
**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**

*Peintures et vernis — Évaluation de la dégradation des revêtements —
Désignation de la quantité et de la dimension des défauts, et de
l'intensité des changements uniformes d'aspect —*

*Partie 8: Évaluation du degré de décollement et de corrosion autour
d'une rayure*



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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 4628-8 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

ISO 4628 consists of the following parts, under the general title *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*
- *Part 2: Assessment of degree of blistering*
- *Part 3: Assessment of degree of rusting*
- *Part 4: Assessment of degree of cracking*
- *Part 5: Assessment of degree of flaking*
- *Part 6: Assessment of degree of chalking by tape method*
- *Part 7: Assessment of degree of chalking by velvet method*
- *Part 8: Assessment of degree of delamination and corrosion around a scribe*
- *Part 10: Assessment of degree of filiform corrosion*

ISO 4628-1 defines the system to be used for designating the quantity and size of defects and the intensity of changes in appearance of coatings and outlines the general principles of the system. This system is intended to be used, in particular, for defects caused by ageing and weathering, and for uniform changes such as colour changes, for example yellowing.

The other parts of ISO 4628 provide pictorial standards or other means for evaluating particular types of defect. As far as possible, already existing evaluation schemes have been used as the basis.

Introduction

After exposure of a coated and scribed test panel in a corrosive environment, the following phenomena can occur around the scribe:

- delamination;
- corrosion.

A combination of both phenomena can also occur.

It is recommended that delamination and corrosion around the scribe be evaluated separately to obtain more detailed information about the coating system.

In addition to the procedure described in this part of ISO 4628, assessments of delamination and corrosion around the scribe can be carried out using optical image processing.

Rating of other defects is described in other parts of ISO 4628.

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

1 Scope

This part of ISO 4628 specifies a method for assessing delamination and corrosion, caused by a corrosive environment, around a scribe in a coating on a test panel or other test specimen.

NOTE An example of a corrosive environment is salt spray (fog) as used in the method of exposure described in ISO 7253 or ISO 9227 (see the Bibliography).

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

ISO 21227-1, *Paints and varnishes — Evaluation of defects on coated surfaces using optical imaging — Part 1: General guidance*

ISO 21227-3, *Paints and varnishes — Evaluation of defects on coated surfaces using optical imaging — Part 3: Assessment of delamination and corrosion around a scribe*

3 Terms and definitions

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

3.1

corrosion

area of visible corrosion products

3.2

delamination

loss of adhesion of a coating

4 Principle

The degree of delamination around a scribe is assessed either directly after the end of the exposure period immediately after removal of the test panel from the exposure environment or after conditioning for a specified period.

The degree of corrosion around the scribe is assessed either immediately after removal of the test panel from the exposure environment or after removal of the coating.

Both the area of delamination and the area of corrosion are determined either by measurement and calculation or by using pictorial standards.

NOTE The extent of other defects may also be determined at the same time as the degree of delamination and degree of corrosion. The methods used are as follows:

- blistering in accordance with ISO 4628-2 [2];
- rusting in accordance with ISO 4628-3 [3];
- cracking in accordance with ISO 4628-4 [4];
- flaking in accordance with ISO 4628-5 [5];
- filiform corrosion in accordance with ISO 4628-10 [6].

5 Procedure

5.1 General

The degree of delamination and degree of corrosion are determined either by measurement and calculation or by comparing the scribes with the pictorial examples given in Figure 1. The measurement and calculation procedures given in 5.2 and 5.3 are generally preferred to the assessment described in 5.4 using pictorial standards.

The assessment of the degree of delamination may be made immediately after removal of the panels from the conditioning environment (see 5.2.1), but can also be carried out after a further conditioning period to determine whether coating adhesion can regenerate itself (see 5.2.2).

The assessment of the degree of corrosion may be made using the coated panel (see 5.3.1) or after stripping off the coating (see 5.3.2).

5.2 Assessment of delamination

5.2.1 Directly after the end of the exposure period

Rinse the test panel with fresh tap water immediately after exposure, blowing off residues of water from the surface using compressed air if necessary, and inspect for visible changes. Carefully remove any loose coating using a knife blade held at an angle, positioning the blade at the coating/substrate interface and lifting the coating away from the substrate.

Depending upon the coating type and degree of delamination, some force may be necessary to remove the coating, but a boundary should be found where the coating becomes tightly adhered to the substrate, this being the limit of delamination.

If desired, compressed air or adhesive tape may be used instead of a knife blade. It is important to remove the loose coating completely.

If necessary, rinse the test panel again with fresh tap water.

Measure, in millimetres, the total width of the zone of delamination at a minimum of six points uniformly distributed along the scribe. Ignore delamination beyond the beginning and end of the original scribe.

Determine the arithmetic mean and record this as the mean overall width of the zone of delamination, d_1 .

