) brighter or larger than the background scintillation (see 3.12.14) noise. When the screen is viewed with a 10X or greater magnifier and with the radiation level on the photocathode adjusted to obtain best spot contrast, the opaque or dark spots which exceed a contrast of 30 percent of their surrounding area shall not exceed the size and quantities specified in Table IV. The size of noncircular spots shall be determined on the basis of area equal to circular spots. When the distance between two spots is less than the maximum dimensions of either spot, the two spots shall be considered as one spot with a size equal to the sum of the maximum dimensions of the two spots plus the amount of separation between them. Graininess caused by a grainy or "peppery" phosphor screen, channel-to-channel gain variations, or fiber-to-fiber transmission variations shall not be discernible over the useful diameter to the degree that it detracts from normal operation, when viewed with a 10X or greater magnifier and with the photocathode uniformly illuminated. Due to the subjectivity of these measurements, disagreement concerning compliance shall be resolved by performing a resolution test in the disputed area, measured at an input illumination of not greater than 1 x 10^{-4} fc incident to the photocathode. If the assembly passes the minimum resolution test in compliance with 3.6.15 and/or the visual requirements stated above, the assembly shall be accepted.

Table IV. Assembly dark spots.

Size of spot in inches	Number of spots within a 0.22 inch diameter circle	Number of spots within an annulus bounded by two circles, 0.22 inch and 0.58 inch in diameter	Number of spots within an annulus bounded by two circles, 0.58 inch in diameter and the total screen diameter
.015 < size	0	0	0
.012 < size ≤ .015	0	1	2
.009 < size ≤ .012	0	3	6
.006 < size ≤ .009	1	6	10
.003 < size ≤ .006	1	15	20
size ≤ .003	disregard	disregard	disregard
Note: The 0.22 inch and 0.58 inch circles on the image screen shall be concentric and their centers shall be coincident with the optical axis of the assembly.			

3.6.20 Phosphor decay. With an input illumination of 1 x 10^{-5} fc to 5 x 10^{-5} fc, the decay due to the output phosphor screen response shall be within the limits specified in 3.12.2 at 10 milliseconds, 100 milliseconds, 500 milliseconds, and 1 second from the start of decay.

3.7 Reliability. The assembly shall have a mean time to failure of not less than 2000 hours when operated under the reliability test conditions specified herein. The reliability test shall be conducted on assembly(s) in which the entire assembly useful cathode area shall be directly illuminated with a target brightness adjusted to achieve an equivalent photocathode illumination at levels corresponding to a T/1.58 objective lens. The target brightness source shall be located 20 inches from the front of front of the assembly(s) under test. The target shall have a color temperature of 2856 K and completely fill the field-of-view of the monocular under test. The target brightness shall be 1×10^{-4} foot-lamberts (fL), which shall be raised to 5×10^{-3} fL for 5 seconds and to 50 fL for 3 seconds once during each on-period. Sufficient instrumentation shall be provided to ensure immediate recognition of a catastrophic failure as well as a change in relative output brightness. In addition, the assembly(s) shall be subjected to the environmental conditions of Table V listed below. On-off cycling shall consist of 55 minutes of on-time followed by 5 minutes of off-time. Input voltage to the assembly shall not be less than 2.7 Vdc nor more than 3.0 Vdc. The initial brightness gain of each assembly shall be between 7,500 and 15,000. Acceptable limits of brightness gain during and at the completion of the test shall be 5,000 to 20,000. No gain adjustment shall be allowed during the test or inspections. Signal-to-noise ratio shall not be less than 3.5 during this test or any inspection. The assembly parameters: luminance gain; EBI; signal-to-noise ratio; photocathode, microchannel plate, and screen quality; output brightness uniformity; and useful cathode diameter shall be tested at room temperature as specified herein once each 200 hours ± 50 of operating time. Reliability test assemblies shall be removed from the test condition for not more than 15 hours 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 unless acceptable continuous monitoring instrumentation records the actual time of failure. Failed assemblies which have been removed from the test shall not be replaced; a failed assembly repaired and returned to the test shall be used for information only.

Table V. Reliability test environmental conditions.

Parameter	Environmental Conditions
Temperature	$40^{o}C \pm 5C^{o}$
Temperature cycling	Not applicable
Vibration	2.2 g ± 10% peak acceleration at any non-resonant frequency between 20 Hz and 60 Hz measured at mounting points on the equipment. The duration of vibration shall be at least 10 minutes during each period of equipment on-time.

3.8 Identification and marking. The assembly shall be identified and serialized in accordance with drawing SM-D-657310. The marking shall include a coded acceptance date such that the first two numbers shall be the last two digits of the year, and the last two numbers 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.

