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MILITARY STANDARD
QUALITY CONTROL OF LIQUID MISSILE
PROPELLANTS
AT
CONTROL STORAGE POINTS



AMSC N/A

FSC 9135

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FOREWORD

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: San Antonio ALC/SFRM, Kelly AFB TX 78241-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1. SCOPE

1.1 GENERAL. This military standard provides minimum guidance for quality control of liquid missile propellants at contractor's control storage points which store propellants owned by SA-ALC/SF, Kelly AFB TX, under the Fuels Division, Air Force Stock Fund for AF, other DOD agencies, NASA, Department of Energy (DOE). It also provides general information on handling, storage and safety. Unless otherwise specified, this standard does not apply to control storage facilities located on Air Force Bases.

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, Standards, and Handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this standard to the extent specified herein. (See 2.4.1)

MILITARY SPECIFICATIONS

MIL-P-7254	Propellant, Nitric Acid (IRFNA)
MIL-P-16005	Propellant, Hydrogen Peroxide (H ₂ O ₂)
MIL-P-25508	Propellant, Oxygen (LOX)
MIL-P-25576	Propellant, Kerosene (RP-1)
MIL-P-25604	Propellant, Uns-Dimethylhydrazine (UDMH)
MIL-P-26536	Propellant, Hydrazine (AH)
MIL-P-27201	Propellant, Hydrogen (H ₂)
MIL-P-27401	Propellant, Pressurizing Agent, Nitrogen (N ₂)
MIL-P-27402	Propellant, Hydrazine-Unsymmetrical Dimethylhydrazine (50 percent N ₂ H ₄ - 50 percent UDMH)(N ₂ H ₄ /UDMH mix)
MIL-P-27404	Propellant, Monomethylhydrazine (MMH)
MIL-P-27405	Propellant, Fluorine (F ₂)
MIL-P-27407	Propellant, Pressurizing Agent, Helium (He)
MIL-P-27408	Propellant, Mixed Oxides of Nitrogen (MON-10)
MIL-P-27415	Propellant, Pressurizing Agent, Argon (Ar)
MIL-S-27626	Sampler, Liquid Oxygen TTU-131/E
MIL-P-87896	Propellant, Nitrogen Trifluoride (NF ₃)
MIL-P-87897	Propellant, Deuterium (D ₂)
MIL-P-87930	Propellant, Hydrazine - Water (70% Hydrazine -30% Water) (H-70)
MIL-P-87931	Propellant, Isopropyl Alcohol (IPA)
MIL-P-87932	Propellant, Neon, Liquid (Ne)

MILITARY STANDARDS

MIL-STD-101	Color Code for Pipelines and for Compressed Gas Cylinders
MIL-STD-129	Marking for Shipment and Storage

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MIL-STD-172 Color Code for Containers of Liquid
Propellants

2.1.2 Other Government Documents, Drawings, and Publications. The following other Government documents, drawings, and publications form a part of this standard to the extent specified herein. (See 2.4.2)

DOD 4145.26M DOD Contractor's Safety Manual for
Ammunition,
Explosives, and Related Dangerous Material

AFR 127-100 Explosive Safety Manual

AFM 91-13 Maintenance of Permanently Installed Storage
and Dispensing Systems for Unconventional
Fuels

AFM 161-30 Vol II Liquid Propellants

49 CFR Code of Federal Regulations Parts 100-199

2.2 Non-Government Publications. The following documents form a part of this standard to the extent specified herein. The issues of the documents which are indicated as DOD adopted shall be the issue listed in the issue of DODISS specified in the solicitation. The issues of documents which have not been adopted shall be those in effect on the date of the cited DODISS. (See 2.4.3)

NATIONAL AEROSPACE STANDARD

NAS 3620 Propellant, Nitrogen Tetroxide (N2O4)

2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless specific exemption has been obtained.

2.4 Source of Documents.

2.4.1 Government specifications and standards. Copies of the referenced military specifications and standards are available from the Department of Defense single stock point, Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099. For specific acquisition functions, these documents should be obtained from the contracting activity or as directed by the contracting activity.

