RA-915M

Zeeman mercury analyzer

Direct mercury determination in natural gas

INTRODUCTION

High concentration of mercury occurs in the natural gas. Mercury concentration in gas ranges from ng/m³ levels to hundreds of µg/m³. Besides its toxicity, mercury, being present in hydrocarbon gas, initiates corrosion of pipelines and catalyst poisoning during gas transportation and processing. These effects have serious implications for the gas-processing industry.
The use of **RA-915M mercury analyzer** with Zeeman background correction of nonselective absorption provides direct real-time mercury determination in natural gas within the whole range of mercury concentration in natural gas from ng/m³ to mg/m³ level.

MEASUREMENT METHOD

The measuring method is based on the use of atomic absorption spectrometry with Zeeman background correction embodied in **RA-915M mercury analyzer**, which provides the unique combination of the low detection limit and high selectivity of the direct continuous measurements.
As a result, the analyzer provides direct determination of mercury in a hydrocarbon gas flow due to the elimination of preliminary precipitation and collection of mercury in absorption traps.
Therefore, analyses can be carried out with the ultralow detection limit in real time.
To perform a measurement, the analyzer is placed near a gas well or other sampling point (gas pipeline, separator, etc). The gas line should be supplied with a pressure-reducing valve maintaining pressure in the line at (1.0±0.2) bar. The gas flows continuously through Teflon™ hoses into the **RP-91NG attachment** and then arrives at the analytical cell. The gas flow rate is controlled by a valve. The blank signal is regularly checked by passing the gas through a special filter with the Hg absorption efficiency of 98–99%.
Natural hydrocarbon gas can be analyzed in a laboratory. In this case, it is recommended to deliver the gas samples to the laboratory in special vessels made of materials that don't absorb mercury (e.g. Tedlar® gas sampling bags, cylinders).

MEASUREMENT RANGE

The measurement ranges of the mass concentration of mercury in natural gas are as follows:
0.002–20 µg /m³ (with a multipath cell);
0.5–2000 µg/m³ (with a single-path cell).

Allowed content of the non-measurable components (in mg/m³ for t=20°C, p=1 bar) in the natural gas depending on measured Hg concentration range.

Non-measurable component	Measured Hg concentration range, ng/m³			
	2 – 10	10 – 100	100 – 1000	>1000
Hydrogen sulfide (H_2S), mg/m³	10	100	1000	1000
Sulfur dioxide (SO_2), mg/m³	10	100	1000	1000
Benzene (C_6H_6), mg/m³	0.5	5	50	500
Nitrogen oxides (NO_x), mg/m³	100	1000	1000	1000
Mercaptans, mg/m³	10	100	1000	1000
Aromatic compounds (excluding benzene), mg/m³	10	100	1000	1000

ANALYSIS FEATURES

- Simple operation and maintenance
- No need of sample preparation
- Direct mercury determination without its preliminary accumulation on a gold trap
- Results in real time
- Low limit of detection, high selectivity
- Wide dynamic measurement range: more than five orders of magnitude
- Stable calibration
- Reliable results regardless of the gas flow rate
- Portable device: analysis in the field is possible
- Low running cost: no consumables needed

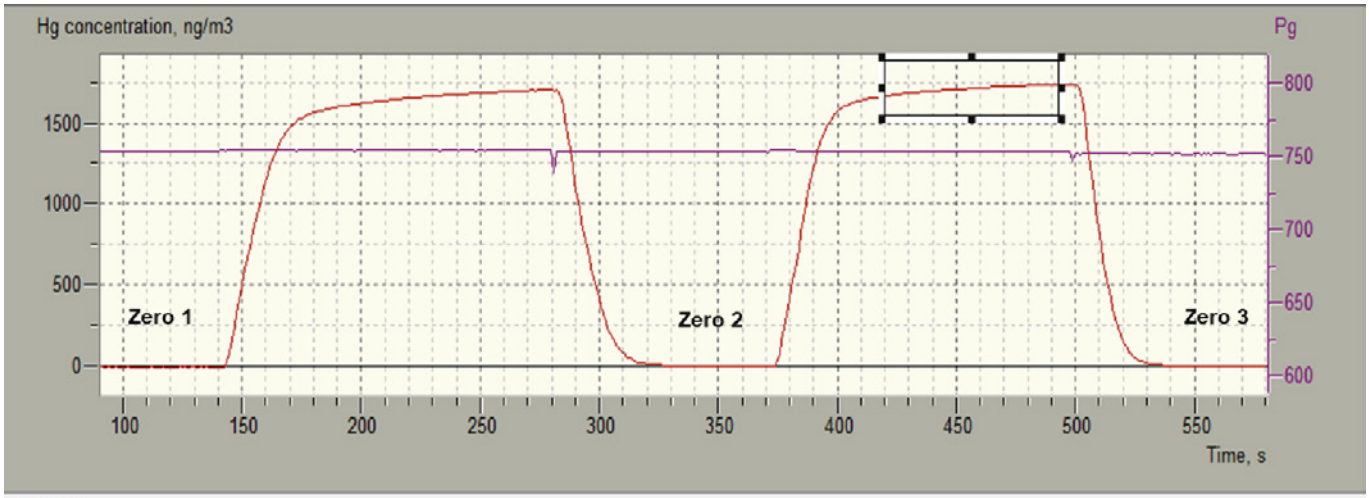
EQUIPMENT AND REAGENTS

The following equipment and materials are used for analysis:

- Mercury analyzer RA-915M with RP-91NG attachment;
- PC with Windows® and RAPID software;
- «Tedlar®» gas sampling bags/cylinders.

EXAMPLES OF ANALYSIS

Sample: purified natural gas



Statistics

N	Beginning of the range, ...	End of the range, sec	X mean, ng/m3	SD, ng/m3	Xmin, ng/m3	Xmax, ng/m3	Comment
1	230	277	1691	11	1670	1709	Replicate 1
2	452	499	1732	9.2	1714	1746	Replicate 2
3	98	132	0.02	0.65	-1.19	1.42	Zero 1
4	352	370	3.76	0.80	2.37	5.69	Zero 2
5	559	578	3.97	0.70	3.03	5.54	Zero 3

1, **3**, **5** – Zero check
Replicate 1 – Natural gas (measured value 1691 ng/m³)
Replicate 2 – Natural gas (measured value 1732 ng/m³)