



Government
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International
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STANDARD OPERATING PROCEDURE

Petrol and Diesel Fuel Quality Assurance







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Standard Operating Procedure: Petrol & Diesel Fuel Quality Assurance

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Foreword

Ensuring the quality of fuel supplied and used within Vanuatu is fundamental to protecting our environment, supporting public health, and enabling the efficient performance of our transport and energy systems. As our country continues to strengthen its response to climate change and environmental challenges, improving fuel quality management is a critical and practical step forward.

As a Small Island Developing State, Vanuatu faces unique vulnerabilities to climate change while also managing increasing demand for energy and transport services. Poor fuel quality not only affects engine performance and increases maintenance costs but also contributes to higher emissions and environmental degradation. These Fuel Quality Assurance Standard Operating Procedures (SOPs) reflect the Government's commitment to addressing these challenges through practical, cost-effective, and locally appropriate solutions.

Developed by the Department of Energy (DoE) with technical assistance from the Global Green Growth Institute (GGGI) under the Low Emissions and Climate Resilient Development (LECRD) Phase 2 programme funded by the Governments of New Zealand and Ireland in collaboration with relevant government agencies and stakeholders, this SOP provides a structured and risk-based framework for monitoring and verifying fuel quality across the entire supply chain, from importation through to storage, distribution, and end use. It is designed to complement national fuel standards and ensure that fuel supplied within Vanuatu consistently meets required specifications.

Recognizing the country's operational context, the SOP adopts a pragmatic approach that builds on existing systems, including the use of Certificates of Quality issued by accredited laboratories in exporting countries. It focuses on key fuel quality parameters most likely to be affected during local handling and storage, while introducing a cascading testing framework that enables efficient and timely identification of potential issues.

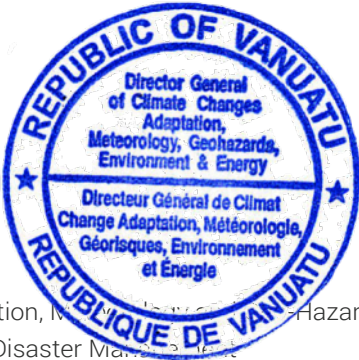
Importantly, this SOP is not only a technical tool but also a foundation for strengthening institutional capacity, coordination, and awareness among stakeholders. Through its implementation, we aim to enhance confidence in the national fuel supply system, support cleaner and more efficient technologies, and contribute to reduced emissions and improved environmental outcomes.

This initiative underscores the Government's commitment to safeguarding the quality of our energy resources while advancing our broader climate and sustainable development goals. I encourage all stakeholders to work collaboratively in implementing these procedures to ensure their effectiveness and long-term success. Through these efforts, we take a meaningful step towards a cleaner, more resilient, and sustainable future for Vanuatu.

Sincerely,



David Gibson
Director General
Ministry of Climate Change Adaptation, Meteorology, Geohazards,
Energy, Environment and National Disaster Management







1 Scope and Purpose

This Standard Operating Procedure (SOP) defines the national fuel quality assurance regime for petrol and diesel destined for use in internal-combustion engines (excluding specialist applications such as motorsport/racing).

2 Philosophy and Methodology

The regime balances practicality with assurance by focusing routine effort on simple, robust field and local-laboratory tests, and escalating only when warranted. It follows a cascading approach: screen in the field, confirm in the local laboratory, diagnose if needed, then deploy external referee/specialist tests only when justified by risk or dispute.

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3 Structure of Tests (Groups)

Sixteen tests are organised into five groups, classified as either formal (mandatory) or informative (non-mandatory):

Formal (mandatory, when they can be applied):

- Group 1 — Field tests (comprising 6 tests): quick screens performed in the field. These are further detailed in Section 7.
- Group 2 — Local laboratory tests (comprising 7 tests plus Karl Fischer water determination, if available): confirmatory/quantitative checks performed in the laboratory. These are further detailed in Section 8.

Informative (non-mandatory, used when warranted):

- Group 3 — Diagnostic tests (comprising all 16 tests): recommended diagnostic procedures that a local laboratory can provide. These are further detailed in Section 9.
- Group 4 — External laboratory tests: specialist/referee tests and periodic specification verification. These are further detailed in Section 10.
- Group 5 — Own tests (comprising up to 9 tests): practical guidance for distributors/end users for voluntary self-checks where circumstances enable these tests to be conducted. These are further detailed in Section 11.

Table 1: The 16 Tests Detailed by the SOP, and their Assigned Groups

ID	Petrol Test	Diesel Test	Grp1 Field	Grp2 Lab	Grp3 Diag & Ext	Grp4 Ext	Grp5 Own
1	Appearance / Colour (Clear & Bright)	Appearance / Clarity (Clear & Bright)	x	x	x		x
2	Colour trending (against retain/reference)	Colour trending (against retain/reference)	x	x	x		
3	Density @15°C (Hydrometer or handheld densimeter)	Density @15°C (Hydrometer or handheld densimeter)	x	x	x		(x)
4	Water-finding paste (tank dip)	Water-finding paste (tank dip)	x		x		x
5	Filter patch (particulate screen)	Filter patch (field particulate screen)	x	x	x		x
6	Odour noted incidentally (not a formal test)	Odour noted incidentally (not a formal test)	(x)	(x)	x		(x)
7	Microbial check (dip-slide)	Microbial check (dip-slide)			x		(x)
8		Flash point (ASTM D93 / EN ISO 2719)			x		
9		Water content (Karl Fischer, EN ISO 12937)			x		
10		pH of water bottoms (dipstick)			x		
11		Water shake / bottle test (phase check)			x		
12		Glycerine/glycerol dropout (methanol shake)			x		(x)
13		Cold-soak screen (-10 to -1°C)			x		x
14		Copper corrosion (EN ISO 2160)			x		
15		FTIR			x		
16	XRF for metals and other contaminants	XRF for metals and other contaminants			x		

Key Description

Field Group 1 field tests

Lab Group 2 local laboratory tests

Diag Group 3 diagnostics tests

Ext Group 4 external laboratory tests

Own Group 5 distributor and end-user own tests

(x) Inclusion depending upon circumstances

4 Sampling

Sampling must follow the "Sampling SOP – Group 1 & Group 2" (Annex B). In brief: draw representative samples, use clear colourless glass containers for visual tests and amber glass containers accepted for use with diesel and petrol for retains, label at point-of-fill. Deliver Group 2 samples to the laboratory promptly; store retains securely in a DG-suitable store.

5 Responsibilities

- Testing Officers: follow this SOP; ensure safety; collect representative samples; carry out tests; advise on and document results.
- Energy/Fuel Regulator: plan risk-based sampling, oversee compliance, initiate enforcement where required, and coordinate referee testing.

6 Safety

- Fuels are Class 3 flammables—control ignition sources; use appropriate PPE (gloves, eye protection), ventilation, and spill control.
- Bond/ground when sampling from metal tanks/into metal containers to avoid static discharge.
- Follow the specific equipment/instrument safety guidance for each test.

7 Group 1 – Field Tests (Formal)

Intended for rapid screening in the field; apply in the order below when applicable and safe.

1. Appearance (Test 1: Clear & Bright).
2. Colour Trending (Test 2).
3. Density (Test 3).
4. Water-Finding Paste (Test 4) — bottom water check where practical and safe (do not compromise H&S).
5. Filter Patch Screen (Test 5).
6. Odour Noted (Test 6) — observational only; do not conduct purposeful sniffing.

Trigger to Group 2 testing: any fail/borderline in Group 1 tests. Take retains and take to local laboratory for testing.

8 Group 2 – Local Laboratory Tests (Formal)

Conduct the following, as applicable, in the order below and as applicable for the fuel under test.

1. Appearance (Test 1 & Test 2) – repeat clear & bright and colour trending under controlled lab lighting.
2. Density (Test 3) – use hydrometer rather than densimeter if sample is not clear and bright.
3. Filter Patch (Test 5).
4. Odour Noted (Test 6) – record only if noted during routine handling (no purposeful sniffing).
5. Microbial Screen (Test 7) – perform if results from one of Tests 1, 2, 3 or 6 indicate potential active microbial activity.
6. Flash Point (Test 8; diesel).
7. Water Content if available (Test 9; diesel).

Trigger to Group 3: any Fail/borderline in Group 2 tests, or unresolved suspicion, in which case apply relevant diagnostic tests.

9 Group 3 – Diagnostic Tests (Informative)

Use when Group 1 or 2 testing indicates failure or suspicion. Choose test based on likely cause.

