19 May 1969

Materiel Test Procedure 10-2-060
Deseret Test Cente

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

FUEL THICKENERS, FLAMETHROWER

AD 714 [illegible]

1. OBJECTIVE

The objective of this Materiel Test Procedure (MTP) is to establish uniform procedures for determining and evaluating the technical performance of flamethrower fuel thickeners in terms of the criteria established by applicable Qualitative Material Requirements (QMR's), Small Development Requirements (SDR's), Technical Characteristics (TC's), and other design requirements or specifications. These procedures will also permit evaluation of the relative safety of tested materials in the hands of Army troops and the safety of those materials for service testing.

2. BACKGROUND

A military fuel thickener is a chemical used to convert gasoline to a thick, jellylike substance which may range in consistency from a pourable liquid to a rubbery, very thick gel. This gel material is used in turn as the fuel in portable and mechanized flamethrowers, fire bombs, and flame-warfare field expedients.

The consistency of thickened fuel will vary with the temperature, age, and volatility of the gasoline, age and type of thickener, and the amount of moisture present. The best consistency of blend to use in a specific situation, under prevailing climatic conditions, is determined largely through experience and through field testing.

3. REQUIRED EQUIPMENT

a. Fire-fighting equipment.
b. Material handling equipment.
c. Proving ground facilities to include:

1) Test site having:

a) No fire hazards
b) Firm, well-drained ground

2) Environmental chambers:

a) Temperature/humidity
b) Rain
c) Fungus
d) Sunshine
e) Pressure/altitude

d. Meteorological equipment to measure and record:

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1) Temperatures
2) Barometric pressures
3) Wind velocity
4) Relative humidity

e. Still and motion picture cameras for color and black-and-white photography.
f. Hand-mixing equipment.
g. Storage containers.
h. Mechanical mixing equipment.
i. Transferring equipment.
j. A portable flamethrower.
k. Fuels, including

1) Gasoline
2) Others, if required

l. Instructional materials.
m. Fuel heating equipment.
n. Equipment and facilities required in the applicable sections of MIL-T-50009.
o. Peptizer.

4. REFERENCES

A. USATECOM Reg. 385-6, Safety Release.
B. TM 3-366, Flame Fuels.
C. JAN-I-711, Incendiary Oils, Consistency of; Test Procedures.
D. MIL-T-50009, Thickener, Incendiary Oil, M4.
E. MIL-STD-810B, Environmental Test Methods.
F. MTP 7-1-002, Air Portability and Airdrop.
G. MTP 7-2-509, Airdrop Capability of Materiel.
H. MTP 8-2-500, Receipt Inspection.
I. MTP 8-2-503, Rough Handling and Surface Transport.
J. MTP 8-2-510, Decontamination.
K. MTP 8-2-512, Leak Testing of Agent-Filled Munitions and Containers.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP provide general procedures for determining the technical characteristics and performance of the test items. Specific testing requirements and procedures will be dictated by the performance and characteristics criteria for a particular test item.

The following procedures shall be performed on a selective basis as required to determine if the test item meets the criteria established:

a. Receipt Inspection - An inspection of the test item as received

to: (1) determine its physical and chemical characteristics and (2) identify damage or deterioration incurred during shipment to the test site. During this inspection the test item containers will be serially numbered for subsequent identification.

b. Safety Evaluation - The objective of this procedure is to check the safety statement issued by the developing agency and to identify the hazards, if any, which must be included in the safety release recommendation required by USATECOM Reg. 385-6 (reference 4 A).

c. Leak Test - A study to determine if the test item packaging leaks when subjected to standard leak tests and conditions.

d. Simulated Environmental Tests - A study to determine the effects of extreme temperatures, fungus, humidity, sunshine, and water on the test item and its packaging.

e. Decontamination Test - A study to determine the ease or difficulty involved in decontamination, and the effects of the process on the test item packaging.

f. Rough Handling and Surface Transportability Test - A study to determine the effects of rough handling and surface transport on the test item packaging.

g. Air Transportability and Airdrop Capability Test - A study to determine the effects of air transport and airdrop conditions on the test item packaging.

h. Operational Performance Test - A study to determine the conditions and quantities of the test item required to produce a satisfactory thickened fuel.

i. Laboratory Analyses - A study to determine if the test item meets specified requirements for gel consistency and formation, moisture sensitivity, etc.

5.2 LIMITATIONS

None.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Safety Statement

The test officer shall ensure that a Safety Statement has been received from the developing agency and is understood. The safety statement includes information pertaining to the item's operational limitations and specified hazards peculiar to the materiel to be tested.

