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**Aviation Fuelling** Guide

2003 Edition

# Aviation Fuelling Guide

This document is a fuelling guide meeting ExxonMobil Aviation Standards. For additional information contact the Regional Operations groups.

## Foreword

Aviation products, including Jet Fuels, Aviation Gasolines, Lubricants and Specialties, are among the most critical products that ExxonMobil manufactures and markets from the standpoint of exacting quality requirements.

Strict precautions must be taken to see that these products are manufactured to the proper specifications and delivered safely to our customers in the same condition.

International flights account for a high percentage of the world's air travel and aircraft operators expect common global standards of product quality and service at airports world-wide. ExxonMobil must be sensitive to and responsive to these needs and desires of its customers, providing them with cost effective service and product quality satisfactory to their requirements and International specifications.

Standards and procedures to ensure the integrity and safety of our employees, contractors and customers are paramount. Product reliability is maintained by diligent application of ExxonMobil Aviation quality control standards. 'Near Miss' reporting is an integral part of avoiding even the smallest of incidents. ExxonMobil Aviation places great importance on keen observation and intervention.

Every employee is trained to:-

### **Be Alert – See the Risk – Act and Report it.**

The purpose of this guide is to define standardised procedures as they pertain to aviation fuel handling and, to serve as a practical reference source for airport fuelling personnel and aviation product customers. By adhering to these standards, airport service personnel contribute to:

- Safety on the ground and in the air**
- Efficient airline operation**
- The satisfaction and goodwill of the customer and the public**

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Full details of ExxonMobil Aviation Standards are contained in the Aviation Operations Standards Manual (AOSM). The AOSM is the reference document and takes precedence in all cases.



## Contents

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01 Aviation engine fuels – general

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02 Fuel contamination

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03 Safety

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04 Fuel receipts

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05 Airport storage

---

06 Loading mobile fuellers

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07 Servicing of aircraft

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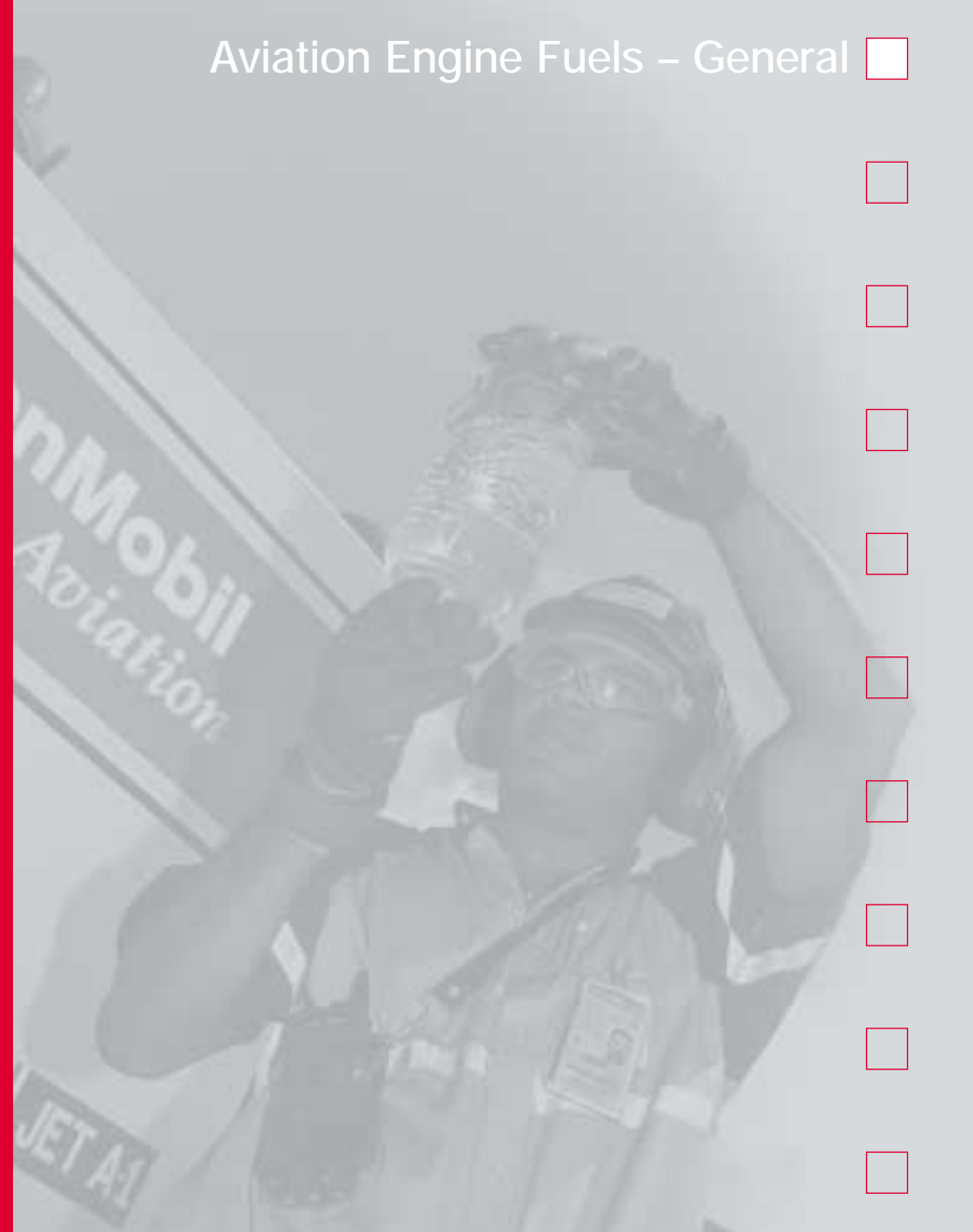
08 De-fuelling of aircraft

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09 Lubricating oils

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Watch your step, don't trip!



The physical characteristics of aircraft engine fuels need only a brief treatment in this guide. The composition and performance of engine fuels likewise permits only a brief treatment. To do justice to these two aspects in all their ramifications would require too great a space to be included in a guide designed to cover safe fuelling procedures.

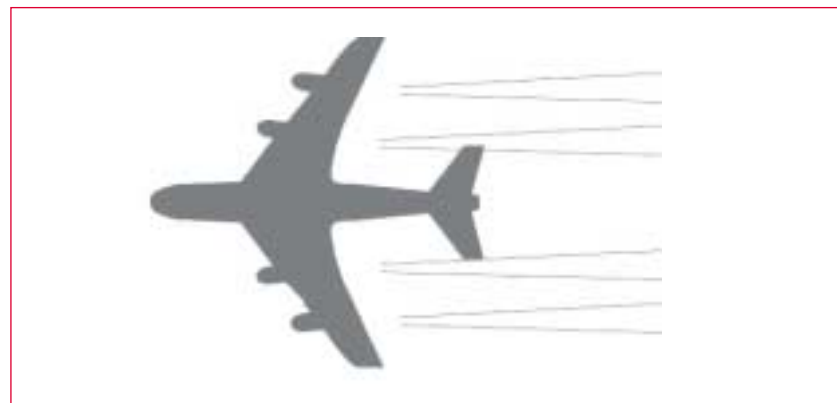
### Aviation Gasoline – AVGAS

- There are three main grades of aviation gasoline in use today for piston engine aircraft: Avgas 80, Avgas 100 and Avgas 100LL. However, Avgas 80 is only available at relatively few locations. (Defining Specifications are U.K. Defence Standard 91-90 and the U.S. ASTM D-910. There is no Joint Fuelling Systems Checklist for Avgas.)
- Aviation gasoline is a mixture of components derived from crude petroleum and synthetic hydrocarbon blending agents with the addition of very small quantities of chemical agents such as tetraethyl lead, inhibitors and dyes. Avgas 100/100LL are very high-octane fuels specific for high compression aircraft engines.
- Aviation gasoline is a highly flammable product. Rules and regulations concerning its handling and storage must be strictly followed to prevent unsafe conditions.

### Aviation Jet Fuels

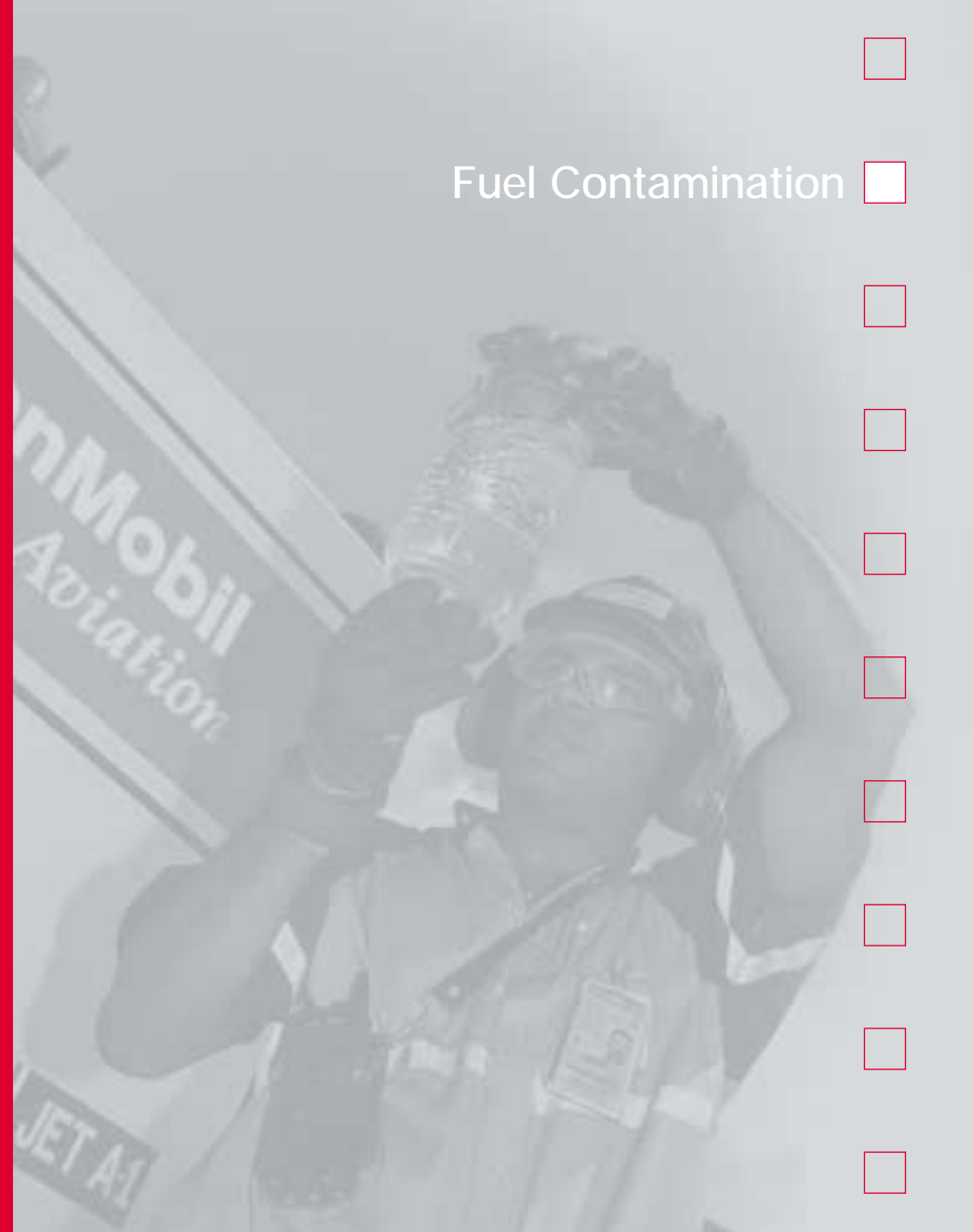
Two basic types of jet fuel are used for turbine powered aircraft: Kerosene type jet fuel (Jet A-1, Jet A) and Wide-Cut jet fuel (Jet B). (The defining specifications for Commercial Jet fuel are U.K. Defence Standard 91-91 and the U.S. ASTM D 1655. There is a Joint fuelling Systems Checklist for Jet A-1 that embodies the most stringent requirements of these two specifications.)

