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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 In the future, when these test methods become stand-alone International Standards, this part of ISO 8873 will be withdrawn.

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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.

4.3.2 Cleaning and background contamination check

4.3.2.1 Cleaning

Prior to testing, clean the head-space apparatus and/or dynamic chamber and all internal hardware and equipment that will be in contact with the specimen or test apparatus. Scrub the interior surfaces with an alkaline detergent, then thoroughly rinse with tap water. Scrub again with methanol and re-rinse with deionized water. Dry the chambers and equipment. Place them in position in the environmental enclosure and purge with clean air for 12 h under the test conditions specified.

4.3.2.2 Measurement of background contamination

Measure the background contamination by conducting a head-space analysis or procedure A test (for either procedure A or B tests) without the specimen installed in the chamber to ensure that the contamination is within the quality assurance limits. Start the air-sampling procedure after the initial 12 h system purging with clean air, without the additional 24 h clean air purging as required in procedure A. The concentration of volatile organic compounds shall not exceed background levels. If it is required to remove background contamination, purge the chamber sampling lines and associated equipment again with clean air and/or re-clean with detergent until the measured contamination levels are acceptable. Take care to avoid contamination of the equipment by hand contact or by contaminated air movement.

4.3.3 Head-space analysis

4.3.3.1 Incubation

Immediately after production, install the specimen (4.3.1) in the head-space chamber (4.2.2), which has been cleaned and checked as specified in 4.3.2. Seal the head-space chamber and hold at (40 ± 2) °C in the environmental enclosure (4.2.5) for 24 h.

4.3.3.2 Cleaning of analysis equipment

Before collecting an air sample, operate the chemical analysis apparatus (sampling lines, flow controller/meter and sample pump) for 3 h without connecting to the head-space chamber sampling port in the environmental enclosure (4.2.5) to purge the system.

4.3.3.3 Air-sample collection

After the specimen has been in the head-space chamber for 24 h, install the sorbent tube to the air and connect the sample line to the head-space sampling port. Collect the air sample and remove the sorbent tube or collection media from the air-sampling system and seal it in an appropriate container pending analysis (see 4.2.7).

4.3.4 Dynamic chamber test — Procedure A

Perform the procedure on two separate specimens. Place the specimen in the dynamic chamber (4.2.3), which has been cleaned and checked for background contamination as specified in 4.3.2. Start the air-exchange system (4.2.6) and operate the chamber in the environmental enclosure (4.2.5) for (24 ± 1) h prior to installing the air-sampling apparatus (4.2.7) and collecting the air sample as specified in 4.3.3.3.

4.3.5 Dynamic chamber test — Procedure B (see Figure 1)

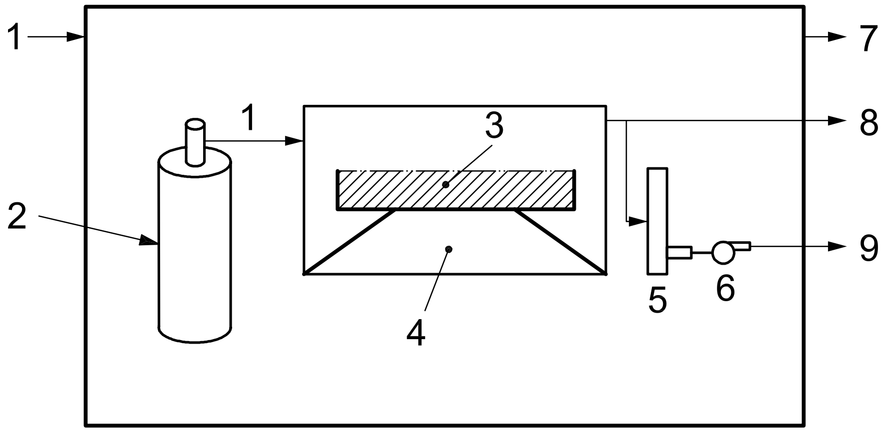
Place the specimen in the dynamic chamber (4.2.3), which has been cleaned and checked for background contamination as given in 4.3.2. Start the air-exchange system (4.2.6) and operate the chamber in the environmental enclosure (4.2.5). Install the air-sampling apparatus (4.2.7) and take the chamber air samples as specified in 4.2.3. Measure the chamber concentrations after approximately 1 h, 12 h, 1 day, 2 days, 4 days, 7 days, 14 days and 30 days. The exact time spacing is not critical, however, record the exact times of sampling (see 4.2.7).

