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Glossary of terms

additives	Material(s) (usually chemical products) added to change the existing properties of, or impart new characteristics to, aviation fuels (e.g. *fuel system icing inhibitors* (FSII), and *static dissipater additives* (SDA).
Appearance Check	A field check to confirm the acceptability of the fuel (i.e. the correct colour and visually clear, bright and free from particulate matter and undissolved water at ambient temperature).
apron	An area of an airport where aircraft are parked and refuelled
batch	In aviation terms, a batch of product is an identifiable quantity, produced at a refinery, tested and identified as a single entity. If product from two different batches is mixed, it is re-tested and re-identified as a new batch.
bonding	The physical connection of two metal objects by an electrical conductor that equalises the charge or electrical potential between the two objects. Example: bond the fuelling vehicle to the aircraft with a metal cable to equalise the charge and thus reduce the possibility of generating sparks when the fuelling nozzle is connected to the aircraft.
bridger	Tank truck used to supply aviation fuel from one storage area to another, such as refinery to terminal or terminal to airport.
bunded area	The spill containment area around a fuel storage tank.
calibration	Making precise measurements and adjustments to equipment or systems to obtain optimum performance and to certify that output data falls within prescribed tolerances.
cathodic protection	A method of preventing or reducing corrosion to a metal surface (by using an impressed direct current or attaching sacrificial anodes).
Certificate of Analysis(CoA)	A Certificate of Analysis is issued by independent inspectors and/or laboratories and contains the results of measurements made of all the properties included in the relevant fuel specification and, for Jet A-1, the requirements of the latest issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List. It cannot however include details of the additives added previously. It shall include details relating to the identity of the originating refinery and to the traceability of the product described. It shall be dated and signed by an authorised signatory.
Certificate of Quality (RCQ) (Refinery Certificate of Quality)	An *RCQ* is raised whenever full certification tests are performed at a refinery. The RCQ normally shows the applicable specification requirements for the products being tested, the date, the test method and the test results. It also includes the amount and type of additives used, the quantity of the batch, the batch number and the number of the tank containing the product. The RCQ is signed by designated personnel.
chemical water detector	*Chemical water detectors* are used to confirm the presence of free or suspended water in Jet fuel. There are types designed to give a positive indication of water in fuel at concentrations of 30 parts per million and above.
clay treater	A treater that uses a medium of a special Attapulgus clay, either in bulk or in replaceable cartridges. The special clay adsorbs and picks up surface active agents, colour bodies and very fine particles in the fuel, not otherwise removable.
coalescer	The first stage of a *filter/separator* is called a *coalescer*. It filters out solid particles and causes small free water droplets in the fuel to form into large droplets, which will settle out by gravity.
colour	In aviation gasolines, colour relates to the appearance of the product as compared to the expected colour, e.g. Avgas Grade 100LL is dyed blue and therefore is checked against this known standard for product identification. In aviation Jet fuel colour indicates a rating against a fixed standard.
commingle	The mixing of the same product grade from two different sources or batches so that each loses its original identity.
compartment	A liquid-tight division in a cargo tank.
contaminated fuel	Fuel that does not meet specifications for any reason. Examples include water or *particulate* matter that is in excess of specified limits or mixed with other fuels.
contamination	Foreign matter, solid or liquid, which gets into any aviation product, e.g., water, rust, dirt, another product grade, etc.
Control Check	The *Control Check* consists of an *Appearance Check* plus density determination.
custody transfer	An event where fuel passes from one entity/operator to another.
deadman	A hand-held control, which starts the flow of product and automatically shuts off flow if released for any reason. The device may be fitted with an intermittent feature that has to be released at regular intervals to prevent it from shutting off.
dedicated	Equipment is *dedicated* to carrying and storing only a single grade of product. For tanks, vessels, tank trucks, tank containers and rail cars, *dedicated* means that at least the previous three cargoes have been the same product as the one being loaded/ stored and change of grade procedures have been followed. See **segregated**.
defuelling	Removal of fuel from an aircraft.
differential pressure	The difference in pressure readings (psi/bar) between the inlet and outlet sides of a filter vessel. Often referred to as *Delta P*.
dipstick	A graduated rod or stick that is inserted into a tank to measure the amount of product in the tank.

distillation	The process to separate the components of a liquid mixture by boiling the liquid and then recondensing the resulting vapour.
drip stick	A graduated rod or tube that drops from the bottom of an aircraft fuel tank and measures the amount of fuel in the tank.
driveaway interlock	A safety device on fuelling vehicles that prevents vehicle movement unless all fuelling hoses are stowed securely on the vehicle and movable fuelling platforms are fully lowered.
fast flush	Refers to an effective water draw-off from storage tanks.
filter elements	Generic term given to separation media installed in various types of vessels (i.e. *filter/coalescers, separators, filter monitors* and *microfilters*) to remove suspended water and particulate matter.
Filter Membrane Test	A test for solid contaminant in a sample of fuel that is passed through a filter membrane, which is then weighed (*Gravimetric Test*), or matched to a colour standard (*Colour Test*) to determine the degree of contamination.
filter monitor	A vessel containing water absorbing elements that will continuously remove solids and free water from aviation fuels. With proper maintenance, it also provides a positive shut-off of flow if the level of free water or solids in the fuel system is unacceptable. Governed by EI 1583 specification.
filter/separator (FWS)	A vessel with two stages of filtration and water separation, through which fuel passes to remove dirt and water. The first stage (*coalescer*) removes dirt and coalesces water; the second stage (*separator*) prevents residual water droplets that have not yet settled from leaving the vessel with the fuel. (See **coalescer**). Governed by EI 1581 specification and EI 1582 Similarity.
fixed fuelling system	An arrangement of aviation fuel storage, pumps, piping, and associated equipment, including dispensing hydrants, cabinets, and/or pits at an airport, designed to service aircraft at locations established by the installation of the equipment.
flash point	The lowest temperature at which a liquid or a solid gives off enough vapour to form flammable air vapour mixture near its surface.
floating suction	Suction pipe that floats on the top of the liquid surface permitting product withdrawal from the top layer of liquid in the tank, which directionally is the cleanest fuel in the tank at the time.
free water	Water other than dissolved water, generally in droplets that may cause cloudiness and may settle due to gravity and form a defined layer at the bottom of a container.
freezing point	The temperature at which a liquid becomes a solid, at normal atmospheric pressure.
fuel sense line	Small diameter line that typically runs from the hydrant coupler/ in line pressure control valve to a *venturi*.
Fuel System Icing Inhibitor (FSII)	Approved substances added to fuel to prevent formation of ice crystals in fuel upon cooling.
fueller	Refers to the equipment used for fuelling (e.g. mobile refuelling truck).
fuelling cabinet	A fixed, above-ground structure with hose, meters, and auxiliary equipment, from which fuel can be dispensed into an aircraft. (See also **fixed fuelling system**.)
fuelling operation	This includes fuelling, defuelling and may include *additional services* where authorised.
fuelling safety zone	Areas with a radius of at least 3 metres (10 feet), or as specified by local regulations, from filling and venting points on the aircraft, hydrant pits, fuelling vehicle and its hoses in use.
Gravimetric Test	A membrane filtration test using two pre-weighed filter papers to allow a quantitative assessment of particulate in the fuel.
gum, existent	*Gum* is a non-volatile residue left following evaporation of the fuel.
Hazardous Area Classification	A system of classification for electrical equipment to determine requirements for operation in the presence of flammable vapours etc. e.g. in Europe ATEX. (See **intrinsically safe**.)
Hose End Pressure Control Valve (HEPCV)	A spring or air operated internal sensing valve located just upstream of an aircraft fuelling nozzle, which limits normal operating pressure and surge pressures at the aircraft fuelling adapter.
hot fuelling	Fuelling of an aircraft while the aircraft engine is operating.
hydrant	An in-ground fixed fuelling system designed to permit the transfer of fuel.
Hydrant Emergency Stop Button (ESB)	A button that causes the hydrant system pumps to shut down when activated and closes valves to terminate any gravity flow into hydrant. ESBs are normally located near to aircraft stands and they should be accessible and clearly identified.
hydrant pit valve	A mechanism connected to the termination point of each lateral to allow fuel to flow through the hydrant vehicle.
hydrant servicer	A fuelling vehicle that connects to the hydrant system to deliver fuel to an aircraft. Sometimes referred to as simply *servicer.*
incident	An occurrence, associated with the operation of an aircraft, which affects or could affect the safety of operations.
interface cut	A procedure used to isolate or segregate one product from another at the receiving end of a *non-dedicated* pipeline, as the products go into tankage.
intermediate terminal/ storage	A storage terminal or plant situated between the supplying refinery and the airport operating storage. Also includes receipt storage at an airport from which fuel is transferred to airport operating tanks.

intrinsically safe	Equipment and wiring that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous zone atmospheric mixture in its most easily ignited concentration. See **hazardous area classification**.
isolation	A physical means of separating equipment containing different grades of fuel or certified and uncertified aviation fuel grades. (See **segregated**.)
Joint Venture	Joint ownership or operation of aviation (or other) facilities by two or more companies.
lanyard	A cable that is attached to the *hydrant pit valve* during fuelling operations and which can be used to close the pit valve in an emergency situation.
leak	Any loss of fuel due to a defect in the storage, piping, or delivery system.
low point (designated)	A drain point in a pipeline where significant quantities of *particulate*/water would accumulate if the position was not flushed on a regular basis. The frequency of flushing should be determined by documented experience. Where pipelines are in turbulent flow conditions, it is unlikely that significant quantities of *particulate*/water will accumulate.
master meter	A certified accurate meter used to check flow meters on dispensing equipment or fixed facilities.
meter prover	A volumetrically calibrated tank used to prove the accuracy of the meters used on aircraft fuelling equipment. Also called *meter proving tank* or *calibration tank*.
microfilter (micronic filter)	A filter specifically designed to remove only dirt particles from a fuel stream. Typically used upstream of *Filter Water Separators (FWS)* in high dirt environments to prolong the life of the FWS elements. Governed by EI 1590 specification.
micro-separometer (MSEP)	A test method for determining water separation characteristics of Jet fuel.
non-dedicated	A system of tankage, pipes, vehicles, etc., in which more than one product or grade of product can or does flow through the same system; single valve isolation is considered non-dedicated. Also referred to as a *multi-product* system.
nozzle screen	A screen filter, no coarser than 60 mesh, installed in a fuelling nozzle to catch any solid contaminants that might enter the fuelling system between the last filter and the aircraft.
particulates	Solid contaminants found in Jet fuel (i.e., dirt, rust, sand, fibres).
Periodic Test	A selected set of tests carried out on samples of static stock after 6 months to confirm that fuel meets the relevant specifications and that the quality of the fuel has not changed significantly since the last test was carried out.
power take-off (PTO)	An engine or transmission-powered splined drive shaft used to provide power to a pump, or other equipment
pre-check valve	A device used to check the operation of automatic high level shut-off on fuellers.
pressure, operating	The pressure against a pump's maximum no-flow head, existing in a system under flowing conditions or static conditions but excluding surge pressures.
pressure, test	The pressure at which a system or a component of the system is tested to verify its integrity.
qualification	Demonstrated skill, documented training, demonstrated knowledge, and experience required for personnel to properly perform the duties of a specific job.
ramp	See **apron**.
Recertification Test	A selected set of tests carried out on fuels during or after certain types of movement to verify that the fuel has not been contaminated and that the quality of the aviation fuel concerned has not otherwise changed. Samples tested shall remain within the specification limits. Test results for specified critical properties shall also be within maximum variances of the previous analysis of the same fuel batch.
relaxation time	The time required to allow any build-up of static electricity within the fuel to dissipate. This is calculated by including volumetric capacity in a fuel handling system, which increases the residence time (downstream of any charge generating equipment such as filters) for the purpose of dissipating, or losing, static electricity charge, before the fuel discharges from the fuel system into a tank, truck or aircraft.
segregated	Either the aviation fuel grade is in equipment that is isolated from other systems carrying different fuel grades. Or the certified aviation fuel is in equipment that is isolated from other systems carrying uncertified aviation fuel of the same grade. See **isolation**.
separator element	The second-stage cartridge in a *filter-separator* vessel that allows passage of fuel but rejects fuel water droplets. The separator element is downstream of the *coalescer* cartridge. See **filter/separator**.
settling time	The time required after receipt and before shipment of product from a storage tank to provide adequate settling of any solids and water.
similarity	The requirement for combinations of *filter /separator elements* and vessels to meet the EI 1581 specification. A similarity data sheet confirms that a specific element and vessel configuration at a designated maximum flow meets the requirements of EI 1581. Governed by EI 1582 specification.
slug valve	An inline valve that is triggered to close and shut off flow, when excess water builds up in a sump and trips a solenoid by means of a float or electrical probe.
smoke point	The *smoke point* test provides an indication of the relative smoke-producing properties. A high smoke point indicates a low smoke-producing tendency.
static dissipator additive	Aviation approved additive for improving fuel conductivity leading to more rapid relaxation of static electricity. Sometimes referred to as *anti-static additive.*

static electricity	An electrical potential generally built up by friction (e.g. filter or *filter/separator* and fuel, and pipelines and fuel). A build-up of static electricity may be great enough to cause sparking or arcing capable of causing combustion.
static storage	Storage tanks that have had no new fuel introduced in these time periods: Jet fuel – 6 months; Avgas – 6 months.
sulphur, total	Control of total sulphur below a maximum limit ensures that possible corrosion of turbine metal parts by the sulphur oxides formed during combustion is minimal.
sump	The lowest point in a storage tank, vehicle tank or filter, purposely designed to collect water and particulate. When a tank or filter is *sumped* the contaminants are removed as part of routine quality assurance tests or maintenance on equipment.
surfactants (surface active-agents)	Detergent-like compounds frequently found in Jet fuel. These compounds are of concern because they have a disarming effect on elements used in filter/water separators. Clay treatment is one means used in removing surfactants from Jet fuel.
test, corrosion, copper strip	No more than a slight tarnish on a copper strip after immersion in the fuel for 2 hours at 100°C assures that the fuel will not corrode copper or copper alloys in the fuel system.
thermal stability test	A *Jet Fuel Thermal Oxidation Test (IP323 / ASTM D 3241)* is used to ensure that acceptable thermal stability, at specific temperature, fuel system pressure, and fuel flow rate is maintained. Fuel instability leads to thermal breakdown causing particle formation, either in suspension in the fuel, or as lacquer build-up on heater tubes, causing blocked fuel filter, injection nozzles, and inefficient heat exchanger operation.
thief pump	A small hand- or motor-operated pump with a long suction tube, which reaches to the bottom of a tank to drain off any water collected on the tank bottom, or to collect samples.
ullage	Measurement of the space remaining from the hatch down to the fuel level.
uplift	The quantity of fuel transferred to an aircraft.
vendor	For the purpose of this Standard, the term *vendor* includes various providers (e.g. into-plane services, airport fuel storage facility/hydrant operators).
venturi	A device in the fuel flow stream for providing a reduced fuel pressure for control of secondary pressure control systems.
visijar	A clear glass container with a lid, which is permanently connected to a sample point to facilitate a visual appearance check, and to minimise skin contact with fuel. Also known as a *closed circuit sampler*.
Visual Check	A Visual Check is an *Appearance Check* plus the use of a *chemical water detector* to confirm water-free status.
waste fuel	Fuel not suitable for aircraft or aviation use.
water defence system	A device that senses a predetermined level of free water in *filter/separator* sumps, and automatically stops the flow of fuel to prevent downstream contamination.
working tank	The fuel storage tank being used to supply fuel to fuelling trucks or a hydrant system.

Table of acronyms

Acronym	What it means	Acronym	What it means
AFQRJOS	Aviation Fuel Quality Requirements for Jointly Operated Systems (JIG Check List)	kPa	kilo Pascals (units of measure)
API	American Petroleum Institute	LEL	Lower Explosive Limit
APU	Auxiliary Power Unit	LI	Lubricity Improver (same as CI)
ASTM	ASTM International	MAWP	Maximum Allowable Working Pressure
AVGAS	Aviation Gasoline	MBG	Microbiological Growth
BS	British Standard	MDA	Metal Deactivator Additive
CoA	Certificate of Analysis	MF	Microfilter (Micronic Filter)
CI	Corrosion Inhibitor (same as LI)	MOGAS	Motor Gasoline
CIS	Commonwealth of Independent States (former Soviet Republics)	MSDS	Material Safety Data Sheets
CWD	Chemical Water Detector	MSEP	Micro Separometer
DEF STAN	Defence Standard (UK Ministry of Defence)	MTC	Multiple Tank Composite Sample
DiEGME	Diethylene Glycol Mono Methyl Ether (see FSII)	NDT	Non-Destructive Testing
DLA	Defense Logistics Agency (US)	NFPA	National Fire Protection Association (US)
dP	Differential Pressure	OEM	Original Equipment Manufacturer
EI	Energy Institute	PCV	Pressure Control Valve
ESB	Emergency Stop Button	PPE	Personal Protective Equipment
FIFO	First In First Out	ppm	Parts Per Million
FSII	Fuel System Icing Inhibitor	PQ	Product Quality
FWS	Filter Water Separator	PTO	Power Take Off
GPM	Gallons Per Minute	pS/m	Pico Siemens per Metre
GPU	Ground Power Unit	PSI	Pounds per Square Inch
HEPCV	Hose-End Pressure Control Valve	P-V	Pressure-Vacuum (Vent)
IATA	International Air Transport Association	QC	Quality Control
IBP	Initial Boiling Point	RCQ	Refinery Certificate of Quality
IFQP	IATA Fuel Quality Pool	RPM	Revolutions Per Minute
IGS	Inert Gas Systems	RTD	Resistance Temperature Device
ILPCV	In-Line Pressure Control Valve	RVP	Reid Vapour Pressure
IP	Institute of Petroleum (Test Methods)	SDA	Static Dissipator Additive
IPA	Iso-Propyl Alcohol	STC	Single Tank Composite Sample
ISGOTT	International Safety Guidelines for Oil Tankers and Terminals	TAN	Total Acid Number
JAA	Joint Aviation Authority (Europe)	USG	United States Gallons
JFTOT	Jet Fuel Thermal Oxidation Test	USGPM	Unites States Gallons per Minute
JIG	Joint Inspection Group	UV	Ultra-Violet
JSCL	Joint Systems Check List (See AFQRJOS)	WSIM	Water Separability Index Modified (Test now replaced by MSEP)

List of useful publications

The following standards shall be used where identified within the JIG documents. They should also be used as a source of additional and background information as required.

American Petroleum Institute (API)
API Manual of Petroleum Measurement Standards
API 1543 Documentation, Monitoring and Laboratory Testing of Aviation Fuel during Shipment from Refinery to Airport
API 1595 Design, Construction, Operation, Maintenance and Inspection of Aviation Pre-Airfield Storage Terminals
API 2013 Cleaning Mobile Tanks in Flammable or Combustible Service
API 2611 Terminal Piping Inspection – inspection of In-service Terminal Piping Systems
API 650 Welded Steel Tanks for Oil Storage
API RP 652 Lining of Above Ground Petroleum Storage Tank Bottoms

Energy Institute (EI)
IP Petroleum Measurement Manual
IP 160 Density and API Gravity of Crude Oil and Petroleum Products-Hydrometer Method
IP 274 Determination of electrical conductivity of aviation and distillate fuels
IP 323 Jet Fuel Thermal Oxidation Test
IP 365 Density and Relative Density of Liquids by Digital Density Meter
IP 559 Determination Of Density Of Middle Distillate Fuels – Hand Held Oscillating U-tube Density Meter Method
IP 585 Determination of Fatty Acid Methyl Esters (FAME), derived from Bio-Diesel fuel, in aviation turbine fuel - GC-MS with selective ion monitoring/scan detection method
IP 599 Determination of Fatty Acid Methyl Esters (FAME) in aviation turbine fuel
EI 1529 Aviation fuelling hose and hose assemblies
EI/JIG 1530 Quality assurance requirements for the manufacture, storage and distribution of aviation fuels to airports
EI 1540 Recommended Practice, Design, Construction, Operation and Maintenance of Aviation Fuelling Facilities
EI 1541 Performance requirements for protective coating systems used in aviation storage tanks and piping
EI 1542 Identification markings for dedicated aviation fuel manufacturing and distribution facilities, airport storage and mobile fuelling equipment
EI 1550 Filtration Handbook
EI 1560 Recommended practice for the operation, inspection, maintenance and commissioning of aviation fuel hydrant systems and hydrant system extensions
EI 1581 Specification and Qualification Procedures for Aviation Jet Fuel Filter Separators
EI 1582 Specification for Similarity for EI 1581 Aviation Jet Fuel Filters/Separators
EI 1583 Laboratory Tests and Minimum Performance Levels for Aviation Fuel Filter Monitors
EI 1584 Four-inch Hydrant System Components and Arrangements
EI 1585 Guidance in the Cleaning of Aviation Fuel Hydrant Systems at Airports
EI 1590 Specification and qualification procedures for aviation fuel microfilters
EI 1594 Initial pressure strength testing of airport fuel hydrant systems with water
EI 1596 Design and construction of aviation fuel filter vessels
EI 1597 Procedures for overwing fuelling to ensure delivery of the correct fuel grade to an aircraft
EI 1598 Design, functional requirements and laboratory testing protocols for electronic sensors to monitor free water and/or particulate matter in aviation fuel
EI 1599 Laboratory tests and minimum performance levels for aviation fuel dirt defence filters
EI Guidelines for the investigation of the microbial content of petroleum fuels and for the implementation of avoidance and remedial strategies
EI Model Code of Practice – Part 2, Design Construction and Operation of Petroleum Distribution installations
HM 20 Proving of Aviation fuelling positive displacement meters
HM 50 Guidelines for the cleaning of tanks and lines for marine tank vessels carrying petroleum and refined products

ASTM International (American International Standard for Testing and Materials)
ASTM D2276/IP 216 Standard Test Method for Particulate Contaminant in Aviation Turbine Fuel by Line Sampling
ASTM D2624 or IP274 Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
ASTM D3241 Jet Fuel Thermal Oxidation Test
ASTM D6469 Standard Guide for Microbial Contamination in Fuels and Fuel Systems
ASTM D6986 Standard Test Method for Free Water, Particulate, and Other Contamination in Aviation Fuels (Visual Inspection Procedures)
ASTM D4176 Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels
ASTM D4057 Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D4306 Standard Practice for Aviation Fuel Sample Containers for Tests affected by Trace Contamination
ASTM D7566 Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons

Comitee Europeen des Normalisation (CEN) and British Standards
EN 12312-5 Aircraft Ground Support Equipment-Specific Requirements - Part 5 Aircraft Fuelling Equipment
BS EN 14015:2004 Specification for the design and manufacture of site built, vertical, cylindrical, flat-bottomed, above ground, welded, steel tanks for the storage of liquids at ambient temperature and above
BS 3492 Specification for road and rail tanker hoses and hose assemblies for petroleum products, including aviation fuels
BS 5842 Specification for thermoplastic hose assemblies for dock, road and tanker use

International Air Transport Association (IATA)
Guidance Material on Microbiologial Contamination in Aircraft Fuel Tanks
Guidance Material on Turbine Jet Fuels Specifications
Guidance Material on Standard Into-Plane Fuelling Procedures
Dangerous Goods Regulations

International Civil Aviation Organization (ICAO)
Technical Instructions for the Safe Transport of Dangerous Goods by Air

International Organization for Standardization (ISO)
ISO 1825 (EI1529) Rubber hoses and hose assemblies for aircraft ground fuelling and defuelling
ISO 3170 (IP 475) Methods of Test for Petroleum and its Products. BS 2000 – 475: Petroleum Liquids. Manual Sampling)
ISO 6789 Assembly tools for screws and nuts – hand torque tools – requirements and test methods for design conformance testing and recalibration procedure
ISO/IEC Guide 43-1:1997 Proficiency testing by interlaboratory comparisons

Part 1: Development and operation of proficiency testing schemes, and
Part 2: Selection and use of proficiency testing schemes by laboratory accreditation bodies

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

Society of Automotive Engineers (SAE)
AS 1852 Nozzles and Ports – Gravity Fuelling Interface Standard for Civil Aircraft
ARP 5789 Aviation Fuel Facilities
ARP 5818 Design & Operation of Aircraft Refuelling Tanker Vehicles
AS 5877 Detailed Specification for Aircraft Pressure Refuelling Nozzle

International Safety Guidelines for Oil Tankers and Terminals (ISGOTT)

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Vitol Tank Terminals International BV
Vopak Oil EMEA
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Chapter 1

Introduction

1.1 Purpose

This document is intended for the guidance of members of the Joint Inspection Group (JIG) and companies affiliated with members of JIG and IATA Airlines. It does not preclude the use of any other operating standards, procedures, equipment maintenance or inspection procedures. Neither JIG Ltd, its members, nor the companies affiliated with its members accept responsibility for the adoption of this document or compliance with this document. Any party using this document in any way shall do so at its own risk. For JIG Joint Ventures and locations on the JIG Inspection Programme see also Appendix A18.

