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Materiel Test Procedure 6-3-089
General Equipment Test ActivityU. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

3445

FLASH UNIT, ELECTRONIC

1. OBJECTIVE*

This document provides test methodology and testing techniques to determine to what degree electronic flash units, and their associated tools and equipment, perform the mission as described in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), and Technical Characteristics (TC's), and the suitability of electronic flash units for use by the Army.

2. BACKGROUND

A requirement exists for a device that illuminates a subject brilliantly enough to photograph it. The electronic flash unit performs this mission and is used by the photographer much like the more familiar flashbulb. While the mission of supplying light is the same for both, the operating characteristics of the electronic flash unit make it logistically and economically more suitable for use by the Army. First, the electronic flash unit is a repeating-type device; that is, it can be used over and over again before needing a replacement bulb. Further, if properly operated, the electronic flash unit can give consistent results unattainable from a group of distinct flashbulbs. The color temperature of the electronic flash unit is very near that of white light, eliminating the need for filters when using daylight film. Although exact times vary, most electronic flash units recycle (prepare for another flash) in approximately five to ten seconds. The electronic flash unit is sometimes called a "strobe" light due to its short (about 1/1000 sec.), action stopping, flash duration.

The electronic flash unit consists essentially of a gas discharge tube and the circuitry to "build" a charge. The electric charge is "built" and stored on a large capacitor by the electronic circuit when power is applied to the unit. When the camera shutter contacts close, the charge on the capacitor is applied to the gas discharge tube, resulting in the physical processes that emit light. The test item may include a shoe or other means for mounting the flash unit on a camera, cable(s) or cord(s) for synchronizing the flash with camera action and for connecting the flash unit with the power source(s), a supply of batteries, a battery charger, and case(s) for carrying and/or transit.

3. REQUIRED EQUIPMENT

- a. Still Picture Camera(s) and Film as required for use with test

*This MTP is intended to be used as a basic guide in preparing actual test plans for the subject equipment. Specific criteria and test procedures must be determined only after careful appraisal of pertinent QMR's, SDR's, TC's and any other applicable documents.

ization procedures.

b. Operational Performance - An evaluation to determine, through normal operations, the ability of the test item to operate under the intended conditions by service personnel.

c. Transportability - An evaluation to determine the ability of the test item to be prepared for transport and to be transported by service personnel.

d. Maintenance - An evaluation to determine and appraise the test item's maintenance characteristics and requirements, a verification and appraisal of its malfunctions, an evaluation of the test item's associated publications and other common and special support elements (maintenance test package), an appraisal of the test item's design for maintainability (AMCP 706-134: accessibility, ease of maintenance, standardization, and interchangeability), an evaluation of component and system durability and reliability, and the calculation of indicators which express the effects of appropriate preceding aspects.

e. Safety - An evaluation to determine the test item compliance with safety requirements and to confirm the test item's safety characteristics during conduct of all tests, to comply with requirements of the applicable section of USATECOM Regulation 385-6.

f. Human Factors Evaluation - An evaluation to determine the adequacy of the design and performance characteristics of the test item and associated equipment in terms of compatibility with the capabilities and limitations of specified user personnel with the test item under the environmental and operational conditions for which it was designed. Characteristics of the test item as related to human factors and revealed during the conduct of each test shall be examined.

g. Value Analysis - An evaluation directed at analyzing the primary function and features of the test item for the purpose of reducing the cost of the test item without compromising performance and safety characteristics.

h. Compatibility - An evaluation to determine the ability of the test item to operate in conjunction with related equipment.

5.2 LIMITATIONS

This MTP is oriented to camera-mounted or hand-carried flash units using battery or commercial power. It can be modified as appropriate for airborne flash units.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Inspection

Perform the following procedures upon arrival of the test item at the test site:

6.1.1.1 Arrival Inspection

Subject the test item to the applicable inspection sections of MTP 6-3-500 and the following:

- a. Visually inspect the test item and record the following:
 - 1) All Identification markings.
 - 2) List of accompanying printed materiel and any instances of disagreement with test item markings.
 - 3) Equipment, time, and personnel required to remove test item from carrier.
 - 4) Comments regarding method and materials used to secure test item.
 - 5) Test item damages, or defects.
- b. Photograph any damages noted, and identify the photographs.
- c. Record all other pertinent data.

