

5 March 1980

MILITARY SPECIFICATION

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

This specification is approved for use by USAERADCOM, 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 lens.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or requests for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

L-P-378	- Plastic Sheet and Strip, Thin Gauge, Polyolefin
NN-P-71	- Pallets, Material Handling, Wood, Stringer Construction, 2-Way and 4-Way (Partial)
QQ-S-781	- Strapping, Steel, and Seals
PPP-B-566	- Boxes, Folding, Paperboard
PPP-B-585	- Boxes, Wood, Wirebound
PPP-B-601	- Boxes, Wood, Cleated-Plywood
PPP-B-621	- Boxes, Wood, Nailed and Lock Corner
PPP-B-636	- Boxes, Shipping, Fiberboard
PPP-B-640	- Boxes, Fiberboard, Corrugated, Triple-Wall
PPP-C-1797	- Cushioning Material, Resilient, Low Density, Unicellular, Polypropylene Foam
PPP-S-760	- Strapping, Nonmetallic (and Connectors)
PPP-T-97	- Tape, Packaging/Industrial, Filament Reinforced

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Hq, USA Electronics Research and Development Command, ATTN: DRDEL-E, 2800 Powder Mill Road, Adelphi, MD 20783) by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- MIL-P-116 - Preservation-Packaging, Methods of
- MIL-B-117 - Bags, Sleeves and Tubing - Interior Packaging
- MIL-P-11268 - Parts, Materials, and Processes Used in Electronic Equipment
- MIL-M-13231 - Marking of Electronic Items
- MIL-P-14232 - Parts, Equipment and Tools for Army Materiel, Packaging of

STANDARDS

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipping and Storage
- MIL-STD-147 - Palletized and Containerized Unit Loads, 40 Inch x 48 Inch Pallets, Skids, Runners, or Pallet-Type Base
- MIL-STD-150 - Photographic Lenses
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts
- MIL-STD-454 - Standard General Requirements for Electronic Equipment
- MIL-STD-781 - Reliability Tests: Exponential Distribution
- MIL-STD-810 - Environmental Test Methods
- MIL-STD-1188 - Commercial Packaging of Supplies and Equipment

DRAWINGS

ELECTRONICS COMMAND

- DL-SM-B-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.)

3. REQUIREMENTS

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

3.2 First article. When specified in the contract or purchase order, the contractor shall furnish first article objective lenses in accordance with 4.3.

3.3 Construction. The objective lens shall be constructed in accordance with DL-SM-B-850131 and all provisions of this specification as specified herein.

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 lens shall consist of optical components assembled within a housing as specified herein.

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 Field flatness. The field of the objective lens produced from an object at infinite distance shall be flat within 0.025 mm across a 25 mm diameter focal plane.

3.6.4 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) photo-multiplier tube and a 2854, ± 200 kelvin (K) light source.

3.6.5 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.

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

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

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

3.6.9 Modulation transfer function. The modulation transfer function (MTF) of the objective lens shall not be less than that specified in figures 2 and 3.

3.6.10 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 move the reticle pattern in elevation. An adjustment made by turning one control shall not affect the position established by the other control. Adjustment will be apparent to the operator by tactile indexing with audible clicks.

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

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

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

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

3.7 Environmental.

3.7.1 Vibration. The objective lens shall not be damaged (see 6.3) by simple harmonic motion having an amplitude of 0.015 inch, (0.03 inch total excursion) with the frequency being varied between 10 and 55 hertz (Hz).

3.7.2 High temperature storage and operation. The objective lens shall not be damaged by storage in any temperature from $+23^\circ$ to $+68^\circ\text{C}$ and shall operate as specified herein at any temperature from $+23^\circ$ to $+52^\circ\text{C}$.

3.7.3 Low temperature storage and operation. The objective lens shall not be damaged by storage at any temperature from $+23^\circ$ to -62°C and shall operate as specified herein at any temperature from $+23^\circ$ to -54°C .

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

3.7.5 Temperature shock. The objective lens shall not be damaged after being subjected to temperature changes between $+23^\circ$ and $+68^\circ\text{C}$ in 5 minutes and between $+23^\circ$ and -62°C in 5 minutes.

3.7.6 Humidity. The objective lens shall not be damaged when operated in an atmosphere with relative humidity of 95, ± 5 percent over a temperature range of $+27^\circ$ to $+54^\circ\text{C}$ and shall not be damaged after storage up to $+65^\circ\text{C}$ minimum with 95, ± 5 percent relative humidity.

3.7.7 Immersion. The objective lens shall not be damaged 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 lens shall not be damaged 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 50 g's, ± 15 percent (see 6.3). Shock pulses applied along the other 2 axes shall have a peak amplitude of 100, ± 15 g's.

3.8 Reliability. The objective lens shall have a Mean Time Between Failure (MTBF) of not less than 1000 hours when operated under the reliability test conditions specified herein.

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

3.10 Workmanship. Unless otherwise specified, workmanship of the objective lens shall conform to Requirement 9, MIL-STD-454.

