Department of the Interior
Office of Aviation Services

Aviation Fuel Management Handbook

United States Department of the Interior Handbook
September 2024

Foreword

Department of the Interior bureau aviation program managers should use the Office of Aviation Services (OAS) Aviation Fuel Management Handbook to manage aviation fuel in support of their aviation programs. This document serves as the official guideline for our organization outlining procedures that all employees are expected to follow. It has been created to ensure clarity and consistency across all departments.

Please note that this document supersedes the last written version, dated January 1994. All previous policies are now considered outdated and are no longer in effect. Questions regarding handbook contents should be directed to the Office of the Director, Office of Aviation Services, 300 E. Mallard Drive, Ste. 200, Boise, Idaho 83706-3991.

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Director, Office of Aviation Services
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Revision History

Date	Document Version	Document Revision Description	Document Author
09/26/24		This document has undergone a complete rewrite to enhance clarity, align with current operational standards, and supersedes January 1994 version.	DOI-OAS

Contents

Chapter 1 General Provisions

1.1 Objective

The objective of the Department of the Interior (DOI) Office of Aviation Services Aviation Fuel Management Handbook is to provide a roadmap for the implementation and execution of aviation fuel storage tank management functions, provide a basic description of the elements, and identify primary roles and responsibilities. The standards and procedures detailed in this handbook are a compilation of industry developed and accepted standards used to achieve and maintain fuel quality and fire safety. This handbook promotes practical checklist-type actions to focus fuel program managers.

The goal is to develop proactive management actions leading to the optimal resource decisions to support overall aviation fuel storage tank management and regulatory compliance. This handbook identifies a corporate view of "what's important" as a roadmap to this goal. This handbook is intended to bring the DOI Aviation Fuel Management community to a best-in-practice standing.

This handbook is intended to guide program managers through federal regulations with recommended implementation guidance BUT is not a substitute for federal and state regulations or DOI policy. Managers must be familiar with and understand respective regulatory authority requirements.

1.2 Applicability

This handbook is written for DOI Aviation Managers and describes general responsibilities for personnel. The standards and procedures detailed in this handbook are applicable to DOI aviation fuel management programs. Managers will have to determine which standards and policies are applicable to their aviation fueling operation.

The intent is to manage fuel quality and fire safety to the same level of effectiveness achieved by Fixed Base Operators (FBO) at major airports. The behind-the-scenes fuel quality control actions ensure airline passengers are protected from aircraft accidents/incidents caused by poor fuel quality. The procedures in this handbook will ensure DOI passengers/pilots are afforded the same level of fuel quality and fire safety.

The included Air Transport Association of America (ATA) Specification 103 forms are not mandatory for use. Locally developed forms for unique fuel systems are acceptable. It is recommended that ATA Specification 103 forms be utilized for DOI Aviation Fueling operations that support wide body passenger aircraft.

- **Example:** The Midway Fish & Wildlife Refuge has in the past provided fuel support to described passenger aircraft. The government fueling operation should meet all ATA Specification 103 requirements. If ATA Specification 103 forms are used, the entity using the forms should procure the specification form, which is copyright protected.

Contracting Officers shall incorporate applicable handbook requirements into contract language when agency aviation program fuel support is provided by contract. (See Chapter 23)

1.3 Library

The provisions in this handbook may not cover all DOI agency conditions/circumstances. The following listed standards provide additional guidance relative to aviation fuel management from the time of acceptance to final distribution and consumption. Applicable industry standards can be purchased through the specific industry websites.

Websites include:

American Petroleum Institute (API):

https://www.api.org/

API standards pertain to certain field-erected steel bulk storage tanks for periodic inspections (i.e., annuals and/or other frequency) to supplement the STI standard as appropriate. Applicable API Standards include:

- API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
- API Standard 650, Welded Tanks for Oil Storage

ASTM D1655 Standard Specification for Aviation Turbine Fuels:

https://www.astm.org/d1655-24.html

This specification covers purchases of aviation turbine fuel under contract and is intended primarily for use by purchasing agencies. This specification does not include all fuels acceptable for reciprocating aviation turbine engines, but rather, defines the following specific types of aviation fuel for civil use: Jet A and Jet A-1. The fuels shall be sampled and tested appropriately to examine their conformance to detailed requirements as to composition, volatility, fluidity, combustion, corrosion, thermal stability, contaminants, and additives.

ASTM MNL 5-5th Aviation Fuel Quality Control Procedures:

https://www.astm.org/mnl5-5th-eb.html

This manual provides guidance material on common procedures that are used to assess and protect aviation fuel quality. Aviation fuel, by its unique use, is one of the most carefully controlled petroleum products, and therefore, it is required to meet rigorous fuel-quality standards. In many cases, the field procedure or test method listed herein is a simplified version of the corresponding American Society for Testing and Materials (ASTM) method or standard practice. It should be emphasized that the formal ASTM standard method supersedes the instructions given in this publication. In other cases, when there is no ASTM procedure, a non-ASTM procedure is included to make this publication as complete a reference as possible. This document explains several ASTM test methods used as field tests.

ASTM D 910 Standard Specification for Leaded Aviation Gasolines:

https://www.astm.org/d0910-21.html

This specification covers purchases of aviation gasoline under contract and is intended primarily for use by purchasing agencies. This specification does not include all gasoline acceptable for reciprocating aviation engines, but rather, defines the following specific types of aviation gasoline for civil use: Grade 80, Grade 91, Grade 100, and Grade 100LL.

Air Transportation Association (ATA) 103 Standard for Jet Fuel Quality Control at Airports:

https://publications.airlines.org/products/spec-103-standard-for-jet-fuel-quality-control-at-airports-revision-2023-1

ATA Specification 103 provides guidance for the safe storage and distribution of jet fuel at airports as currently practiced in the commercial aviation industry. It also includes forms that can be used to record performance of tests and inspections.

CFR 49 Transportation:

https://www.ecfr.gov/current/title-49

Set of rules and regulations issued by the federal agencies of the United States regarding transportation and transportation-related security. It covers requirements for handling, shipping, and transporting hazardous materials or hazardous waste. It also includes standards for markings, labels, placards, shipping papers, training, emergency response and performance-oriented packaging.

Energy Institute (EI) 1529 Aviation Fueling Hose and Hose Assemblies:

https://publishing.energyinst.org/topics/aviation/aviation-fuel-handling/ei-1529-aviation-fuelling-hose-and-hose-assemblies2

Addresses standard performance requirements and manufacturer's test procedures for aircraft fueling hose, hose couplings and hose assemblies suitable for a broad range of aviation fuel servicing equipment, including fuelers and hydrant servicers.

EI 1581 Specifications and Laboratory Qualification Procedures for Aviation Fuel/Water Separators:

https://publishing.energyinst.org/topics/aviation/aviation-fuel-handling/ei-specification-1581-specifications-and-laboratory-qualification-procedures-for-aviation-fuel-filterwater-separators

This publication specifies minimum laboratory performance, mechanical requirements and qualification test procedures for filter/water separators for use in systems that handle aviation fuel (jet fuel or aviation gasoline) at any point in the supply chain. It is applicable to filter and/or water separators intended for use in commercial jet fuel or aviation gasoline (defined as Category C), military jet fuel (defined as Category M) and military jet fuel containing an additive used to enhance thermal stability (defined as Category M100).

It covers Type S filter and/or water separators intended for use where significant levels of free water and particulate matter in the fuel can be expected, Type S-LW where minimal levels of free water can be expected, and Type S-M where minimal levels of free water and minimal levels of particulate matter can be expected.

EI 1583 Laboratory tests and minimum performance levels for aviation fuel filter monitors:

https://publishing.energyinst.org/topics/aviation/aviation-fuel-handling/ei-1583-laboratory-tests-and-minimum-performance-levels-for-aviation-fuel-filter-monitors

As of 3 December 2020, EI no longer sells EI 1583 laboratory tests and minimum performance levels for aviation fuel filter monitors.

NWCG Standards for Airtanker Base Operations, PMS 508:

https://www.nwcg.gov/announcement/general/nwcg-standards-for-airtanker-base-operations-pms-508

The NWCG Standards for Airtanker Base Operations (SABO) standardizes operations and procedures at interagency airtanker bases to ensure safe, efficient, and effective operations in support of interagency goals and objectives. Further objectives include:

- Support wildland fire and aviation policy through interagency coordination and cooperation.
- Provide common, interagency standards when working with contractors and air operations management. • Facilitate the interoperability of airtanker base personnel among all participating wildland fire agencies and organizations through standardization.
- Provide a reference for commonly accepted forms, checklists, etc.
- Provide a framework for developing local Airtanker Base Operations Plan (ABOP), which provide local, and agency-specific guidance.
- Provide a standard interagency guide to airtanker base management, operations, responsibilities, and administration, available to all members of the airtanker base community

NWCG Standards for Helicopter Operations, PMS 510, Chapter 13 – Fueling Operations:

https://www.nwcg.gov/publications/pms510

The NWCG Standards for Helicopter Operations (NSHO) establishes the standards by which helicopter operations are to be conducted under the exclusive direction and operational control of federal, state, and local agencies in the accomplishment of interagency fire suppression and natural resource aviation management. These standards:

Promote safe, cost-efficient, and effective aviation services in support of agency and interagency goals and objectives.

Define national, interagency helicopter management, and operational procedures for helicopter users from participating agencies.

Facilitate the ability of personnel from different agencies to work cooperatively on incidents or projects.

Provide a framework within which areas, regions, states, and local units can provide supplemental, site-specific guidance.

MIL-STD-3004 Department of Defense Standard Practice Quality Assurance for Bulk Fuels, Lubricants, and Related Products

https://www.dla.mil/Portals/104/Documents/Energy/Quality%20and%20Technical%20Support/E_MilSTD3004_1603.pdf

This Standard provides Department of Defense (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.

National Fire Protection Association (NFPA) 10 Standard for Portable Fire Extinguishers

https://www.nfpa.org/codes-and-standards/nfpa-10-standard-development/10

NFPA 10 is intended for persons tasked with selecting, purchasing, installing, approving, listing, designing, and maintaining portable fire extinguishers and Class D extinguishing agents.

National Fire Protection Association (NFPA) 30 – Flammable and Combustible Liquids Code:

https://www.nfpa.org/codes-and-standards/nfpa-30-standard-development/30

NFPA 30 applies to the storage, handling, and use of flammable and combustible liquids and is the basis for legal regulations developed by municipalities. The code applies to users, producers, distributors, and others involved with the storage, handling, or use of flammable and combustible liquids. NFPA 30 covers the storage of flammable and combustible liquids in fixed tanks such as ASTs, vaulted tanks, and tanks within buildings.

National Fire Protection Association (NFPA) 385 - Standard for Tank Vehicles for Flammable and Combustible Liquids:

https://www.nfpa.org/codes-and-standards/nfpa-385-standard-development/385

NFPA 385 provides for safe transportation of flammable and combustible liquids in tank vehicles through design and construction requirements for tank vehicles that are equivalent to those of the U. S. Department of Transportation (DOT) and through safe operating procedures.

National Fire Protection Association (NFPA) 407 - Standard for Aircraft Fuel Servicing:

https://www.nfpa.org/codes-and-standards/nfpa-407-standard-development/407

NFPA 407 and other standards and resources provide a standard for the storage and delivery of aviation fuel in an airport environment. NFPA 407 is the generally accepted industry best practice at many airports; however, local fire code and regulations at specific airports may differ.

Steel Tank Institute (STI):

https://stispfa.org/library-resources/standards-regulatory-resources/

Standards for Inspection of Aboveground Storage Tanks (ASTs) includes the inspection of shop-fabricated steel tanks and containers built to a nationally recognized standard for above ground storage of non-corrosive, stable, combustible, and flammable liquids. Field-erected ASTs (up to 75,000-gal) may also be inspected periodically. STI SP001 is an inspection standard protocol that meets the compliance requirements of the EPA.

1. Test or inspect ASTs for integrity on a regular or periodic schedule and when material repairs are made for comparison to the baseline.
2. Perform integrity tests that include, but are not limited to visual inspection, hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or other systems of non-destructive testing.
3. Designated inspectors perform monthly and annual inspections.
4. STI certified inspectors perform formal internal and external inspections according to the schedule identified in STI SP001.

1.4 Authority

The authority for this handbook is provided in Departmental Manual 350 DM 2, General Program Requirements Issuance of Aviation Policy and Guidance.

1.5 Policy

Departmental personnel responsible for Aviation Fuel Management functions (procurement, receipt, transportation, storage, dispensing, etc.) should use applicable procedures detailed in this handbook when supporting government owned and operated aircraft.

DOI agency fuel management programs providing fuel support to civil/vendor aircraft operations shall in addition to handbook requirements, comply with applicable requirements contained in NFPA 407 and ATA 103. Personnel providing fuel support to civil aircraft operations shall be trained in fuel management operations.

Agencies providing aviation fuel for civil aircraft must ensure their fuel management programs meet applicable industry accepted standards. Government liability can only be minimized with rigid adherence to industry established fuel quality and fire safety standards. Inspection and fuel quality control records must be kept on file and able to withstand the scrutiny applied during Accident/Incident Investigations. Aircraft under contract to DOI are to be considered civil aircraft. Contracted aircraft in Alaska are contracted under a dry rate (government provides the fuel), whereas On-Call Helicopter on Hawaiian contracts are under a wet rate where the contractor provides the fuel.

1.6 Deviations/Waivers

Request(s) for handbook deviation/waivers from mandated requirements shall be addressed to the Director, Office of Aviation Management, 300 E. Mallard Drive, Ste. 200, Boise, Idaho 83706-3991. The request must contain justification and proposed alternate procedures that must not compromise personnel safety, impair fuel quality, or damage the environment.

1.7 Responsibilities

In the subparagraphs below are some of the typical responsibilities for different personnel levels related to aviation fuel management. Agencies may find the information useful in organizing and assigning specific responsibilities for various levels of management.

Agency/Bureau Directors/Superintendents

Directors/Superintendents are responsible for personnel safety through the implementation of DOI Aviation Fuel Management Program. Directors analyze agency aviation mission support requirements and submit Congressional budget proposals for facilities, equipment, and personnel. Agency Directors allocate funds for site specific needs (personnel, training, inspections, equipment, etc.).

Agency Program/Facility/Site Managers

- Ensure storage tank management programs comply with all applicable Federal, State, and local requirements and DOI policy.

- Complete notification to regulators for new Aboveground Storage Tanks (ASTs IAW applicable agency rules and regulations.
- Ensure notification accurately describes the tank system.
- Maintain an accurate storage tank inventory. Maintain information on the locations and physical characteristics of fuel storage tanks, including key features of variances and compliance orders.
- Monitor the capacity, life span, condition, and other factors of fuel.
- Complete applicable Federal, State, local, and DOI required tank training.
- Ensure spill response capabilities meet regulatory requirements.
- Complete spill notifications to authorities according to regulatory requirements (Federal, State, local, and DOI).
- Managers should use allocated funds to acquire equipment, personnel, and personal protective equipment (PPE).
- Managers will assign personnel, designate specific fueling duties and schedule training to ensure personnel are adequately trained.
- Managers shall ensure fuel management procedures, unique to each facility, are developed and implemented.

Supervisors

Supervisors are responsible for:

- Ensure all storage tanks on the installation are compliant and follow applicable Federal, State, and local regulations.
- Comply with federal/state/DOI requirements, perform daily/monthly operational inspections, and submit work orders to correct any issues identified.
- Ensuring trained personnel are assigned fueling duties.
- Documentation of formal training.
- Re-evaluating personnel proficiency through personal observation.
- For implementation and maintaining records regarding fuel ordered, received, stored, and dispensed.
- Maintaining inspection records of fueling equipment
- Scheduling equipment preventive maintenance (nozzle screen, filter change, etc.)
- Ensuring fuel samples from tank, nozzle, and filter sump are analyzed at prescribed frequencies.
- Reporting unsafe conditions (excessive spills, fires, damage to aircraft or fueling vehicles/facilities, etc.) to Office of Aviation Services (OAS)

Employees

Employees are responsible for:

- Performing daily, monthly, annual operational inspections, and documenting results.
- Performing fuel management tasks in accordance with training, policy, and regulations.
- Knowing regulatory requirements pertaining to each assigned task.
- Daily inspection and maintenance of aviation fueling equipment.
- Obtaining and analyzing fuel samples from equipment (tanks, nozzles, sumps, etc.).
- Reporting unsafe conditions to supervisors.

Office of Aviation Services (OAS)

OAS is responsible for DOI Aviation Fuel Management program oversight. The OAS office in Boise shall be contacted for sites located in the lower 48 states. The OAS, Alaska Regional Office, shall be contacted for assistance for Alaska and Pacific Island sites. OAS will provide department bureaus with the following:

- Advice on fuel procurement services Defense Logistics Agency (DLA) and local purchase.
- Advice on fuel system (fixed and mobile) design, operation, inspection, and maintenance.
- Advice on fuel quality control procedures (sampling techniques, sample analysis, etc.).
- Advice pertaining to specific fuel system inspection and maintenance procedures (filter element change out procedures, differential pressure recording, etc.).
- Responses to fuel quality issues/concerns.
- Information on new innovations and the use of the latest equipment.
- Periodic inspections of agency fuel management programs.

Solicitation/contract specification development

Pilots are responsible for ensuring the proper grade of clean fuel is pumped into the aircraft. Pilots should take the following actions to ensure fuel quality:

- Pilots shall verify the dispensing system (barrels, refueling unit, storage tank, etc.) is marked with the required fuel grade for aircraft flown.
- Pilots should verify fuel appearance meets expectations for color and clear & bright condition. 100 LL (Blue), 100 (Green), JET A (Clear to Straw).
- Pilots must be alert for non-aviation approved filters, nozzles, hoses, etc.
- Pilots must sump aircraft in accordance with aircraft manufacturer’s instructions and/or FAA Advisory Circular 20-125. At least 10 ounces of fuel shall be drained

from each sump until clear and bright results are achieved. The Gats Jar (Appendix K) or equal, when used properly, will ensure pilots drain the necessary amount of fuel for visual evaluation. Fuel accumulated from aircraft sumps shall be recycled when possible.

- Pilots shall review the aircraft operations manual, engine capabilities and limitations section, to determine if refueling systems comply with the aircraft requirements for the type and grade of fuels approved and type and number of additives approved for use.

Records Keeping Requirements

Records must be maintained in accordance with (IAW) applicable DOI and regulatory requirements. Tank system records must be maintained in preparation for regulatory inspections to demonstrate compliance. Records that must be maintained include:

- Tank installation records (construction as-built, equipment testing, regulatory notification/permit) should be kept for the life of the tank.
- Corrosion protection equipment (operation, inspection, testing) is retained for three (3) years.
- Tank repair and upgrade documentation (tank/liner integrity inspection, construction plans, testing, regulatory notification) should be kept for the life of the tank.
- Integrity testing IAW industry standards (e.g., API/STI/PEI).
- Visual inspections (STI monthly/annuals); kept for three (3) years.

1.8 Definitions

The following definitions/acronyms are common to fuel management. The sources of these definitions are NFPA 407 Standard for Aircraft Fuel Servicing, ATA 103 Standard for Jet Fuel Quality Control at Airports, and Mil-STD-3004 Department of Defense Standard Practice Quality Assurance for Bulk Fuels, Lubricants, and Related Products.

Aircraft: A device that is used or intended to be used for flight in the air for transportation of personnel or cargo.

API: American Petroleum Institute

API Degrees: API Hydrometer Units for fuel API Gravity measurement.

API Gravity: The petroleum industry's scale and method of measuring density of liquid petroleum products. Established range for petroleum products is 0-100.

Aboveground Storage Tank (AST): ASTs are an unburied storage tank and include any aboveground container storing fuel or bunkered tank or partially buried tank, with a volume of 55 gallons or greater. ASTs are typically classified by the method of construction such as “Shop Fabricated or Field Constructed.”

Aviation Gasoline (avgas): Specially blended gasoline used to power reciprocating piston aircraft engines.

Aviation Gasoline Grade 100: Specially blended gasoline used to power reciprocating piston aircraft engines. Color coded Green.

Aviation Gasoline Grade 100LL: Specially blended gasoline used to power reciprocating piston aircraft engines. Color coded Blue.

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

ASTM: American Society for Testing and Materials.

ASTM D1655: Standard Specification for Aviation Turbine Fuels

ASTM D 910: Standard Specification for Leaded Gasolines

Bonding: Involves connecting two or more metallic objects together by means of a conductor that equalizes the electrostatic potential between the objects. Primary focus of bonding is fuel dispensing system to aircraft.

Bulk Container/Tank: 119 Gallons or greater. (See 49 CFR)

Bulk products: Liquid petroleum products which are normally transported by pipeline, tank car, tank truck, or trailer, barge, or tanker, and stored in tanks or containers having a capacity of 208 Liters (55 gallons) or more.

Civil Aircraft: Aircraft other than public aircraft.

Clay Treatment Vessel: A filtration vessel equipped with bulk clay, clay bags, or clay canisters used for removing surfactants (surface-active-agents) from jet fuel.

Clear (clean) and bright: Clear (clean) is the absence of visible solids, a cloud, a haze, an emulsion, or free water in the product. Some specifications define this as Appearance, Workmanship, or as Workmanship, Finish, and Appearance. Bright is the sparkle of clean, dry product in transmitted light.

Closed Circuit/Under wing Refueling: A pressurized fueling system designed to prevent spills, minimize fuel contamination, and prevent escape of flammable fuel vapors.

Coalescence: The property of a coalescer element to bring together very fine droplets of free and entrained water to form large droplets which are heavy enough to fall to the bottom (sump) of a filter/separator vessel.

Coalescer Element: The first stage cartridge in a filter/separator vessel that removes solid particles and coalesces free water from fuel. It is upstream of the separator cartridge.

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

Contaminated product: A product where one or more grades of another product has been inadvertently mixed, or a product containing foreign matter such as dust, rust, water, or emulsions to the extent it changes the characteristics of the product.

Contaminant: A foreign substance in a product.

Deadman Control: A control device which must be physically held open by the system operator to allow fuel to flow. When released, fuel flow stops automatically. (See Appendix I)

Dedicated system: A system of pipeline(s), vessel(s), and/or truck(s) used solely to move only one fuel.

Density: The amount of mass (weight) in a unit volume of material.

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

Differential Pressure (Delta P): The measured difference in pressure between any two points, generally between inlet and outlet connections on filtration vessels.

Direct Reading Differential Pressure Gauge: A pressure gauge which automatically displays the differential pressure between the inlet and outlet connections of filtration vessels. (See Appendix I)

Disarming Action: The rendering of elements in filtration systems incapable of performing their designed functions, e.g., coalescers incapable of coalescing water and separator elements incapable of separating water from fuel.

Dissolved water: Water in a solution which cannot be removed by mechanical means. 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.

Dormant stocks: Stocks where new product has not been added to existing stocks in a tank for six months or more.

Downgrading: The procedures by which an off-specification or contaminated product is approved for use as a lower graded product, such as using Jet A/100 LL for non-aviation purposes.

Dry Fuel: Free of water.

Effluent: Stream of fluid at the outlet of filtration vessels.

Elements: A generic term given to different types of decontamination media installed in various types of filtration vessels.

EI: Energy Institute

EI Specification 1529: Aviation fueling hose and hose assemblies.

EI Specification 1581: Specifications and qualification procedures for aviation jet fuel filter separators

EI Specification 1583: Laboratory tests and minimum performance levels for aviation fuel filter monitors

Entrained water: Water carried by a product which does not settle out readily. Small droplets of free water in suspension which may make jet fuel appear hazy or cloudy. Entrained water can be removed by mechanical means (for example, filter/separator).

Filter: A decontamination device to remove solid particles from fuel.

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

Filter/Separator: A filtration vessel which removes solids and coalesces free water from jet fuel. All filter/separators are equipped with two types of cartridges: coalescer elements (first stage) and separator elements (second stage).

Flash Point: The lowest fuel temperature at which the vapor above the fuel will ignite.

Floating Suction: Pump suction piping with floatation capability used to draw fuel from the upper level in a jet fuel storage tank.

Free Falling Fuel: Fuel dispensed, unrestricted, through an open port nozzle will cause a potential hazardous static charge buildup.

Free Water: Water in fuel other than dissolved water. Free water may be in the form of droplets or haze suspended in fuel (entrained water or an emulsion) and/or water layered at the bottom of the container holding the fuel.

Freeze Point: The coldest fuel temperature at which the last fuel wax crystals disappear when fuel physically changes from a solid back to a liquid when warmed.

Gauging (gauging): Gauging is the act of measuring the height of product in a tank. During the process of gauging of a tank, the temperature of the fuel is normally taken.

Gauging for water: Obtaining the depth of water bottom by taking a water cut. This is normally accomplished by coating a plumb bob, tape, or gauging stick with water-finding paste. (See Appendix J)

Haze: Undissolved free water dispersed in fuel that is visible (usually more than 30 PPM in jet fuel). Fuel appears hazy or cloudy, that is not clear and bright. (See Appendix K)

Identification tests: Selected tests applied to a sample to quickly determine the type or grade of product represented or to determine that the quality has not been altered by time or handling.

Influent: Stream of fluid at the inlet of filtration vessels.

Inspect: To examine critically especially to detect flaws, errors, etc.

Into Plane: Aircraft refueling operation.

Issue Tank: An issue tank is any tank not physically connected to any equipment or facility and used to dispense fuel to vehicles, mobile trailers, ground support equipment, or portable containers.

JET A: Dominant turbine fuel. Appearance varies from clear to straw colored.

Micron: One micron (micrometer, 10-6 meter) is one-thousandth part of one millimeter (approximately 25,400 microns equal one inch). The average human hair is about 100 microns in diameter. The openings in a 100-mesh screen are 150 microns.

Misfuelling: The accidental fueling of an aircraft or refueling vehicle tank with an incorrect grade of product.

NFPA: National Fire Protection Association

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

Over-wing Fueling. Open port fueling.

Particulates: Solid contaminates found in jet fuel/100 LL, such as dirt, rust, sand, and fibers.

Piping System: Piping systems allow the transfer of fuel from a source to the point of use. Fuel piping may be constructed above or below ground. Pipelines (above ground and underground) for transporting petroleum within the facility are regulated under the SPCC regulations. Transfer areas such as Loading and Unloading racks are regulated by the SPCC Rule.

POC: Point of Contact

Portable Tank: A portable tank is any mobile tank used for mobility maintenance, research and development, or similar purposes. Portable tanks may be used for issue or support purposes.

Primary Containment: Containment of fuel container (truck, tank, barrel, blivets, bladders, etc.) as a primary means to hold or contain fuel in the immediate vicinity.

PSI: Pounds per Square Inch

PSID: Pounds per Square Inch Differential

Public Aircraft: See appendix F.

Relative Density: The ratio of weight of any volume of fuel to the weight of an equal volume of water. Sometimes referred as Specific Gravity.

Secondary Containment: Structure or system designed to prevent the accidental release of fuel from a primary containment system.

Separator Element: The second stage cartridge or shroud in a filter/separator vessel that allows passage of jet fuel but repels free water. It is located downstream of the coalescer cartridge. Meets EI Specification 1581.

Settling Time: The time allowed for water or dirt entrained in jet fuel to drop to the bottom (sump) of the fuel storage tank.

Single Element: Filtration type that meets EI specification 1583. The element removes water through absorption while filtering out particulate.

Sparkle: Cause to glitter or shine.

SPCC: Spill Prevention Control and Countermeasure.

Storage Tank: A large container used for liquid (fluid) storage.

Sump: A chamber or depression installed at the bottom of a fuel storage tank or filtration vessel to facilitate the collection and removal of contaminates.

Sump Fuel: Fuel removed from storage tanks, filtration vessels, and aircraft refuelers while performing routine quality control tests and equipment maintenance.

Surfactants: An acronym for surface-active-agents that are chemical substances or detergent like compounds frequently found in jet fuels. These chemicals disarm the water removing capability of coalescer cartridges in filter/separators. Clay treatment is the primary means in removing surfactants from jet fuel.

Suspended Water: Undissolved free water that is so finely dispersed as to be invisible to the naked eye (see haze).

Thief (Sump) Pump: A small pump having a suction line which extends to the low point of a fuel storage tank for the purpose of drawing off water which may have accumulated.

Under Wing Fueling: Closed port fueling.

Waste Fuel: Fuel that is contaminated resulting from exposure to biological activity, surfactants, oil/water separators, chemicals, petroleum product mixes, surface drains, and from other various water/solid combinations.

Water Defense System: A device which senses the predetermined level of free water in filter/separator sumps and automatically stops the flow of fuel to prevent downstream contamination.

Water Slug: A large amount of free water.

Vaulted Aboveground Storage Tank (V-AST): These systems are considered a "bulk storage container" or AST for the purposes of the SPCC Rule. Vaulted tank means a tank that is contained in a concrete or other type of man-made solid walled space (e.g., vault) either below or aboveground level or subgrade. The vault can be accessed through a manway or a top that is opened to atmosphere. It may or may not be possible to visually inspect the tank on all sides, however it must be possible to visually detect any leaks from the tank. Vaulted tanks are aboveground storage tank, and the vault is classified as the secondary containment. Also, a tank contained above the floor of a subterranean vault.

