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Matériel Test Procedure 7-2-095  
General Equipment Test Activity

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

SURVIVAL EQUIPMENT (AVIATION)

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1. OBJECTIVE\*

This document provides test methodology and techniques necessary to determine the technical performance and safety characteristics of aviation survival equipment and associated tools and equipment as described in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's) and Technical Characteristics (TC's), and to determine the item's suitability for service tests.

2. BACKGROUND

Requirements exist for specially prepared and packaged materiel consisting of medicinals, implements, consumables, clothing, personal equipment, and other equipments of essential value in enhancing the probability of aircraft crew member survival, escape, and rescue under and following emergency situations.

This survival equipment is required in kit form packaged for the individual airman or group usage. Construction of the kit containers and packaging techniques employed will be such that the possibility of contamination or damage to the contents is minimized in the normal aircraft mission environment and under the different, and at times hostile and/or extreme, environmental conditions of ultimate usage. Implicit within the requirements for survival equipment is the absolute need for long shelf life ensuring expected performance when emergency situations arise.

The range of materiel and components required for all the possible survival, escape, and evasion situations and environments embraces the basic needs of man . . . . food, protective clothing, tools, medicine, medical supplies, and weapons, to name a few terrain oriented survival materiel. Over water survival equipment includes the basic components of over terrain kits and certain life saving equipment such as inflatable vests, life rafts, shark repellent, exposure suits and clothing. In addition, signaling devices such as radios, mirrors, smoke bombs and flares are needed for assisting would-be rescuers in locating the survivor(s). Finally, items of personal equipment are essential to maintain minimum standards of hygiene and a measure of human comfort in hostile environments.

3. REQUIRED EQUIPMENT

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3.1 GENERAL EQUIPMENT

\*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. **STATEMENT #8 UNCLASSIFIED**

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- a. Measuring Tape, Ruler, and Caliper
- b. Weighing Scale
- c. Still Camera and Film
- d. Stop Watch
- e. Lens Bench
- f. Weighing Bottles
- g. Geiger-Mueller Type Survey Radiation Level Meter
- h. Radioactive Detecting Flow Chamber or equivalent
- i. Thermocouple
- j. Environmental and Climatic Test Facilities:
  - 1) Altitude chamber.
  - 2) Waterproofness test chamber or container.
  - 3) Low temperature test chamber meeting the requirements of MIL-C-7951.
  - 4) Shock testing machine meeting the specifications of MIL-S-4456.
  - 5) Humidity test chamber meeting the requirements of MIL-C-7951.
  - 6) High temperature test chamber meeting the specifications of MIL-C-7951.
  - 7) Fungus test apparatus meeting the specifications of MIL-E-5272C.
  - 8) Solar test chamber meeting the specifications of MIL-E-5272C.

4.

#### REFERENCES

- A. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- B. USATECOM Regulation 700-1, Value Engineering.
- C. USATECOM Regulation 705-4, Equipment Performance Report.
- D. AMCP 706-134, Maintainability Guide for Design.
- E. USAGETA Document, Human Factors Evaluation Data for General Equipment (HEDGE).
- F. Federal Test Method Standard No. 101a, Preservation, Packaging and Packing Materials: Test Procedures.
- G. Federal Test Method Standard No. 151a, Metals: Methods of Testing.
- H. Federal Test Method Standard No. 406, Plastics: Methods of Testing.
- I. Federal Test Method Standard No. 601, Rubber: Sampling and Testing.
- J. Federal Test Method Standard No. 751a, Stitches, Seams, and Stitching.
- K. DDD-L-20, Label; for Clothing, Equipment, and Tentage, (General Use).
- L. MIL-L-1497, Labeling of Metal Cans for Subsistence Items.
- M. MIL-E-5272, Environmental Testing, Aeronautical and Associated Equipment, General Specification, for.
- N. MIL-C-7951, Chamber; Altitude, Humidity and Temperature Test.
- O. MIL-S-4456, Shock, Variable Duration, Method and Apparatus for.
- P. MIL-STD-129, Marking for Shipment and Storage.
- Q. MIL-STD-130, Identification Marking of U. S. Property.



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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.

g. Safety - An evaluation to determine the safety characteristics and possible hazards of the test item.

h. 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 conformance to accepted human factors engineering design criteria.

i. 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.

## 5.2 LIMITATIONS

None.

## 6. PROCEDURES

### 6.1 PREPARATION FOR TEST

#### 6.1.1 Initial Inspection

Upon receipt of the test item at the test site, perform applicable procedures of MTP 10-2-500 and the following:

a. Visually inspect the packaged test item. Record the following:

- 1) Evidence of damage incurred during transport or storage.
- 2) Exterior identification markings not in accordance with MIL-STD 129 or other governing documents.
- 3) Evidence of defects in test item materials and construction, treatment and finish, and/or workmanship. Particular attention should be given to kit container seals, seams and stitching, grommets, and snap fasteners. Metal components should not be misaligned nor contain any sharp edge, crack, dent, nick, burr, or sliver. Life saving equipment (rafts, vests, etc.) should not have been manufactured before specified dates.
- 4) Date of manufacture.

#### 6.1.2 Inventory Check

a. Conduct an inventory against the Basic Issue Items List (BIIL). Record evidence of the following:

- 1) Missing literature or instructions for use
- 2) Shortages in kit contents, including maintenance package

3) Improper content

b. Submit an Equipment Performance Report (EPR) for each noted shortage or discrepancy.

6.1.3 Division of Survival Materiel into Testing Groups

To provide a tractable system for testing a wide variety of aviation survival materiel, place test item material possessing similar characteristics into common groups.