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 as 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 that supplies and services conform to prescribed requirements.

4.1.1 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. First article inspection (4.3).
- b. Quality conformance inspection (4.5).
- c. Packaging inspection (4.9).

4.3 First article inspection.

4.3.1 Inspection. Each objective component shall be inspected in accordance with table I. Presence of one or more defects shall be cause for rejection of that component.

TABLE I. Inspections.

Defects	Requirement paragraph	In process
101. Performance requirements specified in notes appearing on drawings.	3.3	X
102. Linear or diametral tolerances of 0.002 inch or less.	3.3	X

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TABLE I. Inspections. - Continued

Defects	Requirement paragraph	In process
103. Angular dimension having a tolerance of 15 minutes of arc or less.	3.3	X
104. Machine finishes of 32 micro-inches RMS or finer.	3.3	X
105. Tolerances of position or form 0.002 inch or less.	3.3	X
106. Screw thread Class 3 or better.	3.3	X
107. Load requirements for springs.	3.3	X
108. Lubrication requirements including dry lubricant finishes.	3.3	X
109. Material hardness when specified on drawings	3.2	X

4.3.2 Tests. Following successful completion of the inspections specified in 4.3.1, each first article objective lens 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. First article inspection.

Inspection	Requirement paragraph	Test paragraph
Equivalent focal length	3.6.1	4.6.1
Flange focal distance	3.6.2	4.6.2
Field flatness	3.6.3	4.6.3
T-number	3.6.4	4.6.4
Veiling glare/stray light	3.6.5	4.6.5
Linear distortion	3.6.6	4.6.6
Field of view	3.6.7	4.6.7
Relative illumination	3.6.8	4.6.8
Modulation transfer function	3.6.9	4.6.9
Reticle movement	3.6.10	4.6.10
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
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
Reliability	3.8	4.8

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 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 2854 K color temperature shall be ± 200 K. References within environmental requirements and tests to "initial measurements", "operate", "pretest", or "performance check during test" shall be defined as the modulation transfer function test.

4.5 Quality conformance inspection.

4.5.1 Group A inspection. During manufacturing, the inprocess inspections of table I shall be performed. Sampling shall be in accordance with MIL-STD-105, Inspection Level II, combined AQL one percent defective. Following completion of the inspections of table I, each objective lens that has passed the inspections, 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. Component tests of table III may be performed prior to assembly of objective lenses for the examination of table I.

TABLE III. Group A inspection.

Inspection	Requirement paragraph	Test paragraph
Field of view	3.6.7	4.6.7
Relative illumination	3.6.8	4.6.8
Modulation transfer function, on-axis	3.6.9	4.6.9

4.5.2 Group B inspection. Objective lenses which have passed the inspections specified in 4.5.1 shall be formed into lots (see 6.3). Sample objective lenses shall be selected and subjected to the inspection of table IV. Sampling shall be in accordance with MIL-STD-105, combined AQL of 1.5 percent for the group, inspection level II. Inspections shall be performed in the order listed.

TABLE IV. Group B inspection.

Inspection	Requirement paragraph	Test paragraph
Equivalent focal length	3.6.1	4.6.1
Flange focal distance	3.6.2	4.6.2
Field flatness	3.6.3	4.6.3
T-number	3.6.4	4.6.4
Veiling glare/stray light	3.6.5	4.6.5
Linear distortion	3.6.6	4.6.6
Modular transfer function, off-axis	3.6.9	4.6.9.2
Reticle movement	3.6.10	4.6.10

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4.5.3 Group C inspection. Group C inspections shall be conducted on objective lenses selected from lots which have passed the inspections in 4.5.2. The sample(s) shall be subjected to the inspections specified in table V. Samples shall be selected in accordance with 4.5.3.1. Inspections may be performed 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
<u>Subgroup 1</u>		
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	3.7.7	4.7.7
<u>Subgroup 2</u>		
High intensity shock	3.7.8	4.7.8
Temperature shock	3.7.5	4.7.5
Humidity	3.7.6	4.7.6
Altitude	3.7.4	4.7.4

4.5.3.1 Sampling for Group C inspection.

Subgroup 1: For this subgroup, 3 objective lenses shall be randomly selected and shall be subjected to the Group C, Subgroup 1 inspection specified in table V. The sample shall be selected from the total quantity in lots passing Group B inspection each 30 days or from each 100 objective lenses in lots passing Group B inspection, whichever occurs first. The first samples selected shall be at the start of the contract from the first quality conformance inspection lot.

Subgroup 2: For this subgroup, 1 objective lens shall be randomly selected from the first quality conformance inspection lot to pass Group B inspection. For subsequent Group C, Subgroup 2 inspections, 1 objective lens shall be randomly selected every third month from the inspection lots passing Group B inspection that month.

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).

4.5.5 Disposition of Group C inspection units. Any objective lenses 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 lens.

4.5.6 Group D inspection. Group D inspection shall be conducted on objective lenses selected from units which have passed the inspection in 4.5.1. Tests shall be conducted in accordance with table VI.

