10 March 1969

Materiel Test Procedure 10-2-165
General Equipment Test Activity

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

SURVIVAL KITS

1. OBJECTIVE

This document provides test methods and techniques for determining the technical performance and safety characteristics of survival kits, as described in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), Military and/or Technical Characteristics (MC's or TC's) and the suitability of survival kits for service testing.

2. BACKGROUND

There are innumerable military missions where the threat of an individual being cut off from his parent unit is prevalent. Air operations especially expose personnel to the danger of being isolated in remote areas where environmental conditions force the individual to consider only one thought--survival. In the case of a downed airman or cut off infantryman, rescue may be hours or days away; even in an optimum situation where the survivor's exact location is known, immediate pickup by the rescue unit is not always possible. Weather conditions may necessitate a delay in rescue. In such a case survival becomes paramount, if only for several hours.

The survival kit is designed specifically to meet the needs of this individual. The survivor must be protected from the weather; in a cold, frozen climate he could very easily freeze before he is reached; in a hot, dry climate he could die from sun exposure and thirst. Hunger is a constant consideration for the survivor - he must be provided with enough rations to sustain him initially, and with the means of trapping, or catching game or fish in case isolation is extended.

The same considerations apply to survival on the water. The equipment for overwater kits is identical to that contained in the hot climate kit with the exception of a life raft with auxiliary equipment such as a paddle, sea water kit, and a desalter kit for obtaining fresh water.

Engineering tests to insure technical performance of the survival kits are a prerequisite to putting this item into service use because of the possible consequences of performance failures in a real situation.

3. REQUIRED EQUIPMENT

a. Scales
b. Steel Tape
c. Pressure Gage
d. Thermometer (Fahreheit scale)
e. Salt Spray Chamber
f. Rockwell Hardness Tester, Scale C
g. Tensile Strength Tester

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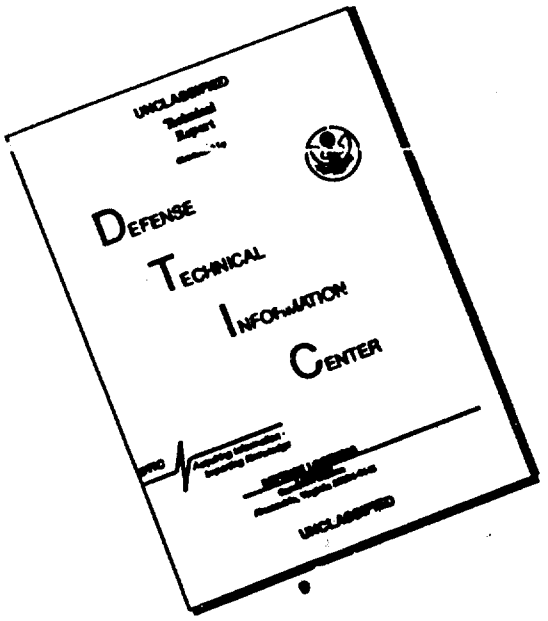

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h. Desicator or Vacuum Test Chamber
i. Potentiometric Apparatus
j. Fabrics Testers as required
k. Drop Tower
l. Vibration Tester
m. Altitude Chamber
n. Camera
o. Stopwatch

4. REFERENCES

A. Military Specification MIL-F-43231A, Food Packet, Survival, General Purpose.
B. Military Specification MIL-S-43301A, Survival Kit, Individual, Overwater, Army.
C. Military Specification MIL-S-43302A, Survival Kit, Individual, Hot Climate, Army.
D. Military Specification MIL-S-43456, Survival Kit, Individual, Cold Climate, Army.
E. USATECOM Regulation 385-6, Safety Release.
F. USATECOM Regulation 700-1, Value Engineering.
G. USATECOM Regulation 705-4, Equipment Performance Report.
H. Federal Standard FED-STD-151, Metals, Test Methods, Methods 243,811.
I. Federal Standard FED-STD-406, Plastics, Methods of Testing.
J. Federal Specification CCC-T-191b, Textile Test Methods.
K. Army Regulation AR 705-15, Operation Of Materiel Under Extreme Conditions of Environment.
L. Standard Methods for Examination of Water, Sewage, and Industrial Waste, American Public Health Association.
M. Federal Standard 101a, Method 279, Vibration (Sinusoidal Motion) Test.
N. MTP 6-2-510, Environmental Chamber Tests.
O. MTP 10-2-195, Life Rafts.
P. MTP 10-2-500, Physical Characteristics.
Q. MTP 10-2-501, Operator Training and Familiarization.
R. MTP 10-2-503, Surface Transportability (General Supplies and Equipment).
S. MTP 10-2-505, Human Factors.
T. MTP 10-2-508, Safety.