- Kerosene type jet fuels have a flash point above 38°C (100F) with the exception of Jet B. At ambient temperatures below 30°C these fuels are not considered to give off flammable vapours. However in tropical and many sub-tropical regions where ambient temperatures rise above 30°C, the product must be treated as flammable.  
Note:- Vapour Spaces in storage tanks, filters, compartments etc. may contain explosive mixtures of air and fuel vapours under all temperature conditions. Ignition sources must be excluded at all times.
- The key difference between Jet A1 and Jet A is the freeze point (-47°C for Jet A1 and -40°C for Jet A).
- Wide-Cut jet fuel (Jet B) contains both naphtha (gasoline) and kerosene fractions. It is thus a highly flammable product under all ambient conditions and must be handled in the same manner and with the same precautions that are required for aviation gasoline.



Stay focussed, wear protective glasses.

Fuel Contamination



## Fuel Contamination

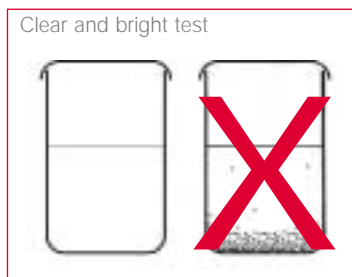
The delivery of clean, dry fuel of the proper grade into the aircraft tanks is one of the greatest responsibilities of the fuelling crew, because aircraft engines are particularly intolerant of fuel contamination. The four principle contaminants that reduce the quality of both gasoline and jet fuels are water, rust or scale, dirt and other petroleum products. Any one of them can cause engine failure, which may result in loss of life and aircraft.

### Water occurs in three different forms.

- Dissolved in the fuel. This cannot normally be removed from the fuel.
- Entrained or suspended in the fuel. Entrained water may sometimes be detected with the naked eye. The finely divided droplets reflect light and in high concentrations give the fuel a dull, hazy or cloudy appearance. Particles of entrained water may coalesce or unite to form droplets of water.
- Bulk quantities of water. These may be caused by leakage into storage tanks through fill lines, manholes, etc.; delivery of water laden fuel; condensation of moisture from the atmosphere; or the coalescence and subsequent settling of entrained water.

### Tests for Detecting Presence of Water

- 01 "Clear and Bright": When this term is applied to a fuel test sample taken in a colourless glass jar, it means that the fuel is completely free of visible solid contamination and water (including any resting on the bottom or sides of the container). The sample must also possess an inherent brilliance and sparkle in the presence of light. (Cloudy or hazy fuel is caused, usually, by free and dispersed water but it can also occur because of finely divided dirt particles.)



- 02 HYDROKIT,: A "Go No-Go" type of water detector. The test consists of exposing a pre-measured fuel sample to a reactive powder, which is colour sensitive to free water in concentrations of about 30 ppm or more. The powder changes from white to pink if the fuel contains about 30 ppm or more of free water after two minutes of contact with the fuel.
- 03 Shell Water Detector (SWD): This test consists of a small yellow capsule, fitted to a syringe, which is then exposed to a 5ml fuel sample drawn through the syringe. The colour of the centre of the capsule changes according to water content, and changes to green when there is a positive indication of water contamination (around 30ppm) capsules may only be used once and are only to be used in accordance with the procedures on the Shell Water Detector (SWD).

## Particulate

Particulate or dirt is normally found in the form of rust or scale, which has been released from the inside of tanks, piping and transportation vehicles. Foreign contaminants can also be present in the form of lint from wiping rags, particles from gaskets and hoses, and dust (e.g. inhalation through tank vent openings).

### Tests for Detecting Presence of Dirt

- 01 "Clear and Bright": (Refer to previous description as for water testing).
- 02 Colour: An "on the spot" test procedure utilising a filter membrane. A measured quantity of fuel is passed through the membrane and is rated against a set of ASTM colour standards.
- 03 Weight: (Only used if the "Colour" test produces off-spec results). A test procedure, which measures the weight of solid contaminants, collected from a fuel sample on a filter membrane. The holder, complete with membrane, is sent to a laboratory for determination of the total amount of solids in the fuel.

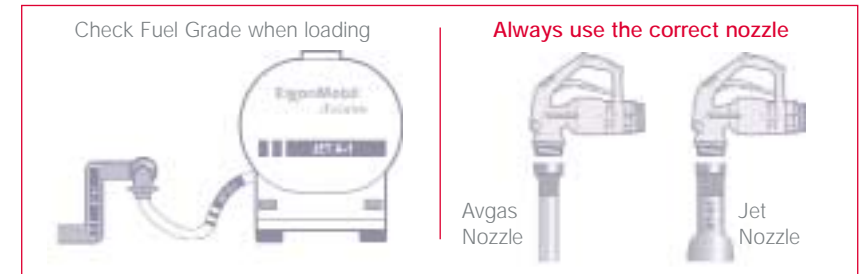
## Contamination with other Types or Grades of Fuel

An aircraft engine is designed to operate most efficiently on a certain type of fuel of definite specifications. The use of fuel that deviates from these specifications reduces operating efficiency and, under some conditions, can cause complete engine failure. At the airport, contamination with other products can be detected by simple checks such as appearance, colour, density or specific/API gravity, and sometimes flashpoint.

### Remember:

- Piston engines require aviation gasoline of the proper grade. Flight is endangered if the aircraft is serviced with jet fuel or with avgas of a lower grade/octane than specified. **It is against ExxonMobil policy to supply Mogas for aircraft use.**
- As an additional safeguard, make your own assessment of the aircraft type (Avgas or Jet). Piston engined aircraft (which all require Avgas) can be identified by:
  - An alternator (not featured on a turbo prop. engined aircraft).
  - Cooling fins on the engine.
  - Exhausts of a smaller diameter, compared to those of a turbo prop engine.
  - A turbo prop engine would also typically have a large air intake.
  - CAUTION: Some piston engines may have nacelle marks indicating "Turbo-Charged". This does not mean they use jet fuel. All piston engines regardless of labels use avgas. Turboprop engines, however, are derived from jet engines and use jet fuel.
- A Jet nozzle will not normally go into an Avgas overwing fuelling point (67mm nozzles as opposed to 45mm nozzles). This should help to prevent a misfuelling but should not be relied upon due to all Avgas tanks not necessarily having smaller overwing fuelling point.

## Check Fuel Grade



### ALWAYS CONFIRM GRADE REQUIRED WITH CUSTOMER

- If there is no product identification on the aircraft fuelling point, customer to complete fuelling authorising form.

For further information, consult ExxonMobil Best Practices Video, "Misfuelling Prevention".

