INCH-POUND

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MILITARY SPECIFICATION

LENS ASSEMBLY, OBJECTIVE, 155MM AN/TVS-5

This specification is approved for use by US Army Communications-Electronics Command, 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 Lens Assembly, Objective, 155mm AN/TVS-5 (see 6.1), which is referred to herein as the objective.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

MILITARY

MIL-P-11268 - Parts, Materials, and Processes Used in Electronic Equipment

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving the document should be addressed to: HQ, USA Communications-Electronics Command, ATTN: AMSEL-ED-TM, Fort Monmouth, NJ 07703-5023 by using the 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-M-13231	-	Making of Electronic Items
MIL-O-13830	-	Optical Component for Fire Control Instrument; General Specification Governing the Manufacture, Assembly, and Inspection of

STANDARDS

MILITARY

MIL-STD-150	-	Photographic Lenses
MIL-STD-171	-	Finishing of Metal and Wood Surfaces
MIL-STD-202	-	Test Methods for Electronics and Electrical Component Parts
MIL-STD-454	-	Standard General Requirements for Electrical Equipment
MIL-STD-810	-	Environmental Test Methods

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg #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.g).

DRAWINGS

USA COMMUNICATIONS-ELECTRONICS COMMAND

SM-D-850131 - Lens Assembly, Objective, AN/TVS-5

(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 Lens Assembly Objective is part of the Night Vision Sight, Crew Served Weapon, AN/TVS-5.

3.2 Qualification. Unless otherwise specified by the contract or purchase order (see 6.2.b), objectives assemblies furnished under this specification shall be products approved as qualified products (see 3.10.4 and 6.4).

3.2.1 Initial production testing. When specified in the contract or purchase order, the contractor shall furnish first article objectives in accordance with 4.3.

3.3 Construction. The objective shall be constructed in accordance with SM-D-850131 and all provisions of this specification as specified herein. Unless otherwise specified, treatment and painting shall conform to MIL-STD-171.

3.4 Material. Material 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.

3.5 Components. The objective shall consist of optical components assembled within a housing as specified on the drawing.

3.6 Performance characteristics.

3.6.1 Equivalent focal length. The equivalent focal length of the objective lens shall be 155 mm, ± 1 mm.

3.6.2 Flange focal distance. The flange focal distance shall be 1.20 mm, ± 0.50 mm.

3.6.3 T-number. The T-number of the objective lens shall not be greater than T/1.70 measured with a S-20 extended red (ER) (see Figure 1) photomultiplier tube and a 2854, ± 200 kelvin (K) light source.

3.6.4 Veiling glare/stray light. The veiling glare/stray light luminance contribution shall not be greater than 2.5 percent of total illumination when viewing a black spot subtending 1° in the field of view centered in a uniformly illuminated 180° field.

3.6.5 Linear distortion. The linear distortion of the objective shall be less than 2 percent pincushion at the edge of the 25mm format.

3.6.6 Field of view. The field of view of the objective shall be a minimum of 156 milliradians when measured across a 25mm format.

3.6.7 Relative illumination. The relative illumination of the image formed by the objective shall not vary across the 25mm format by more than ± 80 percent of maximum value.

3.6.8 Modulation transfer function. The modulation transfer function (MTF) shall meet the requirements of Figures 2 and 3 when measured on-axis and off-axis (2/3 field) all in the same focal plane. The measurement shall be made over the spectral band as defined in Figure 1.

3.6.9 Reticle movement. Two external control knobs shall control the position of the reticle pattern viewed by the observer using the sight. One control shall move the reticle pattern in azimuth; another control shall move the reticle pattern in elevation. An adjustment made by turning one control shall not cause the reticle to deviate from a straight line of travel by more than 0.5 milliradian. Adjustment will be apparent to the operator by tactile indexing with audible clicks.

3.6.9.1 Adjustment accuracy. Each click of either adjustment control shall displace the reticle pattern 0.25 ± 0.04 milliradian.

3.6.9.2 Reticle excursion. The reticle adjustment controls shall move the reticle a minimum of 2.5° in any direction from the optical axis.

3.6.9.3 Torque. The dynamic torque required to adjust the reticle position shall be between 0.5 and 4.0 inch pounds.

3.6.9.4 Rotational alignment. The reticle shall not appear rotated more than 1° from its proper orientation.

3.7 Environmental.

3.7.1 Vibration. The objective shall not be damaged (see 3.10.1) by simple harmonic motion having an amplitude of 0.015 inch, (0.03 inch total excursion) with the frequency being varied between 5 and 55 hertz (Hz).

3.7.2 High temperature storage and operation. The objective shall not be damaged (see 3.10.1) by storage in any temperature from +23° to +68°C and shall operate as specified, herein, at any temperature from +23°C to +52°C.

3.7.3 Low temperature storage and operation. The objective shall not be damaged (see 3.10.1) by storage at any temperature from +23° to -51°C and shall operate as specified herein at any temperature from +23° to -51°C.

3.7.4 Altitude. The objective shall not be damaged (see 3.10.1) when operated at a pressure equivalent to 10,000 feet altitude above sea level.

3.7.5 Temperature shock. The objective shall not be damaged (see 3.10.1) after being subjected to temperature changes between +23° and +68°C in 5 minutes and between +23° and -51°C in 5 minutes.

3.7.6 Humidity. The objective shall not be damaged (see 3.10.1) when subjected to an atmosphere with relative humidity of 95, ± 5 percent over a temperature range of +20°C to +68°C.