- NOTE:
1. The selection of group identifiers is arbitrary and is required principally for convenience in stating test procedures and in maintaining test records.
  2. For the purposes of this document, the following listed divisions of survival materiel has been accomplished. Hereafter, engineering tests will reference these groups and will specify appropriate tests for dominant characteristics for items of each group.

Group I. MEDICAL PRODUCTS AND EQUIPMENT

Group IA: Medicinal substances, drugs, chemical compounds, tablets, ointments, powders, and/or antiseptics used to treat disease or injury and/or otherwise provide for the well being of the survivor(s).

Group IB: Materials such as bandages, splints, snake bite kits, surgical sponges and soap, and equipment devoted to medical treatment of disease or injury.

Group II. TOOLS AND IMPLEMENTS

Group IIA: Tools. Equipments used or worked by hand for cutting, sawing, scraping, chopping of wood, metal, or foodstuff.

Group IIB. Implements. Devices or small instruments such as burning lenses, tweezers, safety pins, sewing kits, knives, forks, spoons, and metal or plastic items of personal equipment such as razors, shaving mirrors, etc.

Group III. RATIONS AND WATER

Group IV. FABRICS

This group contains the resultant of weaving, knitting, or felting of natural or synthetic fibers or filaments into pliable material for clothing, protective suits, hats, mittens, exposure suits, tents, sleeping bags, etc.

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- Group V. DISTRESS SIGNALING EQUIPMENT
- Group VA. Smoke and Illumination Signal Flares.
- Group VB: Signal Mirrors.
- Group VC: Sea Markers (dye).
- Group VD: Radio Equipment.
- Group VE: Lights.
- Group VI. MAGNETIC COMPASS
- Group VII. SEA WATER DESALTER EQUIPMENT
- Group VIII. INFLATABLE CRAFT AND LIFE VESTS
- Group IX. REPELLANTS, SHARK, INSECT, AND LEECH
- Group X. CONTAINERS AND UNIT KITS.
- Group XI. MANUALS AND MAINTENANCE PACKAGE

6.1.4 Inspection and Preliminary Operation

a. Perform preliminary operational checks, inspections, and adjustments in accordance with draft technical manuals or other governing documents and regulations.

b. Examine test item component nomenclature, warning, and instructional data plates and labels for conformance with MIL-STD-130, DDD-L-20, MIL-L-1497, and other governing documents. Record evidence of errors, omissions, and/or deleted plates or labels.

c. Inspect, examine, and determine the extent to which test item(s) conform to the standards and specifications, using the following documents as guidelines for this determination:

- 1) Group I Materiel: Examine to determine evidence of acceptance by the Surgeon General, USA, and for documentation indicating that processes employed to prepare and package the materiel for survival usage meet the criteria of the Food and Drug Administration (FDA) or other applicable governing organization regulations.

NOTE: Engineering tests for Group I items will stress the packaging, transportability, human factors, and effects of extreme environmental conditions on the physical characteristics of these items. Medical worth to the human body will be assumed as that stated by official documents of the Surgeon General, USA, and will at no time be considered or implied as the object of tests or

procedures found in this document.

- 2) Group III Materiel: Inspect for evidence of Surgeon General, USA, approval as dietary fare. Determine if packaging and processing have been performed in accordance with the standards of MIL-STD-668.
- 3) Group IV Materiel: Fabric material of this group should have been tested using the applicable procedures of MTP 10-2-160 and MTP 10-2-175.
- 4) Group VA Materiel: Applicable equipment of this group should have been evaluated according to MTP 4-2-131.
- 5) Group VD Materiel: Applicable equipment of this group should have been evaluated according to MTP's: 6-2-514, 6-2-515, 6-2-517, and 6-2-242.
- 6) Group VIII Materiel: Boats and vests should have been evaluated according to MTP's: 10-2-194 and 10-2-195.
- 7) Group IX Materiel: Applicable repellants of this group should have been evaluated according to MTP 10-2-185.
- 8) Group X Materiel: Equipment of this group should have been evaluated according to applicable procedures of MTP 10-2-165.
- 9) Group XI Materiel: Inspect for adequacy according to MTP 10-2-507.

#### 6.1.5 Physical Characteristics

Measure and/or record the following for each class of equipment as applicable:

NOTE: Data obtained in previous tests need not be remeasured.

- a. Group I: Medical Products:
  - 1) Overall dimensions
  - 2) Weight
- b. Group II: Tools and Implements
  - 1) Dimensions
  - 2) Weight
  - 3) Cutting edge hardness (Rockwell)
  - 4) Carrier type, e.g., hand sling, belt loop, etc
- c. Group III: Rations and Water:
  - 1) Net weight or quantity of unit product
  - 2) Number of product units per package
  - 3) Identification of each product, e.g., meat bar, coffee-instant, onion powder, etc.
- d. Group IV: Fabrics:
  - 1) Dimensions, overall

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- 2) Components and location dimensions.
- 3) Type of cloth/fabric/textile, e.g., cotton, cotton duck, down, woven nylon, webbing, etc.
- 4) Color.
- 5) Fastener type(s), i.e., slide, snaps, etc.
- 6) Stitching type(s), e.g., box stitching, and stitches per unit length (for major seams).

e. Group V. Distress Signaling Equipment:

