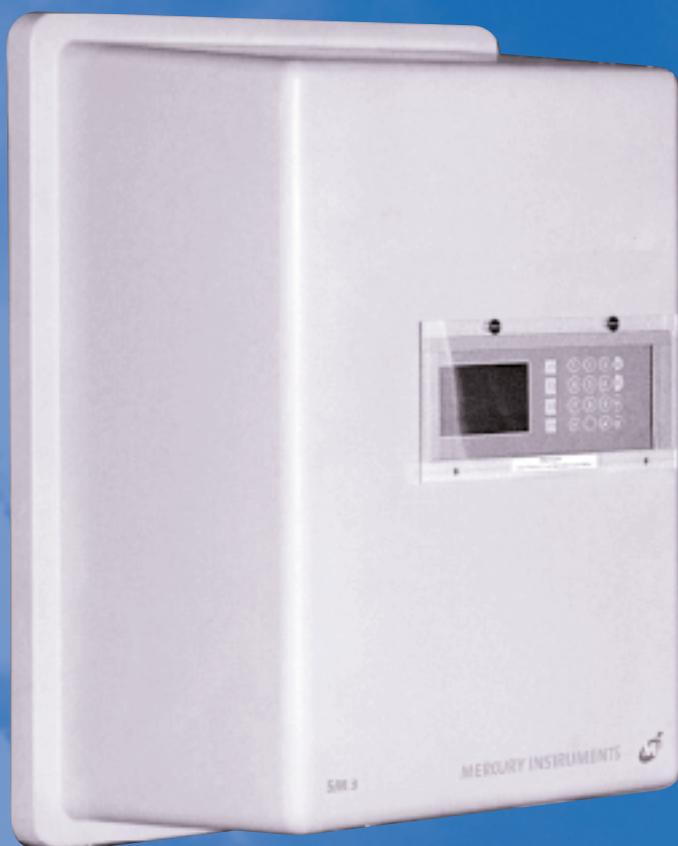


Continuous Emission Monitor (CEM)
for Mercury



SM-3 Mercury Stack Gas Monitor



MERCURY INSTRUMENTS · ANALYTICAL TECHNOLOGIES

-  Detects elemental, ionic and bound mercury
-  Thermocatalytic principle - no use of reagents
-  Maintenance-free solid state catalyst
-  True continuous measurement (no measuring cycle)
-  3 ranges selectable
-  Corrosion protected rugged construction
-  Approved by German Authorities

Mercury
in air and gases



Mercury
stack monitors



Mercury
laboratory analyzers



Mercury
process analyzers



The SM-3's fields of application:

- Municipal Waste Incinerators
- Sewage Sludge Incinerators
- Hazardous Waste Incinerators
- Cement Production
- Coal Fired Power Plants
- Thermal Soil Resanitation Plants
- Wood Combustors Using Recycled Wood
- Metal Recycling Furnaces

The SM-3 Mercury Stack Gas Monitor is used for continuous monitoring of mercury in stack gas. Bound forms of mercury like HgCl_2 , HgO , HgS and particulate mercury are detected as well as elemental mercury.

Operating principle

A sample gas stream is taken from the duct through a heated sampling system. The gas is drawn through a high-temperature particulate filter and subsequently enters the reduction unit. In this part of the analyzer a thermocatalytic reduction of ionic and bound mercury is performed. Elemental mercury vapor is formed as a result of this transformation process. The gas is then dried in a maintenance-free peltier cooler and fed to the mercury detector where the mercury concentration is measured. The high surface temperature of the gas entry filter guarantees that mercury is thermally completely desorbed from particles and thus also detected.

Design features



All surfaces coming into contact with the sample gas are heated to temperatures $>180^\circ\text{C}$ to prevent any adsorptional loss of mercury. The sample line is made of perfluoroalkoxy (PFA), a material which shows extremely weak interaction with mercury vapor. Sampling and reduction are performed at temperatures far above the dew point. Therefore no condensate is formed before all mercury is in elemental state.