The primary purpose of this document is to provide a set of agreed standards that shall be used by a company in preparing the detailed quality control and fuel handling procedures for joint airport depots and/or hydrant systems at the specific location.

Mandatory requirements in this Standard are designated by the word "shall." Recommendations and best practices are designated by the word "should." Optional items are designated by the word "may."

Note: Only the latest revision of any document or standard, referenced in this document, shall be considered. A glossary of terms, table of acronyms and a list of useful publications is included at the beginning of this Standard.

1.2 Scope

The following chapters in this document define standards for the design of airport storage and handling systems, where relevant to quality control considerations, and for the preparation of operating and quality control procedures to be used in such systems.

Corresponding standards applicable to supply and distribution facilities and into-plane fuelling services may be found in the following companion documents:

(a) Quality assurance requirements for the manufacture, storage and distribution of aviation fuels to airports (EI/JIG Standard 1530)

(b) Aviation fuel quality control and operating standards for into-plane fuelling services (JIG 1).

1.3 Application

Companies operating to JIG Standards shall operate to the entirety of this Standard. Detailed procedures based on this Standard shall be prepared and incorporated in, or appended to, the signed operating agreement covering the system to make them formally binding.

The fuel quality specifications shall also be incorporated in all operating agreements, by reference to the current issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List, or approved aviation fuel specification.

1.4 Staff responsibilities and inspection requirements

1.4.1 Staff responsibilities

It is the responsibility of the operation's management (i.e. the operating company board of directors or the operating committee) to ensure that the facility design and operating procedures, as set out in manuals and other directives, conform to acceptable industry standards and to all the relevant requirements of government

authorities with respect to safety, security, fire prevention and environmental protection.

The prime responsibility of airport storage (and hydrant) depot staff is to ensure that all consignments of fuel are received and maintained in complete conformity with the requirements of the agreed specifications, and that they are delivered in a safe and satisfactory manner.

The manager of an airport storage (and hydrant) depot facility shall have overall responsibility for all aspects of the operations under his/her control, and shall be responsible for ensuring that all operations are carried out in accordance with the agreed procedures, and with all generally accepted standards of safety and good practice. It is expected that upstream facilities supplying into airports operating to the JIG 2 Standard have adopted EI/JIG 1530 standard.

The manager shall be fully satisfied with the documentation and quality of fuel stocks received. It is the responsibility of the fuel supplying companies to satisfy themselves as to the standards of their supply sources and, if requested, to confirm that the fuel quality is acceptable and that the supply facilities meet recognised industry standards.

If the manager has doubts about the quality of any fuel stocks received, or is dissatisfied with documentation or any other aspect of the supply arrangements, he/she should immediately advise the local representative of the fuel supply company, who should then take the matter up through company channels.

A process for handling supply shortages should be available for each airport depot location. This should be developed with the airport authorities, airline representatives and supplying companies and should include procedures for advising customers of reduced fuel allocations. The manager is responsible for keeping the procedures up to date and for deciding when it is necessary to implement them.

1.4.2 Inspection requirements

Inspections to JIG Standards shall be carried out at least once per year to ensure compliance with locally prepared procedures.

The locally prepared (site-specific) procedures/operations manual shall include an updated list of any approved variances from the current issue of this standard (see "Standards Variance Approvals" below).

Before leaving the location, the inspector shall discuss the recommendations to be made in the report with the facility manager. Where these recommendations cover deviations from procedures laid down in the manuals of the system concerned, corrective action shall be implemented by the manager. If issues arise during the inspection that have an impact on another aviation fuelling operation at the airport, the inspector should invite both facility managers to participate in a meeting at the end of the inspection. Items of a serious nature shall be communicated to the location management without delay. An inspection report shall be finalised and issued as soon as possible by the inspecting company but not later than six weeks after inspection completion. In the event that the general inspection assessment is less than satisfactory then the report shall be issued not more than three weeks later.

It is the responsibility of the facility management to initiate the required corrective action recommended in the report. The facility management shall continuously update and close out recommendations.

1.4.3 Standards Variance Approvals

Locations which require specific operational variations to the JIG Standards shall have a documented Variance Approval Process. Variances shall be unanimously approved by the Board of Directors or Management Committee of the organisation **("Location Management")** with the approval of each of their organisation's Technical Authority. The **"Technical Authority"** is the office or designated representative providing technical management support to the component members of the Location Management.

The JIG Variance Approval Certificate (see Appendix A2) shall be used as described below for approval by Location Management and review and approval by the Technical Authority. Copies of the form are available to download from www.jigonline.com

1) A Variance Approval Certificate shall be prepared and approved by the Location Management.
2) The Location Manager then circulates the Variance Approval Certificate to the location Technical Authorities for review and approval.
3) The Technical Authorities then respond to the Location Manager indicating approval of the Variance or requesting clarification or amendment of the Variance Approval Certificate.
4) Following the successful review and approval of a Variance Approval Certificate the Location Manager provides the Location Management and any users of the facility with a copy of the Variance Approval Certificate.

It is the responsibility of the Location Manager to inform the Location Management when variances have been closed out and to re-submit variances for a three-yearly review.

It is the responsibility of the Location Management to ensure that all users of the facility are aware of all approved variances.

Variance Approval Certificates

Variance Approval Certificates shall include a description of additional actions taken to mitigate the risk and detail the rectification action(s) that will be taken to close out the variance.

Variance Approval Certificates are not permanent or evergreen and shall show target dates for each rectification action and a target completion date based on the time required for compliance. They shall be reviewed annually by the Location Management and at least every three years by the Technical Authority.

Variance Approval Certificates shall be available for review during inspections. Any variation from JIG Standards noted during an inspection, but not documented by a Variance Approval Certificate, may be the subject of a recommendation by the inspector. The recommendation will either be to comply with the JIG Standard, or, if there is a reason why this is not feasible, to prepare a Variance Approval Certificate for review and approval.

Chapter 2

Sampling and testing

2.1 General

At appropriate stages during the handling and storage of aviation fuels, samples will be required for laboratory or visual examination to establish that products meet the requirements of the relevant specification, or to detect contamination or deterioration.

2.2 Sampling

Sampling shall be undertaken by competent, trained personnel using correct procedures and apparatus. This is to ensure that the sample obtained is truly representative of the material from which it has been drawn.

If an employee cannot correctly identify the colour of aviation fuel and its related identification colour code because of colour blindness, they shall not be engaged in aviation fuel operations.

Sampling shall be in accordance with the latest requirements of the following procedures or other approved standard or equivalent:

(a) ISO 3170 (IP Petroleum Measurement Manual, Part VI, Sampling Section 1, Manual Methods.)

(b) ASTM International Standard Practice for Manual Sampling of Petroleum and Petroleum Products. (D4057).

For detailed sampling procedures, not covered here, reference should be made to the above publications.

Sampling equipment fabricated from copper or its alloys shall not be used for sampling Jet fuels. Refer to ASTM D4306 for suitable materials.

2.2.1 Basic requirements

(a) Samples shall be drawn from a gauge hatch or other suitable opening giving direct and unrestricted access to the bulk of the liquid.

(b) Containers shall be as specified in Section 2.2.3, "Sample containers".

(c) Before sampling, the apparatus and the container shall be flushed and rinsed thoroughly at least three times with the product to be sampled and allowed to drain before use.

(d) No sample container shall be completely filled with liquid. Approximately 5% ullage shall always be left to allow for expansion.

(e) Containers shall be sealed and labelled immediately after filling. The label attached to the sealed container should bear the following relevant information where applicable:

- Sample no.:
- Date and time:
- Taken by:
- Place:
- Type of sample:
- Tank no./vehicle compartment no./or location:
- Batch no.:
- Grade or specification:

- Test required/performed:
- Airline:
- Aircraft registration:
- Inspector/sampler mark:

(f) Records shall be maintained of all samples taken.

(g) If samples are required by a customer or other authorised party, a duplicate shall be taken and retained until clearance is obtained.

2.2.2 Sampling terminology

Upper Sample

A sample obtained from the middle depth of the upper third of the tank contents.

Middle Sample

A sample obtained from the middle depth of the tank contents.

Lower Sample

A sample obtained from the middle depth of the lower third of the tank contents.

Single-tank Composite Sample

A sample obtained by blending Upper, Middle and Lower samples. For a vertical tank of uniform cross-section, the blend consists of equal parts of the three samples.

Multiple-tank Composite (MTC) Sample (ships and barges)

This is a mixture of individual composite samples from several compartments, each of which contains the same grade of product. The mixture is blended in proportion to the volume of material in each compartment. It is permissible to combine up to seven compartment samples into a single MTC.

Bottom Sample

A sample obtained from the material on the bottom surface of the tank or container at its lowest point.

Drain Line Sample

A sample obtained from the water draw-off or drain point of a storage or vehicle tank or filter body.

Line Sample

A sample obtained from a line sampling point, drawn while the product is flowing.

Hose-End Sample

A sample obtained from a fueller or hydrant servicer delivery hose-end coupling or nozzle.

2.2.3 Sample containers

(a) Laboratory sample containers

Glass or metal, or specially approved plastic containers for laboratory testing or for retention samples shall be new or provided by the laboratory in a clean condition (see ASTM D 4306 for suitable containers).

Metal containers shall be of an approved design, preferably internally lined with a suitable epoxy coating. Plastic containers may be used only after

examples of the constructional material have been checked for compatibility with the product(s) to be stored, and have been approved for use by the company.

Containers, even when new, should be carefully rinsed at least three times with the product to be sampled; this is critical for a number of properties being tested, particularly in the case of Microseparometer (MSEP) testing.

(b) Field sampling containers

Clear, clean glass jars of at least 1 litre capacity with wide necks and screw caps or closed sampling clear glass containers or "visijars" shall be used for product examination in connection with the Appearance Check and Visual Check procedures.

Buckets used for flushing shall be manufactured from good quality stainless steel or lined with white enamel. The enamel lining shall be no thicker than 2mm (0.08") to allow static charges to dissipate. Buckets shall be equipped with an effective bonding cable and clip.

(c) Packaging for air transport

Containers for the transportation of samples by air shall be of an International Civil Aviation Organisation (ICAO) approved design and shall be dispatched in accordance with the latest edition of the "ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air" and "IATA Dangerous Goods Regulations".

2.3 Sample testing

2.3.1 General

Testing shall be accomplished in accordance with the latest requirements of the following approved standards or equivalent:

(a) IP Standard Methods for Analysis and Testing of Petroleum and Related Products.

(b) ASTM Standards.

The laboratory analyses of aviation fuel shall be carried out only by the company's own approved laboratories, or by an approved third party laboratory. The approved laboratory shall participate in a recognised Aviation Fuel Cross Check Programme to assure the quality of its testing work. See EI/JIG 1530 Standard for more guidance on laboratories.

2.3.2 Definitions

(a) Refinery Certificate of Quality

The Refinery Certificate of Quality is the definitive original document describing the quality of an aviation product. It contains the results of measurements, made by the product originator's laboratory, of all the properties listed in the relevant fuel specification and, for Jet A-1, the requirements of the latest issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List. It also provides information about the addition of additives, including both type and amount of any such additives. In addition, it includes details relating to the identity of the originating refinery and traceability of the product described.

Refinery Certificates of Quality shall always be dated and signed by an authorised signatory.

(b) Certificate of Analysis

A Certificate of Analysis is issued by independent inspectors and/or laboratories and contains the results of measurements made of all the properties included in the relevant fuel specification and, for Jet A-1, the requirements of the latest issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List. It cannot, however, include details of the additives added previously. It shall include details relating to the identity of the originating refinery and to the traceability of the product described. It shall be dated and signed by an authorised signatory.

Note 1: A Certificate of Analysis shall not be treated as a Refinery Certificate of Quality.

Note 2: For blends using synthetic components meeting the requirements of Annex A1 or Annex A2 of ASTM D 7566, refer to Annex D3 and Annex J of Defence Standard 91-91. The Certificate of Analysis shall document the percentage of the synthetic component.

(c) Recertification Test Certificate

This document contains the results of the Recertification Test (see 2.3.4 (b) below) and confirms that the product is satisfactory. It shall be dated and signed by an authorised signatory.

(d) Periodic Test Certificate

This document contains the results of the Periodic Test (see 2.3.4 (c) below) and confirms that the product is satisfactory. It shall be dated and signed by an authorised signatory.

(e) Release Certificate

This document supports any transfer of product, confirming compliance with the relevant fuel specification and, for Jet A-1, the requirements of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List and contains at least the following information:

- date and time of loading or transfer
- grade of fuel
- batch number and batch density (at 15°C) of the product in the tank from which it originated
- "Water Free" certification.

If required by the company, the density and the temperature of the product after loading should also be recorded.

The Release Certificate shall be dated and signed by an authorised signatory.

2.3.3 Test requirements

Where product can be positively identified by documentary evidence as belonging to a particular batch, covered by a related Refinery Certificate of Quality, then it is only necessary to conduct such additional tests as are required to prove that product quality has not changed.

The results of such tests shall be compared with the results of the last tests, as well as reviewed for compliance with specification. If any test results indicate that the sample does not comply with the applicable specification, or that contamination has occurred, the product shall be immediately quarantined and remain under quarantine until further testing has established that the quality is in compliance with the fuel specification and approved by the company.

2.3.4 Testing terminology

(Refer to section 5.3 for test requirements at airport depots.)

(a) Certificate of Analysis testing

This test covers all tests required by the relevant fuel specification and, for Jet A-1, the latest issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List.

Unless FAME (Fatty Acid Methyl Ester) can be controlled to limit the exposure in Jet Fuel to less than 5 mg/kg in accordance with JIG Bulletin 75, then in markets and supply chains where FAME is present in multiproduct systems, FAME concentration shall be tested by an approved method, wherever Jet fuel has been transported in multi-product transport systems that also carry gas oil / diesel fuel or non-dedicated storage that may have contained gas oil / diesel fuel.

Sample quantity required:

Jet A-1	2 litres minimum
Aviation gasoline (Avgas)	25 litres

An approved sample container as specified in 2.2.3 shall be used.

(b) Recertification Test

This test is carried out to verify that the quality of the aviation fuel concerned has not changed and remains within the specification limits after transportation in ocean tankers or multi-product pipelines, etc.

The results of all Recertification Tests shall be checked to confirm that:

- the specification limits are met.
- no significant changes have occurred in any of the properties.

This check should be made by comparing the recertification results with the corresponding values shown on the last previous analysis made on the fuel (e.g. with a Refinery Certificate of Quality or previous Certificate of Analysis or previous Recertification Test Certificate). It is important to check that the determined properties have not changed. It is the only way to be reasonably sure that the remaining unchecked specification properties have also not changed significantly and remain satisfactory.

The check shall be carried out by recording all relevant details on forms of the type shown in Appendix A11/A12. Acceptable differences are given on the forms. If one or more of the results exceeds these values then the product shall not be released until an adequate explanation is found, or until it is confirmed that the product meets the remaining unchecked specification properties.

There may be occasions where contamination significantly affects more than one of these results, but the differences remain within the acceptable limits.

Detailed advice on how to identify and deal with such instances should be provided for inclusion in the relevant operating manual.

In circumstances where more than one new batch is received into a tank:

- Where facilities and circumstances permit, the tank contents should be circulated to ensure the homogeneity of the product before sampling.
- Additional columns shall be introduced on the recertification forms so that a separate column is used for each batch and for any stock that was in the tank.
- The comparison shall be based on calculated values, taking into account the amount of each batch in the tank.
- If more than 3 new batches are received into a tank the comparison becomes meaningless due to accumulative error, and a Certificate of Analysis test shall be performed on a representative tank sample.

Test requirements are set out in the table below:

	Jet A-1	**Avgas**
Appearance/colour	X	X
Saybolt colour	X	–
Distillation	X	X
Flash point	X	–
Density @ 15°C	X	X
Reid vapour pressure	–	X
Freezing point	X	–
Corrosion (copper)	X	X
Existent gum	X	X
Lead content	(1)	X
Knock rating (motor method) lean	–	X
Conductivity and temperature	(2)	–
MSEP	X	–
Thermal stability (JFTOT)	(3)	–
FAME	(4)	–

Sample quantity required:

Jet A-1: 2 litres minimum
Avgas: 4 litres

An approved container as in sub-section 2.2.3 shall be used.

(1) If contamination with leaded fuel is possible.

(2) To be carried out on bulk stock in storage, or immediately after taking a sample from bulk storage.

(3) Where, contrary to recommended practice, Jet A-1 is received from ships equipped with copper pipework in their cargo tanks, this test shall be performed.

(4) Unless FAME (Fatty Acid Methyl Ester) can be controlled to limit the exposure in Jet Fuel to less than 5 mg/kg in accordance with JIG Bulletin 75, then in markets and supply chains where FAME is present in multiproduct systems, FAME concentration shall be tested by an

approved method, wherever Jet fuel has been transported in multi-product transport systems that also carry gas oil / diesel fuel or non-dedicated storage that may have contained gas oil / diesel fuel.

(c) Periodic Test

This test is carried out to certify that product which has been static in storage for more than 6 months conforms to the relevant specifications and that the quality of the product has not changed since the last tests were carried out.

Samples for periodic tests should be taken from each tank which has contained product and which has had no product receipts for 6 months. Samples should also be taken from each tank in which less than half of the product has been replaced during the 6-month period.

The results of all periodic tests should be checked carefully against previous analysis reports to confirm that no significant changes have occurred, taking note of the comments under item 2.3.4 (b) above in respect of recertification tests.

Test requirements are shown in the table below.

	Jet A-1	Avgas
Appearance/colour	X	X
Saybolt colour	X	–
Distillation	X	X
Flash point	X	–
Density @ 15°C	X	X
Reid vapour pressure	–	X
Corrosion (copper)	X	X
Existent gum	X	X
Lead content	–	X
Knock rating (motor method) lean	–	X
Conductivity and temperature	(1)	–
MSEP	X	–
Thermal stability (JFTOT)	X	–

Sample quantity required:

Jet A-1: 2 litres minimum
Avgas: 4 litres

An approved container as specified in sub-section 2.2.3 shall be used.

(1) To be carried out on bulk stock in storage or immediately after taking a sample from bulk storage.

(d) Appearance Check (Clear and Bright)

This check is a field test to confirm that aviation fuel meets the appearance requirement of the specification.

Aviation fuel shall be of the correct colour and be visually clear, bright and free from solid matter and undissolved water at normal ambient temperature.

Samples for Appearance Check shall be drawn into scrupulously clean, clear glass jars or "visijars" (see 2.2.3 (b), Field sampling containers).

Test requirements are shown in the table below.

	Jet fuel	Avgas
Appearance/colour	X	X
Particulate contaminant (visual)	X	X
Water – visual	X	X

Sample quantity required: 1 litre after flushing sampling line.

The following should serve as a guide to the Appearance Check of fuel samples:

- Colour. The various grades of Avgas are dyed to aid recognition while the colour of aviation Jet fuels may vary, usually in the range from water white to straw colour.
- Undissolved water (free water) will appear as droplets on the sides, or as bulk water on the bottom of the sample jar. In Jet fuel it can also appear as a cloud or haze (suspended water).
- Solid matter (particulate matter), generally consisting of small amounts of rust, sand, dust, scale etc., suspended in the fuel or settled out on the bottom of the jar.
- The terms "Clear" and "Bright" are independent of the natural colour of fuel. "Clear" refers to the absence of sediment or emulsion. "Bright" refers to the sparkling appearance of fuel having no cloud or haze.

If any water/dirt is observed, the sampling procedure shall be repeated until a clear and bright sample is obtained.

(e) Visual Check

A Visual Check is an Appearance Check for Jet fuel with the addition of a chemical water check (see 2.3.4 (j)). Use an IATA recommended chemical water detector.

Samples for a Visual Check shall be drawn into scrupulously clean, clear glass jars or "visijars" (see 2.2.3 (b), Field sampling containers).

(f) Control Check

This is an Appearance Check plus a fuel density determination. This check is frequently made to confirm the correct grade and unchanged quality of fuel stocks by comparison of the result with the value shown on the documentation. If these two figures (corrected to standard temperature conditions) differ by more than 3.0 kg/m^3, contamination should be suspected and the matter shall be investigated before the aviation fuel is accepted for use.

(g) Membrane filtration test

This test shall be carried out and evaluated in accordance with joint ASTM D2276/IP216 Standard Test Methods and Colour Standards incorporated in these methods. Colour shall be recorded on a wet and dry basis.

Double (matched weight or preweighed) 0.8 micron membranes are used for gravimetric tests. Colorimetric tests are normally performed with a single membrane, but double (unweighed) colorimetric membranes may also be used in certain circumstances, as described in Appendix A6.7. The quantity of fuel passed through the membranes used in both colour and gravimetric determinations shall be 5 litres.

(h) Conductivity Test

This test shall be carried out in accordance with ASTM D2624 or IP274 procedures, using an approved conductivity meter.

(i) Tests for microbiological growth

The fundamental method for assessing the presence of microbiological growth in storage tanks and filters is the daily clear and bright test on a sump sample. Presence of discoloured water (brown or black), a lacy interface between the fuel and water layers or organic debris in the fuel or water layer are all indications of likely microbiological activity requiring immediate further investigation and appropriate expert advice.

The investigation shall include an assay test for microbiological activity carried out on drain line samples of Jet fuel using a recommended test kit (see IATA recommended list) and checking filter membrane colour test history for any rising trend. Internal inspection and investigation of filter vessels may also be required.

Warning and Action (quarantine) limits should be defined with reference to the IATA Guidance Material on "Microbiological Contamination in Aircraft Fuel Tanks" and following advice from appropriate experts in the use of field testing kits and the interpretation of results.

Guidance on appropriate sampling and monitoring strategies for control of microbial contamination throughout the aviation fuel supply chain up to point of delivery to aircraft is available in the JIG Information Document – Microbial Monitoring Strategies, available on the JIG Website.

(j) Principle of application of chemical water detectors

The primary field check for suitability of aviation fuel is the Appearance Check. This may be confirmed by the use of a chemical water detector test for Jet fuel to indicate the presence of free water in the sample. The application of the chemical water detector test is mandatory for samples that can be considered representative of into-plane fuel quality, although it may also be used in other sampling applications where it is considered appropriate to have a verification of free water status. (See 2.3.4 (e) for permitted chemical water detectors.)

(k) Table of minimum test requirements

The following table summarises the minimum test requirements for all airport operations.

Operation	**Control Check** [1]	**Visual Check (chemical water detector required)**	**Appearance Check[1]**
Receipts by pipeline, (dedicated or multi-product) barge/coastal vessels before and during discharge	**X**		
Receipts by rail or road tank car	**X**		
Receipt tank sample for recertification			**X**
Airport storage tank sump drain before release for service	**X**	**X**	
In service airport storage tanks sump drain – daily		**X**	
Airport storage tanks sump drain not in service (settling or awaiting release)			**X**
Airport fixed filter vessel sumps (receipt) and strainers			**X**
Airport hydrant filter, loading filter and vehicle filter sumps – daily		**X**	
Fueller drain points – routine off-ramp (fueller tank draining after filling)		**X**	
Sampling during fuelling and defueling		**X** [2]	
Hydrant low point servicing vehicle tank sump flushing before use and after use – daily		**X**	
Hydrant low point flushing – each low point line sample		**X**	

[1] A chemical water detector test may also be performed to provide verification of free water status.

[2] Requirement for hydrant servicer fuelling samples is detailed in JIG 1 5.3.2. A chemical water detector test shall be performed on at least one of the samples taken during fuelling.

Chapter 3

Depot facilities – design features

3.1 General

Observance of certain fundamental practices in the design of airport depot and hydrant facilities is considered essential to ensure that product quality is maintained and safety and environmental requirements are met. A summary of the required routine test frequencies is included as Appendix A1.

3.1.1 Any new installation, or alteration or extension of the existing facilities, shall be approved by the company at that facility. Commissioning procedures shall be in accordance with recognised industry standards. For recommended soak test requirements, refer to Appendix A5.

3.1.2 Instructions for performing the product receipt and delivery/filling operations shall be clearly displayed for reference by the persons operating the equipment.

3.1.3 All facilities used for handling aviation fuels shall be fully grade-segregated.

3.1.4 No copper or cadmium alloys, cadmium plating, galvanised steel or plastic materials shall be permitted for piping, nor shall zinc-rich internal coatings be used for piping or tankage.

3.1.5 Pump start/stop switches at product receipt and fueller loading areas and depot emergency shut-down buttons shall be safely accessible and clearly identified.

