Tti Testing Laboratories

DIVISION 16 · PETROLEUM

Pale to dark.
Colour is judged
against glass
standards, ASTM D1500.

Read the oil.

We help petroleum businesses verify fuel quality, operational safety and regulatory compliance. From refinery to consumption.

- OGRA approved third-party quality laboratory
- ISO/IEC 17025 accredited · PNAC LAB 022
- ISO/IEC 17020 accredited inspection body

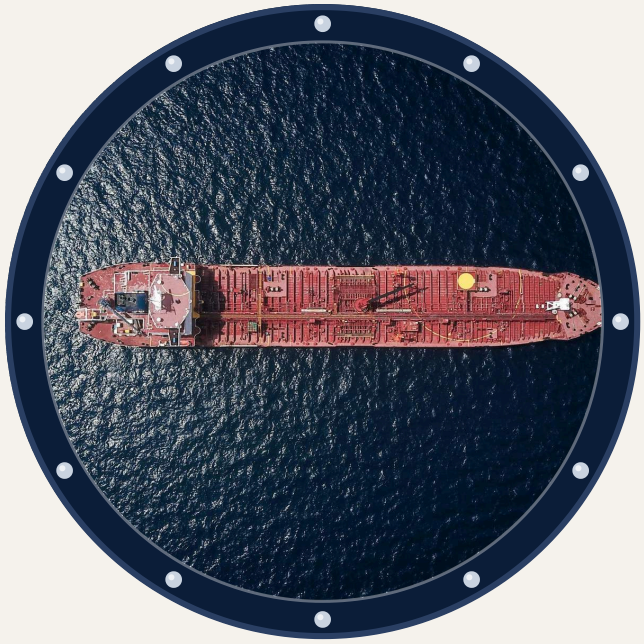
111 786 001

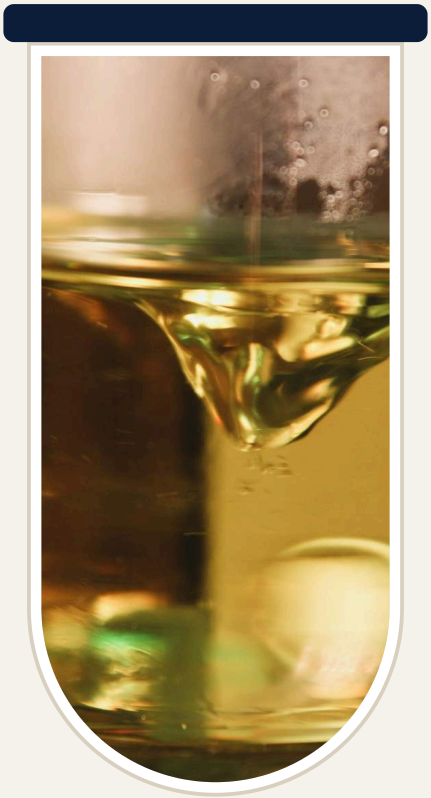
www.ttilabs.net

Two questions on every cargo.

Comprehensive testing and quality control across energy and non-energy petroleum products.

A petroleum cargo answers two questions before money moves: how much product changed hands, and what that product is. Tti answers the second, sample by sample, to the named method.





QUANTITY · HOW MUCH?

Settled by measurement.

Shore tank gauging, vessel ullage or innage, temperature, and correction to a standard reference condition.

QUALITY · WHAT IS IT?

Settled by analysis.

Laboratory analysis of a sample that represents the parcel, against the specification the contract names.

FIVE TESTING GROUPS

Trusted by producers, manufacturers, distributors and industrial users

01 **Fuels & distillates**

02 **Lubricants & greases**

03 **Transformer oil**

04 **Base oils & heavy fuels**

05 **Oil condition monitoring**

OGRA APPROVED · ISO/IEC 17025 · ISO/IEC 17020

Pakistan's largest testing scope in Oil & Gas.