3.7.7 Immersion. The objective shall not be damaged (see 3.10.1) after being immersed in fresh water to a depth of not less than 3 feet for a period of not less than 30 minutes.

3.7.8 High intensity shock. The objective shall not be damaged (see 3.10.1) by a sequence of shocks applied in each direction along each of 3 mutually perpendicular axes (horizontal, vertical, and optical axis when the reticle pattern is erect). The shocks shall be half sine pulses and shall have a time duration of 4 milliseconds, ± 5 percent. Shock pulses applied along the axes horizontal and perpendicular to the optical axis shall have a peak amplitude of 50g's (see 3.10.2), ± 15 percent. Shock pulses applied along the optical axis shall have a peak amplitude of 100, ± 15g's.

3.8 Marking. Unless otherwise specified, the objective and all components shall be marked per MIL-M-13231.

3.9 Workmanship. All objectives shall be free from cracks, splits, cold flow, shrinkage, inclusions, porosity, or any similar characteristics. Threads shall be full and undamaged for the entire length or depth as required on the applicable drawing. Objectives shall be free from burrs and shall be free from ships, dirt, grease, rust, corrosion, or any embedded foreign material. The cleaning methods used shall not damage (see 3.10.1) any of the objectives, nor shall the parts be contaminated by the cleaning agent. Optical quality requirements defined as scratches, digs, edge chips, bubbles, coating defects and cementing defects shall be in accordance with MIL-O-13830 except that inspection of optical cleanliness shall be with the unaided eye (without 3X magnification). All moving parts and adjustments shall be examined to insure that they move freely throughout their entire range without sticking, binding, or creeping. The requirements of MIL-STD-454, Requirement 9, shall apply unless otherwise specified.

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

3.10.1 Damage. Breakage, loosening, shifting, evidence of corrosion or failure of any finish, hardware, connection or component; leakage or condensation of moisture within the objective lens; or degradation in input or output characteristics.

3.10.2 "g". "g" is a unitless measure of the quantity of units of force associated with the earths gravity that a object is subjected to.

3.10.3 Room temperature. Room temperature is defined as +23°C, ± 3°C.

3.10.4 Qualified product. A product which has successfully met all of the requirements of an IPT or First Article witnessed by the CECOM, Concurrent Engineering Directorate or its designated representative. Should the supplier make substantial changes in the process, personnel, location, or equipment used to produce a qualified product, or have not delivered the qualified product to the Federal Government within 12 months of contract award, an IPT shall be performed to the extent necessary to verify continued compliance to specification requirements for all characteristics of the product affected by the changes.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, 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 that supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 3 and 5. The inspection set forth in this specification shall become part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification 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 Components and materials inspection. The supplier is responsible for insuring that components and materials used are manufactured, examined and tested in accordance with referenced specifications and standards as specified herein.

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

a. Initial production testing (4.3).
b. Quality conformance inspection (4.5).
c. Packaging information (4.8).

4.3 Initial production testing.

4.3.1 Inspection. Each objective component shall be inspected in process in accordance with the defects listed in Table I and per the requirements of 3.3, 3.4, 3.8 and 3.9. Presence of one or more defects shall be cause for rejection of that component.

TABLE I. Inspections.

Requirements
Performance requirements specified in notes appearing on drawings.
Linear or diametrical tolerances of .002 inch or less.
Angular dimension having a tolerance of 15 minutes of arc or less.
Machine finishes of 32 micro-inches RMS or finer.
Tolerances of position or form 0.002 inch or less.
Screw thread Class 3 or better.
Load requirements for springs.
Lubrication requirements including dry lubricants finishes.
Material hardness when specified on drawings.

4.3.2 Tests. Following successful completion of the inspections specified in 4.3.1, each IPT objective shall be subjected to all inspections in Table II. Failure of any inspection shall be cause for rejection of that objective lens. Inspections may be performed in any order.

TABLE II. Initial production testing.

Inspection	Requirement paragraph	Test paragraph
Effective focal length	3.6.1	4.6.1
Flange focal distance	3.6.2	4.6.2
T-number	3.6.3	4.6.3
Veiling glare/stray light	3.6.4	4.6.4
Linear distortion	3.6.5	4.6.5
Field of view	3.6.6	4.6.6
Relative illumination	3.6.7	4.6.7
Modulation transfer function	3.6.8	4.6.8
Reticle movement	3.6.9	4.6.9
Vibration	3.7.1	4.7.1
High temperature storage and operation	3.7.2	4.7.2
Low temperature storage and operation	3.7.3	4.7.3

TABLE II. Initial production testing - Continued.

Inspection	Requirement paragraph	Test paragraph
Altitude	3.7.4	4.7.4
Temperature shock	3.7.5	4.7.5
Humidity	3.7.6	4.7.6
Immersion	3.7.7	4.7.7
High intensity shock	3.7.8	4.7.8

4.3.3 Disposition of IPT samples. Disposition of IPT samples shall be in accordance with the contract or purchase order.

4.4 Inspection conditions. Unless otherwise specified in the contract or purchase order, inspections shall be performed as specified herein. Tolerances on specified illumination levels shall be ± 10 percent. Neutral density filters used in test equipment shall have a transmission characteristics within 10 percent of the nominal filter transmission from 0.35 to 1.0 micrometer. When a collimator is used, equivalent focal length (EFL) of the collimator shall be at least six times the EFL of the objective lens under test. The clear aperture of the collimator must be six inches or greater. Tolerance on 2854K color temperature shall be ± 200K. References within environmental requirements and tests to "initial measurements", "operate", "pretest", or "performance check during tests" shall be defined as the modulation transfer function test.

