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MIL-STD-3004-1
11 September 2018

SUPERSEDING
MIL-STD-3004D
with Change 1
28 MAR 2016

DEPARTMENT OF DEFENSE STANDARD PRACTICE

QUALITY ASSURANCE FOR BULK FUELS, LUBRICANTS AND RELATED PRODUCTS

AMSC N/A

Part 1 of 2

FSC 91GP

FOREWORD

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

2. Certain provisions of this Standard are subject to international standardization agreements. When amendment, revision, or cancellation of this Standard is proposed and would affect or violate the international agreement concerned, the preparing activity shall take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

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

4. Unless specifically stated, all references to Government documents and non-Government publications refer to the most recent version or revision of that document or publication.

5. References to the QAR include Military Service personnel designated to perform these functions.

6. Details about Packaged Products included in MIL-STD-3004D with change 1 and all previous versions have been removed from this version. Details about Packaged Products are now included in MIL-STD-3004-2 published by DLA Aviation. For additional information about Packaged Products, contact DLA Aviation, ATTN: DLA JDTA, 8000 Jefferson Davis Highway, Richmond, VA 23297-5000.

7. Due to the extent of the changes in this revision, marginal notations are not used to identify changes with respect to the previous issue.

8. Address comments, suggestions, or questions regarding this document to Defense Logistics Agency Energy (DLA Energy) Quality Operations, Room 2843, DLA Headquarters Building, 8725 John J. Kingman Rd, Fort Belvoir VA, 22060-6222, or to the Lead Standardization Office, at DSCC.Standardization@dla.mil. For exceptions, deviations or waivers to the requirement cited in this document, contact Defense Logistics Agency Energy (DLA Energy) Quality Operations, Room 2843, DLA Headquarters Building, 8725 John J. Kingman Rd, Fort Belvoir VA, 22060-6222. Since contact information can change, please verify the currency of this address information using the ASSIST Online database URL http://quicksearch.dla.mil/.

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1. SCOPE

1.1 Scope. This Standard provides DoD Policy, general instructions, and minimum procedures for use by the Military Services and the Defense Logistics Agency in performing quality assurance 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 and included in contracts as necessary. This Standard includes policy and responsibilities derived from Executive Agency documents (see 1.3 below). The information contained relates to quality assurance where applicable (e.g., direct delivery to customers, destination acceptance, etc.). This Standard also contains Intra-Governmental Receipt Limits (IGRL). This Standard is available for download from ASSIST Online website: http://quicksearch.dla.mil/.

1.2 Applicability. Quality assurance (QA) is a planned and systematic pattern of all actions necessary to provide 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 (CQA) is a method to determine if a supplier of products 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, CQA responsibility is fulfilled when the product or service is accepted by the Government and the product no longer belongs to the contractor or 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 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, designates the Director, Defense Logistics Agency (DLA), as the DoD Executive Agent (EA) for Bulk Petroleum for the DoD, with authority to re-delegate to DLA Energy.

1.3.1 Policy. The DoD EA for Bulk Petroleum executes supply chain management for all Bulk Petroleum owned by the Department of Defense and is 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 develops standardized quality policy and procedures across the supply chain to reflect the various DoD fuel system requirements and maximize effectiveness/efficiency.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this Standard. This section does not include documents cited in other sections of this Standard or recommended for additional information or as 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, or 5 of this Standard, whether or not they are listed below.

2.2 Government Documents.

2.2.1 Specifications, Standards, and Handbooks. The following specifications, standards, and handbooks 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 1135	Interchangeability of Fuels, Lubricants and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations
STANAG 1385	Guide Specification for (Minimum Quality Standards) for Naval Distillate Fuels (F-75 and F-76)
STANAG 3149	Minimum Quality Surveillance for Fuels
STANAG 3390	Guide Specification and Inspection Standards for Fuel Soluble Lubricity Improvers (S-1747)
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 Fuels (F-24, F-27, F-34, F-35, F-37, 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 (AQAP)
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 7063	Methods of Detection and Treatment of Fuels Contaminated by Microorganisms
STANAG 7090	Guide Specification for NATO Ground Fuels
STANAG 7091	Guide Specification for NATO Land System Oils for Engines and Transmissions
STANAG 7093	Guide Specification for NATO Land System Automotive Fluids

(Copies of these document are available online at http://quicksearch.dla.mil.)

AIR AND SPACE INTEROPERABILITY COUNCIL (ASIC)

AIR STD 4021	Allowable Deterioration Limits for Stored Fuels, Lubricants, and Associated Products

(Copies of this document are available online at http://quicksearch.dla.mil.)

FEDERAL STANDARDS

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5 MIL-DTL-16884 Fuel, Naval Distillate
MIL-DTL-25524	Turbine Fuel, Aviation, Thermally Stable (JPTS)
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
MIL-PRF-6081	Lubricating Oil, Jet Engine (LA6)
MIL-PRF-9000	Lubricating Oil, Shipboard Internal Combustion Engine, High Output Diesel (LO6)
MIL-PRF-17331	Lubricating Oil, Steam Turbine and Gear, Moderate Service (LTL)
MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (NATO S-1747)
MIL-PRF-32490	Additive, Lubricity Improver, Diesel
MIL-PRF-52308	Performance Specification Filter-Coalescer Element, Fluid Pressure
MIL-S-53021	Stabilizer, Additive, Diesel Fuel

(Copies of these documents are available online at http://quicksearch.dla.mil.)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-161	Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels
MIL-STD-1548	Into-Plane Servicing of Fuels at Commercial Airports
MIL-STD-3004-2	Quality Assurance/Surveillance for Packaged Fuels, Lubricants and Related Products

(Copies of these documents are available online at http://quicksearch.dla.mil.)

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.

DEPARTMENT OF DEFENSE PUBLICATIONS

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

DoD Manual 4140.25 DoD Management of Bulk Petroleum Products, Natural Gas, and Coal

DoD Manual 4140.27 Vol 2 DoD Shelf-Life Management Program: Material Quality Control Storage Standards

(Copies of these documents are available online at http://www.esd.whs.mil/.

DLA ENERGY HANDBOOK

DLA Energy Handbook 4120.1

(Copies of this document are available online at http://www.dla.mil/Energy/About/Library/Publications.aspx.

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.

AIRLINES FOR AMERICA (A4A) (Previously AIR TRANSPORT ASSOCIATION (ATA))

ATA SPEC 103 Standard for Jet Fuel Quality Control at Airports

(Copies of this document is available online at https://publications.airlines.org.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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

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.)

AMERICAN PETROLEUM INSTITUTE (API)

API/IP MPMS API Manual of Petroleum Measurement Standards

RP 1595 Design, Construction, Operation, Maintenance, and Inspection of Aviation Pre-Airfield Storage Terminals

(Copies of these documents are available online at http://www.api.org.)

ASTM INTERNATIONAL

ASTM Manual 5 Aviation Fuel Quality Control Procedures

ASTM Manual 47 Fuel and Fuel System Microbiology: Fundamentals, Diagnosis, and Contamination Control

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 adopted)
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 D396	Standard Specification for Fuel Oils (DoD adopted)
ASTM D482	Standard Test Method for Ash from Petroleum Products (DoD adopted)
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 D873	Standard Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method) (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 D2392	Standard Test Method for Color of Dyed Aviation Gasolines (DoD adopted)
ASTM D2622	Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
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)
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 D3341	Standard Test Method for Lead in Gasoline – Iodine Monochloride Method (DoD adopted)
ASTM D3487	Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus (DoD adopted)
ASTM D3699	Standard Specification for Kerosene (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 D4294	Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry (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) (DoD adopted)
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 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 D5453	Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
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 Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines (DoD adopted)
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 D6615	Standard Specification for Jet B Wide-Cut Aviation Turbine Fuel ASTM D6751 Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels
ASTM D6883	Standard Practice for Manual Sampling of Stationary Coal from Railroad Cars, Barges, Trucks, or Stockpiles
ASTM D6890	Standard Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber
ASTM D7170	Standard Test Method for Determination of Derived Cetane Number (DCN) of Diesel Fuel Oils-Fixed Range Injection Period, Constant Volume Combustion Chamber Method
ASTM D7224	Standard Test Method for Determining Water Separation Characteristics of Kerosene-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 D7430	Standard Practice for Mechanical Sampling of Coal
ASTM D7467	Standard Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)
ASTM D7547	Standard Specification for Hydrocarbon Unleaded Aviation Gasoline
ASTM D7619	Standard Test Method for Sizing and Counting Particles in Light and Middle Distillate Fuels, by Automatic Particle Counter
ASTM D7688	Standard Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR) by Visual Observation
ASTM D7797	Standard Test Method for Determination of the Fatty Acid Methyl Esters Content of Aviation Turbine Fuel Using Flow Analysis by Fourier Transform Infrared Spectroscopy – Rapid Screening Method

(Copies of these documents are available online at http://www.astm.org.)

ENERGY INSTITUTE (EI)

EI HM 50	Guidelines for the Cleaning of Tanks and Lines for Marine Tank Vessels Carrying Petroleum and Refined Products

EI 1535	Minimum Criteria to Determine Acceptability of Additives for use in Multi-Product Pipelines Co-Transporting Jet Fuel
EI 1570	Handbook on Electronic Sensors for the Detection of Particulate Matter and/or Free Water during Aircraft Refueling
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
EI 1598	Design, Functional Requirements and Laboratory Testing Protocols for Electronic Sensors to Monitor Free Water and/or Particulate Matter in Aviation Fuel
EI/JIG STD 1530	Quality Assurance Requirements for the Manufacture, Storage and Distribution of Aviation Fuels to Airports
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
IP 540	Determination of the Existent Gum Content of Aviation Turbine Fuel-Jet Evaporation Method
IP 564	Determination of the Level of Cleanliness of Aviation Turbine Fuel – Laboratory Automatic Particle Counter Method
IP 565	Determination of the Level of Cleanliness of Aviation Turbine Fuel – Portable Automatic Particle Counter Method
IP 577	Determination of the Level of Cleanliness of Aviation Turbine Fuel – Automatic Particle Counter Method using Light Extinction
IP 583	Determination of the Fatty Acid Methyl Esters Content of Aviation Turbine Fuel using Flow Analysis by Fourier Transform Infrared Spectroscopy - Rapid Screening Method
IP 585	Determination of Fatty Acid Methyl Esters (FAME), derived from Bio-Diesel Fuel, in Aviation Turbine Fuel – GC-MS with Selective Ion Monitoring/Scan Detection Method
IP 590	Determination of Fatty Acid Methyl Esters (FAME) in Aviation Turbine Fuel – HPLC Evaporative Light Scattering

	Detector Method
IP 599	Determination of Fatty Acid Methyl Esters (FAME) in Aviation Turbine Fuel – Gas Chromatography using Heart-Cut and Refocusing

(Copies of these documents are available online at http://www.energyinst.org/home.)

EUROPEAN COMMITTEE FOR STANDARDIZATION

EN 228	Automotive Fuels - Unleaded Petrol - Requirements and Test Methods
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 these documents are available online at http://www.cen.eu.)

GOSUDARSTVENNYI STANDARTY (GOST), EURO-ASIAN COUNCIL OF STANDARDIZATION, METROLOGY, AND CERTIFICATION (EASC)

GOST 305-82	Diesel Fuel, Specifications
GOST 10227-86	Fuels for Jet Engines, Specifications
GOST R 52050	Aviation Turbine Fuel Jet A-1

(Copies of these documents are available online at http://global.ihs.com.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 3170	Petroleum Liquids – Manual Sampling
ISO 4406	Hydraulic Fluid Power-Fluids – Method for Coding the Level of Contamination by Solid Particles
ISO 8217	Petroleum Products – Fuels (Class F) – Specifications for Marine Fuels ISO 9001 Quality Management Systems Requirements
ISO 10012	Measurement Management Systems- Requirements for Measurement Processes and Measuring Equipment
ISO 17025	General Requirements for the Competence of Testing and Calibration Laboratories

(Copies of these documents are available online at https://www.iso.org/iso/catalogue.)

JOINT INSPECTION GROUP (JIG)

JIG 1	Aviation Fuel Quality Control & Operating Standards for Into-Plane Fueling Services
JIG 2	Aviation Fuel Quality Control & Operating Standards for Airport Depots & Hydrants
JIG 3	Aviation Fuel Quality Control & Operating Standards for Supply & Distribution Facilities

(Copies of these documents are available online at http://www.jigonline.com.)

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
SAE J 1966	Oils, Lubricating, Aircraft Piston Engine (Nondispersant Mineral Oil) (LA6)

(Copies of these documents are available online at http://www.sae.org.)

UNITED KINGDOM MINISTRY OF DEFENCE – (UK MOD)

DEF STAN 91-090	Gasoline Aviation: Grades 80/87, 100/130 and 100/130LL Joint Service Designation: AVGAS 80, AVGAS 100 and AVGAS 100/130LL
DEF STAN 91-091	Turbine Fuel, Aviation Kerosene Type, Jet A-1, NATO Code: F-35, Joint Service Designation: AVTUR

(Copies of these documents are available online at https://sts.defencegateway.mod.uk.)

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

3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

3.1 Definitions.

3.1.1 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.

3.1.2 Additive. A material added to another, usually in small amounts, to impart or enhance desirable properties or to suppress undesirable properties.

3.1.3 Appearance. Color, clarity, or evidence of stratification and contaminants that may be observed by visual examination of sample.

3.1.4 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. Access to ASSIST is via http://quicksearch.dla.mil. The ASSIST database lists defense and federal specifications and standards, defense handbooks, and commercial item descriptions (CIDs). Quality Product Lists (QPLs), adopted non-Government Standards (NGS) and other related standardization documents used by the DoD may be accessed at http://qpldocs.dla.mil/.

3.1.5 B20. A fuel blend consisting of 20 (+/-1) volume percent (vol %) of biodiesel with the remaining 80 vol % 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 or EN 14214. The B6 to B20 blends conform to the requirements of ASTM D7467 specification. DoD only allows the use of B20 in non-tactical equipment.

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

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

3.1.8 Basic Sediment and Water (BS&W). The BS&W test 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.

3.1.9 Batch. A specific quantity of product that is processed or utilized as a single unit and tested to meet test criteria and specifications.

3.1.10 Batch Number. A unique number that is assigned by the refinery, intermediate terminal, or pipeline company that provides traceability to a specified quantity of product.

3.1.11 Biodiesel. Generic term for fuel comprised of mono-alkyl esters of long-chain fatty acids derived from vegetable oils or animal fats. Biodiesel 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 for use in standard diesel engines and should not be confused with the vegetable and waste oils used as fuel in converted diesel engines.

3.1.12 Biodiesel Blend (BDI). A mixture of a specified percentage of biodiesel with diesel fuel. The blend is identified as "B##" where "##" is the percentage of biodiesel in the blend. As such, B20 is a mixture of 20 percent biodiesel and 80 percent diesel fuel.

3.1.13 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.

3.1.14 Bulk Petroleum Products. Liquid petroleum product transported by various means and stored in tanks or containers having an individual fill capacity greater than 205 liters (about 55 gallons). Exceptions: various sized collapsible containers such as 240 USG (908 L) totes or larger may also be considered packaged products.

3.1.15 Bunkers. Fuel intended for consumption to propel water-borne craft. Bunkers can be distillate, such as F-76, commercial MGO (e.g. DMA) or JP-5. The term bunkers can also refer to a residual fuel oil such as Intermediate Fuel Oil 180 or Fuel Oil 380.

3.1.16 Burner Fuel. Any petroleum liquid suitable for the generation of heat by combination in a furnace or firebox as a vapor or a spray, or a combination of both.

3.1.17 Calculated Carbon Aromaticity Index (CCAI). An index of the ignition quality of a residual fuel oil (marine fuel) calculated using results or tested density, kinematic viscosity and temperature at which viscosity was determined. CCAI results provide an estimate of the ignition delay of a fuel.

3.1.18 Calibration. Adjustment of measurement instruments based on comparison to reference standards in order to provide accuracy and consistency in measurements.

3.1.19 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.

3.1.20 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.

3.1.21 Certificate of Analysis (CoA). A CoA is issued by a laboratory that is preferably not of the originating refinery, usually at some point downstream of the point of manufacture, typically in the intermediate supply terminals where several batches of jet fuel may be commingled and that product re-batched. A CoA is not treated as a Refinery Certificate of Quality (RCQ).

3.1.22 Certificate of Conformance. A statement applied to the Material Inspection and Receiving Report or Invoicing, Receiving, Acceptance and Property Transfer (iRAPT) Energy Receiving Report (ERR) by the Contractor indicating that the product being provided conforms to specification/contractual requirements. This statement is in lieu of a Government Inspection.

3.1.23 Clean (Clear) and Bright. The absence of visible particulate, a cloud, a haze, an emulsion, and 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.

3.1.24 Coalesce. To unite to form one mass. A coalescer is a teflon-coated canister or container that 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.

3.1.25 Commingling. The mixing of two or more products of different ownership, type, or grade.

3.1.26 Conductivity. The ability of a given substance to conduct electric current.

3.1.27 Contaminant. A foreign substance in a product.

3.1.28 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.

3.1.29 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).

3.1.30 Cracked Stock. A petroleum fraction obtained from a cracking process rather than from simple distillation. In a cracking process, the larger hydrocarbon molecules are split into smaller molecules resulting in increased quantities of low- boiling fractions.

3.1.31 Custody Transfer Point. The point at which possession and control of product passes from one party to another, such as from a contractor to the Government. Title (ownership) normally passes between the parties involved at this point also

3.1.32 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.).

3.1.33 Defense Working Capital Fund (DWCF). 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/Federal Agencies) that reimburse the DLA Division DWCF for costs incurred.

3.1.34 Defense Fuel Support Point (DFSP). A bulk fuel storage facility (depot, terminal or FLC) that receives, stores and issues DLA-owned product in support of a Military Service or Federal Agency's requirements. There are three categories of DFSP:

3.1.34.1 Intermediate DFSP. DFSP that stores fuel for subsequent issue to multiple end customers.

3.1.34.2 Base-Level DFSP. DFSP located on a Service-operated or Service-owned, contractor-operated military installation that routinely issues to the end user.

3.1.34.3 Afloat DFSP. Any MSC or Navy asset afloat that carries and issues DWCF fuel.

3.1.35 DWCF Batch Number. A unique number that is assigned that identifies a specific quantity of product in a single tank at a location holding DWCF fuel.

3.1.36 Dehydration. The removal of water.

3.1.37 Density. The density of a material is defined as its mass per unit volume. Density is typically reported at $15^{o}C$ in kg/L or kg/m^3. In some cases (for instance in the U.S. oil and gas industry), density is also defined as its weight per unit volume at specified temperature, although this quantity is more properly called specific weight.

3.1.38 Depot. An industrial (military, Government, or commercial) facility for the storage of bulk fuel, additives or lube oils from which these products are usually transported to end users or further storage facilities. Within the text of this document, the terms depot, DFSP and FLC are considered interchangeable, unless otherwise specified.

3.1.39 Deteriorated Product. A product in which one or more characteristics have changed over time to a level of quality outside the limits of the applicable specification.

3.1.40 Diesel Fuel. A distillate fuel used in diesel engines. DLA Energy procures many grades of diesel, based on customer requirements. Some of the more common grades are: DF1, DF2, DS1, DS2, DSS and F76. For a complete listing of DLA Energy Product Codes refer to DLA Energy Commodities Handbook 4120.1 that is available online at http://www.dla.mil/Energy/About/Library/Publications.aspx or from DLA Energy Quality Technical Support Directorate, 8725 John J. Kingman Road, STE 2843, Fort Belvoir, VA 22060-6220).

3.1.41 Dissolved Water. Water in a solution which cannot be removed by mechanical means (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.

3.1.42 Distillate Marine Fuel. A distillate fuel whose derived sources can be from petroleum, synthetic, or renewable, used 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 designated Marine Gas Oil (MGO) with the most common grades being DMA under ISO 8217 and F-76 under MIL-DTL-16884.

3.1.43 Downgrading. The procedures by which an off-specification or contaminated product (due to deterioration or contamination) is approved for use as a lower grade of the same or similar product, or as a completely different product.

3.1.44 Drag Reducer Additive (DRA). Also known as Drag Reducing Agents, DRAs and Flow Improvers are any material that reduces frictional pressure during fluid flow in a conduit or pipeline.

3.1.45 Drop (As related to marine vessel cleaning requirements). The removal by draining of final contents from lines, piping, pumps, etc. prior to introducing a different

content.

3.1.46 Enterprise Business System (EBS). The EBS is used to perform real property management, materiel management, supply chain tasks of finance, order fulfillment, planning, procurement, and system outcomes for energy commodities.

3.1.47 Energy Receiving Report (ERR). The Wide Area Workflow (WAWF) ERR is the electronic equivalent of the DD Form 250 for overland shipments and DD Form 250-1, Tanker/Barge Material Inspection and Receiving Report, for waterborne shipments.

3.1.48 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).

3.1.49 Equivalent Tests. 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. Information on equivalent IP/ISO test methods can be found at http://publishing.energyinst.org/ip-test-methods.

3.1.50 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. It is defined by ASTM D5798.

3.1.51 F-76 (Fuel, Naval Distillate). Diesel fuel made to specification MIL-DTL-16884 is designed for use at all temperatures above 35°F and as the principal burner fuel for steam-powered ships (See paragraph 5.10.6 for more details).

3.1.52 Fatty Acid Methyl Ester (FAME). Sometimes referred to as biodiesel or B100, methanol is the alcohol used to form this product.

3.1.53 Filtering. A process of mechanically removing particulate or free water from a petroleum product using a medium such as filtering paper, clay or diatomaceous earth.

3.1.54 Filter-Separator. A mechanical device designed to remove particulate contaminants and to coalesce and separate water from fuels.

3.1.55 Fleet Logistics Centers (FLC). Within the text of this document, FLC refers to a U.S. Navy fuel depot.

3.1.56 Floc Point. The temperature at which waxy materials in a lubricating oil separate from a mixture of oil and Freon (Registered trademark of E.I. Dupont de Nemours, Inc.) R-12 refrigerant, giving a cloudy appearance to the mixture; also called Freon floc point. Floc Point is generally used to evaluate the tendency of refrigeration oils to plug expansion valves or capillaries in refrigerant systems. This is not to be confused with cloud point, the temperature at which wax precipitates from an undiluted oil.

3.1.57 Free on Board. A term in international commercial law specifying at what point respective obligations, costs, and risk involved in the delivery of goods shift from the seller to the buyer.

3.1.57.1 Free on Board Destination (FOB Destination). The buyer takes ownership of the product when it arrives at their delivery location. Typically, under FOB Destination, the seller bears the risk of loss or damage to the item during shipment.

3.1.57.2 Free on Board Origin (FOB Origin). The buyer takes ownership of the product at the seller's location and is responsible for it at that point. Typically, under FOB Origin, the buyer bears the risk of loss or damage to the item during shipment. \

3.1.58 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.

3.1.59 Fungible Fuel. Fuel that is fully interchangeable with other fuels of the same chemical properties or specification. This means fuel of the same grade manufactured by different refineries may be mixed and blended together during transit. Such fuel would lose its manufacturer's identity, but would have the same chemical properties as the specified product. Fuels containing formulations or characteristics which can be mixed and shipped in common distribution systems are fungible. Fuels containing unique formulations or characteristics (e.g., military specifications) are not fungible.

3.1.60 Fungible Pipeline System. Fungible pipeline systems are those that transport fungible fuel product batches commingled with others meeting the same specifications. In accordance with pipeline agreements and operating standards, all batches entering the fungible system have full documentation (RCQ or CoA) showing compliance with specification requirements.

3.1.61 Gas-free. A tank, compartment, or container is consider gas-free when sufficient fresh air is introduced into it to lower the level of flammable, toxic, or inert gas to that required for specific purpose, e.g., hot work, entry, etc.

3.1.62 Gasohol. Defined by ASTM D4814 Standard Specification for Automotive Spark-Ignition Engine Fuel, gasohol is a mixture of 90 vol% gasoline and 10 vol% denatured ethyl alcohol (ethanol) used as automotive gasoline.

3.1.63 Gasoline. Spark-ignition engine fuel used in internal engines. DLA Energy procures many grades of gasoline, based on customer requirements. Some of the more common grades are MUM, MUP & MUR. For a complete listing of DLA Energy Product Codes, refer to the DLA Energy Commodities Handbook 4120.1, available online at http://www.dla.mil/Energy/About/Library/Publications.aspx or from DLA Energy DQ, 8725 John J. Kingman Road, STE 2843, Fort Belvoir, VA 22060-6220.

3.1.64 Gasoline-Oxygenate Blend. Spark-ignition engine fuel consisting primarily of gasoline with one or more oxygenates.

3.1.65 Gauging (Gaging). The act of measuring the height of product in a tank. During the process of gauging a tank, the temperature of the fuel is also normally measured.

3.1.66 Gauging for water. Obtaining the depth of the water bottom by taking a water measurement. This is normally accomplished by coating a plumb bob, tape, or gauging stick with water-finding paste.

3.1.67 Gum. Description of resin-like, fuel insoluble deposits (contaminants) formed during the oxidative and thermal deterioration of petroleum fuels. The term is also used to mean a residue remaining after fuel is evaporated.

3.1.68 Heel. Previous batch of product remaining in a tank prior to refilling. The size/quantity of the product heel may be attributed to factors such as pumping limitations, tank design, stockage objectives, or various other reasons. Product heel should be kept as small as possible to maintain batch integrity.

3.1.69 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). Truly homogenous product is assumed when the API Gravity differs by no more than ± 0.3 degrees. This limit is established from the precision and bias criteria contained in ASTM D1298.

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, and in all likelihood would not, meet the precision requirements.

3.1.70 Identification Tests. Selected tests applied to a sample to quickly determine the type or grade of the product represented or to determine if a product property may have been altered by time or handling. See Type C test.

3.1.71 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.

3.1.72 Innage. The height of liquid in a tank or container measured from the bottom of the tank to the top surface of the liquid.

3.1.73 Inspect. To examine critically to detect flaws, errors, etc.

3.1.74 Interface. The common boundary (or surface) between two liquids (immiscible liquids) (e.g., oil and water).

3.1.75 Intra-Governmental Receipt Limits (IGRL). 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.

3.1.76 Joint Petroleum Office (JPO). A Combatant Command (CCMD) staff function responsible for all aspects of petroleum logistics within the cognizance of the Combatant Commander. Responsibilities include management of petroleum products, including war reserves, peacetime operating stocks, distribution of product, quality control, facilities management, and the development of contingency plans.

3.1.77 Light-Ends. The lower-boiling fractions of a fuel or oil.

3.1.78 Long Term Storage. Product at a depot for a period longer than that indicated in Table VIII which has not been recertified to at least a Type B-2 test. (See 5.9.1 for additional information.)

3.1.79 Low Sulfur Diesel (LSD). Diesel fuel with a maximum sulfur content of 0.05 mass percent (500 ppm by mass).

3.1.80 Lubricity. The ability of a fluid to reduce the friction between two surfaces in motion.

3.1.81 Marine Gas Oil (MGO). A distillate fuel, containing no residuals, used primarily for vessel propulsion. MGO is the generic term that refers to a distilled petroleum product intended for use in a maritime environment. There are several grades of MGO governed by specifications such as ISO8217 (commercial) and MIL-DTL-16884 (F76). Some grades of MGO may contain FAME which could be detrimental to marine propulsion systems.

3.1.82 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, and a vessel representative. (See Energy Receiving Report (ERR) for details about the iRAPT/WAWF electronic equivalent of the DD Form 250/250-1.)

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.