All surfaces coming into contact with the sample gas are heated to temperatures $>180^\circ\text{C}$ to prevent any adsorptional loss of mercury. The sample line is made of perfluoroalkoxy (PFA), a material which shows extremely weak interaction with mercury vapor. Sampling and reduction are performed at temperatures far above the dew point. Therefore no condensate is formed before all mercury is in elemental state.



SM-3: Installation at a municipal waste incinerator

This minimises signal noise and avoids nonspecific peaks. The SM-3 does not use any gold collector for mercury preconcentration thus giving a very fast response and providing results continuously and in real-time. Possible problems connected with "poisoning" of the gold surface are also avoided. The straightforward analysis avoiding wet-chemical sample treatment ensures high reliability and low maintenance.

Easy to operate

The SM-3 is operated via a waterproof membrane keypad. All inputs required are selected in a readily understandable menu shown on the graphical display. Conditions which may lead to a malfunction are detected by sensors and indicated by a status message provided via relay contacts.

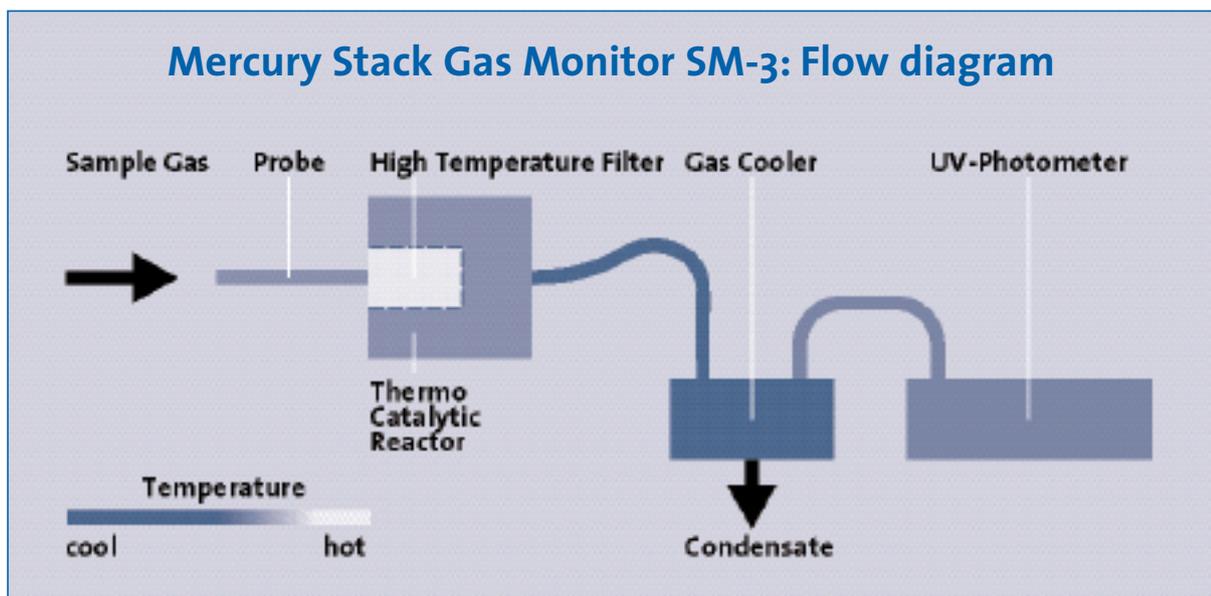
Low maintenance and low costs of ownership

Thanks to the new thermocatalytic sample treatment method no reagents are required. Compared to first generation instruments employing wet chemical sample preparation methods, the SM-3 features clearly increased reliability and requires only minimum maintenance. This results in particularly low cost of ownership and maximum availability.