1. Re-verification – repeat relevant Group 2 tests on fresh aliquots to confirm results.
2. pH of Water Bottoms (Test 10) – if fuel is not clear & bright (assesses corrosive/biological activity in water bottoms).
3. Water Shake / Bottle Phase Check (Test 11; petrol) – if petrol density outside expected bounds. Test for blending with alcohol fuels.
4. Glycerine/Glycerol Dropout (Test 12; diesel) and Cold-Soak Screen (Test 13; diesel) – if diesel density out-of-range or blending with non-standard fuels suspected.
5. Copper Strip Corrosion (Test 14) – if odour is unusual, fuel not clear & bright, or darker than expected.
6. FTIR (Test 15; local lab) – if diesel fails the cold-soak screen. Provides a confirmation of ester carbonyl (biodiesel or vegetable oil) presence.
7. XRF (Test 16) – if above indicate high likelihood of lube-oil contamination or blending with non-standard fuels (identifies sulphur, metals and others).

Trigger to Group 4: where diagnostic results suggest specification breach requiring referee evidence or broader specification checks.

10 Group 4 – External Laboratory (Informative / Referee)

External laboratory tests are used sparingly—primarily for disputes/referee evidence and periodic (annual) specification verification. They are to be deployed when stakes are high and legally defensible results are required (e.g., for prosecution), and to validate bulk fuel against a supplier CoQ with the results of this also serving as referee checks against local tests where relevant. External laboratory checks include XRF (Test 8), FTIR (Test 16), and broader specification sets of tests aligned with EN 228 (petrol) and EN 590 (diesel), excluding octane/cetane engine tests unless specifically arranged.

11 Group 5 – Own Tests (Informative)

Intended to be deployed by distributors and some end-users, provided as informative tests.

1. Clear & Bright and Colour (Tests 1 & 2).
2. Hydrometer Density (Test 3) – recommended for those where there is a risk of contamination with other fuels.
3. Water-Finding Paste (Test 4).
4. Filter Patch (Test 5) – gravity-draw variant acceptable as a simplification.
5. Oder Noted (Test 6).
6. Microbial Dip-Slide (Test 7) – recommended if fuel is not clear & bright.
7. Water Shake (Test 11; petrol) and Cold-Soak (Test 13; diesel) – if incorrect fuel/blending is suspected.
8. Glycerine Dropout (Test 12; diesel) – if coconut oil/biodiesel contamination is suspected.

12 Decision Logic (Cascading Application)

The following cascading decision logic is to be followed:

1. Conduct Group 1 field tests. If all clear: record & close. If any Fail/borderline: take sample retains and send to laboratory for Group 2 tests.
2. Conduct Group 2 local laboratory tests. If all clear: record & close. If Fail/borderline: proceed to Group 3 diagnostics.
3. Conduct relevant Group 3 diagnostics tests, aiming to identify likely cause. If breach indicated and enforcement requires more robust results, commission relevant Group 4 referee testing.
4. Conduct relevant Group 4 external laboratory tests. Use for disputes/referee evidence and periodic verification on bulk product.
5. Group 5 own tests: encourage their use by distributors and significant end users as part of awareness program; results are advisory.

13 Documentation & Records

Labelling of fuel samples and recording of formal test results shall comply with the following:

13.1 Fuel Sample ID

The fuel sample container label must provide the following information (whether by code or in full), written in permanent ink (or an equivalent indelible marking):

- Date and time of sample.
- Fuel type.
- Site location of where sample was taken.
- Type of tank sample drawn from.
- Draw point (from nozzle, bottoms, etc.).
- Sampling/testing officer.
- Volume of sample taken
- Any other information required to identify the sample from another.

An example of a standardised label format is included in Annex C for guidance only and may be adapted to suit alternative labelling systems, including paperless/electronic solutions as these are developed.

13.2 Recording of Group 1 Tests and Results

A Group 1 test sheet (covering Tests 1–6) shall record, at minimum (whether by code or in full):

- Sample ID.
- Sample notes (e.g., condition, container, draw point).
- Date and time of Group 1 testing (local).
- Testing officer (name/signature).
- Results for Tests 1–6 performed.
- Pass/Fail decision for each test performed.
- Test-specific notes/observations (as applicable).
- Required action (e.g., take retains and submit for Group 2 testing, issue warning notice, schedule revisit, etc.).

An example of a standardized test sheet for Group 1 testing is included in Annex D for guidance only and may be adapted to suit alternative recording, including for paperless/electronic solutions as these are developed.

13.3 Recording of Group 2 Tests

A Group 2 test sheet (covering Tests 1–9) shall record, at minimum:

- Sample ID.
- Sample notes (e.g., condition, container, draw point).
- Date and time of Group 2 testing (local).
- Testing officer (name/signature).
- Laboratory.
- Test equipment identification and calibration checks carried out.
- Results for the Group 2 tests performed.
- Pass/Fail decision for each test performed.
- Test-specific notes/observations (as applicable).
- Required action (e.g., submit for Group 3 testing, issue warning notice, schedule revisit, etc.).

In addition, it is recommended to capture relevant visual evidence with photographs.

An example of a standardized test sheet for Group 2 testing is included in Annex E for guidance only and may be adapted to suit alternative recording, including for paperless/electronic solutions as these are developed.

14 Nonconformities & Actions

The response to non-compliance is in two parts:

1. First: Immediate actions are to be taken where testing identifies a critical safety concern, including stop-sale/quarantine of affected product, secure retains and referee samples, regulator notification, and issue of defined clearance conditions before release.
2. Second: Graded enforcement is determined using a culpability/impact score (considering breach severity, volume affected, supplier capability, intent, recurrence, consequences, response quality, and documentation integrity) that maps to an enforcement band with prescribed actions. These actions escalate from education-first measures (advisory notice, corrective action plan, enhanced monitoring) through formal non-compliance (quarantine, written warning, audits), to significant and willful breaches (recall and referral for prosecution).

These are detailed in Annex F: Non-Compliance: Decision Framework & Actions.

The regulator retains discretion in applying these measures and has the right to choose a more educative, proportionate approach during the introductory period while the sector adapts and awareness improves, provided safety is not compromised.

15 Test Frequency

In the absence of direction provided by other government programs or by the Energy Regulator, every distributor supplying more than a combined 500 litres per year of petrol and/or diesel for use in internal-combustion engines shall be subject to on-site visits and Group 1 tests at the following frequency:

1. **Baseline frequency:** Twice yearly (approximately six months apart), where no Group 1 test Fails are recorded.
2. **After a Fail:** If a Group 1 Fail is recorded, retesting shall be carried out within one month. Once a clear (no Fails) Group 1 test has been achieved, the testing frequency shall revert to twice yearly (approximately six months apart).
3. **Reduced frequency:** Testing may be reduced to once yearly (approximately 12 months apart) after three successive rounds of Group 1 tests have been completed with no Fails.

16 SOP Deployment (Informative)

This section is informational only, as the deployment mechanism will depend on resource circumstances and availability specific to each locality, and which may also change over time and therefore cannot realistically be prescribed in a fixed way within the SOP. The rollout of the SOP is also highly dependent on the design of complementary initiatives, such as any government programme to raise awareness of best-practice fuel storage and housekeeping.

Accordingly, this SOP can only set out non-mandatory recommendations—principally that consideration be given to delegating authority to suitable local agencies to undertake fuel testing at the local level.

Broader fuel quality assurance and awareness-raising activities may involve other local entities in order to achieve the widest possible reach. In the context of Vanuatu, such local resources could include provincial and municipal councils, area and regional councils, councils of chiefs, church and community groups, women's and youth associations, farmers' and fishers' cooperatives, local NGOs and community-based organisations, and TVET centres or other local training providers where these are present.

17 Review and Improvement

This SOP shall be reviewed annually for effectiveness, trigger thresholds, test inventories and test frequency. Baseline parameters (e.g., expected density ranges of fuels in the marketplace) shall be regularly updated to match the specifications of fuel received into the country.



ANNEX A

Test Procedures

Test 1: Clear-and-Bright (C&B) Visual Inspection

1 Purpose and Scope

Rapid field/laboratory screen to detect free water, haze, and particulates in petrol and diesel at custody-transfer and downstream checkpoints. Provides a simple pass/fail appearance assessment and optional haze indication.

2 Safety and Precautions

- Follow dangerous-goods handling requirements; control ignition sources; ensure adequate ventilation.
- Wear appropriate PPE (gloves and eye protection).
- Use clean, dry, glassware; avoid plastics that can shed or retain static charge.
- Follow any specific site health and safety requirements.

3 Apparatus

- Clear, colourless glass jar, preferably 300-500ml capacity with tight sealing cap (fill target: at least 200ml).
- Bright daylight, or bright diffuse white light source (≥ 1000 lux) and contrasting backgrounds (white and black).
- Lint-free wipes, sample labels, and a log sheet (or digital form).

4 Sampling

- Purge the sampling line as required. Draw the sample from the relevant point (e.g., tank low point, loading gantry, discharge, or nozzle).
- Use clean, dry equipment. Fill the jar to at least 200ml, cap, and wipe the exterior dry.
- Identify and label the sample; record source, date/time, and operator.

5 Test Conditions

Examine the sample at storage/ambient temperature. Where a controlled lab is used, keep the sample near 20–30 °C (i.e., container at a “neutral” temperature – between cool and warm to touch).

