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DEPARTMENT OF DEFENSE STANDARD PRACTICE

QUALITY ASSURANCE/SURVEILLANCE FOR FUELS, LUBRICANTS AND RELATED PRODUCTS

AMSC N/A **FSC 91GP**

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FOREWORD

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3. The tables in this Standard are numerous; therefore, they are located at the end of Section 6, preceding the Appendices and Index.
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1. SCOPE

1.1 Scope. This Standard provides DoD Policy, general instructions, and minimum procedures to be used by the Military Services and the Defense Logistics Agency in performing quality assurance/ surveillance functions of U. S. Government-owned fuels, lubricants, and related products worldwide at all locations except product procurement facilities which are covered by requirements contained in the contract. Requirements for procurement needs may be derived from this document as necessary. This Standard includes policy and responsibilities derived from Executive Agency (see 1.3 below) documents. The information contained herein is appropriate to quality assurance where applicable (e.g. direct delivery to customers, destination acceptance, etc.). This Standard also contains intra-Governmental receipt limits.

1.2 Applicability. Quality assurance (QA) is a planned and systematic pattern of all actions necessary to give confidence that adequate technical requirements are established; products and services conform to established technical requirements; and satisfactory performance is achieved. "For the Government, Contract Quality Assurance is a method to determine if supplier of product and/or services fulfilled its contract obligations pertaining to products and/or services provided. It includes all actions required to ensure the Government is receiving the proper products and/or services. By common usage, Petroleum Quality Assurance responsibility is fulfilled when the product and/or service are accepted by the Government and the product no longer belongs to the contractor or when the service is complete." Quality surveillance (QS), as used herein, is the aggregate of measures (blending, stock rotation, sampling, etc.) used to determine and maintain the quality of product receipts and Government-owned bulk petroleum products to the degree necessary to ensure that such products are suitable for their intended use. A vigilant quality surveillance program, implemented by properly trained personnel, is necessary to protect the original product quality and the interests of the Government. Policy and procedures discussed for QS on receiving Government-owned fuel apply to Military Service acceptance requirements for fuels purchased by DLA Energy under the Bulk and Direct Delivery program groups).

1.3 Executive Agency. Pursuant to the authority of the Secretary of Defense, DoD Directive 5101.8, DoD Executive Agent (DoD EA) for Bulk Petroleum, 11 August 2004, designates the Director, Defense Logistics Agency (DLA), as the DoD Executive Agent (EA) for Bulk Petroleum for the Department of Defense (DoD), with authority to re-delegate to the Defense Logistics Agency Energy.

1.3.1 Policy**.** The DoD EA for Bulk Petroleum will execute supply chain management for all Bulk Petroleum owned by the Department of Defense and be responsible for all Bulk Petroleum supply management (to include quality management). The DoD EA for Bulk fuels is responsible for coordination with Defense customers, other Federal Agencies, and friendly forces where the United States is the designated fuels Role Support Nation.

1.3.2 Responsibility. In conjunction with the other DoD Components, DLA Energy will develop standardized quality policy and procedures across the supply chain to reflect weapon systems requirements and maximize effectiveness and efficiency.

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this Standard. This section does not include documents cited in other sections of this Standard nor does it include those recommended as additional information or examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, and 5 of this Standard, whether they are listed or not.

2.2 Government Documents.

2.2.1 Specifications and Standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

INTERNATIONAL STANDARDIZATION AGREEMENTS

STANAG 1110	Allowable Deterioration Limits for NATO Armed Forces Fuels, Lubricants and Associated Products
STANAG 3149	Minimum Quality Surveillance of Fuels
STANAG 3390	Guide Specification and Inspection Standards for Fuel Soluble Lubricity Improvers
STANAG 3609	Standards for Maintenance of Fixed Aviation Fuel Receipt, Storage and Dispensing Systems
STANAG 4714	Minimum Quality Surveillance For Lubricants and Associated Products
STANAG 7036	Fuels to be Introduced Into and Delivered by the NATO Pipeline System (NPS)
STANAG 7090	Guide Specification for NATO Ground Fuels
STANAG 7093	Guide Specification for NATO Land Systems Automotive Fluids

FEDERAL SPECIFICATIONS

C-T-91	Tallow, Inedible
O-M-232	Methanol (Methyl Alcohol)
SS-G-659	Graphite, Dry (Lubricating)
TT-I-735	Isopropyl Alcohol
VV-C-846	Cutting Fluids: Emulsifiable Oils
VV-D-1078	Damping Fluid, Silicone Base (Dimethyl Polysiloxane)
VV-G-632	Grease, Industrial, General Purpose
VV-G-671	Grease, Graphite
VV-P-236	Petrolatum, Technical
VV-L-825	Lubricating Oil, Refrigerant Compressor, Uninhibited

FEDERAL STANDARDS

FED-STD-791	Testing Method of Lubricants, Liquid Fuels, and Related Products

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COMMERICAL ITEM DESCRIPTION

A-A-52530	Gasohol, Automotive, Unleaded
A-A-59113	Lubricating Oil, Machine Tool Sideways
A-A-59137	Lubricating Oil, Breech Block (for Naval Ordnance)
A-A-59173	Grease, Silicone
A-A-59290	Hydraulic Fluid, Arresting Gear
A-A-59354	Hydraulic Fluid, Petroleum Base, for Machine Tools
A-A-59004	Anti-Galling Compound, Thread Lubricating, Seizing Resistant, and Calcium Hydroxide Containing
A-A-50178	Wax, Machine Stitching
A-A-59255	Wax, Paraffin, Technical
A-A-50493	Oil, Penetrating (for Loosening Frozen Metallic Parts)
A-A-52624	Antifreeze, Multi Engine Type
A-A-58092	Tape, Antiseize, Polytetrafluorethylene
A-A-59197	Fatty Oil (for Metal-Working Lubricants)

DEPARTMENT OF DEFENSE SPECIFICATIONS

DOD-G-24508	Grease, High Performance, Multipurpose (Metric)
DOD-G-24650	Grease, Food Grade, Food Processing Equipment (Metric)
DOD-L-25681	Lubricant Molybdenum Disulfide, Silicone
DOD-L-81846	Lubricating Oil, Instrument, Ball Bearing, High Flash Point
DOD-PRF-24574	Lubricating Fluid for Low and High Pressure Oxidizing Gas Mixtures
DOD-PRF-85734	Lubricating Oil, Helicopter Transmission System, Synthetic Base
MIL-C-11796	Corrosion Preventive Compound, Petrolatum, Hot Application
MIL-DTL-4339	Corrosion Preventive, Soluble Oil for Water Injection Systems (NATO Code Number C-630)
MIL-DTL-5020	Liquid, Compass, Aircraft
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-16884	Fuel, Naval Distillate
MIL-DTL-17111	Fluid, Power Transmission
MIL-DTL-23549	Grease, General Purpose
MIL-DTL-25524	Turbine Fuel, Aviation Thermally Stable (JPTS)
MIL-DTL-46014	Lubricating Oil, Spindle
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34, NATO F-35, and JP-8+100 (NATO F-37)
MIL-DTL-85470	Inhibitor, Icing, Fuel System, High Flash NATO Code S-1745

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Check the source to verify that this is the current version before use.

MIL-G-21164	Grease, Molybdenum Disulfide, for Low and High Temperatures, NATO Code Number G-353
MIL-G-25013	Grease, Aircraft, Ball and Roller Bearing, NATO Code Number G-372, Metric
MIL-G-25537	Grease, Aircraft, Helicopter Oscillating Bearing, NATO Code Number G-366, Metric
MIL-G-81827	Grease, Aircraft, High Load Capacity, Wide Temperature Range
MIL-L-15719	Lubricating Grease (High-Temperature, Electric Motor, Ball and Roller Bearings)
MIL-L-19701	Lubricant, All-Weather, Semi-Fluid, for Aircraft Ordnance, Metric
MIL-L-23398	Lubricant, Solid Film, Air-Cured, Corrosion Inhibiting, NATO Code Number S-749
MIL-L-24131	Lubricant, Colloidal Graphite in Isopropanol
MIL-L-24478	Lubricant, Molybdenum Disulfide in Isopropanol
MIL-L-46000	Lubricant, Semi-Fluid (Automatic Weapons)
MIL-L-46150	Lubricant, Weapons, Semi-Fluid (High Load-Carrying Capacity)
MIL-L-87177	Lubricants, Water Displacing, Synthetic
MIL-H-19457	Hydraulic Fluid, Fire-Resistant, Non-Neurotoxic
MIL-H-22072	Hydraulic Fluid, Catapult, NATO Code Number H-579
MIL-H-81019	Hydraulic Fluid, Petroleum Base, Ultra-Low Temperature, Metric
MIL-PRF-2104	Lubricating Oil, Internal Combustion Engine Combat/ Tactical Service
MIL-PRF-3150	Lubrication Oil, Preservative, Medium
MIL-PRF-3572	Lubricant, Colloidal Graphite in Oil
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-PRF-6081	Lubricating Oil, Jet Engine
MIL-PRF-6083	Hydraulic Fluid, Petroleum Base, for Preservation and Operation
MIL-PRF-6085	Lubricating Oil: Instrument, Aircraft, Low Volatility
MIL-PRF-6086	Lubricating Oil, Gear, Petroleum Base, NATO O-153, O-155
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-7870	Lubricating Oil: General Purpose, Low Temperature, NATO O-142
MIL-PRF-8188	Corrosion-Preventive, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-9000	Lubrication Oil, Shipboard Internal Combustion Engine, High-Output Diesel
MIL-PRF-10924	Grease, Automotive and Artillery
MIL-PRF-12070	Fog Oil
MIL-PRF-14107	Lubricating Oil, Weapons, Low Temperature
MIL-PRF-16173	Corrosion Preventive Compound, Solvent Cutback, Cold-Application
MIL-PRF-17331	Lubricating Oil, Steam Turbine and Gear, Moderate Service
MIL-PRF-17672	Hydraulic Fluid, Petroleum, Inhibited
MIL-PRF-18458	Grease, Wire Rope - Exposed Gear

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Check the source to verify that this is the current version before use.

MIL-PRF-21260	Lubricating Oil, Internal Combustion Engine, Preservative Break-in
MIL-PRF-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number O-156
MIL-PRF-23827	Grease, Aircraft and Instrument, Gear and Actuator Screw
MIL-PRF-24139	Grease, Multipurpose, Water Resistant
MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (NATO S-1747)
MIL-PRF-26087	Lubricating Oil, Reciprocating Compressor, Ground Support
MIL-PRF-27617	Grease, Aircraft and Instrument, Fuel and Oxidizer Resistant
MIL-PRF-32033	Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature)
MIL-PRF-46002	Preservative Oil, Contact and Volatile Corrosion-Inhibited
MIL-PRF-46010	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting NATO Code S-1738
MIL-PRF-46147	Lubricant, Solid Film, Air Cured, Corrosion Inhibiting
MIL-PRF-46170	Hydraulic Fluid, Rust Inhibited, Fire Resistant, Synthetic Hydrocarbon Base, NATO Code No. H-544
MIL-PRF-46176	Brake Fluid, Silicone, Automotive, All-Weather, Operational and Preservative
MIL-PRF-52308	Filter-Coalescer Element, Fluid Pressure
MIL-PRF-46167	Lubricating Oil, Internal Combustion Engine, Arctic
MIL-PRF-53074	Lubricating Oil, Steam-Cylinder, Mineral
MIL-PRF-63460	Lubricant, Cleaner and Preservative for Weapons and Weapons Systems
MIL-PRF-81329	Lubricant, Solid Film, Extreme Environment, NATO Code Number S-1737
MIL-PRF-81322	Grease, Aircraft, General Purpose, Wide Temperature Range, NATO Code G-395
MIL-PRF-83261	Grease, Aircraft, Extreme Pressure, Anti-Wear
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537
MIL-PRF-83363	Grease, Transmission, Helicopter, NATO G-396
MIL-PRF-85336	Lubricant, All-Weather, (Automatic Weapons)
MIL-PRF-87252	Coolant Fluid, Hydrolytically Stable, Dielectric
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile
MIL-T-17128	Transducer Fluid, Sonar
MIL-W-10885	Wax, Impregnating, Waterproofing, for Laminated Paper Tubes for Small Arms Ammunition
MIL-W-12598	Wax, Microcrystalline, Impregnating
MIL-W-13945	Wax, Hydrocarbon (for Ordnance Use)
MIL-W-20553	Wax, Desensitizing

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DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-161	Identification Methods for Bulk Petroleum Products Systems, Including Hydrocarbon Missile Fuels
MIL-STD-290	Packaging and Marking of Petroleum and Related Products
MIL-STD-1548	Into-Plane Servicing of Fuels at Commercial Airports

(Copies of these documents are available online at CAC-enabled site https://assistca.dla.mil/ or from non-CAC enabled ASSIST sites https://assist.dla.mil/ or http://assistdocs.com/ , by phoning the ASSIST Customer Service Desk, 215-697-6396, Mon-Fri, 0730 to 1600 EST, or by writing the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.2.2 Other Government Documents, Drawings and Publications. The following other Government documents, drawings and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DOD DIRECTIVES

DoD 4140.25	DoD Management Policy for Energy Commodities and Related Services
DOD Directive 5101.8	DoD Executive Agent (DoD EA) for Bulk Petroleum

DOD PUBLICATIONS

DODM 4140.25-M	DoD Management of Bulk Petroleum Products, Natural Gas, and Coal

(Copies of these documents are available online at http://www.dtic.mil/dtic/findit/dticatiz.html or from DLA Administrative Support Center, 8725 John J. Kingman Road, STE 0119, Fort Belvoir, VA 22060-6220)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AIR AND SPACE INTEROPERABILITY COUNCIL (ASIC)

AIR STD 15/04K	Allowable Deterioration Limits for Stored Fuels, Lubricants, and Associated Products

(Copies of this document are available online at http://www.dtic.mil/dtic/ or by writing Defense Technical Information Center 8725 John J. Kingman Road, Suite 0944, Fort Belvoir, VA 22060-6218)

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

ANSI/AGMA 9005	Industrial Gear Lubrication

(Copies of these documents are available online at http://www.agma.org/ from American Gear Manufacturers Association, 500 Montgomery Street, Suite 350, Alexandria, VA 22314)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQ Z1.4	Sampling Procedures and Tables for Inspection by Attributes

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ANSI/NCSL Z540.3	Requirements for the Calibration of Measuring and Test Equipment

(Copies of these documents are available online at http://www.ansi.org or from American National Standards Institute, 11 West 42nd Street, 13th floor, New York, N.Y. 10036)

AMERICAN PETROLEUM INSTITUTE (API)

API/IP MPMS	API Manual of Petroleum Measurement Standards

ENERGY INSTITUTE (EI)

EI 1581	Specifications and Qualifications Procedures for Aviation Jet Fuel Filter/Separators
EI 1583	Laboratory Tests and Minimum Performance Levels for Aviation Fuel Filter Monitors
EI 1590	Specifications and Qualification Procedures for Aviation Fuel Microfilters
HM 50	Hydrocarbon Management-Guideline for the cleaning of tanks and lines for marine tank vessels carrying petroleum and refined products
IP 170	Determination of Flash Point – Abel Closed Cup Method
IP 224	Determination of low lead content of light petroleum distillates by dithizone extraction and calorimetric determination

(Copies of these documents are available online at http://www.energyinstitute.org/ or from Energy Institute, 61 New Cavendish Street, London W1G 7AR, UK.)

ASTM INTERNATIONAL

ASTM Manual 5	Aviation Fuel Quality Control Procedures
ASTM Sec 05/Vol 05.05	Combustion Characteristics; Manufactured Carbon and Products, Catalysts
ASTM D56	Standard Test Method for Flash Point by Tag Closed Cup Tester (DoD adopted)
ASTM D86	Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure (DoD adopted)
ASTM D93	Standard Test Methods for Flash-Point by Pensky-Martens Closed Cup Tester (DoD adopted)
ASTM D130	Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test (DoD adapted)
ASTM D323	Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method) (DoD adopted)
ASTM D381	Standard Test Method for Gum Content in Fuels by Jet Evaporation (DoD adopted)
ASTM D482	Standard Test Method for Ash from Petroleum Products (DoD adopted)

Source: https://assist.dla.mil -- Downloaded: 2016-12-11T08:45Z
Check the source to verify that this is the current version before use.

ASTM D524	Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products (DoD adopted)
ASTM D613	Standard Test Method for Cetane Number of Diesel Fuel Oil (DoD adopted)
ASTM D664	Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration (DoD adopted)
ASTM D665	Standard Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water (DoD adopted)
ASTM D892	Standard Test Method for Foaming Characteristics of Lubrication Oils (DoD adopted)
ASTM D909	Standard Test Method for Supercharge Rating of Spark-Ignition Aviation Gasoline (DoD adopted)
ASTM D910	Standard Specification for Aviation Gasolines (DoD adopted)
ASTM D975	Standard Specification for Diesel Fuel Oils (DoD adopted)
ASTM D976	Standard Test Methods for Calculated Cetane Index of Distillate Fuels (DoD adopted)
ASTM D1094	Standard Test Method for Water Reaction of Aviation Fuels (DoD adopted)
ASTM D1298	Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (DoD Adopted)
ASTM D1364	Standard Test Method for Water in Volatile Solvents (Karl Fisher Reagent Titration Method) (DoD adopted)
ASTM D1500	Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale) (DoD adopted)
ASTM D1655	Standard Specification for Aviation Turbine Fuels (DoD adopted)
ASTM D1796	Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure) (DoD adopted)
ASTM D2274	Standard Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method) (DoD adopted)
ASTM D2276	Standard Test Method for Particulate Contaminant in Aviation Turbine Fuel by Line Sampling (DoD adopted)
ASTM D2624	Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels (DoD adopted)
ASTM D2699	Standard Test Method for Research Octane Number of Spark-Ignition Engine Fuel (DoD adopted)
ASTM D2700	Standard Test Method for Motor Octane Number of Spark-Ignition Engine Fuel (DoD adopted)

Source: https://assist.dla.mil -- Downloaded: 2016-12-11T08:45Z
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ASTM D2709	Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge (DoD adopted)
ASTM D3237	Standard Test Method for Lead in Gasoline by Atomic Absorption Spectroscopy (DoD adopted)
ASTM D3240	Standard Test Method for Undissolved Water in Aviation Turbine Fuels (DoD adopted)
ASTM D3241	Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels (DoD adopted)
ASTM D3487	Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus (DoD Adopted)
ASTM D3699	Standard Specification for Kerosine (DoD adopted)
ASTM D3703	Standard Test Method for Hydroperoxide Number of Aviation Turbine Fuels, Gasoline, and Diesel Fuels (DoD Adopted)
ASTM D3828	Standard Test Methods for Flash Point by Small Scale Closed Cup Tester (DoD adopted)
ASTM D3948	Standard Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer (DoD adopted)
ASTM D4052	Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter (DoD Adopted)
ASTM D4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products (DoD adopted)
ASTM D4176	Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures) (DoD adopted)
ASTM D4177	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products (DoD adopted)
ASTM D4306	Standard Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination (DoD adopted)
ASTM D4806	Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel (DoD adopted)
ASTM D4814	Standard Specification for Automotive Spark-Ignition Engine Fuel (DoD adopted)
ASTM D4815	Standard Test Method for Alcohol and C1 to C4 Alcohols in Gasoline by Gas Chromatography, Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl (DoD adopted)
ASTM D4953	Standard Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method) (DoD adopted)
ASTM D5001	Standard Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE)

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ASTM D5006	Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels (DoD adopted)
ASTM D5059	Standard Test Method for Lead in Gasoline by X-Ray Spectroscopy (DoD adopted)
ASTM D5190	Standard Test Method for Vapor Pressure of Petroleum Products (Automatic Method) (DoD adopted)
ASTM D5191	Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method) (DoD adopted)
ASTM D5304	Standard Test Method for Assessing Middle Distillate Fuel Storage Stability by Oxygen Overpressure (DoD adopted)
ASTM D5452	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration (DoD adopted)
ASTM D5599	Standard Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection
ASTM D5798	Standard Specification for Fuel Ethanol (Ed70-Ed85) for Automotive Spark-Ignition Engines
ASTM D5854	Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
ASTM D6078	Standard Test Method for Evaluating Lubricity of Diesel Fuels by the Scuffing Load Ball-on-Cylinder Evaluator (SLBOCLE)
ASTM D6079	Standard Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR)
ASTM D6217	Standard Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration
ASTM D6751	Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels
ASTM D7224	Standard Test Method for Determining Water Separation Characteristics of Kerosine-Type Aviation Turbine Fuels Containing Additives by Portable Separometer
ASTM D7371	Standard Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) Content in Diesel Fuel Oil Using Mid Infrared Spectroscopy (FTIR-ATR-PLS Method)
ASTM D7467	Standard Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)
ASTM D7547	Standard Specification for Unleaded Aviation Gasoline
ASTM D7688	Standard Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency reciprocating Rig (HFRR) by Visual Observation

(Copies of these documents are available online at http://www.astm.org or from ASTM International, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959)

EUROPEAN COMMITTEE FOR STANDARDIZATION

EN 228	Automotive fuels - Unleaded petrol - Requirements and test methods

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EN 590	Automotive fuels - Diesel - Requirements and test methods
EN 15751	Automotive fuels – Fatty acid methyl ester (FAME) fuel and Blends with diesel fuel- Determination of oxidation stability by accelerated oxidation method

(Copies of this document are available online at http://www.cen.eu/ or from CEN-CENENEC Management Centre, Avenue Marnix 17, B-1000 Brussels).

GOSUDARSTVENNYI STANDARTY (GOST), Euro-Asian Council of Standardization, Metrology, and Certification (EASC)

GOST 305-82	Diesel Fuel, Specifications, dated March 31, 1982
GOST 10227-86	Fuels for Jet Engines, Specifications, Revised March 1998, with Amendments Nos. 1,2 , 3 and 4

(Copies of these documents are available online at http://global.ihs.com/ or from Customer Service and Technical Support,15 Inverness Way East, Englewood CO 80112

UNITED KINGDOM MINISTRY OF DEFENCE – (UK MOD)

STANDARD 91-91	Turbine Fuel, Aviation Kerosene Type, Jet A1, NATO Code F-35, Joint Service Designation: AVTUR

(Copies of this document are available online at http://www.dstan.mod.uk/ or from the UK Defence Standardization Room 1138, Kentigern House, 65 Brown Street, Glasgow G2 8EX)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8217	Petroleum products – Fuels (class F) – Specifications for marine fuels
ISO 9001	Quality Management Systems Requirements

(Copies of these documents are available online at http://www.iso.org/iso/catalogue_ics or from the International Organization for Standardization (ISO) 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 77	Recommended Practice on Static Electricity

(Copies of this document are available online at http://www.nfpa.org or from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269-9101)

SAE INTERNATIONAL

SAE AMS 1424	Deicing/Anti-Icing Fluid, Aircraft SAE Type I
SAE AMS 1428	Fluid, Aircraft Deicing/Anti-icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV

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SAE AMS 2518	Thread Compound, Anti-Seize, Graphite-Petrolatum
SAE AMS-G-4343	Grease, Pneumatic System
SAE AMS-G-6032	Grease, Plug Valve, Gasoline and Oil Resistant, NATO Code Number G-363, Metric
SAE AMS-M-7866	Molybdenum Disulfide, Technical, Lubrication Grade
SAE AS 8660	Silicone Compound NATO Code Number S-736
SAE AS 87132	Lubricant, Cetyl Alcohol, 1-Hexadecanol, Application to Fasteners
SAE J 1703	Motor Vehicle Brake Fluid
SAE J 1899	Lubricating Oil, Aircraft Piston Engine (Ashless Dispersant)
SAE J 1966	Lubricating Oils, Aircraft Piston Engine (Non-Dispersant Mineral Oil)
SAE J 2360	Automotive Gear Lubricants for Commercial and Military Use

(Copies of these documents are available online at http://www.sae.org/ or SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096)

2.4 Order of precedence. In the event 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 a specific exception has been obtained.

3. DEFINITIONS, ACRONYMS, and ABBREVIATIONS

3.1 Definition List.

Acceptance	The act of an authorized Government representative by which the Government assumes for itself, or as agent of another, ownership of existing and identified supplies tendered, or approves specific services rendered, as partial or complete performance of the contract on the part of the contractor.
Additives	Compounds used to impart new properties to a product or to improve a property which it already possesses. For example, mixed tertiary butylphenols (oxidation inhibitor) when added to a gasoline improves its resistance to oxidation.
Appearance	Color, clarity, or evidence of stratification and contaminants that may be observed by visual examination of sample.
ASSIST	Acquisition Streamlining and Standardization Information System. The ASSIST-Online database is the official source for all Defense Standardization Program documents and contains the most current information on these documents prepared by Department of Defense DoD. It can be accessed at https://assistca.dla.mil/ or http://assistdocs.com/ or https://assist.dla.mill/ . The ASSIST

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database lists defense and federal specifications and standards, defense handbooks, commercial item descriptions (CIDs), Quality Product Lists (QPLs), adopted non-government standards (NGS) and other related standardization documents used by the DoD.

B20 — A fuel blend consisting of 20 volume percent (vol %) of biodiesel with the remaining 80 vol % a light middle or middle distillate diesel fuel meeting Specification D975 grades No.1-D and No.2-D for any sulfur level specified. The biodiesel component of the blend will conform to the requirements of ASTM D6751. The B6 to B20 blends fall under the ASTM D7467 specification.

Ballast — Water taken on board when a vessel is empty or partially loaded/ discharged to increase draught so that the propeller is fully immersed, stability and trim are maintained and stresses minimized.

Barrel — A volume of liquid petroleum product equal to 42 U. S. gallons (USG) (159 Liters (L)).

Biodiesel — Refers to a vegetable oil or animal fat-based diesel fuel consisting of long-chained mono-alkyl esters. Biodiesel is typically made by chemically reacting lipids (e.g., vegetable oil, animal fat (tallow)) with an alcohol. DoD does not allow the use of biodiesel synthesized using tallow. Bio-diesel can be used alone, or with 6 to 20 volume percent (vol %) of biodiesel (B6 to B20) blended with petroleum diesel as outlined in ASTM D7467. DoD only allows the use of B20 biodiesel. Biodiesel is meant to be used in standard diesel engines and should not be confused with the vegetable and waste oils used to fuel converted diesel engines.

Bleeding — Change in physical characteristics and homogeneity of grease evidenced by separation of oil from the grease.

Blending — The procedures by which predetermined quantities of two or more similar products are homogeneously mixed to upgrade one of the products or to produce an intermediate grade or quality. This term is also used to define the injection of additives, such as corrosion or icing inhibitors, into fuels.

BOCLE Test — ASTM D5001, Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE), correlates measurement of wear scars to lubricity/engine wear protecting capabilities of aviation fuels

Bulk products — Liquid petroleum products which are normally transported by pipeline, tank car, truck or trailer, barge or tanker, and stored in

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	tanks or containers having a capacity of more than 55 USG (208 L). (Exception: A 500 USG (1890 L) collapsible drum is considered a packaged item.)
Bunkers	Fuel intended for consumption to propel water-borne craft. Bunkers can be distillate, such as F-76, MGO, or JP-5. Bunkers can also mean a residual fuel oil such as Intermediate Fuel Oil 180 and Fuel Oil 380.
Burner Fuel	A petroleum distillate and residual oil used to heat homes and buildings, such as Grade No.1-D S15; S500 or S5000; Grade No.2-D S15; S500 or S5000; and Grade No.4-D.
Calibration	The comparison of a measurement system or device of unverified accuracy against one of known or greater accuracy. Used to check, detect, and correct any deviation from required performance specifications by the unverified measurement system or device.
Capitalization	The process whereby the DLA division of the Defense-wide Working Capital Fund assumes management responsibility and ownership (title) without reimbursement for inventories financed from other DoD appropriations or funds, except as stipulated in DoD 7000.14-R.
Cargo Fuel	Fuel carried on board ship for eventual issue to consuming vessels as a bunker fuel or turn-in to a deep-water DFSP.
Certificate of Conformance	A statement applied to the Material Inspection and Receiving Report by the Contractor indicating that the product being provided conforms to specification/ contractual requirements. This statement is in lieu of a Government Inspection.
Clean (clear) and bright	The absence of visible solids, a cloud, a haze, an emulsion, or free water in the product (some specifications define this as Appearance, Workmanship, or as Workmanship, Finish, and Appearance). Bright is the sparkle of clean, dry product in transmitted light.
Coalesce	To unite to form one mass. A coalescer is designed to combine small water droplets into larger ones so they will fall to the bottom of the container. Many filters in use are combination filter/coalescer usually called filter-separators.
Commingling	The mixing of two or more products of different ownership, type, or grade.
Conductivity	The ability of a given substance to conduct electric current.

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Contaminant	A foreign substance in a product
Contaminated product	A product into which one or more grades of another product has been accidentally mixed, or a product containing foreign matter such as dust, rust, water, or emulsions to the extent it changes the characteristics of the product.
Continuous sample	A dynamic sample of fuel obtained from a pipeline in such a manner as to provide a representative average. This sample may be collected on a continuous basis (drip sample), or intermittently and proportional to time or flow (flow-proportional sample).
Cracked stock	A petroleum fraction obtained from a cracking process rather than from simple distillation. In a cracking process, the hydrocarbon molecules are altered resulting in increased quantities of low-boiling fractions.
Dedicated system	An arrangement of pipeline(s), vessel(s), and/or truck(s) used exclusively to move only one fuel type (e.g. jet fuel, diesel, etc.).
Defense Working Capital Fund	A DoD revolving fund that finances the buying and selling of goods and services. It also provides cost visibility and accountability to facilitate business operations. DLA inventories are sold to end user operational accounts (military units and Federal Agencies) that reimburse the DLA Division DWCF for costs incurred.
Dehydration	The removal of water.
Density	The density of a material is defined as its mass per unit volume. In some cases (for instance in the U.S. oil and gas industry), density is also defined as its weight per unit volume; although, this quantity is more properly called specific weight. NOTE: The density of a material varies with temperature and pressure. (The variance is typically small for solids and liquids and much greater for gases.) Increasing the pressure on an object decreases the volume of the object and therefore increases its density. Increasing the temperature of a substance (with some exceptions) decreases its density by increasing the volume of that substance.
Deteriorated product	A product in which one or more characteristics have changed to a level of quality outside the limits of the applicable specification.
Dissolved water	Water in a solution which cannot be removed by mechanical means

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	(e.g. filter/separator). The concentration of dissolved water varies with product temperature, the relative humidity of air contacting the product surface, and the chemical composition of the product.
Distillate Marine Fuel /Marine Gas Oil	This fuel is the petroleum distillate fuel for use in marine diesel engines, gas turbines, and boilers. The official name of the fuel is "Distillate Marine Fuel" according to the specification ISO 8217. It is often called "Marine Gas Oil (MGO)" in the industry.
Downgrading	The procedures by which an off-specification or contaminated product (do to deterioration or contamination) is approved for use as a lower grade of the same or similar product; or as a completely different product.
Entrained water	Water carried by a product which does not settle out readily. Entrained water can be removed by mechanical means (e.g. filter/separator).
E85	Fuel blend consisting of 51 to 83 vol % denatured ethanol with the remainder of gasoline or other hydrocarbon by volume. Used in flexible fuel ground vehicles with automotive spark-ignition engines.
FAEE	Fatty Acid Ethyl Ester; sometimes referred to as biodiesel or B100 (properties similar to FAME). Ethanol is the alcohol used to form this product.
FAME	Fatty Acid Methyl Ester; sometimes referred to as biodiesel or B100. Methanol is the alcohol used to form this product.
Filtering	A process of mechanically removing solids or free water from a petroleum product using a medium such as filtering paper, clay or diatomaceous earth.
Filter-separator	A mechanical device designed to remove solid contaminants and to coalesce and separate water from fuels.
Free water	Water in a petroleum product other than dissolved water. Free water may be in the form of droplets or haze suspended in the product and/or a water layer at the bottom of the container.
Gasohol	A mixture of 90 vol % of gasoline and 10 vol % denatured ethyl alcohol (ethanol) used as automotive gasoline: "as per A-A-52530 (Gasohol, Automotive, Unleaded)."
Gauging (gaging)	The act of measuring the height of product in a tank. During the

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	process of gauging a tank, the temperature of the fuel is also normally measured.
Gauging for water	Obtaining the depth of the water bottom by taking a water cut. This is normally accomplished by coating a plumb bob, tape, or gauging stick with water-finding paste.
Gum	Description of resin-like, fuel insoluble deposits (contaminants) formed during the oxidative and thermal deterioration of petroleum fuels.
Homogeneity	A quality or state of being homogeneous or having a uniform composition. A product is considered homogeneous when its base components are mixed uniformly throughout (no stratification). NOTE: The criteria for homogeneity may not apply for post-procurement products. For example, a sample taken from a depot tank after the receipt of a new batch may not, in all likelihood would not, meet the repeatability precision requirements.
Identification Tests	Selected tests applied to a sample to quickly determine the type or grade of the product represented or to determine if a quality has been altered by time or handling.
Inert gas system	A gas or mixture of gases that contain insufficient oxygen to support hydrocarbon combustion used in cargo tanks to reduce the possibility of fire, explosion, or product deterioration. Introducing an inert gas or, more commonly, exhaust which has been "scrubbed" or filtered to remove any particulates, prevents the formation of a flammable atmosphere in cargo tanks during cargo operations in tankers.
Innage	The height of liquid in a tank or container measured from the bottom of the tank to the top surface of the liquid.
Inspect	To examine critically especially to detect flaws, errors, etc.
Interface	The common boundary (or surface) of two liquids (immiscible liquids (e.g. oil and water).
Intra-Governmental receipt limits	The extent that properties of DoD-owned petroleum products may change beyond specification requirements and remain acceptable for receipt and issue within the DoD logistic system.
Light-ends	The lower-boiling fractions of a fuel or oil.

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Long Term Storage	A product will be considered under long term conditions when either the product has remained in storage for a period as indicated in Table VIII without a turnover of at least two-thirds of the tank content or if new product has not been received into existing stocks for 6 months.
Lubricity	Ability of a fluid to reduce the friction between two surfaces in motion. In fuels, it refers to a value that is measured by a Ball-on-Cylinder Lubricity Evaluator (BOCLE) test, scuff load BOCLE (SLBOCLE) test, or the high frequency reciprocating rig (HFRR) test.
Marine Gas Oil (MGO)	A distillate fuel, containing no residuals, used for vessel propulsion.
Material Inspection and Receiving Report (DD Form 250/250-1)	The Government document identifying the contractor, product origin, product type, quality, quantity, and the destination of the product. The DD Form 250 document is signed by the Government Representative while the DD Form 250-1 (Tanker Barge Material Inspection and Receiving Report) is signed by the Government Representative, a refinery/facility representative along with a vessel representative. NOTE: For bunkers, a completed commercial report and/or order form should be used instead of the DD Form 250, which the Government will clearly annotate with quantity of fuel received, then sign and date the form.
Micron	One micron (µm, micrometer) is 1/1000 of one millimeter or 10^{-6} meter (approximately 25,400 µm equal one inch). The average human hair is about 100 µm in diameter. The openings in a 100-mesh screen are 150µm.
Mineral oil	Lubricating oils from petroleum sources with or without additives.
Off-specification Product	A product which fails to meet one or more of the physical, chemical, or performance requirements of the specification.
Outage (or ullage)	The linear distance between the top surface of the liquid in a drum, tank, or tank car and the top of the container (or ullage may refer to available fill volume of the tank and is the difference between the full (rated) capacity and the actual contents of a storage container). In some tanks and tank cars, it is the difference between a reference mark and the surface of the liquid. It is important that some significant difference always exists in order to allow free space for content expansion is case of a rise in temperature. This Quantity is ships' tanks are normally determined by outage (ullage) gauges.

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Oxygenated fuel	A fuel containing a chemical compound that has oxygen as a part of its chemical structure (e.g. alcohols, ethers) and is miscible with conventional hydrocarbon Oxygenated fuels generally show higher octane but lower heating values than that of hydrocarbon fuels.
Packaged products	Petroleum products stored, transported, and issued in containers of 55 USG or 400 pound capacity or less but also includes 500 USG collapsible drums which are managed by DLA Aviation.
Pipeline batch	The quantity of a product pumped into the pipeline in one continuous operation.
Pipeline tender	A quantity of product offered or designated for pipeline shipment. It may be moved in one or more batches.
Preaward Survey (PAS)	An evaluation of a prospective contractor's capability to perform a proposed contract.
Product equilibrium	When all residual movement has ceased in a storage tank after receipt of product. A tank must be at equilibrium to be ready for final gauging or measurement after receipt.
Qualified Products List (QPL)	An electronic list in the Qualified Products Database (QPD) (accessed through the ASSIST website) of products or families of products that have successfully completed the formal qualification process (including all specified periodic tests) that examines, tests, and verifies that a specific product design meets all the applicable specification requirements.
Quality	The composite of materiel attributes including performance, features and characteristics of a product, or service to satisfy a given requirement.
Quality Assurance (QA)	A planned and systematic pattern of all actions necessary to ensure that adequate technical requirements are established; that products and services conform to these established technical requirements; and that satisfactory performance is achieved. Contract Quality Assurance is a method the Government uses to determine if products and/or services a supplier provided fulfilled its contractual obligations. It includes all actions required to ensure the Government is receiving the proper products and/or services. By common usage, Petroleum Quality Assurance responsibility is fulfilled when the product is accepted by the Government and no longer belongs to the contractor or when the service is completed.

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Quality Assurance Representative (QAR)	An organizational title assigned to the individual responsible for Government contract QA functions. QARs have cognizance over the procurement of product and/or services at contractor facilities (e.g. refineries, terminals, packaging plants, laboratories, and into-plane sites). DLA Energy QARs perform both QA and in some cases QS functions. The Military Services may use other organizational titles for their personnel performing QA and QS functions.
Quality Control Plan (QCP)	The written procedures developed by a contractor, encompassing contractor programs, processes and inspections, which assures the quality of services, quality and quantity of products, and conformance to other related contract requirements.
Quality Product Database (QPD)	This database consists of the officially approved electronic QPLs. QPD may be accessed through ASSIST website at CAC-enabled site https://assistca.dla.mil/ and active version of QPL-25017. Only those electronic QPLs published in the QPD are the official source for qualified products.
Quality Status List (QSL)	A list containing shelf-life information to determine if Type II (extendible) shelf-life material may continue to be used.
Quality Surveillance Program	Program of inspections, sampling, testing, and documentation established to assure quality of Government-owned product.
Reclamation	Procedure to restore or change the quality of an off-specification or contaminated product so it will meet the specification of the original product or a lower grade product. The reclamation process, when properly applied, will result in down-grading, blending, purification, or dehydration.
Relative Density	The ratio of the mass of a given volume of liquid at a standard temperature to the mass of an equal volume of pure water at a standard temperature. The standard reference temperature must be clearly stated (e.g. Relative Density at 60 °F; or Relative Density at 15 °C) when results are reported.
Repeatability	Allowable differences in test result values on the same sample by the same operator under the same test condition, using the same equipment.
Reproducibility	Allowable difference in test result values on the same sample by different technicians, laboratories, or equipment under the same test condition.

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Requiring Installation	A military installation, organization, or facility authorized to requisition and receive material from designated distribution and storage points.
Residual Marine Fuel (RME 180 and RMG 380 Grades)	Petroleum residual fuel for use in marine diesel engines and boilers. This product (grade) of marine fuel is a heavier fuel than a marine distillate fuel.
Sample	A portion extracted from a total volume which may or may not contain constituents in the same proportions that are present in that total volume. Bulk Products, samples can be taken from acceptance tanks, storage tanks, delivery trucks, intermodal containers, pipelines, barges or tankers. Samples may be taken either manually (upper, middle, lower, bottom, composite all-level) or automatically (line, flow-proportionate). For DLA Energy contracts, samples are taken in accordance with API Manual of Petroleum Measurement Standards (MPMS), Chapter 8, Section 1, Sampling of Petroleum and Petroleum Products (ASTM D4057) and/or Automatic Sampling of Petroleum and Petroleum Products (ASTM D4177). Samples are identified by a sample tag noting location, product, tank number, type of sample/sampler, and date (see continuous sample). Packaged Products, samples may be taken from drums or cans using a tube or thief sampler. Sampling may also be accomplished by selecting an individual unit from a collection of packaged products.
Sample Tag	DD Form 2927, Petroleum and Lubricants Sample Identification Tag or equivalent is the standard label used for petroleum and lubricant samples.
Settling time	The time a product needs to remain undisturbed or un-agitated in a storage tank to reduce the static charge of the fuel and/or to allow water and sediment to be eliminated/reduced from the product.
Service Control Point	Military service agency that provides technical guidance on equipment and infrastructure. e.g.- Air Force Petroleum Agency (AFPA).
Shall	A directive or requirement: command. (Compare to “Should”)
Shelf life, Type I	A definite non-extendable period of shelf life.

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Shelf life, Type II	An assigned shelf-life period that may be extended after completion of inspection, testing, or restorative action.
Should	Not required, but highly recommended. (Compare to "Shall")
Specification	A detailed description of the product's essential performance and/or physical and chemical characteristics. Specifications can be classified as Federal, Military, Commercial, or Voluntary Standard. Specifications can be categorized as functional, design, or a performance specification. Petroleum specifications are usually a combination of functional and performance categories.
Specification limits	Boundaries or parameters that define acceptable performance for a process expressed as a target maximum or minimum limit, or both an upper and lower limit (range).
Specific gravity	See relative density.
Storage Tank	A fixed container that can be above ground, underground, or collapsible, made of steel, fiberglass, or fabric, that is used to store liquid POL.
Super-clean fluid	A fluid having a specified particulate contamination limit so low that the product is packaged in hermetically sealed containers under clean room conditions.
Surfactant	Any substance which when dissolved in water or aqueous solution, reduces its surface tension or the interfacing tension. Also called a surface-active agent. Tends to block removal of entrained water in fuels.
Synthetic oil	Materiel not refined from petroleum sources; usually produced by chemical synthesis.
Tank Car (TC or RTC)	Rail car specifically designed to transport petroleum products.
T-AO	Fleet Replenishment Oilers (MSC Auxiliary Vessel). Fleet replenishment oilers are the largest subset of Naval Fleet Auxiliary Force ships. They provide fuel to deployed Navy ships at sea, as well as to their assigned aircraft. Oilers and the ships they refuel sail side by side as fuel hoses are extended across guide wires.
T-AOE	Fast Combat Support Ships (MSC Auxiliary Vessel). Fast combat support ships provide fuel, ammunition, food and other cargo.

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	These ships are especially valuable because of the speed and ability to carry all the essentials to replenish Navy ships at sea.
T-AKE	Dry Cargo/Ammunition Ships (MSC Auxiliary Vessel). Dry Cargo/Ammunition Ships are the newest class supply ship in the fleet. They are able to deliver ammunition, provisions, stores, spare parts, potable water and petroleum products to the Navy's carrier strike groups and other naval forces worldwide. Designed to operate for extended periods at sea, the Lewis and Clark class ships have improved cargo handling equipment that increases efficiency and makes the ships more cost effective to operate and maintain.
Testing	The determination of product physical and chemical properties. Depending on the location, mode of storage, and transportation (see Table IX) the following type tests are defined:
Type A Tests	Complete quality conformance specification acceptance tests.
Type B-1 Tests	Partial analysis checking for the principal characteristics most likely to be affected in the course of moving the product.
Type B-2 Tests	Partial analysis to verify stability of characteristics susceptible to deterioration due of age.
Type B-3 Tests	Partial analysis for contamination; in particular, for controlling the re-injection of pipeline interface products.
Type C Tests	Quick, simple, partial analysis to verify product quality and to ensure that no change has taken place. Type C tests can be referred to as identification tests.
Thief	A sampling apparatus designed so a liquid sample can be obtained from any specified point in the container.
Tolerance	Allowed variations within a specified standard.
Transmix	A mixture of gasoline and diesel fuels and jet fuel resulting from various operations such as pipeline transfers, barge transfers, cross contamination of tanks.
Truck	As defined in DoDM 4140.25-M and this document, can be either a truck, tank wagon and truck trailer.
Tank Truck (TT)	A delivery truck with a capacity between 4,000 or 11,000 USG (15,000 to 41,600 L), equipped with a 15-ft (5 m) hose but usually not requiring a meter.

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Tank Wagon (TW)	Delivery truck with a capacity up to 5,200 USG (19,700 L) equipped with a meter, nozzle, 100 feet (30m) of hose, and used for making multiple, small deliveries.
Truck and Trailer (TRR)	A delivery truck (line haul) usually having a 9,000 USG (34,000 L) capacity (minimum) equipped with a 15-foot (5 m) hose. A meter is not required unless specifically stated in contract terms and conditions.
Turbine Fuels	Turbine fuel is a mixture of hydrocarbons, broadly classified as kerosene based. JP-8 (NATO F-34) is a kerosene type fuel similar to commercial Jet A-1 with the addition of Corrosion Inhibitor/Lubricity Improver (CI/LI), Fuel System Icing Inhibitor (FSII), and Static Dissipater Additive (SDA). JP-5 (NATO F-44) is a high flash point kerosene type of fuel. JP-4 (NATO F-40) is a highly flammable fuel containing gasoline and kerosene fractions. This grade is maintained in select areas to aid in cold weather starting. TS-1 is a fuel supplied in Commonwealth of Independent States (CIS) and various locations in southwest Asia. Typically this fuel has a flash point lower than JP-8. JP-8+100 (NATO F-37) is a fuel that contains an additive consisting of antioxidants, detergent/dispersants, metal deactivators, and solvents which increases the thermal stability of JP-8. JPTS (Jet Propellant Thermally Stable) is a jet fuel used in limited quantities for special applications used for high altitude and has a high thermal stability. Jet A (procured to ASTM D1655) and Jet A-1 (procured to DEFSTAN 91-91) are standard commercial aviation turbine engine fuels.
Ullage	See outage.
Vapor pressure (VP)	The measure of pressure exerted by the vaporized phase of a product on the interior of a special container under specified test conditions.

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Verification Tests	The testing performed by the supplier on samples verified (witnessed) by the QAR after the supplier has completed full specification testing and certified each shipping tanks as ready for acceptance. The scope of the testing is the minimum required to verify that the results presented by the supplier on his full spec test report in fact reflects the product being offered.
Volatile alkyl lead antiknock	Volatile alkyl lead compounds (e.g. tetramethyl lead and tetraethyl lead) which increase the octane rating when added to gasoline in small proportions.

3.2 Acronyms and Abbreviations.

ACS	American Chemical Society
AFPA	Air Force Petroleum Agency
AGMA	American Gear Manufacturers Association
AIR Card	Aviation Into-plane Reimbursement Card
AKI	Anti-Knock Index
AO	Anti-Oxidant additive
AMPS	DLA Account Management and Provisioning System
ARP	Alternate Release Procedure
ASSIST	Acquisition Streamlining and Standardization Information System
APC	Army Petroleum Center
API	American Petroleum Institute
BBL	Barrel
BDN	Bunker Delivery Note
BOCLE	Ball On Cylinder Lubricity Evaluator
BS&W	Bottom, Sediment and Water, or may be referred to as Basic, Sediment and Water
BTU	British Thermal Unit
CCAI	Calculated Carbon Aromaticity Index
CEPS	Central European Pipeline System
CID	Commercial Item Descriptions
CI/LI	Corrosion Inhibitor /Lubricity Improver additive
CTP	Custody Transfer Point
COCO	Contractor-Owned, Contractor-Operated
CU	Conductivity Unit

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DCMA	Defense Contract Management Agency
DFAMS	Defense Fuel Automated Management System
DFARS	Defense Federal Acquisition Regulations Supplement
DFSP	Defense Fuel Supply Point
DMA	Diesel Marine A
DMF	Distillate Marine Fuel
DoD	Department of Defense
DoDSSP	Department of Defense Single Stock Point
DWCF	Defense Working Capital Fund
EA	Executive Agency
EI	Energy Institute
FAEE	Fatty Acid Ethyl Ester
FAME	Fatty Acid Methyl Ester
FAR	Federal Acquisition Regulations
FAS	Fuels Automated System
FLC	Fleet Logistic Centers
FMD	Fuels Manager Defense
FOB	Free on Board
FSC	Federal Supply Class
FSII	Fuel System Icing Inhibitor
GOCO	Government-Owned, Contractor-Operated
IFO	Intermediate Fuel Oil
ISO	International Organization for Standardization
IGRL	Intra-Governmental Receipt Limits
JP	Jet Propellant
JPO	Joint Petroleum Office
JPTS	Jet Propulsion, Thermally Stable
MDA	Metal Deactivator Additive
MGO	Marine Gas Oil
MPMS	Manual of Petroleum Measurement Standards
MMR	Motor Mid-grade, Reformulated (unleaded) gasoline
MPR	Motor Premium, Reformulated (unleaded) gasoline
MRR	Motor Regular, Reformulated (unleaded gasoline)
MSC	Military Sealift Command

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MSEP	Microseparometer
MUM	Motor Unleaded, Mid-grade gasoline
MUP	Motor Unleaded, Premium gasoline
MUR	Motor Unleaded, Regular gasoline
NATO	North Atlantic Treaty Organization
NAVSUP	Naval Supply Systems Command
NGS	Non-Government Standards
NSN	National Stock Number
PAS	Preaward Survey
POL	Petroleum, Oils and Lubricants
PORTS	Paperless Ordering & Receipt Transaction Screen
ppm	Parts Per Million
psi	Pounds per Square Inch
PC&S	Post, Camp and Station
QAR	Quality Assurance Representative
QAS	Quality Assurance Specialist
QCP	Quality Control Plan
QPD	Qualified Products Database
QPL	Qualified Products List
QS	Quality Surveillance
RME	Marine Residual Fuel Oil, such as RME-180
SCP	Service Control Point
SDA	Static Dissipater Additive
STANAG	Standardization Agreement (NATO document)
ULSD	Ultra Low Sulfur Diesel
USG	U.S. Gallons
VP	Vapor Pressure
VOL %	Volume Percentage
WSIM	Water Separation Index, Modified

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4. GENERAL REQUIREMENTS

4.1 Personnel competency. Personnel responsible for handling fuels and lubricants shall be thoroughly trained and fully qualified to perform their assigned responsibilities. They shall be aware of the hazards in handling fuels and lubricants, as well as the applicable safety and operating procedures.

4.2 Service/contractor responsibilities. The owning Service/Contracted activity shall have the responsibility of maintaining quality and quantity of Defense Working Capital Fund products while in their keeping (e.g. receiving, storing, sampling, testing, and releasing) and shall dispense those products as required to using activities. The Service/Contracted activity shall develop, establish and maintain a quality surveillance program IAW this Standard for Defense Working Capital Fund products from the point of receipt on the installation to the point of sale. The program shall be in accordance with this standard and be in effect from receipt to end-item issue. Quality problems involving Defense Working Capital Fund product (e.g. off-spec product, downgrading of product, etc.) shall be addressed as outlined in this Standard. Adequate sampling and testing programs can reduce or in some cases eliminate quality problems.

4.2.1 Sampling. All samples shall be taken in accordance with ANSI Z1.4, API MPMS, Chapter 8, Section 1, Manual Sampling of Petroleum and Petroleum Products (ASTM D4057), and Section 2, Automatic Sampling of Petroleum and Petroleum Products (ASTM D4177), and/or as prescribed by product specification or contract requirements. For Aerospace Energy Commodities (e.g. gases, cryogenics, liquid propellant and hypergols) refer to the appropriate product specification to determine appropriate sampling methods and procedures.

4.2.1.1 Precautions. The precautions required to ensure representative sampling are many and depend on type of product being sampled, the type of container from which it is drawn and the sampling procedures employed. Each procedure is suitable for sampling a specific product under definite storage, transportation and container conditions.

4.2.1.2 Personnel conducting sampling. Because improperly taken samples can completely invalidate a test, only trained and experienced personnel shall be assigned to sample the products. This cannot be overstressed: No amount of laboratory work gives reliable data on a product if the sample is not a true representation of that product.

4.2.1.3 Responsibility. This Standard shall in no way alter any assigned responsibility of the various activities outside the continental United States for submitting special samples to a designated laboratory or as directed by cognizant headquarters.

4.2.1.4 Types of samples. A sample is a portion of fuel taken which represents that entire batch or delivery or a specific spot within a tank or container. The various types of samples follow:

4.2.1.4.1 All level sample. One taken by submerging a stoppered beaker or bottle to a point as near as possible to the draw off level, then opening the sampler and raising it at such a rate that it is about three fourths full as it emerges from the liquid.

4.2.1.4.2 Upper sample. One taken from the middle of the upper third of the tank contents.

4.2.1.4.3 Middle sample. One taken at the middle height of the tank contents.

4.2.1.4.4 Lower sample. One taken at the middle point of the lower third of the tank contents.

4.2.1.4.5 Top sample. One taken six inches below the top surface of the tank contents.

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4.2.1.4.6 Composite sample. A blend of spot samples mixed in proportion to the volumes of material from which the spot samples were obtained.

4.2.1.4.7 Drain sample. One taken from the draw off or discharge valve.

4.2.1.4.8 Bottom sample. One taken on the bottom surface of the tank, container, or pipeline at its lowest point. The drain and bottom samples are usually obtained to check for water, sludge, scale, or other contaminants.

4.2.1.4.9 Bottom water sample. A spot sample of free water taken from beneath the petroleum contained in a ship or barge compartment or a storage tank.

4.2.1.4.10 Single tank composite sample. A blend of the upper, middle, and lower samples of the tank contents. The portion of the sample quantity to be taken at each level varies according to the type of tank and shall be determined by applicable procedure (see 4.2.1).

4.2.1.4.11 Conveyance composite sample. A blend of individual all-level samples from each compartment of the ship, barge, or carrier that contains the same grade of product in proportion to the volume of product in each compartment.

4.2.1.4.12 Outlet (suction) sample. One taken at the level of the tank outlet.

4.2.1.4.13 Automatic sample. A sample taken from a pipeline conveying the product in such a manner as to give a representative average of the stream throughout the period of transit.

4.2.1.4.14 Mixed sample. One obtained by mixing or vigorously stirring the contents of the original container and then pouring out or drawing off the quantity desired.