3.1.83 Metal Deactivator (MDA). MDA is a fuel additive contains N,N'-disalicylidine- 1,2-propanediamine as an active ingredient, a chelating molecule that wraps itself around trace metal atoms in fuel and thus shields the fuel from their catalytic propensity. Experience has shown that MDA at the recommended dosage rate is usually sufficient to treat fuel that becomes off-specification for thermal stability. If used, its concentration must be reported on the Certificate of Quality (COQ). It is typically not added without the written consent from the procuring activity and user.

3.1.84 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.

3.1.85 Mineral Oil. Lubricating oils produced from petroleum sources with or without additives.

3.1.86 MSC Auxiliary Vessels. The Military Sealift Command (MSC) is a United States Navy organization that controls most of the replenishment and military transport ships of the Navy. These ships are made up of a core fleet of ships owned by the United States Navy and others under long-term-charter augmented by short-term or voyage-chartered ships.

3.1.87 Off-Specification Product. A product which fails to meet one or more of the physical, chemical, or performance requirements of the specification.

3.1.88 On-Board Quantity (OBQ). The material present in a vessel's cargo tanks, void spaces, and pipelines before the vessel is loaded. On-board quantity may include any combination of water, oil, slops, oil residue, oil/water emulsion, and sediment.

3.1.89 Outage (or Ullage). The linear distance between the top surface of the liquid in a drum, tank, or tank car/truck 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/trucks, it is the difference between a reference mark and the surface of the liquid. It is important to note that some significant difference exists to allow free space for content expansion in case temperature rises. This quantity in ships' tanks are normally determined by outage (ullage) gauges.

3.1.90 Oxygenate. An oxygenate is a hydrocarbon that contains an oxygen atom bonded 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 burning, more efficient fuel.

3.1.91 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 fuels. Oxygenated fuel generally has higher octane, but lower heating values than that of hydrocarbon fuels.

3.1.92 Particle Counting. A method for determining the level of dispersed particles, specifically dirt particles and water droplets in the range from 4µm (c) to 30µm (c). A cumulative channel count is collected and provided for each defined channel. Results are reported ISO Codes in accordance with ISO 4406.

3.1.93 Pipeline Batch. The quantity of a product pumped into a pipeline in one continuous operation.

3.1.94 Pipeline Tender. A quantity of product offered or designated for pipeline shipment. It may be moved in one or more batches.

3.1.95 Post, Camps, and Stations (PC&S). The Post, Camps, and Stations purchase program supports the military Services, DoD activities, and Federal agencies with fuels that are delivered by a vendor directly to the customer.

3.1.96 Pre-Award Survey (PAS). An evaluation of a prospective contractor's capability to perform a proposed contract

3.1.97 Product Code. Product codes are used by DLA Energy to identify items of supply in various computer systems. Product codes are usually a combination of 2 or 3 letters and/or numbers. DLA Energy-DQ maintains the current listing of all product codes and creates addition product codes as required. Below is a listing of the primary product codes utilized in this document as well as other applicable commonly used nomenclatures.

Product Code	Nomenclature (Specification)	NATO Code
130	Gasoline, Aviation, Grade 100 Low Lead (LL) (ASTM D 910)	F18
BDI	Diesel Fuel, Biodiesel	

DF1	Diesel Fuel, Grade 1-D S5000 (ASTM D 975)	
DF2	Diesel Fuel, Grade 2-D S5000 (ASTM D 975)	
DS1	Diesel Fuel, Grade 1-D S15 (ASTM D 975)	
DS2	Diesel Fuel, Grade 2-D S15 (ASTM D 975)	
E85	Gasoline, Automotive (ASTM D 5798)	
F76	Fuel Oil, Naval, Distillate (MIL-DTL-16884)	F76
FS4	Fuel Oil, Burner, Grade No. 4 (ASTM D396)	
FS5	Fuel Oil, Burner, Grade No. 5 (ASTM D396)	
FS6	Fuel Oil, Burner, Grade No. 6 (ASTM D396)	
JA1	Turbine Fuel, Aviation Jet A-1 (ASTM D 1655 or DEFSTAN 91-091)	F35
JAA	Turbine Fuel, Aviation Jet A (ASTM D 1655 or *NATO F24 w/FSII, CI & SDA)	F24*
JAB	Turbine Fuel Aviation, Jet B (ASTM D 6615)	
JP4	Turbine Fuel Aviation, JP-4 (MIL-DTL-5624)	F40
JP5	Turbine Fuel Aviation, JP-5 (MIL-DTL-5624)	F44
JP8	Turbine Fuel Aviation, JP-8 (MIL=DTL-83133)	F34
JTS	Turbine Fuel Aviation, Thermally Stable (MIL-DTL-25524)	
KS1	Kerosene, Grade No. 1-K (ASTM D 3699)	
MGR	Gasoline, Automotive, Leaded (ASTM D 4814)	
MUM	Gasoline, Automotive, Unleaded, Mid-Grade (ASTM D 4814)	
MUP	Gasoline, Automotive, Unleaded, Premium (ASTM D 4814)	
MUR	Gasoline, Automotive, Unleaded, Regular (ASTM D 4814)	
RP1	Propellant, Kerosene, Grade RP1 (MIL-DTL-25576)	
RP2	Propellant, Kerosene, Grade RP2 (MIL-DTL-25576)	
SIH	Inhibitor, Icing, Fuel System FSII (MIL-DTL-85470)	
TS1	Turbine Fuel Aviation, TS1 (GOST 10227)	

For a complete listing of DLA Energy Product Codes refer to the DLA Energy Commodities Handbook 4120.1 available online at http://www.dla.mil/Energy/About/Library/Publications.aspx or from DLA Energy DQ, 8725 John J. Kingman Road, STE 2843, Fort Belvoir, VA 22060-6220).

3.1.98 Product Equilibrium. When all residual movement has ceased in a storage tank after receipt of product. Ensure tank is at equilibrium for final gauging or measurement after receipt.

3.1.99 Product Quality Deficiency Report (PQDR). A PQDR is a report submitted by a customer or depot to report an off-specification product condition or an operational issue where the product is suspected of causing the problem. It is used to identify, report, and resolve conditions negatively impacting the war fighter. The PQDR process provides timely quality feedback to activities responsible for design, development, purchasing, production, supply, maintenance, contract administration, and other functions so that action can be initiated to determine cause, take corrective action, and prevent recurrence. It also integrates deficiency

analysis and resolution processes to identify root cause and prevent or mitigate recurrence within acquisition, quality, systems engineering, and overall life cycle management plans. It allows originating activities a means to obtain cost credit, replacement, and/or contractual remedy for procurement related quality deficiencies resulting from poor workmanship, nonconformance to applicable specifications, drawings, standards, processes or other technical requirements.

3.1.100 Qualified Product Database (QPD). A database that consists of the officially approved Government electronic QPL and Qualified Manufacturers List (QML), and may be accessed through ASSIST. Only Government electronic QPLs and QMLs in the QPD are the official source for qualified products and manufacturers. The link to the QPD webpage is found on ASSIST Online.

3.1.101 Qualified Product List (QPL). An electronic listing in the QPD 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. The link to the QPL webpage is found on ASSIST Online.

3.1.102 Quality. The composite of materiel attributes including performance, features and characteristics of a product, or service to satisfy a given requirement.

3.1.103 Quality Assurance (QA). A system of activities, the purpose of which is to provide to the producer and user of a product, measurement, or service the assurance that it meets the defined standards of quality with a stated level of confidence and includes quality planning and quality control. A planned and systematic pattern of all actions necessary to ensure that adequate technical requirements are established; that products, quantity accountability, and services conform to these established technical requirements; and that satisfactory performance is achieved. It includes: Quality planning during specification development and review; Quality support to contracting and acquisition teams; Quality oversight of product and service providers to assure compliance to contracts and agreements; Quality control operations for products and services incoming or in the Government supply chain; and, Quantity measurement and control activities. Contract QA (CQA) is a method the Government uses to determine if products and/or services a supplier provided fulfilled its contractual obligations and includes all actions required to ensure compliance to contractual or agreement terms and conditions. Generically the term QA refers to all processes and procedures encompassing Quality planning/development, CQA, Quality surveillance, and Quality Control.

3.1.104 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 QA and in some cases QS functions. The Military Services may use Quality Representative (QR) or other organizational titles for their personnel who perform QA and QS functions.

3.1.105 Quality Control Hold (QC Hold). A designation used for product that is of unverified quality (for example product awaiting initial or retest testing results following receipt or internal transfer or beyond its shelf-life testing per guidance identified in this document).

3.1.106 Quality Hold. A designation used for product with a verified off-specification test result and outside the Intra-Governmental Receipt Limits (IGRL) that prevents using the product for its intended purpose. If DWCF product, process a disposition request in accordance with 5.13.2 of this document.

3.1.107 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.

3.1.108 Quality Notification (QN). Quality Notifications are reports of customer/depot complaints on purchased products/services.

3.1.109 Quality Surveillance (QS). A subset of QA encompassing the program of inspections, sampling, testing, quantity measurement and control, and documentation established to monitor the quality/quantity of product being received, stored and issued within the supply chain.

3.1.110 Recertification Test Certification (RT Certificate). A limited test analysis used to verify product quality.

3.1.111 Reclamation. Procedure to restore or change the quality of an off-specification or contaminated product so it meets the specification of the original product or a lower grade product. The reclamation process, when properly applied, results in re-grading, blending, purification, or dehydration.

3.1.112 Refinery Certificate of Quality (RCQ). The RCQ is produced at the point of manufacture and is the definitive original document describing the quality of a production batch of fuel. All other testing reports done downstream of the refinery (COA, COQ, RC, RT, etc,) are used to establish traceability back to the RCQ.

3.1.113 Regrade. Re-designation of an energy commodity that fully complies with its specification requirement to another energy commodity grade for unconditional use.

3.1.114 Relative Density (Specific Gravity). The ratio of the mass of a volume of a liquid at a specific temperature to the mass of an equal volume of pure water at the same or different temperature. Both reference temperatures are explicitly stated. Common reference temperatures include 60°F, 20°C and 15°C.

3.1.115 Release Certificate (RC). The Release Certificate is an operational document issued by the operator of the site handling/transferring the product that is linked to one or more laboratory test certificates.

3.1.116 Repeatability. The difference between two test results, obtained by the same operator using the same apparatus under constant operating conditions on identical test material would, in the long term and with correct operation of the test method, exceed the values given only in one case in twenty.

3.1.117 Representative Sample. A portion extracted from a total volume that contains

the constituents in the same proportions as are present in the total volume.

3.1.118 Reproducibility. Quantitative expression of the random error associated with operators working in different laboratories, each obtaining single results on identical test material when applying the same method.

3.1.119 Requiring Installation. A military installation, organization, or facility authorized to requisition and receive material from designated distribution and storage points.

3.1.120 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 (MGO/DMA).

3.1.121 Remaining on Board. The material remaining in a vessel's cargo tanks, void spaces, and pipelines after a cargo is discharged. Remaining on board quantity may include any combination of water, oil, slops, oil residue, oil/water emulsions, and sediment.

3.1.122 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 or 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, Standard Practice for Manual Sampling of Petroleum and Petroleum Products (ASTM D4057), ISO 3170 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).

3.1.123 Sample Tag. DD Form 2927, Petroleum and Lubricants Sample Identification Tag or equivalent label used for identification of petroleum and lubricant samples.

3.1.124 Settling time. The time a product remains undisturbed or un-agitated in a storage tank to reduce the static charge of the fuel, allow product to reach equilibrium and/or to allow water/sediment to precipitate/settle from the product.

3.1.125 Service Control Point (SCP). Military Service Agency that provides technical guidance on the use of commodities (bulk or packaged), equipment and infrastructure. The three SCPs are the Army Petroleum Center (APC), the Navy Petroleum Office, and the Air Force Petroleum Office (AFPET).

3.1.126 Shall. A directive or requirement; a command.

3.1.127 Shelf Life, Type I. A definite non-extendable period of shelf life.

3.1.128 Shelf Life, Type II. An assigned shelf-life period that may be extended after successful completion of inspection, testing, or restorative action.

3.1.129 Should. Not required, but highly recommended.

3.1.130 Specification. A document prepared to support acquisition that describes essential technical requirements for material and the criteria for determining whether those requirements are met. Specifications are classified as Federal, Military, Commercial, or Voluntary Standard. Specifications are categorized as functional, design, or a performance specification. Petroleum specifications are usually a combination of functional and performance categories.

3.1.131 Specification Limits. Boundaries or parameters that define acceptable performance for a characteristic expressed as a target maximum or minimum limit, or both an upper and lower limit (range).

3.1.132 Specific Gravity. The ratio of the density of any substance to the density of some other substance taken as standard, water being the standard for liquids and solids. (Also referred to as relative density.)

3.1.133 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 product.

3.1.134 Stripping. The removal of final contents of a cargo tank, possibly using equipment additional to the vessels main cargo pumps.

3.1.135 Super-Absorbent Polymer (SAP). SAP is water absorbing polymer used in fuel filter monitors designed in accordance with Energy Institute specification. Filter monitors containing SAP are not used for fuel containing Fuel System Icing Inhibitor (FSII).

3.1.136 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.

3.1.137 Surfactant. In fuels, surface active material (or surface active agent) that could disarm (deactivate) filter separator (coalescing) elements so that free water is not removed from the fuel.

3.1.138 Synthetic Petroleum Product. Materiel not refined from petroleum sources; usually produced by chemical synthesis.

3.1.139 Tank Car (TC or RTC). Rail car specifically designed to transport product.

3.1.140 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 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.

3.1.141 T-AOE. Fast Combat Support Ships (MSC Auxiliary Vessel). Fast combat support ships provide fuel, ammunition, food and other cargo. These ships are especially valuable because of the speed and ability to carry all the essentials to replenish ships at sea.

3.1.142 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.

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

3.1.143.1 Type A Tests. Complete quality conformance specification acceptance tests.

3.1.143.2 Type B-1 Tests. Partial analysis checking for the principal characteristics most likely to be affected in the course of moving the product.

3.1.143.3 Type B-2 Tests. Partial analysis to verify stability of characteristics susceptible to deterioration due to age, environmental or storage conditions.

3.1.143.4 Type B-3 Tests. Partial analysis for contamination; in particular, for controlling the re-injection of pipeline interface products.

3.1.143.5 Type C Tests. Quick, simple, partial analysis to verify product quality and to ensure that no change has taken place. Type C tests are sometimes referred to as identification tests.

3.1.144 Thermal Stability. Thermal stability is the resistance of fuel to change caused by thermal stress (elevated temperature). The Jet Fuel Oxidation Test (IP323/ASTM D3241), often referred to as JFTOT®, is used to ensure that jet fuel has acceptable thermal stability.

3.1.145 Thief. A sampling apparatus designed so a liquid sample can be obtained from a specified point in the container.

3.1.146 Tolerance. Allowed variations within a specified Standard.

3.1.147 Transmix. A mixture of gasoline, diesel fuel and/or jet fuel resulting from various operations such as pipeline transfers, barge transfers, cross contamination of tanks.

3.1.148 Truck. As defined in DoD 4140.25-M and this Standard, can be either a tank truck, tank wagon or truck trailer.

3.1.148.1 Tank Truck (TT). A delivery truck with capacity between 4,000 to 11,000 USG (15,000 to 41,600 L), equipped with a 15-ft (5m) hose, but usually not requiring a meter.

3.1.148.2 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.

3.1.148.3 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.

3.1.148 Turbine Fuels. Turbine fuel is a mixture of hydrocarbons, broadly classified as kerosene based.

3.1.148.1 JP-8 (NATO F-34). 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). This is also referred to as dual purpose kerosene.

3.1.148.2 JP-5 (NATO F-44). A high flash point kerosene type of fuel. It is additized with CI/LI and FSII.

3.1.148.3 JP-4 (NATO F-40). A highly flammable fuel containing gasoline and kerosene fractions. This grade is maintained in select areas to aid in cold weather starting. It is additized with CI/LI, FSII, and SDA.

3.1.148.4 TS-1. A kerosene type fuel supplied in various locations in southwest Asia. Typically, this fuel has a lower flash point than JP-8. For DoD use, it is additized with CI/LI, FSII, and SDA. Use of the Russian additive package is not authorized without approval from the Service Control Point.

3.1.148.5 JP-8+100 (NATO F-37). JP-8 that has been additized with thermal stability improver additive. This additive, referred to as the +100 additive, consists of antioxidants, detergent/dispersants, metal deactivators, and solvents which increases the thermal stability of JP-8.

3.1.148.6 JPTS (Jet Propellant Thermally Stable). A jet fuel used in limited quantities for special applications in high altitude aircraft requiring a high thermal stability fuel.

3.1.148.7 Jet A w/ Additives (NATO F-24). F-24 (NATO). Jet A (ASTM D1655) with mandatory addition of CI/LI, FSII, and SDA at concentrations prescribed in accordance with MIL-DTL-83133.

3.1.148.8 Jet A w/ Additives +100 (NATO F-27). Jet A (NATO F-24) additized with the +100 additive per concentrations prescribed in MIL-DTL-83133.

3.1.148.9 Jet A (procured to ASTM D1655) and Jet A-1 (procured to DEFSTAN 91-91). Standard commercial aviation turbine engine fuels.

3.1.149 Ullage. That volume of a closed system or container which is filled with vapor.

3.1.150 Ultra-Low Sulfur Diesel (ULSD). Diesel fuel with a maximum sulfur content of 0.0015 mass percent (15 ppm by mass). (See Low Sulfur Diesel)

3.1.151 Vapor Pressure (VP). The pressure exerted by the vapor of a liquid when in equilibrium with the liquid.

3.1.152 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 tank as ready for acceptance. The scope of the testing is the minimum required to verify that the results presented by the supplier on the full specification test report in fact reflects the product being offered.

3.1.153 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.

3.1.154 Wide Area Workflow. Wide Area Workflow (WAWF) eBusiness Suite is a secure web-based system for electronic invoicing, receipt, and acceptance. The iRAPT application within WAWF allows Government vendors to submit and track invoices and receipt/acceptance documents over the web. It also allows Government personnel to process those invoices in a real-time, paperless manner.

3.2 Acronyms and Abbreviations.

A4A	Airlines for America (previously Air Transport Association (ATA))
ACS	American Chemical Society
AFPET	Air Force Petroleum Office
AGMA	American Gear Manufacturers Association
AIR Card®	Aviation Into-plane Reimbursement Card
AKI	Anti-Knock Index
AO	Anti-Oxidant additive
AMPS	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	Basic Sediment and Water
BTU	British Thermal Unit
CCAI	Calculated Carbon Aromaticity Index
CCMD	Combatant Command
CID	Commercial Item Descriptions
CI/LI	Corrosion Inhibitor /Lubricity Improver
CTP	Custody Transfer Point
CoA	Certificate of Analysis
COCO	Contractor-Owned, Contractor-Operated
CONUS	Continental United States
COQ	Certificate of Quality
CU	Conductivity Unit
DCMA	Defense Contract Management Agency
DFARS	Defense Federal Acquisition Regulations Supplement
DFSP	Defense Fuel Support Point
DLA	Defense Logistics Agency
DMA	Distillate Marine A
DMF	Distillate Marine Fuel

DoD	Department of Defense
DPK	Dual Purpose Kerosene
DRA	Drag Reducer Additive
DWCF	Defense Working Capital Fund
EA	Executive Agency
EBS	Enterprise Business System
EI	Energy Institute
ETR	Ellipsometric Tube Rater (Ellipsometer)
FAME	Fatty Acid Methyl Ester
FAR	Federal Acquisition Regulations
FLC	Fleet Logistic Centers
FOB	Free on Board
FPCON	Force Protection Condition
FSC	Federal Supply Class
FSII	Fuel System Icing Inhibitor
GOCO	Government-Owned, Contractor-Operated
GOGO	Government-Owned, Government-Operated
HFRR	High Frequency Reciprocating Rig
IAW	In Accordance With
IFO	Intermediate Fuel Oil
ISO	International Organization for Standardization
ITR	Interferometric Tube Rater
IGRL	Intra-Governmental Receipt Limits
JIG	Joint Inspection Group
JP	Jet Propellant
JPO	Joint Petroleum Office
JPTS	Jet Propulsion, Thermally Stable
LSD	Low Sulfur Diesel
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
MSEP	Micro-Separometer (Sometimes referred to as WSIM)
MUM	Motor Unleaded, Mid-grade gasoline
MUP	Motor Unleaded, Premium gasoline
MUR	Motor Unleaded, Regular gasoline
OBQ	On-Board Quantity
OCONUS	Outside the Continental United States
NATO	North Atlantic Treaty Organization
NAVSUP	Naval Supply Systems Command
NGS	Non-Government Standards
nm	Nanometer (nm equals 10^{-9} meter)
NSN	National Stock Number
PAS	Pre-Award Survey
POL	Petroleum, Oils and Lubricants
PORTS	Paperless Ordering & Receipt Transaction Screen
PQDR	Product Quality Deficiency Report

ppm	Parts Per Million
psi	Pounds per Square Inch
PC&S	Posts, Camps and Stations
QAR	Quality Assurance Representative
QC Hold	Quality Control Hold
QCP	Quality Control Plan
QPD	Qualified Products Database
QPL	Qualified Products List
QR	Quality Representative
QS	Quality Surveillance
RC	Release Certificate
RCQ	Refinery Certificate of Quality
RT	Recertification Test Certificate
RME	Marine Residual Fuel Oil, such as RME-180
SAP	Super Absorbent Polymer
SCP	Service Control Point
SDA	Static Dissipater Additive
SLBOCLE	Scuffing Load Ball-On-Cylinder Lubricity Evaluator
STANAG	Standardization Agreement (NATO document)
TEL	Tetraethyl lead
ULSD	Ultra Low Sulfur Diesel
USG	U.S. Gallons
VP	Vapor Pressure
VOL %	Volume Percentage
VTR	Visual Tube Rater
WAWF	Wide Area Workflow

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 involved with handling fuels and lubricants, as well as the applicable safety, environmental and operating procedures.

4.2 Service/Contractor Responsibilities. The custodial Service/Contracted activity shall maintain quality and quantity of Defense Working Capital Fund (DWCF) products while in their possession (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 in accordance with this Standard for DWCF 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 of product to end-item issue. Quality problems involving DWCF product (e.g., off-spec product, downgrading of product, etc.) shall be addressed as outlined in this Standard. Appropriate 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), ISO 3170 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 Representative Sample. The precautions required to ensure representative sampling are many and depend on environmental conditions, the 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 responsibilities of the various activities outside the continental United States to submit 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 a product taken which represents that entire batch or delivery or a specific spot within a tank or container. The various types of samples are as follows:

4.2.1.4.1 All level Sample. A sample obtained by submerging a stoppered beaker or bottle to the bottom of the outlet suction level but always above free water, then opening the sampler and raising it at a uniform rate such that it is between 70 percent and 85 percent full when withdrawn from the product.

4.2.1.4.2 Spot Sample. A sample taken at a specific location in a tank, container or from a flowing stream in a pipe at a specific time.

4.2.1.4.3 Upper Sample. A spot sample taken from the middle point of the upper third of the tank contents.

4.2.1.4.4 Middle Sample. A spot sample taken from the middle tank's contents (a distance of one-half of depth of liquid below the liquid's surface).

4.2.1.4.5 Lower Sample. A spot sample taken at the middle point of the lower third of the tank contents.

4.2.1.4.6 Top Sample. A spot sample taken within six inches below the top surface of the tank contents.

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

4.2.1.4.8 Drain Sample. A sample taken from the draw-off or discharge valve.

4.2.1.4.9 Bottom Sample. A sample 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.

4.2.1.4.10 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.

4.2.1.4.11 Single Tank Composite Sample. A blend of the upper, middle, and lower spot 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 procedures (references in paragraph 4.2.1 contain specifics).

4.2.1.4.12 Conveyance Volumetric Composite Sample. A blend of individual all-level or spot samples from each compartment of the ship, barge, or carrier that contains the same grade of product proportional to the volume of product in each compartment.

4.2.1.4.13 Outlet (Suction) Sample. A sample taken at the level of the tank outlet.

4.2.1.4.14 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.

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

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

4.2.1.5 Taking of Samples. A sample log shall be maintained for all samples taken (See 4.2.1.5.2 for sample log requirements).

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 fuel sample containers used for samples taken for thermal stability, MSEP, electrical conductivity, lubricity, trace metals, copper corrosion, or particulates 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 three times 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 bottles are acceptable. If clear glass containers are used, then they shall be prepared (e.g., wrapped in aluminum foil immediately after sampling) to prevent light exposure. Sufficient liquid product shall be in 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, samples shall not be taken through storage tank clean-out lines, manifolds, water draw-offs, bleeder valves, or hose nozzles. Such samples are not likely 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. When sampling from Afloat DFSPs and access to a representative sample cannot be obtained through a manhole or sampling hatch, tanks may be sampled through a sounding tube. In these cases, ensure all foreign matter is cleaned/flushed from the sounding tube to prevent entry of contaminants that are not representative of the tank's content.

d. Containers such as drums shall be sampled with a thief. When 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. For sampling collapsible bladders, obtain an in-line sample from a sampling port that is located on an attached hose, filter separator or pump. Before obtaining the sample, ensure the fuel in the attached hoses, strainers and pumps is displaced by rotating or flushing twice the capacity of product through the hoses leading up to the sampling point.

f. 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.

g. 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 that at minimum shall contain the following information. This information shall be annotated at the time of sampling, regardless of test results.

a. Sample number

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

c. Type of 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. Amount of product the sample represents

j. Type of tests requested to be performed by the laboratory

k. Date sample sent to the laboratory

l. Date results received back from the laboratory

m. Laboratory Report number (when a test report is generated)

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

4.2.1.6 Sampling Precautions.

a. Samples shall be well protected from contamination and exposure to direct sunlight. Some 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. Direct sunlight also causes Thermal Oxidation Stability degradation in aviation fuel. If clear glass bottles are the only containers available for sampling a product that is sensitive to sunlight exposure, cover the bottles 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, necessary precautions shall be taken to ensure samples are representative of the product and satisfactory for vapor pressure tests (see ASTM D4057). Whenever practicable, liquid fuel samples should be maintained at a temperature between minus 1°C and 4°C (30°F and 40°F). This helps preserve product characteristics from the point of sampling to the laboratory.

c. If the API gravity 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 prepare a composite of these samples for additional testing. If the API gravity variation is not within reproducibility limits, test each sample 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 (1USG) total size.

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 20L (5 USG) unless otherwise directed.

4.2.1.7.3 Jet Fuel. Samples of jet fuel requiring full specification testing shall be 8L (2 USG), 4L (1 USG) of which will be used for the filtration time/particulate contamination test.

4.2.1.7.4 E85 Sample. When required, submit a 4L (1 USG) sample for specification conformance testing, to include ethanol content.

4.2.1.7.5 BDI Sample. When required, submit a 4L (1 USG) sample for specification conformance testing.

4.2.1.8 Identification of Samples. Following sampling, each sample container shall be identified by securely attaching a DD Form 2927, Petroleum and Lubricants Sample Identification Tag, or other equivalent approved tag. Information on the tag shall include:

a. Organizational name or location of the facility at which the sample is taken.

b. Name of individual(s) taking the sample.

c. Grade of material.

d. Amount and unit of measure (gallons, liters, barrel, etc.) of product the sample represents.

e. Specification of material, when known.

f. Storage tank number or sample source and location.

g. Date sample was taken.

h. Type of sample.

i. Reason for sample.

j. 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.

k. Sample number if submitting to an off-site or different lab for analysis. Processing lab shall include the submitting lab's sample number on their report(s).

4.2.1.8.1 Sample Serial Numbers. Each sample shall be assigned a serial number that allows for the sample to be uniquely identified. The unique sample ID number shall include reference to the calendar year for historical purposes.