1.9 Prohibitions

The following prohibitions are applicable to Government aviation fuel management programs. The prohibitions are categorized into three areas: fuel quality, fire safety, and pollution prevention.

Fuel Quality

- Filters with water absorbent media (Aquacon/Fuel Gard) shall not be used with fuels containing the Fuels System Icing Inhibitor (FSII) additive. This filtration type meets EI 1583 specifications.
- Use of unfiltered fuel is prohibited. Use of non-aviation qualified filtration is considered unfiltered. Aviation qualified filtration meets EI Publication 1581, Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators or EI Publication 1583, The Institute of Petroleum Specifications and Qualification Procedures for Aviation Fuel Monitors with absorbent elements. Exception: When using portable (5-gallon or less) containers for into wing fueling the final filtration is Mr. Funnel or equal.
- Maximum operating pressures/flow rates shall not be exceeded. Filter manufacture's literature details specific vessel/element pressure/flow rate limitations.
- The filter manufacture's time-based element/filter change out criteria (1 year) shall not be exceeded.

- The use of fuels contaminated above 2.0 mg/Gallon particulate (downstream of filtration) is prohibited. Determined by In-line sampling method using matched weight monitors. (See Appendix M).
- The use of fuels failing color/particle assessment testing via in-line sampling method is prohibited. Filter membranes rated greater than 2 dry or 3 wets are considered failures. Additional testing shall be required when failures are noted. (See Appendix M).
- Use of fuels contaminated above 15 parts per million (ppm) free water (downstream of filtration) is prohibited.
- Fuel nozzles shall not to be dragged across the ground.
- Continuous use of over-wing fuel servicing nozzles not having a dustcover, bonding wire, and nozzle screen is prohibited.
- Galvanized metals, brass or copper shall not be used in primary fuel system components and shall not be used downstream of filtration system. The preferred metals are aluminum or stainless steel which has little effect on fuel properties. Exception: Copper lines to gauges are acceptable.
- Drum bungs shall never be left loose or open to the environment.
- Drum fuel shall not be used without performing a visual inspection with an explosion proof flashlight of the contents. The contents should be free of visible contamination (water, rust, dirt, etc.). Users shall be able to see bottom of the drum through the fuel. Users shall visually inspect the exterior for dents, rust, and other possible leaks. Users shall ensure fuel color meets specifications for fuel type through visual analysis (Mason jar or white bucket) of a nozzle sample.
- Pilot(s) shall not dispense fuels into aircraft without verifying the correct fuel type and grade.
- Personnel shall not receive fuel from vendors without appropriate fuel grade verification. The desired verification method is through API Gravity tests and visual color analysis the fuel is the correct type and grade.

Fire Safety

- Smoking in aircraft refueling units or within 50’ of aircraft refueling equipment is prohibited.
- Radio transmissions during fuel transfer operations are prohibited unless the radios are intrinsically sealed/safe.
- Cellular/satellite phones shall not be used within 50’ of fuel transfer operations.
- Aircraft refueling operations shall not be performed inside a building or within 50 feet of a building.
- Free-falling fuel (JET B and AVGAS) without a drop tube during aircraft refueling unit or storage tank loading is prohibited.

- Plastic funnels and containers shall not be used for aircraft fueling (JET B and AVGAS). Exception: Funnels made from static conductive plastic such as: Mr. Funnel by Raycor or equal are acceptable. (See Appendix J)
- Over-wing aircraft refueling nozzles shall not have hold open devices (notches). Nozzle shall not be locked in the open position.
- Underwing/closed circuit refueling operations shall not be performed without operational deadman control devices. **Note:** Devices shall shut down fuel flow within 5% of rated flow. (See Appendix I)
- Deadman control devices shall not be defeated/locked open.
- Use of underwing/closed circuit nozzles failing the pre-operation nozzle interlock check is prohibited.
- Aircraft refueling or defueling operations shall not be accomplished without bonding wire connections in place to equalize static electricity.
- Truck loading operations shall not be performed without bonding wire connections in place.
- Wearing of static producing clothing such as nylon, rayon, etc. is prohibited when performing fuel transfer operations.
- Use of aircraft refueling hose that does not meet API/EI 1529 Type C qualifications are prohibited for aircraft refueling operations.
- Aircraft refueling operations shall not be performed with passengers on board.
- Aircraft refueling operations shall not be performed if unauthorized personnel are within 50’ of the aircraft.
- Personnel driving aircraft refueling units shall not approach aircraft until rotors or props have completely stopped.
- Non-approved equipment shall not be used to transport, transfer receive, re-circulate, or dispense aviation fuel.
- Untrained personnel shall not perform fueling or defueling operations.
- Rapid/hot refueling operations shall not be performed with flammable fuels such as 100 LL, Jet B and JP-4. Jet A, Jet A1 and JP-8 are approved fuels for rapid/hot refueling operations.
- Objects such as inventory gauge tapes, sample containers and thermometers shall not be suspended or lowered into a tank or refueling unit compartment while it is being filled. Static charges shall be given at least 30 minutes to dissipate before using these devices.
- Gasoline and other flammable liquids shall not be handled/transferred in open buckets. **Exception:** Field fuel quality control surveillance checks.
- Fueling personnel shall not carry matches or lighters on their person during fuel handling operations.

- Fuel hose shall not be allowed to drape over the aircraft wings trailing edge.
- Unauthorized fuel additives shall not be used. Approved additives are designated in ASTM D 1655 and ASTM D 910.
- Government personnel shall not operate over-wing nozzles during commercial aircraft refueling. **Exception:** Government Pilots are permitted to fuel aircraft.

Pollution Prevention

- Threaded fittings shall not be buried underground.
- Leaking or otherwise defective pumping equipment, plumbing, hoses, nozzles, bonding cables, etc., shall not be used to transfer fuel.
- Spilled fuel shall not be flushed into sewers, drains, or natural waterways. The spill area shall be immediately bermed with earth containment or fuel absorbent pads.
- Tank overfill devices shall not be disconnected or overridden.
- Fuel storage tanks shall not be filled above their rated 95 percent capacity.
- Sump samples (Aircraft, Filter, and Tank) shall not be disposed of on the ramp, ground, or waterways.
- Never leave fuel transfer operations (receiving, re-circulations, transfers, dispensing) unattended.
- Never disconnect hoses or remove fuel system components while under pressurized conditions.
- Cam lock connections shall not be used unless safety wired.

Chapter 2. Environmental

2.1 Pollution Prevention

Bureaus/agencies shall comply with applicable pollution prevention regulations. Environmental personnel must assess aviation refueling activities to determine whether oil pollution regulation provisions are applicable.

2.2 Spill Prevention Control and Countermeasure (SPCC)

SPCC Plans must be prepared and implemented when applicable. A facility is subject to the SPCC regulations if it can be reasonably expected that a discharge of fuel or oil will enter navigable waters.

Aboveground facilities having a total aboveground storage tank capacity of 1,320 gallons or less, provided no single container has a capacity more than 660 gallons do not require SPCC plans. Underground facilities (storage tanks) having a total storage capacity of less than 42,000 gallons do not require SPCC plans.

2.3 Secondary Containment

Secondary containment is required for fuel storage tanks having a capacity greater than 660 gallons. Secondary containment is also required if more than 1320 gallons (aggregate) is stored on site.

The best management practice is to provide secondary containment for all fuel stored (barrels, 5-gallon cans, etc.)

2.4 Fuel Spill Reporting

Oil and hazardous substance spill reporting requirements vary State to State. Agencies shall contact their State Office of Environmental Conservation to determine requirements.

The National Response Center (NRC) at (800) 424-8802 shall be called to report an oil spill or hazardous substance release under certain specific conditions. A National Spill reporting requirements flow chart is located at Appendix D.

Agencies should develop internal communication protocols to make appropriate notifications while keeping Agency managers informed.

2.5 Excess Fuel

When in the best interest of the government, surplus fuel may be disposed of in accordance with 41 CFR Part 102-40 which provides guidance for the reporting, transfer, donation, or abandonment/destruction of hazardous materials. A certificate of property transfer recommending the fuel be directly donated to eligible entities shall be prepared for approval of disposal with the following conditions added:

- Recipients of the fuel must be advised in writing not to use surplus fuel for aviation purposes.
- The government must not be liable for how the surplus fuel is used.

- Removal of any government identification on drum surface.
- New ownership is identified on the drum.
- Date of transfer.

Chapter 3. Stationary Aircraft Refueling Systems

Stationary systems are defined as permanently installed systems that consist of a storage tank and a dispenser. Some components unique to aviation fuel dispensing systems are: Fuel dispensing nozzles with 100 mesh screen, dust cap, and bonding wire, API/EI 1529 Type C Hose, and EI 1581 or EI 1583 qualified filtration.

3.1 State AST Regulations

States primarily regulate ASTs. The requirements can usually be found in environmental regulations and/or the fire code. There may be a requirement to: paint the tank; fill pipe a certain color to identify its contents, provide alarms in addition to those federally required, and register the tank.

3.2 Reserved

3.3 Stationary Aircraft Refueling System Design Requirements

Stationary Aviation refueling facilities/equipment shall be designed to safely dispense fuel while maintaining fuel quality. Engineers' familiar with unique requirements pertaining to flammable liquid fuel transfer systems used to support aviation programs should review and approve new facility construction plans. A recommended source for system components is ATA specification 103 which is used to design major airport fuel systems.

3.4 Site Selection

The authority having jurisdiction (AHJ), usually the local fire chief, should be contacted for stationary fuel system site approval regarding property lines, buildings, and right of ways.

3.5 Procurement Recommendations

Bureaus/Agencies requiring stationary aviation fuel dispensing systems should purchase systems from companies specializing in aviation fuel dispensing system fabrication/construction. The companies specializing in these systems are familiar with code requirements related to fuel quality, fire safety, and environmental conservation. The OAS fuel quality assurance specialist should be contacted for current information related to system manufacturers.

3.6 Storage Tank Requirements

Storage tanks shall meet UL requirements. Single wall storage tanks meeting UL 142 requirements may be used with appropriate environmental precautions such as: cathodic protection, leak detection, over spill prevention, automatic shut off devices, remote impoundment, spill recovery bucket, etc. Storage tanks meeting UL 2085 is preferred for new construction.

3.7 Environmental

The following NFPA 30 Flammable and Combustible Liquid Code design requirements should be met when agencies use double walled tanks (secondary containment tanks as detailed in UL 2085). The requirements are centered on environmental conservation. A review of system/tank

installations should be made in conjunction with agency environmental personnel to determine system/tank acceptability for continued use or required modifications.

The provisions listed below are applicable to new construction:

- The capacity of the tank shall not exceed 12,000 gal (45,420 L).
- All piping connections to the tank shall be made above the normal maximum liquid level.
- A technique shall be provided to prevent the release of liquid from the tank by siphon flow.
- A procedure shall be provided for determining the level of liquid in the tank. This measurement shall be accessible to the delivery operator.
- A system shall be provided to prevent overfilling by sounding an alarm when the liquid level in the tank reaches 90% of capacity and by automatically stopping delivery of liquid to the tank when the liquid level in the tank reaches 95% of capacity. In no case shall these provisions restrict or interfere with the proper functioning of the normal vent or the emergency vent.
- Spacing between adjacent tanks shall be not less than 3 ft. (0.9 m).
- The tank shall be capable of resisting damage from motor vehicle impact through installation of suitable collision barriers.
- Where the method of secondary containment is enclosed, it shall be provided with emergency venting.

3.8 Fuel Storage Tank Accessories

Double-walled (secondary containment) above ground storage tanks should have the following accessories:

- Properly sized emergency vents (primary and secondary tanks).
- Properly sized normal vent (primary tank).
    i. The normal vent for the primary tank should be vacuum/pressure type.
    ii. The vent shall be positioned at least 12 feet above ground level to allow adequate vapor dispersion.
- Floating suction system integrated to the dispensing system pump.
- Receipt port spill containment bucket where receipts are via over-wing nozzle.
- Tank ladder, off set catwalk, and railing system to allow personnel access to tank top.
- Tank interior (Epoxy lined).
- Tank exterior (painted reflective color; white, silver, etc.).
- UL label (142, 2085, etc.) shall be metal and permanently attached to the tank.
- Applicable fuel identification and warning signs.

(a) Flammable or Combustible.

(b) JET A/B or 100LL.

(c) No Smoking.

- Water removal hand pump with drop tube installed to allow water removal from the tanks low end (receipt end). Tank should be sloped (1/20) towards receipt end.
- Leak detection indicator for the tank interstice.
- Fire extinguisher. Type and size must meet fuel system size requirements. See NFPA 10.
- Receipt line filtration meeting EI Publication 1581- Specifications and Qualification Procedures Aviation Jet Fuel Filter/Separators or EI Publication 1583 - Specifications and Qualification Procedures - Aviation Fuel Filter Monitors with Absorbent Type Elements. ****Not required if utilizing fuel receipt via over wing nozzle only****.
- Tank gauging port/equipment to allow accurate inventory management.
- Fuel quantity gauge such as Morrison Clock Gauge.
- Leak detection equipment on tanks with hidden bottoms where leaks would not be visible. Leak detection equipment should also be installed on underground piping systems.
- Maintenance hole cover to allow annual tank inspection.
- Vapor recovery system meeting current industry standards.

3.9 System Dispensers

Fixed fuel system dispensers should meet the following design requirements to ensure fuel quality, fire safety, and environmental preservation.

- Dispenser pumps must be UL listed and labeled for flammable liquids. Dispenser pump components (seals, impellers, etc.) and piping and valves must be compatible with the fuel dispensed.
- Piping and valves must be compatible with designed fuel system pressures and flow rates.
- EI 1542 guidelines for identification markings for dedicated aviation fuel manufacturing and distribution facilities, airport storage, and mobile fueling equipment shall be used as guidance for marking fixed fuel storage/transfer facilities. The fuel grade shall be marked on piping, valves, outlets, inlets, and nozzles.
- The fuel system should be designed to allow fuel recirculation through the dispenser and tank.
- Fuel systems shall have isolation valves where individual components may require removal for maintenance or replacement. **Example:** Periodic filter element replacement requires filter vessel isolation using ¼ turn ball valves on the inlet and outlet lines.

- The fuel system fire extinguisher(s) requirement (size & number) stipulated in NFPA 10 shall be required.
- Fuel-dispensing manifolds should be housed in an enclosed, non-combustible, cabinet with secondary containment sloped to a low point drain. The following components are common to fuel dispensing manifolds/cabinets:
    i. Carbon steel/stainless steel or aluminum piping (sized to match components and fuel flow rate).
    ii. Stainless steel flexible connectors shall be incorporated where piping is subject to physical stress. Such as ground movements from earthquakes, frost heaves, etc.
    iii. ¼ turn ball valves shall be used to isolate system components such as filter vessel(s) during filter element replacements.
    iv. Fuel system pressure gauges (pump discharge).
    v. Direct reading differential pressure gauge on systems operating at greater than 25 PSI. (See Appendix I).
    vi. A pump cut off switch tied to the differential pressure gauge. Designed to cut pumps off if excess differential pressure is encountered.
    vii. Pressure relief valves and piping (used to relieve thermal and system pressure build ups back to the tank).
    viii. Fuel receipt and issue couplers shall be non-interchangeable (fuel specific) to limit cross contamination potential. This requirement pertains to fuel operations having multiple fuel grades (JET A and 100 LL).
    ix. One accurate re-settable fuel metering device for registering fuel in US gallons of fuel pumped.
    x. Bonding reel with a minimum of 50-foot cable and alligator clip. Bonding cables will be of a flexible, durable design and material.
    xi. Aircraft refueling hose qualified to EI/API 1529 Type C specifications.
    xii. Hose reel with electric or mechanical rewind capability.
    xiii. Over wing aircraft refueling nozzle with bonding wire assembly (plug/clip), 100 mesh screen, and dust cap.
    xiv. When required-Under wing/closed circuit servicing nozzle with screen and dust cap.
    xv. Deadman control device required for pressurized refueling with under wing/closed circuit nozzle. (See Appendix G).
    xvi. Emergency shut off switch (Panic button) mounted shall be more than 20 feet but less than 30 feet from tank/dispenser.
    xvii. Pump on/off switch - designed for flammable liquid storage and transfer systems (NFPA 70 contains applicable code requirements).

xviii. Filter vessel/element(s) combinations qualified to (EI/API Publication1581 -Specifications and Qualification Procedures Aviation Jet Fuel Filter/Separators or EI/IP Publication 1583 - Specifications and Qualification Procedures - Aviation Fuel Filter Monitors with Absorbent Type Elements.

xix. Filtration (vessel/element combination) must be sized to withstand pumping pressures and flow rates. The filter vessel shall be mounted with sufficient clearance (minimum of 8 inches) to allow sumping and cartridge replacement.

xx. Filter vessels shall have the following accessories:

1. Air eliminator.
2. A differential pressure gauge is required on systems having discharge pressures greater than 25 PSI.
3. Pressure relief valve(s).
4. Sump drain.
5. Fuel sampling probe (installed in downstream piping) Gammon Model GTP –7 or equal.

xxi. Filter vessel exteriors must have the following information annotated on the vessel exterior.

1. Date of element(s) change-out.
2. Element(s) model #.
3. Element(s) manufacturer.
4. Vessel model #.
5. Vessel manufacturer.
6. Number of elements installed.

3.10 Stationary Fuel System Security

Security procedures should be developed and implemented for each system dispensing aviation fuel. Fuel system/dispenser access should be limited to trained and authorized personnel. Tank/dispenser access points should be secured to prevent theft, sabotage, or accidental fuel releases to the environment. The pump on/off switch, access hatches and main tank issue valve should be locked in the off/closed position. Where possible the entire system should be enclosed inside a locked chain link fence and under remote camera surveillance.

In the immediate area a sign shall be posted that contains phone numbers for the tank owner. It also should contain phone numbers for emergency response personnel and physical site address. The sign shall also include any other pertinent information such as emergency shut down procedures or emergency power cut off switch location.

Chapter 4. Mobile Fuel Dispensing Systems

Bureaus requiring mobile aviation fuel dispensing systems (trucks, trailers, etc.) should purchase systems from companies specializing in mobile aviation fuel dispensing system fabrication/construction. The companies specializing in this area are familiar with code requirements related to fuel quality, fire safety, and environmental conservation. The design/equipment requirements detailed below were extracted from NFPA 407 Standard for Aircraft Fuel Servicing and NFPA 385 Standard for Tank Vehicles for Flammable and Combustible Liquids.

4.1 Cargo Tanks

Aircraft refueling unit cargo tanks hauling flammable/combustible liquids, greater than 119-gallon capacity, shall meet Department of Transportation Specifications detailed in 49 CFR Part 173. Cargo tanks built to DOT specifications shall have identification placards attached per 49 CFR Part 178. Cargo tanks shall be stainless steel or aluminum. Tanks shall have the following accessories to ensure fuel quality, fire safety, and environmental conservation.

- Properly sized emergency vent(s).
- Properly sized normal vent (s).
- Rollover/overturn protection.
- Appropriate fuel identification placards (JET A/100LL) and warning signs (minimum of 3-inch letters, contrasting background). (E.g., Flammable/Combustible, No Smoking).
- Cargo Tank Sump drain valve(s) spring loaded to the closed position.
- Bottom loading assembly.
- Drop tube (top loading).
- Tank access ladder, where required.
- Normally closed dispensing/loading valve (internal valve).
- Vapor recovery system meeting current industry standards.

4.2 Mobile Fuel Dispensing System

Mobile Aircraft refueling unit dispensing systems shall meet the following minimum design/equipment requirements.

- Dispenser pumps must be UL listed and labeled for flammable liquids. Dispenser pump components (seals, impellers, etc.) and piping and valves must be compatible with the fuel dispensed. Dispenser pumps must be approved for aviation use, UL listed and labeled for flammable liquids. Dispenser pump components (seals, impellers, etc.) and piping and valved must be compatible with the fuel dispensed. **Note:** Non-aviation **FILL-RITE** pumps are **NOT** approved.
- Piping and valves must be compatible with designed fuel system pressures and flow rates.

- The fuel system should be designed to allow fuel recirculation through the dispenser and tank. Daily recirculation of fuel is critical to fuel dispensing system inspection and preventive maintenance activities.
- Fuel systems should have isolation valves where individual components may require removal for replacement/maintenance. **Example:** Periodic filter element replacement requires filter vessel isolation. This is best accomplished using ¼ turn stainless steel ball valves (recommended) on the inlet and outlet lines.
- Stainless steel/steel/aluminum piping (sized to match components and flow rate).
- Fuel system pressure gauges.
- A differential pressure gauge for filter vessel is required on systems operating at 25 PSI or greater. The direct reading differential pressure gage is recommended.
- Pump cut off switch tied to the differential pressure gauge or filter vessel sump sensor. Designed to cut pump/flow off if excess differential pressure or excessive water is experienced.
- Pressure relief valves and piping used to relieve thermal and system pressure build ups.
- One accurate re-settable fuel metering device for registering fuel in US gallons of fuel pumped.
- Bonding reel with 50-foot cable and alligator clip.
- Aircraft refueling hose qualified to EI/API 1529 Type C specifications.
- Hose reel with electric or mechanical rewind capability.
- Over wing aircraft refueling nozzle with bonding wire assembly (plug/clip), 100 mesh screen, and dust cap.
- Aircraft fuel servicing vehicles shall be marked with fuel grade identification, (combustible or flammable), and No Smoking signs on the vehicle front, each cargo tank side, and rear of the cargo tank.
- When required under wing/closed circuit servicing nozzle with 100 mesh screen and dust cap.
- Deadman control device (required for pressurized refueling with underwing/closed circuit nozzle.
- On each side of the refueling unit clearly identified emergency shut off switches/valves including operational method (push/pull)
- Enclosed electrical wiring in conduit designed for flammable liquid storage and transfer systems (NFPA 70 contains applicable code requirements).
- Fire extinguisher(s) required per NFPA 407 one on each side rated at 40 BC.
- Filter vessel/element(s) combinations qualified to EI Publication1581-Specifications and Qualification Procedures Aviation Jet Fuel Filter/Separators or EI Publication 1583-Specifications and Qualification Procedures- Aviation Fuel Filter Monitors with

Absorbent Type Elements. The vessel shall be mounted with sufficient clearance (minimum of 8 inches) to allow sumping and cartridge change out. Filtration (vessel/element combination) must be sized to withstand pumping pressures and flow rates.

a. Filter vessels shall have the following accessories.
    i. Air eliminator
    ii. On systems having discharge pressures greater than 25 PSI a direct reading differential pressure gauge is required.
    iii. Pressure relief valve(s)
    iv. Sump drain
    v. Fuel sampling probe (installed in downstream piping) Gammon Model GTP –7 or equal.
b. Filter vessel exteriors must have the following information annotated on the vessel exterior.
    i. Date of element(s) change-out.
    ii. Element(s) model #
    iii. Element(s) manufacturer
    iv. Vessel model #
    v. Vessel manufacturer
    vi. Number of elements installed.

4.3 Security Measures

Mobile Aircraft refueling units should be secured to prevent unauthorized use. Equipment should be parked away from buildings (minimum of 50') and other critical equipment when not in use. Mobile equipment shall not be left unattended within 500' of residential areas such as: schools, hospitals, apartment buildings, etc. Fuel dispensing nozzles and tank access points (sump drains, manholes, etc.) should be secured with padlocks when equipment is publicly accessible. Equipment ignition keys should be removed and secured when refueling activities are completed. Units should be enclosed in a fenced in area under remote camera surveillance when possible.

Chapter 5. Deployable Storage Tank/Dispensing Systems

Deployable systems are designed for temporary use at remote locations where commercial fuels/servicing equipment is not available to meet projects and unplanned incident requirements. Deployable storage tank/dispensing systems should not be used for recurring aviation support.

- Agencies using deployable fuel storage and dispensing systems shall ensure the following requirements are met.
- An individual is identified (on Resource Order, PASP/MASP etc.) as the responsible party for the operation of the fuel site for the entire duration the fuel site is deployed.
    a. The responsible party shall be trained in the following:
        i. Operation of fueling system (assembly, inspection, testing, and maintenance).
        ii. Fuel Quality Control Procedures.
        iii. Emergency fuels spill response/reporting. Trained to hazmat awareness level.
        iv. Receiving and dispensing aviation fuel
        v. Daily maintenance of fuel equipment (bladder, pump, hose, filter, sump, containment, etc.).
        vi. Inventory/Documentation/Recordkeeping.
        vii. Overall aviation and fuel site safety.
- Deployable storage system tanks must be fuel grade specific/compatible. The tank manufacturer must validate/certify fuel compatibility prior to tank procurement.
- Deployable storage system tanks (bladders and blivets) must be cleaned and inspected periodically. The manufacturer's frequencies, specifications and procedures shall be followed for maintenance of bladders and blivets. The manufacturer's guide for each bladder/blivets shall be available for each system.
- Personnel performing inspection/cleaning/repairs shall be trained on specific requirements pertaining to each task. Job hazards must be emphasized to ensure personnel safety.
- On-site inspection and sampling of remote site fuel facilities is essential in assuring fuel quality at receipt and/or prior to dispensing into aircraft. Bureaus having remote site fueling activities shall designate specific bureau personnel to conduct this activity.

5.1 Markings

The following deployable storage tank/dispensing system marking requirements should be implemented to ensure fuel quality and fire safety.

Bulk Collapsible Tanks (bladders)

Large collapsible storage tanks, accessory fueling lines and equipment should be marked or sign attached. The markings/signs should be applied to the secondary containment dike. The

markings/signs should be applied to exterior walls and be visible from any approach direction. A minimum of four sign sets (Fuel grade, flammable, and No Smoking) will be required.

250 and 500-Gallon Collapsible Blivets

Each blivet end shall be marked/signed with the fuel grade contained. Letter color shall contrast with blivet color. The letter size shall be at least 3 inches.

5-Gallon and Smaller Containers

Containers shall be marked with grade of fuel contained. The fuel container manufacturer has, in many cases, identified fuel grade on 5-gallon containers.

Hose Lines

Hose lines should be marked by signs or labeled adjacent to the nozzle to indicate the type of fuel dispensed.

5.2 Secondary Containment

Secondary containment shall be maintained daily (water drained, debris removed, walls/straps inspected, fuel sheen removed, etc.). Secondary containment shall be required for blivets and bladders regardless of size. Dispensing pump modules shall be put in secondary containment.

5.3 Fuel Site Considerations

Listed below are minimum fuel site considerations.

- Map and/or pictures of area.
- Are permits required? (30-day lead time, 60 days if on State of Alaska, D.O.T. property) Is it OK with the local landowner/residents?
- Is it feasible to share with another function or agency?
- Flat and level, usually 50x50 feet.
- Power lines/obstructions.
- Access for fuel delivery.
- Distance from buildings.
- Acceptable for aircraft using site.
- Out of high traffic areas.
- Away from other aircraft.
- Away from water/streams, as much as possible.
- Fire extinguishers are required for all portable sites.
- Spill kits are required for all portable sites.

5.4 Security Measures

The most critical element of Remote site security is personnel involvement. Each day, personnel must inspect the general area, bladder, secondary containment, and dispensing module to ensure the site is meeting requirements pertaining to environmental conservation, fuel quality and fire safety. Deployable fuel systems should be secured in perimeter fencing, when possible, to prevent unauthorized use. Deployed systems should be monitored through remote camera surveillance when possible.

5.5 Remote Fuel Site Inspection Form and Checklist

Remote Aircraft Refueling sites require daily inspections to ensure fuel quality and fire safety. The inspection criteria and associated form are in Appendix H.

Chapter 6. Drum/Barrel Fuel

The following procedures shall be followed when using drummed aviation fuel. The procedures will help ensure fuel quality is maintained from the time of procurement to consumption.

6.1 Procurement

Bureau personnel, responsible for procuring drummed aviation fuel, should include the following requirements in specification language.

- Specify new drums when procuring (JET A and AVGAS).
- Specify the drum bungs be sealed with tamper proof seals.
- Specify the drums be marked with the fill date, fuel grade, and supplier identification (name and address).
- Specify filtered fuel when possible.

6.2 Storage

Bureau personnel, responsible for storing drummed aviation fuel, should take the following actions when storing drums.

- Store drums in secondary containment.
- Store drums on their sides with bungs level or if positioned upright, must be blocked to allow water run-off from the drumhead.
- Store drums on dunnage with proper blocking and bracing.
- Separate drums by fuel grade. Recommend 50-foot geographical separation.
- Ensure drums are dated to ensure fuel can be used on a first in first out basis.
- Ensure drums are marked with the project ID and party chief name if intended to be reused.
- Ensure stored drums do not exceed established shelf life (24 months for JET A and 12 months for 100 LL). Shelf-life extensions can be obtained through fuel sample submittal and laboratory analysis.