6 Procedure (Visual “Clear & Bright” Check)

1. Allow the sample to settle on a stable surface for 1–2 minutes.
2. In a field situation, hold the jar above eye height with the sun/ambient light behind the jar. In a laboratory setting, hold the jar before a white background under bright, diffuse light and look through the body of liquid for haze/cloud, suspended matter, or streaks.
3. Gently swirl to form a shallow vortex and observe beneath the vortex for descending droplets/strings of water or rising particulate.
4. Tilt the jar and inspect the heel for beads or a layer of free water and for sediment.

7 Pass/Fail Criteria

- **Pass (Clear and Bright):** No visible solids or haze; no free water detected; appearance water-white to straw/amber depending on product.
- **Fail (Not Clear and/or Not Bright):** Any haze/cloudiness, visible particulate, water beads or layer, or doubtful appearance. Treat marginal cases as suspect and escalate.

8 Documentation & Retain Samples

- Record product, source point, location, date/time, temperature, observer, result (Pass/Fail), and remarks (e.g., “slight haze”, “water beads at heel”).
- When Fail/Suspect, take and seal a retain sample and maintain chain-of-custody per site procedures.

9 Notes & Limitations

- Visual inspection does not detect very fine droplets/particles below visual resolution.
- Ensure glassware is clean and dry—residual water or lint can mimic failure.
- For borderline results, treat as suspect and escalate.

Test 2: Colour Trending Screen

1 Purpose and Scope

Early-warning screening method to detect colour shifts in petrol and diesel that may indicate oxidation, contamination, improper blending, ageing, or poor storage/handling. Intended to be carried out immediately after the Test 1: Clear-and-Bright (C&B) Visual Inspection.

2 Principle

Compare the colour of a current sample with expectations. Record the observed colour value. A darker than expected sample triggers follow-up actions following the SOP logic path.

3 Safety and Precautions

- Observe dangerous-goods handling; control ignition sources; ensure good ventilation.
- Wear appropriate PPE (gloves and eye protection).
- Use clean, dry, clear glassware; avoid tinted containers and plastic vessels that can shed or hold static.
- Follow any specific site health and safety requirements.

4 Apparatus

- Colourless glass jars preferably with tight caps as for Test 1: Clear-and-Bright (C&B) Visual Inspection.
- Optional: colour comparator card or in-house visual grade scale (0–5).
- Lint-free wipes, labels, and a log sheet or digital form.

5 Procedure – Visual Comparator Method

At the completion of the Test 1: Clear-and-Bright (C&B) Visual Inspection:

1. Place the current sample jar against a matte white background under the specified lighting.
2. Allow 1–2 minutes for any entrained bubbles to dissipate; do not shake.
3. View horizontally through the mid-depth of the jar.
4. Rotate 90° around the vertical axis and repeat the comparison to minimise glare effects.
5. Compare to expectations and record as a qualitative descriptor (e.g., “normal”, “slightly dark”, “very dark”).

6 Pass/Fail Criteria Actions on Result

- Pass – colour “normal”.
- Warning – colour “slightly dark”.
- Fail: colour “very dark”.

7 Documentation and Retains

- Record product, grade, location, sampling point, date/time, qualitative descriptor.
- Retain sample if failed.

8 Notes and Limitations

Although potentially subjective on the part of the tester, a tester is expected to become very aware of the colour of normal fuels. Hence the usefulness as a simple screen.

Test 3: Density Check — Portable Density Meter

1 Purpose and Scope

Field screening method to verify fuel density against the expectations using a portable density meter. If conducted in the field, this procedure uses the same jar sample taken for the Clear & Bright (C&B) test. If the measured/15 °C-corrected density falls outside the expected band, a retain is taken and density is confirmed in the laboratory.

2 Principle

Measure fuel density and temperature with a portable density meter (e.g., oscillating U-tube), record the as-measured values, and correct to 15 °C using the meter's built-in function. Compare the 15 °C result to the pre-defined expected band for the product/grade (set from batch documentation and local experience).

3 Safety and Precautions

- Observe dangerous-goods handling; eliminate ignition sources; ensure good ventilation.
- Wear PPE (gloves and eye protection).
- Avoid vapour loss and air entrainment; keep containers capped when not measuring.
- Work with clean, dry equipment to prevent contamination and erroneous readings.
- Follow any specific site health and safety requirements.

4 Apparatus

- Portable density meter with temperature readout/correction capability and clean sampling tube/adaptor.
- Clean, clear glass sample jar used for the C&B test.
- Lint-free wipes; labels; log sheet or digital form.

5 Sampling

- Use the same sample drawn for the C&B test; do not re-sample unless sample contamination is suspected.
- Ensure the sample is visually acceptable (C&B Pass). If not, use retain sample and test in the laboratory using hydrometer.
- Gently invert the jar once or twice to homogenise; avoid vigorous shaking and air bubbles.

6 Test Conditions

Conduct measurements at ambient/storage temperature (neither cold nor warm to touch). Allow the meter to thermally stabilise. If the sample is unusually cold or warm, allow it to equilibrate towards ambient before measurement. Minimise exposure time to reduce vapour loss (especially for petrol).

7 Meter Check & Preparation

- Inspect the meter and tubing; ensure they are clean and dry. Rinse with a small amount of the sample if needed and discard the rinse.
- Perform a quick functional check/zero per manufacturer instructions (e.g., air and/or water check).
- Confirm date/time and instrument ID are correct for traceability.

8 Procedure — Portable Density Meter

1. Draw the sample into the meter per manufacturer instructions, ensuring no bubbles are trapped (repeat fill if bubbles are seen).
2. Record the as-measured density (ρ_{meas}), the sample temperature (T_{meas}) and the 15 °C correction density (ρ_{corr}).
3. Rinse the meter with a small volume of clean sample between different products/grades; perform a final rinse with isopropanol if changing between petrol and diesel.

Test 3: Density Check — Portable Density Meter *(continued)*

9 Expected Bands and Acceptance

Register expected 15 °C density bands for each product and supplier (e.g., PPC or VFS) based on original supplier and batch documentation. Example placeholders:

- Unleaded petrol (15 °C): _____ to _____ kg/m³ (site-defined).
- Automotive diesel (15 °C): _____ to _____ kg/m³ (site-defined).

10 Pass/Fail Criteria

Pass: p15 is within the expected band.

Fail: p15 is outside expected band.

11 Laboratory Confirmation — Hydrometer

For failed samples or sample not deemed Clear & Bright, follow up with laboratory hydrometer test:

- In the laboratory, select a hydrometer appropriate to the expected density range and a thermometer for sample temperature.
- Gently mix and pour the sample into a tall, clean hydrometer cylinder; avoid bubbles. Immerse the hydrometer without touching the walls; allow to settle.
- Read the hydrometer scale at the bottom of the meniscus; record density and temperature.
- Apply temperature correction to 15 °C providing "lab p15".
- Compare lab p15 with the expected band and with the field meter result; investigate discrepancies.

12 Documentation and Retains

- Record product, original supplier (PPS or VFS), location, sampling point, date/time, instrument ID, ρ_{meas} , T_{meas} , p15, expected band, result (Pass/Outside band), and remarks.
- For Outside-band results, retain sample ID, custody records, hydrometer ID, lab p15, and final disposition.

13 Notes and Limitations

- Entrained air and vapour loss can bias readings; ensure bubble-free fills and minimise open handling, especially for petrol.
- Temperature strongly influences density; always record temperature and correct to 15 °C.
- Differences between instruments (meter vs hydrometer) should be within site-defined tolerance; investigate larger biases.
- Use dedicated/cleaned equipment to avoid cross-contamination between grades.

Test 4: Water-Finding Paste — Bottom Water Check (Dipstick)

1 Purpose and Scope

Simple field check to detect free water at the bottom of diesel and petrol storage tanks using a dipstick and water-finding paste. Intended for routine housekeeping at depots, forecourts, and small outlets, but also to be used for quality screening.

2 Safety and Precautions

- Follow site safety rules: control ignition sources, ensure ventilation, use PPE (gloves/eye protection).
- Open tank hatches cautiously and avoid breathing vapours.
- Use tank's own dip stick if exists and is in suitable condition, otherwise use a clean, dry dipstick or gauging tape.
- Keep bystanders clear; secure covers after the check.

3 Apparatus

- If required, clean, dry dipstick or gauging tape and bob (flat face preferred).
- Water-finding paste compatible with the product.
- Lint-free wipes; sample labels and log sheet.

4 Preparation

- If a mobile tank, allow contents to settle (e.g., 10–15 minutes after deliveries or tank movements).
- Wipe the dipstick clean and dry; review paste colour-change reference if provided.
- Identify low points in the tank (sump, suction area) and plan dip locations.