3.1.6 Fuelling vehicle parking, road/rail discharge and fueller loading areas shall be constructed of a low-permeability material. The surface areas shall have a positive slope and drainage to an oil/water interceptor.

3.1.7 Tank bunds shall meet the requirements of local legislation and have a capacity of at least 110% of the storage capacity of the largest tank contained within a bund wall. Containment is normally provided by a bund, however if local legislation permits the second skin of a double skin tank to qualify as secondary containment then this is acceptable provided that:

- Vertical 'catchpot' tanks (typical German design) have a double bottom on the primary containment.
- Tank overfill containment is provided (the volume and extent of overfill containment shall be assessed against the environmental risk, but will typically be based on flow rate and time).
- Horizontal double-skinned tanks have all pipework entries above the maximum liquid level, but discharge shall be at low level inside the tank.
- The second skin containment volume meets national regulations (the 110% rule may not apply).

Semi-buried or buried tanks may not require a bund; however, the overfill containment shall be provided as above.

3.2 Tankage

3.2.1 The number and size of tanks should be sufficient to provide adequate working capacity, taking into account peak period airport requirements, supply replenishment arrangements and emergency stock coverage. Allowance should also be made for settling, testing and tank cleaning requirements.

3.2.2 Each grade of aviation fuel shall be stored in a dedicated and segregated tank.

Aviation fuels shall be stored in suitably bunded (see 3.1.7) horizontal or fixed roof vertical tanks (or fixed roof vertical tanks with an internal floating roof/cover if required by local legislation). Tank top walkways shall have non-slip surfaces, handrails and kick plates. Tanks shall be constructed and installed to avoid ingress of water and dirt, and to provide a positive low point to collect water and sediment for ease of removal. To achieve this, horizontal tanks shall be installed with a continuous slope of 1:50 minimum, and vertical tanks shall have a cone-down bottom with a continuous slope of 1:30 minimum to a centre sump.

3.2.3 Tanks shall be fitted with:

(a) Pressure/vacuum relief valves for above-ground tanks storing Avgas. Free vent devices may be used for buried Avgas tanks and should be specified for Jet fuel storage unless high ambient temperatures require additional safeguards. Screens to prevent the ingress of foreign bodies shall have a coarse mesh with approximately 5mm (0.2 inch) holes. Note: local legislation may also require the use of flame arrestors.

(b) A low point sump with a drain line and suitable valve for the draining of water and sediment. The drain line should be of non-rusting material, selected to avoid galvanic action created by dissimilar metals (for example between stainless steel and mild steel), of approximately 50mm diameter fitted with an in-line sampling valve. In the case of above-ground vertical tanks, the drain line should lead to a large capacity stainless steel, or internally lined mild steel sample receiving vessel, provided with:

- a self-closing (spring-loaded or equivalent) quick-acting valve at entry and any sampling point upstream
- a cone-down bottom with drain valve
- a suitable motor-driven product return system; and
- at least 200 litre capacity.

There will be instances where the receiving vessel will need to be significantly larger, depending on, for example, the storage tank size or mode of delivery of product to the storage tank. The design shall ensure that it is not possible for water to accumulate in the drain lines (where it could freeze and prevent draining in cold weather conditions). Other tanks should be cleared by gravity draining or by a thief suction pump. In the case of large underground tanks, an electric drain pump is desirable, to enable water or sediment to be removed by rapid withdrawal of a large sump sample.

Provision shall be made for taking a line sample from the tank drain line between the tank and the sample-receiving vessel during flow. The self-closing valve at entry to the sample-receiving vessel and the valve used for taking a line sample should be simultaneously accessible to allow for one-man operation. An example of a suitable design is shown in Appendix A10. The line sample may be taken into an open container (glass jar) or a suitable glass closed system.

(c) Separate product inlet and outlet connections. Inlet pipes should discharge near the bottom of the tank and be designed to minimise splash filling. In the case of horizontal tanks, the inlet pipe should be at the high end, directing flow towards the low end sump.

(d) Manholes to facilitate entry for gas freeing and cleaning.

(e) Gauge hatches to provide means of sampling and tank dipping.

(f) Floating suction arms, bonded to the tank shell, with position indicators and/or check cables, also bonded to the tank shell, shall be installed in Jet fuel tanks. Floating suctions are also recommended for Avgas. For effective bonding of check cables they shall be installed with permanent metal-to-metal contact with the tank shell. Position indicators should be used for large above-ground vertical tanks.

Note: Where legislation requires the installation of internal floating roofs/covers it is critical to ensure that the floating suction will not interfere with the operation of the floating cover.

(g) All main storage tanks shall be completely coated internally with a light coloured epoxy material, approved as being compatible with aviation fuels. This shall include the underside of the roof.

(h) Tanks shall be prominently numbered and marked with grade stored (EI 1542 designation) and, as a minimum, show the date of the most recent internal inspection and cleaning.

(i) All storage tanks (and product recovery tanks above 1,000 litres) shall be fitted with high-level alarm systems and the systems shall be routinely tested (see 6.1.4). Low-level alarm systems should also be considered for storage tanks, especially for hydrant locations where pump cavitation has to be avoided.

Product recovery tanks (PRTs) shall have a sloped bottom (minimum 1:30 for new builds) to a sump located in the lowest point of the tank with a drain line to enable water to be removed. The tank shall be constructed of stainless steel or mild steel internally lined with a light coloured epoxy lining. PRTs shall have a means of access for visual inspection and cleaning and shall be designed to avoid the ingress of water and contaminants with all tank opening and vents being located above ground. PRTs shall be identified as product recovery tanks intended for aviation use, with the grade of aviation fuel also identified on the tank together with an indication of the tank sump drain piping volume.

(j) Small product recovery tanks (PRTs) of less than 1000 litres capacity and all tankside quick flush tanks (QFTs) shall either be fitted with spring loaded self-closing inlet valves or high-level alarm system(s). Where fitted, high level alarm systems shall be tested as per (i) above.

(k) Any tank incorporating a system design that allows automatic and/or uncontrolled receipt of product e.g. from thermal relief/pressure relief/air eliminator systems shall be risk assessed to ensure an adequate level of control is in place to prevent overfill.

(l) At locations supplied by vessel or pipeline or by multiple simultaneous discharge of road tankers or rail tank cars, storage tanks shall be fitted with a high level audible alarm and a separate "high-high" level system that shuts down the fuel flow when a predetermined level of fuel in the tank is reached.

For locations supplied by single discharge of road tanker or rail tank car an audible high level alarm or a single shut down device is the minimum requirement.

A suitable record for tank details is included as Appendix A8.

3.3 Pipework

3.3.1 Each grade of aviation fuel shall be handled in a completely separated system. There shall be no interconnecting lines between pipelines that handle different products.

For dedicated systems, single valve separation is acceptable. However, pipelines handling product that has been received via non-dedicated systems shall be physically and positively segregated using one of the following methods:

- a double block and bleed (DBB) valve arrangement. This can be either a single DBB valve with two independent seals and a cavity between them or two valves with a drain arrangement in a pipe spool between them (when the valves are in a closed position the cavity or drain spool shall be checked to confirm no product is passing, see 6.1.8)
- a removable distance (spool) piece
- a spectacle blind or equivalent.

3.3.2 Deadlegs in pipework should be removed, but where present they should be equipped with a drain point and drained quarterly. All hydrant lines, and other long pipelines, shall incorporate low points to facilitate the removal of water and sediment.

3.3.3 All new hydrant lines shall be lined internally with an epoxy material, approved as being compatible with aviation fuels.

3.3.4 All pipework receipt and loading facilities shall be clearly marked in accordance with EI 1542 product name and colour coding, and with flow direction arrows.

3.3.5 Road bridger and railcar receipt connections should be fitted with couplings of a size and type chosen to give the maximum practical degree of grade security.

3.3.6 Grade selective couplings shall be fitted to fueller bottom loading connections and to hydrant pit valves where more than one fuel is handled.

3.3.7 Wherever possible, all newly installed pipelines shall be routed above ground. Where new buried pipelines are unavoidable they shall be located in sleeves, trenches or sand-filled culverts and cathodically protected where appropriate. All buried pipelines shall be pressure tested in accordance with the requirements of 8.7.2.

3.4 Filtration

3.4.1 Receipt and loading systems shall have separate filter vessels. The following shall be provided at inlets to storage and on fueller loading racks and hydrant delivery lines:

For Jet fuel

- Filter separators qualified to EI 1581 by test or similarity (EI 1582).
- All new filter vessels shall meet the requirements of EI 1596.
- For existing vessels, conversions shall meet, by test or similarity (EI 1582), the latest edition of EI 1581 requirements.
- A pre-(micro)filter meeting EI 1590 may be installed upstream to remove solids and extend the service life of coalescer elements installed in filter separators.

For Avgas

- A 5-micron (nominal) or finer microfilter meeting EI 1590, or a filter water separator. Where receipts are by gravity into underground tankage a 100 mesh strainer is required.

General

At certain locations, filter monitors meeting the performance requirements of EI 1583 may be considered as an alternative to filter separators, provided that the engineering implications and manufacturer's recommended maximum service life for elements have been fully considered.

Where it is required to supply Jet fuel containing Fuel System Icing Inhibitor (FSII) filter separators shall be used and fitted with the correct class of EI 1581 latest edition elements (suitable for use in Jet fuel blended with FSII). However, the injection of the additive (DiEGME) downstream of fuelling equipment filtration is the preferred method of supplying FSII-treated Jet fuel to aircraft. Filter monitors shall not be used with Jet fuel containing FSII.

3.4.2 All filtration and water separation equipment shall be maintained and checked regularly as detailed in Appendix A6. A suitable record for filtration details is included as Appendix A7.

3.4.3 Jet fuel shall contain static dissipator additive to reduce static electricity hazards. If in an emergency Jet fuel without static dissipator additive has to be received into airport tanks, either adequate relaxation time (30 seconds minimum) shall be provided between the filter and the inlet to the storage tank or reduced (50%) loading/filling rates shall be observed.

3.5 Hydrant systems and pit valves

3.5.1 All 4" hydrant pit valves shall be qualified to EI 1584. EI 1584 Third Edition break-away type hydrant pit couplers shall not be used in conjunction with pit protection barriers (for example "igloos") that may interfere with this characteristic. If a break-away type hydrant pit coupler is used in conjunction with a rigid pantograph piping assembly or a coupler lift assist device (CLAD) then this should be in accordance with the coupler manufacturer's advice.

The condition and integrity of all hydrant valves shall be tested in accordance with the procedure in Appendix A14.

3.5.2 All new hydrant systems shall be equipped with dual air lanyard pilots. A dual air lanyard system should be fitted to all existing hydrant systems where possible.

3.5.3 All hydrant systems shall be provided with equipment that allows the fuel flow to be shut down quickly in an emergency. The preferred hard-wired fixed system consists of Emergency Stop Buttons which, when activated, shut down the hydrant pumps (and valves where the pressure head results in continued fuel flow with pumps shut down).

Emergency Stop Buttons (ESBs) shall be located close (within 80 metres) to each fuelling bay and should also be located close to low point flushing valves. They shall be clearly identified and easily accessible. High visibility identification signs should be located such that they remain visible at all times.

Note: At some airports the hydrant emergency stop system is controlled by stop buttons located on the fuelling vehicle or carried by the fuelling operator. These

systems shall be clearly identified and tested in accordance with section 8.4.

3.5.4 All hydrant pit covers shall be tethered or permanently connected to pits.

3.5.5 Hydrant pits shall be clearly identified and, where more than one grade of fuel is available, grade marked. The area around hydrant pit covers should be painted with a warning pattern to ensure apron vehicles or aircraft avoid driving over or parking on them. All hydrant low point drains shall be clearly identified.

3.5.6 All new hydrant systems shall incorporate a means of testing and proving the integrity of the system. Further information concerning pressure testing and tightness integrity (leak detection) is contained in EI 1540 Recommended Practice, Design, Construction, Commissioning, Maintenance and Testing of Aviation Fuel Facilities (sections 5.3.4, 5.3.5 and Annex E).

3.5.7 Cathodic protection should be installed for all new hydrant systems. Refer to EI 1540.

3.6 Hydrant and transfer pump facilities

3.6.1 Hydrant pump process management (sequencing/use) should be controlled by a Programmable Logic Controller.

3.6.2 Hydrant and other remotely operated pumps should be protected against overheating (e.g. no/low flow or temperature shutdown). To determine if retrospective action is required a risk assessment should be carried out (note that flow related shutdown prevents a high temperature from occurring). Other protection measures may include instrumentation linked to alarms or automatic shutdown (e.g. vibration sensors, suction and discharge pressures). All new hydrant and other remotely operated pumps shall have no/low flow and high temperature instrumentation initiating an automatic pump shutdown. Actions as a result of an alarm or automatic shutdown shall be defined in design documentation. Note that temperature related shutdown for pump motors is a separate issue and that instrumentation may not be required for air operated diaphragm pumps.

3.6.3 Pumps should be located in a containment area fitted with a suitable liquid hydrocarbon detector alarm system that should be checked at least annually.

3.6.4 Suitable configuration of firefighting equipment shall be defined by a risk assessment.

3.7 Test facilities for fuelling vehicles

A test facility capable of simulating both gradual and rapid termination of fuel flow into aircraft shall be available. The facility should be capable of accepting simultaneous full flow deliveries from all combinations of deck and/or reel hoses likely to be used.

An example of a suitable test rig is shown at Appendix A15.

All pipework, fittings and filter membrane test points should be stainless steel, aluminium or epoxy lined mild steel.

Test rig pressure gauges should have a range of 0–10.5 bar (0–150 psi) and be clearly visible from the rig valves. 10-12 cm (4–5 inch) diameter faces should be specified for ease of reading. Digital pressure gauges or Bourdon gauges filled with glycerine/silicone fluid shall be used.

3.8 Electromagnetic radiation hazards

Potential ignition hazards to petroleum storage, dispensing, or handling facilities may be created by emissions from electromagnetic devices such as radio and radar. Beam/ signal strength has been known to cause ignition of flammable vapour-air mixtures from inductive electrical heating of solid materials or from electric arcs or sparks from chance resonant connections. For additional information refer to MIL-STD-461 and NFPA 407. The following guidance should be followed.

- Locate the radio transmitting antennas as far as practically possible from the fuel storage or transfer areas.
- Do not locate fuel storage or transfer facilities closer than 90 metres (300 feet) from aircraft warning antennas.
- Do not locate fuel storage or transfer facilities closer than 150 metres (500 feet) from airport ground approach and control equipment.
- Do not locate fuel storage or transfer facilities closer than 90 metres (300 feet) from areas where airborne surveillance radar may be operated.
- Do not locate fuel storage or transfer facilities closer than 30 metres (100 feet) from airport surface detection radar equipment.

Chapter 4

Receipt procedures

4.1 Documentation

4.1.1 Any transfer of product to an airport depot shall be supported by a Release Certificate, before receiving the incoming product.

At the airport, a record shall be maintained of the Release Certificate and batch number, quantity and receiving tank(s), together with the results of all tests carried out.

4.1.2 Where applicable, each batch shall be accompanied by a Refinery Certificate of Quality and a Certificate of Analysis if relevant. These documents shall show fuel grade and confirm that the batch conforms to the relevant specification or the latest issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List. Where applicable a Recertification Test Certificate shall also accompany each delivery, proving that the product quality has not changed in transit. All of these documents shall be readily available at the airport depot.

Batch number, density and other relevant information may be communicated by fax, email or other devices pending mailing of the Refinery Certificate of Quality.

The following deviation from the above would be acceptable subject to agreement by the technical authorities of the location management:

(a) Refinery Certificate of Quality is not required to be available at the airport depot, but shall be available at the supplying location. It is the airport depot manager's responsibility to ensure that these certificates are available.

(b) Where a large number of different batches is involved, Refinery Certificates of Quality may not be appropriate, in which case a Certificate of Analysis is required. However, the Refinery Certificates of Quality shall be available at the supplying location.

At locations where either (a) or (b) is applicable an example of a recent Refinery Certificate of Quality from each supplying refinery should be available at the airport depot.

4.1.3 For fungible pipeline systems (ie. pipeline systems with multiple input and delivery points where fuel to the same specification is interchangeable) it may not be possible, for each batch delivered ex-pipeline, to provide a Certificate of Analysis that identifies the originating refinery (see 2.3.2(b)). However, even in this situation, the pipeline operator shall have original Refinery Certificates of Quality and volume data for all batches entering the system so that the authenticity of all product can be assured.

4.2 Receipt – general

4.2.1 New airport depots shall only handle aviation fuels.

Fuel shall be received into fixed storage in accordance with the design requirements in Chapter 3. Each grade shall normally be received at the airport from segregated intermediate storage that has been recertified, via a dedicated pipeline or other fully dedicated means of transport. If this intermediate storage is located at the airport the procedures in 5.3.2 shall apply.

Subject to agreement of the technical authorities of the location management, in special circumstances, final airport storage may receive product from a non-dedicated pipeline. Approval will only be given if the final pipeline connection to the airport depot is dedicated to Jet fuel and is designed and operated to minimise the chance of contamination from the multi-product pipeline. In such circumstances the airport depot facilities shall include a slop tank, facilities for disposing of slops, and a tank(s), isolated by double block and bleed valves, for storing newly received product waiting for recertification. There shall be no means by which unrecertified product in the pipeline or reception tank(s) can be mixed with product that has been recertified. If this system is used, the procedures and requirements detailed in section 4.4 shall be applied at the airport depot.

4.2.2 Where an existing airport depot is fed by a multi-product pipeline or vessel:

(a) Aviation fuels shall only be received via white products cargo lines. Jet fuel should be received via lines reserved for middle distillates (kerosene, gasoil, automotive diesel, etc., but note FAME issues detailed in 2.3) and aviation gasolines via lines reserved for light distillates (gasolines, special solvents, etc.).

(b) Wherever possible, product-to-product pumping should be adopted, without the introduction of water to separate products or to clear lines handling aviation fuels. If lines handling aviation fuels have to be left full of water, it should not be sea water but should be fresh or suitably buffered (pH neutral) water.

(c) Aviation fuels should not be left in multi-product lines between receipts.

(d) When receiving multi-product cargoes the discharge sequence shall be arranged to minimise the effects of interface contamination of the aviation grades. Leading and trailing grade interfaces shall be diverted into non-aviation storage or slop tanks.

(e) One or more tanks shall be segregated for receipt of product, checked for water, and any water removed before receipt begins. More than one vessel may be discharged into the same tank.

4.2.3 If, during product receipt, the depot receipt filter differential pressure rises at a much faster rate than is typical for the location, or if excessive water or solids are suspected or observed in routine samples, a colorimetric filter membrane test should be conducted upstream of receipt filtration as a check on the quality of the incoming product. The result, if greater than either 6 (wet) or 5 (dry), should be used to initiate further investigations but shall not be used as the only reason for halting the transfer or rejecting the product. The investigation process should include some or all of the following steps:

(i) Perform a double membrane colorimetric test (see A6.7.2) upstream of receipt filtration to check for colour bodies. If the difference between the colour ratings of the two membranes is 3 (wet) or less then no further investigation is necessary.

If the difference exceeds 3 (wet):

(ii) Perform a gravimetric filter membrane test (see A6.7.3) upstream of receipt filtration to quantify the problem.

Gravimetric test results in excess of 1.0mg/litre obtained upstream of receipt filtration are considered excessive and will require discussions with the supplier.

4.3 Receipt from single grade pipeline

4.3.1 During receipt of the product, samples shall be drawn upstream of any receipt filtration from the pipeline of the receiving installation at the start, middle and end of the transfer, and at any change of batch. These samples shall be checked according to Control Check.

4.3.2 Automatic or continuous line monitoring systems (e.g. calibrated densitometers and turbidity analysers (or equivalent)) may be used as an alternative to the sampling requirements in 4.3.1.

4.3.3 If large amounts of water, solid contaminants or abnormal density are noted, the flow shall be stopped if possible, or diverted to a slop tank, and the pumping station of the pipeline notified. Delivery to the storage tank shall only be resumed after clearance has been given by the depot manager.

4.4 Receipt from multi-product pipeline

4.4.1 Procedures similar to 4.3.1 and 4.3.2 above shall be followed but with sampling frequency increased to 2 hours.

4.4.2 The most important quality protection measure in multi-product pipeline movements is the method of handling grade interface cuts. Care should be taken to ensure that the leading and trailing interfaces between the grades handled in the pipeline are directed into non-aviation storage.

4.4.3 To limit the degradation of Jet fuel due to interface commingling or pipeline pick-up, leading and trailing consignments should be one of the following products, listed in order of preference.

(a) light distillate feedstock (naphtha)

(b) middle distillate

(c) motor gasoline.

Note: Motor gasoline should be free of detergent type additives in pipelines handling Jet fuel grades.

4.4.4 There should be special receipt and testing procedures as described in section 5.3.2 (i.e., recertification shall be carried out before release of product (see 2.3.4 (b)).

4.4.5 Certain product additives are known to be harmful to aviation fuels because of their surface active properties. When products containing these additives precede aviation fuel pipeline consignments, there is a danger that the resultant pick-up can lead to quality problems.

Where harmful additives are known to be included in products intended for transportation within multi-product pipelines carrying aviation products, the carrier company should be requested to exclude the additives from the product entering the pipeline and injection should take place after the break-out points.

4.5 Receipt from coastal/inland waterway vessel

Aviation fuels should, whenever possible, be delivered to storage by dedicated vessels and be discharged through completely grade-segregated systems. See EI HM50 for more detail on cleaning of tanks and lines for marine tank vessels.

A dedicated vessel is one that transports exclusively one grade of product in all cargo compartments and which has transported the same grade during the previous three

journeys. A vessel that uses cargo tanks for ballast on return journeys, irrespective of the previous cargo carried, shall be treated as a non-dedicated vessel. A grade/product segregated system is a system where the pipelines and equipment used are exclusively reserved for the grade/product concerned. There shall be no interconnecting lines between receipt pipelines that handle different grades/ products.

Mixed cargoes including non-aviation products shall not be permitted on any vessel discharging directly into airport storage, unless facilities exist for discharge into special receipt tankage (see section 4.2.1 and 4.2.2.) followed by transfer by segregated lines to service tanks.

4.5.1 Procedures before discharge

(a) The vessel's papers shall be checked to ensure that all documents are readily available. Documents to be checked are:

(i) Release Certificate

(ii) Refinery Certificate of Quality and Certificate of Analysis if the cargo has been shipped from another terminal

(iii) Bill of Lading

(iv) ullage report

(v) Recertification Test results on the ship's loaded samples, if applicable (see EI/JIG Standard 1530 section 10.1.5), which may be transmitted to the receipt location by email or fax

(vi) inspector's (surveyor's) report from the load port

(vii) inventory of samples.

(b) A check shall be made to ascertain that all of the deck cargo accesses of the vessel are closed and secured.

(c) If the ullage in any compartment differs significantly (+/- 0.2%) from the loading figures shown on the ullage report, the ship's Master should be consulted; if no satisfactory explanation is obtained, the suspect compartment should not be discharged and the supplying company should be advised. Fuel in the suspect compartment may be unloaded only if the results of a Recertification Test carried out on a Composite Sample from the compartment are satisfactory.

(d) All vessel cargo tanks shall be checked for the presence of water, using a suitable water-finding paste. If significant levels of water are observed the ship's Master and the supplying company concerned shall be advised promptly. Contingency plans, agreed with supplying companies, shall be available to deal with this situation.

(e) A one-litre Middle Sample shall be taken from each compartment and checked according to the Control Check. If satisfactory results are obtained and the density is within 3.0 kg/m^3 of the results reported on the Release Certificate, the product can be accepted. For inland waterway vessels it is permissible to combine up to three compartments for the Control Check.

The conductivity of these samples should also be checked so that, if necessary, static dissipator additive can be added during discharge in a manner that ensures adequate mixing with the product (see section 4.8).

If the results of the Control Check are not satisfactory, the supplying company concerned shall be advised, a letter of protest should be served on the ship's Master, and the vessel shall not be discharged unless and until agreed by the company at the receiving location. Contingency plans, agreed with the supplying companies, shall be available to deal with this situation.

(f) An additional 5-litre multiple tank composite sample shall be prepared, using approved containers (see section 2.2.3 (a)) and sealed in the presence of the ship's Master or their representative. This sample need not be tested unless the quality of the consignment is subsequently questioned. It shall be retained at the installation until at least 2 days after complete exhaustion of the relevant batch(es).

4.5.2 Procedures during discharge

During receipt of the product, samples shall be drawn from the receipt pipeline at a point as close to the ship as possible for a Control Check. For dedicated vessels, line samples shall be drawn approximately 5 minutes after beginning and immediately before the end of the discharge. For receipt from non-dedicated vessels, samples should also be taken at least every 2 hours during discharge. Automatic or continuous line monitoring systems that include calibrated densitometers/ turbidity analysers (or equivalent) may be considered as equivalent to the above monitoring.