- 1) For smoke and illumination signal flares:
  - a) Nomenclature
  - b) Color of smoke produced
  - c) Color of flare light
  - d) Length of time smoke produced
  - e) Length of time flare produces usable light
  - f) Weight
- 2) For signal mirrors:
  - a) Dimensions
  - b) Weight
- 3) For sea markers:
  - a) Color
  - b) Useful life time (in calm water)
  - c) Type of dye, e.g., fluorescein, etc.
- 4) For radio equipment:
  - a) Frequency coverage and limits
  - b) Receiver sensitivity and signal to noise figure
  - c) Emission types, e.g., A1, A2. . . , etc.
  - d) Transmitter power output, per emission type
  - e) Useful transmitter range
  - f) Dimensions
  - g) Weight
  - h) Antenna type, e.g., whip, dipole, etc.
- 5) For lights:
  - a) Weight, including specified batteries
  - b) Battery type
  - c) Bulb type
  - d) Manufacturer's rated amp hours for battery

f. Group VI. Magnetic Compass:

- 1) Weight

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- 2) Card calibration resolution
- 3) Color
- 4) Luminous marking characteristics:

- a) Color
- b) Dominant wave-length

g. Group VII. Sea Water Desalter(s):

- 1) Salt removing chemical(s) type(s).
- 2) Capacity, sea water, as specified by the manufacturer.
- 3) Disrupting time, as specified by the manufacturer.
- 4) Rated output of potable water per unit package of desalting chemical.
- 5) Number of unit packages of desalting chemical(s) supplied.

h. Group VIII. Inflatable Craft and Life Vests:

- 1) Weight
- 2) Deflated (packaged) dimensions
- 3) Inflated dimensions
- 4) Color
- 5) Inflation pressure
- 6) Automatic inflation characteristics:
  - a) Time to inflate
  - b) Type of gas
  - c) Pressure attained

i. Group IX. Repellants: Shark, Insect, and Leech:

- 1) Chemical composition
- 2) Specific use
- 3) Alternate uses
- 4) Quantity supplied

j. Group X. Containers and Unit Kits:

- 1) Weight.
- 2) Dimensions.
- 3) Type of kit, when applicable, e.g., over water, hot climate, etc.

k. Group XI. Manuals and Maintenance Package:

- 1) Dimensions
- 2) Weights
- 3) Adequacy of containers

1. Survival materiel included within Groups I through X which are qualified on the basis of physical and/or chemical properties alone (e.g.,

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razor blades, plastic bags, safety pins, etc.) should be subjected to MTP 10-2-500, Material Characteristics Test Methods for metals, structural sandwich construction, plastics, and textile materials. Where appropriate testing methods are not provided by MTP 10-2-500, the following Federal Standards should be consulted:

- 1) Federal Test Method Std. No. 151A: Metals.
- 2) Federal Test Method Std. No. 101A: Preservation, Packaging and Packing Materials: Test Procedures.
- 3) Federal Test Method Std. No. 601: Rubber: Sampling and Testing.
- 4) Federal Std. No. 751A: Stitches, Seams, and Stitching.
- 5) Federal Test Method Std. No. 406: Plastics; Methods of Testing.

#### 6.1.6 Operator Training and Familiarization

Test personnel shall receive training and familiarization in accordance with applicable procedures of MTP 10-2-501, and the following:

a. Familiarize the test team concerning the purpose and methods required to test aviation survival equipment. The following topics should be stressed during these familiarization sessions:

- 1) Sequence of Tests and Adjustments: Tests and adjustments should be carried out in the specified order so that factors affecting each test will have been established and re-testing and re-adjustment will be reduced or eliminated.
- 2) Terminology: Familiarize team members with trade terms and unique state-of-the-art terminology not otherwise defined in the supplied instructional matter.

b. Record all pertinent data required by MTP 10-2-501.

#### 6.2 TEST CONDUCT

NOTE: All equipment failures shall be reported in accordance with USATECOM Regulation 705-4.

##### 6.2.1 Performance Characteristics Tests

###### 6.2.1.1 Implement and Tool Performance Tests

###### 6.2.1.1.1 Knives and Axes - Perform the following:

a. Use test item axes, knives, etc., to cut material simulating vines, shrubbery, tree sprouts, saplings, etc. The tool shall be employed as prescribed by attached survival instructions, and record the following:

NOTE: The test item should not be sharpened prior to being used, but should be used as supplied in the survival kit.

- 1) Physical properties of simulated vines, shrubbery, etc., including:
  - a) Hardness, density, etc.
  - b) Dimensions, thickness, diameter, etc.
- 2) Length of time required to cut through material
- 3) Description of resulting cut(s), e.g., ragged, clean-cut, etc.

b. Continue activities described in step a until the test item implement requires sharpening and record length of time the item was used before it requires sharpening.

c. Hone the cutting edge of the test item, utilizing the sharpening stone included with the implement in accordance with provided instructions, and record the number of sharpening strokes, average length of stroke, and the elapsed time required to sharpen the implement.

d. Repeat step a and record information as regards cutting ability before and after sharpening.

e. Should the results of step c prove unsatisfactory, repeat steps c and d using a sharpening stone of known and proven quality.

6.2.1.1.2 Saws - Perform the following for each type of saw included in the survival kit:

a. Use survival saws (wood/hack-saw types) to saw wood, metal, and ice and record the following:

- 1) Physical properties of wood, metal, and ice
- 2) Dimensions, thickness, density, etc.
- 3) Length of time required to saw through each material

b. Continue step a until the saw is dull. Record the elapsed time.

