

## ICP FOR CRUDE OILS AND RESIDUAL FUELS



# ICP for Crude Oils and Residual Fuels TT-5708

ICP for Crude Oils and Residual Fuels TT-5708 adheres to the ASTM D5708 Standard Test Methods for Determination of Nickel, Vanadium, and Iron in Crude Oils and Residual Fuels by Inductively Coupled Plasma (ICP) Atomic Emission Spectrometry.

It facilitates the determination of nickel, vanadium, and iron in crude oils and residual fuels through inductively coupled plasma (ICP) atomic emission spectrometry. The test methods involve sample dissolution in an organic solvent or decomposition with acid. Comparative analysis of measurement results from both methods is conducted, along with investigation into spectral interference between each element, accuracy, and precision. The results meet satisfactory standards.

## APPLICATIONS

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The primary application of the ICP for Crude Oils and Residual Fuels TT-5708 is to determine the concentration of specific metallic contaminants—primarily **Nickel (Ni)**, **Vanadium (V)**, and **Iron (Fe)**—in crude oils and residual fuels, in compliance with the **ASTM D5708** standard. This analysis is critical because these metals, even at trace levels, can cause significant operational problems, including poisoning expensive catalysts, causing corrosion, and forming harmful deposits.

### Key Industries

- **Petroleum Refining:** This is the most critical industry for this test. Refineries must measure nickel and vanadium in their crude oil feedstock because these metals severely poison and deactivate the catalysts used in key refining units like the Fluid Catalytic Cracker (FCC), leading to reduced efficiency and costly catalyst replacement.
- **Marine and Bunkering:** The shipping industry uses residual fuels (bunker fuels) in large marine engines. High levels of vanadium in the fuel can lead to catastrophic high-temperature corrosion on engine components such as exhaust valves and turbochargers, making this test essential for fuel quality assurance.

- **Power Generation:** Power plants that burn residual fuel oil in their boilers or turbines rely on this test to monitor fuel quality. Vanadium, in particular, can form corrosive ash deposits on turbine blades and boiler tubes, causing severe damage, reducing efficiency, and leading to expensive downtime.

## FEATURES

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- More than 70 different elements can be tested.
- Enables simultaneous testing of multiple elements, allowing all elements to be tested at once with a single sample injection.
- Offers rapid analysis speed, averaging about 5 elements per minute, with the fastest test speed reaching up to 10 elements per minute.
- Features low detection limits, with most elements detectable at parts per billion (ppb) levels.
- Provides a wide linear range, spanning up to 5-6 orders of magnitude, allowing for testing of both high and low content simultaneously without the need to change the standard curve.
- Exhibits minimal chemical interference, resulting in more accurate test results.

## Performance characteristics

### Safe and Reliable Solid-State RF Power Supply

The instrument utilizes a solid-state RF power supply known for its safety and reliability. The radio frequency power supply features a compact size, high output efficiency, stable output power, and various safety protection functions including water circuit, air circuit, and overload protection. These features significantly enhance the instrument's safety and reduce the failure rate.

### High Degree of Automation

The instrument achieves an exceptional level of automation, with all operations, aside from the power switch, executed through software. Intelligent software provides real-time feedback and prompts for various operations, ensuring efficient and error-free usage.

### Automatic Ignition

The software enables fully automatic one-key ignition, with all parameter setting changes automatically managed. Advanced automatic matching technology ensures a high ignition success rate and simplifies the operation process.

### High-Precision Airflow Control System

The instrument's plasma gas, auxiliary gas, and carrier gas operations are controlled by a high-precision mass flow controller (MFC). The flow rate is continuously adjustable, and the output airflow is highly accurate, guaranteeing the precision of test data.

## TECHNICAL SPECIFICATIONS

|                          |               |
|--------------------------|---------------|
| High Frequency Generator |               |
| Working Frequency        | 27.12MHz      |
| Stability                | ± 0.05%       |
| Output power             | 800W ~ 1600W  |
| Output power Stability   | ≤0.2%         |
| Scanning spectrometer    |               |
| Light path               | Czerny turner |
| Focal length             | 1000mm        |

|                            |                                                                                                               |
|----------------------------|---------------------------------------------------------------------------------------------------------------|
| Raster specification       | Ion-etched holographic grating, engraved line density<br>3600L / mm or 2400L / mm; scribed area (80 × 110) mm |
| Line dispersion reciprocal | 0.26nm/m                                                                                                      |
| Resolution                 | ≤0.008nm(3600 wire grating)                                                                                   |
| Main Unit Parameters       |                                                                                                               |
| Scanning wavelength range  | 195nm□ 500nm□ 3600L/mm wire grating□                                                                          |
| Repeatability              | RSD≤1.5□                                                                                                      |
| Stability                  | RSD≤2.0□                                                                                                      |

## Sample measurable element evaluation

Now for the detection of Crude Oils and Residual Fuels, the application R&D center has evaluated the details as shown in Table 2:

| Sample                        | Tested elements            | Instrument     | Sample processing (for reference only)                                                                                                                                                                                                                                                                                                  | Standard       |
|-------------------------------|----------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Crude Oils and Residual Fuels | Nickel<br>Vanadium<br>Iron | TT-5708<br>ICP | Weigh 0.5g of sample into a microwave digestion tank, add 6ml nitric acid and 2ml hydrogen peroxide, preheat it on a 150°C electric hot plate for about 10 minutes, cool it, and load it into the microwave digestion to run the program. After completion, cool to room temperature and make the volume constant. To 50ml to be tested | ASTMD5708-2012 |



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