6.1.2 Safety

a. Test and subtest plans and procedures shall ensure performance in the safest manner consistent with accomplishing the mission. The cardinal principle is to limit exposure of a minimum number of personnel, for a minimum time, to a minimum amount of hazardous material consistent with safe and efficient operations. Plans shall include safety procedures, precautions,

protections, and emergency procedures as necessary. Technical information on the hazards and safety characteristics of the test item as provided by the Safety Statement and other pertinent information will be included. Such information shall include evaluation of potential hazards; analysis of risks; limitations; and precautions, including special test equipment and techniques that should be incorporated in test plans and procedures.

b. A specific individual shall be charged with responsibility for safety. He shall be familiar with the nature and use of the test item and its packaging, shall have full knowledge of the hazards and safety aspects of the test, and shall review test procedures for evaluation of hazards and recommend control measures.

c. All personnel who participate in or observe the tests shall be briefed on the hazards involved and proper test methods and procedures.

6.1.3 Security

Security considerations shall be adequately determined and provided for as applicable for each procedure.

6.1.4 Logistical Requirements

Prior to the conduct of the test, the test officer shall ensure that all logistical requirements are satisfied.

6.2 TEST CONDUCT

6.2.1 Receipt Inspection

a. Subject the test item to the applicable procedures of MTP 8-2-500 following its arrival at the test site, with emphasis on the following:

1) Method of packaging
2) Test item description
3) Instructional materials included

b. Record the method of transportation used to transport the test item to the test site.

c. Number and identify each container of the test item to be used.

6.2.2 Safety Evaluation

The test item's safety shall be determined as follows:

NOTE: This test shall be conducted in accordance with all safety standard operating procedures (SOP's) and local regulations pertaining to safety as well as special provisions applicable or peculiar to the specific item or class of items.

a. Observe the handling and use of the material in accordance with existing instructions, directives, and similar guidance. Record any hazardous conditions such as fumes, chemical reactions with flesh, flammability, etc.

b. Record any information for inclusion in the Safety Release Recommendation required by USATECOM Regulation 385-6.

c. Perform additional checks that may be required to verify all the safety aspects included in the safety statement. Record any deficiencies and recommended inclusions.

6.2.3 Leak Test

Determine if the test item packaging leaks as described in the applicable sections of MTP 8-2-512 at the completion of the following tests:

a. Extreme temperature tests (paragraph 6.2.4.1).
b. Rough handling and surface transportability tests (paragraph 6.2.6).
c. Air transportability and air drop capability tests (paragraph 6.2.7).

6.2.4 Simulated Environmental Tests

6.2.4.1 Extreme Temperature Tests

Unless otherwise directed, the test item shall be subject to the following temperature tests:

6.2.3.1.1 Low Temperature Tests - Place a representative sample of packaged test items (minimum of 10), which have successfully passed the leak test of paragraph 6.2.3 in a temperature chamber and perform the following:

a. Reduce the chamber temperature to -80°F (-62.2°C), maintain it at -80°F for a period of 72 hours, and then perform the following.

1) Visually inspect the test item's packaging and record any damage.
2) Remove the test material from one package and record the following:

   a) Degree of lumping, solidifying, etc. of the test item.
   b) Equipment required and method used to remove the test material from the package.

3) Photograph the condition of the test material and its packaging.
4) Subject one packaged test item to the leak test procedures of paragraph 6.2.3.

NOTE: The test should be accomplished within 15 minutes of removing the test item from the chamber.

b. Raise the chamber temperature to -15°F (-26°C) or the test item's minimum operating temperature, and maintain this temperature until stabilization is reached. If stabilization is attained in less than 24 hours, maintain

temperature for a complete 24 hour interval. Perform the following:

NOTE: Stabilization, unless otherwise specified, is considered to be reached when the temperature of the test item does not change more than 3.6°F (2.°C) per hour.

1) Visually inspect the test item's packaging and record any damage.
2) Remove the test material from one package and record the following:

   a) Degree of lumping, solidifying, etc. of the test item.
   b) Equipment required and method used to remove the test material from the package.

3) Photograph the condition of the test material and its packaging.
4) Subject one packaged test item to the leak test procedures of paragraph 6.2.3.
5) Verify the operability of the test item by subjecting 1/3 of the remaining test items to the procedures of paragraph 6.2.8.2.

NOTE: Leakage and operability checks should be accomplished within 15 minutes of removing the test items from the test chamber.

c. Increase the chamber temperature to local ambient temperature, retain the test item at this temperature until stabilization is reached and then perform the following:

1) Visually inspect the test item's packaging and record any damage.
2) Remove the test material from one package and record the following:

   a) Degree of lumping, solidifying, etc. of the test item.
   b) Equipment required and method used to remove the test material from the package.