5.2.2 After conditioning

The extent to which adhesion can regenerate itself after drying is determined as follows.

Rinse and condition the test panel after exposure. Assess the degree of delamination as described in 5.2.1 after conditioning for 1 h and again after conditioning for 24 h at a temperature of $(23 \pm 2)^\circ\text{C}$ and a relative humidity of $(50 \pm 5)\%$, as specified in ISO 3270.

5.3 Assessment of corrosion

5.3.1 Directly after the end of the exposure period

Rinse the test panel with fresh tap water immediately after exposure, blowing off residues of water from the surface using compressed air if necessary, and inspect for visible changes. Carefully remove any loose coating using a knife blade held at an angle, positioning the blade at the coating/substrate interface and lifting the coating away from the substrate.

A suitable paint remover or other means, e.g. compressed air or adhesive tape, may be used instead of a knife blade. It is important to remove the loose coating completely.

If necessary, rinse the test panel again with fresh tap water.

Measure, in millimetres, the width of the zone of corrosion at a minimum of six points uniformly distributed along the scribe. Ignore corrosion beyond the beginning and end of the original scribe.

Determine the arithmetic mean and record this as the mean overall width of the zone of corrosion, w_c .

5.3.2 Evaluation of corrosion on stripped test panels

Remove the coating carefully from the test panel with a suitable paint remover that will not exacerbate the corrosion. Rinse the test panel rapidly with clean tap water, blow dry with compressed air and immediately coat completely with a suitable, non-hygroscopic, clear coating material such as an aerosol lacquer.

Rate the zone of corrosion according to the pictorial standards given in Figure 1 or, if possible, measure the area, in square millimetres, using optical imaging as described in ISO 21227-1 and ISO 21227-3. Note any etched areas, which appear bright.

5.4 Assessment using pictorial standards

If required, assess the area of delamination and corrosion using the pictorial standards given in Figure 1.

NOTE These pictorial standards are based on the rating system defined in ISO 4628-1.

6 Calculation and expression of results

6.1 Degree of delamination

Calculate the degree of delamination d , in millimetres, using the equation:

$$d = \frac{d_1 - w}{2} \quad (1)$$

where

d_1 is the mean overall width of the zone of delamination, in millimetres;

w is the width of the original scribe, in millimetres.

If the delamination is non-uniform, increase the number of measurement points so that they are more closely spaced, or calculate the degree of delamination d , in millimetres, using Equation (2). Ignore delamination beyond the beginning and end of the original scribe. Determine the size of the area by, for example, laying transparent millimetre-grid paper over the area and counting the number of squares corresponding to the area.

$$d = \frac{A_d - A_l}{2} \times \frac{1}{l} \quad (2)$$

where

A_d is the area of delamination, including the scribe area, in square millimetres;

A_l is the area of the scribe in the area evaluated, in square millimetres;

l is the length of the scribe in the area evaluated, in millimetres.

Express the results as:

- either the degree of delamination d , to the nearest millimetre, determined directly after the end of the exposure period, plus the degree of delamination after further conditioning, if determined;
- or the numerical rating obtained from the pictorial standards as described in 5.4.

6.2 Degree of corrosion

Calculate the degree of corrosion c , in millimetres, using the equation:

$$c = \frac{w_c - w}{2} \quad (3)$$

where

w_c is the the mean overall width of the zone of corrosion, in millimetres;

w is the width of the original scribe, in millimetres.

If the corrosion is non-uniform, increase the number of measurement points so that they are more closely spaced, or calculate the degree of corrosion c , in millimetres, using Equation (4). Ignore corrosion beyond the beginning and end of the original scribe. Determine the size of the area by, for example, laying transparent millimetre-grid paper over the area and counting the number of squares corresponding to the area.

$$c = \frac{A_c - A_l}{2} \times \frac{1}{l} \quad (4)$$

where

A_c is the area of corrosion, including the scribe area, in square millimetres;

A_l is the scribe area in the area evaluated, in square millimetres;

l is the scribe length in the area evaluated, in millimetres.

Express the results as:

- either the degree of corrosion c , to the nearest millimetre, determined directly after the end of the exposure period, plus the degree of corrosion found on stripped test panels, if determined;
- or the numerical rating obtained from the pictorial standards as described in 5.4.