6.3 Dispensing

Bureau personnel responsible for dispensing aviation fuel from drums must take the following actions/precautions to maintain fuel quality and fire safety during dispensing operations.

- Allow adequate settling time after movement. 1 hour per foot JET A and 15 minutes per foot 100 LL before drum is placed into service.
- Drums positioned upright for aircraft refueling must be blocked on opposite side of bungs to allow water run-off from the drumhead. The blocking must prevent water accumulation at the bungs.

- Inspect each drum's contents prior to use. The visual inspection of the drum's interior, performed with an explosion-proof flashlight (preferred), must reveal clear and bright fuel to be considered satisfactory for use. Fuel that appears cloudy or obstructs the drum bottom shall be rejected for aviation use.
- In service drums must be closed (pump removed and bung re-installed) during inclement weather (snowstorms, thunderstorms, etc.) and extended periods of refueling inactivity (overnight, weekends, etc.).
- Drums must be bonded to the aircraft prior to pump activation. A static bonding wire (50 feet) with clips will be used to equalize static electricity potential.
- Fuel issued from drums must be filtered through filters meeting EI/Institute of Petroleum standards for water and particulate removal. **Examples:** Filtration meeting EI/Institute of Petroleum standards manufactured by Velcon are: ACO 21001K, ACO 51201K, ACO 60901K, ACO 40501SPK, and ACO 40901SPK. See chapter 16 for additional information on approved fuel filtration.
    a. Fuel filters used (wet) must be changed out annually.
    b. A reduction in dispensing flow rate is also cause for filter change.
- Fuel dispensing nozzles must be inspected before each use. Nozzle barrels must be clean (free of dirt, wasp nests, etc.). Nozzle dust caps, bonding wires and screens must be in good condition.
- Pumps, filters, hoses shall be dedicated by fuel grade to prevent cross contamination (do not use same pump for jet fuel and AV gas without cleaning unit, emptying hose, and changing filter).

6.4 Reutilization

Drum reuse is limited to one year (365 calendar days) in which a new drum is opened. Drums may not be reused once the field season is completed. Bureau/agency party chiefs must designate personnel responsible for project/field season drum management. Personnel must be briefed on their responsibilities pertaining to drum fuel management. Policies and procedures contained in this handbook shall be referenced by designated personnel.

- Bureau/agency personnel requiring drum reuse during the field season must comply with CFR 49 173.28 hazardous materials regulations. Some critical considerations are as follows:
- Ensure drum condition (integrity) is unchanged.
- Ensure drum is refilled with the same fuel.
- Ensure drum is only filled to 95% capacity.
- Ensure the custodian (designated by project manager) refills the drum.
- The custodian (designated by project manager) is responsible for drum transport.
- Custodians shall return all (empty/full) drums to point of origin and never abandon in place (**Exception:** see 2.4).

- Bureau/agency personnel must perform the following actions to ensure custody and fuel quality is maintained when drums are reused.
- Clearly identify the project, project dates, and drum's custodian on each drum used in support of specific projects.
- Maintain user custody throughout the project/field season.
- Perform visual inspections of drum interiors prior to each refilling. Reject for further use if corrosion, leaks, water, debris, etc. is detected.

6.5 Environmental

Bureau/agency personnel shall take special precautions to preserve the environment when using drummed aviation fuel. In addition to storing drums in lined (secondary containment) when possible, the following actions should be taken.

- Maintain a spill kit at each drum storage/dispensing location.
- Physically inspect each storage/dispensing site daily.
- Take immediate corrective actions to eliminate leaks.
- Clean up fuel spills immediately.
- Report all spills immediately.

Chapter 7. Aircraft Accidents/Incident Response Requirements

The following actions shall be accomplished when an aircraft crash or incident occurs where fuel quality from a government fuel dispensing system requires quality verification. **Example:** An aircraft crash or hard landing where a sudden, unexplained, loss of engine power should cause fuel quality verification. The actions (notifications, security, investigation, and fuel sampling) may require participation by multiple participants.

7.1 Notification

Agencies shall notify the Boise, OAS Safety Officer, immediately when aircraft accidents/incidents occur. The aircraft's last fueling point shall be determined immediately following an aircraft accident or incident where an engine problem was encountered. Pilots of aircraft using the same fuel source shall be immediately notified to check fuel quality in their aircraft.

7.2 Security

The senior bureau/agency official responsible for the fuel point shall ensure "LOCK OUT-TAG OUT" procedures are performed on the suspect fueling system. The OAS Investigator-In-Charge (IIC) or designated representative shall ensure the last fuel system used is kept out of service until the investigation clears the system. The IIC or designated representative shall authorize entry to the fuel site for investigative purposes and shall release the fuel source for use when the investigation reveals the source is not in question.

7.3 Investigation

The OAS Investigator-In-Charge (IIC) or designated representative shall ensure the following actions are taken when responding to aircraft incidents/accidents involving fuel quality. Historical records pertaining to the last system used to refuel the incident aircraft should be reviewed for trends related to fuel quality problems. Documentation pertaining to the following listed categories should be reviewed:

- Color and Particle Assessment, Velcon Hydrokit, Aqua-Glo, Clear and Bright, API Gravity, etc. (field fuel sampling results).
- Differential pressure documentation (daily readings, flow rates, max allowable).
- Equipment preventive maintenance inspections, and filter element replacement frequencies.
- Qualification and training of fueling personnel.

7.4 Physical Inspection

The OAS Investigator-In-Charge (IIC) or designated representative should physically inspect the last system used for serviceability. The following equipment items, related to fuel quality, should be inspected to ensure functionality:

- Filter elements (type) and change out date.

- Differential pressure (current readings).
- Hose condition (cuts, abrasions, type).
- Servicing nozzle condition (screen, dust cap).
- The fuel storage tank should be gauged for water. Water found greater than ¼ inch should be recorded on accident investigation records.
- Filter vessel should be sumped. Result should be rated and recorded on accident investigation records.
- Tank interior should be visually inspected. Result should be annotated on accident investigation record.

7.5 Sample Collection

The OAS Investigator-In-Charge (IIC) or designated representative shall, if warranted, draw fuel samples for ASTM specification testing. The samples should be collected from the incident aircraft and the last fuel source. The laboratory requires two gallons of fuel from each (aircraft fuel tank(s) and fuel dispensing system) for ASTM specification testing. Two gallons from each aircraft fuel tank is not possible under many crashed aircraft circumstances. Personnel should get as much fuel as possible under these circumstances. The laboratory can perform prioritized ASTM specification tests to allow a partial result.

7.6 Fuel Sample Management

Fuel sample container openings must be sealed after closure to prevent sample tampering. Seal numbers, if available, must be documented on custody transfer logs and hazardous material shipping documents. Fuel sample containers shall be marked to indicate the fuel sample source (aircraft fuel tank(s)/dispensing system identification).

Sample containers shall be tagged **SUSPECT FUEL - AIRCRAFT ACCIDENT/INCIDENT**. The tag should also include the following information:

- Sample source (tank ID).
- Sample type (sump, top, middle, bottom, etc.).
- Geographical location (city/state).
- Date.
- Aircraft registration number/fuel system identification.
- Known contaminates (firefighting foam, etc.).
- POC name (typically the person responsible for acquiring and shipping the fuel samples).
- POC phone number.
- POC signature.

7.7 Fuel Sample Tracking

Fuel samples must be logged for tracking. At minimum the log should contain the following information:

- Sample number (locally assigned).
- Sample source.
- Sample date.
- Sampler ID
- Shipper ID.
- Seal number.
- Seal condition.
- Log custodian ID.

7.8 In-Field Analysis

The OAS Investigator-In-Charge (IIC) or designated representative should draw samples for visual analysis. Fuel samples should be taken from aircraft tank sumps and refueling equipment sumps (filter and tank). A nozzle sample should be taken from the nozzle used to perform the aircraft servicing. All samples shall be analyzed visually for color, Clear and Bright appearance, water content, and particulate content. Observations shall be recorded on a field fuel sample log.

7.9 Crash Kit

Office of Aviation management shall set aside a deployable fuel investigation/sampling kit. The aviation fuel investigation kit should contain the following items.

- (8) DOT-approved one gallon sample cans.
- (12) Clear Mason jars (1 Quart)
- (12) Absorbent Pads
- (12) Rags
- (2) Plastic Funnels
- (2) Flashlights
- (2 Sets) Spare batteries
- Sample tags, shipping tags, and labels.
- Gloves
- Goggles
- Pliers, screwdrivers
- Sealing tape

- Hand cleaner

7.10 Commercial Sources

The OAS Investigator-In-Charge (IIC) or designated representative shall contact commercial vendors determined to be the last fuel source for incident/crashed aircraft. The OAS Investigator-In-Charge (IIC) or designated representative shall request a fuel sample from the system(s) used for the incident/crashed aircraft. The IIC shall also request permission to review records and equipment condition. If allowed the in-field analysis described in paragraph 7.8 should be accomplished. If warranted other aircraft pilots using the same fuel source should be advised to check on board fuel quality.

Chapter 8. Fuel Contamination Reporting Procedures

OAS Management shall be notified immediately when a fuel contamination incident has occurred. Pilots who fueled from the contaminated source must be immediately notified about the contamination. All aircraft fueled from a known contaminated source shall be grounded until appropriate maintenance actions have been accomplished. The source of contaminated fuel must be isolated and placed in secured quarantine ("lock out-tags out") immediately after the discovery of contamination. Bureau/Agency management personnel shall be notified immediately of the contamination problem, as well as commercial vendor management when applicable.

Personnel responding to fuel contamination incidents should take previously stated Chapter 7 actions. OAS Management shall act as the release authority for the aircraft and fuel system involved in the contamination incident. Fuel contamination incidents and investigation results shall be documented in the SAFECOM system.

Chapter 9. Bulk Fuel Procurement Procedures

Agency personnel performing fuel procurement actions must comply with established federal procurement regulations. The following paragraphs detail different procurement options and the suggested requirements pertaining to each option. The procedures should be incorporated to ensure fuel ordered and received is the right grade and on specification.

9.1 Defense Logistics Agency (DLA)

Aviation fuel should be procured through the Defense Logistics Agency (DLA) contracts when possible. DLA contracts contain fuel quality and quantity provisions usually absent under local purchase procurements. The quality and quantity provisions provide a standard OAS can use when performing periodic quality control inspections (field sampling) of DLA contracted fuel shipments. The annual threshold to meet for procuring fuel through DESC is 10,000 gallons.

9.2 Local Purchase Procurements

Procurement officials should schedule receipts for times that allow government personnel to be present. Fuel receipts into government equipment (tanks, refueling units, etc.) should be attended by a trained government representative. Procurement officials should request a Certificate of Analysis (COA) for each fuel delivery to ensure specifications are met. Procurement officials shall request vendor's document, on delivery tickets/bill of ladings, fuel grade (JET A or 100LL) and API Gravity readings. Fuel procurement officials shall specifically request fuel meeting the ASTM specification for the specific grade requested.

- JET A must meet the ASTM D1655 Standard Specification for Aviation Turbine Fuels.
- 100 LL must meet ASTM D910 Standard Specification for Aviation Gasolines.

9.3 Into-Plane Servicing Procurement

Bureaus/Agencies planning to use into plane refueling service from commercial vendors (Fixed Base Operators) should establish an agreement/contract with the vendor. The contract should include an inspection provision by an OAS representative. Upon inspection completion OAS will provide the following:

- Provide the commercial vendor a written list of discrepancies along with recommendations for correction.
- Provide a copy of the list with recommendations to the bureau official requesting the OAS inspection. The OAS representative would provide a recommendation NOT TO USE if discrepancies detected impact fuel quality. The commercial vendor shall not be used until critical discrepancies have been corrected and validated.
- If the inspection is deemed "satisfactory," a letter will be provided to the bureau official requesting the inspection with a recommendation for USE of the fuel.

Chapter 10. Fuel Receipt Procedures

Employees should use the following receipt procedures when vendor fuel deliveries are made to government facilities. The procedures are designed to ensure fuel quality while eliminating incidents/mishaps during fuel transfer operations.

10.1 Pre-Receipt Procedures

The following procedures shall be accomplished prior to fuel transfers from delivery conveyances (tank trucks, rail cars, airplanes, pipelines, barges, etc.).

Inventory

Government personnel should gauge the receipt tank(s) for water and fuel volume. Water detected greater than ¼ inch shall be removed. The volume of fuel contained in the tank will be used to determine if enough room exists in the tank for the expected fuel delivery. Fuel storage tanks shall not be filled above there rated 95 percent capacity.

Inspection

Government personnel shall inspect the receiving fuel system/tank(s) for deficiencies (leaks, ignition sources, valve operation, vent obstructions, off-loading hose condition, etc.) Significant equipment deficiencies must be repaired before fuel transfers are initiated. Minor deficiencies not affecting fuel quality, fire safety, or environmental conservation may be deferred to a later date (faded signs, chipped painted, etc.). The inspection shall be documented on the appropriate inspection form prior to beginning fuel transfer operations.

Documentation Review

Government personnel shall review vendor bill of ladings/delivery tickets for accuracy (fuel grade, API gravity, quantity, delivery destination, contract number, etc.). Personnel shall document findings on ATA form 103.02 or locally developed form. Fuel receipt transfers shall not be performed if the fuel grade or API Gravity doesn't match expectations. All inaccuracies shall be clarified before offloading operations are started. Personnel shall review the Certificate of Acceptance (COA) to ensure the fuel quality meets expectations.

White Bucket Test

Government personnel shall do a white bucket test on a 1-gallon fuel sample collected from the delivery conveyance off-loading manifold. The visual appearance of fuel collected must be the right color and present a Clear and Bright appearance (no evidence of particulate and water contamination). If satisfactory results are not achieved the white bucket test may be repeated four times. The fuel delivery shall be rejected if white bucket results are still unsatisfactory after the fourth sample. The bucket sample should be taken after a settling time of 20 minutes.

API Gravity Test

Government personnel shall perform the API Gravity test (ASTM D 287 Test Method for API Gravity of Crude and Petroleum Products (Hydrometer Method) on a 1000 ml fuel sample collected from the delivery conveyance manifold. The converted API gravity test result must be

within 1° of the converted API gravity noted on the delivery ticket. If the converted API gravity is greater than 1° investigative actions must be taken to determine cause. The loading facility shall be notified when API gravity results vary by more than 1° API gravity. The fuel delivery shall be rejected if sufficient cause is not determined for the API gravity variance. The receipt shall be rejected if the converted API Gravity doesn't fall within the designated range for the fuel grade ordered. The API gravity ranges for the two most used fuels are as follows:

- AVGAS (100LL) 55-84
- JET A (A-1) 33-52

10.2 Receipt Procedures

Government and vendor personnel shall take the following actions to successfully accomplish fuel receipt operations. The actions detailed below shall be accomplished after the pre-receipt tasks are accomplished successfully.

Government Responsibilities

- Government personnel are responsible for the following actions:
- Setting up fuel system valves to direct fuel flow to the appropriate tank(s)
- Ensuring the receiving tank(s) has enough space for the delivery.
- Monitoring the fuel system for leaks during off-loading operations.
- Placing a drip pan under off-loading connections.
- Positioning fire extinguisher(s) upwind of the off-loading operation.
- Ensuring bonding wires remain in place during the operation.
- Ensuring government system components (pumps, gauges, vents, etc.) are monitored during unloading operation.
- Differential pressure readings and flow rates shall be observed during the fuel transfer. The readings and flow rates taken near the end of the transfer operation shall be recorded on the appropriate form. If the differential pressure exceeds established limits filter elements shall be changed.
- Ensuring appropriate emergency actions (government system shut down, personnel evacuation, etc.) are taken when circumstances warrant.
- Ensuring amount delivered matches expectations.
- Ensuring potential ignition sources are identified and eliminated.
- Ensuring constant communication is maintained with the delivery conveyance operator.

Vendor Responsibilities

Vendors are responsible for the following actions:

- Setting up delivery conveyance (valves, pumps, hoses, etc.) for dispensing.

- Connecting the hose to the government system off-loading header. Safety wiring camlock connection ears.
- Ensure bonding wires are in place prior to initiating fuel transfers.
- Initiating and stopping fuel transfer operations when directed by government personnel.
- Monitor dispensing equipment components (pumps, valves, piping, gauges) for malfunction or leaks.
- Take appropriate emergency actions related to the delivery conveyance when circumstances warrant (activating emergency shut offs, closing valves, etc.).

10.3 Post Receipt Procedures

The following actions shall be accomplished by government personnel and vendors after fuel receipts are completed.

Government Responsibilities

Government personnel shall take the following action(s).

- Shut down government system valves, pumps, etc.
- Empty drip pans
- Secure bonding cables
- Inventory (gauge) tank(s) to validate amount received. Storage tanks shall be gauged before and after deliveries to determine the quantity received. The quantity determined by gauging should agree with the quantity noted on the delivery ticket.
- Complete paperwork for fuel receipt documentation (ATA Form 103.02 or locally developed form.)
- Complete paperwork for fuel sample documentation
- Validate delivery conveyance dispensing tank(s) volume. In most instances the dispensing tank(s) should be empty.
- Secure fuel system (close valves, lock gates, secure cabinets, etc.)

Vendor Responsibilities

Vendors shall take the following action(s).

- Shutting down delivery conveyance pumps and closing transfer valves.
- Disconnect, drain, and store delivery conveyance off-loading hoses.
- Disconnect bonding wires.
- Check dispensing tank(s) for volume. In most instances the dispensing tank(s) should be empty.
- Present invoice for government personnel signature.

Chapter 11. Fixed Fuel System Dispensing Operations

The following guidance pertains to aviation fuel dispensing operations using fixed tank(s) and dispensing equipment. The typical Department of the Interior fixed fuel storage/dispensing system has the following major components:

- A tank with secondary containment.
- Transfer piping and valves.
- Fuel dispenser with (pump, hose, nozzle, meter, hose reel, filter, etc).

11.1 General Guidance

Personnel should adopt the following listed practices to ensure fuel quality, fire safety and environmental preservation.

- Fuel should be issued on a first in first out basis.
- A settling time of 1 hour per foot of fuel should be observed. Fuel shall not be issued from storage tank(s) receiving fuel until the proper amount of settling time has elapsed. **Example:** 3 feet of fuel would require 3 hours settling time. **Exception:** Settling time is 1 hour for fuel dispensing systems having floating suction dispensing systems.
- Top loading aircraft refueling unit cargo tanks should be avoided when possible. Splashing can be minimized during loading by placing the end of the loading spout at the compartment bottom. Fuel flow shall be reduced until the spout end is covered with fuel. Bottom filling/loading should be employed whenever available.
- Fuel inventories should be taken daily on active systems and at least monthly on inactive systems. Fuel issues should be recorded daily.

11.2 Preventive Maintenance inspection Requirements

Fuel storage tank/dispensing systems shall be inspected when used. Air Transportation Association (ATA) Inspection Form(s) can be used for maintenance/inspection documentation. If a general or specific inspection item is not applicable the item shall be lined out. Fuel storage tank/system maintenance/inspection records shall be available for inspection during normal working hours. Records shall be kept on file for 1 year.

Inspection Forms

The below listed inspection forms can be used to document preventive maintenance inspections if subscribed to ATA Specification 103.

- 103.01A Fuel Facility Checks - Daily and Monthly
- 103.01B Fuel Facility Checks - Daily - Sump Results and Filter Differential Pressure
- 103.01C Quarterly Fuel Facility Checks
- 103.01D Annual Fuel Facility Checks

Chapter 12. Fuel Storage Personnel Requirements

The following general personnel requirements shall be met by agencies having fixed fuel storage/dispensing systems.

- Primary and alternate storage tank/dispensing system custodians shall be assigned in writing for each fuel storage tank/dispensing system.
- The custodian's identity (name, organization, phone number) shall be posted at the storage tank/dispensing system site.
- Primary and alternate custodians shall be trained on the systems they are responsible for. The training should cover the following areas: receiving fuel, dispensing fuel, emergency shutdown, fuel accounting, fuel system inspection, fuel system preventive maintenance, and personal protective equipment.
- Personnel operating storage tank/dispensing systems must be trained on job hazards, emergency shut down procedures, spill notification procedures, fuel system inspection and documentation requirements, system operational requirements (valve positioning, differential pressure recording, leak detection, security, etc) and personal protective equipment requirements.
- Personnel operating fixed fuel dispensing systems must complete HAZWOPER (Hazardous Waste Operations and Emergency Response) training to first responder operations level. Personnel must take specific actions during fuel spills (leaks, tank overfills, damaged piping, etc.). Personnel must:
    a. Control the source to stop the spill (close valves, shut off pumps).
    b. Contain and secure the spill (dike area, restrict personnel entry).
    c. Notify supervision (report the spill).

Chapter 13. Fuel Dispensing Requirements (Mobile Refueling Equipment)

The following requirements are basic to aircraft refueling operations. NFPA 407 provides a comprehensive detailed approach to aircraft refueling operational requirements.

13.1 Personnel Requirements

Personnel performing aircraft refueling operations with mobile fuel systems must have documented training prior to performing in an unsupervised capacity. Personnel transporting placarded amounts of hazardous materials on public roads must have a Commercial Driver's License (CDL) with the appropriate endorsements. (i.e., cargo tank endorsement). At minimum personnel should be proficient in the following areas:

- (Pre-Use) Fuel system inspection, operation and set up.
- Fuel system components.
- Leak detection procedures.
- Emergency shut down procedures.
- Field fuel sampling techniques (White bucket, API gravity, Velcon Hydro-Kit, etc.).
- Field fuel sample evaluation techniques.
- Spill prevention measures.
- Spill control techniques.
- Spill notification procedures.
- Differential pressure and flow rate recording requirements. Personnel must understand the flow rate to differential pressure relationship and how it dictates maximum allowable differential pressures.
- Bonding techniques (Equalizing static electricity potential between aircraft and fuel system.
- Personal Protective equipment requirements. (Boots, long sleeved shirts and pants)
- Ignition source awareness (lightning, smoking, battery charging, unauthorized power sources, etc).
- Aircraft fuel grade requirements (reciprocating engines vs. turbines).

Chapter 14. General Purpose Vehicle Aviation Fuel Dispensing Systems

Agencies utilizing portable tanks, mounted in general purpose vehicles, shall meet the following equipment and personnel requirements.

14.1 Equipment

General Purpose vehicles, used to transport portable tanks, shall not exceed gross vehicle weight requirements. Tanks shall be positioned and secured properly, to minimize center of gravity and fuel movement effects on vehicle handling during fuel transportation.

14.2 Tank Requirements

Tanks larger than 119 gallons capacity shall meet CFR 49 (173.242/173.243) requirements pertaining to bulk containers. Specific requirements are dependent upon the fuel grade transported.

Tanks smaller than 119 gallons capacity shall meet CFR 49 (173.201/173.202) non-bulk container requirements. Specific requirements are dependent upon the fuel grade transported.

Additional Tank requirements:

- Tanks shall be mounted with suitable cushioning to prevent damage from road vibration.
- Tanks shall have a spring-loaded to the closed position, water drain valve. The water drain valve shall be positioned for easy access during daily operator pre-use inspections.
- Tanks shall be made from aluminum or stainless steel.
- Tanks shall have a lockable vacuum pressure vent cap.

14.3 Dispensing System Requirements

The fuel dispensing system shall meet the following minimum requirements.

- API/EI 1529 Type C hose.
- Filtration meeting EI 1581 or EI 1583 specifications.
- Differential pressure gauges on systems operating at pressures greater than 25 PSI.
- Aviation qualified dispensing nozzle having a dust cap, bonding wire and 100 mesh screens.
- UL listed pump for transferring flammable liquids. NOTE: Pump power source must not be reliant upon the general-purpose vehicle engine. The engine on the vehicle must be off during aircraft refueling operations.
- Bonding reel with cable and clips.
- No Smoking, Fuel Grade, and Flammable signs (positioned on front, sides, and rear of vehicle). UN hazard placards are also required.
- Valves to isolate filter vessel.

- (1) 40 B/C rated Fire Extinguishers.
- Fuel Dispensing meter.

14.4 Personnel Requirements

Personnel transporting fuel in portable containers greater than 119 gallons shall have a Commercial Driver's license with hazmat and tanker endorsements. Personnel shall abide by the duty hours prescribed in the CFR 49 Federal Motor Carrier regulations.

14.5 Environment

Personnel vigilance towards leak detection is essential when using General Purpose vehicles as fuel transportation and dispensing equipment. Vehicles must be inspected for leaks (before and after each servicing). Special attention to tank seam welds and support brackets is required.

Spills clean up equipment shall be maintained on general purpose vehicles dispensing aviation fuel. A bale of 25 absorbent pads shall be kept on the vehicle.

14.6 Security

General Purpose vehicles used to transport and dispense aviation fuel shall be secured to prevent unauthorized use. Vehicles shall be parked in an area remote from inhabited facilities (Minimum of 50 feet). Vehicle keys shall be secured when not in use. Vehicle dispensing system nozzle, vent cap, and tank sump drain shall be locked when not in use.

14.7 Sampling Equipment

The following listed sampling equipment should be kept with the vehicle to allow periodic fuel quality checks.

- White Bucket
- 1 QT Mason Jars
- API Gravity Hydrometer
- API Gravity Conversion wheel
- API Gravity Hydrometer Cylinder

14.8 Inspection Requirements

Applicable inspection criteria associated with mobile refueling systems shall be used for general purpose vehicles transporting and dispensing fuel from portable tanks. Items determined to be non-applicable shall be so annotated.

14.9 Fuel Receipt and Dispensing Procedures

Applicable receipt and dispensing procedures shall be followed to ensure fuel quality and fire safety.

Chapter 15. Portable Container Utilization

Occasionally, mission requirements necessitate portable container (Jerry Can) aircraft fueling operations. Fueling from portable containers creates hazards not encountered during normal aircraft refueling operations.

15.1 Hazards

Portable containers do not have specification filtration (American Petroleum Institute or Institute of Petroleum). Fuel dispensed into aircraft by portable containers is not final filtered resulting in increased contamination potential (particulate and water).

Another hazard requiring mitigation when fueling from a portable container is static electricity. Pouring fuel into aircraft wing tanks or fueling ports from an un-bonded portable container can generate enough static electricity to create a spark and subsequent fire.

15.2 Equipment

The following equipment requirements shall be implemented to minimize hazards encountered when fueling aircraft from portable containers.

Containers

Recommended container materials for pouring fuel into aircraft wing tanks is aluminum, stainless steel, or fuel tank bladder material (Turtle Pac) and shall be:

- Compatible with the fuel grade contained.
- Clean (interior and exterior)
- Undamaged and leak free.
- Electro-Static bonding capable.

Funnels

Specific funnels shall be used when fueling aircraft from portable containers. The funnels are made from a conductive polypropylene material that conducts static electricity. In addition, the funnels have a Teflon coated screen that separates water and particulate.

Approved funnels are manufactured by the Raycor Division, of the Parker Hannifin Corporation. Specific model numbers are RFF1, RFF3C, and RFF8C.

Bonding Wires

A static bonding wire with alligator clips installed on each end will be required for aircraft refueling operations using portable containers. The bonding clips shall be attached to the funnel and container before the aircraft tank cap is removed.

15.3 Procedures

The following procedures must be adhered to when using portable containers for aircraft refueling.

Funnel Procedures

The following procedures pertain to funnel storage inspection, and testing.

- The funnel shall be stored in a location that protects the filter screen from damage.
- The funnel shall be visually inspected prior to each use. Damaged filter screens are cause for removal from service.
- The funnel's water removal capability shall be checked initially and quarterly thereafter. The funnel shall not allow water to pass if the level is less than 1/3 the height of the installed screen. The test would require the introduction of water to the prescribed height and above. If water passes through the filter at a height less than 1/3 the height of the funnel, it shall be considered defective and removed from service.

Portable Container Procedures

The following procedures pertain to portable container inspection and use.

- Containers shall be inspected before filling. Container interiors must be free of rust and debris.
- Container caps and gaskets shall seal tightly.
- Container exteriors shall be marked with fuel grade and date filled.
- Containers should be filled from a fuel system using industry accepted filtration (EI 1581/EI1583).

Dispensing Procedures

Pilots shall use the following procedures when fueling aircraft from portable containers.

- Perform a visual pre-use inspection of the funnel and fuel container.
- Bond the portable container to the funnel.
- Open the aircraft tank port and position the funnel in the tank fill port.
- Slowly pour the fuel into the funnel. If water is detected the fueling operation shall be stopped and the water removed from the funnel. A fuel source containing water shall not be used.

15.4 Summary

Fueling from portable containers shall be avoided if possible. Static electricity and unfiltered fuel make the operation hazardous. Approved funnels, containers, and personnel alertness to fuel contamination is essential during aircraft refueling operations using portable containers. Following the procedures in this handbook will minimize fuel quality and fire hazards when using portable containers for aircraft refueling.

