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MIL-DTL-48558C  
14 September 2012  
SUPERSEDING  
MIL-T-48558B(AR)  
29 May 1990

## DETAIL SPECIFICATION

### TELESCOPE, ELBOW - M138A1

This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers Telescope, Elbow: M138A1, which is one type of elbow telescope that provides an eight power magnification and an eight degree field of view. The telescope has a mil scale reticle for setting elevation. The reticle pattern is illuminated with a battery powered system.

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed 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 requirements of documents cited in sections 3 and 4 of this specification, whether or not documents are listed in this section.

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| Comments, suggestions, or questions on this document should be addressed to:<br>Commander, US Army ARDEC, ATTN: RDAR-QES-E, Picatinny Arsenal, New Jersey<br>07806-5000 or emailed to <a href="mailto:picaardestdznbranch@conus.army.mil">picaardestdznbranch@conus.army.mil</a> . Since contact<br>information can change, you may want to verify the currency of this address information<br>using the ASSIST online database at <a href="https://assist.dla.mil">https://assist.dla.mil</a> . |
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FSC 1240

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2.2 Government documents.

2.2.1 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 are those cited in the solicitation or contract.

## DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-PRF-13830 - Optical Components for Fire Control Instruments;  
General Specification Governing the Manufacture,  
Assembly and Inspection of
- MIL-F-13926 - Fire Control Materiel, Manufacture, and Inspection,  
General Specification for

## DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-1916 - DOD Preferred Methods for Acceptance of Product

(Copies of federal and military specifications, standards, and handbooks are available online at <https://assist.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND  
ENGINEERING CENTER (ARDEC) DRAWINGS

- 5549108 - Telescope, Collimating
- 7680631 - Dioptrimeter
- 8565556 - Pressure Tester – Two Station
- 10549199 - Adapter, Vibration and/or Shock
- 10558254 - Test Fixture
- 11747956 - Gage, Interchangeability, Maximum
- 13005104 - Telescope, Elbow: M138A1

(Copies of these drawings may be requested online at [pica.drawing.request@conus.army.mil](mailto:pica.drawing.request@conus.army.mil) or from U.S. Army ARDEC, ATTN: RDAR-EIS-PE, Picatinny Arsenal, NJ 07806-5000)

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2.3 Order of precedence. Unless otherwise noted herein or in the contract, 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Conformance. A sample shall be subject to conformance inspection in accordance with 4.3.

3.3 Elbow telescope. The telescope shall conform to drawing 13005104.

3.4 Orientation. The telescope shall be able to be mounted in the orientation as stated below:

a. The telescope shall be able to be mounted on an appropriate fixture, which locates and holds in place the locating pin in a horizontal plane and positions the "V" Holder Assembly, drawing 10549272,  $0.750 \pm .002$ " above the pin and to the rear.

b. The "V" located on holder assembly, drawing 10549272, shall be seated over a  $0.812 - 0.0005$ " diameter. The latch on the holder assembly shall be locked to a  $0.500 - 0.001$ " diameter.

c. A horizontal line of sight shall be provided which is parallel in azimuth to the plane defined by surfaces "X" and "Y" on drawing 13005104.

3.4.1 Collimation of reticle. With the telescope oriented as stated in 3.4, the boresight graduation cross shall coincide with a target 20 mils above the horizontal within 1.0 mil. The azimuth of the boresight cross shall coincide with a plane parallel to, but offset from, the plane defined by the surfaces "X" and "Y" on drawing 13005104 within 1.0 mil.