6.1.1.2 Inventory Check

Conduct an inventory against the Basic Issue Item List (BIIL) and record any shortages, and discrepancies as regards the maintenance literature, repair parts, associated tools, associated equipment and components. Prepare an Equipment Performance Report (EPR) when applicable.

6.1.1.3 Physical Characteristics

Determine and record the physical characteristics of the test item as described in the applicable section of MTP 6-3-500 and the following:

NOTE: Do not repeat acceptable data verified during engineering tests.

- a. Mounting provisions (i.e. camera shoe, hand held, other)
- b. Rated light output.
- c. Angular coverage:
 - 1) Vertical
 - 2) Horizontal
- d. Rated recycle time.
- e. Rated color temperature.
- f. Rated flash duration.
- g. Rated number of flashes per battery charge.
- h. Rated battery charging time.
- i. Rated operating life (in particular, the gas discharge tube).
- j. Electrical power requirements as described in the applicable section of MTP 6-3-517.
- k. Other distinguishing characteristics.

6.1.1.4 Pre-Operational Inspection

NOTE: Do not apply power to the test item during this inspection.

Perform the applicable portions of MTP 6-3-501 and the following:

a. Lubricate, clean, and adjust the test item as described in the applicable orders or technical manuals. Record the following for any action taken:

- 1) Personnel required
- 2) Tools required
- 3) Materials required.
- 4) Time to perform the above action
- 5) Difficulties experienced and suggestions for improvement

b. While performing step a, inspect the test item for functional deficiencies or disabilities and record as required.

c. Mount the flash unit on a standard camera shoe or other mount and verify the following:

- 1) Ease of mounting/dismounting.
- 2) Snugness of mounting.

d. Connect the flash unit cord to the camera body to ensure the following:

- 1) Ease of connecting/disconnecting
- 2) Snugness of connection

e. Using several different test items or repair parts, interchange like components and record the following:

- 1) Ease of inserting/removing replacement part
- 2) Evidences of mechanical binding or looseness

6.1.2 Pre-Operational Functional Check

a. Follow any break-in instructions accompanying the test item or in the draft technical manuals for the following:

- 1) Charging the batteries
- 2) Forming the electrolytic capacitor
- 3) Other instructions, as required

b. Using an ohmmeter or other device, ensure the continuity of the flash cable.

c. Using a voltmeter or other device, check the batteries.

d. Energize the flash unit and flash it, either by shorting the contacts or using a test button on the test item. Observe the flash.

e. Record the following, as applicable:

- 1) Deficiencies in equipment operation
- 2) Action taken
- 3) Time to repair

6.1.3 Operator Training and Familiarization

a. Orient service test personnel using the applicable sections of MTP 6-3-502 and the following:

- 1) All members of the test item shall receive a review of operator safety precautions listed in the technical manuals or developed from previous test experience.
- 2) Service test personnel will be instructed in the capabilities of the test item and in the objectives and procedures of the test.
- 3) The set up, operating, and maintenance procedures for the electronic flash unit will be presented. Precautions for operating and transporting will be reviewed. The technical manuals will be made available for study.

b. Record all pertinent data, including the amount of time and type of training or familiarization required for each operator, and the rank, training, and MOS of service test personnel.

6.2 TEST CONDUCT

- NOTE:
1. All equipment failures shall be reported in accordance with USATECOM Regulation 705-4.
 2. All photographs shall be properly identified as required to support each test.

Service test personnel will observe all safety precautions listed in the technical manual.

