

DEPARTMENT OF THE ARMY SUPPLY BULLETIN

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THICKENING COMPOUND, FUEL:  
M1, M2 AND M4  
STORAGE SERVICEABILITY STANDARD

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Headquarters, Department of the Army, Washington, D.C.  
26 May 1971

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SB 3-1365-2, 25 February 1971 is changed as follows:

Page 5, paragraph 6b(2)(a) lines one and two. Change "4.17 percent" to read, "4-percent."

Paragraph 6b(2)(c), line three. Change "4.17 percent" to read, "4-percent".

Paragraph 6b(2)(c)1, line three. Change "10.20 + 0.005 g" to read, "10.00 + 0.05 gram".

Page 7, paragraph 6c(2)(a), line two. Change "6b(3)(t)" to read "6b(2)(a)".

Paragraph 6c(2)(c)1, line four. Change "10.20+ 0.005" to read, "10.00 + 0.05".

Paragraph 6d(1)(c) is superseded as follows:

1. Same as 6b(1)(c)1 except 276.0 + 0.2 gm in place of 192.0 + 0. gram test solvent and 24.0 + 0.2 gram in place of 10.00 + 0.05 gram thickener will be used.

Paragraph 6d(2)(c)1 is superseded as follows:

1. Same as 6b(2)(c)1 except 276.0 + 0.2 gram in place of 240.0 + 0.2 gram of test solvent and 24.0 + 0.2 gram in place of 10.00 ±0.05 gram thickener will be used.

Paragraph 6d(2)(c)2 is superseded as follows:

2. Same as 6b(2)(c)2.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,  
*General, United States Army,*  
*Chief of Staff.*

Official:

VERNE L. BOWERS,  
*Major General, United States Army,*  
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Edgewood (75})  
PG (5)  
USAAPSA (60)

NG: Stage AG NG: Stage AC (3); Div (1).

USAR: None.

For explanation of abbreviations used, see AR 310-50.

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Headquarters, Department of the Army, Washington, D. C.  
25 February 1971

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**1. Purpose and Scope.** *a. Purpose.* This bulletin when used in conjunction with Supply Bulletin SB 3-30 and SB 742-1 provides a method for determining the serviceability of Thickening Compound, Fuel; M1, M2 and M4.

*b. Scope.* The provisions of this bulletin are mandatory for use by all Department of the Army organizations within CONUS and overseas with a receipt, storage and issue mission. This bulletin is not intended for use by organizations with stocks in basic loads.

**2. Applicable Documents.** The following Government documents referenced herein form a part of this bulletin to the extent specified.

- |            |  |
|------------|--|
| MIL-G-3056 | - Gasoline, Automotive, Combat.                            |
| MS-602     | - Test Solvent for Fuel Thickener (dated 22 October 1951). |

- |              |  |
|--------------|--|
| MIL-STD-1439 | - Thickener, Hydrocarbon, Flame Fuels, Consistency of; Mobilometer Test.     |
| MIL-STD-1168 | - Lot Numbering of Ammunition.   |
| SB 3-30      | - Serviceability Standard for CB Material.                                   |
| SB 742-1     | - Ammunition Surveillance and Quality Evaluation Procedures.                 |
| TM 3-250     | - Storage Shipment, and Handling of Chemical Agents and Hazardous Materials. |
| TM 38-750    | - The Army Maintenance Management System.                                    |
| TM 743-200   | - Storage and Materials Handling (Dept of Def).                              |

This bulletin supersedes SB 3-1365-2, 22 June 1970.

- TM 743-200-1 - Storage and Materials Handling Dept of Army).
- TM 9-1300-206 - Care, Handling, Preservation, and Destruction of Ammunition.
- TM 3-366 - Flame Fuels.

**3. Safety Provisions.** Refer to SB 3-30, TM 3-250, TM 9-1300-206, TM 3-366, TM 743200, and TM 743-200-1 and local Standard Operating Procedures.

**4. Surveillance.** a. *Surveillance interval.*

(1) *Initial receipt and prestorage inspection.* Initial receipt and prestorage inspection will be conducted in accordance with SB 3-30 and SB 742-1.

(2) *Periodic cycle.*

(a) M1 Thickener - Periodic surveillance not required. Surveillance will be performed only when a pre-issue requirement exists.