## GRADE IDENTIFICATION

### AVGAS

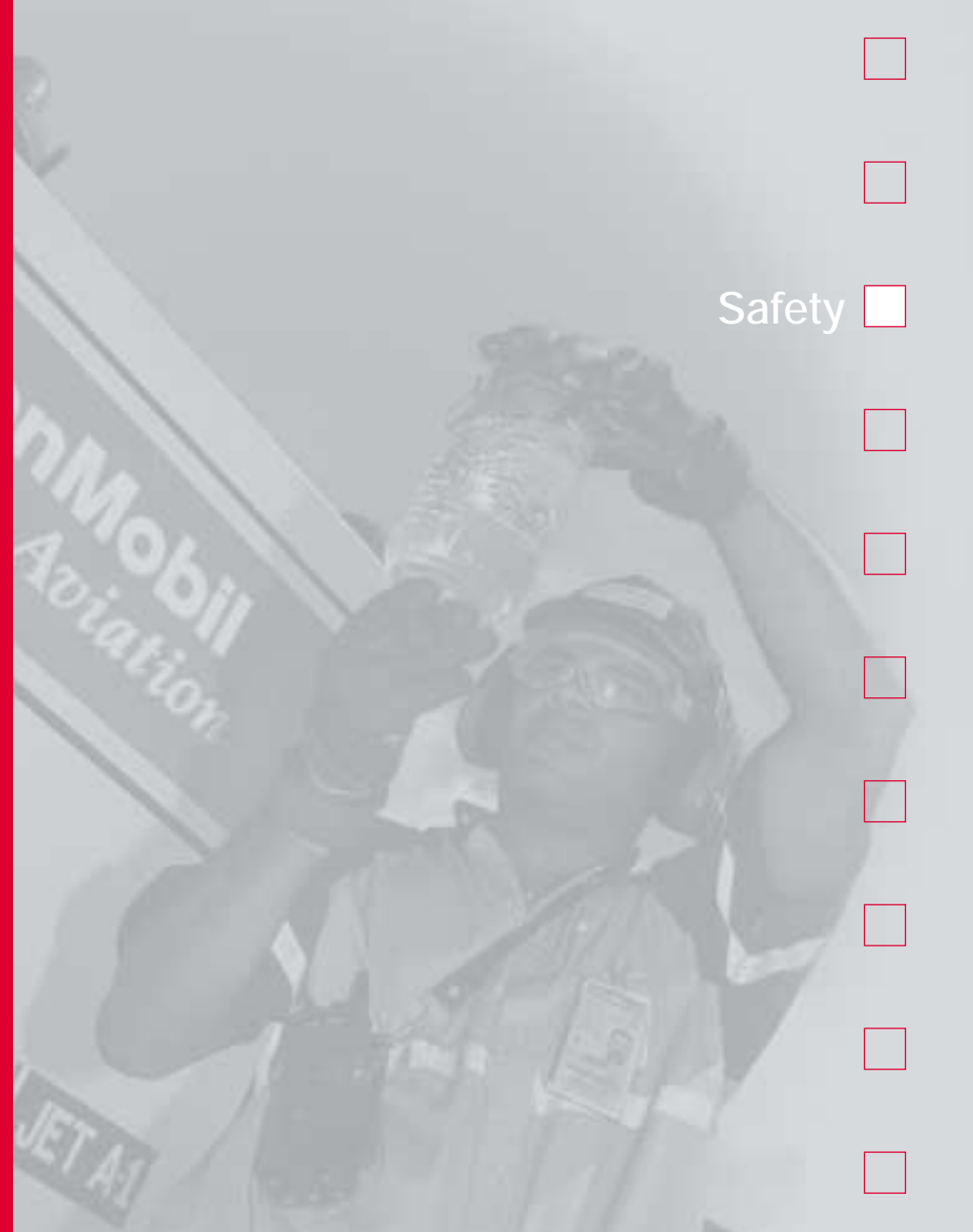
The various grades of aviation gasoline may be recognised by their colour.  
 AVGAS 100 LL – Blue      AVGAS 100 – Green      AVGAS 80 – Red

### Jet Fuel

Jet fuels are colourless (water white) to straw coloured.

- Fuel that is off colour does not meet requirements, and is therefore not to be delivered. An international system of product identification has been established which will assist in ensuring that the proper grade of product is being delivered to the aircraft.

Prevent an injury, report your Near Miss.



Safety

## Fire Hazard

In the case of fire, prevention is better than cure. The danger of fire can be greatly reduced if safety regulations are carried out in every detail during all operations.

FIRE is combustion in terms of visible and rapid oxidation.

To initiate fire, three things are necessary:



If any one of these things is missing then fire will not occur.



## Prevention of... Fire Hazards

### Prevention of Vapour Formation

- 01 Spilled fuel should immediately be wiped up, washed away with water, or surface-covered with a suitable absorbent. Remove the absorbent immediately after the hazard no longer exists.
- 02 Do not fuel or de-fuel aircraft or otherwise dispense fuel in hangars or other closed areas.
- 03 Keep fuel in closed containers to eliminate unnecessary contact with air.
- 04 Keep fuel in as cool a place as possible.
- 05 Avoid splash filling any vessel or tank.



### Prevention of Ignition Sources

- 01 Allow no open fires, lighted cigarettes, matches, mobile phones and other non-intrinsically safe electrical equipment in the vicinity of fuelling operations and storage areas.
- 02 Non-sparking shoes (rubber, cord or sewn leather soles) should be used.
- 03 All static bonding and ground/earth connections must be made in accordance with established procedures.

### Prevention of "Empty" Container Explosions

"Empty" petroleum containers retain residue (liquid and/or vapour) and can be dangerous. Do not pressurise, cut, weld, braze, solder, drill, ground/earth, or expose such containers to heat, flame, sparks, or other sources of ignition; they may explode and cause injury or death. Do not attempt to clean, since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged, and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

### Preparedness for a Fire Emergency

Fire caused by explosive ignition of combustible vapours of flammable liquids can spread very quickly. In such an emergency, swift and decisive action by airport personnel could save lives and property.



A critical factor in bringing a fire under rapid control is experience in the use of fire extinguishing equipment. Such experience can be gained through periodically scheduled practice sessions with fire extinguishers.

At least once a year, all airport personnel should attend fire drill exercises, during which they should have the opportunity to operate different types of fire extinguishers under simulated fire conditions. The drill sessions should be conducted with proper supervision to ensure that all personnel are thoroughly trained to handle fire emergencies.

Fire extinguishers should be checked monthly for general condition (e.g. damage to hose etc) and pressure gauge reading and periodically inspected

internally based on the type of fire extinguisher being used and local regulations.

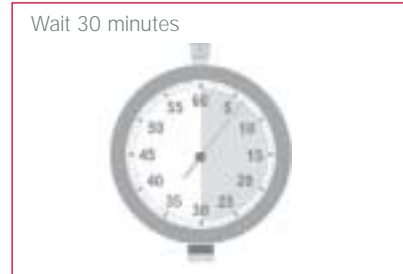
### Experience and Practice Ensure Safety

#### Static Electricity

Static electricity is a constant threat to safe fuelling. Proper care before and during each fuelling will effectively prevent danger from this potential ignition source.

#### Always....

- Allow 30 minutes to elapse after completion of filling of jet fuel storage tanks before opening hatches for gauging or taking of samples. This permits the relaxation of any static charges that may have been generated during filling or hauling.
- If local regulations require ground/earth dispensers where ground/earth points are available. Ground/earth first, then bond.
- The bonding wire should be the first connection to be made to the aircraft and the last to be removed. Bonding connections are to be maintained in good repair and should be replaced when visibly worn or "kinked".
- Ground/earth and bonding connections should be kept clean and not be allowed to become subject to corrosion or covered with paint.
- Check connections at clips and plugs daily for security.
- Check bonding wires weekly for continuity with suitable tester.
- Drag chains or cables should not be used on fuelling vehicles unless absolutely required by local authorities.



## Harmful effects of aviation products on health

### Rules

To reduce health hazards in handling aviation fuels, observe the following precautions:

- Make sure you are familiar with the hazards and precautions indicated in the ExxonMobil Material Safety Data Sheet. (A copy will be on file in the airport record system). See Below.
- Immediately wash any part of the body that comes into contact with aviation fuel, using a waterless hand cleaner, followed by soap and water. Never wear fuel soaked clothing.
- Take care in handling hoses, cans and funnels wet with aviation fuel. Clean and dry any tools that have been in contact with the fuel.
- Dispose of waste that has been in contact with fuel in cans provided for the purpose. Never put wet rags in pockets.
- Wash hands after contact with aviation fuel before putting food, cigarettes or anything else in the mouth.
- Appropriate protective clothing and equipment should be worn (e.g., ear, eye and head protection, non-electrostatic generating clothing, proper footwear and gloves).
- Use a safe solvent and not aviation fuel for washing/cleaning of tools.
- Launder or dry-clean soiled clothing.
- Carefully wipe sample containers of aviation fuels with a rag before touching with bare hands.
- If any aviation fuel is swallowed, call a doctor. Do not induce vomiting.

## Personal protective equipment (P.P.E.)

It is important from a health and Safety perspective that the correct P.P.E. is worn during any fuelling/servicing/defuelling operations, as well as when on the apron in general. The following table gives guidelines as to what items of P.P.E. should be worn in various situations.

Personal protective equipment



Personal Protective Equipment Matrix

POSITION	TASK	UNIFORM	SAFETY BOOTS	SAFETY GLOVES	EAR PROTECTORS	SAFETY GLASSES	BUMP CAP	SAFETY HELMET	HIGH VISIBLE CLOTHING
<b>Refuelling</b>	Apron	Y	Y	Y	Y	Y	Y		Y
	Sample taking/hydrokit/pit flushing	Y	Y	Y	Y	Y	Y		Y
<b>Operations</b>	Connection/disconnection of hoses	Y	Y	Y	Y	Y	Y		Y
	Refuelling overwing	Y	Y	Y	Y	Y	Y		Y
	De-icing in operation	Y	Y	Y	Y	Y	Y		Y
	Management and Visitors	Y	Y	Y	Y	Y	Y		Y
<b>Tank farm</b>	Operating equipment	Y	Y	Y			Y		Y
<b>Operations</b>	Sample taking/hydrokit	Y	Y	Y		Y	Y		Y
	Connection/disconnection of hoses	Y	Y	Y	Y	Y	Y		Y
	In banded area	Y	Y					Y	Y
	Management and Visitors	Y	Y					Y	Y
<b>Workshop</b>	In workshop	Y	Y	*	**	Y			
<b>Operations</b>	In pit/under vehicle	Y	Y	Y		Y	Y		Y
	Welding/Grinding	Y	Y	Y		Y			Y
	Handling petroleum products	Y	Y	Y		Y			Y
	Management and Visitors	Y	Y	Y		Y	Y		Y

\*Appropriate barrier protection to be worn at all times when gloves are not worn \*\*Ear protectors required for air operated tools. All personnel must obey any mandatory P.P.E. signs in special areas, e.g. Compressor and Plant Rooms; Remote start up areas. Additional P.P.E. may be required when tasks come under the control of Work Permit Systems. Refer to the Work Control Procedures.

