



HARDWOOD PLYWOOD & VENEER ASSOCIATION
LABORATORY AND TESTING SERVICE

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REPORT ON

FORMALDEHYDE EMISSIONS FROM WOOD PRODUCTS

LARGE CHAMBER METHOD

ASTM E 1333

PREPARED FOR:

Wood Flooring International
Burlington, New Jersey

TEST NUMBER FC-4041

MATERIAL TESTED:

9/16" Finished 3-Ply Flooring

DATE OF ISSUE:

09/25/06



Test Number: FC-4041
F-N/A

Date of Test: 09/15/06

Supplied by: Wood Flooring International
Burlington, New Jersey

Purpose of Test: Formaldehyde Emission Determination

Product Description: 9/16" Finished 3-Ply Flooring

Exposed Surface: Face and Back

Sample Selection: Supplier

Material Description: Supplier

Date Selected: 09/2006

Loading Rate: 0.13 Sq Ft/Cu Ft

No. of Specimens: 48

Preconditioning: 7 Days Temp. (F) = 73 RH= 52% 0.05 ppm Background HCHO

Chamber Results:

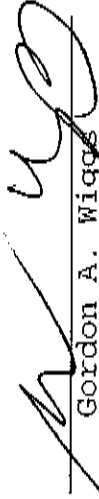
Sample #1 0.05 ppm
Sample #2 0.05 ppm

Test Conditions: Temp. (F) = 77.4 RH= 56%

AVERAGE 0.05 ppm

Adjusted to 77F, 50%= 0.04 ppm

REMARKS: None


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This is a factual report of the results obtained from laboratory tests of sample products. The results may be applied only to the products tested and should not be construed as applicable to other similar products of the manufacturer. The HPVA does not verify the description of materials and products when the description is provided by the client. This report is not a recommendation or a disapprobation by the Hardwood Plywood & Veneer Association of the material or product tested. While this report may be used for obtaining product acceptance, it may not be used in advertising.

REPORT OF FORMALDEHYDE LEVELS FROM WOOD PRODUCTS USING A LARGE SCALE TEST CHAMBER ASTM E 1333

I. SCOPE

This report contains a brief outline of the test method, test identification, description of material, and formaldehyde emission results.

II. TEST METHOD

A. Chamber Details

A large scale laboratory chamber with nominal dimensions of 7.5 ft. x 7.5 ft. x 19.5 ft., and a volume of 1080 cu. ft. was utilized for this test. Samples for emissions testing are loaded into the chamber at a designated loading rate (square feet of exposed surface area per cubic foot of chamber) which is representative of the products' end use application.

The chamber is maintained at a temperature of $77^{\circ}\text{F} \pm 2^{\circ}\text{F}$ and a relative humidity of $50\% \pm 4\%$. The air exchange rate in the chamber is maintained at 0.5 or 1.0 air changes/hour (AC/hr) measured by a gas meter installed in the input duct system. The make-up air entering the chamber is passed through a filter containing Potassium Permanganate impregnated Alumina and its formaldehyde level is reported.

B. Preparation and Conditioning of Test Samples

Samples are conditioned for 7 days (unless otherwise specified) at a temperature of $75^{\circ}\text{F} \pm 5^{\circ}\text{F}$ and relative humidity of $50\% \pm 5\%$.

C. Air Sampling Procedure

Air samples are taken from the chamber at two locations. Sampling points are located at 54" above the floor and approximately one third (1/3) of the distance in from each end of the chamber.

Air from the chamber is drawn through a single midjet impinger containing 20 mL of 1% sodium bisulfite. The impinger is connected to a flowmeter-needle valve assembly which has been calibrated for a flow rate of 1 liter/minute using a DuPont bubble tube. An electric vacuum pump is used to draw air through the sampling apparatus, with the duration of sampling dependent on the emission characteristics of the product (usually between 30-60 minutes). Initial samples are taken 16-18 hours after loading of the test specimens into the chamber.

D. Chemical Analysis

The air samples collected are analyzed using a modified NIOSH chromotropic acid procedure. To a four (4) mL aliquot taken from the impinger, 0.1 mL of 1% chromotropic acid and 6 mL of concentrated sulfuric acid are added. Formaldehyde forms a purple monocationic chromogen with the addition of the chromotropic acid-sulfuric acid solutions. The absorbance of this solution is measured in a spectrophotometer at 580 nm and is proportional to the amount of formaldehyde in the solution. The amount of formaldehyde present is determined from a curve prepared from standard formaldehyde solutions.

E. Calculations

The concentration of formaldehyde in the large chamber is then calculated according to the following equation:

$$ppm = \frac{C_c \times 24.47}{V_s \times M.W.}$$

Where:

ppm = parts of formaldehyde per million parts air
 C_c = total μ g of formaldehyde collected in the sample
 V_s = liters of air sampled at standard conditions (760 mm of Hg and 25°C)
M.W. = molecular weight of formaldehyde (30.03)
24.47 = μ L of formaldehyde gas in one micromole at 760 mm Hg and 25°C.

The formaldehyde level is adjusted for temperature to 77°F and 50% RH using the Berge, et al. formula:

$$C = C_o \cdot e^{-R(1/t - 1/t_o)} \cdot (1 + A(H - H_o))$$

Where:

C = Test Formaldehyde Concentration
 C_o = Corrected Formaldehyde Concentration Level
e = Natural Log Base
R = Coefficient of Temperature (9799)
t = Actual Temperature (°K)
 t_o = Corrected Temperature (°K)
A = Coefficient of Humidity (0.0175)
H = Actual Relative Humidity (%)
 H_o = Standardized Relative Humidity (%)