3) Photograph the condition of the test material and its packaging.
4) Subject one packaged test item to the leak test procedures of paragraph 6.2.3.
5) Verify the operability of the test item by subjecting the remaining test items to the procedures of paragraph 6.2.8.1.

6.2.4.1.2 High Temperature Test - Place a representative sample of packaged test items (minimum of 10), which have successfully passed the leak test of paragraph 6.2.3 in a temperature chamber and perform the following:

a. Adjust the chamber to a temperature of 160°F (71°C) and a relative humidity of 15%, maintain these conditions for a minimum of 48 hours and then perform the following:

1) Visually inspect the test item's packaging and record any damages.
2) Remove the test material from one package and record the following:

   a) Degree of lumping, liquefying, etc.
   b) Equipment required and method used to remove the test material from the package.

3) Photograph the condition of the test material and its packaging.
4) Subject one packaged test item to the leak test procedures of paragraph 6.2.3.

b. Adjust the chamber temperature to the maximum expected usable temperature and relative humidity, as established by design requirements, maintain these conditions for 24 hours and then perform the following:

1) Visually inspect the test item's packaging and record any damage.
2) Remove the test material from one package and record the following:

   a) Degree of lumping, liquefying, etc.
   b) Equipment required and method used to remove the test material from the package.

3) Photograph the condition of the test material and its packaging.
4) Subject one packaged test item to the leak test procedures of paragraph 6.2.3.
5) Verify the operability of the test item by subjecting 1/3 of the remaining test items to the procedures of paragraph 6.2.8.1.

c. Adjust the chamber to local ambient temperature and relative humidity and perform the following:

1) Visually inspect the test item's packaging and record any damage.
2) Remove the test material from one package and record the following:

   a) Degree of lumping, liquefying, etc.
   b) Equipment required and method used to remove the test material from the package.

3) Photograph the condition of the test material and its packaging.
4) Subject one packaged test item to the leak test procedures of paragraph 6.2.3.
5) Verify the operability of the test item by subjecting the remaining test items to the procedures of paragraph 6.2.8.1.

6.2.4.2 Fungus Test

a. Subject a representative sample of the packaged test items to the fungus exposure test of Procedure I, Method 508 of MIL-STD-810B (reference 4E).

b. At the completion of the exposure period perform the following:

1) Record and photograph presence of fungus on the test item packaging.
2) Open the test item package and:

a) Record evidence and degree of contamination
b) Photograph evidence of contamination

3) Verify the operability of contaminated test material by subjecting it to the procedures of paragraph 6.2.8.1.

6.2.4.3 Humidity Test

a. Subject a representative sample of the packaged test items to the humidity exposure test of Procedure I, Method 507, MIL-STD-810B (reference 4E).

b. At the completion of the exposure period perform the following, as applicable:

1) Open the test item package and:

a) Record the condition of the test material
b) Photograph evidence of contamination

2) Dry out the test item, if required, and record the following:

a) Method and equipment used
b) Drying time
c) Drying temperature
d) Amount of material dried
e) Effectiveness of the drying procedure

3) Verify the operability of contaminated test material by subjecting it to the procedures of paragraph 6.2.8.1.

6.2.4.4 Rain Test

a. Subject a representative sample of the packaged test items to the rain exposure test of Procedure I, Method 506, MIL-STD-810B (reference 4E).

b. At the completion of the exposure period perform the following, as applicable:

1) Open the test item package and:

a) Record the condition of the test item material
b) Photograph evidence of contamination

2) Dry out the test item, if required, and record the following:

a) Method and equipment used
b) Drying time
c) Drying temperature
d) Amount of material dried
e) Effectiveness of the drying procedure

3) Verify the operability of contaminat d test material by subjecting it to the procedures of paragraph 6.2.8.1.

6.2.4.5 Immersion Test

a. Subject a representative sample of the packaged test items to the immersion test of Procedure I, Method 512, MIL-STD-810B (reference 4E).
b. At the completion of the exposure period perform the following as applicable:

1) Open the test item package and:

a) Record the condition of the test item material
b) Photograph evidence of contamination

2) Dry out the test item, if required, and record the following:

a) Method and equipment used
b) Drying time
c) Drying temperature
d) Amount of material dried
e) Effectiveness of the drying procedure

3) Verify the operability of contaminated test material by subjecting it to the procedures of paragraph 6.2.8.1.

