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U. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

ARCTIC ENVIRONMENTAL TEST OF WATER HANDLING, WATER STORAGE AND WATER PURIFICATION EQUIPMENT

AD 867022

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the performance and safety characteristics of water handling, water storage, and water purification equipment (including associated tools and equipments), under arctic winter environmental conditions.

2. BACKGROUND

Valid comparisons of different designs are necessary to insure selection of the most suitable water handling, water storage and water purification equipment for U. S. Army use. This MTP provides uniform test procedures for guidance of all USATECOM agencies concerned with the preparation of test directives, test reports, test plans and the conduct of tests for water handling, storage and purification equipment in the arctic. Testing in a natural arctic winter environment is used to substantiate or supplement data obtained during the Engineering Design and Engineering Test Phase. Testing in the arctic generally is not authorized until data from simulated environmental tests provides reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the Arctic.

3. REQUIRED EQUIPMENT

a. Appropriate Arctic Winter uniforms.
b. Vehicles (cargo).
c. Still cameras with associated photographic equipment (black and white or color).
d. Meteorological support instrumentation.
e. Flowmeter.
f. General and special tools (and ancillary items) to perform required maintenance; to uncrate and crate; and to load and handle the test item.
g. Test equipment to analyze the quality of the water.

4. REFERENCES

A. AR 705-15, Operations of Materials Under Extreme Conditions of Environment.
B. AR 705-5, Army Research and Development.
C. AR 70-8, Human Factors and Social Science Research.
D. AR 70-10, Army Materiel Testing.
E. AR 750-6, Maintenance Support Planning.
F. USATECOM Regulation 705-2, Documenting, Test Plans and Reports.

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G. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.
H. MTP 10-4-500, Arctic Preoperational Inspection, Physical Characteristics, Human Factors, Safety and Maintenance Evaluation.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP are designed to determine and evaluate the performance and safety characteristics of water handling, water storage, and water purification equipment.

The specific tests to be performed and their intended objectives are listed below.

a. Preoperational Inspection and Physical Characteristics - This subtest provides for an inspection of the test item to determine:

1) If the test and comparison items are in proper condition for testing.
2) If the test items physical characteristics conform to applicable criteria.

b. Transportability - The objective of this subtest is to determine if the test item (and its accessories) can be handled and transported under arctic winter environmental conditions, and to ascertain the extent of damage from transport over secondary and cross country roads.

c. Installation - The objective of this subtest is to determine if the test item can be installed under arctic environmental conditions and what special tools, materials, or procedures are required for various installations.

d. Functional Suitability - The objective of this subtest is to determine the suitability of the test item for use by the U. S. Army under Arctic environmental conditions. The operational characteristics are tested under various demand rates, and the performance of the test item is evaluated by its ability to provide palatable water, in the volume specified.

e. Human Factors Evaluation and Safety - The objective of this subtest is to determine if:

1) The test item is compatible with the skills, aptitudes, limitations of persons who will operate and maintain it under arctic environmental conditions.
2) The test item is safe for U. S. Army use under arctic environmental conditions.

f. Maintenance Evaluation - The objective of this subtest is to determine if the test item meets the required maintenance and maintainability requirements, as well as durability requirements as defined by QMR's, SDR's, TC's, MC's or other established criteria under arctic environmental conditions.

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5.2 LIMITATIONS

This MTP is limited to general procedures for arctic environmental testing applicable to all water handling, water storage, and water purification equipment.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Since arctic winter environmental tests are normally scheduled from October through March (6 months), ensure that the test items, test comparison and support weapons are delivered to the Arctic Test Center prior to 1 October.

b. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan. Assigned personnel will prepare the plan of test, supervise the conduct of test, collect test data, and report the results of the test. MOS of assigned personnel shall include 7010, 12B and 51N.

c. TDY personnel shall be used to augment assigned personnel and shall be trained to the degree that they are as proficient on the individual weapons as the troops who will use the weapon. MOS of assigned personnel will include 51N and 12B.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel available for reference.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive new equipment training (NET).

f. Record the following information:

1) Nomenclature, serial number(s), and manufacturer's name of the test items.
2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

g. Select test equipment ideally having an accuracy 10 times greater than that of the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test.

j. Prepare a test schedule to include all subtests to be conducted, detailing the minimum time required to complete each subtest and estimating the net testing time required.

k. Record the prevailing meteorological conditions and ensure the environmental conditions are suitable for testing.

6.2 TEST CONDUCT

6.2.1 Preoperational Inspection and Physical Characteristics

a. Upon receipt, carefully inspect the test and comparison items and their shipping containers for completeness, damage and general condition in accordance with the applicable section of MTP 10-4-500.

6.2.2 Transportability

a. Determine that all test (and comparison items) are in good condition, with all parts secure and ready for transport. Crate the test items if required.

b. Select handling gear in accordance with applicable technical manuals and load the test items on suitable trucks.

c. Transport the test items over secondary and cross country trails for a minimum of 50 miles. Note ambient air temperature during transport.

d. Offload the test items (uncrating where necessary), and carefully inspect for damage resulting from transport.

e. Record the following data:

1) Description of manpower and/or equipment plus the time required to prepare, load and off-load the test item from the vehicle.
2) Maximum and minimum ambient air temperatures during transport.
3) Mileage accumulated and road conditions.
4) Difficulties encountered during load, off-loading and transport.
5) Damage which resulted from transport.
6) Malfunctions.
7) Results of inspection.

6.2.3 Installation

NOTE: The following procedure applies to the installation of water purification, water storage reservoirs and water handling equipment.

a. Prepare the installation site to receive the test item and ensure that all tools and handling equipments necessary for the installation are available.

b. Provide a suitable shelter and heating equipment to ensure a constant temperature above 32°F.