2.4.2 Other Government documents. Copies of other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity. The documents listed may be obtained from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

2.4.3 Source of Non-Government publication. Non-Government documents are generally available from reference libraries and technical groups. The document listed may be obtained as follows:

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NAS: Applications for copies should be addressed to the National Standards Association, Inc., 5161 River Road, Bethesda, Maryland 20816.

3. DEFINITIONS

3.1 Missile Propellant. For the purpose of this standard, missile propellants are items included in the missile fuels management category of the Fuels Division, Air Force Stock Fund. It includes propellants, oxidizers pressurants and related items.

3.2 Control Storage Point. Those contractors (AF, DOE, NASA) or DOE or NASA operating sites which require stock fund owned missile fuels and/or related items where there are multiple users of product which have been identified and reported to San Antonio ALC under missile fuels management category procedures. The product at the control storage point may be stored in bulk storage tanks, tank cars, trailers, cylinders or drums. Designation as a controlled storage point requires approval and authorization by San Antonio ALC.

3.3 Point of Sale. Point of Sale is interpreted to mean the point at which the product is transferred from the control storage point container to the individual end user container or system.

4. GENERAL REQUIREMENTS

4.1 Purpose. This standard provides information and guidance instructions for establishing and maintaining quality of missile propellant in storage at control storage points.

4.2 Receipt of Propellant.

4.2.1 Shipments of propellant received from supplies that are accompanied by test reports that show evidence of government inspection and acceptance at the supplier's facility need not be tested prior to unloading into site storage unless conditions as stated in paragraphs 4.2.2 and 4.2.3 exist.

4.2.2 Transport container contents shall be sampled and tested before unloading into site storage when evidence of possible contamination of the product en route exists, such as a broken seal or the absence of a seal or when excess propellant is being transferred from another governmental agency and the sampling and testing are not performed on transport containers prior to shipment.

4.2.3 Transport container contents shall be resampled and retested before unloading into site storage when requested by the activity having cognizance over the contractor.

4.3 Procurement and Use Limits for Propellants.

4.3.1 Procurement Limits. The procurement (Purchase) limits for the chemical composition and physical properties that each propellant must meet are defined in the applicable specification or contract.

4.3.1.1 These specifications established a high quality level which permits

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some deterioration to occur before the propellant becomes unusable.

4.3.2 Use Limits. Use limits are a second level of quality.

4.3.2.1 Use limits represent the minimum quality level of propellant required to provide satisfactory performance in all equipment of a specific system.

4.4 Propellant Testing Requirements.

4.4.1 Each batch of stored propellant will be sampled for testing in accordance with the frequency established in this standard.

4.4.2 Samples shall be drawn, identified, packaged, and shipped in strict accordance with written procedures. (See para 5.2, 5.2.4, and 5.2.5)

4.4.3 Particular care will be taken to insure that all sampling equipment and sample containers are clean and entirely suitable for the particular propellant.

4.5 Laboratories for Testing Propellants.

4.5.1 The contractor's laboratory will be used for the required analysis of all propellants.

4.5.2 If the contractor does not have a laboratory or the laboratory is not equipped for the analysis, the Energy Management Laboratory at Vandenberg AFB or Cape Canaveral AFS shall be used. These laboratories do not have the equipment to analyze F2 or NF3.

Shipping Address:

FB4610
Energy Management Laboratory
Operating Location San Antonio ALC/SFTLE
Bldg 7422
Vandenberg AFB CA 93437

FB2829
OL-FR/SA-ALC/SFTLH
Hanger S, North Annex
Cape Canaveral AF Station
Patrick AFB FL 32925

4.5.3 RP-1 Kerosene samples will be sent to:

FB2300
Transportation Officer
Wright-Patterson AFB OH 45433
ATTN: SFTLA, Bldg 70, Area B

FH1001
Det 20, SA-ALC/SFTLB
Searsport Maine 04974

Energy Management Laboratory/SFTLC

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Bldg 1121 MacDill AFB FL 33608

FH1002

Det 35 SA-ALC/SFTLD

DFSC Terminal-Bldg 1

Mukilteo WA 98275

4.6 Test Reports. The laboratory will complete test report forms for individual sample. The laboratory will retain one copy for its files, send one copy to the submitting activity, and provide additional copies to other activities as requested.