6.2.4.6 Sunshine Test

a. Subject a representative sample of the packaged test items to the sunshine test of Procedure I, Method 505, MIL-STD-810B (reference 4E).
b. At the completion of the exposure period perform the following:

1) Visually examine the test item packaging for and record evidence of deterioration.
2) Determine the effects of test item packaging deterioration by

subjecting the test item package to the immersion procedures of paragraph 6.2.4.5 and recording and photographing evidence of test material contamination.

6.2.5 Decontamination Test

Subject a representative sample of the packaged test item to the applicable decontamination tests of MTP 8-2-510 and determine and record the following:

a. Decontaminating agents and methods providing the most satisfactory results.
b. Effect of the most satisfactory methods and agents on the test item packaging.

6.2.6 Rough Handling and Surface Transportability Test

Subject a representative sample of the packaged test items to one of the applicable sections of MTP 8-2-503, including the shock test of Procedure II, Method 516 and Vibration test of Procedure XI, Method 514 of MIL-STD-810B (reference 4E) and perform the following at the completion of each test.

a. Visually examine the test item package for cracks, breaks, tears, etc.
b. Subject the test item package to the leak test procedure of paragraph 6.2.3.

6.2.7 Air Transportability and Air Drop Capability

Determine the effects of pressure-altitude and vibration similar to what might be encountered by the test item in flight and during air drop as follows:

NOTE: Background information on air transportability is contained in MTP 7-1-002.

6.2.7.1 Simulated Flight Test

a. Subject a representative sample of the packaged test items in their shipping containers to the following conditions simultaneously.

1) Ambient pressure at the maximum altitude to which the test item may be expected to be flown during air transport, and
2) Flight vibration conditions for equipment class g (shipment by common carrier) of Procedure X, Method 514, MIL-STD-810B (reference 4E).

NOTE: The test level shall be in accordance with curve AB, Figure 514-6, and time schedule IV of Table 514-II of reference 4E.

b. At the completion of the simulated pressure-altitude and vibration testing, perform the following:

1) Visually examine the test item shipping containers for, and record the presence of breaks, cracks, undone bindings, etc.
2) Visually examine the test item packaging for and record the presence of breaks, cracks, tears, deformation, etc.
3) Subject the test item package to the leak test procedure of paragraph 6.2.3.

6.2.7.2 Air Drop Capability

Determine the air drop capability of a representative sample of the packaged test item as described in the applicable sections of MTP 7-2-509 with special attention to the following:

a. Rig the test items, with accelerometers attached, in appropriate air drop containers, and drop the containers from aircraft flying at the altitude and speed currently recommended for air drop operations and record the following:

1) Aircraft used
2) Aircraft altitude
3) Aircraft air speed
4) Meteorological conditions
5) Air delivery system trajectory and impact velocities
6) Acceleration "G" force magnitude at impact
7) Type of parachute and rigging used

b. Photograph the air drop test procedures with motion and still camera.

c. At the completion of the test, perform the following:

1) Visually examine the test item's air drop container for, and record the presence of cracks, breaks, undone bindings, etc.
2) Visually examine the test item's packaging for, and record the presence of damages and/or deformations.
3) Subject the test items to the leakage test of paragraph 6.2.3.

6.2.8 Operational Performance

NOTE: 1. The site selected for this subtest is to be free of fire hazards.
2. Carbon dioxide fire-fighting equipment and first-aid equipment should be immediately available at the test site.
3. All gasoline fuels are to be inspected to ensure they are free of water before use.
4. Mixing equipment must be clean, non-galvanized, and spark-proof.

6.2.8.1 Ambient Temperature Test

NOTE: Paragraphs 6.2.8.1.1 through 6.2.8.1.4 are to be performed with all equipment and ingredients at ambient temperature.

6.2.8.1.1 Mixing - Perform the following:

NOTE: 1. Unless otherwise specified by the developing agent, all mixing shall be to obtain the equivalent of MI, 4 percent thickened fuel (see reference 4B, TM 3-366 and Appendix A).
2. Fuel is to be gasoline unless otherwise specified by the development requirements.

a. Hand mix a quantity (approximately 50 gallons) which will be suitable for use in a portable flamethrower according to the instructions supplied by the manufacturer of the fuel thickener.

b. Record the following:

1) Description of the mixing equipment
2) Temperature
3) Description and quantity of thickener
4) Description and quantity of gasoline fuel
5) Sequence of mixing ingredients
6) Mixing time
7) Difficulties encountered during mixing
8) Description of the thickened fuel, including:

a) Appearance
b) Suspension of thickener

c. Photograph the mixing operation and the mixed fuel.