3.9 Humidity. The unprotected assembly pretest values for gain and input current shall not change by more than ±20 percent, the equivalent background input (EBI) shall not increase by more than a factor of three, and all parameters shall remain within the specification limits when subjected to not less than 90 percent relative humidity at temperatures varying between 21° C and 65° C for a period of not less than 240 hours.

3.10 Workmanship. Standards of workmanship shall be such that the assembly will meet all requirements of this specification and any referenced specifications or drawings.

3.11 Electromagnetic interference (EMI). The assemblies manufactured under this procurement shall meet the same EMI requirements as assemblies previously accepted by the U.S. Government as part of AN/PVS-5( ) Night Vision Goggles (the required tests for Night Vision Goggles are RE02, RS01, RS02, and RS03; see MIL-PRF-49065). Test details, including the requirements below, shall be addressed in the EMI test plan and test procedure. Test methods shall be in accordance with Notice 4 to MIL-STD-461A and Notice 3 to MIL-STD-462.

a. The frequencies to be tested under RE02 shall be 14 kHz to 10 GHz.

b. The modified limitations during RE02 are as follows:

1. 20.5 kHz to 35.5 kHz - 35 dB

2. 35.5 kHz to 88.0 kHz - 45 dB

3. 88.0 kHz to 130.0 kHz - 25 dB

4. 130.0 kHz to 340.0 kHz - 20 dB

c. The radiated susceptibility frequencies to be tested under RS03 are 10 kHz to 40 GHz.

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

3.12.1 Photocathode. The photocathode fiber optic faceplate is herein referred to as the photocathode.

3.12.2 Phosphor. RCA F2126 (type No. 10-52) phosphor, or equal, shall exhibit the decay characteristics specified herein. The peak relative spectral response of the phosphor screen shall occur at a wavelength between 0.510 µm and 0.560 µm. The bandwidth shall be less than 0.200 µm measured at the 10 percent points of the spectral response curve. Additionally, the relative response at 0.650 µm shall be less than or equal to 10 percent.

3.12.3 Distortion. The two types of distortion that are important in imaging fiber optics are shear distortion and gross distortion.

3.12.3.1 Shear distortion. Shear distortion causes the image of a straight line to have a discrete, localized, lateral displacement (i.e., a break). Shear distortion is due to localized misalignment errors in the assembly of fibers or multifibers. Shear distortion in fiber bundles is sometimes referred to as incoherency.

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

3.12.3.3 Best-fit straight line. A best-fit straight line is defined as a straight line intersecting the +8 mm and -8 mm points of the input straight line image. The +8 mm and -8 mm measurements are relative to the projected pattern center point.

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

3.12.5 g. g is defined as the magnitude of the earth's mean surface gravitational acceleration with a value of 32.2 feet per second per second.

3.12.6 Rise time and decay time. Rise time is defined as the time required for the assembly to achieve 50 percent of its steady state performance after the voltage source is applied to the assembly. Decay time is defined as the time required for the assembly to achieve a screen brightness of less than 1×10^{-3} fL after the voltage source is disconnected.

3.12.7 Ambient (room) temperature. Ambient (room) temperature is defined as 23°C $+10^{o}$ C/-2° C for all tests except EBI, for which room temperature is defined as 23°C $\pm$ 2° C.

3.12.8 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.

3.12.9 Damage. Damage is defined as:

a. Electrical failure or malfunctioning including arcing, corona, flashing, bright spots, flickering, blinking, or change in input current exceeding 1 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.

3.12.10 Multi-multi pattern variation. Multi-multi pattern variation is defined as discernible spatial gain variation between individual multi-patterns or groups of multi-patterns.

3.12.11 Multi-boundary pattern noise. Multi-boundary pattern noise is defined as discernible spatial gain variation between peripheral and interior channels of a multi-pattern or group of channels.

3.12.12 Modulation transfer. Modulation transfer is defined as 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 lp/mm.

3.12.13 Field emission. Discernible field emission is defined as a 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 low intensity radiation incident on the photocathode.

3.12.14 Scintillations. Scintillations are defined as bright spots which occur on the image screen randomly in space and time.

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

3.12.16 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 shall be able to determine the number of line pairs in both the vertical and horizontal test patterns.