4.2.1.4.15 Spot sample. A sample taken at a specific location in a tank or from a flowing stream in a pipe at a specific time.

4.2.1.4.16 Tube or thief sample. One taken with a sampling tube or special thief, either as a core or spot sample from a specified point in the container.

4.2.1.4.17 Batch/lot samples. One obtained from a collection of units of packaged products.

4.2.1.5 Taking of samples. A sample log should be maintained for all samples taken.

4.2.1.5.1 Sampling apparatus, containers, and procedures. **Warning!** All safety instructions shall be strictly observed.

a. Approved type sample containers shall be used as specified by ASTM, API, Department of Transportation or International Civil Aviation Organization. Samples of aviation fuel submitted specifically for water and sediment determinations shall always be collected in clear glass bottles and protected from exposure to sunlight. Aviation sample containers used for samples taken for thermal stability, water separation index tests shall conform to ASTM D4306.

b. All sampling apparatus and containers shall be thoroughly clean and dry and special care shall be taken so that no lint or fibrous material remains in or on them. Unless otherwise specified in the test procedures, apparatus and containers shall be rinsed with a portion of the product being sampled to ensure the sample is not contaminated with the previous material. Coated cans that have been presoaked with a product are preferred when sampling for water reaction and for thermal stability. If not available, then clear or amber gallon glass jugs work very well. If clear glass containers are used, then they shall be prepared (e.g. wrapped in aluminum foil) to prevent light absorption. Sufficient liquid product shall be in

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the sample lines and fittings before taking any sample. Sampling apparatus shall be cleaned immediately after use and stored so it will remain clean until next use.

c. Unless specifically required for special testing, do not take samples through storage tank clean-out lines, manifolds, water draw-offs, bleeder valves, or hose nozzles. Such samples will not be representative of the product in the tank. When it is necessary to sample service station tanks and access to such tanks cannot be gained though a manhole or sampling hatch, the tanks may be sampled through a servicing hose after first discharging from the hose a volume of product estimated at two-times the capacity of the piping system.

d. Containers such as drums shall be sampled with a thief. In sampling drums and cans, care shall be taken to remove all foreign matter from the area near the enclosure before the plug is removed.

e. Immediately after taking samples, close all sample containers tightly. Do not use sealing wax, paraffin, rubber gaskets, pressure sensitive tapes, or similar material to seal containers. Lightweight sample containers shall be adequately crated to withstand shipment. To prevent leakage caused by thermal expansion of the product, do not fill any sample container above 80 percent volume capacity.

f. Samples for air shipment of turbine fuels and automotive gasoline shall be in UN1A1 cans, NSN 8110-01-371-8315 (1-gallon), with 4G fiberboard boxes, NSN 8110-01-436-7340 (drum and box combination). The round sample can, NSN 8115-01-192-0935, is suitable for ground shipment of fuels products, via United Parcel Service (UPS).

4.2.1.5.2 Sample Log Requirements. Each activity shall maintain a sample log, all samples submitted will contain the following as a minimum information:

a. Sample number

b. Location sample taken (e.g. tank number, truck number, filter-separator number, etc.)

c. Type sample

d. Date sample taken

e. Name of person taking sample

f. Reason sample taken

g. Product and Grade

h. Specification (include approved waiver limits, if known)

i. Volume sample represents

j. Type tests requested

k. Date sample sent to the laboratory

l. Date results received back from the laboratory

m. Laboratory Report number

n. Laboratory Status results (e.g. on-specification, within IGRL, off-specification for XXX test)

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4.2.1.6 Precautions.

a. Samples of gasoline, jet fuel and kerosene shall be well protected from contamination and direct sunlight by using clean, dry cans or brown bottles for leaded product. Some of these products, especially gasoline, will change color rapidly on short exposure to sunlight and result in rapid increase in gum and decrease in stability. Lead additives, such as tetraethyl lead, are particularly unstable in sunlight and may appear as a gray or gray-white precipitate on the bottom of a container. If clear glass bottles are the only containers available for sampling product containing lead, the bottles shall be covered with foil or paper immediately after filling to avoid exposure to sunlight.

b. Samples of gasoline and jet fuel that require the vapor pressure test shall be carefully handled and collected to preclude the loss of light-ends. Vapor pressures are extremely sensitive to evaporation losses and to slight changes in composition. When obtaining, storing, or handling samples, observe the necessary precautions to ensure samples are representative of the product and satisfactory for vapor pressure tests (See ASTM D4057). Whenever practicable, arrangements should be made to maintain liquid fuel samples at a temperature between minus 1°C and 4°C (30°F and 40°F). This helps preserve its characteristics from the point of sampling to the laboratory.

c. If the API gravities of fuel samples taken from the upper, middle and lower levels of a tank do not differ by more than the reproducibility precision statement of the test method used for the type of liquid in question, then make a composite of these samples for additional testing. If the variation is greater, test the samples separately because the fuel may have stratified. In this case, each of the various stratified layers shall be tested independently for conformance to the product specification.

4.2.1.7 Size of samples.

4.2.1.7.1 Normal sample size. Normally, liquid samples submitted for type A or B analysis shall not be less than 4L (one-USG) total size; semisolids shall not be less than 2.25kg (five pounds).

4.2.1.7.2 Special sample size. Special samples and gasoline samples requiring ASTM D909 aviation supercharge method of determining performance numbers shall be of 20L (five USG) size unless otherwise directed.

4.2.1.7.3 Jet fuel. Samples of jet fuel requiring full specification testing shall be 8L (two USG), 4L (one USG) of which will be used for the filtration time/particulate contamination test.

4.2.1.7.4 E85 sample. When required submit a one-gallon sample for specification conformance testing, to include ethanol content.

4.2.1.7.5 B20 sample. When required, submit a one USG sample for specification conformance testing.

4.2.1.8 Identification of samples. Immediately after sampling, identify each sample container by securely attaching a DD Form 2927, Petroleum and Lubricants Sample Identification Tag, or other equivalent approved tag. Information on the tag shall include the location of the facility at which the sample is taken, name of personnel taking the sample, grade of material, quantity represented, specification of material when known, storage tank number and location, date sample was taken, type of sample and reason for sample. For turbine fuel electrical conductivity (in picosiemens per meter (pS/m) units) results, specify tank ambient temperature and request correction of conductivity value to that temperature.

4.2.1.8.1 Markings. In the case of packaged products, the complete markings shown on the container shall be furnished. The container from which the sample was taken shall be marked with the sample number for future identification.

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4.2.1.8.2 Sample serial numbers. Each sample shall be assigned a serial number that shall be determined by taking the calendar year as the prefix number and assigning consecutive numbers as the samples are submitted. For example: the first sample submitted in 2003 would be 03-1, the second 03-2, and so forth. Such sample numbers shall be shown on the sample identification tag and all shipping documents and correspondence pertaining to the sample.

4.2.1.8.3 Retained samples. Unless otherwise specifically instructed, samples shall be retained for 45 days for reference purposes. Truck car samples will be retained for 15 days for reference purpose.

4.2.1.9 Shipping samples to a laboratory - Chain of custody requirement. In order to ensure sample integrity a record of the chain of custody must be maintained by the sample owner until sample disposal. Federal Express and or UPS documentation is to be on file when shipped from the DFSP. Each change of custody shall be documented at the time and place of transfer including signature of the custodian.

4.2.1.10 Precautions for sampling and gauging JPTS cargo tanks or vessels. Gauging, sampling, and water-cutting of JPTS compartments should not be conducted at intermediate terminals unless it is discharged at the intermediate terminal or there is a clear indication of contamination or an abnormal unaccountable quantity loss/gain. If JPTS compartments are gauged/sampled, all equipment introduced into the fuel shall be cleaned and repetitions shall be minimized. A note shall be placed on the DD Form 250-1 or accompanying cargo inventory report explaining complete circumstances.

4.2.1.10.1 Contamination problems. When a partial cargo is to be loaded aboard an arriving vessel, the QAR/Government Representative shall be required to sample/gauge all compartments loaded at previous ports. In the case of JPTS this procedure can present a contamination problem. This type of fuel requires special handling because it is easily contaminated. It is usually the first loaded in a multi-product/multi-port lifting and often the last discharged.

4.2.1.10.2 Unaccountable product loss or gain. Gauging, sampling, and water-cutting of JPTS compartments should not be conducted at intermediate terminals unless it is discharged at the intermediate terminal or there is a clear indication of contamination or an abnormal unaccountable quantity loss/gain. If JPTS compartments are gauged/sampled, all equipment introduced into the fuel shall be cleaned and repetitions shall be minimized. A note shall be placed on the DD Form 250-1 or accompanying cargo inventory report explaining complete circumstances.

4.2.2 Testing. The quality surveillance testing presented in this section is the minimum essential for sound management of Government-owned properties. It represents the balance between good QS practices, cost of quality, and associated risks, and the need to confirm adherence to specification requirements through full specification testing. Only by thorough testing procedures can premium quality surveillance be maintained.

4.2.2.1 Contamination tests. Suspected contamination of petroleum products shall be confirmed by laboratory tests. Tests which have proved most useful in determining whether a product is contaminated and in identifying the contaminating agents are listed under the individual products (see section 5.10).

4.2.2.2 Test methods. All laboratory tests shall be conducted in accordance with the method prescribed in the specification covering the product. However, any special or modified method outlined in this Standard shall be used in lieu of the specification method when products are evaluated within the scope of this Standard. Specification and intra-Governmental receipt limits are absolute. Multiple tests may be performed and if the results do not differ from each other by more than the amount specified for the method repeatability, these results may be averaged to determine compliance with the specification or established intra-Governmental receipt limits.

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4.2.2.2.1 Testing Rounding Protocol. For products identified and purchased to the following specifications MIL-DTL-83133, Turbine Fuel, Aviation, Kerosene Type JP-8 (NATO F-34), NATO-35, and JP-8+100 (NATO F-37),14 SEP 2012, MIL-DTL-5624, Turbine Fuel, Aviation, Grades JP-4 and JP-5, 05 JAN 2004; and MIL-DTL-16884M, Fuel, Naval Distillate, 14 AUG 2012 and under DLA contracts, the rounding process identified within each specification will be used.

a. Only exception to 4.2.2.2.1 is for the determination of the Flash Point under the F-76 specification, which the flash point value is absolute and no value less than 60.0^{o}C is permissible.

b. Test results shall be reported to the same degree of accuracy as stated in the specification using the rounding off method, as mirrored in Table I, Chemical and Physical Requirements and Test Methods, in these specifications (the "specified limiting values"). ASTM test methods cite how to report results and to what accuracy, they are superseded by the requirements within the specification.

c. For acceptance of products under DLA Energy contracts, assure test characteristics are reported in accordance with this rounding protocol as cited in the product specification.

d. For Quality Surveillance oversight of DLA Energy capitalized product, this rounding protocol will also be adhered to.

4.2.2.3 Testing frequency for long term storage of petroleum products. Table VIII outlines the minimum frequency for testing petroleum and related products by broad category. Since it is the responsibility of the cognizant QAR, petroleum officer, or supply officer to maintain strict quality surveillance, the frequency of testing may be increased as required. Considerations for increased testing are conditions of storage, age of stock and type of product. When a long term storage product is tested, a record of the results shall be maintained to provide a basis for determining product deterioration. Whenever consecutive results indicate possible deterioration, testing frequency shall be increased. Once the trend definitely reflects deterioration, the report procedures in 5.13.2 shall be followed. This is especially important for a property such as color that presents no operational problem, but may indicate possible deterioration.

4.2.2.4 Minimum testing. Table IX outlines the minimum sampling and testing requirements considered necessary for determining the quality of petroleum and related products. It covers the conditions under which a sample is taken, the type of sample, and the types of tests required to determine whether the quality is within acceptable limits.

4.2.2.5 Types of tests required. Tables X through XXV provides a detailed breakdown of the type of tests required for each product class. These tests are those most likely to reveal contamination/ deterioration which may have occurred during product handling or storage. Tables XVII through XXV designate Service and NATO prescribed B-2 tests for specific products. When a product being tested fails to meet the specification limits due to contamination, the procedures outlined in Section 5.13.1 (Identification of a non-conforming product) or 5.14.4 Disposition Instructions) are to be initiated.

4.2.2.5.1 Equivalent test. Test methods that provide analogous results and fully correlate with standard ASTM methods, but have not yet been formally accepted by ASTM. These test methods have been found to provide test results essentially identical to those produced by ASTM testing methods.

4.2.2.5.2 Testing. Analytical techniques using instruments, equipment, and other methods to predict fuel and lubricant test values using compositional data typically determined by standard or wet chemistry methods.

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4.2.2.5.3 Alternate test methods. The use of alternate test methods to measure physical properties of fuel is allowed, provided that: the test results are presented in the format required in the specification; the test device has a demonstrated reliability and repeatability equal or better than called for by the ASTM method; and the device has been approved for use by the military services.

4.2.2.6 Testing capabilities. All terminals (commercial and military) receiving bulk products and facilities storing packaged products shall be equipped and capable of performing tests required by Table IX. When the capability does not exist at the terminal or facility, other laboratories, either commercial or military, may be used. Appendix A lists petroleum testing facilities available to military and commercial users.

4.2.2.7 Calibrating test equipment. All laboratories shall calibrate testing and measuring equipment to the accuracy necessary to ensure the equipment is within allowable tolerance limits. ISO 10012-1, Part I shall be used.

4.3 Specifications. Each JPO and petroleum product laboratory shall maintain an up-to-date file of Government fuel and lubricant specifications (both Military and non-Government specifications and standards). It is not practical to include complete specification limits in this Standard, as specifications are subject to change with variations in product availability and technical developments. Copies of this Standard can be obtained through regular channels from ASSIST Online website: https://assistca.dla.mil/ or https://assist.dla.mil/ . Limits cited in this Standard are for Service use of fuel, not for procurement.

4.4 Change in grade of fuel. Any change in grade of fuel requires notification to DLA Energy prior to the change. Where product has been found to be off-specification, the DLA Energy Quality Operations Division (DLA Energy-QA) is notified IAW section 5.13.2 of this standard. DLA Energy-QA performs internal coordination with the Inventory Management Division (DLA Energy-FI), Program Budget Division (DLA Energy-RB) and the Inventory & Distribution Division (DLA Energy-BI) within DLA Energy. In addition it will be coordinated with the respective Service Control Point (SCP). Disposition instructions are provided by DLA Energy-QA. A change in grade may be requested for reasons such as product availability, fuel no longer needed, etc. In these circumstances the activity having physical possession of DWCF fuel shall request concurrence from DLA Energy-FI. They will coordinate acceptability of the change with DLA Energy-QA and determine the inventory impact with DLA Energy-BI before making a decision on acceptance. DLA Energy-FI provides disposition in these cases.

4.5 Government-owned property. Contractors are obligated to adequately protect Government-owned property located on their premises for use on, or in connection with a contract. The periodic inventory and reporting of such property is a contractual requirement. The amount of Government-owned petroleum products in pipelines will be reported as a separate item in stock reports.

4.6 Safety precautions. Throughout this Standard there are general safety precautions and instructions that apply to fuel handling and laboratory operations to ensure personal safety/health and the protection of Government property. Occupational Safety and Health Administration, Department of Labor and standard commercial safety practices shall be observed.

4.7 Measurement, sampling and calibration. For measurement, product sampling and calibration of storage tanks and meters requiring the API Manual of Petroleum Measurement Standards: Chapter 2 covers tank calibration (strapping). Chapter 3 covers tank gauging. Chapter 5 covers measurements by meters. Chapter 7 covers temperature determination. Chapter 8 covers sampling. Chapter 9 covers density determination. Chapter 11 covers volume correction and conversion factors. Chapter 12 covers

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procedures for calculating the net quantities from the gross measurements. Chapter 17 covers marine measurement.

4.8 Compliance with regulations and laws. Many petroleum products are considered hazardous materials and are regulated as such. Users of this Standard must be aware of regulations and laws governing the products that they are handling. In the event of a conflict between this Standard and a law or regulation, the law or regulation takes precedence.

5. DETAILED REQUIREMENTS

5.1 Waterborne Operations. This section applies to all movements of product belonging to or to be accepted by the Government.

5.1.1 Shipments by tankers. This section covers pre-loading and loading procedures for tankers. Those procedures for barges and refueling craft are covered in 5.1.2. Post loading of tankers and barges is addressed in 5.1.4.

5.1.1.1 MPMS Guidelines. QARs utilize the following guidelines/sections of MPMS Chapter 17, Marine Measurement during the applicable phase of each operation:

a. Section 2 - Measurement of Cargoes On Board Tank Vessels.

b. Section 6 - Determining Fullness of Pipelines between Vessel and Shore Tanks.

c. Section 8 - Pre-Loading Inspection of Marine Vessel Cargo Tanks.

5.1.1.2 Filtering requirements. Fuel and lubricant deliveries from fleet replenishment vessels shall be filtered according to filtration standards for the particular product involved, unless these filtration requirements are waived by the receiving ship. Replenishment vessels shall always take action to remove water from their cargoes.

5.1.1.3 Certifying statements[1]. Statements of quantity and quality shall accompany all shipments. The DD Form 250-1 is prepared under the supervision of the cognizant Government QAR (or Military Service designated personnel) to cover marine petroleum shipments and receipts of Government inspected products.

5.1.1.4 Tanker and ocean-going barge inspection policy for MSC vessels. The following applies to vessel cleaning, gas freeing, inspecting and quantity variations between MSC and DLA-ENERGY. It applies only to MSC controlled vessels. Table XXVII is guidance to be used by QARs for the inspection of MSC vessels.

5.1.1.4.1 Responsibility. Vessel owners/operators are responsible for providing vessels suitable to load and deliver the intended cargo and for determining the need-to-clean vessel cargo tanks. This determination is made by monitoring vessel cargo history and by what cargo is to be loaded. The process for monitoring cargo history and identifying when vessel cargo tanks will require cleaning will be developed by tanker owners/operators for each vessel. Copies of the DD Form 250-1 and test reports shall be forwarded to vessels by the loading quality representative should early departure preclude obtaining a copy upon loading completion.

[1]*NOTE: References to the QAR include Military Service personnel designated to perform these functions.*

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5.1.1.4.2 Required cargo cleaning. MSC vessel cargo tanks shall be cleaned whenever the following conditions exist (exceptions to these requirements shall be coordinated with DLA-ENERGY-QA prior to the proposed cargo loading):

a. The vessel cargo tanks held ballast between the prior cargo discharge and the scheduled follow-on cargo.

b. The cargo to be loaded is JP-5, and the previous cargo was other than JP-5.

c. The cargo to be loaded is JP-5 or JP-8/Jet A/ Jet A1 and the previous cargo was F-76.

d. The initial loading of a spot or time charter.

e. The vessel has been in dry dock, or repairs have been performed on the cargo tanks.

f. The cargo to be loaded is MOGAS and previous cargo was F-76.

g. The cargo to be loaded is other than MOGAS and the previous cargo was MOGAS.

5.1.1.4.3 Internal Tank Inspection requirements. QARs will inspect vessels that are loading their first DoD cargo under any MSC charter, or that have not maintained segregated ballast conditions, or that have been dry docked or had repairs made to their cargo system. MSC will provide notification to the QAR prior to loading regarding vessels that have been in dry dock or had repairs done to their cargo system. MSC shall make the request for inspections at the repair facility to the next load port. They may request assistance from a QAR closer to the facility if deemed necessary and acceptable. Any party may request inspection, given proper notification to MSC. When MSC requires a vessel inspection by a QAR, the request shall be forwarded from MSC to the cognizant Region and DLA-ENERGY-QA. This notification shall be done prior to loading the intended cargo, allowing adequate time for the quality representative to be present for an internal tank inspection.

5.1.1.4.4 Suitability to load. Vessels should arrive at the required port ready to load the intended cargo. Vessels shall certify that cargo tanks are suitable for loading the intended cargo by including the following statement in the Notice of Readiness: "All compartments, lines and pumps to be used are suitable for loading and delivering the intended cargo." Vessels shall also provide the quality representative with soundings of product / water onboard and validated onboard quantities (OBQ) prior to loading.

5.1.1.4.5 In-Transit Quantity Variances. Investigations shall be conducted by a MSC representative and DLA-ENERGY Quality personnel for variations exceeding the following (shore-to-shore, loading to final destination): 0.2 % volume for cargoes not requiring cleaning, gas-freeing, drop/strip; 0.3 % volume for cargoes requiring drop/strip only; 0.5 % volume for cargoes requiring cleaning, gas-freeing, drop/strip. The Manual of Petroleum Measurement Standard, Chapter 17.5, Guidelines for Cargo Analysis and Reconciliation, shall be used.

5.1.1.4.6 Responsibility for off-specification cargo. Tanker owner/operators are responsible for off-specification product cargoes when the vessel is identified at fault. The Tanker owner /operator shall be given the opportunity to secure the services of an independent petroleum surveyor in the event a discrepancy would be suspected or identified. A representative sample taken at the custody transfer point shall be used to determine source of contamination.

5.1.1.5 Pre-loading inspection of tankers. The following actions shall be taken prior to approving tankers for loading:

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5.1.1.5.1 Vessel inspection.

a. When a vessel internal cargo tank inspection is required (see 5.1.1.4 for tanker inspection policy for MSC vessels), the QAR shall assure vessel conditioning has been performed in accordance with Table XXVII. Before entering vessel tanks the QAR shall confirm that tanks are gas and vapor free. The vessel owner/operator is responsible for obtaining the services of a Marine Chemist should validation of confined space operation require it. MSC vessels and charters are not on-hire or back-in-service until the QAR accepts the vessel as suitable to load.

b. When a vessel does not require internal cargo tank inspection, the QAR shall validate that the vessel has either properly cleaned and/or stripped. The QAR shall validate the vessel certification, as required in section 5.1.4.3, is written on the Notice of Readiness. The QAR shall validate the liquid measurements are reflected on the OBQ arrival certificate. The QAR shall randomly validate the water content in all cargo tanks by witnessing water cuts on the gauge tape.

5.1.1.5.2 Vessel tank inspection. When requested to perform an inspection a QAR shall personally enter and inspect the vessel's cargo tanks prior to loading to determine suitability for loading. The QAR shall also check systems and lines to assure that they are drained and properly isolated and that any overboard discharge, sea suction and isolation valves are sealed and tagged with serially numbered seals provided by the contractor. All seal numbers shall be recorded on the shipping documents. All cargo valves shall be in the open position prior to physically entering the cargo tanks.

a. In cases of multi-port loadings, the QAR at the initial loading port is responsible for physically inspecting all vessel cargo compartments. Consequently, the QARs at subsequent loading ports shall not enter any cargo tanks and where possible, empty tanks shall then be visually inspected from the deck.

b. All cargo tanks containing liquids shall be gauged and sampled, and samples shall be retained. Where cargo tanks to be filled have on-board quantity (OBQ) from a previous cargo/parcel, the product previously loaded shall be gauged, sampled and tested to the extent deemed necessary for conformance to the applicable specification prior to topping off. Cargo tanks not being topped off (if any) that have been loaded at a previous port shall be gauged and sampled. These samples are to be held in the event loading difficulties result in commingling of products. [2]

c. Tanks used for loading must be coated with an approved epoxy. Coating must be adherent: no flaking, peeling, or blistering.

d. Cargo tanks that contain heating coils shall be checked to assure that the coils are tight and no liquid/steam can escape. One way to validate this is by performing a pressure tightness check on the system. Coils containing yellow metals (copper, bronze, etc.) are not permitted for aviation turbine fuel use. The QAR shall report any vessel found to contain coils with yellow metals to MSC PMO5, DLA-ENERGY Regional Quality Manager and DLA-ENERGY-QA. This precludes chartering that vessel for a cargo of aviation turbine fuel.

e. It is mandatory that JPTS be loaded in tanks in which the last product carried was JP-5, JP-4, kerosene, non-aromatic solvent, unleaded gasoline, or arctic diesel. Prior to loading JPTS, tank cleaning requirements are: tanks must be machine washed with hot water, if cleaning chemical and/or salt water is used, the final wash must be with fresh water. Tank bottoms, interior bulk heads and internals must be completely free of sediment, scale and other contaminants. Tanks must be dry and all liquids completely

[2] NOTE: This gauging and sampling does not apply to tanks containing JPTS. Special tank preparations and cargo handling is required for JPTS, to prevent contamination.

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removed from the tanks' lines after cleaning, must be flushed with fresh water, drained and free of all water. Loading and unloading system must be completely isolated. This will be accomplished by completely separate piping systems or by use of blinds. Valves will not be depended on to effect isolation. No common lines will be used. Steam smothering lines should have at least two valves that can be sealed from the main line to the tanks, or a blind installed that can be readily removed. Each tank will have its own individual vent. If ship has a common vent system, tanks used for JPTS must be isolated from balance of the vent system.

5.1.1.5.3 Vessel tank/internal rust test. When considered necessary and where safety precautions permit, the QAR will require that samples of the rust be taken from selected cargo tanks and tested with the product to be loaded or with a similar solvent. This procedure is performed to determine the effect upon the corrosiveness and gum characteristics of the product. The rust shall be pulverized and added to a sample of the product to be loaded, or to a similar product, in proportions of 5 to10 grams of rust per 100 mL of the liquid. After shaking the mixture vigorously for at least one minute, it shall be filtered free of rust and tested for color, corrosion and residue.

5.1.1.5.4 Vessel loading plans. Loading plans shall be reviewed to determine their suitability, giving consideration to bulkheads, lines, tank capacities, and ship's trim. In the case of split cargoes, the QAR shall ensure the vessel is physically suitable for handling two or more grades of product simultaneously without contamination. The QAR shall ensure all bulkheads are secure and the vessel has double valve separation or line blanks. If valves are used, such valves shall be lashed and sealed in proper position against misuse. Initial and normal pumping rates shall be agreed upon before starting. If differences cannot be resolved locally, they shall be referred to MSC. Prior to loading, all water shall be removed from the vessel pipelines and cargo tanks.

5.1.1.5.5 Multi-port inspection. When a vessel is scheduled for a multi-port loading, the inspector at the first loading point shall inspect, if practical, all of the ship's cargo tanks to determine their suitability for the scheduled product. The vessel shall not be approved for loading part of the cargo unless all cargo tanks are considered suitable for the respective products. QARs at the subsequent loading point(s) shall be advised by appropriate means of the results of the previous tank inspections. This does not preclude rejection by QARs at subsequent loading points if conditions warrant such action.

5.1.1.5.6 Quality and quantity determination. Vessel movements must not be expedited at the expense of quality and quantity determinations, regardless of pressure or protests. Full support shall be given the QAR for reasonable actions taken to assure quality and quantity.

5.1.1.5.7 Vessel rejection/delay. For MSC (Military Sealift Command)-controlled vessels, DLA-ENERGY-QA will be notified immediately to discuss the reason for rejection and/or need for re-cleaning. The QAR shall follow up the DLA-ENERGY-QA notification with a report to the cognizant DLA-ENERGY Region, DLA-ENERGY-BI and MSC on vessel rejection or delays in loading operations. The report shall contain pertinent details, including length of delay anticipated for tank cleaning and product availability. For CONUS locations, telephone MSC Washington, D.C. at 202-685-3121 (FAX: 202-685-5362). All calls shall be confirmed by a message to Commanding Officer, MSC (COMSC), Washington, D.C. with the local MSC representative and DLA-ENERGY as information addresses. For locations outside CONUS, a priority message shall be dispatched to COMSC, Washington, DC, with the same information addressed as for CONUS. Rejection or delays shall be well documented including dates, times, circumstances, personnel, discussion, etc. They shall be detailed on the DD Form 250-1 with supporting documentation included. Contract administrative documentation, to include DD-250-1, of these cargoes shall be kept for 6 ½ years from date of completion IAW the FAR.

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5.1.1.6 Pre-loading procedures (Shore/Tanker).

a. Assure sampling, testing and approval of shore tank prior to loading aboard the vessel (see Table IX).

b. Check loading lines to determine they are properly isolated and do not contain product detrimental to the cargo. Drain free water from each tank to be used through the water draw-off line.

c. Assure loading lines are full. In some cases, especially underwater lines, the lines may be required to be empty prior to loading. Witness opening and closing shore tank gauges, and opening and closing meter readings (when used).

d. Determine the position and setting of the swing line in the shore tank (where applicable) to prevent loading of any free water or sludge from the tank bottom. Water shall be drawn from the tank bottom through the water draw-off if it is anticipated that there is any possibility of loading the water with the cargo.

e. Review the cargo layout and loading plan. The QAR and the master of the vessel (or his designated representative) shall concur on the cargo layout and loading plan.

f. Inspection (to include checking the vessel's log on nature of previous cargoes and the vessel's condition: leaks, previous rejections and excessive delays, for instance) and approval or rejection of the vessel cargo tanks.

g. Assure sea suction and overboard discharge valves are closed and sealed prior to loading. In the case of split cargoes, those valves essential to cargo isolation shall be sealed with serially numbered seals and their numbers recorded on shipping documents.

h. Assure all parties are aware of sampling procedures for "first-in" prior to commencing. Check cargo first-in and line samples' analyses to verify quality of product moving to the vessel.

5.1.1.7 Loading procedures for tankers. Product quality and isolation shall be assured in shore tanks and all lines used in loading. The line fill, approximately 2,000 to 5,000 barrels, shall first be pumped into one or two cargo tank(s) on the vessel. Request the ship's officer to switch from this tank to other tank(s) and continue loading. A sample shall be drawn (after a 30-minute wait) from the first tank and tests performed to determine if the quality of the product being loaded is satisfactory. Further sampling and testing shall be conducted to the extent deemed necessary by the QAR. If at any time during loading there is an indication of contamination, the loading shall be stopped until the cause and extent of the contamination has been determined. When loading aviation turbine fuel or kerosene, loading procedures (from COMSCINST 3121.3) shall be as follows:

5.1.1.7.1 Lines. If the vessel does not have segregated ballast, prior to loading, all lines shall be dropped and water removed from cargo tanks. If simultaneous ballasting or de-ballasting must be performed during cargo operations, record this fact and the reason(s) for it on the Material Inspection and Receiving Report. A description of the degree of segregation that was maintained during the operation should also be recorded.

5.1.1.7.2 Loading rates. Initial loading shall be at a rate not in excess of three feet/one meter per second (about 1,500 barrels per hour through a 12-inch line) through loading lines into the cargo tanks until the discharge outlet has been covered by at least three feet of the product. Thereafter, the normal loading rate may be resumed. The loading rate of three feet per second applies to the flow into each tank. The total loading rate shall not exceed the sum of the allowable rates for the individual tanks being filled. If there is evidence of turbulence or splashing of the product in a cargo tank after the discharge outlet is

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covered by the specified three feet of product, the reduced loading rate shall be continued until turbulence ceases.

5.1.1.7.3 Thirty minute wait. Ullages, water soundings, temperatures and samples, including the first-in samples, shall not be taken from any cargo tank until at least 30 minutes after flow into the tank has ceased in order to dissipate static charge built up during the fuel movement. In the meantime, loading of other tanks may proceed.

5.1.2 Shipments by barges and refueling craft. This section covers pre-loading and loading procedures for barges and refueling craft. Those procedures for tankers are covered in 5.1.1. Post loading procedures for tankers and barges are addressed in 5.1.4.

5.1.2.1 Pre-loading and loading inspection. Precautions and procedures outlined in 5.1.1.4, 5.1.1.5, 5.1.1.6, and 5.1.1.7 are applicable to barges and refueling craft to the extent possible, except rust samples shall be taken only if the last cargo carried indicates this action to be necessary and can be taken under safe condition.

5.1.2.2 Product conversions. Table XXVIII covers conversion from one product to another.

5.1.2.3 Inspection procedures for cargoes. Key operations in loading of barges and refueling craft include the following:

a. Sampling, testing, and approving shore contents prior to loading aboard the vessel (see Table IX).

b. Checking loading lines to determine that they are properly isolated and do not contain product detrimental to the cargo.

c. Ensuring lines are full. Obtaining opening and closing shore tank gauges. Obtaining opening and closing meter readings where necessary.

d. Determining the position of the swing line in the shore tank, where applicable, and setting it at a position to prevent loading of any free water or sludge from the tank bottom. Water shall be drawn from the tank bottom through the water draw-off if it is anticipated that there is any possibility of loading water with the cargo.

e. Checking the cargo layout and loading plan. The QAR and the master of the vessel (or his designated representative) shall concur on the cargo layout and loading plan. The QAR shall assure that the loading plan is for the ordered quantity. If differences exist between the vessel, shore facility and/or the QAR, the matter must be resolved expeditiously prior to commencement of loading. This may require confirmation from the ordering office. Allowable variances from the ordered quantity per the contract are only acceptable if based on a condition of manufacturing, loading or shipping. Neither product suppliers nor vessels should be targeting more or less than the original ordered quantity.

f. Inspecting (to include checking the vessel's log on nature of previous cargoes and leaks, for instance) and approving or rejecting the vessel and individual cargo tanks. Prior to loading aviation turbine fuels, vessels shall have the tanks receiving the product stripped and mucked to remove residual contaminants and moisture (IAW MSC Policy 98-01 and Table XXVII). These procedures shall be applied to barges (over 30,000 barrels size) and refueling craft to the maximum extent possible.

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g. Closing and sealing sea suction and overboard discharge valves prior to loading. In the case of split cargoes, those valves essential to cargo isolation shall be sealed with serially numbered seals and their numbers recorded on shipping documents.

h. Checking/analyzing first-in and line samples to verify quality of product moving to the vessel.

i. Sampling and testing of contents of vessel's cargo tanks during and after loading (see Table IX).

5.1.3 Post, camp, and station purchase program This section excludes fuels which are delivered directly into a vessel's fuel tank (the process of bunkering - see 5.5). It also excludes barge receipts under the post camp and station program (see 5.4). For F.O.B. Destination contracts, the product supplier may have a representative present at the discharge facility in order to witness quantity and quality procedures performed at the destination receipt facility.

5.1.3.1 Shore side. Before commencing with a receipt of fuel, personnel shall assure that the shore-side is ready for discharge to ensure the quality of the product in the receipt tank(s) subsequent to receiving the product. The terminal shall be aware of the time of the vessel's arrival. Personnel shall assure line condition is full and properly isolated in accordance with MPMS. Free water shall be drained from the tank through the water draw off line. Shore tanks shall then be gauged and temperatures determined in accordance with the MPMS. Personnel shall determine net quantity before discharge. If necessary, samples shall be taken of the line to assure product is the same as that being discharged (e.g. when the line contains unlike product in a non-dedicated system or when problems were experienced with the previous receipt). If additives are to be injected into the product during discharge, personnel shall assure injectors are in working order and that required additives are in proper quantity and quality.

5.1.3.1.1 Defuels from USN vessels. Test representative samples sent from the vessel cargo/bunker tanks to assure product quality. In some circumstances the vessel may elect to defuel to a barge to consolidate all product and expedite repairs or operational re-deployment. JP-5 shall be tested to type B-1 series tests plus thermal oxidation stability. F-76 shall be tested to type B-1 series test. Request disposition instructions for off-specification fuel from DLA-ENERGY-QA IAW section 5.13.2.

5.1.3.2 Vessel pre-discharge inspection. Paperwork onboard the vessel shall be examined to confirm product type, quantity and quality, and the presence of free water. If there is any indication the product does not conform to the quality requirements, discharge shall not be commenced until the disposition instructions have been received in accordance with this Standard (see 5.13.2). Personnel shall verify that seal numbers as compared to the DD Form 250-1 are intact. A meeting shall be held with vessel personnel prior to discharge to discuss procedures and pumping rates to be used. Tank gauging/temperature determination shall be witnessed for record and net quantities shall be calculated. If variations of 0.5 % volume are indicated on an individual barge gauging comprising a shipment of two or more barges, then that barge shall be discharged separately and separate shore tank gauges taken. Monitor all-level tank samples and testing as stipulated in Table IX. The remainder of the composite sample shall be retained until discharge is complete and the shore tank is tested. Product is normally discharged when laboratory tests show conformance to specification requirements.

5.1.3.3 Contaminated product. If the product is suspected of being contaminated, it shall be sampled prior to off load and submitted to a laboratory for a minimum of B-3 series analysis. If testing facilities are not readily available, but a visual examination shows contamination, then DLA-ENERGY shall be notified (see 5.13.2). Disposition instructions are provided based on the circumstances (product contaminated, contaminant, the configuration of the discharge facility, the urgency for the product) and options available (availability of filter-separators, product isolation ashore, product blending capability

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ashore, or possibility of product remaining on vessel for disposition at another facility). Prompt action shall be taken to reduce vessel lay time costs.

5.1.3.4 Discharge. Once authorization for discharge has been given, the vessel notifies the shore when ready to commence and ensure communication is maintained between ship and shore for the entire operation. Personnel shall ensure that line samples are being taken as required (Table IX, Serial 5b) and shall monitor logs as well as line sample results.

5.1.3.5 Completion. Upon finishing the discharge, personnel shall determine product Remaining On Board (ROB), calculate net quantity received ashore, investigate any quantity discrepancies, sample and test product after settling, complete discharge DD Form 250-1, and gather any other applicable documents to include ullage sheets, bunker reports, etc. Any delays in discharging and/or investigation results shall be reported to DLA-ENERGY.

a. After the vessel is unloaded, the Government Representative shall examine each cargo tank to determine if any product is remaining onboard. Cargo tanks containing product(s) ROB shall be gauged and the amounts determined by the correct applicable procedures such as capacity tables and wedge formula. If it is impossible to obtain accurate figures, the quantities should be estimated. The quantity, the cargo tank number involved and pertinent information or reason for incomplete discharge shall be entered on the DD Form 250-1, Tanker/Barge Loading/Discharge Report. If it is not the final destination port, the Government Representative at the next discharge port shall be notified of any unusual conditions, gauges, or losses identified.

b. Shipping and handling losses or gains, as cited in DoDM 4140.25-M, shall be recorded by the destination Government Representative on the DD Form 250-1, indicating the cause of the loss/gain to the extent possible. The destination Government Representative remarks, concerning the loss or gain, shall be confined to observations and evaluations made at the receiving terminal. Tank gauges, line capacities and ship ullages shall be checked as necessary in attempting to account for the loss or gain (DoDM 4140.25-M along with paragraph 5.1.1.4.5 of this document establishes loss or gain criteria). If the loss or gain cannot be accounted for at the final discharge point, the Government Representative shall immediately communicate with the QAR at the loading point(s) and simultaneously with the Government at each intermediate discharge point (if any) to determine possible reasons for the loss or gain. Each Government Representative queried shall advise final destination of his findings within 15 calendar days. The final destination Government Representative shall consolidate the data and forward it to the accountable property officer. Corrected DD Form 250-1(s) shall be initiated and distributed as appropriate.

c. The required inspection documents shall consist of DD Form 250-1 (Tanker/Barge Discharge Report), DD Form 250-1 Continuation Sheet, the shore tank ullage or innage report, the vessel ullage or innage report, bunker reports (if any), laboratory test results sheets and such other documents as required. Distribution of these documents should be made in accordance with DFARS and/or contractual requirements.

5.1.3.6 Vessel delay. For MSC-controlled vessels - report to the cognizant DLA-ENERGY Region, DLA-ENERGY-BI and MSC on delays in discharge operations, with pertinent details, including length of delay anticipated. For CONUS locations, telephone MSC Washington, D.C. at 202-685-3121 (FAX: 202-685-5362). All calls shall be confirmed by message to Commanding Officer, MSC (COMSC), Washington, D.C. with the local MSC representative and DLA-ENERGY as information addresses. For locations outside CONUS, a priority message shall be dispatched to COMSC, Washington, DC, with the same information addresses as for CONUS.

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5.1.4 Post-loading - tankers and barges. This section covers post loading of tankers and barges. Procedures for pre-loading and loading of tankers are in 5.1.1.6 and 5.1.1.7. Those procedures for barges and refueling craft are covered in 5.1.2.1.

5.1.4.1 Vessel samples. Government shall witness sampling of vessel cargo tanks. The Government Representative shall monitor cargo tank gauging and temperature determination, and water cuts as time permits. If possible, water shall be stripped ashore before the tanker is released. Maintain surveillance of the stripping operation. Failing this, advise the master to strip water out of the cargo tanks into vessel slop tanks. Report fuel loss during the stripping operation.

5.1.4.2 Determination of quantity. Government Representative shall witness shore tank gauging (opening and closing). The Government Representative shall independently determine shore and vessel net quantities, and ship/shore losses or gains. If a ship/shore loss or gain is determined, the Government Representative will re-compute to confirm the numbers and conduct an investigation if there is still a loss or gain and the variance is outside the allowed variance (see 5.1.1.4.5 for tolerances).

5.1.4.3 Inspection documents covering tanker and barge loading[3]. Government Representative shall assure completion of the required inspection documents that includes a DD Form 250-1, Tanker/Barge Loading Report, Continuation Sheet, ullage or innage report and such other documents as may be required. If the product is loaded from more than one tank, list the tests applicable to each tank in separate columns headed by the tank number. The date the material in each tank was approved and quantity loaded from each tank shall be indicated in the appropriate column. The QAR may require additional testing if the situation so warrants. Assure distribution of these documents is made according to DFARS.

5.1.5 Ship-to-Ship Transfers at Sea. Issuing and receiving vessels are responsible for performing quality checks before, during and after a transfer. The issuing vessel will strip water from the tank just prior to the transfer to assure water and sediment are not transferred. Line samples will be taken and checked for appearance every thirty minutes during the transfer by the receiving vessel.

5.2 Pipeline operations.

5.2.1 Shipments by pipelines. This section applies to all movements of product belonging to or to be accepted by the Government, except movements of Contractor-owned product where quality is verified after receipt at a terminal and prior to delivery to the Government. The movement of petroleum products via multi-product pipelines presents many problems in the control of quality and the operation requires close surveillance. This section furnishes guidance related to quality of petroleum products shipped in pipelines. This does not apply to bunker fuel where the mode of delivery is pipeline.

5.2.1.1 Tariffs and agreements. Carriers' tariffs outline the normal responsibilities of the pipeline company. Supplemental agreements are usually entered into between the Government and the carriers, which further elaborate on the extent of the carriers' responsibilities. Copies of these agreements shall be made available to cognizant quality assurance offices by either the DLA-ENERGY Region or prime contractors as applicable. These documents shall be reviewed by the QARs concerned and the provisions thereof shall be used in product quality surveillance.

5.2.1.2 Laboratory testing. Products shall be tested in accordance with the appropriate Table IX-XXV before entry into and after discharge from a pipeline. For pipelines carrying aviation turbine fuels

[3]It is recommended that laboratory tests report sheets be attached separately vice transcribing results onto the DD 250-1.

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and automotive gasoline, laboratory facilities shall be made available to perform identification tests on products at terminals along the pipeline system.

5.2.1.3 Markings. Single and multi-product pipelines, pumps, and valves shall be marked to clearly identify the grade of a product being carried. These markings shall be placed adjacent to all operating accessories such as valves, pumps, regulators and manifolds. MIL-STD-161 provides guidance on color markings and titles. However, due to security issues, military style markings may be replaced by an acceptable alternative when required by the security office.

5.2.1.4 Identification tests. When products are transferred through a multi-product pipeline, identification tests are required in accordance with Table IX.

5.2.1.5 Multi-product pipelines. Pipelines are to be used wherever possible for one grade of fuel only. However, multi-product pipelines are often used between bulk terminals.

5.2.1.5.1 Product identification. The product entering a multi-product pipeline or discharging from it shall be identified by a flag or sign on the connections to the multi-product pipeline.

5.2.1.5.2 Pumping time. Pumping shall normally be continuous until product has been cutoff.

5.2.1.5.3 Pipeline transfer velocity. Product velocities in pipelines shall be maintained to minimize mixing of product.

5.2.1.5.4 Segregation during transfer. Preferred procedures for segregating products during movement are shown in their order, see the following:

a. Turbulent flow without plugs between products.

b. Hydrocarbon plug between products or grades.

c. Mechanical plugs (batching balls) between products or grades.

d. Disposal of Water-Mixed Product. Provision shall be made for removal and disposal of mixed product and water.

5.2.1.6 Terminal, depot, and base system.

5.2.1.6.1 Product compatibility. Before the pipeline transfer is started, it shall be determined whether the product in the line (line fill) is the same as the issue/transfer tank product or can be included in the transfer.

5.2.1.6.2 Cleaning of pipelines. Incomplete flushing or cleaning of multi-product pipelines is a potential source of contamination. Pipelines are cleaned using various methods, most of which involve various types of pigs. These create large quantities of scale, sediment and water called pig clouds. Isolation of these pig clouds is required so as to preclude a major contamination of working tanks. The preferred method of receiving a pig cloud is into a truck(s) to capture the largest portion of the cloud. Containment in a small tank is next or into a tank that is already scheduled for cleaning in the next three months.

5.2.1.6.3 Valve and pipeline control. Proper blinding off of connecting lines and correct valve control during transfer will minimize the possibilities of pipeline contamination.

5.2.1.7 Cross-country system.

5.2.1.7.1 Turbulent flow. Maintaining of turbulent flow during multi-product movements and a packed line when shipments are static is mandatory to ensure a minimum of transmix.

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5.2.1.7.2 Batch cuts and segregation. Both improper batch cuts and product segregation are potential sources of contamination.

5.2.1.7.3 Contaminated pipeline shipment. Rust contamination during pipeline shipments can result from inadequate corrosion inhibition or scraping of the pipeline.

5.2.1.7.4 System isolation. Isolation of the system from all inter-connecting lines by suitable blinds or two block valves with an open bleeder valve between will minimize the possibility of product contamination.

5.2.1.8 Common transfer lines and pumps for fuels.

5.2.1.8.1 Preferred method. It is preferable to utilize separate pipelines, valves and pumps for each type and grade of fuel in order to maintain the quality of liquid fuels.

5.2.1.8.2 Use of water displacement. Except where approved hydraulically-operated water displacement systems are employed, displacement by water is not recommended.

5.2.1.8.3 References. Detailed information on the operation, maintenance and inspection of facilities used in dispensing and storing fuels may be found in appropriate departmental directives and manuals.

5.2.1.9 Segregation. The segregation of product in military multi-product pipelines is accomplished by maintaining turbulent flow, by the use of a batching plug or buffer batch of a suitable hydrocarbon. During movements with turbulent flow, constant surveillance shall be maintained to ensure minimum flow rates required for turbulent flow. Even though commingling occurs under all conditions at the interface between products, the objective is to control the length of the transmix and ensure its proper disposition. The resultant transmix will vary in amount with factors like pumping rate, distance and contour of the line, line pressure and number of pumping stations. Cuts into terminal storage shall be made in accordance with Table XXIX. If this schedule cannot be followed because of operational requirements or limited capacities of a terminal, cuts shall be made in a manner ensuring delivery of an on-specification product to the consumer. No other product shall be commingled with grades JP-5, JP-8, JPTS or aviation gasoline (all grades).

5.2.1.10 Corrosion control. Fuels transported by pipeline are subject to contamination by rust, sediment (solids), water and surfactants. Periodic checks shall be made to determine the extent of internal deterioration of the pipelines.

5.2.1.10.1 Determination of sediment (solids). An increase in solids content in petroleum products while in transit through a system can indicate rust buildup in the system. Particulate buildup may also be the result of insoluble agglomerates formed from fuel oxidation processes. The amount of solids may be determined by ASTM D2276, D5452, or D6217 as applicable. Solids content of product samples taken at the shipping and receiving points or at periodic intervals at the receiving point will provide data for comparison.

5.2.1.10.2 Corrosion inhibitors. Fuel for military aircraft and ground vehicles may contain approved corrosion inhibitors to reduce corrosion of the pipeline and handling systems. Corrosion inhibitors also enhance fuel lubricity, which is required for some aircraft components. All aviation turbine fuel will normally be supplied by the manufacturer with a corrosion inhibitor. It is permissible to inject approved oil soluble corrosion inhibitors into aviation turbine fuel being moved by pipeline to effectively control pipeline corrosion, subject to the limitation indicated in 5.2.1.10.5. To ensure proper protection, the inhibitor effectiveness shall be checked at various points along the line. This can be accomplished by a

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visual inspection of the steel coupons that have been installed in the fuel stream in the pipeline, or by determining metal loss from change in weight of the specimens (see Test Method 1000 of this Standard for rating level). Another method is making a visual inspection of steel rods or strips that have been used in specific laboratory tests on fuels taken from the pipeline.

5.2.1.10.3 Aviation Turbine Fuel Additive Concentration. In the event corrosion inhibitor shall be added, only those inhibitors listed in the current Qualified Products List for MIL-PRF-25017, and those approved for that product shall be permitted. Care shall be taken to ensure approved concentration in the product is not exceeded. Excessive inhibitor will lower the water separation rating. Only corrosion inhibitors listed in STANAG 3390, Guide Specification and Inspection Standards for Fuel Soluble Lubricity Improvers, are approved for use in the NATO pipeline system.

5.2.1.10.3.1 Location. To locate information, link to the Qualified Products List at the ASSIST website then type the QPL number (25017) and hit enter. Page down to "Revision History" and click on "active version of QPL-25017." Another screen will appear and click on Click on QPD. To get concentration for each additive you click on "source notes

5.2.1.10.4 Pressure drop. A gradual reduction in product flow rates while maintaining a constant pumping pressure can be caused by increased internal corrosion in the pipeline system. A continued increase in pumping pressures to maintain normal product delivery rates may also be indicative of internal corrosion buildup. Such evidence shall be brought to the attention of the responsible authorities.

5.2.1.10.5 Drag Reducer Additive (DRA). Drag reduction additives (DRAs) improve flow in pipelines by reducing turbulence. The present DLA Energy policy is that no DRA will be added to any military aviation turbine fuel, motor gasoline or automotive diesel. To ensure the absence of DRA in government owned fuels, if a pipeline company is injecting DRA into commercial product, the DRA injection must be stopped two (2) hours before and resumed two hours after the expected government fuel batch has passed the injection point. This will preclude the inadvertent inclusion of DRA into the government fuel and should exclude the DRA in any transmix.

5.2.1.11 Quality surveillance pipeline procedures. QARs should:

a. Assure products to be tendered through the pipeline conform to the applicable specification or standard.

b. Maintain surveillance over the pipeline operations during the transfer to another carrier and at key points in the system during the movement of tenders. Examine records of pumping rates, progress of tenders, extent of transmix, gravity and color determinations.

c. Witness the cutting of tenders or batches into pipeline receiving tanks. In emergency circumstances where witnessing batch cuts are impossible, a review of the product change record shall be made when the sampling and testing of the receiving tank are witnessed.

d. Verify the quality of product in pipeline receiving tankage after receipt of the tender or batch. Select the identification tests to be performed for verification of product quality (See Table IX Serial 6).

e. Maintain familiarity with procedures used to protect or condition the pipeline interiors.

f. Where necessary, evaluate the characteristics of the transmix to determine its disposition. The procedures for this evaluation, a suitable form for recording data and a sample of the calculations involved are shown in the product change record form (See Appendix E).

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5.2.2 Receipts by pipeline.

5.2.2.1 Before receipt. Before commencing receipt of fuel, personnel shall assure the quality of the product in the intended receipt tank(s). The terminal shall be aware of the time and quantity of the pipeline tender. Personnel shall assure line condition is full and properly isolated. Tanks shall then be gauged, temperatures taken and a net quantity determined before receipt of product in accordance with the MPMS or other applicable publication. If necessary, samples shall be taken of the line to assure product is the same as that being received. When additives are to be injected during receipt into the tank, personnel shall assure injectors are in working order and that required additives are the proper type and in the proper quantity and quality.

5.2.2.2 During receipt. To the maximum extent possible, personnel shall witness batch cuts to assure they are in accordance with contract or operating agreement (e.g.: heart, mid-point, etc.) See Table XXIX. If line samples are being taken during receipt, assure that each sample is being properly taken. Personnel shall monitor samples taken throughout the receipt of the tender for contamination (e.g. water, increased sediment, secondary products).

5.2.2.3 Completion. Upon completion, personnel shall determine quantity by gauging the receipt tank(s) used, measuring temperatures and calculating net quantity received. Personnel shall investigate any quantity discrepancy in excess of that cited in DoDM 4140.25-M and allow receipt tanks time to settle before sampling and testing. Receipt tanks shall be sampled and tested in accordance with ASTM D4057 (MPMS, Chapter 8.1 or other applicable publication) and Table IX of this Standard. Personnel shall assure samples are retained as called for in the quality control plan or established quality procedures. The DD Form 250 shall be completed and signed.

5.3 Truck and tank car operations.

5.3.1 Shipments by tank truck and tank car.

5.3.1.1 Tank truck and tank car service/conversion. Tank cars and trucks shall be continuously kept in the same grade of service to minimize the possibility of contamination. If this is impracticable, each vehicle shall be processed for a change in grade in accordance with Table XXVI of this Standard, except as outlined in the conversion policy below.

5.3.1.2 Tank truck and tank car conversion policy. The following policy is in effect concerning cleaning requirements of commercial trucks when switching from gasoline to Aviation Turbine Fuel. Trucks are required to be steam cleaned after carrying gasoline and prior to carrying jet fuel. DLA-ENERGY Region Commanders may approve exceptions to this policy for Aviation Turbine Fuel, provided that the transportation officer can verify that trucks and tank cars which previously carried turbine fuels are not available and that there is a definite need to forgo cleaning as required by this Standard. This need to forgo the cleaning would be based on having to load out of a specific facility to accomplish a specific mission[4]. The transportation officer shall then forward a request for exception to the Region Commander, identifying: the need not to clean trucks and tank car; the risks to product quality; and the procedures to be established to abide by the requirements cited below. A complete file should be kept at the region facility for which an exception has been requested. As a minimum the file should include: identification of the facility, the initial request by the transportation officer, identification of quality controls to be in place; approval or disapproval by the Region Commander, and the collected

[4] Each facility shall be a separate request and a separate evaluation. Facilities shall not be combined in this instance.

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data. Exceptions for each facility shall be re-certified by each new commander, transportation officer, and quality manager after initial implementation. All problems with customer rejection of product, or at the facility with off-specification product, shall be reported to DLA-ENERGY-QA. Exceptions shall be curtailed any time loss of quality control is indicated.