(b) M2 Thickener - Surveillance will be performed at periodic cycles of one year. The first scheduled surveillance will be conducted within six months from the date of receipt at the depot.

(c) M4 Thickener - Surveillance will be performed at periodic cycles of three years. The first scheduled surveillance will be conducted within six months from the date of receipt at the depot. Subsequent surveillance will be performed at periods of one year, two years and three years thereafter.

(3) *Pressure inspection.* Pressure inspection of the subject item will be performed in accordance with SB 3-30 and the provisions of paragraphs 5 and 6 of this bulletin when one half or less of the periodic cycle remains. A visual examination will be performed (in accordance with paragraph 5 of this bulletin) on the subject item if more than one half of the periodic cycle remains prior to shipment of the item. If no initial cycle examination has been performed a complete examination as specified in paragraphs 5 and 6 of this bulletin will be performed prior to shipment.

b. *Basis of surveillance.* Surveillance for the subject item will be conducted on the basis of grand, manufacturer's and miscellaneous lots.

c. *Surveillance lots.*

(1) *Grand lot.* A grand lot is created of not more than 20,000 units by grouping all lots from one manufacturer into one large single lot for the purpose of economy in surveillance.

(a) *Kind, type and model.* All lots must be the same kind, type and model; i.e., Thickening Compound, Fuel; M1, Thickening Compound, Fuel, M2 and Thickening Compound, Fuel, M4; however, M1, M2 or M4 Thickener will not be intermixed to create a grand lot.

(b) *Manufacturer.* All lots must be the product of the same manufacturer or reconditioning agency.

(c) *Packing.* All lots must have the same type packing and identification markings.

(d) *Storage.* All lots must be stored under similar conditions at the same depot.

(e) *Serviceability lot status.* All lots must possess the same serviceability lot status; i.e., serviceability known (based upon prior surveillance) or serviceability unknown. However, when new procurement is involved, serviceability will be based upon acceptance inspection in lieu of prior surveillance.

(3) *Manufacturer's lot.* A manufacturer's lot consists of those items manufactured or assembled by one manufacturing or reconditioning activity and bearing the same manufacturing or reconditioning agency's lot identification number.

(a) *Packing.* See 4c(1)(c).

(b) *Storage.* See 4c(1)(d).

(c) *Serviceability lot status.* See 4c(1)(e).

(4) *Miscellaneous lot.* A miscellaneous lot containing not more than 2,000 items, will be created by combining small manufacturer's lots or lot fragments possessing the same technical history; i.e., manufactured by the same technical procedure (indicated by the same lot series number).

(a) *Kind, type and model.* All items must be of the same kind, type and model; i.e., Thickening Compound, Fuel: M1, Thickening Compound, Fuel: M2 or Thickening Compound, Fuel: M4, however, M1, M2 or M4 Thickener shall not be intermixed to create a miscellaneous lot.

- (b) *Manufacturer.* See 4c(1)(b).
- (c) *Packing.* See 4c(1)(c).
- (d) *Storage.* See 4c(1)(d).
- (e) *Serviceability lot status.* See 4c(1)(e).

(1) *End item.* A sample quantity of thickener will be randomly selected as indicated in table I and subjected to a visual examination. In addition, the sample will be subjected to the tests specified in section 6.

d. Sampling. Sampling will be conducted as follows:

**Table I (Visual Inspection)**

Lot Size	1	2	3	4	5	6	7
Up to 50	12*	0	1	-	-	-	-
51 to 200	12	0	1	12	24	1	5
201 to 500	20	1	3	20	40	2	10
501 to 1000	27	2	5	27	54	3	14
1001 to 5000	34	3	8	34	68	4	19
5001 and over	40	4	10	40	80	5	24

Explanation of columns and symbols:

\*Single sampling for this lot size, where sample size exceeds lot size do 100% inspection

1. First sample size.
2. Acceptance number, first sample - major defective.
3. Acceptance number, first sample - minor defective.
4. Second sample size.
5. Combined sample size ( first and second samples combined).
6. Acceptance number, combined sample - major defectives.
7. Acceptance number, combined sample - minor defectives.