6.2.1.1.3 Burning Lens - Perform the following:

a. In the presence of the sun, mount the test item burning lens in a convenient lens holder (simple lens bench).

b. Measure and record the average temperature on the sunward side of the lens, using a thermocouple.

c. Place the thermocouple in the vicinity of the focal point and adjust the focus of the lens until a maximum temperature reading is obtained and record the following:

- 1) Dimensions of thermocouple sensor
- 2) Diameter of focused sun spot at focal point
- 3) Thermocouple reading

6.2.1.2 Signal Flare Performance Tests

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- a. Place ten smoke and ten light flares, submerged in at least five inches of water, in a vacuum test chamber.
- b. Treat the water covering the flares with a detergent and record concentration and chemical composition.
- c. Close-off the vacuum chamber and subject the interior to a vacuum of 15 inches of mercury for a minimum period of one minute, or as otherwise specified. Record actual values.
- d. Observe, through a convenient chamber window/view-port, the test items under the conditions of step c. and record the number of test items which emit a stream of bubbles, indicating defective seals, etc.
- e. Eliminate from the test item lot those flares which emitted bubbles. Re-test as indicated above new samples until a total of ten smoke and ten light flares is available for the remainder of the test procedures.
- f. Immerse the test items under a one-inch head of water at a temperature of 68°F for a minimum period of 24 hours.
- g. In sequence, remove the smoke flares and initiate smoke in accordance with supplied instructions. Record whether or not each test item operated (produced smoke).
- h. Record the time interval that each test item produced useful signal smoke.
- i. In sequence, remove the light signal flares and initiate each in accordance with supplied instructions. Record whether or not each test item operated (burned).
- j. Record the burning time of each signal light flare.

#### 6.2.1.3 Magnetic Compass Performance Tests

- a. Align a turntable calibrated in one degree increments (0° through 360°) to  $N_{\text{magnetic}}$  using a recently calibrated magnetic compass of known and superior performance (in respect to the expected test item performance).
- b. Remove the calibration compass and replace with the test item. Align test item card and case to  $N_{\text{magnetic}}$ . Rotate the item case to the cardinal points (90°, 180°, 270°, and 360°). Record card error at each point. Record the time required for the test item card/needle to stabilize following each 90° rotation.
- c. Measure the test item radiation level with a Geiger-Mueller type survey meter following calibration against a known source of radiation. Record the measured test item radiation level.
- d. Wipe the test item with a moist filter paper (front, back, and sides). Analyze the filter paper for radioactive content in a flow chamber or other instrument capable of detecting less than 1,000 disintegrations per minute, or as otherwise specified. Record the level of contamination.
- e. Submerge the test item in salt water (5 grams of U.S.P. NaCl per 100 ml of distilled H<sub>2</sub>O) at 68°F ± 5°F for a period of not less than twenty-four hours. Following the test interval, inspect for and record evidence of leakage or damage.

#### 6.2.1.4 Desalter Kit Performance Tests

- a. Determine the volatile loss by performing the following:

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- 1) Measure and record the weight of a tared glass weighting bottle to the nearest milligram.
- 2) Place one unwrapped desalting chemical in the weighting bottle.
- 3) Place the bottle (and desalting chemical) without the cover in an oven for sixteen hours at a maintained temperature of  $220^{\circ}\text{F} \pm 12^{\circ}\text{F}$ .
- 4) Following the oven interval, remove the bottle, insert the stopper and quickly transfer to a desiccator.
- 5) Following temperature stability at room temperature, re-weigh the bottle and contents to obtain the final weight.

b. Determine the disrupting time by performing the following:

- 1) Empty one pack of desalting chemical into  $470 \pm 5$  milliliters of synthetic sea water in the test item processing bag at  $65 \pm 5$  degrees F.
- 2) With a stop watch, time and record the length of time required for the chemical to disintegrate (do not agitate).

c. Determine the desalting kit output by emptying one pack of desalting chemical into  $470 \pm 5$  milliliters of synthetic sea water at  $65 \pm 5$  degrees F. and after a period of  $45 \pm 5$  minutes, or as otherwise specified, measure and record the volume of potable water produced.

d. Determine the chemical composition of the desalter output water by subjecting the water obtained in step c. to appropriate analysis of the following:

- 1) Silver concentration.
- 2) Barium concentration.
- 3) Sulfate concentration.
- 4) Chloride concentration.
- 5) Bacteriological quality (tested for presence of pathogenic or coliform organisms in respect to Standard Methods for Examination of Water, Sewage, and Industrial Wastes).

e. Repeat steps c and d an additional four times.

#### 6.2.2 Storage in Simulated Aircraft Environments Tests

Determine the ability of the packaged test item to withstand, for prolonged periods, the extremes of altitude, temperature, and shock as follows:

##### 6.2.2.1 Expansion Due to Altitude and Waterproofness Test

- a. Place the packaged test item or test item kit/container in an altitude chamber meeting the physical requirements of MIL-C-7951.
- b. Reduce the pressure in the chamber to the specified absolute pressure during a period not less than twelve minutes. Maintain the simulated altitude for a period not less than ten hours, or as otherwise specified and

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record pressure and exposure period and time required to reach required pressure.

c. At the completion of the altitude test period, return the chamber pressure to normal atmospheric pressure within one minute, or as otherwise specified. Record actual time.

d. Remove the test item package, kit, or container from the chamber and subject to an inspection. Record evidence of the following or any other indication of change due to the altitude test:

- 1) Increase in container dimensions.
- 2) Lid, cover, or clamps which separated from the package, container, etc.
- 3) Container open, burst, or distorted.

e. Making no adjustment to the test item package, container, kit, etc., submerge the test item in water having a temperature of  $75^{\circ} \pm 5^{\circ}\text{F}$  under a static head of twelve inches of water for a period of ten minutes or as otherwise specified. Record the actual temperature, static head distance and submergence period.

f. Remove the test item from the water container. Open the package, container, kit, etc. Inspect the contents thereof, and record evidence of internal pressure damage or signs of water leakage. In particular, observe for the following:

- 1) Leakage of plastic squeeze bottles
- 2) Water in food packets
- 3) Wet matches
- 4) Illegible packet markings or instructions
- 5) Burst packets or containers
- 6) Other evidence of leakage

g. Radio equipment shall be subjected to the sensitivity, selectivity and audio frequency response tests of MTP 6-2-242.

h. Verify the performance of the signal flares by performing steps f through j of paragraph 6.2.1.2.