4.5.6.1 Sampling for Group D inspection. The acceptance tests shall be performed on the first production lot and every other month, or 100 objective lenses, thereafter, whichever occurs first. Sample size shall be 10.

TABLE VI. Group D inspection.

Inspection	Requirement paragraph	Test paragraph
Reliability	3.8	4.8

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

4.5.6.3 Reinspection of Group D sample units. Unless otherwise specified, sample units which have been subjected to Group D inspection may be accepted on contract or order provided all damage is repaired and the units are resubjected to and pass the tests of tables III and IV.

4.6 Performance characteristics.

4.6.1 Equivalent focal length. The equivalent focal length of the objective lens shall be measured in accordance with MIL-STD-150. Failure to comply with the requirements of 3.6.1 shall constitute failure of this test.

4.6.2 Flange focal distance. The flange focal distance of the objective lens shall be measured in accordance with MIL-STD-150. Failure to comply with the requirements of 3.6.2 shall constitute failure of this test.

4.6.3 Field flatness. The field flatness for the objective lens shall be measured in accordance with MIL-STD-150. Failure to comply with the requirements of 3.6.3 shall constitute failure of this test.

4.6.4 T-number. The T-number of the objective lens shall be measured in accordance with MIL-STD-150. The light source used shall be operated at 2854 K color temperature. The detector used shall have an S-20 ER response, complying with figure 1. Failure to comply with the requirements of 3.6.4 shall constitute failure of this test.

4.6.5 Veiling glare/stray light. The veiling glare or stray light of the objective lens shall be measured in accordance with Method 35, of MIL-STD-150. The detector used shall have an S-20 ER response. Failure to comply with the requirements of 3.6.5 shall constitute failure of this test.

4.6.6 Linear distortion. The linear distortion of the objective lens shall be measured in accordance with MIL-STD-150. Failure to comply with the requirements of 3.6.6 shall constitute failure of this test.

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4.6.7 Field of view. The field of view of the objective lens shall be measured in accordance with MIL-STD-150. Failure to comply with the requirement of 3.6.7 shall constitute failure of this test.

4.6.8 Relative illumination. Relative illumination shall be measured in accordance with Method 8, of MIL-STD-150. The light source used shall be operated at 2854 K color temperature. The detector used shall have an S-20 ER response. Failure to comply with the requirements of 3.6.8 shall constitute failure of this test.

4.6.9 Modulation transfer function. The objective lens shall be tested on a sine wave test pattern setup that utilizes an S-20 ER response photomultiplier conforming to figure 1 and a tungsten illumination source operated at 2854 K color temperature. (If a microscope objective is used to relay the image of the objective lens, the numerical aperture (NA) of the microscope objective shall be equal to or greater than 0.65 and magnification not less than 20X). The pattern-collimator combination shall allow the objective lens to be tested either continuously or at a minimum of 8 distinct, evenly distributed points from 0 to 40 lp/mm including 0 lp/mm.

4.6.9.1 On-axis MTF. The objective lens 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 the requirements of 3.6.9 shall constitute failure of this test.

4.6.9.2 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 3.6.9 shall constitute failure of this test.

4.6.10 Reticle movement. (See 6.2) 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.

4.6.10.1 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.

4.6.10.2 Reticle excursion. With the reticle pattern at its center of movement, align 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.

4.6.10.3 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.

4.6.10.4 Alinement. 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.

4.7.1 Vibration. The objective lens shall be subjected to Method 201A of MIL-STD-202. The induced vibratory force shall be applied in each of 3 mutually perpendicular planes one of which is perpendicular to the optical axis. The duration of vibration shall be 5 minutes in each plane. Any evidence of damage (see 6.3) or failure to pass the modulation transfer function test shall constitute failure of this test.

4.7.2 High temperature storage and operation. The objective lens shall be subjected to Test Method 501, Procedure I of MIL-STD-810. Operating temperature (Step 4) shall be +52°C for 3 hours. Storage temperature (Step 2) shall be +68°C for 6 hours duration. Any evidence of damage shall constitute failure of this test.

4.7.3 Low temperature storage and operation. The objective lens shall be subjected to Test Method 502, Procedure I of MIL-STD-810. Storage temperature (Step 2) shall be -62°C for 9 hours and operating temperature (Step 4) shall be -54°C for 9 hours. Any evidence of damage shall constitute failure of this test.

4.7.4 Altitude. The objective lens shall be subjected to Test Method 500, Procedure I of MIL-STD-810 except that the minimum chamber pressure shall be equivalent to 10,000 feet above sea level. Any evidence of damage shall constitute failure of this test.

4.7.5 Temperature shock. With the objective lens initially at ambient temperature, place it in a chamber which has an internal temperature of 68°C and soak for 4 hours. Remove the objective lens from the chamber and soak for 2 hours at ambient. Place the objective lens in a chamber with an internal temperature of -62°C and soak for 4 hours. Remove the objective lens from the chamber and soak for 2 hours at room temperature. This constitutes one complete 12 hour cycle. Repeat the above cycle for a total test time of 24 hours. Any evidence of damage shall constitute failure of this test.