5. SCOPE

5.1 SUMMARY

This procedure describes the preparation for and methods of evaluating the technical performance and safety characteristics of survival kits. To assess the degree of conformance with required standards and established criteria, the survival kits should be subjected to the following:

a. Preparation for Test - A pre-test inspection to determine the condition of the test item and its associated shipping package upon arrival, a determination of the test item's physical characteristics, and an operator training and familiarization program.

b. Metal Components Tests - A determination of the technical performance characteristics of the metal components.

c. Chemical Components Tests - A determination of the technical performance characteristics of the chemical components.

d. Fabrics Tests - A determination of the technical performance characteristics of the fabric used.

e. Transportability - A determination of the test item's ability to withstand the shock, vibration, and low pressure it may encounter in transporting.

f. Environmental Chamber Tests - A determination of the effects of short-and-long-term chamber tests.

g. Human Factors - A consideration of the man-item relationship stressing ease and simplicity of operation and set-up of the components of the test item.

h. Safety - A determination of the safety features of the test item.

i. Value Analysis - A determination of non-functional, costly, or "nice-to-have" feature of the test item.

5.2 LIMITATIONS

The procedures in this MTP are suitable for testing of hot and cold climate and overwater survival equipment and their components to determine their adequacy and the effects of environment on the components and their storage containers. Test procedures for the life raft included as part of the overwater survival kit are contained in MTP 10-2-195. Medical supplies, electrical/electronic equipment and food are not tested other than determining the adequacy of their storage containers.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Pre-Test Inspection

Upon receipt of the test item package, the following inspection procedures shall be performed:

a. Visually inspect the test item package and record the following:

1) Evidence of package damage or deterioration
2) Identification markings including:

a) Manufacturer
b) Number and date of contract
c) Date of manufacture
d) All other pertinent markings

b. Weigh and measure the test item package and record the following:

1) Contents
2) Weight
3) Length, Width and Height

4) Cubage

c. Unpack the test item and record the type and adequacy of packing and preservation material in the shipping container.

d. Inventory and visually inspect all items in the survival kit, and record the following:

1) Identification of item, name and serial number
2) Evidence of defects in:

a) Manufacturing
b) Material
c) Workmanship

3) Missing items or components

NOTE: Visual inspection shall concentrate on the following:

Fabrics - Shall not be torn, cut or punctured, nor shall there be any smash, weak place, broken or missing yarns, multiple floats or open places, clearly visible at normal inspection distance (approx. 3 feet). Edges shall not be frayed, scalloped, or loopy. Colors shall be uniform

Metals - Shall not be broken or malformed, corroded, or burred. In addition all metal components shall be free of roughness and irregularities, shall be of uniform quality and condition,and painted or coated where required.

Chemicals - Shall show no sign of corrosion or deterioration, including any area of discoloration.

4) Evidence of damage and/or wear
5) Existence of shortages in the package including instructional or repair materials.

e. Photograph all damages.
f. Record presence of instruction markings, including:

1) Identification, name and serial number
2) Operating instructions
3) Caution instructions
4) Service and handling instructions

6.1.2 Physical Characteristics

The test item shall be subjected to the applicable sections of MTP 10-2-500 to determine the physical characteristics of each of the components as appropriate.

6.1.3 Operator Training and Familiarization

Members of the test team shall be oriented in accordance with MTP

10-2-501 and the appropriate data recorded, as well as the following:

a. Test personnel will be oriented in all phases of the test related to their duties according to the applicable technical manuals. During this phase all test personnel will be instructed in the areas listed:

1) Test objectives and procedures
2) Operational performance
3) Handling
4) Transportability
5) Safety
6) Value Analysis

b. Test personnel shall at this time be issued copies of the draft technical manuals, pertinent safety instructions, and gear which are to be returned upon test completion.

c. Supervisory test personnel shall note and record the adequacy of the technical manual or other instructional material for training purposes.