5 Procedure — Dip with Water-Finding Paste

1. Apply a thin, even layer of paste to the bottom 50–100 mm of the dipstick/bob face.
2. Lower the dipstick vertically to the tank bottom at the first chosen point; avoid scraping the walls.
3. Hold in place for ~5–10 seconds to allow contact at the heel/bottom.
4. Withdraw the dipstick smoothly; observe any colour change in the pasted zone (indicates water).
5. Measure and record the length of colour change (mm).
6. As appropriate/possible, repeat at 1–2 additional points (e.g., near fill, near suction/sump) to confirm conditions.
7. Wipe the dipstick clean between dips; re-apply fresh paste as needed.

6 Pass/Fail Criteria

- **Pass:** no colour change (= no free water detected at dip point).
- **Warning:** trace colour change (≤ 2 mm of paste line – indicating small amount of free water present).
- **Fail:** > 2 mm water.

7 Documentation

Record date/time, location, tank/compartments ID, product, dip locations, colour-change length (mm), result (Pass/Warning/Fail).

8 Notes and Limitations

This is a screening method; when water is indicated in diesel, follow up with a laboratory-based water determination.

Test 5: Filter Patch Test — Particulate/Contamination Screen (Petrol & Diesel)

1 Purpose and Scope

Simple field and laboratory screen to assess visible particulate and foreign matter in petrol and diesel by filtering a known volume of sample through a filter patch and visually inspecting the filter patch. Qualitative/visual only.

2 Safety and Precautions

- Observe dangerous-goods handling; eliminate ignition sources; ensure good ventilation.
- Wear PPE (gloves, eye protection); avoid skin contact; do not use mouth-pipette.
- Bond/ground as per site policy; avoid static discharge, especially with petrol.
- Use clean, dry equipment; dispose of used filters and residues according to site procedures.
- Follow any specific site health and safety requirements.

3 Apparatus

- Hand-operated sampling pump or large syringe (≥ 60 ml) with fuel-compatible tubing.
- Inline filter holder (25–47 mm) compatible with fuels.
- Fuel-compatible membrane filters (e.g., PTFE or cellulose nitrate), 0.45–0.8 μm pore size.
- Graduated cylinder or marks on syringe to measure volume.
- Clean, clear glass sample jar — same jar used for the Clear & Bright test if available.
- Forceps (non-serrated), lint-free wipes, neutral white and black backgrounds, bright diffuse light.
- Labels and a log sheet.

4 Preparation

- Assemble the filter holder; place a clean membrane centrally and secure (avoid touching the active surface).
- Pre-wet the membrane with a small amount of sample to seat it (discard the pre-wet).

5 Procedure — Simplified Filter Patch

1. Draw the sample into the pump/syringe and pass it through the membrane using steady pressure. Avoid bubbles and spurting.

2. Filter 100 ml of fuel through the patch.
3. Disassemble; remove the membrane using forceps and place it on a clean glass surface to air-dry for 2–5 minutes (protected from dust).
4. Inspect the dried patch under bright light against white and then black backgrounds. Note colour, speck density, streaks, rust-coloured particles, or fibrous matter.
5. Photograph the patch with sample ID for records.

Alternative Procedure for Non-Formal Test

1. Place filter across a funnel. wet the membrane with a small amount of sample to seat it.
2. Pour 100ml of fuel sample on top of the filter and allow gravity to draw the sample through the filter.
3. Allow the patch to dry and inspect as described above.

6 Interpretation & Actions Visual guide:

Pass — No isolated specks.

Fail — Clearly visible material left on the filter.

7 Documentation

- Record product, location, tank/line, sampling point, date/time, volume filtered, membrane pore size/type, result (Pass/Fail), and remarks.
- Store patch image(s) with the log entry; if a fail, keep a physical retain of the patch in a labelled sleeve if practicable.

8 Notes and Limitations

- This is a qualitative screening method; results are not gravimetric. Use the same membrane type and volume for comparability.
- Petrol volatility can cause rapid evaporation; keep components closed and minimise open handling.
- Very cold fuel increases viscosity; allow to equilibrate toward ambient for consistent flow.
- If the membrane clogs before the target volume, record as a Fail and record the actual volume filtered.

Test 6: Odour-Noted Screen – Simple Test Specification (Petrol & Diesel)

1 Purpose and Scope

Quick sensory screen to detect off-odours in petrol and diesel that may indicate contamination, oxidation/ageing, adulteration, or poor storage/handling. Intended as an added observation when carrying out other tests rather than a test in its own right.

2 Safety and Precautions

- Follow dangerous-goods handling requirements; control ignition sources; ensure adequate ventilation.
- Wear appropriate PPE (gloves and eye protection).
- Work in a well-ventilated area; eliminate ignition sources.
- Follow any specific site health and safety requirements.
- Do not inhale; use the sense of smell only, ~10–15 cm from the opening.
- Limit to 2–3 brief smell checks; move to fresh air immediately after assessment.
- Follow any specific site health and safety requirements.

3 Procedure

Observe smell of fuel when handling during other tests

4 Interpretation and Actions

- **Pass: Petrol:** typical petrol/aromatic note. Diesel: mild kerosene/diesel note. Pass.
- **Fail:** Slight sour/musty/solvent-like/burnt/rancid note, through strong solvent/paint/acetone, rotten-egg/sulphidic, acidic, or pronounced rancid odour.

5 Documentation

Record product, location, sampling point, date/time, assessor(s), odour descriptors, classification (Pass/Fail), and follow-up actions.

6 Notes and Limitations

- Subjective screen: minimise bias (avoid strong ambient odours, perfume, smoke).
- Use as a trigger for objective tests; not a substitute for laboratory analysis

Test 7: Microbial Growth Screen — Dip Slide Test (Diesel)

1 Purpose and Scope

Check for high microbial activity in diesel.

2 Safety and Precautions

- Follow dangerous-goods handling requirements; control ignition sources; ensure adequate ventilation.
- Wear appropriate PPE (gloves and eye protection).
- Use clean, dry, glassware; avoid plastics that can shed or retain static charge.
- Follow any specific site health and safety requirements.
- Work in a well ventilated area; control ignition sources; wear gloves and eye protection.
- Treat used dip slides as biologically contaminated; avoid contact with media surfaces.
- Do not open incubated slides outside of controlled handling; seal properly before disposal per site procedures.

3 Apparatus

- Commercial fuel compatible dip slides (dual media preferred for bacteria and fungi).
- Clean, clear glass jar (250–500 ml) with tight lid — use same sample as Clear & Bright where possible.
- Permanent marker/labels; simple log sheet.
- Incubation capability: warm area/box at $\sim 30^{\circ}\text{C}$ ($\pm 2^{\circ}\text{C}$) or shaded ambient ($25\text{--}35^{\circ}\text{C}$) if no incubator is available.
- Timer/clock; zip lock bags or slide sleeves for incubation.

4 Preparation

- Check dip slide expiry and media integrity; label the slide with sample ID, date/time.

5 Procedure — Dip Slide

1. Open the dip slide container without touching the media. Keep the cap/container for re sealing.
2. Immerse the media fully in the sample jar for ~ 10 seconds; withdraw and allow excess to drain without dripping onto the handle.

3. Re insert the slide into its container without scraping the media. Close firmly.
4. Place the sealed slide in a clean zip lock bag or sleeve for incubation.

6 Incubation

- Incubate at $\sim 30^{\circ}\text{C}$ ($\pm 2^{\circ}\text{C}$) for 24–48 hours; check at 24 h and again at 48 h. If only ambient is available ($25\text{--}35^{\circ}\text{C}$), extend to 48–72 h.
- Keep slides upright and sealed; avoid direct sunlight and fuel vapours pooling around slides.

7 Interpretation & Actions

Use the manufacturer's comparator chart where provided. Example guidance:

- **Pass:** No colonies or a few isolated colonies on either side (very light growth).
- **Alert:** Noticeable but non confluent colonies (light–moderate growth).
- **Fail:** Heavy or confluent growth (dense spots/film).

8 Documentation

Record product, location, tank/line, sampling point, date/time, slide lot/expiry, incubation time/temperature, result (Pass/Alert/Fail), and notes (e.g., visible slime, odour).

9 Notes and Limitations

- Dip slides provide qualitative indication; they are not a quantitative count. Use the same brand/media for trending.
- Growth correlates strongly with the presence of free water; pair with routine water finding and housekeeping.
- Some additives/biocides can inhibit growth and yield false low results; note recent treatments in the log.
- Do not interpret petrol results without also checking for water at interfaces; microbes grow at the fuel water boundary.

Test 8: Flash Point — Pensky–Martens (ASTM D93 / EN ISO 2719)

1 Purpose and Scope

Determination of the closed-cup flash point of diesel sample to screen for light-end contamination (e.g., kerosene/petrol) and verify safety/spec compliance.

2 Safety and Precautions

- Flammable vapours and hot tester surfaces—use PPE (gloves, eye protection, lab coat) and good ventilation.
- Keep ignition sources controlled (tester only); no open flames/sparks nearby.
- Avoid overfilling the cup; handle the hot cup and lid with care.