4.3.6 Chemical analysis of the air sample

Analyse the air sample in accordance with good laboratory practices using a system specified in 4.2.9.

As specified in 4.5, include in the analysis report a listing of all identifiable compounds and their concentration in the air sample.

For trace compounds that are identifiable but not quantifiable, identify the compound and state the sample concentration as being below a specified detection limit in the test report (4.5).



Key

1	clean air in	6	air-sample pump
2	clean dry air	7	environmental chamber exhaust air
3	polyurethane foam specimen	8	dynamic chamber exhaust
4	dynamic chamber	9	air-sample discharge
5	absorber		

Figure 1 — Schematic of equipment and apparatus

4.4 Estimation of indoor air concentrations

4.4.1 General comments

The results of the dynamic chamber tests are used to estimate the indoor air concentration of VOCs in the calculation procedure. However, it is not possible in a laboratory evaluation to quantify the total effects of surface adsorption/desorption, variable product applications, changes in environmental conditions, ageing, product decomposition and interior wall finishing.

4.4.2 Procedure A

In this procedure, the average chamber concentration for each chemical identified shall be used to calculate an emission factor, E, using the expression:

$$E = C(Q/A)$$

where

E is the emission factor, mg/(m^2·h);

C is the equilibrium average chamber concentration, mg/m^3;

Q is the clean airflow rate through the chamber, m^3/h;

A is the exposed surface area of the thermal insulation product sample, m^2;

and

$$Q = B \cdot V_{\text{c}}$$

where

V_{c} is the dynamic chamber volume, m^3;

B is the dynamic chamber air-exchange rate (= 0,3 air exchanges per hour ± 5 %).

The calculation of the estimated indoor air concentration assumes the building to be in a steady-state condition. The indoor concentration for each chemical shall be calculated using a well-mixed, single-zone mass-balance model:

$$C_{\text{i}} = C_{\text{o}} + N/V_{\text{b}}$$

where

C_{i} is the indoor chemical concentration, mg/m^3;

C_{o} is the outdoor chemical concentration, mg/m^3 (assumed to be zero unless otherwise specified);

N is the total building source, mg/h (= $E \cdot A$);

V_{b} is the building ventilation rate, m^3/h.

Since the chamber test parameters were selected to simulate a field installation (250 m^2 of cellular plastic product installed in a 500 m^3 building with a ventilation rate of 0,3 air changes per hour), the calculated indoor air concentration for each compound will be equal to the measured chamber concentration at that loading and air-exchange rate.

4.4.3 Procedure B

In procedure B, the time-varying emission factor, E_t, for each compound (assuming a first-order decay) is given by:

$$E_t = E_0 \cdot \text{e}^{-Kt}$$

where

E_t is the emission factor at time t, $\text{mg/(m}^2 \cdot \text{h)}$;

E_0 is the initial emission factor, $\text{mg/(m}^2 \cdot \text{h)}$;

K is the first-order rate constant, h^{-1};

t is the time, h.

The emission factor or emission rate constants obtained in the dynamic chamber test shall be used in a mass balance model to estimate the indoor air concentrations for each chemical.

The estimated indoor air concentration profile for each chemical shall be calculated from the time-varying emission factor assuming a single point in time of installation. Since the individual adsorption/desorption characteristics of the chemicals are unknown, a simple mass balance model is used to calculate the estimated indoor chemical concentration profiles, using the same material loading and house parameters as in procedure A (4.4.2).

Alternatively, since the dynamic chamber is scaled according to a “typical” house, the chamber concentration profiles for each VOC can be scanned for the limiting time. This time shall be designated as the minimum period that must be provided prior to occupancy of the building.