6.2.8.1.2 Transferring - Perform the following:

NOTE: Thickened fuel may be aged (see paragraph 6.2.8.1.3) either in the flamethrower or in tightly sealed containers.

a. Transfer the thickened fuel of paragraph 6.2.8.1.1 to a portable flamethrower or resealable drum and record the following:

1) Transfer equipment used
2) Time required for transfer
3) Difficulties encountered during transfer
4) For thickened fuel:

a) Viscosity
b) Flow rate

b. Photograph the transfer procedure.

6.2.8.1.3 Aging - Perform the following:

a. Following the manufacturer's instructions, age the thickened fuel and record the following:

1) Time required for aging.
2) Aging temperature.
3) Consistency of the thickened fuel and method of measurement used as described in JAN-I-711 (reference 4C).
4) Characteristics of the aged fuel.

b. Photograph the aging process and aged fuel.

6.2.8.1.4 Performance Test - Evaluate the performance of the test material as follows:

a. Fill the flamethrower with thickened fuel which has not been aged as described in paragraph 6.2.8.1.2.
b. Record the following for each performance test:

1) Ambient temperature
2) Wind speed
3) Relative humidity
4) Flame thrower nomenclature, model number and settings

c. Fire the flamethrower with the unaged fuel, downwind, crosswind and upwind, and record the following:

1) When fired in bursts:

a) Duration of bursts
b) Range and direction
c) Description of flame
d) Description of effects on target

2) During sustained firing

a) Flame duration per charge
b) Range and direction
c) Description of flame
d) Description of effects on target

d. Refill the flamethrower with aged fuel and record the following:

1) Type of transfer equipment used
2) Time required to transfer
3) Difficulties encountered transferring

e. Fire the flamethrower with the aged fuel and record the data required in steps b and c above.
f. Photograph all tests, preferably with motion picture cameras.

6.2.8.1.5 Improvised Mixing Methods - Using methods recommended by the developing agency, repeat the procedures of paragraphs 6.2.8.1.1 through 6.2.8.1.4.

6.2.8.1.6 Mechanical Mixing - Using mechanical mixing equipment as recommended by the developing agency, repeat the procedures of paragraph 6.2.8.1.1 through 6.2.8.1.4.

6.2.8.1.7 Fuel Tests - As required, repeat the procedures of paragraph 6.2.8.1.1 through 6.2.8.1.4 using a variety of fuels and fuel blends.

6.2.8.2 Low Temperature Test

NOTE: Unless otherwise directed, the temperature of the mixing equipment and ingredients shall be at -15°F (-26°C) or the minimum operating temperature of the test material (see paragraph 6.2.3.1.1.b).

Determine the performance characteristics of the test material, at its low temperature, as described in paragraphs 6.2.8.1.1 through 6.2.8.1.4 and as follows:

a. Record the following for test material mixed in a temperature chamber:

1) Temperature of the chamber
2) Time between removal of mix from the chamber and firing

b. Record the following peptizer data:

1) Type and quantity used
2) Blending method used

c. Record the following fuel heating data.

1) Heating equipment used
2) Heating procedure used
3) Mix temperature of fuel

6.2.9 Laboratory Analysis

Determine the characteristics of the test material as described in the applicable quality assurance tests of MIL-T-50009 (reference 4D) and as stipulated by the developing agency or by specification requirements. The following characteristics shall be measured as a minimum:

a. Gel formation
b. Gel consistency
c. Granulation
d. Moisture, in percentage by weight
e. Moisture sensitivity
f. Apparent density

6.3 TEST DATA

6.3.1 Receipt Inspection

Record the data collected as described in the applicable sections of MTP 8-2-500 and the following; for each test item package:

a. Test item identification number
b. Method of transportation
c. Type of packaging (can, drum, bag, pallet, etc.)
d. Nature of test item, including:

1) Chemical name(s)
2) Chemical symbol(s)
3) Nomenclature
4) Federal stock number
5) Physical properties (powder, liquid, etc.)
6) Color
7) Odor

e. Description of instructional materials included

6.3.2 Safety Evaluation

Record the following:

a. Presence of hazardous conditions
b. Information for inclusion in the Safety Release Recommendation
c. Deficiencies encountered
d. Recommendations to increase safety

6.3.3 Leak Test

Record data collected as described in the applicable sections of MTP 8-2-512.

