

INCH-POUND

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SUPERSEDING
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PERFORMANCE 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).

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, 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-LC-LEO-E-EP 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

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2.1.1 Reference 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.d).

DRAWINGS

USA COMMUNICATIONS-ELECTRONICS COMMAND

SM-D-850130 - 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, herein referred to as the objective, is part of the Night Vision Sight, Crew Served Weapon, AN/TVS-5.

3.1.1 First article testing (FAT) When specified in the contract or purchase order, the contractor shall furnish FAT objectives for inspection and approval (see 4.2).

3.2 Construction. The objective shall be constructed to assure compliance with the contract configuration baseline and in accordance with SM-D-850130 as applicable.

3.3 Material. The contractor shall select parts and materials that are fully capable of meeting all of the operational and environmental requirements specified herein. The materials specified in the applicable drawings are recommended, but not mandatory. Selection criteria of the class, grade, or type part shall ensure the material will be able to perform its intended function when it is assembled. Verification of the supplier meeting the overall performance requirements shall be the governing acceptance standard. Recovered materials shall be used to the maximum extent possible.

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

3.5 Performance characteristics.

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

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

3.5.3 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) photomultiplier tube and a 2854, ± 200 Kelvin (K) light source.

3.5.4 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.

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

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

3.5.7 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.

3.5.8 Modulation transfer function.

3.5.8.1 The modulation transfer function (MTF) shall meet the requirements of Figures 1 and 2 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 by the S-20 Extended Red Response Curve.

3.5.8.2 Alternate method for verification of MTF. The MTF requirement for the objective may be verified by attaching the objective to the battery housing assembly, eyepiece assembly and image intensifier assembly to assemble a sight per MIL-PRF-49064E. Verification of the requirements of paragraph 3.6.3, Resolution, of MIL-PRF-49064E at the sight level shall verify the MTF requirement of the objective.

3.5.9 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.

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

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

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

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

3.6 Environmental.

NOTE: Post-environmental verification of performance shall be Flange focal distance (3.5.2), Veiling glare/stray light (3.5.4) and Modulation transfer function (3.5.8). Failure to meet these requirements shall constitute failure due to degradation of performance of input or output characteristics per the damage technical interpretation of 3.10.1.

3.6.1 Temperature extremes. The objective shall not be damaged (see 3.10.1) after storage in any temperature from -51°C to $+68^\circ\text{C}$. The objective shall not be damaged (see 3.10.1) after being subjected to repetitive temperature changes between $+23^\circ\text{C}$ and $+68^\circ\text{C}$ in a 5 minute period and between $+23^\circ\text{C}$ and -51°C in a 5 minute period. The transition from $+68^\circ\text{C}$ to -51°C and from -51°C to $+68^\circ\text{C}$ shall include a 2 hour soak at $+23^\circ\text{C}$. Soak time at temperature extremes shall be sufficient for the entire objective to attain stabilization.

3.6.2 Vibration. The objective shall not be damaged (see 3.10.1) after being subjected to 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). The duration shall be five (5) minutes minimum in each of three (3) mutually perpendicular planes of which one (1) is perpendicular to the optical axis.

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

3.6.4 Humidity. The objective shall not be damaged (see 3.10.1) after storage up to $+68^\circ\text{C}$ with 95, ± 5 percent relative humidity.

3.6.5 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. The objective shall be pre-conditioned by exposure to a temperature of $+45^\circ\text{C} \pm 3^\circ\text{C}$ for a period of 2 hours prior to being immersed in the fresh water at a temperature of $+18^\circ\text{C} \pm 5^\circ\text{C}$.

3.6.6 High intensity shock. The objective shall not be damaged (see 3.10.1) by a sequence of 3 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, ± 15 g's (see 3.10.2).

3.7 Marking. Marking shall be in accordance with applicable drawings unless otherwise specified in the contract or purchase order.

3.8 Workmanship. Workmanship standards shall be such that the objective will meet all requirements of this specification and any reference specifications or drawings.

3.9 Treatment and Painting. Treatment and painting shall be in accordance with the applicable drawings unless otherwise specified in the contract or purchase order.

3.10 Technical interpretations. The following technical interpretations, when referenced in sections 3 or 4, are 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 defined as an acceleration or deceleration of 32.17 feet per second per second.

3.10.3 Ambient Temperature. Ambient temperature is defined as $+23^{\circ}\text{C}$, $\pm 10^{\circ}\text{C}$.

3.10.4 Environmental temperature. Environmental chamber temperatures shall be controlled to within $\pm 5^{\circ}\text{C}$.

4. VERIFICATION

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

- a. First article testing (4.2).
- b. Conformance inspection (4.3).

4.2 First article testing. When specified in the contract or purchase order (see 6.2.f), first article testing shall be performed by the contractor. The quantity of first article test samples shall be as specified in the contract or purchase order (see 6.2.b) and shall be selected from the first production lot.