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4.7.6 Humidity. The objective lens shall be subjected to Test Method 507, Procedure II of MIL-STD-810, except that only two continuous 48 hour cycles shall be required. Any evidence of damage shall constitute failure of this test.

4.7.7 Immersion. The objective lens shall be subjected to Test Method 512, Procedure I of MIL-STD-810. Any evidence of water leakage shall constitute failure of this test.

4.7.8 High intensity shock. The objective lens shall be subjected to Test Method 516, 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 100 g's, ± 15 g's except that the shock pulses applied along the axes horizontal and perpendicular to the optical axis shall be 50 g's, ± 15 percent. Any evidence of damage shall constitute failure of this test.

4.8 Reliability test. The contractor shall conduct the reliability test on 10 objective lenses (see 6.2). The test shall be performed under the test conditions specified herein.

4.8.1 Test conditions. The reliability test shall be conducted in accordance with Test Level C of MIL-STD-781. Performance shall be measured, at a minimum, once every 112 hours of operating time by at least the following tests or inspections:

- a. Field of view
- b. Modulation transfer function

A performance test failure shall be presumed to have occurred immediately after the last successful measurement or inspection. An objective lens shall be removed from the test for failure analysis upon the recognition of a failure. Each objective lens shall be submitted to Group A inspection and the inspection of 4.3.1 if and when the objective lens has accumulated 1500 hours. The objective lens shall be submitted to Group A inspection. The following specific requirements of MIL-STD-781 shall apply.

- (1) Design and performance tests
- (2) Detail reliability test procedure
- (3) Inspection
- (4) Test facilities
- (5) Selection of equipment
- (6) Installation of equipment
- (7) Testing the setup
- (8) Determination of compliance
- (9) Failure actions
- (10) Failure categories
- (11) Analysis of failure
- (12) Failure confirmation
- (13) Verifying repair
- (14) Corrective action
- (15) Restoration of failed equipments
- (16) Final report

4.9 Packaging inspection. The inspection of the preservation-packaging and interior package marking shall be in accordance with the Group A and B quality conformance inspection requirements of MIL-P-116. The inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129.

5. PACKAGING

5.1 Preservation. Preservation shall be level A, B or commercial, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning and drying. The objective lens shall be cleaned and dried as specified in MIL-P-14232.

5.1.1.2 Preservative application. No preservative required.

5.1.1.3 Unit Packing. Unit packing shall be in accordance with the methods or submethods prescribed in MIL-P-116 as specified herein.

5.1.1.4 Lens Assembly, Objective, AN/TVS-5. Each objective lens assembly shall be individually unit packed submethod IA-15 as follows: Cushion each assembly by wrapping with cushioning material conforming to PPP-C-1797 as required to protect the assembly. Place the cushioned assembly within a box conforming to PPP-B-566. Place the box within a barrier bag fabricated of material conforming to MIL-B-117, type II, class E, style I. Heat seal the closure, leaving a small opening for exhausting air. Exhaust the entrapped air and complete the seal.

5.1.1.4.1 Intermediate packing. Place 5 objective lenses, unit packed as specified in 5.1.1.3, within a close-fitting fiberboard box conforming to PPP-B-636, W5c. Close the box in accordance with the appendix of the box specification. Intermediate containers shall not exceed a maximum of 1.5 cubic feet, with at least two dimensions not exceeding 16 inches each.

5.1.2 Level B. Cleaning, drying, preservative application, unit packing and intermediate packing shall be as specified in 5.1.1, except that submethod IC-2 shall be used in lieu of submethod IA-15.

5.1.3 Commercial preservation. Preservation shall be in accordance with MIL-STD-1188.

5.2 Packing. Packing shall be level A, B or commercial, as specified (see 6.2). Shipping containers for level A and B shall be capable of stacking and supporting superimposed loads during shipment and storage without damaging the container(s) or its contents.

5.2.1 Level A. A quantity of objective lenses, unit and intermediate packed as specified in 5.1, shall be packed within a close-fitting box conforming to PPP-B-601, overseas type; PPP-B-621, style 4, class 2; or PPP-B-585, style 2 or 3, class 3. When the gross weight exceeds 200 pounds, or the container length

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and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inch skids, laid flat, shall be applied in accordance with the requirements of the container specification, or if not specified in the specification, in a manner which will adequately support the item and facilitate the use of material handling equipment. Closure and strapping shall be in accordance with the applicable container specification or appendix thereto except that metal strapping shall conform to QQ-S-781, type I, finish A.

5.2.1.1 Unitization. Palletization shall be required when: containers specified in 5.2.1 do not require skids; quantities per destination exceed either a total of 250 pounds (excluding the pallet) or a volume of 20 cubic feet; and the container size permits use of one of the pallet patterns of MIL-STD-147. A quantity of containers, packed as specified in 5.2.1 except that container strapping may be omitted, shall be placed on a pallet, load type I, conforming to MIL-STD-147. The pallet shall conform to NN-P-71, type IV, group I or II woods. The load shall be "bonded" to the pallet by strapping conforming to QQ-S-781, type I, finish A, or shrink film conforming to L-P-378, type IV.

