INTERNATIONAL STANDARD

ISO 11907-3

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Plastics — Smoke generation — Determination of the corrosivity of fire effluents —

Part 3:

Dynamic decomposition method using a travelling furnace

Plastiques — Production de fumées — Détermination de la corrosivité des effluents du feu —

Partie 3: Méthode dynamique de décomposition utilisant un four mobile

Reference number
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Foreword

ISO (the International Organization for Standardization) is a world-wide 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.

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.

International Standard 11907-3 was prepared by Technical Committee ISO/TC61, *Plastics*, Subcommittee SC 4, *Burning behaviour*.

ISO 11907 consists of the following parts, under the general title *Plastics – Smoke generation – Determination of the corrosivity of fire effluents:*

- *Part 1: Guidance*
- *Part 2: Static method*
- *Part 3: Dynamic decomposition method using a travelling furnace*
- *Part 4: Dynamic decomposition method using a conical radiant heater*

Annex A forms an integral part of this part of ISO 11907. Annexes B and C are for information only.

Introduction

This method of test is one of a series being developed by ISO/TC61/SC4 concerning fire tests on plastics and other combustible materials to help assess the corrosivity of their fire effluents.

This test was developed in close connection with the work done in ISO/TC92/SC3.

During a fire, hot and humid smoke may be carried throughout the building, and its various products may condense and settle down on the surfaces of walls, floors and e.g. machines and electronic equipment. In principle, smoke should always be expected to have a corrosive action, irrespective of the composition of the material. Corrosion is generally defined as decomposition, beginning at the surface, of metallic and non-metallic materials. The degree of damage, however, is specific both to the composition of the smoke and to the nature of the materials. The concentrations of the harmful substances depend on e.g. the ventilation and the scale of the fire, while the loss itself depends partly on factors unrelated to the actual fire, such as the air conditions in the rooms of the building, the hygroscopic behaviour of the construction materials and the nature, scale and timing of the rebuilding work.

Plastics – Smoke generation – Determination of the corrosivity of fire effluents –

Part 3:
Dynamic decomposition method using a travelling furnace

WARNINGS

1 Avoidance of misleading inferences

This standard method of test should be used solely to measure and describe the properties of materials, products or systems in response to heat or flame under controlled laboratory conditions and should not be considered or used by itself for describing or appraising the fire hazard of materials, products or systems under actual fire conditions or as the sole source on which regulations pertaining to the corrosivity of fire effluents are based.

2 Avoidance of danger to test operators

a) This test procedure involves combustion processes in which fire hazards may exist from combustion products. To avoid accidental leakage of hazardous combustion products into the surrounding atmosphere, the entire system (combustion apparatus and exposure system) should be placed in a fume cupboard or under a canopy hood.

b) The venting system shall be checked for proper operation before testing and shall discharge into an exhaust system with adequate capacity.

c) As, in unfavourable circumstances, extremely rapid combustion or explosion can occur when the device is in operation, a protective screen between the operator and the tube is recommended and, in addition, care should be taken to ensure that the gas outlet at the end of the quartz tube is of as large a diameter as possible.

1 Scope

1.1 This part of ISO 11907 specifies a test method for generating thermal decomposition products from plastic materials or products in an air stream and assessing the corrosive effects of these fire effluents on targets. It is not intended that the results be used to assess the corrosivity hazard of fire atmospheres.

1.2 It describes a dynamic decomposition test method for the assessment of the corrosion damage of a standardized target by the change in its electrical resistance.

1.3 The decomposition model is suitable for simulating the main fire scenarios, such as a smouldering fire, a developing fire with flame formation, and a fully developed fire. The decomposition model enables a constant flow of smoke to be maintained throughout the exposure time.

The decomposition model and exposure model enable the potential for a contribution to corrosivity to be estimated.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11907. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11907 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 11907-1:1998, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 1: Guidance.*

ISO 11907-2:1995, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 2: Static method.*

ISO 11907-4:1998, *Plastics – Smoke generation – Determination of the corrosivity of fire effluents – Part 4: Dynamic decomposition method using a conical heater.*

3 Definitions

For the purposes of this part of ISO 11907, the following definitions apply.

3.1 corrosion: The reaction of a metallic material with its environment, resulting in a measurable change of the material and possibly in an impairment of the functioning of a metal part or of an entire system.

NOTE – In most cases, the reaction is electrochemical. In others, however, it may be chemical (non-electrochemical) or physical.

3.2 corrosion damage: The physical and/or chemical damage or impaired function caused by chemical action.

3.3 fire effluent: The totality of gases and/or aerosols (including suspended particles) created by combustion or pyrolysis.

3.4 fire model: A laboratory process, including the apparatus, the environment and the test procedure, intended to represent a certain phase of a fire.

3.5 fire scenario: A detailed description of conditions, including environmental, of one or more stages from before ignition to completion of combustion in an actual fire at a specific location, or in a real-scale simulation.

3.6 corrosion target: The sensor used to determine, under specified test conditions, the degree of corrosion damage.

NOTE – This sensor can be a product, a component or a reference material used to simulate them.

4 Principle

An annular furnace is set to a specified temperature and is moved over the test specimen located in a quartz cuvette inside a quartz glass tube through which air is passed at a specified flow rate. The conditions can be chosen to simulate a smouldering or developing fire as well as a developed fire (see ISO 11907-1). A corrosion target consisting of a copper printed wiring board is exposed to the fire effluents and condensation is enhanced by using a cooling system. Condensed products react with the copper if they are corrosive, and the change in resistance of the target is used to denote the corrosion hazard.

5 Apparatus

5.1 Combustion apparatus

5.1.1 The combustion apparatus consists of a quartz tube (see 5.1.2), an annular furnace (see 5.1.3), a flow meter (see 5.1.4) and a cuvette (see 5.1.5), generally arranged as shown in figure 1 (see also 6.1).