6.2 TEST CONDUCT

NOTE: All equipment failure during the test procedure shall be reported in accordance with USATECOM Regulation 705-4.

6.2.1 Metal Components Tests

6.2.1.1 Salt-Fog Exposure

a. Subject all metal components to a salt-fog exposure as directed in reference 4H (FED-STD-151) Method 811 for 100 hours.

b. Record evidence of corrosion or other damage, if any.

c. For components with moving parts, operate the components and observe and record all malfunctions.

d. Photograph all damages.

6.2.1.2 Rockwell Hardness

a. Determine the Rockwell hardness of metal components such as ax blades, saw blades, knife blades, and scarpees, in accordance with the procedures outlined in reference 4H (FED-STD-151) Method 243, hardness scale C.

b. Record the Rockwell hardness.

6.2.1.3 Cutting

a. Subject ax assemblies, saws and knives to appropriate cutting tests to determine their suitability for performing the tasks outlined in the approved instruction booklet.

b. Record test item suitability.

6.2.1.4 Tensile Strength

a. Determine the adequacy of the tensile strength of metal components such as wire snares, fishing lines, etc., by subjecting them to design tensile strength in any suitable jig.
b. Record any discrepancies.

6.2.1.5 Leakage

Test all canned components for leakage as follows:

NOTE: This leakage test shall be performed on the assembled survival kit when the kit container is specified as waterproof.

a. The filled and sealed container shall be submerged in water, contained in a desicator or other suitable container, maintaining a vacuum of 10 inches of mercury (atmospheric pressure 29.9 inches) for at least 30 seconds.
b. Observe the test item and record indications of leakage.

NOTE: Leakage is indicated by a steady progression of bubbles. Isolated bubbles caused by entrapped air are not considered as signs of leaks.

6.2.2 Chemical Components Tests

6.2.2.1 Burning

For items that are to be ignited, i.e., fuels, smoke and illumination signals, flares, etc., the following test shall be performed:

a. Ignite the item in an atmosphere free of air currents and record the ease of ignition.
b. Note the time of ignition and the time when burning ceases. Record the burning life of each component.

NOTE: When two elements are contained in the same component, such as smoke and illumination signal, the life of each element shall be recorded.

c. During burning observe and record the following:

1) Steadiness of flame, smoke, or light emitted.
2) Color of smoke, flame, or light, and luminosity of flame or flare light.
3) Odor of volatile products of combustion.
4) Condition of unburned portion prior to complete combustion - whether solid or liquid.

6.2.2.2 Water Purification and Desalting

For desalter and water purification kits the following test shall be performed:

a. Treat a sample of impure water as specified by the individual kit instructions, for the time specified, and measure and record the amount of potable water produced.

NOTE: For desalter kits, synthetic sea water shall be used; the composition shall be as listed:

Ions	Milli-equivalents per liter	Permissible Deviation	Ingredients	Grams per liter
Anions				
Cl^-	495	7	$CaCl_2$ anhydrous	0.944
$SO_4^=$	47	3	$MgCl_2$ $6H_2O$	9.759
HCO_3^-	2	1	$NaHCO_3$ anhydrous	0.168
			Na_2SO_4 anhydrous	3.337
TOTAL	544	11	NaCl anhydrous	22.347
Cations				
Ca^{++}	17	1		
Mg^{++}	96	4		
Na^+	431	6		
TOTAL	544	11		

The synthetic sea water shall be prepared by dissolving the sodium sulfate in distilled water and then adding this to the solution containing the other dissolved salts. If necessary, an adjustment of the pH to 8.0 shall be made by the addition of 1N sodium hydroxide. The final volume shall be brought up to one liter. In lieu of the above, actual sea water (sampled and verified by analysis) may be used.

b. After treatment, the effluent water shall be tested for the presence of pathogenic or coliform organisms in accordance with the Standard Methods for Examination of Water, Sewage, and Industrial Wastes. Record the results.

c. Determine the total alkalinity (OH^-, $CO_3^=$, and HCO_3^-), calcium plus magnesium, and sodium plus potassium, (Ca^{++} plus Mg^{++}, and Na^+ plus K^+) by any standard method and record values.

d. Determine the pH of the effluent water by means of a potentiometric apparatus, and record the obtained value.

NOTE: The temperature of the test sample shall be regulated at $77 \pm 2°$ F.

