

UT-3000-Tedlar®:

Mercury Determination in Natural Gas Made Easy.



© Wintershall Q4-C platform, North Sea



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Figures: Offshore and onshore natural gas production plants. The special UT-3000-Tedlar setup allows to measure Hg in natural gas and gaseous hydrocarbons fast and accurate.

■ Mercury in Natural Gas

Mercury is a frequent constituent of natural gas. It can be found in concentrations from a few $\mu\text{g}/\text{m}^3$ up to $>10000 \mu\text{g}/\text{m}^3$. In gas samples from Northern Germany concentrations between $700 \mu\text{g}/\text{m}^3$ and $4400 \mu\text{g}/\text{m}^3$ have been reported. The limit for sales gas in Germany is $28 \mu\text{g}/\text{m}^3$. Besides its toxicity mercury causes damage by corrosion to gaskets, turbine vanes and other components of gas plants. For this reasons it is important to monitor the mercury concentrations in natural gas production.

■ Measuring of Hg in Natural Gas by the Tedlar® Bag Technique

The bag sampling technique offers a simple, cost-effective and yet precise method to determine the mercury concentration in natural gas (or in other gas samples). A Tedlar® sample bag (for repeated use available as an accessory) is filled with the gas sample. The valve is closed and the bag is carried to the UT-3000 ULTRATRACER which has been set up in the laboratory or another safe place.



Connecting a Tedlar® bag filled with sample to the UT-3000



Opening of the valve to release sample into the analyzer

Measuring the sample from the bag

After the UT-3000 ULTRATRACER has been switched on the user is asked to enter the sample name. A message on the display tells the operator to connect the sample bag and to open the sample bag valve. After the **F1** key has been pressed the instrument will draw the preset volume of sample from the bag. The end of sampling is indicated by a beeping sound and a message appears: "Close sample bag valve (clockwise); Remove Sample Bag".

Now analysis is started by pressing the **F1** key. After 90 seconds the result will be displayed on the screen.

The sample volume can be set between 0.1 liter and 1 liter, depending on the expected concentration. For higher concentrations the sample volume has to be smaller, for lower concentrations the sample volume should be bigger.

The built-in flow meter is adjusted automatically according to the composition of the sample gas before each measurement in order to achieve the correct sample volume independent from the sample composition.



Working with the UT-3000 Tedlar in the lab

■ Calibration of the Analyzer System

An easy to use calibration device is available as an accessory. It uses the principle of static calibration with mercury saturated air. It is maintenance free and unlike permeation devices does not require re-weighing. This calibration method is according to ISO/DIS 6978-3, ASTM D 5954 and VDI 2267 PART 8 Standard Methods.



Extracting calibration gas from the UT-3000 calibration device

The calibration gas is generated in a specially designed glass chamber surrounded by an aluminium jacket that is cooled by a thermoelectric cooler. The chamber contains elemental mercury of high purity. The temperature of the jar is exactly measured with a high-precision temperature sensor. The temperature signal is transmitted to the UT-3000 ULTRATRACER where the mercury concentration of the calibration gas is calculated. A small volume of air is extracted from the mercury chamber with a syringe and injected into the calibration port of the analyzer.



Injection of calibration gas into the calibration port of the analyzer

■ Sampling System for Natural Gas

For sampling of natural gas under high pressure (for example from a pipeline) a specially designed sampling system has to be used in order to reduce pressure and to guide the sample from the sampling point to the sample bag. The most important requirement for such a sampling system is that it has to retain the mercury concentration of the sample gas unchanged. Of course it must also be suitable for use in hazardous

zone. Mercury Instruments offers a Natural Gas Sampling System which meets these requirements 100%. The pressure regulator is electrically heated thus avoiding condensation caused by the Joule-Thompson effect. This prevents from loss of mercury. Condensate mist is effectively removed by a specially coated membrane filter. Surfaces of



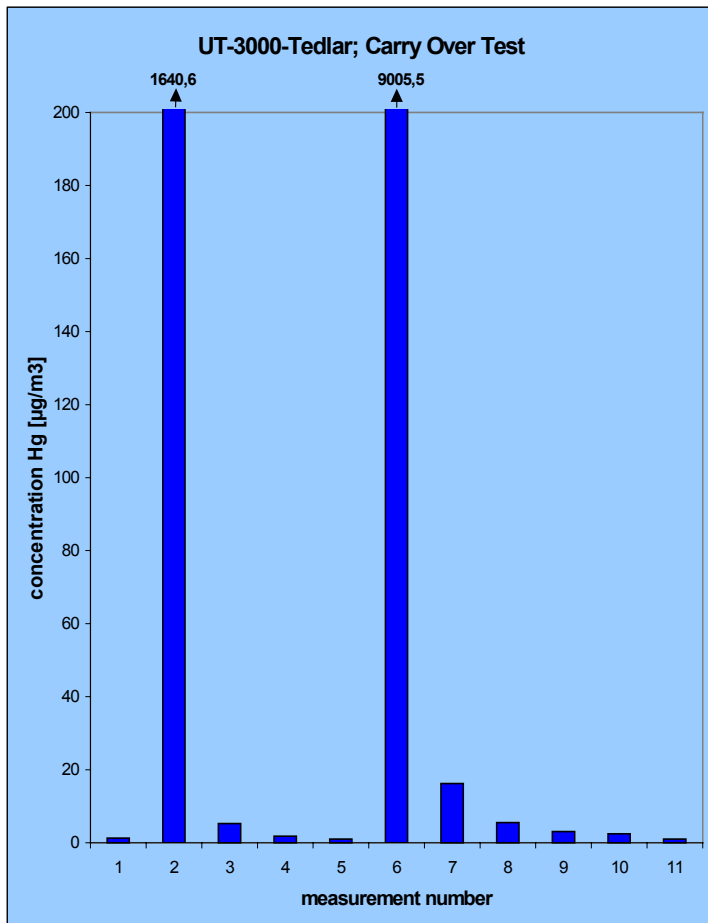
Sampling system (left) and UT-3000 (right), benchtop setup