5.1.2 The quartz tube is $\left(1\,000^{+300}_{\ \ 0}\right)$ mm long with an outer diameter of (40 ± 1) mm and a wall thickness of (2 ± 0,5) mm

5.1.3 The annular furnace, which encloses the quartz tube, is (100 ± 1) mm long and able to traverse the quartz tube coaxially at a speed of (10 ± 0,5) mm/min.

NOTE – Furnaces with the temperature distribution as required in 6.2.3 are commercially available.

The power of the furnace shall be capable of maintaining the temperature required in 6.2.

The furnace heater incorporates a thermocouple used to regulate the temperature of a reference body in conformance with 6.2.3.

5.1.4 The flow meter is capable of measuring air flow per minute (fresh/room air) with an accuracy of 2 %.

5.1.5 As sample holder, a cuvette is used. The cuvette is half a quartz tube with a wall thickness of (1,7 ± 0,2) mm, a height of (15 ± 1) mm and a length of $(400^{+10}_{\ \ 0})$ mm. At each end of the cuvette, there is a 2 mm high lip (see figure 2).

5.1.6 An environmental chamber capable of conditioning at (23 ± 2) °C and (50 ± 5) % RH shall be provided.

5.1.7 An environmental chamber for post-test exposure of the target at (23 ± 2) °C and (75 ± 5) % RH shall be provided.

5.2 Reference body

The reference body consists of a strip, measuring (200 ± 1) mm × (5 ± 0,1) mm × (2 ± 0,1) mm, of austenitic stainless steel. In the middle of the reference body, there is a groove, typically 1 mm deep, 1,2 mm wide and 10 mm long, in which a thermocouple (NiCr-Ni or chromel-alumel) with 1 mm outside diameter is hard-soldered with high-melting silver. The reference body is supported on the underside by two transverse rods of (1 ± 0,1) mm diameter (see figure 3).

In use, the reference body shall be connected to a temperature recorder providing readings to an accuracy of ± 0,5 %.

Before the first measurement, the reference body shall be annealed in air twice at a temperature of (550 ± 50) °C.

5.3 Timing device

The timing device shall be capable of recording elapsed time to the nearest second and shall be accurate to within 15 s in 1 h.

5.4 Corrosion target

The corrosion target shall consist of a copper printed wiring board (PWB) circuit (see figure 4) made by etching a copper-plated laminate base to provide 36 conductor tracks each 52 mm long, 0,3 mm wide and 17 µm thick, at a spacing of 0,3 mm, on a laminated epoxy baseplate having the following characteristics:

Dimensions: $\left(30_{-0,3}^{\;0}\right)$ mm $\times$ $\left(60_{-0,3}^{\;0}\right)$ mm $\times$ $\left(1{,}5_{-0,3}^{\;0}\right)$ mm

Resistance: (8,0 ± 0,5) Ω

5.5 Holder with cooling system

The target holder shall enable one copper PWB to be cooled during the exposure, as shown in figure 5. It shall be made from a stainless-steel block. The cooling water shall flow through two horizontal bores which are connected by a vertical bore. The lower and upper openings of this bore shall be closed. The target shall be attached with two clamps, e.g. as shown in figure 5.

Unless otherwise specified by the referring standard (in relation to a special test objective), normal tap water at (15 to 30) °C shall be passed through the cooling system at a flow rate of approx. 1,5 l/min.

5.6 Alternative corrosion targets

In annex A, examples of alternative corrosion targets are listed. If one of these targets is used, the procedure as described in annex A shall be followed.

5.7 Balance

The balance shall be capable of weighing to an accuracy of ± 0,01 g

5.8 Resistance-measuring device

The device shall be capable of measuring resistance to an accuracy of ± 0,01 Ω over the range (5 to 15) Ω.

6 Setting-up and calibration procedures

6.1 Siting of the apparatus

Site the apparatus in a laboratory fume cupboard (exhaust hood) so that the test is carried out in a substantially draught-free atmosphere.

6.2 Calibration

6.2.1 Measuring the test temperature

Determine the test temperature and the temperature distribution (see 6.2.3 and 6.2.4) periodically using the reference body.

6.2.2 Test sequence

6.2.2.1 Locate the furnace in position 1 (see figure 1) and set it to maintain the required temperature. After the furnace temperature has stabilized, check it using the reference body (5.2) as follows:

Put the reference body in the quartz tube half way between positions 1 and 2 of the furnace, connect the air duct to the quartz tube and set it to the air flow required. Unless otherwise specified by the referring standard, pass air at (100 ± 5) l/h through the quartz tube. Traverse the furnace to position 2 at (10 ± 0,5) mm/min (see figure 1).

Record the highest temperature observed as the reference body temperature.

6.2.2.2 Repeat the procedure of 6.2.2.1 to obtain at least three measurements using the same furnace temperature. If necessary, adjust the equipment until the deviation of three successive individual results from their average is within 3 %.

6.2.3 Temperature distribution

The variation of the reference body temperature with time shall conform to table 1 with the air flow set at (100 ± 5) l/h. The time $t(T_{max})$ used in table 1 is the time taken for the temperature to reach its maximum value T_{max}. The reference body temperature 5 min and 10 min either side of this time shall be as given in table 1.

Table 1

Elapsed time after setting furnace in motion minutes	**Temperature at measurement point** % of T_{max}
$t(T_{max}) - 10$	15 ± 10
$t(T_{max}) - 5$	65 ± 10
$t(T_{max})$	100
$t(T_{max}) + 5$	70 ± 10
$t(T_{max}) + 10$	45 ± 10

6.2.4 Test temperature

Take the test temperature to be the average of the three reference body temperatures.

6.2.5 Reference curve

By plotting a graph of furnace temperature versus reference body temperature over a series of test conditions, obtain the operating reference curve for the apparatus. From this, it is possible to establish the furnace temperature required to heat a given reference body to between 200 °C and 800 °C at a given air flow rate.