3 Apparatus

- Pensky–Martens closed-cup flash point tester (manual/automatic), clean test cup/lid.
- Integrated thermometer/thermocouple and stirrer as per instrument.
- Certified reference material (CRM) or reference check fluid for verification.
- Lint-free wipes; barometer if required by the instrument.

4 Procedure (Simple)

- Mix sample gently; inspect for obvious water/haze.
- Prepare and verify the instrument per manufacturer instructions (run CRM/check).
- Charge the cup to the mark; select the appropriate D93 procedure (A/B/C) per expected flash point.
- Start the run and observe the instrument's prompts; record the observed flash point (°C).
- If the result is close to the limit (site tolerance), repeat on a fresh charge (duplicate).

5 Results, Interpretation and Actions

- **Pass:** Measured flash point $\geq$ the product minimum specified for the grade/regulation in force.
- **Fail/Borderline:** Result $<$ minimum or within site tolerance of the limit.
- **Variation detected:** Result not in line with CoQ, where known.

If required, confirm by repeat D93 and/or escalate to referee testing if warranted. Treat fuel as a safety risk until non-compliant test results resolved.

6 Documentation

- Record product, location, sampling point, retain ID, date/time, instrument ID, method (ASTM D93 / EN ISO 2719) and procedure (A/B/C), result (°C), analyst.
- Note any observations (odour, haze) and attach a photo if relevant.

Test 9: Water Content — Karl Fischer (EN ISO 12937)

1 Purpose and Scope

Determination of water content in diesel using the coulometric Karl Fischer method.

2 Safety and Precautions

- Karl Fischer reagents (methanol-based) are flammable and toxic—use gloves, eye protection, and good ventilation.
- Avoid ambient moisture ingress: keep the instrument's cell sealed; use dry syringes/vials; work promptly.
- Fuel samples are Class 3 flammables—no ignition sources; manage spills appropriately.

3 Apparatus

- Coulometric Karl Fischer titrator compliant with EN ISO 12937 (generator electrode with/without diaphragm).
- Karl Fischer reagents (anolyte/catholyte as required by instrument).
- Dry, gas-tight syringes/needles (e.g., 0.5–2.5 ml) and septum-sealed vials (pre-dried).
- Analytical balance (0.1 mg readability) for sample mass by difference (syringe or vial).
- Certified reference material (CRM) / reference standard appropriate for KF verification.
- Desiccant, lint-free wipes.

4 Procedure (Simple)

Follow the instrument manufacturer's instructions and EN ISO 12937 for all operating steps. The following outline is for context only and does not replace the instrument procedure.

- Instrument preparation: charge/condition the cell with fresh reagents; verify system dryness and drift as instructed.
- Verification: run a blank and a CRM/reference check; confirm results within the acceptance range.
- Sampling: homogenise the sample; avoid visible water/haze carry-over into the syringe/vial.
- Direct injection mode: weigh the dry syringe, draw aliquot, weigh again; inject through the septum; record the KF result.
- Calculations: compute mg/kg (ppm) using the instrument's output and the gravimetric sample mass.
- Quality checks: repeat if near limits or if drift/background is unstable; change reagents/inspect seals if high drift persists.

5 Results, Interpretation and Actions

- **Pass:** Water content $\leq$ the applicable product limit (as per current specification/regulation).
- **Fail:** Result $>$ limit

6 Documentation

- Record product, location, sampling point, retain ID, date/time, instrument ID, method (EN ISO 12937).
- Record sample mass, result (mg/kg), blanks/CRM checks, drift, replicate results, analyst.
- Note any atypical observations and attach a photo if relevant.

Test 10: pH of Water Bottoms — Dipstick Screen (Diesel /Petrol Tanks)

1 Purpose and Scope

Simple field screen to assess the acidity/alkalinity of free water bottoms drawn from fuel tanks using pH indicator strips (or a handheld pH meter). Used to flag corrosion risk, microbial activity, or chemical contamination.

2 Safety and Precautions

- Follow site safety rules: control ignition sources, ensure ventilation, use PPE (gloves/eye protection).
- Open tank hatches cautiously and avoid breathing vapours.
- Keep bystanders clear; secure covers after the check.

3 Apparatus

- pH indicator strips (range ~0–14).
- Clean glass vial (20–50 ml is sufficient) with cap for water-bottom subsample.
- Bottom-water sampling device/valve or thief; lint-free wipes; log sheet.

4 Sampling (Water Bottoms)

- Allow tank to settle if recently filled/moved.
- Draw a small amount (~20–30 ml) from the lowest point/sump; avoid fuel carry-over.
- Cap sample jar immediately.

5 Procedure — pH Strip (Simple)

- Dip the strip briefly into the water subsample; remove and allow color to develop per strip instructions (~1–5 s).
- Compare to color chart and record pH to nearest unit (or 0.5 if possible).

6 Results and Interpretation

- **Pass:** water bottoms near neutral: pH ≈6–8.
- **Fail:** Acidic (pH <6) or basic (pH >8) indicates potential contamination/corrosion/microbial activity.
- **Extreme Fail:** if extreme (pH <5 or pH >9). Escalate investigation.

7 Documentation

Record product, location, sampling point, date/time, pH result.

8 Alternative

A pH meter may be used if suitable equipment is available and testing officers are sufficiently trained in using a pH meter.

Test 11: Water Shake / Bottle Phase Check (Petrol)

1 Purpose and Scope

Simple visual screen for phase behaviour and water tolerance by shaking petrol with water in a clear bottle, then observing separation, haze, or emulsion. Not separating back into two clearly distinct layers indicates potential fuel contamination.

2 Safety and Precautions

- Observe dangerous goods handling; eliminate ignition sources; ensure good ventilation.
- Wear PPE (gloves and eye protection).
- Avoid vapour loss and air entrainment; keep containers capped when possible.
- Work with clean, dry equipment to prevent contamination and erroneous readings.
- Follow any specific site health and safety requirements.

3 Apparatus

- Clear glass graduated cylinder with volume marks (150-200 ml preferred) with leak-tight cap.
- Water, preferably deionized (DI).

4 Procedure (Simple)

- Add 80 ml of petrol to the bottle, then 20 ml of DI water (fuel:water ~ 4:1).
- Cap and shake vigorously for 30 seconds; then place on bench.
- Observe immediately for persistent emulsion/haze; then allow 5–10 minutes to settle and examine the interface.
- Note fuel clarity, presence/height of emulsion band, and any growth of the water layer (e.g., ethanol partitioning from petrol, or other).

5 Results and Interpretation

- **Pass:** quickly separates into two clear layers of same ratio as petrol and added water.
- **Fail:** persistent haze/emulsion (suggests surfactants/contaminants), increase in water layer (indicates ethanol/water phase separation/other non-specification issue).

6 Documentation

Record product, location, sampling point, retain ID (as applicable), date/time original sample, date/time of test, volumes used, observations (clarity, emulsion height, layer growth).

Test 12: Glycerine/Glycerol Dropout – Methanol Shake Screen (Diesel)

1 Purpose and Scope

Indicative screen for polar contaminants (e.g., glycerol/soaps) associated with biodiesel contamination or poor transesterification, using methanol extraction and visual observation in a 500 ml separation funnel.

2 Safety and Precautions

- Methanol is toxic and flammable: use gloves, eye protection, and good ventilation; avoid skin contact and inhalation.
- No ignition sources; use a stopper rated for solvents; do not point flask at people when opening.

3 Apparatus

- 500 ml separation funnel or similar conical flask preferably with stopper.
- Methanol (analytical grade).

4 Procedure (Simple)

- Add 200 ml methanol to the flask.
- Add 50 ml diesel sample (avoid water carry-over).
- Stopper and shake vigorously for 5 seconds; then swirl gently for 10 seconds.
- Set the flask down; observe for 5–15 minutes.
- Look for fine oil droplets or viscous threads descending to bottom of funnel/flask (closely observe the narrow neck).

5 Results, Interpretation and Actions

- **Pass:** no fine oil droplets observed forming, no separate layer forms at the neck of the flask.
- **Fail:** formation of oil droplets. Formation of a separate layer at the bottom of the flask (indicating fuel contamination with other product).

6 Documentation

Record product, location, sampling point, retain ID, date/time original sample, volumes, timings, observations, retain a photo if possible.

Test 13: Cold-Soak Screen (~0 to -1 °C) — (Diesel)

1 Purpose and Scope

Simple screen for wax/solid dropout and haze formation in diesel at low temperature, providing an indication of contamination.

2 Apparatus

- Clear glass jars with secure tops (100–150 ml capacity).
- Chiller or refrigerator capable of ~0 to -1 °C.
- Dial thermometer.

3 Sampling & Fill

- Fill jar with 70–80 ml of diesel sample and seal.
- Label clearly (sample ID, date/time).