4.5 Test report

The test report shall provide the following information:

a) information on the material and the sample preparation procedures;

b) a general description of the test facilities and equipment, including chemical sampling and analysis;

c) an outline of the experimental conditions and procedures, including the time and date of specimen preparation and testing, temperature, relative humidity, air-exchange rate, and the quantity of the specimen;

d) variations in the experimental procedures;

e) the air-sample identifier, all volatile organic compounds identified and selected for analysis, and the equivalent chamber VOC concentrations for each air sample;

f) the accuracy and detection limits of the system for each volatile organic compound identified and selected for analysis;

g) the emission factors and calculated maximum indoor air concentrations at 30 days for procedure A;

h) the first-order emission factor expressions and indoor air concentration profiles for each compound identified for procedure B;

i) the airing-out time (isolation and ventilation period) required to reach the permissible indoor air concentrations;

j) a listing of the permissible indoor air concentrations for all compounds selected for analysis;

k) the background chamber concentrations of volatile organic compounds.

4.6 Assessment of acceptability of the material

In procedure A, the calculated indoor concentration for each individual volatile organic compound shall be compared with the permissible indoor air concentration for that compound. If the identified VOCs do not exceed these concentration limits, the product is deemed acceptable.

In procedure B, all of the individual chemical concentration profiles shall be scanned and a minimum time period shall be established, after which none of the calculated indoor air concentrations for the individual compounds exceed the permissible indoor air concentration, as established by the material standard and/or a toxicologist.

If the minimum period is longer than 30 days, the material is not deemed acceptable.

In any analysis (head-space or procedure A/B), for all volatile organic compounds not identified, the testing laboratory shall contact an expert in toxicological assessment for an opinion on the health hazards of those compounds.

4.7 Accuracy

The accuracy of this test method is not known because interlaboratory data are not available.

5 Test method for air permeance of spray-applied polyurethane foam

5.1 General

This test method is to determine the air permeance of spray-applied polyurethane foam at various differentials with the intent of determining an assigned air permeance rate of the material at the reference pressure difference (ΔP) of 75 Pa.

The method is intended to assess flexible sheet or rigid panel-type materials using a 1 m × 1 m specimen size. The result of this test may be useful in determining the suitability of that material as a component of an air barrier assembly.

5.2 Number of samples

There shall be five samples of materials used to conduct this test.

5.3 Apparatus (see Figure 2)

5.3.1 Airtight test chamber

The airtight test chamber shall be at least 0,32 m deep and capable of receiving a 1 m × 1 m test specimen, anchored to the test chamber by means of a compression frame and clamping devices. The test chamber and compression frame shall be stiff enough to limit deflection within the operating flexibility of the gaskets used to seal the test specimen to the chamber. Two parallel ribbons of self-adhesive gasket material shall be applied at all sealing points of the apparatus/test assembly. The gasket ribbons shall be made of medium-density gasket material that can be fused or glued at the joints. The test apparatus shall contain an over-pressure control device and windows to verify the specimen installation.

5.3.2 Flow-measuring devices

The flow-measuring devices used to gauge the airflow through the test specimen shall be capable of measuring airflow rate up to $1\,880 \times 10^{-5}$ m^3/s, with an accuracy of ± 0,5 % of the reading.