4.5 Quality conformance inspection.

4.5.1 Group A inspection. Each objective that has passed the inspections of Table I and meet the requirements of 3.3, 3.4, 3.8 and 3.9 shall be inspected per Table III. Failure of any objective lens to pass all the tests of Table III shall be cause for rejection of that objective lens.

TABLE III. Group A inspection.

Inspection	Requirement paragraph	Test paragraph
Flange focal distance	3.6.2	4.6.2
Veiling glare/stray light	3.6.4	4.6.4
Modulation transfer function	3.6.8	4.6.8

4.5.2 Group B inspection. Objectives which have passed the inspections specified in 4.5.1 shall be formed into lots by the contractor. Sample objectives shall be selected and subjected to the inspection of Table IV. Sampling shall be in accordance with the contract or purchase order (see 6.2.c). Inspections may be performed in any order.

TABLE IV. Group B inspection.

Inspection	Requirement paragraph	Test paragraph
Effective focal length	3.6.1	4.6.1
T-number	3.6.3	4.6.3
Linear distortion	3.6.5	4.6.5
Reticle movement	3.6.9	4.6.9

4.5.3 Group C inspection. Group C inspections shall be conducted on objectives selected from lots which have passed the inspections in 4.5.1. The sample(s) shall be subjected to the inspections specified in Table V. Samples shall be selected in accordance with the contract or purchase order (see 6.2.c). Testing may be conducted in any order except that in Subgroup 1, Immersion shall be last, and in Subgroup 2, Humidity shall be last.

TABLE V. Group C inspection.

Inspection	Requirement paragraph	Test paragraph
Subgroup 1		
Vibration	3.7.1	4.7.1
High temperature storage and operation	3.7.2	4.7.2
Low temperature storage and operation	3.7.3	4.7.3
Immersion		
Subgroup 2	3.7.7	4.7.7
High intensity shock	3.7.8	4.7.8
Temperature shock	3.7.5	4.7.5
Altitude	3.7.4	4.7.4
Humidity	3.7.6	4.7.6

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

4.5.5 Disposition of Group C inspection units. Any objectives which have been subjected to Group C inspection shall be subjected (after refurbishment if necessary) to the test of Tables III and IV prior to acceptance. Failure of any test of Tables III and IV shall be cause to reject that objective.

4.6 Performance characteristics.

4.6.1 Effective focal length. The objective is placed on a goniometric table that includes a measuring microscope. The light source is a collimated beam, with a pinhole or slit target, of sufficient bundle size as to fill the lens under test at all possible field angles. A red filter shall be used to filter the light source. The size of the pinhole/slit width as geometrically projected through the lens under test shall not be greater than 0.005mm. The microscope measuring ways are previously aligned to the point source or slit source target. The effective focal length (EFL) of the objective assembly is determined by measuring the image translation produced by rotating the goniometer through an angle of ± one (1) degree. The EFL is the quotient of the difference in the measuring microscope readings divided by two over the tangent of one degree. Failure to meet the requirements of 3.6.1 shall constitute failure of this test.

4.6.2 Flange focal distance. The flange focal distance shall be measured when measuring the on-axis MTF. The distance from the rear most protruding surface to the image plane is the flange focal distance. Failure to meet the requirements of 3.6.2 shall constitute failure of this test.

4.6.3 T-number. The T-number is the equivalent f-number of a fictitious lens having a 100 percent transmission that produces the same central photocathode illumination, as the lens under test. The T-number is measured by placing the lens between a collimated light source and integrating sphere incorporating a detector. The signal level is measured. The signal level must be 100:1 above background. The detector shall be in accordance with Figure 1. The light source shall be a tungsten source operating at a color temperature of 2856 (± 200) degrees Kelvin. An iris diaphragm shall be placed one focal length from the entrance of the sphere, and its diameter adjusted until the signal level is the same as without the lens. The T-number is then, the effective focal length, divided by the diameter of the iris diaphragm. Failure to meet the requirements of 3.6.3 shall constitute failure of this test.

4.6.4 Veiling glare/stray light. Veiling glare or stray light is the percent energy that from a one hundred eighty (180) degree white surrounding field enters a one degree black spot. The veiling glare shall be measured with an integrating sphere where the lens under test is placed at the entrance of the sphere on the sphere's equator and at 180 degrees from the entrance a black spot is located. A radiometer consisting of a small pinhole (0.05mm) shall be used over a detector apparatus. The radiance of the surrounding sphere shall be greater than one hundred times the black spot.

The aerial image of the sphere with the black spot is scanned for minimum signal level (i.e. finding the black spot). The geometry of the scanning pinhole relative to the detector position shall not be less than 120 degrees. A 100 percent level is set by replacing the black spot with a white surface. With the white spot removed the radiometric reading is the veiling glare. The detector spectral response shall be in accordance with Figure 1. The source shall be a tungsten source operating at a color temperature of 2856 ± 200 degrees Kelvin. Failure to meet the requirements of 3.6.4 shall constitute failure of this test.

4.6.5 Linear distortion. Using the set-up as described for the effective focal length test, measure the semi-field angle for a semi-field height of plus and minus twelve and one-half (12.5) millimeters. Using the average of the semi-field angle (sfa), the percent distortion is 100*(12.5-efl*tan(sfa))/(efl*tan(sfa)). Failure to meet the requirements of 3.6.5 shall constitute failure of this test.