#### 6.2.2.2 Temperature-Humidity Storage Test

a. Place the packaged test item kit/container in an environmental test chamber and subject the test item to the temperature-humidity cycle as described in Test 105 of MIL-STD-331.

b. Remove the test item from the test chamber and allow it to regain stability at ambient conditions.

c. When temperature stability is achieved, open the test item and carefully inspect it for evidence of damage or change due to the accelerated storage test. Observe for and record evidence of the following:

- 1) Broken glass, i.e., compass cover, etc.
- 2) Open seals
- 3) Component cracks, etc.

d. Subject all radio equipment to the sensitivity, selectivity, and

audio frequency response tests of MTP 6-2-242, and

e. Verify the performance of the signal flares by performing the procedures of step f through j of paragraph 6.2.1.2.

#### 6.2.2.3 Shock Test

a. Using a shock testing machine (see paragraph 3.1j4), subject the test item to fifteen "g" acceleration shocks having a time duration of eleven milliseconds in each of the following directions:

- 1) Parallel to the vertical axis of the test item, three shocks in each direction.
- 2) Parallel to the major test item horizontal axis, three shocks in each direction.
- 3) Parallel to the minor horizontal axis, three shocks in each direction.

b. Record the number of shocks completed before the test item package burst.

c. Provided the test item package did not burst before the completion of the shock test pattern, inspect the package and record evidence of damage.

d. Inspect the components of the package whether the package burst or not and record evidence of the following:

- 1) Broken glass, i.e., compass cover, etc.
- 2) Open seals, burst packets
- 3) Component cracks, etc.

e. Subject all radio equipment to the sensitivity, selectivity, and audio frequency response tests of MTP 6-2-242.

f. Verify performance of the signal flares by performing steps f through j of paragraph 6.2.1.2.

#### 6.2.3 Usage Environment Tests

Determine the effect of extreme environments of survival equipment usage on the physical, chemical, and performance characteristics of test item materiel as follows:

##### 6.2.3.1 Temperature-Humidity Test

a. Place the unpackaged test item components in a humidity test chamber (see paragraph 3.1j5).

b. Adjust the simulated barometric pressure level for tropic sea level.

NOTE: Testing should begin with uncontrolled humidity, at a temperature between 68°F and 100°F.

c. Conduct a 24-hour humidity cycle as follows:

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NOTE: Relative humidity during the basic cycle shall be 95 percent, or as otherwise specified.

- 1) First two hours:
  - a) Gradually raise the temperature to 160°F.
  - b) Limit velocity of air throughout test area to 150 feet per minute or less.
- 2) Next six hours: Maintain the temperature of step c.1.
- 3) Final 16 hours: Gradually reduce the test chamber temperature to a value within the limits of 68°F to 100°F.
- 4) Record the following for each test phase:
  - a) Starting temperature
  - b) Barometric pressure in the chamber
  - c) Relative humidity
  - d) Air velocity through the chamber

d. Repeat step c a minimum of ten times, or as otherwise specified and record the number of cycles completed.

e. At the conclusion of the humidity test, return the equipment to ambient conditions.

f. Inspect the test item components for damage and record indications of the following:

- 1) Packet leakage
- 2) Rust
- 3) Spoilage (food items)

g. Subject the medical supplies to laboratory tests for contamination.

h. Repeat the material characteristics evaluation as described in paragraph 6.1.5. step 1, as applicable.

i. Ignite the signal flares and record the following:

- 1) Difficulties igniting the flares, if any
- 2) Burning time of each flare

j. Subject all radio equipment to the sensitivity, selectivity, and audio frequency response tests of MTP 6-2-242.

#### 6.2.3.2 High Temperature Test

a. Place the unpackaged test item in a high temperature test chamber (see paragraph 3.1j6.).

b. Gradually raise the temperature to 150°F or as otherwise specified and maintain this temperature for eight hours. Record the following:

- 1) Maximum temperature
- 2) Time required to reach maximum temperature
- 3) Relative humidity at maximum temperature

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- c. At the completion of the test period, remove the test item(s) and inspect for damage or change due to the high temperature test.
- d. Repeat the procedures of steps h, i and j of paragraph 6.2.5.1.

#### 6.2.3.3 Low Temperature Test

- a. Place the unpackaged test item components in a low temperature chamber.
- b. Reduce the chamber temperature to -80°F and maintain this temperature for a 72-hour period. At the end of the 72-hour period, raise the chamber temperature to -65°F and maintain this temperature for an additional 24-hour period.
- c. With the test item temperature maintained at -65°F conduct the following evaluation:
  - 1) Inspect the test item components and record evidence of damage.
  - 2) Repeat the procedures of steps h, i and j of paragraph 6.2.3.1.

#### 6.2.3.4 Fungus Resistance Test

- a. Subject the unpackaged test item components to the fungus resistance test conditions, Procedure I, of MIL-E-5272C.
- b. At the completion of the test perform the following:
  - 1) Inspect the test item components and record evidence of contamination by fungus.
  - 2) Repeat the procedures of steps h, i, and j of paragraph 6.2.3.1.

#### 6.2.3.5 Sunshine Test

- a. Subject the unpackaged test item components to the sunshine test conditions, Procedure I of MIL-E-5272C.
- b. At the completion of the test, perform the following:
  - 1) Inspect the test item components and record evidence of damage.
  - 2) Repeat the procedures of steps h, i, and j of paragraph 6.2.3.1.

