



Designation: E1333 – 22

Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber¹

This standard is issued under the fixed designation E1333; 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 concentration in air and emission rate from wood products containing formaldehyde under conditions designed to simulate product use (see 11.5 and Note 9). The concentration in air and emission rate is determined in a large chamber under specific test conditions of temperature and relative humidity. The general procedures are also intended for testing product combinations at product-loading ratios and at air-exchange rates typical of the indoor environment (1).² The products tested, the loading ratios and the air exchange rates employed are described in the test report.

1.2 This test method determines the average formaldehyde concentration in air and emission rate from a number of large size samples. The average concentration and emission rate reported, thus, will not provide information on higher or lower emitting panels in the test lot.

1.3 This method is primarily used for testing newly manufactured panel products that are shipped for testing either seal-wrapped in polyethylene or with waster sheets, or with both. When this test method is used for evaluating other than newly manufactured panel products (after original application, installation or use), the method of packaging and shipping the product for testing shall be described in the test report.

1.4 The quantity of formaldehyde in the air sample taken from the chamber is determined by an adaptation of the National Institute for Occupational Safety and Health (NIOSH) chromotropic acid test procedure. If another analytical procedure is used to determine the quantity of formaldehyde in the air sample, that procedure shall give results of equivalent or greater accuracy and precision than the adapted chromotropic acid procedure. Detailed procedures based on acetylacetone, pararosaniline (see Test Method D5221), 2,4-

dinitrophenylhydrazine (DNPH) (see Test Method D5197) and 3-methyl-2-benzothiazoline (MBTH) (see Test Method D5014) have been found to give results equivalent or greater in accuracy and precision than chromotropic acid. The test report shall note the analytical procedure employed.

NOTE 1—³ The chromotropic acid analytical procedure described in this test method is applicable for testing urea-formaldehyde bonded wood products. According to NIOSH (4th Edition, 8/15/94), the low end of the working range for the chromotropic acid analytical procedure is 0.02 ppm. A more sensitive analytical procedure is recommended for testing wood panel products where formaldehyde concentrations in air are anticipated to be at or below this level. DNPH is recognized as such a method.

1.5 This test method is used to determine compliance with requirements such as those established for building materials by the U.S. Department of Housing and Urban Development (HUD) Rules and Regulations, HUD 24 CFR 3280, for manufactured housing, by Minnesota Statutes Section 144.495, Environmental Protection Agency Formaldehyde Emission Standards for Composite Wood Products, EPA TSCA Title VI 40 CFR Section 770, and California Air Resources Board (CARB), California Code of Regulations sections 93120-93120.12, title 17, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products. Measurement results are also used for comparing concentrations in air and emission rates from different wood products (2) and for determining compliance with product standards.

1.6 This test method is not designed for determining general organic emissions from all indoor materials and products.

NOTE 2—ASTM Committee D22 has developed Guide D5116 which describes small-scale environmental equipment and techniques suitable for determining organic emissions and emission rates from materials and products used indoors.

1.7 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

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 The boldface numbers in parentheses refer to a list of references at the end of this standard.

³ The notes appearing in this test method are not part of the mandatory sections of this standard, are informative in nature, and appear below that section of the standard to which they pertain.

1.8 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. For specific hazard statements, see Section 7.

1.9 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:⁴

D3195 Practice for Rotameter Calibration

D5014 Test Method for Measurement of Formaldehyde in Indoor Air (Passive Sampler Methodology) (Withdrawn 2006)⁵

D5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products

D5197 Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)

D5221 Test Method for Continuous Measurement of Formaldehyde in Air (Withdrawn 1997)⁵

E77 Test Method for Inspection and Verification of Thermometers

E220 Test Method for Calibration of Thermocouples By Comparison Techniques

E337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)

E741 Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution

2.2 HUD Document:⁶

HUD 24 CFR 3280 Manufactured Home Construction and Safety Standards, 24, CFR 3280, Federal Register, Vol 49, No. 155, August 8, 1984

2.3 NIOSH Document:⁶

NIOSH Manual of Analytical Methods, Method No. 3500, Fourth Edition, 1994

2.4 ANSI Standards:⁷

ANSI/HPVA HP-1 Hardwood and Decorative Plywood

ANSI A208.1 Particleboard

ANSI A208.2 Medium Density Fiberboard (MDF) for Interior Applications

2.5 Other Documents:

Minnesota Statutes Section 144.495 325F.18 and 325F.181, Formaldehyde Gases in Building Materials, 1986⁸

California Air Resources Board (CARB) California Code of Regulations sections 93120-93120.12, title 17, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products⁹

EPA TSCA Title VI 40 CFR Section 770 Formaldehyde Standards for Composite Wood Products¹⁰

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *air change rate*—the ratio of hourly conditioned and filtered outside air brought into the chamber, and chamber volume measured in identical volume units (normally expressed in air changes per hour, AC/h).

3.1.2 *emission rate*—formaldehyde emissions per area of exposed surface of tested product in the large chamber per time duration of air sample, normally expressed in mg/(m² · h).

3.1.3 *loading ratio*—the total exposed surface area (not including panel edges) of each product divided by the test chamber volume.

4. Significance and Summary of Test Method

4.1 Significance and Use:

4.1.1 Limitations on formaldehyde concentrations in air have been established for some building products permanently installed in manufactured and conventional homes. This test method provides a standard means of testing typical product sizes, such as 1.2 m by 2.4 m (4 ft by 8 ft) sheets, at product loadings consistent with product end use.

4.2 Summary of Test Method:

4.2.1 This test method incorporates a chamber of 22 m³ (800 ft³) minimum size to evaluate formaldehyde concentrations in air and emission rates from building products over a specified duration of time. This test method employs a single set of environmental conditions but different product loading ratios to assess formaldehyde concentrations in air and emission rates from certain wood products. Conditions controlled in the procedure are as follows:

4.2.1.1 Conditioning of specimens prior to testing,

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

4.2.1.3 Test chamber temperature and relative humidity,

4.2.1.4 Number of air changes per hour, and

4.2.1.5 Air circulation within the chamber.

4.2.1.6 At the end of a 16 to 20-h period in the test chamber, the air is sampled and the concentration of formaldehyde in air and emission rate are determined.

NOTE 3—Care must be exercised in the extension of the results to

⁴ 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.

⁵ The last approved version of this historical standard is referenced on www.astm.org.

⁶ 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>.

⁷ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁸ Available from Print Communications, Dept. of Administration, 117 University Ave., St. Paul, MN 55155.

⁹ Available from California EPA website: <http://www.arb.ca.gov/toxics/compwood/compwood.htm>.

¹⁰ Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, <http://www.epa.gov>.