



SLOVENSKI STANDARD
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Barve in laki – Ugotavljanje odpornosti proti cikličnim korozijskim pogojem – 1.
del: Mokro (slana megla)/suho/vlažno (ISO/DIS 11997-1:2014)

Paints and varnishes - Determination of resistance to cyclic corrosion conditions - Part 1:
Wet (salt fog)/dry/humidity (ISO/DIS 11997-1:2014)

Beschichtungsstoffe - Bestimmung der Beständigkeit bei zyklischen
Korrosionsbedingungen - Teil 1: Nass (Salzsprühnebel)/trocken/Feuchte (ISO/DIS 11997
-1:2014)

Peintures et vernis - Détermination de la résistance aux conditions de corrosion cyclique
- Partie 1: Brouillard salin/sécheresse/humidité (ISO/DIS 11997-1:2014)

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Paints and varnishes — Determination of resistance to cyclic corrosion conditions —

Part 1: Wet (salt fog)/dry/humidity

*Peintures et vernis — Détermination de la résistance aux conditions de corrosion cyclique —
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ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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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 11997-1 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

This third edition cancels and replaces the second edition (ISO 11997-1:2005), which has been technically revised. The main technical changes are:

- a) the time for no drops of moisture are visible on the panels (former 6.4, now 5.4) has been changed;
- b) a reference to ISO 4628-8 for assessment of degree of delamination and corrosion around a scribe or other artificial defect has been added;
- c) the supplementary test conditions previously in Annex A have been integrated in the test report;
- d) the numbering of Annexes C to F has been changed to B to E.

ISO 11997 consists of the following parts, under the general title *Paints and varnishes — Determination of resistance to cyclic corrosion conditions*:

- *Part 1: Wet (salt fog)/dry/humidity*
- *Part 2: Wet (salt fog)/dry/humidity/UV light*

Introduction

Coatings of paints, varnishes and similar materials are exposed to one of four cycles of wet and dry conditions using specified salt solutions in a cabinet in order to simulate, in the laboratory, processes occurring in aggressive outdoor conditions, such as marine environments. Generally, correlation between such outdoor weathering and laboratory testing cannot be expected because of the large number of factors influencing the breakdown process. Correlation can only be expected if the effect on the coating of important parameters (e.g. the nature of the pollutant, the spectral distribution of the incident irradiance in the relevant photochemical region, the temperature of the specimen, the type and cycle of wetting and relative humidity) is known. In contrast to outdoor weathering, laboratory testing in a cabinet is performed with a reduced number of variables which can be controlled, and therefore the effects are more reproducible. The method described may also give a means of checking that the quality of a paint or paint system is being maintained.

The method has been found to be useful in comparing the cyclic salt spray resistance of different coatings. It is most useful in providing relevant ratings for a series of coated panels exhibiting significant differences in cyclic salt spray resistance.

The test cycles included in this part of ISO 11997 have been used successfully, with documented evidence, in the industry for the assessment of performance. The cycles can be summarized as follows.

- **Cycle A (see Annex B):** This cycle is specified in Japanese Automobile Standards JASO M 609-91, *Corrosion test method for automotive materials*, and JASO M610-92, *Cosmetic corrosion test method for automotive parts*.
- **Cycle B (see Annex C):** This is based on the VDA 621-415 cycle and is widely used in Europe. It has also been shown to give good correlation with natural weathering for thermosetting paints in vehicle corrosion.
- **Cycle C (see Annex D):** This cycle was developed in the UK for use with water-soluble and latex paint systems, and has been shown to give good correlation with natural weathering.
- **Cycle D (see Annex E):** This cycle is specified in Japanese Standard JIS K 5621-2003, *Anticorrosive paint for general use*.

It is intended that other cycles will be added at later revisions of this part of ISO 11997, as they are developed for evaluating other paint types.

ISO 11997-2 describes a method for determining the cyclic corrosion resistance of paints which includes UV exposure as part of the cycle. It has been found to give good correlation with natural weathering for industrial maintenance coatings.

Paints and varnishes — Determination of resistance to cyclic corrosion conditions — Part 1: Wet (salt fog)/dry/humidity

1 Scope

This part of ISO 11997 describes a method for the determination of the resistance of coatings to one of four defined cycles of wet (salt fog)/dry/humidity conditions using specified solutions.

2 Normative references

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

ISO 1513, *Paints and varnishes — Examination and preparation of test samples*

ISO 1514, *Paints and varnishes — Standard panels for testing*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 4628-1, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 1: General introduction and designation system*

ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

ISO 4628-3, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting*

ISO 4628-4, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

ISO 4628-5, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 5: Assessment of degree of flaking*

ISO 4628-8, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 8: Assessment of degree of delamination and corrosion around a scribe or other artificial defect*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

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3 Principle

A coated test panel is exposed to a cyclic wet (salt fog), drying and humidity test schedule and the effects of exposure are evaluated by criteria agreed in advance between the interested parties, these criteria usually being of a subjective nature.

4 Salt fog test solution

Prepare the salt fog test solution by dissolving the salt or salts as given in Annexes B, C, D and E in water conforming to at least grade 2 of ISO 3696, to produce the required concentration.

The salts shall be of analytical grade or visually white, and conform with the purity requirements given in Table 1.