5.2.2 Level B. A quantity of objective lenses, unit and intermediate packed as specified in 5.1, shall be packed within a close-fitting box conforming to PPP-B-640, class 2, style E or PPP-B-636, type CF, class weather-resistant. The gross weight of boxes conforming to PPP-B-640 shall not exceed 250 pounds. Closure shall be in accordance with the appendix of the applicable box specification. Reinforcing shall be by pressure-sensitive filament tape banding or nonmetallic strapping conforming to PPP-T-97 and PPP-S-760, respectively; selection of the material and application shall be in accordance with the appendix of the applicable box specification. When the gross weight exceeds 200 pounds, or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, containers shall be pallet-mounted on pallets conforming to NN-P-71, group I or II woods. The load shall be "bonded" to the pallet by strapping conforming to QQ-S-781, type I, finish A or shrink film conforming to L-P-378, type IV. When a single unit is shipped to a single destination no packing is required; the unit container shall serve as the shipping container. Reinforcing shall be as specified above.

5.2.2.1 Unitization. Palletization shall be required when quantities per destination exceed either a total of 250 pounds (excluding the pallet) or a volume of 20 cubic feet; and the container size permits use of one of the pallet patterns of MIL-STD-147. A quantity of objective lenses, unit and intermediate packed as specified in 5.1, shall be placed on a pallet, load type I, conforming to MIL-STD-147. The pallet shall conform to NN-P-71, type IV, group I or II woods. The load shall be "bonded" to the pallet by strapping conforming to QQ-S-781, type I, finish A, or shrink film conforming to L-P-378, type IV.

5.2.3 Commercial packing. Packing shall be in accordance with MIL-STD-1188.

5.3 Marking.

5.3.1 Military marking. In addition to any special marking required by the contract or order, interior packs and exterior shipping containers shall be marked in accordance with MIL-STD-129.

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5.3.2 Commercial marking. In addition to any special marking required by the contract or order, interior packs and exterior shipping containers shall be marked in accordance with MIL-STD-1188.

6. NOTES

6.1 Intended use. The objective lens is used with the Night Vision Sight, Crew Served Weapon AN/TVS-5 for aimed firing at night of individual served weapons.

6.2 Ordering data. Procurement documents shall specify the following:

- a. Title, number, and date of this specification.
- b. Desired level of preservation, packaging and packing (see 5.1, 5.2).
- c. Quantity and schedule for first article testing (see 4.4).
- d. Associate lots for Quality Control Inspection with the monthly requirements established in the contract schedule.
- e. Environmental pollution prevention measures are contained in the packaging material specifications referenced herein. Refer to material specifications or preparing activity for recommended disposability methods.
- f. If this lens assembly is delivered as part of a complete SU-88/TVS-5, the reticle movement test may be done on the assembled system in lieu of 4.6.10 herein.
- g. Necessary actions by the contractor in the event of a Group C or D failure (see 4.5.4 and 4.5.6.2).

6.3 Definitions.

6.3.1 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.

6.3.2 "g". "g" is defined as an acceleration or deceleration of 32.17 feet per second per second.