Chapter 16. Aviation Fuel Filtration

Aircraft refueling equipment shall have filtration unit(s) qualified to EI Publication1581-Specifications and Qualification Procedures Aviation Jet Fuel Filter/Separators or EI Publication 1583-Specifications and Qualification Procedures- Aviation Fuel Filter Monitors with Absorbent Type Elements. Filter vessel/element configurations must match the actual pumping pressures and flow rate in gallons per minute (GPM). Personnel must adhere to manufacturer's specified conditions for filter installation, maintenance, inspection, and element change-out. Exceeding designed element pressures can result in fuel contamination from ruptured filtration. Personnel shall use the following methods to detect contamination build up allowing timely element change outs.

****Spin On Type Fuel Filters Meeting EI-1581 / EI-1583 Specifications Are No Longer Available for Aviation Use. The Use Aviation Approved Spin on Filters is Limited to the Depletion of On Hand Stock****

16.1 Differential Pressure Program

Pressure differential across a filter element is measured as pounds per square inch differential PSID. The maximum differential pressure allowed on a filter vessel with water absorbent element(s) operating at its rated flow is 15 PSID. If a system is operated at 50 percent of its rated flow the maximum differential pressure would be 50 percent of 15 PSID which equals 7.5 PSID.

The maximum differential pressure allowed on a filter vessel with coalescing and separator elements operating at its rated flow is 15 PSID. If a system is operated at 50 percent of its rated flow the maximum differential pressure would be 50 percent of 15 which equals 7.5 PSID.

Record keeping and daily operator review are critical components of the differential pressure program. The accurate recording of differential pressures and flow rates and subsequent review of previous entries allows personnel to check filter vessel element condition through trend analysis. A steady increase in readings would indicate the element(s) are reaching their designed holding capacity. A sudden drop to a zero reading would indicate element(s) rupture which would be cause for system shut down.

The best time to observe flow rates and differential pressures is during daily preventive maintenance inspections. The dispensing system flow rate is closest to the designed flow rate when the system is placed in the recirculation mode.

16.2 Flow Rate Change Out Criteria

Flow rate observation and recording is the only means of monitoring filter performance on fuel dispensing systems not having direct reading differential pressure gauges. Flow rate observation and recording is only effective on filter vessels having water absorbent media, designed to swell up when absorbing free water subsequently affecting fuel flow rates. Personnel shall observe and record fuel flow rates during daily preventive maintenance inspections. Significant decreases in flow rate indicate contamination build up. If the normal flow rate is reduced by 75 percent filter change is recommended.

Note: Filters with water absorbent (Aquacon/Fuel Guard) media shall not be used with fuels containing the Fuels System Icing Inhibitor (FSII) additive. See Interagency Accident Prevention

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16.3 Time Based Change Out Criteria

Filter elements (coalescers, monitors, water absorbent cartridges) shall be changed out **ANNUALLY** based on manufacturer's time-based change out criteria. Teflon screen separators can be reused after manufacturer inspection and cleaning requirements are met. Specific manufacturer (Facet, Telcon, and Raycor) instructions are available for all filter elements.

16.4 Contamination Change Out Criteria

Filtration must meet stringent contamination removal standards. Contamination immediately downstream of filtration shall not exceed the following limits.

Total Solids	2.0 mg/gallon maximum (In-line sampling/Matched Weight Method)
Total Solids	≥3 wet or ≥ 2 Dry-Membrane Appearance maximum Color/Particle Assessment (in-line sampling method)
Free Water	15 ppm (parts per million) – volume (In-line Sampling (Aqua-Glo), Velcon Hydrokit etc.)
Media Migration	10 fibers/liter (see Appendix C)

16.5 Filter Vessel Sumping Requirements

A sump sample shall be taken on a daily when used basis to remove contaminates from the filter vessel. The preferred method of draining is under pressurized conditions. The sump sample must be visually analyzed for water and particulate content. The filter vessel sump shall be drained until clear and bright results are achieved.

Note: Personnel must exercise caution to prevent fuel spills while preventing skin and eye exposure to fuel. Personnel should position themselves upwind to avoid vapor inhalation.

16.6 Filter Vessel Placarding

Filter vessel exteriors must be placarded/decaled per EI Publication 1581 Specifications and Qualification Procedures Aviation Jet Fuel Filter/Separators. The following information shall be noted:

Vessel Manufacturer (name and address)

- Vessel serial number and model number
- Vessel's rated capacity (Flow Rate)
- Date of Manufacture
- Recommended change out Differential Pressure
- Number of and model numbers of elements installed.

- Date of element cleaning and/or change-out

Chapter 17. Aviation Fuel Dispensing Hose

Aviation fuel dispensing hose meeting EI 1529 Type C qualifications is designed to meet specifications related to strength, flexibility, durability, internal breakdown, etc. Hoses meeting the specified standard efficiently release static electricity reducing fire/explosion potential during fuel transfer operations. In addition, hoses meeting the specified standard do not breakdown internally preventing fuel contamination. Non-specification hoses **shall not** be used for aviation fuel into plane dispensing operations.

17.1 Hose Inspection and Maintenance

Aviation fuel dispensing hose shall be inspected daily prior to initial use. Hose coverings must be free of blisters, cuts, and leaks. Hose end couplers must be undamaged and leak free. EI Bulletin 1529 contains information on identifying, packaging, shipping, and using aviation fuel hoses. It also contains information on hose storage, flushing, handling, inspection, and replacement requirements.

Flushing requirements

New EI 1529 Type C hoses must be fuel soaked for 8 hours. At the end of the 8-hour period 500 gallons of fuel shall be rotated through the hose. A visual sample shall be taken after the 500-gallon flush. The visual sample must be clear and bright. New or newly installed used hose shall not be used for aircraft servicing until satisfactory clear and bright sample results are achieved.

Chapter 18. Aviation Fuel Servicing Nozzles

Three types of aviation fuel servicing nozzles are underwing, closed circuit and over wing. Common components of each nozzle type are 100 mesh nozzle screens and dustcovers. Aviation fuel servicing nozzle screens (100 mesh) are the final contamination removal component on aircraft fuel servicing equipment. The screen is designed to remove particulate material 150 micron or greater in size. The fuel nozzle screen must be removed and inspected for damage monthly. Aviation fuel servicing nozzles with damaged or missing screens shall not be used for aircraft refueling operations. (See Appendix G)

Nozzle dustcovers shall be in place whenever the nozzle is not in use. Nozzle dustcovers shall be replaced if material is cracked/damaged.

A unique component on the over wing nozzle is a bonding wire to allow nozzle to aircraft bonding. The bonding clip shall be attached to a metallic point of contact on the aircraft prior to removing the fuel tank cap. Over wing nozzle bonding wires must be checked for continuity when damaged or replaced.

The previously described nozzles are specifically designed for aircraft refueling. An acceptable alternative to the specifically designed over-wing nozzle is a specially modified service station nozzle. A Gammon modification kit includes a bonding wire, screen, and dust cap which satisfactorily converts an OPW, Model 7 service station nozzle into an acceptable aviation fuel servicing nozzle. The Gammon Bulletin that details nozzle components and part numbers is located at Appendix G-1

Chapter 19. Mobile Aircraft Refueling Equipment Preventive Maintenance Requirements

The following checks must be performed by qualified individuals, at the specified frequencies. Any fueling equipment not in daily use must have all daily, monthly, quarterly, and annual checks current and recorded before the equipment is returned to service. See Appendix A for Daily, Monthly and Annual Inspection Forms along with descriptive language for each inspection item.

19.1 Inspection Documentation

Aircraft Fueling Equipment Check Records paper or electronic must be completed by the person performing the tasks, or by the person accepting responsibility for performance of the tasks. ATA Forms 103.04, A through C, should be completed to fully document equipment inspections if subscribed to ATA specification 103. Locally developed forms should be annotated when opting not to subscribe to ATA specification 103.

The legible signature, initials or employee identification number of the person performing the tasks or the person accepting responsibility for the performance of the tasks is required.

- If initials or employee identification numbers are used, a record of each person's name and initials/identification number must be maintained and available for review.
- Supporting documentation, completed by the person performing the tasks and containing their signature, initials or identification number must be available if another person has accepted responsibility for accomplishment of the tasks.

Records must indicate when fueling equipment is not used. Upon completion of the checks, record results using the following condition codes:

Code	Definition
S	Indicates Satisfactory
C	Indicates Comment. Comment required in remarks section. Corrective action must be documented and dated.
N/U	Indicates Unit Not Used
N/A	Indicates Task Not Applicable

Records Retention. Retain records in local files as follows:

- Daily, Quarterly and Annual check records – 1 Year
- Filter change records – 3 Years

19.2 Additional Inspection Requirements

Mobile aircraft refueling equipment transporting flammable fuels on state and federal highways require additional inspections performed by a certified DOT inspection facility. The number and type of inspections is determined by Cargo tank type. 49 CFR 180 details requirements for the continuing qualification, maintenance, or periodic testing of cargo tanks.

DOT specification cargo tanks typical to aviation fuel transport are required to meet requirements listed below.

- External Visual Inspection Annually
- Internal Visual Inspection 5-years
- Leakage Test Annually
- Pressure Test 5-years

Chapter 20. Aircraft Refueling Procedures

Agency personnel shall incorporate applicable procedures when dispensing aviation fuel into plane. Aircraft refueling operations normally require two personnel, the refueling equipment operator and pilot/pilot's representative. Normal refueling operations shall not be started until engines are shut down and/or the rotor blades secured. A fire extinguisher shall be positioned upwind and within reach of the refueling equipment operator.

20.1 General

All ignition sources, in the vicinity of fuel handling operations, shall be removed. Sources of ignition such as static electricity, open flames, engines, ground/airborne radar signals, etc. are covered in Appendix B, Sources of Ignition. Splashing fuel, a static electricity source, shall be minimized during fuel unit loading by placing the end of the loading spout at the compartment bottom. Fuel flow should be reduced until the spout end is covered with fuel. Splashing, when filling storage tanks, can be minimized by slowing down the initial flow rate until the end of the tank inlet line is covered with at least two feet of fuel. Bottom filling shall be employed whenever available.

20.2 Bonding

The hazard of static electricity is minimized through bonding. Fueling equipment shall be bonded, using static bonding wire and clips, to aircraft prior to making fueling connections. The over-wing servicing nozzle, using static bonding wire and clip, shall be bonded to a metallic component of the aircraft.

Note: The National Fire Protection Association (NFPA) no longer recommends grounding aircraft during refueling operations. Grounding may still be required procedure at military or civilian airports or by military helicopter crews.

Exception: If there is no plug receptacle or means for attaching a clip the operator shall touch the filler cap with the nozzle barrel before removing the cap to equalize the potential between the nozzle and the filler port. The nozzle barrel shall be kept in contact with the filler neck until the fueling is completed. When a funnel is used in aircraft fueling, it shall be kept in contact with the filler neck as well as the fueling nozzle spout or the supply container.

Bonding Cables

Bonding cables will be of a flexible, durable design and material. Bonding cable lengths shall be unique to fuel dispensing system mission support requirement. The plug and jack assembly and the spring clamp will be of unpainted, non-rusting metal.

Annually, the bonding system (cables and connections) will be tested for electrical resistance, and periodically inspected for continuity and integrity as required by frequency of use and type of cable.

20.3 Equipment Positioning

Mobile Aircraft Refueling equipment should not be driven directly toward aircraft because brake failure could cause a serious accident.

Aircraft refueling equipment should be driven into position without backing. If aircraft refueling equipment must be backed the equipment must be brought to a full stop 20 to 25 feet away from the aircraft and/or its rotor blades. A ground guide (spotter) will guide the backing approach until the equipment is stopped at the proper distance from the aircraft and its fill port/vent.

A distance of at least 10 feet shall be kept between the aircraft refueling unit and aircraft or helicopter rotor blades. A distance of at least 20 feet shall be kept between the refueling unit exhaust pipe and the aircraft fill port.

Aircraft refueling equipment shall be parked so a clear and open emergency exit is available. A tank trailer should not be detached from its tractor when refueling an aircraft. The aircraft refueling equipment's engine (unless it powers the pump) must be stopped and the brake set. Refueling equipment and aircraft tires should be chocked if appropriate.

20.4 Fire Safety Precautions

The aircraft refueling equipment must be bonded to the aircraft before the servicing hose is pulled. Personnel can eliminate static charge potential by placing both hands on the bonded system for a few seconds.

The ramp/servicing point fire extinguisher(s) must be positioned where they will not be in the fueler's way and where they are not likely to be engulfed if a fire should start. As a minimum, one 80 BC rated fire extinguisher will be available during all refueling/defueling operations.

The over-wing nozzle shall be bonded to the aircraft before the dust cap is taken off the nozzle. If the aircraft has a receiver for the bond plug, it should be used. If not, the alligator clip must be attached to a bare metal part of the aircraft. Underwing/closed circuit refueling nozzles do not require bonding.

Under Wing nozzles require interlock checks prior to starting fuel flow. Operators shall attempt to remove the nozzle with the poppet valve open. Nozzles that can be removed shall not be used for refueling operations. The nozzle interlock check shall be performed before each servicing operation.

20.5 Rapid/Hot Refueling

Rapid/hot refueling operations are abnormal operations that present additional hazards. The fueling system shall be evaluated for compliance with NFPA 407 requirements. The fuel system used to hot refuel helicopters must meet **all NFPA 407 requirements**.

Personnel involved with Hot Refueling operations must adhere to all procedural requirements contained in NFPA 407.

Note: The only fuels authorized for hot refueling operations is JET A or JET A-1.

Rapid/hot refueling operations must not be performed unless requested and approved by the Government. A copy of the contractor's rapid refueling procedures must be kept with the fuel servicing vehicle.

Rapid refueling of aircraft shall be limited to the following aircraft types:

(1) Helicopters

(2) Medical aircraft actively engaged in the transport of medical patients
(3) Firefighting and search-and-rescue aircraft actively engaged in emergency operations

Only turbine engine aircraft fueled with JET A or JET A-1 fuels shall be permitted to be fueled while an onboard engine is operating.

Aircraft permitted to be fueled while an onboard engine is operating shall have all sources of ignition of potential fuel spills located above the fuel inlet port(s) and above the vents or tank openings, including but not limited to the following:

(1) Engines
(2) Exhausts
(3) Auxiliary power units (APUs)
(4) Combustion-type cabin heater

Aircraft fueling while onboard engines are operating shall be permitted only under the following conditions:

(1) A pilot licensed by the appropriate governmental body shall be at the aircraft controls during the entire fueling operation.

(2) All passengers shall be deboarded to a safe location prior to rapid refueling operations, except as permitted in (3).

(3) Patients on board medical transport aircraft shall be permitted to remain on board the aircraft with medical personnel during rapid refueling operations if, in the opinion of the medical provider, removal from the aircraft would be detrimental to the patient's condition.

(4) Passengers shall not board or deboard during rapid refueling operations.

(5) Only designated personnel, properly trained in rapid refueling operations, shall operate the equipment. Written procedures shall include the safe handling of the fuel and equipment.

(6) All doors, windows, and access points allowing entry to the interior of the aircraft that are adjacent to, or in the immediate vicinity of, the fuel inlet ports shall be closed and shall remain closed during refueling operations.

(7) Fuel shall be permitted to be dispensed by one of the following methods:

(a) Into an open port from approved Deadman-type nozzles with a flow rate not to exceed 227 L/min (60 GPM)

(b) Through close-coupled pressure fueling ports

(8) Where fuel is dispensed from fixed piping systems, the hose cabinet shall not extend into the rotor space.

(9) Clearance between aircraft fuel servicing vehicles and rotating components shall be maintained by one of the following methods:

(a) A curb or other approved barrier shall be provided to restrict the fuel servicing vehicle from coming within 3 m (10 ft) of any aircraft rotating components.

(b) Fuel servicing vehicles shall be kept 6 m (20 ft) away from any aircraft rotating components, and a trained person shall direct fuel servicing vehicle approach and departure.

Personal Protective Equipment (PPE)

During all fueling operations, fuel-servicing personnel should wear a long-sleeved shirt, long trousers, and boots (gloves optional). The shirt and pants must be made of 100 percent cotton or other natural fiber or be labeled as non-static.

Chapter 21. Aviation Fuel Quality Requirements

Agencies/bureaus having aviation fuel management programs shall establish and maintain a fuel sampling and testing program. Personnel performing fuel sampling duties shall be trained in fuel sampling techniques and result interpretations. DOI Fuel Quality Control Program sampling and testing information and procedures are provided in Appendix C, Fuel Sampling and Testing Requirements - Fuel Quality Control.

21.1 Appearance

The primary means of fuel identification is color. Aviation fuel (Avgas) is dyed to prevent misuse. Aviation Gasoline (AVGAS) is used in reciprocating engine aircraft. The two grades of aviation gasoline used are 100 LL and 100/130. The two grades of aviation gasoline are dyed as follows:

- 100 LL (Blue)
- 100/130 (Green)

Jet fuels are used for powering turbofan, turbojet, and turboprop engines. The two types of jet fuel are: kerosene based (Jet A, Jet A-50, JP-8, and Jet A-1), and a blend of gasoline and kerosene (Jet B and JP-4). Most commercial operators utilize Jet A, and the military uses JP-8. The difference between JP-8 and JET A is in JP-8's additive package (anti-icing, corrosion inhibitor, and anti-static additives). All grades of jet fuel range in color from clear (water appearance) to straw-colored.

21.2 Contamination

Three common types of fuel contamination are free water, particulate, and filter media migration. Correctly installed filtration meeting specifications will limit water and particulate contamination to acceptable limits. The following limits are established for filtration meeting EI specifications. The contamination limits are established for fuel samples taken from in- line sampling connections located immediately downstream of filtration.

Particulate contamination detection method	**Limits**
Gravimetric Method	≥2.0 mg per gallon
Color and Particle Assessment	≥3 Color Rating on wet membrane or ≥2 Color rating on dry membrane
Water	
Free Water	15 PPM
Media	
Media Migration	<10 Fibers

When particulate content is more than 2.0 milligrams per gallon (0.5 mg per L) as determined on a 0.8-micron filter membrane, it indicates the filtration system is not operating properly. **The use of fuels contaminated above 2.0 mg per gallon downstream of installed filtration is unacceptable.**

When the color rating exceeds 3 on a wet membrane or 2 on a dry membrane the filter may not be operating properly. Membranes are rated against the Gammon color/particle assessment guide. (See Appendix K) A re-sample is required for fuel samples not meeting color particle assessment ratings. The matched weight method must be used as the referee for samples failing color particle assessment ratings. **The limit is less than 2.0 mg/gal.**

Aviation fuel must not be used if it contains more than 15 PPM free water downstream of installed filtration. The human eye can detect free water at 30 PPM. If hazy fuel is observed, it has more than 15 PPM free water. The Haze Chart and Bar Chart are tools that can be used to determine fuel acceptability through visual analysis. (See Appendix K)

Aviation fuel shall not be used if more than 10 fibers are detected in a fuel sample collected downstream of installed filtration.

21.3 In-line Sampling

Aircraft fuel dispensing systems (fixed and mobile) should have in-line sample collection points installed on the downstream side of filtration. In-line sample collection points are required to obtain samples that provide accurate results for comparison with the limits established above. Trained personnel performing in line sampling and analysis in accordance with ASTM D 3240-Standard Test Method for Undissolved Water in Aviation Turbine Fuels and ASTM D 2276-Test Method for Particulate Contamination in Aviation Fuel by Line Sampling can accurately determine the actual contamination levels experienced at the filter outlet.

In-line sampling is not a valid contamination (particulate and water) detection method for aircraft refueling systems (fixed/mobile) that can't sustain a flow rate greater than 50% of the normal flow rate.

The following listing contains aircraft fuel dispensing systems that typically don't operate at 50% of the normal flow rate. In-line sampling is not a valid particulate contamination detection method.

- Deployable storage tank/dispensing systems
- Fueling from barrels

21.4 Visual Sampling

The visual method shall be used in the absence line sampling and ASTM analysis. Agency personnel shall familiarize themselves with the following procedures to perform and document visual sample results. A critical element of the testing procedure is container cleanliness. A dirty container will provide inaccurate results. Containers must be cleaned after each use to ensure accurate results.

The visual method of contamination analysis is the most common method used in the field. The method varies dependent upon the container used. The two most common containers used are a White Bucket or clear 1 quart Mason Jar (See Appendix J). The test objective is to visually analyze fuel samples collected for color, free water, particulate, and fibers.

Visual sampling is normally used when evaluating filter and tank sump samples. Filter vessel sumps and tank sumps are designed to collect water and particulate contamination. Excessive water and particulate contamination shall be removed as it is discovered. Finding free water or

particulate in a sump sample is not cause for shutting down a fuel system, however finding discolored or wrong colored fuel is cause for system shut down and investigation.

Visual Sample Reporting

The results of visual sample analysis must be reported on ATA 103 equipment/facility preventive maintenance or locally developed forms. The ATA 103 tables displayed below detail reporting codes for each contaminate observed.

Particulate Ratings

Rating	Code	Description
Clear	A	No visible particles (rust, dirt, etc.). No unusual color.
Acceptable	B-C	Some fine to small sized particulates (5-20).
Marginal	D	Many fine to small sized particulates (20-50).
Unacceptable	E-I	Dirty-discoloration-large particulates.

Free Water Ratings

Rating	Code	Description
Bright	1	Sparkles
Hazy	2	Dull appearance- fine water droplets throughout
Cloudy	3	Cloudy/milky appearance
Wet	4	Layer of water/Large droplets

Fuel sample results on samples taken from dispensing nozzles must be rated A on the particulate chart and 1 on the free water chart. Nozzle samples downstream of system filtration must be virtually free of contamination.

21.5 Fuel Test Descriptions

Personnel shall follow prescribed procedures when performing in field sampling. Results can be affected by improper sampling techniques. Equipment cleanliness and condition is critical to obtaining accurate results. The following listing describes fuel sampling procedures contained in ATA 103.

Appearance Test

The term "Clear and Bright" means that, when visually examined in a clear glass container, the product is visually free from undissolved water, sediment, and suspended matter. A product suitably free from these contaminants produces a bright sparkling appearance.

The test is performed by drawing a minimum of one quart of product under pressure into a clear glass cylindrical container. Assure that the container and the sampling tap are clean. The sample is then swirled to create a vortex. Visually detectable particulate matter will appear at the lower tip of the vortex. Undissolved (i.e., free) water will appear as a separate layer below the product

when the swirling action stops. A hazed sample usually indicates either suspended free water or very fine particulate matter.

Note: Off colored or abnormal smelling fuel are symptoms of cross contamination between fuel grades.

Jet fuel must be "Clear and Bright" in all phases of handling. Jet A normally ranges in appearance from clear/colorless, straw color to amber, a straw-colored product or a product having no color can both be "Clear and Bright," as defined.

Color Particle Assessment/Membrane Color Filtration Test

This test provides a field method for detection of particulate matter in jet fuel. It is particularly useful in monitoring the cleanliness of fuel received and in evaluating the performance of filter vessels. Because the method produces results which are not quantitative, it is not to be used as the basis for rejection of product. However, it does provide an alert signal, which indicates the need for further investigation using a gravimetric test to determine weight per unit volume or a double membrane test. (See Appendix M)

If both single and double color/particle ratings exceed maximum allowable limits or are in dispute, a matched-weight gravimetric test will govern, or fuel will be rejected.

The operator shall be cognizant of the fact that a wet membrane may appear darker than a dry membrane. This must be taken into consideration if there is a need for immediate evaluation. Ratings are to be made after the membrane is completely dry using the [ASTM D2276] Rating Guide, Shell Oil Evaluation Guide or Gammon Evaluation Guide (SGTP 3940) (See Appendix K).

Whether wet or dry, a membrane with visible particles is cause for concern and requires prompt investigation of the condition of filtration equipment.

The test is performed by passing fuel through an in-line sampler containing a single filter membrane. The sample will be taken under fuel flow conditions. One gallon of fuel shall be flushed through the sampler before one gallon of fuel is sent through the membrane.

The amount of fuel passed through the in-line sampler after flushing is 1 gallon. After sampling the plastic monitor containing the membrane shall be removed from the in-line sampler. The membrane will then be removed from the monitor for drying.

After drying, the membrane will be rated against one of the scales mentioned previously. A rating greater than 2 dry would require a re-sample using a matched weight monitor. The same amount of fuel would be passed through the matched weight monitor.

The two membranes contained in the matched weight monitor would be removed and separated for drying. After drying the membranes would again be rated separately against the previously noted guides.

The samples would be rated as a pass if the ratings are within 2 of each other.

Example: 1 membrane rates as a B1 and the other rates as a B0. The sample would pass with no other action required. If the membranes rated out at B0 and B3 the sample would be rated unsatisfactory, and a Gravimetric test would be required.

The gravimetric procedures are identical with the exception being in how results are interpreted. The membranes are weighed after drying. A difference between the test and control membrane greater than 5mg per Liter would be rated as unsatisfactory.

An unsatisfactory rating shall be cause for investigation. In most instances a filter change will be required.

Free Water Test(s)

Dry fuel is a prime contributor to flight safety. There are numerous ways that water enters fuel systems; the most common are leakage at manholes and tank plumbing, water-laden transport deliveries, condensation of atmospheric moisture in partially filled storage tanks. Over the years, various tests have been developed. However, experience has shown that the human senses cannot be substituted.

Water in fuel is in one of two forms: Dissolved water ("water in solution") or free water.

Dissolved water is water in solution in jet fuel. This water is not free water and cannot be removed by conventional means.

Free water is water in fuel *other than* dissolved water. Free water may be in the form of droplets or haze suspended in fuel (entrained water) and or layered at the bottom of the fuel container (water slugs).

Entrained water is found in fuels in the form of very small droplets, fog, or mist and it may or may not be visible. When large quantities of entrained water are present, the fuel will have a hazy or milky appearance.

The amount of dissolved water in fuel varies with the fuel temperature. Changing fuel temperatures will cause dissolved water to come out of solution as entrained water and is best described as a condition like humidity in the air. The higher the fuel temperature, the higher the potential concentration of dissolved water. When the temperature of the fuel is reduced due to change in ambient temperature or in flight, especially at high altitudes, dissolved water will condense from the fuel and accumulate becoming free water in the form of entrained water. Free water is heavier than fuel and will eventually settle to the bottom of tanks and accumulate in low points in fuel system becoming water slugs.

Free water in fuel causes various problems. The most serious being engine flame-out if a slug of water reaches the engine, or the formation of ice crystals, which can block the filter. Therefore, free water is not permitted to accumulate or remain in fuel systems and free water testing must be performed as scheduled.

Visual Detection

Large quantities of water in fuel can be visually seen. The water quickly separates from the fuel and settles on the bottom of the sample container. Jet fuel varies in color from dark straw to clear and it is possible to mistake an all-water sample as fuel. Adding a known quantity of water to the sample will determine if it is all water or fuel. If the sample is all fuel, the water will quickly separate and settle to the bottom of the sample. If the sample is all water, the added water will not separate.

For additional clarity, a drop of liquid food coloring may be added to the sample. The food coloring will separate from the fuel and settle to the bottom of the sample and color the water when mixed.

Water Sensitive Paste or Paper

Chemically treated paste or paper may be used to indicate the presence of free water. These materials change color when they contact water. They do not readily react to low concentrations of water, such as a hazy fuel sample. These pastes and papers are normally applied to gauging sticks and tapes when checking storage tank bottoms for bulk water.

Hydro Kit

Hydro Kit is one means of checking for free water in fuel. The test consists of adding a pre-measured amount of water-sensitive powder to a sample of fuel. If water is present, the powder turns pink. The chemical powder is sensitive to water concentrations from 0-30 PPM. (Appendix I):

Mercator Kit

Mercator Kit is a test which may be used in detecting free water in concentrations from 60 ppm down to 5 ppm. The test consists of adding a pre-measured amount of water-sensitive powder to a sample of fuel in a special bottle. A disc of filter paper is placed in the screw cap of the bottle. After shaking the contents blue spots appear on the test wafer or disk and indicate the amount of water that is present in the fuel.

Aqua-Glo

Aqua-Glo Kit is a very sensitive and precise test method. It can detect free water concentrations as low as 1 ppm. The test consists of passing a measured amount of fuel through a chemically coated paper disc. The membrane is then compared to a known color standard. The chemical will glow in ultraviolet light proportional to the amount of water in the fuel. This method will require the procurement of specialized equipment for analyzing and taking the sample. (APPENDIX L).

Shell Water Test Kits

Shell Water Detector Kit indicates the presence of suspended free water in jet fuel at the time and temperature of testing by color changes of water-sensitive paper through which fuel has been drawn. A distinct color change is obtained as free water content approaches 30 ppm, giving positive indication of water contamination.

API Gravity Test

This procedure describes the means for measuring the gravity of fuel with a hydrometer. A significant change in gravity may indicate contamination by another product. Hydrometers may be calibrated in one of the following units of gravity measurement: API Gravity, Relative Density (Specific Gravity) or Density. The term "Gravity" will be used throughout this procedure as a general term to avoid repeating these measurement terms.