4.2.1.8.2 Retained Samples. Unless otherwise specifically stated in this document or by contract, samples shall be retained for 45 days for reference purposes. Tank Truck and Rail Car samples shall 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 shall be maintained by the sample owner until sample disposal. Federal Express and/or UPS documentation shall 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 Sampling and Gauging JPTS Cargo Tanks or Vessels. Gauging, sampling, and measuring water content of JPTS compartments should not be conducted at terminals unless it is discharged at the 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. All cleaning of equipment shall be in accordance with Section 4.2.1.5.1.b. A note shall be placed on the DD Form 250, DD Form 250-1, equivalent WAWF ERR, 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 witness sampling/gauging of all compartments loaded at previous ports. In the case of JPTS, this procedure can present a contamination problem, because JPTS requires special handling due to it being easily contaminated. JPTS is usually the first loaded in a multi-product/multi-port lifting and often the last discharged.

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

Utilizing appropriate testing procedures helps ensure quality surveillance is 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 methods 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. Intra-Governmental Receipt Limits (IGRLs) 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's repeatability limit, the results may be averaged to determine compliance with the specification or established IGRL.

4.2.2.2.1 Testing Rounding Protocol. Test results shall be reported to the same degree of accuracy as stated in the applicable product specification. The instructions for reporting results (including accuracy) should be included in the governing test method standard. These requirements may be superseded by the requirement within the product specification document.

a. Test characteristics shall be reported in accordance with the rounding protocol as cited in the product specification. The only exception to Section 4.2.2.2.1 of this document is the determination of the flash point required by the F-76 and JP-5 specifications. For these products the flash point value is an absolute limit as defined in ASTM Practice E29, for using significant digits in test data to determine conformance with specifications.

b. For quality surveillance oversight of DLA Energy capitalized product, this rounding protocol must 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 evaluating product deterioration.

4.2.2.3.1 Records of Long-Term Storage Testing. Complete test records for a specific tank containing product in long-term storage shall be maintained to provide a basis for evaluating product deterioration. Whenever consecutive results indicate possible deterioration, testing frequency shall be increased. Once the trend reflects measurable deterioration, the reporting procedures in Section 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.

4.2.2.3.2 Quality Control Hold (QC Hold). Any tank past the minimum test

frequency date shall be placed on QC hold until samples and acceptable test results are received back from the laboratory. Any tank found to be deteriorating per Section 4.2.2.3.2 above or off-specification shall be reported as required by Section 5.13.2 of this document.

4.2.2.4 Minimum Testing. Table IX outlines the minimum sampling and testing requirements considered necessary for determining/maintaining 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 XXII provide 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 occur during product handling or storage. Tables X through XXII designates 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 Section 5.13.2 (Disposition Instructions) shall be initiated.

4.2.2.5.1 Equivalent Tests. 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 to or better than what the ASTM method calls for; and the device has been approved for use by the military Services. The following link provides information on equivalent IP/ISO test methods: https://www.energyinst.org/technical/test-methods.

4.2.2.6 Testing Capabilities. All terminals (commercial and military) receiving bulk products shall be equipped for and capable of performing tests required by Table IX. When the capability does not exist at the terminal or facility, other authorized commercial or military laboratories 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 ensure that calibration of testing and measuring equipment is up to date and meets accuracy tolerance necessary to ensure the equipment is within allowable limits. ISO 10012 shall be used.

4.3 Specifications. Each 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. Specification limits cited in this Standard are for Government-owned product use, not for procurement. Consult the applicable solicitation and/or contract for procurement specification requirements.

4.4 Change in Grade of Fuel. Any change in grade of DWCF fuel requires notification to DLA Energy, and SCP when required, prior to the change.

4.4.1 When product is off-specification, DLA Energy Quality Operations Division shall be notified in accordance with Section 5.13.2 of this Standard. DLA Energy Quality Operations Division performs internal coordination with Inventory Management Division (DLA Energy FENA), Program Budget Division (DLA Energy RB) and Inventory and Distribution Division (DLA Energy BI) within DLA Energy. In addition, dispositions shall

require coordination with the respective Service Control Point (SCP). Disposition instructions are provided by DLA Energy Quality Operations Division.

4.4.2 When changes in grade are requested for reasons such as product availability, fuel no longer needed, etc., the activity having physical possession of DWCF fuel shall request concurrence through the appropriate DLA Energy Regional Office and DLA Energy FENA. DLA Energy FENA shall coordinate with DLA Energy Quality Operations Division and determine the inventory impact with DLA Energy BI FENB before making a decision on acceptance. For USAF locations, AFPET requires notification of any product grade change or disposition prior to coordination with DLA Energy.

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 shall 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 also 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 procedures for calculating the net quantities from the gross measurements, and 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.

4.9 First-In, First-Out. DFSPs should maintain a first-in, first-out policy for receiving, storing, and issuing fuel. If possible, terminal management should incorporate procedures to issue product on this basis, withdrawing two-thirds of a tank's content before refilling. The tank heel should be kept as small as possible to maintain batch integrity. These procedures should also limit the number of tanks that products are received into by coordinating orders placed for replenishment. Requests for exceptions to the first-in, first-out policy shall be directed to DLA Energy Quality Operations Division.

5. DETAILED REQUIREMENTS

5.1 Waterborne (Marine Transport) Operations. This section applies to all movements of product belonging to or destined for acceptance by the Government.

5.1.1 Shipments by Tankers. This section covers pre-loading and loading procedures for tankers (does not apply to T-AO, T-AOE or T-AKE in dedicated product service unless special circumstances warrant use of such procedures to verify a vessel is suitable to load a capitalized product).

5.1.1.1 MPMS Guidelines. QARs shall 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 Certifying Statements[1]. Statements of quantity and quality shall accompany all shipments. The DD Form 250-1/Receiving Report or WAWF ERR 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.

5.1.1.3 Tanker and Ocean-Going Barge Inspection Policy for Vessels. The following applies to vessel cleaning, gas freeing, inspecting, and quantity variations. Table XXIV shall be used as guidance by QARs for the inspection of vessels.

5.1.1.3.1 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 require cleaning shall be developed by tanker owners/operators for each vessel. Copies of the DD Form 250-1/Receiving Report and test reports shall be forwarded to vessels by the loading quality representative should early departure preclude obtaining a copy upon loading completion.

5.1.1.3.2 Required Cargo Cleaning. DoD vessel cargo tanks shall be cleaned in accordance with Table XXIV (tankers) and XXV (barges) whenever the following conditions exist (exceptions to these requirements shall be coordinated with a Government Representative prior to the proposed cargo loading):

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

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

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

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

d. The cargo to be loaded is JP-5 or JP-8/F-24/Jet A/Jet A-1 and the previous cargo was F76.

e. The initial loading of a charter vessel.

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 previous cargo was MOGAS.

5.1.1.3.3 Internal Tank Inspection Requirements. QARs shall inspect vessels that are loading their first DoD cargo under any Military Sealift Command (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 shall 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 may request the inspection be performed at the repair facility or prior to arrival at the next load port. MSC 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 Quality Operations Division. 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.

5.1.1.3.4 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 quality representative with soundings (ullage or innage) of product/water onboard and validated onboard quantities (OBQ) prior to loading.

5.1.1.3.5 In-Transit Quantity Variances. Investigations shall be conducted by a MSC representative and DLA Energy Quality Operations Division 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.

5.1.1.3.6 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 is suspected or identified. A representative sample taken at the custody transfer point shall be used to determine source of contamination.

5.1.1.4 Pre-Loading Inspection of Tankers. The following actions shall be taken prior to approving tankers for loading:

5.1.1.4.1 Vessel Inspection.

a. When a vessel internal cargo tank inspection is required, the QAR shall assure

vessel conditioning has been performed in accordance with Table XXIV (tanker) or XXV (barge). Before entering any 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 been properly cleaned and/or stripped. The QAR shall validate that the vessel certification is written on the Notice of Readiness, as required in Section 5.1.1.3.4. The QAR shall validate that the liquid measurements are reflected on the OBQ arrival certificate. The QAR shall randomly validate the water content in select cargo tanks by witnessing their water cuts on the gauge tape.

5.1.1.4.2 Vessel Tank Inspection. When requested to perform an inspection, the 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 crew. All seal numbers shall be recorded on the shipping documents. All applicable cargo valves shall be in the open position prior to physically entering the cargo tanks. If the vessel is equipped with a flue-gas type inert gas system (IGS), the QAR shall review the vessel's Inert Gas System Operation and Equipment Manual to validate it is functioning properly and has been maintained as required.

a. All cargo tanks containing liquids shall be gauged and sampled, and samples shall be retained. When cargo tanks contain on-board quantity (OBQ) from a previous cargo or parcel, the previously loaded product shall be gauged, sampled and tested to the extent deemed necessary by the shore quality Government Representative for conformance to the applicable specification prior to topping off or until discharge at the final destination. Cargo tanks containing OBQ, but not being topped off (if any) shall be gauged and sampled[2]. These samples shall be held in the event loading difficulties result in commingling of products.

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

c. 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.

d. Coils containing yellow metals (copper, bronze, etc.) shall not be 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 Quality Operations Division. 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 aviation fuel, kerosene, non-aromatic solvent, unleaded gasoline, or arctic diesel (See

[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.***

Table XXIV [tanker] or XXV [barge]). Prior to loading JPTS, tank cleaning requirements are: tanks shall be machine washed with hot water, if cleaning chemical and/or salt water is used, the final Table XXIV [tanker] or XXV [barge]).). Prior to loading JPTS, tank cleaning requirements are: tanks shall 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 shall be completely free of sediment, scale and other contaminants. Tanks shall be dry and all liquids completely removed from the connected piping after cleaning. The tanks and lines shall be flushed with fresh water and then drained dry. The loading and unloading system shall be completely isolated. This shall be accomplished by completely separate piping systems or by use of blinds. Valves shall not be relied on to effect isolation. Common lines shall not 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 shall have its own individual vent. If the ship has a common vent system, tanks used for JPTS shall be isolated from balance of the vent system.

5.1.1.4.3 Vessel Tank/Internal Rust Test. When considered necessary and where safety precautions permit, the QAR shall require that rust samples 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, the product shall be filtered free of rust and tested for color, corrosion and residue.

5.1.1.4.4 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 to prevent misuse. Initial and normal pumping rates shall be agreed upon before starting.

5.1.1.4.4.1 If differences cannot be resolved locally, they shall be escalated through the proper chain of command. Prior to loading, all water shall be removed from the vessel pipelines and cargo tanks.

5.1.1.4.5 Multi-Port Inspection. When a vessel is scheduled for a multi-port loading, the inspector at the first loading point shall, if practical, inspect 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.

5.1.1.4.6 Quality and Quantity Determination. Vessel movements shall not be expedited at the expense of quality and quantity determinations, regardless of pressure or protests. Full support shall be given to the QAR for reasonable actions taken to assure quality and quantity requirements are met.

5.1.1.4.7 Vessel Rejection/Delay. For MSC controlled vessels, DLA Energy Quality Operations Division must be notified immediately to discuss the reason for rejection and/or need for re-cleaning. The QAR shall follow up the DLA Energy Quality Operations Division notification with a report to the cognizant DLA Energy Region, DLA Energy BI FENB, and MSC on vessel rejection or delays in loading operations. The notification shall contain pertinent details, including length of delay anticipated for tank cleaning and product availability. For CONUS locations, telephone MSC Norfolk, Cargo Fuel Coordinator at 757-443-1473 or CLF MSC CLF Load Manager/GSC-N46 at 757-443-1478 (FAX: 757-443-1506). For locations outside CONUS, a priority message shall be dispatched to MSC Norfolk 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/Receiving Report or WAWF ERR with supporting documentation included. Contract documentation, to include DD Form 250-1/Receiving Report, for these cargoes shall be kept for 6 ½ years from date of completion in accordance with the FAR.

5.1.1.5 Pre-Loading Procedures (Shore/Tanker). The Quality Representative shall:

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

b. Check loading lines to determine that 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. Ensure 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 vessel Master (or designated representative) shall concur on the cargo layout and loading plan.

f. Inspect (to include checking the vessel's log on the nature of previous cargoes and the vessel's condition (e.g., leaks, previous rejections, and excessive delays)) and approve or reject the vessel cargo tanks.

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

5.1.1.6 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 vessel cargo tank(s). When product reaches three feet in the vessel tank(s) or when line fill has been displaced, the QAR or government representative shall request the ship's officer switch tanks and continue loading at a reduced rate. A sample shall be drawn (after a 30-minute wait) from the first tank(s) and tested to determine if the quality of the product being loaded is satisfactory (See Table IX). Further sampling and testing may 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:

5.1.1.6.1 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 DD Form 250-1 or WAWF ERR. A description of the degree of segregation that was maintained during the operation shall also be recorded.

5.1.1.6.2 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(s) after the discharge outlet is covered by the specified three feet of product, the reduced loading rate shall be continued until turbulence ceases.

5.1.1.6.3 Thirty Minute Wait. In order to dissipate static charges built up during the fuel movement, product and water measurements, 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 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.

5.1.2.1 Pre-Loading and Loading Inspection. The precautions and procedures outlined in Sections 5.1.1.4, 5.1.1.5, and 5.1.1.6 are applicable to barges and refueling craft to the extent possible, except that rust samples shall be taken only if the last cargo carried indicates this action is necessary and can be taken under safe conditions.

5.1.2.2 Product Conversions. Table XXV 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 tank 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 vessel Master (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 shall 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 target more or less than the original ordered quantity.

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

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).

5.1.2.4 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.

5.1.3 Shore Side Receipt of Fuel. Before commencing fuel receipts, vessel personnel shall assure that the shore-side is ready for discharge by verifying that product in the tank slated to receive the vessel discharge meets specification and grade requirements. The terminal shall be aware of the time of the vessel's arrival. Shore-side personnel shall assure line condition is full and properly isolated in accordance with MPMS. Free water shall be drained from the receipt tank through the water draw off line. Shore tanks shall then be gauged and temperatures determined in accordance with the MPMS. Shore-side personnel shall determine net quantity before discharge. If necessary, line samples shall be

taken 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 meet quantity and quality requirements.

5.1.3.1 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 disposition instructions have been received in accordance with this Standard (see Section 5.13.2). Personnel shall verify that seal numbers as compared to the DD Form 250-1/Receiving Report or WAWF ERR 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 or more 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 gauging shall be accomplished. QAR or government representative should monitor all-level tank sampling and testing as stipulated in Table IX. The remainder of the composite sample shall be retained until discharge is complete and the shore tank sample is tested. Product is normally discharged when laboratory tests indicate conformance to product specifications.

5.1.3.2 Contaminated Product. If product contamination is suspected, sample barge(s) prior to offload and submit sample to a laboratory for a minimum of B-3 series analysis. If testing facilities are not readily available, notify DLA Energy Quality Operations Division (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 ashore, or possibility of product remaining on vessel for disposition at another facility). Prompt action shall be taken to reduce vessel lay time costs. Requests for disposition shall include the following information for all vessel cargo and bunker tanks: volumes in each vessel tank, max fill for each vessel. The projected shore receiving activity shall provide information on current volume in all product tanks and maximum fill for each tank.

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

5.1.3.4 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/Receiving Report or WAWF ERR, and gather any other applicable documents to include ullage sheets, bunker reports, etc. Any discharging delays and/or investigation results shall be reported on the DD Form 250-1

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 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. 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 variations, as cited in DoD 4140.25-M, shall be recorded by the destination Government Representative on the DD Form 250-1 indicating the cause of the variation to the extent possible. The destination Government Representative's remarks concerning the variation shall be confined to observations and evaluations made at the receiving terminal. Tank gauge readings, line capacities and vessel ullages shall be checked as necessary in attempting to account for the loss or gain (DoDM 4140.25 along with paragraph 5.1.1.3.5 of this document establishes variation criteria). If the excessive variation 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 Representative at each intermediate discharge point (if any) to determine possible reasons. Each Government Representative queried shall advise the final destination of their findings within 15 calendar days. The final destination Government Representative shall consolidate the data and forward it to the accountable property officer. Corrected DD Forms 250- 1 or WAWF ERRs shall be initiated and distributed as appropriate.

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

5.1.3.5 Vessel Delay. For MSC-controlled vessels, report to the cognizant DLA Energy Region, DLA Energy BI FENB and MSC on delays in discharge operations, with pertinent details, including length of delay anticipated. For CONUS locations, telephone MSC Norfolk, Cargo Fuel Coordinator at 757-443-1476 or CLF MSCCLF Load Manager/GSC-N46 at 757- 443-1478. All calls shall be confirmed by message to Commanding Officer, MSC Norfolk 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.

5.1.4 Post-Loading - Tankers and Barges. This section covers post-loading of tankers and barges.

5.1.4.1 Vessel Samples. A Government Representative shall witness sampling of vessel cargo tanks. Time permitting, the Government Representative shall monitor cargo tank gauging and temperature determination, and water cuts. If possible, water shall be stripped ashore before the tanker is released. The Government Representative shall maintain surveillance of the stripping operation. Failing this, advise the Master to strip water out of the cargo tanks into slop tanks. Report fuel loss during stripping operation.

5.1.4.2 Determination of Quantity. The Government Representative shall witness shore tank gauging (opening and closing). The Government Representative shall

independently determine shore and vessel net quantities, and ship/shore variations. If a ship/shore variation is determined, the Government Representative shall re-compute to confirm the calculations and conduct an investigation if the variation is outside the allowed variance (see 5.1.1.3.5 for tolerances).

5.1.4.3 Inspection Documents Covering Tanker and Barge Loading[3]. The Government Representative shall assure completion of required inspection documents, including a DD Form 250-1/Receiving Report or WAWF ERR, Tanker/Barge Loading Report, Continuation Sheet, ullage or innage report, laboratory test results sheets, and other documents, as required. Ensure documentation notes the type and quantity of product in the tank before start of loading (OBQ), if applicable. If the product is loaded from more than one tank, list the test results applicable to each tank in separate columns headed by the tank number. The date the product in each tank was approved and the quantity loaded from each tank shall be indicated in the appropriate column. The QAR may require additional testing if the situation 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 shall strip water from the tank just prior to the transfer to assure water and sediment is not transferred. Line samples shall be taken and checked for appearance every 30 minutes during the transfer by the receiving vessel.

5.2 Pipeline operations.

5.2.1 Shipments by Pipelines. This section applies to all pipeline movements of product belonging to or to be accepted by the Government. It does not apply to movements of fungible 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 Table IX series before entry and after discharge from a pipeline. For pipelines carrying aviation turbine fuels 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. MIL-STD-161 may be used for guidance on color, marking and titles.

[3] ***Note: It is recommended that laboratory tests reports be attached separately vice transcribing results onto the DD 250- 1***

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. Single product pipelines shall be used whenever possible. 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 cut off.

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 here in their order of precedence:

a. Turbulent flow without batching plug (mechanical or hydrocarbon) between products.

b. Compatible Hydrocarbon batching plug (between products or grades).

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

d. Disposal of Water-Mixed Product. Provisions 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 that create large quantities of scale, sediment, and water called pig clouds. Isolation of these pig clouds is required 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. Other options include (in order of precedence), containment in a small tank or in 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 minimizes the possibilities of pipeline contamination.

5.2.1.6.4 Intra-Terminal Transfers. Intra-terminal transfers should be minimized to preclude potential contamination or spills. Where high level or high-high level alarms do not have manual inspection and test procedures, terminals shall request installation of such

hardware. Spill prevention control manuals shall be updated to incorporate a non-product transfer procedure for inspection and testing of the high level or high-high level alarms.

5.2.1.6.5 Minimize Mixing High and Low Sulfur F-76. The current F-76 specification has a 0.0015 mass percent maximum for sulfur while some F-76 in storage contains up to 0.5 mass percent sulfur. As a means of consuming high sulfur F-76, mixing of newly procured ultra-low sulfur F-76 with older stocks shall be minimized. Depot management shall establish a rotation plan as a means of reducing the total sulfur content of the F-76 stocks.

5.2.1.7 Cross-Country System.

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

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. In order to maintain the quality of liquid fuels, it is preferable to utilize separate pipelines, valves, and pumps for each type and grade of fuel.

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

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

5.2.1.9 Segregation. The segregation of product in military and or commercial multi-product pipelines is accomplished by maintaining turbulent flow or 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 due to factors including 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 XXVI. 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, F-24, JPTS, or aviation gasoline (all grades).

5.2.1.10 Corrosion Control. Fuel transported by pipeline is subject to contamination by rust, sediment (particulate), water, and surfactants. Periodic checks shall be made to determine the extent of internal deterioration of the pipelines in accordance with pipeline operational manuals.

5.2.1.10.1 Determination of Sediment (Particulate). An increase in sediments 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 or by introduction of fuel with better solvency. The amount of particulate may be determined by ASTM D2276, D5452, D6217, D7619, IP 564, IP 565 or IP 577, as applicable. Particulate content of product samples taken at the shipping and receiving points or at periodic intervals at the receiving point 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 and increases engine life in ground vehicles. All Military Specification aviation turbine fuel normally contains a corrosion inhibitor supplied by the manufacturer. 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 5.2.1.12. To ensure proper protection, the corrosion inhibitor's effectiveness shall be checked at various points along the line. This can be accomplished by a 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. 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 a corrosion inhibitor/lubricity improver is added, only those lubricity improvers listed in the current Qualified Products List (QPL-25017) for MIL-PRF-25017, and those approved for that product shall be permitted. Care shall be taken to ensure the approved concentration in the product is not exceeded. Excessive lubricity improver concentrations will lower the water separation rating. Only lubricity improvers listed in STANAG 3390 are approved for use in the NATO pipeline system. EI 1535, minimum criteria to determine acceptability of additives for use in multi-product pipelines co-transporting jet fuel, contains guidance on which fuel additives are typically transported via pipeline.

5.2.1.10.3.1 Location. Information on approved corrosion inhibitors can be found at the ASSIST Quick Search page, http://quicksearch.dla.mil, by searching by document Number, choosing Document ID for the appropriate revision, and clicking the media icon.

5.2.1.10.3.2 Metal Deactivator Additive (MDA). MDA shall not be added to aviation turbine fuel purchased for use by the Services unless it is approved in writing by the procuring activity and user. Consult the applicable product specification for details on the approved additives and dosing rates. It should be noted that some commercial aviation turbine fuel specifications do not require customer approval for adding MDA; however, they do require that the addition MDA and subsequent testing be documented on the

Certificate of Quality (COQ).

5.2.1.11 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. Evidence of a drop in pressure shall be brought to the attention of the responsible chain of command.

5.2.1.12 Drag Reducer Additive (DRA). DRAs are prohibited in military specification fuels (includes aviation turbine, naval distillate fuel (F76)). If the presence of DRA is suspected, DRA concentration by ASTM D7872 is to be determined. DRA concentration shall be no higher than 72 µg/L. Typically, 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 hours before and resumed two hours after the expected Government fuel batch has passed the injection point. In most cases, this will preclude the inadvertent inclusion of DRA into the Government fuel and should exclude the DRA in any transmix. If the two-hour criteria in impractical, the pipeline must adjust the injection accordingly to prevent DRA in the product destined for Government acceptance.

5.2.1.13 Pipeline Surveillance Procedures. Personnel shall.

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, API gravity, and color determinations.

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

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).

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. Free water shall be drained from the receipt tank through the water draw off line. 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 the contract or operating agreement (e.g., heart, mid-point, etc.) See Table XXVI. If line samples are being taken during receipt, personnel shall assure that each sample is properly taken and appropriately labeled. 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 fuel, water, and temperatures; and calculating net quantity received in accordance with API MPMS. Personnel shall investigate any quantity discrepancy in excess of that cited in DoD 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, or WAWF ERR, 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 tank truck or tank car shall be processed for a change in grade in accordance with Table XXIII of this Standard.

5.3.1.2 Tank Truck and Tank Car loading.

5.3.1.2.1 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.

5.3.1.2.2 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. *For terminals loading from fungible jet fuel stocks, the procedures used to confirm quality for all customers are acceptable when terminal is in compliance with defined standards as identified in the note under paragraph 5.3.1.2.6.1.

5.3.1.2.3 Procedures at the Loading Rack. Upon arrival at the loading rack, trucks and tank cars shall be inspected for safety discrepancies 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. *For terminals loading from fungible jet fuel stocks, the procedures used to confirm quality for all customers are acceptable when terminal is in compliance with defined standards as identified in the note under Section 5.3.1.2.6.1.

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

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

5.3.1.2.6 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. If being used, truck hoses and pumps shall be checked to assure they are clean and dry. See Table XXIII for product specific cleaning requirements.

5.3.1.2.6.1 F-24/Jet A/Jet A-1. With the conversion to F-24 (JET A with additives)/Jet A-1 (regraded to JP-8 after addition of additives), more load locations do not or will not inspect trucks. Therefore, it is desired that all trucks hauling Jet A/Jet A-1 for DLA be dedicated to jet service. Where this cannot be accomplished, the company/driver must have available documentation on the last product carried from documents required by DOT to be on the truck between a delivery and the next load. Additionally, if required, documentation must be available to show the Government inspector who has responsibility over the facility that conversion requirements in Table XXIII were met. Note: At locations where fungible jet fuel stocks are cited, API Recommended Practice 1595, EI/JIG 1530, or JIG 2/3 compliance is required.

5.3.1.2.7 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 (6) 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.

5.3.1.2.8 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 on delivery documents and retained for one (1) year. Injection rate shall be recorded on the bill of lading. Retained samples of the tank truck/car loading shall be held by the loading facility until product has been received and tested by the using facility.

5.3.1.2.8.1 Additive Documentation. Additive concentrations or volume of an additive injected shall be identified on the quality certificate (RCQ, COA/Q, etc.) or bill of lading. For aviation turbine fuel, documentation shall list the three required additives, FSII, CI/LI, and SDA, in addition to MDA (if applicable). If no additive is in the fuel, then the concentration shall be listed as zero (0). Documenting additive quantities is essential to

traceability and tracking of the minimum and maximum quantities authorized by the applicable product specification.

5.3.1.2.9 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. Seal numbers and the API gravity at 60°F or density at 15°C shall be noted on shipping documents. Sealing of tank trucks is not normally required for quality purposes within CONUS, but may be utilized due to an increase in the Force Protection Condition level or if required by contract, agreement or by other entity. If an FPCON level increase drives a requirement to implement the use of seals, contact the applicable DLA Energy Region for assistance.

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

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 tank truck or tank car receipt of fuel, receiving 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; if not, line condition shall also be checked for quality. Free water shall be drained from the receipt tank through the water draw off line. Receipt tank(s) shall then be gauged, measuring fuel, water, and temperatures, and calculating net quantity received in accordance with API 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. Receiving 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 appropriate for use. Seals, when placed on the tank truck/car, shall be checked to assure they are intact and correspond to the numbers on the shipping manifest/DD Form 250/WAWF ERR, or equivalent form. Afterward, personnel shall break seals, sample and test each compartment in accordance with Table IX. Shipment shall 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 must 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 quantity is satisfactory. Demurrage charges and tampering or missing seals, if any, shall be referred to the cognizant DLA Energy Region.

b. If water is present, it shall be drawn off prior to unloading. Fuels that have a

cloudy appearance or an unusual color shall not be accepted until laboratory tests indicate they are suitable for use. Cloudy or unusual color shall be reported to DLA Energy Quality Operations Division and the applicable Service Control Point.

c. At receipt terminals, personnel shall compare the measured density of the received product at 15°C or API Gravity at 60°F, with the density at 15°C or API Gravity at 60°F reported on the DD Form 250, WAWF ERR or equivalent form. Both shall agree within ± 2 kg/m^3 or 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. Prior to rejection, a receiving organization shall first notify the origin shipping point and quality representative, identifying the product, tank truck/car number, and reason for rejection of the product. Activities shall notify their Service Control Point as soon as possible after rejection. For Service owned product (non-capitalized), submit a PQDR through the SCP to DLA Energy Quality Operations. For capitalized product, submit a customer/depot complaint via DLA Energy Disposition Form through the SCP to DLA Energy Quality Operations.

