**MIL-P-23741A**
15 APRIL 1964

SUPERSEDING
MIL-P-23741(WEP)
24 MAY 1963

## MILITARY SPECIFICATION

# PROPELLANT, MIXED AMINE FUEL, MAF-1

*This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.*

### 1. SCOPE

**1.1 Scope.** This specification covers the requirements for mixed amine fuel, MAF-1 (uns-dimethylhydrazine-diethylenetriamine-acetonitrile, UDMH-DETA-ACN) propellant.

### 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

\# SPECIFICATIONS

MILITARY

MIL-D-25604 —Dimethyl Hydrazine, Unsymmetrical, Propellant
MIL-P-27401 —Propellant Pressurizing Agent, Nitrogen
MIL-D-50025 —Diethylenetriamine

STANDARDS

FEDERAL

FED-STD-791 —Lubricants, Liquid Fuels, and Related Products; Methods of Testing

MILITARY

MIL-STD-105 —Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129 —Marking for Shipment and Storage
MIL-STD-172 —Color Code for Containers of Liquid Propellants

(*Copies of specifications, standards, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.*)

**2.2 Other publications.** The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM Standards on Petroleum Products and Lubricants
ASTM Manual on Measurement and Sampling of Petroleum and Petroleum Products

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

INTERSTATE COMMERCE COMMISSION

49 CFR 71-90—Interstate Commerce Commission Rules and Regulations for the Transportation of Ex-

FSC 9135

plosives and Other Dangerous Articles.

(The Interstate Commerce Commission regulations are now a part of the Code of Federal Regulations (1949 Edition—Revised 1956) available from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402, Orders for the above publication should cite "49 CFR 71–90 (Rev. 1956.")

## 3. REQUIREMENTS

**3.1 Material.** The MAF–1 propellant shall be a product of high quality, suitable for the purpose intended, and so formulated as to meet the requirements specified herein (see 4.4.1).

# 3.2 No data is required by this specification or by applicable documents referenced in Section 2 unless specified in the contract or order. (See 6.2)

**3.3 Requirements.** The MAF–1 propellant shall conform to the requirements specified in Table I when tested as specified in 4.4.

TABLE I—*Chemical and Physical Requirements*

| Requirements | Limits |
|---|---|
| MAF–1 assay: | |
| Unsymmetrical dimethylhydrazine, UDMH ($C_2H_8N_2$), MIL–D–25604 percent by weight | 39.0 ± 1.5 |
| Diethylenetriamine, DETA ($C_4H_{13}N_3$), MIL–D–50025, percent by weight | 49.7 ± 0.7 |
| Acetonitrile, ACN ($CH_3CN$), percent by weight | 10.0 ± 1.0 |
| Water, max., percent by weight | 1.0 |
| Particulate, max., milligrams per liter | 10.0 |
| Density, g/ml at 25° C (77° F) | 0.863 — 0.875 |

# 3.4 **Filter.** A filter with a 10 micron nominal and 40 absolute rating shall be installed between the manufacturer's plant system and the container to be filled for delivery.

**3.5 Qualitative.** The propellant shall be a homogeneous liquid when examined visually by transmitted light.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 **Acceptance inspection.** Conformance of the MAF–1 propellant to the requirements of this specification shall be determined entirely by means of acceptance inspection. Acceptance inspection shall consist of an examination for acceptability of the quality control methods used by the manufacturer, an examination of the sample of filled containers for conformance to the packaging and marking requirements, and examining and testing the sample for tests for all the requirements specified in Section 3.

4.3 **Sampling.**

4.3.1 *Inspection lot.* An inspection lot shall consist of the MAF–1 propellant blended by one manufacturer, with no change in process or materials, in not more than 24 consecutive hours, provided the operation is continuous. In the event the process is a batch process, each batch shall constitute a lot (see 6.3.2).

4.3.2 *Sample for tests.* The sample for tests shall consist of not less than 1000 ml of MAF–1 propellant prepared from random samples selected from each lot in accordance with Method 8001 of Standard FED–STD–791 (ASTM D270). This sample shall be tested for all the requirements of this specification. A lot shall be unacceptable if a sample fails any of the test requirements.

4.3.3 *Sample for examination of filled containers.* A random sample of filled containers shall be selected from each lot of MAF–1 propellant offered for acceptance under contract in accordance with Standard MIL–STD–105 at inspection level II and acceptable quality level (AQL) = 2.5 percent defective.