6.3 Preparation of the PWB

Prepare the PWB by cleaning with a pumice-based acidic powder formulation. Rub the PWB with a piece of moist cotton wool containing the cleaning powder. Thoroughly wash the PWB with deionized water and carefully wipe it dry.

NOTE – By this method, copper surfaces are cleaned chemically as well as physically. The acidic chemical cleaning action removes oxides and wets the PWB surface. No residual film remains after rinsing and drying. Circuits which have been subjected to this treatment show no sign of corrosion in simple condensation tests.

Solder two insulated copper wires, each approximately 0,5 m long, to the end points of the conductor track.

7 Preparation of test samples

7.1 Number of test samples

Carry out each test in triplicate.

7.2 Homogeneous specimens

Determine the specific density (mass per unit area) of each specimen by measuring its dimensions to within ± 0,1 mm and weighing it to within ± 0,05 g.

If the density is greater than or equal to 400 kg/m^3, then cut the specimen to a size of
$l \times w \times d = 400 \text{ mm} \times 15 \text{ mm} \times 2 \text{ mm}$.

If the density is less than 400 kg/m^3, the thickness of the specimen is measured so that the mass per unit length (g/cm) is equal to that of a material with a density of 400 kg/m^3.

i.e.:
For a material with density $\rho = 400$ kg/m^3,

$$\frac{m}{l} = \rho \times w \times d$$

Since the width $w = 1{,}5 \times 10^{-2}$ m, and $d = 2 \times 10^{-3}$ m

$$\frac{m}{l} = 1{,}2 \times 10^{-2} \text{ kg/m}$$

If the density ρ of a material is 40 kg/m^3, then the sample thickness d may be calculated as follows:

$$d = [1{,}2 \times 10^{-2} \text{ kg/m}]\ [40 \text{ kg/m}^3 \times 1,5 \times 10^{-2} \text{ m}]$$
$$= 0{,}02 \text{ m}$$

7.3 Films and fabrics

Arrange cut sections of films and fabrics in layers so that the total mass distributed evenly over the length of specimen is between 3,6 g and 7,2 g. The number of layers as a function of the mass per unit area m_a shall conform to table 2.

Table 2

Mass per unit area, m_a g/m^2	**Number of layers**
≤ 200	6
> 200 and ≤ 300	4
> 300 and ≤ 400	3
> 400 and ≤ 600	2
> 600	1

7.4 Laminates

Separate each layer of a laminated material or product to enable each type of layer to be tested individually, stacked in conformance with table 2 as applicable.

7.5 Loose samples

Distribute loose bulk materials evenly in the cuvette at 1,2 g per 100 mm length. Compact fine-particle-based bulk materials at a pressure of 1,5 g/cm².

NOTE – The thickness of the test specimen should not exceed 30 mm.

If self-ignition occurs and the flames are not propagating parallel to the furnace speed v_f of (10 ± 0,5) mm/min, then repeat the test using the specimen segmentation in figure 6.

7.6 Conditioning

Unless otherwise agreed by the parties involved, condition the test samples for at least 24 h at (23 ± 2) °C and (50 ± 5) % RH.

8 Procedure

8.1 Connect the PWB with the resistance measuring device. Measure the initial resistance R_i of the target to ± 0,02 Ω at (23 ± 2) °C. Clamp the PWB on the holder with its cooling system and position the holder approximately 200 mm into the quartz tube from the downstream end, with its width disposed horizontally and the PWB on top (see figure 1).

NOTE – Exposure in a through-flow chamber downstream of the decomposition apparatus is described in informative annex B.

8.2 Unless otherwise agreed by the parties involved, set the furnace in position 1 (see figure 1) to obtain a temperature of (600 ± 20) °C on the reference body (see 6.2).

8.3 Unless otherwise agreed by the parties involved, pass air at (100 ± 5) l/h through the quartz tube and over the test specimen in the opposite direction to the furnace travel.

NOTE – Apparatus can be used at other temperatures and/or air flow rates to simulate main fire scenarios as characterized in ISO/TR 9122-1[3], e.g. smouldering, developing or fully developed fires.

8.4 Position the specimen with its width horizontal on the base of the cuvette and with the front of the specimen 500 mm from the end of the quartz tube.

8.5 Turn on the water supply (see 5.5) to the PWB holder.

8.6 Start the motorized drive of the furnace so that the furnace begins to move at a speed of (10 ± 0,5) mm/min past the specimen towards position 2 (see figure 1).

8.7 Pass the fire effluents over the corrosion targets continuously during the test until the furnace has reached position 2. Stop the motorized drive of the furnace and take out the PWB.

8.8 Within 5 minutes of removal from the quartz tube, place the PWB in an environmental chamber at (23 ± 2) °C and (75 ± 5) % RH and measure the resistance of the PWB to 0,02 Ω after storage times of 1 h and 24 h.

8.9 Record observations of the visual effects of corrosion on the target (e.g. pitting, bridging, etching away, soot deposit).

9 Cleaning procedure

9.1 Cuvette

Withdraw the cuvette and take out the residues of the sample, taking necessary precautions to avoid operator exposure to combustion products.

Burning out of the cuvette has been found to be acceptable (see 9.3).

9.2 Holder with cooling system

Clean the soiled surface using the following procedure:

- use suitable gloves;
- clean all exposed surfaces with commercial cleaner.

Air-dry and assemble the components for the next test.

9.3 Quartz tube

It is important that the quartz tube be kept clean to ensure that the exposed materials do not become contaminated with the fire effluents from the residues left from earlier tests.

Burning out of the quartz tube and the cuvette by moving the heated furnace (800 °C) from position 2 to position 1 again has been found to be acceptable.

