

Determination of Sulfur in Heavy Fuel Oil, Wear Metals and Additives in Lubricating Oil

Introduction

For environmental and quality reasons, the measurement of sulfur in fuel oils is monitored and controlled by both national and international guidelines. Regulations are in place to cap the sulfur content of fuel oil as a measure to control SO_x emissions, and special fuel quality provisions exist for emission control areas such as ports and coastal areas. In addition the accuracy in determining the sulfur concentration in fuel oils is a critical parameter in determining fuel quality. An off spec fuel can wear out the engine and cause severe damage to other critical parameters.

For the monitoring and analysis of sulfur and many other elements aboard a vessel, we have developed the X-5000, an Energy Dispersive X-ray Fluorescence analyzer (EDXRF), a well-established technique in the petroleum industry.

The analytical performance, closed beam safety and ease of use of traditional bench top XRF units are all captured in the X-5000. And it delivers true field portability, being packaged into an easy to carry, 22 pound battery operated XRF with integrated PC and industrialized large touch screen.

The X-5000 sets the benchmark for performance, power and portability.

No sample preparation, just collect and analyze it right on the spot.

Key Features

- Portable and lightweight
- Fits on any lab bench, at the work site, inspection line, production area
- Sample positioning tray accommodates all sample cups/bottles
- No sample preparation required
- No daily calibrations
- Starts up immediately, results are displayed in seconds
- Closed beam operation for user safety
- Data is stored automatically in a tamper-proof format

Results for Various Heavy Fuel Oils

Sample	Lab Assay	X-5000 Measured
SRM1623C	0.381%	0.381%
SRM1619B	0.696%	0.714%
SRM1621E	0.948%	0.991%
SRM1622E	2.146%	2.139%
SRM2717A	2.996%	3.016%
SRM1620C	4.561%	4.584%
Shell 45	0.54%	0.473%
HFO 31552	0.97%	0.835%
Hi S HFO 380	3.98%	3.671%
MECO 5040	0.860%	0.817%
MECO 5040/100	0.926%	0.998%
MECO 5070	0.975%	0.964%
MECO 5070/100	1.05%	1.043%
MESYS 3006	0.508%	0.501%
MESYS 3006/100	0.551%	0.623%
MAEO 4030	0.577%	0.584%
MAEO 4030/100	0.654%	0.683%

X-5000 EDXRF Specifications

Feature	Specification
Concentration Range	ppm to % levels
Analyzer Weight	10 kg (22 lbs)
Measurement Time	180 sec
Operating Environment	-10 to 50°C
Power Requirements	AC or Battery
Tube Voltage	10 - 50 kV
Tube Current	200 µA
User Interface	Built in Touchscreen
Instrument Dimensions	38 x 33 x 28 mm (15 x 6 x 5 in)
Sample Chamber	29 x 11 x 15 cm (11 x 6 x 5 in)

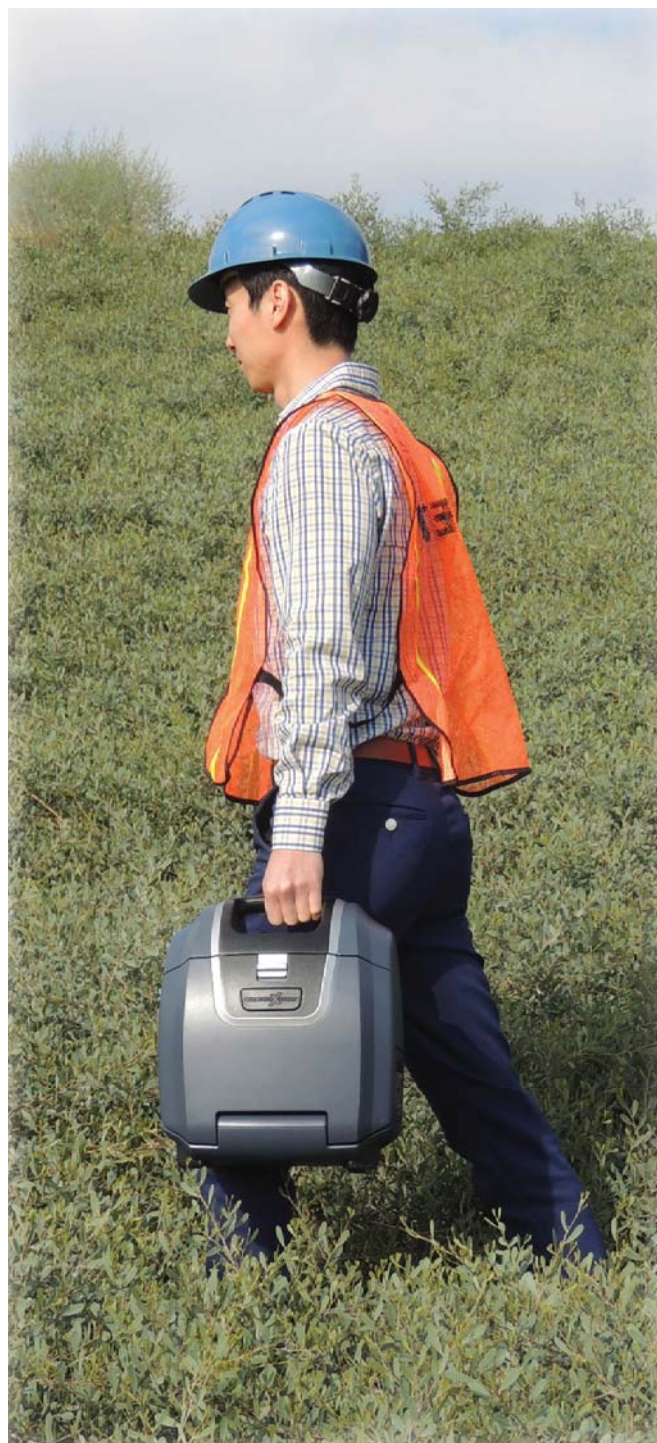
The unique sample tray ensures proper placement of the sample every time for accurate analysis. The sample tray accommodates both bottles and cups of any size. No sample preparation, no daily calibration.

The X-5000 is engineered to be used anywhere - in the field, at the production line, in an inspection area. It ensures operator safety as a fully interlocked, closed beam system. The closed beam, integrated design unique to the X-5000 is a critical safety advancement as portable XRF analyzers continue to increase in X-ray power and be applied to ever more demanding, in-the-field analytical challenges.

Element Detection Limits

Element		LOD's
Arsenic	As	1
Calcium	Ca	5
Chlorine	Cl	15
Cobalt	Co	1
Copper	Cu	1
Iron	Fe	1
Lead	Pb	1
Manganese	Mn	1
Molybdenum	Mo	1
Mercury	Hg	1
Nickel	Ni	1
Phosphorus	P	30
Selenium	Se	1
Sulfur	S	12
Vanadium	V	1
Zinc	Zn	1

- LOD's were found in a clean mineral oil matrix without interfering elements, with test times of 180's



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