



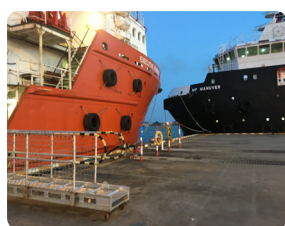
Application Note #1801

Portable EDXRF Fuel Oil Screening of Sulfur (S) to Comply with Marine Pollution (MARPOL) Regulations

Sea vessels require proof that fuel oil meets the 0.10% sulfur standard requirement of MARPOL Regulation 14. Although a time charterer is usually obliged to purchase compliant bunker fuel, the vessel owner is responsible for compliance with MARPOL Annex VI. Nonetheless, bunker suppliers, ship operators and inspectors are all stakeholders in compliance.

Maritime Authorities request the MARPOL sample during inspections. They may also decide to take samples from the engine feed or returning line, especially in Emission Control Areas, to establish that the complaint fuel is actually in use.

Bunker fuel can be tested for sulfur content following guidelines of *ISO 8754-2003: 'Petroleum products -- Determination of Sulfur Content -- Energy-Dispersive X-ray Fluorescence (EDXRF) Spectrometry'* or *ASTM D4249: 'Standard Test Method for Sulfur in Petroleum and Petroleum Products by EDXRF Spectrometry'*.



Suppliers, engineers, ship captains and inspectors need to trust the analyzer measuring fuel oil provides accurate and reproducible sulfur results no matter who takes the measurements or where they are taken.

Bruker's Portable EDXRFs are the accurate and reproducible tools of choice for quick and simple-to-use screening of sulfur in fuel oil for compliance with worldwide MARPOL regulations. They can be used at service labs, supply stations, on docks, in ports and even aboard barges and ships.

Portable Sulfur Analysis Solutions for MARPOL Regulations

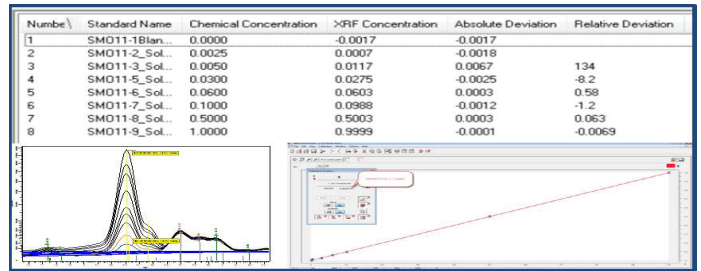
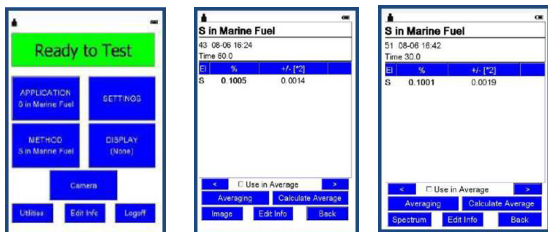
Bruker offers two portable EDXRF sulfur analyzer solutions for compliance with MARPOL regulations. Calibration and setup follow methods for the higher concentration range of sulfur, 0.1 to 5.0%, as outlined in ASTM D4294. They are non-destructive; therefore, tested samples can be retained as required.

- Ready-to-go factory calibrated for sulfur in fuel oil testing
- Measure to 1000 ppm sulfur with error $\leq \pm 90$ ppm sulfur in 30 sec
- LOD of 30ppm (3σ) with LOQ of 100ppm (10σ) using factory calibration
- Easy-to-read and understandable results
- Immediate printing of results with optional Bluetooth™ portable printer
- Capable of measuring elements from Mg to U in ambient air
- Operating range of -10°C to +40°C
- Tablet and laptop PC compatible
- Information stored on internal memory or USB memory stick
- Information can be stored on external computer via USB cable or WiFi
- Lithium Ion battery power or external 120/240V power supply
- Easy transportation in the field within secure carrying case
- Shock resistant; able to withstand 4ft drop in carrying case
- Weight < 12 kg with analyzer, accessories and carrying case

Bruker Portable EDXRF Solutions for Sulfur in Fuel Oil

Bruker's CTX™ 500S and S1 TITAN™ 500S are ready-to-go factory calibrated to comply with MARPOL regulations for sulfur in fuel oil testing. They measure up to 1000 ppm (0.1%) sulfur with an error less than ±100 ppm sulfur in 60 or 30 seconds with an LOD of 30ppm (3σ) and an LOQ of 100ppm (10σ).