9.4 Post-exposure of targets (optional)

If a longer post-ageing is required by the parties involved, store the PWB target at (23 ± 2) °C and (75 ± 5) % RH in an enclosed chamber. At intervals of 24 h after removal from the test, measure the resistance of the PWB target as R_x, where x equates to the number of hours after removal from the test.

NOTE – These atmospheric conditions can be obtained by inserting an open basin containing a saturated aqueous sodium chloride solution into the chamber.

10 Expression of results

Express the corrosivity R_{COR} as the percentage change in the PWB resistance relative to the original value of the resistance, using the following equation:

$$R_{\text{COR}} = 100\left[\frac{R_\text{i}\, R_\text{f}}{8\left(R_\text{f} - R_\text{i}\right)} - 1\right]^{-1}$$

where R_i is the initial resistance and R_f is the final resistance, both measured at (23 ± 2) °C.

NOTE – The manufacturing process for the targets does not result in identical resistance values for each. The equation for expressing the corrosivity has therefore been normalized by bringing the initial resistance to 8 Ω.

11 Precision

The precision of this test method is not known because inter-laboratory data are not available. Inter-laboratory data are being obtained, and a precision statement will be added at the following revision.

12 Test report

The test report shall include the following information:

a) a reference to this part of ISO 11907 and to any referring standard;

b) a detailed description of the material tested;

c) details of the preparation of the test specimens;

d) the reference body temperature and the rate of flow of the combustion air;

e) any major observations on the burning behaviour, e.g. melting behaviour, self-ignition, method of flame propagation;

f) the exposure conditions, including details of post-ageing, if any (see 8.1 and 8.8);

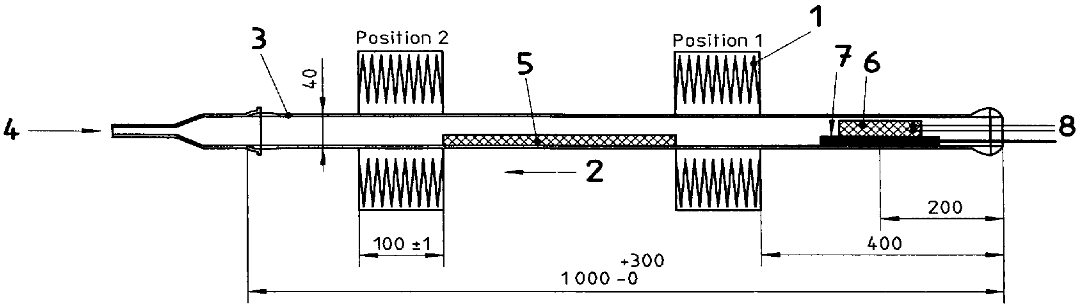
g) the corrosivity R_{COR} and the average R_{COR} with standard deviation;

h) observations on the visual effects of corrosion on the target;

i) if applicable, details of post-exposure (see 9.4);

j) the date of the test.

Dimensions in millimetres



Key

1 Ring furnace
2 Direction of furnace travel
3 Quartz tube
4 Primary air stream
5 Test sample
6 Corrosion detector (PWB)
7 Holder (cooled)
8 Measurement of resistance

Figure 1 – Typical decomposition apparatus and exposure of single corrosion target

Dimensions in millimetres

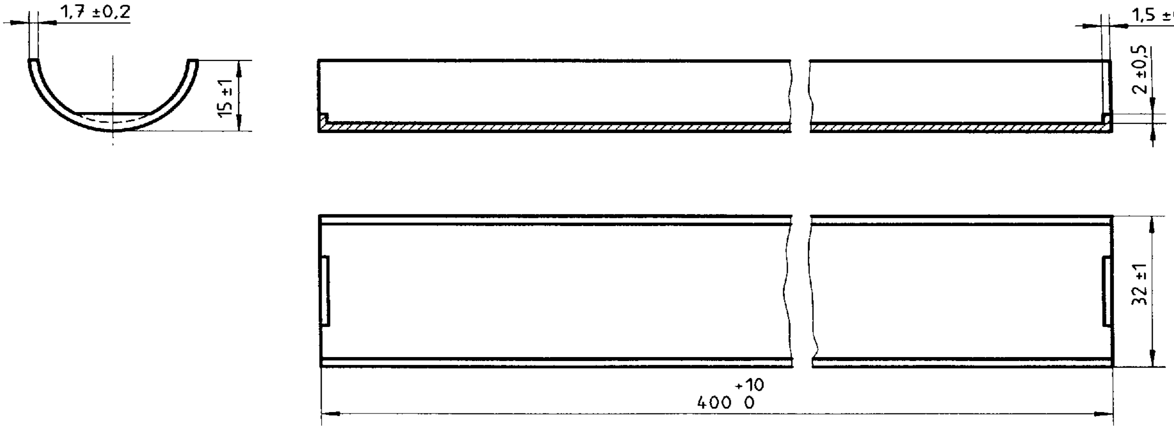
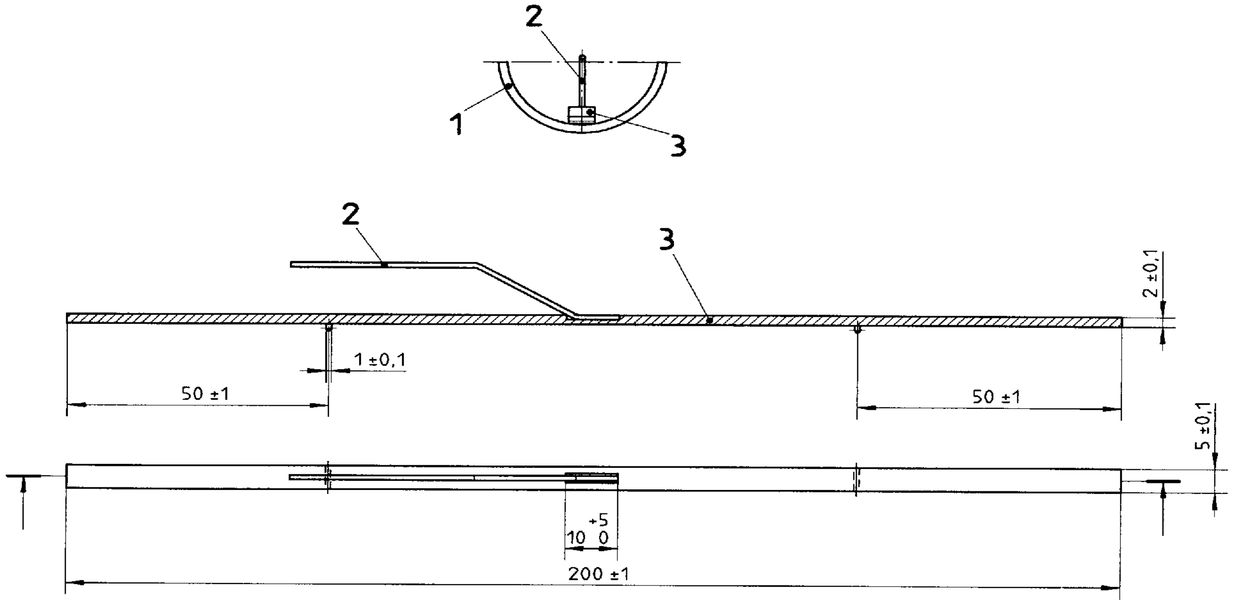