Any observed contamination should be reported immediately to the ship's Master or his representative. If gross amounts of water or dirt are observed the discharge should be stopped and the situation investigated. The supplying company concerned shall be advised promptly. Contingency plans, agreed with supplying companies, shall be available to deal with this situation.

4.5.3 Procedures after discharge

After discharge, the vessel compartments should be checked to ensure that they are empty.

4.6 Receipt from road or rail tank car

Road bridging vehicles and rail tank cars supplying airport depots should be dedicated to one grade of aviation product and be provided with couplings chosen to give the maximum practical degree of grade security. Where equipment is fitted with more than one size/design of discharge coupling, the unused one should be sealed or, preferably, removed. Adaptors that change the size/design of outlet couplings, when connected to vehicle or rail tank car outlets, should not be used.

Where it is necessary to switch vehicles or rail tank cars between grades, it is the responsibility of the fuel supplier to ensure that effective equipment cleaning and change of grade procedures (draining, flushing and testing as per Appendix A16) are followed and recorded and that equipment outlet couplings and grade markings are changed. The receipt location shall ensure that their suppliers provide documentation, including cleaning certification, for all grade changes.

The switching of road or rail tank cars between gas oil/diesel and aviation fuel is strongly discouraged. FAME (Fatty Acid Methyl Ester) concentration shall be tested by an approved method, wherever Jet fuel has been transported in non-dedicated vehicles that may have carried gas oil/ diesel fuel and the change of use procedure shall be validated to ensure that the permitted FAME level in Jet fuel has not been exceeded. Note that FAME may be present due to carryover or cross-contamination within the common unsegregated

distribution system for fuels. Therefore, the FAME level shall be checked following transportation and/or storage in multi-product distribution systems known to present a risk of FAME contamination (see Annex G of Defence Standard 91-91 for further guidance).

The receipt location shall be notified in advance of every change of service between diesel and aviation fuel.

Rail tank cars and road vehicle tanks shall be constructed of either aluminium alloy, stainless steel or mild steel coated internally with an industry approved lining material suitable for use with aviation fuels (EI 1541).

4.6.1 On arrival at the depot the vehicle or rail tank cars should be checked to ensure that the required seals (on manlids and on outlet and filling points) are intact and that the grade markings on the sides and at the outlets are correct. If it is necessary to work at height to carry out these checks, a risk assessment shall be carried out and appropriate measures put in place (such as fall protection equipment) to minimise risk. The documents shall correctly identify the equipment and the quantity and grade of product. A copy of the Release Certificate and, where equipment is not grade-dedicated, details of the previous load carried and the most recent change of grade procedure shall be available and be checked before receipt of the product.

4.6.2 Any trace of free settled water shall be drained off. If water or sediment are present in more than trace quantities, a settling time of 10 minutes shall be observed and a fresh sample drawn. If substantial quantities of water (more than 1 litre) are still present, the measures taken will have to be decided by the manager and the supply source concerned shall be notified. Reasons for rejection shall be entered on the vehicle Release Certificate.

4.6.3 Drain samples shall be drawn from each compartment and checked according to the Control Check. Up to three compartments on any one road or rail tank car may be combined for density determination after conducting the Appearance Check on each compartment sample. The corrected density shall agree within 3.0 kg/m^3 with the results of the batch density of the product in the tank from which the vehicle is loaded and reported on the Release Certificate. If the difference in corrected density exceeds 3.0 kg/m^3 the vehicle shall not be discharged unless a satisfactory explanation is obtained from the supplying location (for example density differences due to tank layering or a change of batch during loading) and confirmed in writing as soon as possible.

4.6.4 Where rail tank cars are not equipped with valves for draining the low points, alternative procedures and equipment should be used to ensure effective removal of free water and sediment and to provide samples for a Control Check.

4.6.5 After discharge the compartments shall be checked to ensure that they are empty. The preferred method is to check each compartment drain point for product.

4.7 Driver controlled deliveries

At some locations the offloading of road tank cars and the quality control checks before discharge may be performed by the delivery driver. However, driver controlled deliveries shall only be made where the vehicles are dedicated, bottom loaded, fitted with grade selective systems and following the agreement of the senior management of the company.

The company shall also introduce additional procedures and equipment to avoid the possibility of a spillage or of receiving contaminated product. The following controls are required:

- to ensure that the driver is in constant attendance, the normal journey time from the supplying location and the airport shall be less than 4 hours and the vehicle shall not be parked overnight
- the offloading facility shall be equipped with a deadman of a type that requires periodic action by the driver to maintain the flow; and
- receiving tanks shall be fitted with a high level alarm system that shuts down the fuel flow (see 3.2.3).

Electronic densitometers meeting IP 559 that convert density readings to density at standard temperature should be used because of their ease of use and accuracy.

The scope of the additional tasks to be performed by the drivers shall be clearly identified and specific written procedures prepared. All drivers authorised to perform driver controlled deliveries shall receive training in the additional tasks to be performed and the training shall be recorded. The receiving location shall maintain records of the training provided and shall only allow access to those drivers who have been trained.

Before tank release, the airport depot staff shall compare the observed density at the standard reference temperature with the expected value, based on the known batch densities of the receipts made into the tank. If the observed and expected densities differ by no more than 3.0 kg/m^3, then the tank can be released.

If the observed density differs by more than 3.0 kg/m^3 from the calculated expected value, there could be a problem and the matter requires further investigation. The first possibility to check is whether there is layering in the tank. To check this possibility, repeat the Control Check on Upper, Middle and Lower Samples. If there continues to be a difference between observed and expected densities then the tank shall be quarantined until the disparity has been explained.

Random checks by a responsible person at the receiving location should be performed at least quarterly to ensure that agreed procedures are followed.

4.8 Static dissipator additive

To ensure that acceptable levels of conductivity are achieved into-aircraft a minimum conductivity target for product receipts should be established, taking into account the typical reduction in conductivity experienced at the airport. Adding static dissipator additive to Jet A-1 at the airport should not be performed. Alternative solutions such as blending low conductivity fuel into higher conductivity fuel should be used. In exceptional circumstances where it is necessary, the following procedures shall apply.

4.8.1 If the documentation for a receipt by pipeline or from road or rail tank car indicates that the conductivity may be low, but within specification, the conductivity should be checked on a sample drawn at the start of the receipt and static dissipator additive added if necessary.

4.8.2 If the conductivity of samples drawn from coastal/inland waterway vessels before discharge is low, it may be necessary to add static dissipator additive.

4.8.3 When an additive is to be blended into aviation fuel, written procedures for quality control, documentation and safe handling procedures shall be prepared and applied. Items normally covered would be:

(a) Additives received are to be clearly identified as a grade approved in the controlling fuel specification. Each receipt shall be accompanied by documentation verifying identity.

(b) The additive batch documentation is to be checked for validity before release for blending.

(c) Released additive is to be held in a clearly designated storage area. Storage and handling procedures are to be in accordance with the manufacturer's recommendations.

(d) Only trained operators are to decant additive, refill the blending equipment and/or adjust the injection rate. The addition rate is to be monitored at regular intervals, taking account of any pre-dilution of the additive.

(e) The effectiveness of blending is to be verified by taking Upper, Middle and Lower Samples, after tank contents have settled, and checking each sample for conductivity.

4.8.4 The amount of static dissipator additive required should be determined carefully, taking into account the maximum cumulative concentration permitted by the specification or the latest issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List, and the amount of additive already introduced upstream. The amount added to each batch of Jet A-1 should be recorded on the Recertification Certificate or Release Certificate.

4.8.5 To achieve adequate mixing of the static dissipator additive with Jet A-1, the additional additive should preferably be introduced by in-line injection during receipt. Where injection equipment is not available it may be added to vessel compartments before discharge, taking precautions to avoid static generation by splashing. Introducing additive into depot tanks from the top should be avoided for safety reasons. However, additive may be introduced into the bottom of tanks before vessel discharge by lowering a caged bottle sampler from the top or by back-pumping from a tankside sample receiving vessel. Static dissipator additive shall not be added to fuelling equipment.

Note: Experience has shown that low conductivity Jet A-1 is very occasionally unresponsive to additional doping with static dissipator additive. The protocol shown below is intended as a temporary measure to be adopted where the conductivity of Jet fuel in airport storage or hydrant systems falls below the specification minimum and the response to re-doping with static dissipator additive is poor.

Low conductivity fuelling protocol

A company can continue to deliver fuel to aircraft with conductivity in the range 25–50 pS/m provided that:

a) the fuel fully meets all other aspects of the specification; and,

b) after reviewing fuel receipt and storage records, there is no evidence that the loss of conductivity is linked to a product quality issue that affects the fuel's suitability for use.

This protocol shall always be seen as a temporary measure to allow airports to continue to operate where the conductivity of fuel in storage tanks or the hydrant cannot be recovered.

In the event of this protocol being invoked to maintain deliveries of fuel to aircraft, all suppliers and into-plane service providers shall be notified immediately.

Action shall be taken by the supplier to remediate the situation as soon as possible.

Chapter 5

Quality control

5.1 Procedures after discharge

5.1.1 After product has been received into storage tanks, the stock shall be quarantined and a local batch number assigned. Tank isolation shall be achieved in an effective way (see 3.3.1). Where positive segregation is required and this is achieved by means of block and bleed valves, and where the bleed valve in the body bleed system shall remain closed for environmental reasons, routine checks shall be carried out as defined in 6.1.8. If the bleed checks indicate that one of the block valves does not seal completely or has been opened in error then the possibility shall be considered that contamination of the new batch has occurred, either into or out of the tank.

5.1.2 Where product is received via fully segregated systems and dedicated transport (e.g., barge, road or rail) a Control Check shall be carried out after settling, as defined in 5.3.1.

5.1.3 Where product is received via non-segregated systems, or by multi-product pipeline, non-dedicated tanker or non-dedicated coastal/inland waterway vessel, a Recertification Test shall be carried out (see 2.3.4 (b)).

After the tank contents have settled for at least 30 minutes, obtain Upper, Middle and Lower Samples and check:

(a) density of each sample to establish homogeneity of product within the tank

(b) freedom from visible sediment and suspended water.

If (a) and (b) above are satisfactory, proceed with sampling and testing as defined in 5.3.2.

Where (a) above indicates layering in the tank, i.e. density difference between layers is greater than 3.0 kg/m^3, proceed as in 5.3.2 (a).

5.2 Product settling

5.2.1 After product has been received into storage tanks via a fully segregated system, the inlet and outlet valves shall be closed. A system to indicate the status of the product in the tank shall be used. This can be achieved by positioning a "settling" sign at the tank outlet valve or by the use of a control system to ensure that the valves remain closed until product release has been approved (see 7.1).

5.2.2 After product has been received into storage tanks via a non-segregated system, tank isolation shall be achieved by means of block and bleed valves or other means of positive segregation. A system to indicate the status of the product in the tank shall be used. This can be achieved by positioning a "settling" sign at the tank outlet valve or by the use of a control system to ensure that the valves remain closed and secured until product release has been approved (see 7.1).

5.2.3 Provided that free water and sediment levels into storage can be consistently maintained at low levels as obtained by filters, approved as per 3.4.1, which are checked and maintained in accordance with Appendix A6, and that the tanks meet the design requirements of section 3.2, minimum settling times before release are:

Horizontal tanks: 1 hour
Vertical tanks: 2 hours

5.2.4 In any other cases, minimum settling times before release are:

Jet fuel: 3 hours per metre depth of fuel or 24 hours, whichever is less
Avgas: 45 minutes per metre depth of fuel

5.2.5 After settling, drain off any water that has collected at the bottom of the tank.

5.3 Product testing

5.3.1 Tanks supplied by a dedicated and segregated system

Take a Bottom Sample, and provided it is free of suspended water and sediment, perform a Control Check.

5.3.2 Tanks supplied by a non-dedicated and/or non-segregated system

After the product has been received through separate lines into receipt tankage, sampling and recertification testing shall be carried out as described below:

(a) When Upper, Middle and Lower Samples are free of sediment and suspended water but the densities indicate layering, i.e. density differences between samples exceed 3.0 kg/m^3, then the following tests should be carried out on each sample.

Jet fuel: Density, Flash Point, Initial Boiling Point, End Point
Avgas: Density, RVP, Octane Rating (lean mixture), End Point

(b) If Upper, Middle and Lower Samples are homogeneous, or after taking samples for testing in line with 5.3.2 (a), a Composite Sample shall be prepared for laboratory testing, i.e. Recertification Test or COA (see 2.3.4 (b)). Where more than three new batches are received into a tank, the recertification comparison becomes meaningless due to accumulative error and a Certificate of Analysis test shall be performed on a representative tank sample.

(c) After satisfactory recertification test results have been obtained, the product may be released. If the results are not satisfactory the batches shall remain quarantined until further testing has established that the fuel is acceptable.

(d) Where layering has occurred, and the Recertification Test is satisfactory, there will have to be local written instructions to cover the problem of releasing product that has significant density differences between layers.

5.3.3 Measure the conductivity and temperature of fuels containing static dissipator additive on completion of settling (see 5.2). For tanks supplied by road or rail transport this check may alternatively be performed on samples drawn from road tanker compartments or rail cars before receipt of product.

Chapter 6

Storage procedures

6.1 Routine checks

To ensure that product quality is satisfactorily maintained in storage, the following procedures shall be applied:

6.1.1 Storage tank and product recovery tank sumps/low points shall be checked daily for the presence of water and sediment. Additional checks should be made when frequent or heavy rainfall occurs. Procedure is to flush at full flow a quantity in excess of the line content from the storage tank sump/low point to the sample receiving vessel, and then to take a line sample for an Appearance/Visual Check. If this check indicates unsatisfactory product, flush a further quantity into the sample receiving vessel and take another line sample for an Appearance/Visual Check. Repeat until a satisfactory sample is obtained. If a satisfactory sample cannot be obtained after flushing several times or if large quantities of water are found, the tank shall be quarantined and the sample retained until measures, decided by the manager, have been taken. The Visual Check for Jet fuel is required for samples drawn from tanks that are either in service or being released for service. For tanks that have not yet been released (see 7.1) an Appearance Check is sufficient. After tank flushing and sampling, the product in the sample receiving vessel shall be settled and any free water removed before being returned to storage. Where there is a possibility of Jet fuel, flushed from a storage tank containing tested product, being contaminated with untested product (for example where a fast flush sample receiving tank is connected to more than one storage tank), then the flushed product shall be returned to untested product tankage.

6.1.2 The correct operation of floating suction arms shall be checked monthly. When a tank has been emptied, for example for maintenance or internal cleaning, procedures for refilling the tank shall ensure that the floating suction arm is filled with fuel and that any contained air is removed. Where air elimination is not built into the design this may require back-filling until the floating suction inlet is fully submerged in fuel.

6.1.3 The condition of free vents and mesh screens shall be checked at least quarterly for evidence of damage or obstruction, or more frequently as dictated by local conditions. Pressure/vacuum relief valves and flame arrestors, where fitted, shall be checked and serviced at least annually and in accordance with the manufacturer's recommendations.

6.1.4 The correct operation of all high-level alarm systems shall be checked at least annually in accordance with written procedures and more frequently if required by local regulations or recommended by manufacturers. A monthly functional check of high-level alarms should also be performed where possible.

Tanks should not be filled to the level at which the high-level alarm is activated except during test procedures.

6.1.5 Where the period of time between product receipts into a tank exceeds 1 month, the conductivity of Jet fuels containing static dissipator additive shall be checked at monthly intervals and recorded with temperature.

6.1.6 When tanks are consistently replenished via fully segregated systems and dedicated transport, no laboratory testing of product received is necessary.

6.1.7 Composite Samples shall be taken for Periodic Test from each tank which has contained product and which has had no product receipts for 6 months (static stock). Samples should also be taken from each tank in which less than half of the product has been replaced during a 6-month period. If the results are unsatisfactory, the tanks shall be quarantined, further Composite Samples taken for Certificate of Analysis testing and the tank(s) shall not be released unless satisfactory test results are obtained.

6.1.8 Where storage tanks are fitted with double block and bleed valves and positive segregation is required, the block valves shall be drained after receipt of product, and checked before release, and at least weekly by opening the bleed valves and draining any product into a suitable container. These checks shall be recorded. If the checks release a significant quantity of product or if there is a continuous flow of product indicating a leaking block valve, then appropriate measures including additional product sampling and testing shall be taken to ensure that the quality of the product is satisfactory before the batch is released.

6.2 Tank inspection and cleaning

6.2.1 Aviation Jet fuel tanks shall be visually inspected annually from outside through a suitable manhole and a tank cleanliness assessment shall be conducted annually (see the table below) to determine that none of the conditions listed under "Cause" are present in the tank. Jet fuel tanks shall be internally inspected and cleaned if necessary 12 months after commissioning and subsequently in accordance with the table below, taking account of the safety precautions outlined in HSSE-MS Standards. This is subject to a maximum frequency of 5 years, provided it is allowed by local regulatory requirements and the necessary conditions have been met (see c below).

Airport storage tank cleaning intervals may be extended to a maximum of 10 years from the date of last cleaning by approved variance from year 5 and if supported by acceptable documented PQ history, annual visual inspection without entry and annual microbial test with acceptable results since last internal cleaning.

Given that tank entry and cleaning is a higher risk activity, opportunities to clean tanks in conjunction with other work should be taken, e.g. it has been drained down and gas freed for mechanical inspection or repair.

	Maximum intervals (years)	
	Visual inspection from outside	Internal inspection and cleaning[a]
	JET FUEL	
Normal frequency	1*	Cause[b] or 3
When conditions stipulated are met [c]	2*	Cause[b] or 5
	AVGAS	
Normal frequency	Not required	Cause[b] or 3
When conditions stipulated are met [c]	Not required	Cause[b] or 5

Notes:

a. 12 months after commissioning, internal inspection is required with cleaning if necessary.

b. "Cause" for aviation fuel tanks is defined as:
- Tank internal surfaces are dirty, i.e. the inspection reveals microbial growth or build-up of sediment exceeding approximately 20% of the tank bottom surface*
- Presence of microbiological contamination, excessive dirt, rust or other debris in water drain samples
- Fuel quality downstream indicates the presence of excessive contamination, e.g. short filter life, poor filter membrane test results or high particle counts (e.g. 18/16/14 which approximates to 1mg/litre of an average dirt containing rust and sand.)
- The condition of the water drain samples shows the presence of excessive rust or microbiological growth or surfactant contamination.

"Cause" shall require more frequent tank cleaning than the maximum limits shown.

c Necessary conditions:
- Agreement of company management.
- Historic tank cleaning and inspection records show that only small amounts of contamination have been found.
- For internal visual inspection without entry, the tank internal surfaces can be adequately inspected (i.e. views of the floor and sump are not obstructed by internal baffles, floating decks or blankets, etc)*.
- Full internal epoxy lining.

* Where the visual inspection without entry does not afford clear unobstructed views of the internal surfaces, and provided the tank design meets the minimum requirements of JIG 2, then annual microbiological growth tests with results within permissible levels is an acceptable alternative.

6.2.2 No chemicals, or cleaning materials that could adversely affect the aviation fuel to be stored in the tanks, shall be used unless required for decontamination of the tank. A Variance Approval Certificate shall be required. If it was found necessary to use a cleaning chemical or if repairs were carried out, or if required by the company, a Composite Sample shall be taken for a Periodic Test before product release (see 2.3.4 (c)).

6.2.3 Detailed records shall be maintained of the types and quantity of sediment found, and of the condition of the tank interior fittings and coatings. A suitable form is shown as Appendix A9. The dates of the most recent tank inspections and cleaning should be marked on the tank shell.

6.2.4 Where no chemicals or cleaning materials have been used and no repairs to the tank internal components have been carried out, the product release procedures shown in section 7.1 are applicable after refilling.

6.2.5 Product recovery tanks shall be inspected, without entry, quarterly for cleanliness and condition. An IATA endorsed microbiological growth test (see 2.3.4 (i)) on a sump sample after flushing, may be carried out as an alternative to quarterly visual

inspection. Cleaning and repairs to internal lining shall be carried out where there is cause. "Cause" for aviation fuel tanks is defined as:

- Tank internal surfaces are dirty, i.e. the inspection reveals microbiological growth or build-up of sediment exceeding approximately 20% of the tank bottom surface
- Presence of microbiological contamination, excessive dirt, rust or other debris in water drain samples. Fuel quality downstream indicates excessive contamination, e.g. short filter life, poor filter membrane test results or high particle counts

6.2.6 Tank-side fast flush tanks shall be kept clean and empty when not in use for draining and sampling

6.3 Change of grade in storage tanks

Airport depots differ greatly in layout and configuration. Change of grade procedures shall be established locally and be agreed by the company. Such procedures should take account of the following points:

(a) Care shall be exercised to ensure that all safety procedures are followed, including the additional precautions applicable to tanks that have contained leaded product.

(b) Tanks shall be emptied of product and thoroughly cleaned. Associated pipelines, pumps, strainers and fittings shall be drained and then flushed with the new grade, using a volume of at least three times the line content. Flushed product shall be downgraded.

(c) Chemical cleaning fluids shall not be used.

(d) All associated filter separator, filter monitor and microfilter elements shall be changed.

(e) Some pipeline and valve modifications may be necessary to maintain positive segregation. Selective couplings, where used, shall be changed.

(f) The installation of floating suctions and alterations to tank venting arrangements may be necessary.

(g) Colour coding and grade marking shall be changed.

(h) After filling with the new grade of product a Recertification Test shall be carried out on a Composite Sample. A sample should also be taken for a Recertification Test from the downstream end of the pipeline affected by the change of grade. The test results shall be satisfactory before the tank content is released (see 2.3.4(b)).

6.4 Testing for microbiological growth

Where microbiological growth has been confirmed as being above acceptable levels (see 2.3.4 (i)), remedial action is required. As a minimum, this shall include on-site assay tests for microbiological activity carried out on Drain Line Samples of Jet fuel using IATA recommended test kits at least every 6 months for a period of 2 years. Where three successive on-site assay tests have shown that microbiological growth levels are at a satisfactory level, the testing intervals may be relaxed or even discontinued, provided there are no other contra-indications of microbiological activity.

An investigation into the source of the contamination of airport fuel storage shall take place and this shall include on-site assay testing of the upstream supply locations (or fuel receipt facilities where logistics may prohibit access to upstream fuel storage).

Note: Fuel samples from storage tanks for assay testing shall be drawn from low point drains and allowed to settle to remove any traces of water. To ensure consistency of test results, sampling should be performed after tank settling and immediately before tank release. Contamination of the sample for testing shall be avoided by strict observance of the test kit manufacturer's guidance on cleanliness. Alcohol wipes should be used to clean sample points before sampling. The sample point shall then be flushed with Jet fuel to remove traces of alcohol before taking the sample for testing. If a positive result is obtained, the test shall be repeated. If the result is confirmed, seek guidance.

Chapter 7

Product release for delivery to into-plane fuelling equipment and hydrant systems

7.1 Product release procedure

Product shall not be released from storage for delivery until the following requirements have been met:

7.1.1 Product has been settled in accordance with 5.2.3 or 5.2.4 and tested in accordance with section 5.3.

7.1.2 Results of the Control Check or Recertification Test, whichever is applicable for the type of shipment involved, show no change in quality when compared with the supplier's Refinery Certificate of Quality, Certificate of Analysis or Recertification Test Certificate – whichever is relevant.

The comparison of quality shall be made on the basis of test results recorded on forms of the type shown in Appendix A11/A12.

7.1.3 The tank sump/low point has been checked for the presence of water and sediment by flushing as described in 6.1.1 until a satisfactory sample has been obtained and checked in accordance with the Visual Check (see 2.3.4(e)).

7.1.4 All required tests and checks have been completed and results recorded.

After satisfactory completion of the steps above, the tank shall be given a local batch number and a Release Certificate (see 2.3.2 (e)) shall be prepared, containing the local batch number as assigned in 5.1.1, and approved by an authorised person and the status of the tank (see 5.2) shall be changed from "settling" to "released". The operation shall be recorded.

7.2 Fueller loading

7.2.1 Procedures and equipment used for loading fuellers shall be designed to prevent fuel spillage. The operator controlling the loading operation shall remain in attendance throughout and shall have immediate access to a means of stopping the fuel flow quickly. A deadman should be used of the type that requires periodic action by the operator within a predetermined time interval to control the operation. If a cordless deadman control is used, it shall be released if the operator is more than 10 metres from the loading point, or is out of line of sight of the loading point.

Adequate spill protection measures (e.g. fuel containment barriers) shall be provided.