#### 6.2.3.6 Salt Spray Test

- a. Subject the unpackaged test item components to the salt spray test of Federal Test Method Standard No. 151, Method 811.
- b. At the completion of the test repeat the procedures of steps f through j of paragraph 6.2.3.1.

#### 6.2.4 Transportability

- a. Subject the test item to the applicable procedures of MTP 10-2-503.
- b. At the completion of each test, unpack the test item, inspect the components and record all indications of damage.

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- c. Subject all radio equipment to the sensitivity, selectivity, and audio frequency response tests of MTP 6-2-242.
- d. Verify the signal flare performance by performing steps f through j of paragraph 6.2.1.2.

6.2.5 Durability

Determine the durability of the test item as described in the applicable sections of MTP 10-2-502.

6.2.6 Maintenance

Evaluate the maintenance-related factors of the test item as described in MTP 10-2-507, 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.

6.2.7 Safety

NOTE: Comply with Safety Release Requirements of USATECOM Reg. 385-6.

- a. Subject the test item to the applicable procedures of MTP 10-2-508.
- b. Test personnel shall observe and record the following throughout the test:
  - 1) Any dangerous or unsafe condition or any condition that might present a safety or health hazard including the cause of the hazard.
  - 2) Steps taken to alleviate safety hazard(s).
  - 3) Adequacy of safety features incorporated into test item design.
  - 4) Adequacy of warning instructions and markings.
  - 5) Suggestions to improve the existing safety precautions.

6.2.8 Human Factors Evaluation

The test item shall be evaluated to determine the degree to which test item physical design and revealed performance characteristics conform to recognize human factors engineering design criteria, by performing the applicable sections of MTP 10-2-505 and the following:

- a. Prepare checklists of design criteria applicable to each aviation survival Engineering Test Group as related to and defined by Human Factors Evaluation Data for General Equipment (HEDGE) in each of the following areas: (The table below relates materiel tested by this document to HEDGE class structure).

<u>MTP 7-2-095 Materiel Test Groups</u>	<u>HEDGE Class Reference</u>
Group I: MEDICAL SUPPLIES	Class IVB
Group II: IMPLEMENTS & TOOLS	Class IIIA
Group III: RATIONS & WATER	Class IVB
Group IV: FABRICS	Class IVC & IVD
Group V: DISTRESS SIGNALING EQUIPMENT	Class IVA
Group VI: MAGNETIC COMPASS	Class IVA
Group VII: DESALTER EQUIPMENT	Class IVB
Group VIII: LIFE RAFTS & VESTS	Class IVD
Group IX: REPELLANTS (SHARK-INSECT)	Class IVB
Group X: CONTAINERS AND UNIT KITS	Class IVD
Group XI: MANUALS AND MAINTENANCE PACKAGE	Class IVD

1) Operation:

a) Controls and indicators:

- (1) Ease of operating and reading
- (2) Adequacy of markings to indicate function

b) Ease of controlling and adjusting test item when installed and operating.

2) Technical performance - revealed performance characteristics which do not conform to recognized human factors design criteria.

3) Maintenance evaluation:

- a) Ease of locating malfunction and determination of cause
- b) Access to defective component
- c) Ease of replacement and/or repair of malfunction

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

- 1) Adequacy of furnished instructions
- 2) Ease of performing tasks
- 3) Human factors design deficiency revealed by particular test
- 4) Time to perform test
- 5) Personnel required for task

c. Observe and record any inadequacies of test item design affecting ease of operation.

d. Observe and record any recommendations to improve man-item effectiveness.

6.2.9 Value Analysis

Throughout all tests, the test item shall be examined for any unnecessary, costly, "nice-to-have" features as described in USATECOM Regulation

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700-1 by performing the following:

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

b. Question test personnel regarding features of the test item which could be eliminated without decreasing the functional value of the test item or decrease man-item effectiveness.

c. Record the following:

- 1) Non-functional, costly, or "nice-to-have" features of the test item.
- 2) Test personnel comments and opinions regarding features to be eliminated.

### 6.3 TEST DATA

#### 6.3.1 Preparation for Test

##### 6.3.1.1 Initial Inspection

Record the following:

a. For the test item package:

- 1) Evidence of damage incurred during transport or storage
- 2) Markings which do not comply with MIL-STD-129

b. Adequacy of preservation and packing:

c. For the test item components:

- 1) Markings which do not comply with MIL-STD-129
- 2) Evidence of defects in test item materials, construction, treatment and finish.
- 3) Dates of manufacture.

##### 6.3.1.2 Inventory Check

Record the following:

- a. Missing maintenance literature or draft technical manuals.
- b. Shortages in repair parts, accessories, or tools (authorized tools).
- c. Missing kits.

##### 6.3.1.3 Inspection and Preliminary Operation

Record the following:

- a. Errors or omissions of plates or labels.
- b. Test item components which fail to comply with the required

standards and specifications.

6.3.1.4 Physical Characteristics

Record the following:

- a. Group I: Medical Products :
  - 1) Overall dimensions, in inches
  - 2) Weight, in pounds
- b. Group II: Tools and Implements :
  - 1) Dimensions, in inches
  - 2) Weight, in pounds
  - 3) Cutting edge hardness (Rockwell)
  - 4) Carrier type, e.g., hand sling, belt loop, etc.
- c. Group III: Rations and Water :
  - 1) Net weight or quantity of unit product.
  - 2) Number of product units per package.
  - 3) Identification of each product, e.g., meat bar, coffee-instant, onion powder, etc.
- d. Group IV: Fabrics :
  - 1) Dimensions, overall, in feet.
  - 2) Components and location dimensions.
  - 3) Type of cloth/fabric/textile, e.g., cotton, cotton duck, down, woven nylon, webbing, etc.
  - 4) Color.
  - 5) Fastener type(s), i.e., slide, snaps, etc.
  - 6) Stitching type(s), e.g., box stitching, and stitches per unit length (for major seams).
- e. Group V: Distress Signaling Equipment:
  - 1) For smoke and illumination signal, flares:
    - a) Nomenclature
    - b) Color of smoke produced
    - c) Color of flare light
    - d) Length of time smoke produced, in minutes
    - e) Length of time flare produces usable light, in minutes
    - f) Weight, in pounds
  - 2) For signal mirrors:
    - a) Dimensions, in inches
    - b) Weight, in pounds