5.3.1.2.1 Exception/quality data. As outlined above, the following data should be collected as part of any exception concerning cleaning requirements switching from gasoline to turbine fuels. The following data shall be collected and requirements met for each DFSP for which an exception is requested:

a. The JP-8 received at the DFSP shall have sufficient headroom difference between the minimum JP-8 specification requirement and actual flash point in the issue tank so that some product degradation can be tolerated. The DFSP issue tank shall have minimum 10 °C headroom above the specification or equal to or greater than 48 °C (118 °F).

b. DFSP personnel shall examine each truck and tank cars previously carrying gasoline to determine if the truck (to include its pumps and piping) have been completely drained and dried. There are no exceptions to a drained and dried conveyance after it has carried gasoline.

c. Test a conveyance composite sample for density and flash point prior to release. DFSPs shall collect and monitor flash point data.

d. Regardless of headroom, only minus 5 °C flash point degradation shall be tolerated at the DFSP level. Results beyond this shall require DFSP personnel to identify the cause of the degradation (e.g. gasoline remaining in the manifold/piping) and discuss with the trucking company methods to preclude recurrence. Failure to correct the situation would require the steam cleaning requirement to be reinstated.

e. As a precautionary measure, the DFSP shall submit conveyance composite samples for B-1 plus ASTM D3241 thermal stability testing every 30 days for the first three months. Barring any problems, samples shall then be continued quarterly for the first year and then tested as deemed necessary by the QAR. This is a precaution against interactions with new reformulated gasolines, or any possible contamination picked up during transport of JP-8.

5.3.1.3 Tank truck and tank car loading.

5.3.1.3.1 Safety. Appropriate safety measures shall be taken during loading and unloading operations. Blanking caps shall be fitted to all filling and discharge connections not in use.

5.3.1.3.2 Loading line. Prior to loading, the contents of the source tank and the loading line to the fill rack shall be checked in accordance with Table IX.

5.3.1.3.3 Procedures at the loading rack. Upon arrival at the loading rack, trucks and tank cars shall be inspected for mechanical condition and suitability to transport the product. Dome covers shall be opened, bottom outlet caps on tank cars removed, and the bottom outlet valves fully opened. This allows residues from previous cargoes to drain completely into a suitable container. The outlet valves shall be inspected and if found defective shall be repaired or replaced prior to loading.

5.3.1.3.4 NATO codes. In NATO countries, wherever possible, the vehicle should be clearly marked with the NATO code numbers of the product being carried.

5.3.1.3.5 Gaskets and hose connections. Care shall be taken to ensure gaskets and hose connections are maintained in good condition so fill and discharge connections will be air and fluid tight.

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5.3.1.3.6 Vehicle tank cleanliness. Each truck or tank car shall be inspected for cleanliness and suitability to receive product. Interiors, including domes, shall be free from loose rust, scale, or dirt and shall be dry (water-free) prior to loading.

5.3.1.3.7 Product free-fall. For top-loading facilities, care shall be taken to prevent fuels other than residuals from free-falling or splashing during loading operations by inserting the discharge hose or loading arm fill pipe to the bottom of the tank. The fill rate shall be slow until hose or fill pipe is covered by six inches of product. Prior to loading, particular attention shall be given to the outlet and safety valves to ensure they are properly seated and in operable condition.

5.3.1.3.8 Recording test results. The contents of each tank car and truck shall be sampled for verification tests (Table IX) upon completion of loading. Test results shall be recorded and retained for one year. Retained samples of the truck/car loading shall be held until product has been received and tested by the using facility.

5.3.1.3.9 Sealing. Where sealing is required domes and/or unloading valves in the case of tank cars and all openings in the case of truck loadings shall be secured and sealed with serially numbered seals immediately after filling. Serially numbered seals and the API gravity at 60 ºF or density at 15 ºC shall be noted on shipping documents.

5.3.1.3.10 Placarding. Trucks and tank cars shall be properly placarded, identifying cargo being carried prior to departure from the loading facility.

5.3.2 Tank truck and tank car receipts. This section excludes tank truck and tank car receipts of motor gasoline, diesel and heating oil under the post, camps and station program (see 5.4).

5.3.2.1 Before receipt. Before commencing a truck or tank car receipt of fuel, personnel shall assure that the receipt tank is ready and that the quality of the fuel in the receipt tank(s) has been determined. The terminal/facility shall be aware of the time and quantity of the arriving trucks. Personnel shall assure line condition is full and properly isolated to receipt tank. Normally, lines are dedicated, however, if not, line condition shall also be checked. Receipt tank(s) shall then be gauged, temperatures taken and a net quantity determined in accordance with MPMS or other applicable publication, before fuel receipt. If necessary, samples shall be taken of the line to assure product is the same as that being received. If product is to be injected with additives while discharging into the tank, personnel shall assure injectors are in working order and that required additives are the proper type and in proper quantity and quality.

5.3.2.2 Truck and tank car arrival. Personnel shall check accompanying paperwork to assure the fuel to be unloaded is the proper type and quantity. Validate the product grade in the truck is the same grade as in the receipt tank. Validate that the receiving point is identical to that on the shipping papers. If not, redirect the truck to the correct off-loading location. If being used, truck hoses shall be checked to assure they are clean and dry for use. Seals, when placed at the load point, shall be checked to assure they are intact and correspond to the numbers on the shipping manifest/DD Form 250. Afterward, personnel shall break seals, sample and test each compartment in accordance with Table IX (workmanship). Shipment must be accompanied by the test report for the product carried from the loading point. Provided all conditions mentioned are satisfactory, the product may be discharged into receipt tanks.

a. Where seals are required, the conveyance will be checked to determine if the required seals are broken or missing, the product shall not be unloaded until it is determined that the quality and

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quantity is satisfactory. Demurrage charges, if any, shall be referred to the cognizant DLA-ENERGY Region. Where tampering is evident, the shipper shall be notified immediately.

b. If water is present, it shall be drawn off prior to unloading. Fuels which have a cloudy appearance or have an unusual color shall not be accepted until laboratory tests indicate they are suitable for use.

c. At Navy, Marine Corps and Army terminals, personnel shall compare the density at 15 °C (API Gravity at 60 °F), with the density at 15 °C (API Gravity at 60 °F) reported on the DD Form 250. Both shall agree within +/- 2 kg/m^3 (0.5 degrees API).

d. In the event water has collected in the bottom outlet valve of a tank car and has frozen, preventing the free movement of the valve, a steam jet, hot water or hot cloths may be used for thawing the ice.

5.3.2.3 Truck and tank car rejection. If truck is rejected, a receiving organization shall first notify the origin shipping point and quality representative, identifying the product, truck number and reason for rejection of the product. Activities shall notify their service control point as soon as possible after rejection of vehicle.

5.3.2.4 After discharge. Personnel shall examine truck or tank car to determine if all product has been discharged into receipt tanks. Installation of a VISI-Flow gauge on the receipt system is another method enabling determination of full discharge. When all trucks/cars have been discharged, personnel shall annotate the receipt quantity on the DD Form 250. Quantity is determined by calibrated meter, gauging receipt tank(s) or methods described in DESC-P-2 Receipt and Shipment of Petroleum Products. When tank gauging is the method used for determining receipt quantities, the temperature shall also be measured and net calculations performed correcting the quantity received to 60 ºF (15 ºC). Personnel shall investigate any quantity discrepancy in excess of that cited in DoDM 4140.25-M. Time shall be allowed for the product to settle in the receipt tank before sampling and testing. Personnel shall sample and test receipt tanks in accordance with the MPMS, Chapter 8 or other applicable publication and Table IX. Samples shall be retained as called for in the quality control plan or established quality procedures.

5.4 Receipts of motor gasoline, diesel and heating oil under the post, camps & stations (PC&S) purchase program. Under DLA ENERGY purchase programs, products required at the base level are normally provided under post, camps, & stations contracts. The following products are normally procured under post, camps, and station contracts, mostly to non- Government specifications: Fuel oils (FO #2, #4, #6, etc.), Gasolines (MUR, MUM, MUP, MMR, MRR, MPR, Gasohol, E85, etc.), diesel fuels (DF-2, DL-1, DL-2, 1-D, 2-D, No. 1/2/4-D, B20, DS-1, DS-2 etc.) and aviation turbine fuel (JP-8, Jet A, Jet A-1, TS-1, etc.). For JP-8 receipt/testing, see Table IX, series 6d. Product is usually delivered directly by the contractor, via truck or tank car to the requiring activity. On fuels, other than aviation, which are delivered via truck or tank car to U.S. Government installations for their use and consumption, Government inspection for identity and quantity will be performed by the receiving activity in order to accept the fuel on behalf of the Government. Note: Trucks may or may not be sealed after loading based upon contract requirements. Normally CONUS does not require trucks to be sealed while OCONUS may require sealing due to security requirements. Whenever the item calls for delivery into or by barge, for either origin or destination contracts, the Contractor shall keep the QAR informed of the loading date and source of supply along with any changes thereto as far in advance of the loading date as is possible to permit necessary inspection by the U.S. Government. The U.S. Government reserves the right to perform quality inspection at all times and places if warranted.

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5.4.1 Truck and tank car arrival/before delivery. Product may be delivered to one location (by truck and tank car fill-to-the-mark or meter) or delivery may be made to several locations (by tank wagon, meter). If unable to take an all-level sample from the truck compartment prior to discharge, then an in-line sample taken after line displacement during discharge may be used. Responsible base personnel shall examine accompanying paperwork, assuring the correct product, quantity and location. Verify seal numbers prior to discharge where seals are applicable. Validate the product grade in the truck is the same grade as in the receipt tank. Validate that the receiving point is identical to that on the shipping papers. If not redirect the truck and tank car to the correct off-loading location. Tank compartments shall be sampled (all-level) and examined for workmanship. Gasoline, diesel fuel and particularly aviation turbine fuel shall not contain visible water and sediment. Burner fuels shall not contain more than a trace of water or sediment. Excessive sediment may plug the burner tip degrading fuel atomization. Water can cause rough burning, corrode the fuel handling system and result in the production of microbiological growth. The type of equipment and type of burner fuel will determine the allowable limits of water and sediment in the fuel. If sample testing indicates an off specification product, product shall not be accepted. The problem shall be reported immediately after the rejection of the truck, info to the appropriate service control point, to the DLA-ENERGY contracting officer (PC&S: DLA-ENERGY-PEA (703-767-9509); DLA-ENERGY-PEC (703-767-9520); DLA-ENERGY-PLB (703-767-9536); DLA-ENERGY-PLC (703-767-9511) and DLA-ENERGY-QA (703-767-8362). These are commercial numbers; the DSN is 427-XXXX, using the last four numbers of the phone numbers above. The facsimile number is 703-767-8506 for DLA-ENERGY-BP and 703-767-8747 for DLA-ENERGY-QA.

5.4.1.1 Truck and tank car after delivery/before departure. For direct delivery to one location - once off-loading has been completed, the truck shall be examined to determine if any product is Remaining On Board (ROB). This shall be annotated on the bill of lading. If multiple drops are being made using a meter, the tank wagon shall also be examined, simply as a check, especially if all quantities are supposed to be delivered.

5.4.2 Barge delivery. Product being delivered by barge shall be sampled and tested in accordance with Table IX, Serial 5 and the appropriate table (Table X – Table XXV) depending on the type of fuel.

5.5 Receipts from the bunkering program. This section applies to commercial bunker fuels (such as MGO or IFO) from commercial suppliers at ports under DLA-ENERGY Bunkers Contract. The commercial supplier shall provide and maintain an inspection system acceptable to the Government covering supplies under this program. The Government has the right to inspect and/or test supplies called for under this program. Unless otherwise noted, inspection will be performed by the receiving activity based on documents required to be supplied by the commercial supplier at the time of delivery. Acceptance of these supplies will take place at destination notwithstanding that inspection by the Government may take place elsewhere prior to acceptance. Note that within the DLA-ENERGY Bunkers Program, DLA-ENERGY does not normally perform inspection at source, rather the receiving vessel is expected to perform both inspection and acceptance functions. Acceptance on behalf of the U.S. Government is normally made by the vessel representative. The products provided under the bunker program may either be under DLA-ENERGY contracts or purchased directly by the vessel. The products are delivered to the vessels via barge, pipeline or truck when the vessels are moored to the docks. They are delivered to the vessels via barge when they are at anchor. The vessel personnel perform quality and quantity checks. Additional testing of bunker samples may be through a DLA-ENERGY, MSC or vessel contract. Vessels requesting participation in the DLA-ENERGY bunker test program shall submit their request through Navy/Coast Guard channels to DLA-ENERGY-QA. The requirements for a bunker test program include the following: (1) A flange with a sample valve (sample collar) is required to be on each

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bunker line to be used for receiving bunkers, (2) A composite sample is taken at the sample point, split three ways between the supplier, vessel and testing laboratory, (3) Sample containers/mailers are provided to the vessel for taking and sending a sample to the authorized testing laboratory, (4) Test results are provided back to the vessel within a specified time frame and (5) When problems are encountered during the delivery and cannot be resolved within the limits of the contract, the contracting office shall be contacted immediately for assistance.

5.5.1 Before bunkering. Validate that the product to be delivered is exactly as ordered. This can be accomplished by taking a representative sample of the offered product and performing as a minimum of type C tests, receiving a certificate of analysis of the product to be tendered, or by validating that the shipping documents indicate the correct product and grade are being delivered. Validate quantity to be received conforms to ordered amount. The vessel personnel have the option to witness manual gauges whether from a shore tank or bunker barge. To prevent fraud, especially on deliveries by bunker barges without delivery meters, the vessel personnel shall witness the product and water gauges for all tanks aboard the bunker barge. This shall include all slop and void spaces that could hold cargo. As deliveries are net volume or by weight, assure a temperature is taken from each cargo and slop tank. Confirm with the vessel which tanks will be issued to the vessel. When participating in a bunker test program, vessel personnel shall assure that the sample collar is properly affixed at the manifold, the sample valve is clean, sufficiently cleaned sample containers are on hand to obtain the drip sample and a sufficient number of containers are on hand to make the required distribution of the samples.

5.5.2 During bunkering. If possible, new bunkers should be segregated until test results have been received and indicate that the product is satisfactory for use. Validate at the commencement of the delivery that the product conforms to specification requirements by taking a sample at the flange. Check the appearance and gravity (if capability exists). Save at least two quarts of any product suspected of being off-specification for future analysis. Stop the delivery and investigate when problems develop. Sample several times during the delivery for a visual inspection for water, sediment or other contaminants separate from the in-line composite drip sample taken. When participating in a bunker test program, start the composite drip sample as soon as the delivery commences so as to obtain a fully representative sample of the entire bunker delivery. Collect the sample as per instructions provided in the kit. Should sampling indicate a problem on a DLA-ENERGY Bunker contract that cannot be resolved locally, discontinue bunkering and notify the DLA-ENERGY- Contracting Officer at (703) 767-8461; or by facsimile to (703) 767-8506. Problems of a quality nature shall also be reported to DLA-ENERGY-QA directly (email QA@dla.mil, phone 703-767-8736, or facsimile DSN 312-427-8747).

5.5.3 After bunkering. Validate quantity issued by the supplier and compare vessel receipt figures against supplier issue figures to confirm that any quantity difference is within acceptable tolerances. If manual gauges are used, the vessel has the option of witnessing the after delivery gauges. In order to prevent fraud, witness the after delivery bunker barge water and product gauges from every tank gauged before bunkering commenced. Maintain a record of the before and after bunker barge gauge readings. As deliveries are net volume or by weight, assure a temperature is taken from each cargo and slop tank. Assure all tanks that were not intended for delivery have not received or issued any product, water or slops during the delivery. For vessels participating in a bunker testing program, follow the instructions in the kit on preparing and dividing the sample into aliquots for shipment to the testing facility and retain samples. Normally one aliquot will be sent to the laboratory, one signed for by the supplier and one retained on the vessel. If the bunker supplier will not accept the sample, annotate in the vessel's log that the sample was refused and retain the contractor's sample also. Retains can be put back into a bunker tank after quality results are received and indicate the product conforms to specification requirements.

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When non-conforming product is indicated, notify the contracting officer providing full documentation on the receipt and the vessel's desired action for disposition of the non-conforming product.

5.5.4 Bunker Delivery Note and Statutory Sample. MARPOL 73/78, Annex VI, Regulation 14 and Regulation 18, requires that a Bunker Delivery Note (BDN) and a representative sample of the delivery be presented to the vessel receiving the bunkers by the supplier. Active duty Navy vessels that have taken the military exemption to these regulations will not accept the samples. MSC will accept samples from both commercial and DLA Energy suppliers. Copy of the BDN to be issued to MSC Vessels.

5.6 Receipts from the into-plane program. DLA-ENERGY contracts are established to service DoD/Federal Civilian aircraft at commercial airports throughout the world. Product is supplied directly to the customer and can be either commercial (Jet A/A-1) or Military (JP-8). Additives such as FSII are provided as per location requirements. Procedures for into-plane servicing are covered under MIL-STD-1548. Problems under Into-Plane contracts shall be reported to the DLA-ENERGY contracting officer (DLA-ENERGY/PHC, 703-767-8469/540-288-3030; FAX: 703-767-8506). Problems of a quality nature shall also be reported directly to DLA-ENERGY-QA (email QA@dla.mil, 703-767-8736/562-256-2509; FAX: 703-767-8747).

5.6.1 AIR Card. The Aviation In-Plane Reimbursement Card (AIR Card) is used to obtain fuel at commercial locations. It identifies the airplane for billing purposes. Use of the AIR Card does not guarantee fuel quality at locations and contractors not contracted to DLA-ENERGY under the Into-Plane Program.

5.6.2 Refueling units. When refueling units containing turbine fuel are converted to JP-8, JP-5 or commercial jet fuel service, refer to Table XXVI of this Standard for appropriate guidance. When the type of turbine fuel to be serviced is different from the type in the aircraft tanks, the fuel shall be serviced at half the normal delivery rate to minimize hazards of static electricity. Kerosene fuel such as Jet A, Jet A-1, JP-8, JP-5, and TS-1 are classified as the same type. A different type would be wide-cut fuel, such as JP-4 or Jet B. Supplies of aviation fuel for use in Secured Fuels are sealed and secured in accordance with AFI 31-101, Volume I.

5.7 Receipts of aviation Secured Fuels and support aircraft. Secured fuel is used on any aircraft on which the President of the United States is a passenger. The below procedures apply only to secured fuels. Support aircraft shall be serviced the same as any other transient aircraft. JP-8 is the primary fuel for use in these aircraft. If JP-8 is not available, alternate fuels (commercial Jet A-1, commercial Jet A or JP-5, and TS-1) may be used. In Table XIII, Support for Secured Fuels, Commercial Jet A-1 includes fuels identified by other National Specifications like the Russian GOST specification TS-1 and Chinese specification No. 3 Jet Fuel. Whenever Secured Fuels are used, tests listed in Table XIII shall be conducted on representative samples taken downstream of the final filtration from refueling units or hydrant servicing equipment prior to issuing fuel. The sample location will be under normal operating pressure and continuous flow.

5.7.1 Refueling on military installations. The Secured Fuels Advance Team will contact the Base Fuels Officer and the Air Force Service Control Point to coordinate fuel support and testing. Those tests, within the capability of the base laboratory, shall be performed on base. Testing beyond the capability of the base laboratory shall be performed at the area laboratory. If time does not permit testing at the area laboratory, the Service Control Point will contact the appropriate DLA-Energy Region Quality Manager for guidance in contacting a local laboratory for testing on a service contract basis.

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5.7.2 Refueling at other locations. The Secured Fuels Advance Team will contact the appropriate DLA-Energy Region Quality Manager for fuel support and testing. The Region Quality Manager will assign a Quality Assurance Representative (QAR), who will, in conjunction with the Secured Fuels Advance Team, locate a fuel source and make necessary arrangements for sampling and testing. The QAR will contact the Secured Fuels Advance Team with test results in the most expedient manner.

5.7.3 Invoice/acquisition procedures.

5.7.3.1 Contractual Laboratory Invoice procedures. For testing done at contract locations, a DLA-Energy QAR will validate invoices and submit invoices for payment per laboratory contractual requirements.

5.7.3.2 Non-contract locations. The DLA Energy QAR will validate the certificates of analyses with the statement, "These services were performed and validated" and include the QAR's signature and date. The certificates of analysis, invoices and W-9, Request for Taxpayer identification Number and Certification (applicable to U.S. Companies only) will go to DLA-ENERGY-Quality Operations Division who will in turn submit to DFAS-CO for payment. DLA-ENERGY-Quality Operations Division will track the expenditures for Secured Fuels laboratory testing. Send invoices to the Defense Logistics Agency Energy, ATTN: (Laboratory Program Manager), DLA-ENERGY-QUALITY OPERATIONS, RM 2843, 8725 John J. Kingman Rd., Fort Belvoir, VA 22060-6222.

5.8 Receipt of approved additives and injection. Fuel is usually delivered to base level fully additized. This requires product to have additives injected either at the refinery, GOCO or COCO terminals, before shipment or en route, such as when product is injected by commercial pipelines just prior to delivery. Finally, product can be injected at the base level, either upon receipt or during a transfer within the facility. In most cases the product to be injected is jet fuel, being injected with FSII, CI/LI, or SDA. The +100 additive is normally injected as part of the base operation into a dedicated refueler. Injection equipment is usually permanently installed, with injectors tapped into the receiving/transfer line, and supplied by a bulk additive tank. Responsible base personnel shall assure injection equipment is in working order and that the rate of injection of the additive into the product is correct.

5.8.1 Receipt of approved bulk additives. Bulk additives are stored in smaller storage tanks (e.g.: 1,000 - 5,000 USG). Additives are delivered by truck (also inter-modal containers for OCONUS) directly from the producer. Upon arrival by truck or inter-modal container, paperwork shall be examined by receiving personnel to assure the proper additive is being received. Because of safety consideration, sampling of additives such as FSII shall be done with safety equipment and the knowledge of the Material Safety Data Sheet (MSDS). Because of cleanliness considerations, additive sampling equipment shall not be used to sample other products. Arriving trucks shall be examined to determine if seals are intact. Truck pumps and hoses shall be clean and capped. Product tank compartments shall be sampled and tested for workmanship and density to determine if any contamination has occurred. The density of additives must be determined in accordance with product specification. Once accomplished, product may be discharged into the proper storage tank. If unable to take an all-level sample from the truck compartment prior to discharge, then an in-line sample taken during discharge may be used for testing.

5.8.1.1 Receipt of turbine fuel approved packaged additives. Packaged additives should be inspected upon arrival for correct identification, content, packaging and damage. Containers should be in good condition upon arrival, and proper paper work should be supplied by the vendor. Packaged additives should be stored under cover, preferably in warehouses or open sheds. In the situation where storage

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must be outside, containers must be off the ground on pallets or dunnage and covered with tarpaulins for protection from the elements. Additives that are in drums should be stored on their sides with proper bracing and blocking if necessary. Bungs should be in horizontal position so leaks may be detected. Drums should never be stored in a vertical position outdoors as water will collect on the drum heads, and could seep through bungs. The proper packaging, storage, and stock rotation (in which the oldest material is issued first) will help to minimize losses due to deterioration.

5.8.2 During injection. To assure the correct additive concentration, personnel shall monitor the quantity of additives expended and compare it to the target concentration and to the quantity of product injected. This can be done by comparing the difference in ullage of the additive tank to the quantity of product injected at regular intervals. Even when monitoring equipment exists that provides the injection rate, a manual check shall be accomplished to assure proper injection rate. This can be accomplished weekly, monthly, etc. depending on the amount of injection being performed and the accuracy of the manual checks. To ease injection calibration accuracy, it is beneficial to premix product with additive prior to injecting into lines, storage tanks, and conveyances. Additives shall not be premixed with other additives ("cocktailed"), which can result in dangerous reactions of the concentrated chemicals.

5.8.3 After injection. Product that has been injected shall be sampled and tested once receipt/transfer has been completed. Personnel shall consider outside temperatures, especially for additives such as SDA. Lower temperatures tend to lower SDA readings and higher temperatures tend to raise the readings.

5.9 Bulk storage. Quality surveillance of bulk products shall begin upon receipt and continue as long as the product is in physical possession of the storage facility. Table IX is referenced for minimum sampling and testing for normal turnaround products and Table VIII outlines frequencies for the testing of products in long term storage (see 5.9.1). Sediment and water are the most common types of contaminants found in storage and dispensing systems. Their presence can cause serious problems in the systems, particularly in the operation of aircraft. Positive action shall be taken to prevent and eliminate their occurrence.

5.9.1 Long-term storage. A product will be considered under long term conditions when either the product has remained in storage for a period as indicated in Table VIII without a turnover of at least two-thirds of the tank content or if new product has not been received into existing stocks for 6 months. Product stored in collapsible containers shall be tested every month as a minimum. When new tanks are put into service and product added (recommended one (1) meter to the new tank), then B-1 testing is to be conducted. Product shall then be monitored for deterioration by requiring B-2 testing to check product stability. This frequency can be maintained as long as deterioration is not detected. However, when deterioration does begin (e.g. in gasolines when the oxidation stability decreases or gum level increases; in diesel fuel when the particulate contamination increases), the frequency of testing shall be increased, such as from six months to four months. As the deteriorating characteristics approach intra-Governmental receipt limits (see Tables I-VII), product shall either be consumed on an expedited basis, or rotated so that it can be consumed elsewhere before exceeding the intra-Governmental receipt limits. The rate of deterioration cannot be predicted as storage locations throughout the world differ in temperature and environment, and the products stored are produced differently from refinery to refinery. Therefore, each product in long-term storage shall be regularly sampled and tested with an increase in testing frequency when deterioration begins.

5.9.2 Bulk tank water restriction. The use of fuel tanks with water bottoms is prohibited unless specifically authorized by the appropriate technical authority. Bulk fuel tanks shall be drained of water

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after each product receipt, a minimum of weekly thereafter and prior to each issue. Floating roof tanks shall be checked more frequently during periods of heavy rain or melting snow. Underground fuel tanks shall be checked more frequently when the water table is high and during periods of excessive rain or melting snow.

5.9.2.1 Corrosives in tanks. In instances where water bottoms in storage tanks cannot be completely removed the water layer shall be checked monthly for the presence of hydrogen sulfide. Hydrogen sulfide, that sometimes forms as a result of bacterial action on sulfates present in the water (see Test Method 1020 in this Standard), is corrosive and will cause the product to fail the copper strip corrosion requirement of the specification.

5.9.2.2 Tank water check frequency. Water checks shall be made daily on issue tanks and weekly on static tanks or each time a tank is gauged, whichever occurs first. When water is found it shall be drained as soon as possible.

5.9.2.3 Microbial Contamination. Microbes can exist in extremely small pockets of water. This growth can be corrosive creating pinpoint holes in metal. Microbial growth cycles can result in contamination that clogs filter. A good water removal program is an important maintenance function.

5.9.3 Storage tanks and piping.

5.9.3.1 Storage of similar products. Storage tanks should continue in one type fuel to the extent practicable. The contents of receiving storage tanks shall always be identified before the receipt of fresh product.

5.9.3.2 Changing product in a storage tank.

a. When storage tanks are changed from one type of fuel to another, tanks shall be inspected, cleaned if required and re-inspected to ensure elimination of excessive rust or sludge. See STANAG 3609 and applicable contract clauses for guidance on this subject.

b. When conversion to E85, tanks selected will be inspected, cleaned, and certified for compatibility and use of E85 by the Military Service Fuels Engineer.

1. Initial Fill Procedures (All Tanks) - fill the tank with E85 that has been tested. For the initial fill allow 48 hours settling time.

2. Displace twice the volume of the dispensing line prior to obtaining a sample. Collect sample into a wide mouth container and visually inspect for particulates, water, and phase separation.

3. Should the sample fail the visual examination, flush the dispensing line until samples are clear and free of visible particles.

4. Test for ethanol content according to ASTM D5798.

c. Ground diesels may switch between summer and winter grades for cloud and pour point purposes. These changes do not require cleaning/inspection between grade changes. In order to promote the swiftest conversion during summer when converting to winter grade, the storage tank shall be brought as low as possible before the conversion begins. Product should not be purchased during a summer grade period for storage when the use of the product is primarily for winter use. Careful planning and ordering procedures must be developed to assure the storage tank will be prepared for the winter use season.

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1. Conversion from low to ultra-low sulfur diesel/B20 will require the removal of all existing diesel fuel from the tank to the maximum extent possible. Empty tank with service pump to remove remaining product, clean tank. Install a 10 micron maximum filter on pumps.
2. After the initial B20 receipt, dispense at least twice the piping fill quantity through the pump to purge the system.

d. Conversion to Ultra-Low Sulfur Diesel (ULSD) Tank. The U.S. Environmental Protection Agency has mandated that diesel fuels shall contain no more than 15 ppm by mass sulfur. Many diesel vehicles built after 2007 will contain emission control devices that will be deactivated by higher levels of sulfur. It is very important that fuel storage tanks be properly converted into ULSD service. The policy for converting a storage tank(s) to ULSD is DLA Policy Document Number DLA-ENERGY-I-15, Conversion of Low Sulfur Diesel Storage to Ultra Low Sulfur Diesel (ULSD) found at the DLA Energy Library page on Defense Knowledge Online (DKO) at https://www.us.army.mil/suite/page/646830.

5.9.3.3 Product cargo check for quality. To the extent practical, product shall be discharged into a single, low-innage shore tank. After discharging and checking for quality, identical products may be combined in common tankage. Gasoline storage tanks shall be kept as full as possible to minimize evaporation losses. These losses are excessive in partially filled cone roof tanks during extended storage.

5.9.3.4 Segregation of product. Grades of product shall be segregated from one another and whenever feasible all issues made through a segregated system. Segregation of different grades and products shall be by some positive means such as a blank flange, spectacle plate, spool piece, double valve with open drain, or double block-and-bleed valve. Segregation by a single valve is not sufficient.

5.9.3.5 Leaking valve contamination. To minimize the danger of contamination from leaking valves, one of the following precautions is recommended:

a. Use of blank flanges between valves.

b. Removal of a section of pipe between two valves.

c. Introduction of a bleeder valve (normally open) between two valves. A catch basin (drip pan) shall be placed under the bleeder valve and monitored on an established schedule to detect leaks. Failure to perform this inspection may result in liquid overflowing the catch basin creating an environmentally unsafe condition.

5.9.3.6 Tank protective treatment. Before an internal protective treatment is applied to any tankage (e.g. coating), approval from the responsible DLA-ENERGY or service technical authority is required.

5.9.3.7 Identification of piping system[5]. Piping systems shall be marked to clearly identify the grade of a product being carried. These markings shall be placed adjacent to all operating accessories such as valves, pumps, regulators and manifolds. MIL-STD-161 provides guidance on color markings and titles. In NATO countries the NATO code numbers for the product grade shall be included in the marking or identification system.

5.9.3.8 Settling time in tank. Settling time is required for determination of quantity measurement for official receipt quantities, sampling for tank certification after receipt or permitting the tank's issue.

[5] NOTE: In certain situations security requirements may dictate what markings are not allowed.

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a. For quantity measurements in tanks greater than 2,000 barrels, a settling time of thirty minutes minimum is required for products that have little to no water (anticipated water level in the tank is less than or equal to one-eighth of an inch). For tanks less than 2,000 barrels allow a minimum settling time of five minutes. For products that retain water and/or sediment (e.g. crude, IFOs, etc.), allow a minimum of twenty-four hours of settling in bulk storage tanks before taking a custody transfer measurement upon receipt. Take a provisional gauge after a minimum of thirty minutes of settling noting it as a preliminary gauge for receipt purposes.

b. For sampling and issuing functions, the following settling times and issues apply. After fuel stocks have been added, allow maximum possible settling times in order to permit reasonable settlement of waters and solids. For aviation fuel a minimum tank settling period of 8 hours prior to issue or transfer is required for tanks greater than 2,000 barrels. For tanks 2,000 barrels, or less, a settling time of thirty minutes minimum is required. Observe a longer settling period if mission requirements allow. Prior to issue or transfer following the settling period, drain the tank water removal systems.

c. For ground fuel tanks greater than 2000 barrels minimum settling time is one hour per foot of product received. For ground fuel tanks 2000 barrels or less, a minimum of 30 minutes settling time is required. Observe a longer settling time if mission requirements allow. This settling period is not necessary when fuel handling system cleanliness has been assured by design to eliminate the ingestion or generation of corrosion products or contaminants and when transfers to the system are made through a properly monitored filter apparatus.

d. The settling period does not apply to bulk storage aboard ships. A settling period of thirty minutes aboard ships is recommended for static dispersing.

5.9.4 Control of static electricity (aviation turbine fuels, kerosene). The following are certain hazards and precautions emphasized in the handling of aviation turbine fuel:

a. In filling any empty tank, the initial fuel flow rate shall not exceed three feet (one meter) per second through a receiving line until the roof of a floating-roof tank is afloat, or a minimum of three feet /one meter above the level of the tank filling line is reached (see 5.1.1.7.2).

b. Agitation of the fuel surface and air, and entrainment of air and water in fuel shall be avoided.

c. The fuel stream into storage tanks shall be horizontal rather than toward the bottom of the tank.

d. NFPA 77 states that removal of outer garments is particularly dangerous in work areas where there may be flammable or explosive atmospheres that are ignitable with low electrical energy. Because some materials exhibit static phenomena, especially under low humidity conditions, the outer garments used in these areas shall be suitable for the work area. Recommend that outer garments not be donned or removed where a flammable or explosive atmosphere may exist.

e. The sampling device shall always be bonded to the tank before the sampling hatch is opened.

f. Personnel shall wait a minimum of thirty (30) minutes after receipts of any type of fuel to allow electrostatic charges to dissipate before gauging or sampling. (See 5.9.3.8 for exceptions for small tanks).

g. Other ignition sources of concern are the cell phone and other portable electronic devices (PED). Cell phones or other PEDs should not be used in and around areas where flammable vapors are a risk, unless they have been tested, approved and labeled as intrinsically safe. If at all possible the use of cell phones and other PEDs should be avoided while working in areas exposed to flammable vapors.

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5.9.5 Filtration[6]. Filtration equipment of a proper type shall be a part of some fuel handling systems (see Table XXXI). The equipment shall be inspected for condition and performance capability in accordance with applicable standards (i.e. MIL-PRF-52308, EI Specification 1581, etc.) or the equipment's operations and maintenance manuals. Micronic filtration equipment conforms to EI Specification 1590. The location of this equipment is to be in accordance with civil engineering design criteria. In commercial installations the requirements for any maintenance of this equipment are to be consistent with the terms of the contract. Because filter-separators generate static electricity their location in the system shall permit a 30-second relaxation time in product travel between the filtration equipment and receiving containers. The 30-second relaxation time applies only to systems designed for fuel without SDA. Systems designed to deliver fuel with 50 pS/m or greater concentration of SDA need not comply with the 30-second relaxation time.

5.9.6 Internal preservation. If any fuel equipment or facility is likely to be out of service for four months or more, then pumps, fans, motors, etc. shall be given adequate protection either in place, or by transfer or storage. Tanks shall be isolated, cleaned, dried and sealed. Water-displacing fluids shall not be used for the internal protection of aviation fuel tanks, as they are difficult to remove completely and they affect the water reaction property of the fuel. However, such fluids may be used as directed for tanks used for other products.

5.9.7 Dispensing from curbside pumps. The provision for bulk storage tanks are applicable except for conditions outlined in 5.9.2.1.

5.9.8 Deterioration of a product. Characteristics of petroleum products change as the product ages and storage conditions may accelerate the change. The degree of deterioration can be determined only by laboratory testing, which shall be accomplished periodically as set forth in Table IX.

5.9.9 Sources of contamination.

5.9.9.1 Inadvertent mixtures. The principle sources of bulk product contamination are: failure to properly identify product in receiving vehicle to proper receipt tank, carelessness in making line connections; error in valve operation during transfer of bulk products; use of contaminated tanks; incomplete cleaning or flushing of product lines; leakage between compartments of a tanker or through partially closed or defective valves. Consequently, every precaution shall be exercised to prevent the inadvertent mixing of different grades of product as well as contaminating the product with foreign materials like water and sediment. Mixture of products can often be detected by changes in appearance, color, gravity, or odor. Laboratory analysis will detect mixtures when not visually detectable. See 5.11 and 5.12 for sources of contamination.

5.9.9.2 Handling personnel. Contamination may also result from accident, inability or failure to follow prescribed procedures, carelessness, or sabotage. Proper identification and strict control of the entire handling and dispensing system shall be maintained to minimize contamination at bulk storage terminal and user activities.

5.9.9.3 Rubber surface to fuel. Refers to characteristics of elastomeric or rubber compounds that change during exposure to fuel. Seal swelling, an interaction between the fuel media and elastomer materials, is desirable (to a point) as a means to prevent leakage.

[6] Note: "DLA Energy will provide direct funding and/or reimbursement for filter elements, coalescer cartridges, and pre-filter elements at Defense Fuel Support Points (DFSPs) and facilities that manage Defense Working Capital Fund (DWCF) bulk petroleum products."

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5.9.9.4 Container sealant. Fuel containers with bullet hole sealing properties may be particularly hazardous if the fuel should penetrate to the sealing media. Long hose lines shall not be kept full of product. The initial throughput of a hose system equal to the volume of the hose shall be checked for excessive contamination. Extra precautions shall be taken to clean the system or containers if it has been used to store or transport diesel fuel or other lightly inhibited material, such as commercial motor gasolines.

5.9.10 Identification of transfers. Identification shall be made on all product transfers. Testing shall be conducted on all product transfers except for transfers of approved stocks from fully segregated systems (pipeline, tank car or truck) and provided that a grade change is not involved. Details of sampling and testing requirements are shown in Table IX.

5.10 Product Intra - Governmental receipt limits (Tables I-VII).

5.10.1 Gasoline, aviation, NATO F-18 (ASTM D910/100 LL) and Unleaded Aviation Gasoline ASTM D7547.

5.10.1.1 Knock rating. The knock value for ratings of 100 or below is stated in terms of octane number and in terms of performance numbers for those above 100.

5.10.1.2 Color. Aviation gasoline may change color for such reason as mixing with gasolines of another color, contamination, or prolonged exposure to light. A visible cloudy or hazy appearance may accompany the color change. This indicates the presence of suspended water, precipitated lead salts, or other particulate matter. A definite yellow case or darkening of color may be caused by the presence of lubricating oil, diesel fuel, heating oil, or other petroleum products of similar nature. Off-color gasoline shall not be used until analysis is performed to determine product usage.

a. Color standards prepared in 4-ounce bottles from fresh, uncontaminated stocks and compared with the questionable gasoline may provide initial information regarding contamination.

b. Confirmation of contamination shall be obtained from the results of other tests. The type of testing to be performed would depend on the type of contamination suspected, e.g.: commingling, cleanliness, water and sediment.

5.10.1.3 Vapor pressure (VP). Vapor pressures can be tested using various methods. A common test is called the Reid Vapor Pressure (RVP) test measuring the vapor pressure created in a defined volume of air to volume of fuel at 100 ºF.

a. A VP above 7.0 psi (49 kPa) indicates contamination by a more volatile product. Additional tests and complete investigation of the previous history of the gasoline may identify the contaminating agent. A possible cause of such contamination could be commingling with automotive gasolines which generally have higher VPs.

b. A VP below 5.5 psi (38.5 kPa) may indicate weathering (loss of volatile fractions) or commingling with other products having a lower VP. Disposition of a weathered gasoline shall be made on the basis of other pertinent tests such as distillation range, knock rating, gum and lead content.

5.10.1.4 Corrosion. A gasoline having a copper strip rating of ASTM 2a or greater is corrosive. This may be caused by the presence of other petroleum products or by corrosive materials having been extracted from sulfur-impregnated rust present in transport or storage systems or sulfate reducing bacteria.

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5.10.1.5 Water and sediment. These characteristics shall be controlled within the transportation, storage, handling and servicing systems in order to avoid serious problems in the operation of aircraft and resultant degradation of the supply readiness position.

5.10.2 Aviation turbine fuel, NATO F-34/JP-8 (MIL-DTL-83133), F-35/Jet A-1, Jet A/Jet A-1 (ASTM D1655) and F-40/JP-4, F-44/JP-5 (MIL-DTL-5624)[7] and TS-1(GOST 10227-86).

5.10.2.1 Existent gum. The existent gum shall not exceed 7.0 mg per 100 ml of fuel and shall be dry in appearance. The preferred vaporizing medium for aviation turbine fuel is steam, however, the existent gum test (ASTM D381) may be performed using air as the vaporizing medium at the following operating temperatures: Bath: 232-246 °C; Test well: 229-235 °C. However, it must be noted that specification and contract requirements shall be followed as product and product characteristics may change.

5.10.2.2 Vapor pressure. In requesting disposition for JP-4 which does not meet the VP intra-Governmental receipt limits (see Table I), the recommended alternate use or disposition shall take into consideration the results of other tests such as the distillation range, existent gum and freezing point.

5.10.2.3 Corrosion. An aviation turbine fuel which has a copper strip corrosion rating of 2a or greater will not be used in aircraft. The fuel shall be segregated and handled in accordance with instructions in 5.13.

5.10.2.4 Fuel system icing inhibitor (FSII). One type of FSII is approved for inhibiting ice formation in turbine fuels. Diethylene glycol monomethyl ether (DiEGME) with a flash point of 85 °C (185 °F) has been identified as the type FSII to be purchased for all jet fuels. FSII lowers the freeze point of entrained or free water present in turbine fuels or in fuel systems. The amount of FSII added to turbine fuels in the wholesale system shall be adjusted to ensure delivery of the fuel with a minimum FSII content of 0.10 vol %, for all grades of turbine fuels. FSII does not readily dissolve into the fuel so it must be dispersed as fine droplets. A proportional-flow injection system is recommended with shearing devices such as meters or mixers downstream of the injector. FSII will not fully disperse in “wet fuel” (fuel containing free water) even with proper additive injection equipment. In fuel containing free water, the FSII will preferentially solubilize in the water resulting in a lower than expected concentration of FSII in the fuel and water bottoms containing high FSII concentrations. It is recommended a filter-separator system be installed upstream of the FSII injection point if the free water content cannot be maintained below 30 ppm by volume during the injection process. The FSII content of turbine fuels shall be verified when a storage tank is designated as an issue tank or when delivery into the bulk tank. Fuel stored in floating roof issue tanks shall be checked for FSII content after each heavy rain. Underground storage tanks shall be checked during periods of heavy rain, melting snow and other periods of high water tables. It should not be allowed to remain in tank bottoms or filter-separator sumps. In FSII treated fuel, the water at tank bottoms and sumps should be carefully drained daily or more frequently if warranted. It is also important to prevent water and moist air from entering the FSII additive tanks because the water dissolves rapidly into the additive. FSII that contains an excessive amount of water will not readily disperse into the fuel and can settle in the aircraft fuel tank causing corrosion and deterioration of the tank lining materials. Therefore, a desiccator or other drying mechanism shall be used in the air vent to prevent entrance of moist air into the FSII storage tank. FSII, either by itself or mixed with water, can be corrosive to epoxy linings or aluminum vessels under certain conditions. Because of its corrosive nature FSII should be stored in stainless steel or Teflon coated tanks. Since laboratory testing has shown long-term stability of FSII is questionable even if stored in stainless steel containers, it is recommended FSII stocks be rotated

[7] NOTE: See T.O. 42B1-1-16, Chapter 6, for JPTS (MIL-DTL-25524) test limits.

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as frequently as possible. Bulk and packaged FSII stocks should be visually one month after delivery and fully retested for quality conformance every 12 months as a minimum. Packaged FSII stocks should be fully retested for quality conformance every 18 months as a minimum. **Warning**: FSII has been determined to be a health hazard. Therefore, special precautions shall be taken to avoid exposure when handling glycols (for example, while sampling and testing). Refer to the manufacturer's MSDS for safety precautions.

5.10.2.5 Flash point specification. JP-5, JP-8, Jet A and Jet A-1 fuel exposed to systems which have recently contained gasoline/naphtha or which have been contaminated by the same is likely to be rendered off-specification for flash point. This is critical non-compliance for JP-5 because of the safety factors involved in handling fuel aboard vessels at sea. For JP-8, Jet A and Jet A-1 the flash point non-compliance is a ground handling safety issue. The extent of the severity for aviation turbine fuels used at land-based locations is based on the degree of flash deterioration.

5.10.2.6 Filtration time. Control of this property is essential to prevent rapid differential pressure buildup in filtration equipment and possible migration of finely divided solids into aircraft. Degradation of filterability may occur in transportation and storage systems and is particularly prevalent when fuel is exposed to saltwater and metallic contaminants.

5.10.2.7 Water and sediment. These characteristics shall be controlled within the transportation, storage, handling and servicing systems in order to avoid serious problems in the operation of aircraft and resultant degradation of the mission readiness position.

5.10.2.8 Conductivity. Conductivity is a measure of its electrical conductance in fuels. By increasing conductance of the fuel, rapid dissipation of an electrostatic charge can be accomplished. Except for direct deliveries to a using activity from a refiner, the static dissipater additive (conductivity additive) most likely will be injected in the JP-4 or JP-8 at the terminal making delivery to the using activity. The conductivity unit (CU) specification requirement for JP-4 and JP-8 is 150-600 picosiemens/meter (pS/m). For JP-8 with the thermal stability improver additive (JP-8+100) the CU limit is 150-700 pS/m. The CU limit for Jet A-1 is 50-600 pS/m. Readings of CUs shall be taken at ambient temperature or 29 °C (85 °F), whichever is lower. If the sample is tested in a laboratory, results shall be corrected to the ambient temperature of the tank in accordance with ASTM D2624.

5.10.2.9 Thermal Stability of JP-5. Most Navy/MSC ships have copper-nickel piping which results in copper leaching into JP-5 that causes oxidation stability testing failures by ASTM D3241. This fuel due to failure of oxidative stability testing is not suitable to be returned to DLA-owned bulk JP-5 stock ashore. Naval Air System Command (NAVAIR) has determined that this product can be burned at sea by shipboard aircraft. Ships carrying JP-5 with non-conforming MIL-DTL-5624 thermal stability results due to copper contamination (no other known cause) may transfer that JP-5 to other ships for use at sea without DLA-ENERGY's disposition.

5.10.2.10 Fuel Standardization Policy. The fuel standardization policy (also known as the Single Fuel Policy) mandates the use of a kerosene base fuel as the single fuel on the battlefield, for both aircraft and ground vehicles/equipment. DoDM 4140.25-M states this policy in great detail. In most cases, this fuel is JP-8. Primary fuel support for sea-based aircraft shall be a high flash kerosene-based fuel, JP-5. In overseas theaters where the predominant fuel is in support of the Navy, JP-5 may be substituted for JP-8, as approved by the Combatant Commander. JP-8 and JP-5 have been tested in all types of tactical vehicles and equipment and can be used interchangeably in most cases with diesel fuel. JP-8 when used in tactical equipment is currently exempt from the sulfur limits required by the EPA when used in ground vehicle equipment for on-grade use in the United States DoD.

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5.10.2.11 Other Aviation Fuel Specifications. Use of Other Aviation Fuel Specifications DLA-ENERGY may obtain aviation turbine fuel conforming to the National specification of another country, if DoD primary fuels (JP-8, JP-5) are not available. All alternate fuel approvals must be processed through the Service Control Points.

5.10.3 Gasoline, automotive, unleaded (F-67).

5.10.3.1 Octane. Gasolines having an octane or performance number below the intra-Governmental receipt limits, specified in Table VI shall be re-sampled and the knock rating verified before considering it below the intra-Governmental receipt limits.

5.10.3.2 Color. F-67 gasolines are normally clear and bright but may undergo a color change due to mixing with dyed fuels (aviation gasolines, certain commercial leaded gasolines, or high sulfur diesel fuels). A cloudy or hazy appearance that may accompany the color change is usually caused by suspended water or precipitated lead salts or other particulates. A yellow cast may be caused by contamination with diesel fuel, lubricating oil, or other petroleum products.

5.10.3.3 Existent gum. Existent gum shall not exceed 7.0 mg/100 mL of gasoline (F-67).

5.10.3.4 Lead content. The maximum amount of lead permitted, by STANAG 7090, Guide Specification for NATO Ground Fuels, is 0.013 g/L for unleaded gasolines (F-67). Lead content in gasoline may be restricted to a lower limit by local regulation. Lead content be determined by ASTM D3341 or ASTM D5059 (Test Method C).

5.10.3.5 Copper Strip Corrosion. Gasoline with corrosion rating of ASTM 2a or greater shall be segregated and reported as prescribed in 5.13.

5.10.3.6 Vapor Pressure (VP). Vapor pressures are determined by class as well as geographic and climatic conditions. They may also be regulated by national authorities. The following intra-Governmental receipt limits are for guidance only:

a. Class 1. Minimum 33 kPa; maximum 72 kPa.

b. Class 2. Minimum 43 kPa; maximum 82 kPa.

c. Class 3. Minimum 53 kPa; maximum 92 kPa.

d. Class 4. Minimum 58 kPa; maximum 97 kPa.

e. Class 5. Minimum 68 kPa; maximum 107 kPa.

5.10.4 Automotive spark ignition engine fuel: commercial gasoline (ASTM D4814) and gasohol, automotive, unleaded (A-A-52530). Under authority of the Clean Air Act, gasolines marketed in the United States, territories and possessions may have restrictions on vapor pressure limits and have mandates for the use of gasoline-oxygenate blends for the purpose of controlling emission. An oxygenate is a hydrocarbon that contains an oxygen atom embedded in a chain of hydrogen and carbon atoms. Oxygenates are usually alcohols or alcohol-derived ethers and are added to gasolines to increase its oxygen content. The increased oxygen content results in a cleaner, more efficient fuel. The restrictions vary by region and time of year. Oxygenated Gasoline is sold in designated areas during the winter months when the carbon monoxide problem is the most serious. Reformulated Gasoline is an oxygenated fuel sold in designated areas year round to control emission. Reformulated Gasoline differs from Oxygenated Gasoline in the amount of oxygenate (2.0% by mass compared to 2.7%). Some states, notably California, may have more restrictive regulations. Fuels using ethanol (ethyl alcohol) as the oxygenate are exempt from EPA mandated vapor pressure limits. Many States now require a blend of 10

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vol % ethanol to either meet the oxygenate requirements or to fulfill a requirement to reduce consumption of petroleum based fuels. Therefore the fuel may be designated as gasoline, not gasohol, and still contain 10 vol % ethanol. The States that do not require ethanol in their gasolines still refer to the 10 vol % blend as gasohol. This is on a State-by-State basis.

5.10.4.1 Octane. Gasolines having an octane or performance number below the intra-Governmental receipt limits, specified in Table VII, shall be re-sampled and the knock rating verified before considering it below the intra-Governmental receipt limits.

5.10.4.2 Existent gum. Existent gum shall not exceed 6.0 mg/100 ml of gasoline. Values for gasohol are based on those of the base gasoline. Commercial gasoline may contain detergent and multifunctional additives designed to maintain engine fuel system cleanliness. These additives can contribute to high unwashed gum levels. Generally, the values will be reduced to acceptable levels by the heptane wash.

5.10.4.3 Lead content. The maximum amount of lead permitted in the U. S. by the Clean Air Act is 0.013 grams /L for unleaded gasoline. Gasohol is considered an unleaded gasoline. Gasoline containing more than the prescribed lead content may be blended with gasoline of a lower lead content so the resultant blend conforms to the requirements. Lead content shall be determined by ASTM D5059.

5.10.4.4 Copper Strip Corrosion. Gasoline with a corrosion rating of ASTM 2a or greater shall be segregated and reported as prescribed in 5.13.

5.10.4.5 Vapor pressure. Values for gasohol are based on those of the base gasoline. Blending to meet the VP limit is permissible provided the resultant blend meets all specifications and inter-Governmental receipt limits.

a. Class AA is for use in ozone non-attainment areas within the U.S. as defined by the EPA. The intra-Governmental receipt limit for VP is 57 kPa (8.3 psi) maximum.

b. Class A is for use at temperatures of 43 °C (109 °F) and above. The intra-Governmental receipt limit for VP is 65 kPa (9.4 psi), maximum.

c. Class B is for use at temperatures between 36 °C (97 °F) and 43 °C (109 °F). The intra-Governmental receipt limit for VP is 72 kPa (10.4 psi), maximum.

d. Class C is for use at temperature between 29 °C (84 °F) and 36 °C (97 °F). The intra-Governmental receipt limit for VP is 82 kPa (11.9 psi), maximum.

e. Class D is for use at temperatures between 21 °C (70 °F) and 29 °C (84 °F). The intra-Governmental receipt limit for VP is 96 kPa (13.9 psi), maximum.

f. Class E is for use at temperatures below 20 °C (68 °F). The intra-Governmental receipt limit for VP is 107 kPa (15.5 psi), maximum.

5.10.4.6 Alcohol content. Total ethanol content in gasohol shall not exceed 11 vol % as determined by ASTM D4815.

5.10.4.7 Water tolerance. Gasohol shall not separate into two phases with the addition of water up to 0.1% by volume at various temperatures based upon class of fuel. Test Method is in ASTM D4814.

5.10.5 E85. This liquid fuel is handled in a manner similar to that of gasoline, the chemical properties of alcohol are different than those of gasoline and must be recognized when establishing a fuel handling standard. To reduce the chance for failure or contamination of alcohol equipment and systems,

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select proper materials and control composition. Ethanol is not compatible with aluminum, and all aluminum products must be removed from a gasoline dispensing system that will be used to dispense E85. The ASTM standard specification for blended ethanol fuel is designated as ASTM D5798. This ASTM specification covers fuel blends for different seasons and geographical areas. In accordance with the EPA regulations, all commercial grades of gasoline must contain certain additives, detergents, and corrosion inhibitors. In a finished blend of E85, any additive that was found previously in gasoline is now contained in E85 (although at reduced levels). While the adding detergent to the hydrocarbon component of E85 is necessary, it is not necessary to add detergent based on the alcohol portion of the product. Overuse of additives with E85 may result in poor vehicle operation. The most common form of hydrocarbon used in the blending of E85 is unleaded gasoline. The hydrocarbon blended with the ethanol in E85 must meet the same standards as gasoline.