Exxonmobil Material Safety Data Sheets

Additional important health and safety information is provided on Material Safety Data Sheets (MSDS), published for each ExxonMobil product. This information typically includes:

- Physical data on the product (e.g., boiling range, vapour pressure).
- The nature and degree of health and safety risks associated with the product.
- Precautionary guidelines for proper and safe handling of the product in order to avoid fires, explosions and acute/chronic health hazards.
- Emergency procedures in the event of fire, spill or excessive exposure to the product by skin contact, ingestion or inhalation.

Careful attention to the precautions and emergency procedures outlined in the ExxonMobil MSDS can protect the health and safety of you and your co-workers.

ExxonMobil as a company urges every user of its products to obtain the appropriate MSDS directly from ExxonMobil Aviation at their offices in Leatherhead, England. The address is:



Operations Technical Group  
Mailpoint 15, ExxonMobil House.  
Ermyrn Way, Leatherhead, Surrey  
England KT22 8UX

### Fuel System Icing Inhibitor(FSII)

FSII is a clear colourless liquid with an ether-like odour. It is required in certain commercial and military jet fuels to prevent condensed water from freezing. Typical concentration used in jet fuel is from 0.10% to 0.15% by volume. FSII is readily absorbed through the skin or by inhalation in quantities that can be harmful. In high concentrations, the vapours are irritating and disagreeable.

- Make sure you are familiar with the hazards and precautions indicated in the MSDS.
- Pure FSII must be handled in a leak free closed system (it can dissolve aluminium and some types of elastomers).
- If handled indoors, ensure adequate ventilation.
- Wear chemical type eye protection if there is a possibility of splashing.
- Prevent skin contact by wearing protective clothing and protective gloves (made of polyvinyl alcohol, natural rubber, neoprene or polyvinyl chloride).
- Do not smoke or use any open flame where FSII is present.
- Clean up spills and dispose of in accordance with local pollution regulations. Spilled FSII must not be flushed away with water or allowed to enter a sewer system.
- If inhaled, remove victim from area (rescuers to use respiratory protection).
- If breathing has stopped, give artificial respiration.
- The victim should be kept calm and a doctor called.
- If ingested, vomiting should be induced and then the victim rested while a doctor is called.
- Eye or skin contact –
  - 1) Flush eyes with plenty of water for at least 15 minutes.
  - 2) Wash skin with soap and water.
  - 3) Remove contaminated clothing and shoes.
  - 4) Obtain medical attention if necessary.



## Fuel Receipts

When receiving product into airport storage tanks, the following procedures must always be carried out without exception.

01 Before receipt, ensure that the receipt storage tank is free of water by checking sump for "Clear and bright" sample. If water is present, drain tank to remove water and check again for "Clear and Bright". Record observations. NOTE: Draw a sample from tank in sufficient quantity to ensure that contents of water draw-off line are removed and product from tank sump is sampled.

02 Check receiving tank to ensure sufficient space is available to receive product. Record observations.



03 On arrival of product examine papers for batch identification and test certificates.

04 Ensure seals are unbroken where use is mandatory by local affiliate. In cases where numbered seals are in use, these should be referenced against delivery documents. In no situation should product be accepted if seals are broken. Inform supervisor if this occurs.



05 Check quantity of product to be delivered with release or advice note.

06 Check grade identification on Bridger/Rail Car/Barge.

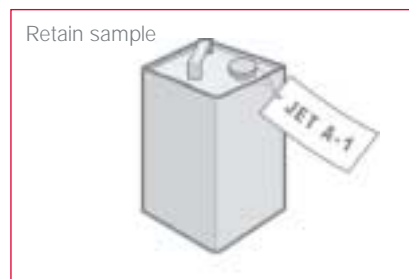
07 Ensure that the correct off-loading position and discharge line are selected.

08 Wait a minimum of five minutes prior to taking a sample.

09 Carry out "Abbreviated Tests" on product sample taken from discharge valve of delivery vehicle:-

- Product is "Clear and Bright"
- Product identification.
- A chemical water test when specified in local operating procedures.
- Conductivity test for fuel containing Static Dissipator.
- Compare tested specific gravity or density with that in accompanying test certificate. Do not accept product outside these limits ( $\pm 3.0$  kg/m<sup>3</sup>) until further investigation shows the product to be satisfactory. Record observations. Note that these measurements are converted to standard temperature measurements to counteract differing conditions at points of measurement.

10 Retain samples if required by local regulations and label with full details of consignment. Use approved sample containers.



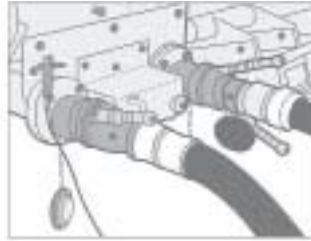
11 Retain delivery documents on file.

12 Make sure fire extinguishers are accessible.

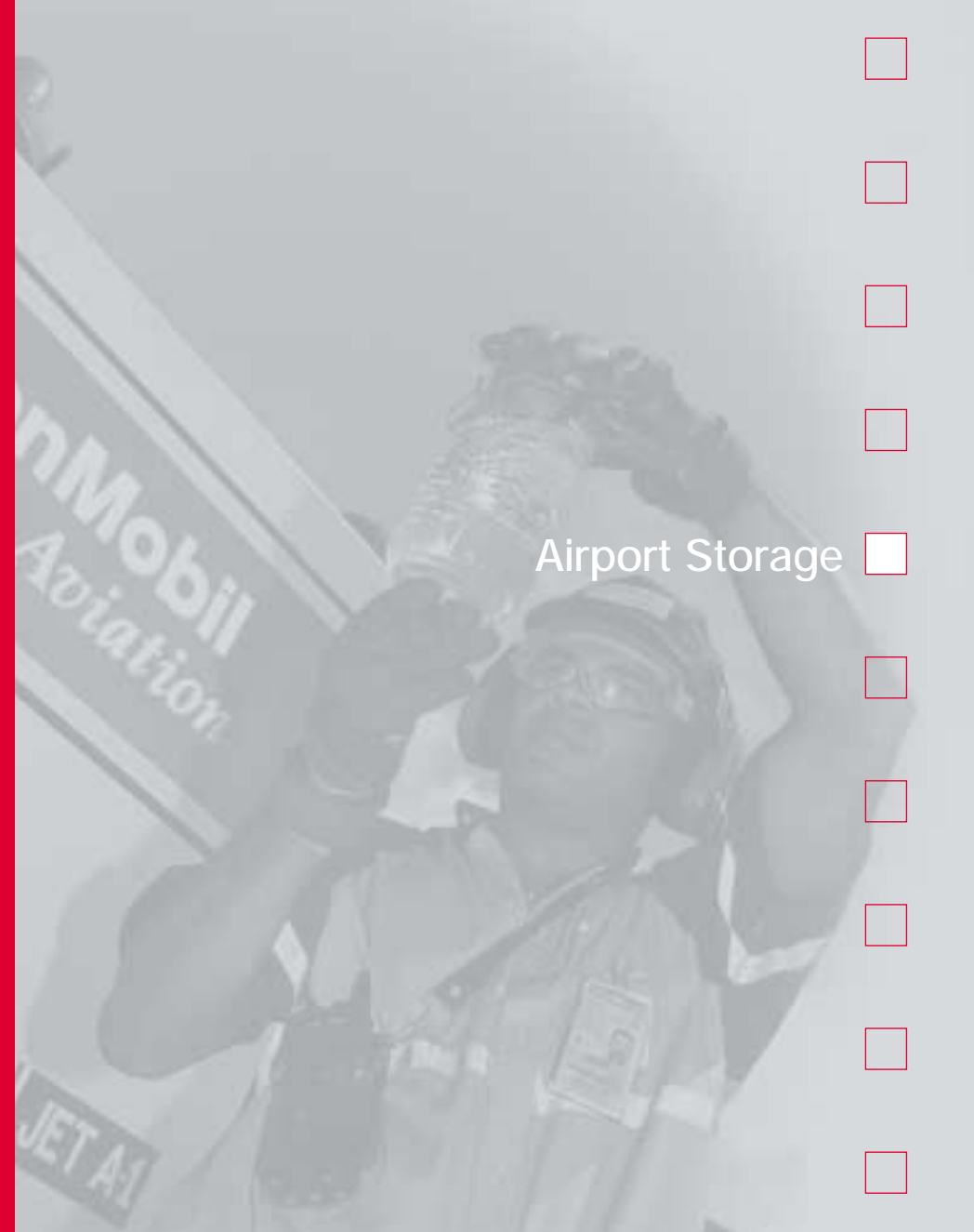


- 13 Bond delivery vehicle to offloading system.
- 14 Connect hose and visually inspect hose for damage, bulges, cuts or softening before discharging product.
  - Discharge may only be carried out by an authorised person.
  - The discharge operation must not be left unattended.
  - Check the differential pressure of filter/separator during discharge and if it is over 15psi contact supervisor.
- 15 Discharge product into storage.
  - Never use a defective hose.
- 16 On completion of discharge ensure delivery vehicle/barge/rail car is completely empty.
- 17 Close receiving tank valves and check quantity received after settling. Record observations.
- 18 Drain Filter Water Separator sump after delivery.
- 19 At no point during this procedure should the vehicle be left unattended.

Bonding



Maintain 3 points of contact when dismounting from the cab.



Airport Storage



## Storage Tanks

- After receipt of product, allow tank to settle for the required time.
- After required settling time, check water draw-off for water as per the “Clear and Bright” test. If water is present, drain tank to remove water and check again for “Clear and Bright”. Record observations.

## Daily Checks

- Check storage tank sumps or low points for water as per the “Clear and Bright” test. If water is present, drain tank to remove water and check again for “Clear and Bright”. Record observations.
- Check sumps of filters under pressure, filter/separators for water as per the “Clear and Bright” test. If water is present, drain tank to remove water and check again for “Clear and Bright”. Record observations.

Storage tank

- Check tank sump daily
- Check floating suction weekly



## Weekly Checks

- For jet fuel storage check operation of floating suction. Record observations.
- Check and record pressure differential of filter/separators on a weekly basis until 0.8 bar (=12 psi) is reached. For all element change outs refer to AOSM.