# 4.3.3.1 *Examination of filled containers.* Each filled container selected in accordance with 4.3.3 shall be examined for defects of the container and the closure, for evidence of leakage, for unsatisfactory marking, and content. Any container in the sample having one or more defects shall be rejected. When the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL–STD–105, the lot represented by the samples shall be rejected.

**4.4 Inspection methods.** Unless otherwise specified, the physical and chemical values designated in Section 3 shall apply to the average of the determinations made on the sample for tests. Inspection conditions shall be as described under the individual tests to which they apply.

# 4.4.1 Conformance of the MAF–1 propellant to the requirements for material (3.1) shall be determined by appropriate examination and testing in accordance with Section 3.

4.4.2 *MAF–1 assay.*

4.4.2.1 *Uns-dimethylhydrazine (UDMH).*

# 4.4.2.1.1 *Procedure.* Draw about a 0.6g sample of MAF–1 propellant into a hypodermic syringe and eject into a tared weighing bottle. Weigh the sample to the nearest 0.2mg. Wash the sample with distilled water into a 250 ml beaker containing 100 ml of 9 N HCl. Titrate in an ice bath (using platinum and calomel electrodes) rapidly with standard 0.1 molar (M) $KIO_3$ until the solution turns yellow, then add the titrant dropwise until one drop causes the indicator needle to show a rapid change on the millivolt scale (650–800 mv). Calculate the percentage of UDMH using the following formula:

$$\% \text{ UDMH} = \frac{(\text{ml } KIO_3)\,(\text{Molarity } KIO_3) \times 1.210}{\text{Wt. of sample in grams}}$$

# 4.4.2.1.2 *Reagents and equipment.* The following reagents and equipment shall apply as test conditions:

(a) pH Meter (platinum and calomel electrodes)
(b) 50–ml buret
(c) Standard $KIO_3$, 0.1M, prepared by dissolving approximately 21.40g of $KIO_3$ dried at 180 ± 2° C (356 ± 4° F) in 1 liter (L) of distilled $H_20$. Weigh to nearest 0.2 mg.

$$\text{Molarity } KIO_3 = \frac{\text{Wt. of } KIO_3}{214.02}$$

(d) Hypodermic syringe: 2-ml and needle
(e) 9 N HCl (3 parts concentrated HCl(12N) to 1 part distilled $H_2O$)

4.4.2.2 *Diethylenetriamine (DETA).*

# 4.4.2.2.1 *Procedure.* Using a hypodermic syringe and needle transfer approximately 1.5g sample of propellant to a tared weighing bottle. Weigh the sample to the nearest 0.2 mg. Transfer the sample and wash the weighing bottle with ethylene glycol-isopropanol mixture (EGIP) into a 250-ml beaker containing 50 ml of EGIP. Add 10 ml of salicylaldehyde, stir, and let stand for 15 minutes. Titrate with 0.6 N HCl in EGIP to a pH of 5.0. A pH meter is used to determine the end point. Calculate the percentage of DETA using the following formula:

$$\% \text{ DETA} = \frac{(\text{ml HCl})\,(\text{N HCl})\,(10.317)}{(\text{sample wt. in grams})\,(\text{DETA}_o)}$$

$DETA_0$ = assay of original DETA conforming to Specification MIL–D–50025, used in preparation of propellant—must exceed 95 percent.

# 4.4.2.2.2 *Reagents and equipment.* The following reagents and equipment shall apply as test conditions:

(a) 1:1 mixture of ethylene glycol and isopropanol (EGIP)
(b) 0.6 N HCl in EGIP prepared by diluting 48 ml of concentrated HCl to 1 L with EGIP. Standardize using sodium carbonate primary standard.

(c) Weighing bottles
(d) Hypodermic syringe: 2–ml and needle
(e) 50–ml buret
(f) pH Meter (glass and calomel electrodes)
(g) Salicylaldehyde—reagent grade
(h) Stirring bar and motor.

# 4.4.2.3 *Acetonitrile (ACN).* The acetronitrile component of the MAF–1 propellant shall be determined by the infrared spectrophotometric technique using a Perkin-Elmer Model 21 Infrared Spectrometer or its equivalent.