### 3.5 Environmental.

3.5.1 Storage temperature. The telescope shall be thermally stabilized at temperatures of  $+160 \pm 5^{\circ}\text{F}$  and  $-60 \pm 5^{\circ}\text{F}$  for a period of not less than 4 hours at each temperature. Upon return to and stabilization at standard ambient temperature,  $+60^{\circ}\text{F}$  to  $+90^{\circ}\text{F}$ , the elbow telescope shall meet the requirements of 3.7 through 3.13 inclusive. (See 6.6)

3.5.2 Operating temperature. The telescope shall meet the requirements of 3.10 inclusive while exposed to and thermally stabilized at temperatures of  $+145 \pm 5^{\circ}\text{F}$  and  $-50$

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$\pm 5^{\circ}\text{F}$  for a period of not less than 4 hours at each temperature. Upon return to and stabilization at standard ambient temperature,  $+60^{\circ}\text{F}$  to  $+90^{\circ}\text{F}$ , the telescope shall meet the requirements of 3.7 through 3.13 inclusive. (See 6.6)

**3.5.3 Shock.** The telescope, mounted to the test equipment using its standard attachment mechanism, shall withstand a total of 75 shock impulses along 3 mutually perpendicular axes as defined in Figure 1. Each shock impulse shall be a half sine wave with a time duration of  $.010 \pm .001$  seconds and peak amplitude for each shock impulse as shown in Table I. Subsequent to shock, the latch and cam lock used for attachment shall not have loosened, the telescope shall show no evidence of damage or physical failure, and it shall meet the requirements of 3.6 through 3.13 inclusive. (See 6.6)

TABLE I. Shock orientation and impulse.

| Orientation  | Shock impulse and direction | Number of impulses |
|--------------|-----------------------------|--------------------|
| Longitudinal | -130 g's, +130 g's          | 15 each direction  |
| Vertical     | -50 g's, +50 g's            | 15 each direction  |
| Transverse   | -50 g's                     | 15 total           |

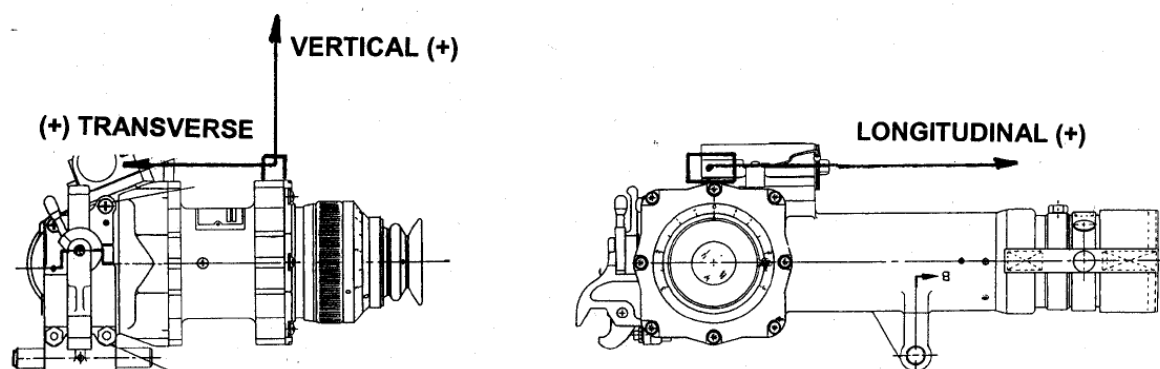


FIGURE 1. Orientation of shock loads.

**3.5.4 Vibration "A".** The telescope, mounted to the test equipment using its standard attachment mechanism, shall withstand a total of 270 minutes of sweep-cycle vibration. The vibration shall be applied for 90 minutes along each of the three mutually perpendicular major axes shown in Figure 1. A complete sweep-cycle shall consist of vibration from origin (5 Hz at 1 inch double amplitude) to mid-point ( $5 \pm 0.5$  g's at 500 Hz) to origin, and shall have a duration of  $15 \pm 1$  minutes. Double amplitude shall be constant at 1 inch between 5 Hz and 10 Hz, and varied with frequency to maintain a constant  $5 \pm 0.5$  g's acceleration between 10 Hz and 500 Hz. Upon completion of vibration, the latch and cam lock used for attachment shall not have loosened, the telescope shall exhibit no evidence of damage or physical failure, and it shall meet the requirements of 3.6 through 3.13 inclusive. (See 6.6)