## Drums

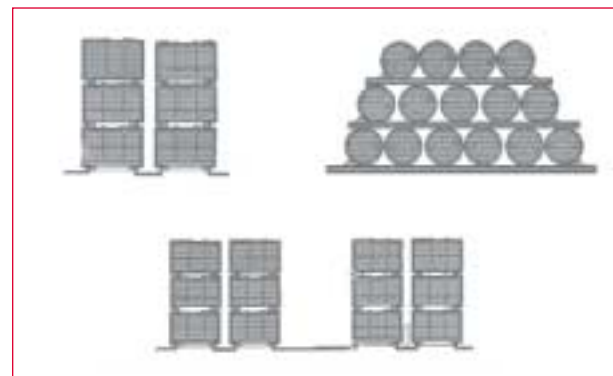
Drums of aviation products meet quality requirements at time of packaging. However, careless handling, improper storage procedures, exposure to abnormal temperatures, extended storage periods, etc., may impair the quality of the drums' contents.

To assist in maintaining the quality of the drums' contents the following precautions are to be observed:

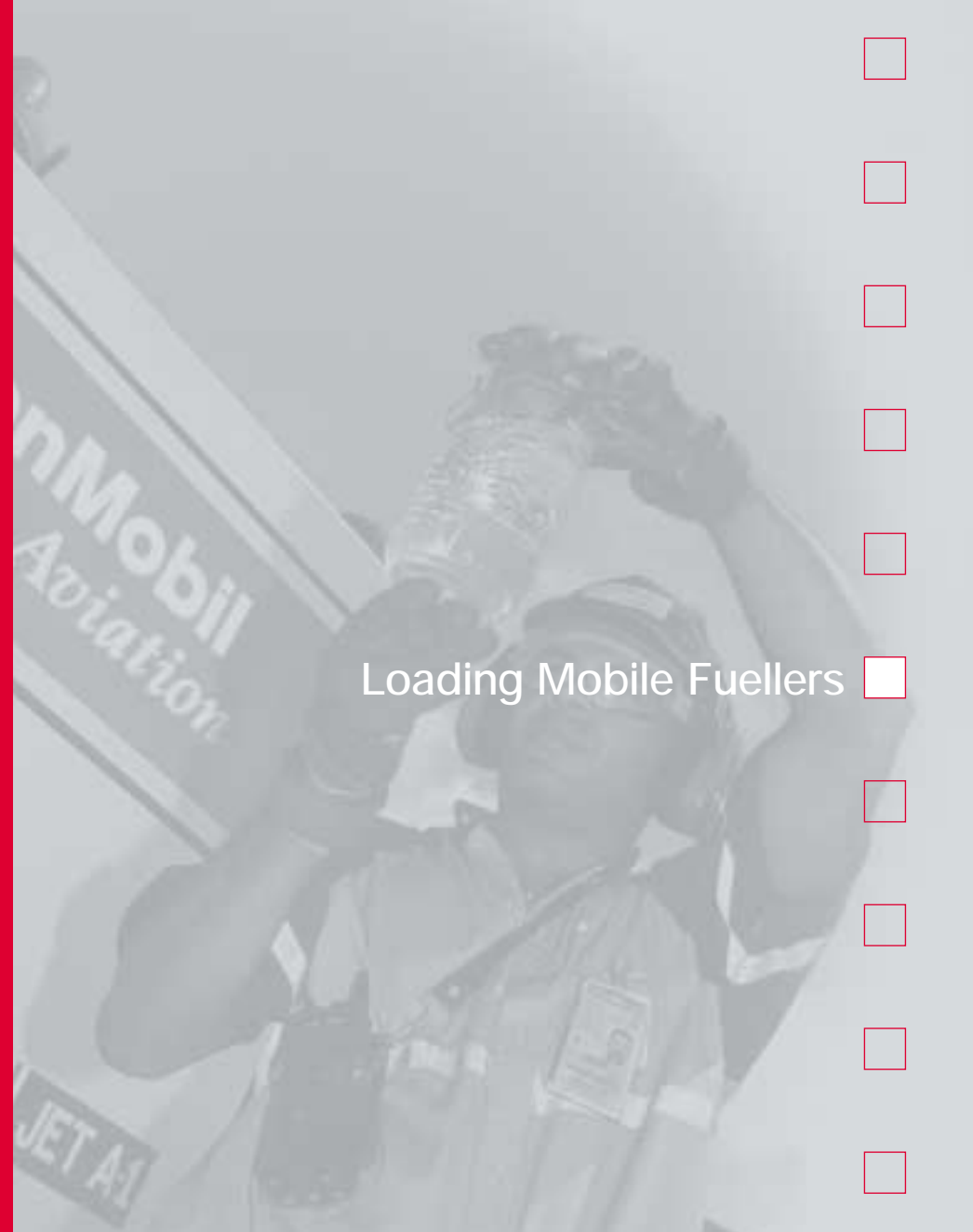
- Drums should not be dropped off vehicles, platforms, drum stacks, etc.
- Seals over bungs should be checked for tightness and freedom from damage.

## Methods of Storage

- Stacking should allow withdrawal of oldest product first (first in – first out).
- Drum markings must be legible.
- Drums should be stored on their sides if possible.
- If drums must be placed upright, they should be tilted slightly to prevent water from collecting around the bungs or kept under cover.



Wear your bump cap on the apron.



Loading Mobile Fuellers

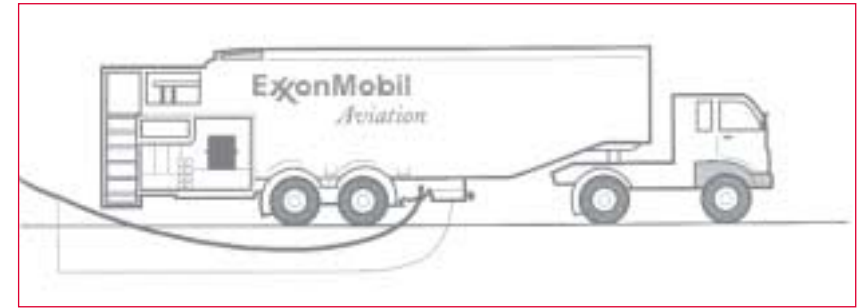
## Bottom Loading Mobile Fuellers

- 01 Ensure that there are no defects with the refueller before beginning any loading procedure.
- 02 Position fueller at correct loading bay.
- 03 Check grade of fuel and fueller against grade to be loaded.
- 04 Shut off engine and turn off the electrical isolation switch.
- 05 Check pump emergency stop button is visible/close.
- 06 Make sure fire extinguishers are accessible.
- 07 Make sure that all the discharge valves are closed.
- 08 Bond fueller to loading system.
- 09 Ensure that the correct loading hose is selected.
- 10 Remove dust cap from hose and fueller coupling.
- 11 Inspect hose and fueller couplings for cleanliness and possible damage.
- 12 Connect hose to fueller and inspect for possible damage.
- 13 Test the operation of the 'high level cut out' and the 'over-fill' sensor after the start of the flow and, if satisfactory, proceed with loading.
- 14 Do not load up to high level shut-off.
- 15 Check the filter differential while the fueller is being loaded.
- 16 During filling of fueller, inspect hose for bulges and softening.
- 17 As the fuelling limit is neared, the flow should be reduced in order to enable an easy and brief shut off.
- 18 When filled to desired level, shut off flow, and disconnect the bottom loading hose and replace dust caps.
- 19 Disconnect bonding wire.
- 20 Record meter reading.

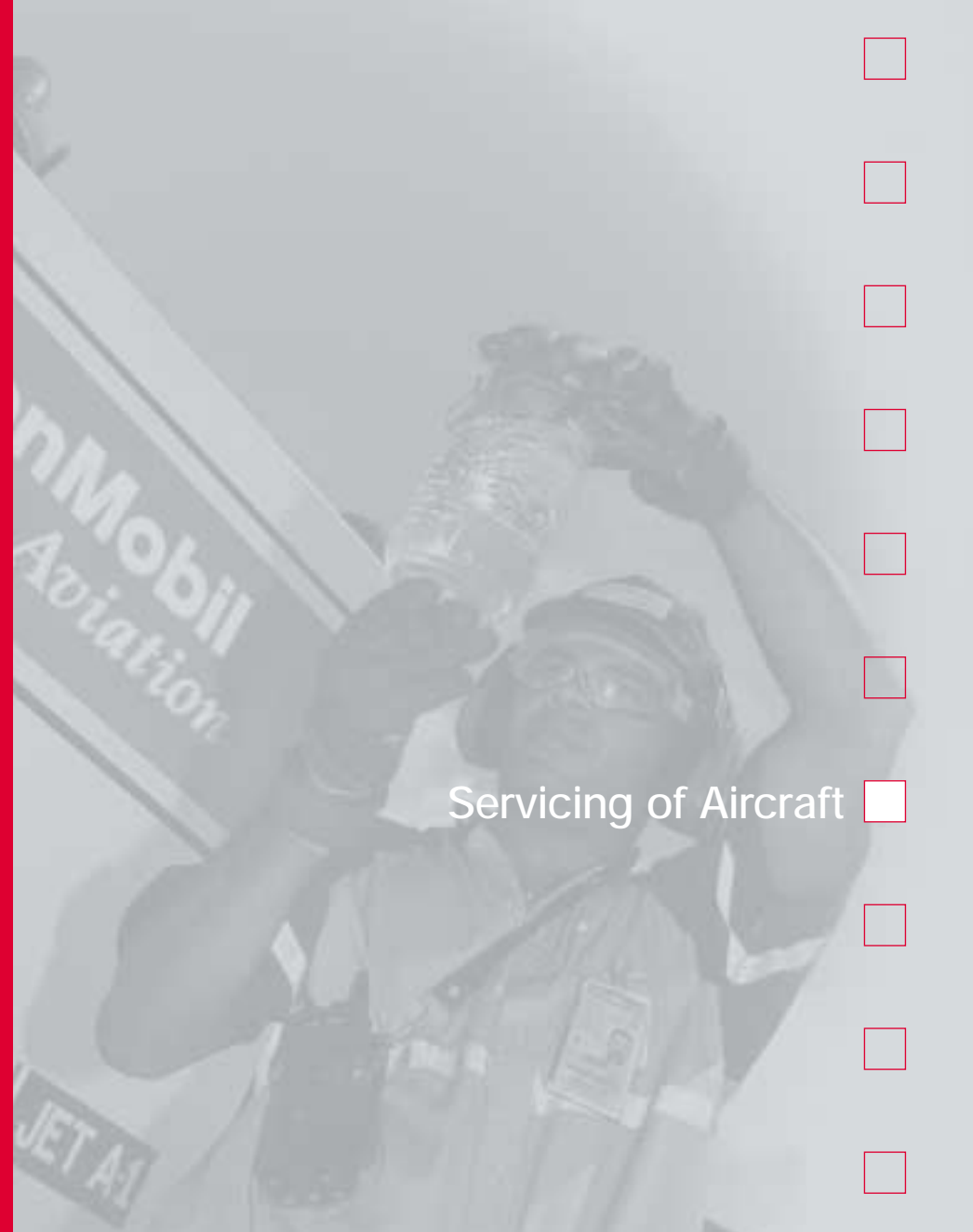
## After Filling Fuellers

- After settling for 5 minutes, ensure fueller low points and filters/sumps/(upstream of monitors) are free of water by sampling and executing "Clear and Bright" test. Record observations.
- Ensure proper grade of product has been loaded.
- Check quantity of product loaded and record.