OGRA

Approved third-party quality laboratory

Named on OGRA's list of approved oil testing facilities, with the largest registered scope for energy and non-energy petroleum testing.

17025

PNAC LAB 022

Eight petroleum methods on the accredited scope. PNAC is a signatory to the ILAC MRA.

17020

Accredited inspection body

Pakistan's first PSQCA-registered inspection body with an ISO/IEC 17020 accredited scope.

PETROLEUM AT TTI

1995
Tti founded in Lahore

2008–2011
OGRA approved; petroleum scope introduced

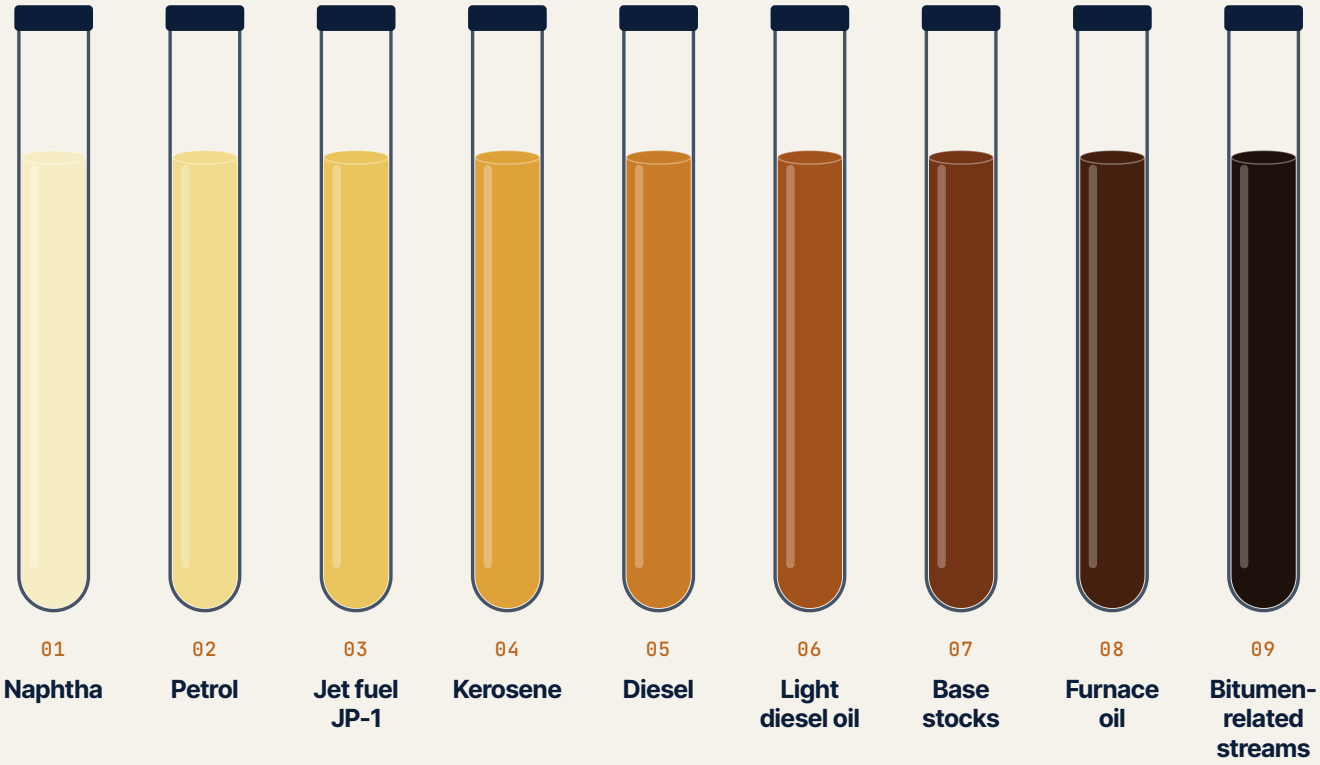
2018–2019
OGRA-compliant

2026
PNAC LAB 022 Rev. 09, valid until 08-08-2027

- Direct access to technical experts
- Uncompromising sample chain-of-custody
- Trusted by 1,500+ global brands

From light ends to heavy residues.