NOTE: Shelter must be provided for certain equipments since they cannot operate below the freezing temperature of water. Other test items, however, which would normally be placed in an unsheltered environment such as large storage tanks, should not be sheltered for the test.

c. Set up the test item in accordance with the instructions contained in the technical manual.

d. Measure the local air temperatures and wind velocities during preparation and installation of equipments.

e. Record the following data:

1) Ambient air temperatures and wind velocity.
2) Type, quantity of special equipment, and special skills required for installation.
3) Number of men and time required to assemble and install the test item.
4) All difficulties encountered during assembly and installation.
5) Description of ground surface and dimensions of the completed site.

f. Photograph the test site and installation. Annotate the photographs to indicate sequence of assembly.

6.2.4 Functional Suitability

6.2.4.1 Water Purification Units

a. Following initial installation, operate the test item in accordance with instructions in the technical manual. Throughout the test measure the flow rate and amount of water processed. (Using a flow meter).

NOTE: During initial operation check all components and connections to insure compatibility with related equipment.

b. During the operation of the purification unit vary the flow to determine if coagulation, filtration, and chlorination process can be adjusted to change raw water quantity characteristics without interruption of flow.

c. Periodically (at least once each hour) draw water samples from the input source (immediately proceeding the test item) and from the effluent stream.

NOTE: These samples will be used to determine if the purification unit meets current radiological standards for water and chemical standards developed by the Surgeon General.

d. Stop and restart the purification unit at least once every two hours. Note any problems in restarting and determine if the quality of the water varies during this cyclic process.

NOTE: The stop and start cycle simulates the fluctuation of water production that may be required by variable water demand in field locations.

e. Expose the purification unit to temperatures, which approach the lower temperature limits of the equipment. Note any operational changes or problems.

f. Record the following data:

1) Malfunctions or failures of the test item.
2) Ambient air and water temperatures.
3) Total gallons of water pumped through the test item.
4) Average pumping rate.
5) Total hours of operation.
6) Number of samples taken, noting the time and conditions at the time the samples were taken.
7) Compatibility of test item with related water purification equipment.

6.2.4.2 Water Storage Reservoirs and Water Handling Equipment

a. During filling and drawoff operations periodically interrupt the pumping and vary the flow rate. Note any effects or operational problems caused by the flow fluctuations.

b. During fill operations measure and note the rate at which the test item can be filled. Also note the capacity of test item.

c. During drain operations measure and note the rate at which the test item can be drained. Also note the amount of water that cannot be withdrawn.

d. Measure and note any changes in the configuration of the test item due to snow, wind, ice, etc.

NOTE: Step d would only apply where the test item is not provided with a shelter as in the case of large storage tanks.

e. Record the following data:

1) The rate at which the test item can be filled and emptied.
2) Storage capacity of the test item.
3) Amount of water that cannot be withdrawn from the test item.
4) Ambient air temperatures and wind velocity, water temperatures, and surface temperatures of the test item.
5) Maximum depth of snow accumulated on the reservoir, on a daily basis.
6) Description and photographs of the effects of rocks, snow and ice on the test item's exterior and any sign of wear, pinholes, cracks, blisters or leakage.

6.2.5 Human Factors Evaluation and Safety

a. Conduct all Human Factors and Safety Tests in accordance with the applicable sections of MTP 10-4-500.

b. Conduct these tests concurrently with the operational tests described in this MTP.

6.2.6 Maintenance Evaluation

a. Conduct all maintenance evaluation tests (Maintenance and Reliability) in accordance with applicable sections of MTP 10-4-500.

b. Conduct these tests concurrently with the operational tests described in this MTP.

6.3 TEST DATA

All test data to be recorded will be as specified in the individual subtests of this MTP.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in the succeeding paragraphs.

6.4.1 Preoperational Inspection and Physical Characteristics

Preoperational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.2 Transportability

Determine the extent of the problems involved in handling, loading, offloading, and transporting the test item in an arctic environment. Prepare a report discussing the problems and detailing special procedures, materiel, or personnel required to support the transport of the test item in an arctic environment.

6.4.3 Installation

Determine the extent of problems involved in installing Water Purification, Water Storage, Water Handling Equipments, in an arctic environment. Prepare a report discussing the requirements for shelters and heating; the need for special equipments and materiels; and the need for design changes to the test item to facilitate future installations in arctic environments.

6.4.4 Functional Suitability

The operation of the test item shall be determined by comparison with previously accepted items of like nature and specifications. Prepare a report on the acceptability of the test item and other components and connections, and analyzing the performance characteristics under varying

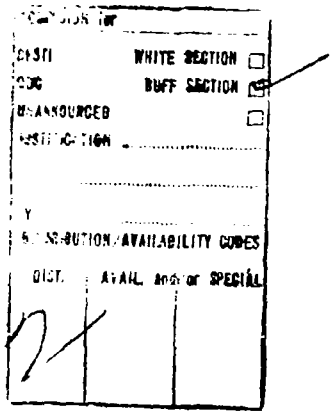
demand rates and temperature ranges.

6.4.5 Human Factors Evaluation and Safety

Human Factors and Safety data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.6 Maintenance Evaluation

Maintenance data (including reliability) shall be reduced and presented in accordance with MTP 10-4-500.



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13. ABSTRACT

This Environmental Test Procedure describes test methods and techniques for evaluating the performance and characteristics of Water Handling, Water Storage and Water Purification Equipment, under Arctic winter conditions. Evaluation is related to the criteria established by Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other design requirements or specifications.

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