4.4.2.3.1 *Equipment and conditions.* The following conditions and articles of equipment or their equivalents shall apply as test conditions:

(a) Spectrometer—Perkin-Elmer Model 21
(b) Cell thickness—0.07 to 0.09 mm
(c) Prism—NaCl
(d) Resolution—984
(e) Response—1
(f) Gain—4
(g) Speed—Setting 10 (2 microns/min)
(h) Scale—5 cm/micron
(i) Calibration point—4.44 microns
(j) Automatic suppression—0

4.4.2.3.2 *Preparation of standard samples.* Samples of MAF–1 propellant to be used as standards for comparison to the propellant sample shall be prepared as follows:

(a) Three 25–ml stoppered weighing bottles shall be cleaned, dried, and tared to the nearest 0.2 mg.
(b) Weigh to nearest 0.2 mg into the first tared weighing bottle, approximately 4.0 g of UDMH, 5.0 g of DETA, and 1.0 g of acetonitrile. Weigh to the nearest 0.2 mg into the second tared weighing bottle, approximately 4.0 g of UDMH, 5.1 g of DETA and 0.9 g of acetonitrile. Weigh to the nearest 0.2 mg into the third tared weighing bottle, approximately 4.0 g of UDMH, 4.9 g of DETA and 1.1 g of acetonitrile.
(c) Calculate the weight percentage of acetonitrile in each standard sample as follows:

$$\% \text{ ACN} = \frac{\text{Wt. of acetonitrile}}{\text{Wt. of total sample}} \times 100$$

4.4.2.3.3 *Preparation of working curve.*

(a) Transfer the standard samples, one at a time, to the infrared cell and scan the region between 4 and 5 microns 3 times. Calculate the average value of the optical density for each sample.
(b) Make a plot of optical density versus percent acetonitrile. Construct a smooth curve through the three points. The curve constructed in this manner is the working curve of 4.4.2.3.4.

4.4.2.3.4 *Analysis of sample.*

(a) Transfer a sample of MAF–1 propellant to the infrared cell and scan the region between 4 and 5 microns 3 times. Calculate the average value of the optical density.[1]
(b) Obtain the weight percent acetonitrile in the MAF–1 propellant by referring to the working curve in 4.4.2.3.3.[2]

[1] MAF–1 containing water has a tendency to fog NaCl windows. Therefore it is best to repolish cell windows frequently.
# [2] Before each analysis or series of analyses on each working day the working curve should be checked by running one standard sample prepared in 4.4.2.3.3. When the standard sample does not match the original working curve, prepare a completely new working curve as per 4.4.2.3.3 using newly prepared standards.

4.4.3 *Water.* The water content of the MAF–1 propellant shall be determined by the vapor phase chromatographic method. This determination shall be made using a partitioning column packed with tetrahydroxyethylethylenediamine (THEED) on celite and involves the preparation of a working curve obtained by analyzing standards. The procedure outlined below is for a Perkin-Elmer Model 154–C Vapor Fractometer but any equivalent instrument is readily adaptable to the method.

# 4.4.3.1 *Reagents and equipment.* The following reagents and equipment or their equivalents shall apply as test conditions:

(a) Perkin-Elmer Model 154-C Vapor Fractometer and Recorder
(b) Perkin-Elmer Micro-Dipper Sample Introduction System with 0.02 ml dipper
(c) Cylinder of compressed helium with automatic regulator
(d) 6 feet of annealed copper tubing ¼ inch O. D.
(e) 2 Perkin-Elmer #154–1158 stainless steel sintered metal plugs
(f) Chromatographic celite, 30/60 mesh
(g) THEED, Fisher Scientific Co. Cat. No. T–399
(h) Methanol, reagent grade
(i) Three 10–ml volumetric flasks
(j) 10–ml measuring pipet
(k) ¼–ml hypodermic syringe with 2-inch needle.