The products Tti tests, set out on one shelf from the lightest distillate to the heaviest stream.



Tints are illustrative, not measured colours. Order follows the products from light to heavy.

FUELS · HEAVY FUELS

Fuels & distillates, base oils & heavy fuels

Petrol, diesel, kerosene, LDO, jet fuel JP-1, naphtha, furnace oil, base stocks and bitumen-related streams. Coal is tested too.

FINISHED OILS

Lubricants & greases

Engine, gear, hydraulic, heat-transfer and compressor oils, industrial lubes and greases.

IN-SERVICE OILS

Transformer oil & condition monitoring

Power transformer and switchgear oils, and cross-product condition checks.

Fuels & distillates.

US$16.9 bn
Petroleum group imports, July 2025 to June 2026 (PBS, provisional)

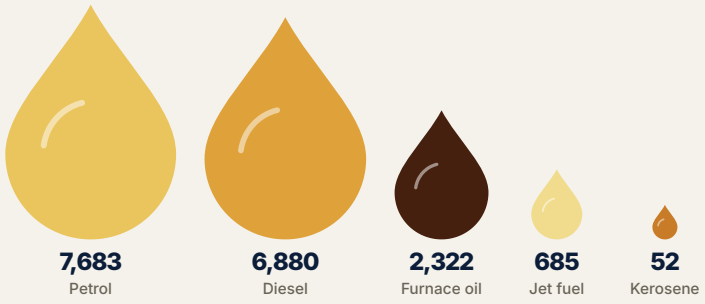
450,000 bpd
Approximate installed refining capacity (Refining Policy 2023)

We evaluate the key quality parameters of fuels and middle distillates: volatility, combustion characteristics, contamination levels and stability, against international specifications and operating requirements.

- Petrol
- Diesel
- Kerosene
- LDO
- Jet fuel JP-1
- Naphtha
- Furnace oil
- Coal

PAKISTAN'S FUEL USE, 2025-26

Consumption, thousand tonnes. Drop area is to scale.



OCAC, province-wise consumption of energy products, 2025-26. The furnace oil figure includes refinery exports.

EURO-V Petroleum Division guidelines moved petrol imports to Euro-V specifications from August 2020, with all diesel imports to conform by January 2021.

The test gives the value. The specification sets the limit.

Each parameter on a fuel certificate controls a behaviour. Parameters marked ◔ are on Tti's accredited scope.

◔	**Density and API gravity**	Mass at a measured volume Crude, petrol, diesel, furnace oil
—	**Distillation range**	Volatility and deposit formation Petrol, diesel, jet fuel
◔	**Flash point**	Fire and handling hazard Diesel, kerosene, jet fuel
—	**Vapour pressure**	Evaporation and vapour lock Petrol
—	**Octane number**	Knock resistance Petrol
—	**Cetane number**	Ignition delay Diesel
—	**Sulphur content**	Emissions and engine wear All grades
◔	**Viscosity**	Atomisation and film strength Diesel, furnace oil, lubricants
—	**Water and sediment**	Contamination in storage and transfer Diesel, residual fuel
—	**Copper strip corrosion**	Corrosive sulphur compounds Petrol, diesel, jet fuel

Parameters and properties as set out in Tti's petroleum inspection article. Other parameters: contact Tti for methods.

THE SPECIFICATIONS

ASTM D975

Diesel fuel

Grades separated by sulphur level.

ASTM D4814

Spark-ignition engine fuel

Volatility varies with season and locality.

ASTM D1655

Jet A and Jet A-1

Composition, volatility, fluidity, combustion, corrosion, thermal stability, contaminants, additives.

The contract decides which edition applies.

