Designation: D6007 – 22

Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber[1]

This standard is issued under the fixed designation D6007; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method measures the formaldehyde concentrations in air emitted by wood product test specimens under defined test conditions of temperature and relative humidity. Results obtained from this small-scale chamber test method are intended to be comparable to results obtained from testing larger product samples by the large chamber test method for wood products, Test Method E1333. The results may be correlated to values obtained from Test Method E1333. The quantity of formaldehyde in an air sample from the small chamber is determined by a modification of NIOSH 3500 chromotropic acid test procedure. As with Test Method E1333, other analytical procedures may be used to determine the quantity of formaldehyde in the air sample provided that such methods give results comparable to those obtained by using the chromotropic acid procedure. However, the test results and test report must be properly qualified and the analytical procedure employed must be accurately described.

1.2 The wood-based panel products to be tested by this test method are characteristically used for different applications and are tested at different relative amounts or loading ratios to reflect different applications. This is a test method that specifies testing at various loading ratios for different product types. However, the test results and test report must be properly qualified and must specify the make-up air flow, sample surface area, and chamber volume.

1.3 Ideal candidates for small-scale chamber testing are products relatively homogeneous in their formaldehyde release characteristics. Still, product inhomogeneities must be considered when selecting and preparing samples for small-scale chamber testing.

1.4 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E1333 Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

2.2 *U.S. Department of Housing and Urban Development Standard:*[3]

HUD 24 CFR 3280, Manufactured Home Construction and Safety Standards

2.3 *National Institute for Occupational Safety and Health Standard:*

NIOSH 3500 Formaldehyde Method[4]

2.4 *Other Documents:*

Minnesota Statutes Sections 144.495, 325f.18, and 325F.181—Formaldehyde Gases in Building Materials[5]

California Air Resources Board (CARB) California Code of Regulations sections 93120-93120.12, title 17, Airborne

[1] This test method is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.03 on Panel Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov; request Federal Register, Vol 49, No. 155, Aug. 8, 1984

[4] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov; request U.S. Dept. of Health and Human Services, 1989.

[5] Available from Print Communications, Dept. of Administration, 117 University Ave., St. Paul, MN 55155.

Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products[6]

EPA TSCA Title VI 40 CFR Section 770 Environmental Protection Agency Formaldehyde Emission Standards for Composite Wood Products[7]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *air change rate, (Q/V):* the ratio of the conditioned and filtered air, *Q*, that enters or is replaced in the small chamber in one hour divided by the interior volume of the small chamber, *V*, air changes per hour (ACH).

3.1.2 *loading ratio, L:* (*L = A/V*) , the total exposed surface area (*A*), excluding panel edges, of the product being tested divided by the test chamber's interior volume, *V*, in m^2/m^3.

3.1.3 *make-up air flow, Q:* the quantity of conditioned and filtered air fed into the chamber per unit time, m^3/h. *Q* can be determined by taking the *Q/A* value from Table 1 and dividing by *A*.

3.1.4 *Q/A ratio:* the ratio of air flow through the chamber (*Q*) to sample surface area (*A*), m^3/h air per m^2 test area (see Section 8, Table 1)

3.1.5 *sample surface area, A:* the total area of all sample faces exposed in the chamber, m^2.

3.1.6 *steady state concentration, C_s:* the formaldehyde concentration (expressed in parts of formaldehyde per million parts air (ppm) under the defined environmental test parameters of this method.

3.1.7 *volume of closed system, V:* the interior volume of the test chamber, m^3.

4. Significance and Use

4.1 Upper limits for the formaldehyde emission rates have been established for wood panel building products made with urea-formaldehyde adhesives and permanently installed in homes or used as components in kitchen cabinets and similar industrial products. This test method is intended for use in conjunction with the test method referenced by HUD 24 for manufactured housing and by Minnesota Statutes for housing units and building materials. This method may also be used for monitoring products for compliance to the California Air Resources Board (CARB) regulation for composite wood products and the Environmental Protection Agency Formaldehyde Emission Standards for Composite Wood Products, EPA TSCA Title VI 40 CFR Section 770. This test method provides a means of testing smaller samples and reduces the time required for testing.

4.2 Formaldehyde concentration levels obtained by this small-scale method may differ from expected in full-scale indoor environments. Variations in product loading, temperature, relative humidity, and air exchange will affect formaldehyde emission rates and thus likely indoor air formaldehyde concentrations.

4.3 This test method requires the use of a chamber of 0.02 to 1 m^3 in volume to evaluate the formaldehyde concentration in air using the following controlled conditions:

4.3.1 Conditioning of specimens prior to testing,

4.3.2 Exposed surface area of the specimens in the test chamber,

4.3.3 Test chamber temperature and relative humidity,

4.3.4 The Q/A ratio, and

4.3.5 Air circulation within the chamber.

5. Interferences

5.1 The NIOSH 3500 analytical method lists phenols as a negative interference when present at an 8:1 excess over formaldehyde. Modifications in the analytical procedure shall be made when relatively high phenol to formaldehyde concentrations (8:1) are anticipated.[8,9]

6. Apparatus

6.1 *Test Chamber*—The interior volume of the small chamber shall be from 0.02 to 1 m^3. The interior of the test chamber shall be free of refrigeration coils that condense water and items such as humidifiers with water reservoirs since water has the potential for collecting formaldehyde and thus influencing test results. The interior surfaces of the small chamber, including any sample support system, shall be a nonadsorbent material. Stainless steel, aluminum, and polytetrafluoroethylene (PTFE) have been found appropriate as chamber lining materials. All joints except for doors used for loading and unloading specimens should be sealed. Doors shall be self-sealing.

6.2 *Make-Up Air:*

6.2.1 The make-up air shall come from a filtered dust-free environment and a formaldehyde concentration in air no more than 0.02 ppm. This can be accomplished by passing make-up air through a filter bed of activated carbon, activated alumina impregnated with potassium permanganate, or other materials capable of absorbing or oxidizing formaldehyde.

6.2.2 Make-up air for the chamber must pass through a calibrated air flow measuring device.

6.2.3 *Air Circulation*—Low speed mixing fans or multi-port inlet and outlet diffusers are two techniques that have been used successfully to ensure mixing of the chamber air over all sample surfaces.

6.2.4 *Air Sampling Port*—The exhaust flow (that is, chamber outlet) is normally used as the sampling point, although separate sampling ports in the chamber can be used. The sampling system shall be constructed of a material to minimize adsorption (for example, glass, stainless steel), and the system should be maintained at the same temperature as the test chambers.

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[6] California Air Resources Board, 1001 "I" Street, Sacramento, CA 95814. http://www.arb.ca.gov/homepage.htm

[7] Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.

[8] Hakes, D., Johnson, G., and Marhevka, J., *Procedure for Elimination of Phenol Interference in the Chromotropic Acid Method for Formaldehyde*, American Industrial Hygiene Association, April 1984.

[9] *Technical Bulletin No. 415*, National Council of the Paper Industry for Air and Stream Improvement Inc. (NCASI), 1983.