6.3.4 Simulated Environmental Tests

6.3.4.1 Extreme Temperature Tests

6.3.4.1.1 Low Temperature Tests -

a. Record the following for each packaged test item, as applicable:

1) Test item identification number
2) For temperature of -80°F:

a) Damage incurred by packaging
b) Type and degree of physical changes (lumping, 10%, etc.)
c) Equipment and method used to empty test item container
d) Leakage data collected as described in paragraph 6.2.3

3) For temperature of -15°F:

a) Damage incurred by packaging.
b) Type and degree of physical changes (solidifying, 10%, etc.).
c) Equipment and method used to empty test item container.
d) Leakage data collected as described in paragraph 6.2.3.
e) Operability data collected as described in paragraph 6.2.8.2.

4) For ambient temperature:

a) Temperature in °F.
b) Damage incurred by packaging.
c) Type and degree of physical changes.
d) Equipment and method used to empty test item container.
e) Leakage data collected as described in paragraph 6.2.3.
f) Operability data collected as described in paragraph 6.2.8.2.

6.3.4.1.2 High Temperature Test -

a. Record the following for each packaged test item, as applicable:

1) Test item identification number
2) For temperature of 160°F:

a) Damage measured by packaging
b) Type and degree of physical damage (lumping, 10%, etc.)
c) Equipment and method used to empty test item container
d) Leakage data collected as described in paragraph 6.2.3

3) For maximum usable temperature:

a) Temperature in °F.
b) Relative humidity in %
c) Damage incurred by packaging
d) Type and degree of physical damage (liquefying, 10%, etc.)
e) Equipment and method used to empty test item container
f) Leakage data collected as described in paragraph 6.2.3.
g) Operability data collected as described in paragraph 6.2.8.1.

4) For ambient temperature:

a) Temperature in °F.
b) Relative humidity in %.
c) Damage incurred by packaging.
d) Type and degree of physical damage.
e) Equipment and method used to empty test item container.
f) Leakage data collected as described in paragraph 6.2.3.

g) Operability data collected as described in paragraph 6.2.8.1.

b. Retain all photographs

6.3.4.2 Fungus Test

a. Record the following as applicable:

1) Test item identification number.
2) Presence of fungus on:

a) Test item packaging
b) Test material

3) Degree of test material contamination (throughout, on surface only, etc.).
4) Operability data collected as described in paragraph 6.2.8.1.

b. Retain all photographs

6.3.4.3 Humidity Test

a. Record the following as applicable:

1) Test item identification number
2) Condition of test material (dry, damp, coagulated, other)
3) For drying procedures:

a) Method used
b) Equipment used
c) Drying time in minutes
d) Temperature in °F
e) Amount of material dried in pounds
f) Effectiveness of the drying procedure

4) Operability data collected as described in paragraph 6.2.8.1.

b. Retain all photographs

6.3.4.4 Rain Test

a. Record the following as applicable:

1) Test item identification number
2) Condition of test material (dry, damp, coagulated, other)
3) For drying procedures:

a) Method used
b) Equipment used
c) Drying time in minutes

d) Temperature in °F
e) Amount of material dried in pounds
f) Effectiveness of the drying procedure

4) Operability data collected as described in paragraph 6.2.8.1

b. Retain all photographs

6.3.4.5 Immersion Test

a. Record the following as applicable:

1) Test item identification number
2) Condition of test material (dry, damp, coagulated, other)
3) For drying procedures:

a) Method used
b) Equipment used
c) Drying time in minutes
d) Temperature in °F
e) Amount of material dried in pounds
f) Effectiveness of the drying procedure

4) Operability data collected as described in paragraph 6.2.8.1

b. Retain all photographs

6.3.4.6 Sunshine Test

Record the following as applicable:

a. Test item identification number.
b. Evidence of test item packaging deterioration.
c. Condition of the test material after immersion (dry, damp, coagulated, other).

6.3.5 Decontamination Tests

Record the following for each test item package undergoing decontamination:

a. Most effective methods and agents.
b. Effect of most effective methods and agents on test item packaging.

6.3.6 Rough Handling and Surface Transportability Test

Record the following for each test performed:

a. Test item identification number
b. Test performed (shock, vibration, etc.)

c. Presence of cracks, breaks, tears, etc
d. Leakage data collected as described in paragraph 6.2.3

6.3.7 Air Transportability and Air Drop Capability

6.3.7.1 Simulated Flight Test

Record the following for each test item:

a. Test item identification number
b. Altitude simulated, in feet
c. For test item shipping container:

1) Presence of cracks, breaks, etc
2) Undone binding, if applicable

d. For test item packaging:

1) Presence of cracks, breaks, tears, etc
2) Deformation

e. Leakage data collected as described in paragraph 6.2.3

6.3.7.2 Air Drop Capability

a. Record the following for each test item:

1) Test item identification number
2) Aircraft used
3) Aircraft altitude, in feet
4) Aircraft air speed, in knots
5) Air conditions (calm, turbulent)
6) Air delivery system trajectory
7) Test item impact velocity, in fps
8) Acceleration force of impact in G's
9) Type of parachute and rigging
10) For test item air drop container:

a) Packing material used
b) Presence of cracks, breaks, etc.
c) Undone bindings

11) For test item package:

a) Damage and/or deformation
b) Leakage data collected as described in paragraph 6.2.3

6.3.8 Operational Performance

6.3.8.1 Mixing

a. Record the following for all mixing procedures:

1) Type of mixing (hand, improvised, machine)
2) Description of mixing equipment
3) Temperature of mixing ingredients and equipment in °F
4) For thickener:

a) Description
b) Quantity in pounds

5) For fuel:

a) Type (gasoline, jet, blend)
b) Description of blend, if applicable
c) Quantity in gallons

6) Sequence of mixing
7) Total mixing time in minutes
8) Difficulties encountered during mixing (lumping, other)
9) Quantity mixed in gallons
10) For thickened fuel:

a) Appearance (applesauce, other)
b) Suspension of thickener (settled, dispersed)

11) For low temperature mixing:

a) Peptizer type used
b) Peptizer quantity used in pounds
c) Peptizer blending method used
d) Fuel heating equipment used
e) Fuel heating procedure used
f) Mix temperature of fuel in °F

b. Retain all photographs.

6.3.8.2 Transferring

a. Record the following for each transfer made:

1) Operating temperature (ambient, low)
2) Transfer equipment used
3) Transfer time in minutes
4) Type storage containers used (drums, cans, etc.)
5) Difficulties encountered during transfer
6) Thickened fuel viscosity
7) Thickened fuel flow rate in gallons per minute

b. Retain all photographs

6.2.8.3 Aging

a. Record the following for each aging procedure:

1) Time required for aging in hours
2) Aging temperature in °F
3) Consistency of aged fuel
4) Description of aged fuel:

a) Properties (jellylike, stringiness)
b) Color

b. Retain all photographs

6.3.8.4 Performance Test

a. Record the following for each test performed:

1) For meteorological conditions:

a) Ambient temperature in °F
b) Wind speed in mph
c) Relative humidity in percent

2) For flamethrower:

a) Nomenclature
b) Model number
c) Settings

3) For all firing data:

a) Direction of fire (downwind, crosswind, upwind).
b) Range in meters.
c) Flame description (billowing, pencil-line stream).
d) Flame area in ft^2.

(1) Along flame path
(2) At target

e) Flame effects on target (sticks, ricochets, disperses, globular adherence, flares, etc.).

4) Burst time, in seconds, for burst fire.
5) Firing time per change, in seconds, for sustained fire.
6) Time between removal of mix from chamber to firing, for low temperature tests, in seconds.

6.3.9 Laboratory Analysis

Record data collected as described in the applicable sections of MIL-T-50009, by the developing agency and by the test material specifications.

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Receipt Inspection

a. Data collected as a result of this procedure shall be presented as indicated in the applicable portions of MTP 8-2-500.

b. The description of the test item, number of items tested, and conditions upon receipt shall be presented in tabular form.

c. Results of the leak subtest shall be presented in narrative or other convenient form.

d. Photographs and X-ray pictures shall be used to substantiate results.

6.4.2 Safety Evaluation

a. A Safety Release Recommendation (USATECOM Regulation 385-6) shall be forwarded to the U. S. Army Test and Evaluation Command within 30 days of the beginning of the test. The Safety Release Recommendation shall contain the following information: special safety considerations or hazards to personnel and materiel (including developmental types of equipment as well as standard components used in assemblage of items being tested).

b. Data and comments relative to the safety hazards observed during any phase of testing.

c. Comments relative to suggested safety improvements.

6.4.3 Leak Testing

a. The results of leak testing shall be presented as prescribed in MTP 8-2-512.

b. Narrative comments, photos, etc., shall be included, as required.

6.4.4 Simulated Environmental Testing

The results of the subtests conducted shall be presented in tabular or other suitable form.

6.4.5 Decontamination Tests

The results of this subtest shall be presented as indicated in the applicable sections of MTP 8-2-510.

6.4.6 Rough Handling and Surface Transport

a. The results of this subtest shall be presented as described in the applicable sections of MTP 8-2-503.

b. Tables, photographs, narrative comments or other means of presentation shall be used wherever helpful in reporting results.