5.3.3 Pressure-measuring device

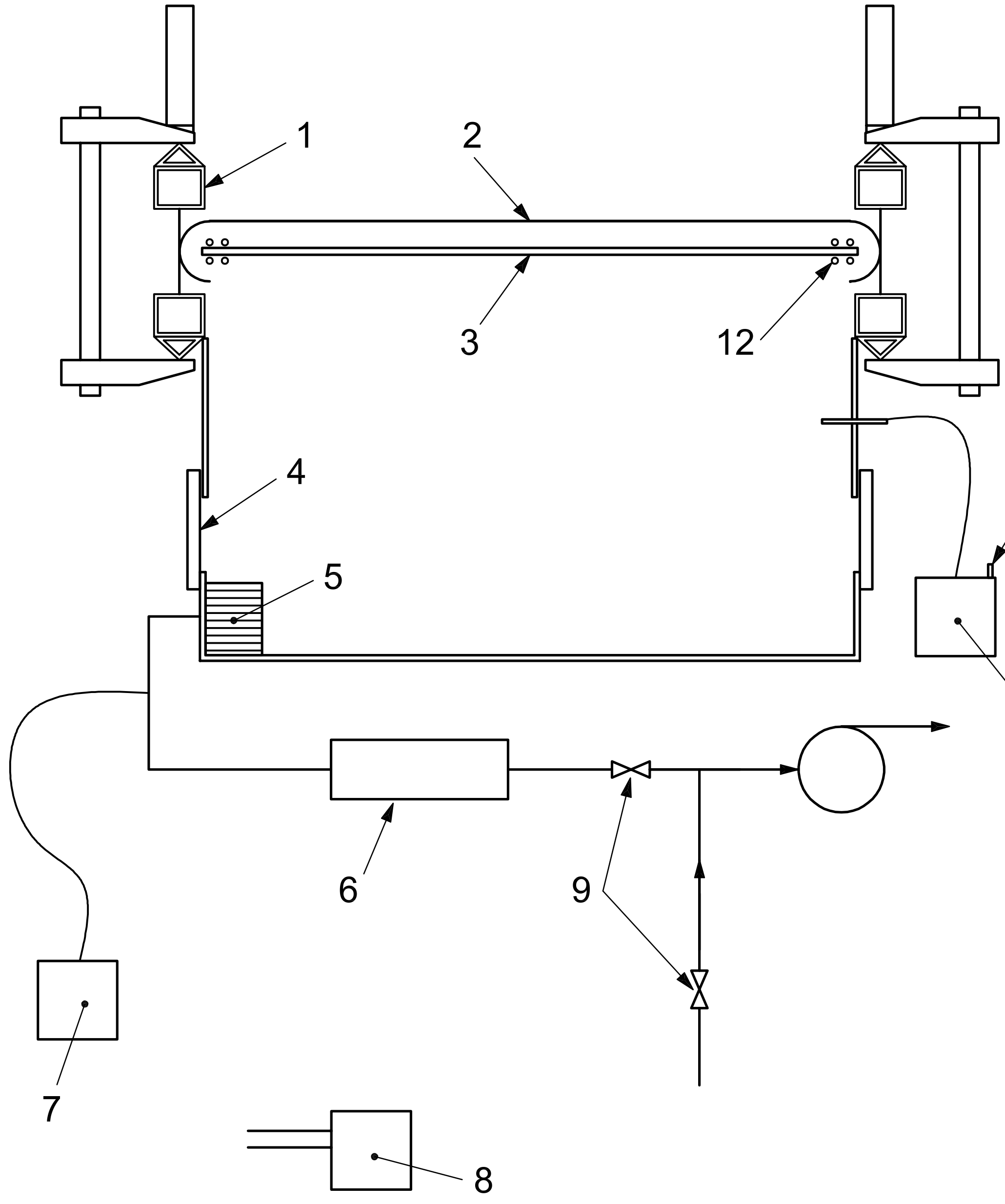
The static pressure differential across the test specimen shall be measured by pressure-measuring devices with an accuracy of ± 0,5 % of the pressure reading. The laboratory barometric pressure shall be measured with a device capable of measuring barometric pressure to within ± 0,5 % of the reading.

5.3.4 Piping

The piping connecting the flow-measuring devices and the vacuum blower shall be airtight and shall contain flow-control devices to regulate the static pressure across the test specimen to within ± 0,5 % of the pressure reading. The pipe connection to the test chamber shall contain an air filter to prevent dust or particulate matter from affecting the flow-measuring-device reading. The piping downstream and upstream of the flow-measuring device shall be designed so the flow regime does not affect the accuracy of the device. The piping shall contain a temperature-measuring device capable of measuring air temperature within to ± 0,1 °C to convert all flow rate measurement to STP units.

5.3.5 Vacuum blower

The blower used to create a vacuum in the test chamber shall be able to produce static pressure differential across the test specimen to within ± 0,5 % of the pressure reading.