Figure 2 – Cuvette

Dimensions in millimetres



Key

1	Cuvette
2	Thermoelement
3	Reference body

Figure 3 – Reference body

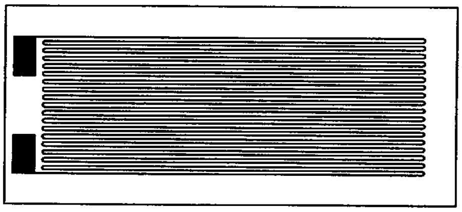


Figure 4 – Copper printed wiring board

Dimensions in millimetres

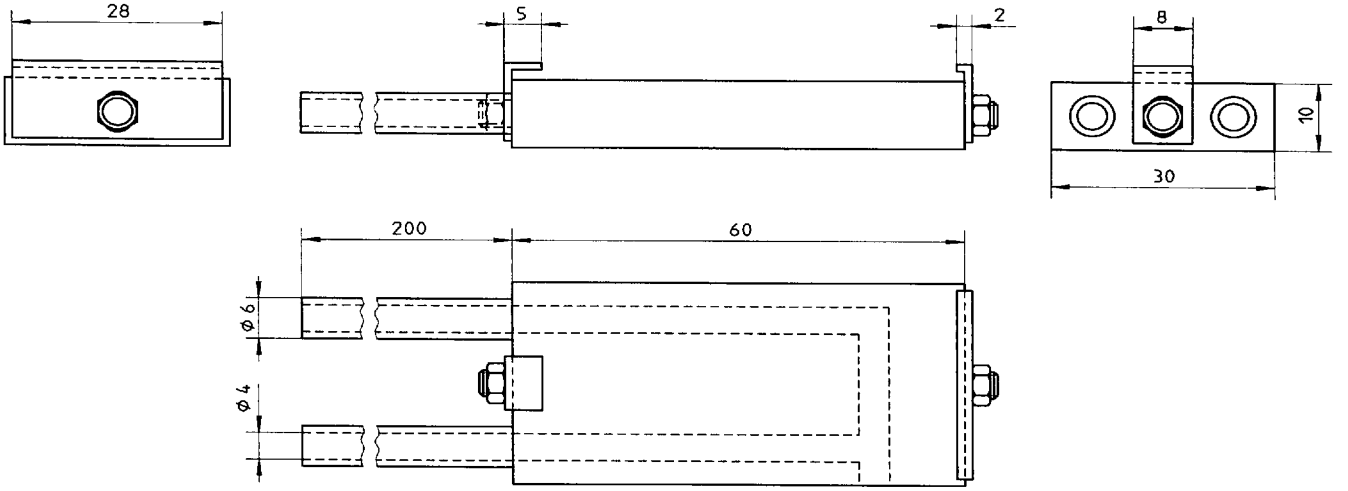
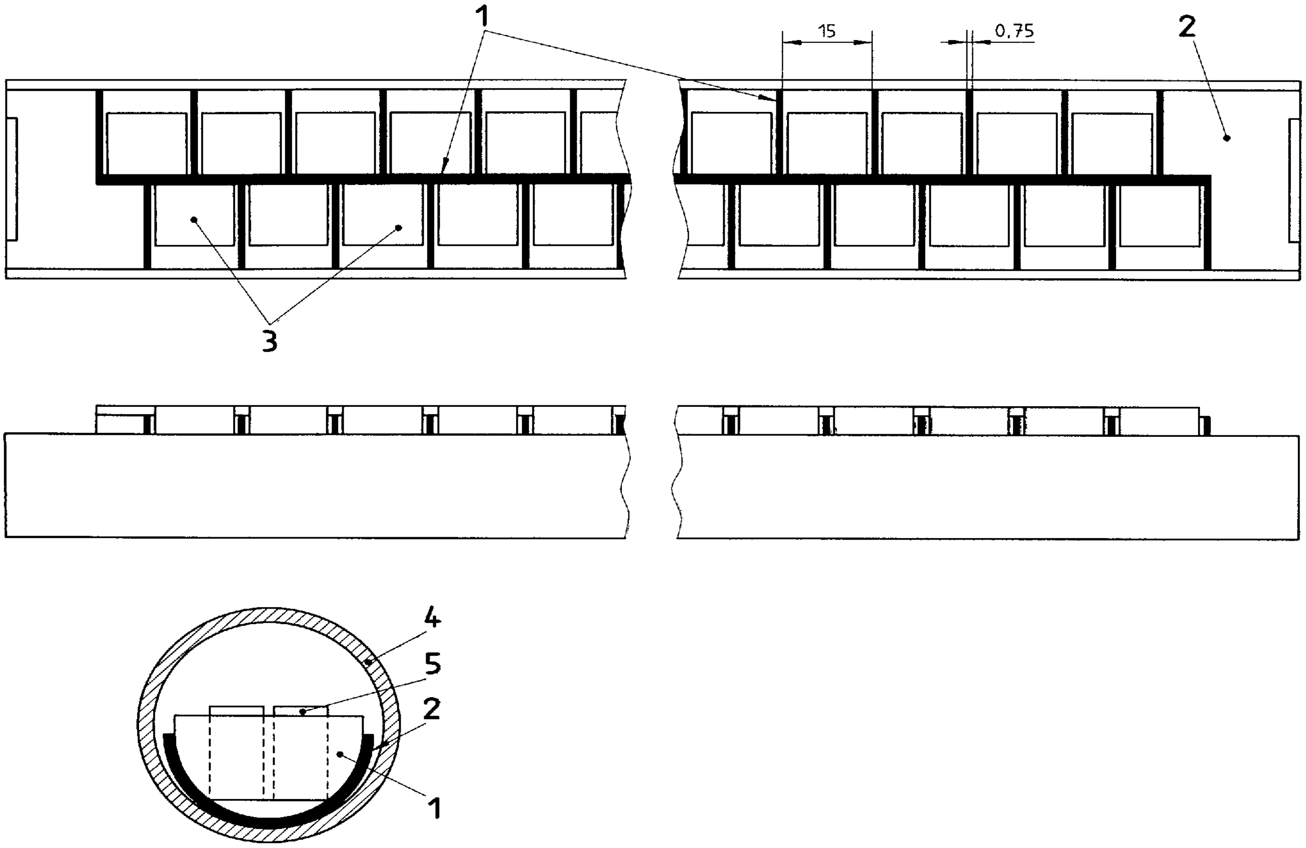


