

16 May 1968

Materiel Test Procedure 3-2-510\*  
Aberdeen Proving Ground

U. S. ARMY TEST AND EVALUATION COMMAND  
COMMON ENGINEERING TEST PROCEDURE

ARTILLERY CARRIAGES AND MOUNTS

AD 717532

1. OBJECTIVE

The objective of this Materiel Test Procedure is to describe a procedure for determining the operating characteristics of artillery carriages and mounts.

2. BACKGROUND

The carriage or mount of an artillery piece is an assembly which supports the cannon during fire or travel. The satisfactory performance of the cannon, in a given situation, is greatly dependent upon the proper functioning of this assembly. Engineering Tests, such as those contained within this test procedure, are required to evaluate the operation of the particular carriage or mount as an indication of weapon system effectiveness.

3. REQUIRED EQUIPMENT

- a. Spring scale
- b. Torque gauges
- c. Strain gauge
- d. Stress coating
- e. Clinometer

4. REFERENCES

- A. MTP 2-2-511, Road Tests of Mobile Weapons
- B. MTP 3-2-501, Characteristic Photographs
- C. MTP 3-2-509, Artillery Cannon
- D. MTP 3-2-600, Recoil and Equilibrator Systems
- E. MTP 3-2-601, Vertical Target Accuracy, Dispersion & Time of Flight
- F. MTP 3-2-801, Measurement of Internal Diameters of Cannon
- G. MTP 3-2-807, Materiel Testing-Non-Destructive Exam
- H. MTP 3-2-808, Strain Measurements, Instrumental
- I. MTP 3-2-810, Weapon Pressure Measurement
- J. MTP 3-2-811, Noise and Blast Measurement
- K. MTP 3-2-815, Recoil Motion Measurement
- L. MTP 3-2-816, Hop Firing
- M. MTP 3-2-817, Jump Firing
- N. MTP 3-2-819, Range Firing of Artillery Weapons
- O. MTP 3-2-825, Location of Impact or Air Burst Positions
- P. AMCP 706-340 series, Carriages and Mounts, General

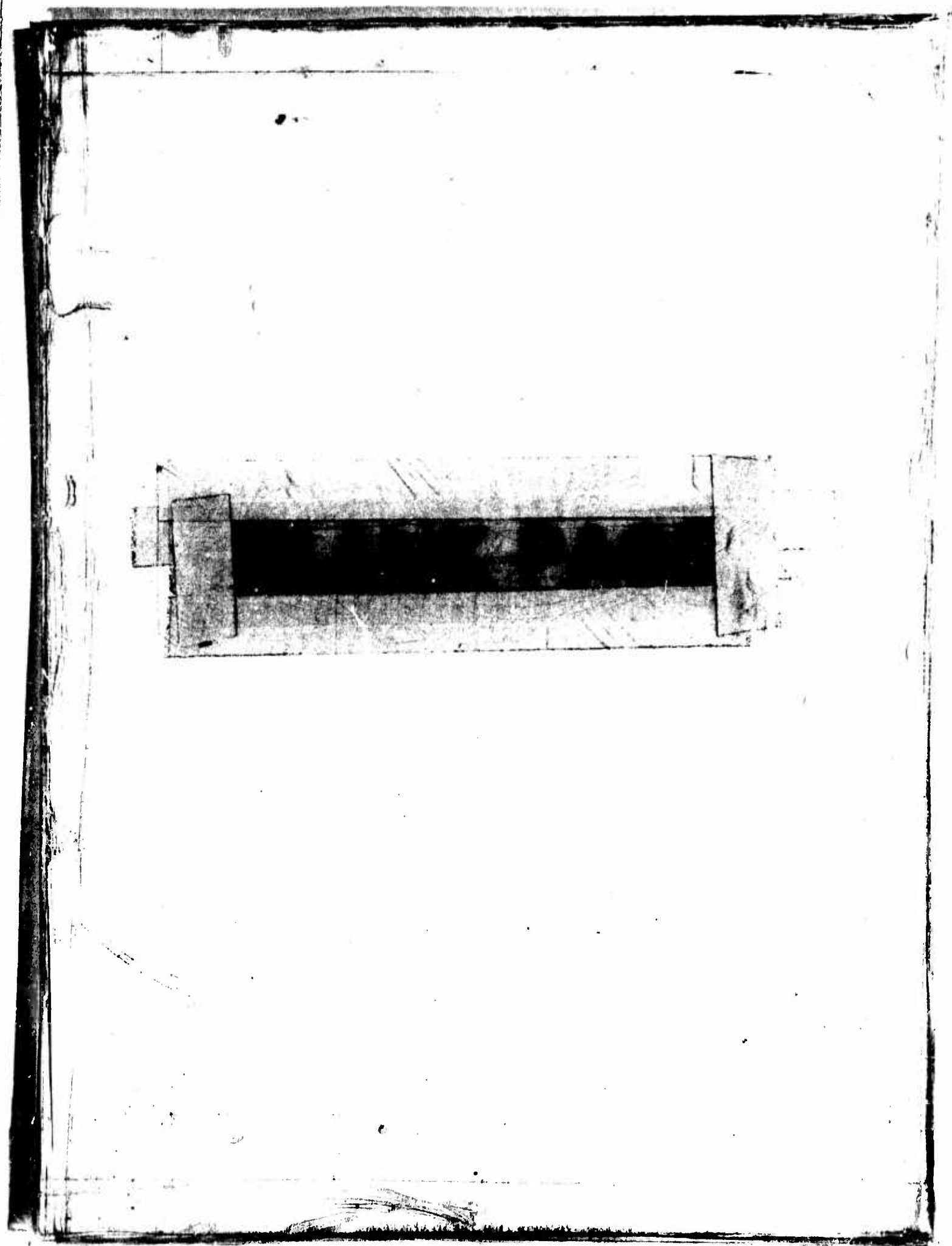
\*Supersedes Ordnance Proof Manual 30-60