6.2.2.3 Leakage

For those combustible items which are waterproofed or watersealed i.e., matches, flares, etc., the following test shall be performed.

a. Submerge the item a minimum of 5 inches below the water surface in a vacuum test chamber.

NOTE: The water shall be treated with a detergent to prevent bubbles from adhering to the samples.

b. Close the test chamber and subject the water surface to a vacuum of 15 inches of mercury for a minimum period of 1 minute.

c. Record the presence of leakage, when applicable, indicated by a stream of bubbles.

d. Remove the samples from the test chamber and ignite to assure waterproof performance. Record any discrepancies.

6.2.3 Fabrics Tests

NOTE: Fabrics in this case shall include plastic, vinyl, and polyethylene used in bags, covers, etc.

a. All fabrics shall be tested using the appropriate methods of Federal Specification CCC-T-191lb, Textile Test Methods or Federal Standard FED-STD-406, Plastics, Methods of Testing, for the following:

1) Tear strength
2) Puncture resistance
3) Abrasion resistance
4) Water permeability

b. Record the results as required.

6.2.4 Transportability

Subject the test item to the applicable drop test, shock test, road transportability, rail transportability and marine transportability tests of MTP 10-2-503 and the following:

6.2.4.1 Vibration Test

a. Visually inspect the survival kit and its components to ensure that the kit is free of defects.

b. Pack the test item in its shipping container (may be multiple packed).

c. Subject the test item to the vibration test procedure of reference 4M (FED-STD-101a) Method 279.

d. At completion of vibration test, the test item shall be examined for damage, cracks, breaks, ruptures, etc. and functional items shall be operated where feasible. In addition all fittings shall be checked for snug fit. Record discrepancies, if applicable.

e. Photograph all damages.

6.2.4.2 Altitude Test

Subject the test item to an altitude test of 40,000 feet as follows:

a. Place the test item in a suitable altitude chamber and reduce the pressure to 5 inches of mercury (2.47 psi) and maintain the pressure for not less than one hour.

b. Increase the chamber pressure to normal ambient pressure and inspect the test item and record evidence of damage, if any.

c. Photograph all damages.

6.2.5 Environmental Chamber Tests

a. Subject the test item to long and short-term storage and environmental tests as directed in the applicable sections of MTP 6-2-510.

b. Determine and record the operability of all functional components at the completion of each environmental chamber test.

6.2.6 Human Factors

Evaluate the effectiveness of the man-item relationship during the performance of the test as prescribed in MTP 10-2-505, and as follows throughout the test:

a. Observe and record any difficulties or awkwardness in handling and carrying, including the adequacy of handles, carrying loops, etc.

b. Observe and record difficulties in accessibility to or operation of the components of the kit.

c. Observe and record the ease of assembling any components and the adequacy of tools for assembly when applicable.

d. Observe and record the adequacy of instructions for operating the components.

6.2.7 Safety

Determine and record test item(s) for safety hazards as described in the applicable sections of MTP 10-2-508 and the following:

a. Personnel shall observe all normal safety precautions governing the operation of the test item and test equipment throughout the test and shall observe and record the following:

1) Any dangerous or unsafe conditions; any condition that might present a safety hazard, including the cause of the hazard and the steps taken to alleviate the hazard.
2) The safety features incorporated into kit design.
3) Adequacy of warning instructions.
4) Suggestions to improve the existing safety precautions.

b. Issue a safety statement in accordance with USATECOM Regulation 385-6.

6.2.8 Value Analysis

Throughout the test, the test item shall be examined for any unnecessary,

costly, or "nice-to-have" features as described in USATECOM Regulation 700-1.

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

b. 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.

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Pre-Test Inspection

a. Record the following:

1) Evidence of package damage or deterioration
2) Identification markings, including:

a) Manufacturer
b) Number and date of contract
c) Date of manufacture
d) All other pertinent markings

3) For test item shipping package:

a) Contents
b) Weight, in pounds
c) Overall dimensions, in feet and inches of:

(1) Length
(2) Width
(3) Height

d) Cubage, in cubic feet

4) Type and adequacy of packing material
5) For components of survival kit:

a) Identification, name, and serial number
b) Evidence of defects in:

(1) Manufacturing
(2) Material
(3) Workmanship

c) Evidence of damage and/or wear
d) Existence of shortages

6) Presence of:

a) Identification plates, name and serial number
b) Operating instruction plates
c) Caution instructions plates.
d) Service and handling instructions plates

b. Retain all photographs.