4.2.1 FAT testing. Each objective in the FAT lot shall be subjected to the inspections of Table I. Samples selected from the lot shall be subjected to the inspections of Table II. Sample size shall be as specified in the contract or purchase order (see 6.2.b). Failure of any inspections shall be cause for rejection of that objective and may be cause for failure of the FAT. Inspections may be performed in any order except for Immersion, which shall follow temperature extremes and temperature shock.

Table I. Unit first article testing.

Inspection	Requirement Paragraph
Effective focal length	3.5.1
Flange focal distance	3.5.2
T-number	3.5.3
Veiling Glare	3.5.4
Linear distortion	3.5.5
Field of View	3.5.6
Relative illumination	3.5.7
Modulation transfer function	3.5.8
Reticle movement	3.5.9

Table II. Sample first article testing.

Inspection	Requirement Paragraph
Temperature Extremes	3.6.1
Vibration	3.6.2
Altitude	3.6.3
Humidity	3.6.4
Immersion	3.6.5
High intensity shock	3.6.6

4.2.3 Disposition of FAT samples. After successful completion of the FAT, the FAT samples shall be refurbished and delivered in accordance with the contract or purchase order (see 6.2.b).

4.3 Conformance inspection. Requirements for conformance inspection shall be a specified in the contract or purchase order (see 6.2.e). Unless otherwise specified, all tests shall be performed at ambient temperature (see 3.10.3).

5. PACKAGING

5.1 Packaging requirements. Packaging and preservation shall be best commercial practice unless otherwise specified in the contract or purchase order (see 6.2.g).

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 FAT testing and disposition of FAT samples (see 4.2).
- c. Necessary actions by the contractor in the event of a lot failure.
- d. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1).
- e. Statement identifying that the contractor must submit his proposal for conformance inspection to include specific requirements to be verified and the sampling plan to be used to provide the desired confidence level.
- f. Statement specifying that FAT testing is, or is not, required and sampling requirements for FAT.
- g. Packaging and preservation (see section 5).

