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**Determination of the emission of
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 1911:2006 is replaced with this Standard.

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Determination of the emission of formaldehyde by building materials and building related products — Large chamber method

Introduction

This Japanese Industrial Standard was established in 2006. 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 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 1962 *Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*

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 the following apply. The target pollutant is formaldehyde.

3.1 surface area

surface area of a test specimen constantly exposed to circulating air in the chamber

3.2 area specific ventilation rate

ventilation rate per surface area of test specimen

3.3 unit specific ventilation rate

ventilation rate per unit number of test specimens

3.4 building materials and building related products (hereafter referred to as “building materials”)

materials used for furniture, building materials, and other related products (including those composed of a combination of such materials) that are to be tested

3.5 large chamber

See the definition in A 1901.

The subject of the test specified in this Standard is large chambers with a volume of 1 000 L or over.

3.6 product loading factor

ratio of the number or surface area of test specimens to the volume of the large chamber

3.7 test specimen

a sample or a part of a sample specially prepared for performing a test of emission characteristics of building materials in a large chamber

4 Symbols and units

For the purpose of this Standard, the following symbols and units apply.

u	: number of test specimens (unit)
A	: surface area of test specimen (m^2)
l	: length of test specimen (m)
v	: volume of test specimen (m^3)
$\rho(0)$	: initial tracer gas concentration ($\mu\text{g}/\text{m}^3$)
$\rho_e(t)$	: tracer gas concentration in the exhaust of the chamber at elapsed time t ($\mu\text{g}/\text{m}^3$)
ρ_s	: tracer gas concentration at a sufficiently long elapsed time (at an equilibrium) ($\mu\text{g}/\text{m}^3$)
ρ_l	: concentration of the target pollutant at the chamber outlet at elapsed time t ($\mu\text{g}/\text{m}^3$)
ρ_b	: background concentration ($\mu\text{g}/\text{m}^3$)
q_u	: unit specific emission factor ($\mu\text{g}/\text{unit} \cdot \text{h}$)
q_A	: area specific emission factor ($\mu\text{g}/\text{m}^2 \cdot \text{h}$)
q_l	: length specific emission factor ($\mu\text{g}/\text{m} \cdot \text{h}$)

q_v	: volume specific emission factor ($\mu\text{g}/\text{m}^3 \cdot \text{h}$)
L_u	: product loading factor per unit (unit/m^3)
L_a	: product loading factor per area (m^2/m^3)
L_l	: product loading factor per length (m/m^3)
L_v	: product loading factor per volume (m^3/m^3)
Q	: ventilation rate of the chamber (m^3/h)
V	: volume of the chamber (m^3)
k_a	: mass transfer coefficient of water vapour (m/h)
n	: air exchange rate (times/h)
t	: elapsed time (hours or days)
η	: coefficient of air change performance
τ_n	: nominal time constant (h)
$\langle \bar{\tau} \rangle$	: mean age (h)

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 formaldehyde 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.

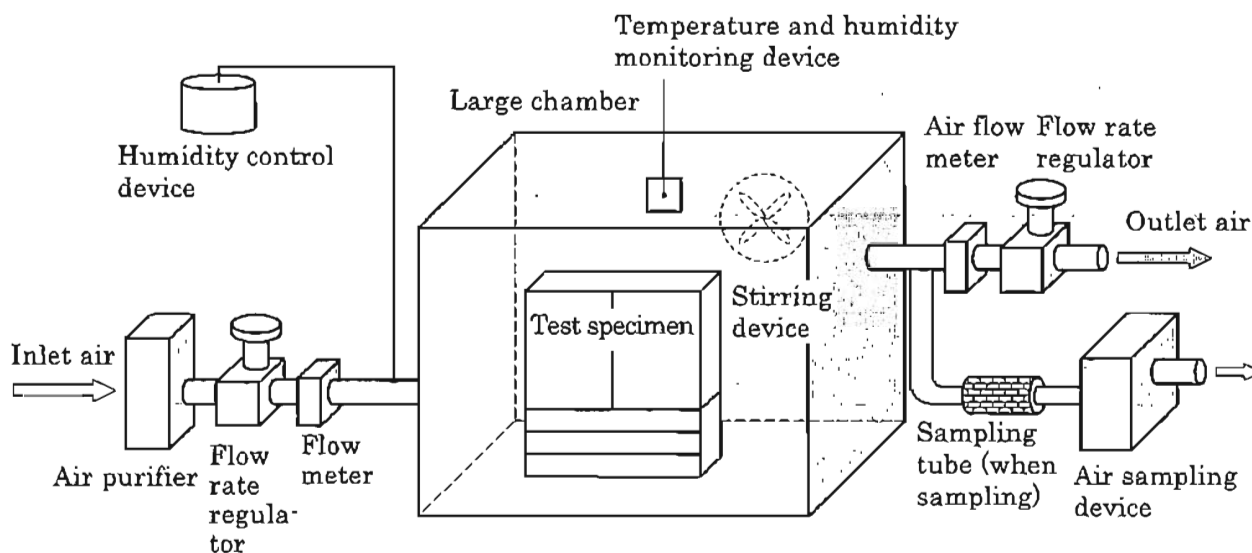


Figure 1 Outline of large chamber system

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 con-

structed 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 A high performance liquid chromatograph (HPLC) shall be used for analysis for formaldehyde emission of building materials.

The analytical instrument used 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 comply with 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 at 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 background concentration of the supply air for the chamber shall be low enough not to interfere with the test, and 12 µg/m³ or under.

Purified water used for humidification shall contain no or little interfering VOC, formaldehyde or other carbonyl compounds. 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 test material.

7.5 Area specific ventilation rate and air exchange rate