**Table II (Tests)**

Lot Size	1	2
Up to 50	3	5.310
51 to 200	4	3.957
201 to 500	5	3.400
501 to 1000	6	3.091
1001 to 5000	7	2.894
5001 and over	8	2.755

Explanation of columns:

1. Sample size.
2. K factor for lower limit of gel consistency test where K is a factor such that:  
 $X + Ks$  - upper limit of test  
 $X - Ks$  - lower limit of test  
 where X and s are estimates of the mean and standard deviation computed from a sample of size N.

(2) *Containers.* A sample quantity of containers will be randomly selected as indicated in table I and a visual examination will be performed for packaging, packing, marking and preservation as specified in SB 742-1.

(3) *Second sample size.* When the number of major defectives exceeds the quantity specified in column 2, but does not exceed the quantity specified in column 6, a second sample equal in size to that specified in column 4, shall be taken, and the

cumulative acceptance number specified in column 6 will be used for acceptance. A second sample is not taken for a minor defect.

(4) *Combined sample size.* When the surveillance interval has been exceeded by 25 percent, or when the approximate date of the last inspection is unknown, the combined

sample plan specified in columns 4, 5, and 7 will be used. The combined sample plan may also be used when additional assurance of quality is desired, e.g., after reword of an item where component quality is unknown.

(5) *Visual examination.* Only a visual examination of packing for a new or reprocessed unit upon receipt at a depot storage area is required. If used units are received unprocessed at a storage area, a complete visual and functional examination shall be performed in accordance with the instructions contained in this bulletin when reprocessing and repacking.

e. Testing. Overseas commands and installations other than depots need not perform the tests specified in section 6. Depots that do not possess testing and/or laboratory facilities will request instructions for testing from the Commanding Officer, Edgewood Arsenal, ATTN: SMUEA-QAER, Edgewood Arsenal, MD 21010.

**5. Inspection.** a. *Visual examination.* The sample will be examined for defects listed in 5b.

b. *Classification of defects.* Refer to tables III and IV for classification of defects. Defects other than those listed in these tables will be reported. Serviceability will be withheld pending investigation by Commanding Officer, Edgewood Arsenal, Quality Assurance Directorate, Engineering Division, Specifications Branch to determine proper defect category into which the unlisted defect belongs.

c. *Packaging, Packing, Marking and Preservation.* See SB 742-1.

**Table III. Thickening Compound**

<i>Categories methods</i>	<i>Defects</i>	<i>Inspection</i>
Critical:	None defined	
Major:		
101	Gel formation incorrect	6
102	Gel consistency incorrect	6
Minor:		
201	Mixing instructions missing	Visual

**6. Functional Tests.** a. Containers selected for removal of thickener for testing, will be sampled as follows:

(1) *Containers.* Containers will be submitted unopened for testing.

**CAUTION**

Because of the hygroscopic nature of the material, sampling must be performed as rapidly as possible.

(2) *Bulk containers.* Containers larger than 5 pounds capacity will be sampled by using a one quart (in volume ) sampler or thief thrust diagonally through the length of the container to insure obtaining a representative cross-sectional sample of the thickener.

**CAUTION**

Replace container cover immediately upon removing sample. DO NOT COMPOSITE SAMPLES.

(3) Place sample in a clean, dry, airtight container (metal or glass) immediately upon removing sample from container.

(4) Identify container containing sample with lot number, manufacturer, and container from which sample was extracted. Container from which sample was withdrawn will be marked accordingly.

b. *ThickenerM4 tests (laboratory).*

(1) *Gel formation.*

(a) *Requirements.*

1. Vortex time must not exceed 420 seconds.

2. The gel must be of a uniform mixture free from lumps or stratification of material, i.e., no lumps, or solvent on top of thickener.

(b) *Equipment required.*

1. *Mechanical stirrer.* With a rotating speed of 300 ±10 revolutions per minute (rpm). The stirrer will be fabricated from a 3/8 inch outside diameter (OD) glass, or corrosion-resistant metal rod. The rod must incorporate four (7/8 by 7/8 by 1/8 inch) vanes of the same material as the rod and set at right angles with the vane faces parallel to the axis of the rod.

2. *Jar.* Glass, square, pint size (mason type) approximately 3 by 3 by 5 inches.