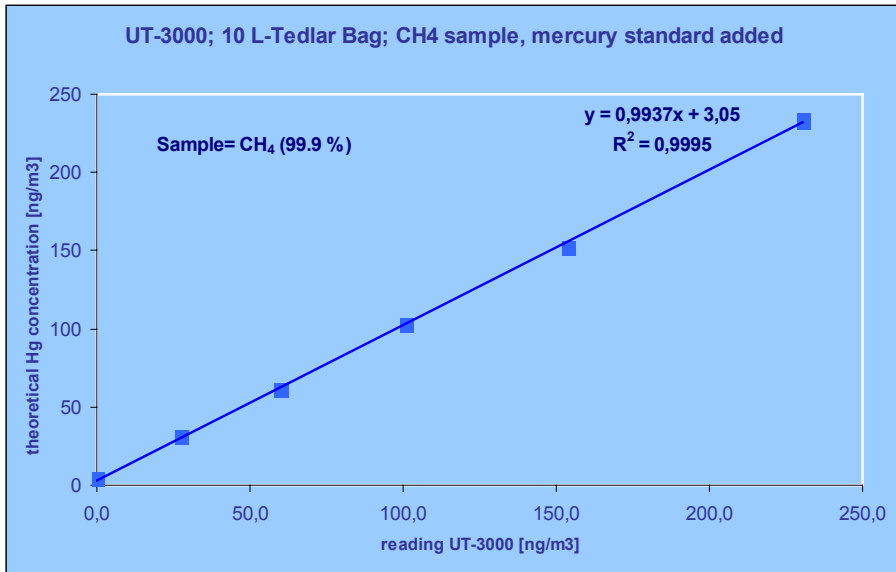
Sampling probe for natural gas

tubing and filters are specially coated for low adsorptivity towards mercury. The design of the system allows a maximum input pressure of 3480 psig (240 bar), the output pressure is adjustable from 1 psig to 28 psig (0.07 bar to 2.0 bar). Standard connectors to interface with the process is 1/4" NPT, others are available optionally.

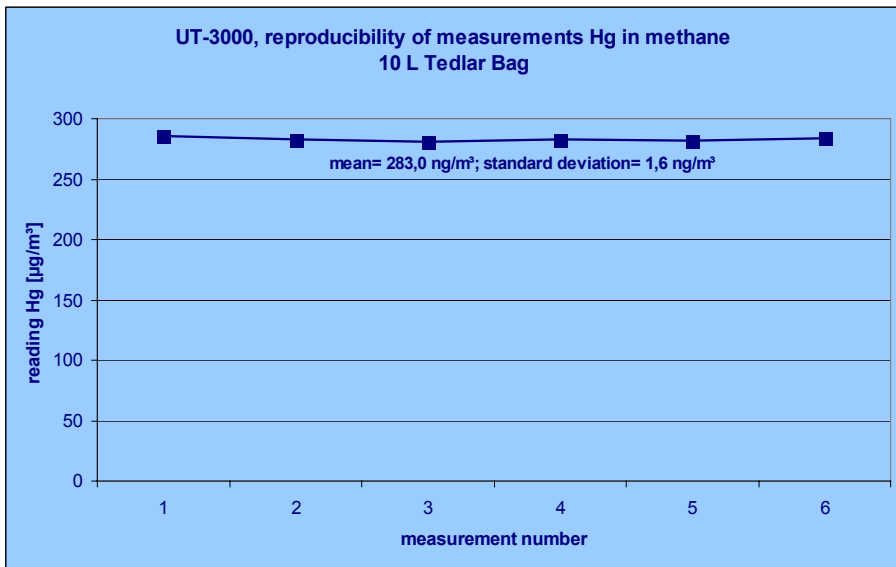
■ Performance Data



Left: measurements of two samples with extreme high mercury concentrations ($>1600 \mu\text{g}/\text{m}^3$ and $>9000 \mu\text{g}/\text{m}^3$) followed by blank determinations. This demonstrates the remarkable low carry over of the UT-3000-Tedlar system.



Recovery rate determined by measurements of methane samples with calibration standard added



Repeated measurement of a methane sample from a 10 liter Tedlar® bag showing excellent reproducibility

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