**THE FUELLER SHOULD NOT BE LEFT UNATTENDED AT ANY POINT DURING THIS PROCEDURE.**



Report unsafe conditions promptly.



Servicing of Aircraft



## Equipment Maintenance and Safety Checks

The following maintenance and safety checks will aid in keeping equipment safe and in proper operating condition.

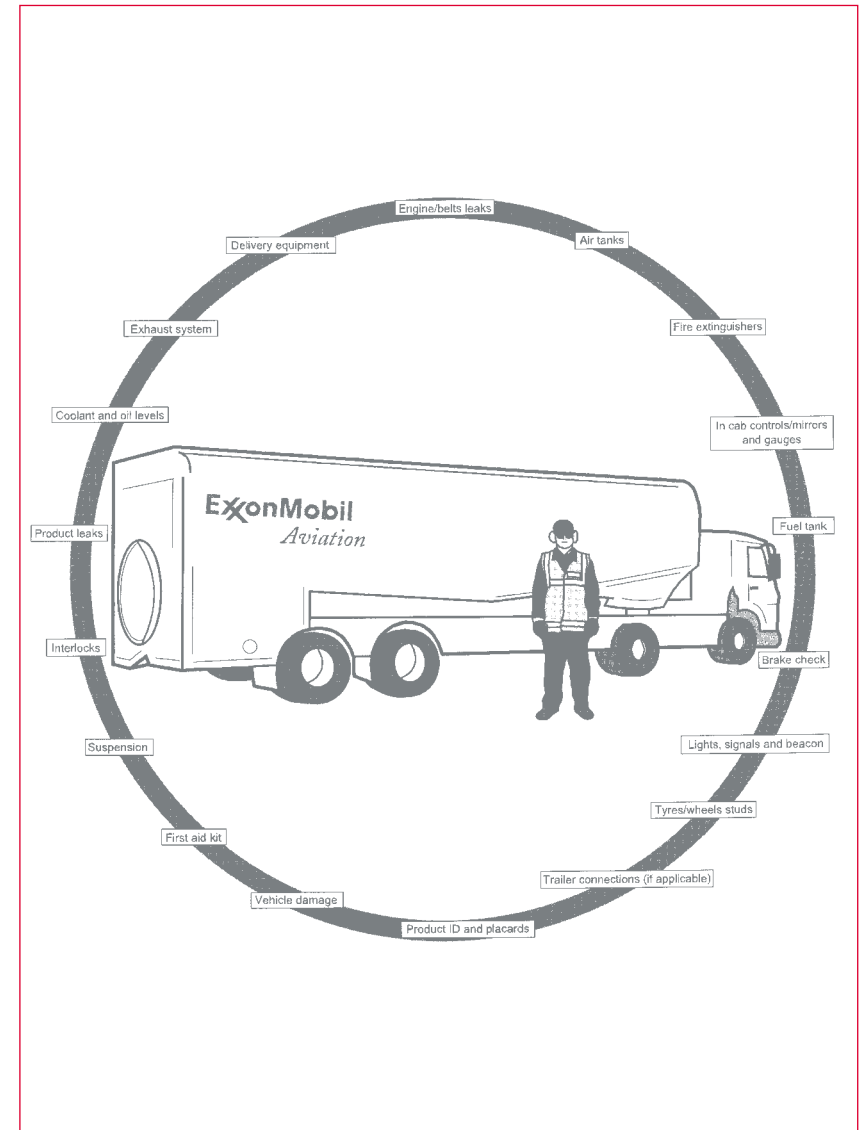
### Daily Maintenance and Safety Checks

- Lights
- Brakes (including handbrakes)
- Oil, fuel, water
- Tyres
- Batteries
- Air tank condensate, alcohol evaporator, etc.
- Deadman control
- Interlocks and override seals
- Hoses and fittings
- Nozzles and couplings
- Bonding and grounding/earthing cables
- Fire extinguishers
- Leaks
- Cleanliness of equipment
- Surge suppressers

### RECORD OBSERVATIONS

#### Daily Product Quality Checks

- Ensure that sumps of fuellers are free of water by conducting "Clear and Bright" test.
- Ensure that filters and filter/separators/monitors are free of water with "Clear and Bright test."
- Record observations.



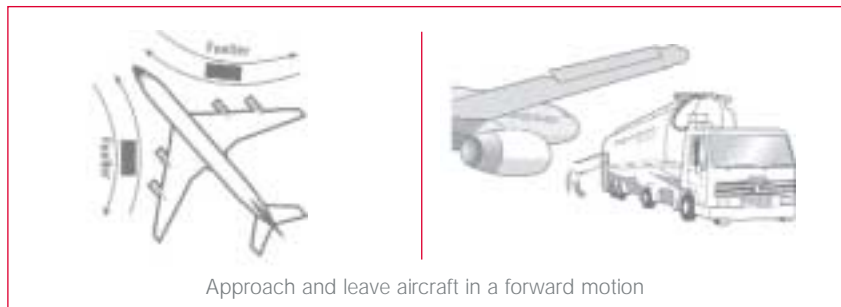
### Pre-fuelling checks

Prior to every fuelling with fueller, hydrant servicer or hydrant cart, the operator must satisfy himself of the following:

- The fuelling unit selected has the product grade required.
- Fuelling unit (for fueller operations) has sufficient fuel to meet customer requirements.
- Where applicable, doors/flaps of fuelling unit are closed and secure.
- No flat, badly worn or damaged tyres.
- Fire extinguishers are in place.
- Brakes of fuelling unit are operating correctly.

### Ramp procedures

- Carefully approach aircraft.
- Stop at a safe distance from aircraft.
- Assure yourself that aircraft engines are stopped.
- Assure yourself that you have clear access to fuelling position.
- Proceed to proper fuelling position at very low speed, ensuring clear exit to drive off in event of an emergency.
- Establish contact with customer and confirm grade of fuel and quantity required. Remember, Avgas is generally used for smaller planes with piston engines and smaller diameter exhausts.



### Servicing from Mobile Refuellers (Fuelling Authority Ticket)

#### Over-wing and Under-wing Refuelling

- CHECK FOR OVER-WING REFUELLING     CHECK FOR UNDER-WING REFUELLING
- In order to prevent ‘crossover’, always confirm grade required by customer (see p15).
- Ground/earth the refueller, if required.
- Bond the fuelling unit to the aircraft.
- Check that all fire extinguishers are readily available in case of emergency.
- Take meter reading and prepare sales documents.
- Set the steps in the correct position (if applicable).
- Set mat in place on the wing.
- Pull up hose over wing mat with extreme care to prevent damaging leading edge of aircraft wing.
- Connect bonding wire from over wing nozzle to aircraft receptacle.
- If the above is not applicable then touch the nozzle on the cap in order to neutralise any static charges.
- Open tank cover/fuelling station access door.
- Remove aircraft fill/adaptor cap. Examine adaptor cap for damage or excessive wear, and if damaged, notify supervisor and customer representative prior to fuelling.
- Gauge tank contents.
- Remove the dust cap and carefully insert nozzle into tank opening, preventing damage to the aircraft.
- Clean valve face of under-wing nozzle and aircraft adapter of visible dust or dirt.
- Connect to aircraft.
- Use clean waterproof tarpaulin sufficient to cover over-wing nozzle and filter neck during rain or snow.

- CHECK FOR OVER-WING REFUELLING    CHECK FOR UNDER-WING REFUELLING
- After obtaining clearance from customer representative, open nozzle and begin delivery.
- Maintain contact between the nozzle and the tank neck at all times to prevent from sparks being created.
- To ensure correct operating procedures maintain continual surveillance throughout fuelling:
  - Hoses
  - Nozzles
- For Jet Fuel, carry out a HYDROKIT or SWD test on a fuel sample taken downstream of filter/separator/monitor shortly after flow begins.
 

Note: In fueller operation it is only necessary to carry out the HYDROKIT or SWD test on the first aircraft fuelled after each refilling, provided subsequent fuellings are consecutive.
- For overwing operations this sample should be taken at the end of fuelling.
- On completion of fuel delivery, close nozzle.
- Report completion of product delivery to customer.
- Confirm that quantity of fuel delivered to aircraft meets customer's request.
- Remove nozzle.
- Replace dust cap.
- Replace and secure fill/adaptor caps.
- Disconnect the nozzle bonding wire if applicable.



