

MIL-T-45658F(MU)
22 June 1973
 SUPERSEDING
 MIL-T-45658E(MU)
 24 March 1969

MILITARY SPECIFICATION

TELESCOPE, STRAIGHT: M103

1. SCOPE

1.1 This specification covers one type of three-power telescope with a ten-degree field of view. A level vial, positioned at the focal plane of the eyepiece, provides for indicating proper orientation of the reticle pattern.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Military

MIL-O-13830	Optical Components for Fire Control Instruments: General Specification Governing the Manufacture, Assembly and Inspection of
MIL-F-13926	Fire Control Materiel: General Specification Governing the Manufacture and Inspection of
MIL-P-14232	Parts, Equipment and Tools for Army Materiel; Packaging and Packing of
MIL-I-45607	Inspection Equipment, Supply and Maintenance of

STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-810	Environmental Test Methods

DRAWINGS

U.S. Army, Frankford Arsenal

F7659740	Telescope, Straight: M103
F8565556	Pressure Tester - Two Station

FSC 1240

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PACKAGING DATA SHEET

7659740

Packaging of Telescope,
Straight: M103

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

3. REQUIREMENTS

3.1 Fabrication.- The telescope shall be manufactured in accordance with Drawing F7659740 and drawings pertaining thereto.

3.2 General specification.- The contractor shall be responsible for adherence to and compliance with the requirements of Specification MIL-F-13926 specified below.

- (a) Order of precedence.
- (b) Dimensions and tolerances.
- (c) Inorganic protective surface finishes.
- (d) Part identification and marking.

3.3 Environmental.

3.3.1 Storage temperatures.- The telescope shall show no evidence of physical failure or damage subsequent to being exposed to and thermally stabilized at -80° and $+160^{\circ}$ F.

3.3.2 Standard temperature.- Unless otherwise specified, the telescope shall meet the following requirements while exposed to and thermally stabilized at a temperature between 60° and 90° F.

3.3.3 Vibration.- This requirement shall be met subsequent to meeting the requirements of 3.7.1. The telescope shall show no evidence of physical failure such as glass breakage, loosening of parts and bonding failure due to being vibrated successively along 3 mutually perpendicular axes. Vibration shall be a simple harmonic motion, the frequency varying either linearly or logarithmically from 5 to 55 to 5 cycles per second (cps) in five minute cycles for a total of fifteen minutes along each of the axes. The amplitude of vibration shall be maintained constant at 1/64 inch (1/32 inch total excursion). Following the vibration test the telescope shall meet the requirements of 3.7.2, and shall then meet all of the following requirements.

3.4 Sealing.- The telescope shall show no evidence of leakage in excess of 0.2 pounds per square inch gage (psig) when subjected to an internal pressure of 5.0 ± 0.1 psig of dry nitrogen gas for a minimum of 2 hours. The dew point of the dry nitrogen gas shall be at least as low as minus 25° Fahrenheit.

3.5 Cleanliness.

3.5.1 Dirt.- This requirement shall be met with the observations for dirt and foreign particles (classed as dirt) made through the eye end of the telescope. The maximum dimension of any particle appearing on the reticle surfaces shall not exceed the width of the reticle line. There shall be not more than three particles within the central 50-mil diameter field of view. There shall be not more than three particles outside the central 50-mil diameter field of view. The angular separation between particles shall be greater than 15 mils. Particles smaller than 1/4 reticle line width shall be ignored regardless of distribution.

3.5.2 Other defects.- There shall be no evidence of moisture, grease, fingerprints, condensates, fractures, or adhesive separations when viewing through the objective end and the eye end of the telescope.

3.6 Illumination of reticle and level vial.- This requirement shall be met with a light source not exceeding 0.25 candle-power positioned adjacent to the illumination window. The reticle markings and the position of the level vial bubble shall be visible when observed in a darkened area.

3.7 Optical characteristics.

3.7.1 Collimation, pre-vibration.

3.7.1.1 Elevation.- The line of sight through the boresight cross of the reticle pattern shall be 60.0 ± 5.0 mils above the horizontal plane. This plane is defined as the plane passing through the axis of the 1.20 inch diameter cylindrical surface and $116^\circ \pm 0^\circ 15'$ clockwise from the keyway centerline (engraved index line). See Figure 1.

