

# H<sub>2</sub>S Analyser & VPP SA4000-3

## H<sub>2</sub>S in Liquid Petroleum Products & Crude Oil

ASTM D7621; IP 570; ISO 8217

- Measurement of potential H<sub>2</sub>S in the liquid phase
- No wet chemistry involved
- Small lab bench footprint
- Critical measurement for product safety and release



Crude Oil • Marine Fuel

## Hydrogen Sulfide in Marine Fuel

Hydrogen sulfide is a natural component in crude oils and a by-product of residual fuel manufacture.  $H_2S$  is extremely toxic both in the liquid and vapour phase and is very harmful to humans, animals and aquatic life. In addition to this, there are long term impacts associated with  $H_2S$ , such as; corrosion.  $H_2S$  is initially contained within the liquid, from where it can slowly be released as gas into the vapour space and can concentrate within the head spaces and venting systems of storage tanks.

Consequently a reliable test method for the detection of  $H_2S$  content at any point in the distribution system is essential.

IP 570; ASTM D7621; ISO 8217

IP 570 covers the testing of  $H_2S$  content of fuel oils including marine residual fuels, distillates and blend stocks in the liquid phase.

**Procedure A:** If fuel is subject to interferences from Methyl mercaptan, dimethyl sulphide or larger mercaptan molecules, then Procedure A will remove the interferences by using the Vapour Phase Processor. The advantage is that the Sensor is protected from aromatics and there are no disputes over interferences affecting results.

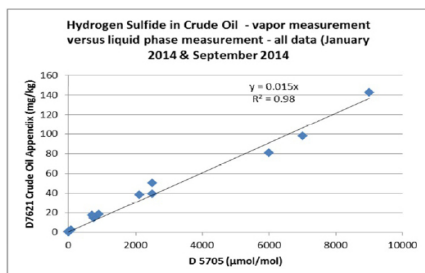
**Procedure B:** If measurements are always below 2mg/kg Procedure B could be adopted without use of the Vapour Phase Processor. However, if the Sensor is exposed to interferences it will become damaged and test results can be elevated.

## Hydrogen Sulfide in Crude Oil

Managing  $H_2S$  is a challenge at every stage of hydrocarbon production, refining and transportation. Crude oil considered to contain high levels of  $H_2S$  may be refused by the operator and devalued by the customer. A primary objective for testing and treatment of crude oil is the reduction of  $H_2S$  content in the liquid phase to typically 7ppm or less (equivalent to a cargo headspace content of typically 70ppm or less).

### ASTM D7621 Appendix X1

Stanhope-Seta, with support from the Industry, undertook a study to show that IP 570/ASTM D7621 can be modified to measure the concentration of  $H_2S$  in stabilised crude oil. As a result of this study, a Crude Oil Appendix has been added to ASTM D7621 Appendix X1.



The Seta Oil Test Kit combined with the  $H_2S$  Analyser & Vapour Phase Processor, offers a simple cost effective solution to determine the presence of  $H_2S$  in accordance with ASTM D7621 Appendix X1.

- 15 minute test duration
- Measures 0-250 mg/kg (0-250 ppm) in the liquid phase
- Repeatable results



IP 570/14a introduced a mandated verification procedure for apparatus performance, details of the IP 570 PTS can be found on the back page. The method also allowed the inclusion of samples containing FAME to be analysed.

## Who should test for hydrogen sulfide?

- Barge suppliers
- Inspection test laboratories
- Bunker fuel suppliers/providers
- Marine fuel suppliers
- Tank storage terminals
- Refineries & fuel blending locations

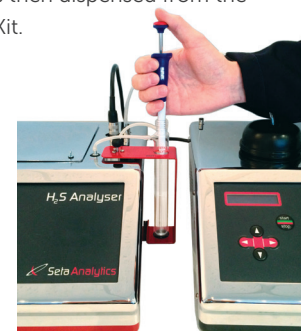


## Principles of Operation

To perform a test, the 'support bracket' for the Test Vessel is mounted outside the  $H_2S$  Analyser. The sample is then dispensed from the Pipette provided in the Crude Oil Test Kit.

Sample identity, operator name and weights of empty/charged syringe are input via the menu display and keys on the front membrane panel.

Users simply press start to begin then test results are automatically populated by the instrument and will appear on screen both as a figure to ppm (mg/kg) and graph.



