Road vehicles - Interior parts and materials - Measurement methods of diffused volatile organic compounds (VOC)

1. Scope

This standard specifies the sampling bag test method for measuring volatile organic compounds (VOC), formaldehyde and other carbonyl compounds which diffuse from automobile interior parts into the air.

This measurement method applies to interior parts such as seat, instrument panel and ceiling material, and also adhesives and coating materials used for the parts.

2. Normative reference

The following standards, when referred to in this standard, constitute a part of the specifications of this standard. As required, the most recently updated version of the applicable standard (including addenda) shall be applied.

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

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

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

3. Definitions

Definitions of main terms used in this standard shall be as follows.

3.1 Automobile interior part

Parts and materials which are used inside of an automobile

3.2 Test onset

Time point when a sampling bag is placed in a thermostatic oven

3.3 Sampling bag

Resin bag having a capacity of 10 L used for measuring VOC, formaldehyde and other carbonyl compounds which diffuse from automobile interior parts

3.4 Test concentration

Concentration of specific VOC, formaldehyde and other carbonyl compounds collected from a sampling bag which has been heated for a specified period of time with one or more test piece in it

AVA Documents
Document Sharing Hub

Full document details: JSAE M902 2011

3.5 Blank concentration

Concentration of specific VOC, formaldehyde and other carbonyl compounds collected from a sampling bag which has been heated for a specified period of time without any test sample

3.6 Recovery rate

Ratio of the total amount of VOC, formaldehyde and other carbonyl compounds collected from a sampling bag to the known total amount of VOC, formaldehyde and other carbonyl compounds supplied to the sampling bag

3.7 Sampling bag value

Concentration increment of a subject gas component due to the diffusion of VOC, formaldehyde and other carbonyl compounds from a test sample, multiplied by the total amount of the gas filled in the sampling bag

3.8 Test sample

Piece of material cut out from automobile interior parts which are to be tested

3.9 Volatile organic compound (VOC)

Volatile organic compounds detected from a sampling bag as diffused from a test sample, excluding formaldehyde and other carbonyl compounds

Note:

VOC components to be measured in this standard are as follows. These components are referred to generically as subject volatile organic compound (or subject VOC): toluene, xylene, ethyl benzene, styrene and p-dichlorobenzene.

3.10 Total volatile organic compound (TVOC)

VOC in the range of n-hexane to n-hexadecane which are detected in a gas chromatographic analysis, as converted to toluene from the total sum of the peak areas of the gas chromatograph

Note:

When a gas chromatograph mass analyzer (GC/MS) is used, TVOC is represented by a VOC value which has been measured by means of a total ion mass detector (TIM) and calculated by a total ion chromatogram (TIC) (see **JIS K0123**).

3.11 Formaldehyde and other carbonyl compound

Formaldehyde and other carbonyl compound which diffuse from a test sample and detected from a sampling bag

Note:

The following materials are counted: formaldehyde and acetaldehyde.

4. Principle

The test method specified in this standard describes a procedure for calculating sampling bag values of VOC, formaldehyde and other carbonyl compounds which diffuse from automobile interior parts of the vehicle subject to the test.

One or multiple test piece put in a sampling bag are heated at a specified temperature, and then the gas in the sampling bag is collected to measure the test concentrations. By comparing the test concentrations with the corresponding blank concentrations, the sampling bag values of VOC, formaldehyde and other carbonyl compounds diffusing from one test sample can be calculated (see **10**).

AVA Documents
Document Sharing Hub

Full document details: JSAE M902 2011

5. Test instruments and gases

5.1 General

Test instruments and gases necessary for determining the sampling bag values of VOC, formaldehyde and other carbonyl compounds diffusing from automobile interior parts are mainly as follows.

– Sampling bag
– Nitrogen gas or air
– Thermostatic oven
– Pumps
– Integrating flowmeter
– Gas analyzer
– Sorbent tube

5.2 Sampling bag

5.2.1 General

General specification and requirements applicable to the sampling bags in this standard shall be in accordance with **5.2.2**, **5.2.3**, **5.2.4** and **7.2**.

5.2.2 Material and capacity

The sampling bag material should be fluorinated resin (e.g., vinyl fluoride (PVF), tetrafluoroethylene –hexafluoropropylene-copolymer (FEP)), unless otherwise specified. The bag capacity shall be 10 L.

5.2.3 Air tightness

Sampling bags shall be sealed securely with a sealing material such as a tape with few effects on the Emission test or heat bonded so as to be isolated from the uncontrolled ambient air.

5.2.4 Blank concentration

Blank concentrations which are observed when a sampling bag is heated shall be as low as possible so that they do not adversely affect the test results. For example, it shall be 0.05 μg or less per bag for VOC, and 0.075 μg or less per bag for formaldehyde and other carbonyl compounds.

5.3 Nitrogen gas or air

VOC, formaldehyde and other carbonyl compound concentrations contained in the nitrogen gas or air to be filled in a sampling bag shall be as low as possible so that they do not adversely affect the test results.

5.4 Thermostatic oven

Temperature shall be controlled in a chamber which is capable of maintaining a constant and homogeneous temperature.

The thermostatic oven where a sampling bag is heated shall be capable of controlling temperatures within ±1.0°C.

5.5 Pumps

Vacuum pumps or other apparatuses which can empty a sampling bag sufficiently shall be used.

5.6 Integrating flowmeter

The volume of collected gases or other gases shall be measured with an integrating flowmeter.

