Appendix X: Conditions for the measurement of formaldehyde released from articles

1. Measurement of formaldehyde released from articles

Compliance with the limit value specified in paragraph 1 of the restriction entry shall be demonstrated by measuring the formaldehyde concentration in the air of a test chamber used under the following conditions:

a. The volume of the test chamber shall be based on the size and type of the test piece.

b. The duration of the test shall be sufficiently long to allow the determination of a steady state concentration as defined in EN 717-1 and shall not exceed 28 days.

c. The temperature in the test chamber shall be (23 ± 0.5) ºC.

d. The relative humidity in the test chamber shall be (45 ± 3) %.

e. The loading factor, expressed as the ratio of the total surface area of the test piece to the volume of the test chamber, shall be (1 ± 0.02) m^2/m^3.

f. The air exchange rate in the test chamber shall be (1 ± 0.05) h^{-1}.

g. The formaldehyde emission, expressed as the concentration in the air of the test chamber, shall be measured at least twice per day throughout the test with a time interval between two consecutive samplings of 3 hours at a minimum. The measurement shall be repeated until sufficient data are available to determine the steady state concentration.

h. An appropriate analytical procedure (e.g. acetylacetone method as described in EN 717-1 or DNPH method according to ISO 16000-3) to measure the formaldehyde concentration in the test chamber shall be used.

i. An appropriate method for sampling of the test pieces shall be used.

j. The steady state concentration of formaldehyde measured in the test chamber shall not exceed the limit value specified in paragraph 1 of the restriction entry.

A number of standardised methods are available for the sampling of test pieces including, but not limited to:

- EN 326-1: Wood-based panels – Sampling, cutting and inspection – Part 1: Sampling and cutting of test pieces and expression of test results
- EN 326-2: Wood-based panels – Sampling, cutting and inspection – Part 2: Initial type testing and factory production control
- EN 326-3: Wood-based panels – Sampling, cutting and inspection – Part 3: Inspection of an isolated lot of panels

- ISO 16000-3: Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air – Active sampling method

2. Test methods based on different conditions

In the event that the conditions in point 1 cannot be applied, alternative methods can be used to demonstrate that the limit value specified in paragraph 1 of the restriction entry is not exceeded.

A number of standardised test methods based on test chambers are available for the measurement of formaldehyde released from articles including, but not limited to:

- EN 717-1: Wood-based panels – Determination of formaldehyde release – Part 1: Formaldehyde emission by the chamber method. This method is based on the conditions indicated in point 1 of this appendix.
- ISO 16000-9: Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method
- EN 16516: Construction products – Assessment of release of dangerous substances – Determination of emissions into indoor air
- ASTM E 1333: Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber
- ASTM D 6007: Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber
- ISO 12460-1: Wood-based panels – Determination of formaldehyde release – Part 1: Formaldehyde emission by the 1-cubic-metre chamber method
- ISO 12219-3: Interior air of road vehicles – Part 3: Screening method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials – Micro-scale chamber method
- ISO 12219-4: Interior air of road vehicles – Part 4: Method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials – Small chamber method

Other test methods for the measurement of formaldehyde released from articles not based on test chambers exist including, but not limited to:

- ISO 12460-3: Wood-based panels – Determination of formaldehyde release – Part 3: Gas analysis method
- ISO 12460-4: Wood-based panels – Determination of formaldehyde release – Part 4: Desiccator method
- ISO 12460-5: Wood-based panels – Determination of formaldehyde release – Part 5: Extraction method (called the perforator method)

- EN 717-3: Wood-based panels – Determination of formaldehyde release – Part 3: Formaldehyde release by the flask method
- ISO 12219-2: Interior air of road vehicles – Part 2: Screening method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials – Bag method
- VDA 275: Formaldehyde release by modified flask/UV Vis Spec method

Although some of the methods in these lists are designed for specific categories of articles, they can also be used for other purposes.

Producers or importers of articles falling into the scope of the restriction are responsible to demonstrate that formaldehyde release from their articles is in compliance with the requirements set out in paragraph 1 of the restriction entry and point 1 of this appendix.

If the test method used to measure formaldehyde released from articles is based on conditions that are different (hereafter alternative method) to those specified in point 1 (hereafter the standard method), compliance shall be demonstrated based on an acceptable correlation between the alternative method and the standard method.

For example, a number of studies have been conducted to correlate formaldehyde emissions from specific categories of articles measured with different test methods. Producers and importers of articles can use available information to calculate formaldehyde emissions from their articles with the standard method from data obtained using an alternative method. Whatever is the level obtained with the alternative method, the emission level corresponding to the standard method shall not exceed the limit in paragraph 1 of the restriction entry.

If reliable comparison data are not available, a possible option could be to perform measurements of formaldehyde emissions from samples of an article with the alternative method and, in parallel, to measure the emissions from samples of the same article with the standard method. As in the previous case, the compliance is demonstrated if the emission values obtained with the standard method do not exceed the limit set out in paragraph 1 of the restriction entry. In this case, corresponding emission values obtained with the alternative method can be used as reference for production control. Parallel measurements should only be repeated in case variations in the characteristics of the article produced or imported (e.g. material, size, production process etc.) may foreseeably impact the release of formaldehyde from the article.

Compliance with the restriction limit can be also demonstrated if the emission limit of the restriction is not exceeded when it is measured in a test chamber used under conditions that are more stringent than the conditions indicated in point 1 (i.e. lower air exchange rate and/or higher temperature and/or higher relative humidity and/or higher loading factor).

Examples on how to correlate test results obtained with different test methods can be found in the following standards:

- EN 326-2: Wood-based panels – Sampling, cutting and inspection – Part 2: Initial type testing and factory production control

- California Environmental Protection Agency, Air Resources Board, Guideline No. CWP-10-001: Establishing a Correlation With an Acceptable Correlation Coefficient (“r” Value)

3. Measurement of formaldehyde concentration in the interior space of road vehicles for the transportation of people and passenger aeroplanes

The interior space of a road vehicle (e.g. car, truck, van, bus and motor-home) for the transportation of people or a passenger aeroplane is the space where people are present under normal and reasonably foreseeable conditions and potentially exposed to formaldehyde via inhalation. To demonstrate compliance with the restriction entry, the formaldehyde concentration in the interior space of road vehicles and passenger aeroplanes shall not exceed the value set out in paragraph 1 of the restriction entry.

For road vehicles the formaldehyde concentration shall be measured under the conditions specified in ISO 12219-1[1] or an equivalent method and the value set out in paragraph 1 of the restriction entry shall not be exceeded when measured in ambient mode according to ISO 12219-1.

For passenger aeroplanes the formaldehyde concentration shall be measured under the conditions specified in ISO 16000-3[2] or an equivalent method and the value set out in paragraph 1 of the restriction entry shall not be exceeded at any time when the aircraft is occupied by passengers.

[1] ISO 12219-1: Interior air of road vehicles – Part 1: Whole vehicle test chamber – Specification and method for the determination of volatile organic compounds in cabin interiors

[2] ISO 16000-3: Indoor air – Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air – Active sampling method