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Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation —

Part 3:
Test methods

Plastiques alvéolaires rigides — Mousse de polyuréthanne projetée pour l'isolation thermique —

Partie 3: Méthodes d'essai

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8873-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

This first edition of ISO 8873-3, together with ISO 8873-1 and ISO 8873-2, cancels and replaces ISO 8873:1987, which has been technically revised.

ISO 8873 consists of the following parts, under the general title *Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation*:

- *Part 1: Material specifications*
- *Part 2: Application*
- *Part 3: Test methods*

Introduction

This part of ISO 8873 provides the test methods required for the specification given in ISO 8873-1. These test methods are currently not stand-alone test standards. In the future, when these test methods become stand-alone International Standards, this part of ISO 8873 will be withdrawn.

Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation

Part 3:
Test methods

WARNING — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory requirements.

1 Scope

This part of ISO 8873 specifies the test procedures that are to be used when testing spray-applied polyurethane foam materials to verify that they meet the requirements given in ISO 8873-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8873-1, *Rigid cellular plastics — Spray-applied polyurethane foam for thermal insulation — Part 1: Material specifications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
air-exchange rate
AER
volume of clean air brought into the chamber in 1 h divided by the chamber volume measured in identical volume units

NOTE This rate is normally expressed in air changes per hour (AC/h).

3.2
air permeance
rate of airflow (l/s), per unit area (m^2) and per unit static pressure differential (Pa)

3.3
chamber-loading ratio
total exposed surface area of each cellular plastic product specimen divided by the test chamber volume

NOTE Since the cellular plastic product is intended to be installed in large continuous areas, only the face of the insulation is exposed in the test procedure.

3.4
clean air
air that does not contain any volatile organic compounds at a concentration in excess of the allowable background level (i.e. 1 % of the permissible indoor air concentration limit for each compound identified)

3.5
dynamic chamber
chamber where a material specimen can be placed and tested to determine the volatile organic compound emission rate under controlled environmental conditions

3.6
GC/MS-SCAN
gas chromatograph/mass spectrometer operated in scan mode

3.7
head-space analysis
procedure for measuring the volatile organic compounds (VOCs) present in the air space enclosed within a static, airtight chamber

NOTE The chamber is assumed to contain VOCs in equilibrium with the VOCs emitted by the specimen in the chamber.

3.8
head-space (static) chamber
airtight chamber where a specimen can be placed and tested to determine the volatile organic compounds emitted under controlled environmental conditions

3.9
internal standard
volatile organic compound (other than that identified in the head-space analysis) which is injected at a known rate into the dynamic chamber in order to verify sample collection and analysis procedures

3.10
permissible indoor air concentration
maximum allowable indoor air concentration of a volatile organic compound

3.11
tracer gas
gaseous chemical (e.g. SF_6 and N_2O) used to study the mixing characteristics of the dynamic chamber and to provide a crosscheck of the air-exchange rate measurements

3.12
threshold limit value
TLV®
time-weighted average concentration for a normal 8 h workday and a 40 h workweek, which nearly all workers may be repeatedly exposed to without adverse effects, day after day

NOTE Also called TLV-TWA (threshold limit value–time-weighted average).

3.13
volatile organic compound
VOC
organic compound with a saturation vapour pressure at room temperature and/or with a boiling point less than 260 °C

4 Standard laboratory procedure for the determination of volatile organic compound emissions from cellular plastic products

4.1 General

This standard laboratory procedure has been developed for the assessment of volatile organic compound emissions from building materials made from plastic.

It specifies recommended procedures for the use of test chambers to evaluate emissions from a product at a point in time following its installation. It contains the following:

a) a head-space analysis procedure for initial identification of volatile organic compounds released by a material;

b) two dynamic chamber procedures (A and B) for characterizing the rate of volatile organic compound emissions from a material;

c) methodology for calculating the estimated indoor air concentrations of volatile organic compounds based on the results of dynamic chamber testing.

The headspace analysis is a static test to identify significant amounts of emitted compounds from the material. It is followed by either dynamic chamber procedure (A or B).

Procedure A determines the long-term VOC emission characteristics of the material. The test is conducted after conditioning the material sample for 30 days.

Procedure B determines the VOC emission profile of the product commencing 20 h to 24 h after installation of the material in a building and continues for 30 days.

The results of procedure A or B are used to calculate the indoor air VOC concentration profiles and to determine the acceptability of the material for new construction and/or retrofit use.

Procedure A is used to evaluate the material in new residential construction when there is a minimum of 30 days from material installation to building occupancy.

Procedure B is a more complex evaluation of the material when the normal 30-day minimum airing-out period associated with new construction is not provided (e.g. occupied buildings).

In these special cases (e.g. occupied buildings), the product and/or application standard will provide the requirements for isolation and ventilation, if necessary. The test results of procedure B will determine the length of time that these requirements are necessary.

The methodology for assessing the acceptability of the material utilizes a comparison of the estimated indoor air concentration of volatile organic compounds (VOCs) with permissible concentrations.

4.2 Apparatus and equipment

4.2.1 General product requirements

All equipment and apparatus in contact with the specimen or the associated air stream, including the air-exchange system, chambers, sample holder and air sampling system, shall be of glass, stainless steel or another inert material. Special care should be taken to ensure that gaskets, seals, sealants, valve and pump components and other associated items are chemically inert.