5.3.2.4 After Discharge. Personnel shall examine truck or tank car to determine whether all product has been discharged into receipt tanks. Installation of a VISI-Flow gauge on the receipt system is another method that may be used to determine when discharge is complete. When all tank trucks/cars have been discharged, personnel shall annotate the receipt quantity on the DD Form 250, WAWF ERR, or equivalent. Quantity shall be determined by calibrated meter, automatic or manual gauging of the receipt tank(s), or other methods described in DLA Energy P-2 Receipt and Shipment of Petroleum Products. When automatic or manual 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°F (15°C). Receiving personnel shall investigate any quantity discrepancy in excess of that cited in DoD Manual 4140.25. 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 under the Post, Camps & Stations (PC&S) Purchase Program. Under DLA Energy Direct Delivery purchase programs, products required at the base level are normally provided under PC&S contracts. The following products are normally procured under PC&S contracts, mostly to non-Government specifications: fuel oils (FL/FS #1, #2, #4, #6, etc.), gasolines (MUR, MUM, MUP, MMR, MRR, MPR, gasohol, E85, etc.), diesel fuels (DF-2, BDI, DS-1, DS-2, DSS, etc.) and aviation turbine fuel (JP-8, F-24, Jet A, Jet A-1, TS-1, etc.). For aviation turbine fuel receipt/testing, see Table IX, series 6d. Product is usually delivered directly by the contractor via tank truck or tank car to the requiring activity. On fuels, other than aviation, which are delivered via tank truck or tank car to U.S. Government installations for their use and consumption, Government inspection for identity and quantity shall be performed by the receiving activity in order to accept the fuel on behalf of the Government.

Note: Tank trucks may or may not be sealed after loading based upon contract requirements. Normally CONUS does not require tank trucks to be sealed, but seals may be utilized due to an increase in the Force Protection Condition (FPCON) level or if required by contract, agreement or by other entity. If FPCON level increase drives a requirement to implement the use of seals, contact the applicable DLA Energy Region for assistance. OCONUS locations 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.

5.4.1 Tank Truck and Tank Car Arrival/Before Delivery. Responsible fuel personnel shall examine accompanying paperwork, assuring the correct product, quantity, and location. Personnel shall 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, and validate that the receiving point is identical to that on the shipping papers. If not identical, personnel shall redirect the truck/tank car to the correct off-loading location. Product tank compartments shall be sampled (all-level) and visually examined for quality. Gasoline, diesel fuel, and particularly aviation turbine fuel shall not contain visible water or 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 microbiological growth. The type of equipment and type of burner fuel determine the allowable limits of water and sediment in the fuel. If sample testing indicates product is off specification, it shall not be accepted. Immediately after the rejection, the receiving activity shall report the problem to the appropriate Service Control Point and to the DLA Energy contracting officer (PC&S: DLA Energy PEA FEPDA (571-767-9509), DLA Energy PEC FEPAB (571-767-9520), DLA Energy PLB FEPB (571-767-9536), DLA Energy PLC (571-767-9511), and DLA Energy Quality Operations Division (571-767-8362 or 8736). These are commercial numbers; the DSN is 392- XXXX, using the last four numbers of the phone numbers above. The facsimile number for DLA Energy Quality Operations Division is 571-767-8747. For Service-owned product (non-capitalized), submit a PQDR through the SCP to DLA Energy Quality Operations. For capitalized product, submit a customer/depot complaint via DLA Energy Disposition Form through the SCP to DLA Energy Quality Operations.

5.4.1.1 Tank Truck and Tank Car After Delivery/Before Departure. For direct delivery to one location, the truck shall be examined to determine if any product is Remaining On Board (ROB) once off-loading has been completed. 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 delivered by barge shall be sampled and tested in accordance with Table IX, Series 5, and the appropriate table (Table X – Table XVII) depending on the type of fuel.

5.5 Receipts from the Bunkering Program. This section applies to commercial bunker fuels (such as MGO, DMA or IFO) from commercial suppliers at ports under DLA Energy Bunkers Contract. The Government has the right to inspect and/or test supplies

called for under this program. Unless otherwise noted, inspection shall be performed by the receiving activity based on documents required to be supplied by the commercial supplier at the time of delivery. Note that within the DLA Energy Bunkers Program, DLA Energy does not normally perform inspection at source. Instead, 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 bunkering program may be either under DLA Energy contracts or commercially purchased directly by the vessel. The products are delivered to the vessels via barge, pipeline, or truck when the vessels are moored to docks. Vessel personnel perform quality and quantity checks. Additional testing of bunker samples may be through a DLA Energy, MSC, or vessel contract. 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 bunker line 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, 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 bunkering vessel which tanks will be used to issue to the receiving 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, the 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 (2) 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 (571) 767-8467

or by facsimile to (571) 767-8506. Problems of a quality nature shall also be reported to DLA Energy Quality Operations Division directly (email QA@dla.mil, phone 571-767-8736, or facsimile DSN 392-767-8747).

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. 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 appropriate portions for shipment to the testing facility and retain samples. Normally one sample is sent to the laboratory, one is signed for by the supplier and one is retained on the vessel receiving the product. 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. Retains can be returned into a bunker tank after quality results are received and indicate the product conforms to specification requirements. When non-conforming product is indicated, notify the contracting officer and provide 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. A copy of the BDN must 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/F-24) with or without additives such as FSII provided as per location requirements. Procedures for into-plane servicing are covered under MIL-STD-1548, JIG 1, and JIG 2 (OCONUS) or ATA Spec 103 (CONUS). Problems under Into-Plane contracts shall be reported to the DLA Energy contracting officer (DLA Energy FEPEA, 571-767-0193, or FEPEB, 571-767-3281). Problems of a quality nature shall also be reported directly to DLA Energy Quality Operations Division (email QA@dla.mil, phone 571-767-8736, or facsimile DSN 392-767-8747).

5.6.1 AIR Card®. The Aviation Into-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, F-24, JP-5, or commercial jet fuel service, refer to Table XXIII 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, F-24, Jet A-1, JP-8, JP-5, and TS-1, when treated with U.S. approved additives, 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 as Secured Fuels are sealed and secured in accordance with AFI 31-101, Volume I. FSII accelerates degradation of SAP; therefore, absorption-type media monitors shall not be used in filter separators where fuels contain FSII.

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 (POTUS) is a passenger. The procedures below apply only to secured fuels. Support aircraft shall be serviced the same as any other transient aircraft. F-24 and commercial Jet A and Jet A-1 are the primary fuels for use in these aircraft. Alternate fuels JP5 or JP-8 may be used. In Table XII, Support for Secured Fuels, Commercial Jet A-1 includes fuels identified by other National Specifications like the Russian GOST R 52050 specification and Chinese specification No. 3 Jet Fuel. Whenever Secured Fuels are used, tests listed in Table XII 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 or Supported by Military Installations. The Secured Fuels Advance Team will contact the DLA Energy Quality Manager to coordinate fuel support and testing. Those tests, within the capability of the base laboratory, shall be performed on base. If testing cannot be performed at a local base laboratory or if insufficient time exists for the sample to be forwarded to a Service/DLA Energy area lab, then local commercial testing shall be performed. Tests performed on DLA Energy service contracts or at any other acceptable commercial laboratory shall be under the direct supervision of a DLA Energy commodity certified Quality Assurance Representative (QAR).

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 shall follow procedures in the latest version of the DLA Energy Aviation Refueling Quality Assurance Procedures Related to Secured Fuel Support. The QAR shall 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 shall validate invoices and submit invoices for payment per laboratory contractual requirements.

5.7.3.2 Non-Contract Locations. The DLA Energy QAR shall validate the invoice with the statement, “These services were performed and validated” and include the QAR’s signature and date. The bill, invoice, and W-9, Request for Taxpayer Identification Number and Certification (applicable to U.S. Companies only) will be mailed or emailed for validation to: Defense Logistics Agency Energy, Quality Operations Division, ATTN: Laboratory Program Manager, 8725 John J. Kingman Road, Ft. Belvoir, VA 22060-6222 or

emailed to SecureFuelInvoicing@dla.mil. DLA Energy Quality Operations Division will then forward the bill, invoice, and W-9 form (if required) to DFAS-CO for payment.

5.8 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 (e.g., product is injected by commercial pipelines just prior to delivery). Product can also be injected at base level, either upon receipt, during a transfer within the facility, or at the fillstand/loading rack. 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 connected into the receiving/transfer/issue line and supplied by a bulk additive tank. Responsible base personnel shall assure injection equipment is in working order and that the additive injection rate 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 normally delivered by tank truck (or intermodal containers) directly from the producer. Upon arrival, paperwork shall be examined by receiving personnel to assure the proper additive is being received. Due to safety considerations, sampling of additives such as FSII shall be accomplished using proper safety equipment and knowledge of the Safety Data Sheet (SDS) requirements. Additive sampling equipment shall not be used to sample other products due to cleanliness concerns. If sealing is required by contract, arriving tank trucks or intermodal containers shall be examined to determine if seals are intact. Tank truck pumps and hoses shall be clean and capped. Product tank compartments shall be sampled and tested for quality and density to determine if any contamination has occurred. The density of additives must be determined in accordance with product specification. Once product specification is verified, product may be discharged into the proper storage tank. If unable to obtain an all-level sample from the tank truck or intermodal container prior to discharge, an in-line sample taken during discharge may be used for testing.

5.8.2 During Injection. To ensure 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 should be accomplished monthly, but may be performed more frequently (e.g., weekly, etc.) depending on the amount of injection being performed and the accuracy of the manual checks. To improve injection calibration accuracy, it is beneficial to premix product with the additive prior to injecting into lines, storage tanks, and conveyances. Additives shall not be premixed with other additives (“cocktailed”), because doing so may result in dangerous/incompatibility reactions of the concentrated chemicals.

5.8.3 After Injection. Once receipt/transfer has been completed, the injected product shall be sampled and tested for proper additive concentration or other approved test method to determine if the product contains the proper amount of additive (e.g., lubricity testing). When dealing with SDA, personnel shall consider outside temperature because lower temperatures tend to lower fuel conductivity readings and higher temperatures tend to raise the readings.

5.8.4 Delivery of Injected Product. All additives injected shall be listed on the Certificate of Quality (CoQ), Refinery Certificate of Quality (RCQ), Recertification Test Certificate (RT), or on the shipping document. Either the concentration of the additive in the fuel or the quantity of the additive injected is required on the documentation.

5.8.5 Injection of Additives During Receipt. When additive injection is accomplished at the receipt terminal, operating personnel shall record the amount of additive injected into the product. The amounts injected shall be listed on the quality certificate and the receipt tank record. Documenting additive quantities is essential to traceability and tracking of the minimum and maximum quantities authorized by the applicable product specification.

5.9 Bulk Storage. Quality surveillance of bulk petroleum 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 turn-over products and Table VIII outlines frequencies for the testing of products in long term storage (see Section 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 aircraft operations. Positive action shall be taken to prevent and eliminate sources of sediment and water. When new tanks or tanks that have been opened for repair/inspection are filled, recommend stopping at one meter to sample and test product for workmanship (visual for water & particulate). If testing fails, perform additional sampling and testing to determine the cause. Once sample passes, continue adding fuel until tank is at desired level and then obtain a representative sample for type B-2 testing. Product in the tank should not be issued until passing results are obtained.

5.9.1 Long-Term Storage. A bulk petroleum product is considered under long-term storage conditions when held for a period longer than six months without an exchange of at least two-thirds of the tank contents. Once product is designated in long-term storage (after six months), it shall be monitored for deterioration by performing B-2 testing to check product stability in accordance with Table VIII. This six-month testing frequency shall be maintained as long as product deterioration is not detected. If deterioration is detected (e.g., in gasolines when the oxidation stability decreases or gum level increases or in diesel fuel when the particulate contamination increases), the frequency of testing shall be increased from six months to four months. As the deteriorating characteristics approach IGRL (see Tables I-VIIa), product shall be consumed on an expedited basis or rotated so that it can be consumed elsewhere before exceeding the IGRL. The rate of product deterioration cannot be accurately predicted because storage locations throughout the world differ in temperature and environment, and the products stored at each location are produced differently from refinery to refinery. Therefore, each product in long-term storage shall be sampled and tested more frequently when deterioration begins.

5.9.2 Tank Product Quality Designations. Product in a tank that is awaiting test results shall be designated on QC Hold. While the tank is on QC Hold, no product shall be issued from the tank without the product owner's permission. If an off-specification condition not within IGRL is found during testing, the tank shall be placed on quality hold and a disposition request shall be submitted per Section 5.13.2 of this document. Any product contained in a tank that meets specification or is within IGRL or has an approved waiver per the procedures in Section 5.13 is acceptable for issue. Management shall have a system in place that enables all fuel facility operators to have clear visibility of a tank's quality condition.Bulk Tank Water Restriction. Bulk fuel tanks shall be drained of water

after each product receipt, a minimum of weekly thereafter, and prior to each issue. Floating roof tanks (without geodesic domes, a roof or other protective cover) shall be checked for water more frequently during periods of heavy rain or melting snow. Underground fuel tanks shall be checked more frequently for water when the water table is high and during periods of excessive rain or melting snow.

5.9.3.1 Corrosives in Tanks. In instances where water bottoms in storage tanks cannot be completely removed, the water layer may contain hydrogen sulfide. Hydrogen sulfide, which sometimes forms as a result of bacterial action on sulfates present in the water, is corrosive and will cause the product to fail the copper strip corrosion requirement of the specification.

5.9.3.2 Tank Water Check Frequency. Water checks shall be performed daily on issue tanks and performed 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. In FSII-treated fuel, the water at tank bottoms and sumps should be carefully drained daily or more frequently if warranted.

5.9.3.3 Microbial Contamination. Microbes can exist in extremely small pockets of water or fuel. This growth can be corrosive and can lead to the creation of pinpoint holes in the coating or metal (this is referred to as microbial induced corrosion or MIC). Microbial growth cycles can also result in contamination that clogs filters. A good water removal program is an important maintenance function that aids in preventing microbial contamination.

5.9.4 Storage Tanks and Piping.

5.9.4.1 Storage of Similar Products. Storage tanks should continue in one type of fuel service to the maximum extent practicable. The contents of receiving storage tanks shall always be verified before the receipt of new product.

5.9.4.2 Changing Product in a Storage Tank.

5.9.4.2.1 When storage tanks are changed from one fuel type 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.

5.9.4.2.2 When converting to E85, tanks selected shall be inspected, cleaned, and certified for compatibility and use of E85 by the Military Service Fuels Engineer. Follow the initial fill procedures below for all tanks

a. Fill the tank with E85 that has been tested. Allow 48 hours settling time following initial fill.

b. Displace twice the volume of the dispensing line(s) prior to obtaining a sample. Collect the sample in a wide mouth container and visually inspect for particulates, water, and phase separation.

c. Should the sample fail the visual examination, flush the dispensing line(s) until samples are clear and free of visible particles. After three consecutive failures, notify the

next level in the chain of command for further instruction.

d. Test for ethanol content according to ASTM D5798.

5.9.4.2.3 Ground diesel products 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 when converting to winter grade during summer, the storage tank content shall be reduced 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 shall be developed to assure the storage tank will be prepared for the winter use season.

a. Conversion from low sulfur diesel fuel to ultra-low sulfur diesel fuel/BDI will require the removal of all existing diesel fuel from the tank to the maximum extent possible. Empty the tank with service pump to remove remaining product and clean tank. Install a 10 micron maximum filter on pumps.

b. After the initial BDI receipt, dispense at least twice the piping fill quantity through the pump(s) to purge the system.

5.9.4.2.4 Conversion to Ultra-Low Sulfur Diesel Fuel (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 to ULSD is DLA Energy Policy Document I-15, Conversion of Low Sulfur Diesel Storage to Ultra Low Sulfur Diesel (ULSD) which can be found at DLA Energy Portal at https://eworkplace.dla.mil/sites/S6/Internal%20Documents/Forms/AllItems.aspx?RootFolder=%2Fsites%2FS6%2FInternal%20Documents%2FDLA%20Energy%20Corporate%20Library%2FDLA%20Issuances.

5.9.4.3 Product Cargo Check for Quality. To the extent practical, product shall be discharged into a single shore tank. After discharging and checking for quality, identical products may be combined in common tankage. DFSPs shall comply with Section 4.9 and not transfer between like product tanks in order to maintain a first-in, first-out management plan. 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.

5.9.4.4 Segregation of Product. Grades of product shall be segregated from one another, and all issues shall be made through a segregated system whenever feasible. 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.

5.9.4.5 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. Installation 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.

5.9.4.6 Bulk Tank Protective Treatment. Before applying an internal protective treatment to any tankage (e.g., coating), approval from the responsible DLA Energy or Service technical authority is required.

5.9.4.7 Identification of Piping System[4]. Piping systems shall be marked to clearly identify the grade of a product being carried. MIL-STD-161 provides guidance on color markings, titles, and placement. In NATO countries, the NATO code for the product grade shall be included in the marking or identification system.

5.9.4.8 Settling Time in Tank. Settling time is required to reduce the static charge of the fuel, allow product to reach equilibrium and/or to allow water/sediment to precipitate/settle from the product. Below are requirements for settling time as relates to safety, accountability and quality.

a. For quantity measurements in tanks greater than 2,000 barrels, a settling time of 30 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 (If potential for electrostatic discharge is probable due to low temperature or humidity, increase settling time to minimum of 30 minutes). For products that retain water and/or sediment (e.g., crude, IFOs, etc.), allow a minimum of 24 hours of settling in bulk storage tanks before taking a custody transfer measurement following receipt. A provisional gauge may be taken after a minimum of 30 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 particulate. 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 water from the tank.

c. For ground fuel tanks greater than 2,000 barrels, minimum settling time is one hour per vertical foot of product received. For ground fuel tanks 2,000 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.

[4] ***Note: In certain situations, security requirements may dictate what markings are allowed***

d. The settling period does not apply to bulk storage aboard ships. A settling period of 30 minutes aboard ships is recommended for electrostatic dissipation.

5.9.5 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 floating pan/roof is afloat, or fuel level reaches a minimum of three feet (one meter) above the level of the tank filling line (see Section 5.1.1.6.2).

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

c. The fuel flow into storage tanks shall be horizontal rather than vertical 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 electro-static energy. Because some materials exhibit this static phenomena, especially under low humidity conditions, outer garments used in these areas shall be suitable for the work area. For these reasons, outer garments should not be donned or removed where a flammable or explosive atmosphere may exist.

e. Always bond sampling devices to the tank before opening the sampling hatch.

f. Personnel shall wait a minimum of thirty minutes after receipts of any type of fuel to allow electrostatic charges to dissipate before gauging or sampling.

g. Other ignition sources of concern are cell phones and other portable electronic devices (PED). These items shall not be used in or 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 intrinsically safe cell phones and other PED should be avoided while working in areas exposed to flammable vapors.

h. Strict adherence to proper bonding procedures shall by enforced whenever fuel is transferred, issued, or received.

5.9.6 Filtration[5]. Filtration equipment of a proper type shall be a part of all fuel handling systems, to include use of supplemental electronic sensors, where appropriate (see Table XXVIII). The equipment shall be inspected for condition and performance capability in accordance with applicable Standards (e.g., MIL-PRF-52308, EI Specification 1581, etc.) or the equipment's operations and maintenance manuals. Micronics filtration equipment shall conform to EI Specification 1590. Electronic sensors that monitor free water and particulate matter which are used to supplement

[5]***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."***

filtration equipment in providing both a particulate and water defense shall conform to EI 1598 and EI 1570. The location of this equipment shall be in accordance with civil engineering design criteria. Infrastructure and equipment used to service aircraft directly shall have either a filter electronic sensor with a supporting filter separator further upstream at the final point of issue. At commercial installations, the requirements for any maintenance of this equipment shall be consistent with terms of the contract. Because fuel movement through filter separators generates static electricity, their location in the system shall permit a 30-second relaxation time in product travel between the filtration equipment and receiving container.

5.9.6.1 All fuel nozzles used to service aircraft shall be equipped with a 100 mesh screen. These screens shall be inspected at least weekly and cleaned as necessary.

5.9.6.2 Fuel issued to aircraft shall be filtered at least twice. The pantograph or fuel servicing vehicle used to directly service aircraft shall be equipped with a fuel filtration system or electronic sensor.

5.9.7 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 adequately protected in-place, or by transfer to storage. Where possible, tanks should be isolated, cleaned, dried, and sealed. Water-displacing fluids shall not be used for the internal protection of aviation fuel tanks, as they affect the water separation property of the fuel, and they are difficult to remove completely. However, such fluids may be used as directed for tanks that store other products.

5.9.8 Sources of Contamination.

5.9.8.1 Inadvertent Mixtures. The principle sources of bulk petroleum product contamination are: failure to properly identify product in a delivery vehicle, misidentified product being received into a tank, carelessness in making line connections, errors 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, and leakage through partially closed or defective valves. Every precaution shall be exercised to prevent the inadvertent mixing of different grades of product and contamination of 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 sections 5.11 and 5.12 for sources of contamination.

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

5.9.8.3 Rubber Surface to Fuel (Compatibility). Refers to characteristics of elastomeric or rubber compounds that change when exposed to fuel. Seal swelling, an interaction between the fuel media and elastomer materials, is desirable (to a point) as a means to prevent leakage.

5.9.8.4 Container Sealant. Fuel containers equipped with bullet-hole sealing properties may be particularly hazardous if the fuel should penetrate to the sealing media. Extra precautions shall be taken to clean the system or container if it has been used to store or transport diesel fuel or other lightly inhibited material, such as commercial motor gasolines.

5.9.8.5 Long Hose Lines. If possible, long hose lines should 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.

5.9.9 Identification of Transfers. Prior to all product transfers, validate product grade is correct for the purpose of the transfer, and valve alignment is correct. Testing shall be conducted on all product transfers except for transfers of approved stocks from fully segregated systems (pipeline, tank car, or truck), provided that a grade change is not involved. Table IX contains details of sampling and testing requirements.

5.10 Product Intra - Governmental Receipt Limits (Tables I-VIIa).

5.10.1 Gasoline, Aviation. NATO F-18 (ASTM D910/100 LL) and Unleaded Aviation Gasolines 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 reasons such as mixing with gasoline 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 color or darkening of color may be caused by the presence of lubricating oil, diesel fuel, heating oil, or other petroleum products of similar color. 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 depends 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. One such test is the Reid Vapor Pressure (RVP) test that measures the vapor pressure created in a defined volume of air to volume of fuel at 100°F. The allowed test methods for vapor pressure of AVGAS are listed in Table VIIa.

a. A VP above 7.0 psig (49 kPa) may indicate 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 psig (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, Copper Strip. Aviation 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.

5.10.1.5 Water and Sediment. These contaminants shall be controlled within the transportation, storage, handling, and servicing systems in order to avoid product degradation and subsequent serious problems in the operation of aircraft.

5.10.1.6 Lead Content. The maximum amount of lead permitted by ASTM D910 is 0.56 Pb g/L or 0.53 TEL mL/L for low lead aviation gasoline (F-18). For unleaded aviation gasoline, the lead content shall not exceed 0.013 Pb g/L. Lead content is determined by ASTM D3237, D3341, or D5059 (Test Method C).

5.10.1.7 Potential Gum. Potential gum shall not exceed 6.0 mg/100mL in aviation gasoline.

5.10.2 Aviation Turbine Fuel. NATO F-24, F-34/JP-8 (MIL-DTL-83133) and (Defence Standard 91-091), F-35/Jet A-1, Jet A/Jet A-1 (ASTM D1655) and F-40/JP-4, F44/JP-5 (MIL- DTL-5624), JPTS (MIL-DTL-25524)[6] and TS-1 (GOST 10227-86).

5.10.2.1 Existent Gum. The existent gum shall not exceed 7 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. Existent gum may also be determined by IP 540. 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 (VP). In requesting disposition for JP-4 that does not meet the VP IGRL (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 Fuel System Icing Inhibitor (FSII). FSII lowers the freezing 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 the minimum FSII content outlined in Table I. FSII does not readily dissolve into 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 become soluble in the water, resulting in a lower than expected concentration of FSII in the fuel and water bottoms containing high FSII concentrations. A filter-separator system should be installed upstream of the FSII injection point if the free water content cannot be

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

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 (without geodesic domes, a roof, or other protective cover) 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. Water-FSII mixtures 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 does not readily disperse into fuel and can settle in an 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 that the long-term stability of FSII is questionable even if stored in stainless steel containers, it is recommended that FSII stocks be rotated. Bulk FSII stocks should be visually checked one month after delivery and fully retested for quality conformance every nine months at a minimum.

Warning: Undiluted FSII is considered health hazard; therefore, special precautions shall be taken to avoid exposure when handling (e.g., while sampling and testing). Refer to the manufacturer's SDS for safety precautions.

5.10.2.4 Flash Point Specification. JP-5, JP-8, F-24, Jet A, and Jet A-1 fuels exposed to systems which recently have contained gasoline/naphtha or have been contaminated by lower flash point fuels are likely to be rendered off-specification for flash point. Not meeting the flash point specification is a critical non-compliance for JP-5 because of the safety factors involved in handling fuel aboard vessels at sea. For JP-8, F-24, Jet A, and Jet A-1, 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 point deterioration.

5.10.2.5 Filtration Time. Control of this property is essential to prevent rapid differential pressure buildup in filtration equipment and possible migration of fine particulates 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.

5.10.2.6 Water and Sediment (Particulate). These contaminants shall be controlled within the transportation, storage, handling, and servicing systems in order to avoid serious problems in the operation of aircraft and a resultant degradation of mission readiness.

5.10.2.7 Conductivity. Conductivity is a measure of electrical conductance in fuels. By increasing the conductance of the fuel, rapid dissipation of an electrostatic charge is possible. Except for direct deliveries to a using activity from a refinery, The Static Dissipater Additive (conductivity additive) will most likely be injected in JP-4, JP-8, Jet A-1 and F-24 at the terminal making delivery to the using activity. Static Dissipater Additive is not approved for use in JP-5 due to incompatibility with shipboard centrifugal

purifiers. The conductivity unit (CU) specification requirement can be found in Table I of this Standard.

5.10.2.8 Thermal Stability of JP-5. Most Navy/MSC ships have copper-nickel piping which results in copper leaching into JP-5, causing oxidation stability testing (thermal stability) failures by ASTM D3241. Shipboard JP-5 which fails oxidative stability testing is not normally suitable to be returned to DLA-owned bulk JP-5 stock ashore. Naval Air System Command (NAVAIR) has determined that 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 by shipboard aircraft. A DLA Energy disposition is not required for these JP-5 transfers. Navy or MSC operations personnel shall coordinate a plan to transfer at sea any remaining JP-5 when a vessel is scheduled to return to port where discharging the JP-5 is required.

5.10.2.9 Fuel Standardization Policy. The fuel standardization policy (also known as the Primary Fuel Policy) mandates the use of a kerosene based fuel as the primary fuel on the battlefield for both aircraft and multi-fuel capable ground vehicles/equipment. DoD Instruction 4140.25 states this policy in great detail. In most cases, this fuel is JP-8, F-24, or Jet A-1 with additives. Primary fuel support for sea-based aircraft shall be a high flash point 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 with diesel fuel in most cases. JP-8, JP-5, F-76, Jet A, Jet A-1 and F-24, when used in tactical equipment, are currently exempt from the sulfur limits required by the EPA when used in ground vehicle equipment for on-grade use in the U.S. DoD.

5.10.2.10 Other Aviation Fuel Specifications. DLA Energy may obtain aviation turbine fuel conforming to the National specifications of another country, if DoD primary fuels (JP-8, JP- 5, F-24) are not available. All alternate fuel approvals must be processed through the respective Service Control Point(s).