Key

1	compression frame	7	temperature-measuring device
2	polyethylene film	8	barometric pressure-measuring device
3	test specimen	9	flow control device
4	window	10	DP measuring device
5	filter	11	laboratory reference
6	flow-measuring device	12	gasket ribbons

Figure 2 — General configuration of test apparatus

5.4 Test procedure for air permeance of spray-applied polyurethane foam

5.4.1 Conditioning of test specimens

All specimens shall be conditioned for 7 days at (21 ± 0,1) °C and (40 ± 5) % RH.

5.4.2 Thin sheet materials

Due to lack of rigidity, flexible materials shall be tested over a rigid support having an air permeance much greater than that of the test specimen. An open grill or wire mesh/screen, fabricated with welded wire having a minimum of 25 mm × 25 mm square grid, is recommended for this purpose due to its high air permeance. The wire mesh portion of the support should be welded to a solid metal frame which will be gasketed and compressed within the test frame.

Figure 3 shows the preparation for a typical flexible sheet material. The following procedure shall be used to seal the perimeter of the specimen:

a) apply a self-adhesive gasket ribbon (flexible elastomeric foam) over the frame of the wire mesh/screen around the entire perimeter of the test area under investigation (1 m × 1 m);

b) apply a second self-adhesive gasket ribbon along the perimeter of the first ribbon in a);

c) all joints in the gasket ribbons shall be fused or glued;

d) cut the flexible sheet material specimen to 1 100 mm × 1 100 mm;

e) upon removal of the protective paper over the self-adhesive gasket, install the specimen over the wire mesh/screen;

f) apply the self-adhesive gasket over the specimen so it lines up with the first ribbon in a), and then apply a second self-adhesive gasket along its perimeter;

g) all joints in the gasket ribbons shall be fused or glued;

h) cut polyethylene film (6 mils) to 1 400 mm × 1 400 mm;

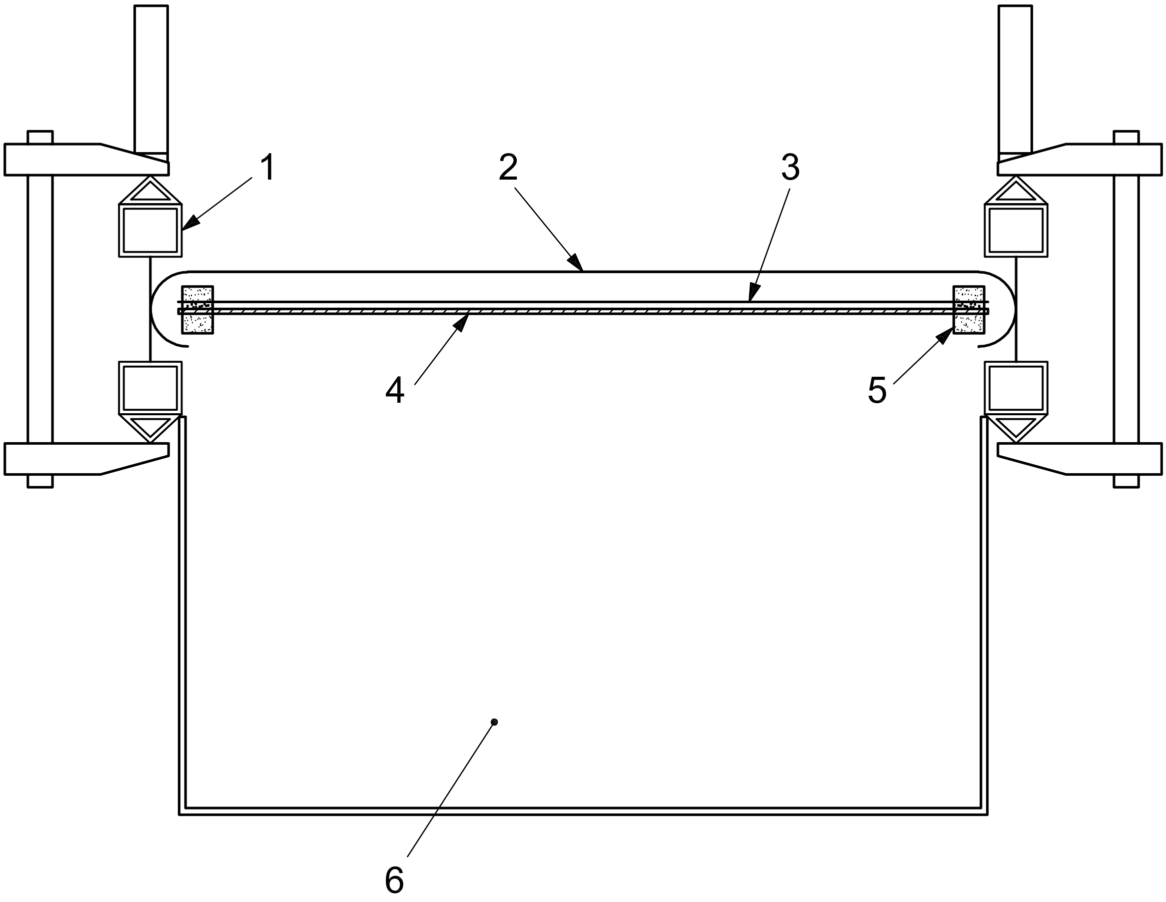
i) upon removal of the protective paper over the ribbon, cover the specimen with the polyethylene film;