5.10.6 Fuel, naval distillate, NATO F-76 (MIL-DTL-16884).

5.10.6.1 Cetane number (ignition quality). If the F-76 does not contain ignition improvers as determined by ASTM D613 in this Standard, the cetane number may be estimated by means of the calculated cetane index as outlined in ASTM D976.

5.10.6.2 Color. Most F-76 fuels are considerably lighter in color than the maximum allowed (ASTM 3 Color) in MIL-DTL-16884. Darkening of color on the ASTM scale generally indicates product deterioration or contamination with another product. If the color exceeds ASTM 4 Color, then type B-2 tests, as outlined in 4.2.2.5 and Table XV shall be performed. If the product passes all the tests except color, then the technical authority shall be contacted prior to use. F-76 shall contain no dye of any kind. MGO, a similar fuel, may contain dye.

5.10.6.3 Flash point. Because F-76 is a standard product in shipboard operation; flash point is a critical safety factor. Flash point of F-76 shall conform to the specification requirement of 60 °C (140 °F), minimum.

5.10.6.4 Distillation. F-76 failing to meet the distillation intra-Governmental receipt limit may be used ashore in low-speed stationary diesel engines or as boiler fuel provided all other specification and intra-Governmental receipt limits are met. This fuel must also meet local sulfur limits.

5.10.6.5 Carbon residue on 10% bottoms. This test is useful in determining contamination with higher temperature boiling range material in F-76. An increase in carbon residue and a darkening of color in stored F-76 indicate either contamination with another product or deterioration of the F-76. The addition of ignition improvers will also increase the carbon residue (see Test Method 1050 in this Standard). If it has been determined that ignition improvers have not been added, then the fuel shall be completely tested for specification requirements to determine if other characteristics of the fuel have been altered because of contamination. If the increase in carbon residue is caused by age deterioration, the product shall be used as soon as possible.

5.10.6.6 Storage Stability. This provides insight into the anticipated time frame that the F-76 will remain stable in storage. After procurement, the results are not limiting, rather high storage stability results are viewed with other characteristics such as particulate content, carbon residue and color to determine whether the F-76 requires immediate consumption or can be held in stock longer. F-76 with high storage stability numbers may be placed on restricted issue. Normally this restriction applies to issues to submarines.

5.10.6.7 Water and sediment. These contaminants shall be held to an absolute minimum to prevent corrosion and wear of fuel pumps and severe corrosion of shipboard gas turbine blades and diesel engine

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injectors. If a sample fails ASTM D4176 because a slight haze was observed, the product must meet the requirements of ASTM D2709 (0.05 vol % max). If the sample fails ASTM D4176, procedure 1, because it contains visible sediment or particulate matter, but meets the specification requirement of 10 mg/L (max) IAW ASTM D5452 or ASTM D6217 the product is considered acceptable provided all other requirements are met. Controls are discussed in other sections of this Standard on bulk transportation, bulk storage, fuel contamination and quality standards.

5.10.7 Fuel oil, diesel (ASTM D975). Diesel fuel consists of a mixture of cracked and straight-run stocks. This produces a fuel of good handling characteristics and availability. Recent innovations in engine and vehicle design and increasing engine performance requirements impose greater emphasis on fuel stability and cleanliness. In addition, the relatively low turnover rates of diesel fuel in non-tactical situations require a fuel that resists deterioration over time.

5.10.7.1 RME 180. Marine Fuel Oil, the commercial denomination (IFO 180) is an intermediate Fuel Oil 180 produced from heavy and medium oil fractions mixture, obtained from primary and secondary crude oil processing. This product is used as combustible for maritime vessels. For testing requirements see Table XVII.

5.10.7.2 RME 380. Marine Fuel Oil, the commercial denomination (IFO 380) is an Intermediate Fuel Oil 380. Along with RME 180 (IFO 180) RME 380 (IFO 380) are the most common intermediate fuel oil grades for maritime vessels (commercially). For testing requirements see Table XVIII.

5.10.7.3 Water and sediment control. Diesel fuel shall be delivered to consuming vehicles through filters or filter separators in order to keep water and/or sediment contamination to the absolute minimum while preventing corrosion and wear of fuel pumps and injectors. Whether a filter or a filter-separator is required, it will be based on the operational requirements at the specific location. For ASTM D975 diesel fuel, Test Method ASTM D2709 is used for Grades No. 1-D, and No. 2-D (all sulfur levels) and Test Method ASTM D1796 is used for Grade No. 4-D.

5.10.7.4 Cetane number. If the diesel fuel does not contain ignition improvers as determined by Test Method 1050 in this Standard, the cetane number may be established by means of the calculated cetane index listed in ASTM D976 or ASTM D4737. However, if estimated, the value shall be reported as a cetane index. The cetane index should never be reported as the cetane number, as the two are not equivalent.

5.10.7.5 Dyed fuel. The Internal Revenue Service requires that a red dye be added to all non-taxable diesel fuel marketed in the United States, territories and possessions. This will generally include fuel that exceeds the sulfur limit for on-road use (Grades No. 1-D, No. 2-D and No. 4-D). Non-dyed fuels (Grades Low Sulfur No. 1-D and Low Sulfur No. 2-D) may acquire a reddish tinge due to cross contamination with dyed fuels. Such fuels may be downgraded to off-road use. Use of red dyed fuel for on-road use is a Federal offense[8].

5.10.7.6 Distillation. Diesel fuel failing to meet the distillation intra-Governmental receipt limit may be downgraded for use in low-speed stationary diesel engines as heating fuel provided all other specification and intra-Governmental receipt limits are met.

[8] NOTE: Under United States regulations if Grades Low Sulfur No. 1-D and Low Sulfur No. 2-D are sold for tax exempt purposes, then at or beyond terminal storage tanks they are required by 26 CFR Part 48 to contain the dye Solvent Red 164 at a concentration spectrally equivalent to 3.9 pounds per thousand barrels of the solid dye standard Solvent Red 26.

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5.10.7.7 Cloud point. The cloud point is the temperature at which paraffinic wax crystals start to appear. It is the lower operating limit for diesel fuel. Cloud point of diesel fuel varies with location and season. The cloud point of the fuel should be below the expected lowest ambient temperature. Diesel fuels with too high a cloud point may be blended with similar or kerosene fuels (1-K kerosene, JP-5, JP-8) with lower cloud points to obtain a usable product. Blending for cloud point shall also take into consideration the locality sulfur requirements as EPA mandated sulfur maximums cannot be exceeded.

5.10.7.8 Carbon residue on 10% bottoms. This test is useful for the determination of the presence of burner fuels or other higher boiling range materials in the diesel fuel. An increase in carbon residue and a darkening of color in stored diesel fuel indicate either contamination with another product or deterioration of the diesel fuel. The addition of ignition improvers will also increase the carbon residue (see Test Method 1050 in this Standard). If it has been determined that ignition improvers have not been added, then the fuel shall be completely tested for specification requirements to determine if other characteristics of the fuel have been altered. If the increase in carbon residue is caused by age deterioration the product shall be used as soon as possible.

5.10.8 Kerosene, NATO F-58 (ASTM D3699)

5.10.8.1 Color. Kerosene may be clear or colored, may darken with age. This normally has no appreciable effect upon its operational capacity. However, even a slight color change brought about by contamination with other products may seriously affect its intended use.

5.10.8.2 Flash point. A flash point below intra-Governmental receipt limit precludes use of kerosene for its intended purpose, since the explosion danger becomes too great.

5.10.8.3 Sulfur. Sulfur limits for Grade 1-K kerosene (intended for use in non-flue connected heaters) shall not be allowed to exceed intra-Governmental receipt limits as a health hazard may result.

5.10.9 Diesel fuel, biodiesel blend, B20 (ASTM D7467). Biodiesel (B100) is a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. B20 is a blend ratio of 80 vol % petroleum-based diesel fuel (ASTM D975) with 20 vol % biodiesel blend stock (ASTM D6751) which requirements are listed in ASTM D7467. A B20 product must be pre-blended prior to delivery. It is not acceptable to attempt blending into a Government tank during the delivery.

5.11 Aviation fuel contamination and quality standards. Delivery of clean aviation fuels to user equipment is essential. Effort has been directed by both the military and industry toward development and improvement of handling and surveillance procedures, equipment, and devices to ensure delivery of clean aviation fuels. The necessity for clean fuel became evident when aviation turbine fuels began causing problems in the modern engine. The purpose of this section is to emphasize the importance of this requirement and to provide guidance to field operating personnel.

5.11.1 Gasoline and turbine fuel differences. Although information herein pertains to both aviation gasoline and turbine fuel, cleanliness requirements for turbine engines are more restrictive than for piston engines. High pressure, complex metering equipment built to close tolerances provides precise fuel metering over a wide range of altitude, speed and power. Dirt and water contamination become more critical for turbine engines and because of high fuel consumption rates contamination accumulates more rapidly. Fine contaminants may block engine fuel supply systems and may erode critical parts of the engine and fuel control system. Free water freezing at high altitudes may plug screens causing engine flameout. Saltwater will especially cause fouling of the fuel quantity probe and corrosion within the fuel system. The separation of contaminants from aviation turbine fuel, particularly grades JP-5 and JP-8, is complicated because of higher viscosity and higher relative density, thereby increasing the required

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settling time. Aircraft engine filters are not designed to remove the fine or excessive amounts of contamination; therefore, fuel cleanup shall be accomplished on the ground rather than in the aircraft.

5.11.2 Quality fuel deliveries. It shall be reemphasized that personnel responsible for delivery of fuel shall take all steps necessary to ensure fuel delivered to aircraft is clean, bright, on-specification and water-free. Samples may be taken and inspected visually as frequently as necessary. If specification or intra-Governmental receipt limits are exceeded, it is obvious that improvement in fuel handling is urgently required. Identifying the source of contamination to prevent future occurrences is the most important aspect of determining necessary corrective action. While changing filter-separator elements may appear to resolve the problem, this action provides only temporary relief if excessive solids or water exists upstream of the filter-separator. Existing and potential problem areas shall be promptly identified and brought to the attention of responsible personnel (Test Method 1010 in this Standard describes a quality surveillance test procedure).

5.11.3 Fuel quality and fuel contamination. The main causes of fuel contamination are commingling with other petroleum products and contamination with water; solids and microbiological growth (see Table XXX).

5.11.3.1 Commingling with other petroleum products. This type of contamination usually results from inadvertent mixing with other petroleum products during transportation and storage. Commingling may be detected by color or odor change, but normally requires laboratory tests ranging from a simple gravity test to a knock rating test in a laboratory engine.

5.11.3.2 Contamination with water, solids, and microbiological growth. This type of contamination can frequently be detected visually since it is not miscible with the fuel. Table XXX of this Standard provides a list of possible contaminants along with a description of each type's appearance, characteristics and effects on aircraft performance. For additional information refer to ASTM Manual on Fuel and Fuel System Microbiology – Fundamentals, Diagnosis, and Contamination Control.

a. Water in fuels may be either fresh or salt and may be present either as dissolved or free water. Dissolved water is that which has been absorbed by the fuel and is not visible. Free water may be in the form of a cloud, emulsion, droplets, or in larger amounts in the bottom of a tank or container. Any form of free water can cause icing in the aircraft fuel system, malfunctioning of fuel quantity probes and corrosion of fuel system components. Saltwater will promote corrosion much more rapidly than fresh water (Test Method 1060 in this Standard describes the determination of free water in jet fuels).

b. Sediment appears as dust, powder, flakes, granular or fibrous materials. Total sediment includes both organic and inorganic materials. If the total sediment as determined by tests is ashed, only the inorganic portion remains. Presence of applicable quantities of fibrous materials is indicative of filter element breakdown, either because of a ruptured element or mechanical disintegration of the filter element in the fuel system. Usually a high metal content consisting of relatively large particles indicates a mechanical failure. Sediment or solid contamination can be separated into two categories: (1) coarse sediment and (2) fine sediment (See Test Method 1010 in this Standard).

(1) Coarse sediment is sediment that easily settles out of the fuel or can be removed by adequate filtration. Ordinarily, particles ten (10) microns in size and larger are regarded as coarse sediment. Coarse particles clog fuel orifices and become wedged in sliding valve clearances and valve shoulders, causing malfunctions and excessive wear of fuel controls and metering equipment. They also clog nozzle screens and other fine screens throughout the fuel system.

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(2) Fine sediment may be defined as particles smaller than ten microns. To a limited degree, this sediment can be removed by settling, filtration and centrifuging. Particles of this size accumulate in fuel controls appearing as a dark shellac-like surface on sliding valves. These particles may be centrifuged out in rotating chambers as sludge-like matter resulting in sluggish operations of fuel metering equipment. Fine particles are not visible to the naked eye as distinct or separate particles. However, they will scatter light and may appear as point flashes of light or as a slight haze in fuel.

c. Microbiological growth consists of living organisms that grow at the fuel water interface. These organisms include yeast, fungus and bacteria, all of which can cause problems associated with microbiological contamination of aviation turbine fuels. Products of microbiological organisms and fungus hold rust and water in suspension and are effective stabilizing agents for fuel/water emulsions. These suspensions cling to glass and metal surfaces and may cause erroneous readings in fuel quantity systems, sluggish fuel control operations and sticking of flow dividers. Microbiological growth is generally found wherever pockets of water exist in fuel tanks. It has a brown, black or gray color and a stringy, fibrous-like appearance. The presence of microbiological growth in fuel being delivered to aircraft is a reliable indication of failure of fuel filtration equipment, inadequate water stripping of storage tanks and a need for more frequent cleaning of fuel storage tanks.

d. Media Migration. The active media in all filter monitor (fuse) cartridges is water absorbent materials known as "super-absorbent polymer." Filter monitor cartridges qualified to EI 1583 4th edition or earlier editions may allow small quantities of this material to pass or migrate into the fuel as the fuel flows through the filter monitor. A portion of this material can then exit the downstream side of the filter monitor entrained in the fuel. Although FSII has been proven to accelerate the media migration process, media migration occurs in the absence of any FSII additive. Initially super-absorbent polymer material takes the form of small solid particulates. These particles form a gel when exposed to water and/or fuel additives. Since both the FSII additive and super-absorbent polymer have very high affinities for water, both FSII and any migrated fragments of super-absorbent polymer may be found in water bottoms. Filters employing "super-absorbent polymer" are no longer used at Navy shore based facilities or at any Air Force fuels activity.

e. Samples representative of fuel serviced to aircraft shall contain no more than ten fibers when a quart sample is visually examined. More than ten fibers indicate the filter or filter-separator elements are not functioning properly and that corrective action shall be taken. Meticulous cleaning of the quart sample bottle is necessary to properly determine fibrous content of the fuel.

5.11.4 Acceptable Fuel.

5.11.4.1 Free water. For product to be acceptable for fueling aircraft, it shall not only meet specification/intra-Governmental receipt limits requirements, but be clean, bright and contain no more than 10 ppm by volume of free water (for Navy requirements, see Note 1 of Table XXXI. The terms clean and bright are independent of the normal color of the fuel. Some of the common colors experienced are water white to various shades of straw. A cloud, haze, specks of sediment, or entrained water indicates the fuel is unsuitable for use and that there is an existing breakdown in fuel handling (e.g., equipment or procedures). Once a breakdown has been identified, steps shall be taken to find the source of the problem so that it may be corrected immediately.

5.11.4.2 Red dye contamination. Aviation turbine fuels are not to contain dye of any kind. The current test for examining for possible contamination of jet fuel with a dye is the "white bucket" test (no dilution permitted), identified in ASTM Manual 5. In this test a portion of jet fuel is placed into a white

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bucket and examined for any color change which may be attributable to the dye. Under current policy if any red or pink color is visually detected the product is not acceptable for use or downgrade.

5.11.4.3 Cloudy or hazy fuel. Ordinarily, a cloud in the fuel indicates the presence of water, but a cloud can also be caused by excessive amounts of fine sediment or a finely dispersed stabilized emulsion. Fuel containing a cloud from either cause is not acceptable for use. For JP-8, JP-5, and JP-4 at the time of government acceptance, the finished fuel or finished fuel blend shall be visually free from undissolved water, sediment or suspended matter, and shall be clear and bright. In case of dispute, the fuel shall be clear and bright at 21 °C (70 °F) and contain no more than 1.0 mg/L of particulate matter. For F-76, product shall be clear and bright and contain maximum of 0.05 percent volume or less of water and sediment.

5.11.4.4 Sediment in fuel. Visible specks or sediment granules in the fuel indicate a particle size larger than forty microns. The presence of any appreciable number of such particles indicates a filter-separators malfunction, a source of contamination downstream of the filter-separator, or an improperly cleaned sample container. Sediment ordinarily encountered is an extremely fine powder, rouge, or silt. In a sample of clean fuel (one taken after a filter), no sediment should be visible.

5.12 Ground mobility fuel contamination. Many of the elements found in aircraft engines are also found in ground-based engines (e.g.: burner cans and injectors) and are just as prone to failure due to fuel contamination. This is especially true with the increased use of turbine engines to replace compression ignition piston engines in ground equipment/vehicles, the more sophisticated fuel delivery systems found in current compression ignition engines, and the introduction of certain alternative fuels. The purpose of this section is to provide information on the nature of the contaminants common to ground mobility fuels and to give guidance to field operating personnel as to the procedures necessary to prevent or eliminate fuel contamination. Whenever specification or intra-Governmental receipt limits on fuel contamination are exceeded, the probable cause shall be investigated and appropriate corrective action taken. Such corrective action shall be completed before the fuel is allowed to reach the using vehicle or equipment.

5.12.1 Ground mobility fuels. The general types of ground mobility fuels are diesel fuel and aviation turbine fuel (JP-8/JP-5, and Jet A/A-1), however, some specialized equipment still use automotive gasoline. The use of aviation turbine fuel as a ground mobility fuel is mandated by the Fuel Standardization policy of DoDM 4140.25-M. JP-8 is kerosene-based fuel and is an acceptable substitute/ alternate for diesel fuel. Using JP-8 is essentially no different than operating diesel engines with diesel fuel products. All three fuels require a high degree of attention to basic housekeeping rules to ensure delivery of a clean, dry product and each type has its own unique problems.

5.12.1.1 Automotive gasoline. Gasoline has a tendency to form gum deposits in storage. Gasohol, a gasoline and alcohol blend, is sensitive to small quantities of free water.

5.12.1.2 Diesel fuel. Because of its higher content of naturally occurring and added surfactants along with a higher viscosity when compared to gasoline, diesel holds water droplets in suspension that resist removal by coalescence. Biodiesel blends can reduce exhaust emissions; however, water absorption occurs at a greater rate. It should be noted biodiesel blends have not been approved for use in tactical/combat vehicles deploying for overseas combat areas.

5.12.1.3 Aviation turbine fuel. Being able to issue aviation turbine fuel as a ground and aviation product may simplify storage, quality control and distribution while supporting the Fuel Standardization policy directed by DoDM 4140.25-M. JP-8 conditions must be maintained IAW the JP-8 specification requirements. The use of commercial jet fuels are not recommended for use as ground fuel unless the

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fuel is additized with corrosion inhibitor/lubricity approver additives IAW QPL-25017 concentration levels. Unless under emergency conditions, the appropriate Service Control Point shall be contacted for guidance and/or assistance prior to using unadditized commercial jet fuels for ground fuel applications.

a. The particulate matter requirement for JP-8 is 1.0 mg/L, but may be issued with 10.0 mg/L for product used as a diesel product for ground use.

b. Fuel conductivity must be between 150 and 600 pS/m for JP-8.

c. JP-8, as a ground fuel, does not meet current Federal, State and local regulations for ultra low sulfur diesel (ULSD) for either on-road or off- road usage in commercial vehicles. If JP-8 is designated for ground fuel use, consult Federal, State and local regulations to determine allowed sulfur content. DoD tactical vehicles and equipment are exempt from environmental sulfur limits imposed on diesel use. However, non-tactical diesel equipment is not exempt. Therefore, product used for commercial equipment must comply with the environmental regulations for the commercial equipment. In many countries, including the US, ultra-low sulfur diesel is required. Many US commercial vehicles made after 2007 will include a pollution control device that is sensitive to total sulfur contents greater than 15 mg/kg (ppm by volume). Using a fuel with higher sulfur content will cause the device to fail and preclude further operation of the equipment. For these commercial vehicles JP-8 fuel is not recommended for use in whole or as a blending stock, as the sulfur content of the final blend will likely be higher than what is required.

5.12.2 Fuel contamination and contamination prevention. Ground fuel contaminants include those caused by the commingling of other fuels, by the introduction of sediment and water, and by the products of fuel deterioration.

5.12.2.1 Contamination with other fuels (commingling). Contamination of this type usually results from an accidental mixing of different types of fuel during storage or transportation or from refueling vehicles or equipment with the wrong fuel. It may also occur in smaller quantities from improper batching in pipelines or from failure to adequately clean fuel tanks when switch loading. The effects of commingling vary with the amount and type of fuels, as the following examples illustrate:

a. Contamination of diesel fuel with gasoline or a low flash point turbine fuel will lower the flash point of the diesel and create a safety hazard, and lower the cetane value.

b. Contamination of motor gasoline, gasohol, or oxygenated gasoline with diesel fuel will reduce the antiknock index (average of research and motor octane numbers) and will cause increased engine deposits, as well as decreased storage stability. It will also expand the flammability limits over that of neat gasoline.

c. Contamination of unleaded gasoline with leaded gasoline will result in damaging the catalytic converter in the using vehicles equipped with emission control systems. In many cases it will also void warranties.

5.12.2.2 Contamination with water. Water in fuel may be either fresh or salt and may be either dissolved or free water. Dissolved water is water that has been solubilize in the fuel and is invisible. It usually does not pose a threat to engines as the amount is generally less than 100 ppm by volume. However, decreasing the fuel temperature can cause dissolved water to come out of solution to form free water. Free water may be in the form of an emulsion, fine droplets in suspension, or in larger quantities that separate and sink to the bottoms of a tank or container. Free water in ground fuels can cause stalling, injector fouling and other engine malfunctions as well as being a cause of corrosion. In cold weather free water may cause blockage of fuel lines by freezing. Diesel fuel contains high levels of surfactants,

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usually left as refinery residuals or those introduced in additive systems. These surfactants keep water droplets in suspension and resist separation by coalescence. If gasohol is exposed to water, it will tend to separate into two phases with the aqueous alcohol phase on the bottom. If this lower phase is delivered to the engine, serious malfunction will result. Water in fuel can arise by condensation, leakage, seepage of ground water into underground storage tanks, or from rain leaking into storage or vehicle tanks.

5.12.2.3 Contamination with sediment. Sediment may be in the form of dust, powder flakes, granular material, fibrous material, agglomerates, sludge, or slime. Sediment includes both organic and inorganic matter. The sediment may be denser than fuel (tending to sink) or lighter than fuel (tending to float). If the fuel container or tank has a water bottom, some or all of the sediment may be present at the fuel and water interface.

a. Inorganic sediment includes metallic and rust particles, siliceous material, and mineral fibers such as fiberglass. Coarse sediment (greater than ten microns) may clog fuel lines and damage fuel injector pumps and other engine components. Fine sediment may form a sludge-like material degrading the operations of fuel pumps and metering equipment. The composition of the sediment usually reveals its source. Metallic particles may be present as a result of mechanical failure further up the fuel system. Rust particles are usually from tanks and pipelines. Fiberglass fibers may indicate the breakdown of filter/coalesce elements.

b. Organic sediment consists primarily of the deterioration of products of fuel and of microbiological debris. The deterioration products take the form of brown to black insoluble material, gums and sludge that can clog filters and screens. Gums are the products of oxidation and polymerization of unsaturated hydrocarbons frequently found in gasolines and distillate fuels. Microbiological organisms include bacteria, yeasts, fungi and protozoa. Bacteria and fungi are the prime categories usually found in fuel systems. Bacteria are single-cell organisms that can live in the presence of free oxygen (aerobic), or in the absence of oxygen (anaerobic). Fungi are larger than bacteria and grow to form fungal mats. Fungi produce spores that can germinate in the presence of water. The organisms can grow in strings, mats, or globules and usually appear black, green, or brown. They are frequently seen on the surface of filter coalescer elements. All microbiological species require the presence of water. Growth takes place at the fuel/water interface where organisms feed on the fuel and can get trace elements as well as moisture from the water layer. Many bacteria and fungi can produce acids and other metabolic products which can promote corrosion of metal surfaces. The mats and globules can block fuel systems.

5.12.2.4 Fuel contamination prevention. The following practices and procedures are recommended to minimize the possibilities of fuel contamination.

a. The use of filter-separators, meeting the performance requirements of MIL-PRF-52308 or EI 1581, is mandatory for aviation and ground fuels issued. Delivery of fuels through a filter-separator should reduce the water and sediment contamination to a minimum and prevent corrosion, wear and deposits in the using equipment and vehicles. Furthermore, the life of the engine-mounted filters will be extended and fewer fuel blockage incidents will occur. Filter-separators are not recommended for use with gasohol as they facilitate water/fuel contact and can encourage phase separation.

b. All fuel tanks, from the using vehicle/equipment back to the bulk storage tank, shall not be allowed to accumulate water bottoms. Fuel tanks shall be drained regularly. This deprives microorganisms of water essential to their growth, reduces corrosion in the fuel system, and prevents freezing of fuel lines in cold weather.

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c. Fuel operating tanks (fixed tanks dispensing fuel directly to using vehicles and equipment) and bulk storage tanks shall be inspected in accordance with STANAG 3609. Ground fuel tanks are inspected whenever fuel samples approach or exceed intra-Governmental receipt limits, or when they show evidence of excessive rusting and sludging, microbiological growth, or liner deterioration.

d. The empty space at the top of the fuel tank breathes through the vent during periodic temperature and pressure cycles. As a result, moisture laden air is drawn into the tank where water can condense on the metal surfaces to cause corrosion and support microbiological growth. Keeping the vehicle full will reduce the volume of air and minimize the chance of condensation.

e. FSII meeting the requirements of MIL-DTL-85470 may be added to diesel fuels at a concentration up to 0.15 vol % to cope with small amounts of water contamination (entrained water), or to keep separated water from freezing. A diesel fuel additive (MIL-S-53021) is available to control the growth of microorganisms and the deterioration of diesel fuel remaining in storage tanks or intended for storage (pre-positioning of material). This additive is a combination antioxidant, metal deactivator, detergent, corrosion inhibitor and biocide intended primarily for use in those fuels for vehicles and equipment destined for depot storage or for pre-positioning material in a fully fueled storage condition. It must be emphasized that additives are not substitutes for good housekeeping and proper maintenance of fuel tanks. Additives are only preventative measures and cannot restore fuel that has already deteriorated past its intra-Governmental receipt limits. Only those additives authorized by the fuel specification preparing activity shall be added.

5.13 Non-conforming product.

5.13.1 Identification of a non-conforming product. A product is deemed to be non-conforming when:

a. A product being accepted by an authorized Government Representative either at origin on an F.O.B. Origin contract basis or at destination on an F.O.B. Destination contract basis determined by inspection and/or tests not to conform to the procurement contract specifications; or,

b. For DLA-ENERGY-owned product determined by inspection and/or tests not to conform to the Intra-Governmental Receipt Limits (IGRL) contained in Tables I-VII.

c. For DLA-ENERGY product determined by inspection and/or test to fall between the product specification and the IGRL, the product is deemed acceptable for use but a report of non-conformance is still requested to improve product quality. Issuance of fuel meeting only the intra-Governmental receipt limit should be used as a “safety net” to continue issuing product to customers when a problem has been identified and corrective action is being taken to prevent recurrence. A product found to meet the IGRL limits after shipment of on-specification product from a DFSP means that a problem has been encountered within the transportation system that requires attention.

d. Reports of non-conforming capitalized product are categorized as Customer/Depot Complaints. DLA-ENERGY-QA manages the Customer/Depot Complaint Program for DLA-ENERGY.

5.13.2 Disposition request procedures. It is DLA policy to issue only those supplies and services that fully conform, in all respects, to the procurement specification requirement.

a. When product does not meet specification limits, the facility having physical possession of the product shall provide pertinent details to DLA-ENERGY-QA for bulk products or DLA AVIATION for packaged products.

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b. Based on these details DLA-ENERGY-QA or DLA AVIATION will provide a decision concerning the product's use, rehabilitation, or disposition. The facilities shall also inform the cognizant DLA-ENERGY Region. Service facilities shall coordinate with their service control point prior to reporting to DLA-ENERGY.

c. For DLA-ENERGY contract locations, DLA-ENERGY may provide rehabilitation direction to the contractor after coordinating with the Service Technical Office and end user to ensure that the end result is a specification/intra-Governmental receipt limits product which is being issued. At Service run GOGOs and Service contracted sites, DLA-ENERGY shall coordinate with the Service Technical Office and end user to ensure that all parties are aware of the disposition actions.

d. When fuel does not meet specification requirements at the time of shipment to an end user for any characteristic(s) that does not have an intra-Governmental receipt limit (see Tables I-VII), and rehabilitation is not possible, DLA-ENERGY-QA will obtain a waiver from the applicable Service technical office prior to shipment to the end user.

e. Where a characteristic does have an intra-Governmental receipt limit and the product does not meet this limit, DLA-ENERGY-QA shall obtain a waiver from the applicable Service Technical Office prior to shipment to an end user.

f. In the case of out-of duty hour emergent requests, DLA-ENERGY-QA shall provide disposition instructions and if possible notify the applicable Service technical office prior to shipment. If it is not possible to contact the Service technical office prior to shipment, then the contact shall be made as soon as practical.

g. When Service-owned product does not meet intra-Governmental receipt limits set forth in this Standard; they will contact the using Service's technical office (see 5.13.3) for a decision concerning its use or disposition.

h. Report of Customer/Depot Complaint and request for disposition instructions shall be sent through channels to DLA-ENERGY-QA. The use of DLA Energy Disposition Form 1960 is recommended. The DLA-ENERGY-QA office Program Manager if known can receive the report by e-mail. If the DLA-ENERGY-QA office Program Manager is unknown the request shall be sent via email to QA@dla.mil or by facsimile (703-767-8747). The Report shall contain, as a minimum, the following details:

(1) Specification and Grade of product non-conforming.

(2) Quantity of non-conforming product by storage tank/conveyance.

(3) Location where non-conforming product is held.

(4) Date of Receipt.

(5) Name of manufacturer, contract number, batch number, qualification number, date of manufacture, as applicable.

(6) Type of container or storage.

(7) Accountable military department.

(8) Need for replacement product.

(9) Detailed laboratory test results and if known, degree of contamination and contaminating materials. Test results reported shall include all known characteristics and whether results are within specification. The appropriate Type A or B test results performed on stock just prior to identification of contamination problem shall also be included.

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(10) Recommended alternate use, disposition, or proposed recovery measures, if appropriate. Facility capabilities to rehabilitate the non-conforming product assist in expediting disposition instructions.

5.13.2.1 Report of non-conforming product exceptions. For non-conforming product found on F.O.B. destination procurements contracts prior to off-load, the activity having acceptance responsibilities shall reject the non-conforming product. The activity shall notify the DLA-ENERGY contracting/quality operations personnel or the military service contracting personnel by telephone or message in order to report the circumstances pertaining to the delivery in question. All information as stated in paragraph 5.13.2 (h) above is required. Disposition of the product on the conveyance is required prior to releasing the conveyance back to the contractor. The supplier needs to contact the contracting officer (or in some cases the DLA-ENERGY contracting office may contact the supplier). DLA-ENERGY shall coordinate with the concerned technical facility of the military department(s) in resolving the shipment and shall advise the receiving facility accordingly. In overseas areas the JPO and DLA-ENERGY Regions shall be advised by DLA-ENERGY of the problem and its resolution. If a military service contract is involved, the responsible service shall take the above action.

5.13.3 Service and DLA responsibilities. The following are the responsible technical organizations of the Services and DLA for petroleum and related products.

a. Army

Mailing Address: U.S. Army Petroleum Center
Room 0522 Mail Stop 6241
8725 John J. Kingman Rd.
Ft. Belvoir, VA 22060-6241

Message Address: USAPC Ft Belvoir VA//AMXPC//
Telephone: Commercial: (703) 767-0649
DSN: 427-0649

b. Navy

Mailing Address: Director
NAVSUP Energy
Attn: Code PS
8725 John J. Kingman Rd., Suite 3719
Ft. Belvoir, VA 22060-6224

Message Address: NAVSUP Energy BELVOIR VA
Telephone: Commercial: 703-767-7334/7341
DSN: 427-7334/7341

c. Air Force

Mailing Address: Commanding Officer
Air Force Petroleum Agency
8725 John J. Kingman Road,
Room 1227
Ft. Belvoir, VA 22060-6241

Telephone: Commercial: 937-255-8070
DSN 785-8070

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Email: afpa@dla.mil

d. DLA-Energy

Mailing Address:
DLA-Energy-QA, Room 2843
8725 John J. Kingman Rd
Ft. Belvoir, VA 22060-6221

Message Address:
DLA-Energy
FT BELVOIR VA//DLA-ENERGY-QA,
Telephone: Commercial: 703-767-8736/8395
DSN: 427-8736/8795

e. DLA- Aviation

Message Address:
DLA-Aviation
Richmond, VA 23297
Attn: DLA-E-JDTA
Richmond, VA 23297

Message Address:
DLA-Aviation
VA//DLA AVIATION-JDTA//
Telephone: Commercial: 804-279-5173
DSN: 695-5173

5.13.3.1 Communication copies. DLA-ENERGY-QA or DLA AVIATION, cognizant JPO, and cognizant DLA-ENERGY Region shall be furnished copies of all communication regarding disposition of Government-owned, off-specification product in overseas areas.

5.13.4 Chain of custody requirement for all samples shipped to a laboratory. In order to ensure sample integrity a record of the chain of custody must be maintained by the sample owner until sample disposal. Chain of custody documentation must be used for all samples forwarded where there is a contractual issue in question. Each change of custody shall be documented at the time and place of transfer including signature of the custodian. Chain of custody documentation shall be forwarded to DLA-ENERGY-QA for inclusion into the Customer Depot Complaint (CDC) file. DLA-ENERGY-QA determine product disposition and sample disposal and notify sample owner(s) accordingly. Documentation and samples representing legal/potential legal disputes shall be maintained until release by DLA-ENERGY-G. See Appendix F for a sample form that may be used to record sample chain of custody.

5.13.5 Laboratory reports. While laboratories are authorized to provide recommended disposition instructions for non-conforming Defense Working Capital Fund product, only DLA-ENERGY-QA can provide official disposition.

5.13.6 Reclamation. This is the procedure that restores or changes the quality of a contaminated or off-specification product so it will meet the specification of the original product or a lower grade product. The process of reclamation, when properly applied, will result in downgrading, blending, purification, or dehydration.

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5.13.6.1 Determining factors. The following factors shall be carefully considered before reclamation is recommended:

a. Contaminating agents present and source of contaminants.

b. Degree of contamination.

c. Probable end use of petroleum product in present condition with consideration given to laboratory analysis, purchase specification, established intra-Governmental receipt limits and safety factors.

d. Feasibility of removing or nullifying undesirable effects of contaminants so the petroleum product may be used.

e. Actual location and quantities of off-specification or contaminated petroleum product.

f. Probable need for reclaimed petroleum product.

g. Availability of time, materials, equipment and labor necessary to reclaim the off-specification or contaminated product.

5.13.7 Reclamation techniques.

5.13.7.1 Downgrading. Downgrading is the procedure by which an off-specification or slightly contaminated petroleum product is approved for use as a lower grade of the same or similar petroleum product.

5.13.7.2 Blending. Blending is that procedure by which predetermined quantities of two or more similar petroleum products are mixed to produce a petroleum product of intermediate grade or quality.

5.13.7.3 Additive injection/mixing. The inclusion of an additive, such as MIL-S-53021 (for automotive diesel fuel) along with other techniques such as blending to bring the characteristics of former off-specification product back into the range of on-specification or intra-Governmental receipt limits.

5.13.7.4. Purification. The removal of contaminating agents by filtration or dehydration.

5.13.7.5 Water removal. Water Removal is accomplished primarily by filtering or settling process. Water in most light petroleum products will settle out if allowed to stand undisturbed from 6 to 24 hours. If the light product is in a storage tank, the excess water may be withdrawn through the water draw-off valve. If the product is in a small container, the water may be separated by filtering and decanting into another container or by siphoning off the water.

5.14 Packaged products. This section covers receipt and storage of packaged petroleum products for direct delivery and stock locations. (See MIL-STD-290 Packaging and Marking of Petroleum and Related Products.) For sampling and testing requirements and the significance of testing, detailed requirements see ASTM D4057 Standard Practice for Manual Sampling of Petroleum and Petroleum Products.

5.14.1 Product receipt. Products are delivered under DLA AVIATION contract either by direct delivery from the contractor's facility to the customer, or from a depot storage facility.

5.14.2 Sampling. All samples shall be taken in accordance with standard procedures described in API, MPMS, Chapter 8, Section 1 or ASTM D4057, or as prescribed by product specifications or contract requirements and ANSI Z1.4.

5.14.2.1 Precautions. The precautions required to ensure a representative sample are many and depend on type of product being sampled, the type of container from which it is drawn and the sampling

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procedures employed. Each procedure is suitable for sampling a specific product under definite storage, transportation and container conditions. Warning: "All safety instructions shall be strictly observed".

5.14.2.2 Personnel to conduct sampling. Because improperly taken samples can completely invalidate a test, only trained and experienced personnel shall be assigned to sample the products. This cannot be overstressed: No amount of laboratory work will give reliable data on a product if the sample is not a true representation of that product.

5.14.2.3 Responsibility. This Standard shall in no way alter any assigned responsibility of the various activities outside the continental United States for submitting special samples to a designated laboratory or as directed by cognizant headquarters.

5.14.2.4 Types of samples. A sample is a portion of a packaged petroleum product taken which represents that entire batch or delivery. The various types of samples are as follows:

a. Tube or thief sample is one obtained with a sampling tube or special thief, either as a core, or spot sample, from a specified point in the container.

b. Batch or lot sample is one obtained from a collection of units of package products.

5.14.2.5 Sampling apparatus, containers, and procedures.

a. Approved type samplers shall be used as specified by ASTM/API procedures. All sampling apparatus and containers shall be thoroughly clean and dry, and special care shall be taken so no lint or fibrous material remains in or on them.

b. Apparatus and containers shall be flushed three times with 10 to 20 % of the volume of the sample container of the product being sampled to ensure the sample is not contaminated with the previous material unless otherwise specified in the test procedures. For each flush, the container shall be closed and shaken for 10 seconds and product replaced for the next flush. All cans shall be thoroughly flushed to ensure complete removal of soldering flux. Sampling apparatus shall be cleaned immediately after use and stored so it shall remain clean until next use.

c. Containers such as drums shall be sampled with a thief. In sampling drums and cans, care shall be taken to remove all foreign matter from the area near the enclosure before the plug is removed.

d. Close all sample containers tightly, immediately after taking the sample. Do not use sealing wax, paraffin, rubber gaskets, pressure sensitive tapes, or similar material to seal containers. Light sample containers shall be adequately crated to withstand shipment. To prevent leakage caused by thermal expansion of the product, do not fill any sample container above 80 % volume capacity.

e. The one gallon sample can, NSN 8110-01-371-8315, is suitable for fuel products and the one gallon sample can, 8110-00-178-8292, is suitable for grease products.

5.14.2.6 Size of samples.

a. Except for liquid units of issue greater than 1-gallon and semi-solids greater than 6.5-pound can or container, all samples shall be submitted in the original unopened container. When instructed to take a sample, the sample size shall be as follows:

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(1) Liquid

Unit of Issue	Sample Size
Less than 1 quart	1 gallon (USG)
1-quart can	Four 1 quart cans
1-gallon can	1-gallon can
Any unit of issue larger than 1 gallon	1 gallon

(2) Semi-solid

Unit of Issue	Sample Size
Less than 1 pound	4 pounds
1-pound can	Four 1-pound cans
5 pound can or container	One 5-pound can or container
6.5-pound can or container	one 6.5-pound can or container
Any unit of issue larger than 6.5 pounds	5 pounds

b. For container sizes not listed in the tables above, contact the appropriate focal point for instructions.

5.14.2.7 Identification of samples. Identify each sample container immediately after sampling by securely attaching a DD Form 2927, Petroleum and Lubricants Sample Identification Tag or the equivalent. The link for DD Form 2927 is:
http://www.dtic.mil/whs/directives/infomgt/forms/forminfo/forminfopage3398.html

Information on the tag shall include the following:

a. Product and Type

b. Date Received

c. Installation

d. Sample Number

e. Laboratory Number (If known)

f. Specification Number with revision

g. National stock number (NSN)

h. Contract number

i. Product batch, lot number or emulsion number

j. Contractor/Manufacturer/Supplier

k. Quantity

l. Sample Source

m. Fill/Delivery/date of manufacture (DOM)

n. Submitter's sample number

o. Sampled by

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p. Date Sampled by

q. Organization, Address, telephone, fax number and email of submitter/POC

r. Test Series, Sample Type and Sample Information and Special/Additional Information

s. Qualification number (if available)

t. In the case of packaged products, the complete markings shown on the container shall be furnished. The container from which the sample was taken shall be marked with the sample number for future identification.

5.14.3 Testing. The quality surveillance segment (testing) presented in this section is the minimum essential to sound management of Government-owned properties. Only by thorough testing procedures can premium quality surveillance be maintained.

5.14.3.1 Contamination tests. Suspected contamination of petroleum products shall be confirmed by laboratory tests. Tests which have proved most useful in determining whether a product is contaminated and the identification of the contaminating agents are listed under the individual products. (See 5.10)

5.14.3.2 Test methods. All laboratory tests shall be conducted in accordance with the method prescribed in the specification covering the product, except any special or modified method outlined in this Standard which shall be used in lieu of the specification method when products are evaluated within the scope of this Standard.

5.14.3.3 Specification receipt limits. Specification receipt limits are absolute. Multiple tests may be performed and if these tests do not differ from each other by more than the amount specified for the reproducibility of the method, the results may be averaged to determine compliance with the specification limits.

5.14.3.4 Testing frequency. For current testing frequency requirements refer to DLA Information System (DLIS) Total Item Record (TIR).

5.14.3.5 Minimum testing. Table IX outlines the minimum sampling and testing requirements considered necessary for determining the quality of petroleum and related products. It covers the conditions under which a sample is taken, the type of sample and the types of tests required to determine whether the quality is within acceptable limits.

5.14.3.6 Test required. Tables X-XIX are a series of charts providing a detailed breakdown of the type of tests required for each class of product. These tests are those most likely to reveal deterioration which may have occurred during product handling or storage. Tables XX-XXV designate Service and NATO prescribed B-2 tests for specific products.

5.14.3.7 Alternate test methods. The use of alternate test methods to measure physical properties is allowed, provided that: test results are presented in the format required in the specification; the test device has a demonstrated reliability and repeatability equal to or better than that called for by the American Society for Testing and Materials (ASTM) and the device has been approved for use by the military services. The types of alternate tests are listed below:

a. Equivalent tests are test methods that provide analogous results and fully correlate with standard ASTM methods but have not yet been formally accepted by ASTM. These test methods have been found to provide test results that will be essentially identical to those results produced by ASTM testing methodologies.

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b. Predictive testing involves the use of instrumental and other types of analytical techniques to predict lubricant test values using compositional data that typically is determined by standard or wet chemistry methods.

5.14.3.8 Calibrating test equipment. All laboratories shall calibrate testing and measuring equipment to the accuracy necessary to ensure the equipment is within allowable tolerance limits. See ANSI/NCSL Z540-1.

5.14.4 Disposition procedures. Prior to submission of samples for testing or prior to reclassification of condition codes, the storage activity shall consult the DoD Quality Status List (QSL) published by DLA AVIATION to determine the status of the particular batch/lot number under a specific contract.

a. If the extension data is listed in the QSL, then the stock shall be updated accordingly.

b. If the QSL indicates condition code "H", then the stock shall be disposed of through DLA Disposition Services (formerly DRMO) in accordance with local procedures.

c. If the item is not listed in the QSL, then the appropriate focal point shall be contacted.

5.14.5 Service and DLA responsibilities. The following are the responsible technical organizations within the Services and DLA for packaged petroleum products:

a. Army	U.S. Army Petroleum Center 8725 John J Kingman Rd. Ft. Belvoir, VA 22060 DSN: 427-0659 FAX DSN: 427-0669 Commercial: (703) 767-0659
b. Navy	NAVSUP Energy Attn: Code PS 8725 John J. Kingman Rd., Suite 3719 Ft. Belvoir, VA 22060-6224 DSN: 427-7341 FAX DSN: 427-7389 Commercial: (703) 767-7341
c. Air Force	Air Force Petroleum Agency ATTN: AFPA/PTPT 2430 C Street, Building 70, Area B Wright Patterson AFB, OH 45433-7632 DSN: 785-8050 FAX: DSN 785-8051 Commercial: (937) 255-8050
d.-DLA	
FSC 9150 only	DLA-Aviation ATTN: DLA-JDTA 8000 Jefferson Davis Highway

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	Richmond, VA 23297-5000 DSN: 695-5173 FAX DSN: 695-4370 Commercial: (804) 279-5173
FSC 9110 or 9160	DLA-Troop Support 700 Robbins Avenue Philadelphia, PA 19111-5096 DSN: 442-5515 FAX DSN: 442-5520 Commercial: (215) 697-5515

5.14.6 Packaging and storage of packaged petroleum products. The care and preservation of packaged oils and lubricants in a ready-for-issue condition, from supplier to user, is an important responsibility of the military services. The appropriate military activity shall prescribe the procedures and establish the requirements in each phase of the storage program. These shall be predicated on the type of item, type of storage, anticipated length of storage, probable end use and other factors.

5.14.6.1 Documentation. Care of packaged products in storage is a program of such magnitude that detailed procedures cannot be included in this Standard. Reference shall be made to appropriate departmental publications. Pertinent highlights are cited in the following paragraphs.

5.14.6.2 Container inspection. Containers shall be inspected before being placed in storage and periodically thereafter. These inspections shall be made more frequently if required by local conditions. If containers are received in an unsuitable condition and repackaging is necessary, the product shall be fully inspected by a Government at the repackaging facility. Under no circumstances shall product be accepted without Government inspection if it has been repackaged by the railroad or trucking company.

5.14.6.3 Container suitability. Before filling, all containers shall be inspected to ensure they are clean, free of loose rust, paint flakes and contaminants and are suitable for receiving the product. Meticulous cleanliness of the container and filling equipment shall be ensured since many products require a high degree of cleanliness and have been micronically filtered. In addition to those mentioned in 5.14.7.2, the specifications for other super-clean fluids are MIL-PRF-7808, DOD-PRF-85734, and MIL-PRF-23699. Containers shall be appropriately marked prior to filling and shall be closed immediately after filling.

5.14.6.4 Drum storage. Except in an emergency, containers shall not be stored in direct contact with the ground. Drums shall be stored on their sides on dunnage with proper blocking and bracing. Bungs shall be in a horizontal position so leaks may be detected and/or eliminated. Drums shall never be stored vertically outdoors as water shall collect on drum heads, seep through bungs and contaminate the product.

5.14.6.5 Separate storage. For identification purposes different products and grades shall be stored separately. Stocks of similar dates of filling shall be stored together whenever possible. Oldest stocks shall be used first.

5.14.6.6 Stock rotation. Where feasible, packaged products opened for spot checking or storage control testing shall be used as soon as possible. When this cannot be done the containers shall be re-closed tightly, marked as having been previously opened and be included in the next issue if possible. To minimize deterioration of a product due to age, excessive corrosion of containers, and/or deterioration of packing and markings, (excluding other quality considerations), the oldest package petroleum products

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shall be issued first. Fill dates on the containers and the condition of the package are the governing factors.

5.14.6.7 Galvanized containers. Internally galvanized containers shall not to be used.

5.14.6.8 Small container storage. Containers smaller than the 55-gallon drum shall be stored under cover, preferably in warehouses or open sheds. In emergency situations containers shall be stored outside, off the ground on pallets or dunnage and covered with tarpaulins for protection from the elements.

5.14.6.9 Contamination. Many things can happen in the filling, handling, storage and dispensing of packaged petroleum products. Some of the more detrimental things include contamination, deterioration of quality, inadvertent use of incorrect products, damage to equipment, loss of identity and loss of product. Improper storage conditions can lead to contamination, deterioration of identification markings and excessive corrosion of metal containers. Refilling of previously used containers without first cleaning and remarking can lead to contamination on issue. The use of an incorrect grade product in unmarked containers can result in incorrect applications with resultant loss of life and equipment. Improper loading, blocking, or bracing of packaged products in transportation equipment will almost always result in container damage and often the loss of product.

a. Water is a common source of contamination which can render packaged products unsuitable for use. Rough handling or improper application of plugs and gaskets will permit breathing and result in condensation of water vapor inside the package. Reasonable protection against atmospheric conditions will reduce water contamination.

b. Packaged petroleum products shall be properly protected from initial filling until ultimate consumption. Leaving containers open or unprotected at the final point of application of the product often results in contamination. Extreme care shall be taken at dispensing points to protect product quality. Instructions concerning disposition of product remaining after partial use of container contents shall be followed.

5.14.6.10 Minimum container markings. It is essential that containers for petroleum products are so marked that:

a. The products may be properly identified.

b. The origin and age of the product may be determined at any time.

c. Any hazard associated with the use or handling of the product is clearly indicated as flammable, toxic, or corrosive.

5.14.6.11 Field-filled container markings. The following minimum markings are required for all containers of petroleum products filled under field conditions:

a. National stock number

b. Nomenclature

c. Specification with revision and amendment number (if applicable)

d. Qualification Number (if applicable)

e. Contractor and contract number

f. Product batch, lot number or emulsion number

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g. NATO code (if applicable)

h. Military symbol (if applicable)

i. Date of filling

j. Weight or volume of contents

k. Filling activity/ telephone number

l. Safety and use markings (when applicable)

5.14.6.12 Marking of boxes and cartons. Minimum markings shall also be shown on boxes and cartons.

5.14.6.13 Marking of contractor supplied product. Packaged oils and lubricants supplied by contractors shall be marked in accordance with MIL-STD-290, or in accordance with provisions of the contract.

5.14.6.14 Marking of used drums. When used drums are refilled in the field all old drum markings shall be completely obliterated and drums thoroughly cleaned before being filled. The filled drums are to be marked as required in 5.14.6.11. Total capacity is 57.2 USG; however, to allow for adequate vapor space the drums shall be filled as follows:

a. 54 USG, maximum, for products which flash at 27° C (81° F) or less.

b. 55 USG, maximum, for products which flash over 27° C (81° F).

5.14.7 Deterioration of products.

5.14.7.1 Lubricating oils and gear oils. Most of these oils are procured as packaged products; however some are also procured and shipped in bulk. Those composed entirely of mineral oils, including those with additives such as viscosity index improvers, pour point depressants, or detergents, are very stable. If the package remains unbroken and airtight, the oil will remain on-specification for a long period of time. Storage guides and factors contributing to deterioration and contamination of packaged oils are contained in 5.14.6. Guides and precautions pertinent to sampling are discussed in 5.14.2.

a. Most existing specifications for oils do not establish a quantitative limit for water content since none should theoretically be present. At the time of packaging, water content is at a negligible level. However, it is possible for a container to breathe air through the closures over a period of time, thus introducing atmospheric moisture into its contents. Very small amounts of water can usually be detected by cloudy or hazy appearance.

b. Engine lubricants and gear oils are required to pass ASTM D892, Foaming Characteristics of Lubricating Oils, which limits the amount of aerated foam in terms of foam tendency and foam stability. This tendency towards foaming is undesirable since it reduces lubricant flow to bearings/gears and decreases the thickness of the fluid film under hydrodynamic lubrication environments. To eliminate this, trace amounts of antifoam additives are added which shall be uniformly dispersed to be effective for controlling foam. Under storage conditions these dispersed antifoam additives may coalesce or stratify, which decreases their effectiveness significantly by allowing high foaming values under ASTM D892. In actual use environments the high mechanical shear induced by gear/bearing activity re-disperses the antifoaming agent so satisfactory foaming control is attained. To ensure against premature failing of samples because of the coalescence tendency, ASTM D892 includes a pre-agitation requirement prior to sample analysis that involves mixing in a Waring-type blender.

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5.14.7.2 Hydraulic fluids. Some hydraulic fluid specifications such as MIL-PRF-5606, MIL-PRF-6083, MIL-PRF-17672, MIL-PRF-46170, MIL-PRF-83282 and MIL-PRF-87257 contain particle contamination limits which are so low the products are required to be packaged under clean room conditions. Very slight amounts of dirt, rust, and metal particles will cause them to fail the specification limit for contamination. Five gallon and fifty-five gallon containers are opened by removing bungs. Quart and gallon containers are usually packaged in hermetically sealed containers, which should be opened by means of a piercing type device. To minimize external contamination, it is recommended that these containers are opened at the top of the vertical side rather than on the top. The act of opening any container may allow more contaminants into the fluid than the specification allows. In opening the container for use or evaluation it is extremely important that the can be opened and handled in a clean environment. The area of the container to be opened shall be flushed with filtered solvent (petroleum ether, mineral spirits or isopropyl alcohol). The device used for opening the container shall be thoroughly rinsed with filtered solvent. After the container is opened, a small amount of the material is poured from the container and disposed of prior to pouring the sample for analysis. Once a container is opened, the unused portion shall be discarded. Military hydraulic fluids, particularly those using ester-synthetic hydrocarbon base stocks, can absorb water. The amount of water absorbed shall be controlled in order to prevent corrosion and other hydraulic system problems.