Fuellers shall be bonded to the loading pipework at all times during the loading operation. (Fuellers shall not be bonded to the hydrant pit when loading directly ex-hydrant.) To reduce ignition sources in the fuel transfer area, fuellers shall not have the engine running during loading. Where loading is controlled by an electronic level control, a separate bonding cable is not required providing the following is in place:

1. The system ensures electrical continuity between the vehicle and loading pipework; and
2. Bonding to the fueller is required to activate the loading pump.

Fuellers shall be equipped with a high-level cut-off device to stop the flow at a predetermined level. The automatic cut-off device pre-check shall be activated shortly after the start of each loading operation. Additional precautions shall be used to ensure that equipment is not over-filled, as described in JIG 1 5.8.1. Fuellers equipped with a single automatic overfill protection device shall not be filled to the level at which the device is activated except when testing the system.

Where fuellers are equipped with two high-level cut-off devices they may be filled to the level at which the first device is set to shut down the flow.

Where fuellers are filled on the ramp from a hydrant system, additional precautions shall be observed to avoid the possibility of a fuel spillage. Two automatic overfill protection devices shall be fitted for new vehicles; but, for equipment manufactured before 2013 only, a single automatic overfill protection device is acceptable provided that filling from the hydrant is via a meter equipped with a preset and provided that the pre-calculated amount is controlled by the meter preset. This operation shall be subject to a risk assessment that shall take account of flow rates, pressures, spill prevention and spill consequences.

7.2.2 On completion of fueller loading, the product shall be allowed to settle for at least 10 minutes. Vehicles may be moved from the loading area to a designated parking area, for settling after loading, before sampling. The fueller tank sump shall then be drained of any water and sediment and a sample taken for Visual Check.

Chapter 8

Hydrant systems

8.1 Flushing low points and hydrant pits

This section covers the routine flushing of hydrant low points, pits and lines. Information about the commissioning of new and extended hydrant systems and techniques for internal inspection and cleaning is contained in EI 1560 (Recommended practice for the operation, inspection, maintenance and commissioning of aviation fuel hydrant systems and hydrant system extensions) and EI 1585 (Guidance in the cleaning of aviation fuel hydrant systems at airports). See also EI 1594 (Initial pressure strength testing of airport fuel hydrant systems with water).

8.1.1 All low points of the hydrant shall be flushed at a high velocity thoroughly once a week, with the line under pressure to ensure removal of any water or sediment, until a clear sample is obtained. In the absence of an adjacent hydrant emergency stop button, procedures shall ensure that there is an effective means of shutting down the flow quickly in the event of disconnection or hose burst during flushing.

The quantity flushed shall be 50 to 200 litres more than the capacity of the sampling pipework. The actual total quantity flushed will depend upon the design of the system and the amount of contamination usually observed. After flushing an amount in excess of the sampling pipework, a line sample shall be drawn during flow for Visual Check.

If excessive water or sediment is found, or if it is not possible to obtain a satisfactory sample for Visual Check, action shall be taken to notify the into-plane fuelling organisations and to identify the source of the contamination.

Any relaxation of the weekly flushing requirement shall require a Variance Approval Certificate. As a minimum, locations shall have a documented history of consistently clean and dry fuel. (Records shall indicate no more than traces of dirt and/or water removed from low points over the previous 12 months.)

8.1.2 Additional checks on the cleanliness of the fuel in the hydrant, including more frequent low point flushing, shall be made during and immediately after any engineering work such as pipework modifications, which may cause an increase in the contaminant in the fuel. The hydrant operating company should advise the into-plane fuelling organisations of the location of any such engineering work. Additional checks shall also be made when other factors, such as the uprating of hydrant pumps, could alter the flow conditions in the hydrant and cause contaminant to be picked up by the fuel.

Investigations shall be undertaken following the notification of an into-plane fuelling vehicle being removed from service during fuelling as a result of a filter monitor dP switch activation or discovery of water/contamination.

The hydrant operator shall liaise with the into-plane operator and should, as a minimum, investigate the following:

- Has the hydrant pit in question been used recently?
- Have there been any changes in the hydrant flow rate or direction?
- Has there been any engineering work carried out on the hydrant?
- Have the into-hydrant filters shown an increase in dP? (Check sump samples.)

Overall, the hydrant operator will need to respond appropriately and proportionately. Guidance for the optimum response cannot be prescriptive, but in the event of a small number of dP switch activations, hydrant pit valve flushing and sampling may be required. In the worst case, where a significant number of dP switches have been activated and there is other strong evidence of fuel quality problems in the hydrant system, the hydrant operator should consider the suspension of hydrant use.

8.1.3 A record of daily hydrant pit usage shall be maintained. If any Jet fuel hydrant pits are not used for a period of 3 months, the contents of the appropriate spur line shall be flushed out and a sample taken for Visual Check. Where hydrant pit risers are directly above a main hydrant line (i.e. not a spur line or deadleg (unused section)), and they can be clearly identified by a construction drawing available on site, the frequency of flushing these unused pits may be reduced to annual frequency and be achieved when performing annual dynamic pit valve tests.

8.2 Hydrant pits and pit valves

8.2.1 Cleaning and maintenance

Hydrant pit box internal components and surfaces shall be kept clean and dry at all times. Adequate regular cleaning and at least weekly inspections shall be carried out and recorded.

8.2.2 Hydrant pit valve checks

Monthly static checks of the seals and annual dynamic checks are in accordance with the schedule laid down in Appendix A14. The dynamic check shall be made on the correct operation of the quick release valve as controlled by the lanyard – valve closing time should be between 2 and 5 seconds. The performance checks of the valve shall be made under pressure at the highest flow rate practicable and may be carried out during a fuelling operation. The results shall be recorded.

Annual wear check of API adaptors shall be carried out using the manufacturer's approved gauge.

With some existing (non EI 1584 type) hydrant pit valves, the valve closing time may exceed 5 seconds. In this situation, it is necessary to observe the overshoot, which should not exceed 200 litres.

8.3 Hydrant pits and low point servicing equipment

The equipment used for flushing low points and unused hydrant pits (including multi-purpose vehicles that also have pit cleaning capability) shall be designed for use with petroleum products and constructed to acceptable safety standards. The equipment shall have satisfactory tank venting arrangements, appropriate pressure relief valves, hydrostatically tested pumping circuits, electrical components appropriate for the area classification of the location in question, air braking safeguards where appropriate, externally mounted emergency stop buttons, etc. All equipment used to conduct hydrant pit and low point tests shall be checked in accordance with JIG Standards and the manufacturer's requirements.

All motorised/self-propelled hydrant flushing vehicles shall be fitted with an interlock system to prevent drive-away or roll-away during flushing hydrants or low points when associated components are removed from their normally stowed position. Seat interlocks should not be fitted to air-operated driver seats. Once per week, the complete interlock system shall be tested by attempting to drive the vehicle from standstill while each interlocked component is removed in turn.

These vehicles should also be fitted with a device that either warns the operator to ensure that the brakes are engaged, or a device that automatically engages the brakes, when leaving the vehicle cab. Such devices shall only be installed provided they can be tested safely.

All new equipment should be powered by diesel or electric motors. Further information on equipment specification may be found in EN 12312-5 Aircraft Ground Support Equipment – Part 5: Aircraft Fuelling Equipment and EI 1560. Tanks shall be constructed of aluminium alloy, stainless steel or mild steel internally coated with a light coloured epoxy material, approved as being compatible with aviation fuels. Flushing equipment shall be fitted with at least one 9kg (minimum) dry powder fire extinguisher. Equipment shall have a low point with drain valve, a sampling point with spring-loaded valve in the inlet pipework for taking a line sample and be equipped with type C (semi-conductive) hose with a pressure coupling. The tank should also be fitted with a contents gauge or sight glass and overfill protection for vehicle-mounted tanks. A means to determine the volume flushed shall be available.

To ensure effective bonding via the semi-conductive hose, any isolating flanges between the connection to the hydrant and the flushing equipment chassis shall be fitted with continuity bridging strips. To avoid potential ignition hazards in the vicinity of the low point/valve chamber, the flushing vehicle shall not be separately bonded to the low point by a bonding cable.

Flushing equipment should be checked for the presence of water and sediment before use. After use, the flushed product shall be settled and any water or sediment removed from the low point of the equipment before the product is returned to storage. If significant amounts of water or sediment are found in the equipment the flushing operation shall be repeated.

8.4 Emergency shut-down system

The fuel hydrant Emergency Stop Buttons (ESBs) shall be clearly identified and easily accessible. Clear access to these buttons should be maintained at all times. High visibility identification signs should be located such that they remain visible at all times.

A monthly check of the hydrant emergency shut-down system shall be performed in accordance with a detailed written test method. Procedures shall ensure that the function of each ESB is checked at least twice per year. The results of each monthly test, including details of the location of the ESBs checked, shall be recorded.

No fuelling shall take place from a stand or section of hydrant where the ESB (fuel hydrant emergency shut-down) system is inoperative, unless an alternative temporary emergency stop procedure has been agreed by all parties. All apron users shall be alerted to the non-operational ESB and shall be made aware of the temporary emergency stop procedure. This temporary procedure shall only be allowed for the absolute minimum timeframe while the ESB system is repaired and returned to service.

8.5 Safety precautions – entry into deep pits

Safety precautions applicable for entry into deep pits shall be strictly enforced (see JIG HSSE-MS Standard).

8.6 Cathodic protection

Where fitted, an agreed maintenance programme shall be in place. Monitoring by trained and competent persons shall be performed at least quarterly and a system check by a qualified person shall be performed annually.

8.7 Hydrant integrity and pressure testing

8.7.1 Hydrants that are fitted with a system to confirm their integrity (tightness control) shall be checked on a regular basis (at least monthly) in accordance with written procedures based on the manufacturer's recommendations and taking into account national and local regulations.

As a minimum, where no leak detection system exists, the system shall be checked at least monthly at normal operating pressure when no fuellings are in progress and the pressure decay over time (minimum 2 hours) recorded. The pressure decay (typically less than 10 psi) shall be compared to previous results. Any increase in pressure drop that cannot be attributed to changes in test pressure or fuel temperature is an indication of a possible hydrant leak or isolation valve failure and further investigation shall be conducted to identify the cause.

In addition, for existing hydrants without leak detection systems, consideration should be given to using a mobile leak detection systems to check for leakage at least every 6 months.

Further information about the checking of hydrant system integrity is contained in EI 1540 Design, Construction, Commissioning, Maintenance and Testing of Aviation Fuelling Facilities, latest edition and EI 1560 Recommended practice for operation, inspection, maintenance and commissioning of aviation fuel hydrant systems and hydrant system extensions.

8.7.2 All buried fuel pipes and hydrant systems without an operational leak detection system shall be pressure tested annually to Maximum Operating Pressure (MOP) to confirm their leak tightness. MOP is defined as maximum pump output pressure at maximum tank head. Where possible the pressure test should be of 8 hours' duration (see API 570 & 2611 for further information), but if test results confirming the absence of leaks can be established positively this may be reduced to a minimum of 1 hour. If test results suggest the possibility of a leak, a pressure test at 110% of Maximum Allowable Operating Pressure (MAOP) should be performed. Where the MAOP is not known, the test should be performed at 125% of the maximum working pressure of the system. Testing shall be in accordance with written procedures that highlight the fact that this normally requires the isolation of pressure relief valves. See EI 1560 10.2.3 for further details on testing.

All pressure test records shall identify both the fuel temperature and pressure against time for the duration of the test.

The condition of the pipe at the soil/air interface at the into-ground point shall be inspected at the same frequency as the pressure test.

8.8 Surge absorbers/relief valves

Surge absorbers, where installed, shall be checked at least once per year for correct operating pressure in line with the manufacturer's recommendations.

8.9 Hydrant high point vents

Checking of high point vents is a high risk operation requiring special procedures, which should not be performed as a routine check. It may, however, be necessary to bleed air from the hydrant system occasionally, for example after filling a section of the hydrant following engineering work. Air in the hydrant can cause vibration and can affect the accuracy of hydrant tightness control systems. Air shall be removed carefully and precautions taken to avoid the generation of fuel/air mist. Where required, a "dry-break" type coupler should be used.

8.10 Hydrant valve chambers

Valve chambers shall be opened and visually inspected at least quarterly without entry to the chamber. Any water contained in valve chambers shall be removed before the inspection. The inspection shall include an external visual check for corrosion, product leaks and chamber condition. If there is any evidence of hydrocarbon within the chamber then a detailed inspection of pipework and valve integrity shall be carried out.

Quarterly inspection is not required where:

- a leak detection system is operational and where valve chambers have documented history of no water ingress
- a leak detection system is operational and where liquid level detectors with remote indication to the control room show that the pipework is above the liquid level. Such liquid level detectors shall be tested for correct operation at least annually.

Where chambers continually fill with water then consideration shall be given to eliminating points of water entry and/or improving corrosion protection for the valves and pipework in the chamber.

A detailed visual internal inspection of valve chambers shall be performed annually in accordance with the confined space entry precautions outlined in JIG HSSE-MS Standard. This inspection shall check for corrosion, product leaks, sealing arrangements where pipes pass through the chamber walls, chamber cover seal condition, electric cabling visual condition and chamber condition, with particular attention to areas that cannot be easily seen during the quarterly inspection.

8.11 Hydrant pumps

Hydrant pumps, programmable logic controllers (PLCs), alarm and detection systems and back pressure control valves on recirculation lines shall be maintained in accordance with the manufacturer's requirements at least annually by trained and competent personnel.

Chapter 9

Documentation

The results of all checks and testing shall be recorded on documents that are readily available, kept up-to-date and retained for a minimum of 1 year (see Retention section below). Records may be held on computers provided that a secure back-up system (run at least weekly) is in place. The records shall include, but not be limited to, the following:

Note: All mandatory checks detailed in this standard shall be recorded.

9.1 Records – quality control

9.1.1 Daily product dips, tank contents and water checks, including date/time.

9.1.2 Details of incoming consignments with reference to Refinery Certificate of Quality or Certificate of Analysis and Release Certificate, quantity, including date and time.

9.1.3 Receipt tank details, settling and release checks.

9.1.4 Product deliveries and transfers including date/time when tanks put in service.

9.1.5 Refinery Certificate of Quality or Certificate of Analysis and Release Certificates covering incoming consignments.

9.1.6 Recertification and Periodic Test Certificates.

9.1.7 Hydrant pit use and low point flushing.

9.1.8 Filter membrane test records.

9.1.9 Filter sump drains.

9.2 Records – maintenance

9.2.1 Storage tank details (Appendix A8) and tank inspection and cleaning records (Appendix A9).

9.2.2 Microfilter and filter separator differential pressure graphs and inspection and maintenance records (Appendix A6.4 and Appendix A7).

9.2.3 Hydrant pit cleaning and checking of pit components (Appendix A14).

9.2.4 Hose inspection and testing (Appendix A13).

9.2.5 Details and dates of all maintenance work.

9.2.6 Equipment Calibration Programme (Appendix A17)

9.3 Signature

All records shall be dated and signed by the person responsible. For computer-generated records, a password-protected access system, traceable to the individual person, is acceptable as an alternative to a signature.

9.4 Records – accident/incident

A detailed record of accidents/incidents should be maintained for at least 5 years.

9.5 Document retention requirements

Aviation quality control documents shall be kept for certain minimum periods to provide adequate history and reference. The following guidelines below indicate minimum retention times, but local regulations or external quality assurance requirements may require longer retention periods. Records of all daily, weekly and monthly checks shall be retained for at

least 1 year. Records of all less frequent routine checks, filter membrane test results and logbooks on all non-routine matters shall be retained for at least 3 years. Other maintenance records shall be retained for at least 1 year, or longer if still relevant to equipment condition (e.g., major repair work or extension(s) to facilities).

The following document retention requirements shall apply:

- Aviation depot logs – 12 months from last dated record.
- Laboratory quality control and product testing records and certificates – 7 years.
- JIG inspections and follow-up – 3 years or until all recommendations have been closed out, if longer.
- Mobile hydrant servicing equipment quality control records – 12 months from last dated record.
- Filtration differential pressure and membrane filtration (filter membrane test) records – a minimum of either 3 years or current and previous change-out if longer.
- Storage tank cleaning and maintenance records – life of tank + 6 years. If the tanks are buried underground, these records shall be kept indefinitely.
- Depot design, modification and major maintenance – life of depot + 10 years
- Underground pipeline design, modification and testing records – life of installation + 10 years.

Chapter 10

General operating requirements and maintenance

10.1 Bonding and earthing

10.1.1 Road and rail vehicles: When discharging or loading, vehicles shall always be bonded to fixed facilities that in turn are suitably earthed. Bonding shall be completed before hoses are attached and before opening valves, fill caps, dip hatches, etc., and remain in position until after hoses are finally disconnected and hatches, etc. closed.

10.1.2 Drain sample buckets: Buckets and metal containers used for fuel draining shall be bonded to the vehicle or tank pipework before and during the draining operation and to the receiving vessel/tank when decanting. Plastic or galvanised containers shall not be used.

10.1.3 Bonding wires: All electrical bonding wires, clips and reels shall be checked daily for firm attachment and general condition, and weekly for electrical continuity (there shall be less than 25 ohms resistance). Where applicable, continuity shall be checked over several revolutions of the reel while unreeling or reeling in the bonding wire slowly. Permissive bonding systems that require a bonding circuit to allow pump start have a self-check function and (usually) indicator lights. These types of systems shall be checked daily for general condition and maintained in accordance with the manufacturer's required maintenance, at least annually.

10.2 Dust caps

All hose and pipework couplings/connections, including tank and filter drain lines, shall be protected by suitable caps or covers when not in use.

10.3 Bulk meters

All meters used for inventory control or for measuring product transfers to third parties should perform accurately in service and shall be tested in accordance with the calibration criteria detailed below.

10.3.1 Calibration criteria

New meters and meters that have been repaired or overhauled shall be calibrated at the location before being brought into service. Meters in service shall be proved every 6 months. To prevent unauthorised adjustment, meters shall be adequately sealed after calibration and before being returned to service.

Meter proving may be performed by means of a calibrated master meter or calibrated prover tank. The capacity of a volumetric proving tank shall not be less than the volume delivered by the meter under test (MUT) in one minute at maximum design flow rate and shall be of sufficient capacity to meet the requirements in HM 20. Master meters should be of approximately similar rated flow to the meter being tested. Master meters shall be recalibrated every 3 years or after a throughput of 15 million litres, whichever occurs first. Master meters that are mobile and service more than one installation should be recalibrated annually or after 15 million litres have passed through them. Prover tanks shall be recalibrated by an approved authority after internal painting, and when damaged or moved (unless designed to be movable) and following any structural change.

Master meters and associated hoses and fittings shall be dedicated to one grade of aviation fuel and only be used for accuracy checks of other meters. They are not operational units.

Meter proving shall be performed at a flow rate of between 70 and 80% of the rated flow of the meter under test or normal maximum flow rate in service, if this is lower. The meter shall be checked against the master meter or prover tank and adjusted until a minimum of two consecutive results within plus/minus 0.05% of the master meter or prover tank are obtained (taking into account the calibration factors). To check meter accuracy at low flow rates a further run shall be performed at 20% of rated flow of the meter under test. The error at this flow rate shall not exceed plus/minus 0.20%.

Procedures shall ensure that product used during meter proving shall be returned to a tank of the same grade of fuel to prevent cross-contamination.

Meters with erratic performance (poor repeatability between runs, low flow performance indicating excessive wear, etc.), or those not capable of being adjusted to meet these calibration criteria, shall be removed from service for repair, overhaul and recalibration, or disposal.

Meter proving shall be carried out in accordance with HM 20 and the EI Petroleum Measurement Manual, the API Manual of Petroleum Measurement Standards or equivalent industry standard.

Meters with pulse transmission from the meter drive to an electronic display meter head generally match or exceed the accuracy of mechanical bulk meters. Different calibration equipment and procedures may be applicable. These should be based on the manufacturer's recommendations and comply with the above calibration criteria.

10.3.2 Records and documentation

Meter testing procedures shall be written in line with 10.3.1. Where meter proving is performed by a third party contractor, it shall be verified that the contractor procedures meet a recognised standard as well as JIG requirements in 10.3.1.

A valid certificate of calibration should be available for the master meter or prover tank, detailing the meter calibration factors for temperature, pressure and meter error.

Meter proving test records shall be completed for each meter proved. Details of the meter under test shall be recorded, including rated flow, start and finish meter totaliser readings and the results of each calibration run.

Meter history records shall be kept for each meter, detailing any adjustments and accuracy obtained, problems encountered, instability of adjustment, items requiring maintenance and action taken. These records shall be retained for at least 3 years.

10.4 Pressure gauges

All critical gauges shall be regularly checked for accuracy and free movement and adjusted, repaired or replaced as necessary. Critical gauges are defined as test rig gauges and hydrostatic hose pressure test gauges. Non-critical gauges should be identified as "for information only" and calibration dates should be shown on critical gauges.

10.4.1 Critical gauges shall be checked 6-monthly against a master gauge or dead-weight tester. Test rig gauges should be accurate to within 2% of full-scale deflection.

Hose pressure test gauges should be accurate to within 5% throughout their normal operating range.

10.4.2 Master gauges shall be calibrated every 3 years at a certified test facility or by checking against a certified dead weight tester. They shall be accurate to within +/- 0.5% of full-scale deflection. Records of current calibration/calibration certificates for master gauges shall be available. Master gauges shall only be used for accuracy checks of other gauges.

10.4.3 Piston type differential pressure gauges need only be checked for free movement throughout the full piston travel and visually for correct zeroing. This shall be done every 6 months.

10.5 Hoses

10.5.1 Loading hoses: All fueller loading hoses shall meet a recognised industry standard suitable for aviation fuel. Hoses meeting the requirements of the latest issue of EI 1529 (Grade 2) or ISO 1825 (See 7.2.1) are preferred, but hoses meeting BS 3492 or BS 5842 or equivalent are also acceptable, subject to an approved variance. (Note: BS 3492 limits maximum operating pressure to 10 bar.)

Receipt/discharge hoses: Railcar and road bridger discharge suction hoses may be of any suitable type (but not type C), including reinforced industrial types. Pantograph systems are also acceptable.

10.5.2 The maximum shelf storage life for EI 1529/ISO 1825 hoses and flexible joints which use a hose-type material is 2 years and the maximum overall service life is limited to 10 years, both periods from the date of manufacture. See EI 1540 7.2.9 for more guidance regarding the storage of new hoses. The maximum service life for depot hoses used on suction or gravity applications is limited to 15 years from the date of manufacture.

10.5.3 All receipt and delivery hoses shall be carefully checked for condition before introduction into use, and thoroughly flushed with the product to be used.

New fueller loading and pit servicing vehicle hoses meeting EI 1529 or ISO 1825 shall be filled with product and left to soak for a minimum of 8 hours at a temperature of 15°C or higher. Longer soak times are required where product temperatures are lower. Product used for hose soaking shall be drained from the hose and shall be downgraded for non-aviation use.

All new hoses shall be flushed with at least twice the hose content. The flushed product shall be returned to a storage tank that is not in service. Before use, new fueller loading hoses and pit servicing vehicle hoses meeting EI 1529 or ISO 1825 shall be tested in accordance with the 6-monthly pressure test procedure in Appendix A13.

Fueller loading hoses and other hoses such as hydrant low point flushing hoses that may be subjected to pressure shall be pressure tested. The condition of hoses used for receipt from road or rail tank car shall be checked visually during use. Testing requirements are detailed in Appendix A13.

10.5.4 All hoses shall be given a permanent identification, and a record maintained of the date of manufacture, the date put into service and details of all testing.

10.6 Hydrometers and thermometers

10.6.1 The applicable standard for hydrometers is BS 718: 1960 (types M50SP and L50SP) and for thermometers it is IP 64C/ASTM E1 No. 12C. For reference purposes, each

location should retain, or have easy access to, at least one hydrometer and thermometer meeting these standards. Alternative instruments meeting the accuracy requirements of these standards are also acceptable.

Where alternative types of instruments are used for field tests, the thermometers should have scale increments of no greater than 0.5°C and hydrometers of no greater than 0.0005 kg/litre.

The accuracy of all in-service instruments shall be checked at least once every 6 months against reference instruments meeting the above standards or in accordance with the other options given in 10.6.4. Resistance temperature devices (RTDs) shall be checked 6-monthly against a reference thermometer.

Electronic densitometers should meet the requirements of IP 559.

10.6.2 Hydrometers and thermometers shall not be left in direct sunlight or near heating appliances. Hydrometers should be stored vertically.

10.6.3 Before each period of use, hydrometers should be carefully examined to ensure that:

(a) the etched line on the hydrometer stem corresponds to the arrow (or line) at the top of the paper scale. A fingernail can be used to detect the etched line position

(b) the bitumen weighting material has not flowed. This would cause the hydrometer to float in a non-vertical plane

(c) the glass is intact.