3. *Mobilometer.* The mobilometer must consist of a highly polished tube, a brass 4-hole disc, plunger rod assembly and bearing, and will be mounted on a suitable base and support, and shall conform to the requirements contained in MIL-STD-1439.

4. *Storage tubes.* Tubes for storage of thickened fuel must be made from iron, steel, anodized aluminum or glass. The inside diameter (ID) will be approximately the same size or slightly larger than the ID of the mobilometer tubes used for testing. The storage tube must be approximately 10 inches long and will be filled to allow a void of  $10 \pm 2$  percent. The storage tubes will be capped at both ends with removable caps of a material similar to the tube and must be capable of withstanding a pressure of 35 pounds per square inch gage (psig). Gaskets will be manufactured from a material that is nonswelling, non-extractable rubber.

5. *Temperature bath.* Constant temperature bath (either liquid or vapor) capable of maintaining the temperature specified in the procedure.

#### NOTE

A constant temperature room may be substituted for a constant temperature bath. Provided room is maintained within limits specified.

6. *Weighing room.* The weighing room must be maintained at a temperature of  $70 \pm 10^\circ$  F and at a relative humidity of 50 percent.

7. *Test solvent.* The test solvent used for the determination of gel consistency will conform to Standard MS 602.

8. *Timing device.* Stop watch accurate to a tenth of a second.

#### (c) Procedure.

1. Put  $192.0 \pm 0.2$  gram of test solvent (Standard MS 602) into the glass jar, and place jar into temperature bath.

2. Immerse the stirrer in the solvent to such a depth that the top of the vanes are approximately 3 centimeters (cm) below the surface of the liquid.

3. Place a mark on stirring rod 1.0 cm below the surface of the solvent.

4. Start stirrer and adjust for a stirring speed of  $300 \pm 10$  revolutions per minute (rpm). Adjust temperature bath to maintain a constant temperature of  $770 \pm 2^\circ$  F throughout the remainder of the test.

#### NOTE

A constant temperature bath is not required if test is performed in a room having a constant temperature of  $77 \pm 20^\circ$ F and the initial temperature of the solvent is within the limits specified.

5. Add  $8.0 \pm 0.1$  gram of sample. Record the time the sample was added and the time lapse until the gel covers the 1.0 cm mark on the stirring rod. The time must not exceed that specified for vortex. The gel mixture must be as specified.

#### (2) Gel consistency.

(a) *Requirements.* 4.17 percent gel. All 4.17 percent gels, when prepared and tested as specified in 6b(2)(c), will have a consistency of not less than 300 grams nor more than 700 grams after being stored at  $150^\circ \pm 5^\circ$  F for  $24 \pm 4$  hours.

(b) *Equipment required.* Same as specified in 6b(1)(b).

(c) *Procedure for 4.17-percent gel.* Prepare duplicate sets of gels, using equipment specified in 6b(1), as follows:

1. Weigh out  $240.0 \pm 0.02$  g test solvent into a quart jar and, while stirring, add  $10.20 \pm 0.005$  g thickener. A small, clean dry piece of paper or a dry glass beaker may be used to weigh out the sample. Maintain the temperature of samples as previously specified during the stirring period.

2. Place each gel in a separate storage container and store at  $150^\circ \pm 5^\circ$  F for  $24 \pm 5$  hours.

#### (d) Sample preparation.

1. Transfer sample from the storage tube to the mobilometer at the time of test, using one of the following methods.

(a) .If the mobilometer tube fits into the storage tube, transfer the gel by removing one cap from the storage tube and inserting the mobilometer tube, without cap or base, into the storage tube, base end first. Push the mobilometer tube down until its base has reached the lower cap of the storage tube. Remove the remaining cap from the storage tube and screw the mobilometer tube base into place. Withdraw the mobilometer tube containing the thickener gel. Cap until consistency determination is made. Clean storage tube thoroughly.

(b) If the gel sample is to be returned to the storage tube fasten one cap of the tube, loosely into place, so that the pass

age of air is facilitated. Remove the base of the mobilometer tube containing the gel sample and insert the lower end of the mobilometer tube a short distance into the open end of the storage tube. Using a solid disc fastened to a rod, slowly push the sample from the mobilometer tube, and into the storage tube. When the transfer has been completed, attach the other storage tube cap and tighten both caps securely. Clean mobilometer tube.