- CHECK FOR OVER-WING REFUELLING    CHECK FOR UNDER-WING REFUELLING
- Close tank cover/fuelling station access door.
- Remove from wing – mat, hose and any other equipment.
- Re-store the hoses.
- If anti-icing additive is added to the fuel, verify that the proper amount has been injected.
- Be sure that information is correct and readable.
- Confirm again with customer's representative grade and quantity of fuel delivered and obtain verifying signature.
- Remove steps and secure on the fuelling unit (if applicable).
- Disconnect bonding from fuelling unit to aircraft.
- Remove the ground/earth wire, if used.
- Double check all equipment has been stowed correctly.
- Remove fueller away from aircraft.

## Servicing from Hydrant Servicers or Carts

### Under-wing Refuelling

- Ground/earth the servicer, if required by authorities.
- Bond the fuelling unit to the aircraft.
- Check that all fire extinguishers are readily available in case of emergency.
- Set the steps in the correct position (if applicable).
- Place fuelling hose in the ready position.
- Open aircraft fuelling station access door.
- Remove the aircraft's fuelling adapter caps. Examine adapter caps for damage or excessive wear, and if damaged, notify supervisor and customer representative prior to starting to fuel.
- Remove the dust cap from the hose nozzle.
- Clean valve face of the hose nozzle and aircraft-fuelling adapter of visible dirt or dust.
- Connect and lock nozzle to the aircraft.

- CHECK FOR OVER-WING REFUELLING    CHECK FOR UNDER-WING REFUELLING

- Place inlet hose in general area of hydrant pit cover.
- Check the level of the servicer “dump tank”.
- Check grade markings and remove appropriate hydrant pit cover.
- Check condition of hydrant pit for cleanliness and fitness for use.  
Contact supervisor if significant defects are noted before fuelling.
- Where applicable, connect lanyard to quick release valve and stretch out on apron in a readily accessible direction.
- Remove dust caps from adapter in hydrant pit and hydrant coupler.  
Check both surfaces to be sure they are clean.
- Connect hydrant coupler to hydrant adapter and where applicable, attach air hoses to control fittings in hydrant pit.
- Position “Igloo” in place over hydrant pit.
- Place a visible “marker” flag upright in the igloo.
- Take meter reading/reset to zero and prepare the delivery document.
- After obtaining clearance from customer, activate quick release valve/deadman control and start delivery.
- For jet fuel, carry out a HYDROKIT or SWD test on a fuel sample taken downstream of filter/separator/monitor.
- To ensure correct operating procedures, maintain continued surveillance throughout fuelling: • Hoses • Nozzles • Operating Pressures • Flow Rates
- On completion of product delivery, deactivate deadman control and close quick-release valve in hydrant pit.
- Take a sample from filter/separator sump or inlet side of monitor and perform “Clear and Bright” test.
- Report completion of product delivery to customer.
- Confirm that grade and quantity delivered to aircraft meets customer request.
- Disconnect hydrant coupler from hydrant adapter and replace the dust caps on adapter and the coupler.

- CHECK FOR OVER-WING REFUELLING    CHECK FOR UNDER-WING REFUELLING

- Disconnect lanyard/control lines from the control valve.
- Check and clean cover seat around the rim of the hydrant box and replace the cover.
- Remove the under-wing nozzles and replace dust caps.
- Replace adapter caps and secure access doors.
- Secure fuelling hoses and nozzles.
- Take meter reading and complete the delivery document. Be sure that all information is correct and readable.
- Confirm again with customer grade and quantity of fuel delivered and obtain verifying signatures.
- Remove steps and secure on fuelling unit (if applicable).
- Disconnect bonding cable from aircraft to fuelling unit.
- Remove the ground/earth wire, if used.
- Remove servicer/cart from aircraft as soon as possible.

For further details of grade confirmation procedure see AOSM Section 040-009 (Product Handling – Fuel Delivery Procedures).

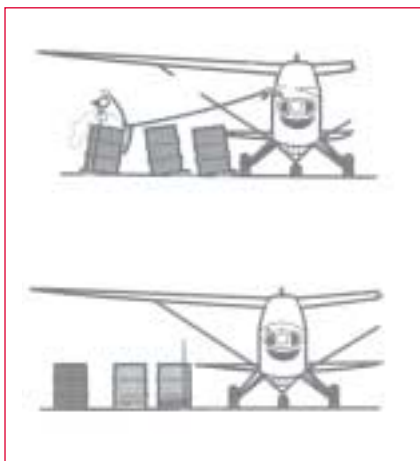
### Servicing from Cabinets

The procedure for fuelling from cabinets is practically identical to that for servicing from fuellers. Additional checks and procedures follow:

- Cabinets must be checked daily for leaks, trash, rags, oil cans and kept clean.
- Covers must be kept closed when not in use.
- In the case of a cabinet, which is seldom used, the fuel should be circulated at periodic intervals to prevent deterioration of the product in the pipeline and hose. After a sufficient quantity has been circulated, a sample should be taken at the nozzle. If necessary, pumping should be continued until a “Clear and Bright” sample is obtained.

### Servicing from Drums

- The following precautions should be observed to ensure safe and acceptable quality delivery of drummed product to an aircraft.
- The grade of drum should be checked by noting the stencilling on the drum head and other identification.
- Drum contents should be checked for water by using dipstick and water finding paste.
- The contents of drums containing water should not be used until the water is removed.
- All aviation gasoline and jet fuel should be filtered into aircraft.  
Note: A number of filter/separators/monitors suitable for operation with a barrel pump are available on the market. Monitors are preferred.
- Barrel pump and filter/separator/monitor must be bonded to barrel before bungs are removed.



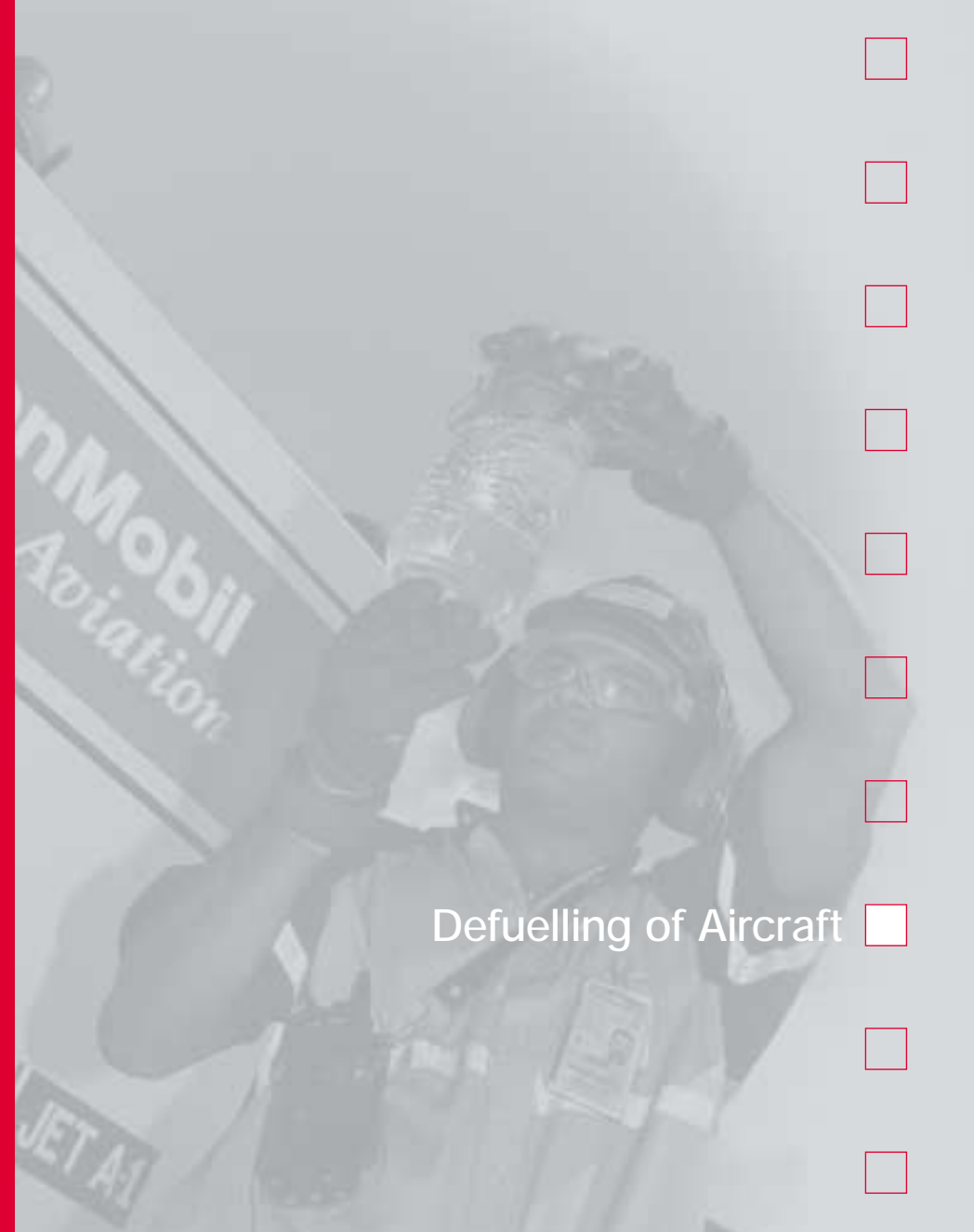
### Fuelling from Drums

- Mount filter/separator or fuel monitor on side of drum, and bond correctly.
- Open large bung and insert the pump suction to the bottom. Large bung should be on high side of the drum.
- Bond discharge nozzle to aircraft before opening aircraft fuel tank.
- Fuelling nozzle or hose should be inserted as far as possible into the aircraft fuel tank to minimise splash filling.
- Commence delivery. Carry out HYDROKIT or SWD test after starting.

### When Switching to a Fresh Drum

- Remove nozzle from aircraft fuel tank.
- Cap aircraft fuel tank.
- Remove bonding and nozzle from aircraft vicinity.
- Remove pump from the empty drum.
- Reseal empty drum.
- Remove filter/separator or fuel monitor.
- Remove bonding.
- Proceed again with fresh drum as described above.

Disconnect, walk around,  
final check, drive away!