3.7.1.2 Deflection.- The line of sight through the boresight cross of the reticle pattern shall be parallel within 5.0 mils to the vertical plane passing through the axis of the 1.20 inch diameter cylindrical surface and $26^\circ \pm 0^\circ 15'$ clockwise from the keyway centerline (engraved index line). See Figure 1.

3.7.2 Collimation, post vibration.- This requirement shall be met subsequent to meeting the requirements of 3.3.3. The incident line of sight specified in 3.7.1.1 and 3.7.1.2 shall emerge within 0.10 mil of the collimation readings established in 3.7.1.

3.7.3 Parallelism of reticle and image.- A line defined by the interrupted vertical line on the geometric axis of the reticle pattern shall be parallel, within 2.0 degrees of arc, to the image of a vertical target line.

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3.7.4 Level vial.- The level vial shall appear centered within 4 divisions (mils) as read on the reticle pattern at the 800 meter range line.

3.7.5 Reticle accuracy.- The angular elevation value between the boresight cross and the maximum range graduation of the reticle pattern shall be within 3.0 percent of the value shown on the reticle drawing.

3.7.6 Resolution.- Resolution shall be 10.0 seconds or less. Resolution consists of detectable line structure and proper line count at one focus setting of an observation telescope of at least 0.5 inch aperature and at least 4 power(4X).

3.7.7 Parallax.- Parallax shall not exceed 0.25 mil when viewing a target between 200 and 300 meters.

3.7.8 Eyepiece focus.- The eyepiece focus setting on the geometric axis of the reticle shall be between -0.5 and -1.0 diopter.

4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 General provisions.- The component and subassembly inspection requirements of MIL-F-13926 form a part of the Quality Assurance Provisions of this specification. Definitions of inspection terms shall be as listed in MIL-STD-109.

4.2 First article (initial production) approval.- The requirement for first article approval and the responsibility (Government or contractor) for first article testing shall be as specified in the contract. The sample for first article approval tests shall consist of three telescopes plus three (3) each of all items covered by SQAP. The sample shall be manufactured in the same manner, using the same materials, equipment, processes, and procedures as used in regular production. All parts and materials, including packaging and packing, shall be obtained from the same source of supply as used in regular production.

4.2.1 Government testing.- When the Government is responsible for conducting first article approval tests, the contractor, prior to submitting the sample to the Government, shall inspect the sample to insure that it conforms to all the requirements of the contract and submit a record of this inspection with the sample, including certificates of conformance for materials.

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4.2.2 Contractor testing.- When the contractor is responsible for conducting first article approval tests, the sample shall be inspected by the contractor for all the requirements of the contract. The sample and a record of this inspection, including certificates of conformance for materials, shall be submitted to the Government for approval. The Government reserves the right to witness the contractor's inspection.

4.3 Inspection provisions.

4.3.1 Submission of product.- Unless otherwise specified by the Contracting Officer, inspection lot size, lot formation and presentation of lots shall be in accordance with "Submission of Product" provisions of MIL-STD-105..

4.3.2 Examination and tests.

4.3.2.1 Components and subassemblies.- All components and subassemblies shall be inspected in accordance with the inspection provisions contained in Supplementary Quality Assurance Provisions (SQAP) listed in the technical data package (TDP). In the absence of SQAP's, the Quality Assurance Provisions of MIL-F-13926 shall apply.

4.3.2.3 Telescope.- Examination and tests related to Section 3 herein shall be performed on a single defect (individual characteristic) basis in accordance with MIL-STD-105 and the sampling plans specified in Tables I and II herein. Examination and tests for Packaging, Packing and Marking shall be in accordance with MIL-P-14232 and Section 5 herein. The tabulated classification of defects in Tables I and II shall constitute the minimum inspection to be performed by the supplier after first article approval and prior to Government acceptance or rejection by item or lot.