6.3 Definitions. See 3.10.

6.4 Subject term keyword listing.
Lens Assembly
Objective

6.5 Changes from previous issue. 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

Preparing activity:
Army - CR

Project 5855-0198

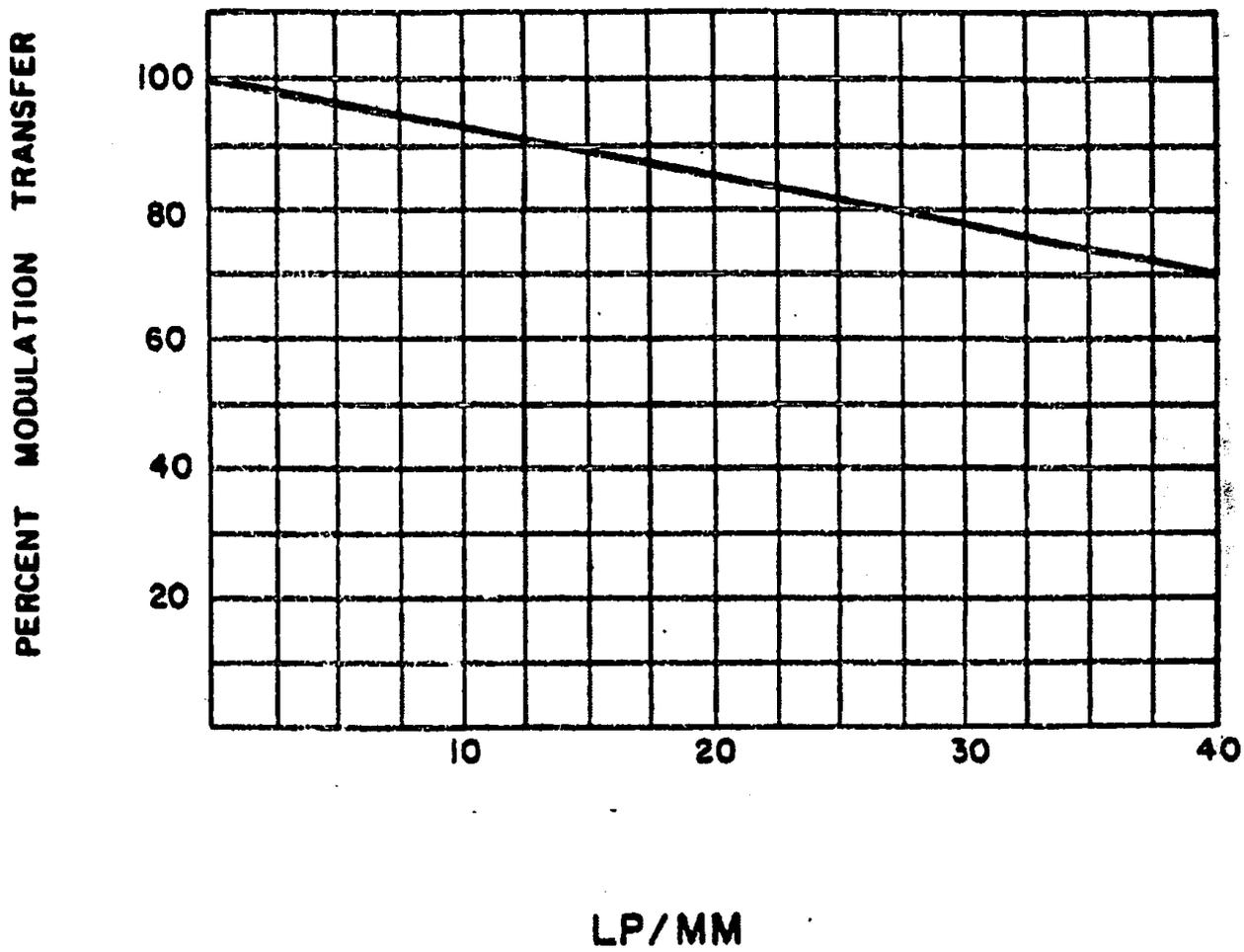


Figure 1. OBJECTIVE MTF ON AXIS

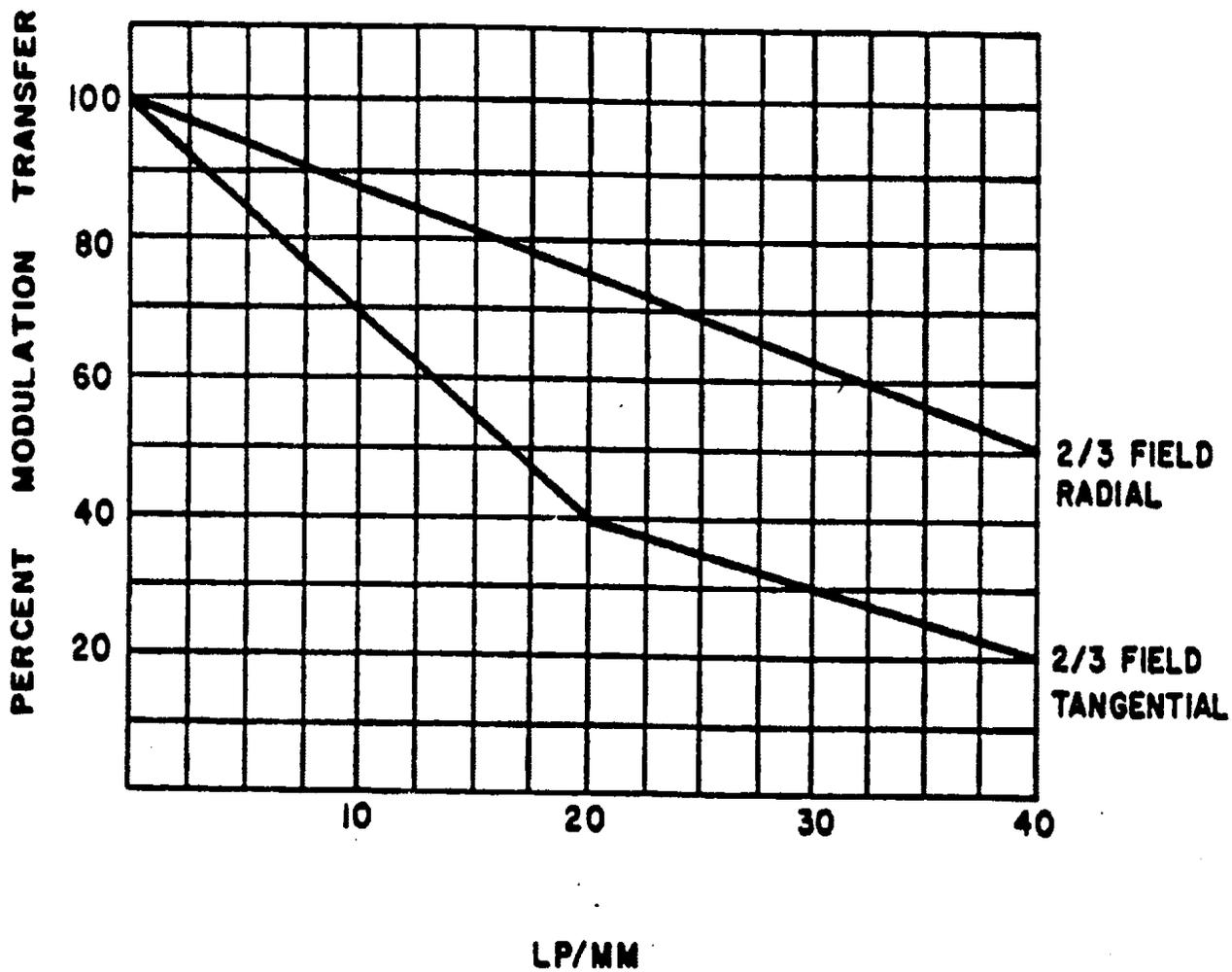


Figure 2. OBJECTIVE MTF OFF AXIS

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.
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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
ML-PRF-49367C (CR)

2. DOCUMENT DATE (YYMMDD)
990304

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)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON
(If applicable)

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