4.4.3.2 *Preparation of column.* The partitioning column used for this determination shall be prepared according to the following directions:

(a) 42.5 g of celite are slurried with about 200 ml of methanol in a 4-inch evaporating dish.
(b) 7.5 g of THEED are dissolved in sufficient methanol in a 250–ml beaker and added to the celite slurry.
(c) The methanol is evaporated from the slurry on a steam bath and the THEED on celite is heated at 100 ± 2°C(212 ± 4°F) in a vacuum oven for one hour.
(d) After the THEED on celite has cooled to room temperature it is resieved through 30 and 60 mesh screens and that portion retained which passes the 30 mesh and is retained on the 60 mesh screen.
(e) The column packing is slowly poured into a 6-foot length of ¼ inch O. D. copper tubing which has been closed at one end with a sintered metal plug. The tubing is tapped continuously while being filled to insure uniform packing and then closed at the other end with a second metal plug.
(f) The copper tubing is then coiled to a 2½ inch O. D. coil (this is accomplished by wrapping it around a lecture gas bottle or similar object) with about 6 inches at each end of the tubing left straight.

4.4.3.3 *Preparation of standards.* Samples of MAF–1 to be used as standards for preparing the working curve (4.4.3.5) are prepared as follows:

(a) Two 10–ml stoppered volumetric flasks are cleaned, dried and tared to the nearest 0.2 mg.
(b) To these flasks are added, by means of a hypodermic syringe and needle, approximately 20-25 mg $H_2O$ and 40–50 mg $H_2O$ respectively, accurately weighed.
(c) About 6 g of MAF–1 are pipetted into each flask containing the $H_2O$, and accurately weighed. About 6 g of MAF–1 are pipetted into a third, clean, dry flask. These operations should be carried out as rapidly as possible and preferably in a low humidity atmosphere to prevent the MAF–1 from absorbing moisture.
(d) The MAF–1 used to prepare these standards should be one that contains less than 0.5 percent $H_2O$. This can be ascertained by running any available MAF–1 samples on the chromatograph (as subsequently described) and estimating from the $H_2O$ peak height approximately how much $H_2O$ is present. (One division peak height is approximately equal to 0.07 percent $H_2O$.) The exact amount of $H_2O$ present need not be known.
(e) The percentage of $H_2O$ added to each standard is calculated by dividing the weight of $H_2O$ added plus the weight of MAF–1 added into the weight of $H_2O$ added and multiplying by 100.
(f) These 3 MAF–1 standards contain-

ing accurately known percentages of $H_2O$ added (0.00, about 0.4 and about 0.8 percent) must be stored in a desiccator until ready to be used but should be used as soon as possible.

4.4.3.4 *Analysis of sample.*

(a) Install the column in the instrument and ready the instrument for operation including the liquid micro-dipper sample introduction system as described in the instruction manual [1] using helium as the carrier gas at a flow rate of 60 ml/minute and a column temperature of 90°C with 8 volts across the bridge.

(b) When a straight line is obtained on the recorder chart at the highest sensitivity setting, samples may be introduced into the column for analysis.

(c) Adjust the pen on the recorder to zero on the chart at recorder range setting of 1 and then set recorder range to 64.

[1] The following document applies when using the Perkin-Elmer Model 154–C Vapor Fractometer. The analogous manual applies when using an equivalent instrument.

Perkin-Elmer Instruction Manual for Model 154–C Vapor Fractometer, No. 990–9017 with supplementary instructions for the Micro-Dipper Sample Introduction System, No. 990–9032.

(d) Fill the No. 6, 0.02 ml micro-pipet with an MAF–1 sample and inject it into the instrument as described in the instruction manual.

(e) After the acetonitrile and unsymmetrical dimethylhydrazine have emerged from the column and the base line is straight on the chart, the recorder range is set at 2 to obtain the $H_2O$ peak (Figure 1).

(f) After the $H_2O$ has emerged and the base line is again straight the next sample may be introduced. The DETA is retained on the column.

(g) All samples and standards are run in a similar manner. Duplicates are not necessary unless it is suspected that quantitative transfer was not effected as judged by the relative peak heights of the acetonitrile and UDMH in different samples.

4.4.3.5 *Preparation of working curve and calculations.*

(a) A plot is prepared of percent $H_2O$ added in the standards as abscissa versus peak height read off the chromatogram to the nearest tenth of a division as ordinate.

(b) The straight line of best fit is drawn through the points and extrapolated back to zero peak height.

(c) The reading on the abscissa (read in the negative direction) at the point where the line crosses the abscissa at zero peak height is the percentage of $H_2O$ originally present in the MAF–1 sample used to prepare the standards (Figure 2).