Description

The scale reading at the intersection of the fuel surface on a freely floating hydrometer and the temperature of the fuel at the time of the test are observed and recorded. The observed readings are then used to correct the gravity to the standard temperature for the test.

Fuel Testing Equipment (Hydrometers)

- **Preferred:** ASTM approved thermo hydrometers graduated in degrees API Gravity and degrees F as specified in [ASTM E100]. Thermo hydrometers recommended for Jet A/A-1 are designated model numbers: ASTM 54HL and 55HL. The thermo hydrometers recommended for aviation gasoline are designated ASTM 57HL and 58HL.
- **Alternative:** ASTM plain form hydrometers graduated in units of density, relative density (specific gravity) or API gravity. These must conform to requirements outlined in (ASTM E100). Plain form hydrometers do not contain a built-in thermometer. An ASTM approved thermometer must be used independently to obtain fuel temperature.
- ASTM approved thermometers graduated in either degrees F or degrees C and specified in (ASTM E1). Specific thermometers recommended are the ASTM 12F (graduated in degrees F) or the ASTM 12C (graduated in degrees C). Thermometers are not required where thermo hydrometers are used.

Cylinder

A clear glass, plastic or metal hydrometer cylinder is required. Clear glass or clear plastic cylinders are preferred since accurate hydrometer readings can only be obtained with translucent plastic or metal cylinders when the sample level is at the top of the cylinder.

Test Procedures

- Collect the sample in a clean hydrometer cylinder and place it in a vertical position in a location free from air currents. Allow a minute or two for air bubbles to disappear. Remove any air bubbles that remain on the surface of the sample by touching them with the corner of a clean paper towel.
- When using a thermo hydrometer, gently lower it into the sample and, when it has settled, depress it about two scale divisions into the liquid and then release it. Gently spin the hydrometer when releasing it. This will assist in bringing it to rest, floating freely away from the cylinder walls.
- When the thermo hydrometer has come to rest and the thermometer is showing a steady reading, read and record the temperature of the sample to the nearest 0.5° C or 1° F. Then read the hydrometer to the nearest scale division and record the value. The correct hydrometer reading is that point on the hydrometer scale at which the principal surface of the liquid cuts the scale.
- When using a plain form hydrometer, first measure temperature with an approved thermometer. Continuously stir the sample with the thermometer taking care that the mercury is kept fully immersed. As soon as a steady reading is obtained, read, and record the temperature of the sample to the nearest 0.5° C or 1° F and then remove the

thermometer. To obtain the hydrometer reading, follow the procedure described in paragraphs 2 and 3 above.

- Correct the observed hydrometer reading to the standard temperature of 60° F for API gravity and relative density, or to 15° C for density using the appropriate correction table.
- Report the corrected gravity measurement.

Cautions

The hydrometer must float freely to obtain a correct reading. It must not come to rest against the side or bottom of the cylinder during the test. The thermometer should not be completely removed from the liquid to read temperature. Evaporation of liquid from the thermometer stem and bulb will lower the temperature and cause an incorrect reading. Hydrometers and thermometers must be inspected periodically to be sure that they are not cracked or that there are no separations of the mercury column.

Interpretation of Results

Once a batch of fuel is produced, its corrected gravity remains relatively constant. A significant change in gravity from that previously determined could indicate contamination with another product and shall be investigated immediately. Very slight differences in test results may occur due to differences in test operators or sample location, but these are usually minimal, such as less than 0.3 API. A difference of 1 degree (+/-) from amount documented on the Certificate of Acceptance is cause for investigation prior to fuel delivery off-load.

White Bucket Test

The purpose of this test is to visually determine the possible presence of surfactants, water and/or solids in turbine fuel.

Test Description

A fuel sample is obtained in a white bucket from sump drains of filter vessels and tanks. The sample is observed for indications of surfactants, or the presence of water and/or solids.

Equipment

Preferred equipment consists of a nine-quart white porcelain bucket and a bright copper coin.

Procedure

The following listed procedures extracted from ATA 103 and must be followed to obtain accurate results.

- Fill the white bucket to an approximate depth of eight inches (200 mm).
- Let the sample settle for one minute to remove air bubbles.
- Place the white bucket on a level surface and inspect the bottom for water droplets, solid contaminants, hazy/cloudy condition and/or brown slime.

Note: A shiny copper coin, dropped into the bucket, can be used as an aid in determining the

clarity of the sample. If the coin characteristics can be easily distinguished, the fuel is considered neither hazy nor cloudy.

Caution: The presence of contamination is much more evident when the sample is taken from a pressurized system. Samples removed from a static system may indicate little contamination when significant contamination can be found under flow or pressurized conditions. Be sure that the fuel sampling tap is free of loose contaminant by flushing the sampling tap at maximum flow prior to drawing the sample. To determine the difference between a haze caused by entrained water or air bubbles, perform a water detection test.

Rating of White Bucket Sample

Moisture Content Indicators

Moisture Content	Indicator	Description
Bright	A	Brightness is a quality independent of the color of the sample and refers to the lack of suspended or free water in the sample. Bright fuel tends to sparkle.
Hazy	B	A condition resulting from fine droplets of moisture dispersed throughout the sample producing a dull hazy appearance. This can be a temporary condition brought about by a drop in temperature. During the first minute, the fuel can appear hazy due to air bubbles.
Cloudy	C	The result of extremely fine droplets of water dispersed throughout the sample giving it a milky appearance.
Wet (Free Water)	D	Any form of free water in the form of droplets or bulk water on the bottom of the bucket or clinging to the sides.
Surfactants	E	Slime in the bottom of the bucket or at the fuel/water interface appearing as a dark brown/black layer; or scum or lacy material is floating in or on the sample.

Solids Contaminant Descriptions

Contaminate	Rating	Description
Clean	1	Refers to lack of particles, silt or sediment, flakes or dye, rust or solids.
Slight Particulate Matter	2	Contains several fine to moderate sized particles.
Particulate Matter	3	A sample in which many small particles may be seen floating or settled on the bottom.
Dirty	4	Discoloration or many particles dispersed in the fuel or settled on the bottom.

Sampling and Testing Frequencies

Agencies having fuel management programs must institute periodic fuel sampling and analysis schedules to ensure fuel quality is monitored and maintained. Most samples will be taken and analyzed under field conditions.

Fuel samples shall be taken and submitted to fuel laboratories for full specification analysis when fuel quality is questionable. The following chart details the type of sample point, purpose, limits, frequency, and analysis method.

Sample Point	Purpose	Frequency	Method
Truck Cargo Tank Sump	Particulate and Water	Daily	Visual (White Bucket or Mason Jar)
Bulk Storage Tank Sump	Particulate and Water	Daily	Visual (White Bucket or Mason Jar)
Filter Vessel Sump Sample	Particulate and Water	Daily	Visual (White Bucket or Mason Jar)
Dispensing Nozzle Sample	Particulate and Water	Daily	Visual (White Bucket or Mason Jar)
Receipt Conveyance	Cross Contamination	Receipts	ATSM D 1298 (API Gravity and White Bucket)
Outlet Side of Filter Separator *	Particulate and Water	Monthly	ATSM D 2276 (System Dependent)

* In-line sampling using color/particle assessment and Aqua-Glo methods shall be used on systems operating at greater than 50% of the designed flow rate. Visual analysis for particulate and (hydro kit, metro cater, or shell water detection for water on systems that don't meet in-line sampling criteria.

Chapter 22. Fuel Accounting

Accounting for fuel requires maintaining a book inventory to track receipts and issues daily. The book inventory is compared to the physical inventory to determine daily gains and losses. An excessive (abnormal) gain or loss shall be investigated immediately.

Monthly the physical inventory shall be compared to the book inventory. An out of tolerance investigation is required if the gain/loss exceeds 1 percent of the throughput (receipts plus issues). The investigation shall at minimum look for undetected spills.

22.1 Physical Inventory Requirements

Fuel contained in active bulk storage tanks shall be inventoried daily. Fuel contained in inactive storage tanks shall be inventoried monthly or when next activated. Tank gauging charts shall be used to convert measurements made by tape and bob.

Equipment Requirements

Trained personnel shall perform physical inventories using the following equipment.

- Gauging charts
- Industry standard metal inventory gauging tape and bob (See Appendix J)
- Industry standard fuel finding and water finding paste (See Appendix J)

Documentation Requirements

Fuel and water measurements obtained through sticking tanks shall be documented. The measurements shall be converted to gallons by using tank specific gauging charts.

Fuel Dispensing Requirements

Fuel dispensed to aircraft from fixed or mobile refueling equipment shall be documented.

Fuel Receipt Requirements

Fuel received into Bulk storage shall be documented by fuel grade.

Fuel contained in fuel storage tanks shall be inventoried prior to and after fuel deliveries. The amount received as noted on the delivery ticket shall be matched against the amount delivered by sticking. Major variations require investigations.

End of Month Reconciliation

Fuel inventories contained in storage tanks and refueling unit cargo tanks shall be reconciled at the end of each month. The reconciliation process is a cross-check involving the actual physical inventory against the running book inventory. The physical inventory should be within 1 percent of the book inventory. Accurate tracking of issues and receipts is required.

Deviations

The fuel accounting requirements pertain to active systems where fuel movement is on-going. In-active systems shall be reconciled as frequently as possible. It shall not be necessary to travel extensive distances to complete inventories for the sake of re-conciliation.

Chapter 23. Contract Language Requirements

The following minimum requirements should be incorporated into helicopter and fixed wing contracts where vendors supply their own fuel. The requirements are centered on insuring fuel quality and fire safety to ensure the safety of government personnel.

Example: Vendors supplying helicopter transportation to Minerals Management Service (MMS) employees working in the Gulf of Mexico also supply fuel to their helicopters. MMS does not have government owned and operated fuel systems.

23.1 Fixed Fuel System Equipment

The following equipment requirements pertain to fixed equipment. The equipment requirements should be stipulated in contract clauses to ensure compliance.

Tanks

- UL/API listed –Fixed fuel system tanks.
- Emergency and normal vents
- Access ladder and Tank internal inspection manhole
- Sump drains valve at tank bottom
- Provisions for removing water from tank top when tank does not have sump drain.
- Tank sloped 1 in 20 feet (away from dispensing end)
- Secondary containment when required.
- Where the means of secondary containment is enclosed, it shall be provided with emergency venting.
- Spill Recovery bucket for fuel deliveries where required.
- Applicable fuel identification and warning signs.
- Flammable or Combustible.
- JET A/B or 100LL.
- No Smoking.
- Fire extinguisher. Type and size must meet fuel system size requirements. See NFPA 10.

Dispensers

- Aviation fuel servicing nozzle with screen, dust cap, and bonding wire
- EI 1529 Type C Hose.
- EI 1581 or EI 1583 Qualified Filtration with the following accessories
- Pressure relief valve
- Sump Drain

- Placarded with current filter change date.
- Placarded with element/cartridge model #
- Differential Pressure Gauge on systems operating at greater than 25 PSI. Direct reading differential pressure gauge is recommended.
- UL listed pump compatible with fuel grade dispensed.
- Pump suction point 6 “off tank bottom if not floating suction
- Piping and valves compatible with the fuel grade dispensed.
- Bonding reel with a minimum of 50-foot cable and alligator clip. Bonding cables will be of a flexible, durable design and material.
- Fire extinguisher. Type and size must meet fuel system size requirements. See NFPA 10.
- When required-Under wing/closed circuit servicing nozzle with screen and dust cap.
- Deadman control device (required for pressurized refueling with under wing/closed circuit nozzle. (See Appendix G)
- Emergency shut off switch (Panic button) mounted shall be more than 20 but less than 30 feet from tank/dispenser.

Mobile Fuel Equipment Requirements

The following equipment requirements pertain to mobile equipment. The equipment requirements should be stipulated in contract clauses to ensure compliance. The requirements are centered on insuring fuel quality and fire safety to ensure the safety of government personnel.

Cargo Tanks

Mobile aircraft refueling unit cargo tanks transporting flammable or combustible liquids shall meet Department of Transportation Specifications detailed in 49 CFR. Tanks should have the following minimum accessories to ensure fuel quality, fire safety, and environmental conservation.

- Properly sized emergency vent
- Properly sized normal vent
- Appropriate fuel identification placards and warning signs (minimum of 3-inch letters, contrasting background). e.g., Flammable/Combustible, Jet A, No Smoking
- Cargo Tank Sump drain valve(s) (spring loaded to the closed position)
- Drop tube (top loading)
- Tank access ladder (where required)
- Normally closed dispensing/loading valve (internal valve)

Mobile Fuel Dispensing System

Mobile Aircraft refueling unit dispensing systems shall meet the following minimum design/equipment requirements.

- Dispenser pumps must be UL listed and labeled for flammable liquids. Dispenser pump components (seals, impellers, etc.) and piping and valves must be compatible with the fuel dispensed.
- Piping and valves must be compatible with designed fuel system pressures and flow rates.
- The fuel system should be designed to allow fuel recirculation through the dispenser and tank.
- Fuel systems should have isolation valves where individual components may require removal for replacement/maintenance. **Example:** Periodic filter element replacement requires filter vessel isolation using ¼ turn stainless steel ball valves (recommended) on the inlet and outlet lines.
- Stainless steel/steel/aluminum piping (sized to match components and flow rate)
- Fuel system pressure gauges.
- A direct reading differential pressure gauge for filter vessel is required on systems operating at 25 PSI or greater.
- Pressure relief valves and piping (used to relieve thermal and system pressure build ups).
- One accurate re-settable fuel metering device for registering fuel in US gallons of fuel pumped. The meter must be positioned so it is in full view of the person fueling the aircraft.
- Bonding reel with 50-foot cable and alligator clip. Bonding cables will be of a flexible, durable design and material.
- Aircraft refueling hose qualified to API 1529 Type C specifications. **Exception:** Non-API hose can be used where ambient temperatures sustained are -35° F.
- Hose reel with electric or mechanical rewind capability.
- Over wing aircraft refueling nozzle with bonding wire assembly (plug/clip), 100 mesh screen, and dust cap.
- When required-Under wing/closed circuit servicing nozzle with screen and dust cap.
- Deadman control device (required for pressurized refueling with underwing/closed circuit nozzle.
- On each side of the refueling unit clearly identified emergency shut off switches/valves including operational method (push/pull)
- Enclose electrical wiring in conduit designed for flammable liquid storage and transfer systems (NFPA 70 contains applicable code requirements).
- Fire extinguisher(s) required per NFPA 407 one on each side rated at 20 BC.

- Filter vessel/element(s) combinations qualified to (EI Publication1581-Specifications and Qualification Procedures Aviation Jet Fuel Filter/Separators or EI Publication 1583-Specifications and Qualification Procedures- Aviation Fuel Filter Monitors with Absorbent Type Elements.) The vessel shall be mounted with sufficient clearance (minimum of 8 inches) to allow sumping and cartridge change out. Filtration (vessel/element combination) must be sized to withstand pumping pressures and flow rates.
- Filter vessels shall have the following accessories.
- Air eliminator
- On systems having discharge pressures greater than 25 PSI a differential pressure gauge is required. A direct reading differential pressure gauge is recommended.
- Pressure relief valve(s)
- Sump drain
- Filter vessel exteriors must have the following information annotated on the vessel exterior.
- Date of element(s) change-out.
- Element(s) model #
- Number of elements installed.
- Aircraft fuel servicing vehicles shall be marked with fuel grade identification, warning (combustible or flammable), and No Smoking signs on the vehicle front, each side, inside cab and rear of the cargo tank.

Personnel Requirements

Contractor/vendor personnel operating fixed or mobile aircraft refueling systems must be trained on the systems they operate. The training must cover the minimum requirements listed below.

- System preventive maintenance (Filter change out, leak repair, component replacement)
- Preventive maintenance inspections (Daily, Monthly, Annual)
- Fuel receipt procedures.
- Fuel dispensing procedures.
- Field quality control sampling techniques.
- Fuel quality control sample result interpretations.
- Differential pressure program.
- Spills clean up and containment and control.
- Program documentation requirements: preventive maintenance inspections, differential pressure, sample results, etc.

Fuel Quality Requirements

The following listing details the minimum requirements contractors/vendors should fulfill to ensure fuel quality meets expectations.

- Sump tanks daily when system is used.
- Sump filter vessels daily when system is used.
- Read and record differential pressures daily when system is used.
- Take nozzle sample and evaluate appearance daily when system is used.
- Check API Gravity on fuel delivery conveyances prior to offload. API gravity should be within 1 ° of the API Gravity recorded on the delivery ticket. API gravity should be within the prescribed range for the fuel grade ordered.
- Check nozzle screens monthly.

Note: Nozzle samples shall be clear and bright.

Personnel Safety

The following listing details minimum actions operators should take to ensure fuel transfer are accomplished safely.

- Ensure ignitions sources are prohibited within the servicing zone.
- Ensure fire extinguishers are positioned properly.
- Ensure equipment is leak free and positioned correctly.
- Ensure bonding cables are utilized as required.
- Ensure proper PPE is worn (long sleeve shirts and pants and boots)
- Ensure appropriate system inspections have been performed.
- Ensure appropriate fuel testing has been performed. (Sump samples, nozzle samples, etc.)

Program Documentation

Contractors/vendors should be required to develop inspection forms to document their fuel management program. They should document equipment inspections, fuel testing results, differential pressure readings, filter change outs and personnel training. The forms should be kept on file for the contract period.

Appendix 1 Fuel Facility Checks – Written Instructions

Daily Checks

General Condition of Tank Yard

- Check the general condition of the yard area for appearance and cleanliness. Report and correct any condition that needs immediate attention, e.g., plugged drainage, weeds, poor housekeeping, damaged or missing filter membrane (Millipore) sampling connection dust caps, etc.
- Evidence of any recent fuel spill, including, but not limited to, staining, strong fuel odors or the presence of fuel in catchment basins, overflow tanks, oil/water separators, or sumps, must be investigated immediately.

Security, Fire and Safety Deficiencies

- Check tank yard and fuel handling facilities for any security, fire or safety deficiencies or unusual conditions requiring immediate corrective actions.
- Fuel Leaks
    - Check tanks, piping, valves, hoses, meters, filters, and other fuel handling equipment for fuel leaks.
- Any visible leaks must be immediately reported and repaired.
- Ensure that all gates and access doors are kept locked when area is unattended.
- All broken fences and gates are to be repaired or replaced immediately.
- In unsecured areas, all tank openings, valves, sump drains, fill caps, monitoring ports, loading/unloading hoses, master electrical switches and other accessible fittings must be kept closed and always locked when not in use.

Storage Tank and Product Reclaim Tank Sumps

- Drain fuel, at maximum practical flow, into suitable container. Sample quantity shall be of sufficient size to ensure displacement of sampling line volume.
- Perform fuel appearance test of sample.
- Record findings of first sample taken, after displacement of sampling line volume.
- Continue draining until clean, dry fuel is obtained.
- Remove tank from service if unable to obtain clean, dry fuel. Report unusual contamination to aircraft operators if it is anticipated that such contamination may impact aircraft operations.

Sump Separators

Sump separators may be drained as needed, but at a minimum, the following shall be done at least once daily:

- Drain until clean, dry fuel is obtained. Sumped fuel does not meet Clear & Bright requirements shall be disposed of.

- Return clean, dry product to storage.
- Remove sump separator form service if unable to obtain clean, dry fuel. Source fuel inputs to sump separator shall also be investigated for the source of contamination.

Filter Sumps

- Drain fuel, at maximum practical flow, into suitable container. Vessel shall be pressurized, but fuel does not have to be flowing through vessel when sample is taken.
- Perform fuel appearance test of sample. If sample indicates presence of microbial contamination, vessel shall be opened and inspected for microbial growth.
- Record findings of first sample taken, after displacement of sampling line volume.

Remove filter vessel from service if unable to obtain clean, dry fuel. Report unusual contamination to aircraft operators if it is anticipated that such contamination may impact aircraft operations.

Filter Differential Pressure

- Under normal flow conditions, check and record differential pressure across all working filters.

Hoses, Swivels, Nozzles and Couplers

- Check condition of all fuel hoses, swivels, nozzles and couplers for wear, damage, and leakage.
- Ensure dust covers or other protective devices are available, installed, and in good repair.
- Check hoses for abrasions, cuts, soft spots, carcass separation, worn covers, blisters, exposed reinforcement, cracks, twists, and sharp bends that give the appearance of pending failure.
- Check tightness of all safety locking devices for all swivel and collar assemblies and hose couplings.
- Check condition of nose and poppet seals on nozzles/couplers for cuts, nicks, and wear.
- Any item that is defective or is leaking must be replaced or repaired immediately.

Static Reels, Cables & Clamps

- Check condition of static reels, cables, and clamps.
- Any defect that affects continuity must be corrected prior to use.

Note: Continuity must be checked after maintenance to static.

Fire Extinguishers

- Verify that fire extinguishers:
    - Are in their designated place
    - Have unobstructed access and visibility
    - Are tagged to indicate monthly inspections are current

    - Have unbroken safety seals or tamper indicators
    - Have no obvious physical damage corrosion or leakage
- When so equipped, the pressure gauge reading, or indicator is in the operable range or position.
- If any fire extinguisher is missing or does not meet the criteria listed above, it shall be repaired, or removed from service and replaced with a serviceable extinguisher of the same or greater capacity.

Relaxation Chambers and Bulk Air Eliminators

Drain fuel, at maximum practical flow, into suitable container. Vessel shall be pressurized, but fuel does not have to be flowing through vessel when sample is taken.

Weekly Checks

Bonding Cable Continuity

- Perform electrical continuity check of static bonding system, also during unreeling through at least one full revolution.
- Resistance must be 25ohms or less and recorded on the appropriate form.
- Defective equipment must be repaired prior to use.

Filter Differential Pressure Recorded at, or Corrected to, Maximum Achievable Flow Rate

At the maximum achievable flow rate, check and record the differential pressure and flow rate. Preferably, flow rate should be above 50% of maximum vessel rated flow. Where the filter cannot be exposed to the maximum achievable flow rate of the facility use a procedure endorsed by the manufacturer of the filter elements to correct the differential pressure to maximum achievable flow rate and record the value. Record method used.

Monthly Checks

Filtration (Millipore) and Free Water Test

- Perform a membrane color/particle (Millipore), under flow, downstream of each filter/separator and monitor vessel.
- Performa free water test downstream of each filter/separator and monitor vessel.
- Record results and attach test membrane to ATA Form 103.08 or equal.

Nozzle Screens

- Examine each nozzle screen for particles or other solid contaminants and inspect for damage.
- If particles are found, investigate sources of contamination (inner hose lining, pipe rust, sand, seals, gaskets, equipment failure, etc.) and take appropriate corrective action.
- Clean screens as necessary or replaced if damaged.

- For nozzle screens on loading rack fitted with filter monitors, one of the following shall be performed even when there is no visual evidence of nozzle screen contamination:
- Nozzle screen shall be cleaned using procedures outlined in Section 3.17 or equivalent procedure, or
- The nozzle screen shall be replaced with a screen that has been cleaned using the Section 3.17 or equivalent procedure, or
- The nozzle screen shall be replaced with new screen.

Signs, Labels & Placards

Verify that fueling equipment is clearly marked with the proper type of fuel being dispensed, flammable; no smoking, emergency fuel shutoff and other appropriate information and instructions, signs or labels as required.

Floating Suctions

Verify satisfactory operation of all tank floating suctions.

Fire Extinguishers

Fire extinguishers shall be maintained in accordance with applicable NFPA 10 guidelines.

- Verify that the fire extinguisher is in designated place with no obstruction to access or visibility.
- Verify pressure gauge reading or indicator in the operable range or position.
- Check condition of tire(s), wheel(s), carriage hose, and nozzle, if applicable. Examine for obvious physical damage, corrosion, or leakage.
- Verify that operating instructions and extinguisher type on nameplates are legible.
- Check for broken or missing safety seals and tamper indicators. Examine for obvious physical damage, corrosion, leakage, or clogged nozzle.
- Verify each fire extinguisher has a tag or label securely attached which indicates that annual maintenance was performed and is current.
- Upon completion of the inspection, update inspection tag.

Note: If any fire extinguisher does not meet the criteria listed above, it shall be repaired by a trained/qualified individual or removed from service and replaced with a serviceable extinguisher of the same or greater capacity. Fire extinguishers that are not serviceable shall be identified as “Out of Service”.

Clay Treaters

Verify efficacy by comparing water separation (MESP or WSI) values upstream and downstream.

Fuel System Icing Inhibitors (FSII)

Where FSII has been pre-mixed into the fuel being delivered, FSII concentration by [ASTM D5006] shall be conducted. FSII limits vary by aircraft.

Quarterly Checks for Fixed Tanks

Emergency Shutoff System

- Operationally check the emergency shutoff system.
    - Coordinate shutoff test with all persons, agents, airlines, fuel suppliers, and other groups having interest in the operation of the system.
    - Each control device must be tested at least once a year.
- Immediately report any operational discrepancies.

Water Defense System - External Checks

- Check operation of water defense systems in accordance with quarterly requirements of [Section 3.12].

Tank High Level Controls

- Check satisfactory operation of tank high level sensing devices and automatic fuel flow shutoff valves, where installed.
- Inoperative controls should be adjusted or repaired immediately or have alternate operating procedures in effect that will provide positive spill prevention while tank is in service.

Product Reclaim Tank and Sump Separators

Product reclaim tanks and sump separators shall be visually inspected for cleanliness or pass a microbiological growth test, as recommended, by affected airlines. Clean as required.

- Check interior for cleanliness and condition. Inspect internal epoxy coating for evidence of chipping, flaking, or other deterioration, if equipped. Clean or repair as required.
- Check satisfactory operation of tank high level sensing devices, where installed.
- Check heaters for proper operation per manufacturer specification, where installed.
- Maintain a record of inspection and cleaning.

Semi-Annual Checks

Hose Pressure Checks

Loading/unloading hoses fitted with reusable couplings, and being operated under system pressure, shall undergo the six-month pressure testing at 225 PSI, per the requirements found in [EI1540].

Note: Pressure testing to 300 PSI is required whenever a new hose attachment or coupling is fitted.

Caution: Recoupling and pressure testing of hoses and fittings should only be carried out by persons adequately trained to proper fittings and testing, using procedures that have been approved by the OEM.

Static Stock Quality Check

A storage tank considered to contain static stock (long-term storage) when:

- No product has been received for 6 months, or
- Less than half of the product has been replaced during a 6-minth period.

Note: Transferring product from one tank to another does not alleviate the static shock status.

Storage tanks containing static shock shall have a composite sample taken for full [ATSM D1655] certification. If the results are unsatisfactory, the tank(s) shall be quarantined until product meets [ATSM D1655] specifications or is disposed of.

Annual Checks

Storage Tank Interiors

- Check fuel storage tank interiors for cleanliness and condition of coating.
- Clean as required (Ref [Section 3.11])...

Filter Differential Pressure Gauges

- Verify proper operation of filter differential pressure gauge(s) in accordance with gauge manufacturers' procedures. Repair differential pressure internal filter, where applicable. A record of all checks shall be maintained, and all inaccurate or defective gauges must be recorded.
- Electronic differential pressure devices shall be calibrated/checked at the frequency specified by the manufacturer.

Filter Elements

- All filter vessels shall be opened annually to visually check condition of interior for cleanliness, and integrity of elements.
- Replace filter elements per criteria found in [Section 3.14]. Filter coalescer life shall not exceed 36 months. Change filter elements per [Section 3.13].

Filter/Separator Heaters

Where installed, check filter/separator sump and drain line heaters for proper operation per manufacturer specifications before freezing weather.

Tank Vents

- Where installed, check cleanliness of tank vent screens. Clean, repair or replace vent screens as required.
- Tanks that have pressure/vacuum vents, check satisfactory operation and condition of poppets and inlet screens. Under freezing conditions, additional checks may be required to assure free movement of poppets.

Cathodic Protection (normally accomplished by certified contractor).

Confirm satisfactory operation of cathodic protection systems. This requirement is generally contracted to businesses specializing in this type of service. State or local regulations may require greater frequency of inspection.

Line Strainers

- If installed, check line strainers for cleanliness and damage.
- Clean or replace screens as required.
- Local conditions may require more frequent check of some strainers, such as those used for truck unloading.

Water Defense System Inspection and Test

- Check operation of water defense systems in accordance with annual requirements of [Section 3.102].

Single Stage Coalescers (Haypacks)

All single stage coalescers shall be opened annually to visually check condition of interior for cleanliness, and integrity of elements.

Filter Vessel Pressure Relief Devices

Perform a visual inspection of filter vessel pressure relief devices. Devices shall not be painted over, and data plate shall be visible. Integrity of tamper proof seals, where fitted, shall be verified.

