

# Substances concentrations measuring methods

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## List of measured pollutants in accordance to GOST 33554-2015

- Some dangerous pollutants in the air of internal space of vehicles were included in the list of measured pollutants. The list of measured pollutants and their maximum allowable concentrations( MACs) in the air of internal space (salon) of test vehicles in atmospheric air were governed by the technical regulation of the Customs Union "On the safety of wheeled vehicles" (018/2011) and by the standard in which norms and test method for the determination of pollutants in the air of internal space (salon) of test vehicles are defined (GOST 33554-2015) .
- Maximum allowable concentration (MAC) in the air of internal space (salon) of test vehicles concentrations is equivalent to the meaning of maximum concentration of pollutants in the air of populated areas and it's formulation was introduced by the health authorities of Russia.
- MAC – is the concentration of pollutants which does not cause reflex, including sub-sensory reactions in the human body during 20 minutes of inhalation (sensation of smell changes and in light sensitivity, etc.)

## List of measured pollutants in accordance to GOST 33554-2015

- carbon monoxide CO
- nitrogen oxide and dioxide (NO, NO<sub>2</sub>)
- light aliphatic hydrocarbons from methane up to heptane (CH<sub>4</sub>-C<sub>7</sub>H<sub>16</sub>)
- formaldehyde CH<sub>2</sub>O

Quantitative measurement of pollutants in the air of internal space (salon) of test vehicles shall be performed with the use of following methods:

### **For formaldehyde, CH<sub>2</sub>O**

- High performance liquid chromatography HPLC with UV detector
- Gas chromatography with capillary or packed column, NPD or MS detector
- High sensitivity photo-electro colorimetric method

### **For nitrogen oxide and dioxide, NO, NO<sub>2</sub>**

- Chemiluminescence, CLD
- High sensitivity electrochemical detector ECH

### **For carbon oxide, CO**

- High sensitivity electrochemical detector
- Infrared opto-acoustic detector

### **For saturated aliphatic hydrocarbons CH<sub>4</sub> and C<sub>2</sub>H<sub>6</sub> - C<sub>7</sub>H<sub>16</sub>**

- Infrared optoacoustic detector ( for CH<sub>4</sub> only)
- Flame ionization detector (FID) and high sensitivity thermal conductivity detector, (TCD) gas chromatography with capillary and packed columns.

It is permitted to use other measuring methods which shall ensure pollutants measurements with required severability and selectivity with the use of MT which meet the metrological requirements shown in Tables 1, 2.

Two methods of measurement are possible:

- on-line analysis of pollutants directly in the air of the interior of the test vehicles;
- stationary method of measuring pollutants in the laboratory after preliminary sampling of air in sealed bags, pipettes, sorption tubes and cartridges.

The choice of the method of measurement depends, first of all, on the weight, the dimensions of the used measuring tools (MT), their installation at the vehicle before the test.

When the MT have the optimum dimensions and the required technical parameters, on-line measurement of the pollutants should be carried out preferably.

# Technical and metrological characteristics of MT

The measuring of pollutants in the air of passenger compartment (salon) of test vehicle is made by means of MT of approved type that passed the state verification.

The MT shall provide the lower and upper limits of pollutants measurement at the presence of associated components (Table 1).

Table 1 - The lower and upper limits of measurements for some pollutants

Pollutant name	Lower limit of measurement, mg/m <sup>3</sup> , not more than	Upper limit of measurement, mg/m <sup>3</sup>	Maximal allowed concentrations, MAC*, mg/m <sup>3</sup>
Formaldehyde CH <sub>2</sub> O	0.015	0.35	0.05
Nitrogen dioxide NO <sub>2</sub>	0.02	2.0	0.2
Nitrogen oxide NO	0.03	4.0	0.4
Carbon monoxide CO	1.0	50.0	5.0
Aliphatic hydrocarbons CH <sub>4</sub> - C <sub>7</sub> H <sub>16</sub>	1.0	500.0	50.0

Note: \* MAC - maximum allowed concentrations of the pollutants in the air in populated areas (atmospheric air)



# Maximum permissible relative error

Table 2 Maximum permissible relative error  $\Delta$  of working MT used to measure of pollutant' s mass concentrations

Measuring range, mg/m <sup>3</sup>	Allowed limit of maximum permissible relative error, $\Delta$ , %	
	WMT 2*	WMT 3*
From $1.0 \cdot 10^{-2}$ to 50.0	15-10	25-20
More than 50.0 up to $0.9 \cdot 10^3$	10-5	20-15 *

Note. \* WMT 2, WMT 3 – working MT of medium (WMI-2) and lower (WMI-3) accuracy classes pursuant to State standard No 8.578, designed for the analysis of gaseous environments of homogenous composition.



# Requirements for conducting of testing procedures in Russian Federation and countries of the Custom Union

The enterprises and test centers where tests are carried out must be accredited by the management bodies of the State Standard of Russian Federation and the countries of the Custom Union to conduct this test procedures

MT which used in the testing process shall be attested by the state metrological service and included in the State Register of Measuring Instruments

In the case the on-line analysis shall be carried out, an additional inter-laboratory calibration procedure of MT shall be fulfilled before and after the test.



**Thank you for your attention!**