j) cut the polyethylene film at each corner as per Figure 4;

k) apply two self-adhesive gaskets to the underside of the wire mesh/screen support (the gaskets should line up below the first ribbon installed in a);

l) upon removal of the protective paper over the gasket, fold and tape each corner of the film with construction tape to ensure complete airtightness as per Figure 5;

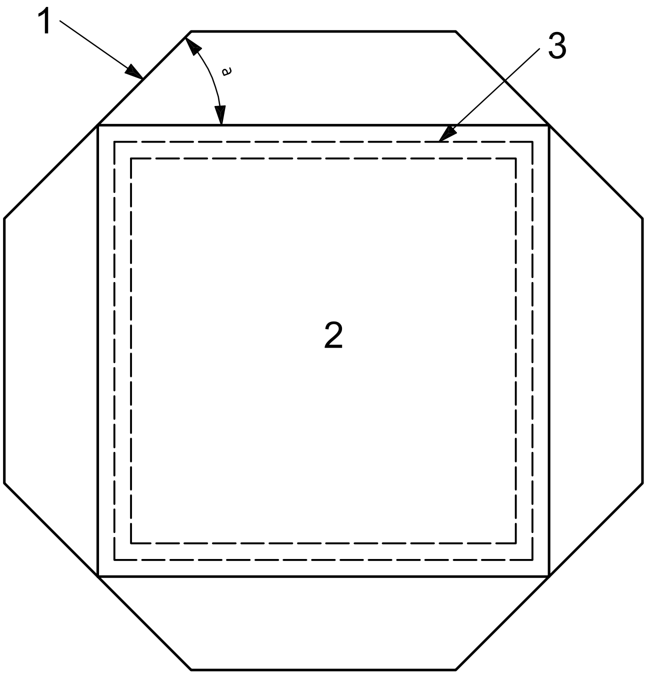
m) from the interior line of the adhesive gasket, cut all the exceeding polyethylene film.



Key

1	compression frame
2	polyethylene film
3	flexible specimen
4	open grill/screen mesh
5	gasket ribbons (adhesive on both sides)
6	test chamber (1 m by 1 m)

Figure 3 — Specimen holder for thin sheet specimens

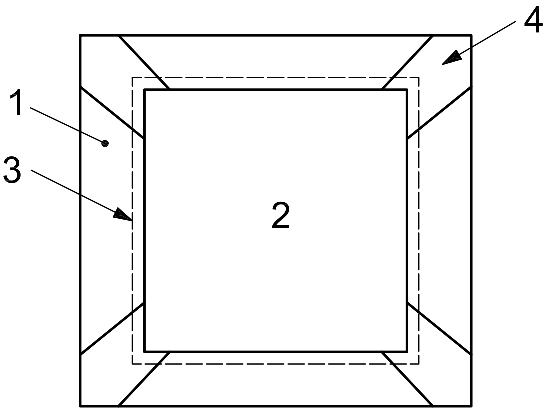


Key

1 polyethylene film
2 specimen
3 gasket ribbon

[a] Typically 45°.