4 Soak Procedure

1. Place jar in chiller/refrigerator.
2. Observe after ~24hrs of holding at ~0 to -1 °C – removing from chiller/refrigerator to do so and observing within ~1 min from chiller/refrigerator removal. Use a paper towel to remove condensation from the outside of the jar if necessary to clearly see the sample through the jar. Tilt jar as necessary to look for stratification of sample. Note cloudiness, crystals, sediment, or gel.
3. In a similar manner, observe the sample after a further ~24hrs of holding at ~0 to -1 °C (~48 hours of holding in total). Note cloudiness, crystals, sediment, or gel.

5 Results and Interpretation

- **Pass:** no sign of cloudiness or separation.
- **Fail:** haze/crystals/separation observed..

6 Documentation

Record product, location, sampling point, retain ID (as appropriate), date/time original sample, soak start/finish times, soak temperature, observations, attach photo if a Fail result.

Test 14: Copper Strip Corrosion — EN ISO 2160

1 Purpose and Scope

Determination of the tendency of petroleum fuels to corrode copper, indicating the presence of reactive sulphur species (e.g., H S, mercaptans, polysulphides) or other corrosive contaminants.

2 Safety and Precautions

- Fuels are Class 3 flammables—use PPE (gloves, eye protection, lab coat) and ensure good ventilation; keep ignition sources controlled.
- Temperature-controlled bath/oven and test vessels become hot—use tongs/forceps; avoid burns.
- Use only approved solvents for rinsing strips; avoid inhalation/skin contact; dispose of wastes appropriately.
- Handle polished copper strips by the edges with clean forceps to prevent contamination.

3 Apparatus

- Copper strip corrosion test kit compliant with EN ISO 2160 (polished copper strips, polishing media).
- Glass test vessels (bombs) with suitable caps/ stoppers, sized to fully immerse the strip.
- Temperature-controlled bath or oven capable of maintaining the specified test condition (e.g., 50 ± 1 °C).
- Forceps/tongs, lint-free wipes, timer.
- Approved rinsing solvent (e.g., toluene or as specified by the method).
- Reference colour/tarnish rating guide/ comparator for EN ISO 2160.

4 Procedure (Simple)

Follow EN ISO 2160 for all operating details. The outline below is for context only and does not replace the standard.

- Prepare the copper strip: polish to a mirror finish per the kit instructions; rinse and dry; avoid touching the surface.
- Charge the clean test vessel with sufficient sample to fully immerse the strip (typically 30–50 ml). Insert the strip and seal.
- Place in the temperature-controlled bath/oven for the time/temperature condition applicable to the product grade (e.g., for diesel, use 3 h at 50 °C).
- At completion of the time, remove the vessel; retrieve the strip with forceps; rinse promptly with the approved solvent; dry without rubbing.
- Evaluate immediately in good, consistent light against the EN ISO 2160 colour/tarnish rating guide.

5 Results, Interpretation and Actions

- **Pass:** Rating 1 (e.g., 1a/1b).
- **Fail:** Rating ≥2 or ambiguous colour change.

6 Documentation

- Record product, location, sampling point, retain ID, date/time, bath/oven setpoint and duration, vessel ID, strip lot/batch.
- Record the EN ISO 2160 rating (e.g., 1a/1b/2) and attach a photo of the exposed strip beside the comparator, analyst.
- Note any atypical observations.

Test 15: FTIR — Sample Submission to Local Laboratory

1 Purpose and Scope

To provide a clean, representative diesel sample (≥ 50 ml) to a local laboratory for Fourier Transform Infrared Spectroscopy (FTIR) testing.

2 Safety and Precautions

- Fuels are Class 3 flammables—use PPE (gloves, eye protection) and ensure good ventilation; no ignition sources.
- Avoid breathing vapours; cap containers promptly; wipe spills immediately.
- Use only clean containers with solvent-resistant, PTFE-lined caps; do not use PVC or previously used food/oil bottles.

3 Apparatus & Materials

- Sample containers (preferred): 60–200 ml amber glass vials accepted for use with diesel (PTFE-lined caps (leak-tight) preferred. Alternative includes fluorinated HDPE bottles with PTFE-lined caps. Proven PET and other caps acceptable for same day delivery).
- Labels (waterproof), indelible marker.
- Secondary containment (zip-bag) and absorbent pads for transport.

4 Sample Requirements

- Minimum volume: 50 ml (target 60–100 ml).
- Container must be clean, dry, and compatible.
- Headspace: $\leq 10\%$.
- Label must include: product, sample ID, date/time, retain ID.
- Take from the same retain as the suspect sample where applicable.

5 Procedure (Simple)

Follow the steps below; laboratory analysis procedures are outside this SOP.

- Prepare a clean, labelled container; record intended volume on the label.
- Gently homogenise the source (avoid creating bubbles/haze); avoid water carry-over.
- Draw the sample using a clean device or pour from the retain sample, as applicable; fill to the required volume and cap immediately.
- Complete the Chain-of-Custody/submission form (sample ID, product, draw point, reason for FTIR, retain linkage).
- Deliver to the local laboratory as soon as practicable (same day preferred). Store/transport cool and shaded.

6 Documentation

Record product, location, draw point, sample/retain IDs, date/time, container type

Test 16: Overseas XRF Analysis – Sampling & Shipping Specification

1 Purpose and Scope

Specification for drawing a petrol or diesel sample from an existing retain and preparing, documenting, and packaging it for shipment to an overseas laboratory for elemental analysis by X ray fluorescence (XRF). It focuses on sampling integrity, chain of custody, and compliance with dangerous goods (DG) shipping requirements. It does not prescribe the analytical XRF method; laboratory test methods are defined by the receiving laboratory.

2 Applicability

Triggered when a field or local laboratory screen indicates potential off specification or contamination that warrants referee testing for metals content.

Applies to shipments to accredited overseas laboratories (e.g., a New Zealand laboratory capable of XRF elemental analysis).

3 Safety and Precautions

During sampling and packaging:

- Observe dangerous-goods handling; eliminate ignition sources; ensure good ventilation.
- Wear PPE (gloves and eye protection).
- Avoid vapour loss and air entrainment; keep containers capped when not measuring.
- Work with clean, dry equipment to prevent contamination and erroneous readings.
- Follow any specific site health and safety requirements.

4 Roles & Responsibilities

- Sampler: draws from the retain, completes labels, seals, and initial documentation.
- QA Reviewer: verifies sample identity, seals, paperwork; authorises shipment.
- DG Certified Shipper/Agent: classifies, packs, marks/labels, and documents DG consignment per current IATA/IMDG and local law.
- Courier/Freight: transports under DG rules; provides tracking and proof of delivery.
- Receiving Laboratory: confirms receipt/condition; performs analysis; issues report.

5 Safety and Compliance

- All samples are treated as Dangerous Goods, Class 3 (flammable liquids). Classification (UN number, Packing Group) depends on product (e.g., Gasoline vs Diesel).
- Packing, marking, labelling, and documentation must comply with current IATA DGR and/or IMDG Code, and local export/import regulations.
- A current Safety Data Sheet (SDS) for the specific product must accompany the shipment.
- Only trained personnel may handle DG packing and documentation.

6 Receiving Laboratory Details (to be completed before sampling)

Laboratory name:

Contact person & email/phone:

Delivery address:

Preferred sample volume/containers for XRF:

Lab test request form reference/ID:

Import requirements (any permits/declarations):

7 Sample Identification and Retain Selection

- Select the retain that corresponds to the site/event under investigation. Confirm seal integrity and documentation.
- Record product, location, sampling point, retain ID, date/time originally taken, storage conditions, and any prior results.

8 Apparatus

- One sample container as prescribed/provided by overseas testing laboratory.
- Retain container stored for local reference.

Test 16: Overseas XRF Analysis — Sampling & Shipping Specification (continued)

9 Sampling from the Retain

1. Work in a ventilated area away from ignition sources; wear gloves and eye protection.
2. Gently invert the retain once to homogenise without entraining air; do not shake.
3. Crack the retain; check for off odours or visible issues and note observations.
4. Fill bottles to laboratory recommended level (this normally provides 10–20% headspace to accommodate thermal expansion and vapour pressure).
5. Seal as provided by laboratory instructions.
6. Label as per laboratory instructions, specifying “XRF elemental analysis” and any special instruction. Enter any shortfall in detailing the product, location, sampling point, retain ID, date/time originally taken, into the “other information” or “special instructions” part of the laboratory’s label.

10 Documentation

- Laboratory’s test request form/sample label.
- DG paperwork prepared by a certified person (Shipper’s Declaration, if required).
- Commercial invoice/pro forma as required by customs; include HS code for fuel samples (consult shipper).

11 Packaging (DG Compliant)

- Pack and label package as required by freight company/handler or pass this responsibility to them.
- Surrender package and documentation to freight company/handler.

12 Results Handling

- Normally results will be provided on-line. Enter these results against the sample’s records.
- Review results for inconsistencies with expected results from normal product.
- **Pass:** no significant content (<10ppm) of elements across the metals and non-metals spectrum of XRF results.
- **Alert:** small content (>10ppm, <30ppm) of one or more of the elements scanned for.
- **Fail:** significant content (>30ppm) of one or more of the elements scanned for.