(d) The $H_2O$ peak height is read off the chromatogram for each sample and from this value the percentage of $H_2O$ in the sample is obtained from the working curve by reading the $H_2O$ added that corresponds to that peak height and adding to it the value for the percentage of $H_2O$ originally present in the sample used to prepare the standard.

**Notes.**

1. Each time samples are to be analyzed fresh standards should be prepared. However, if great care is taken to insure that the standards do not pick up $H_2O$ (by opening flasks only for a short time when filling the pipet, tightly stoppering the flasks and storing in a very dry atmosphere) it is often possible to use the same standards 2 or 3 times. The line on the working curve must not change appreciably.

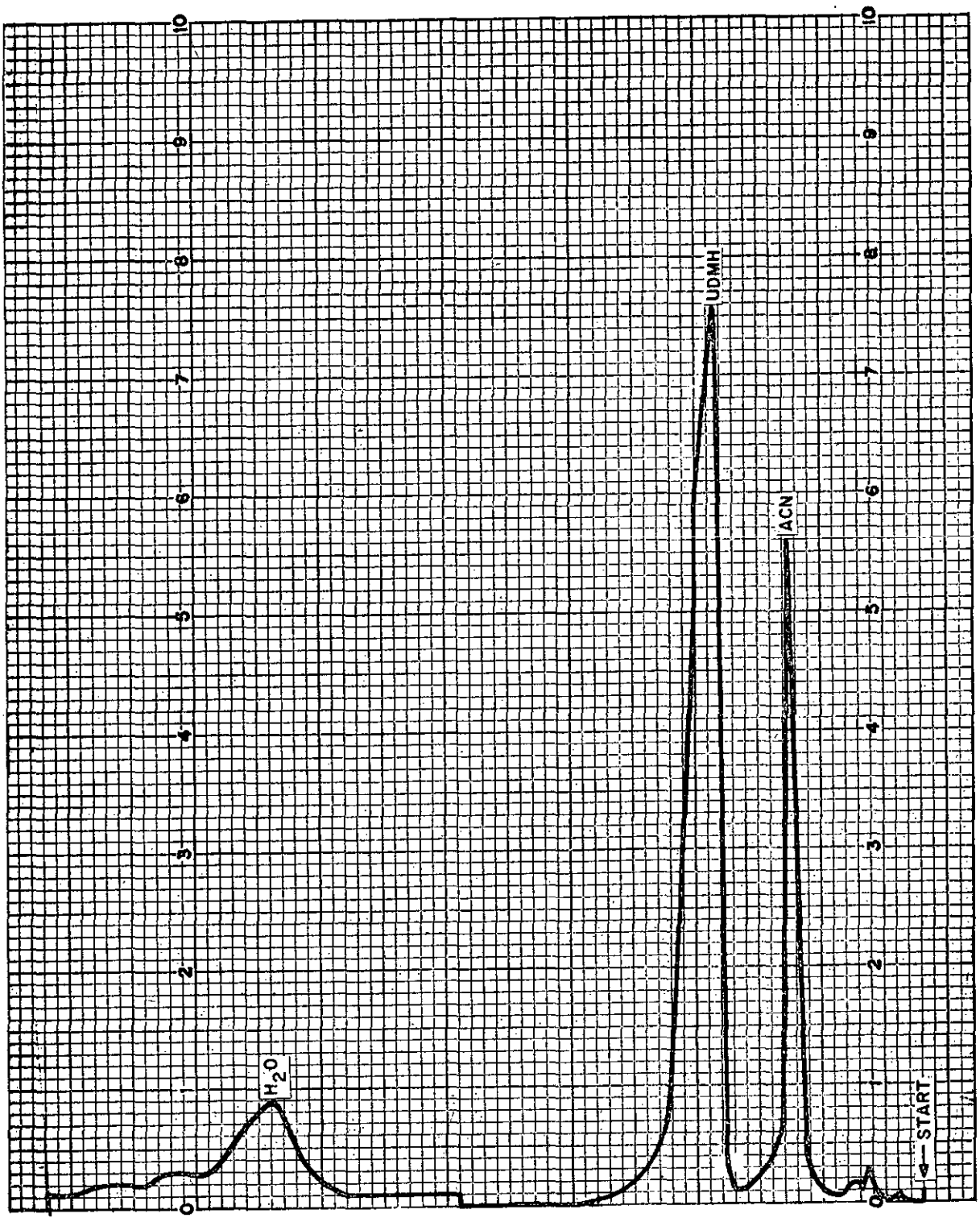


FIGURE 1. *Typical Chromatogram Pattern of MAF–1 Sample*

2. The THEED column will last for at least several months even with frequent use. However, it will be noticed that the retention time for UDMH component will decrease with usage.
3. The precision of the method has been studied statistically and determined to be ± 0.02 percent $H_2O$ in the 0.0 to 1 percent range for the 95 percent confidence limit. The accuracy is estimated to be of the same order of magnitude. On this basis results may be reported to the nearest hundredth of a percent.

# 4.4.4 *Alternate Procedure—Water and Acetonitrile in MAF–1.* Examination of the typical chromatogram shown in Figure 1 shows that both ACN and $H_2O$ can be determined by a single determination.

4.4.4.1 *Reagents and equipment*—as given in 4.4.3.1.

4.4.4.2 *Preparation of column*—as given in 4.4.3.2.

4.4.4.3 *Preparation of standards*—as given in 4.4.2.3.2 and 4.4.3.3.

4.4.4.4 *Analysis of standards and samples*—as given in 4.4.3.4.

4.4.4.5 *Preparation of working curve and calculations*—as given in 4.4.3.5 for the water determination; for acetonitrile proceed as follows:

(a) Prepare a plot of percentage ACN in the standards versus the peak height read to the nearest tenth of a division from the chromatogram.
(b) Measure the ACN peak height from the chromatogram obtained for the sample.
(c) The percentage ACN in the sample is obtained directly from the plot prepared in (a).