5.10.3 Gasoline, Automotive, Unleaded (F-67).

5.10.3.1 Octane. Gasolines having an octane or performance number below the IGRL specified in Table VI shall be re-sampled and the knock rating verified before being considered below the IGRL.

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, precipitated lead salts, or other particulates. A yellow hue may be caused by contamination with diesel fuel, lubricating oil, or other petroleum products.

5.10.3.3 Lead Content. The maximum amount of lead permitted for unleaded F-67 per STANAG 7090 is 5 mg/L. Lead content in gasoline may be restricted to a lower limit by local regulation. Lead content shall be determined by ASTM D3341 or ASTM D5059 (Test Method C).

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

5.10.3.5 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 gasoline vapor pressure receipt limits are listed in Table VI.

5.10.4 Automotive Spark Ignition Engine Fuel: Commercial Gasoline (ASTM D4814). Under authority of the Clean Air Act, gasolines marketed in the United States and its territories and possessions may have restrictions on vapor pressure limits and mandates for the use of gasoline-oxygenate blends for the purpose of controlling emission. The restrictions vary by region and time of year. Oxygenated gasoline is normally sold in designated areas during the winter months when the carbon monoxide problem is 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 percent by mass compared to 2.7 percent by mass respectively). Some States, notably California, may have more restrictive regulations. Many States now require a blend of 10 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 Solvent-Washed Gum. 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 a 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 g/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 D3237 or ASTM D5059 (Test Method C “Low Lead Method”).

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

5.10.4.5 Vapor Pressure (VP). Values for gasohol are based on those of the base gasoline. Blending to meet the VP limit is permissible provided the resultant blends meet all specifications and inter-Governmental receipt limits. The specifications for receipt limits can be found in Table VII of this Standard.

5.10.4.6 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.

See Table X7.1 (U.S. Maximum Temperature for Phase Separation, °C) of ASTM D4814.

5.10.5 E85. Though this liquid fuel is handled in a manner similar to that of gasoline, the chemical properties of alcohol are different from 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, select proper materials and control composition. Since ethanol is not compatible with aluminum, 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 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 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 cetane number cannot be measured directly by ASTM D613, the cetane number may be estimated by means of the calculated cetane index outlined in ASTM D976 (not valid at procurement for fuels containing synthesized materials per MIL-DTL-16884) or by the derived cetane number as outlined in ASTM D6890 or ASTM D7170. Ignition improver additives are not approved for use in F-76.

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 Section 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 not contain dyes of any kind. MGO/DMA, 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. 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 timeframe 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 test results 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 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) in accordance with 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. Continued 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. Diesel fuel may contain up to 5 volume percent of biodiesel.

5.10.7.1 RME 180 (ISO 8217). Marine Fuel Oil, the commercial designation (IFO 180), is an Intermediate Fuel Oil 180 produced from a mixture of heavy and medium oil fractions obtained from primary and secondary crude oil processing. This product is used in the prime mover (engine) of maritime vessels. See Table XVIII for testing requirements.

5.10.7.2 RMG 380 (ISO 8217). Marine Fuel Oil, the commercial designation (IFO 380), is an Intermediate Fuel Oil 380. Along with RME 180 (IFO 180), RMG 380 (IFO 380) are the most common commercial intermediate fuel oil grades for maritime vessels. See Table XIX for testing requirements.

5.10.7.3 Water and Sediment Control. Diesel fuel shall be delivered to consuming vehicles or vessels 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. Operational requirements at the specific location should be used to determine whether a filter or a filter-separator is required. 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 Quality. The cetane quality is determined by direct measurement as cetane number by use of ASTM D613. It may also be indirectly measured by

determination of the derived cetane number by ASTM D6890, D7170 or D7668.the calculated cetane index per ASTM D976 or ASTM D4737. However, if estimated, the value shall be reported as a cetane index. The cetane index shall never be reported as the cetane number, as the two are not equivalent. At procurement, the use of cetane index is limited to the requirements stated in the governing specification.

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 and its territories/possessions. Non-dyed fuels (Grades Ultra Low Sulfur No. 1-D and Ultra 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[7].

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 specifications and Intra-Governmental Receipt Limits are met.

5.10.7.7 Cloud Point. A fuel's cloud point is the temperature at which paraffinic wax crystals first start to appear upon cooling under prescribed conditions. It is the lower operating limit for diesel fuel. Cloud point requirements for diesel fuel varies with location and season. The cloud point of the fuel should be below the location's 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, F-24, Jet A, or Jet A-1) with lower cloud point to obtain a usable product. Blending for cloud point shall also take local sulfur requirements into consideration, as EPA mandated sulfur maximums shall not 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 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. 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 and 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.

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[7] ***Note: Under United States regulations if Grades No. 1-D S15 and No. 2-D S-15 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.***

5.10.9 Diesel Fuel, Biodiesel Blend, BDI (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); requirements are listed in ASTM D7467. BDI product must be pre-blended prior to delivery. It is not acceptable to attempt blending into a Government tank during 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 gas turbine 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 Aviation Gasoline and Gas Turbine Fuel Differences. Although information herein pertains to both aviation gasoline and turbine fuel, cleanliness requirements for gas turbine engines are more restrictive than for reciprocating engines. High pressure, complex metering equipment built to close tolerances provides precise fuel metering over a wide range of altitudes, speeds, and power. Particulate and water contamination become more critical for turbine engines, and contamination accumulates more rapidly because of high fuel consumption rates. 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 gas turbine fuel, particularly grades JP-5, JP-8, and F-24 are complicated because of higher viscosity and higher relative density, increasing the required settling time. As aircraft engine filters are not designed to remove fine or excessive contamination, fuel filtration shall be accomplished on the ground rather than in 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, dry (no free water), bright, and on-specification. Samples may be taken and inspected visually as frequently as necessary. If specification or Intra-Governmental Receipt Limits are exceeded, improvements in fuel handling processes should be evaluated and implemented as needed. 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 particulate or water exists upstream of the filter-separator. Existing and potential problem areas shall be promptly identified and brought to the attention of the applicable SCP and DLA Energy Quality Operations Division.

5.11.3 Fuel Quality and Fuel Contamination. The most prevalent types of fuel contamination are commingling with other petroleum products and contamination with water, particulate, and microbiological growth (see Table XXVII).

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, Particulate, and Microbiological Growth. These types of contamination can frequently be detected visually since they are not miscible with the fuel. Table XXVII of this Standard provides a list of possible contaminants along with a description of each's appearance, characteristics, and effects on aircraft performance. Refer to ASTM Manual 47 for additional information.

a. Water in fuel 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.

b. Particulate (sediment) appears as dust, powder, flakes, and 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 discernable 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 particulate contamination can be separated into two categories: coarse sediment and fine sediment.

1. Coarse sediment is sediment that easily settles out of fuel or can be removed by adequate filtration. Ordinarily, particles 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.

2. Fine sediment may be defined as particles smaller than 10 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 which can cause problems associated with microbiological contamination of aviation turbine fuels. Products of microbiological organisms 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 draining of storage tanks and a need for more frequent cleaning of fuel storage tanks.
Media Migration. The active media in filter monitor (fuse) cartridges is water absorbent materials known as "super-absorbent polymer." Filter monitor cartridges qualified to EI

1583 may allow small quantities of this material to pass or migrate into the fuel as it 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. Super-absorbent polymer material initially 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 (absorbs and holds it), 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 nor at Army or Air Force fuels activities. International filtration standardization organizations have determined that the issue of media migration cannot be permanently resolved so it is their stated intent to discontinue the use of filter monitors at an agreed upon future date.

d. Samples representative of fuel serviced to aircraft shall contain no more than 10 fibers when a quart sample is visually examined. Fibers could indicate the filter or filter-separator elements are not functioning properly and that corrective action must be taken (See Table XXVII for more details about fibers). Meticulous cleaning of the quart sample bottle used for fiber testing is necessary to properly determine the fibrous content of 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 and bright and contain no more than 10 ppm by volume of free water. The terms clean and bright are independent of the normal color of the fuel. Common colors range from water white to various shades of straw. A cloud, haze, specks of sediment, or entrained water indicates that 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 shall not contain dye of any kind. The current test for determining possible contamination of jet fuel with a dye is the "white bucket" test (no dilution permitted) identified in ASTM Manual 5 and EI/JIG Standard 1530. During this test, a portion of jet fuel is placed into a white bucket and examined for an abnormal color that may be attributable to dye. 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 cloudy fuel indicates the presence of water; however, cloudiness can also be caused by excessive amounts of fine sediment or a finely dispersed stabilized emulsion. Cloudy fuel caused by either condition is not acceptable for use. For JP-8, F-24, JP-5, JP-4, Jet A, or Jet A-1 at the time of Government acceptance, the finished fuel or finished fuel blend shall be visually free of undissolved water, sediment, and 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.

5.11.4.4 Sediment in Fuel. Visible specks or sediment granules in fuel indicate a particle size larger than 40 microns. The presence of any appreciable number of such particles indicates a filter-separator 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 components 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/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, NATO F-24, Jet A, and Jet A-1); however, some specialized equipment still uses automotive gasoline. The use of aviation turbine fuel as a ground mobility fuel is mandated by the Fuel Standardization policy of DoD Instruction 4140.25. Aviation turbine fuels are kerosene-based and are normally an acceptable substitute/alternative for diesel fuel (See Section 5.12.1.3 a. and b. for limitations). However, diesel fuel is not an authorized substitute for aviation turbine fuel. All five fuels require a high degree of attention to basic housekeeping rules to ensure delivery of a clean and 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/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 than 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 that biodiesel blends have not been approved for use in some generators and 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 DoD Instruction 4140.25. Aviation turbine fuel conditions must be maintained in accordance with the aviation turbine fuel's specification requirements. The use of commercial jet fuel as ground fuel is not recommended unless the fuel is additized with Corrosion Inhibitor/Lubricity Improver additives in accordance with QPL-25017 concentration levels. Unless under emergency conditions, the appropriate Service Control Point shall be contacted for guidance and/or assistance prior to using un-additized commercial jet fuel for ground fuel applications.

a. Fuel conductivity must be between 150 and 600 pS/m for JP-8 and F-24.

b. As ground fuel, JP-5, JP-8, and F-24 do not meet current Federal, State and local

regulations for ULSD for either on-road or off-road usage in commercial vehicles. If one of these fuels 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 commercial equipment. In many countries, including the U.S., ultra-low sulfur diesel is required. Many U.S. commercial vehicles made after 2007 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-5, JP-8 and F-24 are 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 authorized.

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 those caused 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 less frequently 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 fuel, 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 will also 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 uncontaminated 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 solubilized 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, when fuel temperature decreases, dissolved water drops 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 fuel can cause stalling, injector fouling, other engine malfunctions, as well as corrosion. In cold weather, free water may cause blockage of fuel lines due to freezing. Diesel fuel contains high levels of surfactants, 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 (Particulate). 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. Sediment may be denser than fuel (tending to sink) or lighter than fuel (tending to float). If a 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 10 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/coalescer elements.

b. Organic sediment consists primarily of the deterioration of fuel products and of microbiological debris. Deteriorated product takes 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 gasoline and distillate fuels. Microbiological organisms include bacteria, yeast, 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. These 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. Many bacteria and fungi can produce acids and other metabolic products that 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 or filtration designed specifically for ground fuels is strongly recommended. Delivery of fuels through a filter-separator should reduce the water and sediment contamination to a minimum and prevent corrosion, wear, and deposits in equipment and vehicles. Furthermore, the life of 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. For the purpose of checking for water/sediment when draining filter separator/tank sumps, a clean bucket may be used, which should be manufactured from good quality stainless steel or lined with

white enamel (see ASTM Manual 5 and EI/JIG Standard 1530 for details).

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, 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 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. A product is deemed non-conforming if one of the following conditions exists:

1. A product being accepted by an authorized Government Representative either at origin (on an FOB Origin contract basis) or at destination (on an FOB Destination contract basis) is determined by inspection and/or tests not to conform to the procurement contract specifications.

2. DLA Energy-owned product is determined by inspection and/or tests not to conform to the Intra-Governmental Receipt Limits (IGRL) contained in Tables I-VIIa.

3. DLA Energy-owned product is determined by inspection and/or test to fall between the product specification and the IGRL, and the product is deemed acceptable for use but a report of non-conformance is still requested to track product quality. Issuing fuel meeting only the Intra-Governmental Receipt Limit should be used as a “safety net” that allows customers to continue their mission 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.

b. Reports of non-conforming capitalized product are categorized as Customer/Depot Complaints. DLA Energy Quality Operations Division manages the Customer/Depot Complaint Program for DLA Energy.

c. Any tank containing Government-owned product found to be non-conforming shall be immediately designated as on Quality Hold and not removed from this status until disposition is provided by the owning organization.

5.13.2 Disposition Request Procedures. It is DLA Energy 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 Quality Operations Division for bulk products or DLA Aviation for packaged products.

b. Based on these details, DLA Energy Quality Operations Division 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 product being issued that is on specification/within Intra-Governmental Receipt Limits. 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 Quality Operations Division shall 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 Quality Operations Division shall obtain a waiver from the applicable Service Technical Office prior to shipment to an end user.

f. In the case of an emergency request occurring outside normal duty hours, DLA Energy Quality Operations Division 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 notification shall occur as soon as practical.

g. When Service-owned product does not meet Intra-Governmental Receipt Limits set forth in this Standard, the requestor shall contact the applicable Service Technical Office (see Section 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 to DLA Energy Quality Operations Division. The use of DLA Energy

Disposition Form 1960 is recommended. The report shall me emailed to the DLA Energy Quality Operations Division office Program Manager for the location submitting the report. If the DLA Energy Quality Operations Division office Program Manager is unknown, the request shall be emailed to QA@dla.mil or by facsimile (571-767-8747). As a minimum, the report shall contain the following details:

1. Specification and grade of non-conforming product
2. Quantity of non-conforming product by storage tank/conveyance
3. Location where non-conforming product is held
4. Date non-conforming product was received
5. Name of manufacturer, contract number, batch number, qualification number, date of manufacture, as applicable
6. Type of container or storage where non-conforming product is held
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 product just prior to identification of contamination problem shall also be included.

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

11. The activity shall provide information on current volume in all product tanks, maximum fill for each tank, filtration available, and additive injection possibilities.

5.13.2.1 Report of Non-Conforming Product Exceptions. For non-conforming product found on FOB Destination procurement 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 stated in Section 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 contacts 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 Service(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 actions.

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: 571-767-0659 DSN: 392-767-0659 Email: usarmy.belvoir.usamc.list.usapc-quality-div
b. Navy	Mailing Address:	Director NAVSUP 8725 John J. Kingman Rd., Suite 3724 Ft. Belvoir, VA 22060-6224
	Message Address:	Navy Petroleum Office Ft. Belvoir Telephone: Commercial: 571-767-7351 DSN: 392-767-7351
c. Air Force	Mailing Address:	Commanding Officer Air Force Petroleum Office 8725 John J. Kingman Road, Room 1227 Ft. Belvoir, VA 22060-6241 Telephone: Commercial: 571-767-8705 DSN 392-767-8705 Email:afpet.ptoc@dla.mil
d. DLA Energy	Mailing Address:	DLA Energy Quality Operations Division, Rm 2843 8725 John J. Kingman Rd Ft. Belvoir, VA 22060-6221
	Message Address:	DLA Energy Ft Belvoir/DLA Energy Quality Operations Division Telephone: Commercial: 571-767-8736/8395 DSN: 392-767-8736/8795
e. DLA Aviation	Mailing Address:	DLA Aviation Joint Commodities Division (FAJ) 8000 Jefferson Davis Highway Richmond, VA 23297-5809
	Message Address:	DLA Aviation VA//DLA AVIATION-FAJ// Telephone: Commercial: 804-279-4257/3995/5987 DSN: 695-4257/3995/5987

5.13.3.1 Communication Copies. DLA Energy Quality Operations Division (or DLA Aviation, when appropriate), 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. 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 shall 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 to include the signature of the custodian. Chain of custody documentation shall be forwarded to DLA Energy Quality Operations Division for inclusion into the Enterprise Business System (EBS) Customer Depot Complaint (CDC) Quality Notification (QN). DLA Energy Quality Operations Division determines product disposition and sample disposal and notifies 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 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 Quality Operations Division 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 that 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, filtering, or dehydration.

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

a. Contaminants present and their source

b. Degree of contamination

c. Probable end-use of the 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 the 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. This is a 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. This is a 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. This is a procedure by which an additive, such as MIL-S-53021 (for automotive diesel fuel), along with other techniques such as blending are used to bring the characteristics of former off-specification product back into the range of on-specification or Intra-Governmental Receipt Limit.

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

5.13.7.5 Water Removal. This is a procedure accomplished primarily by filtering or settling processes. 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 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 cleaned and dried, 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 percent 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 plug (bung) before it is removed.

d. All sample containers shall be closed tightly immediately after taking the sample. Sealing wax, paraffin, rubber gaskets, pressure sensitive tapes, and similar materials shall not be used to seal containers. Light sample containers shall be adequately packaged to withstand shipment. To prevent leakage caused by thermal expansion of the product, sample containers shall not be filled above 80% volume capacity.

e. These one gallon sample cans are suitable for fuel products: NSN 8110-01-371-8315 (non-epoxy coated) and 8110-00-178-8292 (epoxy coated).

5.15 Size of Samples.

a. Except for liquid units of issue greater than one gallon and semi-solids greater than a 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:

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. For packaged products, refer to MIL-STD-3004-2.

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

5.16 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. These tags are available for purchase from DLA Document Services via the Navy Forms Online web site: https://navalforms.documentservices.dla.mil/web/public/home. 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
j. Contractor/Manufacturer/Supplier
k. Quantity
l. Sample Source
m. Fill/Delivery/Date of Manufacture (DOM)
n. Submitter's Sample Number
o. Sampled by
p. Date Sampled
q. Organization, Address, Telephone, Fax Number and Email of Submitter/POC
r. Test Series, Sample Type, Sample Information, Special/Additional Information
s. Qualification Number (if available)

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

5.17.1 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 Section 5.10).

5.17.2 Specification Receipt Limits. Specification receipt limits are absolute. Multiple tests may be performed; if the results of those tests are within the reproducibility

limit of the method, the results may be averaged to determine compliance with the specification limits.

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

5.17.4 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 product quality is within acceptable limits.

5.17.5 Test Required. Tables X-XVIII are 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 that may have occurred during product handling or storage.

5.17.6 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 referee ASTM International test method for the given property, 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.

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.

5.17.7 Calibrating Test Equipment. All laboratories shall calibrate testing and measuring equipment to the accuracy necessary to ensure the equipment is within allowable tolerance limits. As of 25 April 2012, the Department of Defense has adopted ISO/IEC 17025, superseding NCSL-Z540.1, “Laboratories, Calibration, and Measuring and Test Equipment.

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 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.

6.3 International Standardization Agreement Implementation. This Standard implements AIR-STD-ACS 4021 and NATO STANAGs 1110, 3149, 4714, and 7036. When changes to, revisions to, 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://assist.dla.mil/ (see Foreword, Section 2).

6.4 Subject Terms (Key Words) List..

Aviation Turbine Fuel Barge
Bulk Storage Coal
Diesel
F-24
F-27
F-76
Gasoline
Greases
Intra-Governmental Receipt Limits Jet Fuel
JP-5
JP-8
Petroleum
Sampling of Petroleum Secured Fuels
STANAG
Tanker Truck Waxes

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

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-113	Guide for the Selection of Lubricants, Functional Fluids, Preservatives 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 these documents are available online at http://quicksearch.dla.mil.)

ENERGY INSTITUTE (EI)

Model Code of Safe Practice Part 16: Guidance on Tank Cleaning

(Copies of this document are available online at http://www.energyinst.org/home.)

FEDERAL REGULATIONS

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

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

OTHER GOVERNMENT DOCUMENTS

AFI 31-101	Integrated Defense
AFJMAN 23-209	Storage and Handling of Hazardous Materials
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
ATP 4-43	Petroleum Supply Operations
TM 4-43.31	Petroleum Laboratory Testing and Operations
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 NWP 38G

Change 3 (Limited Distribution)	Replenishment at Sea
UFC 3-460-01	Design: Petroleum Fuels Facilities
UFC 3-460-03	Operations and Maintenance: Maintenance of Petroleum Systems
UFC 4-310-03	DOD Fuels Laboratory Standards

(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
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. 42B1-1-16	Maintenance Quality Control Procedures for JPTS Thermally Stable Turbine Fuel
T.O.42B1-1-22	Quality Control of Aviation Gasoline
T.O. 42B2-1-1	Use and Grades of Aircraft Engine Lubricating Oils
T.O. 42B2-1-3	General - Fluids for Hydraulic Equipment
T.O. 42C-1-12	Quality Control of Petroleum Products and Chemicals

(T.O.s can be obtained from the ETIMS Catalog listed online at ETIMS 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 (IGRL) for aviation turbine fuels: NATO F-34/JP-8 (MIL-DTL-83133), F-35/Jet A-1, NATO F-24/Jet A (ASTM D1655), F- 40/JP-4 and F-44/JP-5 (MIL-DTL-5624) and TS-1 (GOST 10227-86) [1, 11]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS [2]	ASTM TEST METHOD
Existent Gum, mg/100 mL, max	7	10	D381[3] or IP 540
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
Flash Point, °C, min (JP-5)	60.0[21]	60.0[21]	D56, D93[18], or D3828
Distillation, residue, vol %, max (JP-5, JP-4)	1.5	2.0	D86
Microseparometer rating[19] (With additives):			D3948, D7224 (Referee)
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 C 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	
Particle counting, cumulative channel Counts (For Receipt Use Only)[12,13,15]	Channel Counts	ISO Code	IP 564, IP565, IP577, or D7619[18]
➢ 4 um (c)[16]	[17]	19	
➢ 6 um (c)[16]	[17]	17	
➢ 14 um (c)[16]	[17]	14	
➢ 30 um (c)[16]	[17]	13	
Filtration time, minutes, max.[20]			
JP-4	10	15	Appendix A of MIL-DTL-5624
JP-5 (No reducer ring)	15	20	Appendix A of MIL-DTL-5624
JP-8	15	20	Appendix C of MIL-DTL-83133
FSII, vol %			D5006
JP-4	0.10 - 0.15	0.09 - 0.20	
JP-5	0.08-0.11	0.07-0.15	
JP-8, TS-1, F-24	0.07 - 0.10	0.06 - 0.15	
Conductivity, pS/m			D2624
JP-4, JP-8	150 - 600 [8]	50-700	
F-24	50 - 600 [8]	50 - 700	
Appearance	C&B	C&B [9]	D4176
Peroxide Number, mg/kg (ppm), max [10]	8.0	16.0	D3703, D6447
Fatty Acid Methyl Ester (FAME) mg/kg Max [14]	50mg/kg	50mg/kg	D7797/IP 583, IP 585 (Referee), IP 590, IP599

TABLE I. Intra-Governmental Receipt Limits (IGRL) for aviation turbine fuels - Continued

NOTES:

1. All required tests must be performed (see Tables XI-XII). For test requirements not in this table, specification limits apply.
2. For limits for Secured Fuels, see Table XII.
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, the corresponding test method for GOST 6356 is ASTM D93.
5. Intra-Governmental Receipt Limit is 60, only for fully additized product (excluding products containing static dissipater additive). Lower-than-spec results with other additive combinations will require identifying the situation and communicating with DLA-Energy Quality Operations Division.
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 use on transfers from shore tankage to pier side manifolds; fleet oilers, barges, tankers, and U.S. Naval vessels. The particulate matter requirement for JP-8 and F-24 is 1.0 mg/L, but may be used with 10.0 mg/L for ground use as diesel product.
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 F-24, Jet A, and 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 and F-27 (F-24 +100, respectively, additized with the +100 thermal stability improver additive) the conductivity limit must be between 150 and 700 pS/m (50 and 700 pS/m for F-27) at ambient temperature or 29.4°C (85°F), whichever is lower, unless otherwise directed by the procuring activity. The U.S. 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, retest at a fuel temperature of 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 productrejections.
10. Only for Jet A stored in long-term storage in accordance with Table VIII. There are no specification limits for the aviation turbine fuels listed in Table I; the number is based upon historical information.
11. For determining correct testing results (rounding protocol), see 4.2.2.2.1 Testing Rounding Protocol.
12. Either particulate matter or cumulative particle count may be used in determination if product meets defined standards/limits for Intra-Government receipt. Responsibility for procedure, procurement, and maintenance of any particle counter in support of this option resides with the respective Service that selects to implement particle counting. DLA Energy is not responsible for procurement or maintenance of any equipment in support of this option if selected by a Service.
13. If a cumulative particle count exceeds the limit for any of the specified channels as defined in Table 1, as it relates to Intra-Government transfer, a sample of the represented fuel must be tested for free water (AEL, Aqua-Glo, Hydro-Light, ASTM D3240) and particulate matter (ASTM D2276, ASTM D5452) to determine if product meets existing standards (10 ppm, per Table 1) and assist in determining cause of failure.
14. FAME is defined as material meeting the limits of EN14214 or ASTM D6751. Fatty Acid Methyl Esters that fail to meet the biodiesel quality standards are not permitted in aviation turbine fuel.
15. Activities using a particulate counter must also maintain a gravimetric test (ASTM D5452) capability. If particulate counter fails Table 1 requirements, the gravimetric test must be performed before rejection occurs. The gravimetric test is the referee test method.
16. (c) indicates that the equipment has been calibrated in accordance with ISO 11171.
17. To be reported – not limited.
18. Referee Test Method.
19. Microseparometer is not required if turbine fuel contains static dissipater additive.
20. Not applicable for U,S. Air Force.
21. ASTM D3828 may give results up to 1.7 °C below the ASTM D93 results. ASTM D56 may give results up to 1 °C below the ASTM D93 results.

TABLE Ia. IGRL for kerosene, NATO F-58, ASTM D3699

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Flash Point, °C (°F), min	38.0 (100)	37.0 (98.7)	D56 (referee) or D3828

TABLE II. IGRL 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

NOTE:

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

TABLE III. IGRL) for fuel, naval, distillate, NATO F-76 (MIL-DTL-16884) [1, 8]

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.	[4]	0.1	D2709
Particulate contamination, mg/L, max.	10.0	15.0 [5]	D6217 or D5452
Storage Stability total insoluble, mg/100 mL max.	2.0 1.0	6.0 [6] 3.0[7]	D5304 D2274
Sulfur content, wt. % (max)	0.0015	0.0015[9]	D5453
FAME content, vol% (max)	0.1	0.5	D7963, EN14078 or IP579

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. See note 1 of Table 1 of MIL-DTL-16884N.
5. Shoreside-use only.
6. Storage Stability results greater than 2.0 mg/100 ml. shall be reported to DLA Energy Quality Operations Division.
7. Storage Stability results greater than 1.0 mg/100 ml. shall be reported to DLA Energy Quality Operations Division. 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.
8. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol.
9. Until all F76 fuel procured under MIL-DTL-16884 M or previous revisions is out of the supply system (inventory), the acceptable use/issue limit for sulfur is 0.5 wt%.

TABLE IV. IGRL 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 Grade No.2-D S15 or No.2-D S500	288	293	
min max.	282 338	277 343	

NOTE:

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

TABLE V. IGRL 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	52	55	D93
Distillation,			D86
% v/v recovered at 250° C, max vol.,	65	12	
% v/v recovered at 340° C min	85	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 requirement for F- 54 is max 25 g/m^3 as per EN12205 or min 20 hour by EN 15751.

TABLE VI. IGRL for gasoline, unleaded, NATO F-67 [1]

TEST REQUIREMENTS	SPECIFICATION LIMITS (/F-67)	RECEIPT LIMITS	ASTM TEST METHOD
Color	Clear	Note [2]	Note [3]
Solvent –Washed Gum mg/100mL, max.	5	7	D381
Octane number, motor/research, min.	85.0/95.0		D2700/D2699
Vapor Pressure, kPa			
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	D5191
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			
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	75.0, 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	D86
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.	73.0, min.	
Final boiling pt. (°C)	210, max	204, max	
Class F/F1 @ 70	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 XIII). 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.