6.2.1 Operational Performance

The operational performance of the test item will be determined by placing the test item in extended service in actual mission assignments under TOE environments. Authorized MOS-qualified personnel will operate and maintain the test item using appropriate products, tools and equipment. The length of the operational period will be planned using designated unit mission time and will include sustained mission operations and provisions for scheduled maintenance and allowable downtime. Where mobility is a requirement, moves and relocations will be arranged to use TOE transportation. Suitability of the test item for task operations and conformance with the specified QMR or SDR requirements will be determined by conducting various mission tasks, different task item applications and usage under environmental conditions as required.

Determine the ability of the test item to perform its intended mission as follows:

6.2.1.1 Assembly

a. Have one man unpack the electronic flash unit from its case and set up for normal operation and record the time required for the following:

- 1) Unpacking

- 2) Inserting batteries or applying commercial power
- 3) Mounting flash unit on camera
- 4) Attaching flash cord to camera body.
- 5) Other set-up procedure(s) as required

b. Record the operator's comments on the ease of set-up procedures.

6.2.1.2 Operation

Operate the flash unit during mission assignments using the still picture camera loaded with the appropriate film, and perform the following as mission use allows:

a. Determine and record the following mission information as applicable to each assigned task:

- 1) Mission/task description.
- 2) Weather description.
 - a) Ambient temperature
 - b) Ambient relative humidity
 - c) Precipitation (if any)
 - d) Wind speed, and direction
 - e) Other significant factors
- 3) Hazards the mission presents to the flash unit (e.g. salt exposure on board ship).
- 4) Demands or requirements the mission makes on the flash unit.
- 5) Determine and record the mission required Beam Candle Power Seconds (BCPS) and the flash duration, or the following:
 - a) Maximum camera to subject distance
 - b) Film used (ASA rating)
 - c) Camera used (range of shutter speeds and aperture stops)
 - d) Maximum subject speed (estimated or described)
 - e) Description or estimation of ambient light level

b. Measure and record the recycle time, at least ten times, using a wristwatch with a sweep second hand. For the purpose of this test, recycle time is defined as the time from flash to flash unit readiness, as signified by the indicator light.

c. Determine and record the number of flashes obtained from the flash unit, for each of at least ten distinct sets of batteries, using fresh or freshly charged batteries, as applicable.

d. Observe for and record evidences of electromagnetic interference in accordance with MTP 6-3-513. Clearly indicate each interference and the cause, if known.

e. Perform flash photography as required, identify, and examine the finished (processed) photographs for the following:

- 1) Adequacy of light

- 2) Evenness of light
- 3) Blur due to motion

f. Record any difficulties encountered that prevent or hinder mission accomplishment, such as the following:

- 1) Inability to operate test item in blackout conditions (e.g. could not see and find proper switches or controls).
- 2) Test item carrying case or carrying strap shrinks due to water exposure.
- 3) Water or dust exposure ruins or degrades test item.
- 4) Battery recharge or unit recycle time is slow for successful mission accomplishment.

g. Repeat steps a through f for any environmental conditions necessary for mission completion, and as required by QMR's, SDR's or other developmental criteria.

h. Accumulate sufficient hours on the flash unit to verify mission reliability. The number of operating hours required depends on the specified mission time, reliability, confidence level, and use factors. Operating hours will include transport and set up time. Record the number of operating hours accumulated.

i. Determine and record any evidence of inability to carry and operate the flash unit in combination with other mission-required equipment such as the following:

- 1) Rifle
- 2) Canteen
- 3) Belt
- 4) Pouches
- 5) Pack

6.2.1.3 Securing

Load all components to the electronic flash unit into its transit case(s). Record the following:

- a. Ease of loading and securing
- b. Time required to load and secure for transport

6.2.2 Transportability

Perform the applicable procedures of MTP 6-3-510, MTP 7-3-515, and the following:

a. Review the technical manual for adequacy of procedures for tying down and lifting, and transporting the test item by various media. Any inadequacy of instructions should be reported by EPR.