ANNEX B

Sampling Procedure for Group 1 (Field) & Group 2 (Local Laboratory) Tests

Sampling Procedure for Group 1 (Field) & Group 2 (Local Laboratory) Tests

1 Purpose and Scope

Defines the standard procedures for drawing fuel samples for: a) Group 1 field tests (≥ 200 ml total), and b) Group 2 local laboratory tests (two $\times$ 500 ml: one for testing, one retain). Applies to sampling from forecourt nozzles, bulk/fixed tanks (mid-depth and bottom draws), and drums. The SOP follows common international practice for manual sampling of petroleum products and aims to preserve sample integrity, safety, and traceability.

2 Safety and Precautions

- Fuels are Class 3 flammables—no smoking/open flames; control ignition sources. Use PPE: safety glasses, nitrile gloves, non-sparking footwear/clothing.
- Bonding/earthing: when sampling into portable metal containers or from metal tanks, bond/ground to prevent static.
- Ventilation: work in well-ventilated areas; avoid breathing vapours, especially for petrol.
- Spill control: have absorbent pads, drip trays, and a closable waste container ready; clean spills immediately.
- Lifting/handling: drums and sampling gear can be heavy; use safe lifting practices.

3 Equipment and Materials

- Sampling devices: stainless-steel zone/bottom “thief” sampler; fuel-compatible hand pump or running sampler; dip tape; water-finding paste.
- Containers: amber glass bottles accepted for containing and storing diesel and petrol (60–100 ml, 250 ml, 500 ml, as applicable. The use of PTFE-lined caps preferred).
- Ancillary: clean metal funnel, lint-free wipes, waterproof labels/markers, zip-bags, secondary containment, ice/cooler (no ice in contact with bottles).
- Documentation: sample ID labels, Group 1 test sheet, Group 2 test sheet, photo device.

4 Sample Volumes & Containers

Group 1 (Field):

- Draw a minimum 200 ml total from the source. Preferred: one 250 ml clear glass bottle, PTFE-lined cap.
- Use for visual clear-and-bright and other Group 1 screens (density check, filter-patch, etc.).

Group 2 (Local laboratory):

- Draw two separate 500 ml bottles from the same sampling event: one for testing, one retain.
- Use amber glass bottles with caps accepted for diesel and petrol use.

5 General Sampling Principles

- Representativeness: avoid contamination; rinse sampling device with a small aliquot of product from the source before the official draw.
- Headspace: keep $\leq 10\%$ for diesel; minimise but allow thermal expansion for petrol; cap immediately.
- Homogenisation: gently mix the source (where safe/practical). Do not agitate if water bottoms are suspected—take a bottom check first.
- Flushing at nozzles/valves: discard sufficient product to clear stagnant line contents.
- Documentation: label immediately at point of fill; record sample ID, product, location, draw point, date/time, sampler, purpose (Group 1 or 2 testing), and any field observations.
- Transport/storage: keep cool, upright, out of direct sun; deliver Group 2 test samples to the laboratory as soon as practicable (same day for petrol, ≤ 72 h for diesel).

Sampling Procedure for Group 1 (Field) & Group 2 (Local Laboratory) Tests (continued)

6 Procedures by Source

6A. Forecourt Nozzle Sampling

- Inspect the nozzle/hoses and note grade. Place a grounded metal receptacle/drip tray beneath.
- Sample after nozzle and hose has been used to dispense at least 5 litres of fuel OR a minimum of three times the estimated line volume, whichever is greater, to remove line contents. Alternatively, flush to tank or to waste an equivalent amount.
- Reduce flow, then fill the sample bottle via a clean metal funnel to avoid splash and static. Do not overfill; cap immediately.
- Preferred volumes: Group 1—fill one 250 ml bottle (≥ 200 ml usable). Group 2—fill two 500 ml bottles in sequence from the same flush cycle.
- Record nozzle ID, fuel, flush volume, date and time, officer.

6B. Bulk/Fixed Tank — Mid-Depth (All-Level or Spot)

- Measure ullage/liquid depth. Determine mid-depth (or target zone).
- Using a clean thief/zone sampler: for an all-level sample, open on descent and close on ascent to integrate; for a mid-depth spot, trigger the valve at target depth.
- Retrieve and decant into bottles using a clean metal funnel. Avoid contact with tank walls/manholes that could shed debris.
- Preferred volumes: Group 1—one 250 ml bottle; Group 2—two 500 ml bottles. Consider keeping discrete top/middle/bottom bottles for diagnostics if enforcement is anticipated.

6C. Tank Bottom Draw (Bottom Valve/Cock or Bottom Sampler)

- Check for water bottoms with water-finding paste on a gauged stick/dip tape.
- If a bottom valve/cock is fitted: place container/tray, open slowly and flush to waste until product appears clean and water-free; then collect the bottom sample.
- If no valve is available: use a bottom sampler ("bacon bomb" style) to capture liquid at the floor of the tank.
- Label these specifically as 'Bottom' samples; do not composite with mid-depth samples.
- Preferred volumes: Group 1— ≥ 200 ml; Group 2—two $\times$ 500 ml if the bottom condition is the target of the investigation.

6D. Drum Sampling (Sealed & In-Use)

- Sealed drum: wipe the 2-inch bung area clean; open carefully. Use a clean stainless thief through the bung to take a mid-depth sample; avoid scraping the sides/bottom.
- In-use drum: visually inspect for corrosion/contamination. If representativeness is the goal and no water is suspected, gently roll the drum (1–2 minutes) to mix; let settle briefly to reduce entrained air. If water is suspected, check with water paste first and take a separate bottom sample.
- Decant through a clean metal funnel into bottles; cap immediately. Reseat/secure the bung after sampling.
- Preferred volumes: Group 1—one 250 ml bottle; Group 2—two 500 ml bottles.

7 Field Quality Control (QC)

- Duplicates: collect a duplicate for at least 1 in 10 sampling points (or per plan) and label as such.
- Equipment rinse check: after device cleaning, rinse with the product and discard; document before the official draw.
- Acceptance at collection: reject/replace any sample with leaking caps, wrong container, excessive headspace, visible debris (unless debris is the subject of the investigation).

8 Laboratory Delivery

- Label each bottle at the point of fill: sample ID, product, location, draw point, date/time, sampler.
- Place bottles in secondary containment (zip-bags) and a rigid carrier/cooler.
- Deliver Group 2 test bottles to the laboratory promptly; store retains in a cool, secure location with an index and retention period per policy.