TABLE I - CLASSIFICATION OF DEFECTS

<u>CLASS</u>	<u>REQUIREMENTS</u>	<u>TEST PROCEDURES</u>
<u>CRITICAL:</u> NONE		
<u>MAJOR:</u> AQL 1.0 Defective		
101. Collimation, pre-vibration	3.7.1	4.6.2
102. Vibration	3.3.3	4.6.3
103. Collimation, post vibration	3.7.2	4.6.4
104. Sealing	3.4	4.6.5
105. Cleanliness	3.5	4.6.6
106. Illumination of reticle and level vial	3.6	4.6.7
107. Parallelism of reticle and image	3.7.3	4.6.8
108. Level vial	3.7.4	4.6.9
109. Reticle accuracy	3.7.5	4.6.10
110. Resolution	3.7.6	4.6.11
111. Parallax	3.7.7	4.6.12
112. Eyepiece focus	3.7.8	4.6.13
<u>MINOR:</u> NONE DEFINED		

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4.3.3 Acceptance and rejection.- Rejected lots shall be screened for all defective characteristics. Removal or correction of defective units and resubmittance of rejected lots shall be in accordance with "Acceptance and Rejection" as specified in MIL-STD-105.

4.4 Special sampling.

4.4.1 General.- One telescope shall be selected at random as a special sampling from each 100 produced. The sample shall meet the requirements and tests in Table II.

TABLE II

<u>CHARACTERISTIC</u>	<u>REQUIREMENT</u>	<u>TEST PROCEDURE</u>
301. Fabrication	3.1	Applicable drawings - visual
302. General specification	3.2	MIL-F-13926 - visual

4.4.2 Environmental.- Three telescopes shall be selected at random as samples from each 50 produced, or from each month's production, whichever occurs first. Each sample shall meet the requirements and tests in Table III and shall then meet the requirements and tests in Table I.

TABLE III

<u>CHARACTERISTIC</u>	<u>REQUIREMENT</u>	<u>TEST PROCEDURE</u>
303. Storage temperature (-80° and +160°F)	3.3.1	4.6.1

4.4.3 Failure of sample.- Should any one item of a special sampling fail to meet the specified test requirements, acceptance of the product shall be suspended by the Government until necessary corrections have been made by the contractor and the resubmitted samples have been approved (see 4.3.3).

4.5 Inspection equipment.- Except as otherwise provided for by the contract, the contractor shall supply and maintain inspection equipment in accordance with the applicable requirements of MIL-I-45607.

4.5.1 Government furnished inspection equipment.- Where the contract provides for Government furnished test equipment, supply and maintenance of test equipment shall be in accordance with the applicable requirements specified in MIL-I-45607.

4.5.2 Contractor furnished inspection equipment.

4.5.2.1 Government design.- Unless otherwise specified in the contract, all inspection equipment specified by drawing number in specifications or SQAP forming a part of the contract shall be supplied by the

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contractor in accordance with technical data listed in the technical data package (TDP).

4.5.2.2 Contractor design.- The contractor shall design and supply inspection equipment compatible with the "Test Methods and Procedures" specified in 4.6 of this specification and with the component inspection procedures specified in "Examination" and "Test Facilities" requirements of MIL-F-13926. Since tolerance of test equipment is normally considered to be within 10% of the product tolerance for which it is intended, this inherent error in the test equipment design must be considered as part of the prescribed product tolerance limit. Thus, concept, construction, materials, dimensions and tolerances used in the design of test equipment shall be so selected and controlled as to insure that the test equipment will reliably indicate acceptability of a product which does not exceed 90% of the prescribed tolerance limit, and permit positive rejection when nonconforming. Construction shall be such as to facilitate routine calibration of test equipment.