4.6.6 Field of view. Using twice the average semi-field angle (sfa), measured in the linear distortion test (4.6.5), verify that this angle is equal to or greater than 156 milliradians. Failure to meet the requirements of 3.6.6 shall constitute failure of this test.

4.6.7 Relative illumination. The relative illumination shall be measured with a set-up that consists of a collimated light source, goniometer, and an integrating sphere incorporating a detector. The detector shall be in accordance with Figure 1. The light source shall be a tungsten source operating at a color temperature of 2856 (± 200) degrees Kelvin. The relative signal ratio as a function of angle to the axial signal, is the relative illumination. Failure to meet the requirements of 3.6.7 shall constitute failure of this test.

4.6.8 Modulation transfer function correlation. The objective shall be tested on an MTF apparatus that yields sine-wave MTF response. The MTF apparatus shall have a light source operated at a color temperature of 2856 (± 200) degrees Kelvin, and detector that is in accordance with Figure 1. (If a microscope objective is used to relay the image of the objective lens, the numerical aperture (NA) of the microscope objective shall not be less than 0.65). The MTF apparatus shall allow the objective to be tested either continuously or at a minimum of 4 distinct evenly distributed points from 0 to 40 lp/mm. The area analyzed shall be at least 0.5mm in diameter. The calibration of the MTF apparatus shall be performed before the test data is valid. The calibration procedure to be used is to measure the MTF of a known size target (e.g. slit or pinhole). All references to size are in the aerial image. The MTF of a pinhole is known mathematically as a first order Bessel Function. MTF = $(2J_1 (x))/ x$ where x = 3.1.4156 * (lp/mm)* (pinhole diameter in mm). The MTF of a pinhole goes to zero at a spatial frequency 1.22 times its reciprocal diameter. The MTF of a slit is known mathematically as (sine (x)) /(x), where x = 3.14156 * (lp/mm) * (slit width). The units for x is in radians. The MTF of a slit goes to zero at a spatial frequency at its

reciprocal width. The procedure shall be to measure the MTF of the lens and then measure the MTF of the lens with a very large pinhole/slit. In the case of microprocessor based MTF apparatus which correct for the pinhole/slit size, the size of the pinhole/slit entered into the computer software, when measuring the lens with large pinhole/slit should not be greater than 1/40 of the larger pinhole/slit. The geometrical size of the image shall be 0.030mm ± 0.001, at the aerial image. The size of the slit shall be 0.025 ± 0.001, at the aerial. The MTF of the large pinhole/slit can be determined by taking the ratio of the MTF curves of the lens with large pinhole/slit, divided by the MTF of the lens under test. Differences in modulation of greater than three percent will invalidate the MTF results. See Figure 6 for MTF as a function of spatial frequency and pinhole diameter/slit width. Failure to meet the requirements of 3.6.8 shall constitute failure of this test.

4.6.8.1 On-axis MTF. The objective shall be measured on-axis with the lens in the normal operation orientation (reticle erect) and then rotated about the optical axis 90° and re-measured in the same focal plane. Failure of either measurement to meet requirements of 3.6.8 shall constitute failure of this test.

4.6.8.2 Off-axis MTF. Two off-axis measurements shall be made at 2/3 the semi-field angle, one radially and one tangentially, in the same focal plane selected for the axial case. Failure to meet the requirements of 3.6.8 shall constitute failure of this test.

4.6.9 Reticle movement. Mount the objective to an optical bench so that a collimator target at infinity is projected into the assembly. The collimator used must be of sufficient diameter to fill the aperture of the objective. The targets of Figures 4 and 5 may be combined. The mounting plate to which the objective is secured shall be parallel to the target horizontal reference within 6 minutes. The reticle may be illuminated by an external source for ease of viewing. View the reticle image with a low-power microscope.

4.6.9.1 Adjustment accuracy. With the reticle center on the crosshairs of the target (Figure 5), turn the reticle adjustment 20 clicks to the right and observe the position of the reticle center relative to the two lines A and B. Repeat measurement, moving the reticle 20 clicks to the left of the target center. Repeat these measurements using the up and down reticle adjustment. Failure of the center of the reticle pattern to fall between the two lines A and B for any of the four observations shall constitute failure of this test.

4.6.9.2 Reticle excursion. With the reticle pattern at its center of movement, aline the test target center crosshairs with the reticle. Turn the azimuth adjustment until the center of the reticle reaches one extreme of the 5° circle and then back to the opposite side of the circle. Return the reticle to the center of the circle. Repeat this procedure using the elevation adjustment. Failure to the reticle to traverse the 5° circle or evidence of one adjustment affecting the other or evidence of binding or slipping of the reticle shall constitute failure of this test.

4.6.9.3 Torque. Using a torque wrench and adapter, rotate the elevation adjustment, first clockwise and then counterclockwise, and observe the readings. Repeat this procedure for the azimuth adjustment. Failure of any of the four torque readings to fall between 0.5 and 4 inch-pounds or failure to hear the audible click or feel the tactile indexing shall constitute failure of this test.

4.6.9.4 Alignment. Place a target (Figure 4) containing vertical and horizontal reference lines vertically in the focal plane of the collimator. Verify that the objective lens is level with respect to the mounting pad. Center the reticle pattern on the target crosshairs. Failure of the reticle pattern to maintain alinement with the reference lines within one degree shall constitute failure of this test.