(c) If the storage tube is approximately the same diameter as that of the mobilometer tube, the sample may be transferred in a similar manner to that specified in 6b(2)(d) above, except that the tube from which the gel is to be removed must be held tightly over the receiving tube while using a disc on a plunger to extrude the sample. The receiving tube base must be loosely fastened to facilitate the passage of air while filling the tube. Exercise care not to entrap air in the base of the mobilometer tube.

(d) Any other convenient method of transferring the sample from the storage tube to the mobilometer tube may be used, provided the exposure of the sample to evaporation is not greater than that specified in 6b(2)(d) 1 a and c.

(e) Fill the mobilometer tube with the sample gel to the top of the tube.

(e) *Working stroke.* Five strokes will be made in less than one minute.

1. Manually force plunger down until the disc touches the bottom of the tube.

2. Withdraw the disc until the lower mark on the rod is  $1 \pm 1/4$  inch above the bearing. (This should not take more than ten seconds).

3. Hold a piece of absorbent cloth or paper around the plunger rod to prevent the gel from being carried into the bearing. Errors in measurement will result from dried material being present on the rod, bearing, cover, disc, or in the holes of the disc.

(f) *Consistency determination.*

#### **NOTE**

In the first run in determination, use the total weight consisting of the summation of weights for the disc, plunger, weight pan and any added weights of 50 grams in excess of the upper limit for the gel being tested.

1. After the completion of the working stroke (with the lower mark  $1 \pm 1/4$  inch above the bearing), grasp the plunger rod at the bearing, and place the required weight on the pan.

#### **NOTE**

The time interval between the end of the working stroke and the start of the first run must be  $60 \pm 10$  seconds.

2. Apply the load to the gel by releasing the weighted plunger assembly.

3. Start timing device (stop watch) when the lower mark on the rod passes the upper surface of the bearing.

4. Stop timing device when the upper mark on the rod passes the upper surface of the bearing.

5. Remove the weights from the pan and manually force the plunger down until the disc touches the bottom of the tube. Withdraw plunger until the lower mark is  $1 \pm 1/4$  inch above the bearing. Wipe the rod as previously instructed for the upstroke.

#### **NOTE**

Not more than ten seconds must elapse between stopping the timing device, and placing the plunger assembly in the starting position ( $1 \pm 1/4$  inch above the bearing).

6. Record the total weight used in the run and the elapsed time indicated on timing device.

7. Continue the weighing process and reduce the load by 50 grams for each succeeding run, until the time of fall exceeds 100 seconds. If the time of fall for the first run exceeds 100 seconds, increase the load by 50 grams increments until the time of fall is less than 100 seconds. (Consistency is defined as the load in grams necessary to drive the mobilometer disc a distance of 10 centimeters through the gel in 100 seconds.) The 100 second time of fall is obtained by linear interpolation using full logarithmic graph paper from the two adjacent values falling on either side of 100 seconds. The figure must be estimated to the nearest gram. Applicable standardization factors and mobilometer correction factors will be added to this value to obtain in final corrected consistency value which will be determined to the nearest gram.



c. *Thickener M2 tests (Laboratory).*

(1) *Gel formation.*

(a) *Requirements.*

1. The vortex time will not exceed 300 seconds.

2. The gel shall be as specified in 6b(1)(a) except that after 30 minutes of mixing there shall be no stratification.

(b) *Equipment required.* Same as specified in 6b(1)(b).

(c) *Procedure.* Same as specified in 6b(1)(c) except 6.1 percent gel will require 281.4  $\pm$ 0.2 gram of test solvent and 18.6  $\pm$ 0.1 gram in place of 80  $\pm$ 0.1 gram Thickener with temperature maintained at 77°  $\pm$ 2° F during the stirring period.

(2) *Gel consistency.*

(a) *Requirements.* The 6.1 percent gel will be as specified in 6b(3)(a) except that the gel will have a consistence of 200 to 650 grams after storage at 150°  $\pm$ 100 F for 24  $\pm$ 4 hours. The average consistency of the two samples will not differ more than 80 grams for the same temperature.

(b) *Equipment required.* Same as specified in 6b(1)(b).