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

6.3.4 Lot size. A lot is defined as those objective lenses successfully completing Group A inspection for any one month.

Custodian:
Army - ER

Preparing activity:
Army - ER

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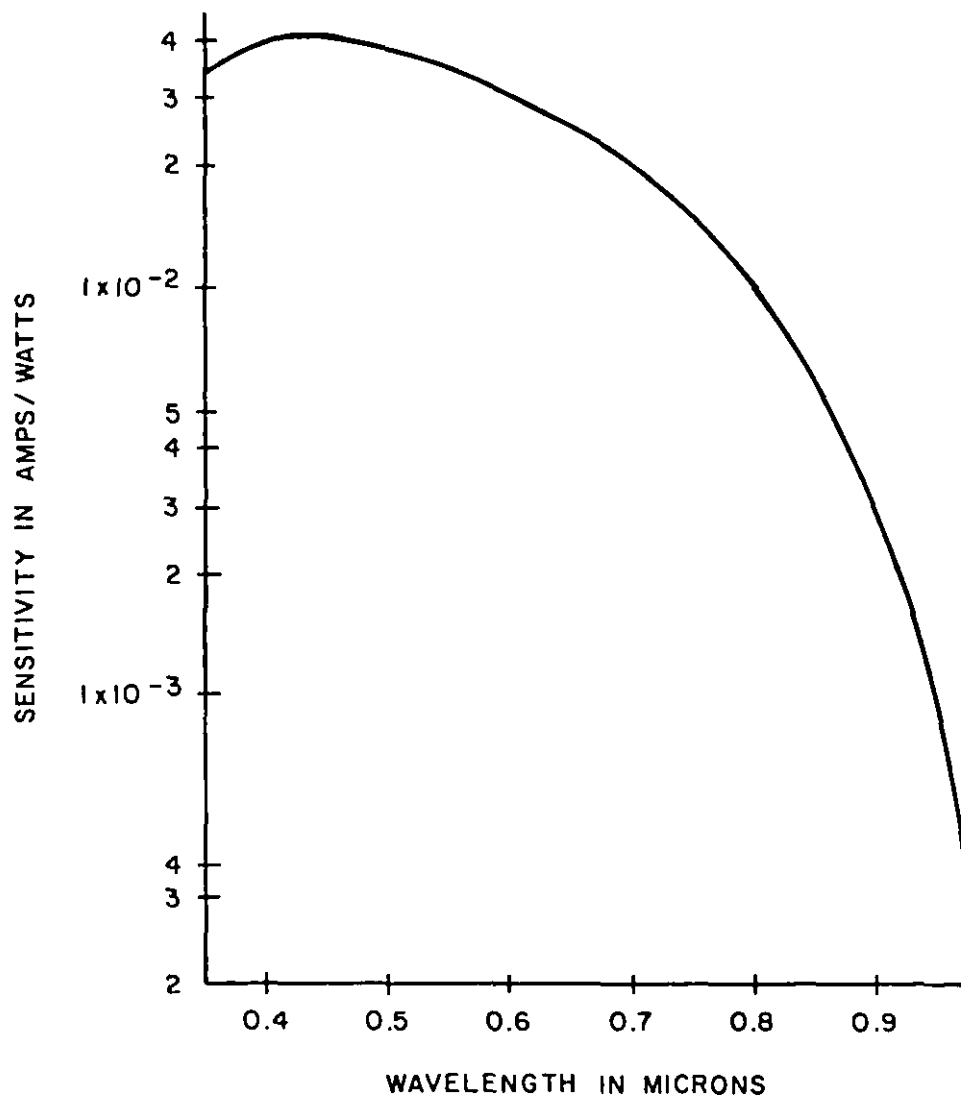