UV-Photometer

Quantitative determination of the mercury concentration is performed in a UV-photometer with an electrodeless low-pressure mercury lamp. This lamp is controlled using the reference-beam-method which ensures a highly stable baseline.

Mercury Stack Gas Monitor SM-3: Flow diagram



Automatic zero adjustment

The zero line of the SM-3 is checked and adjusted automatically after a preset period of time. A magnetic valve stops the sample gas stream and switches over to zero air which has been cleaned in a sulfurized carbon filter. Automatic zero adjustment is performed every hour and requires 30 seconds.

Automatic calibration check

The SM-3 is able to perform an automatic span check at preset time intervals if a suitable calibration gas source (for example from a compressed gas cylinder) is connected to the analyzer.

Automatic self-cleaning filter

To prevent the instrument from being clogged by dust-particles, the SM-3 has a self-cleaning filter system which is operated by compressed air. The cleaning function is automatically activated every hour and is a matter of seconds.

Sampling system

The sample gas is extracted with a stainless steel probe and conducted through a heated tube to the analyzer. The entire sample line is made of perfluoralkoxy (PFA), a material guaranteeing a minimum memory effect.

The dimensions of the sampling system mounting flange are customized (for example DN 65/PN 6 or ANSI 3"/150 lbs).

The importance of continuous mercury emission monitoring

Monitoring of mercury emissions from stack has become a global issue. More strict regulations by authorities as well as the public claim for a complete surveillance of incinerators have caused an increasing interest in continuous emission monitors (CEMs) for mercury. For the potential user of such systems it is important to find a reliable and economic solution. First generation CEMs for mercury were based on the automation of known laboratory methods. This resulted in high maintenance costs, unreliable operation, oversized and heavy construction and last but not least a high price.

A new analytical solution: the SM-3

The operating principle of the SM-3 is based on a completely new technique. Cracking of mercury compounds and reduction of ionic mercury contained in stack gas is performed applying the thermocatalytic method. Wet chemical sample gas treatment using reagents and bubblers is avoided. Maintenance and servicing of the SM-3 are therefore extremely easy. Purchasing costs and costs of ownership are comparatively low. As the SM-3 is a compact-sized and low-weight device, it may also be used for mobile applications. Installation is easy and done in a short time.

SM-3 Technical Specifications

Measuring component:	total mercury Hg(tot)
Measuring principle:	thermocatalytic reduction, atomic absorption at 253.7 nm
Measuring range:	0 - 50 µg/m ³ 0 - 75 µg/m ³ 0 - 500 µg/m ³
Detection limit:	< 1 µg/m ³
Response time T₉₀:	< 60 seconds
Measurement cycle time:	none, continuous measurement without time gaps
Zero drift:	< 1 % of range, auto zero
Air supply:	oil-less compressed air, approx. 1.5 bar (approx. 22 psi)
Operating temperature:	5 - 40 °C
Power supply:	230 VAC / 50 Hz (+10% / -15%)
Electrical power consumption:	max. 1000 VA (analyzer) max. 150 VA/m (sample line)
Signal outputs:	4-20 mA (max. load 500 Ohms) digital status outputs (relais contacts)
Dimensions:	550 x 1000 x 700 mm (WxHxD)
Weight:	approx. 50 kg
Approval:	Test conducted by German TÜV (Munich), Report Nr. 24020562/August 1999), published in GMBI 1999/Nr. 33.

The Response to an Analytical Challenge: Mercury Instruments.

Quantitative trace analysis of mercury has been a challenging task for the analyst until now. We from MERCURY INSTRUMENTS have made it our job to develop instruments for mercury analysis of the highest technical level. The range of applications for our mercury analyzers is unique world-wide.



Mercury Instruments GmbH
Analytical Technologies

Liebigstraße 11b
D-85757 Karlsfeld

Tel.: +49 (0)8131 - 50 57 20
Fax: +49 (0)8131 - 50 57 22

mail@mercury-instruments.de

www.mercury-instruments.de