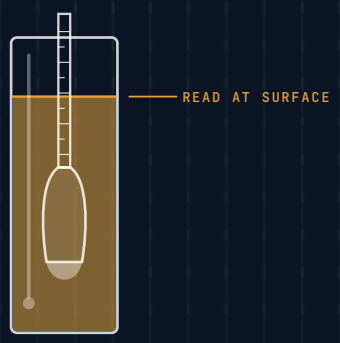
WHEN THE QUESTION IS ADULTERATION

Read density, distillation and flash point together.

Blending kerosene into diesel moves several properties at once, so one result alone can mislead. The dials are schematic.

PNAC LAB 022 · REV. 09 · PETROLEUM PRODUCTS

Eight methods, drawn.



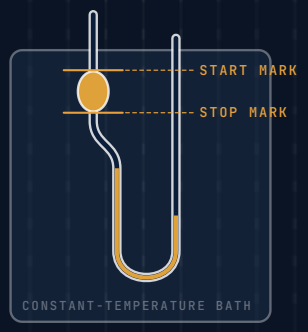
Cylinder, hydrometer, thermometer

D1298 ASTM D1298-24

Density, relative density, API gravity

A glass hydrometer is read in the sample, and the reading is corrected to 15 °C or 60 °F.

> Converts measured volumes to volumes or masses during custody transfer.



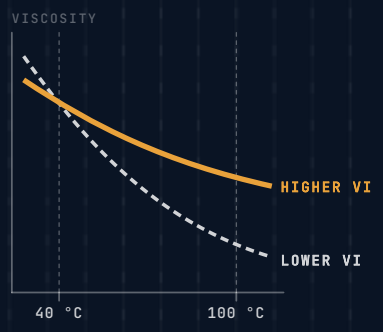
Flow time under gravity, glass capillary

D445 ASTM D445-24

Kinematic viscosity

The time for a volume of liquid to flow under gravity through a calibrated glass capillary.

> Machines depend on the right viscosity of their lubricant; fuels need it for storage and handling.



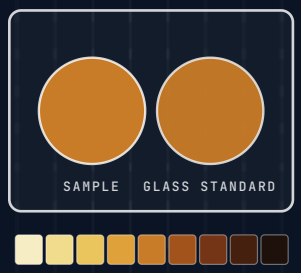
Schematic, no values

D2270 ASTM D2270-24

Viscosity index

Calculated from the kinematic viscosity at 40 °C and at 100 °C.

> A higher index means a smaller fall in viscosity as the oil gets hotter.



compare, step by step

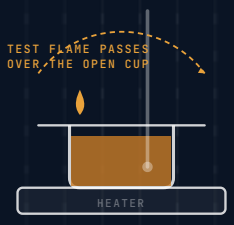
Visual match under a standard light

D1500 ASTM D1500-24

ASTM Color

The sample is matched by eye against glass reference standards.

> A colour outside a product's known range may indicate contamination with another product.



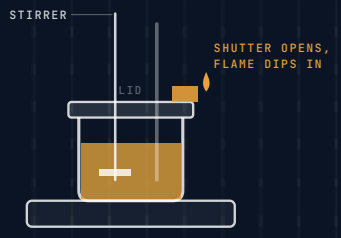
Open cup: flash, then fire point

D92 ASTM D92-24

Flash and fire points, Cleveland open cup

For products that flash above 79 °C and below 400 °C, except fuel oils.

> An abnormally low flash point in an engine oil can indicate gasoline contamination.



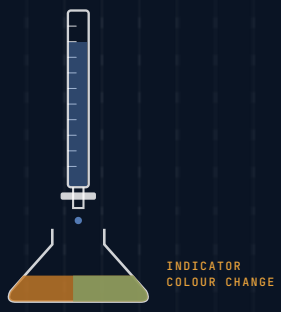
Closed cup, stirred while heated

D93 ASTM D93-25

Flash point, Pensky-Martens closed cup

From 40 °C to 370 °C: distillate fuels, lubricating oils and residual fuel oils.

> Shipping and safety regulations use flash point to define flammable and combustible materials.