TABLE VII. IGRL for automotive spark ignition engine fuel, ASTM D4814 [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/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 8.1of ASTM D4814	+1°C from maximum temperature for phase separation, listed in Table X 7.1 of ASTM 4814	Note[5]

NOTES:

1. All required tests shall be performed (see Table XIII). 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 (RON) and motor octane numbers (MON) or (RON+MON)/2.
4. These requirements only apply to gasohol.
5. Maximum temperature allowable before separation into two phases by addition of 0.1 % water.

TABLE VIIa. IGRL for gasoline, aviation low lead (NATO F-18), ASTM D910, and gasoline, aviation unleaded, ASTM D7547 [2]

TEST REQUIREMENTS	SPECIFICATION LIMITS	RECEIPT LIMITS	ASTM TEST METHOD
Appearance [1]	Clear and Bright	Clear and Bright	D6986
Color Grade 100LL	Blue		D2392
Knock Value, Motor Octane Number Grade UL91, min Grade 100LL, min	 90.8 100	 99 [3]	D2700
Vapor Pressure, kPa, max	38.0-49.0	34.5-50.0 [3]	D323, D5191
Copper Strip Corrosion (2 h @ 100°C), max	No. 1		D130
Lead Content Grade 91UL Pb g/L (g/U.S. gal), max Grade 100LL TEL (mL/L), Pb (g/L), max	 0.0130 (0.05) 0.27 - 0.53 0.56	 0.60 [3]	 D3237, D3341 D3341, D5059 D5059

NOTES:

1. A visual assessment for clear & bright, solid matter, and undissolved water is to be made at ambient temperature
2. All required tests shall be performed except for Knock Value. For test requirements not in this table specification limits apply.
3. Applies to Navy only.

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

PRODUCT DESCRIPTION	MINIMUM TESTING FREQUENCY (MONTHS)
	BULK
Gasoline, Aviation	6
Gasoline, Automotive	6
Turbine Fuels, Aviation[2]	6
Diesel Fuels	6
Kerosene	6
Fuels, Burner	6
Fog Oils	6
Other Petroleum Products, such as Oils and Greases	6

NOTES:

1. Product at a depot/DFSP for a period longer than that indicated in Table VIII which has not been recertified to at least a Type B-2 test.
2. Product stored in collapsible containers shall be tested every month as a minimum.

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, 14,15]	REMARKS [8, 19]
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.	Type 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 Quality Operations Division, additional sampling and testing maybe required as the conditions warrant.
2a	Storage tanks Government Stocks	Bulk	Before pipeline shipment or vessel 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 at a type B level within 90 days need only Type C. Referee sample shall be retained. B2 level testing is required following refilling of bulk or operational tank after internal repair/maintenance is performed.
3	Pipelines Procurement & Government Stocks	Bulk	Before start of loading and after line pack operations	Line sample	Type C for Dedicated Line. B-1 for Common Line	Test results shall be within reproducibility of shipping tank
3a	Pipelines Procurement & Government Stocks	Bulk	Immediately after start of shipment or loading	Line sample, downstream of filter (if equipped) or closest to custody transfer point	Type C	
3b	Pipelines Procurement & Government Stocks	Bulk	Hourly after starting shipment or loading	Line sample, downstream of filter (if equipped) or closest to custody transfer point	Visual, plus additive analysis for FSII & SDA, if line injected	
3c	Pipelines Procurement & Government Stocks	Bulk	During Loading or Shipment	Representative line composite IAW API MPMS, Chapters 8.1, 8.2.	Retained composite	Sample to be retained as Referee. Conduct testing to based on the situation.

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, 14,15]	REMARKS[8, 19]
4	Vessel loading					
4a	Tankers and barges Procurement & Government Stocks	Bulk	Before Start of Loading/After Line Pack Operations	Line Sample	Type C for Dedicated Line (plus particulates if sample fails appearance.) Type B for common line	Test results shall be within reproducibility limits of shipping tank
4b	Tankers and barges First In Procurement & Government Stocks	Bulk	After receipt of line displacement or 1 meter in tank whichever is greater [14]	Spot	Appearance and density Type C-plus particulate if sample fails appearance, and additive analysis for FSII, SDA and lubricity (F76 only), if line injected.	For Government owned product only
				All-level from each compartment	Type C Conductivity, FSII and lubricity (F76 only) as appropriate	Navy underway replenishment/fueling at sea Only for procurement and Government owned product where SDA, FSII or lubricity additives are line injected, and ship's composite fails SDA, FSII or lubricity (F76 only) additives values. (Test each compartment). For intermediate discharges, sample remaining compartments and retain until discharge at destination.
4c	Tankers and barges Procurement (See contract for additional requirements) & Government Stocks	Bulk	After loading	Volumetric composite of cargo tanks after loading	Type B-1[18] only),	Vessel may sail after "C" Tests; Remainder of B-1 tests to be completed before arrival at next load or discharge port.
4d	Yard Oilers Government Stocks	Bulk	After Loading	Each compartment	Appearance, API, flash, BS&W	Normally yard oilers are in dedicated service and carry ships' fuels.
4e	Afloat DFSPs Government Stocks	Bulk	After Loading	Volumetric composite of all level or other representative samples	See Remarks	Shore facility shall perform Type C plus FSII for JP-5 & BS&W for F76

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, 14,15]	REMARKS[8, 19]
5	Vessel discharge					
5a	Tankers and barges (multi-product cargo) Procurement & Government Stocks	Bulk	Prior to discharge	All level from each tank	Appearance and density/API (Test for flash point on high flash cargo tanks if low & high flash cargoes are carried together aboard same vessel without segregated venting system.)	If on-spec, discharge authorized.
				Combined samples from each tank with product to create a volumetric composite. Retain remaining sample for referee testing.	Type B-1[18]	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 shall be retained. Type B-1 testing shall then be performed on an all-level sample taken from the receiving tank. If receiving tank sample fails any of the tests, perform B-1 tests on the tanker retain composite sample to determine the cause of the problem.
	Tankers and barges (Single-product cargo)	Bulk	Prior to discharge	All level from each tank Combined samples from each tank with product to create a volumetric composite. Retain remaining sample for referee testing.	Type C[18]	Discharge is authorized after conformance with Type C tests, and the provisions of Section 5.1.3.1 are met. 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.

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15]	REMARKS [8, 19]
5b	Dock/discharge manifold header Procurement & Government Stocks	Bulk	During discharge	Sample IAW API MPMS, Chapter 8, commencing one half hour after start of discharge and each hour thereafter until discharge completion. One-half quart shall be taken each time. Sample shall be composited after completion of discharge.	Visual and Retained Composite[3]	Retained for referee tests.
				Also, one gallon at one hour, midpoint, and one hour prior to completion.	Particulate and Retain[3]	For barge receipts directly into Airbases, refer to agreement for minimum standards.
5c	After receipt of fuel by waterborne transport. Procurement & Government Stocks	Bulk	After receipt of fuel.	Upper, middle, and lower composite, or all-level (from each storage tank)	Type B-1	Also, Thermal Stability testing after turbine fuel receipt by waterborne transport.
5d	Shipboard JP-5 Defuels for return to Defense Working Capital Fund inventory Government Stocks	Bulk	Before Discharge	Upper, middle, and lower composite or all-level or other representative sample (from each tank to be defueled) Combined samples from each tank to create a volumetric composite	Type B-1 plus thermal stability testing (If JP-5 is being regraded to F76, also test for lubricity.)	If volumetric composite sample fails thermal stability testing, investigative testing will be done on each compartment. If discharge is required (defueling operation), vessel should take samples prior to arrival at discharge port. Upon arrival, samples shall be provided to the responsible person at discharge port (DFSP or FLC) and tested per 5.1.3.1

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15]	REMARKS [8, 19]
5e	Shipboard F-76 Defuels for return to Defense Working Capital Fund inventory Government Stocks	Bulk	Before Discharge	Upper, middle, and lower composite or all-level (from each tank to be defueled) Combined samples from each tank to create a volumetric composite	Type B-1	If discharge is required (defueling operations), vessel should take samples prior to arrival at discharge port. Upon arrival, samples shall be provided to responsible person at discharge port (DFSP or FLC)
5f	Afloat DFSPs Government Stocks	Bulk	Prior to Issue	Upper, middle, and lower composite or all-level or other representative sample (from each issue tank) Bottom Sample	Type C Appearance	For the 1st customer of day (and change of supply tank) a sample shall be taken and checked for visual and then retained for 15 days. If older than one month then type C testing on board vessel. If discharge is required (defueling operation), vessel should take samples prior to arrival at discharge port. Upon arrival, samples shall be provided to responsible person at discharge port (DFSP or FLC)
5g	Afloat DFSPs Government Stocks	Bulk	Prior to Defuel	Upper, middle, and lower composite or all-level (from each tank to be defueled) Combined samples from each tank to create a volumetric composite	Type B-1 plus thermal stability testing	

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15]	REMARKS [8, 19]
6	Pipeline/TC/TT receipts.					
6a	During pipeline Receipt Procurement & Government Stocks	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 shall be used as referee sample if testing of receipt tank fails. If product is Government owned and going into a DFSP, obtain hourly samples throughout receipt to ensure sufficient volume is available at completion of the receipt to make two, 1-gallon composite samples.
6b	After receipt of fuel via multi product pipeline Procurement & Government Stocks	Bulk	After receipt of fuel	Upper, middle, and lower composite, or all-level (from each storage tank)	Type B-1	A (full specification) testing is required if product was fungible and no Type A recertification was provided by the supplier (RCQ, COA, COQ etc.)
6c	TC/TT receipt Procurement & Government Stocks	Bulk	Prior to discharge	Representative sample from each compartment	Visual[11]	Retain sample until receipt tank testing indicates product meets specification or until product is consumed (procurement only).
				Composite from each compartment	Type C[10]	
6d	TC/TT receipt Procurement & Government Stocks	Bulk	During receipt at custody transfer point	Line sample, after line displacement	Type C [10]	First TC/TT of the day shall be sampled from each supplier or new batch. Where capability exists. Not applicable for ground fuels.
6e	TC/TT After receipt of fuel via a dedicated mode Procurement & Government Stocks	Bulk	After receipt of fuel	Upper, middle, and lower composite, or all-level (from each storage tank that received fuel)	Type C Except on initial filling or change of grade which requires B-1	

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15]	REMARKS [8, 19]
7	Transfers within installation or depot Government Stocks					
7a	Receiving Tank: Through a dedicated system Government Stocks	Installations and Depots	After receipt of fuel	Upper, middle, and lower composite, or all-level	Type C[11]	Samples shall be retained for 45 days for referee purposes.
7b	Through a common system Government Stocks	Installations and Depots	After receipt of fuel	Upper, middle, and lower composite, or all-level	Type B-1	Samples shall be retained for 45 days for referee purposes.
7c	Receiving Tank/Initial fill or Product Conversion Government Stocks	Installations and Depots	Initial fill or product conversion	Upper, middle, and lower composite, or all-level	Type B-1	
8	Long-term storage (wherever located) Government Stocks	Bulk	Periodically, as required by Table VIII.	Upper, middle, and lower or all-level (Ensure all-level or spot sample quantity is sufficient to meet testing needs i.e., 1 U.S. gallon for particulate)	B-2 or A (see remarks)	a. Separate samples; upper, middle, and lower samples shall be taken and tested to establish homogeneity (See 3.1.69). If homogenous, combined 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	Afloat DFSPs Government Stocks	Bulk	Every 6 months. Periodic loading does not reset the 6-month requirement.	Upper, middle, and lower composite, all-level or other representative (from each tank to be defueled) Combined samples from each tank to create a volumetric composite	B2	If product have been on-board 6 months or more, obtain samples and then ship to nearest approved military laboratory for testing in accordance with long-term storage requirements in Table VIII.

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15]	REMARKS [8, 19]
9	Filling Points for road tank truck and rail tank car compartments, or other equipment Procurement & Government Stocks	Bulk	Daily on first compartment filled, and on changeover to fresh feed tank after line displacement from the fresh feed tank[17]	Line sample, downstream of filter or as close as possible to custody transfer point	Visual check for color and appearance If sample fails, perform Type C	Information on retaining of samples see note 8.
10	Aircraft Defueling Government Stocks	Aircraft	Prior to defueling	Composite sample from each aircraft sump tanks to be defueled	Appearance	Once aircraft sumps have been drained IAW aircrafts technical orders T.O.s 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 may be reissued to aircraft in accordance with service guidance as long as it meets two filtration requirement or it may be returned to bulk storage through a filter separator [11, 12, 13]. If the product contains +100, additive, the product may be returned to an aircraft requiring +100 or may be returned to bulk storage through a filter separator at a ratio of 1:10 (1 gallon of defueled product to 10 gallons of product in bulk storage)."
11	In rail tank cars, Inter-Modal Containers(ISO-Containers), and road tank truck vehicles and refuelers used in over the road transportation Procurement & Government Stocks	Bulk	Daily on first conveyance for each mode type i.e., road tank truck, rail tank car, etc. Both after loading and before discharge	All level sample from each compartment or from another point that provides a representative sample	Appearance on each compartment Type C on composite	Road tank truck vehicles with multiple compartments shall have a 1 quart representative sample obtained from each compartment. If product contains additives (FSII and/or SDA), that were line injected, then each mode of transportation before discharge shall be tested for FSII and Conductivity[5,7,10].

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15]	REMARKS [8, 19]
12	Tanks containing interface mixtures from pipeline for re-injection Procurement	Bulk	Before re- injection	Upper, middle, and lower composite, or all-level	Type B-3	Re-injection of interface product is to be under the technical control of the pipeline authority, or IAW with Operating Agreement (O.A.)
13	Refueler trucks, skid mounted refuelers, or other dispensing equipment Government Stocks	Bulk	Daily or prior to use	Sump Sample	Check for (visual) color and Appearance	
			30 Days[7]	Line sample, downstream of filter. (Under flow condition)	Laboratory or field analyses for water & sediment [9] See remarks (Aqua- Glo or AEL,Hydro-Light, or equivalent)	(b)The sample fails if the color is 5 or greater, or the visual particle assessment is marginal (M) or unacceptable (U) as assessed with the Millipore guide, or D or greater as assessed by the Gammon guide. Failures shall be retested using a matched weight monitor (ASTM D 2276, appendix X1)

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

SERIES	LOCATION OF STOCKS	TYPE STORAGE	WHEN SAMPLED	TYPE SAMPLE [1]	TESTING REQUIRED [2,4,14,15,16]	REMARKS [8, 19]
14	(a) Tactical Fuel System (Newly established)	(a) Bulk	(a) Upon initial fill/start-up	(a) Line sample, downstream of filter separator	(a) B-1	
	(b) Tactical Fuel System (In continued use)	(b) Bulk	(b) Daily prior to loading first container for shipment	(b) Line Sample downstream of filter separator	(b) See Remarks	(b) Visual check for color and appearance. For turbine fuels, perform analysis for water (Aqua-Glo, Hydro-Light, or AEL) and sediment/particulate by field or laboratory analyses. (ASTM D2276, Appendix X1) Every 14 days, test for FSII and Conductivity[10]
	(c) Tactical Fuel System (In continued use) Note: If product is capitalized, these instructions shall be followed. If the product is non-capitalized, then respective Service technical guidance shall be followed.	(c) Tactical operating storage used for direct aircraft refueling	(c) See Remarks	(c) Line Sample downstream of filter separator **Note:** During initial fill, the sample shall be taken during recirculation	(c) See Remarks Diesel Fuels and Gasoline see note 16	(c) Visual check for color and appearance. For turbine fuels, perform laboratory analysis for water (Aqua-Glo, Hydro- Light, or AEL) and sediment / particulates by field or laboratory analyses. (ASTM D2276, Appendix X1).[10] Conduct a Filter Effectiveness Test every 30 Days. Test every 7 days for FSII and Conductivity[10]
15	New collapsible fabric tanks and or drums attached to a fixed facility **Note:** If the product is capitalized, these instructions shall be followed. If the product is non-capitalized, then respective Service technical guidance shall be followed.	Bulk	Initial fill (before issue) **Note:** after recirculation of fuel	Downstream of filter separator	B-1	

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

NOTES:

1. Use the API MPMS for sampling methods (see Section 4.7 in this Standard).
2. See Tables X through XXII 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, MSEP, 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 of principal characteristics most likely 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. If tested for particulate content, the fuel samples should not exceed 2 mg/L; however, the first and last samples may show higher particulate content due to vessel/shore startup or stripping processes. Particulate contamination results while extremely objectionable, are a physical contaminant that can be removed under proper conditions with proper equipment, and since the product at this point is Government owned, discharge operations shall not be discontinued for this reason. However, the contracting officer, DLA Energy Quality Operations Division, and the Quality Assurance Representative at the loading point shall be advised of any high particulate results. This information shall be used for future planning purposes and for determining possible cleaning actions necessary on the vessel involved. Particulate testing is not required from DFSP to DFSP transfers, but is required on shipments from a supplier to DFSP. This note is not applicable to internal Navy transfers.
4. Flash Point at the receiving point is not required for product used by the U.S. Army. This fuel is tested in accordance with Petroleum Laboratory Operations (TM 4-43.31).
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. Filter-separator performance shall be checked (not to exceed) every 30 days. At the Service Control Point's option, filter separator performance may be checked using color comparison method in lieu of the matched weight monitor.
7. For sample retention see Contractor Inspection Responsibilities (Storage) within contract provisions.
8. Testing may be complete specification testing or an individual test based on request of Government Representative.
9. When field tests exceed limits, samples shall be forwarded to the respective Service area laboratories for further testing. 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 placed in Quality Hold (dead lined) pending successful remedial action as directed by the Service Control Point.
10. For aviation fuel delivery, FSII and SDA shall be tested where capability exists.
11. 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
12. If defueled product grade is other than the grade stored at the location returning the product to bulk storage, the following compatibility requirements must be followed: If location stores JP-8, F24, Jet A (with or without additives) or Jet A-1 (with or without additives) the following on-specification products may be returned to bulk storage in accordance with Service guidance: Jet A (with or without additives), F24, Jet A-1 (with or without additives), JP-8, JPTS and JP-5. If location stores JP-4, JP-5, JPTS or other aviation fuel grade not listed in this note, isolate the refueler and follow the disposition request guidance in 5.13.2 and 5.13.3. If the product is suspected of contamination, product shall be isolated by transferring to a holding tank or refueler vehicle. The product shall be placed, on QC hold. A sample shall be sent to the area laboratory for B-3 testing. If the product is found not suitable for use follow disposition request guidance in 5.13.2 and 5.13.3.
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
16. For Gasoline, Free Water and Sediment testing is not required unless contamination is suspected. For Diesel fuel, when excessive visible sediment is observed, retest using field or laboratory analysis (ASTM D2276, Appendix X1)
17. Not required for dedicated jet fuel trucks loading fungible products.
18. Type A level testing required for Procurements FOB destination (unless otherwise specified by contract/solicitation document.
19. See section 4.2.1.7 for sample sizes.

TABLE X. Tests required aviation gasoline [3]

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance [1,2]	X	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		
Free water determination [2]	X	X	X	
Lead content	X	X		
Potential gum		X		

NOTES:

1. Obtain sample in a clear round 1 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. AVGAS samples shall be checked for particulate and water. Particulate shall be determined visually upstream of filter separators and/or by the particle assessment method downstream of the filter separator. Free water shall be determined downstream of filter separator using a water detector (AEL Aqua-Glo test method or Hydro-Light).
3. For determining correct testing results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol

TABLE XI. 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) [11]	X	X	X	X
Water reaction[2]	X	X	X	
Lead content (If contaminated with leaded fuels suspected)	X	X	X	
Fuel system icing inhibitor[3]	X	X	X	
Filtration time	X	X	X	
MSEP (JP-4 , JP-8, F-24, F-27, Jet A & Jet A-1) [4,5]	X	X	X	
Conductivity (JP-4 and JP-8, F-24, F-27 & Jet A-1) [6]	X	X	X	
Thermal stability (B-1 requirement applies only to JPTS and marine/multi-product mode receipt tank sample)[10]	X	X		
Color (Saybolt)		X		
Acid number		X		
Peroxide Number [8]		X		
Fatty Acid Methyl Ester (FAME)[9]	X	X	X	

NOTES:

1. Obtain sample in a clear round 1 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. Only performed on JP-4 and JP-8.
3. If product contains FSII, product should be checked on delivery into a bulk storage tank and every month thereafter.
4. If the capability does not exist to perform this test at the terminal, a sample can 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 Quality Operations Division.
5. MSEP, testing is not performed if the fuel contains conductivity additive.
6. If fuel contains conductivity additive, CU readings should be taken within two minutes of sampling.
7. For determining correct reporting of test results (rounding protocol) see 4.2.2.2.1 Testing Rounding Protocol
8. Only applicable to Jet A use by the Navy.
9. Only for product transported through multi-product systems, including marine transport.
10. For JPTS: use either TDR, Ellipsometer (ETR) or Interferometer (ITR). ETR is the referee. For all other fuels, follow specification requirements.
11. Flash Point at the receiving point is not required for product used by the U.S. Army. This fuel is tested in accordance with Petroleum Laboratory Operations (TM 4-43.31).

TABLE XII. Support for secured fuels [4]

	JP-5		Jet A		Jet A-1[7]		JP-8		F-24	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Appearance [2]										
Gravity, API @ 60 °F D1298/D4052	36.0	48.0	37.0	51.0	37.0	51.0	37.0	51.0	37.0	51.0
Density at 15°C (kg/m^3)	788	845	775	840	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	6.5	7.0
Distillation (°C) D86[3]										
10% Recovered		205		205		205		205		205
20% Recovered		Report						Report		
50% Recovered		Report		Report		Report		Report		Report
90% Recovered		Report		Report		Report		Report		Report
Final Boiling Point		300		300		300		300		300
Freezing point, °C D5972/D2386		-46		-40		-47		-47		-40
Flash point, °C D93/D56	60		38		38		38		38	
Particulate Matter (mg/L) D2276, D5452, Appendix C of MIL- DTL-83133		0.5		0.5		0.5		0.5		0.5
Conductivity (pS/m) D2624			Report		Report		50	700	50	700
Copper strip corrosion D130		No.1		No.1		No.1		No.1		No.1
Water reaction D1094								1b		
Existent gum (mg/100 mL) D381		7		7		7		7		7
FSII, (vol %) D5006 [1]	0.07	0.20					0.04	0.15	0.04	0.15
Thermal Stability D3241										
Change in pressure drop, mm Hg		25		25		25		25		25
One of the tube deposit rating methods shall be run: (1) Ellipsometer (ETR)[6] (nm) or Interferometer (ITR) (nm)		85		85		85		85		85
(2) Heater tube deposit, Visual Tube Rating (VTR)		< 3		< 3		< 3		< 3		< 3
Fatty Acid Methyl Ester (FAME)[5]		50		50		50		50		50

NOTES:

1. Only use FSII meeting specification MIL-DTL-85470, Inhibitor, Icing, Fuel System, High Flash, NATO Code Number S-1745.
2. Fuel shall be clear, bright, and free of water and sediment on visual examination. Sample will be taken downstream of final filtration on refueler or hydrant servicing equipment.
3. Distillation property criteria are specified in ASTM D86 scale units. ASTM D2887 results shall be converted to estimated D86 results by application of the correlation in Appendix X4, "Correlation for Jet and Diesel Fuel (Procedures A and B)" of D2887 for comparison with the specified property criteria. Distillation residue and loss limits provide control of the distillation process during the D86 test method and do not apply to D2887.
4. Alternate test methods may be performed provided they are authorized by the specification of the product being tested. Referee test methods are preferred.
5. Only for product transported through multi-product systems. FAME (fatty acid methyl esters) is defined as material meeting the limits of EN14214 or ASTM D6751. FAME that fails to meet the biodiesel quality standards are not permitted in aviation turbine fuel.
6. Tube deposit rating shall be measured by ASTM D3241 ETR Ellipsometer (ETR), when available: otherwise, use Interferometer (ITR) or visual (VTR). ETR shall be the referee procedure, otherwise ITR.
7. DEF STAN 91-091, ASTM D1655 and GOST R 52050 are acceptable.

TABLE XIII. Tests required automotive gasoline

PROPERTIES	B-1 TEST	B-2 TEST	B-3 TEST	C TEST
Appearance	X	X	X	X
Color (Visual)	X	X	X	X
Water and Particulate (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	
Unwashed gum/Solvent-washed 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, run Type A test as defined in the legend.
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 XIV. Tests required E85 (ASTM D5798) [1, 2]

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

NOTES:

1. For cleaning see 5.9.4.2
2. In accordance with DOE Handbook for Handling, Storing and Dispensing E85 and Other Ethanol- Gasoline Blends, it is recommended at a minimum to test the following every one to two months: electrical conductivity, particulate content, hydrocarbon content (D5501 with D5798), water content and RVP. The DOE Guidebook link is https://www.afdc.energy.gov/uploads/publication/ethanol_handbook.pdf (May need to save file vs open document)

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 (F-76 only)		X		
Copper strip corrosion		X		
Cetane index [3]		X		
Viscosity (F-76 only)		X		
Water & sediment by centrifuge		X		
Particulate (F-76 only)	X	X		
Storage stability (F-76 only)		X		
Sulfur [4,5,6]	X	X		
Fatty Acid Methyl Ester (FAME) (F-76 only)	X	X		
Lubricity (F-76 only)	X	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 to be contaminated with a higher sulfur content fuel.

TABLE XVI. Test required on BDI

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		

NOTE:
1. Obtain a sample in a clear round 1 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.

TABLE XVII. 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		

NOTE:
1. Perform only if water is observed.

TABLE XVIII. 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	X		
Sulfur		X		
Pour Point		X		
Water	X	X		
Ash		X		
Sodium		X		

TABLE XIX. Tests required on residual marine fuel (RMG 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		

TABLE XX. 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 °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		
Pour Point		X		
Appearance	X	X	X	X
Fatty Acid Methyl Ester (FAME)	X	X		

TABLE XXI. Tests required bulk 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[5]	X[5]
Solid contaminants	X	

NOTES:

1. For application of these tests see Table IX.
2. B-2 tests are listed in Tables XXII.
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.
5. Is only required if the oil fails appearance because of water contamination (cloudiness).

TABLE XXII. Type B-2 tests for bulk lubricating oils[2]

CHARACTERISTICS	SPECIFICATION			
	MIL-PRF-6081 (LA6)	MIL-PRF-9000 (LO6)	MIL-PRF-17331 (LTL)	SAE J 1966 (LA7)
Appearance / workmanship	X			X
Color	X			
Viscosity @ 100°C		X	X	X
Viscosity @ 54°C				
Viscosity @ 40°C	X [1]		X	
Viscosity @ -40°C	X			
Viscosity @ -54°C	X			
Relative density				X
Flash point	X	X	X	X
Pour point		X	X	X
Neutralization number (acid/base)	X	X	X	X
Copper strip corrosion	X		X	X
Corrosion & oxidation stability	X			
Evaporation loss				
Precipitation number				
Ash		X		X
Emulsion			X	
Foam test		X	X[1]	
Water content			X	
Particulate content / trace sediment	X			X
Trace metals				
Carbon residue				X
Hydrolytic stability				
Minimum retest frequency (months)	36	24	24	36
Visual check frequency (months)	12			
Military symbol(s)	None	9250	2190-TEP	1065, 1080, 1100, 1120
NATO Code Numbers	O-133	O-278	O-250	None

NOTES:

1. Option A may be used for Government owned 2190 TEP if the conditions are met as required by ASTM D892.
2. For packaged product information refer to MIL-STD-3004-2.