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5. SCOPE

5.1 SUMMARY

This Materiel Test Procedure describes the methods employed in testing artillery carriages and mounts. Specific subtests described herein include:

a. Force Measurements - The objective of this subtest is to determine the weight and weight distribution of the cannon and carriage, and lunette with the weapon in both traveling and firing positions, and to determine the force required to raise spikes, handspikes, or jacks to raise or lower the carriage to and from traveling and firing positions.

b. Carriage Operation - The objective of this subtest is to determine the operating characteristics of the carriage assembly.

c. Fire Control Equipment Operation - The objective of this subtest is to determine the operating characteristics of the carriage mounted Fire Control Equipment.

d. Lighting Equipment Operation - The objective of this subtest is to determine the operating characteristics of the carriage mounted Lighting Equipment.

e. Range Drum and Elevating Quadrant Operation - The objective of this subtest is to determine the operating characteristics of the range drum and elevation quadrant located on the carriage or mount.

5.2 LIMITATIONS

The procedures described in this Materiel Test Procedure contain no provisions for conducting proof firing, special firing or road tests on artillery carriages and mounts.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 General Preparations

a. Personnel responsible for conducting the test should ensure that applicable instructions and design specifications are available.

b. Reports of previous tests should be available when appropriate.

c. Operating instructions for test instruments to be used in the conduct of the test should be obtained and available to test personnel.

d. A test log book or folder should be prepared and utilized to record data during tests.

e. Availability of the test range facilities shall be checked and firm scheduling verified.

f. Ensure that all test instruments have been calibrated to within desired tolerances.

g. Test personnel should be briefed prior to testing on the purpose of the test and the degree of accuracy expected.

6.1.2 Preparatory Inspection

Personnel responsible for conducting the test shall ensure that the test-item is inspected prior to test to determine deficiencies or discrepancies which may affect test results. Abnormalities discovered during this inspection shall be corrected, whenever possible, on-the-spot, or entered into the test log and taken into account during the data reduction phase of the test. Particular attention shall be given to the following types of discrepancies during this inspection:

- a. Damage to the test item or its components
- b. Inoperable components of the test item which may affect test results
- c. Portions of the test item requiring adjustment prior to testing
- d. Inadequate lubrication of the test item and its components
- e. Rust damage to essential parts of the test item

6.2 TEST CONDUCT

6.2.1 Force Measurements

6.2.1.1 Weight Measurements

- a. Place the weapon in the traveling position and determine and record utilizing platform scales, the total weight of the cannon and carriage.
- b. Repeat measurement taken in a. above with the weapon placed in the firing position.

6.2.1.2 Weight Distributions

- a. Place the weapon in the traveling position and mount spring scales on the front and rear axle, and support each wheel with platform scales or balances.
- b. Record the initial reading of each weight measuring device with the carriage in the traveling position and the cannon positioned at 0° elevation and center traverse.
- c. With the carriage still in the traveling position and the cannon at center traverse, record the weight reading of each weight measuring device with the tube successively at minimum and maximum elevation.
- d. Maintain the carriage in the traveling position and rotate the cannon to maximum right and maximum left traverse. At each traverse position, record the weight readings of each measuring device with the tube successively at minimum and maximum elevation.
- e. Place the weapon in the firing position and mount weight measuring devices as indicated in a. above. Repeat measurements and recordings as indicated in procedures b. through d above.
- f. Place the weapon in the traveling position and mount a spring scale on the lunette.
- g. Position the lunette on the ground, measure and record the amount of force required to raise the lunette from this position to a height of six

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inches.

h. Position the lunette at pintle height and measure and record the force required to raise the lunette from this position to a height of six inches.