## H<sub>2</sub>S Analyser & VPP (Vapour Phase Processor)

ASTM D7621; IP 570; ISO 8217

The H<sub>2</sub>S Analyser was developed with Lloyd's Register's Fuel Oil and Bunker Analysis Service' (FOBAS) along with support of other major international oil companies to offer rapid measurement of H<sub>2</sub>S in petroleum products.

The H<sub>2</sub>S Analyser is an excellent tool for supporting product Quality Control and safety ensuring product is within approved specification. It is also ideal for both product remediation treatment of feedstock components and off-spec products with fast repeat sample measurement capability.

### Key Features

- 15 minute test duration
- Measurement range from 0-250 mg/kg (0-250 ppm H<sub>2</sub>S) in the liquid phase
- Vapour Phase Processor proven to eliminate effects of chemical interferences
- Fully portable operation
- Small lab bench footprint
- Critical measurement method for product safety and release
- No wet chemistry

### Vapour Phase Processor (VPP)

Seta developed the VPP accessory for use with the H<sub>2</sub>S Analyser to improve precision and accuracy of IP 570.

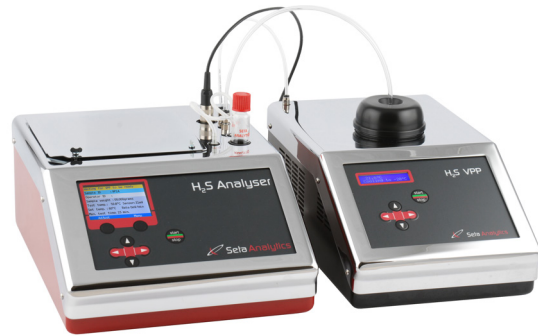
IP 570 Procedure A gives the marine industry a more robust specification tool for monitoring H<sub>2</sub>S by removing any interfering chemicals such as toluene, xylene or Mercaptans which can damage the sensor and 'interfere' with readings.



### How does the VPP work?

Gases emitted from the H<sub>2</sub>S analyser test vessel are passed through a cooled sorbent cartridge before they are measured by the electrochemical sensor. Hydrogen Sulfide passes through the sorbent cartridge whereas methyl mercaptans, dimethyl sulphide and other volatile chemicals are slowed or trapped by the cartridge.

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### Operator Sequence

To conduct a test, 20ml of diluent is decanted into the test vessel, which is inserted into the heater block. After approximately 5 minutes, the diluent has reached 60°C and 1ml of sample is added to the diluent. Sample identity, operator name, weights of empty/charged syringe are input via the menu display and keys on the front membrane panel.

### Unique Test Vessel Design

The H<sub>2</sub>S Analyser features a specifically designed test vessel which;

- Simplifies sample introduction
- Prevents incorrect orientation
- Reduces operator error

The inlet & outlet connections are enhanced making connections to the instrument quick and easy.

Upgrades to accommodate earlier systems are easy and can be achieved in the field via the Test Vessel Upgrade Kit, using part number; SA4022-0



### What samples can the H<sub>2</sub>S Analyser measure?

- Heavy Residual Marine Fuels
- Distillate Marine Fuels
- Fuel Oils
- Road Transport Diesel Fuels
- Stationary Power Fuels
- Refinery Feedstocks
- Light Distillate Products
- Crude Oils

## IP 570 Proficiency Testing Scheme

### IP 570/14a

The IP 570 Proficiency Testing Scheme (PTS) is an inter-laboratory, quality assurance programme which enables users to continually monitor the performance of their H<sub>2</sub>S Analyser in accordance with ISO/IEC 17025. This is achieved by testing a sample with a known, but undisclosed, H<sub>2</sub>S concentration.

### Aim of Proficiency Testing

Proficiency Testing is defined as an evaluation of participant performance against pre-established criteria by means of interlaboratory comparison (ISO/IEC 17043). Proficiency Testing aids laboratories in achieving accurate and reproducible results and therefore provides reassurance in the laboratory's testing.

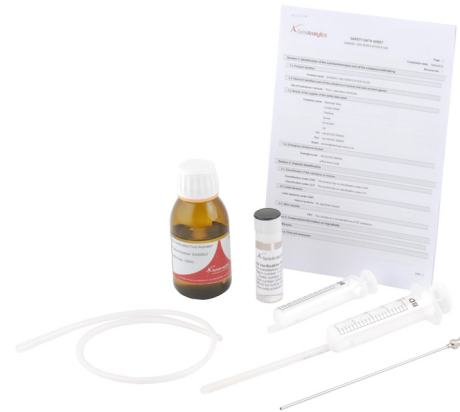
### Method Compliance

Validation of apparatus performance is stated as a mandatory requirement at least every 3 months in IP 570/14a. Participation in the Seta IP 570 Proficiency Testing Scheme is stated as the preferred means to achieve this requirement as it enables laboratories to evaluate their performance for testing H<sub>2</sub>S in the liquid phase using the Seta H<sub>2</sub>S Analyser.