5.14.7.3 Greases. Deterioration of grease is usually indicated by bleeding or a change in texture, but neither constitutes assurance the grease is beyond specification limits. Tests such as penetration, dropping point and oil separation are necessary to make the determination.

a. Penetration is a method of measuring the consistency of grease. Consistency provides a means for classification of greases in accordance with the National Lubricating Grease Institute (NLGI) classification system. Most grease specifications contain a storage stability requirement which specifies that after a certain period of time under prescribed environmental conditions, the grease shall comply with all specification requirements except an expanded penetration. If the penetration is within the storage stability limits, the grease is satisfactory for use.

b. Dropping point indicates the temperature at which grease passes from a semisolid to a liquid state under the conditions of the test. It is not necessarily indicative of service performance. A change in dropping point is an indication the consistency of the grease has changed.

c. Oil separating from grease, commonly known as bleeding, is characteristic of most grease. The amount of bleeding varies with the composition of the grease, the size of the container and storage conditions. A film of free oil does not preclude satisfactory use of grease. However, where an excessive amount of free oil (pourable) is present, the grease shall not be used unless laboratory analysis confirms its continued conformance to specification requirements.

d. Incompatibility between the seal elastomer and the grease may result in the failure of seals to retain lubricating grease and exclude contamination. The deterioration of elastomer seals results in failure of lubricity and causes a shortened bearing life.

e. Grease is formulated with various types of base oils, viscosity additives and thickeners. Some of these greases freeze at extreme cold weather conditions that may result in failure of bearings and equipment. Most military greases will operate down to minus 54° C (minus 65° F), which reflects one of the military's global operability requirements. This property is often determined using the bearing torque test or other rheological tests.

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5.14.7.4 Insulating oils. Special precautions shall be taken to maintain insulating oils in first class condition. Insulating oil is required to have a high dielectric strength. It shall be moisture free and contain no foreign matter. If it is necessary to store insulating oils outdoors the containers shall be protected from the weather. Containers shall not be opened or unsealed before the oil is actually required for use. If necessary to open for test, the utmost precaution shall be taken against the entrance of moisture or other foreign matter.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The purpose of this Standard is to establish common requirements for maintaining quality during the receiving, storing and issuing of government-owned bulk and packaged petroleum products and coal. This Standard is military unique because it covers internal government procedures for the handling and storage of government-owned fuels under conditions not found in the commercial world such as long term storage and special testing requirements.

6.2 International standardization agreement implementation. This standard implements NATO STANAGS 1110, 3149, 4714, 7036, and AIR-STD-ACS (FG) 4021. When changes to, revision, or cancellation of this standard are proposed, the preparing activity must coordinate the action with the U.S. National Point of Contact for the international standardization agreement, as identified in the ASSIST database at https://assistca.dla.mil/ (see Foreword, Paragraph 2).

6.3 Tailoring guidance. To ensure proper application of this Standard, invitations for bids, request for proposals and contractual statements of work should tailor the requirements in sections 4 and 5 of this Standard to exclude any unnecessary requirements.

6.4 Subject terms (key words) list.

Aviation turbine fuel
Barge
Bulk storage
STANAG
Coal
Diesel
F-76
Gasoline
Greases
Intra-Governmental receipt limits
Jet fuel
JP-5
JP-8
Packaged products
Petroleum
Sampling of petroleum
Secured Fuels
Tanker
Truck

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Waxes

6.5 Additional references. The following references are included to identify where additional information may be found.

STANAG

STANAG 1110	Allowable Deterioration for NATO Armed Forces Fuels, Lubricants and Associated Products
STANAG 1135	Interchangeability of Fuels, Lubricants and associated products used by the Armed Forces of the North Atlantic Treaty Nations
STANAG 1385	Guide Specification (Minimum Quality Standards) for Naval Distillate Fuels (F-75 and F-76)
STANAG 3149	Minimum Quality Surveillance of Fuels
STANAG 3390	Guide Specification and Inspection Standards for Fuel Soluble Lubricity Improvers
STANAG 3609	Standards for Maintenance of Fixed Aviation Fuel Receipt, Storage, and Dispensing Systems
STANAG 3682	Electrostatic Safety Connection Procedures for Aviation Fuel Handling and Liquid Fuel Loading/Unloading, Operations during Ground Transfer and Aircraft Fueling/Defueling
STANAG 3747	Guide Specifications (Minimum Quality Standards) for Aviation Turbine Fuel (F-34, F-35, F-40 and F-44)
STANAG 3967	Design and Performance Requirements for Aviation Fuel Filter Separator Vessels and Coalescer and Separator Elements
STANAG 4107	Mutual Acceptance of Government Quality Assurance and Usage of the Allied Quality Assurance Publications
STANAG 4714	Minimum Quality Surveillance for Lubricants and Associated Products
STANAG 7036	Fuels to be Introduced into and Delivered by the NATO Pipeline Systems (NPS)
STANAG 7063	Method of Detection and Treatment of Fuels Contaminated by Micro-Organisms
STANAG 7090	Guide Specifications for NATO Ground Fuels
STANAG 7093	Guide Specification for NATO Land Systems Automotive Fluids

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-113	Guide for the Selection of Lubricants, Functional Fluids, Preservative, and Specialty Products for Use in Ground Equipment Systems
MIL-HDBK-114	Fuels, Mobility, User Handbook
MIL-HDBK-844	Aircraft Refueling Handbook for Navy/Marine Corps Aircraft

(Copies of this document are available online at https://assistca.dla.mil/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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FEDERAL REGULATIONS

29 CFR	Hazardous Communications Standard 29 Code of Federal Regulations (CFR) 1910.1200

(This publication is available from the Superintendent of Documents, US Government Printing Office Washington DC 20402)

OTHER GOVERNMENT DOCUMENTS

AFI 31-101	The Air Force Installation Security Program
AFJMAN 23-209	Storage and Handling of Hazardous Materials
AFMAN 23-110	USAF Supply Manual
CINCLANTFLT/ CINCPACFLT 4026	Fuel Management Afloat Manual
DLAI 4145.11/AFJMAN 23-209/TM 38-410/ MMCO 4450.12A/NAVSUP PUB 573/	Storage and Handling of Hazardous Materials
FM 10-13	Supply and Service Reference Data
FM 10-67-1	Concepts and Equipment of Petroleum Operations
FM 10-67-2	Petroleum Laboratory Testing and Operations
FM 10-70-1	Petroleum Reference Data
FM 101-10-1	Staff Officers Field Manual Organization, Technical and Logistical Data Materials, Construction Effort, and Personnel Requirements for Petroleum Storage and Distribution; Vehicle Fuel and Lubricants Data; Bulk Carrier Capacities; Estimating Class III Requirement; Gasoline and Oil Supply Data for Various Organization Units
NAVAIRINST 10350 (Series),	Utilization of Aircraft Engine and Helicopter Transmission Lubricating Oils
NAVAIR 00-80T-109	Aircraft Refueling NATOPS manual
NAVDOCKS P-342	Fuel Storage Tank Cleaning at the Shore Establishment (Finished Product Tanks)
NAVPERS 10883	Fundamentals of Petroleum
NAVPETOFFINST 4025	Bulk Fuel and Lubricant Sources
NAVPETOFFINST 4025.2	Handling, Storing, Recycling, and/or Disposing of Contaminated Low-Flash Petroleum Product
NAVSHIPS 0900-016-0010	Manual Cargo Tank cleaning
NAVSEA S9086- SN-STM-002/CH 541	Petroleum Fuel Storage, Use and Testing
NAVSUP Manual, Volume II	Supply Ashore
NAVSUP Manual, Volume III, P-485	Navy Supply Systems Command Manual Afloat Supply Procedures

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NWP 38G Change 3 (Limited Distribution)	Replenishment at Sea
UFC 3-460-01	Petroleum Fuels Facilities
UFC 3-460-03	Operations and Maintenance: Maintenance of Petroleum Systems

(DLA and other Federal agencies may obtain copies of these documents from DLA Administrative Support Center, 8725 John J. Kingman Road, STE 0119, Fort Belvoir, VA 22060-6220. The military services should order these publications from their publication distribution office).

Air Force Technical Orders (T.O.)

T.O. 36-1-191	Technical and Managerial Reference for Motor Vehicle Maintenance
T.O. 36Y31-1-1	Removal of Rust and Sediment from Fuel and Oil Servicing Truck and Trailer Tanks and Application of Coating, Interior, Fuel and Water Resistant
T.O. 37A-1-101	USAF Fuel, Water, and Lubricant Dispensing Equipment
T.O. 37A2-2 Series	Hose Carts, Type MH-1 and MH-2
T.O. 42B-1-1	Quality Control of Fuels and Lubricants
T.O. 42B1-1-1	Fuels for USAF Piston and Turbine Support Equipment and Administrative Vehicles
T. O. 42B1-1-14	Fuels for USAF Aircraft
T.O. 42B1-1-15	NATO/ASIC Interchangeability of Aviation Fuels, Lubricants, and Allied Products
T.O.42B1-1-22	Quality Control of Aviation Gasoline
T.O. 42B2-1-1	Uses and Grades of Aircraft Engine Lubricating Oils
T.O. 42B2-1-3	General - Fluids for Hydraulic Equipment

(T.O.s can be obtained from the ETIMS Catalog listed online at https://www.my.af.mil/gcss-af61/ETIMS/index.jsp or from DLA Administrative Support Center, 8725 John J. Kingman Road, STE 0119, Fort Belvoir, VA 22060-6220. The military services should order these publications from TO distribution system.)

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

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TABLE I. Intra-Governmental receipt limits for aviation turbine fuels: NATO F-34/JP-8 (MIL-DTL-83133), F-35/Jet A-1, Jet A (F-24) (ASTM D1655), F-40/JP-4 and F-44/JP-5 (MIL-DTL-5624) and TS-1 (GOST 10227-86) [1,12]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS [2]	ASTM TEST METHOD
Existent Gum, mg/100 mL, max	7.0	14	D381 [3]
Vapor Pressure, kPa, @ 37.8°C (JP-4)	14.0-21.0	10.5-22.5	D323
Distillation, vol % recovered, @ 205°C, min. (JP-5)	10	7	D86
Distillation, residue, vol %, max (JP-5, JP-4)	1.5	2.0	D86
Flash point, °C, min			D56, D93, or D3828[4]
JP-5	60	60	D56,D93(Referee),D3828[4]
JP-8,Jet A, Jet A-1	38	38	D56,D93(Referee),D3828, ISO170[4]
TS-1	28	28	GOST 6356[4]
Microseparometer rating			D3948, D7224
With (additives):			
AO & MDA	90		
AO & MDA & FSII	85		
AO & MDA & CI/LI	80		
AO & MDA & FSII & CI/LI	70	60 [5]	
Particulate matter, mg/L, max			D2276, D5452, or Appendix B of MIL-DTL-83133
Aircraft servicing (AF/Army/Navy)	1.0	0.5/1.0/2.0	
Intra-Governmental transfer	1.0	2.0 [6, 7]	
Intra-Governmental transfer to USAF	1.0	1.5	
Filtration time, minutes, max.			
JP-4	10	15	Appendix A of MIL-DTL-5624 Appendix B of MIL-DTL-83133
JP-5 (No reducer ring)	15	20	Appendix A of MIL-DTL-5624
JP-8	15	20	Appendix A of MIL-DTL-5624 Appendix B of MIL-DTL-83133
FSII, vol %,			
JP-4, JP-5	0.10-0.15	0.09-0.20	D5006
JP-8, TS-1, F-24 (Jet A w/additives)	0.07-0.10	0.06-0.15[11]	
Conductivity, pS/m (JP-4, JP-8)	150-600[8]	50-700	D2624
Appearance	C&B	C&B [9]	
Peroxide Number, mg/kg (ppm), max [10]	8.0	16.0	D3703, D6447

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TABLE I. Intra-Governmental receipt limits for aviation turbine fuels - Continued

NOTES:

1.. All required tests must be performed (see Tables XII-XIII). For test requirements not in this table specification limits apply
2. For limits for Secured Fuels see Table XIII.
3. See 5.10.2.1
4. Test Method ASTM D56 may give results up to 1° C (2° F) below the ASTM D93 results. ASTM D3828 may give results up to 1.7° C (3° F) below the ASTM D93 results. Method IP170 is also permitted; may give results up to 2.2°C (4°F below the ASTM D93 results. For TS-1, corresponding test method for GOST 6356 is ASTM D93.
5. Microseparometer will not be run if turbine fuel contains static dissipater additive. Intra-Governmental Receipt Limit is 60, only for fully additized product (except static dissipater). Lower-than-spec results with other additive combinations will require identifying the situation and communicating with DLA-ENERGY-QA.
6. Where products may be received through a fixed-placed filter vessel, the limits apply to the sample taken after the receipt filter. Samples taken before the receipt filter are for information purposes only. Notify the local QAR for any investigation and/or corrective action (info the DLA-ENERGY Region Quality Manager).
7. For Navy use only. Particulate matter of 8.0 mg/L, maximum, is acceptable for usage on transfers from shore tankage to pier side manifolds; fleet oilers, barges, tankers, and U. S. Naval vessels.
8. The conductivity must be between 150 and 600 pS/m for JP-8 (F-34) and JP-4 (F-40); and 50-600 pS/m for Jet A, Jet A-1 (F-35), at ambient temperature of 29.4° C (85° F), whichever is lower, unless otherwise directed by the procuring activity. In the case of JP-8+100, JP-8 with thermal stability improver additive, the conductivity limit must be between 150 and 700 pS/m at ambient temperature or 29.4° C (85° F), whichever is lower, unless otherwise directed by the procuring activity. The US Navy does not use conductivity additives. Conductivity additive is only added to JP-5 when product is used for issue or purging of Air Forces tactical aircraft.
9. Clear and Bright at ambient temperature, as measured where the sample is taken. If the product is not Clear and Bright at ambient temperature, this test will be conducted at 70 ˚F. An investigation would become necessary should the product fail at 70 ˚F. Steps should be taken (particularly pipeline operations) to confirm that hazy conditions are a result of water and not air. To make this determination: collect a sample of the product in question in a clean, clear glass bottle, place the sample on a flat surface and ascertain as to whether the bubbles in the product rise or fall. In cases where the bubbles rise, the hazy condition is a result of air in the product and should not be a cause for rejection. Further investigation may be warranted, but this simple test may prevent unfounded product rejections.
10. Only for Jet A stored in long term storage in accordance with Table VIII.
11. An upper RECEIPT LIMIT of 0.20 vol %. FSII is acceptable until product acquisition and capitalized storage fully transitions to the revised FSII specification limits of 0.07-0.10 vol %.
12. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol

TABLE II. Intra-Governmental receipt limits for Fuel System Icing Inhibitor, MIL-DTL-85470, NATO S-1745[1]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Total water, mass. %, max.	0.10	0.40	D1364

NOTES:

1. All required tests must be performed (see Table XXV, B-2 requirements). For test requirements not in Table XXV, specification limits apply.

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TABLE III. Intra-Governmental receipt limits for fuel, naval, distillate, NATO F-76 (MIL-DTL-16884) [1,7]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Color, ASTM, max.	3	4 [2]	D1500
Ash, mass %, max.	0.005	0.010	D482
Distillation 90% evaporation, °C End point, °C	 357 385	 360 388	D86 [3]
Water & sediment, vol %, max.	0.05	0.1	D2709
Particulate contamination, mg/L, max.	10.0	15.0 [4]	D6217 or D5452
Storage Stability total insoluble, mg/100 mL max.	3.0 1.5	6.0 [5] 3.0[6]	D5304 D2274

NOTES:
1. All required tests must be performed (see Table XV). For test requirements not in this table specification limits apply.
2. See 5.10.6.2.
3. As the end point of the distillation is approached, if either a thermometer reading of 385 °C or a decomposition point is observed, discontinue the heating and resume the procedure as directed in ASTM D86.
4. Shoreside-use only.
5. Storage Stability results greater than 3.0 mg/100 ml. shall be reported to DLA-ENERGY-QA.
6. Storage Stability results greater than 1.5 mg/100 ml. shall be reported to DLA-ENERGY-QA. This test is performed on the finished product. When ASTM D2274 is utilized, the test period shall be extended from 16 hours to 40 hours.
7. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol

TABLE IV. Intra-Governmental receipt limits for fuel oil, diesel, ASTM D975 [1]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Ash, mass %, max	0.01	0.025	D482
Distillation, °C			D86
90%, vol., Recovered			
Grade No.1-D S15 or No.1-D S500	288	293	
Grade No.2-D S15 or No.2-D S500			
min.	282	277	
max.	338	343	

NOTES:
1. All required tests must be performed (see Table XV). For test requirements not in this table specification limits apply.

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TABLE V. Intra-Governmental receipt limits for fuel oil, diesel, F-54[1]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Ash, mass %, max	0.01	0.025	D482
Color, max	5	6	D1500
Particulate contamination, mg/L, max.	10	20	D6217 EN12662 [2]
Flash Point, °C, min	56	55	D93
Distillation,			D86
% v/v recovered at 180° C, max vol.,	10	12	
% v/v recovered at 340° C min	95	93	
Oxidation Stability, mg/100mL, max [3]	1.5	2.5	D2274 EN12205 [3]

NOTES:
1. All required tests must be performed (see Table XV). For test requirements not in this table specification limits apply.
2. Total contamination requirement for F-54 is max 24 g/m^3 as per EN12662.
3. Total oxidation stability n requirement for F-54 is max 25 g/m^3 as per EN12205.

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TABLE VI. Intra-Governmental receipt limits for gasoline, unleaded, NATO F-67[1]

TEST REQUIREMENTS	SPECIFICATION LIMITS (/F-67)	RECEIPT LIMITS	ASTM TEST METHOD
Color	Clear	Note [2]	Note [3]
Existent gum, mg/100mL, max.	5	7	D381
Octane number, motor/research, min.	85.0/95.0		D2700/D2699
Vapor Pressure, kPa			D5191
Class A	45.0-60.0	43.0-62.0	
Class B	45.0-70.0	43.0-72.0	
Class C/C1	50.0-80.0	48.0-82.0	
Class D/D1	60.0-90.0	58.0-92.0	
Class E//E1	65.0-95.0	63.0-97.0	
Class F/F1	70.0-100.0	68.0-102.0	
Distillation, vol %, evaporated			D86
Class A @ 70°C	20.0-48.0	18.0-50.0	
@100°C	46.0-71.0	44.0-73.0	
@150°C	75.0, min	73.0,min	
Final boiling pt. (°C)	210, max	204,max	
Class B @ 70°C	20.0-48.0	18.0-50.0	
@100°C	46.0-71.0	44.0-73.0	
@150°C	75, min.	73.0, min	
Final boiling pt. (°C)	210, max	204,max	
Class C/C1 @ 70°C	22.0-50.0	20.0-52.0	
@ 100°C	46.0-71.0	44.0-73.0	
@ 150°C	75.0, min.	73.0, min.	
Final boiling pt. (°C)	210,max	204,max	
Class D/D1 @ 70°C	22.0-50.00	20.0-52.0	
@100°C	46.0-71.0	44.0-73.0	
@150°C	75.0,min	73.0, min.	
Final boiling pt. (°C)	210, max	204,max	
Class E/E1 @ 70°C	22.0-50.0	20.0-52.0	
@100°C	46.0-71.0	44.0-73.0	
@150°C	75.0, min.	73, min.	
Final boiling pt. (°C)	210,max	204,max	
Class F/F1 @ 70°C	22.0-50.0	20.0-52.0	
@100°C	46.0-71.0	44.0-73.0	
@150°C	75.0, min.	73.0, min.	
Final boiling pt. (°C)	210,max	204,max	

NOTES:
1. All required tests must be performed (see Table XIV). For test requirements not in this table specification limits apply.
2. See paragraph 5.10.3.2.
3. Test method is Method 103.6 in FED-STD-791.

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TABLE VII. Intra-Governmental receipt limits for automotive spark ignition engine fuel, ASTM D4814 and gasohol, automotive, unleaded, A-A-52530 [1]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Solvent-washed gum, mg/100mL, max [2]	5	6	D381
Antiknock index, min [3]			D2700/D2699
Limited Grade	87	86	
Regular Grade	89	88	
Premium Grade	91	90	
Vapor Pressure, kPa, max [1, 2]			D4953, D5190, D5191
Class AA	54	57	
Class A	62	65	
Class B	69	72	
Class C	79	82	
Class D	93	96	
Class E	103	107	
Alcohol, contents, vol %, max [4]	10	11	D4815 / D5599
Water tolerance, °C	See Table X, 8.1 ASTM D4814	+1 from maximum temperature for phase separation, °C listed in Table X8.1 ASTM D4814	Note [5]

NOTES:
1. All required tests must be performed (see Table XIV). For test requirements not in this table specification limits apply.
2. Value shown for gasohol based on the values of the base gasoline. (see 5.10.4.5 for VP).
3. Average of research and motor octane numbers or (R+M)/2.
4. These requirements only apply to gasohol.
5. Maximum temperature allowable before separation into two phases by addition of 0.1 % water.

TABLE VIII. Minimum frequency for testing long term storage of petroleum products[1]

PRODUCT DESCRIPTION	MINIMUM TESTING FREQUENCY (MONTHS)	
	BULK	PACKAGED
Gasoline, Aviation	6	6
Gasoline, Automotive [2]	6	12
Turbine Fuels, Aviation[2]	6	12
Diesel Fuels	6	12
Kerosene	6	12
Fuels, Burner	6	12
Fog Oils	6	12

NOTES:

1. A product will be considered under long term conditions when either the product has remained in storage for a period as indicated in Table VIII without a turnover of at least two-thirds of the tank content or if new product has not been received into existing stocks for 6 months.

2. Product stored in collapsible containers shall be tested every month as a minimum.

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TABLE IX. Minimum sampling and testing requirements for petroleum products

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
1	Upon procurement at: refineries, blending installations, etc. and at main installations including national depots & ocean-importing points on establishment of new batches.	Bulk	Before acceptance of new material and after establishment of new batch.	Upper, middle, and lower composite, or all-level composite from each storage tank.	A	Samples shall be retained IAW solicitation, contract and/or QCP requirements.
2	Storage tanks and pipelines, for Pipeline Shipments or Vessel Loadings of Government Stocks.					For all stock locations and operations, at the direction of the QAR, and with the concurrence of DLA-ENERGY-QA, additional sampling and testing maybe required as the conditions warrant.
2a	Storage tanks	Bulk	Before shipment or loading	Upper, middle, and lower composite, or all-level composite from each storage tank.	Appearance, API gravity, color, flash point, particulate content, filtration time, FSII, water reaction (as applicable)	Government-owned stocks in tanks that have been tested previously within 90 days need only Type C. Referee sample will be retained.
3	Pipelines	Bulk	Before start of loading and after line pack operations	Line sample	C for Dedicated Line. B-1 for Common Line	Test results shall be within reproducibility of shipping tank
3a	Pipelines	Bulk	Immediately after start of shipment or loading	Line sample, downstream of filter	C	
3b	Pipelines	Bulk	Hourly after starting shipment or loading	Line sample, downstream of filter	Visual, plus additive analysis for FSII & SDA, if line injected	
3c	Pipelines	Bulk	During Loading or Shipment	Representative line composite IAW API MPMS, Chapters 8.1, 8.2.	Retained composite	Sample to be retained as Referee. Testing to be conducted will be based on the situation.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
4	Vessel loading					
4a	Tankers and barges	Bulk	Before Start of Loading/After Line Pack Operations	Line Sample	C for Dedicated Line B for Common Line	Test results shall be within reproducibility of shipping tank
4b	Tankers and barges First In	Bulk	After receipt of line displacement or 1 meter in tank whichever is greater [14]	Spot	C-plus Particulate if sample fails appearance, and additive analysis for FSII & SDA, if line injected	
4c	Tankers and barges	Bulk	After loading	All-level from each compartment	a. Appearance and density b. C c. Conductivity and FSII, as appropriate	a. For Government owned product only b. Navy underway replenishment / fueling at sea c. (Only) For procurement and government owned product where SDA and FSII additives are line injected, and ship's composite fails SDA and FSII additives values. (Test each compartment). For intermediate discharges, sample remaining compartments and retain till discharge at destination.
				Volumetric composite of cargo tanks	B-1	Vessel may sail after "C" Tests; Remainder of tests to be completed before arrival at next load or discharge port.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

4d	Yard Oilers	Bulk	After Loading	Volumetric composite of cargo tanks	API, flash, BS&W	Normally yard oilers are in dedicated service and carry ships' fuels.
4e	MSC Auxiliary Vessels	Bulk	After Loading	Volumetric composite of all levels	See Remarks	Type C+ testing if product contains FSII for JP5; and BS&W for F76
5	Vessel discharge					
5a	Tankers and barges (multi-product cargo)	Bulk	Prior to discharge	All level from each tank	Appearance and density/API	If on-spec, discharge authorized.
				Volumetric composite of each compartment with product.	B-1	These tests will be performed prior to or during discharge of cargo. In the event the capability for testing does not exist at the discharge point, a composite sample from the vessel will be retained, type B-1 tests performed on an all-level sample taken from the receiving tank. If receiving tank fails spec requirements, perform B-1 tests on the tanker retain composite sample to determine the cause of the off-spec problem.
	Tankers and barges (Single-product cargo)	Bulk	Prior to discharge	Composite sample of ship or barge tanks	Type C	Discharge is authorized after conformance with Type C tests, and the provision of Section 5.1.3.2. Retain composite sample until the receiving tank analysis is complete. If product fails, perform B-1 tests on retain composite to help determine the cause of the off-specification problem.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
5b	Dock/discharge manifold header	Bulk	During discharge	a. Sample IAW API MPMS, Chapter 8, commencing one half hour after start of discharge and each hour after until completion of the discharge. One-half quart to be taken each time. Sample to be composited after completion of discharge. b. Also, USG at one hour, midpoint, and one hour prior to completion.	a. Particulate and Retained composite b. Particulate [3]	a. Retained for referee tests. b. For barge receipts directly into A.F. bases, refer to agreement of minimum standards.
5c	After receipt of fuel by waterborne transport.	Bulk	After receipt of fuel.	Upper, middle, and lower composite, or all-level Composite. (from each storage tank)	Type B-1	Also, Thermal Stability testing after turbine fuel receipt by tanker.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4, 15]	REMARKS [9]
5d	Shipboard JP-5 Defuels for return to Defense Working Capital Fund inventory	Bulk	Before Discharge	All-level composite (from each tank to be defueled).	Volumetric Composite Sample B-1 plus thermal stability testing	If volumetric composite sample fails thermal stability testing, investigative testing will be done on each compartment. If turn-in (defueling operation)- Vessel to take samples prior to arrival at discharge port. Upon arrival samples provided to responsible person at discharge port (DFSP or FLC) and tested per 5.1.3.1.1
5e	Shipboard F-76 Defuels for return to Defense Working Capital Fund inventory	Bulk	Before Discharge	Upper, middle, and lower composite or all-level composite (from each storage tank).	Type B-1	If turn-in (defueling operations)- Vessel to take samples prior to arrival at discharge port. Upon arrival samples provided to responsible person at discharge port (DFSP or FLC) and tested per 5.1.3.1.1
5f	MSC Auxiliary Vessels	Bulk	Prior to Issue (note see remarks if defueling)	Volumetric composite of all levels	Type C	If product is less than one month onboard, then no testing required. If older than one month then type C testing onboard vessel. For 1st customer of the day (and change of supply tank) there will be sample taken, checked for visual and then retained for 15 days. If turn-in (defueling operation)- Vessel to take samples prior to arrival at discharge port. Upon arrival samples provided to responsible person at discharge port (DFSP or FLC) and tested per 5.1.3.1.1

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4, 15]	REMARKS [9]
6	Pipeline/TC/TT receipts.					
6a	During pipeline receipt	Bulk	During receipt at custody transfer point	Representative Line sample, IAW API MPMS, Chapter 8 (5 gallon minimum)		Retain sample for 45 days. Retained sample to be used as referee sample if testing of receipt tank fails.
6b	After receipt of fuel via multi product pipeline	Bulk	After receipt of fuel	Upper, middle, and lower composite, or all-level composite. (from each storage tank)	Type B-1	
6c	TC/TT receipt	Bulk	Prior to discharge	Representative sample from each compartment	Visual	
6d	TC/TT receipt	Bulk	During receipt at custody transfer point	Line sample, after line displacement	Type C [11]	First TC/TT of the day will sampled from each supplier or new batch. Not for ground fuels
6e	After receipt of fuel via a dedicated mode.	Bulk	After receipt of fuel.	Upper, middle, and Lower composite, or all-level composite. (from each storage tank)	Type C, except on initial filling or change of grade then, B-1 is required.	
7	Transfers within installation or depot					
7a	Receiving Tank: Through a dedicated system.	Installations and Depots	After receipt of fuel	Upper, middle, and lower composite, or all-level composite.	Type C	Samples will be retained for 45 days for referee purposes.
7b	Through a common system.	Installations and Depots	After receipt of fuel.	Upper, middle, and lower composite, or all-level composite.	Type B-1	Samples will be retained for 45 days for referee purposes.
7c	Receiving Tank/Initial fill or Product Conversion	Installations and Depots	Initial fill or product conversion/	Upper, middle, and lower composite, or all- level composite	Type B-1	

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
8	Long term storage wherever located.	Bulk	Periodically, as required by Table VIII.	Upper, middle, and lower composite or all-level composite (see remarks).	B-2 or A (see remarks)	a. Separate samples; upper, middle, and lower shall be taken and tested to establish homogeneity. If homogenous, these samples shall be mixed for required tests. If not, perform B-2 tests on each level of product. b. Additional tests may be performed at the discretion of the owning or custodial authority, with regard to type of product, age of stock, conditions of storage, etc..
8a	MSC Auxiliary Vessels	Bulk	Periodically, as required by Table VIII	Volumetric composite of all levels	B2	Samples will be taken from sounding tubes. Samples to be taken from each tank and a volumetric composite made. If onboard more than 6 months then sampled by ship and transported to nearest military laboratory for testing in accordance with long term storage requirements in table VIII.
9	Filling Points for road and rail tank car containers, or other equipment.	Bulk	Daily on first container filled, and on changeover to fresh feed tank after completion of line displacement from the fresh feed tank.	Line sample, downstream of filter	Type C	Information on retaining of samples see note 8.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
10	Aircraft Defueling	Aircraft	Prior to Defueling	Composite sample from each aircraft sump tanks to be defueled	Appearance	Once aircraft sumps have been drained IAW aircrafts TOs and or service technical guidance (whichever is more stringent), and sampling indicates that the product is not contaminated and aircraft maintenance personnel confirm fuel quality is not suspect, defueling operation may start. Defueled product shall be returned to bulk storage through a filter separator at a ratio of 1:10 (1 gallon of defueled product to 10 gallons of bulk storage product.[12,13]
11	In rail tank cars, Inter-Modal Containers(ISO-Containers), and road tank vehicles and refuelers used in over the road transportation	Bulk	Both after loading and before discharge	All level sample from the rail car or vehicle	Appearance on each compartment Type C on composite	Road vehicles with multi-compartments shall have sample obtained (proportional) from each compartment sufficient to permit a quart sample. If product contains additives (FSII and/or SDA), which have been line injected, then each mode of transportation shall be tested for FSII and conductivity.[5,8]
12	Tanks containing interface mixtures from pipeline for re-injection.	Bulk	Before re-injection	Upper, middle, and lower composite, or all-level composite.	Type B-3	Re-injection of interface product is to be under the technical control of the pipeline authority, or IAW with O.A.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
13	Packaged fuel stocks wherever stored	Packaged	(a) Periodically as required by Table VIII. (see remark) (b) When contamination or deterioration of product is suspected. (c) When identity is uncertain.	Representative sample IAW API MPMS, Chapter 8	Type B-2 [6]	Where an agreed inspection period has not been stipulated the product is to be inspected at least annually.
14	Refueler trucks, skid mounted refuelers, or other dispensing equipment.	Bulk	(a) Daily or prior to use. (b) 30 Days [7]	(a) Sump Sample (b) Line sample, downstream of filter. After re-circulation of fuel.	See remarks	(a) Check for (visual) color and appearance (Aqua-Glo or AEL or equivalent) (b) Laboratory analyses for water & sediment[10] For Army, this requirement can be met through use of a matched weight monitor.

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,15]	REMARKS [9]
15	Collapsible fabric tanks (bags) and drums on the establishment of tactical refueling systems. Note: If the product is capitalized these instructions are to be followed. If the product is non-Capitalized then individual service technical guidance is to be followed.	Bulk	(a) Daily – before issue (b) 30 Days [7]	(a) After filter-separator. Note: After recirculation of fuel prior to the first refueling of the day. (b) After filter separator	(a) C and See Remarks	(a) Visual check for color, appearance, (Aqua-Glo or AEL) for turbine fuels, and particulates by matched – weight monitor or laboratory filtration. Aviation Turbine Fuels containing additives be checked for FSII and conductivity. Diesel Fuels: When excessive visible sediment is observed retest using matched-weight monitor. (b) Laboratory analysis for water and sediment [10]
16	New collapsible fabric tanks (bags) and or drums attached to a fixed facility Note: If the product is Capitalized these instructions are to be followed. If the product is non-Capitalized then individual service technical guidance is to be followed.	Bulk	(a) Initial fill--before issue. Note: after recirculation of fuel	(a)After the filter-separator .	(a) B-1	

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TABLE IX. Minimum sampling and testing requirements for petroleum products – Continued

NOTES:

1. Use the API MPMS for sampling methods (see 4.7).
2. See Tables XX through XXV for the types of test required on the various products. The legend for the types of testing required is as follows:
   a. Type "A" Test - Complete specification, Water separation index, modified, testing is not performed if the fuel contains conductivity additive (DO NOT PERFORM DOWNSTREAM OF SDA INJECTION.)
   b. Type "B-1" Test - Partial analysis comprising the checking of principal characteristics most likely to have been affected in the course of moving the product.
   c. Type "B-2" Test - Partial analysis to check characteristics susceptible to deterioration because of age.
   d. Type "B-3" Test - Partial analysis for contamination; in particular, for controlling the return (or reintroduction) of pipeline interface products.
   e. Type "C" Test – Quick, simple, partial analysis for verification of product quality, to ensure that no change has taken place.
3. The average particulate content of the 3 fuel samples should not exceed 2 mg/L; however, the first and last samples are obtained under severe discharge conditions they may show high particulate content. Solid contamination while extremely objectionable is a physical contaminant which can be removed under proper conditions with proper equipment, and since the product at this point is Government owned, discharge operations will not be discontinued for this reason. However, the contracting officer, DLA Energy, and the Quality Assurance Representative at the loading point will be advised of any high particulate results obtained. This information will be used for future planning purposes and for determining possible cleaning actions necessary on the vessel involved. **This note is not applicable to internal Navy transfers**.
4. Flash Point at the receiving point is not required for product that is to be use by the U.S. Army. This fuel is tested in accordance with Army quality surveillance program AR 710-2.
5. If unable to take an all-level sample from the compartment prior to discharge, then take an in-line sample at or near the off-loading header during the discharge, immediately upon product displacement of the receipt manifold/hose.
6. No receiving tests are necessary on packaged products, provided the containers are intact and markings adequately identify the product.
7. Filter-separator performance is to be checked every 30 days.
8. For retaining of samples see Contractor Inspection Responsibilities (Storage) within contract provisions.
9. Testing maybe complete specification testing or an individual test based on the request of the Government Representative.
10. When laboratory tests of material from dispensing equipment show evidence of free water or a sediment level exceeding 0.5 mg/L for aviation fuels (1.0 mg/L for U.S. Army, 2.0 mg/L for U.S. Navy), or 10.0 mg/L for diesel fuel, that equipment shall be re-sampled and dead lined pending laboratory confirmation of the initial results. If the second laboratory analysis confirms the presence of free water or sediment exceeding the above limits, improvement in fuel quality must be made. Free water and sediment testing is not required on gasoline unless contamination is suspected.
11. For aviation delivery, FSII and SDA will be tested where capability exists.
12. If the product is suspected of contamination, product will be isolated by transferring to a holding tank or refueler vehicle. The product will be placed, on quality hold. A sample will be sent to the area laboratory for B-3 testing. If the product is found not suitable for use the disposition request guidance in 5.13.2 and 5.13.3 will be followed.
13. Defueled product containing dye shall be isolated and returned to the same aircraft or follow guidance in 5.13.2 requesting disposition instructions.
14. DLA Quality Policy for first ins is one (1) meter or after line displacement whichever is the greater.
15. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol

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TABLE X. Tests required aviation gasoline[5]

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance [1]	X	X	X	X
Particulate matter [2,3]	X	X	X	
Color (Visual)	X	X	X	X
Density or API gravity	X	X	X	X
Distillation	X	X	X	
Copper strip corrosion	X	X	X	
Existent gum	X	X		
Vapor pressure	X	X		
Water reaction	X	X	X	
Lean mixture rating [4]	X	X	X	
Rich mixture rating [4]	X	X		
Lead content	X	X		
Potential gum		X		

NOTES:
1. Obtain sample in a clear round one quart glass bottle, swirl the bottle vigorously so a vortex is formed. Visually check for sediment at the point of the vortex. If sediment is visible, an investigation is necessary in order to determine the source of the contaminant (a spot larger than 3 mm diameter indicates corrective action may be required to prevent the delivery of contaminated fuel).
2. Perform only if visual sediment is present.
3. AVGAS samples will be checked for solids and water. When no laboratory is available to perform these tests, solids will be determined visually upstream of filter-separators and by the particle assessment method downstream of the filter separator.
4. Perform only if Lead content was performed and failed the specification requirement. If the capability does not exist to perform this test at the terminal, a sample will be sent to the nearest Service laboratory that does have the capability. In the event operational necessity dictates issue of product before results are obtained from the Service laboratory, shipments may be made; however, when laboratory results indicate failure, notify DLA-ENERGY-QA.
5. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol

TABLE XI. Tests required lubrication oils [1, 2]

PROPERTIES	B-1 TEST	C TEST
Appearance (to include visual sediment & water)	X	X
Emulsion test	X[3]	
Gravity	X	X
Viscosity	X [4,]	
Flash point	X	
Foam test	X	
Water (by centrifuge)	X	X [5]
Solid contaminants	X[3]	

NOTES:
1. For application of these tests see Table IX.
2. B-2 tests are listed in Tables XVII-XX.
3. Only if the specification has this requirement.
4. For MIL-PRF-17331 and MIL-PRF-9000 viscosity is not required unless the tank has been in long term storage for 3 months and water (by centrifuge) is only required if the oil fails appearance because of water contamination (cloudiness).
5. Is only required if the oil fails appearance because of water contamination (cloudiness).

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TABLE XII. Tests required for aviation turbine fuels[7]

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance [1]	X	X	X	X
Color (visual)	X	X	X	X
Density or API gravity	X	X	X	X
Particulate matter	X	X	X	
Distillation	X	X	X	
Copper strip corrosion	X	X	X	
Freezing point	X	X	X	
Existent gum	X	X	X	
Vapor pressure (JP-4 only)	X	X	X	
Flash point (except JP-4)	X	X	X	X
Water reaction[6]	X	X	X	
Lead content (If contaminated with leaded fuels suspected)	X	X	X	
Fuel system icing inhibitor [2]	X	X	X	
Filtration time	X	X	X	
Water separation index (JP-4 , JP-8 and Jet A) [3, 4]	X	X	X	
Conductivity (JP-4 and JP-8) [5]	X	X	X	
Thermal stability (B-1 requirement applies only to JPTS and marine mode receipt tank sample)	X	X		
Color (Saybolt)		X		
Acid number		X		

NOTES:
1. Obtain sample in a clear round one quart glass bottle, swirl the bottle vigorously so a vortex is formed. Visually check for sediment at the point of the vortex. If sediment is visible, an investigation is necessary in order to determine the source of the contaminant (a spot larger than 3 mm diameter indicates corrective action may be required to prevent the delivery of contaminated fuel).
2. If product contains FSII, product should be check on delivery into a bulk storage tank and every month thereafter if stock remains in long term storage, and no deliveries have been made into the tank.
3. If the capability does not exist to perform this test at the terminal, a sample will be sent to the nearest Service laboratory that does have the capability. In the event operational necessity dictates issue of product before results are obtained from the Service laboratory, shipments may be made, however, when laboratory results indicate failure, notify DLA-ENERGY-QA.
4. Water separation index, modified, testing is not performed if the fuel contains conductivity additive.
5. If fuel contains conductivity additive, CU readings should be taken within two minutes of sampling.
6. Only performed on JP-4 and JP-8.
7. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol

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TABLE XIII. Support for Secured Fuels [1]

CHARACTERISTIC LIMITS	JP-5		Jet A		Jet A-1		JP-8	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Gravity, API @ 60 ºF D1298/D4052	36	48	37	51	37	51	37	51
Density at 15 °C (kg/m^3)	788	845	775	840	775	840	775	840
Weight: lb/USG Calculated	6.6	7.0	6.5	7.0	6.5	7.0	6.5	7.0
Distillation (°C) D86								
10% Recovered		205		205		205		205
20% Recovered		RPT						RPT
50% Recovered		RPT		RPT		RPT		RPT
90% Recovered		RPT		RPT		RPT		RPT
Final Boiling Point		300		300		300		300
Freezing point, °C D5972/D2386		-46		-40		-47		-47
Flash point, °C D93/D56	60		38		38		38	
Particulate Matter (mg/L) D2276, D5452, Appendix B of MIL-DTL-83133		0.5		0.5		0.5		0.5
Conductivity (pS/m) D2624			Report		Report		50	700
Copper strip corrosion D130		1		1		1		1
Water reaction D1094								1b
Existent gum (mg/100 mL) D381		7.0		7.0		7.0		7.0
FSII, (vol %) [2] D5006	0.07	0.20					0.04	0.20
Thermal Stability D3241								
Change in pressure drop, mm Hg		25		25		25		25
Heater tube deposit, visual rating		<3		<3		<3		<3
Appearance [3]								

NOTES:
1. "DLA Energy Aviation Refueling Quality Assurance Procedures Related to Secured Fuel Support" posted on DLA Energy website (DLA Energy-Quality Assurance page) shall be used when conducting Secured Fuel missions.
2. Only FSII which meets specification MIL-DTL-85470, Inhibitor, Icing, Fuel System, High Flash, and NATO Code Number S-1745 is to be used.
3. Water: Fuel must be clear and free of water on visual examination. Sample will be taken downstream of final filtration of refueler or hydrant servicing equipment.

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TABLE XIV. Tests required automotive gasoline

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance	X	X	X	X
Color	X	X	X	X
Water and Solids (Visual Check)	X	X	X	X
Density or API gravity	X	X	X	X
Distillation	X	X	X	
Vapor pressure	X	X		
Copper strip corrosion		X	X	
Existent gum		X	X[1]	
Knock rating (RON and MON)	X[2]	X[2]		
Oxidation stability		X		
Water tolerance[3]	X	X	X	

NOTES:
1. Unwashed gum, without solvent wash, shall not increase by more than 2 mg as compared to the original product. In the event of gum increase exceeding 2 mg, a Type A test, as defined in the legend, will be run.
2. Perform only if Lead Content is performed and fails and/or contamination with another product is suspected. In the case of pipeline, this test shall be performed when considered necessary.
3. Gasohol only.

TABLE XIVa. Tests required E85 (ASTM D5798)[1]

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance	X	X	X	
Water	X	X	X	X
Ethanol Volume	X	X	X	X
Vapor Pressure	X	X	X	X
Higher Alcohols		X		
Sulfur		X	X	
Acidity		X		
Solvent Washed Gum	X	X		
pH		X		
Unwashed Gum		X		
Copper	X	X		

NOTES:
1. For cleaning see 5.9.3.2

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TABLE XV. Tests required diesel fuels and kerosene

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance [1]	X	X	X	X
Color	X	X	X	X
Density and API gravity	X	X	X	X
Distillation	X	X		
Flash point	X	X	X	X
Carbon residue [2] (F-76 only)	X	X		
Cloud point		X		
Pour point		X		
Copper strip corrosion		X		
Cetane index		X[3]		
Viscosity		X		
Water & sediment by centrifuge		X		
Particulate (F-76 only)	X	X		
Storage stability (F-76 only)		X		
Sulfur [4,5,6]		X		

NOTES:
1. For NATO F-76, if the sample has no visible particulates, but is otherwise not clear and bright per ASTM D4176, procedure 1, then the product must meet the requirements of ASTM D2709, 0.05 percent volume of water and sediment, maximum. The fuel is acceptable for appearance if the water and sediment content is 0.05 percent volume or less. If the sample fails ASTM D4176, procedure 1, because it contains visible sediment or particulate matter, but meets the requirement of 10 mg /L, maximum, in accordance with ASTM D5452 or ASTM D6217, then the fuel shall be considered acceptable provided all other requirements are met.
2. Only required if change in color and/or density occurs after procurement.
3. Cetane Index can only be run if no ignition improvers are present. Otherwise, Cetane number shall be given.
4. Kerosene. Grade No.-1K only, if intended for non-flue connected burner.
5. Test to be performed if equipment is available.
6. Sulfur testing is required for ULSD or LSD believed contaminated with a higher sulfur content fuel.

TABLE XVa. Test required on B20

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance[1]	X	X	X	X
Distillation	X	X		
Flash Point	X	X	X	X
Cloud Point or LTFT/CFPP		X		
Viscosity		X		
Copper Strip Corrosion		X		
Water and Sediment		X		
Sulfur		X		
Ramsbottom Carbon Residue	X	X		
Particulate Content	X	X		
Acid Number		X		
Ash Content	X			
Biodiesel Content	X	X	X	
Oxidation Stability		X		

NOTES:
1. Obtain a sample in a clear round one quart bottle, swirl the bottle vigorously so a vortex is formed. Visually check for sediment at the point of the vortex. If sediment is visible, an investigation is necessary in order to determine the source of contamination.

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TABLE XVI. Tests required burner fuel oils

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Flash point	X	X	X	X
BS&W[1] (centrifuge)	X	X	X	X
Density/API Gravity	X	X	X	X
Viscosity	X	X		
Ash		X		
Carbon Residue	X			
Sediment by extraction		X		
Pour point		X		

TABLE XVII. Tests required on Residual Marine Fuel (RME 180 Grade)

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Kinematic Viscosity	X	X	X	X
Density at 15° C	X	X	X	X
Flash Point	X	X	X	X
CCAI		X		
Hydrogen Sulfide		X		
Acid Number		X		
Total sediment aged	X	X		
Carbon Residue	X			
Sulfur		X		
Pour Point		X		
Water	X	X		
Ash		X		
Sodium		X		

TABLE XVIII. Tests required on Residual Marine Fuel (RME 380 Grade)

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Kinematic Viscosity	X	X	X	X
Density at 15° C	X	X	X	X
Flash Point	X	X	X	X
CCAI		X		
Sulfur		X		
Hydrogen Sulfide		X		
Acid Number		X		
Total sediment aged	X	X		
Sulfur		X		
Pour Point		X		
Water`	X	X		
Ash		X		
Sodium		X		

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TABLE XIX. Test required on Marine Gas Oil (DMA Grade)

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Kinematic Viscosity		X		
Density at 15 degree C	X	X	X	
Flash Point	X	X	X	X
Cetane Index		X		
Sulfur		X		
Oxidation Stability	X	X		
Acid Number		X		
Carbon Residue	X	X		
Sulfur		X		
Pour Point		X		
Appearance	X	X	X	X

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TABLE XX. Type B-2 tests for lubricating oils[5]

CHARACTERISTICS	SPECIFICATION						
	A-A-59113	A-A-59137	ANSI/AGMA 9005	DOD-L-81846	DOD-PRF-24574	DOD-PRF-85734	MIL-L-3918
Appearance / workmanship				X			X
Color				X			
Viscosity @ 100 °C		X [2]	X	X [2]	X	X [2]	
Viscosity @ 54 °C							
Viscosity @ 40 °C	X		X	X [2]	X	X [2]	X [2]
Viscosity @ -40 °C						X	
Viscosity @ -54 °C				X			
Relative density							
Flash point	X		X	X	X	**X**	
Pour point	X	X		X	X	**X**	
Neutralization number (acid/base)						X	X
Copper strip corrosion	X				X		X
Corrosion & oxidation stability				X		X	X [3]
Evaporation loss				X		X	X
Precipitation number							
Ash							
Emulsion							
Foam test					X	X	
Water content							
Particulate content / trace sediment				X		X	
Trace metals						X	
Carbon residue							
Sulfur							
Hydrolytic stability					X		
Minimum retest frequency (months)	36	24	24	24	36	36	24
Visual check frequency (months)						12	
Military symbol(s)	None	None	None	None	None	None	None
NATO Code Numbers	None	None	None	None	None	None	None

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TABLE XX. Type B-2 tests for lubricating oils[5] – Continued

CHARACTERISTICS	MIL-DTL-46014	MIL-PRF-2104	MIL-PRF-3150	MIL-PRF-6081	MIL-PRF-6085	MIL-PRF-6086
Appearance / workmanship			X	X	X	X
Color				X	X	
Viscosity @ 100 °C	X [2]	X				
Viscosity @ 54 °C					X	
Viscosity @ 40 °C	X [2]		X	X [2]		X [2]
Viscosity @ -40 °C				X		
Viscosity @ -54 °C				X	X	
Relative density						
Flash point	X	X		X	X	X
Pour point		X	X		X	X
Neutralization number (acid/base)				X	X	X
Copper strip corrosion			X	X		X
Corrosion & oxidation stability	X			X	X [3]	
Evaporation loss			X			
Precipitation number					X	
Ash						
Emulsion						
Foam test		X				X
Water content						
Particulate content / trace sediment	X			X		
Trace metals						
Carbon residue						
Sulfur						
Hydrolytic stability						
Minimum retest frequency (months)	36	36	24	36	24	36
Visual check frequency (months)		12	12	12	12	12
Military symbol(s)	None	OE/HDO-10, OE/HDO-30, OE/HDO-40, OE/HDO-15/40 OE/HDO-5/40	PL-M	None	OAI	OGL, OGR
NATO Code Numbers	None	O-237, O-238, N/A, O-1236, N/A	O-192	O-133	O-147	O-153, O-155

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TABLE XX. Type B-2 tests for lubricating oils[5] – Continued

CHARACTERISTICS	SPECIFICATION						
	MIL-PRF-7808	MIL-PRF-7870	MIL-PRF-9000	MIL-PRF-17331	MIL-PRF-21260	MIL-PRF-23699	MIL-PRF-26087
Appearance / workmanship	X	X					X
Color		X					X
Viscosity @ 100 °C	X		X	X	X	X	X [2]
Viscosity @ 54 °C							
Viscosity @ 40 °C	X	X [2]		X		X	X [2]
Viscosity @ -40 °C		X				X	
Viscosity @ -54 °C	X [2]						
Relative density							
Flash point	X	X	X	X	X	X	X
Pour point		X	X	X	X	X	X
Neutralization number (acid/base)	X		X	X		X	X
Copper strip corrosion				X			X
Corrosion & oxidation stability	X	X				X	
Evaporation loss		X				X	
Precipitation number		X					X
Ash			X				
Emulsion				X			
Foam test	X		X	X [4]	X	X	X
Water content				X			
Particulate content / trace sediment	X		X			X	
Trace metals	X					X	
Carbon residue							X
Sulfur							
Hydrolytic stability							
Minimum retest frequency (months)	36	36	24	24	24	36	36
Visual check frequency (months)	12	12			12	12	
Military symbol(s)	None	None	9250	2190-TEP	PE-10, PE-30, PE-40, PE-15/40	None	None
NATO Code Numbers	O-148, O-163	O-142	O-278	O-250	C-640, C-642, N/A, N/A	O-152, O-154, O-156	None

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TABLE XX. Type B-2 tests for lubricating oils[5] – Continued

CHARACTERISTICS	SPECIFICATION				
	MIL-PRF-32033	MIL-PRF-46167	MIL-PRF-53074	SAE J 1899	SAE J 1966
Appearance / workmanship				X	X
Color	X				
Viscosity @ 100 °C		X	X	X	X
Viscosity @ 54 °C					
Viscosity @ 40 °C	X				
Viscosity @ -40 °C	X	X			
Viscosity @ -54 °C	X				
Relative density				X	X
Flash point	X	X	X	X	X
Pour point	X	X	X	X	X
Neutralization number (acid/base)			X	X	X
Copper strip corrosion	X		X	X	X
Corrosion & oxidation stability					
Evaporation loss	X				
Precipitation number	X				
Ash			X	X	X
Emulsion					
Foam test		X		X	
Water content					
Particulate content / trace sediment				X	X
Trace metals				X	
Carbon residue					
Sulfur					
Hydrolytic stability					
Minimum retest frequency (months)	24	24	36	36	36
Visual check frequency (months)	12			12	12
Military symbol(s)	PL-S	OEA-30	5190, 5230	Type II Type III	1065, 1080, 1100, 1120
NATO Code Numbers	O-190	O-183	None	None	None

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TABLE XX. Type B-2 tests for lubricating oils[5] – Continued

CHARACTERISTICS	SPECIFICATION		
	SAE J 2360	VV-L-825[1]	MIL-PRF-14107
Appearance / workmanship			X
Color			
Viscosity @ 100 °C	X	X	
Viscosity @ 54 °C			
Viscosity @ 40 °C		X	X
Viscosity @ -40 °C			
Viscosity @ -54 °C			X
Relative density			
Flash point	X	X	X
Pour point		X	X
Neutralization number (acid/base)		X	X
Copper strip corrosion	X	X	
Corrosion & oxidation stability			
Evaporation loss			X
Precipitation number			X
Ash		X	
Emulsion			
Foam test	X		
Water content			
Particulate content / trace sediment			
Trace metals			
Carbon residue		X	
Sulfur			
Hydrolytic stability			
Minimum retest frequency (months)	24	36	24
Visual check frequency (months)	12		
Military symbol(s)	GO-75/90, GO-80/90, GO-85/140	RCO-2, RCO-3, RCO-4	LAW
NATO Code Numbers	O-186, O-226, O-228	O-283, O-290	O-157

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TABLE XX. Type B-2 tests for lubricating oils[5] – Continued

NOTES:

1. Also, floc point and dielectric strength.

2. Per temperature in specification.

3. If capability exists.

4. Option A may be used for Government owned 2190 TEP if the conditions are met as required by ASTM D892.

5. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page.