4.7 Environmental. The objective shall be retested to meet the requirements of 3.6.2, 3.6.4, and 3.6.8 after the completion of each environmental test. Failure to meet these requirements shall constitute failure due to degradation of input or output characteristics per the damage technical interpretation of 3.10.1. Operating tests required during environmental tests shall be limited to a visual inspection for damage (see 3.10.1). Temperature chambers shall maintain specified temperatures within ± 2.0°C.

4.7.1 Vibration. The objective shall be subjected to Method 201A of MIL-STD-202. The induced vibratory force shall be applied in each of three (3) mutually perpendicular planes of which one (1) is perpendicular to the optical axis. The duration of vibration shall be five (5) minutes minimum in each plane. Failure to meet the requirements of 3.6.2, 3.6.4, and 3.7.1 shall constitute failure of this test.

4.7.2 High temperature storage and operation. The eyepiece shall be subjected to the test of Method 501.1, Procedures I, of MIL-STD-810, except that the highest storage temperature of Steps 2 and 3 shall be +68°C for a minimum period of six (6) hours. Steps 4 and 5 highest operating temperature shall be +52°C for a minimum of (3) hours. Step 6 stabilization period shall be a minimum of two (2) hours. Failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8 and 3.7.2 shall constitute failure of this test.

4.7.3. Low temperature storage and operation. The objective shall be subjected to the test of Method 502.1, Procedures I, of MIL-STD-810, except that the lowest storage temperature of Steps 2 shall be -51°C for a minimum of nine (9) hours. Step 3 shall be deleted. Step 4 and 5 lowest operating temperature shall be -51°C for a minimum of nine (9) hours. Steps 2 and 6 stabilization period shall be a minimum of two (2) hours. Failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8, and 3.7.3 shall constitute failure of this test.

4.7.4 Altitude. The objective shall be subjected to the test of Method 500.1, Procedure I, of MIL-STD-810, except that the minimum chamber pressure of Step 2 shall be effective to no less than 10,000 feet above sea level. Failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8, and 3.7.4 shall constitute failure of this test.

4.7.5 Temperature shock. The objective shall be subjected to the test of Method 503.1, Procedure I, of MIL-STD-810, except that the high temperature chamber shall be maintained at +68°C, the low temperature chamber shall be maintained at -51°C, and Steps 1, 3, and 5 stabilization periods shall be a minimum of two (2) hours. Immediately after each cold cycle, the eyepiece shall be examined for internal condensation. Evidence of internal condensation or failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8, and 3.7.5 shall constitute failure of this test.

4.7.6 Humidity. The objective shall be subjected to the test of Method 507.1, Procedure II, of MIL-STD-810, except that only two (2) continuous 48 hour cycles shall be required. Failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8, and 3.7.6 shall constitute failure od this test.

4.7.7 Immersion. The objective shall be subjected to the test of Method 512.1, Procedure I, of MIL-STD-810, except that the immersion periods shall not be less than 30 minutes. Any evidence of water leakage or failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8, and 3.7.7 shall constitute failure of this test.

4.7.8 High intensity shock. The objective shall be subjected to the test of Method 516.2, Procedure IV, of MIL-STD-810 in accordance with Figure 516.2-2. The shocks shall be half sine pulses having a time duration of 4 milliseconds, ± 5 percent, and a peak amplitude of 100g's (see 3.10.2), ± 15g's except that the shock pulses applied along the axes horizontal and perpendicular to the optical axis shall be 50g's, ± 15 percent. Failure to meet the requirements of 3.6.2, 3.6.4, 3.6.8, and 3.7.8 shall constitute failure of this test.

4.8 Inspection of packaging. Packaging shall be inspected to determine compliance to requirements of Section 5.

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 objective is used with the Night Vision Sight, Crew Served Weapon AN/TVS-5 for aimed firing at night of crew served weapons.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.
b. Quantity and schedule for IPT testing and disposition of IPT samples (see 4.3).
c. Sampling plans for Group B and Group C testing. As guidance, unless otherwise specified, sampling shall be conducted per the requirements of MIL-STD-105.
d. Environmental pollution prevention measures are contained in the packaging material specifications or preparing activity for recommended disposability methods.
e. Qualification - If product is not qualified at time of award the contract must require qualification prior to first delivery.
f. Necessary actions by the contractor in the event of a Group C failure (see 4.5.4).
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).
h. MIL-STD-810C shall be used for all environmental tests of Section 4 of this specification where MIL-STD-810 is specified.
i. Levels of preservation and packaging (see section 5).

6.3 Definitions. See 3.10.

6.4 Qualification. With respect to products requiring qualification, unless otherwise specified by the contract or purchase order, if a product is not qualified at time of award, the contract shall require qualification prior to first delivery. The activity responsible for approving qualified products is the CECOM, Concurrent Engineering Directorate, ATTN: AMSEL-ED-IN, Fort Monmouth, NJ 07703. Information pertaining to qualification of products may be obtained from the above activity.

