

Road vehicles – Interior – Measurement methods of diffused volatile organic compounds (VOC)

1 Scope

This standard specifies the methods for measuring volatile organic compounds (VOC) and aldehyde compounds in cabin of road vehicles.

2 Normative reference

The following referenced standards contain which, through reference in this standard, constitute provisions of this standard. The latest edition of the referenced standard (including any amendments) applies.

JIS A1962 Indoor air -- Determination of formaldehyde and other carbonyl compounds -- Active sampling method

NOTE Corresponding international standard: **ISO 16000-3** Indoor air -- Part 3: Determination of formaldehyde and carbonyl compounds -- Active sampling method (MOD)

JIS A1965 Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA(R) sorbent, thermal desorption and gas chromatography using MS/FID

NOTE Corresponding international standard: **ISO 16000-6** Indoor air -- Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography MS/FID (MOD)

JIS A1966 Indoor air -- Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography -- Pumped sampling

NOTE Corresponding international standard: **ISO 16017-1** Indoor, ambient and workplace air -- Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography -- Part 1: Pumped sampling (MOD)

3 Terms and definitions

For the purpose of this standard, the following terms and definitions apply.

3.1 Test vehicle

A vehicle of which indoor volatile organic compounds (VOC) and aldehyde compounds are measured. A test vehicle shall have been manufactured through the regular production process, and it shall be within 4 weeks (preferably 14 to 28 days) after completion of assembly and inspection or an equivalent.

3.2 Starting of test

A point of time when the test vehicle is set in the test chamber.

3.3 Indoor concentration

Measured concentration of such specific substances as VOC and aldehyde compounds that have been collected from indoor gas of the test vehicle.

3.4 Background concentration

Measured concentration of such substances as VOC and aldehyde compounds that have been collected from

gas of the test chamber.

3.5 Volatile organic compounds (VOC)

Organic compounds detected in vehicle cabin and test chamber, limited to toluene, xylene, ethyl benzene, styrene, tetradecane, di-n-butyl phthalate and di-(2-ethylhexyle) phthalate. Aldehyde compounds are excluded. These compounds are referred to as "VOC" hereinafter.

3.6 Total volatile organic compounds (TVOC)

Organic compounds detected in the range of n-hexane and n-hexadecane analyzed by gas chromatography. The concentration of TVOC, when referred to in this standard, is calculated by converting into that of toluene on the basis of the sum of peak areas. These compounds are referred to as "TVOC" hereinafter.

Note: When gas chromatograph mass spectrometer (GC/MS) is used, total ion monitoring (TIM) shall be used to measure so that the peak area of the compound is found on a basis of total ion chromatogram (TIC).

In this case, the TVOC shall be represented by the peak area of the compound (Refer to **JIS K0123**).

3.7 Aldehyde compounds

Organic compounds detected in vehicle cabin and test chamber, limited to formaldehyde, acetaldehyde. These compounds are referred to as "aldehyde compounds" hereinafter.

4. Outline of measurement method

This test is a way of measuring the concentration of VOC and aldehyde compounds diffused from a test vehicle cabin. Heat up cabin indoor air of a test vehicle set in the test chamber to a certain temperature, sample test vehicle cabin indoor gas and obtain the vehicle cabin concentration and the background concentration. This leads to figure out the concentration of VOC and aldehyde compounds diffused from the vehicle cabin.

5. Equipment and tools

Equipment and tools required to measure the concentration of VOC and aldehyde in vehicle are as follows.

- Test chamber
- Pump
- Integrating flowmeter
- Analytical equipment
- Collecting tube
- Sampling tube
- Thermocouple

5.1 Test chamber

Figure 1 shows the overview of the test chamber. The test chamber shall meet the requirements specified in **5.1.1 to 5.1.4**.