Immediate and Easy-to-Read Understandable Results



0% to 1.0% Sulfur in Fuel Oil SRMs Calibration: Accuracy, Spectral Overlay, Correlation Curve (Standard error 0.0029%); Reproducibility of 10 measurements of 0.1% sulfur in fuel oil at 60 seconds (0.099 ± 0.0090 accuracy) and 30 seconds (0.1002 ± 0.0090 accuracy).

File #	Date/Time	ID	Application	Method	ElapsedTime	S	S Err
38	8/6/2015 16:15	0.1%_Std	S in Marine Fu	S in Marine	60	0.0975	0.0014
39	8/6/2015 16:17	0.1%_Std	S in Marine Fu	S in Marine	60	0.0973	0.0014
40	8/6/2015 16:18	0.1%_Std	S in Marine Fu	S in Marine	60	0.0992	0.0014
41	8/6/2015 16:20	0.1%_Std	S in Marine Fu	S in Marine	60	0.1010	0.0014
42	8/6/2015 16:22	0.1%_Std	S in Marine Fu	S in Marine	60	0.0990	0.0014
43	8/6/2015 16:24	0.1%_Std	S in Marine Fu	S in Marine	60	0.1005	0.0014
44	8/6/2015 16:26	0.1%_Std	S in Marine Fu	S in Marine	60	0.0981	0.0014
45	8/6/2015 16:27	0.1%_Std	S in Marine Fu	S in Marine	60	0.0995	0.0014
46	8/6/2015 16:29	0.1%_Std	S in Marine Fu	S in Marine	60	0.0995	0.0014
47	8/6/2015 16:30	0.1%_Std	S in Marine Fu	S in Marine	60	0.1013	0.0014
						Avg.	0.0993
						Stdeviation	0.0014

S1 TITAN™ Handheld EDXRF for Sulfur Analysis

Bruker's S1 TITAN™ is the go-to choice for a light-weight handheld EDXRF system with an open-beam configuration for measuring elements from Mg (12) to U (92).



The S1 TITAN™ 500S model is ready-to-go factory calibrated to comply with MARPOL regulations for sulfur in fuel oil testing.

The TITAN™ handheld XRF provides the additional benefit of being agile enough for in-situ measurements. It can also perform Positive Material Identification (PMI) checks of in-service engine room alloys or incoming alloy materials if configured with the ready-to-go Alloy PMI calibration. However, it does require a desktop or benchtop stand for measurements of liquid samples such as sulfur in fuel oil.

CTX™ Portable EDXRF for Sulfur Analysis

Bruker's CTX™ is the go-to choice for a light-weight portable EDXRF system in a safety interlocked and self-contained configuration for measuring elements from Mg (12) to U (92).



The CTX™ 500S model is ready-to-go factory calibrated to comply with MARPOL regulations for sulfur in fuel oil testing.

It shares the same engine as the S1 TITAN™ with a Rh X-ray tube, SDD detector and SharpBeam™ geometry for high performance, speed and sensitivity. They both have touchscreen operation, an internal camera, wireless communication; and, they both run on battery or AC power. A fitted Lowepro Pro

Runner™ RL backpack carry case for easy transport up ladders is available.

Portable EDXRF Sulfur in Fuel Oil Testing Accessories

Along with a laptop and portable printer, it is recommended to obtain sample cups, foil, protection rings, safety windows, transfer pipettes and QC samples of 1000ppm S in oil and a 0 ppm blank oil for MARPOL sulfur test checks.



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