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TABLE XXI. Type B-2 tests for greases, semi-fluids, lubricants, and other grease-like materials[7]

CHARACTERISTICS	SPECIFICATION				
	A-A-59173	DOD-G-24508	DOD-G-24650	MIL-G-21164	MIL-G-25013
Appearance / workmanship	X	X	X		X
Odor		X		X	X
Penetration (un-worked)				X	
Penetration (worked)	X	X	X	X	X
Worked stability		X		X	X
Dropping point / melting	X	X	X	X	X
Oil separation		X		X	X
Evaporation loss / bleed	X	X		X	X
Copper strip corrosion		X		X	X
Oxidation stability (100 hours)	X				
Rust preventive properties		X		X	X
Water resistance		X		X	X
Fuel resistance					
Free-acidity / free alkali					
Molybdenum disulfide content				X	
Boiling water immersion					
Water stability / emulsification					
Water content					
Dirt (particles)	X	X			X
Load carrying capacity		X [5]		X [5]	
Minimum retest frequency (months)	24	24		24	24
Visual check frequency (months)					
Military symbol(s)	None	None	None	GMD	None
NATO Code numbers	None	None	None	G-353	G-372

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TABLE XXI. Type B-2 tests for greases, semi-fluids, lubricants, and other grease-like materials[7] – Continued

CHARACTERISTICS	SPECIFICATION			
	MIL- -G-25537	MIL-G-81937	MIL-L-15719	MIL-L-19701
Appearance / workmanship	X	X	X	X
Odor	X	X		
Penetration (un-worked)	X	X		
Penetration (worked)	X	X	X	
Worked stability	X	X	X	
Dropping point / melting	X	X	X	
Oil separation	X	X		
Evaporation loss / bleed	X	X	X	X
Copper strip corrosion	X	X	X	
Oxidation stability (100 hours)		X		
Rust preventive properties	X	X		X
Water resistance	X	X	X	
Fuel resistance				
Free-acidity / free alkali				
Molybdenum disulfide content				
Boiling water immersion				
Water stability / emulsification				
Water content				
Dirt (particles)	X	X	X	
Load carrying capacity				
Minimum retest frequency (months)	24	24	24	24
Visual check frequency (months)				
Military symbol(s)	None	None	HTG	None
NATO Code Numbers	G-366	None	None	None

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TABLE XXI. Type B-2 tests for greases, semi-fluids, lubricants, and other grease-like materials[7] – Continued

CHARACTERISTICS	SPECIFICATION					
	MIL-L-46000	MIL-L-46150	MIL-PRF-10924	MIL-PRF-18458 [1]	MIL-DTL-23549	MIL-PRF-23827
Appearance / workmanship		X	X	X	X	X
Odor			X			X
Penetration (un-worked)						X
Penetration (worked)	X		X	X	X	X
Worked stability			X			X
Dropping point / melting			X		X	X
Oil separation			X	X	X	X
Evaporation loss / bleed	X	X	X		X	X
Copper strip corrosion	X	X	X		X	X
Oxidation stability (100 hours)	X [4]					
Rust preventive properties	X	X	X			X
Water resistance						X
Fuel resistance						
Free-acidity / free alkali						
Molybdenum disulfide content					X	
Boiling water immersion					X	
Water stability / emulsification						
Water content						
Dirt (particles)						X
Load carrying capacity	X [5]	X [5]	X [5]	X [5]	X [5]	X [5]
Minimum retest frequency (months)	24	24	24	24	24	24
Visual check frequency (months)			12			
Military symbol(s)	LSA	None	GAA	None	None	None
NATO Code Numbers	O-158	None	G-403	None	None	G-354

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TABLE XXI. Type B-2 tests for greases, semi-fluids, lubricants, and other grease-like materials[7] – Continued

CHARACTERISTICS	SPECIFICATION					
	MIL-PRF-24139	MIL-PRF-27617	MIL-PRF-81322	MIL-PRF-83261	MIL-PRF-83363	MIL-PRF-85336
Appearance / workmanship	X	X	X	X	X	
Odor	X		X			
Penetration (un-worked)		X			X	
Penetration (worked)	X	X	X	X	X	
Worked stability	X		X	X	X	
Dropping point / melting	X		X			
Oil separation		X	X	X	X	
Evaporation loss / bleed	X	X	X	X	X	X
Copper strip corrosion	X	X	X			X
Oxidation stability (100 hours)	X	X				X
Rust preventive properties			X			X
Water resistance	X	X	X	X		
Fuel resistance		X				
Free-acidity / free alkali						
Molybdenum disulfide content						
Boiling water immersion						
Water stability / emulsification						X
Water content						
Dirt (particles)	X		X			
Load carrying capacity			X [5]	X [5]	X [5]	X [5]
Minimum retest frequency (months)	24	24	24	24	24	24
Visual check frequency (months)						
Military symbol(s)	None	None	None	None	None	None
NATO Code Numbers	None	G-397, G-398, G-399, G-1350	G-395	None	G-396	None

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TABLE XXI. Type B-2 tests for greases, semi-fluids, lubricants, and other grease-like materials[7] – Continued

CHARACTERISTICS	SPECIFICATION				
	SAE AMS-G-4343	SAE AMS-G-6032	VV-G-632	VV-G-671 [2]	VV-P-236 [3]
Appearance / workmanship	X	X		X	X
Odor	X				
Penetration (un-worked)		X			X
Penetration (worked)	X		X	X	
Worked stability					
Dropping point / melting	X	X	X	X	X
Oil separation	X				
Evaporation loss / bleed	X				X
Copper strip corrosion	X	X	X	X	X
Oxidation stability (100 hours)					
Rust preventive properties	X				
Water resistance					
Fuel resistance					
Free-acidity / free alkali			X	X	
Molybdenum disulfide content					
Boiling water immersion					
Water stability / emulsification					
Water content				X	
Dirt (particles)					X
Load carrying capacity				X [5]	
Minimum retest frequency (months)	24	24	24	24	24
Visual check frequency (months)		6 [6]		12	
Military symbol(s)	None	None	None	None	None
NATO Code Numbers	G-392	G-363	None	G-412	S-743

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TABLE XXI. Type B-2 tests for greases, semi-fluids, lubricants, and other grease-like materials[7] – Continued

NOTES:

1. Also volatile matter.
2. Also ash content.
3. Also neutralization number, viscosity & flash point.
4. Per time cited in specification.
5. If capability exists.
6. Examine each 6 months for hardening.
7. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page.

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TABLE XXII. Type B-2 tests for hydraulic, brake, shock absorber fluids[5]

CHARACTERISTICS	SPECIFICATION					
	A-A-59290	A-A-59354	MIL-DTL-17111	MIL-H-19457 [1]	MIL-H-22072	MIL-H-81019
Appearance / workmanship			X		X	X
Color		X	X		X	
Composition						
Viscosity @ 100 °C			X	X		
Viscosity @ 54 °C					X	
Viscosity @ 40 °C	X [2]	X	X	X	X [2]	X
Viscosity @ 25°C						
Viscosity @ -40 °C			X [2]			
Viscosity @ -54 °C						X
Low temperature stability						
Relative density	X			X	X	
Flash point		X				X
Pour point		X	X	X		
Neutralization Number (acid/base)		X	X	X		X
Copper strip corrosion						X
Corrosion & oxidation stability						X
pH	X				X	
Evaporation loss			X	X	X	
Water content			X	X	X	X
Foam test		X		X	X	X
Particulate content / trace sediment						X
Ash	X					
Precipitation number			X	X		
Rust prevention		X				
Emulsion				X		
Lubricity (steel-on-steel)			X [4]	X [4]		
Gel time						
Minimum retest frequency (months)	24	24	24	24	24	24
Visual check frequency (months)						
Military symbol(s)	None	None	None	None	None	None
NATO Code	None	None	H-575	H-580	H-579	None

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TABLE XXII. Type B-2 tests for hydraulic, brake, shock absorber fluids[5] – Continued

CHARACTERISTICS	SPECIFICATION					
	MIL-PRF-5606	MIL-PRF-6083	MIL-PRF-46170	MIL-PRF-17672	MIL-PRF-46176	MIL-PRF-83282
Appearance / workmanship	X	X	X	X		
Color	X	X				X
Composition						
Viscosity @ 100 °C	X		X		X	X
Viscosity @ 54 °C						
Viscosity @ 40 °C	X	X	X	X		X
Viscosity @ 25°C						
Viscosity @ -40 °C	X	X	X			X
Viscosity @ -54 °C	X	X			X [2]	
Low temperature stability						
Relative density						
Flash point	X	X	X	X	X	X
Pour point	X	X	X	X		
Neutralization Number (acid/base)	X	X	X	X		X
Copper strip corrosion	X	X		X		X
Corrosion & oxidation stability						
pH						
Evaporation loss	X	X				
Water content	X	X	X	X		X
Foam test	X	X	X	X		X
Particulate content / trace sediment	X	X	X	X		X
Ash				X		
Precipitation number						
Rust prevention						
Emulsion				X		
Lubricity (steel-on-steel)	X [4]	X [4]				X [4]
Gel time						
Minimum retest frequency (months)	24	24	24	24	24	24
Visual check frequency (months)	12					12
Military symbol(s)	OHA	OHT	FRH	2075-T-H, 2110-T-H, 2135-T-H	BFS	None
NATO Code Numbers	H-515	C-635	H-544	H-573	H-547	H-537

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TABLE XXII. Type B-2 tests for hydraulic, brake, shock absorber fluids[5] – Continued

CHARACTERISTICS	SPECIFICATION		
	MIL-PRF-87257	SAE J 1703	VV-D-1078
Appearance / workmanship		X	X
Color	X		
Composition			
Viscosity @ 100 °C	X	X	
Viscosity @ 54 °C			
Viscosity @ 40 °C	X		
Viscosity @ 25°C			X
Viscosity @ -40 °C	X	X	
Viscosity @ -54 °C	X		
Low temperature stability	X		
Relative density			X
Flash point	X		X
Pour point			X
Neutralization Number (acid/base)	X		X
Copper strip corrosion	X		
Corrosion & oxidation stability			
pH		X	
Evaporation loss			
Water content			
Foam test	X		
Particulate content / trace sediment	X		
Ash			
Precipitation number			
Rust prevention			
Emulsion			
Lubricity (steel-on-steel)			
Gel time			
Minimum retest frequency (months)	24	24	24
Visual check frequency (months)		12	12
Military symbol(s)	None	None	None
NATO Code Numbers	H-538	H-542	S-1714, S-1716, S-1718, S-1720, S-1724, S-1726, S-1728, S-1732

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TABLE XXII. Type B-2 tests for hydraulic, brake, shock absorber fluids.[5] – Continued

NOTES:

1. Also, hydrolytic stability

2. Per temperature in specification.

3. Fire point test characteristic also required.

4. If capability exists.

5. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page.

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TABLE XXIII. Type B-2 tests for lubricants, (including solid film)[6]

CHARACTERISTICS	SPECIFICATION					
	A-A-59004	DOD-L-25681	MIL-L-23398	MIL-L-24131	MIL-L-24478	MIL-L-87177 [1]
Appearance / workmanship	X	X				X
Color						
Odor					X	
Viscosity @ 100 °C		X				
Viscosity @ 40 °C		X				
Viscosity @ 0 °C						
Viscosity @ -54 °C						
Boiling point						
Flash point		X				X
Pour point						
Density / relative density						
Composition		X				
Oil content	X					
Particle size				X		
Solids content				X	X	
Ash				X		
Adhesion						
Thermal stability						
Endurance life						
Load carrying capacity						X [3]
Minimum retest frequency (months)	12	24	Note [4]	12	12	24
Visual check frequency (months)			6		12	
Military symbol(s)	None	None	None	None	None	None
NATO Code Numbers	None	S-1735	S-749	None	None	None

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TABLE XXIII. Type B-2 tests for lubricants, (including solid film)[6] – Continued

CHARACTERISTICS	SPECIFICATION					
	MIL-PRF-3572	MIL-PRF-46010	MIL-PRF-46147	MIL-PRF-63460	MIL-PRF-81329	SAE AS 87132
Appearance / workmanship	X			X	X	
Color						
Odor						
Viscosity @ 100 °C	X [2]					
Viscosity @ 40 °C						
Viscosity @ 0 °C	X [2]					
Viscosity @ -54 °C				X		
Boiling point						
Flash point	X			X		
Pour point	X			X		
Density / relative density						
Composition						X
Oil content						
Particle size	X					
Solids content	X					
Ash	X					
Adhesion					X	
Thermal stability					X	
Endurance life					X	
Load carrying capacity				X [3]		
Minimum retest frequency (months)	24	Note [4]	Note [4]	36	Note [4]	36
Visual check frequency (months)					6	
Military symbol(s)	None	None	None	None	None	None
NATO Code Numbers	None	None	None	S-758	S-1737	None

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TABLE XXIII. Type B-2 tests for lubricants, (including solid film)[6]- Continued

NOTES:

1. Also, dielectric strength.
2. Per temperature in specification.
3. If capability exists.
4. Discard 12 months from date of manufacture.
5. Discard 6 months from date of manufacture.
6. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page.

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TABLE XXIV. Type B-2 tests for waxes[1]

CHARACTERISTICS	SPECIFICATION							
	A-A-50178	A-A-59255	C-T-91	MIL-W-10885	MIL-W-12062	MIL-W-12598	MIL-W-13945	MIL-W-20553
Appearance / workmanship			X	X		X	X	
Odor	X		X				X	
Color	X	X						
Melting point / solidification point		X	X			X	X	X
Softening point	X			X	X			
Penetration				X	X	X	X	X
Viscosity @ 100 °C				X		X	X	X
Oil content				X			X	X
Flash point				X		X	X	X
Relative density				X	X	X		
Ash			X		X			
Water content			X					
Neutralization Number (acid/base)				X		X	X	X
Saponification number			X			X	X	
Volatile matter						X		
Minimum retest frequency (Months)	36	36	48	36	36	36	36	36
Visual check frequency (months)								
Military symbol(s)	None	None	None	None	None	None	None	None
NATO Code Numbers	None	None	None	None	None	None	None	None

NOTES-

1. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page. Only an approved laboratory under the DoD Shelf Life Program can authorize the customer to extend the shelf life of any item. For laboratories that cannot perform the full B-2 series tests, recommend the following statement be included in the remarks section: "All required tests for shelf life extension were not performed. This lab report does not give authorization to extend the shelf life extension of this item."

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TABLE XXV. Type B-2 tests for misc. products (specialty, cutting, anti-seizing, etc.)[8]

CHARACTERISTICS	SPECIFICATION	
	A-A-59197	ASTM D3487
Appearance / workmanship	X	
Viscosity @ 100 °C		
Viscosity @ 54 °C		
Viscosity @ 40 °C	X [2]	X
Viscosity @ 20 °C		
Viscosity @ -40 °C		
Viscosity @ -54 °C		
Relative density		X
Distillation		
Flash point	X	X
Fire point		
Pour point	X	X
Freezing point		
Penetration (un-worked)		
Penetration (worked)		
Melting point		
Protection		
Corrosion		
Neutralization Number (acid/base)	X	X
Acidity		
Lead corrosion		
pH		
Stability		
Evaporation / bleed		
Residue on evaporation		
Ash		
Precipitation number		
Foaming		
Emulsification properties		
Contamination / sediment		
Water content		X
Dielectric strength		X
Film appearance		
Drying Rate		
Particle size (fineness)		
Surface and interface tension		
Minimum retest frequency (months)	36	24
Visual check frequency (months)		
Military symbol(s)	None	None
NATO Code Numbers	None	None

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TABLE XXV. Type B-2 tests for misc. products (specialty, cutting, anti-seizing, etc.)[8] – Continued

CHARACTERISTICS	SPECIFICATION				
	MIL-DTL-4339	MIL-C-6529	MIL-C-11796	MIL-DTL-5020	MIL-DTL-85470[1]
Appearance / workmanship	X	X	X	X	X
Viscosity @ 100 °C					
Viscosity @ 54 °C					
Viscosity @ 40 °C				X [2]	
Viscosity @ 20 °C					
Viscosity @ -40 °C					
Viscosity @ -54 °C					
Relative density					X
Distillation				X	
Flash point				X	
Fire point					
Pour point					
Freezing point					
Penetration (un-worked)			X		
Penetration (worked)					
Melting point			X		
Protection		X			
Corrosion	X		X	X	
Neutralization Number (acid/base)					
Acidity					X
Lead corrosion					
pH	X				X
Stability		X	X		
Evaporation / bleed					
Residue on evaporation					
Ash					
Precipitation number		X			
Foaming					
Emulsification properties	X				
Contamination / sediment					
Water content					X
Dielectric strength					
Film appearance					
Drying Rate					
Particle size (fineness)					
Surface and interface tension					
Minimum retest frequency onths)	48	36	36	48	18[6]
Visual check frequency (months)				12	1 [7]
Military symbol(s)	None	None	None	FDC	None
NATO Code Numbers	C-630	C-608, C-609, C-610	C-633	S-712	S-1745

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TABLE XXV. Type B-2 tests for misc. products (specialty, cutting, anti-seizing, etc.)[8] - Continued

CHARACTERISTICS	SPECIFICATION				
	MIL-PRF-8188	MIL-PRF-12070	MIL-PRF-16173	MIL-PRF-46002	MIL-PRF-87252
Appearance / workmanship	X	X	X	X	X
Viscosity @ 100 °C	X	X		X	X
Viscosity @ 54 °C					
Viscosity @ 40 °C				X	X
Viscosity @ 20 °C					
Viscosity @ -40 °C					X
Viscosity @ -54 °C					X
Relative density					
Distillation					
Flash point	X	X		X	X
Fire point					X
Pour point				X	
Freezing point					
Penetration (un-worked)					
Penetration (worked)					
Melting point					
Protection	X[2]				
Corrosion			X	X	X
Neutralization Number (acid/base)					X
Acidity					
Lead corrosion	X				
pH					
Stability			X		
Evaporation / bleed				X	
Residue on evaporation					
Ash			X		
Precipitation number				X	
Foaming					
Emulsification properties					
Contamination / sediment					X
Water content					X
Dielectric strength					X
Film appearance			X		
Drying Rate			X		
Particle size (fineness)					
Surface and interface tension					
Minimum retest frequency (months)	36	12	36	24	24
Visual check frequency (months)					
Military symbol(s)	None	SGF-2	None	None	None
NATO Code Numbers	C-638	None	C-620, C-632	None	S-1748

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TABLE XXV. Type B-2 tests for misc. products (specialty, cutting, anti-seizing, etc.)[8] - Continued

CHARACTERISTICS	SPECIFICATION				
	MIL-T-17128	SAE AMS 1424	SAE AMS 1428	SAE AMS 2518	SAE AMS-M-7866
Appearance / workmanship	X	X	X	X	X
Viscosity @ 100 °C	X				
Viscosity @ 54 °C					
Viscosity @ 40 °C	X				
Viscosity @ 20 °C			X		
Viscosity @ -40 °C					
Viscosity @ -54 °C					
Relative density	X	X	X		
Distillation					
Flash point					
Fire point					
Pour point	X				
Freezing point		X	X		
Penetration (un-worked)				X	
Penetration (worked)					
Melting point					
Protection					
Corrosion					X
Neutralization Number (acid/base)	X				
Acidity					
Lead corrosion					
pH		X	X		
Stability					
Evaporation / bleed				X	
Residue on evaporation					
Ash					
Precipitation number					
Foaming					
Emulsification properties					
Contamination / sediment					
Water content					
Dielectric strength					
Film appearance					
Drying Rate					
Particle size (fineness)					X
Surface and interface tension					
Minimum retest frequency (months)	36	Note [5]	Note [5]	36	36
Visual check frequency (months)				12	
Military symbol(s)	None	None	None	None	None
NATO Code Numbers	None	S-1717	S-1719, S-1723	S-720	S-740

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TABLE XXV. Type B-2 tests for misc. products (specialty, cutting, anti-seizing, etc.)[8] - Continued

CHARACTERISTICS	SPECIFICATION				
	SAE AS 8660	O-M-232	SS-G-659	TT-I-735	VV-C-846
Appearance / workmanship	X	X	X	X	X
Viscosity @ 100 °C					
Viscosity @ 54 °C					
Viscosity @ 40 °C					
Viscosity @ 20 °C					
Viscosity @ -40 °C					
Viscosity @ -54 °C					
Relative density		X		X	
Distillation					
Flash point					X
Fire point					
Pour point					X
Freezing point					
Penetration (un-worked)					
Penetration (worked)	X				
Melting point					
Protection					
Corrosion	X				
Neutralization Number (acid/base)					
Acidity		X		X	
Lead corrosion					
pH			X		
Stability					
Evaporation / bleed	X				
Residue on evaporation		X			
Ash					
Precipitation number					
Foaming					
Emulsification properties					X
Contamination / sediment					
Water content					X
Dielectric strength	X [3]				
Film appearance					
Drying Rate					
Particle size (fineness)			X		
Surface and interface tension					
Minimum retest frequency (months)	36	24	48	48	36
Visual check frequency (months)	12	12	12	12	12
Military Symbol(s)	None	None	None	None	OS
NATO Code Numbers	S-736	S-747	S-732	S-737	O-214

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TABLE XXV. Type B-2 tests for misc. products (specialty, cutting, anti-seizing, etc.)[8] – Continued

NOTES:

1. Also, color.

2. Per temperature in specification.

3. If capability exists.

4. Check container for damage.

5. Bulk products should be tested annually prior to the winter season. Packaged products, such as 55-gal drums, have an initial 24-month shelf life from the date of manufacture and should be updated every 12 months.

6. Product should be retested for quality conformance every 12 months for BULK FSII. The minimum retest for frequency for packaged FSII should be in line with the DOD shelf-life program (18 months).

7. One month after receipt a visual check is to be performed..

8. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page.

Only an approved laboratory under the DoD Shelf Life Program can authorize the customer to extend the shelf life of any item. For laboratories that cannot perform the full B-2 series tests, recommend the following statement be included in the remarks section: "All required tests for shelf life extension were not performed. This lab report does not give authorization to extend the shelf life extension of this item."

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TABLE XXVI. Conversion chart for truck (TT), tank cars, truck (tank wagons (TW), tank & trailer (TRR), and Intermodal Containers (IMC)) [1, 2]

LAST PRODUCT CARRIED	PRODUCT TO BE LOADED							
	Gasolines: GASOHOL, MOGAS, E85, AVGAS, JP-4, Jet B	Jet Fuels: Jet A/A-1, JP-8, JP-5, TS-1, KS-1/R/N,	Jet Fuel [3]: JPTS	RP1 /RP2	JP-10/PF-1	Diesel Fuels: F-76,MGO, LS-1/2/S/W, DL-S/W, DS-1/2/S/W,DF1,DF2, HS-1/2,FS1,FS2,FL-2/4,SF-2 ULSD	FSII [4]	Lubricating Oils
Gasolines: GASOHOL, MOGAS, E85, AVGAS, JP-4, Jet B	Drain/Empty	Steam Dry[5]	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry
Jet Fuels: Jet A/A-1, JP-8, JP-5, TS-1, KS-1/R/N,	Drain/Empty	Drain/Empty	Steam Dry	Steam Dry	Steam Dry	Drain/Empty [6, 7]	Steam Dry	Steam Dry
Jet Fuel: JPTS	Drain/Empty	Drain/Empty	Drain/Empty	Drain/Empty	Steam Dry	Drain/Empty	Steam Dry	Steam Dry
RP1/RP2	Steam Dry	Steam Dry	Steam Dry	Drain/Empty	Steam Dry	Steam Dry	Steam Dry	Steam Dry
JP-10/PF-1	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Drain/Empty	Steam Dry	Steam Dry	Steam Dry
Petroleum Solvent or Paint Thinner	Steam Dry	Steam Empty	Steam Dry	Hot Water Rinse & Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry
Diesel Fuels: F-76, MGO, LS-1/2/S/W, DL-S/W,DS-1/2/S/W, DF1,DF2,HS-1/2,FS1, FS2, FL-2/4, SF-2 ULSD	Steam Dry	Drain/Empty	Steam Dry	Steam Dry	Steam Dry	Drain/Empty [6, 7]	Steam Dry	Steam Dry
FSII	Drain/Empty	Drain/Empty	Steam Dry	Steam Dry	Steam Dry	Drain/Empty	Drain/Empty	Steam Dry
Lubricating Oils	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	Steam Dry	NO LOAD	Drain/ Empty[7]
Biodiesel Blends <B15	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry [, 10]	Steam Dry	Steam Dry
Biodiesel Blends ≥B15	Steam Dry [,9]	Steam Dry [,9]	NO LOAD	NO LOAD	NO LOAD	Steam Dry [10]	Steam Dry	Steam Dry

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TABLE XXVI. Conversion chart for truck (TT), tank cars, truck (tank wagons (TW), tank & trailer (TRR), and Intermodal Containers (IMC)) [1, 2] - Continued

LAST PRODUCT CARRIED	PRODUCT TO BE LOADED							
	Gasolines: GASOHOL, MOGAS, E85, AVGAS, JP-4, Jet B	Jet Fuels: Jet A/A-1, JP-8, JP-5, TS-1, KS-1/R/N,	Jet Fuel [3]: JPTS	RP1 /RP2	JP-10/PF-1	Diesel Fuels: F-76,MGO, LS-1/2/S/W, DL-/W, DS-/2/S/W,DF1,DF2,HS-1/2,FS1,FS2,FL-2/4,SF-2 ULSD	FSII [4]	Lubricating Oils
ASTM D975 No. 4D, FS4,FS5,FS6, IFOs	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD
Naphtha	Drain/Empty	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry`
Petroleum Solvent/Paint Thinner	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry	Steam Dry

1. General Instructions for Tank Cars and Trucks :
   a. Conveyances carrying lubricating oil shall be dry and free from loose rust, scale, and dirt. Conveyances carrying other products shall be substantially free from loose rust, scale, dirt.
   b. Saran lined equipment should not be steam cleaned; water wash should suffice.
   c. Petroleum products l shall not be loaded into the conveyances whose previous cargo was caustic, acid, or chlorinated solvents.
   d. Trucks in liquid fertilizer service shall not load aviation turbine fuels directly, but shall carry out at least two loads of commercial gasoline prior to the aviation turbine fuel load.
   e. Conversion of Government-owned tank cars from liquid fertilizer service to aviation turbine fuel service shall only be done when no other alternative exists. Tank cars being converted from liquid fertilizer service to a petroleum product shall be adequately cleaned to remove all traces of liquid fertilizer. At a minimum the equipment must be steam cleaned; dried and will be free from loose rust, scale, and dirt. After cleaning, equipment with unlined compartments should have its compartments lined with an approved coating at this time. Conveyances carrying their initial load of aviation turbine fuel following conversion shall not be released from the loading until they have been sampled a minimum of 24 hours after loading point. The sample shall undergo Type B-2 tests plus Thermal Stability Test (if required by the product specification). After Type B-2 tests indicate compliance with specification requirements, the conveyance can be released pending results of the Thermal Stability tests. The conveyance shall not be unloaded until the loading point notifies the destination that the Thermal Stability test (when required) has passed. When the above condition applies, the DD-250 shall be so noted.
2. Each Military Service shall provide specific guidance for conversion of refueling equipment which exclusively handles Service petroleum products, e.g.: Air Force guidance is contained in T.O. 42B- 1-1, Table 3-1.
3. To be loaded only in aluminum or stainless steel conveyance, or other conveyance lined with an approved epoxy coating. If equipment is coated, clean with hot fresh water not exceeding 58 °C (136 °F) and dry thoroughly.
4. For previous cargoes not listed, contact DLA-ENERGY-QA for acceptability/cleaning procedures.
5. For an additional policy on steam cleaning for JP-8 see 5.3.1.2.
6. If previous cargo contained dye marker, all traces of color must be removed.
7. If product to be loaded does not contain dye, then the vehicle shall not contain any traces of dye prior to loading.
8. Applicable only when loading compatible oils; otherwise, steam and dry.
9. Prior to Loading the Aviation Fuels listed, the conveyance must carry a non-fame cargo and then be steam cleaned and dried.
10. Drain and Empty if loading Biodiesel Blends

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TABLE XXVII. Minimum requirements for the preparation of tanker cargo tanks [1, 2]

LAST PRODUCT CARRIED	PRODUCT TO BE LOADED					
	Jet fuels: JP-4, JET B Gasolines, Mogas, Avgas[5]	Jet fuels: Jet A, Jet A-1, JP-8, DFW	Jet Fuel: JP-5	Jet Fuel: JPTS	Diesel Fuels: F-76, DF1, DF2, D L1, DL2, DS1, DS2, ASTM D975 (No. 1, 2) (B20)	ASTM D975 (No. 4D), FS 4, FS 5, FS 6, IFOs
Jet fuels: JP-4, JET B Gasolines, Mogas, Avgas	A	A,B	A,B	Note [3]	A,B	A
Jet fuels: Jet A, Jet A-1, JP-8, DFW	A	A	A,B	Note [3]	A	A
Jet Fuel: JP-5	A	A	A	Note [3]	A	A
Jet Fuel: JPTS	A	A	A,B	Note [3]	A	A
Diesel Fuels: F-76, DF1, DF2, DL1, DL2, DS1, DS2, ASTM D975 (No. 1, 2) (B20)	A,C,	A,C	A,C	NO LOAD	A, (A,C for B20 only)	A,C
FAME (Fatty Acid Methyl Esters or Diesel Blended 5 vol % FAME or Less (B5 or less)[6]	A, C	A, C	A, C	NO LOAD	A,C	A, C
FAME (Fatty Acid Methyl Esters or Diesel Blended 15 vol % FAME or Less (B15 or less)[6]	A,C	A,C	A,C	NO LOAD	A,C	A,C
FAME (Fatty Acid Methyl Esters or Diesel blended 15 vol % FAME (B15 or higher)[6]	E	E	E	NO LOAD	A,C	A,C

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TABLE XXVII. Minimum requirements for the preparation of tanker cargo tanks. [1, 2] - Continued

LAST PROD	PRODUCT TO BE LOADED					
ASTM D975 (No. 4D), FS4, FS5, FS6, IFOs	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D, A	A
Crude [4]	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D, A	A
Lube Oils	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D, A	A
Naphtha	A, B	A, B	A, B	A, B	A, B	A, B

NOTES:

1. Legend for vessel cleaning requirements broken out into different Types are as follows:

Type	Cleaning Requirement
A	All cargo lines will be dropped, tanks stripped, ballast residue removed.
B	All cargo and vent lines will be drained of previous product and flushed with cold water. Cargo tanks will be thoroughly machine washed using cold water. Cargo tanks must be free of water, loose rust, sludge, mud, silt, etc.
C	The same as for "B," except that hot water will be used instead of cold. If tank interiors are coated, water temperature should not exceed 58 °C (136 °F).
D	Cargo tanks and systems will be processed in accordance with the instructions contained in MIL-HDBK-291, Cargo Tank Cleaning.
E	Not to be loaded without special cleaning instructions. Three clean product/zero biological content intermediate cargoes required. (See Note 6 below)

2. This table is included as a guide only. Requirements for tanker cleaning are determined by MSC vessel cleaning policy (See 5.1.1.4). Contact DLA-QA for tank cleaning requirements for any product not listed in Table XXVII.

3. Special tank preparations and cargo handling is required for JPTS, to prevent contamination. Tanks used for loading must be coated with an approved epoxy. Coating must be adherent: no flaking, peeling, or blistering. It is mandatory that JPTS be loaded in tanks in which the last product carried was JP-5, JP-4, kerosene-based aviation fuels (JP-8, Jet A, etc.), non-aromatic solvent, unleaded gasoline, or arctic diesel. Prior to loading JPTS, tank cleaning requirements are: tanks must be machine washed with hot water, if cleaning chemical and/or salt water is used, the final wash must be with fresh water. Tank bottoms, interior bulk heads, and internals must be completely free of sediment, scale, and other contaminants. Tanks must be dry and all liquids completely removed from the tank's lines after cleaning, must be flushed with fresh water, drained and free all water. Loading and unloading system must be completely isolated. This will be accomplished by completely separate piping systems or by use of blinds. Valves will not be depended on to effect isolation. Cargo tank valves will not be considered as part of the "double block" requirement for cargo system segregation. No common lines will be used. Steam smothering lines should have at least two valves that can be sealed from the main line to the tanks, or a blind installed that can be readily removed. Each tank will have its own individual vent. If ship has a common vent system, tanks used for JPTS must be isolated from balance of the vent system.

[Continued on next page]

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TABLE XXVII. Minimum requirements for the preparation of tanker cargo tanks. [1, 2] - Continued

NOTES Continued –

4. There are no circumstances where a crude carrier is capable of cleaning tanks, pumps and lines sufficiently to load an aviation fuel immediately after a crude cargo. Crude carriers converted to a distillate diesel, aviation fuel or naphtha based fuel must carrier five cargoes of a commercial like product without a quality incident.

5. Motor Gasoline containing Ethanol or MTBE cleaning is to be done by washing with cold sea water and drain well, purge to below 2% hydrocarbon on by volume. Gas free, lift scale and mop. Motor Gasoline unleaded and ultra-low sulfur motor gasoline (unleaded) are to be cleaned washing with cold sea water and drain well.

6. Contamination of aviation kerosene with FAME current specifications permits only 5 ppm by mass FAME in aviation kerosene. Intermediate cargoes and strict washing regime is therefore recommended when the following these cargoes with aviation kerosene. Special note- Specifications for sensitive grades will require extreme care during sampling, to avoid contamination from previous cargoes or buildup of residues. To reduce the possibility of drawing unrepresentative samples, the cleaning of sampling equipment, vapor locks, stand pipes and stilling wells is recommended as part of tank cleaning when tanks have previously held cargoes containing FAME.

Aviation Gasoline-

- To avoid contamination from FAME it is recommended to have three intermediate cargoes with NO FAME between (B100) or any cargo with FAME content greater than 15 vol % (B15) and an aviation gasoline cargo.
- Cargoes with a FAME content of 5 vol % or less (B5 or below) a hot water wash, including flushing of the pumps and lines followed by draining is recommended as a minimum for aviation gasoline cargoes.
- Cargoes with FAME content of 15 vol % (B15) or less, but above B5, a hot water wash, including flushing of pumps and lines, followed by draining is recommended as a minimum. Tanks must be in good condition and washing needs to particularly stringent. A single intermediate cargo with no FAME content is suggested as an alternative, followed by a hot water wash, including flushing of pumps and lines, and by draining for aviation gasoline cargos.

Aviation Kerosene-

- Due to strict limitations on biological contamination (FAME content maximum 5 ppm by volume) three intermediate cargoes with no FAME between FAME (B100) or any cargo with FAME content greater than 15 vol % (B15) and a subsequent aviation kerosene cargo.
- When following cargoes with a FAME content of 5 vol % or less (B5 or below) a hot water wash, including flushing of the pumps and lines followed by draining is recommended as a minimum for aviation kerosene cargoes.
- Cargoes with FAME content of 15 vol % (B15) or less, but above B5, a hot water wash, including flushing of pumps and lines, followed by draining is recommended as a minimum. Tanks must be in good condition and washing needs to particularly stringent. A single intermediate cargo with no FAME content is suggested as an alternative, followed by a hot water wash, including flushing of pumps and lines, and by draining for aviation gasoline cargos. This is per EI (Energy Institute) HM50.

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TABLE XXVIII. Minimum requirements for the preparation of barge cargo tanks [1, 2]

LAST PRODUCT CARRIED	PRODUCT TO BE LOADED					
	Leaded gasoline, aviation	**Gasoline, automotive**	**Turbine fuel, aviation, kerosene type F-34, F-35, F-44**	**Diesel fuel oil - distillate**	**Diesel fuel oil - residual**	**Lube oil**
Leaded Gasoline, Aviation	A	A	B	B	B	B
Gasoline, Automotive	A	A	B	B	B	B
Turbine fuel, aviation, kerosene TYPE, F-34, F-35, F-44	A	A	A	A	A	E
Diesel fuel oil - distillate	C	C	A	A	A	E
Diesel fuel oil - residual	NO LOAD	NO LOAD	NO LOAD	D	A	E
FAME (Fatty Acid Methyl Esters or Diesel blended 5 vol % FAME (B5 or less)	C	C	A,C,F	C,F	C,F	C,F
FAME (Fatty Acid Methyl Esters or Diesel blended 15 vol % FAME (B15 or less)	C	C	A,C,F	F	F	F
FAME (Fatty Acid Methyl Esters or Diesel blended 15 vol %FAME (B15 or higher)	C	C	A,C,F	F	F	F
Lube oils	NO LOAD	NO LOAD	NO LOAD	D	A	E

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TABLE XXVIII. Minimum requirements for the preparation of barge cargo tanks [1, 2] - Continued

NOTES:

1 Legend for vessel cleaning requirements broken out into different Types are as follows:

Type	Cleaning Requirement
A	Drop lines and strip tanks.
B	All cargo and vent lines will be drained of previous product and flushed with cold water. Cargo tanks will be thoroughly machine washed using cold water. Tanks will be gas freed.
C	The same as for Type B., except that hot water will be used instead of cold water.
D	The same as for Type C above. In addition tanks and lines will be flushed with product to be loaded and examined to confirm meeting product specification. Process will be repeated as necessary until passing results are obtained.
E	Cargo tanks and systems must be cleaned in such a manner as will remove all rust, scale, sediment, and all traces of previous cargo and water.
F	Contamination of aviation kerosene with FAME: current specifications permit on up to 5 ppm by volume FAME in aviation kerosene. Intermediate cargoes and strict washing regime is therefore recommended when the following these cargoes with aviation kerosene. Special note- Specifications for sensitive grades will require extreme care during sampling, to avoid contamination from previous cargoes or buildup of residues. To reduce the possibility of drawing unrepresentative samples, the cleaning of sampling equipment, vapor locks, stand pipes and stilling wells is recommended as part of tank cleaning when tanks have previously held cargoes containing FAME. Aviation Gasoline- -To avoid contamination from FAME it is recommended to have three intermediate cargoes with NO FAME between aviation gasoline and any cargo with B100 or any cargo with FAME content greater than 15 vol % B15. - Cargoes with a FAME content of 5 volume % or less (B5 or below) a hot water wash, including flushing of the pumps and lines followed by draining is recommended as a minimum for aviation gasoline cargoes. - Cargoes with FAME content of 15 vol % (B15) or less, but above B5, a hot water wash, including flushing of pumps and lines, followed by draining is recommended as a minimum. Tanks must be in good condition and washing needs to particularly stringent. A single intermediate cargo with no FAME content is suggested as an alternative, followed by a hot water wash, including flushing of pumps and lines, and by draining for aviation gasoline cargos. Aviation Kerosene- - Due to strict limitations on biological contamination (FAME content maximum 5 ppm by volume) three intermediate cargoes with no FAME between FAME (B100) or any cargo with FAME content greater than 15 vol % (B15) and a subsequent aviation kerosene cargo. When following cargoes with a FAME content of 5 vol % or less (B5 or below) a hot water wash, including flushing of the pumps and lines followed by draining is recommended as a minimum for aviation kerosene cargoes. - Cargoes with FAME content of 15 vol % (B15) or less, but above B5, a hot water wash, including flushing of pumps and lines, followed by draining is recommended as a minimum. Tanks must be in good condition and washing needs to particularly stringent. A single intermediate cargo with no FAME content is suggested as an alternative, followed by a hot water wash, including flushing of pumps and lines, and by draining for aviation gasoline cargos. This is per EI (Energy Institute) HM50.

2 In all cases, cargo tanks must be free of water, loose rust, sludge, mud, silt, ballast residue, etc.

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TABLE XXIX. Segregation of product movements via multiproduct pipelines, head product. [1]

GOVERNMENT PRODUCT BEING MOVED	HEAD/TAIL PRODUCT				
	GASOLINE	DIESEL [2]	DYED DIESEL	JP-5	JP-8
GASOLINE		MID-POINT CUT	HEART-CUT	MID-POINT CUT	MID-POINT CUT
DIESEL	HEART-CUT		HEART-CUT	MID-POINT CUT	MID-POINT CUT
DYED DIESEL	N/A	N/A	N/A	N/A	N/A
JP-5	HEART-CUT	MID-POINT CUT	HEART-CUT	MID-POINT CUT	MID-POINT CUT
JP-8		MID-POINT CUT	HEART-CUT	MID-POINT CUT	MID-POINT CUT

NOTES:

1 The following pertains to segregated product as it is moved in the bulk commercial pipeline system. As a rule, Government-owned products are moved via commercial multi-product pipelines from refineries to DFSPs or from DFSP to DFSP. Contract or tariff agreements with the commercial pipeline company outline the type of interface cut (heart-cut or mid-point cut) that will be used on Government product. When Government product is delivered to a customer by pipeline, it is usually through a dedicated system from the DFSP. In those situations where product is delivered directly off of a commercial multi-product pipeline to a using customer, heart-cuts should be used.

2 Ultra Low Sulfur Diesel (ULSD) may require a little more ULSD be cut into military aviation fuels in order to protect the sulfur content of the ULSD. The procedures will be agreed ahead of time with the carrier/contractor and be agreeable to all. Information on the total sulfur content of the typical military aviation fuel will be used as the basis for the formation of the cutting procedures agreed.

Note-

Heart Cut - portions of pure product taken from the line before and after the interface at intermediate terminals.

Mid-point Cut - divided between the two adjacent products, usually at the mid gravity point.

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TABLE XXX. Contamination tables

TYPE CONTAMINANTS	APPEARANCE	CHARACTERISTICS	EFFECTS ON AIRCRAFT
A. WATER			
(1) Dissolved Water	Not Visible.	Freshwater only. Precipitates out as cloud when fuel is cooled.	None unless precipitated out by cooling of fuel. Can then cause ice to form on low-pressure fuel filters.
(2) Free Water	Light cloud. Heavy cloud. Droplets adhering to sides of bottle. Gross amounts settled in bottom.	Free water may be saltwater or fresh water. Cloudy usually indicates water-in-fuel emulsion.	Icing of fuel systems, usually low-pressure fuel filters; erratic fuel gage readings; gross amounts of water can cause flameouts; saltwater will cause corrosion of fuel system components.
B. SEDIMENT			
(1) Rust	Red or black powder, rouge or grains. May appear as dye-like material in fuel.	Red rust (Fe_2O_3) nonmagnetic. Black rust (Fe_3O_4) magnetic. Rust generally comprises the major constituent of total sediment.	Will cause sticking, sluggish or general malfunction of fuel controls, flow dividers, pumps, nozzles, etc.
(2) Sand or dust	Crystalline, granular or glasslike.	Usually present and occasionally constitutes major constituent of total sediment.	Will cause sticking, sluggish or general malfunction of fuel controls, flow dividers, pumps, nozzles, etc.
(3) Aluminum or magnesium	White or gray powder or paste.	Sometimes very sticky or gelatinous when wet with water. Normally present and can constitute the major constituent of total sediment.	Will cause sticking, sluggish or general malfunction of fuel controls, flow dividers, pumps, nozzles, etc.
(4) Fibers		A fiber is defined as a particle having a length to diameter ratio of 20 to 1 or more and having a length of 100 microns or more.	Will cause sticking, sluggish or general malfunction of fuel controls, flow dividers, pumps, nozzles, etc.

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TABLE XXX. Contamination tables – Continued

TYPE CONTAMINANTS	APPEARANCE	CHARACTERISTICS	EFFECTS ON AIRCRAFT
C. EMULSIONS			
(1) Water in fuel emulsions	Light cloud. Heavy Cloud.	Finely divided drops of water in fuel. Same as free water cloud. Will settle to bottom in minutes, hours, or weeks, depending on nature of emulsion.	Same as free water.
(2) Fuel in water or "inverse" emulsions	Reddish, grayish, or blackish. Sticky material variously described as gelatinous, gummy, or "mayonnaise-like."	Fine divided drops of fuel in water. Contains rust which stabilizes or "firms" the emulsion. Will adhere to most materials normally in contact with fuels. Usually present in "globules" or stringy, fibrous-like material in clear or cloudy fuel. Will stand from days to months without separating. This material contains 50-70% water, a small amount of fine rust, and 30-50% fuel.	Same as free water and sediment, only more drastic. Will quickly cause filter plugging or erratic readings in fuel quantity probes.
D. MICROBIOLOGICAL GROWTH			
	Brown, gray, or black. Stringy or fibrous	Usually found with other contaminants in the fuel. Typically found at the fuel water interface but can also form films on the tanks surfaces. Develops only when free water is present.	Fouls fuel quantity probes, sticks flow dividers, and makes fuel controls sluggish.
E. MISCELLANEOUS			
(1) Interface material	Lacy bubbles at interface between fuel and water. Sometimes resembles jellyfish.	Extremely complicated chemically. Occurs only when free water is present.	Effects due to presence of free water.
(2) Air Bubbles	Cloud in fuel.	Disperses upward within a few seconds	None.
(3) Media Migration	Thin to Thickened, light to dark brown, molasses type material	Found in filter-separators utilizing water absorbing (super absorbent polymer based), filter monitor fuse filters. Polymer may migrate downstream of the filter-separator all the way to the aircraft fuel tank.	Capable of blocking the engine fuel filters. May promote microbial growth within the wing tank.

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TABLE XXXI. Minimum standards of filtration and water separation for petroleum products

PRODUCT	INTO TANK CARS AND TRUCKS	INTO DISPENSING UNITS	INTO CONTAINERS (PACKAGE)	INTO AIRCRAFT [1]	INTO USING UNIT
Aviation Gasoline Bulk [2]	150 microns [3] (max) No Visible Water	Filter-Separator 10 ppm by volume water, max.	Filter-Separator [2] 10 ppm by volume water, max.	Filter or Filter-Separator[2] 10 ppm by volume Water, max.	
Aviation Gasoline, Packaged[4]		Filter-Separator [2] 10 ppm by volume Water, max.		Filter or Filter-Separator [2] 10 ppm by volume Water, max.	
Aviation Turbine Fuels, Bulk[2]	150 microns [3] (max.)	Filter-Separator [2] 10 ppm by volume Water, max.	Filter-Separator [2] 10 ppm by volume water, max.	Filter-Separator[2] 10 ppm by volume Water, max.	
Aviation Turbine Fuels, Packaged [4]		Filter-Separator [2] 10 ppm by volume Water, max.		Filter-Separator [2] 10 ppm by volume Water, max.	
Aircraft Piston Engine Lube Oil, - Bulk	240 microns [3] (max.) No Visible Water	240 microns [3] (max) No Visible Water	240 microns [3] (max.) No Visible Water	240 microns [3] (max) No Visible Water	
Aircraft Piston Engine Lube Oil, Packaged		240 microns [3] (max.) No Visible Water	240 microns [3] (max.) No Visible Water	240 microns [3] (max) No Visible Water	
Aircraft jet Engine Lube Oils, - Packaged		25 microns, absolute (max.) No Visible Water	25 microns, absolute (max.) No Visible Water	10 microns (max) (No Filtration necessary for Hermetically sealed containers)	
Aircraft Hydraulic Fluids - Packaged			(Filtered at time of manufacture), 5 microns, absolute (max)	5 microns, absolute (max) (No filtration necessary for hermetically sealed containers)	
Diesel Fuel/ MOGAS (applicable for Army only)			Filter-Separator [2] 10 ppm by volume Water		Filter-Separator 10 ppm by volume Water

NOTES:

1. For Navy aircraft fuels, the limit for water is 5 ppm, by volume.
2. Filter-separator in accordance with EI 1581 or MIL-PRF-52308, or other approved filter-separator equipment.
3. 150 microns equal 100 mesh; 240 microns equal 60 mesh.
4. All visible water to be stripped or drained from fuel prior to issue.

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TABLE XXXII. Bulk and Packaged Additive Shelf Life and Testing Frequency [7]

CHARACTERISTICS[1]	SPECIFICATION			
	MIL-DTL-85470[5] (Bulk FSII)	MIL-DTL-85470[5] (Package FSII)	MIL-PRF-25017[6] (Bulk CI/LI)	MIL-PRF-25017 (Package CI/LI)[6]
Lubricity Test (BOCLE)			X	X
Water Separation (MSEP)			X	X
Ash Content			X	X
Pour Point			X	X
Density @ 15◦C			X	X
Viscosity @ 40◦C			X	X
Flash Point	X		X	X
Total Acid Number	X	X	X	X
pH	X	X	X	X
Color	X	X		
Distillation	X			
Relative Density 20/20◦C	X	X		
Water	X	X		
Ethylene Glycol	X			
NSN	6850-01-057-6427	6850-01-089-5514	6850-01-113-2063	6850-00-292-9780
Shelf Life[2,3]	12 Months	24 Months	12 Months	24 Months
Test Frequency[4]	12 Months	18 Months	6 Months	6 Months

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TABLE XXXII. Bulk and Packaged Additive Shelf Life and Testing Frequency [7] - Continued

NOTES:

1. Characteristics are from the product specifications. Refer to associated additive specification to determine appropriate ASTM test methods.
2. SDA and +100 additives are contracted and controlled through DLA Aviation in Richmond, VA (for address see 5.13.3) and do not have a defined shelf life criteria. Any shelf life and/or testing requirements concerns for these items should be forwarded through them. It is noted that the manufacture states that the self-life for SDA is 5 years, and +100 is 12 months.
3. Shelf Life, for packaged items, applies to those items which are unopened and stored IAW paragraph 5.8.1.1 of this MIL Standard. Bulk additives will be considered to have reached its shelf life if batch has not been depleted or replenished within the 6 month time period. See Note 4 for further instructions.
4. Bulk additives should be tested if the product has been in storage that is unequipped with a nitrogen blanketing or desiccant system and not at least depleted/resupplied with new product once within the shelf life time frame, every 3 or 6 months after shelf life expiration or if visual analysis indicates suspected contamination. Packaged items, if unopened and stored properly, will be tested prior to first use if outside the shelf life time frame. Once opened, packaged additives will be tested every 6 months until depleted or test results do not meet specifications.
5. Follow instructions and ASTM test methods and table properties contained within MIL-DTL-85470 to fulfill verification testing for FSII.
6. Perform conformance tests identified in Table 1 of MIL-PRF-25017 when conducting shelf life testing of CI/LI.
7. For a commodity not listed in Tables I-XXXII, see guidance on packaged product shelf life extension at https://headquarters.dla.mil/j-3/shelflife/default.aspx (CAC Enabled) or https://www.shelflife.hq.dla.mil (non-CAC access). Program POCs for the Military Services and Agency Administrators are listed on the home page.

Only an approved laboratory under the DoD Shelf Life Program can authorize the customer to extend the shelf life of any item. For laboratories that cannot perform the full B-2 series tests, recommend the following statement be included in the remarks section: "All required tests for

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METHOD 1000

TEST FOR EFFECTIVENESS OF PIPELINE RUST INHIBITORS

1. SCOPE

1.1 This method outlines the procedures for determining the effectiveness of rust inhibitors in product moving through pipeline by a steel rod (coupon).

2. APPARATUS

2.1 One SAE-1020 steel rod. Rods sold as SAE-1020 may vary in rusting tendency. The rods used in this test should produce a rating of R-7 in aviation gasoline which does not contain a rust inhibitor.

2.2 Same apparatus as used in ASTM D665, except the oil bath and related heating equipment are not required.

3. PROCEDURE

3.1 Polish the steel rod in accordance with ASTM D665.

3.2 Pour 350 mL of the product into a beaker. Cover the beaker and insert stirrer and polished steel rod. Stir for 10 minutes to ensure wetting the rod.

3.3 Remove 50 mL of the product with a pipette and add 30 mL of synthetic sea water prepared in accordance with ASTM D665. Continue stirring for one hour at room temperature.

3.4 Stop stirring, remove steel rod and examine.

4. REPORT

4.1 Inspect the steel rod for rust and rate using the following chart:

APPEARANCE OF ROD	RATING	DESIGNATION
Free of Rust	Passes	R-1
Trace of Rust, few spots	Passes	R-2
Less than 5% surface rusted	Barely Passes	R-3
5-50% surface rusted	Does not Pass	R-4
50-90% surface rusted	Does not Pass	R-5
Surface covered with light Rust	Does not Pass	R-6
Surface covered with heavy Rust	Does not Pass	R-7

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METHOD 1010

VISUAL QUALITY SURVEILLANCE TEST (Clean/Clear and Bright Test)

1. SCOPE

1.1 This method outlines the procedures for conducting the visual quality surveillance test.

2. CONTAINER

2.1 A round, transparent bottle or laboratory beaker from one L (one quart) to 4 L (one gallon) in size. Container should be as clean as possible.

3. PROCEDURES

3.1 Be sure the sampling valve is free of solid contaminants. Flush sampling valve prior to taking of actual sample.

3.2 Draw the sample as rapidly as possible (full flush) rather than permitting the sample to trickle out. Avoid contaminating the sample from outside sources.

3.3 Check for proper color and all forms of visual contamination by swirling the sample so a vortex is formed. All sediment or water that has settled will accumulate on the bottom of the bottle directly beneath the vortex. Experience will dictate what can be considered excessive sediment. Very fine suspended solids or water will render the product hazy. If the examination is questionable, a laboratory analysis will be made to verify the quantity of contaminant.

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METHOD 1020

TEST FOR SULFIDES IN WATER

1. SCOPE

1.1 This method describes a procedure for determining the presence of hydrogen sulfide that sometimes forms as a result of bacterial action of the sulfates contained in water bottoms in fuel storage tanks.

2. APPARATUS

2.1 250 mL conical flask.

3. Materials

3.1 Dilute (10%) ACS grade, sulfuric or hydrochloric acid.

3.2 Lead acetate paper.

4. SAMPLES

4.1 Representative water samples from storage tank bottoms must be taken in a glass bottle. In some cases it will be necessary to take the water sample in a Bacon bomb sampler. Samples so taken will always be transferred to a glass bottle. To preclude oxidation by air, the filled bottle must be capped immediately. The sample should be tested as soon as possible after sampling to minimize possible changes in the composition of materials in the water.

5. PROCEDURE

5.1 The sample must be shaken thoroughly just prior to performing the test to make certain any sediment present is included in the portion of the sample to be tested.

5.2 Transfer 100 mL of the shaken sample into a 250 mL conical flask. Add 20 mL of dilute (10%) ACS grade, sulfuric or hydrochloric acid to the flask. Immediately place a piece of lead acetate paper folded into a V shape in the neck of the flask. Bring the water to a boil and continue to gently boil for three or four minutes. Observe the color change of the paper.