Before each period of use, thermometers should be carefully examined to ensure that there are no gas bubbles trapped in the fluid column or bulb and that there is no separation of the fluid column.

10.6.4 Every 6 months, or if a measurement of temperature or density is suspected as being inaccurate, having established that the quality and condition of the fuel is not suspect in any way, the accuracy of the thermometer and hydrometer shall be checked.

These checks should be carried out by means of one of the following options:

(a) Sending to a laboratory.

(b) Checking against a reference thermometer/hydrometer on site.

(c) Checking against a reference fluid provided by a laboratory.

(d) Checking by comparison with other thermometers/hydrometers.

Accuracy requirements are +/- 0.5° C and +/- 0.001 kg/litre.

10.7 Fire extinguishers

Fire extinguishers should be marked with identity numbers. A record showing the location and all inspections and maintenance for each extinguisher shall be kept up to date.

Fire extinguishers shall be maintained in accordance with the manufacturer's recommendations. All extinguishers shall be serviced at least once per year by the manufacturer or by competent trained staff certified by the manufacturer or their authorised distributor. For hydrant flushing vehicles, the maintenance dates shall be recorded on a label or tag attached to each extinguisher.

Inspections of the condition of all extinguishers shall be carried out every month. These inspections shall ensure that extinguishers are in their specified places and are readily accessible. The condition of the hose and nozzle (sound and visually free of blockages) should be checked. Permanently pressurised extinguishers should be fitted with a pressure gauge, which shall be tapped to check that the pointer is not stuck and is within the safe zone.

10.8 Electrical equipment

All electrical equipment, both fixed and portable, and wiring shall be of a suitable type for the hazardous area of classification in which it is used and shall be checked and maintained by a trained and competent person(s). Hazardous area classified electrical equipment (e.g. ATEX marked and certified) shall only be maintained by trained personnel. Fixed facility earthing straps/rods shall be checked at least annually for resistance where fitted to storage tanks, pipework and filter vessels etc.

Emergency shut-down switches shall be tested monthly.

10.9 Mobile phones

At airport depots only approved intrinsically safe mobile phones shall be used within the depot. Normal mobile phones shall only be used in the office building and shall remain in the office or other safe area.

10.10 Housekeeping and maintenance

Airport depots should be clean, tidy and well maintained. Storage tanks and pipework should be repainted regularly and ladders, walkways and handrails kept free of rust. All fuel handling equipment should be well maintained and free of leaks. Tank bund areas should be kept free of vegetation and bund drain valves kept closed and secured. Standing water shall be drained from bunds without delay.

10.11 Stock control principles

All airport depots should have written procedures for stock control which are based on the following principles:

a) Nominated members of staff are given clear responsibility for stock control at airports.

b) Aviation fuel volumes are measured on receipt, in storage and on delivery from an airport fuel depot.

c) The accuracy of measuring equipment, including meters and tank gauging equipment, is checked twice per year.

d) Measured volumes of aviation fuel are reconciled at the local standard temperature.

e) Actual oil loss or gain % should be calculated using STA (Standard Temperature Accounting) as:

- Book Inventory less Physical Inventory divided by Volume

f) The Volume divisor is usually throughput but may alternatively be based on opening inventory plus receipts (subject to company agreement).

g) There are approved limits for aviation fuel gains and losses. The Annual Oil Loss Target should be based on historical results for a specific location (taking into account any relevant changes to the operation) and should be no greater than +/- 0.1% for Jet fuels and +/- 0.5% for Avgas.

h) Reconciliations are carried out daily and reported monthly to the financial controller.

i) Losses and gains outside limits are investigated. Oil Loss Performance should be reviewed monthly and, if actual monthly gain or loss falls outside a range of +/- 0.1% from normal seasonal variations, an investigation should be carried out to identify the reason for the variation.

j) Documents used for stock control purposes will be kept for 7 years or longer if required by local legislation.

k) Airport stock control procedures are audited annually.

10.12 Other measurement equipment

Conductivity meters should be calibrated according to the manufacturer's recommended frequency, but as a minimum they shall be calibrated at least 3-yearly by an approved test facility or against a certified standard.

Continuity meters shall be calibrated in accordance with the manufacturer's requirements.

A "click type" torque wrench, where the clutch slips signalling that the correct torque is reached at the desired torque setting shall be used. The beam type torque wrench is not an appropriate type for the required functions in aviation fuel operations.

Torque wrenches shall be calibrated in ft-lbs or Nm in a range including 0-50 ft-lbs / 0-68 Nm. Torque wrenches may also be required in a wider range to accommodate other applications. Torque wrenches shall be calibrated according to the manufacturer's recommended frequency, but at least 5-yearly. Guidance can be found in EN ISO 6789. (Note that the torque wrench should be reset to zero when not in use, to minimise calibration drift.)

Dip tapes should be visually checked before use and shall be inspected annually for kinking/deformation that would affect measurement accuracy and for security of the bottom weight.

10.13 Equipment calibration

All monitoring and measurement devices which are critical to safe operations shall be calibrated on a regular basis to ensure accuracy to within required tolerances. Each location shall establish a list of such equipment and maintain records for each device. See Appendix A17 for more details.

10.14 Deadman control

Where installed on bridger receipt or fueller loading facilities the deadman control shall be performance tested at least monthly.

Chapter 11

Health, safety, security, environment, training and emergency procedures

Any operating entity handling aviation fuels is expected to implement and maintain an HSSE Management System that seeks to proactively improve HSSE performance in preventing injury, ill-heath, environmental and security impacts.

The JIG HSSE Management System Standard describes the minimum expectations with which HSSE systems shall be managed. Entities that operate to the JIG Standards are expected to meet the requirements of the JIG HSSE MS and regulatory requirements.

Locations inspected in accordance with the JIG Inspection Programme shall be externally audited against the standard at least every three years.

Appendices

Appendix A1	Summary of routine test frequencies
Appendix A2	Variance Approval Certificate
Appendix A3	PPE requirements
Appendix A4	Lost time incident report
Appendix A5	Soak testing procedures
Appendix A6	Filtration equipment – routine maintenance and checks
Appendix A7	Filtration details
Appendix A8	Storage tank details
Appendix A9	Example of a form for Tank Inspection and Cleaning report
Appendix A10	Sampling system diagram
Appendix A11	Form for Avgas recertification
Appendix A12	Form for Jet A-1 recertification
Appendix A13	Hose inspection and testing procedures
Appendix A14	Hydrant pit valve testing
Appendix A15	Diagram of a pressure control test rig
Appendix A16	Road tankers/rail tank cars: change of grade and cleaning procedures
Appendix A17	Equipment calibration programme
Appendix A18	JIG Joint Ventures and locations on the JIG Inspection Programme

Appendix A1: Summary of routine test frequencies

	TEST FREQUENCY						
Airport depots	**Daily**	**Weekly**	**Monthly**	**3-monthly**	**6-monthly**	**Other**	**Reference**
Pipework deadlegs				X			3.3.2
Storage and product recovery tank low point draining	x						6.1.1
Floating suction arm check			x				6.1.2
Tank vents and mesh screens				x			6.1.3
Tank high level alarms			x			Yearly	6.1.4
Conductivity (if no fuel received)			x				6.1.5
Periodic test (static stock)					x		6.1.7
Double block and bleed valve drains		x					6.1.8
Tank external visual inspection						1 or 2 years	6.2.1
Tank internal inspection and cleaning						Cause or 3 or 5 years	6.2.1
Hydrant low point flushing		x					8.1.1
Flush unused hydrant pits/spurs				x			8.1.3
Hydrant pit condition/cleaning		x					A14.1.1
Hydrant pit valve integrity check			x				A14.1.2
Hydrant pit valve dynamic test						Yearly	A14.2
Hydrant pit valve wear check						Yearly	A14.3
Hydrant low point flushing vehicle - interlock checks		x					8.3
Hydrant emergency shut down			x				8.4
Hydrant cathodic protection				x		Yearly	8.6
Hydrant integrity (leak detection)			x				8.7.1
Hydrant/buried line pressure test						Yearly	8.7.2
Hydrant valve chamber check				x		Yearly	8.10
Hydrant pumps						Yearly	8.11
Bonding wires	x	x				Yearly	10.1
Bulk meters					x		10.3.1
Master meters						3 years	10.3.1
Critical pressure gauges					x		10.4.1
Master pressure gauges						3 years	10.4.2
Piston differential press gauges					x		10.4.3
Aviation pressure hoses	x		x		x		A13
Gauze strainers		x					A6.5
Hydrometers and thermometers Resistance temperature devices (RTDs)					X x		10.6.4 10.6.1
Earthing straps/rods resistance						Yearly	10.8
Emergency Shut-Down Systems			x				10.8
Conductivity meter						3 years	10.12
Dip tapes						Yearly	10.12
Torque wrench						5 years	10.12
Fire extinguishers			x			Yearly	10.7
Electrical equipment						Yearly	10.8
Stock control			x			Yearly	10.11
Filter vessel air eliminators						Yearly	A6.1
Pressure relief valves						Yearly	A6.1
Filter draining	x						A6.2.1
Filter differential pressure graphs		x					A6.2.2
Filter membrane colorimetric test			x				A6.2.3
Filter internal inspection						Yearly	A6.2.4
Micro filters change						3 years	A6.3.1
Coalescer element change						3 years	A6.3.2
Monitor element change						As per manufacture	A6.3.4
Gauze (QC) strainers		x	x				A6.5

Appendix A2: Variance Approval Certificate

Requested by:		**Position:**		**Operating company:**	
Phone:		**Email:**			
Shareholders:		**Users/throughputters:**			
Variance Title: (Brief description of the Variance)					
JIG Standards reference affected: (JIG Standard – JIG 1, 2 – and relevant section numbers)					
Comprehensive details of deviation from the JIG Standards referenced above: (Attach any additional documents/photos)					
Risk mitigation action during variance: (Detail additional actions to ensure risk from the variance is mitigated)				**Target completion date:**	**Actual completion date:**
Rectification action: (Detail future actions that will be taken to ensure variance closure & withdrawal)				**Target completion date:**	**Actual completion date:**
Variance expiry: (based on maximum time permitted to complete rectification actions)					**Date:**

Name:	**Variance approval by Location Management (eg. Chairman of Board/Management Committee)** Any conditions of approval:	**Approval date:**
Name:	**Local review comments:** (review at least annually) Detail additional mitigation and/or rectification actions if required	**Review date:**
Name:	**Variance closure comments** (all rectification actions completed)	**Closure date:**

Variance review by Technical Authority
Detail additional mitigation and/or rectification actions if required

Company name:	**Reviewed by:**	**Company name:**	**Reviewed by:**

Variance Number: **Operation name:**	**Technical Authority Review date:** (3-yearly)

Appendix A3: PPE requirements

It is important from a health and safety perspective that site-specific risks are identified and the correct PPE is identified, provided maintained and used – this is normally a legal requirement.

JIG has identified minimum requirements for PPE to be worn in routine operational situations, recognising that site-specific requirements taking into account local legislation, airport authority requirements and local safety committee recommendations may be more stringent.

Activities controlled under Control of Work systems which require an activity specific risk assessment and the provision of specific PPE for that non-routine activity are not considered in the minimum requirements.

The following table represents the minimum JIG PPE requirements expected for operators on any JIG site. Visitors are covered under Note 10 below.

	Uniform/ overalls (note 1)	**Safety boots (note 2)**	**Gloves (note 3)**	**Hearing protection (note 4)**	**Eye protection (note 5)**	**Bump cap (note 6)**	**Safety helmet (note 7)**	**High visibility clothing (note 8)**
Tank farm	Y	Y	Risk based	Risk based	Y	Risk based	Risk based	Risk based
Fueller loading	Y	Y	Y	Risk based	Y	Risk based	N	Risk based
Apron	Y	Y	Y (outside fuelling vehicle)	Y (outside fuelling vehicle)	Y (outside fuelling vehicle)	Y	N	Y
Workshop	Y	Y	Risk based	Risk based	Y	Risk based	N	Risk based

Notes: "Y" = expected

"Risk Based" recognises that operations risk and exposures may vary between sites. Each site should assess the specific risks on site and specify minimum requirements appropriate to the activity and risk.

Minimum PPE requirements:

1. **Uniforms/overalls** should have good anti-static properties e.g. be more than 50% natural fibres.
2. **Safety boots** should have ankle support, oil resistant soles and uppers, toe protection and be anti-static/static dissipative
3. **Gloves** should be appropriate to the tasks being performed. Appropriate barrier creams are to be worn at all times when gloves are not worn and operator is exposed to skin hazards.
4. **Hearing protection** should be appropriate to the noise levels in the work area. Ear protectors are required for air-operated tools.
5. The primary purpose of **eye protection** is to prevent hydrocarbon product entering the eyes. A secondary benefit is to prevent grit/dirt entering the eye. Local climatic conditions may affect site-specific requirements.
6. **Bump caps** are designed to prevent minor bumps/bangs causing bruising or laceration to the head. They normally consist of a baseball cap with a plastic insert.
7. **Safety helmets** are "hard hats" worn to prevent severe head trauma due to falling objects. They shall be worn where that risk exists, which is normally within tank farms with overhead walkways/ladders.
8. **High visibility clothing** shall comply with local legal and civil aviation requirements. To minimise the risk of a static discharge, high visibility clothing shall have good anti-static properties where required (e.g. in Europe, certified to EN 1149-3 or equivalent). Avoid loose fitting/ flapping high visibility clothing.
9. **Workshops** often contain hazards that may require additional PPE rules due to the nature of the tasks being performed. For example, loose clothing should not be worn when working with rotating equipment and goggles rather than safety glasses should be worn when operating grinding wheels. Additional PPE controls may also be required for certain tasks.
10. **Visitors** are required to wear the appropriate PPE for the area they are visiting, subject to any risk based deviations authorised by the site manager e.g. safety shoes are allowed in place of safety boots if the visitor is not exposed to foot damage risks or not climbing in/out of vehicles.
11. All personnel shall obey any mandatory **PPE signs** in special areas such as compressor or plant rooms.

Appendix A4: Lost time incident report

A lost time incident (LTI) is defined as a work related incident resulting in a member of the workforce not being available for work on the next calendar day, whether they were due to work it or not. Details of injuries to personnel while on duty shall be recorded and investigated (see JIG HSSE-MS Standard). This form may be used for that purpose.

Location	
Date and time of incident	
Description of incident Include timings and details of people involved	
Investigation Analysis of incident	
Cause of incident	
Potential consequences Future/long-term effect of injury	
Corrective action taken	
Recommendations To reduce the risk of future similar incidents	
Report prepared by	**Date**
Report reviewed by	**Date**
Incident closed out Recommendations implemented	**Date**
Total LTI days lost	

Appendix A5: Soak testing procedures

A5.1 Introduction

Soak testing shall be carried out after construction work or repairs on fuel systems and vehicles to ensure that there are no potential contaminants present in the form of solvents from coatings/linings, welding flux, valve grease, or other general debris. Soak testing is necessary even if the systems are constructed of aluminium or stainless steel.

A soak test consists of filling the system being commissioned with the appropriate fuel grade and leaving it to stand for a soak period. A retention sample of the fuel used is taken before filling as a control. At the end of the soak period, fuel samples are taken from the system being commissioned and submitted for laboratory testing. Test results are compared to the fuel specification limits and to the original certification or recertification test report to look for differences and to establish whether the system is suitable for use. If there is any doubt that the test certificate results are representative of the fuel used, it is recommended that the retention (pre-soak) sample is analysed in parallel with the post-soak sample.

A5.2 Application of soak testing

A5.2.1 New systems and equipment

Site-specific soak test plans should be reviewed and approved by the technical representatives of the operation before commissioning begins.

Soak testing shall be completed on the constructed facility rather than on representative sections of pipe or individual pieces of equipment (e.g. tanks or filter vessels) prior to installation. This ensures that the soak test identifies any contamination caused by the fabrication of the equipment and resulting from on-site construction work.

For tie-ins, where in-situ soak testing may not be practicable, the relatively short sections of pipe, fittings or valves involved may be soak-tested before installation, provided that adequate precautions are taken to maintain the cleanliness of the tie-in components until the new system is put into service.

Once the system has been filled with the correct grade of fuel, all components in the system that contain moving parts in contact with the fuel should be exercised to help 'wash out' any contaminants, for instance by opening and closing each valve a few times.

A5.2.2 Existing systems and equipment

Soak testing is applicable following repair work or modifications to existing systems. As a general rule, if new lining material is applied to an existing tank or pipe then soak testing shall be undertaken if the new lining material covers more than 5% of the coated surface area of the tank or surface area of existing piping. This is a general rule and the company may agree different criteria depending on local circumstances. Each entity (tank or pipework) shall be treated as a separate element for the purposes of defining the percentage area. Minor spot repairs to internal tank lining can be recommissioned after a field cure test without soak testing.

Replacement or repaired equipment (pumps, filter vessels, valves etc.) does not generally require soak testing before use because of the small internal fuel-wetted surface areas compared to the total system. However, some equipment (e.g. fuel pumps) may be stored and shipped with preservative oil or lined with

a rust inhibitor to prevent corrosion. Small amounts of these materials can result in the contamination of large volumes of fuel. Confirmation that no undesirable materials are present on the internal surfaces, which come in contact with the fuel, shall be obtained from the equipment supplier or repairing service before installation.

A5.3 Soak testing procedures

A5.3.1 Soak periods

Tanks, pipelines and ancillary equipment

Due to the stringent test requirements contained in EI 1541, Performance Requirements for Protective Coating Systems used in Aviation Storage Tanks and Piping, there is little risk of fuel contamination from a lining meeting these requirements if the lining is properly applied and allowed to fully cure as per the manufacturer's recommendations. Other contaminants that may be present such as rolling oils, welding flux or valve grease will dissolve into the fuel rapidly or may be removed by flushing and draining of the system or by filtration.

To ensure sufficient contact time is achieved, a minimum 4-day and maximum 7-day soak period shall be allowed after construction work or major repairs to a fuel system provided that the lining used meets the following criteria:

- The lining meets the performance requirements specified in EI 1541.
- The lining is properly applied and allowed to fully cure as per the manufacturer's recommendations.
- The lining is covered by a 10-year application and material warranty.

If the lining material has not been successfully evaluated to meet the requirements of EI 1541 and/or is not covered by a 10-year application and material warranty, additional soak times and sampling and testing shall be applied to demonstrate suitability. The soak time shall be unanimously agreed by the company represented at the location where the work is to be performed.

Hoses

New fueller loading hoses meeting EI 1529 or ISO 1825 shall:

A: Be filled with product and left to soak for a minimum of eight hours at a temperature of 15°C or higher. Longer soak times are required where product temperatures are lower.

B: A sample shall be taken of the soaked product and subjected to an appearance check. Product used for hose soaking shall not be used as aviation fuel and shall be downgraded.

C: If the Appearance Check shows no evidence of manufacturing residue or discolouration then the hose shall be flushed with at least twice the hose content followed by an inspection of the hose-end strainer.

D: If the appearance check is unsatisfactory then steps A, B and C shall be repeated.

Soak testing is not required for low pressure or suction hoses and hose assemblies for road or rail delivery.

A5.3.2 Soak quantities

The general principle is to maximise contact of the fuel with the surface area of the system under test. In most cases this means filling the system with a large quantity of fuel. Although increasing the fuel volume could result in a large amount of contaminated product, it offers the best assessment of the fuel system.

Storage tanks

Fully lined tanks: the potential risk of generating a large quantity of contaminated fuel is significantly reduced in fully lined storage. Fully lined tanks also reduce the contamination potential from exposure to bare metal containing rolling oils from the steel manufacturing process. Filling fully lined storage tanks to the "Normal Fill Level" is recommended for soak testing. However, as a minimum, there shall be sufficient fuel to cover the floating or fixed suction and the receipt nozzle to allow for circulation through the piping system to flush out any contaminants without pump cavitation.

Partially lined and unlined tanks: these are not applicable to airport storage.

The risk presented by the unlined surfaces is the potential contamination from rolling oils and welding flux on bare metal surfaces. These materials can be removed by high pressure water washing, but some soak testing of the unlined surfaces is then required to demonstrate the effectiveness of the cleaning.

Local circumstances may demand more (or less) stringent procedures, which should be agreed by the company in line with the principles set out in this document.

Pipelines and fuelling hoses

Supply lines, hydrant systems and hoses shall be filled completely.

A5.4 Sampling and testing procedures

At the end of the soak period representative samples shall be obtained from appropriate locations as outlined below and submitted for laboratory testing.

Storage tanks

A Bottom Sample from the low point shall be used for horizontal and vertical tanks. A sample taken from this location represents the most severe case, as the fuel is in close contact with the lining and any heavy contaminants are likely to be collected during sampling.

Pipework

Small piping configurations that can be circulated into a tank may be tested as part of the tank soak test and not sampled/tested separately.

Larger supply piping networks shall have samples taken from each major section (e.g. receipt and delivery lines) for separate testing. Samples should be taken from more than one point and combined into a single composite sample.

Hydrant systems

Hydrant piping networks shall have samples taken from each major section for separate testing. Samples should be taken from more than one point (e.g. low point drains, high point vents and hydrant pit valves) and combined into a single composite sample.

Fuelling vehicles

Samples should be taken from all vehicle low points and combined into a single composite sample.

Sampling – general

In all cases it is important to ensure that the sampling point is clean and flushed before taking the sample. Any accumulated solid matter (particulate) and/or free water should be removed until the fuel is clear and bright. Only approved sample containers shall be used and the container shall be flushed and rinsed thoroughly with the product to be sampled and allowed to drain before use. This is very important because sampling lines on tanks may be forgotten in the commissioning.

At the end of the soak period a representative sample is taken from the fuel system and a selection of laboratory tests are carried out to determine the quality of the fuel used in the soak test. The fuel properties tested shall be compared with the specification limits for the grade of fuel used and with the pre-soak test results for the fuel used (either from the original batch certificate or from testing a pre-soak sample). A successful result requires that all tested properties are within the specification limits and within the tolerance limits established for recertification. If any test result does not fully comply with the applicable specification or falls outside the allowable variances, the product shall be re-sampled and re-tested. If the fuel is found to be unsuitable for use, then the reason shall be investigated and the fuel removed and downgraded to non-aviation use, the system re-filled with on-specification fuel and the soak test repeated until a satisfactory result is obtained.

The laboratory tests are:

	Jet fuels	Avgas	Test method	
			ASTM	IP
Appearance	X	X	D4176	
Existent gum	X	X	D381	540
Water reaction		X	D1094	289
MSEP	X		D3948	
Conductivity	X		D2624	274
Saybolt colour	X		D156	
Thermal stability (JFTOT) *	X		D3241	323
Distillation **	X	X	D86	123
Flash point	X		D56	170

* It is recommended that the thermal stability of the fuel used for soak testing has a breakpoint of at least 275°C to allow for test precision.

** Distillation by simulated distillation (i.e. IP406/ASTM D2887) is preferred because this test is more sensitive to residues/contamination.

The following table and accompanying notes provide a summary of the soak test requirements for storage tanks, piping, ancillary equipment and vehicles.

	Storage tanks			Pipelines including hydrant	Ancillary equipment Pumps, valves, meters, filter vessels etc.
	Fully lined	Unlined/partially lined			
Duration	4-7 days (Note 1)			4-7 days	(Note 2)
Minimum fuel volume	Sufficient to fill to normal fill level	Not applicable at airports.		Fill lines completely	
Laboratory testing	Jet fuel: Appearance, Existent Gum, MSEP, Conductivity, Saybolt Colour, thermal stability (JFTOT), Distillation and Flash Point Avgas: Appearance, Existent Gum, Water Reaction and Distillation				
Sample volume	Jet Fuel: 4 Litres or 1 USG Avgas: 4 Litres or 1 USG (20 Litres or 5 USG required for a full specification test)				

Note 1: Applies to lining material meeting EI 1541 and covered by a 10-year joint material and applications warranty from the manufacturer.

Note 2: Newly installed ancillary equipment (e.g. pumps, filter vessels, valves, pit valves, control valves, meters, sense tubing, water drain lines, etc) should be soak-tested during the system soak test.

Appendix A6 Filtration equipment – routine maintenance checks

A6.1 General

All filter and strainer vessels shall have a drain connection at the lowest point of each chamber. The main sump drain line shall be fitted with a sample valve to facilitate regular checks. All drain and sample lines should have self-closing valves (e.g. spring loaded valves).

All filters shall be equipped with direct reading differential pressure gauges to indicate the pressure loss across the unit. These shall be checked every 6 months (see section 10.4.3) and serviced in accordance with the manufacturer's recommendations.