4.2.2 Head-space (static) chamber

The head-space chamber shall be a small container (approximately 1 litre) and shall be constructed of materials that meet the requirements of 4.2.1. The interior should be smooth and easy to clean. The container shall have an airtight opening of sufficient size to allow loading/unloading of the specimen and chamber cleaning. Two ports to allow the removal and return of an air sample shall be provided.

4.2.3 Dynamic chamber

The chamber and all associated hardware shall meet the requirements of 4.2.1. The interior should be smooth and easy to clean. All gaskets shall be of Teflon® or another chemically inert material.

The chamber size is not critical; however, a chamber volume of 0,1 m^3 to 1,0 m^3 will provide a reasonable compromise between sample size and complexity of testing.

The chamber shall be equipped with an airtight opening large enough to allow specimen loading/unloading and chamber cleaning. Ports for temperature and humidity probes and air and gas supply/exhaust connections shall be provided as required. The chamber design shall allow for complete mixing of the air and this shall be verified (with a specimen in place) using a tracer gas decay test.

The surface air velocity over the cellular plastic product specimen should be between 0,04 m/s and 0,05 m/s. This velocity shall be verified using a thermal anemometer or other appropriate air velocity measurement instrument.

4.2.4 Sample storage enclosure

This enclosure shall be large enough to contain the specimen and shall contain shelves to hold the other storage vessels referenced in this part of ISO 8873. The enclosure shall be lined with chemically inert material that is easy to clean, and shall be provided with environmental control and monitoring systems that maintain a temperature of (23 ± 2) °C, a relative humidity of (50 ± 5) %, and a clean air-exchange rate of 0,3 ± 0,015 air changes per hour.

4.2.5 Environmental enclosure

This enclosure shall be large enough to contain the dynamic chamber and all associated equipment, including air sampling equipment, and bottled gas supplies. The enclosure shall be lined with material that is easy to clean and it shall be provided with environmental control systems that maintain a temperature of (40 ± 2) °C.

4.2.6 Air-exchange system

This system shall be capable of supplying a controlled flow of clean air through the test chamber and associated equipment. Clean air may include air supplied from compressed gas cylinders or ambient air, which is conditioned by removing moisture and trace organic chemicals through charcoal filtration or other means.

The equipment shall include the following:

a) a humidification system that maintains the relative humidity (RH) of the airflow at (50 ± 5) % using deionized water (or equivalent), and a humidity indicator/recorder accurate to ± 5 % RH;

b) a temperature recorder/indicator system that can accurately measure airflow temperatures to ± 2 °C at 40 °C; due to compressed gas expansion cooling effects, a reheating system may be required to ensure that the air entering the chamber is at a temperature of (40 ± 2) °C;

c) an air pump or pumps (unless a compressed air supply system is used), set to supply an airflow rate equivalent to 0,3 air changes per hour, based on the volume of the emissions test chamber; the flow rate shall be controllable to within 5 % of the specified value; the chamber shall be operated, and verified to be, at a slight positive pressure to avoid contamination of the test chamber and sampling systems;

d) a flow indicator/recorder, accurate to within 5 % of the reading;

e) a particular filter system where applicable.

4.2.7 Air-sampling system

The air-sampling system shall be placed in the environmental enclosure (4.2.5) connected to the exhaust port of the dynamic chamber, and shall direct the required amount of exhaust flow through the VOC absorbent media.

All system components from the chamber to the VOC absorber shall be constructed of chemically inert materials.

The system shall include an air-sampling pump and a device or devices that can measure and control the air-flow through the sampling system to within 5 % of the specified value. The pump shall be operated in suction mode to avoid contamination of the air sample.

A precision timing device shall be used to measure the sample collection interval. The device shall be capable of measuring an elapsed time of 8 h ± 2 % of the elapsed time.

For collection of the airflow samples, charcoal sorbent tubes or alternative collection media should be used. The air-sampling rate shall be selected based on the specifications of the sorbent tubes; generally a sampling rate of 0,2 l/min is recommended. Sorbent tube manufacturers' recommendations should be followed regarding the sample airflow rate and sampling time.

The exhaust air shall be sampled close to the exit from the chamber to ensure that the air sample is well mixed and represents the chamber concentration.

The air-sampling-system design and operation shall be sufficiently sensitive to ensure that the overall chemical analysis is consistent with the required VOC detection levels.

4.2.8 Clock/elapsed time indicator

The timing system shall provide a record of the starting and completion times of all laboratory procedures. The system shall be capable of indicating the time elapsed from the beginning of the test (in hours, minutes, seconds).

4.2.9 Chemical analysis system

The recommended equipment for identifying VOCs is GC/MS-SCAN. Other equivalent techniques may be used. For measuring the chamber concentrations, the sampling and analysis procedure and equipment shall have a detection limit of 1 % of the permissible indoor air concentration limit for the volatile organic compound.

4.2.10 Airtight glass containers

The glass containers shall have airtight lids and shall be sized to tightly contain the various referenced cellular plastic product specimens (excess container volume shall not be more than 10 % of the specimen volume).

4.2.11 Specimen holder

Use an open-pan type container for the specimen, made of chemically inert product. The holder shall seal on the sides and at the bottom allowing VOC emissions into the chamber only through the top surface of the specimen.

4.3 Test procedure

4.3.1 Specimen preparation

The specimen shall be prepared in accordance with the relevant material standard.