4.5.2.3 Inspection equipment design requirements.

4.5.2.3.1 Orientation, collimation pre-vibration, vibration and collimation post vibration.- The special testing equipment for these tests shall consist of the following main assemblies:

- a. Mounting plate assembly
- b. Collimation test stand assembly
- c. Vibration test stand assembly
- d. Vibration machine

4.5.2.3.1.1 Mounting plate assembly.- The mounting plate assembly utilized to mount and orient the telescope for the pre-vibration collimation, vibration and post-vibration collimation tests shall incorporate the necessary mounting features (thread segments, seating shoulder and locating key) for the telescope. The mounting plate assembly shall provide for positioning the axis through the 1.20 inch diameter cylindrical surface of the telescope in the horizontal plane within 10 seconds of arc when the mounting plate is positioned on the collimation test stand assembly. The mounting plate assembly shall also position the telescope so that its keyway centerline (engraved index line) lays in a plane that bisects the axis of the 1.20 inch diameter cylindrical surface and forms an obtuse angle of $116^{\circ} + 0^{\circ} 1' 30''$ with the horizontal plane, as shown in Figure I. Features shall be designed into the mounting plate assembly that will assure positive and accurate positioning and re-positioning (repeated removal and replacement) of the mounting plate assembly on the collimation test stand within 5 seconds in all planes.

4.5.2.3.1.2 Collimation test stand assembly.- The assembly shall function as a holder for the mounting plate assembly, with the telescope positioned with its optical-mechanical axes in a horizontal plane. Features shall be designed into the collimation test stand assembly that will assure positive and accurate positioning and re-positioning (repeated removal and replacement) of the mounting plate assembly on the test stand assembly within 5 seconds in all plane. A target projector collimator shall also be part

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of the test stand assembly. The target projector collimator shall have an entrance pupil of at least 2.0 inches, with an appropriate calibrated target reticle pattern for measuring the collimation accuracies of the telescope. The target projector collimator shall be positioned so that its optical axis is maintained horizontal within 10 seconds, and aligned coincident to the axis through the 1.20 inch diameter cylindrical surface of the telescope under test. The vertical reticle line of the collimator shall be adjusted plumb. Unless otherwise specified the collimator shall be adjusted for infinity focus. Alignment of the collimator shall be by means of auto-collimation, with the telescope removed from the line of sight.

4.5.2.3.1.3 Vibration test stand assembly.- The vibration test stand assembly shall function as a holder for the mounting plate assembly with the telescope optical-mechanical axes maintained in a horizontal position. Features shall be designed into the vibration test stand assembly that will assure positive and secure mounting of the mounting plate assembly on the vibration test stand.

4.5.2.3.1.4 Vibration machine.- The vibration test stand shall be firmly and securely mounted on the vibration machine. The vibrating machine shall be capable of providing the amplitude and frequency specified in 3.3.3. The vibrating machine shall also be capable of vibrating the telescope along 3 mutually perpendicular axes while the telescope is maintained in the position specified in 4.5.2.3.1.3.

4.5.2.3.2 Accuracy requirements (optical characteristics).- The special testing equipment utilized to test the optical accuracies of the telescope shall incorporate the applicable design requirements specified in 4.5.2.3.1.1 and 4.5.2.3.1.2. The target projector collimator shall contain a crossline reticle pattern and the necessary calibrations for measuring the appropriate optical accuracies of the telescope. The vertical reticle line of the collimator shall be adjusted plumb. Unless otherwise specified the collimator shall be adjusted for infinity focus.

4.5.2.3.2.1 Parallelism of reticle and image.- The target pattern for this test shall be accurate within 15 minutes.

4.5.2.3.2.2 Reticle accuracy.- The target pattern for this test shall be accurate within .5%.

4.5.2.3.2.3 Resolution.- The target pattern for this test shall be accurate within 0.5 second.

4.5.2.3.3 Sealing.- The pressure testing equipment to test sealing of the telescope shall conform to the internal pressure test requirements of Sheets 1 and 2 of Drawing F8565556, Pressure Tester-Two Station.

4.6 Test Methods and Procedures.

4.6.1 Storage temperature.- The testing equipment utilized in this test shall be in accordance with the "Test Facilities" requirements of MIL-F-13926 and the conditions of 3.3.1. The telescope shall be placed in the test chamber and the temperature of the chamber reduced gradually (see Note 1) to -80°F. The telescope shall remain at this temperature

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for a minimum of 2 hours. At the completion of this 2 hour period the temperature of the test chamber shall be gradually raised to +160°F. The telescope shall remain at this temperature for a minimum of 2 hours. At the completion of this 2 hour period the temperature of the test chamber shall be gradually reduced to room ambient temperature (+60° to +90°F), and the telescope removed from the test chamber. The telescope shall then be subjected to the visual, tactile and audible examination of 4.6.3.1. The telescope shall conform to the requirements of 3.3.1. Caution shall be exercised during this test to avoid subjecting the telescope to thermal shock.