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- 3) For sea markers:
  - a) Color
  - b) Useful life time (in calm water)
  - c) Type of dye, e.g., fluorescein, etc.
- 4) For radio equipment:
  - a) Frequency coverage and limits
  - b) Receiver sensitivity and signal to noise figure
  - c) Emission types, e.g., A1, A2. . ., etc.
  - d) Transmitter power output, per emission type
  - e) Useful transmitter range
  - f) Dimensions, in inches
  - g) Weight, in pounds
  - h) Antenna type, e.g., whip, dipole, etc.
- 5) For lights:
  - a) Weight, including specified batteries, in pounds
  - b) Battery type
  - c) Bulb type
  - d) Manufacturers rated amp-hours for battery
- f. Group VI. Magnetic Compass:
  - 1) Weight, in pounds
  - 2) Card calibration resolution
  - 3) Color
  - 4) Luminous marking characteristics:
    - a) Color
    - b) Dominant wave-length
- g. Group VII. Sea Water Desalter(s):
  - 1) Salt removing chemical(s) type(s).
  - 2) Capacity, sea water.
  - 3) Disrupting time, in minutes.
  - 4) Rated output of potable water per unit package of desalting chemical.
  - 5) Number of unit packages of desalting chemical(s) supplied.
- h. Group VIII: Inflatable Craft and Life Vests:
  - 1) Weight, in pounds
  - 2) Deflated (packaged) dimensions in inches
  - 3) Inflated dimensions in feet
  - 4) Color
  - 5) Inflation pressure in psi
  - 6) Automatic inflation characteristics:

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- a) Time to inflate in minutes
- b) Type of gas
- c) Pressure attained in psi

i. Group IX. Repellants: Shark, Insect, and Leech:

- 1) Chemical composition
- 2) Specific use
- 3) Alternate uses
- 4) Quantity supplies

j. Group X. Containers and Unit Kits:

- 1) Weight, in pounds
- 2) Dimensions, in inches
- 3) Type of kit, when applicable, e.g., over water, hot climate, etc.

k. Group XI. Manuals and Maintenance Package:

- 1) Dimension, in inches
- 2) Weight, in pounds
- 3) Adequacy of containers

l. Material Characteristics - Material characteristics of the test item components collected as described in the applicable section of MTP 10-2-500, or other applicable document.

6.3.1.5 Operator Training and Familiarization

Record data collected as described in the applicable sections of MTP 10-2-501.

6.3.2 Test Conduct

6.3.2.1 Performance Characteristics

6.3.2.1.1 Implement and Tool Performance Tests -

Record the following:

a. Knives and Axes:

- 1) Physical properties of simulated vines and shrubbery:
  - a) Hardness, density, etc.
  - b) Dimensions
- 2) Length of time required to cut through material

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- 3) Description of cut
- 4) Length of time before implement required sharpening
- 5) Ease of sharpening:
  - a) Number of strokes used
  - b) Average length of stroke
  - c) Time required for sharpening
- 6) Change in cutting ability after sharpening:
  - a) Using sharpening stone provided
  - b) Using sharpening stone of known quality, if applicable

b. Saws:

- 1) Type of saw
- 2) For each material cut:
  - a) Physical properties of material being cut
  - b) Dimensions of cut
  - c) Length of time required to make cut
- 3) Total time saw is used before it becomes dull

c. Burning Lens:

- 1) Average temperature on the sunward side, in °F.
- 2) Dimensions of thermocouple sensor
- 3) Diameter of focused sun spot at the focal point
- 4) Temperature as measured by thermocouple

6.3.2.1.2 Signal Flare Performance Tests -

Record the following:

- a. For the detergent used:
  - 1) Chemical composition
  - 2) Concentration, in ounces per quart
- b. Vacuum, in inches of Hg
- c. Length of time test item(s) were subjected to vacuum
- d. Total number of flares which emitted bubbles:
  - 1) Smoke flares
  - 2) Illumination flares
- e. For each smoke flare:
  - 1) Improper functioning, if any
  - 2) Length of time smoke was produced

f. For light flares:

- 1) Improper functioning, if any
- 2) Length of time light was produced

6.3.2.1.3 Magnetic Compass Performance Tests -

Record the following:

- a. Card error at each cardinal point (90°, 180°, 270°, and 360°), in degrees.
- b. Time required for card to stabilize following each 90° rotation, in seconds.
- c. Radiation level, in milliroentgen per hour.
- d. Radioactive contamination, in disintegrations per minute.
- e. Evidence of leakage or other damage following a soak period in NaCl solution.

6.3.2.1.4 Desalter Kit Performance Tests -

Record the following:

- a. Weight of weighing bottle, in milligrams
- b. Weight of weighing bottle and desalting chemical, in milligrams:
  - 1) Before being placed in the oven
  - 2) After being placed in the oven
- c. Disrupting time, in minutes
- d. Volume of potable water produced, in milliliters
- e. Output water analysis results, including:
  - 1) Silver concentration
  - 2) Barium concentration
  - 3) Sulfate concentration
  - 4) Chloride concentration
  - 5) Bacteriological quality

6.3.2.2 Storage in Simulated Aircraft Environments Tests

6.3.2.2.1 Expansion Due to Altitude and Waterproofness Test -

Record the following:

- a. Chamber pressure, in inches of Hg.
- b. Length of time required or taken to reach specified chamber pressure, in minutes.
- c. Length of time specified pressure maintained, in hours.
- d. Length of time used to return chamber to ambient pressure, in minutes.
- e. Inspection results:

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- 1) Increase in test item container dimensions.
- 2) Lid, cover, or clamps which separated from the package, container, etc.
- 3) Container open, burst, or distorted.