NOTE: Determine the height at which the weight of the lunette is counterbalanced if such a condition exists.

i. Attach weight measuring devices to all lifting spikes, handspikes, and jacks and measure and record the force required in lifting, at each point, to raise the carriage to traveling position or to lower it from traveling to firing position.

#### 6.2.2 Carriage Operation

##### 6.2.2.1 Top Carriage Operation

a. Mount an appropriate torque gauge on the elevating handwheel of the top carriage.

b. Measure and record the amount of torque required to elevate the cannon from 0° elevation to both minimum and maximum elevation positions.

c. Measure and record the amount of torque required to depress the cannon from maximum and minimum elevation positions to 0° elevation.

d. Elevate the cannon from 0° elevation to both maximum and minimum elevation positions. Measure and record the number of turns required to elevate the cannon to these positions and the number of mils per turn or the elevation handwheel ratio.

e. Measure and record utilizing an appropriate clinometer or angular measuring device such as a quadrant, the angular limits of both maximum and minimum elevation positions.

NOTE 1: This measurement shall be made with the cannon at maximum recoil and with the bottom carriage successively at center, maximum right and maximum left traverse. Wheels shall be level and trails at maximum spread when this measurement is taken.

NOTE 2: Equilibrators located on the carriage shall be tested in accordance with procedures described in MTP 3-2-816 (Hop Firing)

##### 6.2.2.2 Bottom Carriage Operation

a. Mount an appropriate torque gauge on the traversing handwheel of the bottom carriage.

b. Measure and record the amount of torque required to traverse the cannon from center traverse to both maximum right and maximum left traverse positions.

c. Measure and record the amount of torque required to traverse the cannon from both maximum right and maximum left to the center traverse position.

d. Traverse the cannon from center traverse to both maximum right and maximum left traverse positions and measure and record the number of turns required to traverse the cannon to these two positions and the number of mils per turn (traverse handwheel ratio).

e. Measure and record, utilizing an appropriate clinometer or angular measuring device, the angular limits of both maximum right and maximum left traverse positions.

NOTE 1: This measurement shall be made with the cannon at maximum recoil and with the top carriage successively at 0° elevation, maximum and minimum elevation. Wheels shall be level and trails at maximum spread when this measurement is taken.

#### 6.2.2.3 Miscellaneous Carriage Measurements

a. Examine the spades and floats of the carriage and rate in the log or test record, any tendency to dish.

b. Examine the carriage locking devices and determine by moving carriage mating parts, any tendency of locking devices to become unlocked. Note discrepancies in the test log or record.

#### 6.2.2.4 Carriage Cradle Operation

a. Exercise the cannon retracting mechanism and observe and record any tendency of the slides and guides to bind.

b. Inspect the slides and observe and record any rust formations noticed.

c. Spray the cradle and slides with water and observe and record whether drain holes are adequately preventing accumulations of water.

d. Attempt to static fire the weapon with the cannon retracting mechanism engaged. Observe and record whether the cradle interlock prevents firing until disengagement.

#### 6.2.3 Carriage Mounted Fire Control Equipment Operation

a. Incline or elevate the right side of the carriage through a maximum of 45° at intervals of 5° each.

b. Adjust the carriage mounted fire control instrumentation until a level condition is obtained at each 5° interval.

c. Record the inclination angle at which fire control instruments are unable to compensate for cant thus preventing the achieving of a level condition.

NOTE: Normally, loss of cant compensation will occur within 45°. In the event that compensation occurs beyond 45°, the maximum testing angle (45°) shall be recorded.

d. Repeat procedures a. through c. above, for the left side of the carriage.

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e. Observe and note in the test log or record, any tendency of the on carriage fire control equipment to bind or become inoperative.

#### 6.2.4 Carriage Mounted Lighting Equipment

a. Turn on all carriage mounted lighting equipment provided for traveling and firing.

b. Utilizing an illumination meter, measure and record illumination at successive distances, 2 ft, 4 ft, 6 ft and 12 ft., from each light source.

c. Observe and record any light source for equipment illumination that is inoperable or that provides insufficient illumination.

#### 6.2.5 Range Drum and Elevation Quadrant

a. Install a quadrant or clinometer on the mount of the weapon under test.

b. Elevate and depress the weapon under test, from 0° elevation to maximum elevation, while observing the elevation and range drum readings at increments of 5°.

c. Record both clinometer readings and elevation and range drum readings for each angular increment in elevation.

d. Observe and record any excessive backlash in the elevation controls while performing step b. above.

NOTE: If backlash is excessive, adjust it to a maximum of one-sixth of a handwheel turn and again check at various elevations.

### 6.3 TEST DATA

#### 6.3.1 Force Measurements

##### 6.3.1.1 Weight Measurements

a. Record the total weight of the cannon and carriage in pounds for the weapon in the traveling position.

b. Record the total weight of the cannon and carriage in pounds for the weapon in the firing position.