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3.5.5 Vibration "B". The telescope, mounted to the test equipment using its standard attachment mechanism, shall be vibrated in the vertical plane shown in Figure 1 for a total of  $15 \pm 1$  minutes of sweep cycle vibration. A complete sweep-cycle shall consist of vibration from origin (5 Hz at 1 inch double amplitude) to mid-point ( $5 \pm 0.5$  g's at 500 Hz) to origin, and shall have a duration of  $15 \pm 1$  minutes. Double amplitude shall be constant at 1 inch between 5 Hz and 10 Hz and varied with frequency to maintain a constant  $5 \pm 0.5$  g's acceleration between 10 Hz and 500 Hz. Upon completion of vibration, the latch and cam lock used for attachment shall not have loosened, the telescope shall exhibit no evidence of damage or physical failure, and it shall meet the requirements of 3.6 through 3.13 inclusive. (See 6.6)

3.6 Collimation change, post shock and vibration. The line of sight established in 3.4.1 prior to the shock or vibration test shall not deviate more than .25 mil in azimuth or .25 mil in elevation due to subjecting the telescope to Vibration "A", Vibration "B", or Shock.

3.7 Sealing. The elbow telescope unit shall be capable of holding dry nitrogen at a minimum internal pressure of 5 psig for a period of 1 hour  $\pm$  5 minutes without the loss of pressure in excess of 0.2 psi for that 1 hour period.

3.8 Purging. The interior of the telescope shall be purged with dry nitrogen supplied at a pressure of  $6.00 \pm 0.25$  psig until the dew point of the emergent gas is no higher than -25 °F. Purging apparatus shall be removed when the relief valve is reseated and maintains a pressure of  $3.0 \pm 0.1$  psig.

### 3.9 Optical.

3.9.1 Parallax. The parallax at the center cross of the reticle pattern shall not exceed 0.25 mil when viewing targets between 125 meters and infinity.

3.9.2 Reticle accuracy. The angular separation between the 0 mil and the 60 mil graduations shall be  $60 \pm 0.50$  mils.

3.9.3 Parallelism of reticle and image. With the telescope oriented as stated in 3.4, the 20 mil horizontal line of the telescope reticle shall be parallel to the image of a leveled horizontal line within 30 minutes of arc.

3.9.4 Resolution. The resolution of the optical axis shall be 5 seconds of arc or less when using an observation telescope of at least 3 power and an entrance pupil of at least 0.4 inches. Resolution consists of detectable line structure and proper line count in all four meridians. Total spread in focus shift between meridians shall not exceed  $\frac{1}{2}$  diopter as measured at the eyepiece.

3.9.5 Cleanliness. The optical system shall meet the cleanliness requirements of MIL-PRF-13830 and there shall be no more than 3 particles of dirt visible on the reticle and the area of such particle shall not be in excess of the area equivalent to a size 10 dig.

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There shall be no dirt within the optical system which interferes with observation or adversely affects image quality.

### 3.10 Operability.

3.10.1 Torque of diopter adjustment. The running torque required to operate the diopter adjustment shall be within the values specified in Table II at the corresponding temperatures.

TABLE II. Diopter adjustment torque.

| Temperature    | Torque required        |
|----------------|------------------------|
| +60°F to +90°F | 5 to 9 inch pounds     |
| -50 ± 5°F      | 25 inch pounds maximum |
| +145 ± 5°F     | 25 inch pounds maximum |

3.10.2 Attachment. The elbow telescope locking mechanism shall be operable when exposed to the operating temperatures of 3.5.2. The telescope shall be retained in a manner representative of its use on the Mount, Telescope M172A1.

3.11 Reticle illumination. The reticle markings shall be clearly distinguishable when observed in ambient light conditions ranging from dusk into darkness.

3.12 Interchangeability. Telescope interchangeability shall be verified by the insertion, seating, and subsequent removal of a maximum fit gage.