Appendix 2 Sample Form 103.01A Fuel Facility Checks– Daily and Monthly

FUEL FACILITY CHECKS	STATION:	FACILITY:	MONTH:	YEAR:

DAILY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
RECORD DAILY SUMP RESULTS ON ATA FORM 103.01B & DAILY FILTER DIFFERENTIAL PRESSURE ON ATA FORM 103.06 (WEEKLY CORRECTED DP SHOULD BE RECORDED ON ATA FORM 103.01C)																															
1. GENERAL CONDITION OF TANK YARD																															
2. SECURITY, FIRE & SAFETY DEFICIENCIES																															
3. HOSES, SWIVELS, NOZZLES & COUPLERS																															
4. STATIC REELS, CABLES AND CLAMPS																															
5. FIRE EXTINGUISHERS																															
6. EMPTY SUMP SEPARATORS																															
IDENTIFICATION OF PERSON PERFORMING TASKS OR PERSON ACCEPTING RESPONSIBILITY THAT TASKS WERE PERFORMED																															

MONTHLY	CONDITION	DATE	SIGNATURE
1. FILTRATION MEMBRANE TEST (MILLIPORE)			
2. FREE WATER TEST			
3. LOADING RACK NOZZLE SCREEN VISUAL INSPECTION			
3a. LOADING RACK NOZZLE SCREEN CLEANING *(only required for loading racks with filter monitors)*			
4. SIGNS, LABELS & PLACARDS			
5. FLOATING SUCTIONS			
6. FIRE EXTINGUISHERS			
7. CLAY TREATERS			
8. FSII CONCENTRATION (FOR PRE-MIXED JET-A WITH FSII ONLY)			

REMARKS:

CONDITION CODES: S = SATISFACTORY; C = COMMENT (REQUIRED IN REMARKS SECTION); N/U = NOT USED; N/A = NOT APPLICABLE

RETAIN ON FILE FOR 12 MONTHS

ATA FORM 103.01A
01/2023

Appendix 3 Sample Form 103.01B Fuel Facility Checks – Daily Sump Results

FUEL FACILITY CHECKS - DAILY SUMPS	STATION:	FACILITY:	MONTH:	YEAR:

STORAGE TANK SUMP (RECORD RATING OF FIRST SAMPLE TAKEN, AFTER LINE DISPLACEMENT)

RECORD SUMP SAMPLE RATING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

FILTER SUMP (RECORD RATING OF FIRST SAMPLE TAKEN, AFTER LINE DISPLACEMENT)

RECORD SUMP SAMPLE RATING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

PRODUCT RECLAIM TANK SUMP (RECORD RATING OF FIRST SAMPLE TAKEN, AFTER LINE DISPLACEMENT)

RECORD SUMP SAMPLE RATING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

RELAXATION CHAMBERS (RECORD RATING OF FIRST SAMPLE TAKEN, AFTER LINE DISPLACEMENT)

RECORD SUMP SAMPLE RATING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

BULK AIR ELIMINATORS (RECORD RATING OF FIRST SAMPLE TAKEN, AFTER LINE DISPLACEMENT)

RECORD SUMP SAMPLE RATING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
IDENTIFICATION OF PERSON PERFORMING TASKS OR PERSON ACCEPTING RESPONSIBILITY THAT TASKS WERE PERFORMED																															

RATING OF SUMP SAMPLES:

SOLIDS: 1 = CLEAN, 2 = SLIGHT, 3 = PARTICULATE, 4 = DIRTY

WATER: A = BRIGHT, B = HAZY, C = CLOUDY, D = WET (FREE WATER), E = SURFACTANTS

RETAIN ON FILE FOR 12 MONTHS

ATA FORM 103.01B

01/2023

Appendix 4 Sample Form 103.01C Fuel Facility Checks – Weekly

FUEL FACILITY CHECKS - WEEKLY	STATION:	FACILITY:	WEEK BEGINNING:

BONDING CABLE / SYSTEM CONTINUITY CHECKS *(including during unreeling through one full revolution)*

REEL ID	OHMS	DATE	SIGNATURE

CORRECTED DIFFERENTIAL PRESSURE (EACH FILTER) **METHOD USED:**_____

FILTER NUMBER	OBSERVED DP	ACTUAL FLOW RATE	CORRECTED DP	DATE	SIGNATURE

REMARKS:

ATA FORM 103.01C

RETAIN ON FILE FOR 12 MONTHS **01/2023**

Appendix 5 Sample Form 103.01D Fuel Facility Checks – Quarterly and Semi-

FUEL FACILTY CHECKS			STATION:		FACILITY:		QUARTER:		YEAR:	
QUARTERLY	ID#	ID#	ID#	ID#	ID#	ID#	ID#	ID#	ID#	ID#
1. EMERGENCY FUEL SHUTOFF SYSTEM										
DATE & CONDITION CODE:										
CHECKED BY:										
2. WATER DEFENSE SYSTEM - EXTERNAL										
DATE & CONDITION CODE:										
CHECKED BY:										
3. TANK HIGH LEVEL CONTROLS										
DATE & CONDITION CODE										
CHECKED BY:										
4. PRODUCT RECLAMATION TANKS	*RECORD RESULTS ON FORM 103.07B*									
5. SUMP SEPARATORS	*RECORD RESULTS ON FORM 103.07C*									

SEMI-ANNUAL										
1. HOSE PRESSURE TEST - *(ONLY REQUIRED IF USING REUSABLE COUPLINGS ON FUEL HOSES)*	ID#	ID#	ID#	ID#	ID#	ID#	ID#	ID#	ID#	ID#
TEST PRESSURE (PSI)										
DATE & CONDITION CODE:										
CHECKED BY:										
2. STATIC STOCK QUALITY CHECK	ID#	ID#	ID#	ID#						
DATE										
ASTM D1655 ACCOMPLISHED										
CHECKED BY:										

REMARKS:

CONDITION CODES: S = SATISFACTORY; C = COMMENT (COMMENT REQUIRED IN REMARKS SECTION); N/U = NOT USED; N/A = NOT APPLICABLE **ATA FORM 103.01D**

RETAIN ON FILE FOR 12 MONTHS **01/2023**

Appendix 6 Sample Form 103.01E Fuel Facility Checks – Annual

FUEL FACILITY CHECKS - ANNUAL	STATION:	FACILITY:	YEAR:

ANNUAL	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #	ID #
1. STORAGE TANK INTERIORS	*RECORD RESULTS ON FORM 103.07A*									
2. DIFFERENTIAL PRESSURE GAUGES										
DATE & CONDITION CODE										
CHECKED BY:										
3. FILTER ELEMENT VISUAL INSPECTION	*RECORD RESULTS ON FORM 103.09A*									
3a. FILTER ELEMENT CHANGE	*RECORD RESULTS ON FORM 103.09B*									
4. FILTER/SEPARATOR HEATERS										
DATE & CONDITION CODE										
CHECKED BY:										
5. TANK VENTS										
DATE & CONDITION CODE										
CHECKED BY:										
6. CATHODIC PROTECTION										
DATE & CONDITION CODE										
CHECKED BY:										
7. LINE STRAINERS										
DATE & CONDITION CODE										
CHECKED BY:										
8. WATER DEFENSE SYTEM										
DATE & CONDITION CODE										
CHECKED BY:										
9. SINGLE STAGE COALESCERS (HAYPACKS)										
DATE & CONDITION CODE										
CHECKED BY:										
10. FILTER VESSEL PRESSURE RELIEF DEVICES										
DATE & CONDITION CODE										
CHECKED BY:										

REMARKS:

CONDITION CODES: S = SATISFACTORY; C = COMMENT (COMMENT REQUIRED IN REMARKS SECTION); N/U = NOT USED; N/A = NOT APPLICABLE

ATA FORM 103.01E

RETAIN ON FILE FOR 12 MONTHS

01/2023

Appendix 7 Sample Form 103.02 Record of Fuel Receipt by Transport Truck

RECORD OF FUEL RECEIPT BY TRANSPORT TRUCK

STATION:	DATE:	RECEIPT NO:

REQUIRED CHECKS	1	2	3	4	5
PRIOR TO RECEIPT:					
DESIGNATE & SUMP RECEIVING TANK					
GAUGE TANK & RECORD VOLUME					
SET VALVES FOR RECEIVING					
CONDITION OF OFF LOAD HOSE					
COA PRESENT & MATCHES ISSUING TANK					
BILL OF LADING/DELIVERY TICKET/NO.					
CORRECT DESTINATION					
CORRECT GRADE OF FUEL					
CORRECT VOLUME					
TRANSPORT TRUCK					
CONNECT GROUND CABLE					
COMPARTMENT SEALS					
CLEAR & BRIGHT TEST					
OBSERVED API GRAVITY					
API GRAVITY, CORRECTED TO 60 °F					
OBSERVED FUEL TEMPERATURE, °F					
FSII CONCENTRATION (FOR PREMIXED JET-A WITH FSII ONLY)					
DURING RECEIPT					
DIFFERENTIAL PRESS. REC. FILTER (PSI)					
CHECK SYSTEM FOR LEAKS					
AFTER RECEIPT					
RE-POSITION VALVES					
DISCONNECT AND STOW HOSE					
DISCONNECT GROUND CABLE					
GAUGE TANK & RECORD VOLUME					
WHITE BUCKET CHECK-TANK SUMPS					
WHITE BUCKET CHECK - FILTER SUMPS					
SIGNATURE OF PERSON PERFORMING CHECKS					

REMARKS:

S = SATISFACTORY C = COMMENT (COMMENT REQUIRED IN REMARKS SECTION)
RATING OF SUMP SAMPLES
SOLIDS: 1 = CLEAN, 2 = SLIGHT, 3 = PARTICULATE, 4 = DIRTY
WATER: A = BRIGHT, B = HAZY, C = CLOUDY, D = WET (FREE WATER), E = SURFACTANTS **ATA FORM 103.02**

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Appendix 8 Aircraft Fueling Equipment Checks – Written Instructions

Daily Checks

General

The following periodic checks shall be performed by qualified individuals, at the specified frequencies, on all aircraft fueling equipment, including fueling cabinets. Additional or more frequent checks may be required due to local conditions.

Maintenance requirements specified in this section are generally limited to those items required for maintaining fuel quality and safety. Additional programs should be established to ensure mechanical reliability of all equipment servicing aircraft.

Daily checks shall occur once each calendar day. Tanker truck tank sumping shall be performed prior to or during the first aircraft servicing of the day.

Any fueling equipment not in daily use shall have all daily, weekly, monthly, quarterly, semi-annual, and annual checks current and recorded before the equipment is placed in service.

Aircraft Fueling Equipment Check Records

Aircraft fueling equipment checks shall be recorded in accordance with [Section 2.1.2].

Daily Checks

All operators (storage tank and into-plane) are required to immediately report any observed deficiencies to the responsible party. For example: water in hydrant pits, missing dust caps, blocked EFSOs, damaged hydrant pit covers, fuel leaks, etc.

General Condition

- Check general condition, ignition sources, safety hazards, security, fuel leaks, general appearance.
- Take appropriate corrective action for noted defects.
- Units with fuel leaks shall not to be used to service aircraft.

Filter Sumps

- Filter vessel shall be under pressure, but fuel does not have to be flowing through the vessel when the sample is taken.
- Drain approximately one gallon of fuel into a suitable container. Fuel flowing from sump drain valve should be at maximum practicable flow to ensure adequate flushing occurs.
- Perform fuel appearance test of filter sumps according to [Section 3.1].
- Record findings of first sample taken according to [Section 3.1].
- Continue to sample until clean, dry fuel is obtained.

Remove unit from service if unable to obtain clean, dry sample after three samples have been drained. Report unusual contamination to aircraft operators if it is anticipated that such contamination may impact aircraft operations.

Filter Differential Pressure

Under normal flow conditions, check and record differential pressure (Ref. [Section 3.9]).

Note: Filter differential pressure shall be periodically monitored during fueling operation. Sudden drops or increases of differential pressure indicates a problem. Fueling shall be immediately terminated and unit removed from service to investigate the problem.

If differential pressure exceeds 15 psi on filter/separators, 15 psi on filter monitors, 15psi on dirt defense filters, or 22 psi on water barrier filters, the equipment shall be removed from service.

- **Deadman Controls**
- Perform a functionality check of the Deadman control system.
- Remove vehicle from service if Deadman control does not function properly.

Safety Interlocks

Verify proper operation of safety interlock system. Defective interlock systems shall be repaired immediately.

- Remove one nozzle from its storage position and attempt to move unit. Unit should not move.

Note: Some refueling trucks may move slightly under heavy engine acceleration due to high gear reduction drive trains. Movement should be minimal and shall stop upon returning engine to idle.

- Repeat task for each additional nozzle, coupler, lift platform and bottom loading interlock, as applicable.
- Defective interlock systems should be repaired immediately.

Nozzle Fueling Pressure

- Check and record nozzle delivery fueling pressure.
- Nozzle pressure must be periodically monitored during fueling operation.
- Nozzle pressure shall not exceed 50 PSIG under conditions of constant flow.
- Immediately remove unit from service if pressure exceeds 50 PSIG.

Hoses, Nozzles and Swivels

- Check condition of all fuel hoses, swivels, nozzles and couplers for damage, leakage, or excessive wear (e.g., cracks that expose the internal reinforcement).
- Ensure dust covers or other protective devices are available, installed, and in good repair.
- Check choses for abrasions, cuts, soft spots, carcass separation, worn covers, blisters, exposed reinforcement, cracks, twists, and sharp bends that give the appearance of pending failure.

- Check tightness and safety wiring of all swivel and collar attachment screws and hose couplings.
- Check condition of nose and poppet seals on nozzle for cuts, nicks, and wear.
- Any item which is defective, or leaking shall be repaired or replaced before being used to service aircraft.

Static Reels, Cables & Clamps.

- Check the condition of static bonding reels, cables, clamps, and connections.
- Any defect that affects continuity shall be corrected prior to use.

Note: Continuity must be checked after maintenance to static bonding systems.

Lift Platforms

- Check the general condition and verify proper operation of lift platforms.
- Check functioning of all platform proximity safety switches (wands).
- Remove unit from service if deficiencies are noted.

Fire Extinguishers.

Verify that fire extinguishers:

- Are in their designated place.
- Are tagged to indicate monthly inspections are current.
- Have unbroken safety seals or tamper indicators.
- Have no obvious physical damage, corrosion or leakage.
- When so equipped, the pressure gauge reading, or indicator is in the operable range or position.

If any fire extinguisher is missing or does not meet the criteria listed above, it shall be repaired or removed from service and replaced with a serviceable extinguisher of the same or greater capacity.

Surge/Relief Tanks

Check atmospheric surge tanks and thermal relief tanks. Drain water and sediment from tank as needed. Any tank or vessel that has the ability to be recycled and/or reintroduced into the fueling system shall be secured and designed to prevent the ingress of contaminants.

Note: Waste tanks (if installed) shall be placarded as such and are not available for product recovery/recycle.

Air Tanks

Drain all moisture from air tanks to prevent damage to air system components and freezing during cold weather.

Refueling Truck Troughs

- Check truck troughs for water.
- If standing water is present, clean troughs and drains.

Caution: If standing water is found in truck troughs, extra care must be used in inspecting tank compartments and filter drains for water.

Refueling Truck Sumps

- Drain minimum of one gallon of fuel at high flow rate into a suitable container.
- Perform fuel appearance test on a fuel sample from each tank compartment or sump drain (Ref. [Section 3.1]).
- Record findings from each tank compartment or sump drain of the of first sample taken according to [Section 3.1].
- Continue to sample until clean, dry fuel is obtained.
- Additional checks are required during and immediately after inclement weather.
- Remove unit from service if unable to obtain clean, dry fuel after three samples have been drained. Report unusual contamination to aircraft operators if it is anticipated that such contamination may impact aircraft operations.

Refueling Truck Bottom Loading Pre-check

- Verify proper operation of high-level shutoff systems on refueling trucks, which are bottom loaded by operating pre-check controls during filling.
- Trucks should not be bottom loaded with an inoperative high-level shutoff system unless alternate procedures are followed.

Weekly Checks

Static System Continuity Test

- Perform electrical continuity check of static bonding system, also during unreeling through at least one full revolution.
- Resistance shall be 25 ohms or less, and record on the appropriate form.
- Defective equipment shall be repaired prior to servicing aircraft.

Filter Differential Pressure Recorded at, or Corrected to, Maximum Achievable Flow Rate

At the maximum achievable flow rate, check and record the differential pressure and flow rate. Preferably, flow rate should be above 50% of maximum vessel rated flow. Where the filter cannot be exposed to the maximum achievable flow rate of the equipment, use a procedure endorsed by the manufacturer of the filter elements to correct the differential pressure to maximum achievable flow rate and record the value. Record method used.

Monthly Mobile Unit Checks

Filtration Test and Free Water Test

Perform a membrane color/particle (Millipore) test, under flow, downstream of each filter/separator, filter monitor, dirt defense filter, and water barrier filter vessel.

Perform a free water test downstream of each filter/separator and monitor vessel.

Note: Use of bottom loading connections on tank trucks for recirculation should be avoided in order to prevent erroneous test results.

Nozzle Screens

- Examine each nozzle screen for particles or other solid contaminants. If particles are found, investigate possible sources of contamination (inner hose lining, pipe rust, sand, seals, gaskets, equipment failure, etc.) and take appropriate corrective action.
- Clean screens as necessary
- For nozzle screens on refueling equipment fitted with filter monitors one of the following shall be performed even when there is no visual evidence of nozzle screen contamination:
- Nozzle screen shall be cleaned using the procedures outlined in [Section 3.17] or equivalent procedure, or
- The nozzle screen shall be replaced with a screen that has been cleaned using the [Section 3.17] or equivalent procedure, or
- The nozzle screen shall be replaced with a new screen.
- Verify screens are sized 100 mesh.
- Damaged screens are to be replaced.

Fuel Hoses

- Lay hoses out full-length with system at full operating pressure and check hoses for abrasions, cuts, soft spots, carcass separation, worn covers, blisters, exposed reinforcement, cracks, twists, and sharp bends that give the appearance of pending failure.
- Check couplings at both ends for cracks and signs of slippage or leakage.
- Replace any defective hoses prior to further servicing of aircraft.

Signs, Labels and Placards

- Verify that unit is clearly marked with applicable signs, placards, and labels (Ref [Section 2.8.15]). .

Section 2.8.15 Signs Placards & Labels

- *Product identification on each side and rear*
- *FLAMMABLE on all sides*
- *NO SMOKING on all sides*
- *NO SMOKING posted prominently in cab of vehicles.*

- *EMERGENCY FUEL SHUTOFF placard adjacent to each emergency fuel shutoff control. Placards shall also indicate operation (e.g., Push, Pull, Turn, etc.).*
- *Fire extinguishers located in enclosed compartments shall have their location clearly marked.*
- *Aircraft fueling pressure and filter differential pressure gauges shall be identified.*
- *Filter and tank drain valves shall be identified.*
- *A placard or stencil indicating the last date (month and year) during which the filter elements/monitors were last changed shall be placed on the filter housing.*
- *A placard or stencil indicating the date (month and year) during which the filter elements/vessel were last inspected shall be placed on the filter housing.*
- *A date place in accordance with [EI 1596].*
- *A sign or placard indicating proper procedure for engaging the pumping system should be prominently displayed adjacent to pump controls.*
- *A sign or placard indicating normal and override positions on the interlock device.*
- *A sign or placard indicating upstream/downstream membrane connection sampling ports.*
- *A sign or placard indicating aviation fuel additive reservoirs (e.g., "FSII ONLY").*

Meter Seals

- Verify that meter calibrators/adjusters are sealed.
- Meters with missing seals may only be used with airline permission and must be calibrated.

Fire Extinguishers

Fire extinguishers shall be maintained in accordance with the applicable [NFPA 10] guidelines.

- Verify that fire extinguisher is located in designated place with no obstruction to access or visibility.
- Verify pressure gauge reading or indicator in the operable rage or position.
- Check condition of tire(s), wheel(s), carriage, hose, and nozzle, if applicable. Examine for obvious physical damage, corrosion, or leakage.
- Verify operating instructions and extinguisher type on nameplates are legible.
- Check for broken or missing safety seals and tamper indicators. Examine for obvious physical damage, corrosion, leakage, or clogged nozzle.
- Verify each fire extinguisher has a tag or label securely attached which indicates that annual maintenance was performed and is current.
- Upon completion of the inspection, update the monthly inspection tag.

If any fire extinguisher does not meet the criteria listed above, it shall be repaired by trained/qualified individual or removed from service and replaced with a serviceable extinguisher of the same or greater capacity. Fire extinguishers that are not serviceable shall be identified as "Out of Service".

Emergency Fuel Shutoff System

- Verify that each emergency fuel shutoff control device will completely stop fuel flow before overrun has exceeded the requirements in [Section 2.8.5]. Record findings on the appropriate form.
- Equipment with a defective emergency fuel shutoff system shall be removed from service until the system has been repaired.

Section 2.8.5 Emergency Fuel Shutoff System

Refueling equipment shall be equipped with an emergency fuel shutoff system in addition to a deadman control. Emergency fuel shutoff system shall meet the requirements of [NFPA 407].

Each emergency fuel shutoff control shall completely stop fuel flow within a maximum 5% overrun, but at flow rates below 50% of rated flow, a shutdown in 10% of the fuel flow rate is allowed.

***Example**: If actual flow rate at the time of emergency fuel shutoff activation is 500 GPM, total overrun must not exceed 25 gallons.*

Deadman Control System

- Verify that the Deadman control system will completely stop fuel flow before overrun has exceeded the requirements in [Section 2.8.4]. Record findings on the appropriate form.
- Equipment with a defective Deadman control system shall be removed from service until the system has been repaired.

Section 2.8.4 Deadman Control System

All aircraft fueling equipment shall have a handheld Deadman control device. The Deadman control system shall completely stop fuel flow within 5% of the fuel flow rate at the time of release. This test should be run at flow rates from 100% of rated flow down to 10% of rated flow, but at flow rates below 50% of rated flow, a shutdown in 10% of the fuel flow rate is allowed.

***Example:** If actual fuel flow rate at the time of Deadman control release is 500 GPM, total overrun must not exceed 25 gallons (represents 5% of the actual flow rate)*

Lift Platforms

- Verify the safe and dependable operation of all lift platforms.
- Thoroughly inspect the lift, including lift mechanisms/components and emergency let-down mechanisms, lift interlocks, hydraulic lines, couplings, lighting, wiring, handrails, steps, working surface, and signage.
- Any deficiencies shall be repaired prior to returning unit to service.

Refueling Truck Tank Interiors

- Visually inspect tank interior from dome cover openings for water, debris, surfactants, microbial growth, and other contamination.
- Check epoxy coated tanks for coating deterioration.
- Clean and repair as necessary.
- Record results on the appropriate form.

Refueling Truck Vents and Dome Covers

- Check tank dome covers, including latches, hinges, seals, and gaskets.
- Verify that hinges are forward mounted and will close with forward motion of the vehicle.
- Verify proper operation of tank vents.
- Correct any deficiencies as necessary.

Refueling Truck Trough Drains

- Manually check trough drains for plugging. Use cable or wire to ensure there are no obstructions present.
- More frequent checks may be required during inclement weather.

Dirt Defense and Electronic Water Sensor System

Check operation of system and proper signal management. Use the tool approved by the manufacturer to simulate, under flow, sensor failure modes. Each of the programmed logic conditions shall be simulated. Confirm that the indicator lamp flashes at the correct frequency, and that the vehicle's Deadman system shuts down, as appropriate.

Quarterly Checks

Vehicle Inspection

Perform a thorough overall inspection of the unit to identify components with excessive wear and pending equipment failure.

Pressure Controls

Operator must have written test procedures specific to the vehicle pressure control systems and test facilities at that location.

- Check all primary and secondary pressure control equipment. Adjust as necessary. Record primary and secondary fuel pressure settings.
- Regardless of type, the primary pressure control system shall be defeated to properly test the setting of the secondary control system.

Caution: NEVER ADJUST PRESSURE CONTROL EQUIPMENT WHILE FUELING AN AIRCRAFT.

Note: All testing of pressure control equipment should be conducted at a test facility or through test connections on tank trucks.

When performing this test, it is required that a calibrated gauge is utilized to directly measure the pressure in the nozzle or the fixture to which the nozzle is connected. The test shall have the operator restrict flow by partly closing a valve downstream until the pressure in the nozzle is at its maximum both with the primary pressure control enabled and disabled.

Water Defense System Check - External Check

- Check operation of water defense system in accordance with quarterly requirements of [Section 3.12].

Internal Valve Check

Ensure that the internal valve functions properly by engaging the high-level shutoff pre-check valve while monitoring the meter. Listen for the valve to close and ensure the meter completely stops. Note: on some vehicles, the pre-check function is disabled during recirculation when the vehicle is completely full. Check with the truck manufacturer for details of the specific system.

Interlock Override Function Check

Verify the proper operation of the interlock override control by having at least one interlock device activated, ensuring vehicle does not move until activating interlock override.

Upon satisfactory verification of the operation of the override control, seal the control back in the normal position using breakaway wire or breakaway plastic seal.

Surge Absorbers

- Where installed, check the general condition and operating pressure setting of each unit.
- Recharge as required.

Differential Pressure Limiting Devices

Verify the proper operation of differential pressure limiting devices and record results on the appropriate form.

Semi-Annual Checks

Hose Pressure Check

Refueling hoses fitted with reusable couplings, and being operated under system pressure, must undergo the six-month pressure testing at 225 PSI, per the requirements found in [EI 1540].

Note: Pressure testing to 300 PSI is required whenever a new hose attachment or coupling is fitted.

Caution: Recoupling and pressure testing of hoses and fittings should only be carried out by persons adequately trained in their proper fittings and testing, using procedures that have been approved by the OEM.

Annual Mobile Unit Checks

Filter Vessels and Elements

- A visual inspection of all vessel interiors is to be performed on an annual basis regardless of filter element replacement frequency (Ref. [Section 3.13]).

    - Verify that the vessel interior is generally clean and free of water, sediment, evidence of microbial growth or other contamination. Clean interior and repair coating as necessary.
    - Verify that all elements are undamaged and secure.
- Verify filter element condition by utilizing procedures outlined in [Section 3.14]:
- Filter coalescer elements service life shall not exceed 36 months.
- Teflon and synthetic separator elements may be reused up to 36 months, if they are cleaned and tested in accordance with the element manufacturer procedures.
- Filter monitor elements service life shall not exceed 12 months.
- Dirt defense elements service life shall not exceed 36 months.
- Water barrier element service life shall not exceed 12 months.
- **Fueling Pressure and Differential Pressure Gauges**
- Verify that accuracy of fueling pressure (or nozzle pressure) gauges used to monitor fuel delivery to aircraft is within +/- 2 percent of full scale.
- Verify proper operation of filter differential gauge(s) in accordance with gauge manufacturers' procedures. Repair or replace as required (Ref. [Section 3.9]).
- Replace, or repair and calibrate defective gauges.
- Replace differential pressure gauge internal filter, where applicable.

Electronic differential pressure devices shall be calibrated/checked at the frequency specified by the manufacturer.

Meter Calibration

- Verify all aircraft fueling equipment meters in accordance with [Section 2.1.12.1].
- Meter adjusters/calibrators are to be sealed upon completion of calibration.

Note: [HM 20] provides guidance on providing positive displacement meters.

- **Water Defense System Inspection and Test**

Check operation of water defense system in accordance with annual requirements of [Section 3.12].

- **Single Stage Coalescers (Haypacks)**

All single stage coalescers shall be opened annually to visually check condition of interior for cleanliness, and integrity of elements.

Filter Vessel Pressure Relief Devices

Perform a visual inspection of filter vessel pressure relief devices. Devices shall not be painted over, and data plate shall be visible. Integrity of tamper proof seals, where fitted, shall be verified.