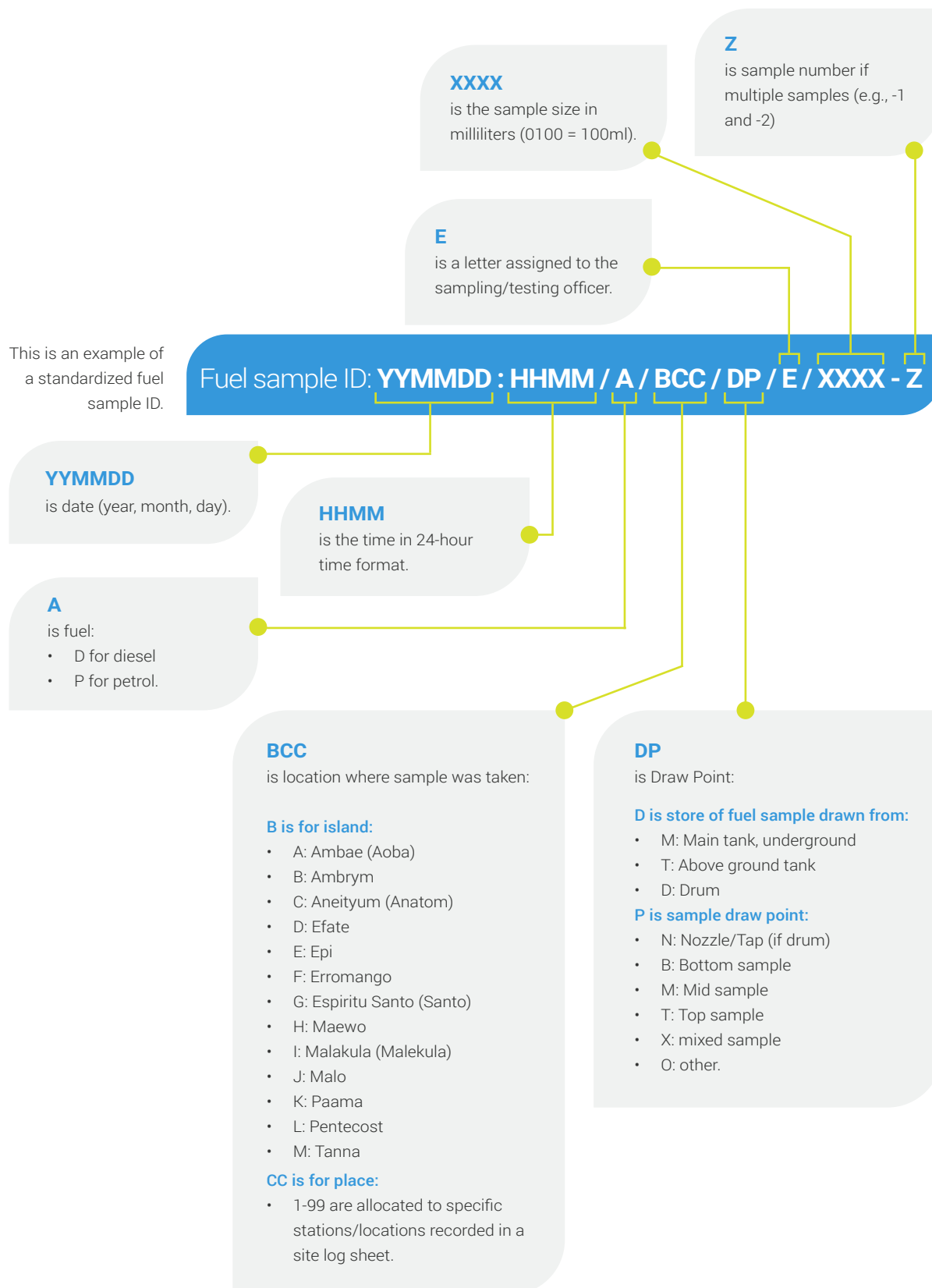
9 Acceptance / Rejection Criteria

- **Accept:** accepted bottle type; glass preferred for diesel), adequate volume, legible label, intact seal, no leakage.
- **Reject/Resample:** PET or unsuitable plastic; unacceptable cap; insufficient volume; gross contamination inconsistent with the sampling aim; missing label.



ANNEX C

Example Format for Labelling Fuel Samples





ANNEX D

Example of Field Test Sheet Group 1

Example of Field Test Sheet – Group 1

If any Fail/borderline result is recorded, take retains and submit to Group 2 (Local Laboratory).

Sample ID:

Product:

Location (Site/Island):

Draw Point:

Date / Time (Local):

Officer:

Retain Bottle ID where taken:

Test	Result / Reading	Pass / Fail	Notes
Test 1 – Appearance: Clear & Bright		☐ Pass ☐ Fail	
Test 2 – Colour Trending		☐ Pass ☐ Fail	
Test 3 – Density		☐ In band ☐ Out of band	
Test 4 – Water Finding (if safe/applicable)		☐ No Water ☐ Water	
Test 5 – Filter Patch (if needed)		☐ Accept ☐ Excessive	
Test 6 – Odour (observed only)		☐ Normal ☐ Unusual	

Overall Field Screen: ☐ Acceptable ☐ Borderline ☐ Fail Action:

Density Pass/Fail Criteria:

- XXX-XXX g/litre petrol.
- YYY-YYY g/litre diesel.



ANNEX E

Example of Local Laboratory Test Sheet Group 2

If any Fail/borderline result is recorded, take retains and submit to Group 2 (Local Laboratory):

Sample ID:

Product:

Location (Site/Island):

Draw Point:

Date / Time (Local):

Officer:

Retain Bottle ID where taken:

Test	Result / Reading	Pass / Fail	Notes
Test 1 – Appearance: Clear & Bright		☐ Pass ☐ Fail	
Test 2 – Colour Trending		☐ Pass ☐ Fail	
Test 3 – Density @15 °C		☐ In band ☐ Out of band	
Test 5 – Filter Patch		☐ Accept ☐ Excessive	
Test 6 – Odour (observed only)		☐ Normal ☐ Unusual	
Test 7 – Microbial Screen (as applicable)		☐ Pass ☐ Fail	
Test 12 – Flash Point (Diesel)		☐ Pass ☐ Fail	
Test 13 – Water Content (Diesel)		☐ Pass ☐ Fail	

Overall Lab Assessment:

☐ Compliant ☐ Borderline ☐ Non-compliant

Action:

Pass/Fail Criteria:

Density:

- XXX-XXX g/litre petrol.
- YYY-YYY g/litre diesel.

Diesel Flashpoint:

- >XX oC Pass
- < XX oC Fail
- UUoC to VV oC warrants further assessment.



ANNEX F

Non-Compliance: Decision Framework and Actions

Non-Compliance: Decision Framework and Actions

The framework below provides non-conformance response, on an informative basis, and comprises:

- Immediate safety actions—applied in all cases, irrespective of culpability or impact score;
- Graded enforcement—based on a culpability/impact score that maps to an enforcement band with prescribed actions.

1 Immediate Safety Actions (apply regardless of score)

- Stop-sale / quarantine at the draw point(s).
- Secure retains and take referee samples (maintain chain-of-custody).
- Notify the regulator and the supplier within 24 hours.
- Define clearance conditions (e.g., pass on confirmatory tests) before product release.

2 Culpability & Impact Scoring (to gauge severity)

Score each factor, A to H, sum the points, then apply the score to the action band in Section 3.

A. Severity of specification breach (0–6)

- 0 = within measurement uncertainty / administrative defect only
- 2 = minor out-of-spec (no safety/engine risk)
- 4 = material out-of-spec (engine/reliability risk)
- 6 = safety-critical (flash point, heavy contamination, mis-grade)

B. Volume/extent affected (0–5)

- 0 = <500 L; contained, not sold
- 2 = 0.5–5 kL or limited retail release
- 3 = 5–50 kL or multi-site release
- 5 = >50 kL and/or wide distribution

C. Supplier knowledge & capability (0–4)

- 0 = small/remote outlet with limited technical capacity, acted in good faith
- 2 = established distributor with QA procedures
- 4 = major supplier (professional QA expected) or accredited operator

D. Intent / conduct (0–5)

- 0 = demonstrably accidental; immediate self-report & cooperation
- 2 = negligence (missed SOP steps, weak housekeeping)
- 4 = reckless disregard (ignored flags/alerts)
- 5 = deliberate mis-blending/misrepresentation/tampering

E. Recurrence history (0–4)

- 0 = first event; no prior warnings
- 2 = prior warning in last 24 months
- 6 = repeated pattern / prior sanction

F. Consequence to users/environment (0–4)

- 0 = no field impact; contained before sale
- 2 = complaints/operability issues
- 4 = engine damage, safety incident, spill, or environmental harm

G. Response quality (0–3)

- 0 = immediate corrective actions, full transparency, preserves evidence
- 3 = slow/partial cooperation
- 6 = obstruction; poor records; lost retains

H. Documentation integrity (0–3)

- 0 = complete CoQ/records; traceable
- 2 = missing/incomplete records
- 6 = falsified or altered records

Total score = A + B + C + D + E + F + G + H.

3 Enforcement Bands and Actions

Use the total score to select the baseline action set; escalate or de-escalate with justification.

Band 1 (0–6): Education-first, advisory

- Verbal/written advisory notice.
- Corrective Action Plan (CAP) with short deadlines.
- Targeted training (housekeeping, sampling, documentation).
- Enhanced monitoring (e.g., extra Group 1 screens for 3 months).

Non-Compliance: Decision Framework and Actions *(continued)*

Band 2 (7–12): Formal non-compliance

- Formal Notice of Non-Compliance.
- Quarantine at affected sites until clearance criteria met.
- Mandatory CAP + follow-up audit; cost recovery for testing/oversight.
- Written warning placed on record; increased sampling for 6–12 months.

Band 3 (13–18): Significant breach

- Stop-sale/quarantine + targeted recall where applicable.
- Civil penalties/fines (tiered to volume, severity, and culpability).
- Compliance audit (multi-site), public notice where permitted.
- Probationary status with frequent unannounced inspections for 12 months.

Band 4 (≥19): Major / willful breach

- Maximum civil penalties; multi-site quarantine/recall.
- License/permit suspension or revocation (where applicable).
- Referral for prosecution and restitution for demonstrable consumer harm.
- Public naming and comprehensive compliance plan before re-entry.

Note on proportionality: For major fuel suppliers (high capability, dedicated QA teams), assign higher weight to factors C and D; for small remote outlets, emphasise education and CAP unless safety-critical or repeated.

4 Acceptance / Rejection Criteria

- Passing confirmatory tests (same parameters that failed, plus linked diagnostics).
- Evidence of root-cause fix (e.g., repaired seals, water draw, filtration completed).
- Regulator sign-off recorded.

5 Governance & Due Process

- Referral: All Band 2+ cases sent to the Energy/Fuels Regulator for adjudication.
- Decision basis: scoring sheet, test reports, supplier profile, past history, CAP adequacy, and consumer impact.
- Timelines: notification (<24h), CAP submission (5–10 working days), verification window, and appeal period.
- Appeals: allow written appeal with evidence (including referee results) within a defined timeframe.