### Summary Report Content

- A table detailing the data reported
- Z-score performance indicators
- An evaluation of the findings
- Advice relating to any action required
- A summary of the scheme
- Comments relating to inconsistent data

Z-scores are calculated from taking the ratio of the difference between the mean and the mean test result and the test method reproducibility standard deviation. The Z-score is an indication of performance against the published test method precision.

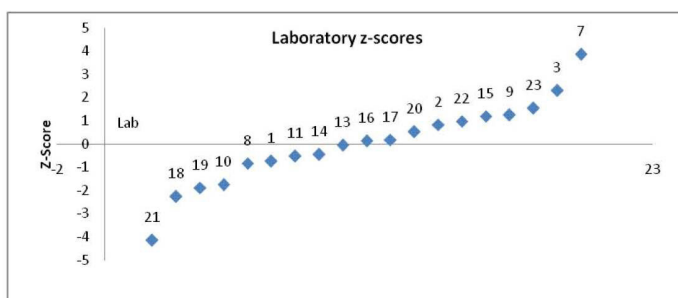


### Benefits of Participating in the PT Scheme

- Continual validation of laboratory and apparatus performance
- Ability to demonstrate compliance with laboratory accreditation requirements (ISO 17025)
- Diagnostic support provided if incorrect results are reported
- Inter-laboratory comparison of test results and performance
- Identifies problems such as inadequate test or measurement processes and procedures
- Repeat samples available for incorrect and result investigation
- Easy online result reporting
- Z-Score performance indicators
- Identifies problems with the calibration of laboratory test equipment

### Quarterly Subscription

Comprises; 4 PT Scheme kits distributed over a 1 year period. Kits are only distributed in January, April, July and October.



## Calibration & Verification Equipment

### Static Calibration & Verification Kit for Sensor (SA4001-2)

The H<sub>2</sub>S Static Calibration & Verification Kit enables users to verify and calibrate the H<sub>2</sub>S Sensor.

This kit comprises of; traceable verification gas, regulator and connection hose.



### H<sub>2</sub>S Airflow Calibration & Verification Kit (SA4011-0)

This kit comprises of; a calibrated flowmeter, stand and tubing. The flowmeter is easily connected to the instrument to verify and calibrate the air flow of the instrument.



### H<sub>2</sub>S & VPP Temperature Calibration Kit (SA4019-2)

The H<sub>2</sub>S & VPP Temperature Calibration Kit allows users to easily calibrate the temperature.

The kit consists of; a calibrated thermometer, test block and insulation.



#### Technical Specification

Measurement Range:	0-250 mg/kg H <sub>2</sub> S in the liquid phase (0-250ppm H <sub>2</sub> S)
Operating Limits:	5-40c maximum (80% RH)
Viscosity Range	Up to 3000 mm <sup>2</sup> /s
Principle of Measurement	Advanced Electrochemical sensor
Test Duration:	25 minutes with VPP
Sample Size:	1ml, 2ml, 5ml (depending on H <sub>2</sub> S concentration)
Diluent Volume:	20ml
Voltage:	12V DC, supplied with universal A/C transformer
Computer Interface:	RS232
H <sub>2</sub> S Size (HxWxD)/Weight:	210 x 300 x 410 mm / 8kg
VPP Size (HxWxD)/Weight:	400 x 240 x 200 mm / 7.8kg
Voltage / Power:	100 to 250V 50/60Hz / 50W max

#### Ordering Information

H <sub>2</sub> S Analyser	SA4000-3
H <sub>2</sub> S Vapour Phase Processor (VPP)	SA4015-0
IP 570 PT Scheme Quarterly subscription	SA4032-0
H <sub>2</sub> S Crude Oil Test Kit	SA4021-0

#### Calibration & Verification

Static Calibration & Verification Kit - Sensor	SA4001-2
H <sub>2</sub> S Airflow Calibration & Verification Kit	SA4011-0
H <sub>2</sub> S & VPP Temperature Calibration Kit	SA4019-2