
EMISSION TEST METHOD ISO 16000-9

Various chemicals are emitted from building and interior decoration materials into indoor air. The aim of the testing is to enhance the development and use of low-emitting building materials. The classification presents emission requirements for the materials used with respect to good indoor air quality.

ISO 16000-9 specifies a general laboratory test method for determination of the area specific emission rate of volatile organic compounds (VOCs) from newly produced building products or furnishing under defined climate conditions. The method can also, in principle, be applied to aged products. The emission data obtained can be used to calculate concentrations in a model room.

ISO 16000-9 applies to various emission test chambers used for determination of the emission of volatile organic compounds from building products or products. A general description of an emission test chamber is given. ISO 16000-9 is also applicable to wood-based panels and other building products, in order to determine the emission rate of formaldehyde.

TEST CHAMBER

The test chamber is consisting of stainless steel and has a volume of 119 litres. The air clean-up is realized in multiple steps. Before loading the chamber a blank check of the empty chamber is performed. The operation parameters are 23 °C, 50 % relative air humidity (in the supply air) with an air exchange rate of ½ per hour. The loading of the test chamber is 0.4 m² test specimen per m³ air volume.

VOC EMISSIONS TESTING AFTER 4 WEEKS

The emissions of organic compounds are tested by drawing air samples from the chamber outlet through Tenax TA tubes (main tube and backup tube). Analyses are done by thermal desorption and gas chromatography / mass spectroscopy. All single substances are identified if the toluene equivalent in the Total Ion Chromatogram (TIC) exceeds 2 µg/m³. Quantification is done with the respective response factor and the TIC signal, or in case of overlapping peaks by calculating with fragmentions. All non-identified substances are quantified as toluene equivalent if giving more than 2 µg/m³.

The results of the individual substances are calculated in three groups depending on their appearance in a gas chromatogram when analysing with a non-polar column (HP-1):

- Volatile organic compounds VOC: All substances appearing between these limits.
- Very volatile organic compounds VVOC: All substances appearing before n-hexane (n-C6).
- Semi-volatile organic compounds SVOC: All substances appearing after n-hexadecane (n-C16).

TESTING OF ALDEHYDES AFTER 4 WEEKS

The presence of aldehydes C1 – C4 is tested by drawing air samples from the chamber outlet through DNPH-coated silicagel tubes. Analysis is done by solvent desorption, HPLC and UV-/diode array detection (ISO 16000-3). The absence of the aldehydes is stated if the specific wavelength UV detector response is lacking at the specific retention time in the chromatogram. Otherwise it is checked whether the detection limit is exceeded. In this case the identity is finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

TESTING OF AMMONIA AFTER 4 WEEKS

The presence of ammonia is tested by drawing air samples from the chamber outlet through silicagel tubes coated with sulphuric acid. Analysis is done by solvent desorption and UV/VIS spectroscopy. The absence of ammonia is stated if the signal is lacking at the specific wavelength. Otherwise it is checked whether the detection limit is exceeded.

ACCREDITATION

The testing methods described above have been accredited (EN ISO/IEC 17025:2005) by DANAK (no. 522). But some parameters are not yet covered by that accreditation. It is difficult to obtain accreditation for complex mixtures of substances. But the analysis is done for these parameters at the same level of quality as for the accredited parameters.

UNCERTAINTY OF THE TEST METHOD

The relative standard deviation of the test method is amounted to 22% (RSD). The expanded uncertainty U_m is 45% and equals $2 \times \text{RSD}\%$.

CATEGORIES OF IDENTITY:

- 1 = definitely identified, specifically calibrated
- 2 = identified by comparison with a mass spectrum obtained from a library, identity supported by other information, calibrated as toluene equivalent
- 3 = identified by comparison with a mass spectrum obtained from a library, calibrated as toluene equivalent
- 4 = not identified, calibrated as toluene equivalent

INTERPRETATION OF THE RESULTS

The Swedish Building Material Assessment (version 2011):

- the Total VOC ("TVOC") after 4 weeks: the recommended limit of $200 \mu\text{g}/\text{m}^2\text{h}$, the accepted limit of $400 \mu\text{g}/\text{m}^2\text{h}$.
- the formaldehyde emission after 4 weeks: the recommended limit of $50 \text{mg}/\text{m}^2\text{h}$.

The French VOC regulation, Émissions Dans L'air Intérieur (2011):

- TVOC limit values:
 - Class A+ : $\text{TVOC} < 1000 \text{mg}/\text{m}^3$
 - Class A : $\text{TVOC} < 1500 \text{mg}/\text{m}^3$
 - Class B : $\text{TVOC} < 2000 \text{mg}/\text{m}^3$
 - Class C : $\text{TVOC} > 2000 \text{mg}/\text{m}^3$