Only an approved laboratory under the DoD Shelf-Life Program can authorize a shelf-life extension of any item. For laboratories that cannot perform the full B-2 series tests, recommend the following statement be included in the remarks section of the lab report: "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."

TABLE XXIII. Conversion chart for tank trucks (TT) tank cars (TC), 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, F-24, JP-5, TS-1, KS-1/R/N,	Jet Fuel [3]: JPTS	RP1 /RP2[4]	JP-10/PF-1[4]	Diesel Fuel: F-76	FSII [4]	Lubricating Oils	Diesel Fuels: DF1,DF2,DS1, DS2,ASTM D975
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	Steam/Dry
Jet Fuels: Jet A/A-1, JP-8, F-24, JP-5, TS-1, KS-1/R/N,	Drain/Empty	Drain/Empty	Steam/ Dry	Steam/Dry	Steam/Dry	Steam/ Dry	Steam/ Dry	Steam/ Dry	Steam/Dry
Jet Fuel: JPTS	Drain/Empty	Drain/Empty	Drain/Empty	Drain/Empty	Steam/ Dry	Steam/Dry	Steam/Dry	Steam Dry	Steam/Dry
RP1/RP2	Steam/ Dry	Steam/Dry	Steam/ Dry	Drain/Empty	Steam/ Dry	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	Steam/Dry
Petroleum Solvent or Paint Thinner	Steam/ Dry	Steam/Dry	Steam/ Dry	Hot Water Rinse & Dry	Steam/ Dry	Steam/ Dry	Steam/Dry	Steam/ Dry	Steam/Dry
Diesel Fuel: F-76	Steam/ Dry	Steam/Dry[9]	Steam/ Dry	Steam/ Dry	Steam/ Dry	Drain/Empty	Steam/Dry	Steam /Dry	Steam/Dry
Diesel Fuels: DF1,DF2,DS1, DS2,ASTM D975	Steam/ Dry	Steam/Dry	Steam/Dry	Steam/Dry	Steam/Dry	Steam/Dry	Steam/Dry	Steam/Dry	Drain/Empty
FSII	Drain/Empty	Drain/Empty	Steam/ Dry	Steam/ Dry	Steam/ Dry	Steam/Dry	Drain/Empty	Steam/ Dry	Steam/Dry

TABLE XXIII. Conversion chart for tank trucks (TT), tank cars (TC), Tank wagons (TW), Tank & Trailer (TRR), and Intermodal Containers (IMC) [1, 2] - Continued

LAST PRODUCT CARRIED	PRODUCT TO BE LOADED										
	JP-4,Jet B: Gasolines GASOHOL, MOGAS, E85,AVGAS,	Jet Fuels: Jet A/A-1 JP-8, F-24, JP-5, TS-1-KS-1/R/N	Jet Fuel[3]: JPTS	RP1/RP2[4]	JP-10/PF-1[4]	Diesel Fuel: F-76	Biodiesel Blends (≤B15) DF1,DF2,DS1, DS2, ASTM D975	Biodiesel Blends (> B15) DF1,DF2,DS1, DS2, ASTMD975	FSII	Lubricating Oils	Diesel Fuels: DF1,DF2, DS1, DS2, ASTM D975
Lubricating Oils	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	Stream/Dry	Stream/Dry	NO LOAD	Drain/Empty[8]	Steam/Dry
Biodiesel Blends(≤B15) DF1,DF2,DS1,DS2, ASTM D975	Steam/Dry	Steam/Dry	NO LOAD	NO LOAD	NO LOAD	Steam/Dry	Drain/Empty	Steam/Dry	Steam/Dry	Steam/Dry	Steam/Dry
Biodiesel Blends(>B15) DF1,DF2,DS1,DS2, ASTM D975	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	Steam/Dry	Drain/Empty	NO LOAD	NO LOAD	Steam/Dry
Heavy Fuel Oils, Distillate Fuels, ASTM D975, (No.4D),D396,(FS4,FS5, FS6), Residual Fuel Oils, ISO 8217,class F (IFOs)	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	NO LOAD	Steam/Dry	Steam/Dry	NO LOAD	NO LOAD	Steam/Dry
Naphtha	Drain/Empty	Steam/Dry	Steam/Dry	Steam/Dry	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	Steam/Dry	Steam/Dry	Steam/Dry

TABLE XXIII. Conversion chart for tank trucks (TT), tank cars (TC), Tank wagons (TW), Tank & Trailer (TRR), and Intermodal Containers (IMC) [1, 2] - Continued

NOTES:

1. General Instructions for Tank Cars and Trucks:
   a. Conveyances (all) shall be dry and free from loose rust, scale, and dirt
   b. Saran lined equipment should not be steam cleaned; water wash should suffice.
   c. Petroleum products shall not be loaded into the conveyances where the previous cargo was caustic, acid, or chlorinated solvents.
   d. Tank trucks and cars 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 must 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. The sample shall undergo Type B-2 testing 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, WAWF ERR or equivalent form shall be so noted.
2. Each Military Service shall provide specific guidance for conversion of refueling equipment which exclusively handles their 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 Quality Operations Division for acceptability/cleaning procedures.
5. For additional guidance applicable to fungible aviation fuel shipments see Section 5.3.1.2 (including subparagraphs).
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 same specification products; otherwise, steam and dry.
9. Prior to loading the aviation fuels listed, the conveyance must have carried a previous non-FAME cargo and then be steam cleaned and dried. Trucks that have previously carried biodiesel create a risk of cross-contamination of Jet Fuel with residual biodiesel components. Diesel fuel may contain up to 5% FAME without reporting it as biodiesel. Because of the difficulties in making a determination at the load rack of the presence of FAME in the previous load, the more stringent “Steam/Dry is required.
10. Drain and Empty if loading biodiesel blends

TABLE XXIV. 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, F-24, JP-8	Jet Fuel: JP-5	Jet Fuel: JPTS	F-76	Biodiesel Blends (≤B15)[6] DF1, DF2, DS1,DS2, ASTM D975	Biodiesel Blends (>B15)[6] DF1,DF2, DS1,DS2, ASTM D975	Heavy Fuel Oils, Distillate Fuels, ASTM D975, (No.4D), D396, (FS4, FS5, FS6), Residual Fuel Oils, ISO 8217,class F (IFOs)	Crude[4]	Lube oils	Naphtha	F-76
Jet Fuels: JP-4, Jet B, Gasolines, Mogas, Avgas[5]	A	A,B	A,B	Note [3]	A,B	A	A	A	A	A,B	A,B	A,B
Jet Fuels: Jet A, Jet A-1, F-24, JP-8	A	A	A,B	Note [3]	A,B	A	A	A	A	A,B	A,B	A,B
Jet Fuel: JP-5	A	A	A	Note [3]	A,B	A	A	A	A	A,B	A,B	A,B
Jet Fuel: JPTS	A	A	A,B	Note [3]	A	A	A	A	A	A,B	A,B	A
F-76	A,C	A,C	A,C	NO LOAD	A	A	A	A,C	A	A,B	A,B	A
Biodiesel Blends (≤B15)[6] DF1,DF2, DS1,DS2,ASTM D975	A,C	A,C	A,C	NO LOAD	A,C	A,C	A	A,C	A,C	A,C	A,C	A,C
Biodiesel Blends (>B15)[6] DF1,DF2, DS1,DS2,ASTM D975	E	E	E	NO LOAD	A,C	A,C	A	A,C	A,C	E	E	A,C
Heavy Fuel Oils, Distillate Fuels, ASTM D975, (No.4D),D396,(FS4,FS5,FS6) Residual Fuel Oils, ISO 8217,class F (IFOs)	NO LOAD	NO LOAD	NO LOAD	NO LOAD	A,D	A,D	A,D	A	A	A,C	NO LOAD	A,D
Crude[4]	NO LOAD	NO LOAD	NO LOAD	NO LOAD	A,D	A,D	A,D	A	A	NO LOAD	NO LOAD	A,D
Lube Oils	NO LOAD	NO LOAD	NO LOAD	NO LOAD	A,D	A,D	A,D	A	A	A	NO LOAD	A,D
Naphtha	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A	A,B	A	A,B
F-76	A,B	A,B	A,B	NOTE [3]	A	A	A	A,C	A	A,B	A,B	A

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

1. Legend for vessel cleaning requirements are as follows:

TYPE	CLEANING
A	All cargo lines shall be dropped, tanks stripped, ballast residue removed.
B	All cargo and vent lines shall be drained of previous product and flushed with cold water. Cargo tanks must 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 shall be used instead of cold. If tank interiors are coated, water temperature should not exceed 58°C (136°F).
D	Cargo tanks and systems shall be processed in accordance with the instructions contained in EI HM 50 Guidelines for the cleaning of tanks and lines for marine tank vessels carrying petroleum and refined products.
E	Not to be loaded without special cleaning instructions. Three clean product/zero biological content intermediate cargoes required. (See Note 6 below)

NOTES:

2. This table is included as a guide only. Requirements for tanker cleaning are determined by MSC vessel cleaning policy (See Section 5.1.1.4). Contact DLA Energy Quality Operations Division for tank cleaning requirements for any product not listed in Table XXIV. If tank contains ballast water or water used for tank cleaning/washing, every effort shall be made to remove this free-water to the minimum level possible by draining or by use of a pump."

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.

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 carry three cargoes of a commercial like product without a quality incident.

5. Gas free, lift scale and mop. Motor Gasoline unleaded and ultra-low sulfur motor gasoline (unleaded) are to be cleaned by washing with cold, sea water and drain well.

6. Contamination of aviation kerosene with FAME current specifications permits only 50 ppm by mass FAME in aviation kerosene. Intermediate cargoes and strict washing regime is therefore recommended when loading aviation kerosene cargoes following cargos containing FAME. **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, cleaning of sampling equipment, vapor locks, stand pipes and stilling wells is recommended as part of 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.

NOTES Continued Aviation Gasoline:

Cargoes with FAME content of 15 vol % (B15) or less, but above B5, require 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 shall be 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 50 ppm by mass) three intermediate cargoes are required 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, require a hot water wash, including flushing of pumps and lines, followed by draining is recommended as a minimum. Tanks shall be in good condition and washing shall be 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) HM 50.

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

LAST PRODUCT CARRIED	PRODUCT TO BE LOADED					
	Leaded gasoline, aviation	**Gasoline, automotive**	**Jet Fuel Jet A/ F-24, Jet A-1, JP-5, JP-8**	**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
Jet Fuel Jet A/ F-24, Jet A-1, JP-5, JP-	A	A	A	A	A	E
Diesel fuel oil - distillate	C	C	A, C	A	A	E
Diesel fuel oil - residual	NO LOAD	NO LOAD	NO LOAD	D	A	E
FAME (Fatty Acid Methyl Esters or Diesel Blended 15 vol % FAME or Less (B15 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 higher)	C	C	A, C, F	F	F	F
Lube oils	NO LOAD	NO LOAD	NO LOAD	D	A	E

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

a. Legend for vessel cleaning requirements are as follows:

TYPE	CLEANING
A	All cargo lines shall be dropped and tanks stripped.
B	All cargo and vent lines shall be drained of previous product and flushed with cold water. Cargo tanks shall be thoroughly machine washed using cold water. Tanks shall be gas freed.
C	The same as Type B., except that hot water shall be used instead of cold water. If tank interiors are coated, water temperature should not exceed 58°C (136°F).
D	The same as for Type C above. In addition, tanks and lines shall be flushed with product to be loaded and examined to confirm meeting product specification. Process shall be repeated as necessary until passing results are obtained.
E	Cargo tanks and systems shall be cleaned in such a manner to remove all rust, scale, sediment, and all traces of previous cargo and water.
F	Contamination of aviation kerosene with FAME: current specifications permit up to 50 ppm by mass FAME in aviation kerosene. Intermediate cargoes and strict washing regime is therefore recommended when loading aviation kerosene cargoes following cargeos containing FAME. **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, cleaning of sampling equipment, vapor locks, stand pipes and stilling wells is recommended as part of 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), require 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, require 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 50 ppm by mass) three intermediate cargoes are required 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 shall 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) HM 50.

NOTE:
1. In all cases, cargo tanks must be free of water, loose rust, sludge, mud, silt, ballast residue, etc.
2. This table is included as a guide only. Contact DLA Energy Quality Operations Division for tank cleaning requirements for any product not listed in Table XXV.

TABLE XXVI. 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 shall be agreed to ahead of time with the carrier/contractor and be agreeable to all. Information on the total sulfur content of the typical military aviation fuel must be used as the basis for the formation of the cutting procedures agreed upon.

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.

TABLE XXVII. Contamination tables

TYPE CONTAMINANTS	APPEARANCE	CHARACTERISTICS	EFFECTS ON AIRCRAFT
A. WATER			
(1) Dissolved Water	Not Visible	Freshwater only. Precipitates out causing cloudiness 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 cloudiness. Droplets adhering to sides of bottle. Majority of water settled in bottom.	Free water may be saltwater or fresh water. Cloudiness 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. Samples representative of fuel serviced to aircraft shall contain no more than 10 fibers (See paragraph 5.11.3.2. e. for more details)	Will cause sticking, sluggish or general malfunction of fuel controls, flow dividers, pumps, nozzles, etc.

TABLE XXVII. Contamination tables - Continued

TYPE CONTAMINANTS	APPEARANCE	CHARACTERISTICS	EFFECTS ON AIRCRAFT
C. EMULSIONS			
(1) Water in fuel emulsions	Light to heavy cloudiness.	Finely divided drops of water in fuel. Same as free water cloudiness. 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 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 fuel. 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 on 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 internal tank surfaces. Develops only when free water is present.	Fouls fuel quantity probes, binds fuel controls sluggish.
E. MISCELLANEOUS			
(1) Interface material	Lacy bubbles at interface between fuel and water. Sometimes resembles jellyfish-like substance.	Extremely complicated chemically. Occurs only when free water is present.	Effects due to presence of free water.
(2) Air Bubbles	Cloudiness in fuel.	Disperses upward within a few seconds	None.
(3) Media Migration	Thin to gelatinous, light to dark brown, molasses type material	Found in or possibly downstream of filter-separators utilizing water absorbing (super absorbent polymer (SAP) based), filter monitor fuse filters. Polymer may migrate downstream of the filter-separator all the way to the aircraft fuel tank. FSII accelerates degradation of SAP; therefore, absorption-type media monitors shall not be used in filter separators where fuels contain FSII .	Capable of blocking the engine fuel filters. May promote microbial growth within the wing tank. May cause densitometer type fuels quantity gauges to read erratically or not at all.

TABLE XXVIII. Minimum standards of filtration and water separation for petroleum products

PRODUCT	INTO TANK CARS AND TRUCKS[5]	INTO DISPENSING UNITS[4]	INTO CONTAINERS (PACKAGE)	INTO AIRCRAFT[4]	INTO USING UNIT
Aviation Gasoline Bulk [1]	150 microns [2] (max) No Visible Water	Filter-Separator 10 ppm by volume water, max.	Filter-Separator 10 ppm by volume water, max.	Filter or Filter-Separator [1] 10 ppm by volume Water, max.	
Aviation Gasoline, Packaged[3]		Filter-Separator [1] 10 ppm by volume Water, max.		Filter or Filter-Separator [1] 10 ppm by volume Water, max.	
Aviation Turbine Fuels, Bulk[1]	150 microns [2] (max.)	Filter-Separator [1] 10 ppm by volume Water, max.	Filter-Separator [1] 10 ppm by volume water, max.	Filter-Separator [1] 10 ppm by volume Water, max.	
Aviation Turbine Fuels, Packaged [3]		Filter-Separator [1] 10 ppm by volume Water, max.		Filter-Separator [1] 10 ppm by volume Water, max.	
Aircraft Piston Engine Lube Oil, Bulk	240 microns [2] (max.) No Visible Water	240 microns [2] (max) No Visible Water	240 microns [2] (max.) No Visible Water	240 microns [2] (max) No Visible Water	
Aircraft Piston Engine Lube Oil, Packaged		240 microns [2] (max.) No Visible Water	240 microns [2] (max.) No Visible Water	240 microns [2] (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[7]			Filter-Separator [1,6] 10 ppm by volume Water		Filter-Separator[1,6] 10 ppm by volume Water

NOTES:

1. Filter-separator in accordance with EI 1581 or MIL-PRF-52308, electronic sensors that provide both a water and solid defense in accordance with EI 1598 and EI 1570, or other approved filter-separator equipment or a combination thereof.
2. 150 microns equals 100 mesh; 240 microns equals 60 mesh.
3. All visible water shall be stripped or drained from fuel prior to issue.
4. All dispensing units or equipment that issue Aviation Gasoline or Aviation Turbine Fuel directly to aircraft shall have a filter separator or electronic sensor installed at point of issue meeting requirements of Note 1.
5. 150 micron equals 100 mesh; 240 micron equals 60 mesh for Lubricating Oils for Tank Cars, Trucks and Intermodal Containers.
6. Applicable for Army only.
7. See 5.12.2.4. a.

TABLE XXIX. Bulk additive shelf life and testing frequency [6]

CHARACTERISTICS[1]	MIL-DTL-85470[4] (Bulk) FSII	MIL-PRF-25017[5] (Bulk CI/LI)
Workmanship	X	X
Ash Content		X
Pour Point		X
Density @ 15◦C		X[6]
Viscosity @ 40◦C		X[6]
Flash Point		X[6]
Total Acid Number	X	X[6]
pH @25°C (25% solution in water	X	X
Distillation	X	
Relative Density 20/20◦C	X	
Water	X	
Ethylene Glycol	X	
NSN	6850-01-057-6427	6850-01-113-2063
Shelf Life[2,3]	18 Months	24 Months
Test Frequency[4]	9 Months	15 Months
NATO Code Numbers	S-1745	S-1747

Note: For Packaged Products refer to MIL-STD-3004-2, contact DLA Aviation

TABLE XXIX. Bulk 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 thermal stability improver (+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 manufacturer states that the shelf -life for SDA is 5 years, and for +100 is 12 months.
3. For bulk additives, product stored in a tank without a nitrogen blanketing or desiccant system, which has not been resupplied with new product at least once within the shelf-life time frame, shall be visually inspected every 3 months and laboratory tested every 6 months or if visual analysis indicates suspected contamination. Once opened, packaged additives should be tested every 9 or 15 months until depleted or test results do not meet specifications.
4. Follow instructions and ASTM test methods and table properties contained within MIL-DTL-85470 to fulfill verification testing for FSII.
5. Perform conformance test identified in Table 1 of MIL-PRF-25017 when conducting shelf-life testing of CI/LI.
6. For shelf-life of Packaged Products refer to MIL-STD-3004-2, DoD 4140.27-M Vol 2 or contact agency office DLA Aviation.

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APPENDIX A

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 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

TABLE A1 List of Air ForceLaboratories

AIR FORCE LABORATORIES	TYPE PRODUCTS	TYPE TEST
Aerospace Fuels Laboratory (FP2070) AFPET/PTPLA 2430 C Street, Bldg. 70, Area B Wright Patterson AFB OH 45433-7631 COMM: (937) 255-2106 DSN: 312-785-2106	Aviation Turbine Fuel	A
	Diesel	A (Except Cetane Number)
	BDI Biodiesel Blend	B-2 (Except Oxidation Stability
	Burner Fuel	A
	MOGAS	A (Except Knock Rating and Oxidation Stability)
	AVGAS	A (Except Knock Rating)

APPENDIX A

TABLE A1 Air Force Laboratories -- Continued

AIR FORCE LABORATORIES	TYPE PRODUCTS	TYPE TEST
Aerospace Fuels Laboratory (FP 2075) AFPET/PTPLE 1747 Utah Avenue, Bldg. 6670 Vandenberg AFB, CA 93437-5220 COMM: (805) 606-5873 DSN: 312-276-5873	Aviation Turbine Fuel	A
	Diesel	A (Except Cetane Number)
	Burner Fuel	A
	BDI Biodiesel Blend	B-2 (Except Oxidation Stability)
	MOGAS	A (Except Knock Rating and Oxidation Stability)
	AVGAS	A (Except Knock Rating and Oxidation Stability)
Aerospace Fuels Laboratory (FP2080) AFPET/PTPLF Bldg. 1546, West Row Gate #6 RAF Mildenhall, Suffolk UK IP28 8NF COMM: 011-44-1-638-54-2043 DSN: 314-238-2043	Aviation Turbine Fuel	A
	Diesel	A (Except Cetane Number)
	Burner Fuel	A
	AVGAS	A (Except Knock Rating and Oxidation Stability)
Aerospace Fuels Laboratory (FP2083) AFPET/PTPLG Unit 5161, Bldg. 854 Kadena Air Base Okinawa Japan APO AP 96368-5161 COMM: 011-81-611-634-1602 DSN: 315-634-1602	Aviation Turbine Fuel	A
	Diesel	A (Except Cetane Number)
	Burner Fuel	A

APPENDIX A

TABLE A2 Army Laboratories

ARMY LABORATORIES	TYPE PRODUCTS	TYPE TEST
U.S. ARMY TARDEC Petroleum Laboratory 5085 U Avenue, Bldg. 85 New Cumberland, PA 17070-5083 COMM: (717) 770-6511 DSN: 312-771-6511	Aviation Turbine Fuel	B-1, B-2, B3
	Diesel & B20	B-2
	AVGAS	B-2
	MOGAS	B-2
	Chemicals	B-2
	Coal	B-2

TABLE A3 DLA Energy Laboratories

DLA ENERGY LABORATORIES	TYPE PRODUCTS	TYPE TEST
Mail Address: DLA Energy Europe & Africa Petroleum Laboratory CMR 422 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	Aviation Turbine Fuel	A (except JP-5 hydrogen)
	Diesel	A (except lubricity)
	Burner Fuel	A (except lubricity)
	F-76	B-2 (Except Storage Stability)
	MOGAS	B-3 (plus Vapor pressure)
	AVGAS	B-1 (except lead)
DLA Energy Pyongtaek Petroleum Laboratory APO AP 96271 Bldg. 848 Camp Humphreys, Korea COMM. (82)(031)-691-0963 DSN 315-753-7291	Aviation Turbine	A (except naphthalene, Hydrogen Content for JP-5)
	JPTS	A
	Ground Mobility	B-1, B-2, B-3 B-1 plus
DLA Energy Alaska Petroleum Laboratory Bldg. 986 Warehouse St COMM: 907-384-7180 DSN: 317-384-7180 JBER, Alaska 99506	Aviation Turbine	B-1, B-2, B-3
	DFA, DF1, DF2, DS-1	B-1, B-2, B-3
	DS-2, Burner fuel	B-1, B-2, B-3
	Aviation Gasoline	B-1, B-2, B-3
	Motor Gasoline	B-1,B-2, B-3

TABLE A4 Navy Laboratories

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 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351 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 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-2
	F-76	B-1
	2190 (LTL)	B-2
	9250 (LO6)	B-2
	JP8	B-2
	Jet A	B-1
	MUR (ASTM D4814)	B-1
	Fuel Oil	B-1
FLC Jacksonville FL Code 700, Fuel Dept. 8808 Somers Road, Bldg. 56 Jacksonville, FL 32226-2600 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-1
	F-76	B-1
U.S. Naval Station Rota Spain Attn: Fuels Officer PSC 819, Box 21 FPO AE 09645-21 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-2
	JP8	B-2
	F-76	B-1

TABLE A4 Navy Laboratories -- Continued

NAVY LABORATORIES	TYPE PRODUCTS	TYPE TEST
FLC San Diego Petroleum Laboratory Bldg. 70A Point Loma Annex San Diego, CA 92106 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-2
	F-76	B-2
	2190 (LTL)	B-2
FLC Puget Sound Manchester Fuel Department Attn: Q.A. Laboratory 7501 Beach Drive East Port Orchard, WA 98366 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-2
	JP-8	B-2
	F-76	B-2
	2190 (LTL)	B-1
	9250 (LO6)	B-1
FLC Pearl Harbor POL Laboratory 300 Neches Ave Bldg 1685, Code 704 Pearl Harbor, HI 96860-4549 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-2
	F-76	B-2
	2190 (LTL)	B-2
Commanding Officer FLC Yokosuka Guam Area Fuel Division Laboratory PSC 455, BOX 190 FPO AP 96540-1082 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	C
	JP-8	C
	F-76	C
	RME 25	C

TABLE A4 Navy Laboratories -- Continued

NAVY LABORATORIES	TYPE PRODUCTS	TYPE TEST
Commanding Officer FLC Yokosuka Code 700 PSC 473, Box 11 FPO AP 96349-0011 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	A
	JP-8	A
	F-76, Diesel	B-2
	2190 (LTL)	B-2
	Gasoline	B-2 + Engine
Officer-in-Charge FLC Yokosuka Det. Sasebo PSC 476, Box 7 FPO AP 96322-0001 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-5	B-2
	JP-5	B-2
	F-76	B-2
	2190 (LTL)	B-2
U.S. Navy Support Facility Diego Garcia Attn: Petroleum Testing Lab PSC 466, Box 24 FPO AP 96595-0004 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351		
Commanding Officer FLC Yokosuka Det. Hachinohe, Code 703.1 Unit 5260 PO AP 96319-5000 Contact Navy Petroleum Office (NPO) at: Telephone: Commercial: 571-767-7351 DSN: 392-7351	JP-8	B-2

APPENDIX B

SIGNIFICANCE OF TESTS

B.1 SCOPE

B.1.1 Scope. This appendix covers 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 certain significance in relation to the quality of the product tested. Certain ones can provide 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 a mandatory part of 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 embrittlement of boiler fire boxes and boiler tubes.

B.4 Basic Sediment and Water (BS&W). The BS&W test 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 provides 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 percent of the sample, the carbon residue on the last 10 percent 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 required 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 the distillation mid-boiling point or from density and distillation recovery temperature measurements.

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 engines of stationary installations do not require high cetane numbers (below 40). Smaller, high-speed engines operating at 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 an 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 picosiemens/meter (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 containing Stadis 450

conductivity additive. The U.S. Navy does not use conductivity additive in JP-5. Conductivity additive is only added to JP-5 when the product is used for issue or purging of Air Force tactical aircraft or when used in a refueler that does not have a static relaxation vessel.

