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**Determination of the emission of
volatile organic compounds and
aldehydes without formaldehyde by
building materials and building related
products — Large chamber method**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

Consequently **JIS A 1912:2008** is replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Determination of the emission of volatile organic compounds and aldehydes without formaldehyde by building materials and building related products — Large chamber method

Introduction

This Japanese Industrial Standard was established in 2008. The intent of this revision is to achieve unification of terms and definitions, and symbols with the related standards. The comparison table between previous and current editions of this Standard on technically significant revisions is given in Annex F.

No corresponding International Standard has been established at this point.

1 Scope

This Standard specifies a method for determination of the amount of volatile organic compounds (hereafter referred to as “VOC”) and carbonyl compounds other than formaldehyde emitted into the air from furniture, building materials and building related products by using a large chamber.

It is applicable to furniture, building boards, wall papers, floor materials, as well as adhesives and paints used for installation and combined products thereof.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

- JIS A 1901 *Determination of the emission of volatile organic compounds and aldehydes by building products — Small chamber method*
- JIS A 1911 *Determination of the emission of formaldehyde by building materials and building related products — Large chamber method*
- JIS A 1962 *Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*
- JIS A 1965 *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 or MS-FID*
- JIS A 1966 *Indoor air — Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography — Pumped sampling*
- JIS K 0123 *General rules for gas chromatography/mass spectrometry*

JIS K 0124 *General rules for high performance liquid chromatography*

JIS K 0557 *Water used for industrial water and wastewater analysis*

JIS Z 8703 *Standard atmospheric conditions for testing*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS A 1901 and JIS A 1911 and the following apply. The target pollutant is VOC and carbonyl compounds other than formaldehyde.

4 Symbols and units

For the purpose of this Standard, the symbols and units given in JIS A 1901 and JIS A 1911 and the following apply.

5 Principle

The unit specific or area specific rate of target pollutant emission from a building materials under test is determined using a large chamber, based on the chamber outlet concentration, air flow rate and the number or surface area of test specimens.

Air is circulated in a large chamber having specific temperature, relative humidity and ventilation rate conditions, and the air sampled at the chamber outlet is used to determine the chamber outlet concentration, background concentration, travel blank and ventilation rate. From these obtained values, the unit specific or area specific emission factor of the target pollutant at a specific elapsed time t is calculated (see clause 13).

6 Apparatus

6.1 General

Principal laboratory equipment used for determination of the target pollutant emission factor of building materials shall be as follows :

- large chamber;
- stirring device;
- air purifier;
- temperature and humidity control device;
- air flow meter;
- air sampling device;
- sealing material for the test specimen;
- rack for setting the test specimen;
- analytical instrument.

6.2 Large chamber, complying with relevant specifications and requirements given in

the following. See Figure 1 for the outline of the large chamber system. No air shall be allowed to circulate from the outlet back to the inlet.