4.4.5 *Density*—The density of the MAF–1 propellant shall be determined in accordance with Method 402.2 of Standard FED–STD–791 (ASTM D941).

4.4.6 *Particulate.* The MAF–1 propellant sample shall be tested for solid particle contamination in a clean dust-free area in accordance with the following method. (see 6.3.1)

4.4.6.1 *Reagent preparation.* The complete filter apparatus shall be washed with detergent and water. Rinse the apparatus twice with warm, distilled water. Assemble the 47-mm filter apparatus using an 0.80 micron filter disc and connect to a vacuum system. Turn on the vacuum system and filter separately a desired volume of isopropyl alcohol, petroleum ether, and distilled water. Each reagent shall be filtered three times.

4.4.6.2 *Apparatus and bottle preparation.* Prior to each sample test all items of the filtration apparatus and sample bottle, including cap, shall be cleaned. Remove all sample tags from bottles and flasks. Wash with detergent and water. Rinse twice with warm, filtered distilled water. Rinse twice with filtered isopropyl alcohol and allow to dry thoroughly. Finally, rinse twice with the filtered petroleum ether and allow to dry thoroughly until the petroleum ether vapors completely disappear. Immediately cap the sample bottles after cleaning. Reassemble the filter apparatus.

# 4.4.6.3 *Procedure.* Weigh one 10-micron solvent-resistant filter disc to the nearest 0.1 mg. Using forceps, place the filter disc in a covered petri dish and identify suitably. Using an additional filter disc, repeat the above procedure and set aside as the control filter. Using forceps, remove the identified tared filter disc from the petri dish and place on the filter holder base. Clamp the filter holder funnel to the base. Thoroughly agitate the sample for tests and collect a 500 ± 5 ml sample of MAF–1 propellant in the cleaned sample bottle. Using vacuum, filter the entire contents of the sample bottle by pouring into the filter funnel in approximately 250–ml portions. Rinse the sample bottle with filtered distilled water. Thoroughly rinse the sides of the filter funnel and the filter disc by pouring the sample bottle rinsing into the funnel. Disconnect