Figure 5 – Water-cooled holder for corrosion targets

Dimensions in millimetres



Key

1 Sheet-steel insert
2 Cuvette
3 Total of 48 test samples
4 Quartz tube
5 Test sample

Figure 6 – Segmentation with loose bulk materials

Annex A
(normative)

Alternative corrosion targets

A.1 Sheet-metal targets

The sheets may consist, for example, of the following metals:

- iron;
- steel;
- copper;
- aluminium;
- zinc.

The dimensions of each sheet shall be 60 mm × 20 mm × the maximum available thickness between 0,7 mm and 1 mm.

Clean and degrease the sheets prior to exposure by placing them in pure ethyl alcohol and then exposing them to ultrasonic vibration for 10 min. After removal from the alcohol bath, spray the sheets with fresh ethyl alcohol and dry them in a current of hot air. To remove any corrosion products that might be present, immerse the targets in a second bath for 15 min in a cleaning solution conforming to table A.1 and maintained at (20 ± 2) °C.

Table A.1 – Cleaning solutions

Target	**Cleaning solution**
Iron	10 % (*V*/*V*) hydrochloric acid
Steel	10 % (*V*/*V*) hydrochloric acid
Copper	5 % (*V*/*V*) sulfuric acid
Aluminium	5 % (*V*/*V*) nitric acid
Zinc	5 % (*V*/*V*) acetic acid

After removal from the second bath, rinse the sheets with distilled water and dry them in an oven at 70 °C for 1 h.

A.1.1 Holder with cooling system

Clamp each sheet-metal target on the holder and position the holder in the chosen exposure chamber.

A.1.2 Holder without cooling system

The target holder shall be constructed as shown in figure A.1. The holder shall be made of glass, precision ceramic material, etc., and have a thickness of 5 mm.

Place the target in the slots in the holder.

Position the holder in the quartz tube (see figure 1) or in a flow-through exposure chamber (see annex B).

A.1.3 Assessment of corrosion damage

Measure the corrosive attack on the metal by monitoring the change in the mass of each target. Record the following values:

a) the exposed area A, in square metres;

b) the change in mass Δm, in grams;

c) the density ρ, in kilograms per cubic metre;

d) the duration of the corrosion test t, in hours;

e) the storage time t_S after exposure, in days;

f) a pitting or surface roughness evaluation (qualitative).

Remove any loose corrosion products on the target carefully by brushing under flowing water.

Dry each target and determine its mass m_2 to the nearest milligram, using a balance accurate to 0,1 mg.

Calculate the change in mass Δm, using the following equation:

$$\Delta m = m_2 - m_1$$

where

m_1 is the mass of the target before exposure;
m_2 is the mass of the target after exposure.

Note that, in some cases of corrosion, exposure will lead to accelerated oxidation, in which case Δm will be positive, indicating a mass gain. Otherwise Δm will be negative, indicating a loss in mass due to corrosion.

Calculate the values of relevant parameters, such as those listed in table A2.

Table A.2 – Parameters which may be used to characterize corrosive attack

Parameter	**Symbol**	**Unit**	**Formula**
Material consumed per unit area	m_a	$g \cdot m^{-2}$	$-\Delta m/A$
Increase in material per unit area	m_z	$g \cdot m^{-2}$	$+\Delta m/A$
Reduction in thickness	$-\Delta d$	mm	$-\Delta m/A \cdot \rho$
Rate of consumption of material per unit area	v	$g \cdot m^{-2} \cdot h^{-1}$	$-\Delta m/A \cdot t$

A.2 Other resistance targets

When measuring increased electrical resistance due to conductive metal loss, other electrical resistance targets have also been found to be useful. These targets are composed of two identical elements. While both the elements are exposed to the combustion products, only one of them is used for measuring the corrosiveness of the combustion products. The other is protected and used as a reference element. Both the elements are used in a modified Kelvin bridge circuit to determine the increase in resistance of the target. In the circuit, the protected element serves as a reference and also provides temperature compensation.