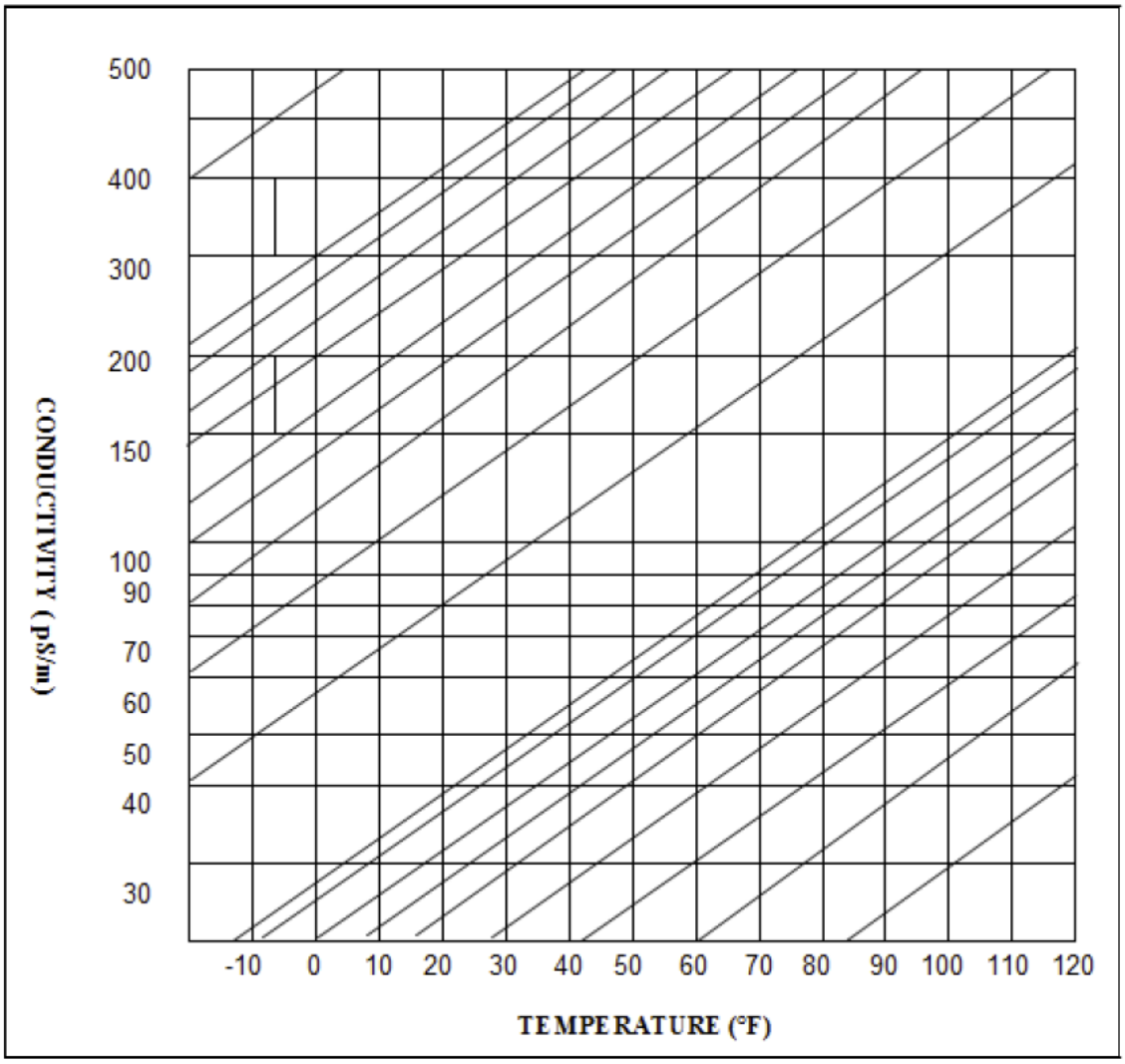

FIGURE B-1. Conductivity

APPENDIX B

B.11 Copper Strip Corrosion. This test indicates whether a petroleum product is free of corrosive compounds.

B.12 Distillation. This test is a measure of the product's volatility. 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 oil 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 a 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 after quick evaporation of the fuel under conditions of the 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 has an adverse effect on 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.

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B. 17 Fuel System Icing Inhibitor (FSII). 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.

B. 18 API Gravity or Density. Density, relative density and specific gravity are factors that govern the quality and pricing of crude and finished petroleum products. 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: Degree API at 60°F (141.4 / (relative Density 60/60°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.

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.

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 (MON). 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.192 Octane Number-Research Method (RON). 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 ((RON+MON)/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.

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 (SLBOCLE) test by ASTM D6078, the high frequency reciprocating rig (HFRR) test by ASTM D6079, or the ball-on-cylinder lubricity evaluator (BOCLE) test by ASTM D5001. 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. Sulfur content is also important for gasoline and diesel fuel to be used as on-road fuels for environmental compliance.

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.

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 5.10.2.6

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. 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 Micro-Separometer (MSEP). The MSEP (previously referred to as water separation index modified or WSIM 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 MSEP rating. Fuels having low MSEP 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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COAL SURVEILLANCE PROCEDURES

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 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/.)

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 with properties ranging 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.

C.4.1.3 Bituminous. A dense, firm black coal, representing about fifty (50) percent of the steam and 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.

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 percent, weight, maximum for coal greater than 1 ¼ inch, and 15 percent, 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 percent, 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 is 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 ASTM International. Adhering to these procedures is critical to the veracity of the sample results.

b. Before any analysis is conducted, care should be taken to ensure 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 by one degree Fahrenheit. The metric system expresses the heat content in calories. One BTU equals 252 calories. To compare the heating value of two or more coal types, 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 (SO2) is formed in the combustion process and is discharge into the atmosphere along with other combustible byproducts such as hydrogen sulfide (H2S) and nitrogen oxides (NOx). If these 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 diluent 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 content 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 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 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.

C.4.3.9 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 coal 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, WAWF ERR or equivalent form 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 Section C.5.10). The activity shall immediately provide notification to DLA Energy Quality Operations Division 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 Section 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 shall 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 Quality Operations Division (email QA@dla.mil, phone 571-767-8736, or facsimile DSN 392-767-8747) 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.

C.4.8 Acceptance. When all contract requirements are satisfied, inspection and acceptance are accomplished by designated facility personnel on behalf of the Government. An Energy Receiving Report (in lieu of the DD Form 250) is entered into the Wide Area Work Flow (WAWF) by the contractor. The QAR then inspects the WAWF ERR (test documentation and shipment invoice) and certifies the report is correct. Acceptance is then carried out in WAWF by the customers designated acceptor certifying acceptance by a Government or Government contract employee. The ERR is then routed, through WAWF, to the proper office 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 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 Section 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 or ERR, 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). It should also include requirements for labeling and retaining samples (specify retention time for each sample). A size consist sample must be retained for 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.

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 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.5.1.10 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 or ERRs, analytical test reports).

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, ERR or equivalent form, 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, ERR or equivalent.

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. ERRs, DD 250s, or equivalent form, 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 on-specification 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 indicating the type of coal and number of rail cars or trucks are in transit.

c. A record of delays in delivery and demurrage charges. Delays in offloading should be documented in detail to support demurrage payment. Identify actions being taken (e.g., receipt sampling, testing), or other actions involved in the demurrage charges.

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 Section 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.[8] 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 sample tags regarding each sample to assure proper analysis and reporting of the sample submitted. The information listed in Section 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).

[8] ***Note: The use of glass containers for mailing is not permitted***

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 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:

U.S. Army TARDEC Petroleum
Laboratory
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 and coordinate 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.

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 D7430, 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 D7430 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 D6883, for rail or trucks shipments (9-Point, Car top Sampling). The sampling guide in ASTM D6883 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 D6883. 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 D6883. 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.

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 D6883 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.

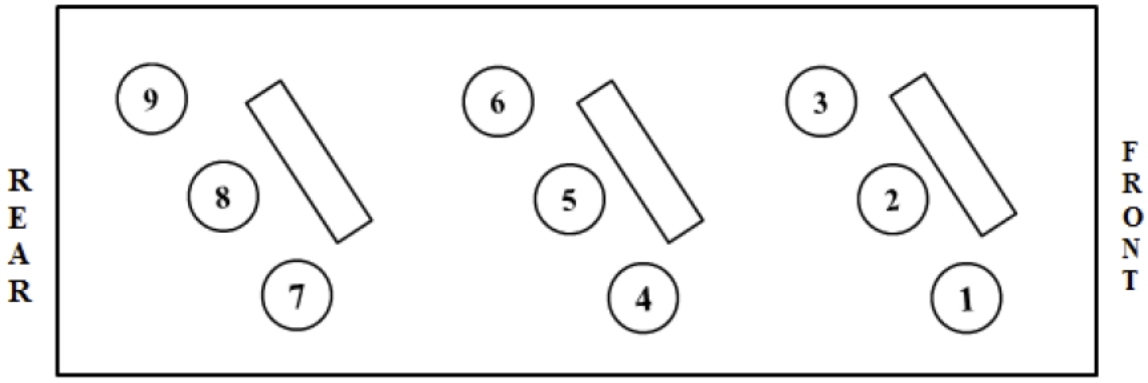

FIGURE C-2. Car Top Sampling

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%.

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, 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/ERR 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 Section C.5.6).

(4) When visual examination indicates that a shipment shall 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 Section 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 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 FEA (Phone: 571-767-8527; FAX: 571-767-8757), DLA Energy BPE (Phone: 571-767-8362; FAX: 571-767-8366), and DLA Energy Quality Operations Division (email QA@dla.mil, phone 571-767-8736, or facsimile DSN 392-767-8747). 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 TARDEC Petroleum Laboratory 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 Section C.5.2.3)

APPENDIX D

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.1.2 RESPONSIBILITIES

D.4.1 Combatant Command (CCMD) Joint Petroleum Office (JPO). The CCMD JPO responsibilities are outlined in DoD Manual 4140.25. Communication between DLA Energy and the CCMD JPO on all petroleum matters is authorized and necessary.

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 Section 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 Appendix A of this document. 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 Quality Operations Division (Bulk Products) or DLA Aviation (Packaged Products) should be notified, as stated in Sections 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.

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 (See MIL-STD-3004-2).

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 with knowledge of a conflict between what is written in this Standard and any Service technical publication is requested to bring it to the attention of DLA Energy Quality Operations Division. Resolution of these conflicts shall be addressed individually.

D.4.5 Quality 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 email.

c. Performs the following, when requested:

(1) Investigates 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) Participates in pre-award surveys and post-award conferences.

(3) Monitors/witnesses the analysis of special samples of products submitted to commercial laboratories under contract.

(4) Maintains surveillance over the special blending and compounding of products.

(5) Assists 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. Advises 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 DoDM 4140.25 should be used.

f. Maintains vigilance over quality and quantity of Government-owned petroleum products, containers, and equipment in the possession of contractors.

g. Advises 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 or termination of use under a contract.

h. Verifies 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 the 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 DoDM 4140.25. 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 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 Text 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 Energy Quality Operations Division; 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 Quality Operations Division. For Service owned product (non-capitalized),

PQDR information is input into Product Data Reporting and Evaluation Program (PDREP); supplemental information is forwarded to DLA Energy Quality Operations Division. PQDRs are used to evaluate contractor performance under best value.

D.5 QUALITY CONTROL PLAN/PROCEDURES.

D.5.1 Quality Control Plan (QCP)/Procedures. Each fuel handling activity is usually required to establish a written quality control plan. Service technical orders, field manuals, Standard Operating Procedures (SOPs), Statements of Work (SOWs) and instructions fulfill this requirement. For contractors, they usually have 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 shall be followed. If the responsible 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 QCP 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 required for such operations as: testing, sampling, loading, discharges, or when an unscheduled situation arises that might cause a problem in product or service. Notification shall 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. Established Service guidelines or company policy should include an individual training program and documentation requirements.

e. A QCP 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 QCP 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 QCP describes the procedures used for blending. This includes all products and additive injection at all locations.

h. A QCP 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 shall be labeled and retained. The retention time is also specified for each sample. Sampling is in accordance with the MPMS, Chapter 8, and retention times in accordance with the contract or this Standard.

i. A QCP 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 shall be conducted and 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 QCP describes the method by which all laboratory and field testing and measuring equipment is calibrated in accordance with ISO 10012. For items not covered by that publication, the applicable manufacturer's recommended calibration method(s) are used.

k. A QCP 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 QCP 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 QCP describes how all required records and reports will be prepared and maintained. The plan states where, how, when, who, and for how long documents retained. The documents to be covered include, but not limited to, test reports (both additive and product), blending records, gauging records, movement records, dock logs, corrective action requests, quality/quantity investigations, ullage reports, DD Forms 250 and 250-1, WAWF ERR or equivalent form, bills of lading, certificates of calibration, manufacturers' certificates of conformance, and any other documents affecting product.

n. A QCP 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 calibrates, calibrated scales, or calibrated meters.

o. A QCP 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.

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APPENDIX E

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 SUGGESTED FORMAT FOR A PRODUCT CHANGE RECORD

E.2.1 Product Change Record. The following information should be included in a product change record.

a. Location: Enter the name of terminal or website 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.

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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:

$$\frac{\text{(Average relative density of BBLS mix) - (relative density of head product x 100)}}{\text{(Relative density of displacing product) - (relative density of head product)}}$$

n. BBLS Displacing product in mix: Enter in this column the results of the following formula: (Percent displacing product in BBLS mix) × (BBLS mix)

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.2.2 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 hours (14 minutes): API: 45.9, Sp Gr (relative density): 0.7976.

(2) Barrels mix at 0809 hours (14 minutes) is 33.8.

(3) Average gravity of volume increments at 0808 hours (13 minutes) at 0809 hours (14 minutes) is an API gravity of 47.2 API, or relative density of 0.7918.

(4) Example: Percent displacing product in mix would be: (0.7918 Average relative density of BBLS Mix) - 0.7161(relative density of head product) ×100 = 73.99% of mix (0.8184 Relative density of displacing product) – (0.7161relative density of head product).

(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).

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	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. Sample calculation product change record

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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 reference only.

PETROLEUM SAMPLE CHAIN OF CUSTODY DOCUMENT			COC DOCUMENT NUMBER
RECEIV NG 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)

CHA N 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

CHA N OF CUSTODY

ITEM NO.	DATE	RELEASED BY	RECEIVED BY	PURPOSE OF CHANGE OF CUSTODY
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	NAME, GRADE OR TITLE	
		SIGNATURE	SIGNATURE	
		NAME, GRADE OR TITLE	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)

______________ (Name) ______________ (Organization) (IS) (ARE) NO LONGER

REQUIRED AS EVIDENCE AND MAY BE DISPOSED OF AS INDICATED ABOVE. (If article(s) must be retained, do not sign, but explain in separate correspondence.)

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FIGURE F-1. Chain of Custody Document - Page 2

APPENDIX G

BEST PRACTICES FOR FUEL SYSTEM CONTAMINATION DETECTION AND REMEDIATION

G.1 SCOPE

G.1.1 Scope. This appendix provides some basic recommendations, processes, and reference material to assist fuels contamination investigators engaged in efforts to determine the cause of fuel contamination and potential avenues to remediate the contaminated fuel. This Appendix is not a mandatory part of this Standard. The information contained herein is intended for guidance only. The information contained within in this Appendix was extracted from the University of Dayton Research Institute report titled "*Best Practices for Fuel System Contamination Detection and Remediation"*.

G.2 GENERAL

G.2.1 General. DoD personnel are tasked with providing a clean, on-spec supply of jet fuel for a large variety of aircraft and ground powered vehicles. Occasionally, fuel filters become fouled and/or fuel samples appear contaminated with particulate. Fuel handlers must make several decisions based on the apparent severity of the product's condition. In the majority of cases the only remediation necessary is filtration and water separation. However, if the contamination is the result of a failing valve, pump, other component, or a microbial infestation, filtration may only prolong the point at which corrective action is required to return the fuel system to normal operation. Failure to take prompt corrective action may result in greater total costs due to possible fuel downgrade or complete shutdown of fuel delivery system. In order to provide the most useful analysis of contaminants, laboratory personnel may need guidance on appropriate analysis protocols based on sample source, (for example: bulk storage, filter separator, aircraft and refueler sumps, etc.). Additional guidance should be included suggesting probable root-causes based on contaminant identification and quantities or ratios. Frequently, a sample analysis is produced in great detail but will be of limited usefulness to field personnel without some reference to correlate contaminant analysis with typical contaminant sources. A DoD study gathered DoD, industry, and International Air Transport Association (IATA) type "best practice" information as it applies to specific DoD fuel system components. The collected material composition data for all fuel wetted components seen in normal operation was compared with field histories of normal component failure modes and typical component wear patterns to develop a profile of likely contaminant composition. Key information from the identified best practices are contained within this appendix. The complete report titled "*Best Practices for Fuel System Contamination Detection and Remediation"* is available from the Defense Technical Information Center website *www.dtic.mil* . The DTIC Accession Number for the report is AD1047333.

G.3 Recommendations. Based on a review of current commercial and DoD aviation fuel contamination investigation practices, several recommendations were developed to enhance the DoD fuel contamination investigator's efforts.

G.3.1 Implement a Crisis Management Approach to Contamination Identification and Mitigation**.** The extent and quantity of contamination will determine if it is necessary to implement the full Crisis Management approach outlined in Figure G-I. The first three actions are to confirm contamination is present, determine the extent of contamination, and then quarantine affected systems. These actions should be performed whenever QA testing fails

specification or other non-fuel material is present in the fuel delivery system.

<table>
<tr><td colspan="4">Contamination</td><td colspan="2">Off Spec</td></tr>
<tr><td colspan="4">Confirm and Define Contaminant</td><td colspan="2">Confirm Spec test failure</td></tr>
<tr><td>Water</td><td>Particulate</td><td colspan="2">Microbial Growth</td><td>Commingling</td><td>Deterioration</td></tr>
<tr><td colspan="6">Determine Extent of Contamination</td></tr>
<tr><td colspan="6">Quarantine Affected System(s) & Equipment</td></tr>
<tr><td colspan="6">Collect Samples for Special Analysis to Include Baseline Contaminated Fuel, Retain Filters & Duplicate Samples for Further Evaluation</td></tr>
<tr><td colspan="6">Submit Samples for Special Analysis</td></tr>
<tr><td colspan="6">** Make Appropriate Local & Higher HQ Notifications
Is it Necessary to Reduce Operational Capability?
Do we understand the problem well enough to solve locally with increased filtration, water removal, or other enhanced housekeeping effort?</td></tr>
<tr><td colspan="6">If too many unknowns for simple solutions then:
Select Mitigation Manager (Local or Area</td></tr>
<tr><td colspan="6">Assemble Investigation Team, Disseminate All Available Information, (Include supporting documentation: Equipment records, Analysis History)</td></tr>
<tr><td colspan="3">Analyze Contaminants</td><td colspan="3">Analyze Fuel Samples</td></tr>
<tr><td colspan="6">Report Results
Result details should be detailed enough to support likely sources based on field conditions.</td></tr>
<tr><td colspan="6">Refined Contaminate Identification / Typical Cause / Probable Source</td></tr>
<tr><td colspan="6">Choose Mitigation Process</td></tr>
<tr><td colspan="6">Confirm Successful Mitigation, (re-sample)</td></tr>
<tr><td colspan="6">All team members: Report contamination extent, description, response, and resolution to Area Labor DLA for inclusion in Case History Archive</td></tr>
<tr><td colspan="6">**If product is capitalized, notification shall be IAW procedures outlined in 5.13.2 of this document. If product is non-capitalized, notification should be IAW service-directed requirements (preferably via a Product Quality Deficiency Report (PQDR)).</td></tr>
</table>

FIGURE G-I. Crisis management approach to contamination identification and mitigation

G.3.2 Quality Assurance Testing. Require quarterly sampling of storage tank bottoms at the sump with a "true" bottom thief. Line samples may be an adequate substitute for "all level" samples but are unlikely to capture conditions on the tank bottom. Require periodic inspections and necessary repairs of all sample acquisition equipment. Combined samples should be created from representative samples from each tank or tank layer. Timed lowering or 'momentarily dipping' of an open bottle into multiple tanks or through multiple tank layers should be discouraged.

G.3.3 Filter – Separator element analysis. Ensure that personnel responsible for filter-separator servicing are using proper tools and procedures, to include physical examination of separator elements, whenever filtration elements are replaced for high delta pressure. Microscopic evaluation of filter-coalescer elements replaced due to high differential pressure may provide the definitive definition of contaminant source. Filter material should be sampled in strips not isolated rectangular coupons. Use of a manual hacksaw should be strongly discouraged in favor of a powered band saw. Obtain a powered metal cutting shear, or "nibbler" for removing ends form the metal tube. This is a hand drill size tool that requires little training, has few safety considerations, and produces few if any metal particles. Along with operational testing of filters during initial qualification, filter material should be examined to determine which layer is likely to capture given size particle.

G.3.4 Microbial Contamination Testing. Additional testing of Army helicopters and Navy aircraft is needed to verify that results from JP-8 testing are applicable across all US military aircraft. Records analysis should indicate the most probable airframes to see microbial fouling and an appropriate testing frequency. It would be arbitrary to establish microbial test limits analogous to the IATA test limits without a comprehensive analysis of aircraft fuel cell maintenance and fuel filter "out of cycle" replacement records on line aircraft. Filter-Separators tend to concentrate all forms of contamination; water, particulate, and microbial. Periodic testing of filter-separator water bottoms may provide the earliest indication of microbial contaminants in bulk storage tanks and fuel receipts. Any microbial levels, in fuel with normal FSII concentrations, above the nuisance level of 500 RLU, (Relative Light Units, measurement units used in Adenosine Tri-Phosphate quantification), or an equivalent CFU, (Colony Forming Units, estimate of growth test level should trigger aggressive water removal from all low points and sumps in the fuel delivery system. Daily microbial testing should be continued until results stabilize at levels between 100 and 400 RLU or an equivalent CFU test level. Large bulk storage tanks that produce test levels over 10,000 RLU or with visible rag layer on water
bottom samples may need to be stirred and filtered for several days in order to ensure a clean fuel delivery. Microbial contamination does not develop overnight. Since it may take months to become a serious problem there is little reason to require sampling kits, at all storage locations. It is more important to take microbial contamination samples correctly than to take them quickly. The most appropriate utilization of these kits would be to position them within overnight shipping distance of the fuel storage facilities. If microbial contamination is
suspected, a kit and instructions on proper sampling can be quickly provided. Transit time for the sampling kit will also facilitate finding local personnel who are qualified to properly obtain samples and prepare them for shipment.

G.4 Special Sample Acquisition. Special sampling procedures are used whenever it is necessary to determine a source for fuel phase contamination or when the water phase in a fuel sample or sump drain is abnormally colored, contains a high load of particulates, appears to be corrosive or forms a stable emulsion with the fuel phase when shaken.

G.4.1 Water or Solid Contaminant, High Filtration DP, Noxious Sump, High Particulate, Microbial. Resample from failed sample location, separate water phase if present and re-test. If failure is repeated, evaluate possible extent of contaminant. Sample upstream and downstream from first location identified to find extent of suspected contamination.

G4.1.1 Sump and low point samples. Keep water-bottom sample, divide into two identical samples, prepare one sample for area laboratory. Examine water bottoms for evidence of fungal

or bacterial growth. Test for PH. Record observations.

G4.1.2 Fuel all-level and line samples. Divide fuel sample into two identical samples. Test one container for failure condition. Save second container for area laboratory. Save and document particulate filters after weight is recorded for lab analysis. If required, obtain two, one-gallon samples for area laboratory.

G4.1.3 High Differential Pressure. Obtain two, one-gallon samples for Area laboratory. Take and retain filtration samples upstream and downstream of Filter/Separator. Package filter elements for shipment to area laboratory. Inspect coalescer elements for proper water separation action, clean or replace if coalescent ability is reduced.

G.4.2 Fuel Degraded or Comingled Conductivity, Flashpoint, API Gravity, FSII, Color, Filtration Time, Coper Strip, Distillation, Existent Gum, Freeze Point, Total Acid, Thermal Stability, Peroxide Number.

G.4.2.1 Re-sample from failed sample location and re-test. If failure is repeated, evaluate possible extent of contaminant. Sample upstream and downstream to find extent of suspected contamination.

G.4.2.2 Fuel all-level and line samples. Divide fuel sample into two identical samples. Test one container for failure condition. Retain second container for area laboratory. Obtain two one-gallon samples for Area laboratory if required. Save and document particulate filters after weight record for lab analysis.

G.5 Typical Contaminant Effects on Laboratory Tests. Quality assurance test failures must be reported to appropriate area laboratory/operation personnel; however, prompt use of information found in Figure G-II may assist in finding the source of contamination without additional analysis and with a minimum delay. This figure contains only typical contaminant effects of quality assurance tests and is by no means complete.

Lighter Product Contamination	
API Gravity	High
Distillation IBP	10% is Low
Reid Vapor Pressure	High
Flash Point	Low
Viscosity	Low
Color Due to Possible AVGAS Comingling	Red, Blue, Green Tint
Heavier Product Contamination	
JFTOT fails	Diesel Comingling
Microseparometer Fails	Possible Oil or Diesel Contamination
Water Reaction Fail	Possible Oil or Diesel Contamination
Filtration Time	High
Freeze Point	Fails Low
Viscosity	High
Existent Gum	High and Oily

Distillation FBP	90% Residue is High	
API Gravity	Low	
Color Due to Possible Red Diesel Comingling	Red Tint	
Deterioration		
API Gravity	Low,	Weathering loss of light ends
Distillation IBP	10% High,	
Reid Vapor Pressure	Low	
Existent Gums	High and Dry	Oxidation
Visual Color Change		
Water & Sediment Contamination		
Visual Test	Hazy	Water
Water Reaction	Fail	
Microseparometer	Fail	
Cloud Point	Fail	
Filtration Time	High	Sediment (fine)
Particulate Test	High	Sediment / Rust
Fiber Content Test	High Fiber Count	Filter Element Failure

FIGURE G-II. Typical Contaminant Effects on Laboratory Tests

G.6. Unknown Contaminant Analysis. Sample reports generated by contract laboratories typically explain results in precise descriptive language that may not be easily understandable by field personnel or those without advanced laboratory training. Table G-I lists the most common analytical instrumentation used to analyze samples for evidence of contamination along with a brief description of their operation and limitations.

TABLE G-I. Typical Laboratory Instrumentation for Unknown Contaminant Analysis

Instrument	Sample Composition	Results Expected	Limitations
GC-MS[1]	Fuel	Column dependent "fingerprint", signal evolution, (time), is proportional to mass of sample molecule and its affinity to column coating. Amplitude of signal is proportional to concentration of ion fragments, (MS), number of carbon atoms, (FID, organics only)	Components are identified by searching libraries of pure component spectra stored in the instrument's computer memory. Comparative analysis; should properly have baseline samples. Considerable operator skill may be necessary in order to properly choose between several "matches" in spectral library. Prior experience in evaluating hydrocarbon liquids is absolutely necessary to avoid errors in interpretation.
GC-FID[1]	Fuel		
GC-FTIR[1]	fuel	FTIR Fingerprint (atomic bond information) of sample molecule	
LC-MS[1]	fuel	Molecular mass and polarity "fingerprint"	
Electrode (pH, ISE, etc.)	Water or fuel / oil	Determines how acidic or basic a solution is.	

FTIR	liquid or solid	Bulk analysis of sample for type of atomic bonds present	Works best on pure sample or single contaminant. Signals from all components are superimposed.
Raman	Fuel or Water Bottom	Produces a molecular "fingerprint"	
ICP-AES	Fuel	Elemental analysis, usually looking for metal content in high ppm to mid ppb concentration.	Very low concentrations may leave test solution before analysis is complete
Microscopy, Light / SEM	Solids /Particles or Filter Residue	Particle size and shape, some materials are obvious by shape or color, others are not obvious without extensive experience in particle identification.	Identification tends to be either obvious, (as metal shavings or fibers), or ambiguous.
UV-VIS	Fuel or Water Bottom	May be useful to quantify dye or comingled liquid content.	No comprehensive spectral libraries are available to compare against actual fuel contaminants.
XRF	Solids /Particles or Filter Residue	Elemental analysis	Elemental percentage in single particles or across field of view. Most accurate when standards with same composition are available for comparison.
SEM/EDS	Solids /Particles or Filter Residue	Elemental analysis at high magnification for particles less the 10um	
ATP	Water or Fuel	Microbial activity evaluation: minimal, active, very active. Re-sample and re-test to verify active and very active readings.	Time sensitive, should be run no later 2 to 4 hours after sampling or 24 hours after acquisition if stored on ice.

[1]GC- instruments, (Gas Chromatography), utilize a long packed tube to separate sample components, propelled by a carrier gas. LC-instruments, (Liquid Chromatography), utilize a liquid carrier instead of a gas carrier. Columns are chosen to separate suspected components and in general a column suitable for fuel analysis is not suitable for water analysis. Various detectors, sensitive to different changes in physical properties, are arranged at the column exit to produce a signal that is recorded as a "chromatograph". Results are reported in order of "goodness of fit". If there are multiple 'hits' with a high percentage of agreement the chemist must either use a more sensitive test or rate the results base on his knowledge the sample history.

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(Project 91GP-2017- 009)

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