Defuelling of Aircraft



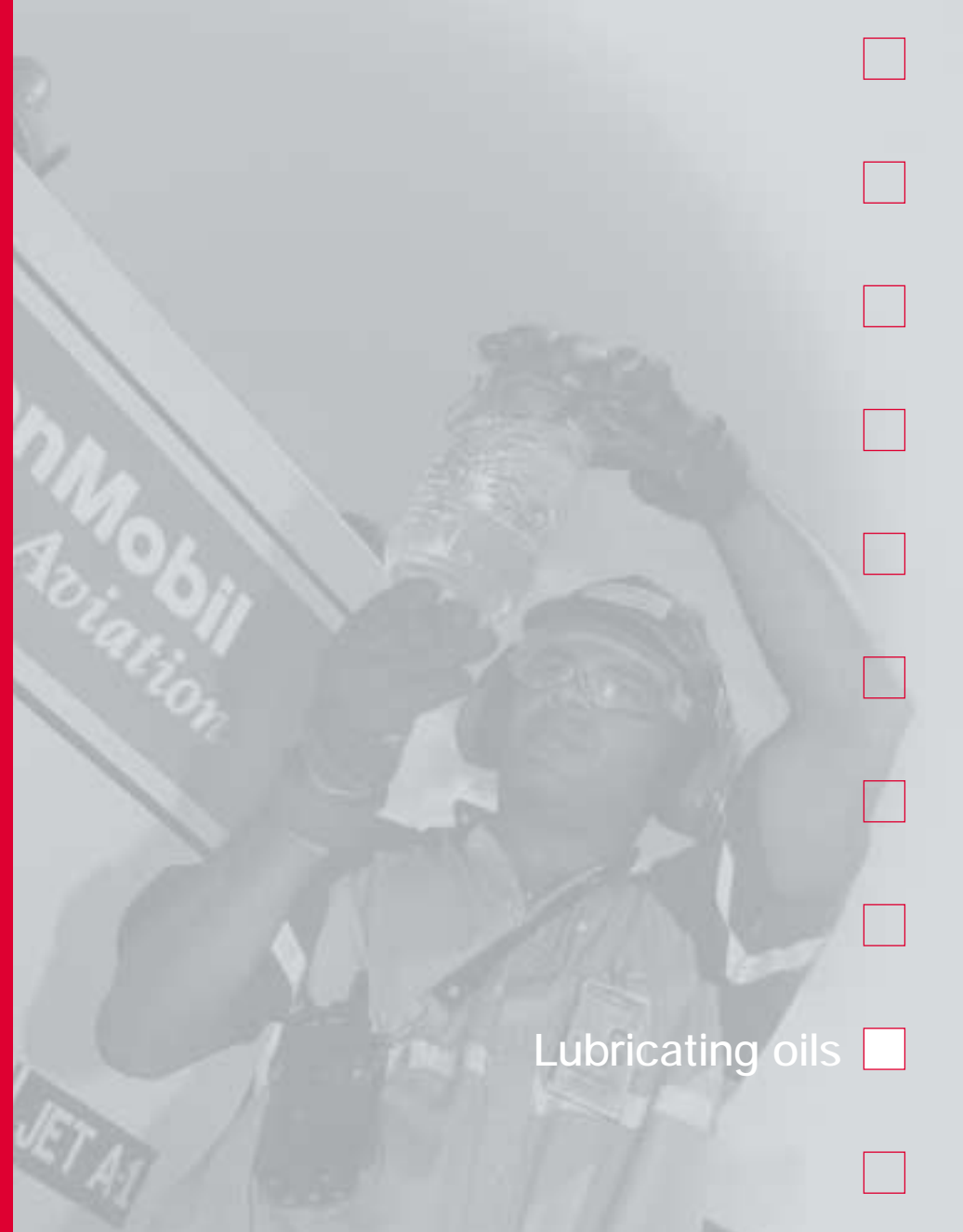
## Defuelling of Aircraft

Occasionally, it is necessary to remove fuel from an aircraft. The procedures used will vary from one location to another because the differences in equipment available and other circumstances.

Defuelling is no less hazardous than fuelling and the same precautions are necessary concerning fire, contamination and static electricity.

In preparing for and carrying out defuelling operations, every necessary precaution must be taken:

- to protect the absolute safety of subsequent fuellings, and
  - to avoid the degradation of product in the fuel handling system.
- 
- Defuelling must be carried out only with proper approval of your supervisor.
  - Defuelled products must be regarded with suspicion. Check it carefully for identification and possible contamination before delivering to another aircraft (of the same customer).
  - ALWAYS DEFUEL IN THE OPEN AIR, NEVER INSIDE A HANGAR.
  - Guard against static electricity hazards by using proper bonding connections.
  - Never place an unprotected metal standpipe into an aircraft tank. A flexible hose that is in good condition will not damage the bottom or sides of the tank.
  - Always clean nozzle screens after defuelling.



Lubricating oils



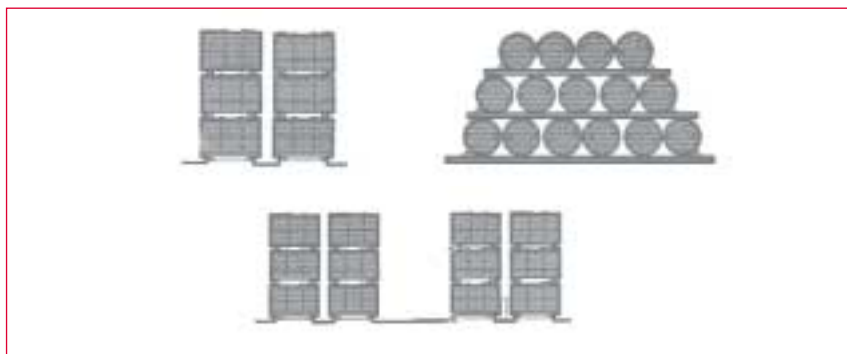
## Piston Engine Lubricants

### Receipts

- Aviation lubricants in drums or packages received at airport must be inspected for their exterior condition and identifying data.
- Check accompanying shipment documents against the products received for identity and quantity.

### Storage

- Stocks must be properly stacked and inspected periodically for leaks.
- Drums/cans must never be stacked directly on the ground/earth, they should be placed on timber (or like) support. Cans and packages must be stored in a dry, clean room/shed.



- Check frequently that drums/cans are clean and grade mark/batch identification is legible.
- Remove from storage always on the basis of first in, first out. (Old stock being used first according to filling date/batch number.)
- Aviation piston engine lubricants must not remain in storage more than 18 months from filling date without testing. The minimum number of drums/cans to be selected for the Basic Test is Set out in AOSM Section 040-012 Record test results.

## Servicing Equipment (Piston Oils)

- Make sure dispensing unit is scrupulously clean.
- Ensure dispensing unit is free of water by checking sumps, filter, etc., with "Clear and Bright" Test. Record results.
  - Make sure the drum/container selected contains correct grade.
  - Check grade markings on both dispenser and drum/container.
  - Check for first in, first out.
- Stand drum/container on end for ten minutes before decanting.
  - Draw sample with transparent tube from lowest point.
  - Check for water with paste or paper.
  - Check for appearance and cleanliness. All dirt and water must be removed before product is used. Record observations.
- After filling dispensers, ensure unit is free of water by checking sumps, filter, etc., with "Clear and Bright" test. Record results.

## Delivery

From Dispensers:

- When approaching and delivering to aircraft, the same precautions and delivery sequence must be observed as when delivering fuel. Bonding servicing unit to aircraft is not required.

From Cans:

- Clean top before inserting spout.
- After delivery remove empty can from aircraft and dispose of properly.
- Discard partially filled cans into a suitable disposable container. Do not hold for reuse.

## TURBO ENGINE OIL

Turbo oil is a special product that requires careful handling and control. Turbo oil should only be handled in sealed containers and is not to be repackaged.

### Receipts

Same as for piston engine lubricants.

### Storage

Under normal storage conditions, turbo oils have no time limit shelf life. However, they should be supplied on a first in, first out basis.

### Delivery

Turbo engine oils are not delivered by supplier directly into aircraft. Sealed containers are:

- delivered into customer storage, or
- handed to customer at the aircraft.

### Safe Container Handling

For safe handling of petroleum product containers, see AOSM Sections 040-012 and 040-013. Disposal of empty petroleum containers must be in compliance with local regulations

## Jet Fuel Conversion Factors

KILOGRAMMES/ CUBIC METRES	KILOGRAMMES/ GALLONS	GALLONS/ METRIC TONNES	BARRELS/ METRIC TONNES
775	2.934	340.83	8.115
780	2.953	338.64	8.063
785	2.972	336.47	8.011
790	2.99	334.45	7.963
795	3.009	332.34	7.913
800	3.028	330.25	7.863
805	3.047	328.19	7.814
810	3.066	326.16	7.766
815	3.085	324.15	7.718
820	3.104	322.16	7.671
825	3.123	320.2	7.624
830	3.142	318.27	7.578
835	3.161	316.36	7.532
840	3.18	314.47	7.487
<b>MULTIPLY</b>	<b>BY</b>	<b>TO OBTAIN</b>	
cubic metres	264.168	gallons (US)	
cubic metres	6.2898	barrels	
<b>MULTIPLY</b>	<b>BY</b>	<b>TO OBTAIN</b>	
Barrels (42's)	0.792452	drums (53's)	
Barrels (42's)	0.15899	cubic metres	
Barrels (42's)	42	gallons (US)	
Cubic metres	6.2898	barrels(42's)	
Cubic metres	61,023.38	cubic inches	
Cubic metres	35.3144548	cubic feet	
Cubic metres	264.168	gallons (42's)	
Gallons (US)	231	cubic inches	
Gallons (US)	0.13368	cubic feet	
Gallons (US)	0.00379	cubic metres	
Gallons (US)	3.78541	litres	
Gallons (US)	0.83268	imperial gallons	
Gallons (IMP)	4.545962	litres	
Litres	1,000.03	cubic centimetres	
Litres	61.02503	cubic inches	
Litres	0.035315411	cubic feet	
Litres	0.264178	gallons (US)	
Litres	0.219975	imperial gallons	

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