3.13 Workmanship. Workmanship of the elbow telescope shall be in accordance with the requirements of MIL-F-13926 and MIL-PRF-13830.

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## 4. VERIFICATION

TABLE III. Requirement/verification cross reference matrix.

| Method of Verification<br>1 - Analysis<br>2 - Demonstration<br>3 - Examination<br>4 - Test |  |                        |   |   |   | Class of Verification<br>A - First Article<br>B - Conformance |   |                           |
|--|--|------------------------|---|---|---|---|---|---------------------------|
| Section 3<br>Requirements  | Description                                  | Verification<br>Method |   |   |   | Verification<br>Class   |   | Section 4<br>Verification |
|  |  | 1                      | 2 | 3 | 4 | A   | B |                           |
| 3.1  | First article                                |                        |   | X | X | X   |   | 4.2                       |
| 3.2  | Conformance                                  |                        |   | X | X |   | X | 4.3                       |
| 3.3  | Elbow telescope                              |                        |   | X | X | X   | X | 4.3.2.4                   |
| 3.4  | Orientation                                  |                        |   |   | X | X   | X | 4.4                       |
| 3.4.1  | Collimation of reticle                       |                        |   |   | X | X   | X | 4.4.1                     |
| 3.5.1  | Storage temperature                          |                        |   |   | X | X   | X | 4.5.1                     |
| 3.5.2  | Operating temperature                        |                        |   |   | X | X   | X | 4.5.2                     |
| 3.5.3  | Shock  |                        |   |   | X | X   | X | 4.5.3                     |
| 3.5.4  | Vibration “A”                                |                        |   |   | X | X   |   | 4.5.4                     |
| 3.5.5  | Vibration “B”                                |                        |   |   | X |   | X | 4.5.5                     |
| 3.6  | Collimation change, post shock and vibration |                        |   |   | X | X   | X | 4.6                       |
| 3.7  | Sealing                                      |                        |   |   | X | X   | X | 4.7                       |
| 3.8  | Purging                                      |                        |   |   | X | X   | X | 4.8                       |
| 3.9.1  | Parallax                                     |                        |   |   | X | X   | X | 4.9.1                     |
| 3.9.2  | Reticle accuracy                             |                        |   |   | X | X   | X | 4.9.2                     |
| 3.9.3  | Parallelism of reticle and image             |                        |   |   | X | X   | X | 4.9.3                     |
| 3.9.4  | Resolution                                   |                        |   |   | X | X   | X | 4.9.4                     |
| 3.9.5  | Cleanliness                                  |                        |   | X |   | X   | X | 4.9.5                     |
| 3.10.1   | Torque of diopter adjustment                 |                        |   |   | X | X   | X | 4.10.1                    |
| 3.10.2   | Attachment                                   |                        |   |   | X | X   | X | 4.10.2                    |
| 3.11   | Reticle illumination                         |                        |   |   | X | X   | X | 4.11                      |
| 3.12   | Interchangeability                           |                        |   |   | X | X   | X | 4.12                      |
| 3.13   | Workmanship                                  |                        |   | X |   | X   | X | 4.13                      |

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2)

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## b. Conformance inspection (see 4.3)

4.2 First article. When specified, a sample shall be subjected to first article verification in accordance with Table IV.

TABLE IV. First article inspection criteria.