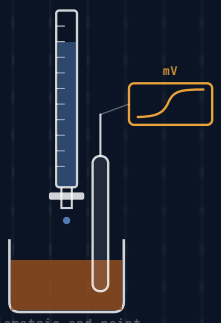
Colour-indicator titration

D974 ASTM D974-22

Total acid number

Acidic constituents titrated to a colour-indicator end point.

> Tracks additives and the degradation products formed in service, such as oxidation products.



Potentiometric end point

D2896 ASTM D2896-21

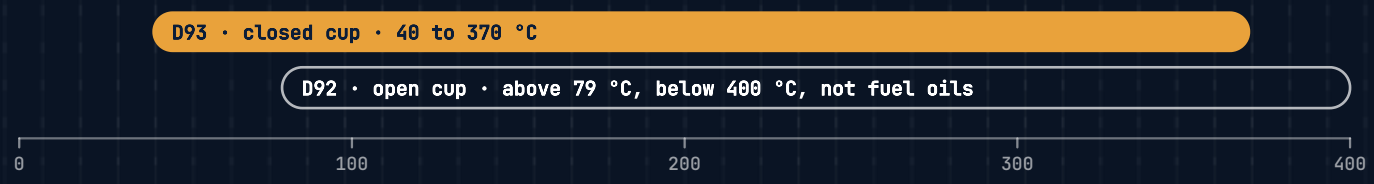
Total base number

Basic constituents titrated with perchloric acid to a potentiometric end point.

> A measure of basic additives in new and used oils; condemning limits are set empirically.

FLASH POINT, °C

Ranges stated in each method's scope



KINATIC VISCOSITY, MM²/S · LOG SCALE

Oil carries a message.

Lubricants carry valuable information about both oil health and equipment condition. Laboratory analysis turns it into maintenance intelligence.

WHAT WE MONITOR

- Viscosity behaviour
- Additive performance
- Oxidation stability
- Acidity and alkalinity balance
- Wear metal contamination

THE MACHINES BEHIND THE SAMPLE

Engines

Gearboxes

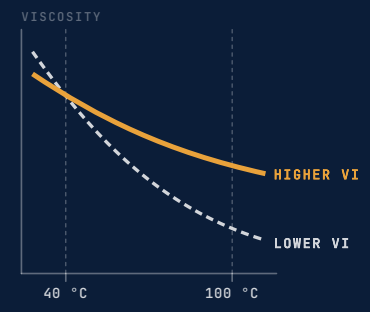
Compressors

Hydraulic systems

Engine oils | Industrial lubes | Hydraulic oils | Heat transfer oils | Gear oils | Compressor oil | Greases

Three readings from one oil.

Each reading uses a method on Tti's accredited scope. Drawings are schematic.

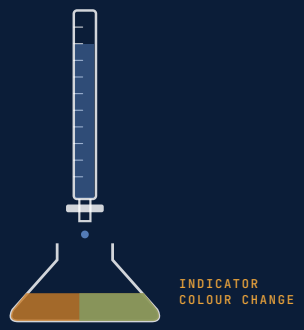


Schematic, no values

VISCOSITY · ASTM D445, D2270

How it thins as it heats.

Kinematic viscosity at 40 °C and 100 °C gives the viscosity index. A higher index means a smaller fall in viscosity as the lubricant gets hotter.

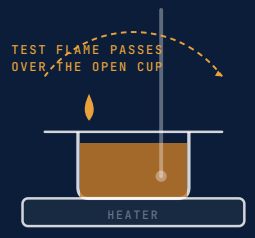


Colour-indicator titration

ACID AND BASE NUMBERS · ASTM D974, D2896

What the additives are doing.

New and used oils carry acidic and basic constituents, as additives or as degradation products formed in service, such as oxidation products. Condemning limits are set empirically.