Appendix 9 Sample Form 103.04A Aircraft Fueling Equipment Checks – Daily

AIRCRAFT FUELING EQUIPMENT CHECKS	STATION:	EQUIPMENT ID#	MONTH:	YEAR:

DAILY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1. GENERAL CONDITION																															
2. FILTER SUMPS - RECORD RATINGS																															
3. FILTER DIFFERENTIAL PRESSURE (RECORD PSI)*																															
4. DEADMAN CONTROLS																															
5. SAFETY INTERLOCKS																															
6. NOZZLE FUELING PRESSURE (RECORD PSI)																															
7. HOSES, NOZZLES & SWIVELS																															
8. STATIC REELS, CABLES & CLAMPS																															
9. LIFT PLATFORMS																															
10. FIRE EXTINGUISHERS																															
11. SURGE/RELIEF TANKS																															
12. AIR TANKS																															
13. REFUELING TRUCK TROUGHS																															
14. REFUELING TRUCK SUMPS																															
14a. ADDITIONAL TANK COMPARTMENT/SUMP DRAIN																															
14b. ADDITIONAL TANK COMPARTMENT/SUMP DRAIN																															
14c. ADDITIONAL TANK COMPARTMENT/SUMP DRAIN																															
15. REFUELING BOTTOM LOADING PRE-CHECK																															
IDENTIFICATION OF PERSON PERFORMING TASKS OR PERSON ACCEPTING RESPONSIBILITY THAT TASKS WERE PERFORMED																															

*Note: Use this form or form 103.06 to record daily differential pressure

REMARKS:

CONDITION CODES: S = SATISFACTORY; C = COMMENT (COMMENT REQUIRED IN REMARKS SECTION); N/U = NOT USED; N/A = NOT APPLICABLE

RATING OF SUMP SAMPLES: SOLIDS: 1 = CLEAN, 2 = SLIGHT, 3 = PARTICULATE, 4 = DIRTY

WATER: A = BRIGHT, B = HAZY, C = CLOUDY, D = WET (FREE WATER), E = SURFACTANTS

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Appendix 10 Sample Form 103.04B Aircraft Fueling Equipment Checks – Weekly

AIRCRAFT FUELING EQUIPMENT CHECKS	STATION:	EQUIPMENT ID#	MONTH:	YEAR:

WEEKLY					
1. STATIC SYSTEM CONTINUITY TEST	DATE:	DATE:	DATE:	DATE:	DATE:
REEL ID:	OHMS:	OHMS:	OHMS:	OHMS:	OHMS:
REEL ID:	OHMS:	OHMS:	OHMS:	OHMS:	OHMS:
IDENTIFICATION OF PERSON PERFORMING TASKS					
2. CORRECTED FILTER DIFFERENTIAL PRESSURE	DATE:	DATE:	DATE:	DATE:	DATE:
OBSERVED DP:					
ACTUAL FLOW RATE:					
CORRECTED DP:					
RECORD METHOD USED:					
IDENTIFICATION OF PERSON PERFORMING TASKS					

REMARKS:

ATA FORM 103.04B
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Appendix 11 Sample Form 103.04C Aircraft Fueling Equipment Checks – Monthly

AIRCRAFT FUELING EQUIPMENT CHECKS	STATION:	EQUIPMENT ID:	MONTH:	YEAR:
MONTHLY	CONDITION CODE	DATE	CHECKED BY	
1. FILTRATION MEMBRANE TEST (MILLIPORE)				
2. FREE WATER TEST				
3. DIRT DEFENSE AND ELECTRONIC WATER SENSOR SYSTEM				
4. NOZZLE SCREEN VISUAL INSPECTION/CLEAN				
5. FUEL HOSES				
6. SIGNS, LABELS & PLACARDS				
7. METER SEALS				
8. FIRE EXTINGUISHERS				
9. EMERGENCY FUEL SHUTOFF SYSTEM (EACH EFSO)				
FLOW RATE:				
RECORD OVERRUN (GALLONS)*:				
FLOW RATE:				
RECORD OVERRUN (GALLONS)*:				
FLOW RATE:				
RECORD OVERRUN (GALLONS)*:				
10. DEADMAN CONTROL SYSTEM				
FLOW RATE:				
RECORD OVERRUN*:				
NOTE - VERIFY EACH DEVICE WILL COMPLETELY STOP FUEL FLOW BEFORE OVERRUN HAS EXCEEDED 5% OF ACTUAL FLOW RATE				
10. LIFT PLATFORMS				
11. REFUELING TRUCK TANK INTERIORS	*USE FORM 103.07D*			
12. REFUELING TRUCK VENTS & DOME COVERS				
13. REFUELING TRUCK TROUGH DRAINS				

REMARKS:

CONDITION CODES: S = SATISFACTORY; C = COMMENT (COMMENT REQUIRED IN REMARKS SECTION); N/U = NOT USED; N/A = NOT APPLICABLE

ATA FORM 103.04C

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Appendix 12 Sample Form 103.04D Aircraft Equipment Checks – Quarterly, Semi-Annual, and Annual

AIRCRAFT FUELING EQUIPMENT CHECKS		STATION:	EQUIPMENT ID:	YEAR:

QUARTERLY	1ST QTR	2ND QTR	3RD QTR	4TH QTR
1. VEHICLE INSPECTION CONDITION CODE				
CHECKED BY & DATE:				
2. PRESSURE CONTROLS CONDITION CODE				
PRIMARY FUEL PRESSURE SETTING (PSI)				
SECONDARY FUEL PRESSURE SETTING (PSI)				
CHECKED BY & DATE:				
3. WATER DEFENSE SYSTEM - EXTERNAL CHECK CONDITION CODE				
CHECKED BY & DATE:				
4. INTERNAL VALVE CHECK CONDITION CODE				
CHECKED BY & DATE:				
5. INTERLOCK OVERRIDE FUNCTION CHECK CONDITION CODE				
CHECKED BY & DATE:				
6. SURGE ABSORBERS CONDITION CODE				
CHECKED BY & DATE:				
7. DIFFERENTIAL PRESSURE LIMITING DEVICE CONDITION CODE				
CHECKED BY & DATE:				

SEMI-ANNUAL *(ONLY REQUIRED IF USING REUSEABLE COUPLINGS ON FUEL HOSES)*				
1. PERIODIC HOSE PRESSURE TEST	ID #	ID #	ID #	ID #
TEST PRESSURE (PSI)				
CONDITION CODE				
CHECKED BY & DATE:				

ANNUAL			
1a. FILTER WATER SEPARATOR ANNUAL INSPECTION/CLEANING	*Use form 103.09A*	3. DIFFERFENTIAL PRESSURE GAUGE CONDITION CODE	
Use form 103.09A (req. every 12 months)		CHECKED BY & DATE:	
1b. FILTER MONITOR ANNUAL ELEMENT CHANGE	*Use form 103.09B*	4. METER CALIBRATION CONDITION CODE	
Use form 103.09B (req. every 12 months or when DP is 15psi)		CHECKED BY & DATE:	
1c. WATER BARRIER ANNUAL ELEMENT CHANGE	*Use form 103.09B*	5. WATER DEFENSE SYSTEM INSPECTION & TEST CONDITION CODE	
Use form 103.09B (req. every 12 months or when DP is 22psi)		CHECKED BY & DATE:	
1d. FILTER WATER SEPARATOR/DIRT DEFENSE ELEMENT CHANGE	*Use form 103.09B*	6. HYDRANT PIT COUPLERS CONDITION CODE	
Use form 103.09B (req. every 36 months or when DP is 15psi)		CHECKED BY & DATE:	
1e. DIRT DEFENSE FILTER ANNUAL INSPECTION/CLEANING	*Use form 103.09C*	7. FILTER VESSEL PRESSURE RELIEF DEVICES CONDITION CODE	
Use form 103.09C (req. every 12 months)		CHECKED BY & DATE:	
2. FUELING PRESSURE GAUGES CONDITION CODE		8. EI 1598 TYPE ELECTRONIC WATER SENSOR CONDITION CODE	
CHECKED BY & DATE:		CHECKED BY & DATE:	

REMARKS:

CONDITION CODES: S = SATISFACTORY; C = COMMENT (COMMENT REQUIRED IN REMARKS SECTION); N/U = NOT USED; N/A = NOT APPLICABLE

ATA FORM 103.04D

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Appendix 13 Sample Form 103.06 Filter Vessel Record – Daily

FILTER VESSEL RECORD - DAILY

STATION: _____ MONTH _____ YEAR _____

VESSEL MFG. _____ DATE LAST ELEMENT CHANGE _____

MODEL NO. _____ DATE LAST INTERIOR INSP. _____

FIXED UNIT NO. _____ P/N ELEMENTS INSTALLED _____

MOBILE UNIT NO. _____ TYPE OF ELEMENTS (CIRCLE ONE): COALESCER (15 PSI MAX) / MONITOR (15 PSI MAX) / DIRT DEFENSE (15 PSI MAX) / WATER BARRIER (22 PSI MAX)

RATED FLOW (GPM) _____ DATE WATER DEFENSE CHECK _____

DIFFERENTIAL PRESSURE RECORD

	DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	N/U	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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	5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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SIGNATURE																																

N/U = NOT USED

RETAIN ON FILE FOR 12 MONTHS

ATA FORM 103.06
01/2023

Appendix 14 Sample Form 103.07A Tank Inspection and Cleaning Record Storage

TANK INSPECTION AND CLEANING RECORD
STORAGE TANKS

THIS FORM IS TO BE USED FOR RECORDING THE ANNUAL VISUAL INSPECTION AND CLEANING FOR STORAGE TANKS

Station:_____ Facility:_____ Tank Number: _____

	SEDIMENT AND RUST						MICROBIAL			COATING		ACTION TAKEN			
	PLACE AN "X" IN ALL BOXES APPLICABLE TO THE TANK CONDITION						PLACE AN "X" INDICATING IF MICROBIAL GROWTH IS OBSERVED. IF TESTING WAS CONDUCTED AS PART OF AN INVESTIGATION, INDICATE TEST KIT AND KIT RESULTS			INSPECT INTERNAL COATING FOR EVIDENCE OF CHIPPING, FLAKING, OR OTHER DETERIORATION. PLACE AN "X" IN APPLICABLE BOX		PLACE AN "X" TO INDICATE TANK CLEANING AND/OR COATING REPAIR ACTION AS APPROPRIATE			
	Sediment			Rust			Microbial Growth			Internal Tank Coating					
DATE INSPECTED	CLEAN	LESS THAN 1/10 AREA OF TANK BOTTOM	GREATER THAN 1/10 AREA OF TANK BOTTOM	CLEAN	LESS THAN 1/10 AREA OF TANK BOTTOM	GREATER THAN 1/10 AREA OF TANK BOTTOM	MICROBIAL GROWTH OBSERVED	MICROBIAL KIT PERFORMED	MICROBIAL KIT RESULTS	COATING IN GOOD CONDITION	COATING REQUIRES REPAIRS	CLEANED	NOT CLEANED	COATING REPAIRED	SIGNATURE OF PERSON PERFORMING TASKS

REMARKS:

RETAIN ON FILE INDEFINITELY

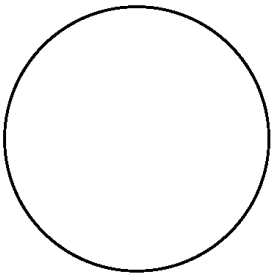
ATA FORM 103.07A
01/2023

Appendix 15 Sample Form 103.08 Fuel Quality Test Record

FUEL QUALITY TEST RECORD

AGENCY: _____ DATE: _____

AIRPORT: _____ FACILITY: _____

SAMPLING PORT	FILTRATION MEMBRANE TEST (MILLIPORE) ASTM D2276	WATER TEST
AFTER FILTRATION ( ) PARTICULATE ( ) CLAY ( ) FILTER/ SEPARATOR ( ) FILTER MONITOR ( ) DIRT DEFENSE ( ) WATER BARRIER DIFFERENTIAL PRESSURE: _____ psi UNIT NO. _____	 ATTACH MEMBRANE	(30 ppm allowable) PPM = _____

DRY RATING:
SAMPLE SIZE (GAL):
NOTE: ONE GALLON FLUSH - ONE GALLON SAMPLE

_____

SIGNATURE OF PERSON PERFORMING TASK

REMARKS:

RETAIN ON FILE FOR 12 MONTHS

ATA FORM 103.08

01/2023

Appendix 16 Sources of Ignition

Properties of Fuels

How a fuel ignites depends on its physical properties. The properties of aviation and turbine fuels that relate to ease of ignition are flash point, flammability limits, vapor pressure, auto ignition temperature, distillation range, and electrostatic susceptibility. These properties are charted in the table below.

Property	**Gasoline**	**Kerosene Grades**		**Blends of gasoline and kerosene**
	AVGAS	JET A, JP-5, JP-6	JET A-1, JP-8	JET B, JP-4
Flash Point (By Closed-Cup Method at Sea Level)	-50°F	+95° to +145°F		-10° to +30°F
Flash Point (By Air Saturation Method)	-75° to -85°F	None		-60°F
<u>Flammability Limits</u> Lower Limit Upper Limit Temp Range for Flam Mixtures	 1.4% 7.6% -50°F to +30°F	 0.6% 4.9% +95° to +165°F		 0.8% 5.6% -10° to +100°F
Vapor Pressure ASTM D 323	5.5 to 7.0 lb/sq in	0.1 lb/sq in		2.0 to 3.0 lb/sq in
Auto Ignition Temperature	+825° to +960°F	+440° to +475°F		+470° to 480°F
Freeze Point	-76°F	-40°F	-58°F	-60°F
<u>Boiling Points</u> Initial End	 110°F 325°F	 325°F 450°F		 135°F 485°F
Pool Rate of Flame Spread*	700 to 800 ft per min	100 ft per min or less		700 to 800 ft per min
* In mist form, rate of flame spread in all fuels is very rapid.				

Static Electricity

Nature of Static Electricity

Static electricity is formed when two unlike materials touch or rub; electrons are exchanged or redistributed between the two materials at the point or surface where they touch. This exchange of electrons causes unlike, but equal, charges on the two materials, and these charges attract each other as they seek electrical balance. It takes energy to separate the two surfaces because the force of electrical attraction is opposed. Since energy is never lost, the energy used to separate the attracting surfaces reappears as an increase in the electrical tension or voltage between the two surfaces. If a surface that has such a charge is a conductor and if there is a conductive pathway through which the charge can move, the charge will follow the path and leak away as it tries to find an unlike charge to balance it. If the surface that has such a charge is a nonconductor (insulator), the charge is trapped. The same sort of trapping of a charge happens when the charge is on a conductor that touches only nonconductors, because in this situation there is no path through which the charge can leak away. Equal but unlike static charges will stay as close as possible to each other. If the attraction between them is strong enough, the charge from one surface may jump the gap to the other surface in its search for equilibrium. This impulsive discharge of electricity results in a spark, and static sparking is a serious fire danger to refueling operations.

Safety Measures

The charges on different materials can be equalized by connecting them with a conductor (bonding) thus significantly reducing sparking potential from static electricity. AVGAS must not be placed in plastic containers, nor plastic funnels used. The level of static electricity build-up has sufficient potential to be an ignition source when AVGAS is poured from the plastic container. Bonding is also very difficult without the proper equipment.

Bonding

Bonding is the process through which two conductive objects are connected to lessen their potential differences. Bonding does not dissipate the static electricity. It equalizes the charges on two unlike objects (an aircraft and a refueling nozzle) to preclude arcing, in the presence of flammable vapors, as the two objects are joined. A nozzle-to-aircraft bond is required. This bond is made before the nozzle dust cap or gas tank cap is removed so that if there is a spark, it will occur before fuel vapor is present. For the same reason, the nozzle bond must not be disconnected until refueling is completed and the gas tank cap and nozzle dust cap have been replaced. Then if a spark occurs, only small amounts of fuel vapor should be present, probably not enough to support combustion.

Other Sources of Ignition

Engines

Operating aircraft, vehicle, and equipment engines generate heat by burning fuel. They also generate static electricity because of friction between their moving parts.

- Dangers. The engine heat of an idling aircraft turbine engine is in the auto ignition range of JP-4. Poorly maintained vehicle engines and/or exhaust/flame arrestor systems may backfire or discharge sparks.

- Safety Measures. An aircraft must not be refueled until its engines are shut down, except as allowed under closed-circuit refueling described in CHAPTER 4. Restrict vehicle access to the refueling area. Only those vehicles involved in servicing aircraft are allowed to come within 50 feet of the refueling operation. Vehicles used in and around refueling areas must be maintained to a high standard.

Electrical Circuits

When electricity is flowing through a circuit, it can jump a small break or defect in the circuit by arcing. An electrical arc is simply a continuous flow of sparks between two points.

- Dangers. The danger from arcing is the same or greater than from a spark. An arc usually generates more heat than a single spark.
- Safety Measures. Work is not allowed to be done on an aircraft's batteries while the aircraft is being refueled. Batteries should not be changed/ replaced; and battery chargers should not be connected, used, or disconnected during refueling. Aircraft radios may operate to receive messages during refueling, but radio transmission from the aircraft being refueled is not allowed because of the danger of arcing. Flashlights are not to be used within 50 feet of the refueling operation unless they are the approved explosion-proof type. Electrically powered tools are not to be used in the refueling area. The electrical circuits of vehicles used in refueling operations must be maintained in top condition to prevent short circuits around defects.

Radar

The beam of high-frequency radar equipment can ignite a flammable vapor-air mixture. It can ignite the mixture by inducing heat in solid materials in the path of the beam or by intensifying an existing electrical charge or stray current to the point where it will arc or discharge as a spark.

- Dangers. The degree of danger depends on the peak power output of the radar unit. Some types of radar are more dangerous than others as sources of ignition.
- Safety Measures. Safety measures must be taken when using airborne weather-mapping radar, airborne surveillance radar, airfield surface-detection radar, and airfield approach and traffic control radar. They are described below.
- Airborne weather-mapping radar. A weather-mapping radar unit mounted in an aircraft must be shut down before and during refueling of the aircraft.
- Airborne surveillance radar. Airborne surveillance units must be shut down before the aircraft approaches within 300 feet of a refueling or fuel storage area.
- Airfield surface-detection radar. An aircraft must not be fueled, nor aviation fuel stored within 100 feet of the antenna of airfield surface-detection radar.
- Airfield approach and traffic control radar. An aircraft must not be fueled, nor aviation fuel stored within 300 feet of the antenna of airfield approach and traffic control radar.

Open Flames

The danger of any open flame is that it will ignite fuel or a flammable vapor-air mixture. No open flame, open-flame device, or lighted smoking materials are allowed within 50 feet of an

aircraft refueling operation. Personnel who refuel aircraft may not carry lighters or matches on their persons and must not allow anyone else to carry a lighter or matches within 50 feet of an aircraft that is being refueled. Use of exposed-flame heaters, welding or cutting torches, and flare pots within 50 feet of refueling operations is forbidden.

Tools and Equipment

Drills, buffers, grinding machines, and similar tools are likely to throw off sparks when used on metal. Photographic flashbulbs and electronic flash devices may also cause sparks. No metalworking tools are allowed to be used within 50 feet of an aircraft being refueled. Flashbulbs or electronic flash devices are not to be used within 10 feet of refueling equipment or the fill port or fuel tank vents of aircraft.

Sparks from Vehicles

A vehicle may pick up a static charge from two sources. One source is movement (unlike materials rubbing). The other source is the charge that spreads to the vehicle as its fuel or cargo tanks are filled. CHAPTER 6, Bonding, outlines safety measures to be taken.

Sparks from Personnel and Clothing

The human body conducts electricity. In a very dry atmosphere, a person can build and hold a charge of several thousand volts when walking over rugs or working in certain manufacturing operations.

- Formation of Charge. Although a charge of this strength is unusual, the body does build up a charge during normal movement and work. Often the clothes and shoes of workers are moist enough to drain off the static electricity as fast as it is generated. The moisture provides a path for the charge to follow. Outer clothing, especially if they are made of wool or synthetic fiber, build a charge not only by absorbing part of the body charge but also by rubbing against the body and underwear. When the charged clothes are moved away from the body or taken off, the electrical tension or voltage increases to the dangerous point. If the clothes are wet with fuel, the danger is even more serious. Fuel-soaked clothes have been known to burst into flames as they were removed. Sparks can also be generated by worn footwear. Soles so worn that nails are exposed present a danger since fuel spills in refueling areas are common and fuel vapors near the ground ignite easily.
- Safety Measures. Before opening an aircraft, fuel port or doing anything else that would let fuel vapors escape into the air, individuals must bond them-selves to the container by taking hold of it. If it is an aircraft or piece of metal equipment, a bare metal part can be held with both hands for a few seconds. Although this bonding will not completely discharge static electricity, it will equalize the charge on the body with the charge on the piece of equipment. No clothing is to be removed within 50 feet of a refueling operation or in an area where a flammable vapor-air mixture may exist. Individuals must not enter a flammable atmosphere after removing a garment, and least 10 minutes must pass before carrying the garment into such an atmosphere. If fuel gets on clothing, the person(s) must leave the refueling area as soon as refueling is completed and wet the clothes with water before taking them off. If there is not enough water at the site to wet the clothes thoroughly, individuals can ground themselves to a piece of grounded equipment by

taking hold of it before taking off the clothes. A skin irritation from fuel is not fatal; the fire that may follow a static discharge from clothing may be fatal.

Lightning

Lightning is a massive discharge of static electricity. Static charges build up in storm clouds until discharged as lightning.

- Dangers. The lightning stroke itself may present an ignition danger. In addition, lightning may suddenly release a charge trapped on an aircraft that is insulated from the ground. Such a freed charge may produce an arc of sufficient strength to ignite a flammable vapor-air mixture.
- Safety Measures. Stop refueling operations when there is lightning in the immediate area. Operations are not to be continued until the lightning has stopped.

Appendix 17 Fuel Sampling and Testing – Fuel Quality Control Program

General

Fuel Quality Control Program is referenced in the handbook, CHAPTER 21, Quality Control. This Appendix provides procedural guidance in the overall sampling and testing of fuels for effectively managing the Interior Fuel Quality Control Program.

Fuel Sampling and Testing Requirements

Sampling and testing of petroleum products must be accomplished during each phase of fuels transfer. This includes verification of fuel type and quality at the bulk dispensing facility pumping into fuel transport vehicles or trailers and at the fuel storage facility being operated by the bureau. It also includes any fuel source into the fuel vehicle or trailer which shall be conducting the into-aircraft refueling, and finally, fuel quality assurance prior to any into-aircraft fueling operations.

Testing

All petroleum testing shall be accomplished by trained personnel. These individuals may teach operators to perform API gravity, Aqua-Glo, and particulate contaminants by color particle assessment method or gravimetric tests on fuel owned or transferred by DOI bureaus. Office of Aviation Services personnel are available to make liaison visits and to give technical assistance to DOI bureaus they support. Additionally, bureaus shall designate and adequately train personnel to conduct these tests if qualified Office of Aviation Services personnel are unavailable.

Common Contamination Hazards

Quality control and surveillance testing and sampling are used to find common contamination hazards. The hazards which may affect aircraft are sediment, water, microbiological growth, and commingled fuel.

Sediment

Sediment from tanks, pipes, hoses, pumps, people, and the air contaminate fuel. The most common sediment found in aviation fuels are pieces of rust, paint, metal, rubber, dust, and sand. Sediment is classified by particle size.

- Coarse Sediment. Particles classified as course are 10 microns in size or larger (25,400 microns equal 1 inch). Coarse sediment settles out of fuel easily, and it can also be removed by adequate filtering. Particles of coarse sediment clog nozzle screens, other fine screens throughout the aircraft fuel system, and most dangerously, the fuel orifices of aircraft fuel injectors. Particles of this size also get wedged in sliding valve clearances and valve shoulders where they cause excessive wear in the field controls and fuel injection equipment.
- Fine Sediment. Particles classified as fine are smaller than 10 microns in size. Removing fine sediment by settling or filtering is effective only to a limited degree. The particles can be centrifuged out of fuel in a rotating chamber. Fine sediment accumulates in fuel

controls and forms a dark, shellac-like surface on the sliding valves. It can also form a sludge-like material that causes fuel injection equipment to operate sluggishly. Particles of fine sediment are not visible to the naked eye, but they do scatter light. This light-scattering property makes them show up as point flashes of light or as a slight haze in the fuel.

Water

Either fresh or salt water may be in fuel. Water (fresh or salt) may be present as dissolved or free water.

- Free Water. Free Water can be removed from fuel by adequate filtering. It can be seen in the fuel as a cloud; emulsion; droplets; or in large amounts at the bottom of a tank, sample container, or filter/separator. Fresh or salty free water can freeze in the aircraft fuel system, can make certain aircraft instruments malfunction, and can corrode the components of the aircraft fuel system. (Salt water is more corrosive than fresh water.) Ice in an aircraft fuel system can make the engines fail.
- Dissolved Water. Dissolved water is water that has been absorbed by the fuel. It cannot be seen and cannot be separated out of the fuel by filtration or mechanical means. The danger of dissolved water is that it settles out as free water when the fuel is cooled to a temperature lower than that at which the water dissolved. Such a cooling of fuel is likely at high altitudes. Once freed, all the dangers of free water are present.

Microbiological Growth

If there is no water in the fuel, microbes cannot grow. Microbiological growth is brown, black, or gray and looks stringy or fibrous. It causes problems because these organisms hold rust and water in suspension and act as stabilizing agents for water-fuel emulsions. These suspensions cling to glass and metal and can cause false fuel quantity readings. They also make fuel controls operate sluggishly and make fuel flow dividers stick. Microbiological growth in aircraft fuel is a reliable indication that the fuel filters have failed, that the water has not been properly stripped from the fuel, or that the fuel storage tanks need to be cleaned more frequently. Addition of FSII to JP-4 has helped curb microbiological growth. However, it is still necessary to remove all water from aviation fuel and aircraft fuel systems.

Commingled Fuel

Since each aircraft engine is designed to burn one type and grade of fuel, the consequences of using a mixture of different fuels can range from small variations in engine performance to total loss of power and engine failure. The consequences of commingling depend on the physical properties of the fuel.

Filters/Separators and Single Element Monitors with Absorbent Media

Filter/separators help to keep fuel clean and free from water. When fuel is left in the dispensing hose at the end of the day's operation, it should be re-circulated through the filter/separator before operations resume.

Sampling and Testing Frequency

Fuel in a System or Refueler

The fuel in tank or refueler must be sampled and tested before use and again when the filter elements of the filter/separator on the system or refueler are changed. Refuelers should be tested during the daily pre-operational recirculation of fuel. This sampling and testing should be performed before any fuel is dispensed.

Fuel in Aircraft Tank(s)

A visual check of the fuel in aircraft tanks shall be made by the flight crew before each flight. The sample should be taken after the fuel tank sumps have been drained. The sample should be drawn in a clean, clear glass container. The size of the sample may vary depending on the condition of the fuel. If contamination shows in the sample, more fuel should be drawn. If water, sediment, or any other suspicious matter is visible in the fuel after 1 quart or more is drawn the aircraft shall not be flown and the Chief Pilot or Supervisor shall be consulted.

Laboratory Testing

Laboratory testing ensures that the fuel's quality meets specifications; that unknown products are identified; that existing or potential contamination causes are identified; that unfavorable field test results are corroborated; and that off-specification fuels are not used. Each using bureau should submit petroleum samples to Office of Aviation Services for coordination with the laboratory for testing by qualified technicians. These samples are submitted as follows:

- When fuel quality is questionable.
- After any aircraft accident or serious incident in which the engine failed or engine failure is suspected.

System Sampling and Testing

Certain minimum requirements for testing at the user level must be carried out before refueling aircraft and before flight. The scope of the testing is restricted by the availability of testing equipment suitable for use in field situations, availability of trained personnel to conduct the test, and by the short time frame in which test results must be obtained. This testing identifies the most common forms of aircraft fuel contamination. These are commingling, particulate matter, and water.

Testing From the Fuel Source

Fuel supplies must be tested to confirm their identities (API gravity test); to detect water (Aqua-Glo test); and to detect particulate contaminates by color comparative ratings. The aviation fuel contamination test kit is designed to provide a final check on aviation fuel just before fueling of an aircraft. It includes the API gravity test, the Aqua-Glo test, and the Millipore test (a test for particulate contaminates). The kit is usually operated by trained individuals.

- Fuel Classification (API Gravity Test). Each type and grade of fuel has a particular API gravity range. The API gravity test indicates whether a fuel is what it is supposed to be. It is used hand in hand with visual examination. A visual check differentiates fuels by color: JP-4, JP-5, and JP-8, Jet A, etc., are clear to amber; and AVGAS, grade 100/130, is green, and 100 low-lead (100LC) is blue. The API gravity test confirms the color identification. This test is necessary because the dyes used in fuels may lose color with

age or when subjected to heat. The API gravity test is a measure of the average specific gravity or weight of the hydrocarbons (molecules) present.

- Water Detection (Aqua-Glo Test). The presence of water in a fuel is tested with the automotive/aviation fuel water detector kit, commonly called the Aqua-Glo kit. Aviation fuels may not be used if they contain more than 15 parts per million (PPM) of water. The Aqua-Glo water detection test checks to see that the filter/separator is working properly. If a reading is below the maximum allowable amount (15 PPM), the fuel is within limits. If the test shows more than 15 PPM of water in the sample, the fuel is "off specification." This indicates the filter failed or that there is a malfunction in the system. The fuel, and the system or refueler pumping it, should be removed from service immediately for further examination. The fuel must be segregated and sampled.

  The sample may be sent to Office of Aviation Services to coordinate laboratory tests called for by its specification. The equipment must be inspected to see if any source of water is present. The filter must be opened, and its filter elements removed and replaced. Before the system or refueler may be placed back in service, it must be retested to be sure that the water content of the fuel is below the maximum reading.

- Fibrous Material. Samples of fuel that are to be dispensed to aircraft should contain no more than 10 fibers when a 1-quart sample is visually examined. When more than 10 fibers can be seen, the filter or filter/separator elements are not functioning properly. Corrective action should be taken.

- Membrane Color Ratings. Filter membrane color ratings are used to determine the quality of aviation turbine fuels (its particulate contamination). Appendix C discusses the use and procedures of this test.

- Gravimetric (Membrane Filtration). Using a field sampling kit, a measured volume of fuel is passed through a pair of filter membranes in a field monitor. The field monitor is then removed from the field sampling kit and forwarded to a qualified laboratory for weighing.