| Examination or Test                          | Requirement Paragraph | Verification Paragraph |
|--|-----------------------|------------------------|
| Orientation                                  | 3.4                   | 4.4                    |
| Collimation of reticle                       | 3.4.1                 | 4.4.1                  |
| Storage temperature                          | 3.5.1                 | 4.5.1                  |
| Operating temperature                        | 3.5.2                 | 4.5.2                  |
| Shock  | 3.5.3                 | 4.5.3                  |
| Vibration "A"                                | 3.5.4                 | 4.5.4                  |
| Collimation change, post shock and vibration | 3.6                   | 4.6                    |
| Sealing                                      | 3.7                   | 4.7                    |
| Purging                                      | 3.8                   | 4.8                    |
| Parallax                                     | 3.9.1                 | 4.9.1                  |
| Reticle accuracy                             | 3.9.2                 | 4.9.2                  |
| Parallelism of reticle and image             | 3.9.3                 | 4.9.3                  |
| Resolution                                   | 3.9.4                 | 4.9.4                  |
| Cleanliness                                  | 3.9.5                 | 4.9.5                  |
| Torque of diopter adjustment                 | 3.10.1                | 4.10.1                 |
| Attachment                                   | 3.10.2                | 4.10.2                 |
| Reticle illumination                         | 3.11                  | 4.11                   |
| Interchangeability                           | 3.12                  | 4.12                   |
| Workmanship                                  | 3.13                  | 4.13                   |

4.2.1 First article quantity. First article inspections shall be performed on three (3) complete units.

4.2.2 First article inspection to be performed. The first article inspection shall be performed in accordance with Table IV.

4.2.3 First article rejection. If any item of the sample fails to comply with any of the first article requirements, the first article shall be rejected.

4.3 Conformance inspection.

4.3.1 Lot formation. Lot formation shall be in accordance with the lot formation requirements of MIL-STD-1916, paragraph "Formation and identification of lots and batches."



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4.3.2 Classification of characteristics.

4.3.2.1 Conformance inspection quantity. Conformance inspection quantities shall be in accordance with 4.3.2.4 and MIL-STD-1916, paragraph “Sampling of lots or batches.” Conformance criteria shall be in accordance with MIL-STD-1916, paragraph “Verification level (VL).”

4.3.2.2 Conformance inspection to be performed. The conformance inspection shall be performed in accordance with 4.3.2.4.

4.3.2.3 Conformance rejection. If any item fails to comply with the applicable conformance inspection requirements, the lot shall be rejected.

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| 4.3.2.4  | <u>Elbow telescope.</u>                         |                           |                          | Drawing number<br>13005104      |
|--|---|---------------------------|--------------------------|---------------------------------|
| Classification   | Examination or test                             | Conformance<br>criteria   | Requirement<br>paragraph | Next higher<br>assembly<br>None |
|  |   |                           |                          | Inspection<br>method reference  |
| <u>Critical</u>  | None defined                                    |                           |                          |                                 |
| <u>Major</u>   |   |                           |                          |                                 |
| 101  | Presence of Plate,<br>Identification, 13010960  | 100%                      | 3.3                      | Visual                          |
| 102  | Completeness of assembly                        | 100%                      | 3.3                      | Visual                          |
| 103  | Orientation                                     | 100%                      | 3.4                      | 4.4                             |
| 104  | Collimation of reticle                          | 100%                      | 3.4.1                    | 4.4.1                           |
| 105  | Storage temperature                             | 3 units per lot <u>1/</u> | 3.5.1                    | 4.5.1                           |
| 106  | Operating temperature                           | 100%                      | 3.5.2                    | 4.5.2                           |
| 107  | Shock   | 100%                      | 3.5.3                    | 4.5.3                           |
| 108  | Vibration "B"                                   | 100%                      | 3.5.5                    | 4.5.5                           |
| 109  | Collimation change, post<br>shock and vibration | 100%                      | 3.6                      | 4.6                             |
| 110  | Sealing   | 100%                      | 3.7                      | 4.7                             |
| 111  | Purging   | 100%                      | 3.8                      | 4.8                             |
| 112  | Parallax  | 100%                      | 3.9.1                    | 4.9.1                           |
| 113  | Reticle accuracy                                | 100%                      | 3.9.2                    | 4.9.2                           |
| 114  | Parallelism of reticle and<br>image             | 100%                      | 3.9.3                    | 4.9.3                           |
| 115  | Resolution                                      | 100%                      | 3.9.4                    | 4.9.4                           |
| 116  | Cleanliness                                     | 100%                      | 3.9.5                    | 4.9.5                           |
| 117  | Torque of diopter<br>adjustment                 | 100%                      | 3.10.1                   | 4.10.1                          |
| 118  | Attachment                                      | 100%                      | 3.10.2                   | 4.10.2                          |
| 119  | Reticle illumination                            | 100%                      | 3.11                     | 4.11                            |
| 120  | Interchangeability                              | 100%                      | 3.12                     | 4.12                            |
| <u>Minor</u>   |   |                           |                          |                                 |
| 201  | Workmanship                                     | VL-II                     | 3.13                     | 4.13                            |
| NOTES:   |   |                           |                          |                                 |
| <u>1/</u> Lot shall be accepted if there are 0 failures, and rejected if there are 1 or more failures. |   |                           |                          |                                 |