All filters shall be fitted with air eliminators at the highest point in the filter vessel, and thermal pressure relief valves. Air eliminators shall be inspected annually for proper functioning of the air release mechanism or whenever the filter/separator is opened up, following the procedures outlined in the manufacturer's manuals. Air eliminators that cannot be inspected, e.g. types of welded construction, shall have a visual flow indicator device installed to indicate correct operation. Thermal relief valves are set at a predetermined setting that shall be tested in accordance with the manufacturer's recommendations but at least annually.

Air eliminators and thermal relief valves shall be fitted with outlet pipework routed to suitable spill containment. Isolation valves, where fitted, shall be sealed in the open position.

All filters shall have a plate confirming compliance with the relevant specification and showing the correct designation of the elements installed. The dates of internal inspection and element changes shall be marked on the body of the vessel.

The maximum achievable flow rate through each filter vessel in service shall be calculated and compared to the rated flow as shown on the manufacturer's plate. The maximum achievable flow rate shall be marked on the vessel or a suitable area close to the vessel and noted in the filter records. If the rated flow is significantly greater than maximum achievable flow, then the possibility of de-rating the vessel shall be discussed with the manufacturer.

Stacked elements are no longer acceptable. Where stacked elements are being used, the stacked elements shall be replaced by full-length single elements at the next internal inspection. Note: this applies to all element types (monitors, coalescers, separators and microfilters).

All filter water separators shall have similarity certificates in accordance with EI 1582 confirming compliance of the installed elements and vessel to EI 1581.

New filter elements shall be stored in the manufacturer's original packaging in a cool dry place. Elements shall be used on a first-in-first-out basis and subject to the manufacturer's recommended maximum shelf life.

A6.2 Routine checks on all filters

A6.2.1 Daily, at the start of the morning shift, filter vessels shall be drained of any free water while under pressure. Details of any free water or sediment found shall be recorded. A sample shall then be taken for a Visual Check (hydrant and fueller loading filters), or an Appearance Check (receipt and transfer filters).

A6.2.2 Periodically during each pumping operation, the differential pressure (dP) should be observed to ensure that the maximum limit is not exceeded. Unexpected variations should be reported and investigated.

Once a week, when pumping at the highest flow rate normally used, the differential pressure and flow rate shall be recorded.

Weekly graphs of dP shall be prepared, corrected to, or recorded at, maximum achievable flow rate. The correction to maximum achievable flow shall be established by using either a conversion graph, table or calculator supplied or endorsed by the filter manufacturer.

The conversion from observed dP to corrected dP at maximum achievable flow is not accurate when dP readings are taken at low flow rates and is not valid where a reading is taken at less than 50% of maximum flow. For this reason, dP readings used for the preparation of weekly graphs should be recorded when the filter is operating at, or as close as possible to, maximum achievable flow.

If the corrected dP is 5 psi or more below the previous corrected dP reading, an investigation shall be conducted and the filter vessel should be opened for inspection and element replacement if necessary.

A6.2.3 For airport depot Jet fuel filtration, colorimetric filter membrane tests shall be carried out from a point immediately downstream of each filter. Tests shall be performed monthly for product receipt and fueller loading filters. Tests shall also be performed on at least one into-hydrant filter each month in rotation, such that every into-hydrant filter is checked quarterly.

At locations where filter membranes and records of filter vessel inspections and element changes confirm that fuel is consistently clean, the period between filter membrane tests may be extended to quarterly. To be "consistently clean", monthly records over a period of at least 2 years shall confirm filter element life in excess of 12 months and all downstream monthly colorimetric ratings of 3 (dry) or less. If a colorimetric rating in excess of 3 (dry) is found downstream of a filter, monthly testing for all filters in similar service shall be reinstated until investigations have confirmed that the filtration is performing satisfactorily.

In case of unsatisfactory results, additional filter membrane checks may be necessary. If a value of 4 (dry) or more, or an increase of 2 (dry) is obtained above the normal value at that location, this should be investigated and, if necessary, brought to the attention of the Jet fuel supplier.

All filter membrane tests shall be carried out at a flow rate of at least 50% of the rated flow of the equipment and according to ASTM D 2276/IP 216. All results shall be recorded and the colorimetric membranes retained for 3 years.

A6.2.4 Every 12 months all filters shall be opened and inspected internally for cleanliness of vessel, element appearance, proper fitting of elements and condition of internal lining and cover seal. The cover seal shall be replaced after a maximum of three compressions. The tightness of coalescer and separator elements (and other elements where appropriate) shall be checked with a calibrated torque wrench that positively confirms the torque setting ("click stop" type) and adjusted in accordance with the element manufacturer's recommendations. Elements found to be damaged or showing signs of microbiological growth (such as leopard spotting) or surfactant contamination shall be investigated and (if growth/contamination is confirmed) shall be

replaced. Teflon-coated and synthetic separator elements shall be inspected and tested in accordance with the manufacturer's recommendations.

If blanking plates/elements have been fitted to reduce flow, these shall be checked in accordance with the manufacturer's recommendations at least annually for correct fit/torque and absence of leakage/ bypass.

The results of the inspection shall be recorded.

After opening for inspection or filter element change-out, procedures should ensure that the vessel is refilled very slowly to allow entrapped air to vent and to ensure that no damage is caused to the installed elements.

A6.2.5 Additional filter inspections may be necessary, to check for element seal leakage, etc., if abnormal amounts of solids or water are found downstream of the filter.

A6.3 Element change criteria

A6.3.1 Micro-filters (MF)

MF elements shall be replaced:

- if the differential pressure reaches the manufacturer's recommended maximum at (or corrected to) the maximum achievable flow rate through the filter vessel as currently installed. The maximum achievable flow rate will usually be less than the design or rated flow of the vessel
- if flow rate falls to unacceptably low levels
- if filter membrane tests are carried out and abnormal results are obtained (see 2.3.4 (g))
- if unusual sediment is found downstream of the filter
- if there is a sudden drop in differential pressure without any obvious cause being found
- after 3 years.

A6.3.2 FWS coalescer elements (first stage)

Coalescer elements shall be changed:

- if the differential pressure reaches 1.0 bar (15 psi) at (or corrected to) the maximum achievable flow rate through the filter vessel as currently installed. The maximum achievable flow rate will usually be less than the design or rated flow of the vessel
- if filter membrane tests are carried out and abnormal results are obtained (see 2.3.4 (g))
- if there is a sudden drop in differential pressure without any obvious cause being found
- if unusual sediment or traces of free water are found downstream of the filter
- after 3 years.

It is not mandatory to perform routine single element tests. However, if a test is carried out and the element fails, all the coalescer elements in the vessel shall be replaced.

A6.3.3 FWS separator elements (second stage)

Teflon-coated and synthetic elements shall be:

- inspected and tested annually in accordance with the manufacturer's recommendations and/or when coalescer elements are changed
- changed if washing in accordance with the manufacturer's instructions fails to restore them.

Note: The separator(s) needs to be completely wet with aviation fuel to perform a valid test. Ideally, the test should be performed immediately after removing the element(s) from the vessel.

A6.3.4 Monitor type elements

Monitor type elements shall be replaced:

- if the differential pressure reaches 1.5 bar (22 psi) at (or corrected to) the maximum achievable flow rate through the filter vessel as currently installed. The maximum achievable flow rate will usually be less than the design or rated flow of the vessel
- if flow rate falls to an unacceptably low level
- if filter membrane tests are carried out and abnormal results are obtained (see 2.3.4 (g))
- if unusual sediment or more than a trace of free water is found downstream of the vessel
- if there is a sudden drop in differential pressure without any obvious cause being found
- after the maximum service life recommended by the manufacturer.

A6.4 Records

A6.4.1 Records shall be kept of:

- all daily drainings
- weekly differential pressure readings.

A6.4.2 Records shall be kept of all filter maintenance showing at least the following:

- number and type of new elements installed
- differential pressure before and after change
- throughput since the previous change
- the reason for change and any relevant details.

An example of a suitable form is included as Appendix A7.

A6.5 Gauze strainers

Where gauze strainers are required for fuel quality reasons they shall be fitted with a sample point, drained weekly and inspected monthly.

Other strainers such as pump protection strainers shall be opened, checked for damage and cleaned at least once per year unless they are installed such that they form a pipework low point. All low points shall be drained at least monthly.

A6.6 Differential pressure gauges

All differential pressure gauges shall be tested as per the requirements of 10.4.

A6.7 Filter membrane monitoring – Jet fuels

Membrane preparation, testing and final evaluation should be in accordance with ASTM D2276/IP 216 Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling. 5-litre samples shall be taken for all tests.

A record shall be maintained, showing clearly the test results for each filter. In addition, the exposed colorimetric test membranes shall be retained. All results shall be checked and compared carefully with previous values, and appropriate action taken if high dirt levels are indicated (see below).

A6.7.1 Colorimetric test

Test monitors containing one unweighed membrane shall be used. These may be prepared at the airport.

After test, the wet exposed membranes should be colour rated against the ASTM Colour Standards in the recommended manner. They should then be dried and again rated against the colour standard. Colour rating in the wet condition after sampling provides an immediate indication of fuel cleanliness. The dry rating should be recorded for future reference/comparison. Typically the ratings are one or two points lower after drying (although exceptionally the difference between wet and dry ratings may exceed 2). If a value of 4 (dry) or more, or an increase of 2 (dry) above the previous month's colour rating is obtained, a double membrane colorimetric membrane test should be performed as a first step in an investigation.

To provide a visual record of any changes in fuel quality, the used membranes should be retained for a minimum of 3 years.

A6.7.2 Double membrane colorimetric test

Test monitors containing two unweighed membranes shall be used. These may be prepared at the airport. The reason for using two membranes is to distinguish between particulate contamination and harmless colour bodies. If the fuel is dirty, the upper (upstream) membrane may have a significantly darker colour after testing than the lower membrane. If the fuel contains soluble colour bodies then both membranes will be stained by the test.

After test, the exposed membranes should be allowed to dry and then rated against the ASTM Colour Standards in the recommended manner. To provide a visual record of any changes in fuel quality, both used membranes should be retained for a minimum of 3 years.

Colour ratings shall be assessed as follows:

If the difference between the rating of the upper and lower membranes is 3 (dry) or more, the fuel may not be acceptable. To determine whether there is a problem, an immediate investigation, including a gravimetric filter membrane test and filter vessel inspection shall be carried out until the cause of the problem has been identified and a further double membrane or gravimetric test result is satisfactory.

A6.7.3 Gravimetric test

Test monitors containing 2 pre-weighed membranes (or a matched weight pair) shall be prepared by an approved laboratory in strict accordance with the recommended procedure and sent to the airport depot.

Tests should be carried out in the recommended IP/ASTM manner. After test, the used monitor shall be returned, without opening, to the laboratory, and the gravimetric result determined in accordance with the IP/ASTM procedure. Any results outside the normal range for the location shall be investigated.

Appendix A7: Filtration details

The following details shall be recorded and kept up to date.

Type (MF/FWS/Monitor)

Location	
Filter no.	
Vessel – make – model – rated flow	
Microfilter/coalescer/monitor elements – make – model – quantity	
Separator elements – make – model – quantity	
Last change of elements – date – throughput – differential pressure	
Previous change of elements – date	
Previous change of cover seal (to be changed after three compressions) – date	
The following details were updated On .....(date)	
Current throughput (since last change)	
Current differential pressure	
Latest filter membrane tests Colorimetric (wet and dry)	
Other data/comments	

Appendix A8: Storage tank details

The following details shall be recorded and kept up to date.	
PRODUCT	
TANK NO.	
Date of construction	
Function (service/recovery/defuel)	
Capacity	
Horizontal or Vertical (H or V)	
Single or Double wall (S or D)	
Fixed roof	
Above ground or Buried (A or B)	
P/V valve or Free vent	
Internally coated	
Floating suction	
Overfill alarm system(s)	
Floating blanket	
Bottom - cone up - cone down, slope 1:? - flat - sump	
Tankside sample points for: - upper sample - middle sample - lower sample - bottom sample	
Sample receiving tank (200 litre min)	
Enclosed sampling system	
Central recovery tank	
Firefighting facilities	

Appendix A9: Tank Inspection and Cleaning Report

_____ Terminal/Airport Number _____

1. TANK DATA

Tank Number _____ Capacity _____ m3/USG

Vertical ☐ Horizontal ☐ Other _____

Above Ground ☐ Semi-Buried ☐ Buried ☐

Date Constructed _____ Leaded/Unleaded _____

Extent of Lining _____ Date of Lining _____

Grade Before Cleaning _____ Grade After Cleaning _____

Date of Last Repair _____ Type of Repair _____

Date of Last Inspection _____ Date of This Inspection _____

2. TYPE OF INSPECTION By Entry ☐ Without Entry ☐

Entry Permit Number _____ Dated _____

3. CLEANING METHOD _____

4. INSPECTION OF FITTINGS CONDITION

Contents Gauge _____

Temperature Gauge _____

Level Alarms _____

Floating Suction/Swivels/Cables _____

Water Drain Facilities _____

Valves: Inlet _____

Outlet _____

P & V _____

Leak Detection System _____

Under-floor Valves _____

Other Fittings (Specify) _____

5. DETAILS OF CONTAMINATION REMOVED

Quantity of Sludge _____ Quantity of Water _____

Comments _____

6. DETAILS OF EXTERNAL EXAMINATION

7. DETAILS OF INTERNAL EXAMINATION

(a) Floor

(b) Walls

(c) Columns And Beams

(d) Roof

8. DIAGRAM

Horizontal Section

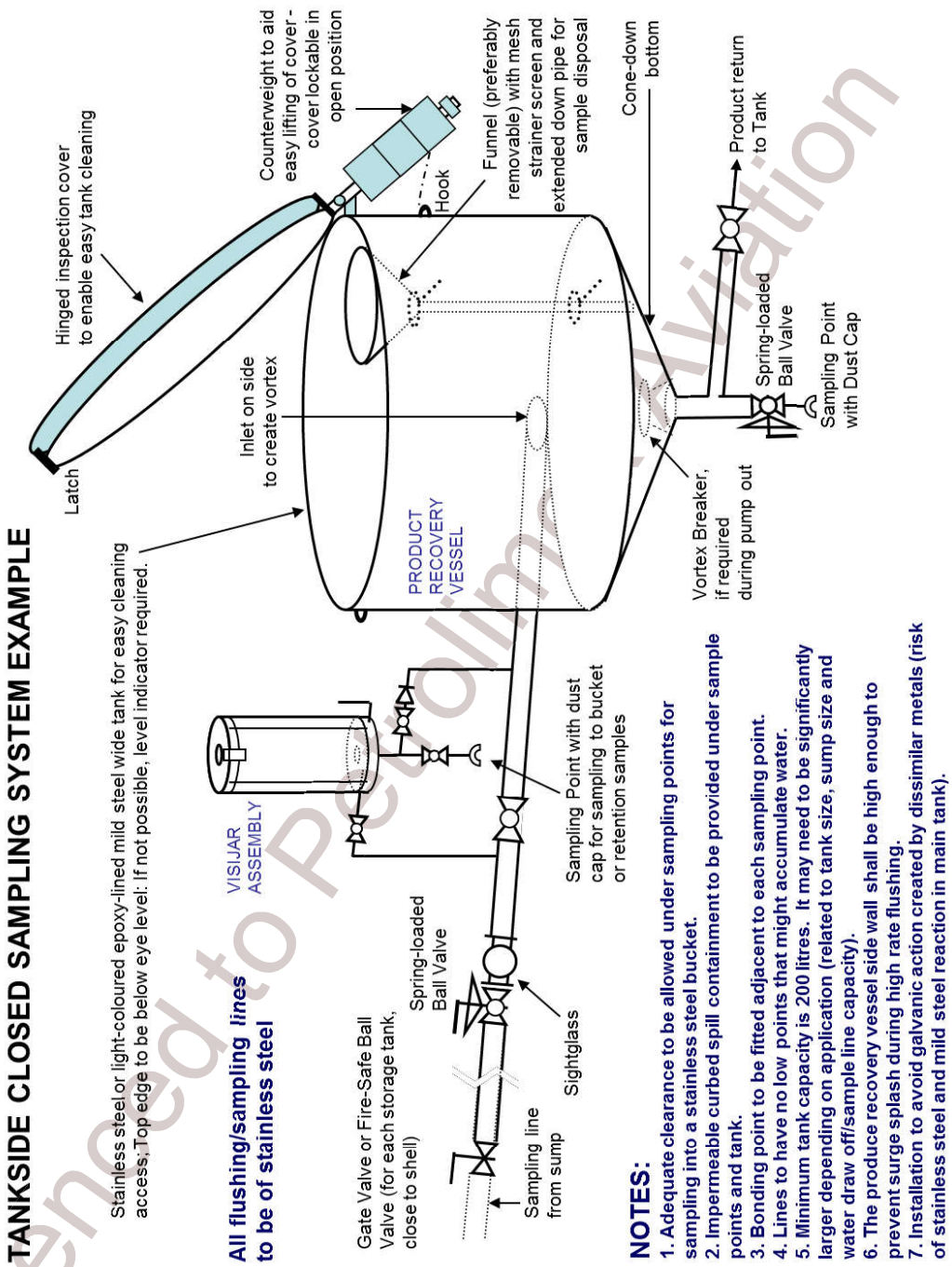
9. REMARKS (reason for inspection, quality control test results etc.)

10. RECOMMENDATIONS

- The Tank is considered to be clean and satisfactory for the storage of Aviation product
- The following actions should be completed before the Tank can be considered suitable for the storage of Aviation products:

Signed _____ Inspector _____

Appendix A10: Sampling system diagram



Appendix A11: Form for Avgas recertification

Date: **Grade** **Quantity in Tank Before**
Tank No: **Specification** ***ASTMD910** **Quantity Received**
Batch No: ***DEF STAN 91/90** **Quantity In Tank After**
*Delete as appropriate

Property	Test Method*	Spec Limits	Previous Recert (Heel)	New 1 RCQ/ CoA	New 2 RCQ/ CoA	New 3 RCQ/ CoA	Weighted average	Current Recert.	Accept. Diff.
Appearance									
Lean Knock Rating	D2700								3
Tel Content, gPb/1	IP228								0.05
Density at 15ºC, kg/m³ Upper Middle Lower	D1298								3.0
Distillation Initial Boiling Point 10% evaporated at ºC 40% " 50% " 90% " End Point, ºC Sum of 10+50% evaporated Recovery, % vol Loss, % vol	D86								 8 4 6 6 6 10 10 - -
Reid Vapour Pressure, kPA	D323								4.5
Corrosion, Cu strip	IP154								Spec Limit
Existent Gum, mg/100ml	D381								3

Batch recertification approved by …….. Date ……

Tank checked and released for service …… Date ……

Where minimum/maximum limits are given, the Acceptable Difference values do not apply to results below minimum or above maximum.

* Test methods as per relevant specification.

Appendix A12: Form for Jet A-1 recertification

Date: **Quantity in tank before**
Tank No: **Quantity received**
Batch No: **Quantity in tank after**

Property	Test Method *	"Checklist" Limits**	Previous Recert (Heel)	New 1 RCQ/ CoA	New 2 RCQ/ CoA	New 3 RCQ/ CoA	Weighted average	Current Recert.	Accept. Diff.
Appearance		C&B							
Saybolt Colour	D156	Report							Def Stan 91/91 Annex E
Distillation- Initial boiling point 10% Recovered, ºC 50% Recovered, ºC 90% Recovered, ºC End Point ºC Residue, % vol Loss, % Vol	D86	 Report 205 max Report Report 300max 1.5 1.5							 - 8 8 8 8 - -
Flash Point ºC	IP170	38 min							3.0
Density at 15ºC, kg/m³ Upper Middle Lower	D1298	775/840							 3 3 3 3
Freezing Point, ºC	D2386	-47 max							3
Corrosion, Cu Strip Existent Gum (Steam jet)	D130 IP540	1 max 7.0 max							Spec Spec
Microseparometer (MSEP) rating ***	D3948	70 min							
Elec Conductivity PS/m at ºC	D2624	50 min 600 max							Spec
FAME Content mg/kg****	IP583/ IP585/ IP590/ IP599	50 max							

Batch recertification approved by …….. Date ……
Tank checked and released for service …….. Date ……

Where minimum/maximum limits are given, the Acceptable Difference values do not apply to results below minimum or above maximum.

* Test methods as per relevant specification.

** See JIG Bulletin for latest issue of AFQRJOS

*** Precision data is not available for fuel containing static dissipator additive. An MSEP rating below the minimum specification limit should be grounds for investigation, but is not to be used as the sole reason for rejection of a fuel batch – see JIG Bulletin 65.

**** FAME test limit, see JIG bulletin 75 for guidance on when FAME testing is required.

Appendix A13: Hose inspection and test procedures

This Appendix does not apply to aircraft fuelling hoses. Test procedures for these hoses are detailed in Appendix A13 of the Standards for Into-plane Fuelling Services.

A13.1 Monthly – all airport depot hoses

A13.1.1 Fully extend the hose and apply normal pump pressure to loading hoses .

A13.1.2 While under pressure (or for suction hoses, during product transfer) inspect for external damage, leakage and other signs of weakness.

Inspect for coupling slippage indicated by misalignment of the hose coupling and exposed areas where slippage has occurred.

A13.1.3 With the hose fully extended, release the pressure completely and inspect for soft areas. Particular attention should be paid to sections of the hose within about 45cm (18 inches) of couplings, since these sections are particularly prone to deterioration. These sections shall be examined for weakness by pressing the circumference to feel for soft spots, blisters etc.

Note: Kinking of the hose (especially repeated kinking) may damage the internal structure of the hose and should be avoided. If the internal lining in the hose becomes damaged, the fuel may travel along the carcase and appear some distance from the source of the damage.

Note: It is not necessary to remove wheel fittings and hose protection beads.

A13.2 Six-monthly test – pressure hoses only

A13.2.1 A pressure test, using a hydrostatic test pump, shall be carried out when commissioning new hoses, whenever couplings are attached or re-attached to hoses, when accidental damage to a hose is suspected, and routinely every 6 months.

Note: The fitting of re-attachable end-fittings to hoses (where agreed by the Company) shall only be performed by competent trained staff certified by the hose manufacturer or their authorised distributor.

Required test pressures are shown in the table below.

Pump output pressure	6 monthly hydrostatic test/ pressure	Commissioning new hoses with factory fitted couplings	Attaching/ reattaching couplings
Less than or equal to 5.5 bar (80 psi)	No requirement	15 bar	20 bar
Greater than 5.5 bar (80 psi)	15 bar test	15 bar	20 bar

A13.2.2 The test procedure is to connect the fully extended hose to the test pump and fill with fuel. It is not necessary to remove the hose if there is a suitable isolating valve in the pipework upstream of the connection. However, the hose shall be pulled out from any stowage position and be tested in a straight position without bends or kinks.

Appropriate PPE including eye protection shall be worn.

Gradually apply test pressure and bleed any entrapped air from the hose and test equipment. Because of the possibility of a hose burst, do not closely inspect the hose during pressurisation and wait for 1 minute after reaching maximum test pressure before inspecting. Maintain test pressure for at least 3 minutes and only as long as is necessary to inspect for external damage and coupling slippage.

Release pressure completely, re-pressurise to 3.5 bar and examine as described in A13.1.2. Finally, release pressure and drain the test pump to prevent possible contamination of product during future use.

A13.3 Damaged hoses

Any of the following abnormalities noticed during daily operation, monthly or 6 monthly tests requires immediate hose replacement:

- soft spots, kinks/ deformities, bulges or blisters, excessive abrasion or cracking exposing the carcass textile reinforcement
- any cut in the hose structure that has damaged the carcass textile fabric
- if the hose has been run over once by any vehicle.

However, small cuts do not justify replacement unless the rubber in the immediate area is loose and could allow liquid to enter between the cover and carcass. If the defect is close to the hose end, then it is permissible to cut the damaged section and re-attach the couplings. A hydrostatic pressure test is required before the hose is returned to service.

Appendix A14: Hydrant pit valve testing

Hydrant pit valves shall be inspected and tested in accordance with the following schedule to ensure that the performance of the equipment is within acceptable limits. There shall also be a planned maintenance system in accordance with the manufacturer's recommendations. All equipment used for the following checks shall be checked in accordance with the manufacturer's requirements.

A14.1 Static testing/inspection

A14.1.1 Weekly

1. Ensure pit box is clean and free from water, product and surface dirt/grit. Clean if required.
2. Examine condition of pit lining.
3. Ensure valve and components are free from product leaks.
4. Examine condition of jacking screws, where fitted.
5. Visual examination of operating handle/linkage and lanyard connections.
6. Ensure presence and condition of dust cap and tether.
7. Examine pit lid condition, seal (if fitted), tether (if required), pit number and grade marking if applicable.

Any defects shall be reported immediately.