6. REPORT

6.1 Report negative for sulfides if there is no color change in the lead acetate paper. Report positive for sulfides if the color of the lead acetate paper changes. The color may vary from a light brown to a black.

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METHOD 1030

DETERMINATION OF SMALL AMOUNTS OF LEAD IN FUELS

1. SCOPE

1.1 This method covers the determination of lead alkyls content of fuel in the range of 0.001g to 0.020 g of lead per L. Note: This method is not applicable to fuels containing metal salts other than lead that are capable of producing colored sulfides.

2. SUMMARY

2.1 The lead alkyl is extracted by refluxing the unconverted to lead chloride that is then measured by a colorimetric method, using sodium sulfide. The brown color is compared to the color obtained by adding a known quantity of lead nitrate to a sodium sulfide solution.

3. APPARATUS [9]

3.1 Extraction apparatus.

3.2 Beakers - in Pyrex glass, 250 mL.

3.3 Burette - 5 mL, graduated in 0.05 mL.

4. REAGENTS

4.1 Hydrochloric acid (relative density = 1.19)

4.2 Sodium sulfide solution, 20g in one L of distilled water.

4.3 Lead nitrate. Solution: dry lead nitrate crystals for one hour in an oven at 110 °C. Dissolve 0.8g of the dry lead nitrate in distilled water and make up to one L with distilled water. Discard the solution if it is more than two months old.

4.4 Ammonium hydroxide solution. Prepared by mixing 30 parts of ammonium hydroxide (relative density = 0.925) with 70 parts of distilled water.

5. PROCEDURE

5.1 Thoroughly clean all glassware.

5.2 Transfer 50 mL of the filtered sample to the flask, add 15 mL of HCl and heat until boiling. When reflux commences, regulate the heat to stop bumping in the flask and to avoid flooding the condenser. After 10 minutes of refluxing, stop heating to allow the sample to cool for a few minutes and then drain the acid layer into a 250 mL beaker. Add 15 mL of distilled water to the flask and reflux the mixture for 5 minutes, using full heat. Cool for a few minutes and drain the water layer into the beaker already containing the acid layer.

5.3 Add 30 mL of water to the beaker. Neutralize with the ammonium hydroxide solution to change the color of indicator paper (pH 7). Make up to 100mL with distilled water.

5.4 Fill the burette with the lead nitrate solution.

5.5 Place 100 mL of distilled water in a second beaker; the volume must be identical to that in the first beaker.

[9] Note: All glass must have a low lead content.

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METHOD 1030 - Continued

5.6 Add 10 mL of sodium sulfide solution to each beaker. Swirl gently. A brown color will develop in the test solution. Match this color by addition of lead nitrate solution to the second beaker (blank solution).

5.7 The preceding operations must be carried out rapidly to avoid color changes. If less than 0.2 mL or more than 2 mL of lead nitrate solution has been used, the test should be repeated using a suitable volume of sample. Note: Avoid contact between the lead nitrate solution and vapor from the ammonium sulfide.

6. CALCULATION

6.1 Calculate the total lead content, as follows:

$X = (0.5) * (n) / V$

X = Lead content in g/L

n = mL of lead nitrate solution used

V = volume of the sample in mL

7. PRECISION

7.1 The reproducibility of the method is 0.001 g/L for lead contents under 0.020 g/L.

8. REFEREE

8.1 IP-224 Test Method will be used as a referee method.

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METHOD 1040

DETECTION OF HEAVY HYDROCARBON CONTAMINATION IN AVIATION GASOLINE

1. SCOPE

1.1 This method of test covers the determination of trace amounts of turbine engine fuel or other heavy hydrocarbon contaminant (JP-4 or heavier) in aviation gasoline. It is intended as a field evaluation method and is not to be used in place of the distillation or other specification test.

2. DEFINITIONS

2.1 Capillary attraction: The attraction of a liquid to a solid, and the accompanying movement of the liquid over the solid as in the movement through a wick.

2.2 Chromatography: The separation of mixtures into their constituents by preferential absorption by a solid such as a strip of filter paper.

2.3 Aviation gasoline: Fuels conforming to ASTM D910 having a final boiling point of 170 °C or less.

2.4 Turbine engine fuel: Fuels conforming to MIL-DTL-5624, MIL-DTL-83133 or ASTM D1655 and other fuels having a final boiling point above 238 °C.

3. OUTLINE OF METHOD

3.1 Twenty five (25) ml each of a known quality aviation gasoline of the same grade being tested and the fuel of questionable quality is dyed with approximately 0.01 mg of powdered fuel soluble dye in addition to that already contained in the fuel. (Note: liquid dye is not to be used since the solvent will show up as contaminant in this test). Nine (9) mL of each of the dyed fuels are placed in separate 10 ml test tubes. The test tubes are mounted in a suitable holder and 0.6 cm (1/4") strips of the #10 filter paper or other absorbent paper 20 cm (8 inches) long are extended to the bottom of the test tubes. After five minutes, the height of the fuel on the paper is noted. If the height of the fuel of questionable quality is 0.6 cm (¼") higher than the fuel of known quality, then contamination should be suspected.

4. APPARATUS

4.1 10 ml test tubes 15 mm x 85 mm.

4.2 20 cm (8-inch) ruler.

4.3 Holder (fabricated in accordance with figure 1).

4.4 #40 Whatman filter paper.

4.5 50 ml beakers.

5. REAGENTS

5.1 Reference fuel (aviation gasoline that has been tested for complete specification tests and is maintained in a sealed container).

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METHOD 1040 – Continued

6. PROCEDURE

6.1 Measure 25 mL each of reference fuel and sample to be tested into separate 50 mL beakers. Add approximately 0.01 g of blue dye to each beaker and mix thoroughly by swirling.

6.2 Transfer the dyed fuel to separate 10 mL test tubes. Fill the test tube to the top lip. Insert the filled test tubes into the holder.

6.3 Lower a 0.6 cm wide by 20 cm long (or ¼" by 8") long strip of Whatman filter paper into the test tube until it touches the bottom of the tube. Affix the top of the filter paper to the holder in an extended position.

6.4 After 5 minutes and 15 minutes, record the heights of the fuels on the two filter papers.

6.5 Contamination is indicated by the height of the fuel on the chromatography strip of the unknown sample versus the height of the referenced fuel on the chromatography strip. A height of 0.6 cm (or ¼") above the referenced fuel would indicate possible contamination.

7. REPORT

7.1 Report the difference in centimeters or inches between the sample and the referenced fuel heights on the chromatographic strip.

8. PRECISION

8.1 Results should not differ by more than 0.3 cm (or 1/8").

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METHOD 1040 – Continued

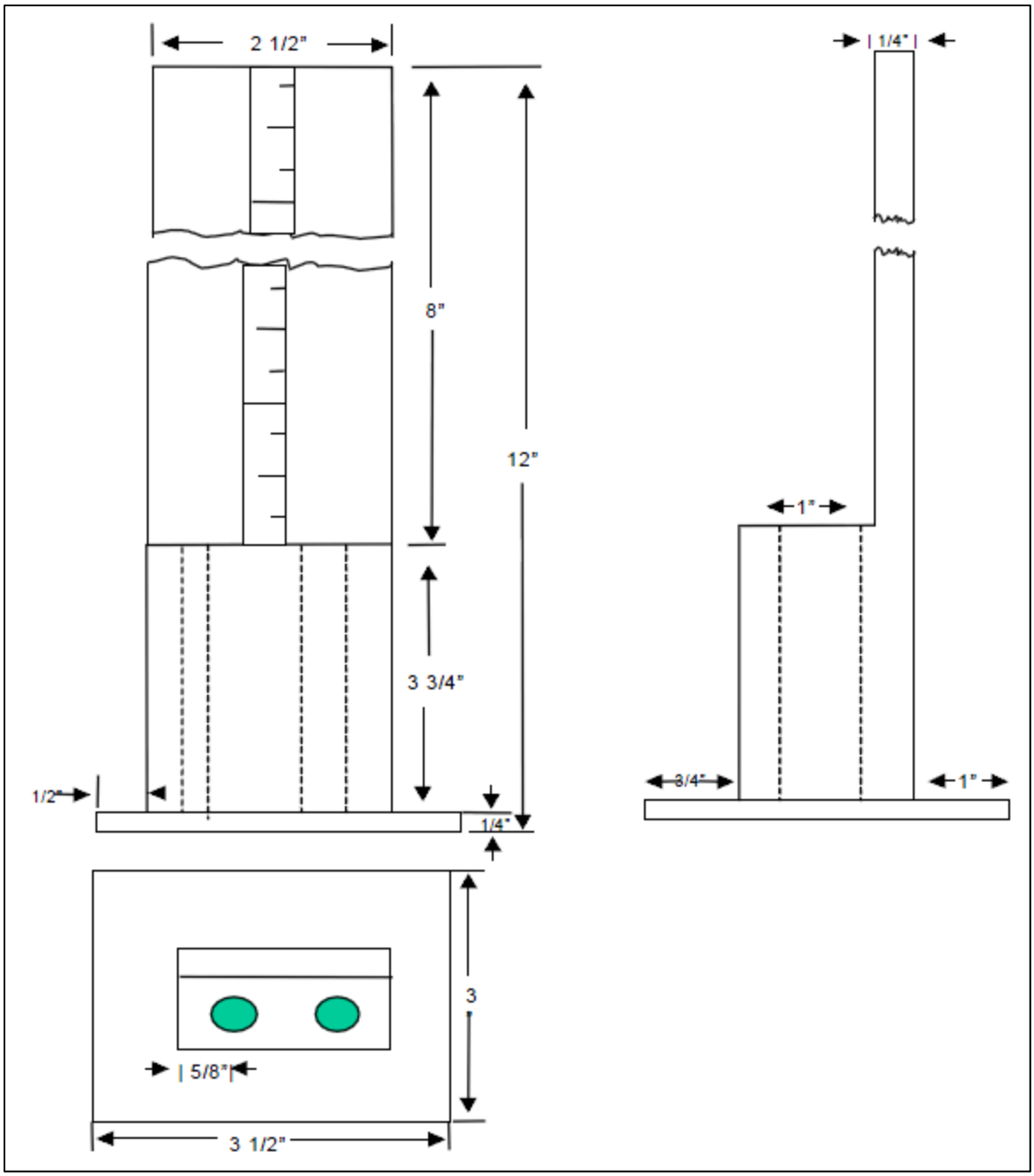

FIGURE 1. Chromatography strip holder

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METHOD 1050

DETECTION OF NITRATE IGNITION-TYPE IMPROVERS IN DIESEL FUEL

1. SCOPE

1.1 This method of test covers the determination of organic nitrate ester type cetane improver additives used in diesel fuel. It is intended as a screening test for those diesel fuel inspection test procedures that are affected by the presence of cetane improvers, namely ASTM D524 and ASTM D976.

2. SUMMARY

2.1 A diesel fuel sample is saponified in a potassium hydroxide-butanol mixture and then filtered through a glass fiber filter disc. The material remaining on the disc is treated with diphenylamine reagent after drying. The presence of a nitrate ester cetane improver is revealed by the formation of a blue ring and blue/black spot due to oxidation of diphenylamine to intense blue quinoidal compounds by the nitrate salt. No color change confirms the absence of a cetane improver.

3. APPARATUS

3.1 Reaction bottle, screw cap bottle, 29.6 mL (1 ounce) capacity, wide-mouth, flint glass, with a tin or Teflon-lined screw cap.

3.2 Glass fiber filter paper, 3.7 cm diameter, grade 93AH (H. Reeve Angel, Inc., Clifton, NJ, or equivalent).

3.3 Pipette, 10 mL capacity.

3.4 Graduated cylinders, 10 mL and 25 mL capacity.

3.5 Suction flask, a holder to accommodate a 60 mL glass-fritted crucible.

3.6 Crucible, 60mL capacity, glass-fritted, crucible, medium porosity.

3.7 Oven, suitable for drying filter discs at 110° C (230° F).

4. REAGENTS

4.1 Saponification mixture (IN). Prepared by mixing 6.5g potassium hydroxide (ACS grade) with 100 mL absolute butanol and heating to dissolve the KOH. After solution cools, the mixture is filtered through the glass fiber filter paper.

4.2 Diphenylamine (1% solution). Prepared by dissolving 0.250g diphenylamine (ACS indicator grade) in 25 mL sulfuric acid (relative density 1.834).

4.3 Toluene (ACS reagent grade).

4.4 Benzene (ACS reagent grade).

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METHOD 1050 - Continued

5. PROCEDURE

5.1 Pipette 10 mL of sample into reaction bottle and add 5 mL of toluene followed by 10 mL of the saponification mixture.

5.2 Affix cap to reaction bottle tightly and, after mixing contents, place in an oven maintained at 38 °C for four hours.

5.3 Remove reaction bottle from oven and allow to cool to room temperature.

5.4 Filter contents of reaction bottle through the 60 mL glass-fritted crucible fitted with the glass fiber filter disc.

5.5 Wash reaction bottle with a 25 mL aliquot of benzene and transfer to the glass-fritted crucible.

5.6 Carefully remove the glass fiber filter disc and dry in the oven at 110 ^{o}C for 15 minutes.

5.7 Remove filter disc and cool to room temperature.

5.8 Add three (3) drops of diphenylamine solution to center of disc and observe whether blue or blue/black color forms.

6. REPORT

6.1 The presence of organic nitrate ester type cetane improvers will be reported if the formation of a blue color occurs. Reference samples of diesel fuels containing 0.5 vol % of any one of the approved cetane improvers (amyl nitrate, cyclohexyl nitrate, hexyl nitrate, and isopropyl nitrate) given an intense blue to blue/black color throughout the reagent spot, whereas those samples only containing 0.1 vol % produce a blue ring at the outer boundary of the reagent.

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METHOD 1060

DETERMINATION OF FREE WATER IN AVIATION AND TURBINE FUELS USING THE AEL MK I OR MK II FUEL DETECTOR (NSN 6640-00-999-2786)

1. SCOPE

1.1 This method covers the determination of the level of free water in aviation and turbine fuels by a portable field instrument, the Free Water Detector (FWD). Not all paragraphs contained in this method apply to all FWD models. The procedure, as outlined in the manual accompanying the specific FWD unit, supersedes the Procedures section of this Appendix. (Not used by the U. S. Army / U.S. Air Force uses the procedures outlined in T.O. 42B-1-1, Section V.): ASTM D3240, Undissolved Water in Aviation turbine Fuels. Aqua-Glo is used by the Army and Air Force and is a backup for the Navy.

2. SUMMARY

2.1 A sample of fuel is passed through a chemically treated filter pad and placed in the filter holder of the AEL MK I or MK II detector. The chemical on the pad is sensitive to any free water in the fuel, producing a fluorescent pattern readily visible under ultraviolet light. After filtration, the pad is examined under the ultraviolet light contained in the viewer kit. The amount of free water in the fuel sample is determined by the intensity of fluorescence on the test pad. Visual comparison is made with a series of standards representing known quantities of water.

3. APPARATUS

3.1 Combined Contaminated Fuel Detector (CCFD), or the MKIII Contaminated Fuel Detector (CFD) and either the MKII Free Water Detector (FWD) or earlier MKI FWD.

3.2 Viewer kit

3.3 Detector test pads and standards

3.4 Slide plate

3.5 Sample pads

3.6 Polyethylene bottle

3.7 Filter holder

3.8 Forceps

4. PROCEDURES

4.1 Mark the polyethylene bottle used with the AEL MK III contaminated fuel detector 8.25 cm (3 ¼") from the bottom. When the bottom is filled to this mark, a 500 mL sample will be obtained.

4.2 Fill the polyethylene sample bottle to the 500 mL mark with fuel to be tested.

4.3 Open a free water detector envelope and place the detector pad, orange-side up, on the contaminated fuel detector filter base. Attach the bottle receiver to the filter base and plug in the ground wire jack. Handle the detector pad with forceps only and use each pad only one time.

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METHOD 1060 - Continued

4.4 Check to make certain the fuel flask is empty and the drain valve closed.

4.5 Shake the sample bottle containing the 500mL fuel sample vigorously for approximately 30 seconds.

4.6 Immediately after shaking, turn on the vacuum pump, unscrew bottle cap and place the bottle receiver and pad assembly firmly over the end of the bottle. All of the threaded portion of the bottle top should be inserted into the bottle receiver. The entire assembly (pad holder, bottle receive, and fuel sample bottle) is then picked up as a unit, inverted, and then inserted (pad holder end) into the fuel flask of the MK III contaminated fuel detector. This step should be accomplished in as short a time as possible in order to keep any free water present in suspension.

4.7 After the 500 mL sample has passed through the detector pad, turn off the vacuum pump immediately, and remove the bottle and the bottle receiver. Note: Under no circumstances continue to draw air through the detector pad.

4.8 Remove the detector pad from the filter base using forceps and place it (orange-side up) in the free water detector slide depression.

4.9 Light the ultraviolet bulb in the free water detector by holding the light switch in the ON position. Insert the slide containing the test pad.

4.10 Look through the view port of the box and compare the brightness of the fluorescence of the test pad with that of the set of standards to determine the amount of free water. Free water content is indicated in parts per million by the numbers located directly above the standards.

4.11 Drain the fuel from the flask of the AEL MK III contaminated fuel detector through the Tygon tubing.

5. REPORT

5.1 Results should be reported as no free water or as actual free water or as actual free water content (estimated to the nearest parts per million).

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METHOD 1070

TEST FOR WATER REACTION OF AVIATION FUELS

1. SCOPE

1.1 This method covers the determination of the presence of water-miscible components in aviation gasoline and turbine fuels, and the effect of these components on volume change and on the fuel-water interface. This test is NOT performed on JP-5.

2. PROCEDURE

2.1 Use ASTM D1094 with the following exceptions:

a. Interface conditions. Use the following chart to rate the condition of the interface.

INTERFACE CONDITIONS

RATING	APPEARANCE
1	Clear and Clean
1b	Small, clear bubbles covering not more than an estimated 50% of the interface and no shreds, lace, or film at interface.
2	Shreds, lace, or film at the interface
3	Loose lace or slight scum or both.
4	Tight lace or heavy scum or both.

b. Degree of separation. Use the following chart to rate the degree of separation.

SEPARATION

RATING	APPEARANCE
(1)	Complete absence of all emulsions and/or precipitates within either layer or upon the fuel layer.
(2)	Same as (1), except small air bubbles or small water droplets in the fuel layer.
(3)	Emulsions and or precipitates within either layer or upon the fuel layer, and/or droplets in the water layer or adhering to the cylinder walls, excluding the walls above the fuel layer.

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MILITARY SERVICES PETROLEUM LABORATORIES AND FUEL TESTING CAPABILITIES

A.1 SCOPE

A.1.1 Scope: This Appendix is not a mandatory part of this Standard. The information contained herein is intended for guidance only. Unless otherwise directed, all samples should be forwarded to the laboratory designated in the appropriate service regulations. It is recommended to contact the laboratories listed below prior to submission of samples to ensure capabilities exist to perform/accomplish sample testing requirements.

A.2 LIST OF LABORATORIES

AIR FORCE LABORATORIES	TYPE PRODUCTS	TYPE TEST
Aerospace Fuels Laboratory (FP2070) AFPA/PTPLA 2430 C Street, Bldg 70, Area B Wright Patterson AFB OH 45433-7632 COMM: (937) 255-2106 DSN: 785-2106	Jet Fuel Packaged POL Chemical Diesel B20 Biodiesel Blend Burner Fuel MOGAS AVGAS	A B-2 B-2 A B-2 (Except Cetane Number) A A (Except Knock Rating) A (Except Knock Rating)
Aerospace Fuels Laboratory (FP 2075) AFPA/PTPLE 1747 Utah Avenue, Bldg. 6670 Vandenberg AFB, CA 93437-5220 COMM: (805) 606-5873 DSN: 276-5873	Jet Fuel Diesel Burner Fuel	A A A
Aerospace Fuels Laboratory (FP2080) AFPA/PTPLF Bldg 725, West Row Gate #6 RAF Mildenhall, Suffolk UK IP28 8NF COMM: 011-44-1-638-54-2043 DSN: 314-238-2043	Jet Fuel Diesel Burner Fuel	A A A
Aerospace Fuels Laboratory (FP2083) AFPA/PTPLG Unit 5161, Bldg 854 Kadena Air Base Okinawa Japan APO AP 96368-5161 COMM: 011-81-611-734-1602 DSN: 315-634-1602	Jet Fuel Diesel Burner Fuel	A A A

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ARMY LABORATORIES	TYPE PRODUCTS	TYPE TEST
USAPC Petroleum Laboratory ATTN: RDTA-DP U Avenue, Bldg. 85-3 New Cumberland, PA 17070-5005	Jet Fuel Package POL Chemicals Coal	B-1, B-2, B-3 B-2 B-2 B-2
HHD, 260th QM Bn Bldg. 120 ATTN: AFZP-SQG Hunter Army Airfield, GA 31409-5130	All	B-1, B-2, B-3
US Army Aviation Center & Ft. Rucker Bldg. 800, N Ave ATTN: ATZB-DOL-M-POL-BR Fort Rucker, AL 36362-2018	Aviation Fuel	B-1, B-2, B-3
CDR 101st AVN DIV and Ft. Campbell Bldg. 7137, 4th Ave ATTN: AFZB-RB-M Ft. Campbell, KY 42223-5000	Jet Fuels and Ground Mobility Fuels	B-1, B-2, B-3
CDR Combat System Test Activity Bldg. 362 ATTN: STECS-TS-PC APG MD 21005-5059	All	B-1, B-2, B-3
HHD, 505th QM Bn. Rt 74 Chibana, Bldg. 53140, Okinawa Japan ATTN: APAJ-GOQ-L Unit 35130 APO AP 96376-5130	All	B-1, B-2, B-3

DLA-ENERGY LABORATORIES	TYPE PRODUCTS	TYPE TEST
Mail Address: DLA Europe & Africa Petroleum Laboratory CMR APO AE 09067 Sample Address: DLA Energy Europe & Africa Petroleum Laboratory Bldg. 320, Rhine Ordnance Barracks Am Opelkreisel 67663 Kaiserslautern, Germany COMM: 011-49-631-3406-2284/2288 DSN: 314-493-2284/2288	Jet Fuel Diesel Burner Fuel MOGAS AVGAS	A B-2 B-1 B-1 B-1

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DLA-ENERGY LABORATORIES	TYPE PRODUCTS	TYPE TEST
DLA Energy Petroleum Laboratory – Pyongtaek Korea APO AP 96218-02666 Bldg. 848 DSN 315-753-7291 Comm. (82)(031)-691-0963	Aviation Turbine JPTS Ground Mobility Packaged Products	A, except naphthalene's A B-1, B-2, B-3 B-1 plus
DLA Energy Bldg .986 COMM: 907-552-7180 DSN: 317-552-7180 Petroleum Laboratory - Anchorage Ft. Richardson, AK 99505-5700	Aviation Turbine DFA, DF1, DF2 Aviation Gasoline Motor Gasoline	B-1, B-2, B-3 B-1, B-2, B-3 B-1, B-2, B-3 B-1, B-2, B-3

NAVY LABORATORIES	TYPE PRODUCTS	TYPE TEST
Naval Air Systems Command Fuels and Lubricants Division, AIR 4.4.5 22229 Elmer Road, Bldg. 2360 Patuxent River, MD 20670 Ship samples to: Naval Air Systems Command HAZMART Bldg. 2385 22680 Hammond Road Sample (AIR 4.4.5) Patuxent River, MD 20670	Aviation & Ship Fuels; Turbine Engine Oils (Special samples only as defined in NAVAIR 00-80T-109)	All
Mid-Atlantic Regional Fuels Laboratory 9673 Virginia Avenue, Bldg. W-388 Norfolk, VA 23511-3323	JP-5 F-76 2190 (LTL) 9250 (LO6) JP8 Jet A MUR (ASTM D4814) Fuel Oil	B-2 B-1 B-2 B-2 B-2 B-1 B-1 B-1
FLC Jacksonville FL Code 700, Fuel Dept. 8808 Somers Road, Bldg. 56 Jacksonville, FL 32226-2600	JP-5 F-76	B-1 B-1
U. S. Naval Station Rota Spain Attn: Fuels Officer PSC 819, Box 21 FPO AE 09645-21	JP-5 F-76	B-2 B-1

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NAVY LABORATORIES	TYPE PRODUCTS	TYPE TEST
FLC San Diego Petroleum Laboratory Bldg 70A Point Loma Annex San Diego, CA 92106	JP-5 F-76 2190 (LTL)	B-2 B-2 B-2
FLC Puget Sound Manchester Fuel Department Attn: Q.A. Laboratory 7501 Beach Drive East Port Orchard, WA 98366	JP-5 F-76 2190 (LTL)	B-2 B-2 B-1
FLC Pearl Harbor POL Laboratory 300 Neches Ave Bldg 1685, Code 704 Pearl Harbor, HI 96860-4549	JP-5 F-76 2190 (LTL)	B-2 B-2 B-2
Commanding Officer FLC Yokosuka Guam Area Fuel Division Laboratory PSC 455, BOX 190 FPO AP 96540-1082	JP-5 JP-8 F-76 RME 25	C C C
Commanding Officer FLC Yokosuka Code 700 PSC 476, Box 7 FPO AP 96349-0011	JP-5 JP-8 F-76, Diesel 2190 (LTL) Gasoline	A A B-2 B-2 + Engine
Officer-in-Charge FLC Yokosuka Det. Sasebo PSC 476, Box 6 FPO AP 96322-0001	JP-5 JP-8 F-76 2190 (LTL)	B-2 B-2 B-2
U. S. Navy Support Facility Diego Garcia Attn: Petroleum Testing Lab PSC 466, Box 24 FPO AP 96595-0004	JP-5 F-76 2190 (LTL)	B-2 B-2 B-2
Commanding Officer FLC Hachinohe, Code 703.1 Unit 5260 APO AP 96319-5000	JP-8	B-1

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SIGNIFICANCE OF TESTS

B.1 SCOPE

B.1.1 Scope This appendix discusses the significance and purpose of some of the tests used in the quality surveillance of fuels and lubricants. This Appendix is not a mandatory part of this Standard. The information contained herein is intended for guidance only.

B.2 GENERAL

B.2.1 General. Each of the various tests of fuels and lubricants indicated in the product specification has a certain significance in relation to the quality of the product tested. Certain ones can give a quick, easy and positive identification of the product and at the same time, aid in detecting the presence of contaminants. Although descriptions of the testing equipment and test methods are not to be included in this publication, it is considered worthwhile to include a brief statement on the significance and purpose of certain tests. These statements may assist by providing a better understanding and appreciation of the scope and importance of the Quality Surveillance Program. For a more detailed coverage of this subject, see the ASTM Manual 1, Manual on Significance of Tests of Petroleum Products.

B.3 Ash. The ash content of an oil is determined by burning off the organic matter and weighing the remaining inorganic materials. Straight mineral oils normally contain only a trace of ash. Oils containing metallic salts as additives will have larger amounts of ash than straight mineral oils. Increase of ash content is indicative of contamination with inorganic matter such as sand, dust and rust. In the case of straight mineral oil this must be very low as any abrasive substance such as sand, clay, or rust may damage the internal metal surfaces of engines, fuel injectors, plug injection nozzles, or form deposits in the engine. Residual fuels should have low amounts of ash since some constituents of ash may cause corrosion or embitterment of boiler fire boxes and boiler tubes.

B.4 Bottom sediment and water. The bottom sediment and water test (BS&W) is conducted on fuel to determine the amount of water and other foreign materials that may be present. Excessive sediment will plug the burner tips and may prevent proper atomization. Clogging of the strainers, accumulation of sediment in fuel tanks and formation of carbon deposits may be a result of a high percentage of BS&W. Water in the fuel may freeze and also clog the lines resulting in improper flow of the fuel.

B.5 Carbon residue. The results of the carbon residue test are an estimation of the carbonizing properties of a lubricating oil or fuel. The carbon residue on a lubricating oil is not directly related to carbon formation in an engine, but gives an indication of the type of carbon formation (loose and flaky, or hard and flinty) and is useful primarily as an identity and control test in conjunction with other specification tests. In diesel fuels, after distilling off 90%, the carbon residue on the last 10% must be low enough to avoid large carbon deposits that could cause coking in the fuel injectors and affect the fuel spray pattern. High carbon residual fuels should be carefully checked for sediment. The Ramsbottom test is the required test for both fuel and lubricants as it has better repeatability and correlates better to carbon formation.

B.6 Cetane index. An approximation of the cetane number (the ignition performance) of distillate diesel fuels, which does not contain a cetane improver additive, calculated from the API gravity and mid-boiling point or from density and recovery temperature measurements.

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B.7 Cetane number. The cetane number is a measure of the ignition performance of a diesel fuel obtained by comparing it to reference fuels in a standardized engine test and is based on a scale resembling that of octane numbers. This value is determined by a test method which measures the length of time (ignition lag) between injection and starting of combustion within the combustion chamber of an engine. The cetane number requirement varies with the type of diesel engine. Large, slow-speed units of stationary installations do not require high cetane numbers (below 40). Smaller, high-speed engines having 1,000 rpm or more require fuels of high Cetane number (above 40). The cetane number is related to operating and starting characteristics at low temperatures. The higher the cetane value, the better or easier the starting capability. Cetane number is not to be confused with cetane index. The cetane number is determined by ASTM D613; the cetane index is a calculated value and may not always equate with the cetane number.

B.8 Cloud and pour points. The cloud point is the temperature at which wax crystals or water in an oil or fuel appear, causing the oil or fuel to appear cloudy or hazy. In wick feed systems, the waxy crystals may clog the wick and either wax or water crystals may block filter passages in fuel systems. The cloud point is the limiting factor for controlling low-temperature operability of diesel and burner fuels. Vehicles and equipment will experience low temperature fluidity problems (filter plugging, fuel line restrictions, and waxing) if operated with diesel fuels having cloud points above ambient temperature. The pour point is the lowest temperature at which flow is observed under controlled conditions. The pour point as determined by laboratory test procedures is only indicative of its behavior at low temperatures. The fact that an oil or a fuel has a specific pour point is not indication that it can be handled satisfactorily at that temperature. Because of the low temperatures encountered by aviation fuels in high altitudes and cold weather flying, the low temperature characteristics are determined by freezing point test.

B.9 Color. Various types of petroleum products such as aviation and automotive gasolines are dyed to permit a rapid visual determination of product type and grade. Visually detectable changes in color intensity or hue may be an indication of product contamination or deterioration. Aviation turbine fuels have no color limitations on procurement or use. This is not to be construed to mean visual color determination is without significance. Unexpected color changes will require additional testing to ensure product quality. Progressive darkening of jet and distillate type fuels during storage is a good indication that oxidation is occurring with the formation of insoluble gums. Naphthas and solvents intended for use as fabric cleaners should be water white to prevent discoloration of the fabric.

B.10 Conductivity. This measures the electrical conductance of the fuel in pS/m. Conductivity additive reduces the amount of time necessary for static charges to dissipate. Conductivity readings can be affected by temperature readings. Figure B-1 shows the effect of temperature on a sample of JP-8 with Stadis 450. The US Navy does not use conductivity additive. Conductivity additive is only added to JP-5 when the product is used for issue or purging of Air Force tactical aircraft.

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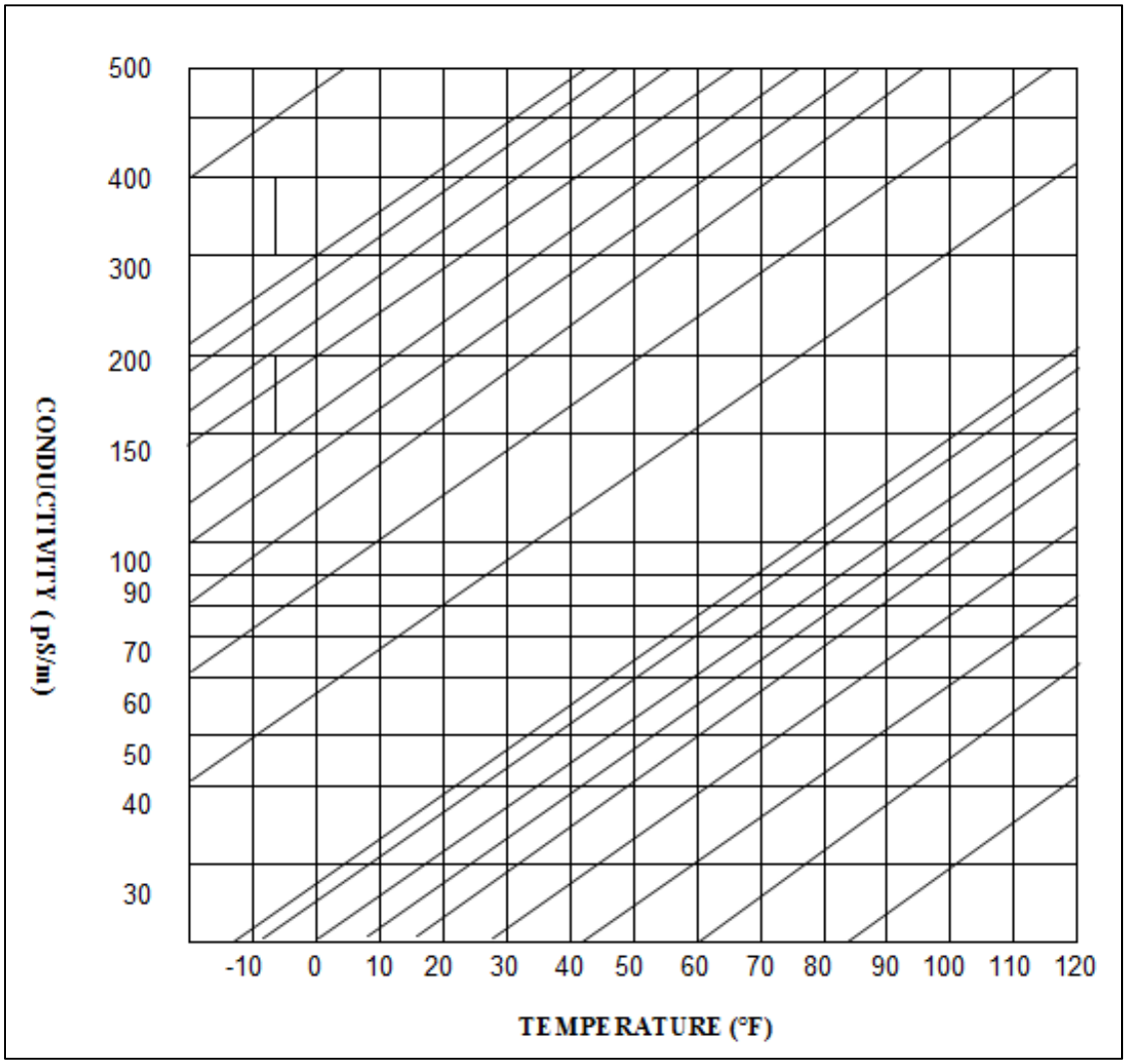

FIGURE B-1. <u>Conductivity</u>

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B.11 Copper Strip Corrosion. This test indicates whether a petroleum product is free of corrosive compounds.

B.12 Distillation. The distillation test is a measure of the volatility of a product. The lower boiling fractions of a gasoline indicate the starting ability of an engine at the given temperature, and the engine's ability to warm up quickly when using that gasoline. An excessive amount of highly volatile constituents in gasoline may cause vapor lock; conversely, an excessive amount of heavy-ends may not completely burn in the combustion chamber and consequently may cause damage through excessive crankcase dilution. Specifications designate minimum and maximum percentages to be evaporated at specified temperatures as well as initial and final boiling points of the product. A high end point and high percentage of residue may be indicative of contamination of gasoline with fuel or oil. Fuel with considerable lower initial boiling point or flash point may be indicative of contamination with gasoline.

B.13 Existent gum. Existent gum is the amount of nonvolatile residue present in the gasoline or aviation turbine fuel at the time of test. The results indicate the quantity of gum deposition which may occur if the product is consumed immediately, but do not indicate the stability of the product toward gum formation on storage. As the name implies, the gum is a sticky, tacky, varnish-like material that is objectionable in fuel systems. When present in excess, it tends to clog fuel line filters, pump screens, aircraft engine fuel systems, carburetor jets, and cause manifold deposit and sticky intake valves.

B.14 Filtration time. The filtration time test determines the filterability of aviation turbine fuels. It is designed to identify those fuels which can cause rapid differential pressure build up in filtration equipment.

B.15 Flash point. The flash point of a product is an indication of its fire hazard during handling and storage. The flash point is primarily applicable to lower temperature boiling range products such as diesel fuel, JP-5, kerosene and solvents. It is also used to determine whether a product is contaminated. As an example, very small quantities of gasoline will lower the flash point of diesel fuel considerably below the minimum safe operating level. On new lubricating oils, the flash point is used primarily for the purpose of identification and classification, and must be above the operating temperature of the equipment.

B.16 Foam stability. This paragraph addresses Government-owned lubricating oil. All lubricating oils will foam to some extent when agitated. The foam that is formed in additive oils is often very stable and instead of breaking quickly tends to build in the oil system with subsequent oil loss through the breather outlets and other openings in the engine crankcase. Consequently, additive type motor oils are frequently treated with antifoam agents to eliminate potential foaming difficulties. The foam test requires agitating the oil sufficiently so a large quantity of foam is formed, then noting the time required for this foam to collapse. Some lubricants containing antifoam additive may fail initial foam tests. If they meet the foam requirements after agitation as described in Option A of ASTM D892, Foaming Characteristics of Lubricating Oils, they are satisfactory for use.

B.17 Fuel system icing inhibitor. This is a quantitative test to determine the concentration of diethylene glycol monomethyl ether in aviation turbine fuel. The FSII additive prevents ice formation in aircraft fuel systems. ASTM D5006 (using the B2 AIA Kit) is the preferred method.

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B. 18 API Gravity or density. Density, relative density, specific gravity are a factors that governs the quality and pricing of crude petroleum. Accuracy of these tests, whichever is applicable for petroleum and its products is necessary for the conversion of measured volumes to volumes or masses, or both, at the standard reference temperatures during transfer. The storage, handling and combustion of automotive, aviation and marine fuels are affected by density, which makes it a significant quality indicator. The API gravity of a petroleum oil is based on an arbitrary hydrometer scale which is to a specific formula:

Degrees API at 60°F = (141.5 / (Relative Density 60/60 ^{o} F)) - 131.5
(Source: API MPMS Chapter 1, Vocabulary, API Gravity)

B.18.1 Relative Density. The relative density of a petroleum oil or a mixture of petroleum products with other substances is the ratio of the weight of a given volume of the material at a temperature of 60 °F to the weight of an equal volume of distilled water at the same temperature. If the relative density is determined at a temperature other than 60 °F, the result is corrected to that temperature by the use of the appropriate correction tables. The higher the relative density, the lower the API gravity. The API scale is now used almost exclusively by the petroleum industry to designate the gravities of petroleum liquids. Correct gravity is important in the gauging of the liquid content of storage tanks, tankers and barges. A change of gravity may indicate a change of composition caused by mixing of grades of product.

B.19 Knock value. The knock value is normally expressed as an octane number for automotive gasoline and as octane or performance number for aviation gasoline. These values are determined by actually comparing the knocking tendency of a fuel to laboratory standard test fuels of known knock value in a standard test engine. The significance of knock value is to indicate whether the fuel will tend to burn uniformly and evenly in a cylinder without pre-ignition or detonation. Fuels of inadequate knock value will reduce power output in all types of engines and, if used for more than brief periods, can cause overheating of the engine unit, burned pistons and cylinders, lubrication failure, and even piston and cylinder melting.

B.19.1 Octane number-motor method. Octane number of automotive gasoline is determined by a method of test that is indicative of fuel antiknock performance in engines operating at high engine speeds and wide open throttle.

B.19.2 Octane number-research method. Octane number of automotive gasoline is determined by a method of test that is indicative of fuel antiknock performance in engines operating at relatively low engine speeds, low engine temperatures and wide open throttle.

B.19.3 Antiknock index ((R+M)/2). The antiknock index is the average of the motor and research octane numbers. This value indicates the knocking tendency of the fuel under average driving conditions.

B.19.4 Octane/performance number-aviation method. Antiknock rating is determined by a method of test that indicates the knock characteristics at lean fuel-to-air ratio in engines operating under lean or cruise conditions.

B.19.5 Octane/performance number-supercharge method. Antiknock ratings are determined by a method of test that indicates the knock characteristics under supercharge rich mixture condition, corresponding to the mixture ratio used in an aircraft engine under takeoff and climbing conditions. The antiknock characteristics of a fuel above 100 octane are expressed in terms of a tetraethyl lead or performance number.

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B.20 Lubricity. In lubricants it is proportional to film strength. In fuels it refers to a value that is measured either by the scuffing load wear test, the high frequency reciprocating rig test, or the BOCLE test. The tests were developed to determine the ability of the fuel to properly lubricate fuel-wetted components/surfaces.

B.21 Potential gum or oxidation stability. Stability of a fuel is its ability to retain its original properties, except for evaporation losses, after prolonged storage. When added to fuel chemical inhibitors tend to retard gum formation, but they will not reduce gum that has already been formed. The stability value is determined by a test that indicates the presence of gum materials and the relative tendency of gasoline and aviation turbine fuel to form gums after a specified period of accelerated aging. In addition, the formation of gum may reduce the knock values of gasoline.

B.21.1 Oxidation stability. For automotive gasolines, the oxidation stability may be expressed as the induction period (sometimes called the breakdown time), which is measured as the time in minutes elapsed during the accelerated test until the fuel absorbs oxygen rapidly.

B.21.2 Accelerated gum. For aviation gasoline and aviation turbine fuels the oxidation stability may be expressed as the potential or accelerated gum. It is the gum plus lead deposits (from leaded fuels) measured at the end of a specified accelerated aging (oxidation) period.

B.22 Sulfur. Grade 1K kerosene, intended for use in non-flue connected burner appliances and in wicked illuminating lamps, must not contain appreciable levels of sulfur in order to prevent the formulation of sulfur compounds in combustion gases. The presence of sulfur compounds may present a health and toxicological hazard.

B.23 Thermal oxidation stability for turbine fuels. The thermal oxidation stability for turbine fuels (ASTM D3241) measures the high temperature stability of gas turbine fuels, which subjects the test fuel to conditions that can be related to those occurring in gas turbine engine systems. Test results are indicative of fuel performance during gas turbine operations and can be used to assess the level of deposits that form when liquid contacts a heated surface that is at a specified temperature.

B.24 Vapor pressure. The vapor pressure of a fuel is determined by the RVP test and indicates the tendency of the fuel to vaporize. Vapor Pressure increases with temperature for any given gasoline. Gasoline must have a certain vapor pressure to ensure adequate starting and accelerating qualities.

B.24.1 Vapor lock. Too high a vapor pressure for the particular operating condition may cause what is commonly known as vapor lock, which prevents the fuel from reaching the engine.

B.24.2 Vaporization. The tendency of gasoline to vaporize in an automobile fuel system is indicated by the vapor-to-liquid ratio of that gasoline at conditions approximating those in critical parts of the fuel system. This test is currently used at procurement levels in conjunction with Vapor Pressure test to determine vaporizing properties of automobile gasoline.

B.25 Viscosity. Viscosity is the measure of a liquid's resistance to flow. The significance of viscosity depends on the intended use of the product. From the point of view of application and performance, proper viscosity is highly important since specified minimum and maximum rates of flow are required for all fuels and lubricating oils. In fuel, viscosity determination serves

as an index of how it will flow to the burners, the extent to which it will be atomized and the temperature at which the fuel must be maintained in order for heavy residual fuel to be properly atomized.

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B.26 Water and sediment.

B.26.1 Aviation fuels. Significance of contamination of aviation fuels with water and sediment is covered in Section 5.9.

B.26.2 Automotive fuels. Significance of contamination of automotive fuels with water and sediment is covered in Section 5.10.

B.26.3 Diesel and burner fuels. Diesel fuels must be clean and should not contain more than a trace of foreign substances, otherwise fuel pump and injector difficulties may occur. Excessive sediment and rust will plug the burner tip and the fuel will not atomize properly. Water can cause rough operation and may corrode the fuel handling system, causing the formation of rust in the system and can also create significant microbiological deterioration problems. The type of equipment and type of burner fuels will determine the amount of sediment that is permissible in the fuel.

B.26.4 Lubricating oils. Care should be exercised to avoid contaminating lubricating oils with water, as it will hasten the decomposition of many oils, wash out additives, emulsify, and lead to engine malfunctioning. In used lubricating oils, water sediment may indicate poor maintenance or malfunctioning of screens, or its formation may have been caused by condensation of combustion products.

B.27 Water reaction. A measure of the presence of water-miscible compounds in aviation gasoline and turbine fuels (See Test Method 1070 in this Standard). An interfacial emulsion may indicate a carryover of treating compounds or contamination with surfactants (surface active agents). A change in fuel volume indicates a contamination with alcohol or other components which absorb appreciable amounts of water. An interface emulsion may also indicate contamination with microbiological growth. Not performed on JP-5.

B.28 Water separation index modified (WSIM). The WSIM (also referred to as microseparometer or MSEP method) test measures the water separation characteristics of fuels. The test reflects the ease with which a fuel releasing dispersed or emulsified water surfactants has an adverse effect on the WSIM rating. Fuels having low WSIM rating will poison filter-separators and prevent them from functioning properly.

B.29 Water tolerance. The ability of fuel and alcohol blends to resist separation into two phases when a known quantity of water is added.

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RECEIPT AND QUALITY SURVEILLANCE OF COAL

C.1 SCOPE

C.1.1 Scope. This appendix provides general instruction and procedures to be used by the Military Services and the Defense Logistics Agency in receipt and quality surveillance of coal.

C.2 APPLICABLE DOCUMENTS

C.2.1 General. The documents listed in this section are specified in C.3, C.4, and C.5 of this appendix.

C.2.2 Non-Government publications. The following documents form a part of this appendix to the extent specified herein. Unless otherwise specified, the issues of this appendix are those cited in the solicitation or contract.

ASTM INTERNATIONAL

Annual Book of ASTM Standards, Section 5, Petroleum Products, Lubricants, and Fossil Fuels, Volume 05.05, Gaseous Fuels, Coal and Coke

ASTM D2234	Standard Practice for Collection of a Gross Sample of Coal
ASTM D4749	Standard Test Method for Performing the Sieve Analysis of Coal and Designating Coal Size (DoD adopted)

(Copies of these documents are available online at http://www.astm.org or from ASTM International, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959)

C.3 DEFINITIONS

C.3.1 Definitions. The definitions in Section 3 of this Standard apply to this appendix.

C.4 GENERAL INFORMATION

C.4.1 Coal Rank. A classification designation that indicates the degree of coalification or metamorphism, that is expressed in successive stages according to percentages of fixed carbon, moisture, and ash. The degree of coalification is classified into four general categories, or "ranks"; lignite, sub bituminous, bituminous, and anthracite.

C.4.1.1. Lignite. Also referred to as brown coal, is the lowest rank of coal. Lignite has the lowest carbon content, 25 – 35 percent and a heating value less than 8,300 BTUs per pound. Typically, lignite has high moisture, greater than 30 percent, and volatile content of ~27 percent.

C.4.1.2 Sub bituminous. A coal whose properties range from those of lignite to those of bituminous coal. Typically, sub bituminous coal has a carbon content of 35 – 45 percent, and a heating value of 8,300 – 11,500 BTUs per pound. Sub bituminous coal has an inherent moisture content of 20 – 30 percent, and a volatile content of 35 – 47 percent. Sub bituminous coal generally has a much lower sulfur content than other types, making it an attractive, cleaner-burning fuel.

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C.4.1.3 Bituminous. A dense, firm black coal, representing about fifty (50) percent of the steam-electric power generation in the United States. It is also used as a raw material in the steel and coke industries. Bituminous coal has a carbon content of 45 – 85 percent, and a heating value of 10,500 – 15,500 BTUs per pound. Bituminous coal has a moisture content of 7 – 20 percent, and a volatile content of 14 – 36 percent. The only drawback to bituminous coal-fired power plants is the sulfur content. The sulfur content ranges from 0.5 – 3.0 mass percent (5,000 – 30,000 ppm by mass).

C.4.1.4 Anthracite. The highest rank of coal, anthracite is a hard, brittle, lustrous coal. It represents only a very small segment of the U.S. coal market. Currently, it is only found in 11 northeastern counties of Pennsylvania. Anthracite has a carbon content of 85 – 98 percent and a heating value of 13,500 – 15,000 BTUs per pound. Anthracite coal has very low moisture content, less than 7 percent and a volatile content of 5 – 15 percent.

C.4.2 Specifications. Coal specifications are based on the boiler requirements outlined by the coal-burning facility. Reduced efficiencies plus increased maintenance and handling costs are associated with the use of non-specification coal. Table C-I outlines the significant coal combustion characteristics and sensitivities for six (6) different coal combustion technologies.

TABLE C-I. Significant Coal Characteristics Combustion Performance. [1]

Properties	Single Retort	Multiple Retort	Traveling Grate	Spreader Stoker	Pulverized Firing	Cyclone
Size Consist	V	V	V	V	V	V
Moisture	M	M	I	M	V	M
Caking Index	I	I	V	M	N	N
Ash Fusibility	I	I	M	M	I	V
Grind ability	N	N	N	N	V	N
Friability	M	M	M	M	N	N
Volatile Matter	M	M	M	I	I	M
Fixed Carbon	N	N	N	N	M	N
Ash Content	I	I	I	I	M	M
Calorific Value	I	I	I	N	N	N
Ash Viscosity	M	M	M	N	I	V
Ash Composition	♦	♦	♦	♦	♦	♦
Sulfur	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦

Notes
1. Legend for Table is as follows:
V – Very important, **I** – Important, **M** – Minor importance, **N** – Little/No importance
♦ Very important for fouling refractory, but little importance to combustion,
♦♦ Important from a corrosive standpoint, but little importance to combustion

C.4.2.1 Size requirement. The size requirement (size-consist) is also part of a coal specification. Double-screened coal is coal that has been screened for both top and bottom size.

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Size is defined by the percentage of the coal sample retained on top of the largest-sized screen and the percentage passing through the smallest-sized screen. An example of double-screened coal requirement is: 5%, weight, maximum for coal greater than 1 ¼ inch, and 15%, weight, maximum for coal less than ¼ inch. Single-screened coal is only screened for bottom size. Size is defined by the percentage of sample passing through the smallest-sized screen. An example of single-screened coal requirement is: 15%, weight, maximum for coal less than ¼ inch.

C.4.2.2 Specification revision. A facility's coal specifications may require revision based on equipment changes, operational problems or Environmental Protection Agency (EPA) compliances. The revision of the coal specification will be accomplished by the submission of DD Form 416, Purchase Request for Coal, Coke or Briquettes. The request will specify the new requirement or specification and must include justification for the revision or change. Changes needed during the contract performance will require formal contract modification by the contracting officer. Contractor agreement and equitable price adjustment will be obtained by the contracting officer to establish the new coal specification requirement. Until the contract is modified, coal ordered will continue to comply with the original specification requirements.

C.4.3 Significance of Testing. Many large consumers of coal, as well as most of the large coal mining companies, have laboratories that sample and analyze coal. This work is done by the consumer to verify the quality of the coal purchased and to measure the efficiency of their coal burning equipment. The coal producer performs periodic analyses to monitor coal preparation methods and variations within a coal seam.

a. Standards used for analytical testing of coal, along with coal specifications and definitions have been subjected to continuous study and refinement for more than 60 years by the American Society for Testing and Materials (ASTM). Adhering to these procedures is critical to the veracity of the sample results.

b. Before any analysis is conducted, Care should be taken to insure that the sample represents the material being produced. A coal sample usually contains some ratio of coal particles and extraneous material such slate, pyrite, etc. The analysis is only as good as the sample it represents.

C.4.3.1 Proximate Analysis. The proximate analysis is an evaluation of four items: moisture, volatile matter, fixed carbon, and ash. The sum of the percentages of each must equal 100 percent. This analysis is roughly designed to separate the combustible matter from non-combustible matter, and is used in some instances to determine rank.

C.4.3.2 Calorific Value. The calorific value of coal, or heat content, is express in BTUs per pound. A BTU (British Thermal Unit) is the amount of heat required to raise one pound of water from 60°F to 61°F. The metric system expresses the heat content in calories. One BTU equals 252 calories. To compare the heating value of two or more coals, the calorific value must be expressed on a dry basis.

C.4.3.3 Sulfur. Is a naturally occurring element in fossil fuels that originated during the coalification process. Sulfur combined with moisture creates a highly corrosive liquid that is detrimental to all carbon steel combustion equipment components. In recent years, the Environmental Protection Agency (EPA) along with state regulatory agencies has been scrutinizing the sulfur content of coal and other fossil fuels. When fuels containing sulfur are burned, sulfur dioxide (SO_2) is formed in the combustion process and is discharge into the atmosphere along with other combustible byproducts such as hydrogen sulfide (H_2S) and nitrogen oxides (NO_x). If these

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emissions are combined with a sufficient quantity of water vapor then sulfuric acid is emitted into the atmosphere. This is commonly referred to as acid rain. For these reasons, the federal government has implemented stringent sulfur regulations in an attempt to drastically reduce the quantity of combustible byproducts emitted into the atmosphere.

C.4.3.4 Ultimate Analysis. The composition of coal is better represented by the ultimate analysis. This analysis reports the percentage of carbon, hydrogen, sulfur, oxygen, nitrogen, and ash in a coal sample. It also provides the data needed to calculate combustion factors for steam generation plants. However the data provides little assistance in predicting the burning characteristics of coal in a fuel bed.

C.4.3.5 Moisture. All coal has some form of moisture which acts as a diluents during the combustion process. As a rule, a one percent increase in moisture will reduce the calorific value by 80-120 BTUs. Moisture may be considered as surface moisture that comes from external sources such as snow, rain, and mechanical cleaning processes, or inherent moisture (not external) which is proportional to the coals' rank. The moisture reported in proximate analysis is both surface and inherent. High moisture can affect the handling characteristics of coal. Freezing temperatures cause wet coal to amass, which directly effects offloading, pulverize capacity, and flow from storage bunkers.