4.4 Orientation. Test fixture 10558254 or equivalent shall be used for the inspection of the M138A1 Elbow Telescope. Follow the calibration and setup instructions on 10558254 prior to positioning the telescope to the fixture. The telescope shall be oriented and secured on the test fixture as specified in 3.4 to verify compliance with this requirement.

4.4.1 Collimation of reticle. With the orientation of 4.4 established, the intersecting point of the boresight cross of the telescope reticle shall be within the tolerance block of the

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target reticle. The intersecting point must be within the limit specified in 3.4.1. Observe the telescope reticle orientation to the target prior to vibration testing.

4.5.1 Storage temperature. With a fresh battery installed and the telescope purged per 3.8, the telescope shall be placed in the test chamber and the temperature of the chamber reduced gradually to  $-60 \pm 5^{\circ}\text{F}$  and shall remain at this temperature for a minimum of 4 hours. At the completion of this 4 hour period, the temperature shall then be gradually raised to  $+160 \pm 5^{\circ}\text{F}$  and the elbow telescope shall remain at this temperature for a minimum of 4 hours. At the completion of this 4 hour period the temperature of the test chamber shall be gradually reduced to room ambient temperature ( $+60^{\circ}\text{F}$  to  $+90^{\circ}\text{F}$ ) at which time the telescope shall be removed from the test chamber. The elbow telescope shall then meet the requirements listed in 3.5.1. As an option, the telescope may be removed from the environmental chamber and be inspected at the high and/or low temperature to observe the elbow telescope's condition if a failure is suspected. (See 6.7)

4.5.2 Operating temperature. With a fresh battery installed and the telescope purged per 3.8, the telescope shall be placed in the environmental chamber and the temperature of the chamber reduced gradually to  $-50 \pm 5^{\circ}\text{F}$ . The telescope shall remain at this temperature for a minimum of 4 hours. At the completion of this 4 hour period, and while at  $-50 \pm 5^{\circ}\text{F}$ , the elbow telescope shall meet requirements listed in 3.5.2. Upon completion of this portion of the test, the telescope shall then be placed back in the environmental chamber and the temperature shall be raised gradually to  $+145 \pm 5^{\circ}\text{F}$ . The telescope shall remain at this temperature for a minimum of 4 hours. At the completion of this 4 hour period, and while at  $+145 \pm 5^{\circ}\text{F}$  the elbow telescope shall again meet requirements listed in 3.5.2. Upon completion of this test, the elbow telescope shall be returned to the environmental chamber and the temperature shall be gradually reduced to room ambient temperature ( $+60^{\circ}\text{F}$  to  $+90^{\circ}\text{F}$ ) at which time the elbow telescope shall be removed from the test chamber and shall again meet requirements listed in 3.5.2. (See 6.7)

4.5.3 Shock. The telescope shall be positioned on adapter 10549199 or functional equivalent and secured to the shock test equipment. The telescope shall then be subjected to a shock test in accordance with 3.5.3. Upon completion of the shock test, the telescope shall meet the requirements listed in 3.5.3.

4.5.4 Vibration "A". The telescope shall be positioned on adapter 10549199 or functional equivalent and secured to the vibration test equipment. The telescope shall then be subjected to a vibration test in accordance with 3.5.4. Upon completion of the vibration test, the telescope shall meet the requirements listed in 3.5.4.