FIG. 1. S-20 EXTENDED RED RESPONSE CURVE

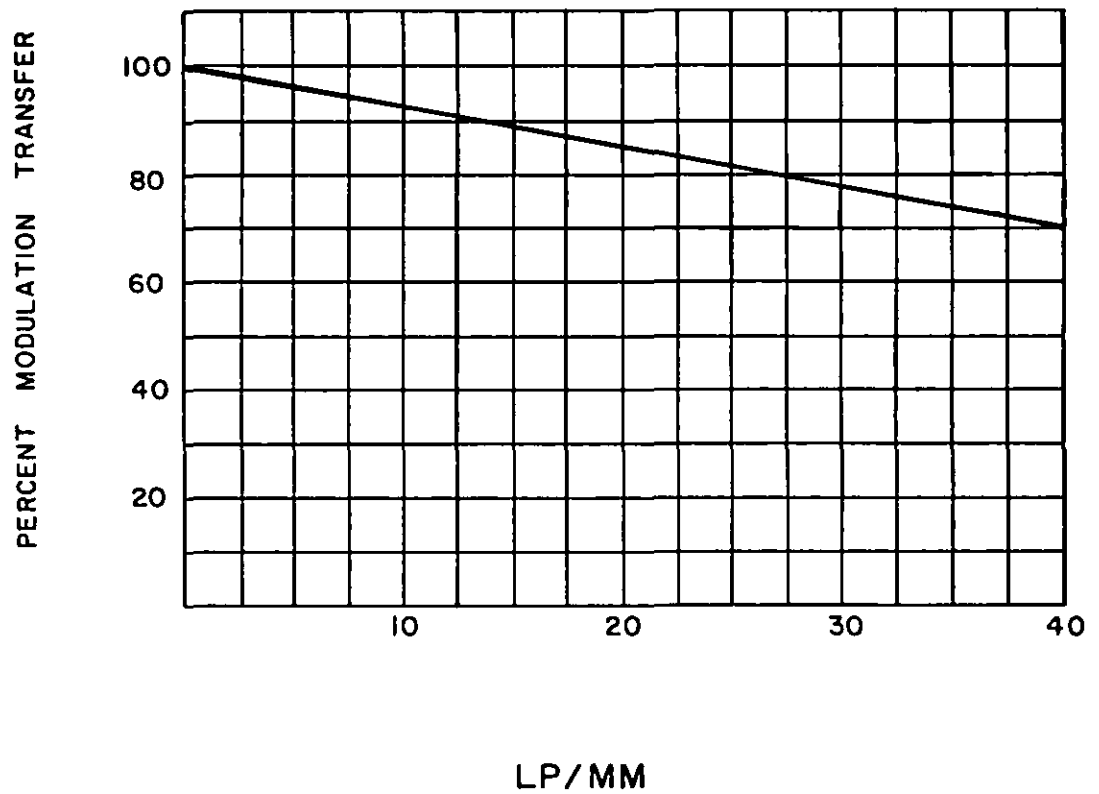


FIG. 2. OBJECTIVE MTF ON AXIS

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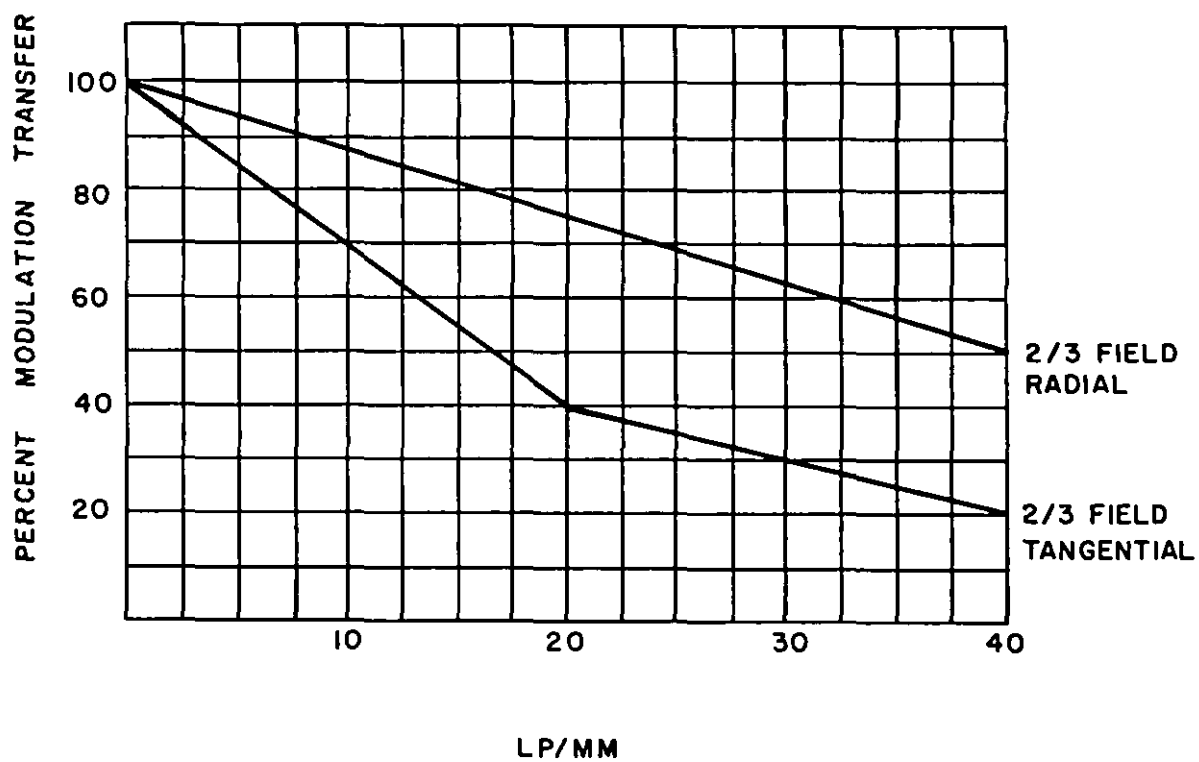