NOTE: The rate of temperature change in the test chamber shall not exceed 20 degrees per hour throughout the temperature cycling test of 4.6.1.

4.6.2 Collimation, pre-vibration.- Perform this test with the telescope positioned on the test equipment that conforms to 4.5.2.3.1.1 and 4.5.2.3.1.2.

4.6.2.1 Elevation.- Direct a line of sight through the telescope eyepiece to the target reticle pattern in the projector collimator. The angular elevation value between the boresight cross of the telescope reticle pattern and the horizontal target line image shall conform to the requirements of 3.7.1.1, as measured on the target. Record the angular elevation value between the horizontal line of the boresight cross and the horizontal target line image.

4.6.2.2 Deflection.- Perform this test in conjunction with the test in 4.6.2.1. The angular deflection value between the boresight cross of the telescope reticle pattern and the vertical target line image shall conform to the requirements of 3.7.1.2, as measured on the target. Record the angular deflection value between the vertical line of the boresight cross and the vertical target line image. Subsequent to recording the pre-vibration collimation values (4.6.2.1 and 4.6.2.2), remove the mounting plate assembly (with telescope installed) from the collimation test stand (4.5.2.3.1.2) and position it on the vibration test stand (4.5.2.3.1.3). Subject the telescope to the vibration test in 4.6.3. Caution must be exercised during this transfer of the mounting plate assembly. All unnecessary shocks which would tend to render the testing equipment inaccurate for subsequent tests shall be avoided.

4.6.3 Vibration.- Perform this test with the vibration test stand, containing the mounting plate assembly (with telescope installed), positioned and secured on the vibration machine that conforms to 4.5.2.3.1.4. The telescope shall be vibrated in accordance with Procedure IX, Part I, of MIL-STD-810, except that the frequency, frequency cycling and amplitude of vibration shall be as specified in 3.3.3. Immediately following the vibration cycle, and prior to the examination for evidence of physical failure, the telescope shall be subjected to the test in 4.6.4. Caution shall again

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be exercised during transfer of the mounting plate assembly. Upon completion of the test in 4.6.4, the telescope shall be subjected to the tests specified in 4.6.3.1.

4.6.3.1 Examination.- Subsequent to the test in 4.6.4, the telescope shall be thoroughly examined for any evidence of physical failure. A visual and tactile examination shall be made for missing or damaged parts. A tactile examination shall also be conducted to determine looseness of parts. An audible examination shall be made of the telescope by shaking it and listening for loose internal parts or broken components. Any one of the possible defects defined above shall be cause to consider an assembly defective. The telescope shall be subjected to the tests in 4.6.5 through 4.6.13 inclusive to determine overall compliance with 3.3.3.

4.6.4 Collimation, post vibration.- Conduct this test subsequent to vibration and prior to the examination for physical failure resulting from vibration. Again position the mounting plate assembly, with telescope installed, on the collimation test stand as in 4.6.2. Observe the position of the boresight cross of the telescope with reference to the target reticle pattern in the collimator. Any change in the position of the boresight shall not exceed the tolerance specified in 3.7.2.

4.6.5 Sealing.- The internal pressurizing of the telescope to test sealing shall be performed with special testing equipment conforming to 4.5.2.3.2. Remove Screw MS-35233-59 from the Housing 7659745 and apply the pressure to the telescope through the tapped hole by means of an appropriate adapter. Pressurize the telescope with dry nitrogen gas to 5.0 ± 0.10 psig in accordance with the procedure for internal pressure testing that is delineated on Sheet 1 and 2 of Drawing F8565556. The applied pressure shall be retained for a minimum of 2 hours. Any evidence of leakage in the telescope at the end of the 2 hour time period shall not exceed the tolerance specified in 3.4, as measured on the pressure gauge of the testing equipment. Upon satisfactory completion of the sealing test remove the test adapter from the telescope housing and replace the screw MS-35233-59.