NOTE: Transportability evaluation of this item will be conducted in conjunction with other commodity items, as applicable

or convenient. If this is not feasible, data from the Engineering Test on the test item shall be sufficient to verify transportability.

b. Prepare the test item for transport by various media in accordance with test item specifications and record the following:

- 1) Organization/Unit being simulated
- 2) Type, size, and serial number of flash unit
- 3) Type of container used for packing
- 4) Dimensions of container
- 5) Weight of container
- 6) Time required to disassemble test item for packing
- 7) Degree of disassembly required
- 8) Time required to pack item
- 9) Methods of packing
- 10) Gross weight of packing container plus test item

c. Transport the test item by various media and record the following:

- 1) Mileage and time of travel
- 2) Type of carrier (rail, marine, etc).

d. Upon completion of each test of MTP 6-3-510 and 7-3-515, visually inspect the test item for damage, and perform functional checks as described in paragraph 6.1.3 above. Record the following:

- 1) Identity of test performed
- 2) Damage incurred and cause of damage, if known
- 3) Effects of damage and action taken

6.2.3 Maintenance

Evaluate the maintenance-related factors of the test item as described in MTP 6-3-524, and 6-3-506 with emphasis on the following:

- a. Organizational (O), Direct Support (F), and General Support (H) Maintenance Requirements.
- b. Operator through General Support Maintenance Literature.
- c. Repair parts.
- d. Tools.
- e. Test and handling equipment.
- f. Calibration and maintenance facilities.
- g. Personnel skill requirements.
- h. Maintainability.
- i. Reliability.
- j. Availability.

NOTES: 1. Describe the effect of the failure on mission accomplishment, safety, and damage to other components of the test item.

- Also note whether improper scheduled maintenance or improper operating instructions contributed to the failure.
2. DS and GS Technical Manuals published on standard components of a test prototype will be evaluated only to the extent necessary to determine their applicability and adequacy when used with the item undergoing service testing.
 3. Inadequacies or suggested improvements to draft maintenance literature will be reported on DA Form 1598 as prescribed by USATECOM Regulation 750-15.
 4. Inadequacies or suggested improvements to published manuals will be reported on DA Form 2028 as prescribed by USATECOM Regulation 750-15.

6.2.4 Safety

Perform the applicable procedure of MTP 6-3-523 and the following:

- a. Service test personnel will make appropriate suggestions to improve the safety precautions listed in the technical manual.
- b. Throughout the test, observe hazards to personnel resulting from inherent design features and from use during mission operations.
- c. Record the information collected as required by MTP 6-3-523 and the following:

- 1) Non-operable safety features
- 2) Inadequate safety features
- 3) Recommendations for additional safety features

6.2.5 Human Factors Evaluation

Throughout the conduct of all tests determine the effectiveness and characteristics of the man-item interaction as related to human factors by performing the appropriate procedures of MTP 6-3-525 and the following:

- a. Prepare check lists to evaluate the human factors characteristics using Human Factors Evaluation Data for General Equipment, (HEDGE), for Class IV A equipment, including but not necessarily limited to the following:

- 1) Assemble/disassemble and locate:
 - a) Unstow/restow
 - b) Assemble, connect, emplace
- 2) Prepare for use:
 - a) Align, calibrate, adjust
 - b) Check out
- 3) Utilization:
 - a) Activate test item

b) Receive photograph

4) Maintenance :

- a) Perform preventive maintenance .
- b) Perform non-scheduled maintenance, including removal/
replacement of components.

5) Doff/don or lift the item and carry it with other related
equipment in performance of prescribed mission.

b. Evaluation of the tasks of step a shall include but not be limited
to the following:

- 1) Title of task conducted
- 2) Adequacy of instructions and tools to perform the task
- 3) Mental and physical effort required
- 4) Design of the test item as it affects the task
- 5) Time required to perform the task
- 6) Personnel required for task

6.2.6 Value Analysis

Throughout the test, the test item shall be examined for any un-
necessary, costly, or "nice-to-have" features as described in USATECOM Regulation
700-1.

a. During the conduct of the test observe features which could be
eliminated without compromising performance, reliability, durability, or safety.

b. Informally question test personnel for features of the test item
that may be eliminated without decreasing the functional value of the test item.

c. Record the following:

- 1) Non-functional, costly, or "nice-to-have" features of the
test item.
- 2) Test personnel's comments.