FIG. 3. OBJECTIVE MTF OFF AXIS

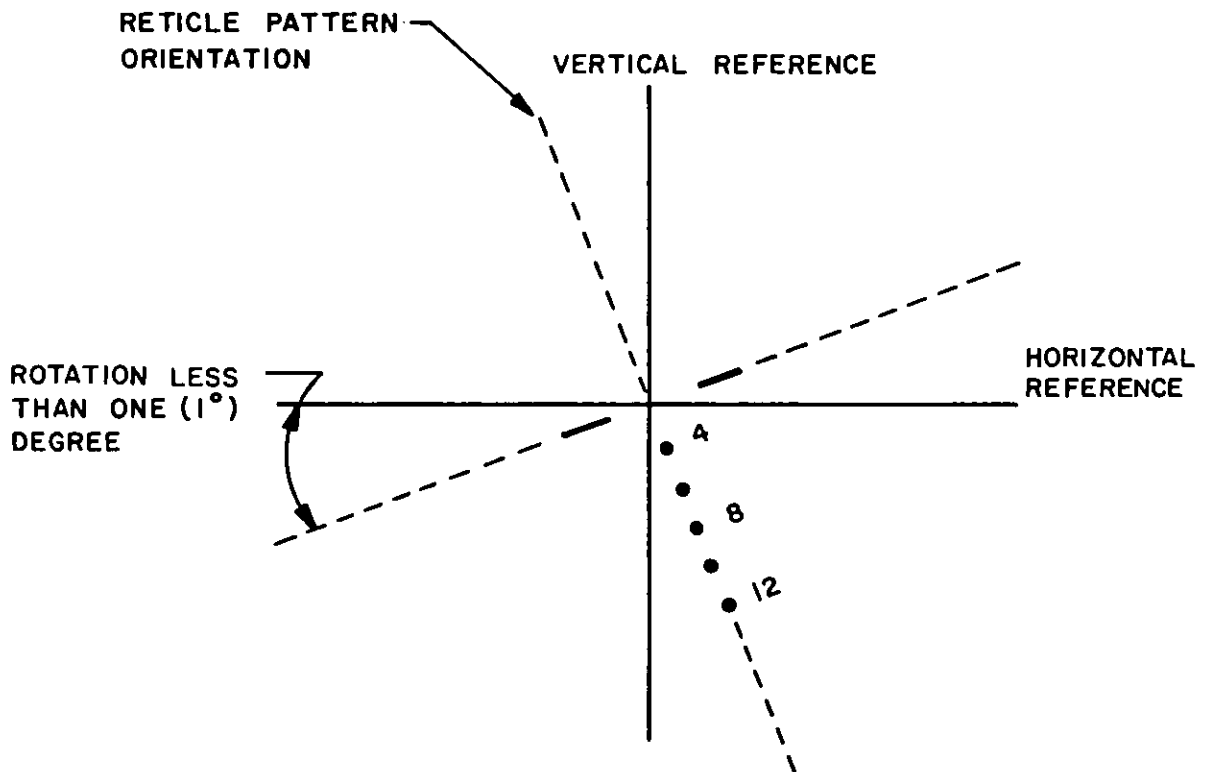
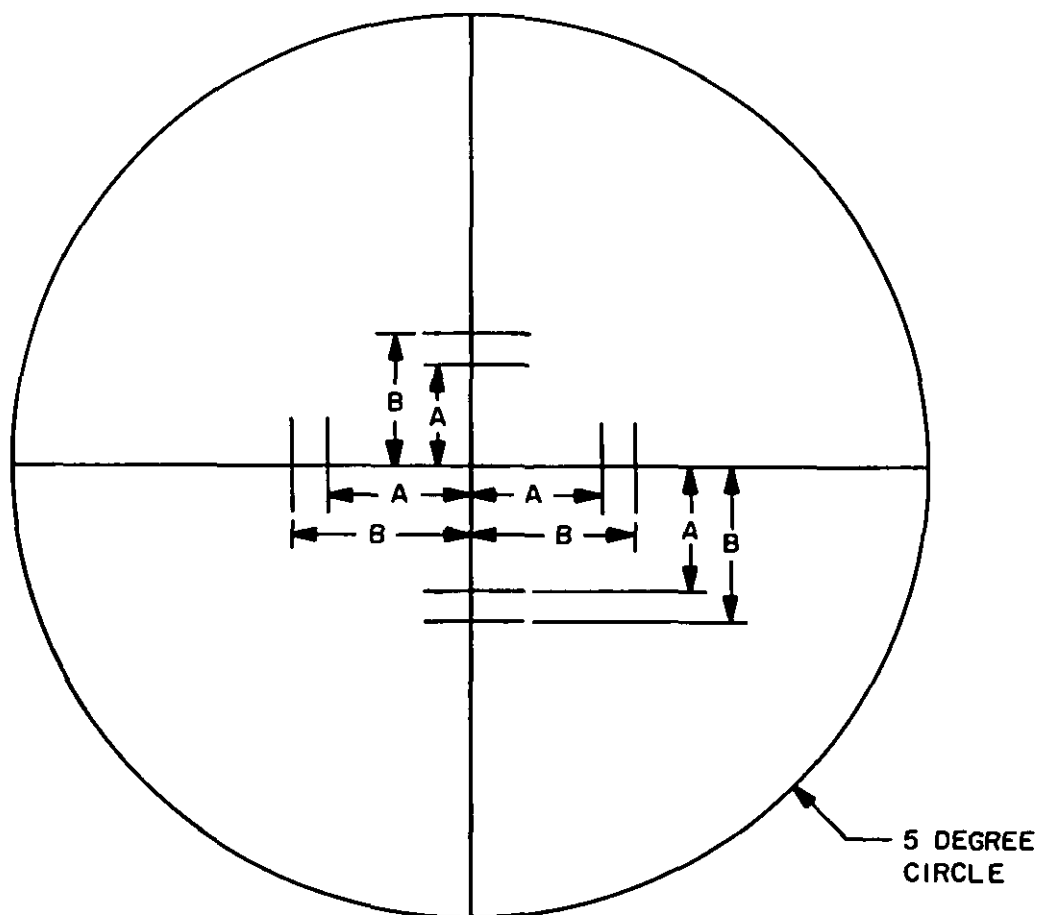


FIG. 4. RETICLE PATTERN ORIENTATION

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NOTE :

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

FIG. 5. TEST TARGET

FOLD

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

POSTAGE AND FEES PAID
DEPARTMENT OF THE NAVY
DoD-316
XX 314



COMMANDER
US ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND
ATTN: DRDEL-ED
ADELPHIA, MD 20783

FOLD

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NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

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C. REASON FOR RECOMMENDED CHANGE(S)

2. REMARKS

SUBMITTED BY (Printed or typed name and address — Optional)

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DATE