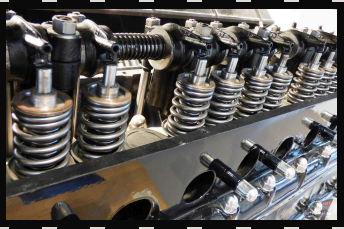
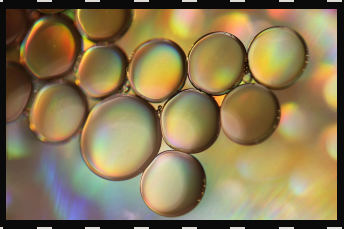


Open cup: flash, then fire point

FLASH POINT · ASTM D92

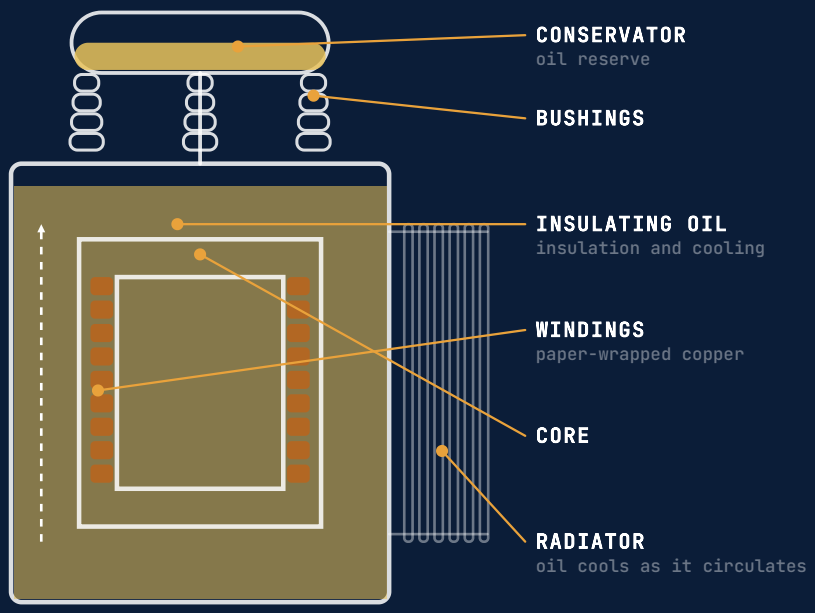
Whether fuel got in.

An abnormally low flash point in an engine oil can indicate gasoline contamination.

SUPPORTING UNINTERRUPTED POWER

Inside the tank, the oil does two jobs.



SCHEMATIC, NOT TO SCALE

Transformer oils insulate and cool electrical equipment and keep it stable in operation.

WHAT WE EVALUATE

- Dielectric strength
- Moisture content
- Dissolved gases
- Acidity
- Oxidation by-products

THE OIL REVEALS

Insulation degradation **Overheating** **Internal faults**

Power transformers | Switchgear oils

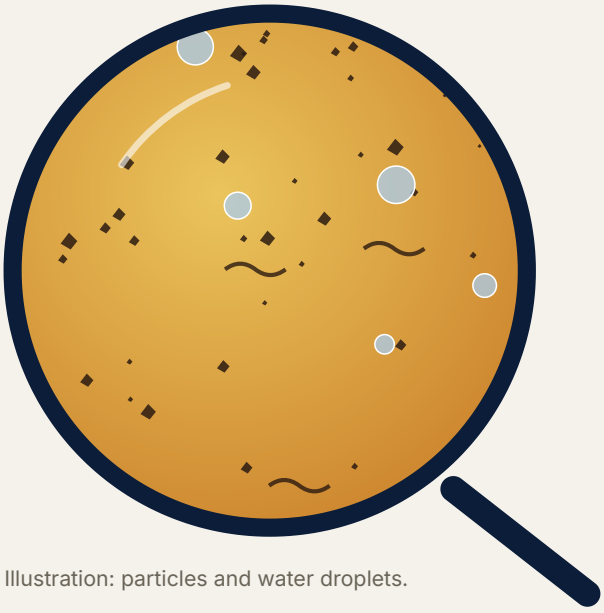


Illustration: particles and water droplets.

OIL CONDITION MONITORING

What is in the oil that should not be.

Particle contamination, water ingress and suspended solids compromise lubrication systems and hydraulic circuits.