4.5.5 Vibration "B". The telescope shall be positioned on adapter 10549199 or functional equivalent and secured to the vibration test equipment. The telescope shall then be subjected to a vibration test in accordance with 3.5.5. Upon completion of the vibration test, the telescope shall meet the requirements listed in 3.5.5.

4.6 Collimation change, post shock and vibration. After any required shock and vibration testing, and with the orientation of 4.4 re-established, observe and record the

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telescope reticle orientation to the target and compare it to the reticle orientation recorded prior to vibration testing. The observed change in reticle orientation shall be within the limits stated in 3.6.

4.7 Sealing. Accuracy of the test equipment shall be equal to or exceed the accuracies depicted on Pressure Tester – Two Station Drawing 8565556. Prior to the start of the test, secure the poppet valve in a closed position and set the diopter adjustment to +3. Pressurize the telescope with dry nitrogen to a minimum of 5 psig and then remove the pressure source. Observe interior pressure of telescope. After a period of at least 1 hour, observe the interior pressure of the telescope and compare with starting pressure. Any observed change in pressure shall be within the limits stated in 3.7.

4.8 Purging. Accuracy of the test equipment shall be equal to or exceed the accuracies depicted on Pressure Tester – Two Station Drawing 8565556. Connect the test equipment to the purging valve of the telescope. Adjust the dry nitrogen pressure to  $6.00 \pm 0.25$  psig. The pressure is to remain constant until the dew point of the emergent gas is no higher than -25 °F. Purging apparatus shall then be removed and the relief valve shall reseal and maintain an internal pressure within the limits stated in 3.8.

4.9 Optical.

4.9.1 Parallax. This test shall be performed with the telescope positioned as stated in 4.4. Set the collimator projector to 125 meters. The 20 mil reticle graduation of the telescope will establish the geometric axis. Observe any apparent movement between the intersecting point of the telescope's boresight cross and the tolerance block of the target reticle's horizontal and vertical lines. Any apparent movement between these two points when the inspector's head is moved up and down or from side to side is considered parallax. The amount of parallax shall not exceed the limits specified in 3.9.1. Repeat the above test with the collimator projector set to infinity.

4.9.2 Reticle accuracy. This test shall be performed with the telescope positioned as stated in 4.4. The telescope shall be unlocked in the adapter and the zero range graduation of the reticle placed in coincidence with the corresponding line of the target reticle by means of shimming the unit in the fixture. When coincidence has been established, observe the position of the 60 mil reticle line with respect to the limit lines of the target reticle. The angular separation between the 0 mil and the 60 mil graduations shall be within the limits specified in 3.9.2.

4.9.3 Parallelism of reticle and image. This test shall be performed with the telescope positioned as stated in 4.4. Sight through the telescope and observe that the 20 mil horizontal line is in coincidence with the horizontal target reticle line at the short vertical line. Parallelism of the telescope's 20 mil horizontal reticle line shall not exceed the 30 minute mark on the target reticle as per 3.9.3. This test may be performed at the same time as 4.9.2.

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4.9.4 Resolution. To perform this test, a wall target containing the appropriate resolution test pattern shall be employed. Construction of the resolution target and the method of inspection shall be as outlined in MIL-PRF-13830. During this test, the telescope may be supported in a “V” block and packing shims may be used to position it. The telescope must resolve the test pattern within the limits specified in 3.9.4 when using an observation telescope of at least 3 power and an entrance pupil of at least 0.4 inches.

4.9.5 Cleanliness. The unit under test shall be subjected to the test procedures outlined in MIL-PRF-13830 for conformance to the requirements of 3.9.5.

4.10 Operability.

4.10.1 Torque of diopter adjustment. The running torque of the diopter adjustment shall be tested by use of a torque wrench and appropriate adapter at the temperatures specified in Table II for compliance with the requirements of 3.10.1.