Note:

Other equipment having equivalent or better performance may be used.

Documents
Document Sharing Hub

Full document details: JSAE M902 2011

5.7 Gas analyzer

VOC analysis shall be performed by means of a gas chromatograph with a hydrogen flame ionization detector (GC/FID) or a gas chromatograph with a mass analyzer (GC/MS). A high-speed liquid chromatograph (HPLC) shall be used for the analysis of formaldehyde and other carbonyl compounds.

Note:

Gas analyzers are according to **JIS A1962**, **JIS A1965** and **JIS A1966**, but other equipment having equivalent or better performance may be used.

5.8 Sorbent tube

Sorbent tubes such as Tenax-TA® or Tenax-GR® shall be used for collecting and analysis of VOC. DNPH cartridges shall be used for collecting and analysis of formaldehyde and other carbonyl compounds.

Note:

Sorbent tubes are according to **JIS A1962**, **JIS A1965** and **JIS A1966**.

6. Test conditions

6.1 General

Test conditions shall be in accordance with **6.2 to 6.6**. The test room shall be sufficiently ventilated so as to minimize the back ground effect.

6.2 Test sample size

A test sample shall have a surface area of 100 cm^2 (e.g., 10 cm x 10 cm) in general, and a small opening shall not be sealed. Thickness of the test sample is not specified.

6.3 Storage period and storage conditions of test sample

Each test sample shall be wrapped appropriately and stored so as not to be contaminated by chemical substances or affected by heat, humidity or other factors. Storage period of test piece shall not be longer than 2 weeks after production.

The storage period and storage conditions of the test piece shall be reported. This requirement applies also to the case where such conditions are agreed upon between the parties concerned. Details are specified in **Annex A** with respect to preparation and storage of the test piece.

6.4 Heating temperature

Sampling bags shall be heated at 65±1°C.

Note:

The heating temperature may be specified between the parties concerned.

6.5 Heating time

Sampling bags shall be heated for 2 h±5 min.

Note:

The heating time may be specified between the parties concerned.

6.6 Gas amount to be filled in a sampling bag

Amount of nitrogen gas or air to be filled in a sampling bag shall be 5 L.

AVA Documents
Document Sharing Hub

Full document details: JSAE M902 2011

7 Verification of test conditions

7.1 Monitoring of test conditions

Heating temperatures shall be monitored and recorded. Temperature accuracy of measuring instruments shall be within ±0.5°C.

7.2 Recovery rate

Recovery rates of the subject VOC, formaldehyde and other carbonyl compounds shall be measured using corresponding standard gases. Sampling bags shall provide average recovery rates of 70% or more for the subject VOC and 60% or more for formaldehyde and other carbonyl compounds.

8. Test method

8.1 Test equipment

The test equipment arrangement is outlined in **Figure 1**.

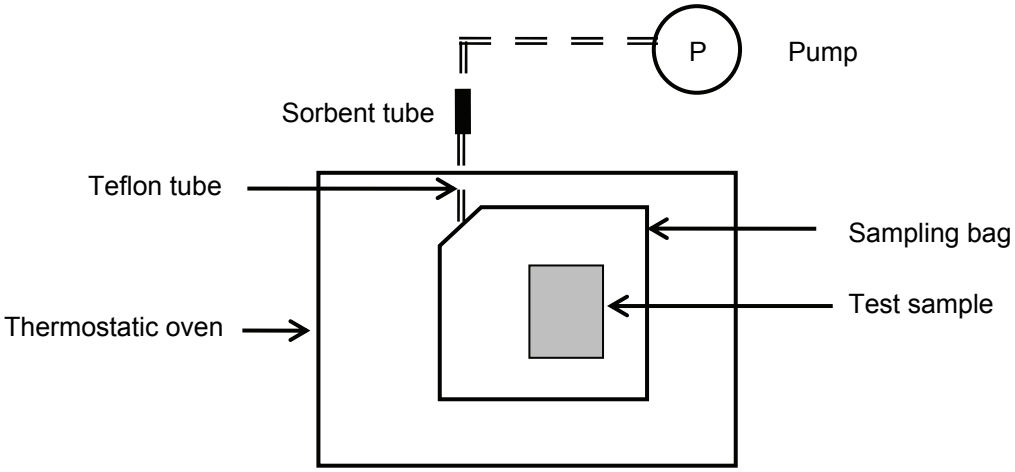

Figure 1 Outline of test equipment arrangement

8.2 Preparation for testing

8.2.1 Cleaning of sampling bags

Sampling bags shall be cleaned prior to testing as follows:

– connect a teflon tube to the sampling bag sleeve;

– fill the bag with nitrogen gas or air, then empty the bag using a pump;

– repeat the filling and emptying operation three times.

Note:

Sampling bags may be heated beforehand (for example, 80°C × 30 min or longer) in order to lower the blank concentrations.

8.2.2 Preparation of sampling bags

Cut an end of a sampling bag after cleaning, and put one or multiple test piece in it. Fold the cut end of the sampling bag and securely seal the portion using a sealing material (e.g., tape) or heat bond the portion. Fill the sampling bag with nitrogen gas or air, and then empty the bag using a pump. Fill the bag again with a certain amount (5 L) of nitrogen gas or air. The same sequence of operation shall be applied to a sampling bag without a test sample to make it a blank sampling bag.

Documents
Document Sharing Hub
Full document details: JSAE M902 2011