01
Contamination trends

02
Abnormal wear indicators

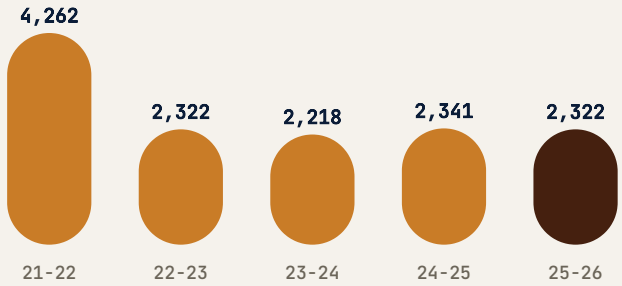
03
Corrective action before costly failures

BASE OILS & HEAVY FUELS

Heavy petroleum, verified.

Base stocks, furnace oil and bitumen-related streams: density, ash content, carbon residue, water contamination and product composition.

FURNACE OIL IN PAKISTAN, THOUSAND TONNES



OCAC, province-wise consumption; 2025-26 includes refinery exports.

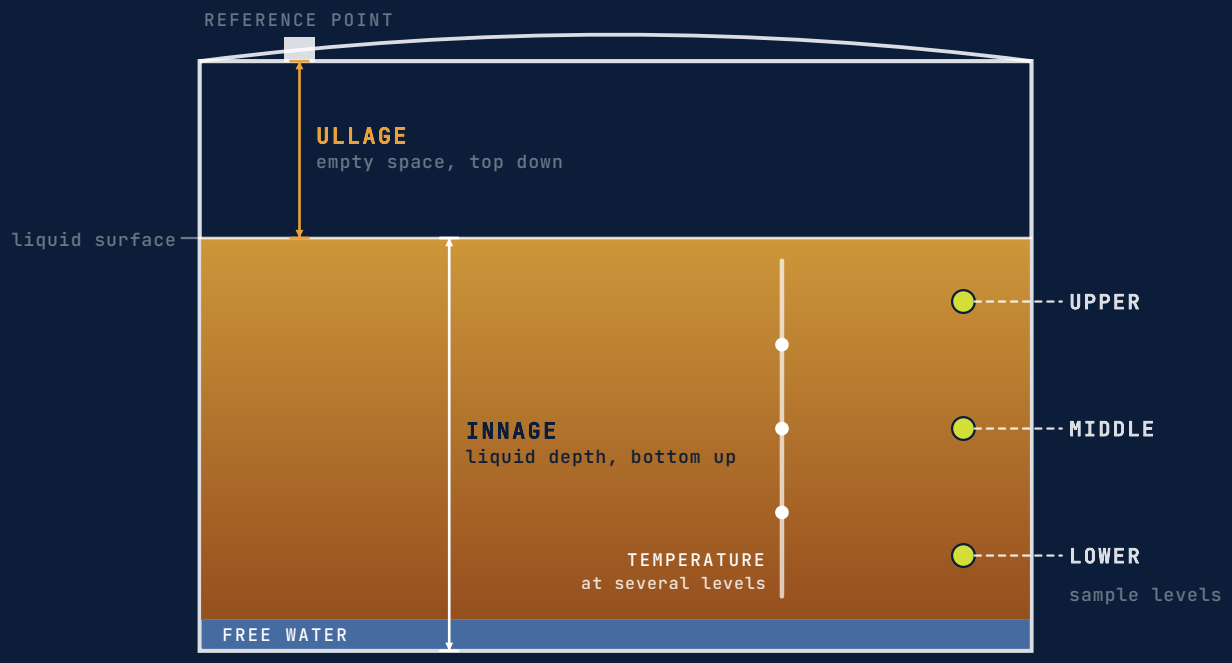
GC SUITE GC-MS, HS-GC-MS, GC-EI/CI and GC-FID, with petroleum testing among their applications.

The sample decides.

A laboratory result is only as good as the sample it describes. Sampling is where most petroleum disputes are decided.