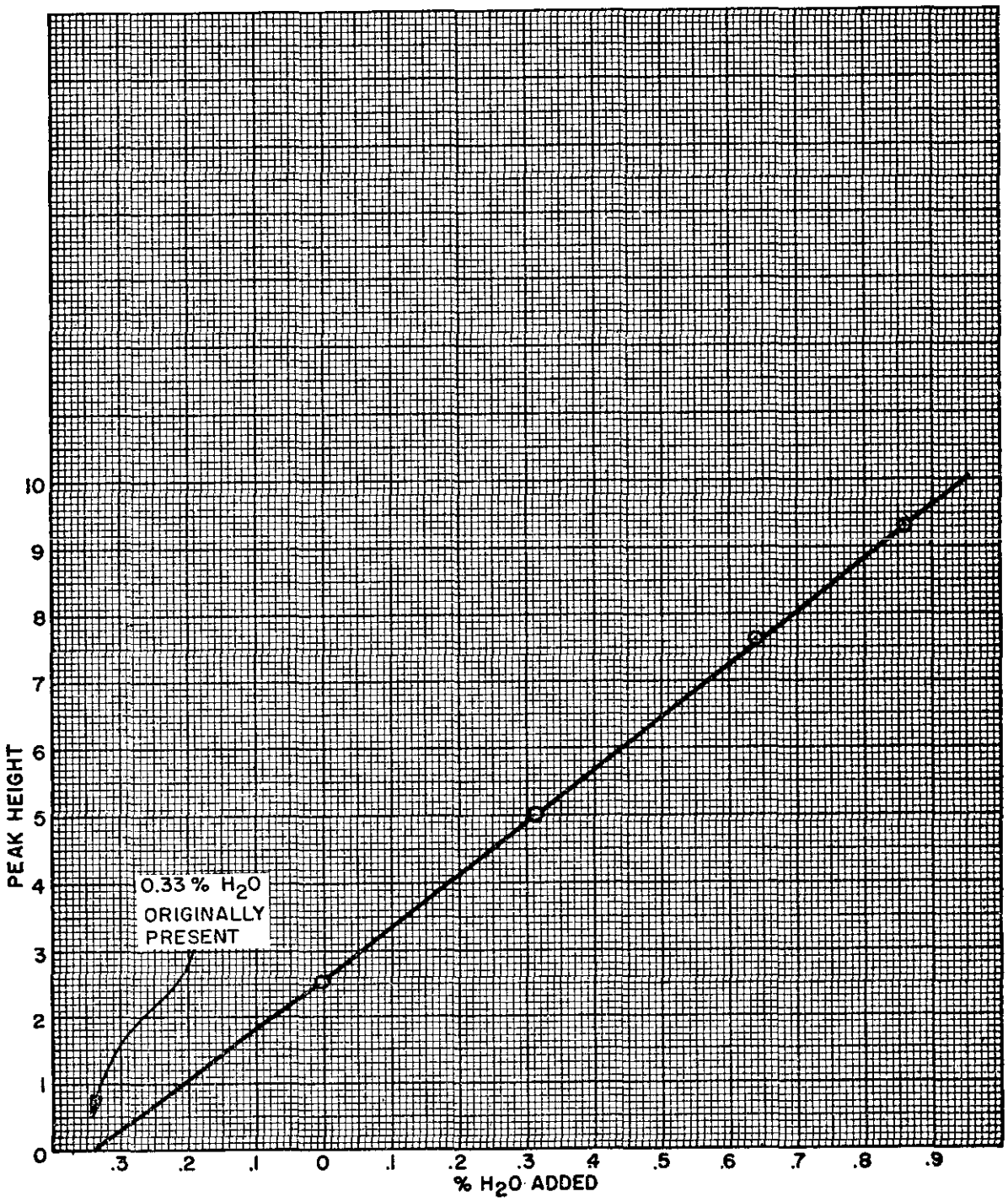


FIGURE 2. *Typical Calibration Curve for Water Analysis*

the funnel from the base and rinse the filter disc surface carefully with a jet of filtered distilled water to accumulate residue toward the center of the disc while vacuum continues. Release vacuum. Using forceps, immediately place the filter disc in the covered petri dish. In at least one filtration process of each group of samples to be tested, a control filter disc shall be placed on the filter funnel holder directly below but apart from the test filter disc. Weight increase greater than 0.2 mg of the control filter disc indicates inadequate flushing of sample residue and shall not be permitted. When a control filter disc is used during filtration, immediately place the disc in an additional covered petri dish. Place the dish(es) in a vacuum oven at approximately 158° F (70° C) for 30 minutes. Remove the dish(es) from the oven and allow to cool to ambient temperature. Reweigh the filter disc(s) to the nearest 0.1 mg and record. By difference, obtain the increase weight of the test filter disc. By difference, determine gain or loss in tare weight of the control filter disc. Apply the weight change of the control filter disc as a correction factor for each test result. Calculate particulate using the following formula:

Particulate, mg/L = (Corrected weight of residue in milligrams) × 2.