6.4.7 Air Transportability and Air Drop Capability

a. Air transportability data shall be presented in summary form as

indicated in the applicable sections of MTP 7-1-002, and include the pressure-altitude cycling and vibration conditions the test item was subjected to.

b. Air drop capability data shall be presented as prescribed in MTP 7-2-509 including narrative comments regarding ease or difficulty encountered in accomplishing the airdrop and photographs as applicable.

6.4.8 Operational Performance

Data from this subtest shall be presented in narrative form, supplemented by tabular data and photographs. This report shall clearly indicate whether the test material meets specifications.

6.4.9 Laboratory Analysis

The results of the laboratory analysis shall be presented as described in MIL-T-50009 or as directed by the developing agency and specification characteristics.

APPENDIX A

COMPUTING AMOUNTS OF INGREDIENTS FOR FLAMETHROWER FUELS

The consistency of flamethrower fuel depends upon the amount of fuel thickener mixed into a specific amount of gasoline. The standard of measurement used to describe the consistency of flamethrower fuels is the percentage of weight of MI fuel thickener required to produce a given consistency. For example, a 4-percent-consistency thickened fuel is made by adding 4 percent by weight of MI thickener to gasoline. Any thickened fuel which has equivalent characteristics will be described as 4-percent-consistency thickened fuel. The basing of all flamethrower fuel consistency measurements on the use of MI fuel thickener permits standardization of terminology and simplifies calculations when using other fuel thickeners. For example, if 10 ounces avoirdupois (not fluid ounces) of M4 fuel thickener is mixed with 500 ounces of gasoline, the mixture is actually 2 percent thickener by weight. However, this fuel has a consistency equivalent to one mixed with 4-percent MI thickener. Therefore both fuels are described as 4-percent-consistency flamethrower fuels.

When mixing a small batch (less than 50 gallons) of thickened fuel, the following rule of thumb may be used. Since gasoline weighs approximately 100 ounces avoirdupois per gallon, mix 1 ounce of MI fuel thickener into each gallon for each 1 percent consistency desired.

EXAMPLE: To mix 40 gallons of 4-percent-consistency thickened fuel--

Weight of MI fuel thickener required = 1 X 40 X 4

= 160 ounces (or 10 pounds)

To prepare a mixture of the same consistency if M4 thickener is used, use one-half the weight of MI thickener that would be required. If M2 thickener is to be used, use two-thirds the weight of MI thickener that would be required.

When mixing large batches of thickened fuel (50 gallons or more), the rule-of-thumb method is not sufficiently accurate, and the exact weight of ingredients required should be calculated as shown in the following examples. (All the following equations are based on the use of MI fuel thickener.)

To calculate the weight of thickener required to produce a mixture of a given consistency, it is necessary to determine the weight of the gasoline it is to be mixed into. The density of gasoline varies by as much as 15 percent, depending on the blend and the amount of weathering it has undergone, and its density also varies greatly with temperature. Therefore, it is necessary to weigh the gasoline before mixing or to determine its specific weight and volume. For convenience in using the following equations, it is recommended to weigh a gallon of the gasoline. In the following calculations, it is assumed that 1 gallon of the gasoline to be used has been found to weigh 6.20 pounds. Then, to calculate the weight of MI thickener required, the following equation can be

used:

$$W = \frac{V \cdot D \cdot C}{100 - C}$$

where W = weight of MI thickener required,
V = volume of mixture desired,
D = density of gasoline, and
C = desired consistency in percent.

EXAMPLE: How many pounds of MI thickener are required to mix 50 gallons of 4-percent thickened fuel using gasoline weighing 6 pounds per gallon?

$$W = \frac{50 \times 6.20 \times 4}{100 - 4} = \frac{1240}{96} = 12.9 \text{ pounds}$$

To calculate the percentage consistency of thickened fuel, use the following equation:

$$C = \frac{W \cdot 100}{(V \cdot D) + W}$$

EXAMPLE: What is the percentage consistency of thickened fuel mixed from 50 gallons of gasoline and 13 pounds of MI fuel thickener when the density of the gasoline is known to have been 6.20 pounds per gallon?

$$C = \frac{13 \times 100}{(50 \times 6.20) + 13} = \frac{1300}{323} = 4 \text{ percent}$$

To calculate the volume of gasoline required to prepare a mixture of desired consistency from a given quantity of MI fuel thickener, use the following equation:

$$V = \frac{W \cdot (100 - C)}{D \times C}$$

EXAMPLE: How much gasoline is required to prepare 4-percent thickened fuel from 13 pounds of MI thickener when the gasoline weighs 6.20 pounds per gallon?

$$V = \frac{13 \times (100 - 4)}{6.20 \times 4} = \frac{1248}{24.8} = 50 \text{ gallons.}$$