6.2.7 Compatibility

Determine and record the compatibility of the test item with related
equipment as described in the applicable section of MTP 6-3-512.

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Inspection

6.3.1.1.1 Arrival Inspection -

a. Record the data collected as described in applicable procedures of

MTP 6-3-500, and the following:

- 1) All identification markings.
- 2) List of accompanying printed material and any instances of disagreement with test item markings.
- 3) Equipment, time and personnel required to remove test item from carrier.
- 4) Comments regarding method and materials used to secure test item.
- 5) Test item damages.
- 6) Test item defects.
- 7) Other pertinent data.

b. Retain all photographs.

6.3.1.1.2 Inventory Check -

Record any deficiencies or shortages in the material listed in the Basic Issue Item List (BIIL).

6.3.1.1.3 Physical Characteristics -

Record the data collected as described in the applicable section of MTP 6-3-500 and the following:

- a. Mounting provisions
- b. Rated light output, in BCPS (beam candle power seconds)
- c. Angular coverage in degrees:
 - 1) Vertical
 - 2) Horizontal
- d. Rated recycle time in seconds
- e. Rated color temperature, in degrees Kelvin
- f. Rated flash duration, in milliseconds
- g. Rated number of flashes per battery charge
- h. Rated battery charging time, in hours and minutes
- i. Rated operating life, in cycles
- j. Electrical power requirements as described in MTP 6-3-517
- k. Other distinguishing characteristics.

6.3.1.1.4 Pre-Operational Inspection -

Record data collected as described in the applicable sections of MTP 6-3-501 and the following as required:

- a. For any action taken:
 - 1) Personnel required
 - 2) Tools required
 - 3) Materials required

- 4) Time, in minutes, to perform action
 - 5) Difficulties experienced and suggestions for improvement
- b. Evidence of any functional deficiency or disability.
- c. For each mounting of the flash unit:
- 1) Type of mount (camera shoe/other)
 - 2) Ease of mounting/dismounting
 - 3) Snugness of mounting
- d. For each connection of the flash unit cord(s)
- 1) Ease of connecting/disconnecting
 - 2) Snugness of connection
- e. For each interchange of like components:
- 1) Identity of component
 - 2) Ease of inserting/removing replacement part
 - 3) Any evidence of mechanical binding or looseness

6.3.1.2 Pre-Operational Functional Check

Record the following, as applicable:

- a. Deficiencies in equipment operation
- b. Action taken
- c. Time to repair

6.3.1.3 Operator Training and Familiarization

Record data collected as described in the applicable sections of MTP 6-3-502 and the following:

- for each operator.
- a. Amount of time and type of training or familiarization required
 - b. Rank
 - c. Training time, in MOS, in months.
 - d. Experience, in MOS, in months.
 - e. MOS.

6.3.2 Test Conduct

6.3.2.1 Operational Performance

6.3.2.1.1 Assembly -

Record the following:

- a. Time required, in minutes, for one man to perform the following:

- 1) Unpacking
- 2) Inserting batteries or applying commercial power
- 3) Mounting flash unit on camera
- 4) Attaching flash cord to camera body
- 5) Other set-up procedure(s) as required

b. Operator's comments on the ease of set up procedures.

6.3.2.1.2 Operation -

a. Record the following mission information as applicable to each assigned task:

- 1) Mission/task description
- 2) Mission weather discription:
 - a) Ambient temperature, in degrees F
 - b) Ambient relative humidity, percent
 - c) Precipitation (description: e.g. light rain)
 - d) Wind speed in knots, and direction, in degrees
 - e) Other significant factors
- 3) Hazards the mission presents to the test item (moisture, salt spray, brush or tree limbs striking flash unit, etc).
- 4) Required BCPS and flash duration, or the following:
 - a) Maximum camera to subject distance, approximated or estimated.
 - b) Film used on mission (in particular the ASA rating).
 - c) Camera used on mission (in particular its range of shutter speeds and aperature stops).
 - d) Maximum subject speed, estimated or described.
 - e) Description of ambient light level encountered on mission.