6.3 Assessment using pictorial standards

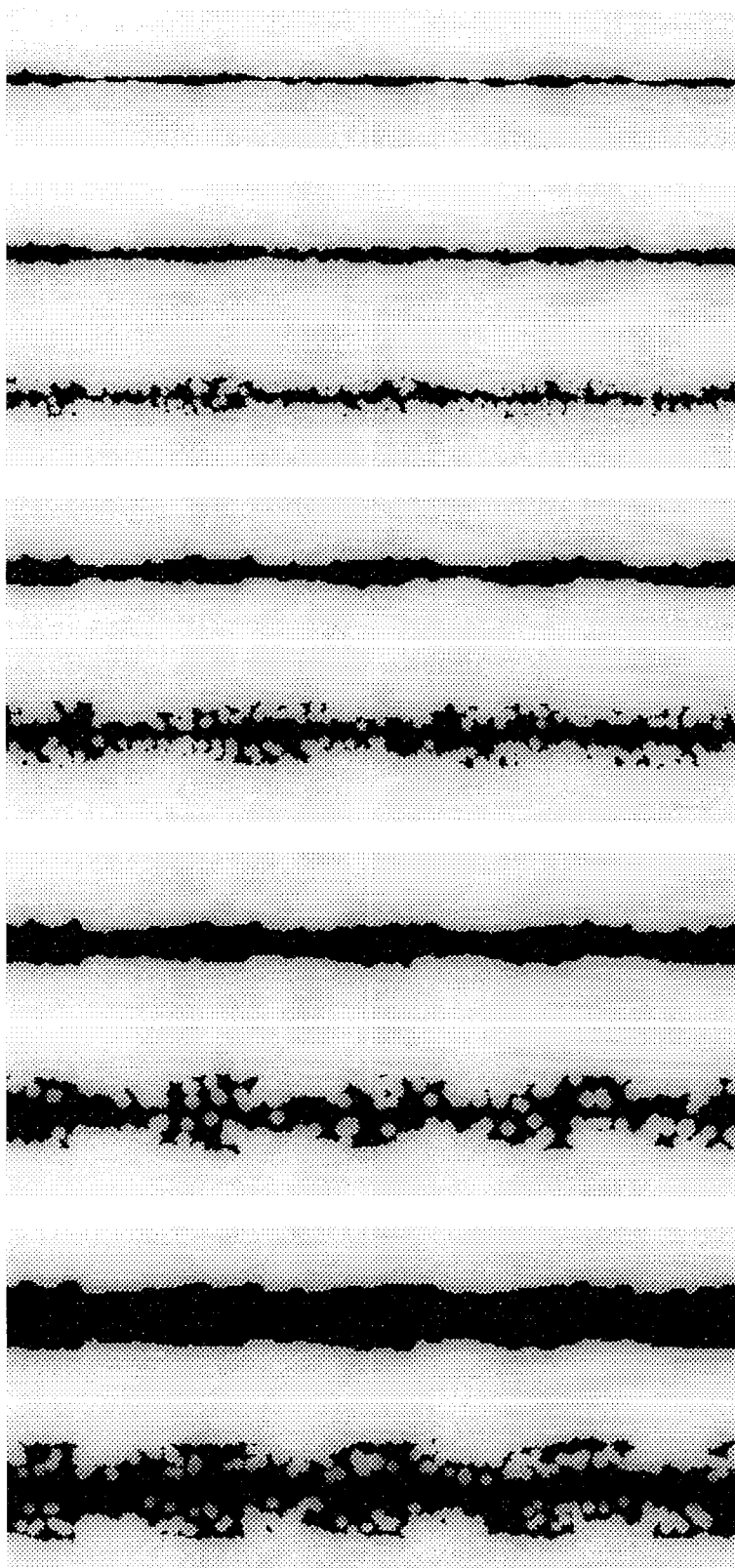
The numerical rating shall be given as indicated in the following example:

Delamination and corrosion around a scribe: corrosion grade 2; delamination grade 3.

7 Test report

The test report shall contain at least the following information:

- a) all information necessary for identification of the coating examined, including film thickness and number of coats;
- b) a reference to this part of ISO 4628 (ISO 4628-8:2005);
- c) details of the exposure of the coating, including:
 - a description of the corrosive environment,
 - the duration of the exposure in the corrosive environment;
- d) details of the assessment procedure, including:
 - the type of scribe tool used,
 - the shape, width and length of the scribe,
 - whether the coating was removed or not;
- e) the results of the assessment, including the results of the individual determinations and their means, calculated in accordance with Clause 6;
- f) any deviations from the procedure specified;
- g) any unusual features (anomalies) observed during the assessment;
- h) the date of the assessment.



Grade 1 — Very slight

Grade 2 — Slight

Grade 3 — Moderate

Grade 4 — Considerable

Grade 5 — Severe

**Figure 1 — Pictorial standards for assessment of degree of delamination
and corrosion around a scribe
(approximate scale 1:1)**

Bibliography

- [1] 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*
- [2] 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*
- [3] 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*
- [4] 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*
- [5] 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*
- [6] ISO 4628-10, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 10: Assessment of degree of filiform corrosion*
- [7] ISO 7253, *Paints and varnishes — Determination of resistance to neutral salt spray (fog)*
- [8] ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