Testing Fuel in Aircraft Tanks

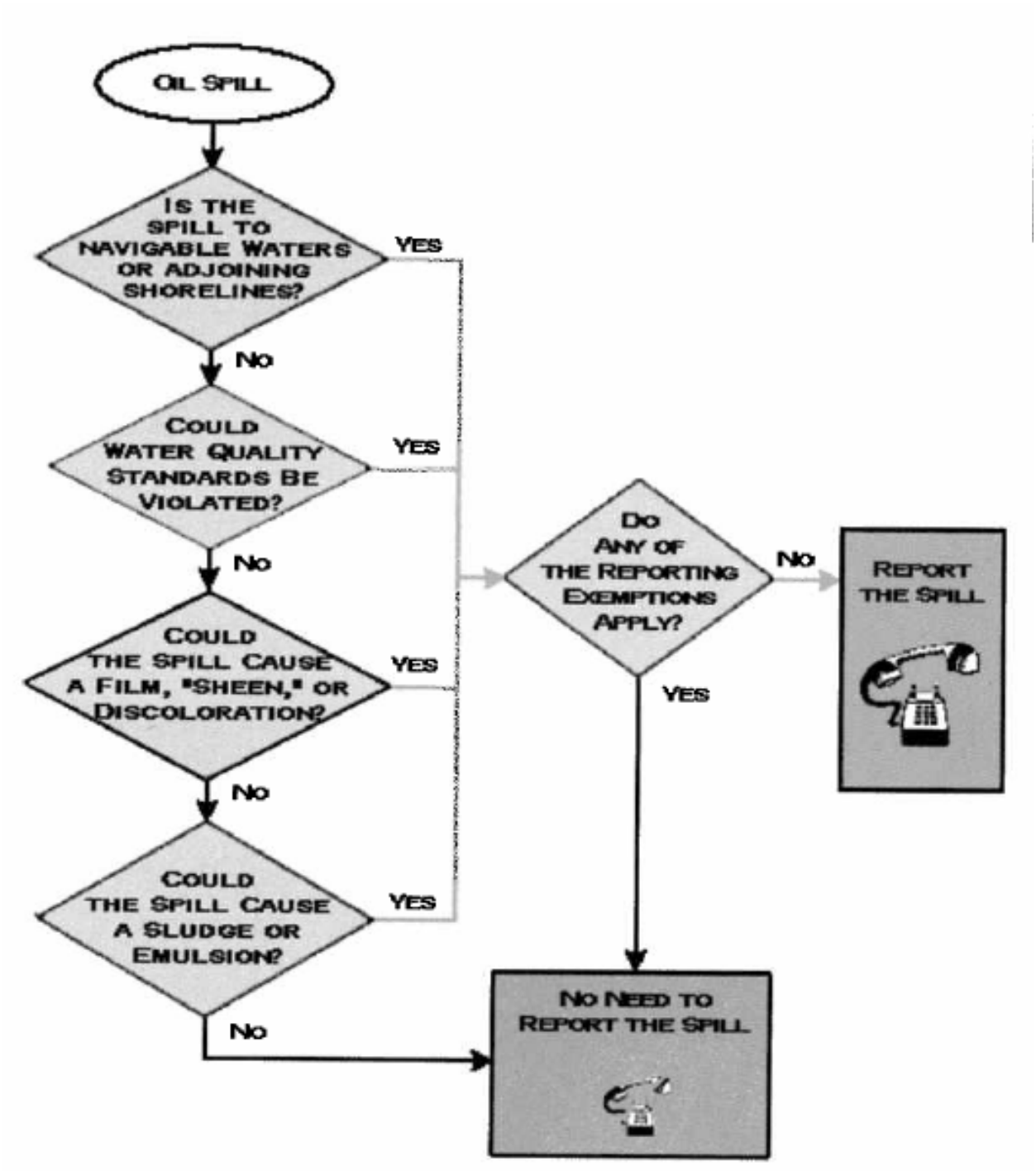
Fuel in aircraft tanks must be checked by the aircraft crew before flight operations begin. Taking a preflight sample is the only way of ensuring that the fuel on board does not contain water or other visible contaminants. (The sample must be taken after the fuel tank sumps have been drained. Check for contamination by taking a sample from fuel sumps and filters in accordance with the operator's manual.) Although visual checks safeguard against and warn of contamination, they do not ensure that the checked product meets all requirements of its specification. When a visual check indicates that the fuel may be contaminated, the aircraft should not be permitted to fly, and the fuel sample should be sent to the supporting laboratory for testing. Any remaining fuel in storage should be isolated and not used until test reports are received. Any fuel that fails a visual check should be segregated and held until laboratory test results are received. To visually check a fuel, draw a sample in a clean sample bottle and look for the items described below.

- Color. The color of an aviation fuel depends on its type and grade. Leaded fuels must be dyed, so AVGAS is dyed differently for different grades. Grade 100/130 is dyed green, and grade 100 low lead is dyed blue. Jet fuels, because they are unleaded, are not dyed.

They may be any color from water white to amber. Proper color indicates freshness and uniformity, but not necessarily quality. An off color or color of the wrong intensity does not always mean that the fuel is "off specification," but it does mean that contamination signs should be looked for.

- Cleanliness and Brightness. The fuel should be clean and bright. Cleanliness and brightness are distinct from fuel color. Clean means without visible sediment, cloud, haze, emulsion, or free water. Bright means having the characteristic sparkled of clean, dry fuel in transmitted light.
- Cloud or Haze. Ordinarily, a cloud or haze in fuel indicates the presence of water, but cloudiness can be caused by large amounts of fine sediment. Cloudy fuel is not acceptable for use in aircraft. When a clean, bright fuel cools, a light cloud may form. Such a cloud indicates that dissolved water has separated out into a very small amount of free water. Since free water is not acceptable in aviation fuels, the fuel should be rejected. If a cloud is present in a fuel after it has been passed through a filter/separator system, the filter elements in the filter/separator should be replaced. Also, the source tank should be stripped of both water and emulsion. Cloudy fuel should be re-circulated through fresh filter elements. A precipitation cloud can be removed by a filter/separator that is working properly.
- Sediment. To be visible to the naked eye as specks, sediment particles must be larger than 40 microns. Visible sediment particles in a sample indicate that the filter/separator is not working properly; that there is a source of contamination downstream of the filter/separator; or that the sample container was not cleaned properly. In a sample of clean fuel, no sediments should be visible. However, even with the most efficient filter/separator and careful fuel handling, occasionally there will be visible sediment particles in fuel. This sediment will normally be in the form of an extremely fine powder, rouge, or silt.
- Water. Entrained water may appear as a cloud or haze, and it may settle out. Free water may be visible as droplets or at the bottom of the sample container. If any free or entrained water is present, the fuel is unacceptable.
- Fibrous Material. A quart sample of acceptable aviation fuel should not contain more than 10 fibers. The presence of more than 10 fibers-per-quart indicates that the filter/separator from the servicing vehicle is not working properly or that the filter elements are breaking down. The fibers can be detected visually, but a specific count can be determined only by laboratory testing.

Appendix 18 When to Report Fuel Spills



Appendix 19 Fuel Personnel Hazwoper Training Levels/Flow Chart

Fuel Site Personnel – Satellite, deployable, fixed fuel site locations working in and around fueling systems.

↓

Awareness Training Required

Fueling Site Set-Up Personnel – Temporary site operational personnel that develops fueling system operations.

↓

Awareness Training Required

Fueling Distribution Support Personnel – Responsible for maintaining, repair, and development of equipment, specializing in Fuel site systems and development.

↓

First Response Level Training Suggested
Awareness Required

Fuel Distribution System Specialists – Manages personnel and equipment specializing in fueling operations.

↓

First Response Level Training Required

Hazmat Specialist – Individuals that are identified by the local unit that have hazmat response authority and responsibility. First contact for spill response.

↓

Hazmat Required Training

Awareness Training – Hazwoper, Spill containment, Equipment Use, etc.

First Response – Same as above with 40-hour CFR 49 Hazmat Training.

Hazmat – Required training IAW Title 49 Subtitle B Chapter I Subchapter C Part172 Subpart §172.704.

Appendix 20 Public Aircraft

Public aircraft means any of the following aircraft when not being used for a commercial purpose or to carry an individual other than a crewmember or qualified non-crewmember:

- An aircraft used only for the United States Government; an aircraft owned by the Government and operated by any person for purposes related to crew training, equipment development, or demonstration; an aircraft owned and operated by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments; or an aircraft exclusively leased for at least 90 continuous days by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments.
    - For the sole purpose of determining public aircraft status, commercial purposes means the transportation of persons or property for compensation or hire, but does not include the operation of an aircraft by the armed forces for reimbursement when that reimbursement is required by any Federal statute, regulation, or directive, in effect on November 1, 1999, or by one government on behalf of another government under a cost reimbursement agreement if the government on whose behalf the operation is conducted certifies to the Administrator of the Federal Aviation Administration that the operation is necessary to respond to a significant and imminent threat to life or property (including natural resources) and that no service by a private operator is reasonably available to meet the threat.
    - For the sole purpose of determining public aircraft status, governmental function means an activity undertaken by a government, such as national defense, intelligence missions, firefighting, search and rescue, law enforcement (including transport of prisoners, detainees, and illegal aliens), aeronautical research, or biological or geological resource management.
    - For the sole purpose of determining public aircraft status, qualified non-crewmember means an individual, other than a member of the crew, aboard an aircraft operated by the armed forces or an intelligence agency of the United States Government, or whose presence is required to perform, or is associated with the performance of, a governmental function.
- An aircraft owned or operated by the armed forces or chartered to provide transportation to the armed forces if:
    - The aircraft is operated in accordance with title 10 of the United States Code.
    - The aircraft is operated in the performance of a governmental function under title 14, 31, 32, or 50 of the United States Code and the aircraft is not used for commercial purposes; or
    - The aircraft is chartered to provide transportation to the armed forces and the Secretary of Defense (or the Secretary of the department in which the Coast Guard is operating) designates the operation of the aircraft as being required in the national interest.

- An aircraft owned or operated by the National Guard of a State, the District of Columbia, or any territory or possession of the United States, and that meets the criteria of paragraph (2) of this definition, qualifies as a public aircraft only to the extent that it is operated under the direct control of the Department of Defense.

Appendix 21 Fuel Servicing Nozzles

COMMERCIAL CCR NOZZLE

MODEL 64018

The Carter 64018 family of commercial Closed Circuit Refueling Nozzles (CCR) are designed in accordance with A-A-5937 (supersedes MIL-C-53071) yet have more convenient inlet connection alternatives. They are designed to connect to vehicles, helicopters and ground units, that have receptacles in accordance with U.S. Army drawing C13219E0479 or equal. The nozzle provides "tight fill" capability and limits system pressure. Positive interlock is provided. Both Standard and Arctic temperature versions are available.

FEATURES

- Mates with all HR Textron and other manufacturers helicopter receptacles designed for tight filling.
- Positive interlock system - nozzle will not open unless connected and closes automatically when disconnected.
- Light weight and rugged construction.
- Limits pressure to vehicle adapter to 15 psi regardless of inlet pressure.
- Light weight and rugged construction.
- Carter Unisex Coupling Quick Disconnect for easier operation.
- Adapters available for underwing to CCR interchange.
- Commercial length bonding cable optional.
- Standard (-25° to +140° F) and Arctic (-65° to +95° F) versions available.
- 40, 60, & 100-mesh strainers available.
- Nozzle spare parts identical to those used in the 64017 Military versions.

MILITARY CCR NOZZLE

MODEL 64017

The Carter 64017 family of Closed Circuit Refueling Nozzles (CCR) are designed and qualified in accordance with A-A-5937 (supersedes MIL-C-53071) Type I, Class A & B. The Arctic unit is in accordance with MIL-N-53094. They are designed to connect to vehicles, helicopters and ground units, that have receptacles in accordance with U.S. Army drawing C13219E0479 or equivalent. The nozzles provide "tight fill" capability and limits system pressure. Positive interlock is provided. Both standard and Arctic temperature versions are available.

FEATURES

- Standard nozzle meets latest U.S. Army requirements (MIL-N-52747D modified by contract).
- Arctic nozzle meets latest U.S. Army requirements of MIL-N-53094 (to latest contract) Light weight and rugged construction.
- Meets human engineering standards.
- Positive interlock system - nozzle will not open unless connected and closes automatically when disconnected.
- Light weight and rugged construction.
- Limits pressure to vehicle adapter to 15 psi regardless of inlet pressure.
- Standard (-25° to +140°F) and Arctic (-65° to +95°F) versions available.
- Standard meets ten color requirements, option to meet green color requirement. (Arctic version is green in accordance with specification).
- Standard, Type I, Class A nozzle, with 100-mesh strainer and 2" female camlock inlet.
- Optional, Type I, Class B nozzle, comes with 100-mesh strainer, non-valved unisex coupling and dust cap. (Standard nozzle only)

UNDERWING REFUELING NOZZLE

MODEL 64027

The Carter Model 60427 Underwing Nozzle is utilized world-wide by more companies and at more airports than any other nozzle. Tens of thousands have been produced for the industry since it introduction in 1970. Although designed for the commercial application, it has been widely used by the military, especially in their pantograph, hot refueling operations. It is of modular design with various swivel disconnects, hose end regulators and other options available to tailor the nozzle to a customer's specific requirements. In reality, the 60427 is a family of nozzles building upon the base unit to achieve the desired end product.

FEATURES

- Connects to 3-lug international standard aircraft adapter.
- Self-adjusting pressure loaded nose seal. No mechanical adjustments or springs used. Leak free under extreme side loads, worn adapters and extreme temperatures.
- Nose seal can be changed with minimum of disassembly (Optional).
- Lead-in ramps of stainless steel for longer life.
- Operating handle fully protected from damage.
- Bicycle-type handles with replaceable grips standard for ease of operation & low cost replacement.
- Two threaded ports in nozzle body for simultaneous vacuum breaker and product sampling fitting installation are standard.
- Lightweight and rugged.
- Modular construction - easy to customize to specific requirements.
- 2, 2 1/2 & 3" NPT & BSPP threaded quick disconnect inlets available.
- Optional 60- & 100-mesh screens retained with snap ring for ease of removal.
- 35, 45 & 55 psi Hose End Regulators available.
- Choice of new Ball Valve or Dry Break Disconnect for easy strainer inspection available.
- Bonding cable, vacuum breaker & 6" longer handles - optional.
- Low pressure drop.

OVERWING REFUELING NOZZLE

Appendix 22 Gammon Nozzle Modification

GAMMON

GAMMON TECHNICAL PRODUCTS, INC.
P.O.BOX 400 - 2300 HWY 34
MANASQUAN, N.J. 08736

PHONE 732-223-4600
FAX 732-223-5778
EMAIL gammontech@gammontech.com

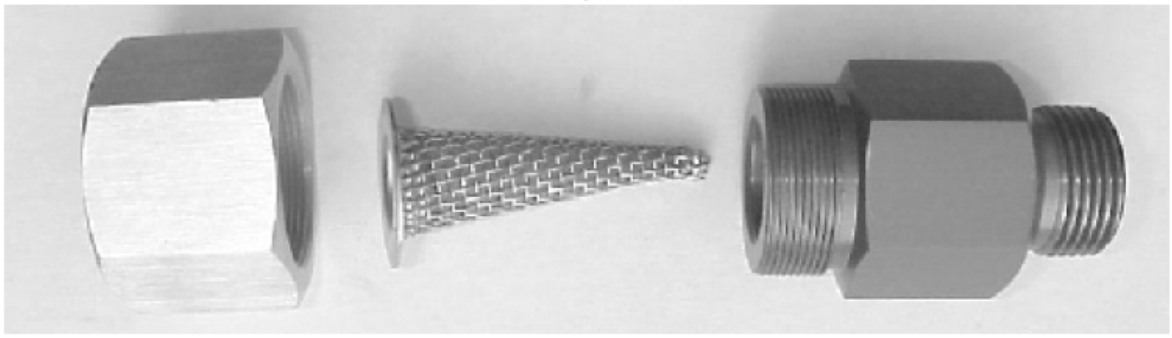
1" NOZZLE STRAINER BULLETIN 152 (07/00)

HEAVY DUTY NOZZLE STRAINER 1" NPT

This simple product serves an important function, providing a "last line of defense" to prevent you from dispensing debris from your nozzle. Our heavy duty strainer is made of 6061-T6 aircraft grade aluminum with a 100 mesh 300 series stainless steel cone strainer and Dupont Viton gasket, compatible with almost any liquid product from motor oil to Avgas. It was developed primarily for use with the OPW 7 series automatic nozzle, an excellent nozzle, but due to being automatic, it cannot accept a spout strainer. Fits any 1" npt nozzle. Do not use nozzles with hold-open devices for aviation fuels or self-service installations.

Discover small problems *before* they become big ones.
Protect your customer from inadvertent contamination.
Easily Inspected and cleaned.
Mounts simply between the hose and the nozzle.
Good for Gasoline, Diesel, Oils and Lubricants.
Quality construction, Including hard-coat anodizing on male threads.

GTP-8923 1" FEMALE INLET, 1" MALE OUTLET ASSEMBLY



AVAILABLE ACCESSORIES:

Heavy Duty Static Bonding and Grounding Cable - To attach to any 1" nozzle, allows you to bond the nozzle to the tank ***BEFORE*** you remove the tank cap and maintain that bond reliably. The cable is a full 4' of heavy 1/8" vinyl coated 7x7 galvanized steel with a heavy duty MIL-SPEC die cast aluminum clamp.
GTP-9012

Heavy Duty Dust Cap - (Fits OPW-7 nozzles) Keeps debris from entering the nozzle spout when not in use. Not compatible with some gasoline dispensers with the nozzle storage built in. Solid Urethane, precision cast, good from -40 to +200 degrees Fahrenheit.
GTP-9013

Appendix 23 Test Kits and Equipment

Color Particle Assessment Kit

Direct Reading DP Guage

Deadman Control Devices

Velcon Hydro-Kit

FIG 1.0 MR. FUNNEL

FIG. 1.1 API GRAVITY CALCULATOR

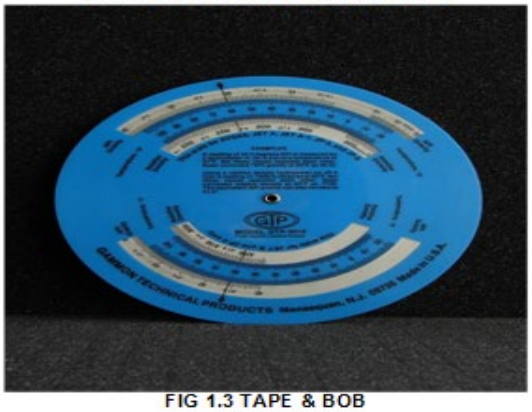


FIG. 1.2 MASON JAR

FIG 1.3 TAPE & BOB

FIG 1.4 WATER FINDING PASTE

FIG 1.5 FUEL FINDING PASTE

FIG 2.0 WHITE BUCKET

FIG 2.1 GATS JAR

FIG 2.2 GAMMON IN-LINE SCREEN

FIG 2.1 COLOR/PARTICLE ASSESSMENT GUIDE

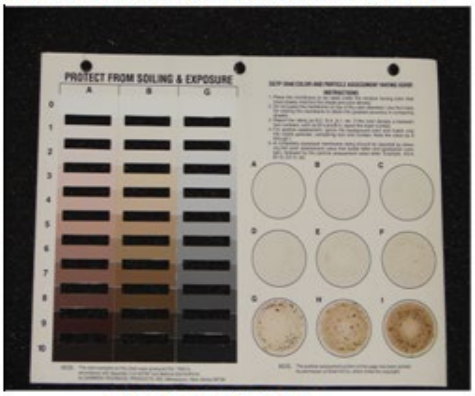


FIG 2.4 HAZE CHART

FIG 2.5 BAR CHART

FIG 3.0 AQUA GLO PAD

FIG 3.1 AQUA GLO MONITOR

FIG 3.2 AQUA GLO SET UP

FIG 3.4 AQUA GLO READER

FIG 3.5 AQUA GLO READER (BACK)

FIG 3.6 AQUA GLO READER (BOTTOM)

FIG. 4.0 IN-LINE SAMPLER (MATCHED WT.)

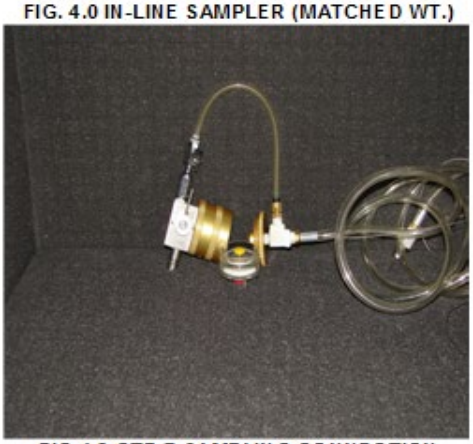


FIG 4.1 IN-LINE SAMPLER (COLOR & PART)

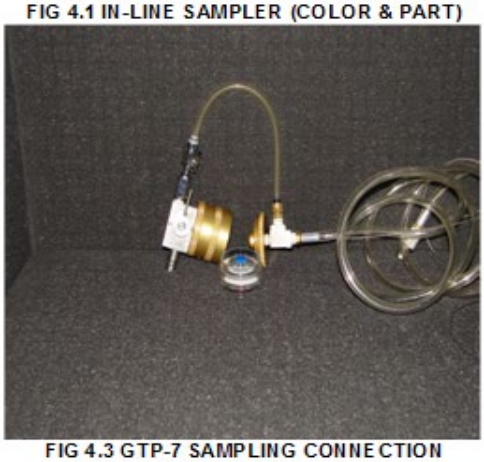


FIG 4.2 GTP-7 SAMPLING CONNECTION

FIG 4.3 GTP-7 SAMPLING CONNECTION

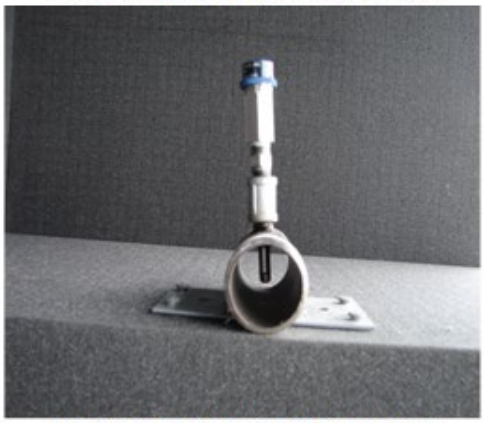
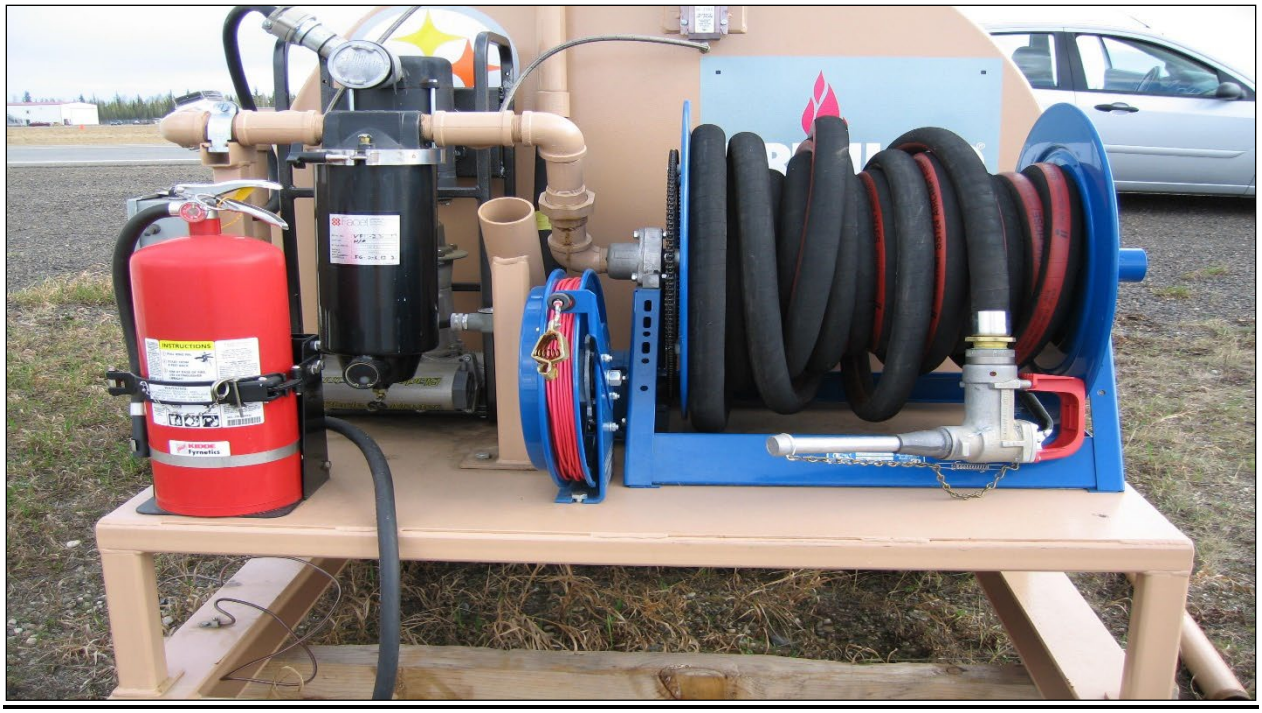


FIG. 4.4 IN-LINE SAMPLING SET UP

FIG 3.6 AQUA GLO READER (BOTTOM)

Appendix 24 Fixed Aircraft Refueling System



Appendix 25 Mobile Aircraft Refueling Unit

Appendix 26 Deployable Aircraft Refueling Systems

Figure 1 Alaska Fire Service 500-gallon bladder set up in a containment dike.

Figure 2 Alaska Fire Service Blivets (250 and 500 gallon).

Figure 3 Alaska Fire Service Dispensing Module: Gasoline engine powered pump (shielded ignition, spill plate, spark arresting muffler, filter, meter, bonding wire, hose, dispensing nozzle, etc.).

Appendix 27 General Purpose Vehicle Aircraft Refueling System

Appendix 28 Commercial Aviation Fuel Training Course Listings

National Air Transportation Association

https://mynata.my.site.com/NATAKnowledge/s/

Aviation Training Academy

http://aviationta.aero/

Appendix 29 Commercial Aviation Fuel System Component Retailers

Gammon Tech

http://www.gammontech.com/

Parker Velcon Aviation

http://www.pecofacet.com/

http://www.velcon.com/

Fjord Aviation Products

http://www.fjordav.com/

Hewitt Aviation Fueling Products

http://www.husky.com/hewitt/

OPW Global

http://www.opwglobal.com/

Acetank and Fueling Equipment

https://www.acetank.com/

Appendix 30 Commercial Aviation Fuel System Manufacturers (Mobile and Fixed)

Acetank and Fueling Equipment

https://www.acetank.com/

Garsite

http://garsite.com/

Skymark Refuelers

http://skymarkrefuelers.com/

Appendix 31 Bibliography

The following Bibliography lists references for information/procedures contained in this handbook.

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- Manual of Aviation Fuel Quality Control Procedures. American Society for Testing and Materials Manual Service: MNL 5, Editor Jim Gammon, 2004
- Handbook of Aviation Fuel Properties. American Petroleum Institute (API), CRC. Report # 530 3rd Printing, 1988.
- Specifications and Qualification Procedures for Aviation Jet Fuel Filter Separators (F/S). American Petroleum Institute Bulletin 1581, 4th Edition, 2000.
- Specifications and Qualification Procedures - Aviation Fuel Filter Monitor with Absorbent Type Elements. Institute of Petroleum, 4th Edition 2004.
- Equipment for Handling and Testing Aviation Fuels, Gammon Technical Products Inc, Catalog of Petroleum Equipment Institute (PEI), distributor updated Bulletin(s), 2006.
- Standard for Aircraft Fuel Servicing, National Fire Protection Association (NFPA) No. 407, 2007.
- Aviation Fueling Hose. American Petroleum Institute Bulletin 1529, 5th Edition, 1998
- Airport Equipment Marking for Fuel Identification API Bulletin 1542, 5th Edition, 1991.
- Standard for Tank Vehicles for Flammable and Combustible Liquids. NFPA 385 2000.
- Flammable and Combustible Liquid. NFPA 30, 2003
- Motor Fuel Dispensing Facilities and Repair Garages. NFPA 30A, 2003.
- Dept of Defense Standard Practice Quality Surveillance for Fuels Lubricants and Related Products. Military Standard Mil Std 3004 1999
- Transportation of Hazardous Materials. 49 CFR Part 397, 2007.
- Oil Pollution Prevention. EPA 40 CFR 112, 2007
- Emergency Response to Hazardous Substance Releases. OSHA 29 CFR 1910.120 (q) (6) 2007
- Interagency Aviation Transport of Hazardous Materials. NFES 1068. 2005