4.7 Use of Test Data. Test data shall be used as follows:

4.7.1 To determine if propellant is usable.

4.7.2 To predict further storage life.

4.7.3 To determine what action should be taken with respect to deteriorated propellants.

5. DETAILED REQUIREMENTS

5.1 Inspection.

5.1.1 Monthly Inspection.

5.1.1.1 Filled drums and cylinders of liquid propellants in storage will be inspected visually for exterior condition appearance at least once each month.

5.1.1.1.1 Drums or cylinders showing signs of leaking other than around the bung or valve outlet will have their contents transferred to a replacement drum or cylinder.

5.1.1.1.2 Drums with bung leaks that cannot be fixed by tightening the bung or replacing the gasket will have contents transferred or contact SA-ALC/SFS/SFT for disposition instructions.

5.1.1.1.3 Cylinders with leaking valves that cannot be fixed will have contents transferred or the cylinder will be emptied and the product disposed of in a appropriate manner.

5.1.1.1.4 Bulk storage tanks, trailers/tank cars, associated lines and equipment will be visually inspected every month for leaks. If a leak is observed and cannot be repaired, the propellant will be promptly transferred to another clean container suitable for the product.

5.1.2 Propellant Sampling Frequencies. Samples shall be taken as follows:

5.1.2.1 Bulk Storage.

5.1.2.1.1 Liquid/gaseous nitrogen, liquid/gaseous helium, liquid/gaseous hydrogen, liquid/gaseous oxygen, liquid/gaseous argon, and liquid neon.

a. At three month intervals.

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b. Immediately after filling when storage tank/tubebank was previously empty or opened for maintenance/inspection.

c. When contamination is suspected.

5.1.2.1.2 IRFNA, H₂O₂, UDMH, AH, N₂H₄/UDMH Mix, MMH, N₂O₄, H-70, IPA, RP-1, NF₃, D₂ and MON-10.

a. At six month intervals.

b. Immediately after filling when storage tank was previously empty or opened for maintenance/inspection.

c. When contamination is suspected.

5.1.2.2 Tank Trucks/Trailers/Tank Cars/Tubebank Trailers.

5.1.2.2.1 Liquid/gaseous nitrogen, liquid/gaseous helium, liquid/gaseous hydrogen, liquid/gaseous oxygen, liquid/gaseous argon, and liquid neon.

a. Every three months when tank trucks/trailers/tank cars/tubebank trailers are used for propellant storage.

b. Immediately after loading tank trucks/trailers/tank cars.

If the applicable specification contains a continuous service paragraph then the trailer/tank car may be sampled IAW the continuous service paragraph if the criteria of continuous service is met.

c. When contamination is suspected.

5.1.2.2.2 IRFNA, H₂O₂, UDMH, AH, N₂H₄/UDMH Mix, MMH N₂O₄, H-70, IPA, RP-1, NF₃, D₂ and MON-10.

a. At six month intervals when tank trucks/trailers/tank cars are used for propellant storage.

b. Immediately after loading trailer/tank car.

c. When contamination is suspected.

5.1.2.3 Drums/Cylinders.

a. From one drum/cylinder of each manufacturer's batch prior to use.

b. When contamination is suspected.

c. Sample each previously opened drum/cylinder which has been returned to control storage prior to reissuing.

d. Sample the contents of any drum/cylinder immediately after filling.

5.1.2.3.1 Some propellants require a nitrogen or inert gas blanket because the propellants will react with air and the atmospheric moisture. Therefore,

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sealed drums of propellant should not be opened for only sampling and testing.

5.2 Sampling.

5.2.1 Precautions in Sampling.

5.2.1.1 Sampling is the most important operation in the analysis of a propellant. The best analysis can be completely invalidated by poor sampling techniques. Therefore, caution must be exercised in taking the sample so that it will represent the composition of the sampled container.

5.2.1.2 Precautions that must be observed while taking samples are:

- a. Use of proper safety equipment.
- b. Assure hands or gloves are clean.
- c. Assure sampling equipment and sampling containers are clean.
- d. Rinse sampling equipment and container with the product prior to taking the sample.
- e. Assure proper sampling equipment is being used.
- f. Assure precautions are taken to insure that the sample or storage containers are not contaminated.