(c) *Procedure for 6.1-percent gel.* Prepare duplicate gels using equipment specified in 6b(1)(c) as follows:

1. Same as 6b(2)(c)1 except 281.4  $\pm$ 0.2 gram in place of 240.0  $\pm$ 0.2 grams of test solvent and 18.6  $\pm$ 0.1 gram in place of 10.20  $\pm$ 0.005 gram of thickener will be used.

2. Same as 6b(2)(c)2.

(d) *Sample preparation.* Same as 6b(2)(d).

(e) *Working stroke.* Same as 6b(2)(e).

(f) *Consistency determination.* Same as 6b(2)(f).

d. *Thickener M11 tests (Laboratory).*

(1) *Gel formation.*

(a) *Requirements.*

1. The vortex time will not exceed 30 minutes.

2. The gel will be as specified in 6b(1)(a).

(b) *Equipment required.* Same as specified in 6b(1)(b).

(c) *Procedure for 8 percent gel.* Prepare duplicate gels using equipment specified in 6b(1)(c) as follows:

1. Same as 6b(1)(c)1 except 276.0 $\pm$ 0.2 gram in place of 240  $\pm$  0.2 gram of test solvent and 24.0  $\pm$ 0.2 gram in place of 10.20  $\pm$ 0.005 gram thickener will be used.

(2) *Gel consistency.*

(a) *Requirements.* The 8-percent gel must be as specified in 6b(2)(a) except that the 8-percent gel shall have a consistency of 300 to 900 grams. The average consistency of the two samples shall not differ more than 80 grams.

(b) *Equipment required.* Same as specified in 6b(1)(b).

(c) *Procedure for 8-percent gel.* Prepare duplicate gels using equipment specified in 6b(1)(c) as follows:

1. Same as 6b(1)(c)1 except 276.0  $\pm$ 0.2 gram in place of 240  $\pm$ 0.2 gram of test solvent and 24.0  $\pm$ 0.2 gram in place of 10.20  $\pm$ 0.005 gram thickener will be used.

2. Same as 6b(1)(c)2.

(d) *Sample preparation.* Same as 6b(2)(d).

(e) *Working stroke.* Same as 6b(2)(e).

(f) *Consistency determination.* Same as 6b(2)(f).

e. *Field evaluation.*

(1) Installations other than depots and overseas commands will perform a visual inspection in accordance with 5a.

(2) The following procedure may be used in lieu of tests specified in 6b through 6d.

(a) *Requirements.* The gel must be a uniform mixture free from lumps, or stratification of material i.e., no lumps or solvent on top of thickener.

(b) *Equipment required.*

1. Drum, open head, non galvanized 42 or 55 gallon.

2. Paddle, wooden, mixing (approximately 5 foot long with cross bars).

3. Can, 5 gallon, with removable head or other necessary size can having removable head for storing thickened fuel (as many as testing requires).

4. Fuel, gasoline unleaded and undyed preferred (Automotive combat gasoline conforming to MIL-G-3056 may be used).

**NOTE**

When reporting results, indicate type fuel used. Fuel must be moisture free.

- 5. Scale, for weighing material (graduated in pounds and ounces and accurate to 1/2 ounce).
- 6. Flameproof coveralls.
- 7. Conductive platform for mixing.
- 8. Static ground wire.

**CAUTION**

Thickener is hygroscopic in nature, therefore, every precaution shall be taken to prevent exposure of the thickener to the atmosphere any longer than is necessary.

(c) *Procedure for field evaluation.*

- 1. Attach static ground wire to mixing drum.
- 2. Move fire-fighting equipment into area.
- 3. Weigh out gasoline in the amount specified in table VI. Pour gasoline into 42 or 55 gallon drum. When testing M2 Thickener, gasoline must be maintained at 85° ±5° F. The gasoline need not be heated for testing M4 Thickener, if the temperature is above 40 ° F.

**Table VI. Fuel and Thickener Requirement**

Type Thickener	Weight (ounces)	
	Thickener	Gasoline
M4	16 ±1	384 ±2
M2	16 ±1	240 ±2
M1	16 ±1	184 ±2

- 4. Weigh out thickener in the amount specified in table VI.
- 5. Breakup any large lumps, by hand, and slowly add thickener to fuel while stirring the gasoline.
- 6. Using paddle, continue to stir the mixture until the fuel achieves the appearance of applesauce.
- 7. Take sample of thickener mix and place in glass jar. Observe the particles of thickener. If the

thickener mix remains in suspension without settling, the thickener and gasoline mixture has been stirred long enough. However, if the thickener mix begins to settle, continue to mix until thickener mix remains in suspension.