Vessel compartments are read two ways. Innage is the depth of liquid from the tank bottom to the surface; ullage is the empty space from the top down. Both describe the same liquid.

For quality, a tank is sampled at upper, middle and lower levels. A composite combines them in proportion to the volume each represents.



Schematic shore tank. Readings are averaged across levels and corrected to a standard reference condition: 15 °C or 60 °F.

Six stages, two certificates.

Opening gauging
Before transfer: starting volumes, on-board quantity

Ullage or innage
Before and after: volume on board, remaining on board

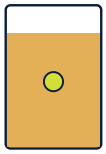
Temperature & density
During and after: inputs for correction

Cargo sampling
During transfer: the whole parcel

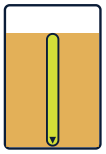
Laboratory analysis
Alongside or after discharge: meets the specification?

Quantity & quality certificates
After gauging and analysis

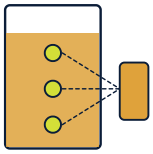
THREE KINDS OF SAMPLE · ASTM D4057 MANUAL, D4177 AUTOMATIC



Spot
One point in a tank, compartment or pipeline.



Running
Only the column it was taken from.



Composite
Levels combined in proportion to volume.

WHAT THE CERTIFICATE DOES

The certificate of quantity and quality is what a buyer's bank examines under a documentary credit, and what a claim turns on.

CHAIN OF CUSTODY

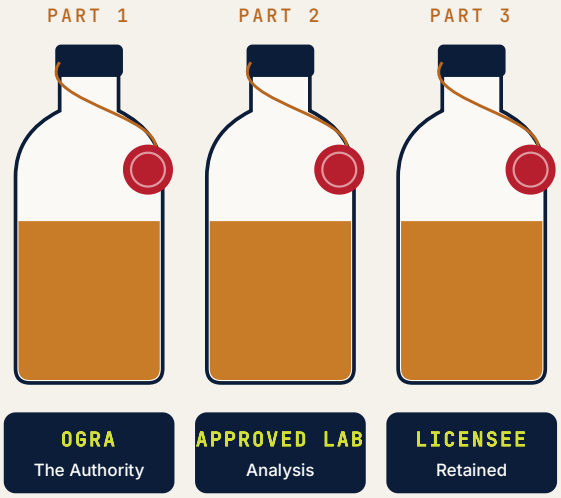
A sample must be traceable to the tank, the time, the method and the person who drew it, and stay sealed until tested. Tti keeps secure chain-of-custody controls from receipt to report.

Tti's part is the laboratory side: analysis of the sample to the named method. Source: Tti, Petroleum Inspection and Testing in Pakistan, 29 Sep 2026.

OGRA · PAKISTAN OIL RULES, 2016

One sample, three seals.

Since the 2018 amendment, a sample taken under rule 58 is sealed in three parts: one for the Authority, one for the approved laboratory, and one kept by the licensee where applicable.



Rule 42	**Imports**	Each imported consignment is subject to quality clearance from the approved laboratory.
Rule 48	**Licence**	No oil testing facility operates without a licence.
Rule 52	**Approval**	The Authority may declare a licensed facility an approved laboratory.
Rule 58(1)	**Methods**	Samples are taken, handled, stored and tested to ASTM; otherwise IP or API procedures.
Rule 58(4)	**Certificate**	The approved laboratory analyses within three days and certifies to the Authority.
Rule 58(5)	**Disputes**	A disputed result goes to another approved laboratory.
Rule 60	**On request**	Any person may apply for sampling and testing, at their own cost.

FUEL SPECIFICATION

Euro-V fuels

The 2023 refining policy lets refineries sell products to the minimum Euro 5 specification notified by the Petroleum Division.

READING A PETROLEUM REPORT

01 The accreditation scope covers the parameter tested.

02 The sample ID matches the tank and the transfer.

03 The method and its edition match the specification.

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Trusted by producers, manufacturers, distributors and industrial users. From refinery to consumption.

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