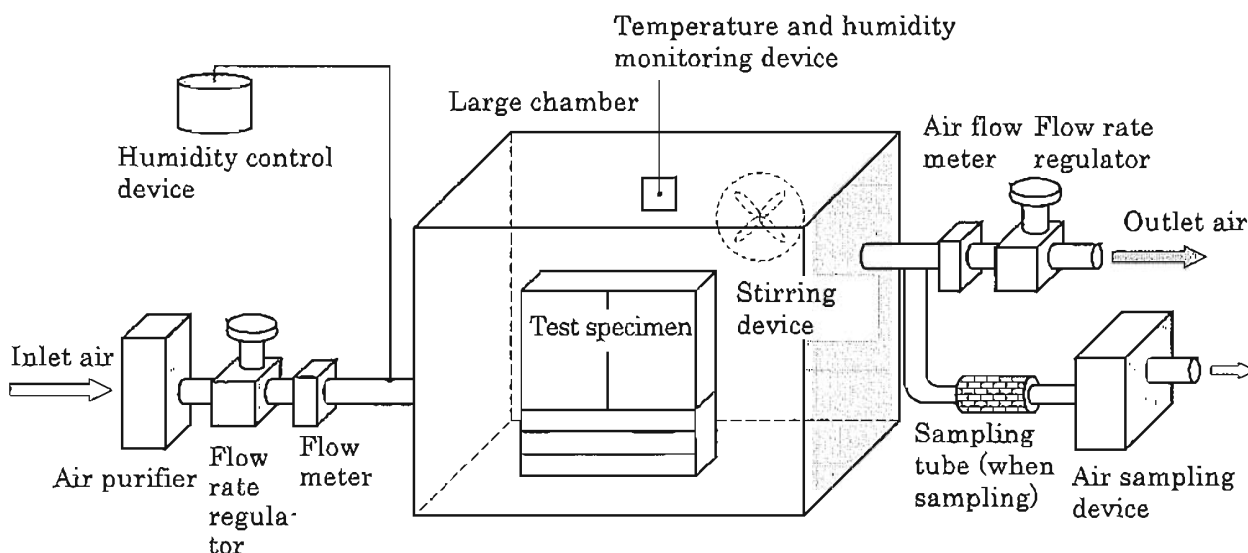


Figure 1 Outline of large chamber system

6.2.1 Shape Parts of a large chamber which may be exposed to the target pollutant shall be made from materials with very low sorptive property, such as stainless steel or glass. The chamber shall have a volume of over 1 m³ up to and including 80 m³. The chamber shall be designed to facilitate circulation of the inside air. The chamber shall be of a construction allowing easy cleaning and washing. For reference, Annexes A, B and C show examples of large chambers with a 2 m³, 14 m³ and 24 m³ volumes, respectively.

The sealing material used for a large chamber shall have low emission and low sorptive properties and a minimum influence on the background concentration.

6.2.2 Airtightness The large chamber shall be airtight so that there is as little air exchange as possible with uncontrolled outside air. The air inside the large chamber, therefore, should be controlled under a pressure a little higher than the atmospheric pressure, ensuring that it is not influenced by the test site ambient.

6.2.3 Air supply device The large chamber shall be equipped with a device capable of continuous control of ventilation rate at a constant value (such as a flow rate control device). The requirements specified in 7.4 apply.

6.2.4 Installation site The large chamber shall be installed indoors.

6.3 Stirring device The large chamber may be provided with a stirring fan for homogenizing the concentration inside the large chamber. The stirring fan shall be constructed so that cleaning and washing is easy, and have low emission and low sorptive properties and a minimum influence on the background concentration.

6.4 Air purifier The purifier shall ensure that the supply air is as clean as possible.

In order to prevent a rise in background concentration, an air purifier shall be provided.

6.5 Temperature and humidity control device The air inside the large chamber shall be maintained at the required temperature.

Temperature and relative air humidity shall be continuously monitored independently of the systems for controlling the temperature and air humidity.

Precautions shall be taken to avoid condensation or spray of water in the large chamber.

6.6 Air flow meter Installed at the outlet or the inlet of the chamber to measure correctly the ventilation rate through the chamber.

6.7 Air sampling device Use the outlet air of the large chamber for sampling. If a duct or tube is used, it shall be as short as possible and maintained at the same air temperature as that in the large chamber.

Such a duct or tube shall be made of a material with a very low sorptive property, e.g. polytetrafluoroethylene.

Ensure that exhaust from the large chamber is isolated from the laboratory environment.

A multiport sampling manifold may be used to provide flexibility for duplicate air sampling.

6.8 Sealing material for the test specimen The sealing material is used for sealing surfaces other than the expected emission surfaces. The sealing material shall have low emission and low sorptive properties, and a minimum influence on the background concentration.

6.9 Rack for setting the test specimen The test specimen, which is basically set at the centre of the large chamber, may be mounted on a rack as required. The rack used shall be constructed so that cleaning and washing is easy, and have low emission and low sorptive properties and a minimum influence on the background concentration.

6.10 Analytical instrument For the analysis of VOC emission, a gas chromatograph with a flame ionization detector (GC/FID) or a gas chromatograph with a mass spectrometer (GC/MS) shall be used. For the analysis of emission of carbonyl compounds other than formaldehyde, a high performance liquid chromatograph (HPLC) shall be used.