4.4.6.4 *Reagents and equipment.* The following reagents and equipment shall apply as test conditions:

(a) Petroleum ether: boiling point 86—140° F (30–60° C), ACS reagent grade
(b) Isopropyl alcohol: ACS reagent grade
(c) Water: double distilled or deionized
(d) Apparatus: filter, complete with fritted glass base, 300–ml glass funnel and holding clamp to hold a 47–mm membrane filter disc
(e) Pump: vacuum (or aspirator), capable of pulling 85 percent of the ambient pressure
(f) Bottle: sample, small mouth, 1 liter, permanently marked, with polyethylene lined cap
(g) Bottle: wash, 3 required
(h) Flask: filter, 1 liter, with neoprene stopper
(i) Disc: filter, membrane, 0.80 micron, 47–mm diameter
(j) Disc: filter, polyethylene membrane, solvent resistant, plain, white, 10 ± 3.0 microns, 47–mm diameter
(k) Dish: petri, glass with cover, 2 required
(l) Balance; analytical, ± 0.05 mg sensitivity, 0.1 mg accuracy
(m) Oven: vacuum, capable of maintaining approximately 158° F (70° C) and pulling 85 percent of the ambient pressure.

## 5. PREPARATION FOR DELIVERY

# **5.1 Preservation and packaging.** Unless otherwise specified, the MAF–1 propellant shall be packaged in ICC 17C mild steel or ICC 5, 5A, or 5C Type 304 or 307 stainless steel drums, tank trucks, and tank cars conforming to Interstate Commerce Commission regulations as contained in the Code of Federal Regulations 49 CFR 71–90. The space above the liquid level shall be filled with contractor-furnished dry nitrogen gas conforming to Specification MIL–P–27401 at atmospheric pressure for drums and 5–10 psig for tank trucks or tank cars. The contractor shall assure that gaskets which shall be made of teflon or other material approved by the procuring activity are serviceable and shall furnish new gaskets when necessary. The contractor shall perform the usual inspection and cleaning to assure that all containers are free from contamination, and are suitable for shipment and storage.

**5.2 Marking.** In addition to any special marking required by the contract or order, containers shall be marked in accordance with Standards MIL–STD–129 and MIL–STD–172 including lot, batch or control number. The nomenclature shall be as follows: PROPELLANT, MIXED AMINE FUEL–1.

5.2.1 *Labeling.* Each drum shall be labeled with a dangerous article caution label re-

quired by regulations or statutes without exception. The label shall contain the following information in red letters:

WARNING! HAZARDOUS LIQUID AND VAPOR FLAMMABLE.
Do not breathe vapor.
Do not get in eyes, on skin or clothing.
Use with adequate ventilation.
Keep away from heat, sparks, and open flame.
Keep container closed.
In case of contact, immediately flush skin or eyes with plenty of water for 15 minutes; for eyes, obtain medical attention.

## 6. NOTES

**6.1 Intended use.** The MAF–1 propellant covered by this specification is intended for use as a fuel in rocket engines.

**6.2 Ordering data.** Procurement documents should specify the following:

(a) Title, number, and date of this specification
(b) Method of shipment, type and capacity of containers
(c) Quantity by weight in pounds (avoirdupois)

**6.3 Definitions.**

6.3.1 *Particulate.* Particulate is defined as the undissolved solids retained on a 10-micron filter paper.

6.3.2 *Batch.* A batch is defined as the end product of all the raw materials mixed or blended in a unit operation.

**6.4 Flammability.** MAF–1 has a flash point of 0° C(32° F). No smoking or open flames shall be permitted in the vicinity where this propellant is being handled.

# **6.5 Changes from previous issue.** The outside margins of this document have been marked "#" to indicate where changes (deletions, additions, etc.) from the previous issue have been made. This has been done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written irrespective of the marginal notations and relationship to the last previous issue.

# Custodians:
Army—MI
Navy—WP
Air Force—12
Review Interest:
Army—MI
Navy—WP
Air Force—12

Preparing activity:
Navy—WP
(Project No. 9135–0006)

Review/user information is current as of the date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current DODISS.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1964—751056/T-29