3.12.17 Environmental gain computations and formula.

a. G_{htji} - High temperature luminance gain

b. G_{ltji} - Low temperature luminance 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 background brightness output

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

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

i. Compute high temperature luminance gain (G_{htji}) where:

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

j. Compute low temperature luminance gain (G_{ltji}) where:

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

3.12.18 Overshoot. Overshoot is defined as the amplitude of output brightness above a steady state condition at turn-on.

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

3.12.20 Contrast. Contrast is defined as [(B1-B2)/(B1+B2)].

3.12.21 Degradation of performance. Degradation of performance is defined as a significant change in measurable characteristics which results in failure of the assembly to meet specified requirements or which indicates there is an inherent defect in the operating characteristics of the unit.

4. VERIFICATION

4.1 Classification of inspection. Inspection shall be classified as follows:

a. First article test inspection (4.2).

b. Conformance inspection (4.3).

4.2 First article test (FAT) inspection. Unless otherwise specified in the contract or purchase order (see 6.2.f), the FAT inspection shall be performed by the contractor. The quantity of the first article samples shall be as specified in the contract or purchase order (see 6.2.b) and shall be selected from the first production lot. First article test of the power supply shall be as proposed by the contractor and approved by the government.

4.2.1 First article testing. Each assembly in the first production lot shall be subjected to the performance tests of Table VI, which may be performed in any order. After completion of this testing, assemblies selected as samples for FAT testing shall be subjected to the tests of Table VI-A, which may be performed in any order. Failure of any test shall be cause for rejection of that assembly and may be cause for failure of the FAT inspection.

Table VI. Unit first article test inspection.

Test	Requirement Paragraph
Workmanship	3.10
Identification marking	3.8
Photocathode sensitivity	3.6.1
Burn-in (ESS)	3.6.2
EBI	3.6.6
Luminance gain	3.6.7
Halo	3.6.8
Bright source protection	3.6.9
Signal to noise ratio	3.6.10
Fixed pattern noise	3.6.11
Output brightness uniformity	3.6.12
Image alignment	3.6.13
Peripheral illumination stability	3.6.16
Center resolution	3.6.15.1
Peripheral resolution	3.6.15.2
MTF	3.6.17
Useful cathode diameter	3.6.18
Photocathode, MCP, and screen quality	3.6.19
Lens interface	3.6.14

Table VI-A. Sample first article test inspection.

Test	Requirement Paragraph
Weight	3.2.1
Phosphor decay	3.6.20
Phosphor spectral response	3.12.2
Vibration	3.6.3
Mechanical shock	3.6.4
Environmental temperature	3.6.5
Humidity	3.9
Reliability	3.7
Electromagnetic interference	3.11

4.2.2 Disposition of FAT inspection samples. Disposition of FAT inspection samples shall be as specified in the contract or purchase order (see 6.2.b).

4.3 Conformance inspection. Requirements for conformance inspection shall be as specified in the contract or purchase order (see 6.2.g). Unless otherwise specified, all tests shall be performed at ambient temperature.

4.4 Inspection lot. For purposes of inspection, a lot shall be defined by the contractor.

5.0 PACKAGING

5.1 Packaging requirements. For acquisition purposes, the packaging requirements shall be as specified in the contract or purchase order (see 6.2 i). When actual packaging of materials is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point’s packaging activity within the Military Department’s of Defense Agency’s automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The Image Intensifier Assembly covered by this specification is intended for use in an electro-optical viewing device to intensify low light level such that a visible image is presented for viewing and sighting purposes.

6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Quantity and schedule for first article test (FAT) inspection of all line items and disposition of FAT inspection samples.

c. Necessary actions by the contractor in the event of a lot failure.

d. Sampling plan for lot testing.

e. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced.

f. Statement specifying that FAT inspection is, or is not, required.

g. Statement identifying that the contractor must submit his proposal for conformance inspection to include the specific requirements to be verified and the sampling plan to be used to provide the desired confidence level.

h. Statement identifying that the contractor must submit his proposal for environmental stress screening (ESS).

i. Packaging requirements.

6.3 Definitions. See 3.12.

6.4 Subject/term/keyword listing.

Image intensifier assembly
Image intensifier module
Power supply assembly

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

Custodian:
Army – CR
Navy – AS

Preparing Activity:
Army - CR

Project 5855-0094

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-49052G	2. DOCUMENT DATE (YYMMDD) 990304

3. DOCUMENT TITLE
Image Intensifier Assembly, 18 Millimeter Microchannel Wafer, MX-9916/UV

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME US Army Communications-Electronics Command	b. TELEPHONE (Include Area Code) (1) Commercial (732) 532-9129 (2) AUTOVON 992-9129
c. ADDRESS (Include Zip Code) ATTN: AMSEL-LC-LEO-E-EP Fort Monmouth, NJ 07703-5023	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340