6.3.1.2 Physical Characteristics

Record data as required in applicable sections of MTP 10-2-500.

6.3.1.3 Operator Training and Familiarization

Record the following·

a. Applicable data as required in MTP 10-2-501.
b. Adequacy of technical manuals and other instructional material provided, for training.

6.3.2 Test Conduct

6.3.2.1 Metal Components Tests

6.3.2.1.1 Salt-Fog Exposure -

a. Record the following:

1) Evidence of corrosion or other damage.
2) For components with moving parts, malfunctions, if any.

b. Retain all photographs.

6.3.2.1.2 Rockwell Hardness -

Record the following for each item tested:

a. Test item
b. Rockwell Hardness, Scale C

6.3.2.1.3 Cutting -

Record the following for each item tested:

a. Test item
b. Suitability for performing the tasks outlined

6.3.2.1.4 Tensile Strength -

Record the following for each item tested:

a. Test item.
b. Any discrepancies in design tensile strength, if applicable.

6.3.2.1.5 Leakage -

Record the following for each item tested:

a. Test item
b. Location of leaks, when applicable

6.3.2.2 Chemical Components Tests

6.3.2.2.1 Burning -

Record the following for each item tested:

a. Test item.
b. Ease of ignition.
c. Burning life of each element, in minutes.
d. Steadiness of flame, smoke or light.
e. Color of smoke, flame, or light and luminosity of flame or flare light.
f. Odor of volatile products of combustion.
g. Condition of unburned portion when applicable.

6.3.2.2.2 Water Purification and Desalting -

Record the following:

a. Kit under test.
b. Amount of impure water used, in milliliters.
c. Amount of potable water produced, in milliliters.
d. Presence of pathogenic or coliform organisms in effluent water.
e. Total alkalinity (OH^-, $CO_3^=$, and HCO_3^-), calcium plus magnesium, and sodium plus potassium (Ca^{++} plus Mg^{++}, and Na^+ plus K^+) of the effluent water.
f. The pH of the effluent water.

6.3.2.2.3 Leakage

Record the following for each item tested:

a. Test item
b. Presence of leakage when applicable
c. Any discrepancies in ignition after test

6.3.2.3 Fabrics Tests

Record the following for each fabric tested:

a. Type fabric
b. Tear strength
c. Puncture resistance
d. Abrasion resistance
e. Water permeability

6.3.2.4 Transportability

Record data as required in the applicable sections of MTP 10-2-503.

6.3.2.4.1 Vibration Test -

a. Record damages incurred to the test item, if any.
b. Retain all photographs.

6.3.2.4.2 Altitude Test -

a. Record the following:

1) Length of exposure to altitude, in hours
2) Damages incurred to the test item, if any

b. Retain all photographs.

6.3.2.5 Environmental Chamber Tests

Record data as required in applicable sections of MTP 6-2-510.

6.3.2.6 Human Factors

Record data as per applicable sections of MTP 10-2-505 and the following throughout the test:

a. Any difficulties or awkwardness in handling, including adequacy of handles, carrying loops, etc.
b. Any difficulties in accessibility to, or operation of the components of the kit.
c. Ease of assembling any components, and the adequacy of tools for assembling when applicable.
d. Adequacy of instructions for operating the components.

6.3.2.7 Safety

Record the following throughout the test:

a. Normal safety precautions taken for testing procedures.
b. Any dangerous condition or safety hazard, including the cause of the hazard and steps taken to alleviate the hazard.
c. Safety features incorporated into kit design.

d. Adequacy of warning instructions.
e. Suggestions to improve the existing safety precautions.

6.3.2.8 Value Analysis

Record the following:

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

6.4 DATA REDUCTION AND PRESENTATION

Data obtained during the conduct of this test will be summarized making use of photographs and charts as appropriate. All photographs and charts will be properly identified and labelled. Test data will be obtained for each survival kit tested, and summarized and evaluated as required.

Data obtained for each performance characteristic will be compared with established technical performance characteristics as specified in QMR's, SDR's, or other developmental criteria. Test data obtained for different types of survival kits undergoing the same test will be compared, when appropriate.

In addition to charts and photographs, presentation shall include narrative reports of all phases of the test.

The presentation shall conclude with a summarization of the suitability of the test item for service testing.