4.10.2 Attachment. When the telescope is stabilized at the operating temperatures during 4.5.2, the elbow telescope shall be placed on fixture 10558254 or equivalent, fully secured using the locking mechanism, and then subsequently removed without the use of tools to verify conformance with the requirements of 3.10.2.

4.11 Reticle illumination. Place the instrument in a dark room having a controlled light source. The observer and the instrument must be dark adapted. Prior to performing the test, place a white, matted surface approximately 2 feet from the telescope window and install a fresh battery in the telescope. Perform the test by observing the reticle pattern and determine that this pattern is clearly discernible by means of the internal light source while in the dark room. Gradually raise the level of illumination to where the reticle pattern becomes indiscernible. Place a fixed stop having an aperture of one-half inch over the objective window and observe that the reticle pattern is again clearly discernible by means of the internal light source.

4.12 Interchangeability. The interchangeability gage 11747956 shall be applied to the mounting surfaces of the telescope to assure maximum fit condition. The gage shall be firmly seated without binding, fully secured using the locking mechanism, and subsequently removed, to meet the requirements specified.

4.13 Workmanship. Workmanship of the elbow telescope shall be verified in accordance with MIL-F-13926 and MIL-PRF-13830.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military

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Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

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

6.1 Intended use. The Telescope, Elbow: M138A1, when mounted on Telescope Mount and Quadrant: M172A1, is primarily used to lay the M198 and M777 series of howitzers in azimuth and elevation for direct fire.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Selection of an applicable level of preservation, packaging, and packing in accordance with MIL-STD-2073-1, Department of Defense Standard Practice for Military Packaging.
- c. Packaging Data Sheet, SPI13005104, as applicable (See 6.5).
- d. Applicable stock number.
- e. Provisions for first article testing.

6.3 Inspection equipment design.

6.3.1 Submission of designs for approval. Contractor designs for final acceptance inspection must be approved by the Government prior to fabrication or procuring the equipment. The contractor is referred to MIL-HDBK-204 for guidance. Submission of design concept on inspection equipment is permissible for tentative approval. The completion date for design review will be based on the date of the final submission of designs and the required delivery schedule as stipulated in the contract. Submit designs as required to: Commander, U.S. Army Armament Research, Development and Engineering Center, ATTN: RDAR-QEW-A, Picatinny Arsenal, NJ 07806-5000. This address will be specified on the Contract Data Requirements List DD Form 1433 in the contract. When the contractor submits inspection equipment designs to the Government for approval, he must give the following information in his letter of transmittal:

- a. The contract number.
- b. The contract item (name, model number, etc).

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- c. The designs remaining to be submitted and the expected date of submittal.

6.4 Drawings. Drawings listed in Section 2 of this specification under the heading U.S. Army Armament, Research Development and Engineering Center (ARDEC) Drawings may also include drawings prepared by, and identified as Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal, or Picatinny Arsenal drawings. Technical data originally prepared by these activities is now under the cognizance of ARDEC.

6.5 Packaging data sheet drawings. The following packaging data sheet drawings should be obtained from U.S. Army ARDEC, ATTN: RDAR-EIL-P B455, Picatinny Arsenal, NJ 07806-5000.

|              |   |  |
|--------------|---|--|
| SPI 13005104 | - | Special Packaging Instructions for Telescope, Elbow:<br>M138A1 |
|--------------|---|--|

6.6 Environmental samples. If desired by the manufacturer, it is acceptable to verify compliance with the requirements of 3.7 through 3.13 inclusive only once per unit, provided this verification takes place after the conclusion of all environmental testing required for the given unit.

6.7 Thermal shock. A rate of change in temperature of 5°F per minute or less is recommended to avoid subjecting the telescope to thermal shock.

6.8 Subject term (key word) listing.

Fire Control  
Howitzer  
M777  
M198  
Towed Artillery

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

Custodian:  
Army-AR

Preparing activity:  
Army-AR  
(1240-2012-004)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.