A14.1.2 Monthly

The integrity of the valves shall be checked once per month. This is done by depressing the equalising valve as described below. As a small amount of fuel will be released, a protective shield/cover shall be used to contain any spray of fuel and to protect the operator. Alternatively, a test coupler and pressure gauge kit may be used, if supplied for the purpose by the manufacturer with instructions for use. With the main valve in the closed position, the test coupler is attached, thus opening the equalising valve. A continued rise in pressure within the coupler indicates that the pit valve needs to be repaired.

A14.1.2.1 Lanyard operated valves

1. Ensure that the operating mechanism is free from obstruction, is secure and that no excessive free play is observed.
2. With the valve operating mechanism in the closed position, and using the necessary shield/cover, depress the equalising valve. After the initial release of fuel, a steady flow will indicate a failure of the main seal and the valve shall be removed from service for repair.

   If only a few drops of fuel are observed following the initial release of fuel, the valve is serviceable.

A14.1.2.2 Dual air operated valves

1. As A14.1.2.1(1) above.
2. With the valve operating mechanism in the closed position, and using the necessary shield/cover, depress the equalising valve. After the initial release of fuel, a steady flow will indicate a failure of the pilot valve seals and/or the main valve seal. The valve shall not be used in this condition.

   If only a few drops of fuel are observed following the initial release of fuel, the valve is serviceable.

A14.2 Annual dynamic testing

Close the hydrant pit valve from full flow rate, by pulling the lanyard. The valve closure time shall be between 2 and 5 seconds. This test may be performed during aircraft fuelling.

Note: Certain older mechanically operated pit valves were not designed to meet the more stringent performance requirements currently recognised within the industry, and may not meet all the above requirements.

In this situation, and in conjunction with the manufacturer of the valves, accurate performance criteria should be agreed and included in the written testing/operating procedures.

The following procedure is considered best practice (use a stopwatch):

A) Lanyard-operated valve testing

1. Following bonding, connection of lanyard and other normal preparatory work, connect the servicer pit coupler to the hydrant pit valve to be tested.
2. Connect servicer delivery hoses to a receiving vehicle with sufficient ullage for test and venting systems designed to tolerate maximum achievable flow rates. (This test can also be performed during an aircraft refuelling.)
3. Establish the highest achievable flow rate and, with the deadman still activated, pull the lanyard.
4. Observe the time immediately when the lanyard is pulled.
5. The total time from operation of the lanyard until flow stops should not exceed 5 seconds.
6. The time of valve closure, from when flow begins to decrease until flow stops, should not be less than 2 seconds.
7. Contact the manufacturer or their local distributor for adjustment or replacement if the above times are exceeded.

B) Dual air and lanyard-operated valve testing

1. Following bonding, connection of lanyard and other normal preparatory work, connect the servicer pit coupler to the hydrant pit valve to be tested.
2. Connect servicer delivery hoses to a receiving vehicle with sufficient ullage for test and venting systems designed to tolerate maximum achievable flow rates. (This test can also be performed during an aircraft refuelling.)
3. Open the pilot valve and activate the deadman to allow air supply to the coupler and the pit valve.

4. Establish the highest achievable flow rate and, with the air still applied, terminate the air supply to the pit valve and release air pressure either by activating the test valve (see diagram below) on the coupler or alternatively by removing the quick disconnect coupling to the pilot.
5. Observe the time immediately when the air is disconnected, then when the flow rate begins to decrease and finally when the flow stops.
6. When a test valve is used, reset to its normal fuelling setting.
7. The total time from operation of the lanyard/disconnection of the air until flow stops should not exceed 5 seconds.
8. The time of valve closure, from when flow begins to decrease until flow stops, should not be less than 2 seconds.
9. Contact the manufacturer or their local distributor for adjustment or replacement if the above times are exceeded.

A14.3 Annual wear check

The outlet adaptor of each pit valve shall be checked for wear annually, using an appropriate gauge provided or approved by the pit valve manufacturer.

A14.4 Testing after repair or overhaul

After repair or overhaul, the valve shall be fully tested, preferably on a test rig at the maximum flow to which the valve will operate in service. Closure time by pulling the lanyard (see A14.2) shall be between 2 and 5 seconds.

A14.5 Records

A14.4.1 All routine checks and the results of performance tests shall be recorded.

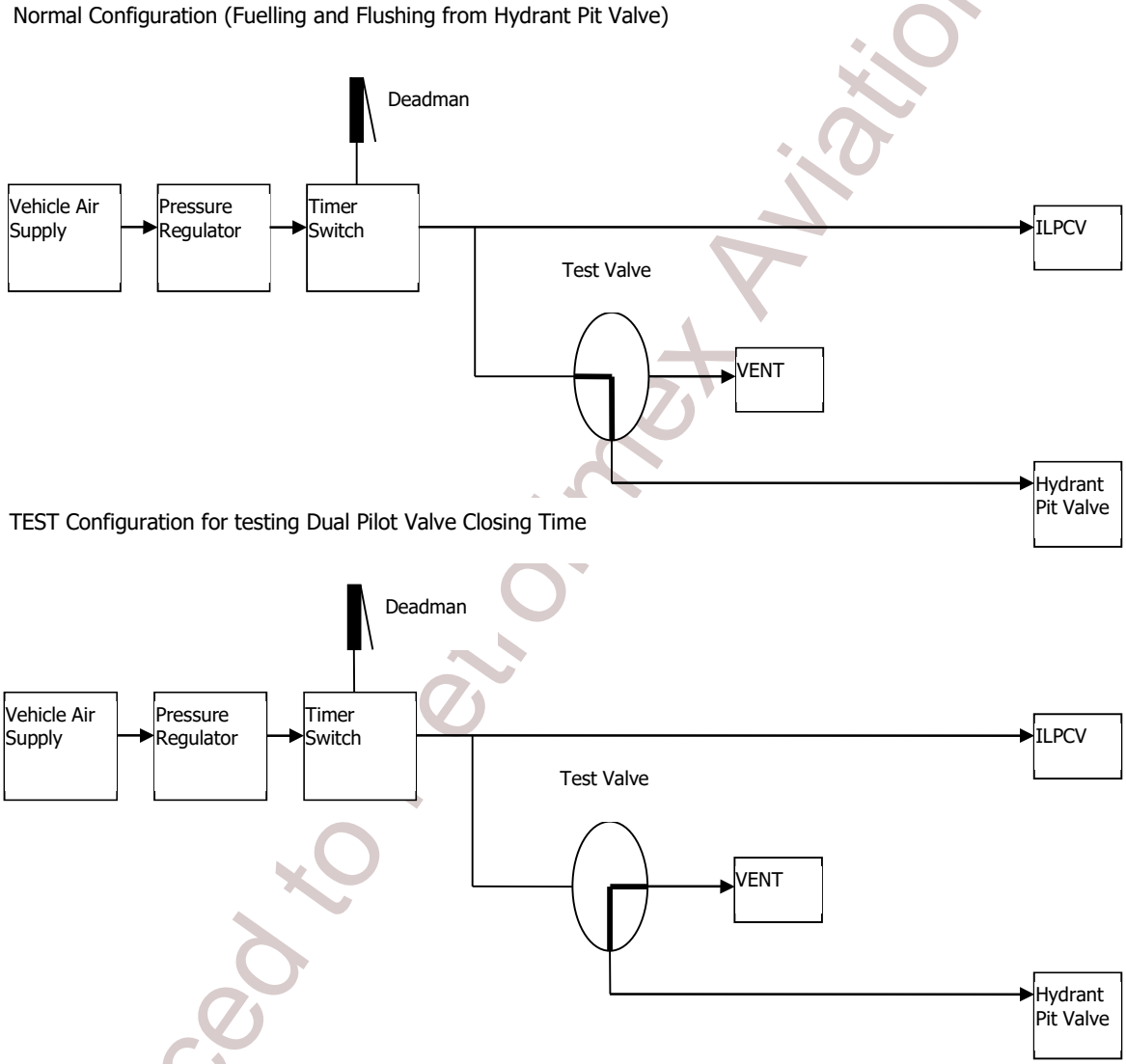
A14.4.2 All defects and the required maintenance/repair shall be recorded.

A14.6 Training

All staff as appropriate shall be fully trained to carry out the above procedures safely and effectively.

Written operating procedures shall be readily available and should cover any particular requirements relating to all makes/types of pit valves used in the hydrant system.

Figure A14.1 Arrangement for testing hydrant pit valve closing time on hydrant pit valves fitted with dual pilot valves



Appendix A15: Diagram of a pressure control test rig

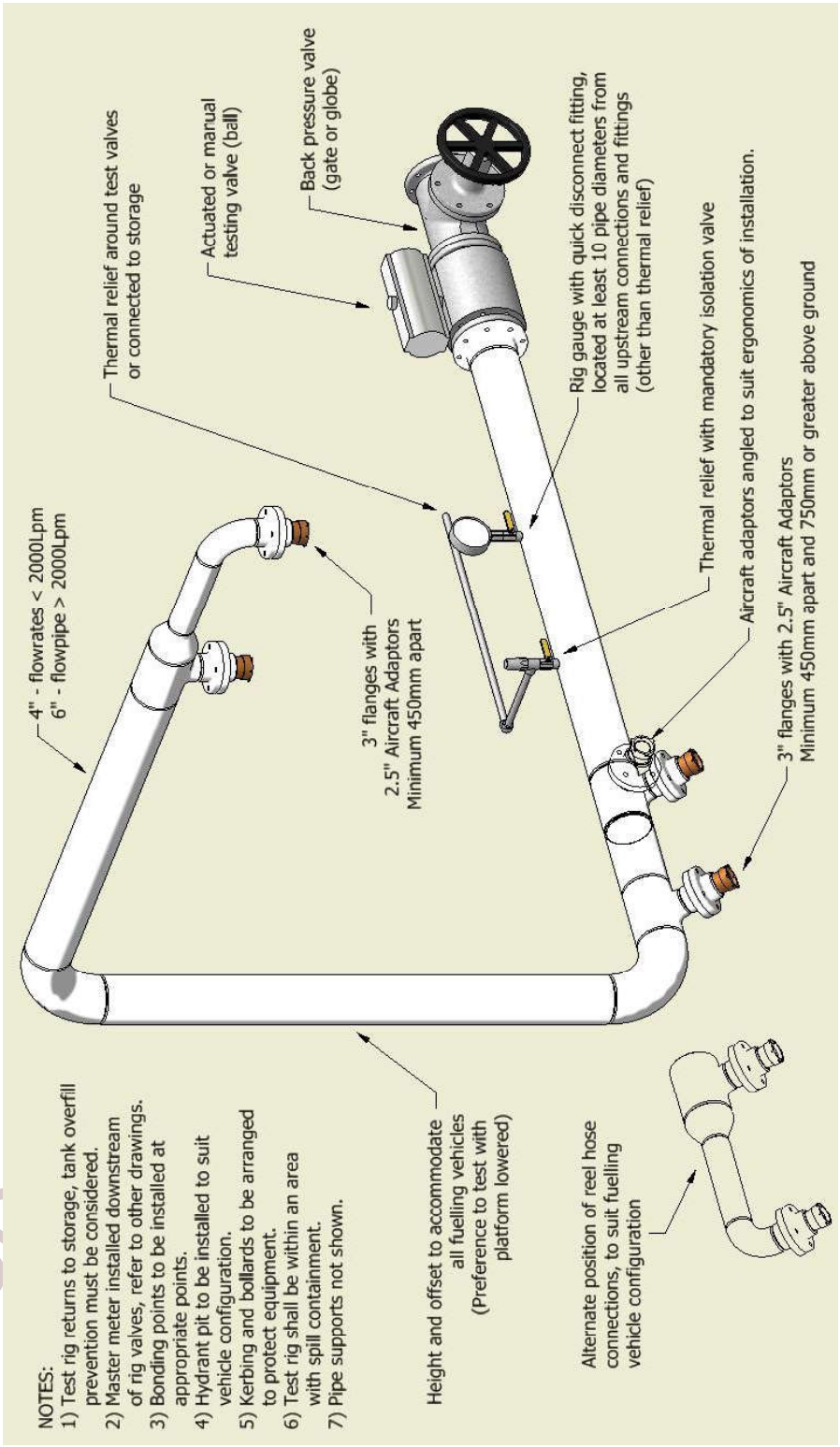


Figure A15.1: An example of a suitable test rig for pressure control and deadman testing

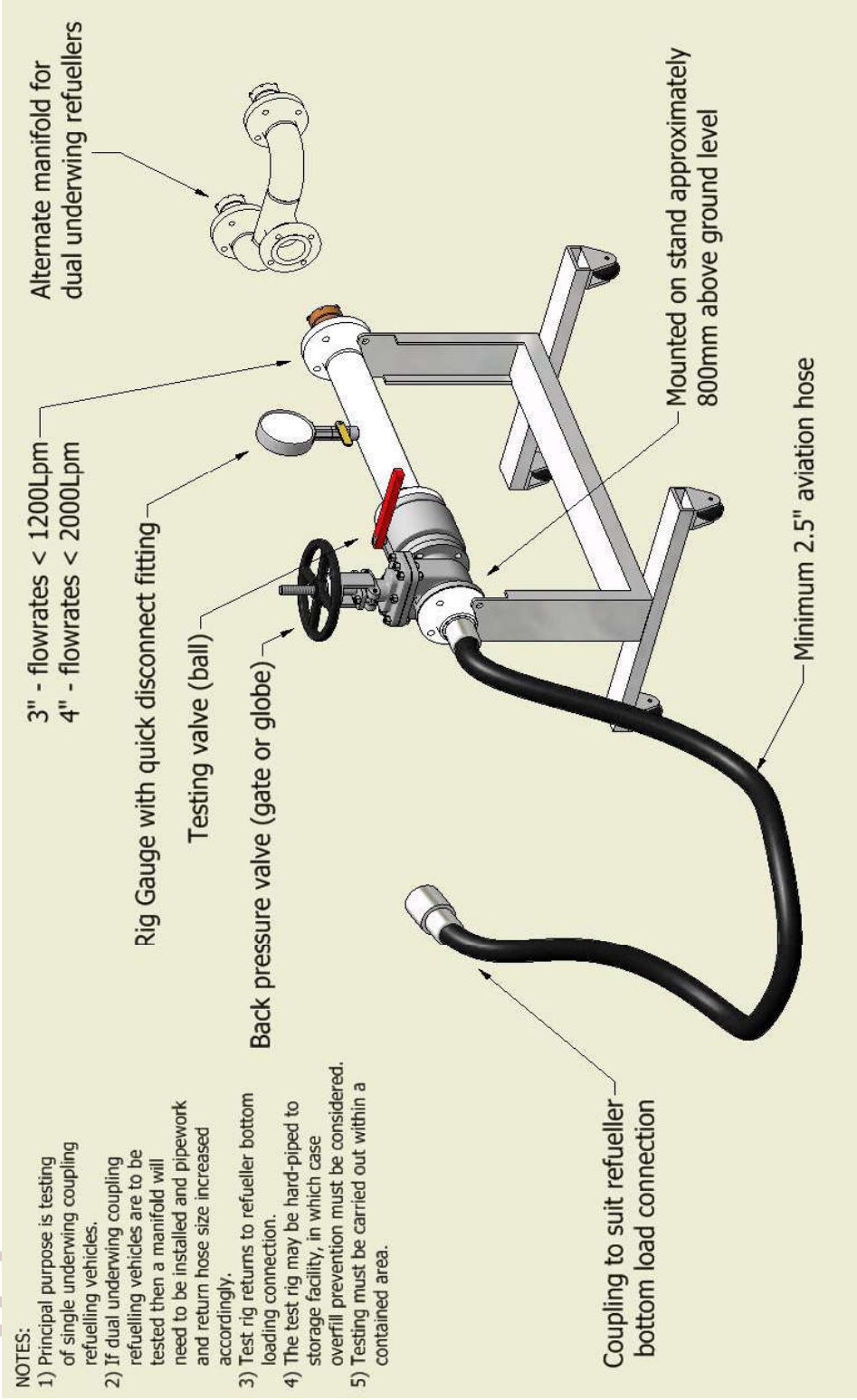


Figure A15.2: An example of a suitable test rig for fuellers by circulation or tank return

Appendix A16: Road tankers/rail tank cars: change of grade and cleaning procedures

A16.1

Dedicated rail tank cars and road tankers are the preferred option but where rail tank cars or road tankers have been previously used for other duties, cleaning procedures shall be employed to ensure they are fit for purpose to carry aviation fuels.

A16.2

Only vehicles which have carried an acceptable last load shall be used for the transportation of aviation fuels. When changing road tankers and rail tank cars from one grade to another, procedures A, B or C in the table below shall be applied to ensure there is no product contamination from the last grade carried.

Table A16.1: Road tanker/rail tank car grade changes

Previous grade carried	Grade to be loaded	
	Jet fuel	**Avgas**
Avgas	B	-
Motor gasoline (leaded or unleaded)/Jet-B/JP-4	B	A
Kerosene/JP-8/TS1	A	B
Jet A/A-1	-	B
Gas oil or diesel, including ultra-low sulphur diesel and biodiesel, containing up to 15% bio component*	C	C
Black oils, chemicals, lubricating oils, vegetable oils and biodiesel containing greater than 15% FAME	Seek specialist advice	
*It should be noted that diesel/gas oil that is not declared as a 'bio' fuel may still contain FAME at concentrations up to a level defined by the locally applicable diesel specification (e.g. 7% for EN 590).		
Cleaning procedure A: The tank, pipework, and where installed, meter, pump and filter, shall be completely drained until no liquid remains (drainings to be downgraded to non-aviation use). Internally inspect each compartment through the tank access chamber to ascertain that it is clean and dry. If sludge or dirt is present, it shall be removed.		
Cleaning procedure B: The tank, pipework, and where installed, meter, pump and filter, shall be completely drained. Introduce flushing product to cover the foot valves (flushing product shall be the		

new grade to be loaded or, for Avgas, should preferably be unleaded motor gasoline); hold for 10 minutes. The tank and pipework shall be completely drained until no liquid remains (drainings to be downgraded to non-aviation use). Internally inspect each compartment through the tank access chamber to ascertain that it is clean and dry. If sludge or dirt is present, it shall be removed.

Note: Precautions are required to mitigate the risk of static discharge occurring.

The intention of these procedures is to confirm that the next grade can be loaded safely and delivered in an uncontaminated condition. If these procedures fail to satisfy this requirement then flushing in the case of procedure A, or further flushing in the case of procedure B, of the compartments may be required. If the vehicle tank cannot be left in a suitable condition for filling by using procedures A or B, then the tank shall be gas-freed and thoroughly cleaned. Detergents or cleaning chemicals shall not be used.

In circumstances where the above procedures are not permitted due to automatic loading and/or vapour recovery systems, then local procedures that meet these additional requirements shall be developed.

Cleaning procedure C:

Either the tank shall be gas-freed and thoroughly cleaned, or the tank shall carry a buffer load (motor gasoline or kerosene) followed by grade change procedure A or B as required. The first cargo of Jet A-1 loaded after a cleaning/buffer load shall be tested for FAME to validate the change of grade procedure.

Steam cleaning may be considered equivalent to the procedures above. If undertaken, adequate drying/draining is required.

Appendix A17: Equipment calibration programme

All monitoring and measurement devices shall be calibrated on a regular basis to ensure accuracy to within required tolerances. Each location shall establish a list of such equipment and maintain records, showing for each device:

- identity/reference number of equipment
- frequency of required calibration (in line with the manufacturer's recommendations)
- date of calibration and next due date for calibration
- signature of the individual responsible for the calibration
- certificate of calibration if performed by a third party
- details of adjustments and repairs carried out.

The following table shows examples of the type of equipment requiring calibration, the required frequency and the section reference where more detail can be found.

Equipment	Calibration frequency	Reference
Bulk meters	6 months	10.3.1
Master meters	3 years	10.3.1
Hose pressure test gauges	6 months	10.4.1
Test rig gauges	6 months	10.4.1
Master gauges	3 years	10.4.2
Thermometers	6 months	10.6
Hydrometers	6 months	10.6
Electronic densitometers	6 months	10.6
Conductivity meters	3 years	10.12
Continuity meters	Manufacturer's recommendation	10.12
Torque wrenches	Manufacturer's recommendation (maximum 5 years)	10.12

Appendix A18: JIG Joint Ventures and locations on the JIG Inspection Programme

A18.1 JIG Joint Ventures

At many airports, aviation fuels are stored and delivered, either by hydrant system or direct into mobile fuellers, through fixed facilities that are jointly owned and operated by more than one company. In these cases the equipment standards, quality control and general fuel handling standards and procedures followed shall be agreed by and be acceptable to each of the participants, to ensure that their contractual commitments to airlines or other customers are being met.

A JIG Joint Venture is an aviation fuel handling operation where there is a minimum of two Guarantor Member companies from the list below, operating to this Standard.

BP	Kuwait Petroleum
Chevron	Shell
Eni	Total
ExxonMobil	

A18.2 Application to Joint Ventures

A JIG Joint Venture as described above shall operate to the entirety of this Standard. Detailed procedures based on this Standard shall be prepared and incorporated in, or appended to, the signed operating agreement covering the system to make them formally binding to all participants. If company participation is different between the airport depot and the into-plane fuelling operations, separate agreements and procedures shall be prepared for each independent operation.

The fuel quality specifications shall also be incorporated in all operating agreements, by reference to the current issue of the JIG Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Check List, or approved aviation fuel specification.

A18.3 Staff responsibilities and inspection requirements

A18.3.1 Staff responsibilities

It is the responsibility of the operation's management (i.e. the operating company board of directors or the operating committee) to ensure that the facility design and operating procedures, as set out in manuals and other directives, conform to acceptable industry standards and to all the relevant requirements of government authorities with respect to safety, security, fire protection and environmental protection.

The prime responsibility of airport storage (and hydrant) depot staff is to ensure that all consignments of fuel are received and maintained in complete conformity with the requirements of the agreed specifications, and that they are delivered in a safe and satisfactory manner by hydrant or direct into fuelling vehicles to the satisfaction of all participants.

The manager of an airport storage (and hydrant) depot facility shall have overall responsibility for all aspects of the operations under his/her control, and shall be responsible for ensuring that all operations are carried out in accordance with

the agreed procedures, and with all generally accepted standards of safety and good practice.

The manager shall be fully satisfied with the documentation and quality of fuel stocks received. It is the responsibility of the fuel supplying companies to satisfy themselves as to the standards of their supply sources and, if requested, to confirm that the fuel quality is acceptable and that the supply facilities meet recognised industry standards. The manager of the location shall check that the supply locations which are part of the JIG JITS inspection programme and operated to JIG 3 have adopted EI/JIG 1530 as their standard for the quality assurance for aviation fuels that they handle.

If the manager has doubts about the quality of any fuel stocks received, or is dissatisfied with documentation or any other aspect of the supply arrangements, he/she should immediately advise the local representative of the fuel supply company, who should then take the matter up through company channels, other participants being advised as necessary.

A process for handling supply shortages should be available for each airport depot location. This should be developed with the airport authorities, airline representatives and supplying companies and should include procedures for advising customers of reduced fuel allocations. The manager is responsible for keeping the procedures up to date and for deciding when it is necessary to implement them.

A18.4 Inspection requirements

Inspections to JIG Standards shall be carried out at least once per year to ensure compliance with locally prepared procedures. JIG inspections shall be carried out at into-plane fuelling services at least once per year. However, the frequency of these JIG inspections may be increased or decreased at certain locations by unanimous agreement of the participant companies.

Inspections shall be conducted to ensure compliance with the locally prepared procedures. The locally prepared (site specific) procedures/operations manual shall include an updated list of any approved variances from the current issue of this Standard (see "Standards Variance Approvals" in section 1.4.3), and a copy of this manual (in English language) shall be made available to JIG inspectors.

Before leaving the location, the JIG inspector shall discuss the recommendations to be made in the report with the facility manager. Where these recommendations cover deviations from procedures laid down in the manuals of the system concerned, corrective action shall be implemented by the manager. If issues arise during the inspection that have an impact on another aviation fuelling operation at the airport, the JIG inspector should invite both facility managers to participate in a meeting at the end of the inspection. Items of a serious nature shall be communicated to all participants as well as to the local manager without delay. If matters of a controversial nature arise during the inspection, the inspector may call an immediate meeting of all participants to resolve the issue(s).

An inspection report shall be finalised in the JIG Inspection Tracking System and issued as soon as possible by the inspecting company but not later than six weeks after inspection completion. If the general inspection assessment is less than satisfactory then the report shall be issued not more than three weeks later.

It is the responsibility of the facility management to initiate the required corrective action recommended in the report. The JIG Inspection Tracking System shall be used by the

facility management to monitor and address any related inspection report recommendations. The facility management shall continuously update and closeout recommendations directly in the JIG Inspection Tracking System without delay. Any matters of contention shall be referred to the international participants for resolution.