5.2.1.3 Ideally, the product should be agitated prior to sampling. Complete agitation usually cannot be achieved due to the size of the containers and the safety problems encountered in handling of toxic propellant.

5.2.1.3.1 In some cases, the sample has to be taken by the best means available.

- a. Drums of propellants are normally sampled by using a thief, siphon, or pump.
- b. Most bulk containers have a sampling valve located in an area to provide a representative sample.

5.2.2 Method of Sampling.

5.2.2.1 The method of sampling, safety procedures and safety equipment to be used during sampling are subject to approval by the agency having cognizance of the contractor.

5.2.3 Sample Identification.

5.2.3.1 Each sample will be identified by means of a tag bearing the following information:

- a. Name and location of activity submitting the sample (including telephone number).
- b. Sample Number. Each sample will have a unique identifying number.

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- c. Name of Product.
- d. Specification Number.
- e. Batch/Lot Number (if sample was taken from the shipping container).
- f. Grade or Type.
- g. Quantity sample represents.
- i. Date sampled.
- j. Type of tests required, periodic or resample.

5.2.4 Sample Containers.

5.2.4.1 The sample container used for sampling the product shall be made from a material that will not react with or be decomposed by the propellant. Sample containers used by the Air Force for propellants and related chemicals are provided below:

a. UDMH, Hydrazine UDMH/Hydrazine Mix, or MMH. Screw cap bottle, Sargeant-Welch Co. Part No. S-8240D or E (or equivalent), equipped with screw cap, Part No. S-9611, (or equivalent). Conical cap liners of polyethylene, teflon, or Kel-F only will be used. A screw cap teflon bottle, Nalgene P/N 1600 with closure, or equivalent.

b. Fuming Nitric Acid. Screw cap teflon bottle, Nalgene P/N 1600 with closure, (or equivalent). Only teflon or Kel-F bottles will be used for Fuming Nitric Acid.

c. Gaseous Propellants, Nitrogen Tetroxide, and UDMH/Hydrazine Mix. Cylinder, Hoke Part No. 8HD1000 and valves, Hoke Part No. 2462-L84Y (or equivalent). Two valves are required. Gaseous Propellants (such as gaseous nitrogen) samples require one valve with a rupture disk.

d. Liquid Oxygen and Liquid Nitrogen. Liquid Oxygen Sampler, TTU-131/E, military specification MIL-S-27626 or 59672 P/N 600646.

e. RP-1. One gallon can epoxy phenolic lined with cap and seal DOT17C NSN 8110-00-128-6819.

5.2.5 Shipping of Samples.

5.2.5.1 Shipment of samples will be accordance with Department of Transportation (DOT) regulations governing the transportation of explosives and other dangerous articles by means of freight.

5.2.5.2 No more than one sample will be shipped in any one package.

5.2.5.3 No material other than specified packing will be included.

5.2.5.4 Shipping containers may be fabricated locally.

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5.2.5.5 Information required in this standard will be placed in a waterproof envelope and securely fastened to the outside of the shipping box.

5.3 Health Hazards, Safety Procedures, and Fire Prevention.

5.3.1 For specific instruction on Health Hazards, Safety Procedures, and Fire Prevention, the propellant handler must refer to applicable regulations. A comprehensive listing of applicable regulation is beyond the scope of this document. Safety practice standards shall meet the requirements of DOD 4145.26M "DOD contractor's Safety Manual for Ammunition, Explosives and Related Dangerous Material." Additional guidance may be found in the OSHA standards, NFPA pamphlets, and AFM 161-30, (Vol II), "Chemical Rocket/Propellant Hazards, Liquid Propellants."

5.3.2 The following are general comments to alert the propellant handler on the potential hazards in handling propellants.

5.3.2.1 The prevention of injury from exposure to toxic materials requires a coordinated application of engineering control procedures, utilization of personal protective measures, and medical surveillance over the personnel engaged in work in which exposures may occur.

5.3.2.2 Supervisors are responsible for the implementation of the prescribed precautionary measures as outlined in the applicable documents and as may be locally developed by Medical Service and Safety personnel.

5.3.2.3 All work involving the use of the liquid rocket propellants must be done under the direction of personnel thoroughly familiar with these materials, and the precautionary procedures and emergency measures required for their handling.