The analytical instrument used for the analysis of VOC emission shall be in accordance with clause 6 of JIS A 1965, clause 6 of JIS A 1966 or clause 5 of JIS K 0123. Alternatively, an instrument having an equivalent or better accuracy to these may be used. The analytical instrument used for analysis of emission of carbonyl compounds other than formaldehyde shall be in accordance with 6.3.1 of JIS A 1962 or clause 5 of JIS K 0124. Alternatively, an instrument having an equivalent or better accuracy to these may be used.

7 Test conditions

7.1 General

The test conditions shall be as specified in 7.2 to 7.5. This test shall be conducted under conditions near atmospheric pressure conditions.

7.2 Temperature and relative humidity

The temperature inside the large chamber shall be 28 °C, and the relative humidity during the test shall be 50 % as specified in JIS Z 8703. The large chamber shall be capable of being controlled within the following tolerance range :

temperature : (28 ± 1.0) °C, relative humidity : (50 ± 5) %.

To check the dependence of temperature and humidity on material performance, measurements under other temperatures and air humidity conditions should be made.

Initial variations can be observed in the large chamber climate after opening the chamber door and loading a test specimen, due to the temperature difference between the inner temperature of the large chamber and test site temperature. These variations should be recorded.

NOTE : Temperature and relative humidity significantly affect the emission factor.

The range of temperature and relative humidity shows fluctuations with time and care shall be taken not to cause temperature distribution and humidity distribution in the large chamber as far as possible.

7.3 Supply air quality and background concentration

The TVOC concentration in the supply air and the background shall be low enough not to interfere with the test and 50 µg/m³ or under, with concentration of a single target pollutant 5 µg/m³ or under.

Purified water used for humidification shall contain no or little interfering target pollutant. It shall be water of A1 or better specified in JIS K 0557, and shall be free from detection of target element.

7.4 Mass transfer coefficient

The mass transfer coefficient in terms of ambient air velocity over the surface of the building material inside the large chamber should be about 9 m/h to 18 m/h when determined using water vapour.

NOTE : The influence of mass transfer coefficient may be significant in the case of emission by transpiration. The degree of the influence depends on the base material. On the other hand, the influence of mass transfer coefficient in the case of emission by internal dispersion is small.

Appropriate stirring shall be carried out to avoid concentration distribution. If a stirring fan is provided to homogenize the concentration in the chamber, it shall not create a forced convection field causing the mass transfer coefficient to be 18 m/h or over.

The mass transfer coefficient 9 m/h to 18 m/h is approximately equivalent to the wind velocity 0.1 m/s to 0.3 m/s of the ambient air flowing over the surface of building material.

7.5 Area specific ventilation rate and air exchange rate

Under steady conditions, the chamber outlet concentration is dependent on the area specific ventilation rate (Q/A) selected as a parameter for setting the conditions for the emission test.

The air exchange rate shall be kept constant at $0.5 /h \pm 0.05 /h$.

For comparison of results from different large chambers, the ratio, n/L , of air exchange rate and the product loading factor shall be the same for each large chamber.

NOTE : The ratio, n/L , of the air change rate, n , and the product loading factor, L , may affect the emission factor.

8 Verification of test conditions

8.1 Monitoring of test conditions

Temperature, relative humidity, and ventilation rate shall be monitored and recorded continuously with instruments meeting the following accuracy specifications :

- temperature : ± 0.5 °C;
- relative humidity : ± 5 %;
- ventilation rate : ± 10 %

Temperature and relative humidity of air may be measured at the inlet or outlet of the chamber.

8.2 Airtightness of large chamber

The airtightness of the large chamber should be checked with a minimum frequency of every 12 months either by pressure maintenance and/or pressure drop measurements, by comparison of simultaneous measurement of flow rates at the inlet and the outlet ports, or by measuring tracer gas dilution.

8.3 Air exchange rate in large chamber

The ratio of the volume Q of clean air brought into chamber measured by means of an air flow meter set at the chamber outlet or inlet divided by the chamber volume V shall be taken as the air exchange rate n .

The variation of the air exchange rate from the set value should be as small as possible. Checks of air exchange rate using tracer gas should normally be made with a minimum frequency of every 12 months.

If the test is carried out in the outlet with an air flow meter that is not permanently installed, note that the back pressure introduced by the instrument can lower the flow rate through the large chamber.

8.4 Efficiency of the internal large chamber air mixing