A.3 Test report

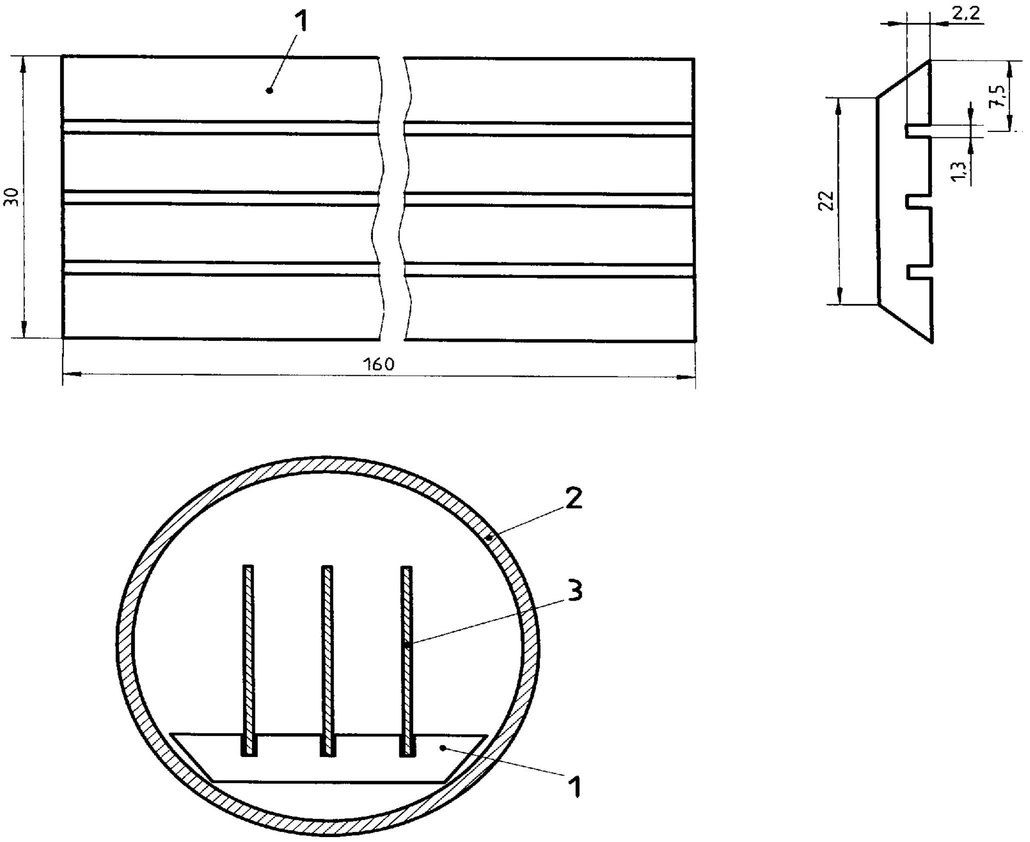
The test report shall include the following information in addition to the items listed in clause 11:

a) a full description of the corrosion targets exposed;

b) a description of any changes in the appearance of the corrosion targets, e.g. pitting, change in surface gloss;

c) any other physical or chemical changes observed, e.g. in surface roughness, cracking, electrical resistance.

Dimensions in millimetres



Key

1 Corrosion-detector holder
2 Quartz tube
3 Corrosion detector

Figure A.1 – Holder without cooling system

Annex B
(informative)

Exposure in a flow-through chamber

The use of a flow-through chamber can give the following advantages:

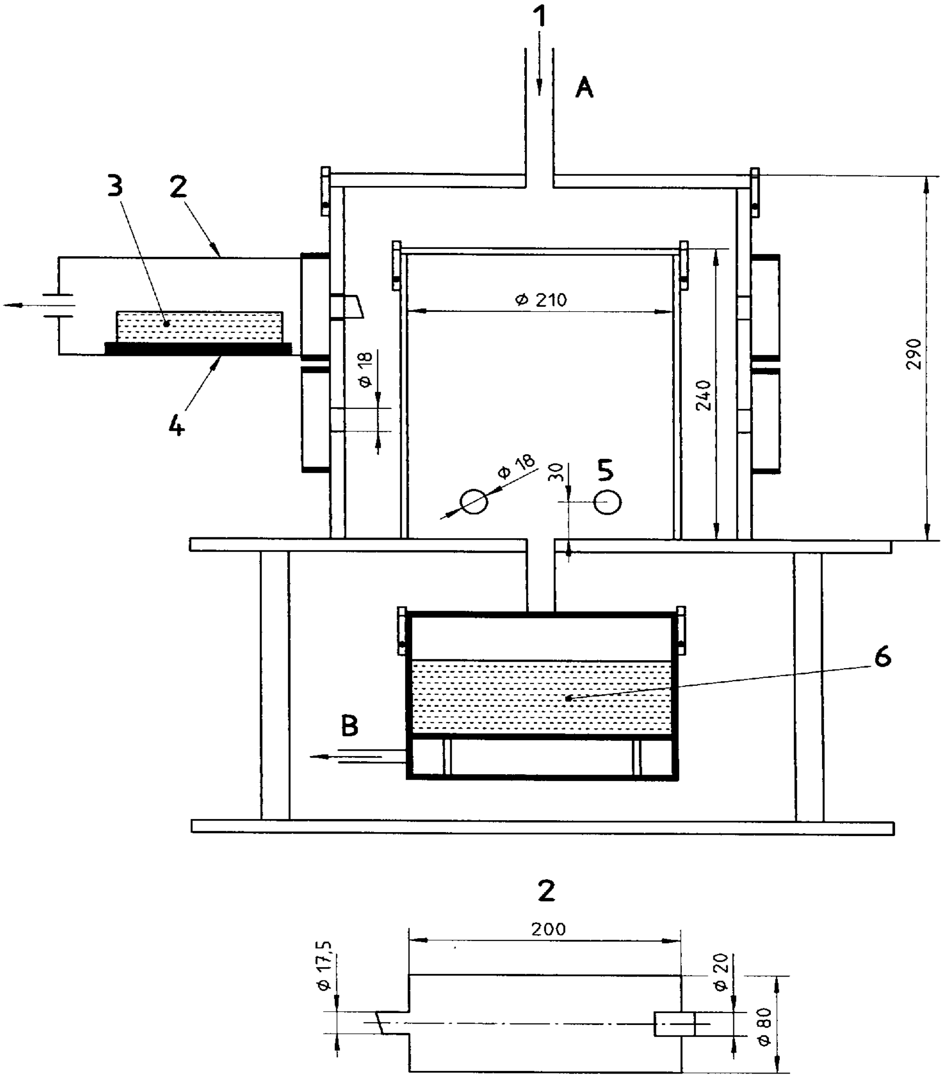
- larger targets and/or a greater number of targets can be exposed;