- f. Water temperature, in degrees F.
- g. Static head of water, in inches
- h. Time test item(s) soaked, in minutes
- i. Inspection results:

- 1) Leakage of plastic squeeze bottles
- 2) Water in food packets
- 3) Wet matches, etc.
- 4) Illegible packet markings or instructions
- 5) Burst packets or containers
- 6) Other evidence of leakage

j. Radio equipment performance data collected as described in the applicable sections of MTP 6-2-242.

k. Signal flare performance data collected as described in paragraph 6.2.1.2, steps f through j.

#### 6.3.2.2.2 Temperature Humidity Storage Test -

Record the following:

a. Evidence of damage or change due to the accelerated storage test, including:

- 1) Broken glass
- 2) Open seals, burst packets
- 3) Component cracks

b. Radio equipment performance data collected as described in the applicable sections of MTP 6-2-242.

c. Signal flare performance data collected as described in paragraph 6.2.1.2, steps f through j.

#### 6.3.2.2.3 Shock Test -

Record the following:

a. Number of shocks applied to the test item before the test item package burst, if applicable.

b. Damage to test item package.

c. Evidence of damage to the test item components, including:

- 1) Broken glass
- 2) Open seals, burst packets
- 3) Component cracks

d. Radio equipment performance data collected as described in the applicable sections of MTP 6-2-242.

e. Signal flare performance data collected as described in paragraph 6.2.1.2, steps f through j.

6.3.2.3 Usage Environmental Tests

6.3.2.3.1 Temperature-Humidity Test -

Record the following:

- a. Barometric pressure, in chamber, in psi.
- b. Starting temperature in °F.
- c. Relative humidity, in percent.
- d. Air velocity through chamber, in fps.
- e. Number of cycles performed.
- f. Indications of damage, including:

- 1) Packet leakage
- 2) Rust
- 3) Spoilage (food items)

g. Contamination of medical supplies.

h. Material characteristics data collected as described in paragraph

6.1.5. step 1.

i. For the signal flares:

- 1) Difficulties igniting the flares, if any
- 2) Burning time of each flare, in minutes

j. Radio equipment performance data collected as described in the applicable sections of MTP 6-2-242.

6.3.2.3.2 High Temperature Test -

Record the following:

- a. Evidence of damage to the test item components.
- b. Test item performance data collected as described in steps h, i, and j of paragraph 6.2.3.1.

6.3.2.3.3 Low Temperature Test -

Record the following:

- a. Evidence of damage to the test item components.
- b. Test item performance data collected as described in steps h, i, and j of paragraph 6.2.3.1.

6.3.2.3.4 Fungus Resistance Test -

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Record the following:

- a. Contamination by fungus.
- b. Test item performance data collected as described in steps h, i, and j of paragraph 6.2.3.1.

6.3.2.3.5 Sunshine Test -

Record the following:

- a. Evidence of damage.
- b. Test item performance data collected as described in steps h, i, and j of paragraph 6.2.3.1.

6.3.2.3.6 Salt Spray Fog -

Record post test inspection data collected as described in steps f through j of paragraph 6.2.3.1.

6.3.2.4 Transportability

Record data collected as described in the applicable sections of MTP 10-2-503, and the following:

- a. Indications of damage.
- b. Radio equipment performance data collected as described in the applicable sections of MTP 6-2-242.

6.3.2.5 Durability

Record data collected as described in the applicable sections of MTP 10-2-502.

6.3.2.6 Maintenance

Record data collected as described in the applicable sections of MTP 10-2-507.

6.3.2.7 Safety

Record data collected as described in the applicable sections of MTP 10-2-508, and the following:

- a. Any dangerous or unsafe conditions or any condition that might present a safety hazard including the cause of the hazard.
- b. Adequacy of safety features incorporated into test item design.
- c. Adequacy of warning instructions and markings.
- d. Suggestions to improve the existing safety precautions.

6.3.2.8 Human Factors Evaluation

- a. Record data collected as described in the applicable sections of

MTP 10-2-505, and the following:

- 1) Any inadequacies of test item design affecting ease of operation.
  - 2) Recommendations to improve man-item effectiveness.
- b. Retain completed HEDGE checklists.

#### 6.3.2.9 Value Analysis

Record the following:

- a. Non-functional, costly, or "nice-to-have" features of test item.
- b. Test personnel comments and opinions regarding features which could be eliminated in accordance with criteria of USATECOM Regulation 700-1.

#### 6.4 DATA REDUCTION AND PRESENTATION

##### 6.4.1 General

Data obtained during conduct of the engineering tests shall be summarized, making use of curves, charts, photographs, or other graphic materials, as appropriate.

Data obtained for each test item technical characteristic shall be compared with technical performance characteristics specified in applicable QMR's, SDR's, or other development criteria.

In addition, the data presentation shall include written, narrative reports on all tests specified by this document.

##### 6.4.2 Desalter Kit Performance Tests

Compute the volatile loss of the desalting chemical according to the following expression:

$$\% \text{ Volatile Loss} = \frac{\text{Initial chemical weight} - \text{final chemical weight}}{\text{Initial chemical weight}} \times 100$$

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