##### 6.3.1.2 Weight Distributions

a. Record the initial readings of each weight measuring device with the carriage in the traveling position and cannon positioned at 0° elevation and center traverse, in pounds.

b. Record the readings of each weight measuring device in the traveling position and the cannon with the carriage at center traverse and the tube successively at maximum and minimum elevation, in pounds.

c. Record the readings of each weight measuring device with the carriage in the traveling position and the cannon successively at maximum and minimum traverse and the tube successively at minimum and maximum elevation

for each traverse position, in pounds.

d. Repeat recordings specified in a. through d. above with the carriage in the firing position.

e. Record in pounds, the force required to raise the lunette from ground position to a height of six inches.

f. Record in pounds, the force required to raise the lunette from pintle height to a height of six inches.

g. Record the height in inches at which the weight of the lunette is counterbalanced if possible.

h. Record in pounds, the force required in lifting, at each point, to raise the carriage to traveling position or to lower it from the traveling position to firing position.

### 6.3.2 Carriage Operation

#### 6.3.2.1 Top Carriage Operation

a. Record in ft. pounds, the torque required to elevate the cannon from elevation to both minimum and maximum elevation positions.

b. Record in ft. pounds, the torque required to depress the cannon from maximum and minimum elevation positions to 0° elevation.

c. Record the number of handwheel revolutions required to elevate the cannon to maximum and minimum elevation positions or the number of mils per turn, (handwheel ratio).

d. Record in mils, the angular limits of both maximum and minimum elevation positions.

#### 6.3.2.2 Bottom Carriage Operation

a. Record the torque, in ft. pounds, required to traverse the cannon from center traverse to both maximum right and maximum left traverse positions.

b. Record the torque, in ft. pounds, required to traverse the cannon from both maximum and minimum traverse positions to center traverse position.

c. Record the number of turns required to traverse the cannon from center traverse to both maximum right and maximum left traverse positions and the number of mils per turn (handwheel ratio).

d. Record in mils, the angular limits of maximum right and maximum left traverse positions.

#### 6.3.2.3 Miscellaneous Carriage Operation

Record observations on the operation and suitability of spades, floats and locking devices.

#### 6.3.2.4 Carriage Cradle Operation

Record observations on the condition and operation of slides and guides, rust formations, and the adequacy of drain holes and cradle interlocking mechanisms.

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6.3.3 Carriage Mounted Fire Control Equipment Operation

- a. Record the inclination angle in degrees, at which cant compensation fails for both the right and left sides.
- b. Record observations on the tendency of fire control equipment to bind or to become inoperative.

6.3.4 Carriage Mounted Lighting Equipment

- a. Record illumination measurements in ft. candles for all carriage mounted illumination sources.
- b. Record all observed inoperative or insufficient lighting equipment.

6.3.5 Range Drum and Elevation Quadrant

- a. Record clinometer readings and elevation and range drum readings for each angular increment in elevation, in mils.
- b. Record observations regarding backlash in elevation controls of the elevation and range drum.

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Force Measurements

6.4.1.1 Weight Measurements

Compare weight recorded in 6.3.1.1 for the cannon and carriage to prescribed or specified values and determine whether acceptable in both positions (traveling and firing).

6.4.1.2 Weight Distributions

Compare data recorded in 6.3.1.2 with prescribed or specified data and determine whether the measured condition is acceptable.

6.4.2 Carriage Operation

6.4.2.1 Top Carriage Operation

Compare data recorded in 6.3.2.1 with prescribed or specified values and determine whether the measured condition is acceptable.

6.4.2.2 Bottom Carriage Operation

Compare data recorded in 6.3.2.2 with prescribed or specified values and determine whether the measured condition is acceptable.

6.4.2.3 Miscellaneous Carriage Operation

Compare data recorded in 6.3.2.3 with prescribed or specified values

or conditions and determine whether the measured condition is acceptable.

6.4.2.4 Carriage Cradle Operation

Compare data recorded in 6.3.2.4 with prescribed or specified values and determine whether the measured condition is acceptable.

6.4.3 Carriage Mounted Fire Control Equipment Operation

Compare data recorded in 6.3.3 with prescribed or specified values and determine whether the measured condition is acceptable.

6.4.4 Carriage Mounted Lighting Equipment

Same as 6.4.3 for data recorded in 6.3.4.

6.4.5 Range Drum and Elevation Quadrant

- a. Compare clinometer readings recorded in 6.3.5 with elevation and range drum measurements recorded in 6.3.5 for each angular elevation increment.
- b. Determine the % error between values.
- c. Compare % errors as calculated with prescribed or specified values and determine if within acceptable limits.
- d. Compare recorded observations on backlash in elevation controls with specified conditions and determine if acceptable.