4.6.6 Cleanliness.- The telescope shall be visually examined through the eyepiece and objective with the unaided eye. Inspection for moisture shall be made by the technique of shadowing. Inspection for dirt or foreign particles shall be made by viewing a uniformly illuminated field having a brightness of approximately 300 apparant foot candles. Cleanliness of the telescope shall conform to the requirements of 3.5.

4.6.7 Illumination of reticle and level vial.- A device consisting of a .19 ampere lamp energized by 3.0 volts shall be utilized to illuminate the telescope reticle. The illuminated etchings of the reticle pattern shall be clearly defined when visually examined against a darkened background. Should the brightness of a reticle defect be greater than the brightness of a reticle line, or should the position of the level vial bubble not be visible, the defect shall be cause for rejection.

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4.6.8 Parallelism of reticle and image.- Direct a line of sight through the telescope eyepiece and obtain coincidence of one extremity of the telescope's vertical reticle line with that of the vertical target line. Observe for coincidence at the opposite extremity of the telescope's vertical reticle line. The vertical reticle line of the telescope shall be parallel to the vertical target line image within the tolerance specified in 3.7.3, as measured on the target.

4.6.9 Level vial.- Direct a line of sight through the telescope eyepiece to the vertical target line and verify the plumb of the vertical reticle line of the telescope. Observe the position of the bubble in the level vial with reference to the vertical reticle line. The bubble shall be centered on the vertical reticle line within the tolerance specified in 3.7.4. Each division on the 800 meter range line represents 1.0 mil.

4.6.10 Reticle accuracy.- Perform this test utilizing a wall target. The angular valve of the reticle pattern between the boresight cross and the 800 meter range line (112.58 mils) shall not exceed the tolerance specified in 3.7.5, as measured on the target.

4.6.11 Resolution.- Perform this test utilizing an auxiliary telescope that conforms to the requirements of 3.7.6 and a resolving power chart on a wall target. The resolving power chart shall represent the angular subtense for the seconds of arc specified in 3.7.6, and shall contain four line sets as shown in Figure 1 of MIL-O-13830. The test method and procedure shall be in compliance with the "Resolution Test" specified in MIL-O-13830. Resolution shall meet the requirements of 3.7.6.

4.6.12 Parallax.- Adjust the target projector collimator for a focus setting between 200 meters and 220 meters. Direct a line of sight through the telescope eyepiece to the target. Parallax is recognized as any apparent movement of the vertical and horizontal reticle lines of the telescope with respect to the target image when the observer's head is moved side to side or up and down. Parallax on the optical axis (geometric center of the reticle) shall not exceed the tolerance specified in 3.7.7. Adjust the target projector collimator for a focus setting between 275 meters and 300 meters and repeat the test for parallax. Again, parallax shall not exceed the tolerance specified in 3.7.7.

4.6.13 Eyepiece focus.- This test shall be made with the aid of a calibrated dioptometer having a magnification of at least 3 power, and a diopter measuring range of zero to minus one diopter. Set the dioptometer objective scale to zero and adjust the dioptometer eyepiece for best focus of the dioptometer reticle. Position the dioptometer at the eyepiece of the telescope. Observe through the dioptometer and obtain best focus of the telescope reticle by adjustment of the dioptometer objective scale. The telescope reticle shall be in best focus within the tolerance specified in 3.7.8 as measured on the dioptometer objective scale.

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5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking.- Packaging, packing, and marking shall be in accordance with Specification MIL-P-14232 and Packaging Data Sheet 7659740. The level of protection shall be as specified in the procurement document.

6. NOTES

6.1 Intended use.- The M103 Telescope is primarily intended for use with the M67, 90 millimeter Rifle. A ballistic-type reticle pattern provides range data for HEAT ammunition.

6.2 Ordering data.- Procurement documents should specify:

- a. Title, number, and date of this specification.
- b.. Selection of an applicable level of preservation, packaging, and packing (see 5.1).
- c. Applicable stock number.
- d. Applicable packaging data sheet (see 5.1).