Table 1 — Purity of salts

Impurity	Maximum mass fraction of impurity %	Method of determination
Total	0,5	Calculated as a percentage of the dry salt
Iodide	0,1	Calculated as a percentage of the dry salt
Copper	0,001	Determined by spectrophotometry or another method of similar accuracy
Nickel	0,001	Determined by spectrophotometry or another method of similar accuracy

If the pH of the solution is outside the required range (see Annexes B, C, D and E), the presence of undesirable impurities in the salt or the water or both shall be investigated. The pH determination shall be based on electrometric measurement at 25 °C, but a narrow-range indicator paper which can be read in increments of 0,3 pH-units or less and which has been calibrated against electrometric measurements may be used in routine checks. Any necessary corrections shall be made by adding hydrochloric acid, sodium hydrogen carbonate (both of purity conforming to the requirements of Table 1) or analytical-grade sodium hydroxide, of appropriate concentrations.

NOTE Attention is drawn to the possible changes in pH resulting from loss of carbon dioxide from the solution when it is sprayed, or from dissolution of carbon dioxide from the ambient atmosphere. Such changes may be avoided by reducing the carbon dioxide content of the solution by, for example, heating it to a temperature above 35 °C before it is placed in the cabinet or making the solution from freshly boiled water.

Filter the solution before placing it in the reservoir of the cabinet, in order to remove any solid matter which might block the apertures of the spraying device.

5 Apparatus

Ordinary laboratory apparatus and glassware, together with the following:

5.1 Spray cabinet, made of, or lined with, material resistant to corrosion by the sprayed solution and having a roof which prevents condensed moisture dripping onto the test specimens. The cabinet shall have a capacity of not less than 0,4 m³ in order to ensure even distribution of the spray.

The size and shape of the cabinet shall be such that the salt fog deposition rate is within the limits given in Annexes B, C, D and E.

NOTE Cabinets with a volume greater than 2 m³ will be difficult to operate unless careful consideration is given to their design and construction.

Factors to be taken into consideration in the design and construction of the cabinet are given in Annex A.

If the cabinet has been used for a spray test, or for any other purpose, using a solution differing from that specified for the current test cycle, it shall be thoroughly cleaned before use.

5.2 Hot-air blowers, capable of maintaining the cabinet and its contents at the specified temperatures and achieving the required heating rates (see Annexes B, C, D and E). The temperature shall be controlled by a thermostat element placed within the cabinet at least 100 mm from the walls of the cabinet.

5.3 Means for spraying the salt solution, comprising a supply of clean compressed air at a controlled pressure, a reservoir to contain the solution to be sprayed, and one or more atomizers made of material resistant to the solution. The compressed-air supply to each atomizer shall be passed through a filter to remove all traces of oil or solid matter, shall be at a suitable pressure depending upon the type of atomizer nozzle and shall be adjusted so that the rate of collection of spray in the cabinet and the concentration of the collected spray are kept within the specified limits (see Annexes B, C, D and E).

The reservoir containing the solution to be sprayed shall be a tank made of material resistant to the solution and shall be provided with means of maintaining a constant flow of solution to the atomizers.

The atomizers shall be made of inert material, for example glass or plastic.

NOTE Baffles may be used to prevent direct impingement of spray on the test specimens, and the use of adjustable baffles is helpful in obtaining uniform distribution of spray throughout the cabinet.

5.4 Drying-air supply, of 20 % to 30 % relative humidity for cycles A and D (see Annexes B and E) and of (50 ± 20) % relative humidity for cycles B and C (see Annexes C and D). The air shall be passed through a filter to remove all traces of oil or solid matter and shall have a flow rate sufficient to ensure that, at the start of a dry phase, no drops of moisture are visible on the panels after the drying time specified for cycles A and D and after 45 min to 75 min for cycles B and C. The panels shall not be dried by heaters inside the cabinet walls.

NOTE It is common practice to vent the cabinet to the atmosphere outside the laboratory.

5.5 Collecting devices, at least two, of chemically inert material (see Note). The collecting devices shall be placed in the zone of the cabinet where the test panels are placed, one close to the spray atomizer(s) and one remote from the spray atomizer(s). They shall be placed so that only spray and not liquid falling from test panels or from parts of the cabinet is collected. If two or more atomizers are used, the number of collecting devices shall be at least twice the number of atomizers.

NOTE Glass funnels with the stems inserted into graduated cylinders have been found to be suitable collecting devices. Funnels with a diameter of 100 mm have a collecting area of approximately 80 cm².

5.6 Test panel racks, made of inert non-metallic material such as glass, plastic or suitably coated wood. Exceptionally, test panels may be suspended. In this case, the material used shall be synthetic fibre, cotton thread or other inert insulating material; on no account shall metallic material be used. All racks shall be placed at the same level in the cabinet so that the solution cannot drip from panels or racks at one level onto other panels placed below.

5.7 Control equipment, for providing wet (salt fog)/dry/humidity cycles for the times and temperatures specified in Annexes B, C, D and E.

6 Sampling

Take a representative sample of the product to be tested (or of each product in the case of a multi-coat system), as described in ISO 15528.

Examine and prepare each sample for testing, as described in ISO 1513.