- a secondary air stream can be introduced to provide cooling and dilution effects.

A typical flow-through exposure chamber is cylindrical with a diameter of 290 mm and height of 290 mm. Inside this cylinder is a cylindrical closed section with a diameter of 210 mm and height of 240 mm. The volume of the chamber through which the fire effluents flow is (11^{+1}_{0}) litres. The construction of such a chamber is shown in figure B.1. The corrosion targets are exposed in cylindrical exposure tubes made of poly(methyl methacrylate) (PMMA) which can be fixed to the outer wall of the chamber. The relation between the volume flow rate at the top of the chamber (point A) and the flow rate at the outlet point B are chosen so that 60 % of the incoming flow is sucked away at point B. Hence a stream of combustion products flows over the corrosion targets. Figure B.2 shows the components of the equipment assembled.

The flow-through chamber described above is similar to that used for head-nose exposure in the related toxicity test given in ISO/TR 9122[3],[4].

Dimensions in millimetres

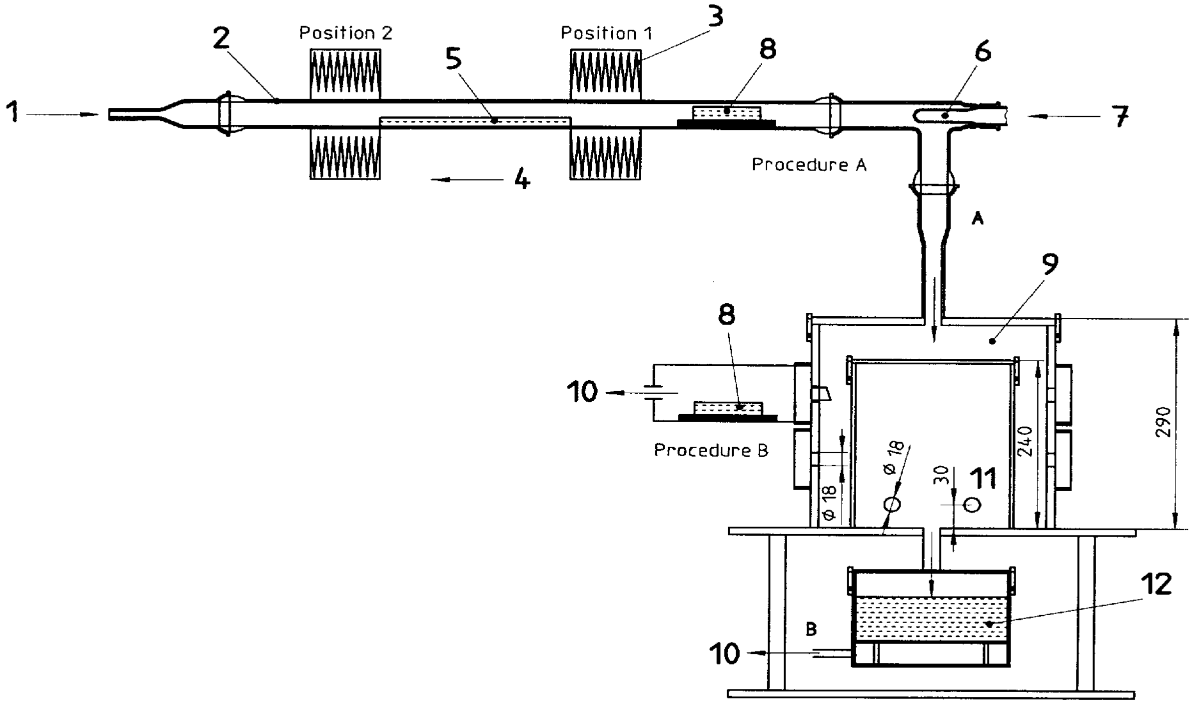


Key

1 Fire-effluent input
2 Exposure tube
3 Corrosion target
4 Target holder (uncooled)
5 Four holes
6 Cotton wool

Figure B.1 – Typical flow-through exposure chamber

Dimensions in millimetres



Key

1 Primary air stream
2 Quartz tube
3 Ring furnace
4 Direction of furnace travel
5 Test sample
6 Dilution unit (optional)
7 Secondary air stream
8 Corrosion target
9 Exposure chamber
10 Exhaust
11 Four holes
12 Cotton wool

Figure B.2 – Use of a flow-through exposure chamber – Components of equipment assembled

Annex C
(informative)

Bibliography

[1] ISO 7384 1986, *Corrosion tests in artificial atmospheres – General requirements.*

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