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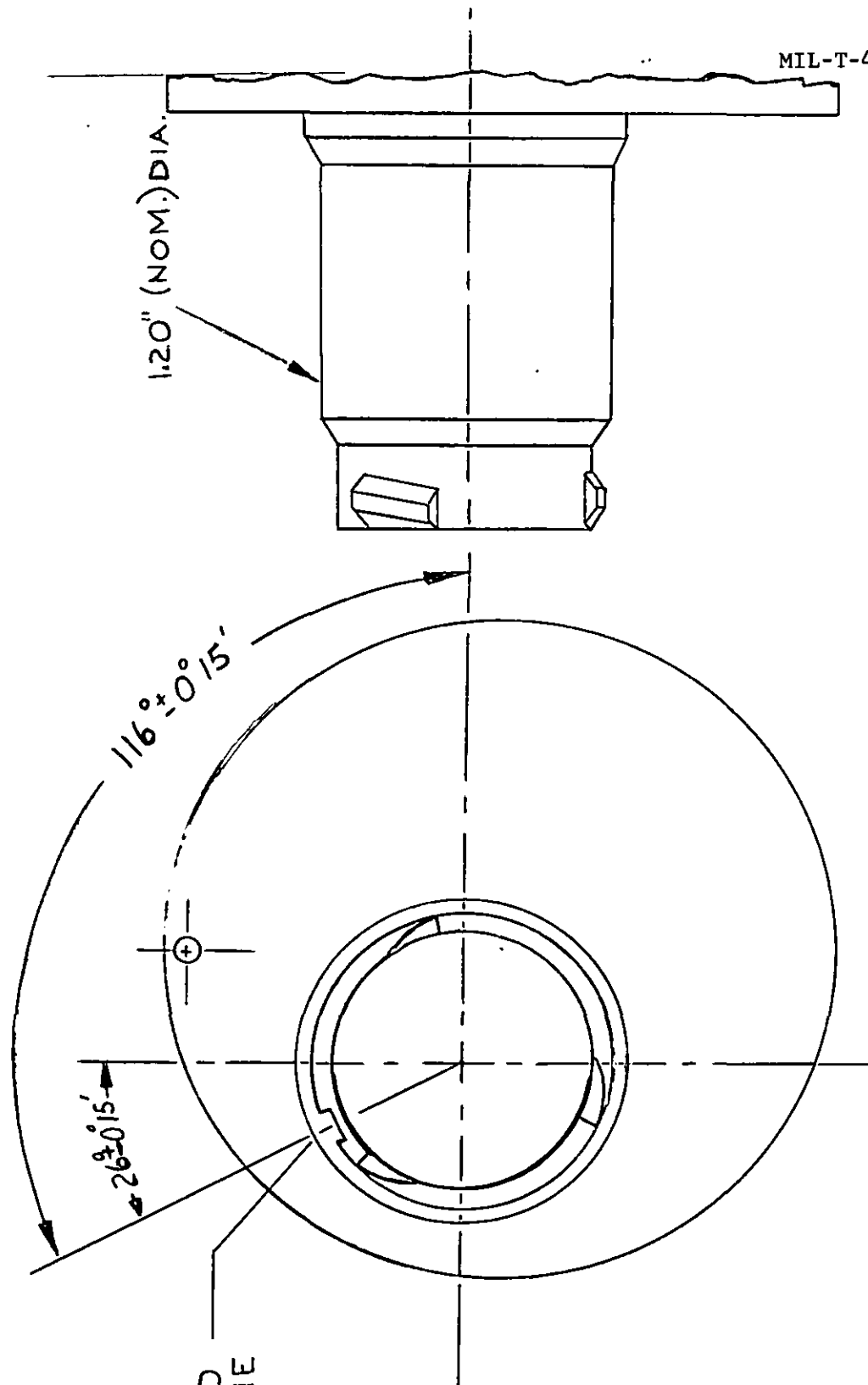
Preparing activity:

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ENGRAVED
INDEX LINE

FIGURE 1