**NOTE**

When thickener is added to gasoline, it disperses and swells in the fuel. The gasoline and the thickener must be stirred until the particles of thickener expand to fill the entire volume of the gasoline. Stirring prevents the particles from settling and keeps them uniformly suspended. Thickened fuel does not attain its final stage of gel until it has aged.

- 8. Pour thickened fuel into a drum. Place head on drum and seal. Fuel must remain in sealed container for a minimum period of 24 hours.
- 9. Consistency of the thickener will vary with the percentage and type of thickener used from a pourable liquid resembling a thick maple sugar to a gel resembling a gelatin dessert or jelly. Refer to TM 3-366 for examples. The consistency of thickened fuel can vary greatly even if mixed under ideal conditions. This variation can be the result of different mixing techniques, different manufacturing methods of the principal ingredients, temperature and humidity differences.
- 10. After a minimum period of 24 hours but not more than 26 hours, in storage, check consistency. Consistency must be as specified in 6e(2)(c)9 above.

**WARNING**

- Relieve pressure buildup slowly before removing lid.
- 11. Test for consistency as follows:
    - (a) Draw a sample of the mixture in a clean dry glass container.
    - (b) Invert the container and observe the manner in which the mixture flows.

**WARNING**

DO NOT handle thickened fuel with hands to check consistency. Fuel on hands and clothing creates a fire hazard. Also, repeated skin exposure to gasoline, especially the leaded varieties, may be harmful.

**7. Documentation.** *a. Report forms.* When reporting data, the following forms will be used:

- DA Form 984 - Munition Serviceability Report.
- DA Form 985 - Data Sheet for Grand Lots, Miscellaneous Lots or Depot Lots.
- DA Form 2415 - Ammunition Condition Report.

*b. Reporting.*

(1) *Data.* When reporting data, forms specified in 7a will be prepared in accordance with instructions contained in SB 3-30 and TM 38-750.

(2) *Submission.* Reports required by this document will be submitted as follows:

(a) Original and one copy to the Commanding Officer, Edgewood Arsenal, ATTN: SMUEA-QAER, Edgewood Arsenal, MD 21010.

(b) One copy to the Commanding General, U. S. Army Ammunition Procurement and Supply Agency, ATTN: SMUAP-QA-LM, Joliet, IL 60436.

**8. Special Instructions.** *a. Equipment calibration.* Prior to an inspection operation or test, all measuring devices that require calibration will be inspected to verify that the calibration interval and equipment limits have not been exceeded. See SB 742-1.

*b. Errors or omissions.* Comments regarding errors or omissions will be forwarded on DA Form 2028 to Commanding Officer, Edgewood Arsenal, ATTN: SMUEA-QAES-B, Edgewood Arsenal, MD 21010.

By Order of the Secretary of the Army:

W. C. WESTMORELAND.  
*General, United States Army*  
*Chief of Staff.*

Official:

KENNETH G. WICKHAM,  
*Major General, United States Army,*  
*The Adjutant General.*

Distribution:

*Active Army:*

Cof Engrs (1)	Div (5)
Dir of Trans (1)	Bde (2)
ACSC-E (1)	Regt/gp/bat gp (2)
TSG (1)	Bn (1)
USAMC (25)	Instl (2)
USAMUCOM (25)	PMS Sr Div Units (1)
USACDCEC (10)	GENDEP (5)
CONARC (25)	Dep (5)
OS Maj Comd (10)	Army Dep (5)
LOGCOMD (2)	Arsenals (2) except
MDW (1)	Edgewood (75)
Armies (2)	PG (5)
Corps (2)	USAAPSA (60)

NG: State AG (3); Div (1).

USAR: None.

For explanation of abbreviations used, see AR 310-50.

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## The Metric System and Equivalents

### *Linear Measure*

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

### *Weights*

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 decagram = 10 grams = .35 ounce  
 1 hectogram = 10 decagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

### *Liquid Measure*

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

### *Square Measure*

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

### *Cubic Measure*

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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**PIN: 022450-000**