5.3.2.4 Fuels should be separated from oxidizers at all times during storing and handling operations.

5.3.2.5 Oxidizers are not combustible but can cause spontaneous ignition in contact with combustible materials.

5.3.2.6 Smoking or open flames are prohibited in areas where fuels or oxidizers are stored or handled.

5.3.2.7 Food and cigarettes should not be carried in the storage or handling areas because of the likelihood of contaminating these items with toxic chemicals.

5.3.2.8 Matches or lighters will not be taken into storage areas or into areas where materials are being handled.

5.3.3 Special Handling Requirement.

a. Whenever it is necessary to transfer fuels or oxidizers to other containers, care shall be exercised to assure that the receiving container is specifically suited to that material.

b. No fuel will be transferred inside the storage building. This

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work will be performed on the transfer platform.

c. Drums will be handled carefully to avoid spillage and damage. Manhandling of drums will be kept to an absolute minimum.

d. The exteriors of contaminated drums will be cleaned and decontaminated as soon as practicable.

e. Drums will be protected from prolonged periods of direct sunlight.

f. When handling fuels, all equipment must be grounded and bonded to prevent accumulation of static charges.

g. Good housekeeping of the storage area will be practiced at all times.

h. Buildings and grounds will be kept free of all debris, weeds, grass, and other vegetation.

i. Spillage and leakage will be promptly cleaned up and decontaminated.

j. Drums will be kept orderly at all times.

5.3.4 Toxicity and Potential Health Hazards.

5.3.4.1 Adequate precautions must be taken to assure that the rocket or missile propellants do not enter the human system through the lungs, skin, or mouth.

5.4 Bulk and Drum/Cylinder Storage of Liquid Propellants.

5.4.1 Storing Operations.

5.4.1.1 Fuels and oxidizers will be stored only in their own facilities and no unauthorized fuel or oxidizer will be transported into these facilities.

a. Compatibility tables are provided in AFM 91-13.

b. Quantity distance storage criteria is contained in AFM 127-100.

c. Drums will be stored with bungs up and are kept tightly sealed at all times. Unless otherwise approved by SA-ALC/SFTT, Kelly AFB TX 78241-5000, all drums will be stored in such a manner that any container can be inspected or removed without moving more than one other container.

d. Fuels and oxidizers will be stored in separate areas.

e. All storage areas will be maintained in a clean and orderly condition at all times.

f. Drums of hydrazine, UDMH, MMH and other hydrazine-based propellants must have a nitrogen atmosphere above the propellant.

5.4.2 Operations Permitted.

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5.4.2.1 No operations will be permitted in storage area except such operations incidental to storage as:

- a. Receipt of propellant at storage.
- b. Transfer of propellant to servicing trailers or replacement drums/cylinders.
- c. Sampling of propellants.
- d. Removal of propellants from storage.
- e. Cleaning of area for safe conditions.
- g. Decontamination of transporting vehicles.
- h. Handling equipment and field servicing trailers.

5.4.3 Drum Markings.

5.4.3.1 Care will be taken to prevent mutilation of markings and labels on containers.

5.4.3.2 Inspections will be made to see that markings are intact whenever propellants are received, stored, issued or transferred in order to avoid the danger of using the improper propellant.

5.4.3.3 If required, the drum will be remarked. Information on marking is contained in the product specification, MIL-STD-101, MIL-STD-129, and MIL-STD-172.

5.5 Propellant Testing.

5.5.1 General.

5.5.1.1 Each propellant sample will be analyzed in accordance with the methods in the applicable specification.

5.5.1.2 Each propellant shall meet the requirements of the applicable specification.

5.6 Special Requirement.

5.6.1 Once a propellant has been transferred from the controlled storage tank or transport vessel and is recorded as a sale (Ref Para 3.3) it becomes the property of the individual end user or identified program. Any quantity of this propellant that cannot be immediately consumed may be considered for return to the controlled storage tankage. Such returns must be scrupulously controlled by the controlled storage operator to assure the returned product meets specification and will not affect quality of product in the bulk storage containers to which returned. In this regard, a sample of the product shall be drawn from the transfer line and analyzed prior to return. Acceptance of propellant return will be confirmed by crediting the sale to the individual end user or program concerned.

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Custodian

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Review Activities

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NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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