6.5 Subject term keyword listing.
Lens Assembly
Objective

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

Custodian:
Army - CR

Preparing activity:
Army - CR

Project 5855-A375

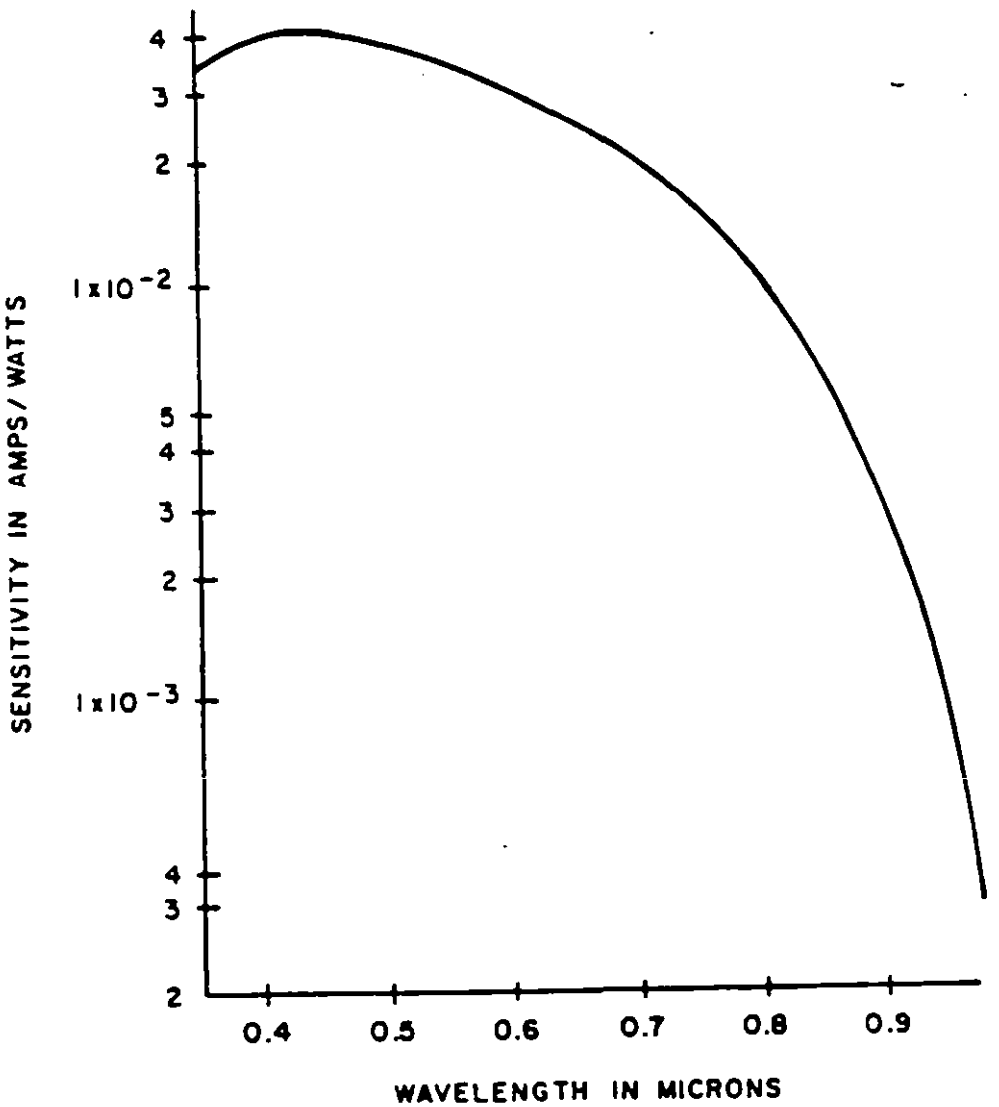


FIG. 1. S-20 EXTENDED RED RESPONSE CURVE

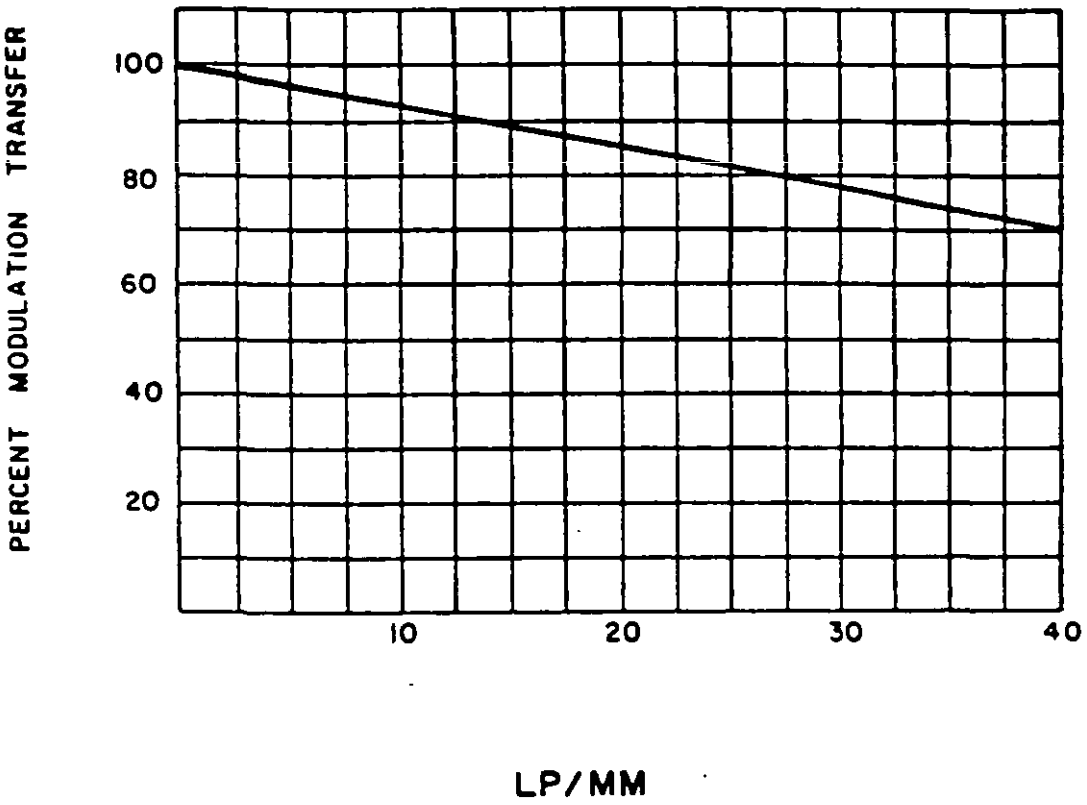


FIG. 2. OBJECTIVE MTF ON AXIS

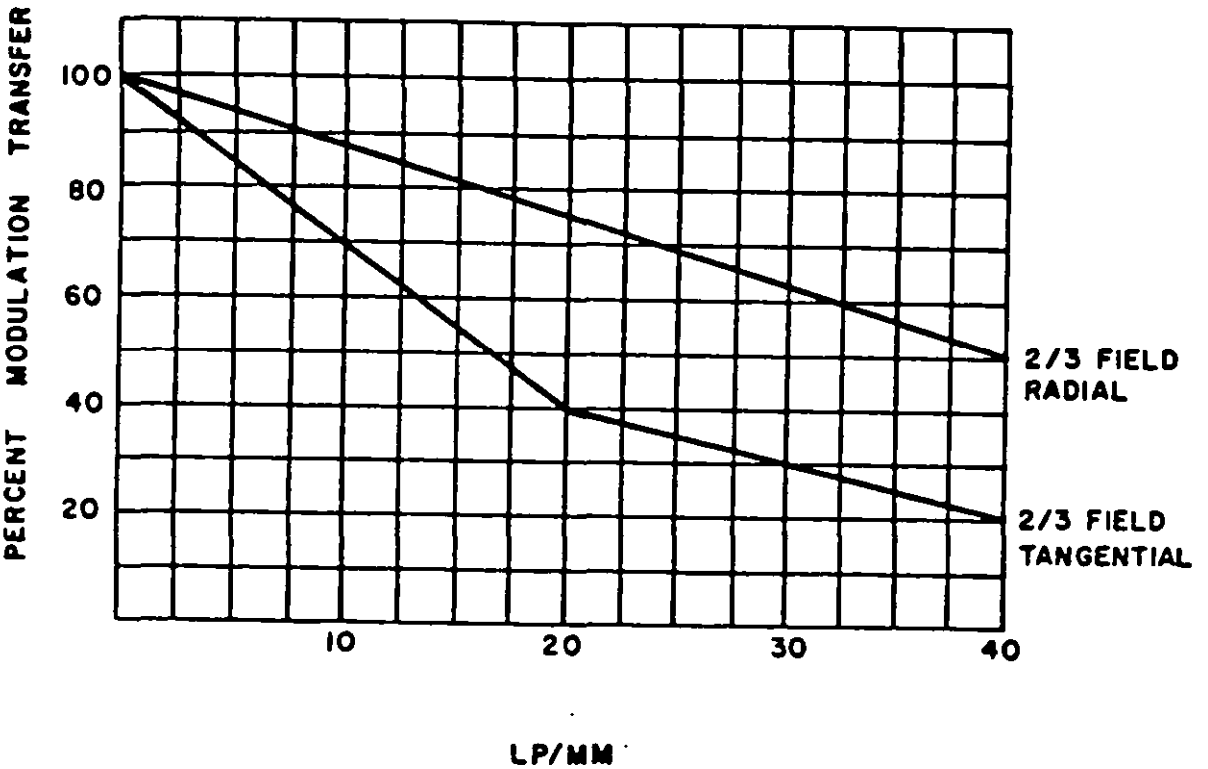


FIG. 3. OBJECTIVE MTF OFF AXIS

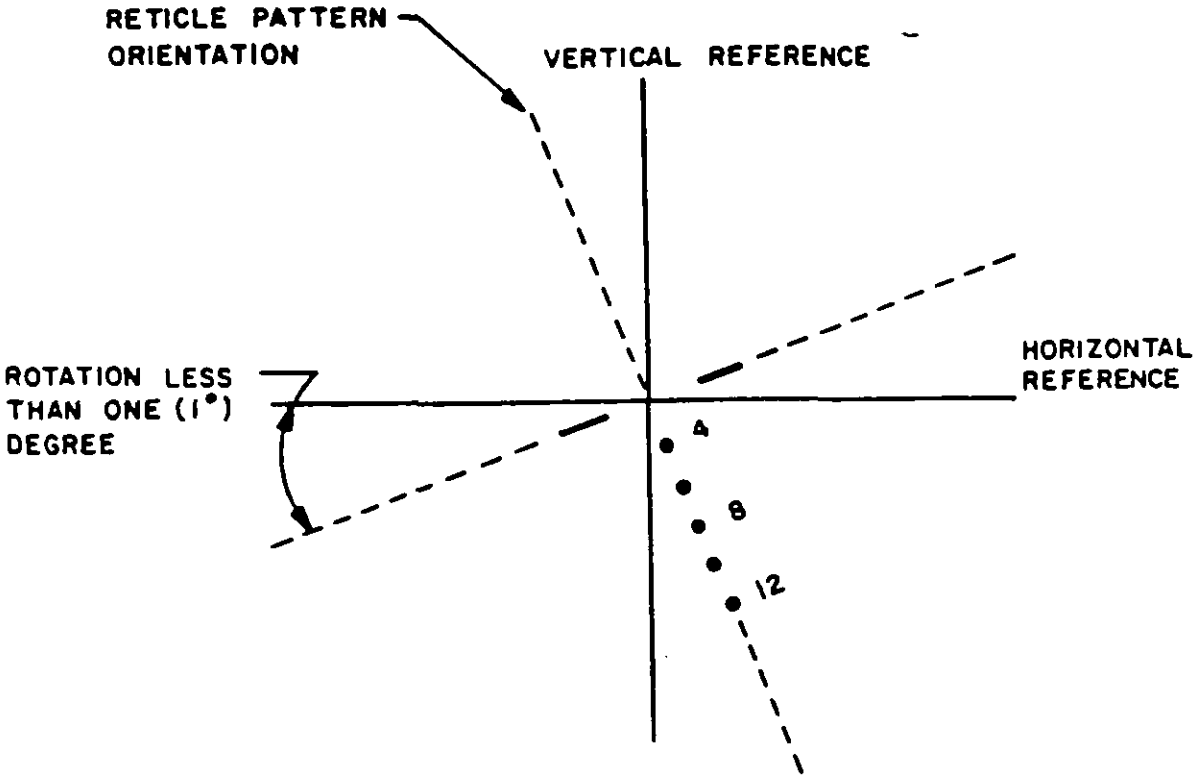