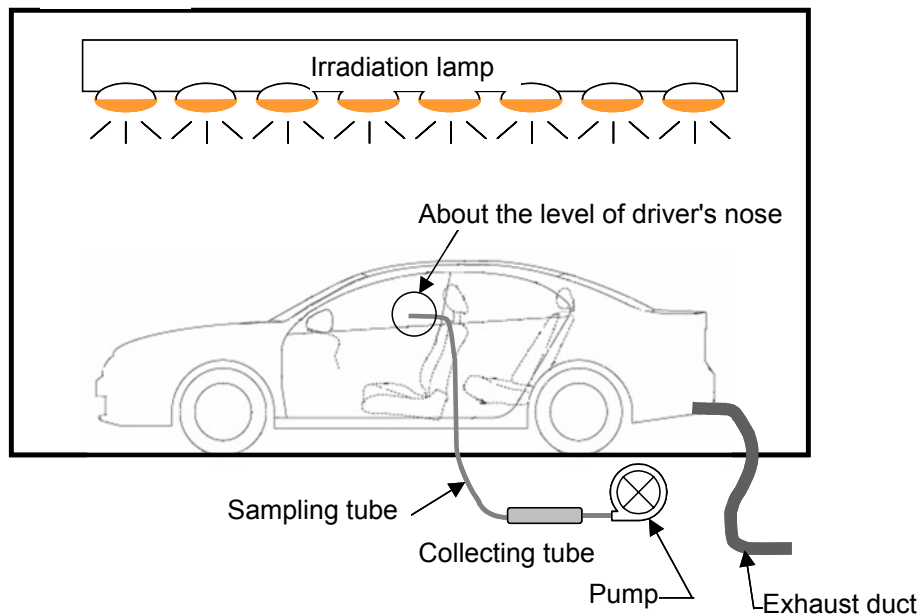


Figure1 – Overview of test chamber

5.1.1 Dimensions

Test chamber shall be large enough to set the test vehicle inside.

5.1.2 Temperature and humidity control

Temperature and relative humidity in the test chamber shall be maintained at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 10)\%$ respectively.

5.1.3 Irradiation control

Temperature at the temperature measuring point as indicated in 6.2 shall be maintained at $(40 \pm 2)^\circ\text{C}$ for passenger cars and trucks, and $(35 \pm 2)^\circ\text{C}$ for buses.

5.1.4 Exhaust duct

Exhaust duct shall be installed to allow evaluation in the driving mode with the engine running.

5.2 Pump

Pump shall be used to collect gases to collecting tubes. The pump shall be capable of sucking specified volume of air, with collecting tubes connected.

5.3 Integrating flowmeter

An integrating flowmeter shall be used for measuring the amount of collected air.

Note: Other equipment may be alternatively used as long as they have equivalent or better performances than integrating flowmeters. (Accuracy of flow amount shall be within $\pm 10\%$ for the flow amount between 100ml and 200ml and within $\pm 5\%$ for the flow amount between 201ml and 1000ml.

5.4 Analytical equipment

Gas chromatograph-flame ionization detector (GC/FID) with thermal desorption unit or gas chromatograph-mass spectrometry (GC/MS) shall be used for analyzing VOC. High performance liquid chromatograph (HPLC) shall be used for analyzing aldehyde compounds.

Note: Analytical equipment shall be in accordance with **JIS A 1962, JIS A 1965 and JIS A 1966**. Or, other equipment may be alternatively used as long as they are as equally or more accurate than the ones referred to in these standards.

5.5 Collecting tube

Tenax-TA, Tenax-GR, and the like, shall be used for collecting VOC. DNPH cartridges shall be used for collecting aldehyde compounds.

Note: Collecting tubes shall be in accordance with **JIS A1962**, **JIS A 1965** and **JIS A1966**.

5.6 Sampling tube

Sampling tubes shall be used for collecting gases to collecting tube. Sampling tubes shall have less sorbability of VOC and aldehyde compounds. (e.g. polytetrafluoroethylene tube, etc.)

5.7 Thermocouple

Thermocouple shall be used for measuring air temperature at the collecting position.

6. Test condition

The test chamber shall be adequately ventilated and shall not be affected by the background. Also, the test conditions shall be in accordance with **6.1** and **6.2**.

6.1 Test vehicle requirements

A test vehicle shall have been manufactured through the regular production process, and it shall be within 4 weeks (preferably 14 to 28 days) after completion of assembly and inspection or an equivalent.

6.2 Air collecting position and temperature measuring point

6.2.1 Passenger car

At a level of driver's nose shall be an air collecting position and a temperature measuring point. Fix the driver's seat and steering wheel at a normal driving position, for example, and draw an imaginary line by connecting the top of the steering wheel and the support of the headrest. The point approximately 50 cm away from the steering wheel on the imaginary line shall be set as a collecting and measuring point (Refer to **Figure 2**).

6.2.2 Truck/Bus

At a level of driver's nose shall be an air collecting position and a temperature measuring point. Fix the driver's seat and steering wheel at a normal driving position, for example, and draw an imaginary line by connecting the top of the steering wheel and the top of the headrest. The point approximately 60 cm from the steering wheel on the imaginary line shall be set as a collecting and measuring point (Refer to **Figure 3**).

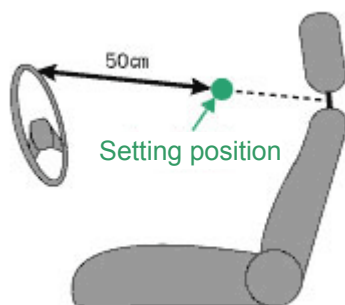


Figure 2 – Air collecting position and temperature measuring point (passenger car)

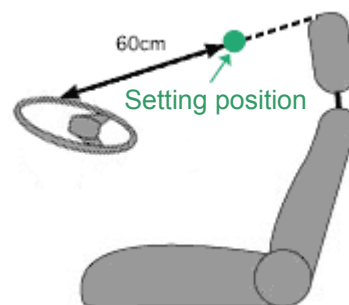


Figure 3 – Air collecting position and temperature measuring point (truck/bus)