b. Record at least ten different (i.e. distinct) recycle times, in seconds.

c. Record the number of flashes obtained from each set of batteries, for at least ten distinct sets of batteries (fresh/charged).

d. Record the following for electromagnetic interference, if applicable:

- 1) Evidence of interference
- 2) Cause of interference (flash, cable radiation, etc)

e. Record the following, for each of the finished photographs:

- 1) Identification of photograph
- 2) Evidence of inadequacy of light
- 3) Evidence of unevenness of light
- 4) Evidence of blur due to motion

f. Record any difficulties encountered that prevent or hinder mission accomplishment, as follows:

- 1) Identity of mission/task, and the condition(s) imposed.
- 2) Description of difficulty (cause/effect on the test item) such as the following:
 - a) Inability to operate test item in blackout conditions (e.g. could not see and find proper switches or controls).
 - b) Test item carrying case or carrying strap shrinks due to water exposure.
 - c) Water or dust exposure ruins or degrades test item.
 - d) Battery recharge or unit recycle time is slow for successful mission accomplishment.
- g. Record the number of operating hours accumulated on the test item.
- h. Record all evidence of inability to carry and operate flash unit in combination with other mission required equipment.

6.3.2.1.3 Securing -

Record the following:

- a. Ease of loading and securing
- b. Time required to load and secure for transport

6.3.2.2 Transportability

Record the following:

- a. Data collected in accordance with the applicable procedures of MTP 6-3-510, and MTP 7-3-515.
- b. Any inadequacy of instructions in the technical manual.
- c. During packaging:
 - 1) Organization/Unit simulated
 - 2) Type, size, and serial number of flash unit
 - 3) Type of container used for packing
 - 4) Dimensions of container, in inches
 - 5) Weight of container, in lbs.
 - 6) Time required to disassemble test item for packing, in minutes.
 - 7) Degree of disassembly required
 - 8) Time required to pack item, in minutes
 - 9) Method of packing
 - 10) Gross weight, in pounds, of packing container plus test item
- d. For each transport test:
 - 1) Mileage and time of travel
 - 2) Type of carrier (rail, marine, etc)
- e. For each visual inspection and check of the test item as described in paragraph 6.1.2:

- 1) Identity of test performed
- 2) Damage incurred and cause of damage, if known
- 3) Effects of damage and action taken

6.3.2.3 Maintenance

Record data collected as described in the applicable section of MTP 6-3-524 and MTP 6-3-506.

6.3.2.4 Safety

Record data collected as described in the applicable section of MTP 6-3-523 and the following:

- a. Non-operable safety features
- b. Inadequate safety features
- c. Recommendations for additional safety features

6.3.2.5 Human Factors Evaluation

- a. Record the data collected as required by MTP 6-3-525
- b. Retain complete checklists

6.3.2.6 Value Analysis

Record the following:

- a. Non-functional, costly, or "nice-to-have" features
- b. Test personnel's comments

6.3.2.7 Compatibility

Record data collected as described in the applicable section of MTP 6-3-512.

6.4 DATA REDUCTION AND PRESENTATION

All data will be summarized using tabulations and/or charts as applicable. The data will be analyzed to determine the extent to which the test item and maintenance package meet the requirements of the QMR's, SDR's, and detail specifications of the test item.

Where more than one measurement is made during an evaluation, calculate and display the arithmetic mean. In particular, display the mean number of flashes per battery charge, and the mean recycling time (in seconds).

Photographs will be properly identified, and retained or submitted as required to support each test.

A Safety Confirmation, based on the data of paragraph 6.3.2.4 shall be presented in accordance with USATECOM Regulation 385-6.

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13. ABSTRACT
This Army Service Test describes test methods and techniques for evaluating the performance and characteristics of Electronic Flash Units, and for determining their suitability for service use by the US Army. The evaluation is related to criteria expressed in applicable Qualitative Materiel Requirements, (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other appropriate design requirements and specifications.

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