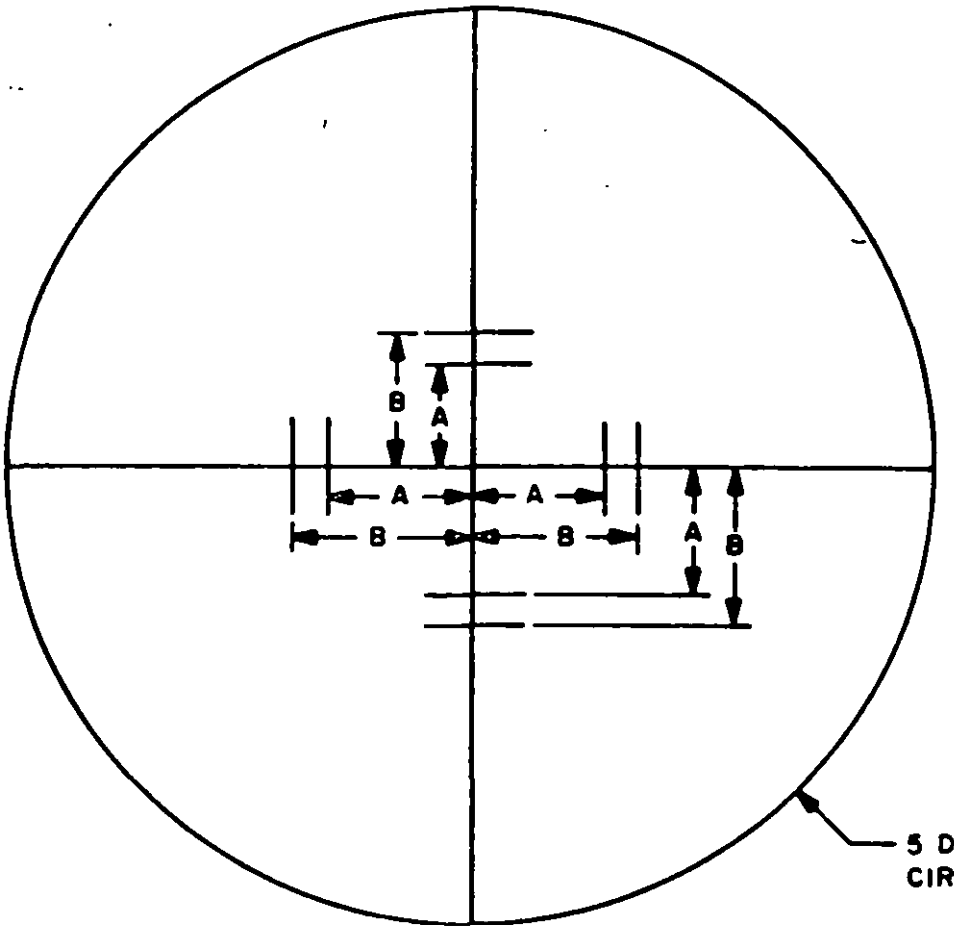


FIG. 4. RETICLE PATTERN ORIENTATION



NOTE:

1. DIMENSION OF A EQUALS: F X 0.00425
2. DIMENSION OF B EQUALS: F X 0.00575
3. DIMENSION OF CIRCLE EQUALS: .0873 X F
4. F = FOCAL LENGTH OF COLLIMATOR

FIG. 5. TEST TARGET

lp/mm	PINHOLE MTF, %	SLIT MTF, %
0	100	100
2	100	100
4	98	98
6	96	96
8	93	94
10	89	90
12	84	86
14	79	81
16	73	76
18	67	70
20	60	64
22	54	57
24	47	50
26	40	44
28	33	37
30	26	30
32	19	23
34	14	17
36	8	11
38	4	5
40	0	0

PINHOLE DIAMETER - 0.035MM
SLIT WIDTH - 0.025MM

FIGURE 6. MODULATION TRANSFER FUNCTION

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	2. DOCUMENT DATE (YYMMDD)
	MIL-L-49367B(CR)	27 May 1992

3. DOCUMENT TITLE
LENS ASSEMBLY, OBJECTIVE, 155MM AN/TVS-5

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	b. TELEPHONE (Include Area Code) (1) Commercial	(2) AUTOVON
CECOM	(908) 532-5851	992-5851
c. ADDRESS (Include Zip Code) AMSEL-ED-TM 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	