C.4.3.6 Ash. The chemical composition of the ash is important in determining the fouling characteristics in a boiler. The quantity of ash generated will help determine the cost and type of ash handling equipment that is required for a given steam generation plant. There are four (4) fundamental measurements of coal ash with respect to clinkering tendency and slagging. They are the softening or fusion temperature of the ash, ash chemical composition, and the total percent ash in the coal.

a. Initial Deformation Temperature (IDT) - the temperature at which the first rounding of the apex of the ash cone occurs.

b. As Softening Temperature (AST) – the temperature at which the cone has fused down to a spherical lump in which the height is equal to the width at the base.

c. Hemispherical Temperature (HT) – the temperature at which the cone has fused down to a hemispherical lump at which point the height is one half the width at the base.

d. Fluid Temperature (FT) – the temperature at which the fused mass has is almost flat with a maximum height of 1/16 in.

C.4.3.7 Volatile Matter. Volatile matter in coal is given off as volatile gases, such as hydrogen, carbon monoxide, methane, and sulfur dioxides. Volatile matter reflects the coals' ability to ignite and burn. Coal having a low volatile content will be more difficult to ignite and burn than coal having a high volatile content. Volatile content is a very important chemical characteristic during suspension burning.

C.4.3.8 Free Swelling Index (FSI). Among the numerous test methods used to determine the expansion and swelling, or caking characteristics of coal, the free swelling index (FSI) is the most widely accepted. All bituminous coals coke in the sense that when the volatile matter is driven off by heat in the absence of air, the fixed carbon and ash remaining is coke. The caking

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characteristic of coal, however, is the tendency of coal to melt together into a solid mass. Caking characteristics have little or no effect on the performance of spreader stokers or pulverized coal fired boilers.

C4.3.9 Petrographic Analysis. This type of analysis is typically conducted during a mine evaluation or pre-award survey. The Petrographic analysis of coal was originally used to study the lithography of coal as a sedimentary rock and to identify the various coal laminae. Two methods were used: the thin section method and the polished surface method. By studying the various lithotypes and microlithotypes present, a determination could be made with regards to the quantity of homogeneous constituents. These constituents are called macerals. Macerals can be distinguished into the following types: Macerals whose origin is definitely due to woody and cortical tissues are vitrinite, fusinite, and semi-fusinite. Macerals whose origin is definitely due to plant material other than woody tissues are resinite, sporinite, alginate, cutinite, and sclerotinite. Macerals whose origin has not yet been traced to a specific vegetable tissue is called micrinite. Micrinite is completely structureless and was probably derived from humic mud and therefore from strongly decaying plant material. Since each of the various macerals has definite characteristics, a petrographer can determine the characteristics of a particular coal. By knowing the amount of the various macerals present, a petrographer can also predict a coals' behavior under certain conditions.

C.4.4 DLA-Energy contracts. Under DLA-Energy contracts coal is usually inspected at source, with acceptance at destination. The contractor samples and tests coal prior to delivery. Commercial analytical test reports are prepared and accompany the DD Form 250 before or along with the shipment. If the accompanying documentation, visual examination of the coal being delivered, or the sampling/testing of the coal being delivered shows failure to meet the contractual requirements, then it should be rejected as non-conforming (see C.5.10). The activity shall immediately provide notification to DLA-Energy with all pertinent information regarding off-specification coal. The contractor may request a waiver through the contracting officer for Government acceptance of the nonconforming coal.

C.4.5 Quality control plan/procedures. The facility should establish a written quality control plan for each coal-burning facility (see C.5.1).

C.4.6 Government Representative. In the event work is contracted out a Government Representative should be assigned to the contract. The representative will serve as point of contact when coal is received, sampled, tested, or when problems arise.

C.4.7 Personnel training. The receiving facility is responsible for acceptance and receipt sampling. Only personnel who have been trained and are experienced to receive, sample, and test coal should be assigned these functions. Guidelines or policy should require individual training programs and should document completed training. DLA-Energy teaches the "Coal Sampler's Certification Course" to installation personnel on a cost-reimbursable basis. Contact DLA-Energy-QA (email QA@dla.mil, phone 703-767-8736, or facsimile DSN 312-427-8747) to request the DLA-Energy "Coal Sampler's Certification Course" training. Installations may provide this training through alternate means provided the same level of instruction is provided. Personnel assigned the responsibility of coal receipt should also be familiar with applicable coal contact requirements. Personnel not experienced in performing visual examination should receive on the job training from experienced personnel.

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C.4.8 Acceptance. When all contract requirements are satisfied, acceptance is accomplished by designated facility personnel on behalf of the Government. The DD Form 250 is completed by the responsible official by signing in block 21b, Acceptance. Block 22 is signed to acknowledge receipt quantity and may be signed by a Government or Government contract employee. The DD Form 250 is then forwarded to the proper office within 24 hours of acceptance to exact payment.

C.5 DETAILED GUIDANCE

C.5.1 Quality control plan.

C.5.1.1 Organization. The quality control plan should contain the name of a person responsible for coordination on changes and updates to the quality control plan. The quality control plan should also contain the name of personnel who are points of contact in receiving, storing, issuing and consumption.

C.5.1.2 Schematic diagram. The quality control plan should contain a detailed schematic of the facility identifying the coal offloading locations, conveyor systems, sampling points, testing locations and storage locations. Information on the type of storage, handling equipment, additive treatment for dust reduction or freeze prevention, and movements of coal within the facility should be included.

C.5.1.3 Government Representative. The quality control plan should include name of the Government Representative (see C.4.4), their telephone, cell phone, pager, and facsimile numbers. The quality control plan should include a sufficient notification time that allows the Government Representative to be present when coal is received, sampled or tested.

C.5.1.4 Documentation. Identify in the quality control plan who will assure receipt of copies of solicitations, contract awards and modifications. Identify how product receipt documents such as DD Form 250s, test reports and weigh bills will be received and distributed. Identify who will prepare or receive supplemental documentation such as: blending records (if performed), corrective action requests, quality/quantity investigations, certificates of calibration (e.g. scales for determination of weight and any other testing equipment), and manufacturers' certificates of conformance (additives for dust control, freeze proofing, etc.). State where (the office) and how long this documentation will be kept. Note: Contract specified sampling and testing methods can be found in the Annual Book of ASTM Standards, Section 5, Petroleum Products, Lubricants and Fossil Fuels, Volume 05.05, Gaseous Fuels, Coal and Coke.

C.5.1.5 Blending. If performed, the quality control plan should include detail procedures on how coal blending is accomplished.

C.5.1.6 Sampling. The quality control plan should define and include minimum procedures for the following in the sampling plan: coal sampling for chemical analysis, size-consist, and additives (receipt and storage sampling). Include requirements for labeling and retaining samples (specify retention time for each sample). A size consist sample must be retained for a full seven days.

C.5.1.7 Testing. The quality control plan shall identify or contain the test procedures to be used for conducting each test. Table C-II outlines by coal rank, the tests typically performed. If testing is contracted to a commercial laboratory, the testing requirements and methods shall be outlined in the QCP.

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TABLE C-II. Coal Analysis

Analyses.	Properties.	Sub-bituminous.	Bituminous.	Anthracite.
Proximate Analysis (H20, VM, FC, ash)	Chemical	●	●	●
Ultimate Analysis (C, H, O, N, S, ash)	Chemical	●	●	●
Calorific Value (Btus)	Chemical	●	●	●
Fixed Carbon	Chemical	●	●	●
Ash Content	Chemical	●	●	●
Moisture Content	Chemical	●	●	●
Volatile Matter	Chemical	●	●	●
Sulfur Content	Chemical	●	●	●
Grindability (Hardgrove Index)	Physical		●	●
Ash Fusibility	Physical	●	●	
Caking Index	Physical		●	
Friability	Physical		●	
Free-swelling Index	Physical		●	
Size Consist	Physical	●	●	●

C.5.1.8 Calibration of testing and measuring equipment. Include procedures in the quality control plan for the calibration of testing and measuring equipment, if used at the facility.

C.5.1.9 Credits and debits. The quality control plan should identify who will monitor the credits and debits for coal contracts.

C.5.1.10 Off-specification product/operational problems. The quality control plan should outline procedures for notification of nonconforming coal or operational problems related to using nonconforming coal. Include notification of DLA-Energy and SCPs when any problem arises, both remedial and preventative type of corrective action. Examples of areas to be included are: off-specification product during and after receipt and loss/gain investigations.

C.5.1.11 Product rejection. Include in the QCP procedures on identifying conditions for rejection and notification of DLA-Energy. DLA-Energy Contracting Officer shall be notified of off-specification coal and approve the rejection before it is returned to the contractor.

C.5.2 Ordering and receiving procedures. All coal orders are issued and funded by the installation. All coal shipments should be inspected when received, before final acceptance. Clear and proper inspection procedures are essential, as they show compliance to contract requirements and are the basis for accurate analytical results. Proper inspection, sampling and testing procedures support coal being rejected and provide supporting evidence for a price adjustment claim. These procedures should also be timely because prolonged or delayed inspection could cause demurrage costs to accrue against railcars or contractor's trucks.

C.5.2.1 Documentation. Examine all documentation before offloading (e.g.; weigh bills, DD Form 250s, analytical test reports).

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a. Rail shipment identification. Documentation for rail shipments shall be faxed by the contractor directly to the receiving facility, SCP and DLA-Energy Offices specified in the contract prior to shipment arrival. Rail cars may be separated in transit by the rail company in the course of normal business practices; therefore, it is necessary to check each car number against the DD 250 for each shipment. Contractor documentation provided to destination should include sufficient information to identify the loaded cars by railcar number, quantity loaded, loading source, and consignee on the DD Form 250.

b. Truck shipment identification. Commercial analytical test results for new stockpiles shall be faxed to the receiving facility before or concurrent with the first truck delivery from that stockpile. Material Inspection and Receiving Reports, DD 250s, identifying truck tickets and weights for each day's delivery are to be provided to the receiving activity within 48 hours after delivery.

c. Source of coal. Receipt documents should identify the required source listed in the contract. Coal from another mine may not be substituted except as authorized by contract modification. Before an alternate mine is added to the contract, a mine analysis sample should be performed to determine the mine's capability to deliver spec coal. Report the use of unauthorized mines to the contracting officer immediately.

C.5.2.2 Quantity determination. When quantity is determined by a facility's weigh scale, and not by railroad weigh bill or truck scale weight, then the scales used shall be calibrated as required by state or local requirements, whichever is more stringent.

C.5.2.3 Credits and debits. Credit and debits are determined based on the analytical test report data issued by the Army Petroleum lab. Coal may be regularly and continuously sampled by the using facility in accordance with ASTM D2234. The Army Petroleum lab shall analyze each sample with respect to the actual tonnage sampled. If the Army analysis report determines that any coal delivered does not meet the contractor's guaranteed specification, the installation may apply its rights for credits and debits under contract clauses to include "Sampling and Evaluation" and "Consideration for Excess Sulfur and Ash". If the final determination is a debit, then the contractor shall be debited before the closing of the contract. Credits shall not be issued. This data should be reported to the contracting officer prior to end of the contract (penalties for low ash or high sulfur shall be taken by the contracting officer directly for each delivery affected).

C.5.2.4 Shipments after end of contract. The installation shall not order any coal after the contract expiration date. Deliveries of properly placed orders may be accepted up to the last day of the month following contract expiration. Note: The Contracting Officer may authorize a contractor's request for acceptance of end-of-contract shipments, provided the installation is in agreement.

C.5.2.5 Acceptance/rejection log. An acceptance/rejection log is recommended, recording all coal shipments accepted or rejected. This will prevent the offloading of over shipments after contract completion. The following should be considered when developing a tracking system:

a. A method to assure that shipments and shipping notices are being made according to the delivery schedule.

b. A schedule that indicates the type of coal and number of rail cars or trucks that are in transit.

c. A record of delays in delivery and demurrage charges. Delays in offloading should be documented in detail to support payment of demurrage. Identify actions being taken (e.g. receipt sampling, testing), or other actions involved in the demurrage charges.

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C.5.3 Inspection procedures. All coal received is to be inspected and sampled for chemical analysis. Sampling techniques should comply with the standards cited in the contract for coal sampling methods.

C.5.3.1 Visual examination. Visual inspections should be simple and thorough. They are mostly subjective, for example, examining coal by comparing to previous shipments. Each coal shipment should be visually inspected before unloading to assure that:

a. The shipment is free from slate, bone, rocks, sulfur balls, dirt and other foreign material.

b. The coal is properly prepared, is reasonably free from fines (coal smaller than the bottom screen size), oversize coal (coal larger than the top screen size), and is not weathered. If the coal does not appear to meet the minimum size requirements, as determined by visual examination and the facility wishes to reject the coal, a size-consist sample should be collected. The facility may elect to sample for size-consist on a regular or periodic basis for verification purposes. The size-consist analysis should be performed in accordance with C.5.8 below.

c. There is no evidence of loss or theft in transit. During the visual examination assure railroad cars were loaded to full capacity. Loss in transit can occur when hopper doors are not completely closed during loading, doors are forced ajar during transit, a hole in a car is not patched properly, or a hole patch worked loose. Ordinarily loss in transit can be determined by a depression in the contour of the coal above or near the holes or openings in the car. Theft usually occurs when cars stand for extended periods of time and can be detected by irregular appearances in the coal on the top of the car. A record should be kept with all information on discrepant shipments received, including car numbers and discrepancy observed. If losses appear to be something other than random theft, e.g.: losses occur regularly or from consistent locations, then fraud should be considered and reported to the proper authorities for investigation.

C.5.4 Sampling general.

C.5.4.1 Personnel. Only personnel who are qualified by obtaining certification in accordance with the requirements of section C.4.7 shall collect and prepare the coal samples for official analysis.

C.5.4.2 Sample preparation. Prepare samples in accordance with ASTM test methods.

C.5.4.3 Sample containers.[10] Sample containers should be thoroughly clean, dry and inspected for foreign matter. Care should be taken to protect the gross sample when storing.

C.5.4.4 Sample tags. Make complete and correct entries on samples tags regarding each sample to assure proper analysis and reporting of the sample submitted. The information listed in C.5.4.6 should appear on the sample identification tag.

C.5.4.5 Sample retention time. When size consist is in dispute, the screened sample should be retained in a protected area for one week from the date the sample test was completed, or for a longer time, as determined by the QAR (the sample shall be available to the Contractor and the QAR for inspection).

C.5.4.6 Sample identification for testing. Proper identification of coal shipments and timely submission of coal samples is essential. Inaccurate entries may result in preventing the receiving

[10] Note: The use of glass containers for mailing is not permitted.

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facility from recovering liquidated damages in claim actions for product substitution. The following information should be provided:

a. Name and complete mailing address of the facility submitting the sample.

b. Name of the contractor supplying the coal.

c. Contract number.

d. Contract line item number.

e. Size and kind of coal.

f. Tons represented by the sample.

g. Railroad car, truck, or barge number/s.

h. Name of mine and state where the mine is located.

i. Sample number.

j. Sample can number.

k. Sampling point and ASTM condition used in obtaining sample.

l. Date the coal was delivered.

m. Provide mailing addresses of those who shall receive a copy of the analysis.

n. Special test requested, i.e. Hardgrove Grindability Index.

o. Identification of coal sampler.

p. Signature and date signed.

C.5.4.7 Mailing coal samples for chemical analysis. Package the sample in accordance with ASTM test methods. Send samples to the following Army testing facility or designated commercial laboratory for analysis:

US ARMY PETROLEUM CENTER (USAPC)
PETROLEUM TESTING FACILITY
ATTN: AMSTA-LCEJPT, BLDG 85-3
U AVENUE
NEW CUMBERLAND PA 17070-5005

C.5.4.7.1 Special Sample. When packaging and mailing "special" coal samples to be tested for dry ash or free swelling index include the following:

a. Mark "Special Sample" for dry ash or free swelling index analysis.

b. Include in Remarks: "Coal represented by this sample is subject to rejection".

c. Mark the mailing wrapper, "Special Sample".

d. Forward by air mail.

e. Inform the DLA-Energy contracting officer, coordinating with the service control point, by telephone or facsimile that the sample was mailed, and provide the sample container number. This shall enable the Contracting Officer to expedite the testing of the coal sample.

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C.5.5 Sampling for chemical analysis. The collection of the gross sample for chemical analysis is the single most important function in the process of testing for coal quality and payment. Sampling for chemical analysis should occur at time of receipt. Automatic samplers in accordance with ASTM D4702 are best for obtaining coal samples due to consistency of timing and type of cuts. Coal may also be sampled manually in accordance with ASTM D2234 with the preferred sampling conditions being either condition A (Stopped-Belt Cut) or condition B (Full-Stream Cut). Condition C (Part-Stream Cut) and condition D (Stationary Coal Sampling) of ASTM D2234 are considered to be the least reliable methods of sampling coal. If condition C or D are called for in the contract, extreme care is needed to assure proper sampling. Table 2 of ASTM D2234 should be used when determining increment weight. It is recognized that in some cases it is not feasible to use either ASTM D4702 or ASTM D2234 conditions A, B, or C. Therefore, the following is provided as a guide in obtaining the samples for chemical analysis.

C.5.5.1 Sampling equipment. All sampling devices should have an opening of at least two and one half times larger than the top size of the coal being sampled. The device should be capable of retaining the required increment weight and not spill material when the increment is withdrawn. Equipment such as a square shovel with built-up metal plates 4 inches (10 mm) high, a hand-operated auger, or a powered auger may be used in obtaining coal samples from stationary conveyances. The sample device should be capable of collecting the entire increment. Post-hole diggers may not provide a representative sample because small particles may escape.

C.5.5.2 Procedures. For obtaining stationary samples, use diagrams and tables in ASTM D4915, for rail or trucks shipments (9-Point, Car top Sampling). The sampling guide in ASTM D4915 is to be used only when the preferred methods in ASTM D2234, condition “A” condition “B” or condition “C” are not feasible. Condition “D” is the least desirable method for the collection of a gross sample. The use of this method should only be used when it is required by the contract or when sampling conditions A, B, or C is not feasible.

C.5.6 Sampling for dry ash and free swelling index. The gross sample for determination of ash and FSI should be obtained by using the methods outlined in ASTM D2234, Condition “D”, and ASTM D4915. Samples should be prepared in accordance with ASTM test methods.

C.5.7 Sampling for size consist. The facility is responsible for performing the sizes consist sampling and testing when required at destination for railcars and trucks. Stationary sampling of trucks may be performed by activity personnel, provided training and safety requirements are met. Sampling for size consist is performed when a visual inspection indicates coal exceeds the size requirement in the specification. If the facility does not have properly trained personnel or necessary equipment to perform the sampling or testing, the facility may contract for this function to an approved coal inspection company. When determining the size consists on coal received, use the contract specification requirement.

C.5.7.1 Collection of the size consist sample (9-Point, car-top sampling method). Sample should be taken in accordance with figure C-1 below and ASTM D4915. A size consist sample should be no less than 453.59 kg (1000 pounds) taken in equal increments, from the nine points of each conveyance, representing one shipment of no more than five (5) conveyances, received in one day. The sample should be collected, weighed, and then screened without mixing or other preparation. The following minimum weights and increments are required for the number of cars and/or trucks to be represented by the sample.

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Numbers of Conveyances	Minimum Weight from Each Point/Conveyance	Total Increment Weight from Each Car
1	50.80 kg (112 lbs)	453.59 kg (1000 lbs)
2	25.40 kg (56 lbs)	226.80 kg (500 lbs)
3	17.24 kg (38 lbs)	151.50 kg (334 lbs)
4	12.70 kg (28 lbs)	113.40 kg (250 lbs)
5	10.42 kg (22 lbs)	90.72 kg (200 lbs)

FIGURE C-1. Weights and Increments

a. Lay out three diagonals across the top of each conveyance to be sampled (see figure C-2). Remove the top 450 mm (18 inches) of the coal from each of the diagonals to form trenches the width of the coal sampling device. Begin at the front corner of the conveyance extending diagonally across. Begin the second trench near the center and the third at the rear corner. Distribute the spoil over the top of the undisturbed coal where it shall not intrude into the sample.

b. Collect equal increments from each of the nine sampling points. As can be seen from figure C.2., the sampling points 1, 3, 4, 6, 7, and 9 are located near the edge of the conveyance.

c. The required minimum weight of each increment is found in the chart above.

d. A shovel meeting ASTM D4915 requirements shall be used. Build up standard flat square shovel with two sides and back plates. Build up should be at least 4 inches (100 mm), constructed from metal. Exercise care in taking each increment to keep to a minimum the quantity of coal falling from the sides into the bottom of the trench. Each shovel full taken without loss of coal is considered an increment.

e. At each point (figure C.2.) proceed as follows:

(1) Trench 1, first sampling point. Retain the first increment for the sample and spoil the second. Then alternately retain one increment and spoil one until the predetermined weight of coal is collected at point number 1.

(2) Trench 1, second sampling point. Spoil the first increment then retain the second and third increment. Then alternately spoil two increments and retain one increment, until the predetermined weight is obtained.

(3) Trench 1, third sampling point. Spoil the first two increments, retain the third and spoil the next three. Then alternately retain one and spoil three until the predetermined weight is collected.

(4) Trench 2, fourth sampling point. Collect as trench 1, third sampling point (see above).

(5) Trench 2, fifth sampling point. Collect as trench 1, first sampling point (see above).

(6) Trench 2, sixth sampling point. Collect as trench 1, second sampling point (see above).

(7) Trench 3, sampling points 7, 8, and 9. These sample points shall be handled the same as trench number 1, sampling points 1, 2, and 3, respectively.

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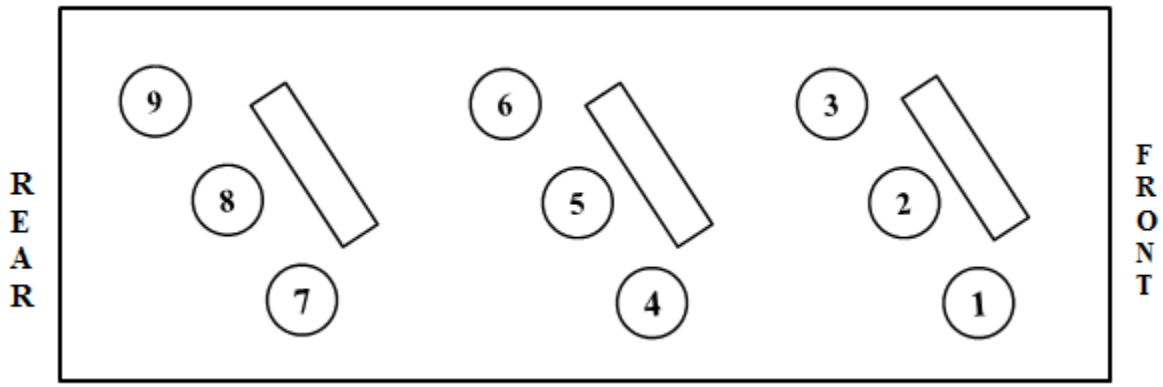

FIGURE C-2. Car Top Sampling

C.5.8 Size-consist test procedures. The sieve analysis should be performed in accordance with ASTM D4749.

C.5.8.1 Record of analysis. For each sieve analysis performed the following information should be recorded:

a. Contractor providing the coal.

b. Contract number and contract line item number.

c. Conveyance identification and number/s.

d. Mine name and seam the coal originated from.

e. Method used in obtaining the sample (ASTM D2234).

f. Date the sample was obtained.

g. Date the sieve analysis was performed.

h. Type, kind (round hole or square) and size of screen(s) used, and whether automatic or manual method was used.

i. Percent of coal remaining on the screen (single-screen coal).

j. Percent of coal remaining on the top screen, percentage of coal passing through the bottom screen and the total percent between the screens (double-screened coal).

k. Percentage gained or lost.

l. Name of the person performing the sieve analysis.

C.5.8.2 Example of calculation. A sample of one thousand pounds was used to perform the sieve analysis. A double-screen analysis was required with a top size of 2″ and a bottom size of ¾″. One hundred pounds of coal remained on the top screen, and fifty pounds passed through the bottom screen after completion of the test. Eight hundred and fifty pounds remained between the two screens.

a. Top size percent (weight of coal remaining on top screen) (100 lbs, top screen/1000 lbs, total sample) x 100 = 10%.

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b. Bottom size percent (Weight of Coal Passing through the Bottom Screen) (50 lbs pass thru, bottom screen / 1000 lbs, total sample) x 100 = 5%.

C.5.8.3 Testing accuracy. To ensure the accuracy of the size testing, a gain or loss percentage should also be calculated. A gain or loss percentage is the total weight remaining on the top screen, plus the total weight remaining on the bottom screen, plus the total weight passing through the bottom screen, and divided by the total weight of the sample used to perform the test times 100.

a. Gain (Loss) = (total weight of sample (1000 lbs)) minus (100 lbs top + 50 lbs pass bottom + 840 lbs remaining on bottom screen) / (total weight of sample (1000 lbs)) x 100 = 1%.

b. If the gain or loss is greater than two percent (2%), the testing tolerance has been exceeded and the results are invalid. The test should be repeated after validation of proper testing technique.

C.5.9 Rejection of unidentified or non-conforming shipments. Shipments should be rejected for any of the following:

a. A discrepancy exists in or between the shipping notices, weigh bills, and contract requirements or the DD Form 250 is not received. For example: coal is sent to wrong facility; coal is received from the wrong mine or contractor; receipt of an unauthorized over shipment; or coal test reports showing non-conforming coal.

b. When visual examination shows non-conforming coal (inherent or foreign matter).

(1) When rejection of coal is based on excessive inherent material (e.g.; slate, bone, dirt, rock or other contaminating material that through experience would fail the ash requirement), the Contractor may request the facility to obtain a sample and have the sample analyzed for ash content. The Contractor should make the request through the Contracting Officer within 48 hours after the notice of rejection.

(2) When a shipment is rejected based on excessive foreign matter (e.g.; magnetite, wood, large sulfur balls, lumps of rock, slate), the facility should immediately advise the contracting officer through channels of the rejection. The contracting officer notifies the contractor of the rejection. No sample for ash analysis is required for rejections based on foreign matter.

(3) When the basis for rejection is excessive oxidized or weathered coal, the Contractor may request a sample be obtained and analyzed for FSI, if FSI is required or guaranteed by the contract (use the sampling procedures in C.5.6).

(4) When visual examination indicates that a shipment will be rejected for size consist, a sample should be obtained and a sieve analysis performed. Guidance for obtaining a sample for sieve analysis is found in C.5.7.1 (nine-point method). The nine-point method outlined, along with ASTM D4749 should be used as a standard for obtaining the 1,000 pound sample for testing for size consist.

c. Coal shipment should be rejected when visual examination shows there is evidence of loss or theft in transit that exceeds the tolerances established by the railroad tariff. The facility should take action to have the shipment weighed as near to the point of acceptance as possible. If railroad scales are not available and the shipment cannot be weighed without delay, any excessive back haul or additional freight adjustments should be established by the railroad claim agent or other designated individual. All parties involved in the dispute may, by visual examination, determine an agreed revised estimated weight to be accepted. As stated earlier, if losses appear to be something other

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than random theft, e.g., losses occur regularly or from consistent locations, then fraud should be considered and reported to the proper authorities for investigation.

C.5.10 Product rejection procedures. When chemical samples taken during offloading are tested and reported as nonconforming, the Contracting Officer shall be notified, identifying the failing characteristic, quantity of coal, and location.

C.5.10.1 Notification to Contracting Officer. The facility shall notify the Contracting Officer, DLA-Energy-APC (Phone: 703-767-8527; FAX: 703-767-8757), DLA-Energy-BPE (Phone: 703-767-8362; FAX: 703-767-8366), and DLA-Energy-QA (email QA@dla.mil, phone 703-767-8736, or facsimile DSN 312-427-8747). DLA-Energy-BPE monitors coal Product Quality Deficiency Reports (PQDRs). Include the following information:

a. Name of the Contractor

b. Contract number

c. Quantity of coal in tons awaiting disposition

d. Date of shipment

e. Status of the shipment

f. Nature of the discrepancy or problem

g. Point of origin

h. Railroad car or truck numbers

i. Status of any ongoing or planned testing pertaining to the coal shipment, Chemical Analysis.

C.5.10.2 Notification of contractor. The contractor is formally notified of the rejection by the contracting officer. The contractor has the right to confirm coal quality or provide missing information. The contractor may request acceptance by the Government of nonconforming coal, referred to as a contract waiver request. The contracting officer shall provide the facility with disposition instructions on the rejected coal through required channels in a timely manner.

C.5.10.3 Withdrawal of rejection. If testing shows the coal meets contract specification requirements, the facility shall notify the contracting officer, coordinating with the service control point, of the results. The contracting officer shall then withdraw the rejection notice, notifying the contractor. The receiving facility is responsible for paying any charges associated with the delay of offloading the conveyances due to the unsubstantiated rejection. The facility should not discuss with the contractor matters regarding nonconforming coal. Negotiations, as appropriate, are conducted through the contracting officer.

C.5.11 Evaluation of the Coal. Upon receipt, the U.S. Army Petroleum Center or contract-designated laboratory shall test and issue an analytical test report of the coal sample. These reports are used to evaluate contractor performance. These reports can also be used by the facility to compare results received at origin to those received at destination. The price paid to the supplier may be adjusted either up or down based upon the test results of the sample taken at the destination (see C.5.2.3)

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GOVERNMENT QUALITY SURVEILLANCE OF FUEL

D.1 SCOPE

D.1.1 Scope. This appendix provides general information on the Governments quality surveillance program for fuels, lubricants and related products. This appendix is not a mandatory part of this Standard. The information contained herein is intended for guidance only.

D.2 APPLICABLE DOCUMENTS

D.2.1 This section is not applicable to this appendix.

D.3 DEFINITIONS

D.3.1 The definitions in Section 3 of this Standard apply to this appendix.

D.4 RESPONSIBILITIES

D.4.1 Joint Petroleum Office (JPO). The JPO is responsible in overseas areas for ensuring an adequate quality surveillance program is maintained within the unified command. Direct communication between DLA-Energy and the JPO on all petroleum matters has been authorized.

D.4.2 Military Services. The Service having physical possession of the petroleum products is responsible for establishing and maintaining a quality surveillance program. The Services also establish or furnish minimum usability limits for petroleum products.

D.4.2.1 Non-conforming product. All Service-owned petroleum products exceeding allowable specification limits should be reported to the owning military Service Control Point for disposition instructions. For nonconforming Defense Working Capital Fund products, the Services retain the right of acceptance (see 5.13 for disposition procedures with non-conforming, Defense Working Capital Fund product).

D.4.2.2 Service laboratory testing. See Appendix A for a breakdown of Service laboratories, their locations, and testing capabilities. For overseas locations, laboratory facilities are provided and maintained for the testing of fuels and lubricants in accordance with DLA 4155.29. The Military Service(s) should identify when laboratory support cannot be provided as cited above.

D.4.2.3 Specification development. The Military Services, as engineering support activities, develop specifications, or accept specifications developed by other organizations.

D.4.3 Headquarters DLA-Energy, its regions and offices. DLA-Energy maintains and oversees quality control programs to assure product quality is maintained from purchase to customer receipt. DLA-ENERGY maintains this Standard in coordination with the technical services.

D.4.3.1 Nonconforming Defense Working Capital Fund product. In addressing nonconforming, Defense Working Capital Fund product, the requirements of this Standard should be followed. When Defense Working Capital Fund products show deterioration beyond specification requirements, DLA-Energy-QA or DLA Aviation should be notified, as stated in 5.13 and 5.14.4. Customers should be notified prior to receiving product when only meeting intra-Governmental receipt limits. Service control points determine the acceptability of material not meeting intra-Governmental receipt limits.

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D.4.3.2 Commercial laboratory facilities for bulk petroleum products. DLA-Energy contracts for commercial laboratory testing of petroleum products worldwide in accordance with the needs of DLA-Energy and the Military Service(s).

D.4.3.3 (DLA AVIATION). For packaged products, DLA Aviation maintains and oversees quality control programs to assure product quality is maintained from purchase to customer receipt.

D.4.3.4 Commercial laboratory facilities for packaged petroleum product. DLA Aviation identifies and contracts for commercial laboratory testing of packaged products. The Military Service(s) identify to DLA Aviation required testing coverage.

D.4.4 Conflict with service publications. Anyone who has knowledge of a conflict between what is in this Standard and any Service technical publication is requested to bring it to the attention of DLA-Energy-QA/BP. Resolution of these conflicts will be addressed individually.

D.4.5 Quality surveillance representative (Government Representative) responsibilities. The Government Representative responsibilities include the following:

a. Assure that the contractor establishes and maintains an acceptable program for the control of quality of petroleum products furnished to or handled for the Government. The contract may require a written quality control plan or procedures.

b. Report to the region and the ordering officer at the activity placing the order, any information on delays in shipping the product caused by labor strikes, fires, or other conditions that result in non-availability of cargo or the inability of the contractor to perform. The reports should be made as soon as possible, but no later than the next working day, via telephone, fax, or e-mail.

c. Perform the following, when requested:

(1) Investigate petroleum product reported to be contaminated or causing unsatisfactory operation of equipment. The results of any findings given to a using activity are in an advisory capacity only.

(2) Participate in pre-award surveys and post-award conferences.

(3) Monitor/witness the analysis of special samples of products submitted to commercial laboratories under contract.

(4) Maintain surveillance over the special blending and compounding of products.

(5) Assist the military supply and transportation offices on pertinent matters.

(6) For issues effecting termination settlement at the facility, ascertain the quality and quantity of products on hand, volume of tank bottoms, and numbers of drums.

d. Advise the contracting officer, through appropriate channels, of contractor noncompliance with contract provisions in those cases where adequate local correction is not possible or failure to report might jeopardize the rights of the Government under the contract.

e. In contracts relating to receipt and storage of products procured for Government use, if the contractor does not provide technical personnel to perform laboratory testing, the Government Representative may be responsible for performing those tests necessary to assure the quality of products received, stored, and shipped at that location. Instructions contained in this Standard and DoDM4140.25M should be used.

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f. Maintain vigilance over quality and quantity of Government-owned petroleum products, containers, and equipment in the possession of contractors.

g. Advise the contracting officer of the date and time a commercial storage tank used to store Government-owned product is put into or out of service. Such reports apply to the removal of tanks from service for cleaning or repairs as well as initial use of termination of use under a contract.

h. Verify inventory process for Government-owned petroleum product. This certifies the accuracy of the inventory data and agrees or disagrees in writing with the contractor's stated cause(s) of losses/gains. In the event that the Government Representative's opinion as to loss data is at variance with the statements of the contractor, the Government Representative submits his reasons for non-occurrence by letter to the office receiving the report. The Government Representative assures, to the extent practicable, that all factual data pertaining to losses are included in the stock report or in a separate letter. Certain contracts provide for periodic evaluations of contractor performance by the Government Representative. These reports are valuable tools in the correction of deficiencies and selection of contractors. Accordingly, such reports should factually report any and all significant areas and incidents of poor performance. Details relating to losses and accounting of Defense Working Capital Fund products are contained in the DoDM4140.25M. There is no Government Representative certification on the DD Form 1788, Bulk Petroleum Terminal Report. The results of the periodic Government Representative inventory verification is documented with wording from the appropriate contract clause and filed with the individual transaction document. These documents are kept at the DFSP with a copy forwarded to the cognizant property administrator or accountable activity. The Government Representative witnesses the contractor inventories within the time intervals listed below. The Government Representative witnesses the contractor's end-of-month inventories whenever the adequacy of the contractor's inventory reporting system is questionable and continues until the contractor's system is considered acceptable. The witnessing of the inventory and verification of the contractor's system should be scheduled at different times within the intervals provided below with the contractor's coordination. The following time intervals are the minimum, in determining the frequency of inventory verification:

(1) Active DFSP (three or more issues/receipts in six months): witness inventory and verify against receipts/issues monthly.

(2) Semi-active DFSP (less than three issues/receipts in six month): witness inventory and verify against issues/receipts once each calendar quarter.

(3) Commingled storage (Government-owned product stored with contractor-owned product): verify that sufficient inventory is on hand each calendar quarter.

(4) Foreign Government and NATO held storage under memorandums of agreement (MOAs) or country-to-country agreements: inventory should be witnessed and verified by the Government Representative according to the terms of the agreement.

i. Losses of Government-owned product in the custody of contractors, which are caused by accident or mishap, including line breaks, tank overflows, spillage, product contamination, and fire, are investigated by the Government Representative, and a detailed factual report is provided to the accountable activity and the contracting officer.

j. Government property is subject to loss, damage, or destruction and may be found, upon receipt, to differ from the property indicated to have been shipped. In order to assist in the preparation of reports of survey, the Government Representative responsible for inspection of

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shipments received submits all pertinent information to the designated accountable activity and the contracting officer.

k. Certain contracts require the Government Representative to certify the contractor invoice for specified services delineated in the contract, e.g.: guard service, laboratory testing services, overtime, etc. Since the Government Representative normally is not physically present at the facility during the entire period covered by the invoice, a certification as follows should be used. "Based on recorded checks made during surveillance of the contractor's quality program and a review of the contractor's time and attendance records, I certify the contractor's invoice to be true and correct." Specified service invoices shall comply with contractual requirements which are covered under Bulk Services Contract clause G148.05, paragraph b, subparagraph 3.

l. The Government Representative is responsible for developing their own checklists and tailoring them to the particular facility.

m. SF 361, Transportation Discrepancy Report, is prepared by the designated accountable activity when Government-owned petroleum and related products, shipped on Government bills of lading, are received at a contractor's facility in an improper condition, and such damage, loss, or destruction is attributable to causes incident to shipping. In order to facilitate the preparation of this report, the Government Representative responsible for inspection at contractor's facilities receiving shipments submits all pertinent information to the designated accountable activity. The Government Representative checks shipments to determine the extent of the damage, shortage, and the cause, if possible. Information and documents submitted include:

(1) Two true copies of Government bill of lading, including discrepancy notation on the reverse side.

(2) Certified true copies of the freight bill or delivery receipt showing any discrepancy notation and signature thereon.

(3) A signed statement of the carrier's local agent (carrier's inspection report) admitting existence of the shortage or damage. It should be noted that this is not an admission of liability.

(4) The receiving Government Representative checks signed statement containing the bill of lading number, the number of packages received, the condition of the packages, a record of seals on the car or vehicles at origin and destination, and whether applied by shipper or carrier, and a statements as to the cause of damage, if known or otherwise a reliable opinion based on circumstantial evidence shall be furnished.

n. The Government Representative assists in the development of operating agreements, between the Government and the carrier that establish procedures for transportation, accountability, and quality control of Government fuel. The instructions applicable to petroleum movements via Government-owned multi-product pipeline systems are contained in this Standard and departmental instructions.

o. The Government Representative assures that samples of Government-owned petroleum products in bulk storage at Government or contractor-operated terminals in CONUS are submitted in accordance with this Standard.

p. When Government-owned stock in the custody of a contractor is indicated to be off-specification or projected to deteriorate below specification requirements in the near future, the Government Representative forwards copies of the test reports to DLA-Energy, ATTN: DLA-

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Energy-QA; and to the appropriate DLA-Energy Region. The reports should clearly indicate the product deficiency by appropriate comment on the reports and its relation to any recommended disposition action.

q. Implemented in 1992, process control (formerly in-plant quality evaluation) is used in the quality surveillance program to assess the adequacy of contractors' processes to consistently meet contractual requirements in storage and laboratory testing contracts. (Note: This does not apply to mandatory inspection requirements performed on vessel loadings/discharges, pipeline shipments/receipts.) For those contractor facilities whose processes are in control and where no customer complaints have been received, the cognizant Government Representative may reduce physical oversight at that facility.

r. The Government Representative assists in the reporting and investigation of customer complaints or product quality deficiency reports (PQDRs) in a timely manner to DLA-Energy-QA. Basic PQDR information is input into the DLA-Energy-QA database (CDC); supplemental information is forwarded to DLA-Energy-QA. PQDRs are used to evaluate contractor performance under best value.

D.5 QUALITY CONTROL PLAN/PROCEDURES.

D.5.1 Quality control plan/procedures. Each fuel handling activity is usually required to establish a written quality control plan. Service technical orders, field manuals, and instructions fulfill this requirement. For contractors, the contractor usually has the option to provide and maintain an inspection system that, as a minimum, incorporates the requirements such as those in Q91 (ISO 9001) Quality Systems - Model for Quality Assurance in Design/Development, Production Installation, and Servicing. However, the exact requirements for contractor quality control plans/procedures appear in the contract and those requirements rather than this appendix are what must be followed. If the owning service/contractor chooses to comply with Q91 quality system format, then all the specific quality provisions listed below would normally be included in the Q91 written quality plan:

D.5.2 Typical contents of a quality control plan/procedures.

a. The existing organization of the service or storage facility is defined, identifying points of contact responsible for coordinating all quality control functions within the facility. In each key position a person should be appointed, such as laboratory, tank farm, docks, etc., to act as point of contact for operations.

b. A quality control plan contains a detailed schematic of the facility. All areas covered by the inspection system are marked, such as blending, pipelines, tanks, docks, loading racks, laboratories, and all other areas concerning key processes.

c. In the event responsibility for petroleum products has been contracted out, a quality control plan assigns a Government Representative to the contractor and includes the representative's name, their telephone, pager, and facsimile numbers, to allow contact. Notification is made for such operations as: testing, sampling, loading, discharges, or when an unscheduled situation arises that might cause a problem in product or service. Notification will be in sufficient time, as identified in the quality control plan, to allow the representative to be present.

d. Only competent and properly trained personnel are to be assigned responsibility of receiving/storing/releasing, sampling, and testing of Defense Working Capital Fund fuel.

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Established service guidelines or company policy should include an individual training program and the training completed should be documented.

e. A quality control plan states how documents will be controlled: A quality control plan outlines document distribution time for reporting, document retention time, and projected date for the next review and obsolete documents will be removed from the area. Required documents include the quality control plan, specifications, test procedures, SOPs, and any other material directly affecting the inspection system.

f. A quality control plan describes the procedures used for receiving both product and additives. This includes: item specification, quality procedures (receipt and storage), and a description of the location and overall receiving operation.

g. A quality control plan describes the procedures used for blending. This includes all products and additive injection at all locations.

h. A quality control plan describes the sampling plan. The plan includes as a minimum procedures for the following: additives (receipt and storage); tank samples; line samples; conveyance samples; and samples to be taken prior, during, and after loading. The plan contains the method by which all samples will be labeled and retained. The time of retention is also specified for each sample. Sampling is in accordance with the MPMS, Chapter 8, and retention times in accordance with this Standard.

i. A quality control plan describes the tests to be conducted on each sample submitted. It contains the test procedures for each test. The requirements of Tables VIII and IX are incorporated into the plan. The plan specifies where the tests will be conducted. When samples are to be shipped for testing, the plan states the quantity, type of container, identification, packaging, packing, and mode of shipment to be used.

j. A quality control plan describes the method by which all laboratory and field testing and measuring equipment is calibrated in accordance with ISO 10012-1. For items not covered by that publication, the applicable manufacturer's recommended calibration method(s) are used.

k. A quality control plan includes detailed information on the type of storage and handling equipment and procedures to be used. All tanks, lines, valves, manifolds should be designed to handle the specified product and be in good repair. The plan includes a description of: the use of segregated/common product systems; controls to assure the capability for proper gauging, sampling, and draining of water; filtration; circulation; and other process/system used in maintaining product integrity during storage and handling.

l. A quality control plan describes the manner by which products will be moved from acceptance tanks to the conveyance. Examples of information needed are size of lines, type of product in lines, valves to be operated/blocked/blinded, how lines will be packed, etc. The plan includes details on how product integrity will be assured immediately before, during, and after loading and shipping operations. The plan gives detailed information on the procedures to be used to assure line fills meet specification requirements; conveyance inspection criteria prior, during, and after loading; completion and distribution of required documentation; and any other information deemed necessary.

m. A quality control plan describes how all required records and reports will be prepared and maintained. The plan states where, how, when, who, and for how long retained. The documents to be covered include, but not limited to, test reports (both additive and product), blending records,

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gauging records, movement records, dock logs, corrective action requests, quality/quantity investigations, ullage reports, DD Forms 250 and 250-1, bills of lading, certificates of calibration, manufacturers' certificates of conformance, and any other documents affecting product.

n. A quality control plan describes how the contractor will determine the quantity of product and additives received, stored, injected, and shipped. All measurements are made in accordance with the MPMS, Chapters: 2 (Tank Gauging), 5 (Metering), 7 (Temperature Determination), 10 (Sediment and Water), 11 (Physical Properties Data), 12 (Calculation of Petroleum Quantities), and 17 (Marine Measurement). Procedures should cover shore facilities and conveyances (vessels, trucks, pipelines, etc.) All quantities are determined by use of calibrated bobs and tapes, calibrated scales, or calibrated meters.

o. A quality control plan outlines the complete plan of corrective action. This includes notification of DLA-Energy and DLA-Energy Regions when any unscheduled event arises that may affect product or service quality or quantity. It includes both remedial and preventative type of corrective action. Examples of items to be included (but not limited to) are: off-specification product (prior to, during, and after loading / discharge); conveyance rejection; leaks; loss/gain investigations, etc.

D.6 NOTES

D.6.1 This section is not applicable to this appendix.

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PRODUCT CHANGE RECORD

E.1 SCOPE

E.1.1 Scope. This appendix provides general guidance on preparing a product change record. This appendix is not a mandatory part of this Standard. The information contained herein is intended for guidance only.

E.2 APPLICABLE DOCUMENTS

E.2.1 This section is not applicable to this appendix.

E.3 DEFINITIONS

E.3.1 The definitions in Section 3 of this Standard apply to this appendix.

E.4 SUGGESTED FORMAT FOR A PRODUCT CHANGE RECORD

E.4.1 Product Change Record. The following information should be included in a product change record.

a. Location: Enter the name of terminal or location on line where data is being generated.

b. Date: Indicate day, month, and year data was accumulated.

c. From: Indicate name, density (API gravity), and flash (if applicable) of head product.

d. To: Indicate name, density (API gravity), and flash (if applicable) of material displacing head product.

e. Pumping rate: Indicate barrels per hour and barrels per minute.

f. Change arrived: Indicate dispatcher's estimated time of product arrival and actual time of first gravity break.

g. Time: Indicate the hour and minute each line sample is taken.

h. API gravity/density: Enter the API gravity/density of each line sample.

i. Tank Number: Enter the number of the tank or tanks receiving the interface (if applicable).

j. Flash: Indicate flash point in degrees Celsius (Fahrenheit) (if applicable).

k. BBLS Mix: Indicate increment volume receiving from time of one sample to the next.

l. Average API Gravity/density: Indicate average API gravity.

m. Average relative density. Indicate the average API Gravity/density converted to relative density.

. Percent displacing product in mix: Enter in this column the results from the following formula:

$$\frac{\text{(Average relative density of BBLS mix) - (relative density of head product}}{\text{(Relative density of displacing product) - (relative density of head product)}} \times 100$$

n. BBLS Displacing product in mix: Enter in this column the results of the following formula:

(Percent displacing product in BBLS mix) × (BBLS mix)

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o. BBLS head product in mix: Enter in this column the result of the following formula:

(BBLS Mix) - (BBLS Displacing product in mix)

p. Gravity change: Enter in this column the result of the following formula:

(Average relative density of BBLS MIX) - (Relative density of head product)

E.4.2 Example of product change record. The product change record illustrates typical entries. An example of a minute increment calculation is as follows:

a. Head product is gasoline with 66.1 API gravity and 0.7161 relative density.

b. Displacing product is fuel oil with 41.4 API Gravity and 0.8184 relative density.

c. Flow rate is 2025 barrels per hour or 33.74 BBLS per minute.

d. Calculation:

(1) Sample at 0809 (14 minutes): API: 45.9, Sp Gr: 0.7976

(2) Barrels mix at 0809 (14 minutes) is 33.8.

(3) Average gravity of volume increments at 0808 (13 minutes) at 0809 (14 minutes) is an API gravity of 47.2 API, or density of 0.7918.

(4) Example: Percent displacing product in mix would be:

$$\frac{\text{(0.7918 Average relative density of BBLS Mix) - 0.7161(relative density of head product)}}{\text{(0.8184 Relative density of displacing product) – (0.7161relative density of head product)}} \times 100 = 73.99\% \text{ of mix}$$

(5) Example: BBLS Displacing product in mix would be:

(73.99% displacing product of fuel oil mix) × (33.8 BBLS mix) = 8.8 head product (gasoline) in mix

(6) Example: BBLS head product in mix would be:

(33.8 BBLSs mix) - (25.0 BBLS displacing product fuel oil) = 8.8 BBLS head product (gasoline) in mix

(7) Similar data should be calculated for each increment of change. The cumulative totals of each product are then added and inserted at bottom of applicable columns of the work sheet (see figure E-1.).

E.5 NOTES

E.5.1 This section is not applicable to this appendix.

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APPENDIX E

	Time	API Gravity	Tank No.	Flash	Bbls Mix	Average API Gravity	Average relative density	% FO in Mixture	Bbls FO in Mixture	Bbls MOGAS in Mix	QTY Change
LOCATION:	7:55	66.1									
PRODUCT: MOGAS	7:57	65.9			67.5	66.0	0.7165	0.39	0.27	67.2	0.0004
API GRAVITY: 66.1	7:58	65.8			33.8	65.9	0.7158	0.68	0.23	33.6	0.0007
RELATIVE DENSITY: 0.7161	7:59	65.7			33.8	65.8	0.7172	1.07	0.36	33.4	0.0011
FLASH: N/A	8:00	65.2			33.8	65.5	0.7183	2.15	0.73	33.1	0.0022
	8:01	64.7			33.8	65.0	0.7201	3.91	1.3	32.5	0.0040
	8:02	63.8			33.8	64.3	0.7227	6.45	2.2	31.4	0.0066
TO	8:04	61.7			67.5	62.8	0.7283	11.93	8.1	59.4	0.0122
PRODUCT: FUEL OIL	8:05	58.2			33.8	60.0	0.7389	22.29	7.5	26.3	0.0228
API GRAVITY: 41.4	8:06	54.1			33.8	56.2	0.7539	36.95	12.5	21.3	0.0378
RELATIVE DENSITY: 0.8184	8:07	50.3			33.8	52.2	0.7703	52.98	17.9	15.9	0.0542
FLASH: N/A	8:08	48.5			33.8	49.4	0.7822	64.61	21.8	12.0	0.0661
	8:09	45.9			33.8	47.2	0.7918	74.0	25.0	8.8	0.0757
	8:10	44.2			33.8	45.1	0.8012	83.19	28.2	5.6	0.0851
	8:11	43.4			33.8	43.8	0.8072	89.05	30.1	3.7	0.0911
	8:12	43.2			33.8	43.3	0.8095	91.30	30.9	2.9	0.0934
PUMPING RATE:	8:13	42.3			33.8	42.8	0.8118	93.55	31.6	2.2	0.0957
BARRELS PER HOUR: 2025	8:14	42.2			33.8	42.3	0.8142	95.89	32.4	1.4	0.0981
BARRELS/MINUTE: 33.75	8:15	42.0			33.8	42.1	0.8151	96.77	32.7	1.1	0.0990
	8:16	41.4			33.6	41.7	0.8170	98.63	33.3	0.5	0.1009
	8:18	41.4			67.5						
CHANGE ARRIVED:	8:20	41.4			67.5						
DISPATCHER EST: 0750 HRS											
FIRST BREAK: 7:57 a.m.											

FIGURE E-1. <u>Sample calculation product change record</u>

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APPENDIX F

PETROLEUM SAMPLE CHAIN OF CUSTODY DOCUMENT

F.1 SCOPE

F.1.1 Scope. This appendix provides the examples of page 1 and page 2 of the Chain of Custody Document recommended for tracking sample history and transfer of custody. See figures F-1 and F-2. This appendix is not a mandatory part of this Standard. The information contained herein is intended for guidance only.

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APPENDIX F

PETROLEUM SAMPLE CHAIN OF CUSTODY DOCUMENT			COC DOCUMENT NUMBER
RECEIVING ACTIVITY		LOCATION	
NAME, GRADE AND TITLE OF PERSON FROM WHOM RECEIVED ☐ OWNER ☐ OTHER		ADDRESS (Include Zip Code)	
LOCATION FROM WHERE OBTAINED		REASON OBTAINED	TIME/DATE OBTAINED
ITEM NO.	QUANTITY	DESCRIPTION OF ARTICLES (Include product, seal numbers, final destination, condition and unusual marks or scratches)	

CHAIN OF CUSTODY

ITEM NO.	DATE	RELEASED BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	

Page 1

FIGURE F-1. Chain of Custody Document Page 1

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CHAIN OF CUSTODY				
ITEM NO.	DATE	RELEASED BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	
		SIGNATURE NAME, GRADE OR TITLE	SIGNATURE NAME, GRADE OR TITLE	

FINIAL DISPOSITION ACTION

RELEASED TO OWNER OR OTHER (Name/Unit) _____

DESTROY _____

OTHER (Specify) _____

FINIAL DISPOSITION AUTHORIY

ITEM(S) _____ ON THIS DOCUMENT, PETAINING TO THE INVESTIGATION INVOLVING _____ (Grade)

_____ (IS) (ARE) NO LONGER

(Name) (Organization)

REQUIRED AS EVIDENCE AND MAY BE DISPOSED OF AS INDICATED ABOVE. (If article(s) must be retained, do not sign, but explain in separ correspondence.)

(Typed/Printed Name, Grade, Title) (Signature) (Date)

WITNESS TO DESTRUCTION OF EVIDENCE

THE ARTICLE(S) LISTED AT ITEM NUMBER(S) _____ (WAS) (WERE) DESTORYED BY THE EVIDENCE CUSTODIAN, IN MY PRESENCE, ON THE DATE INDICATED ABOVE.

(Typed/Printed Name, Organization) (Signature)

Petroleum Sample Chain of Custody Document - Page 2

FIGURE F-2. Chain of Custody Document Page 2

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