Figure 4 — Top view of polyethylene placement over specimen with double-perimeter gaskets



Key

1 polyethylene film
2 specimen (1 m by 1 m)
3 gasket ribbon
4 tape

Figure 5 — Bottom view of polyethylene seal at double-perimeter gaskets on underside of rigid specimen or open mesh/screen for thin sheet specimen set-up

5.4.3 Rigid materials

Figure 6 shows the preparation for a typical rigid-panel-type material. The following procedure shall be used to seal the perimeter of the specimen:

a) apply a self-adhesive gasket ribbon over the rigid test specimen around the entire perimeter of the area under investigation (1 m × 1 m);

b) all joints in the gasket ribbons shall be fused or glued;

c) cut polyethylene film (6 mils) to 1 400 mm × 1 400 mm;

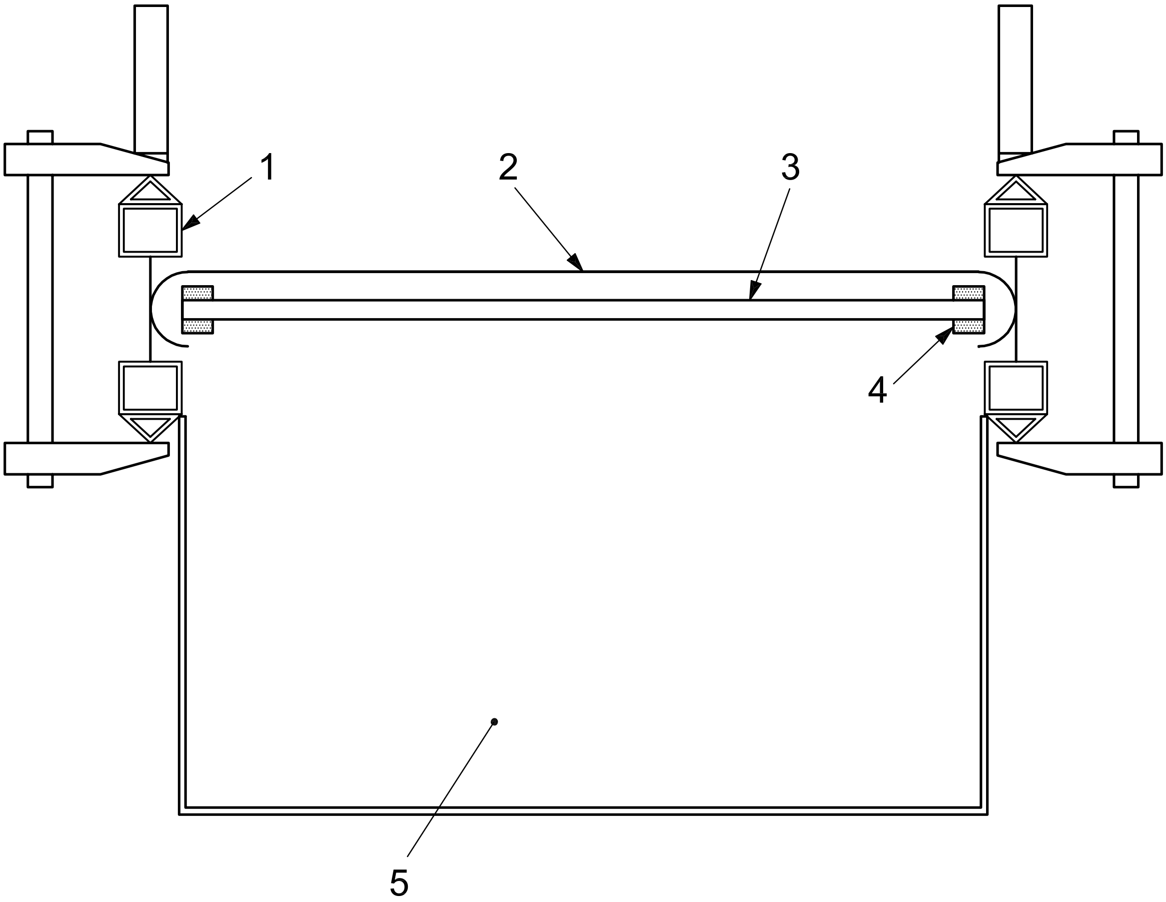
d) upon removal of the protective paper over the self-adhesive gasket ribbon, cover the specimen with the polyethylene film;

e) cut the polyethylene film at each corner as per Figure 4;

f) apply a second self-adhesive gasket ribbon to the underside of the specimen (the ribbon should be applied directly below the first ribbon installed in a), and seal corner junctions by fusing or glueing;

g) upon removal of the protective paper over the self-adhesive gasket ribbon, fold and tape each corner of the film with construction tape to ensure complete airtightness as per Figure 5;

h) from the interior line of the self-adhesive gasket ribbon, cut all the exceeding polyethylene film.



Key

1 compression frame	4 gasket ribbons (adhesive on both sides)
2 polyethylene film	5 test chamber (1 m by 1 m)
3 rigid specimen	

Figure 6 — Test set-up for rigid specimens

5.5 Test procedure for control

5.5.1 Control tests

The laboratory shall confirm the integrity and accuracy of the apparatus by verifying the following.

The impact of the open mesh/screen on the air-leakage-rate measurements shall be assessed. If not negligible, it shall be taken into account when calculating the air leakage rates.

The air-leakage rate across one specimen of a 12,5-mm-thick regular gypsum board shall be determined in accordance with procedures outlined in this part of ISO 8873 for a rigid-panel-type material. The air-leakage rate of the regular gypsum board shall not exceed 0,02 l/(s·m^2) at a pressure differential of 75 Pa within a justifiable margin of error.

5.5.2 Specimen testing

Proceed as follows:

a) install the sealed test specimen on the test chamber;

b) install the compression frame over the specimen;

c) check through the window that the specimen is properly placed;

d) anchor the specimen to the test chamber and compress the gaskets, as required;

e) measure the extraneous air leakage (Q_{ei}) of the test apparatus/specimen at various static pressure differentials (ΔP), near the six ΔP data points (25 Pa, 50 Pa, 75 Pa, 100 Pa, 150 Pa and 300 Pa), and correct the airflow rate values to STP (T = 20 °C and P_{atm} = 01,325 kPa);

f) cut the top section of the polyethylene film;

g) measure the total air leakage (Q_{ti}) at various static pressure differentials (ΔP), near the six ΔP data points (25 Pa, 50 Pa, 75 Pa, 100 Pa, 150 Pa and 300 Pa), or as specified by the agency or authority, and correct the airflow rate values to STP.

5.5.3 Calculation of air permeance

The flow rate across the specimen shall be Q_{ti} minus the extraneous flow rate of Q_{ei} when tested.

The flow rate equation shall be established through linear fitting of data by the method of least squares for the pressure readings. The coefficient of determination (r^2) shall be calculated and presented.

Air leakage data with $r^2 <$,99 shall not be accepted unless proper explanations are given for the data. All air-leakage rates shall be expressed in l/(s·m^2). The air-leakage rate at the reference pressure difference, ΔP, of 75 Pa shall be identified on the graph.

An error analysis shall be performed that includes an examination of the sources of error, an evaluation of systematic errors and propagation of error, and the resulting value of error on airflow values through the material tested.

5.6 Test report

The test report shall include the following information:

a) identification of the material tested including thickness;

b) material sampling procedure used;

c) measured airflow versus pressure difference data in graphic from (log/log graph) for the specimens; the air-leakage rate at the reference pressure difference, ΔP, of 75 Pa shall be identified on the graph;

d) calculated air permeance versus the pressure difference in tabular form;

e) error analysis.

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