
**Corrosion protection of steel structures
by protective paint systems —
Assessment of, and acceptance criteria
for, the adhesion/cohesion (fracture
strength) of a coating —**

Part 2:

Cross-cut testing and X-cut testing

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Anticorrosion des structures en acier par systèmes de peintures —

*Évaluation et critères d'acceptation de l'adhésion/cohésion (résistance à
la rupture) d'un revêtement —*

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Partie 2: Essai de quadrillage et essai à la croix de Saint André



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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 16276-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 139, *Paints and varnishes*, in collaboration with Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 14, *Protective paint systems for steel structures*.

ISO 16276 consists of the following parts, under the general title *Corrosion protection of steel structures by protective paint systems — Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating*:

- [ISO 16276-2:2007](https://standards.iteh.ai/catalog/standards/sist/d3ab8f88-a88c-4f67-b2df-e2fd812863b6/iso-16276-2-2007)
- *Part 1: Pull-off testing* <https://standards.iteh.ai/catalog/standards/sist/d3ab8f88-a88c-4f67-b2df-e2fd812863b6/iso-16276-2-2007>
 - *Part 2: Cross-cut testing and X-cut testing*

Introduction

The main purpose of this part of ISO 16276 is to supplement the ISO 12944 series with regard to the field assessment of, and acceptance criteria for, the adhesion/cohesion of a coating.

NOTE This part of ISO 16276 is intended for assessment of cross-cut testing and X-cut testing of paint coatings on steel structures on site. ISO 2409 specifies a cross-cut test and ASTM D 3359 an X-cut test for general purposes, without instructions for interpretation of the results and without acceptance or rejection criteria.

Fracture strength testing is normally destructive and therefore requires repair work, the extent of which will depend on the specification and on the durability required of the protective paint coating.

An objective of this part of ISO 16276 is to minimize variability and achieve uniformity of practice in the assessment of the fracture strength of a protective paint coating and to establish acceptance/rejection criteria for such coatings. The method uses test equipment based on the cross-cut and X-cut principles.

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Corrosion protection of steel structures by protective paint systems — Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating —

Part 2: Cross-cut testing and X-cut testing

1 Scope

This part of ISO 16276 specifies procedures for rating the resistance of coating systems when a cut in the form of a right-angle lattice pattern (cross-cut) or in the form of an X (X-cut) is made into the coating, penetrating through to the substrate.

This part of ISO 16276 is only applicable if the cross-cut or X-cut test method is specified, together with the rating from the appropriate rating scale.

NOTE The characteristics of the coating can make the assessment of the result of a cross-cut or X-cut test difficult.

This part of ISO 16276 also specifies suitable equipment and defines inspection areas, sampling plans and acceptance/rejection criteria.

It does not specify ratings for particular coating systems.

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 2409:2006, *Paints and varnishes — Cross-cut test*

ISO 12944-7, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 7: Execution and supervision of paint work*

ISO 12944-8, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 8: Development of specifications for new work and maintenance*

ISO 19840, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces*

ASTM D 3359-02, *Standard Test Methods for Measuring Adhesion by Tape Test*

3 Terms and definitions

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

3.1

fracture strength

force required to exceed the attachment forces

- between coats or between coat and substrate (adhesion) and/or
- within a coat (cohesion)

NOTE This part of ISO 16276 does not define a method for determining fracture strength (see ISO 16276-1).

3.2

adhesion

phenomenon of attachment at the interface between a solid surface and another material caused by molecular forces

NOTE Adhesion should not be confused with cohesion.

[ISO 4618:2006]

3.3

cohesion

forces that bind a film into an integral entity

NOTE Cohesion should not be confused with adhesion.

[ISO 4618:2006]

3.4

coat

continuous layer of a coating material resulting from a single application

[ISO 4618:2006]

3.5

coating

continuous layer formed from a single or multiple application of a coating material to a substrate

[ISO 4618:2006]

3.6

inspection area

designated area to which a sampling plan has been applied, which can be the whole structure or a selected section of the structure

4 Principle

4.1 General

The resistance of coating systems to adhesive and cohesive failures due to cutting is assessed using either the cross-cut test or the X-cut test, whereby it is assessed qualitatively using a scale from 0 to 5, minimum to maximum damage, for each method (see ISO 2409 and Annex A).

The cross-cut test is suitable for film thicknesses up to 250 µm. The X-cut test is not limited by thickness.

For hard coatings, it might not be possible to use the cross-cut test, in which case the X-cut test should be used.

For coatings containing pigments that have a flake format, the assessment of either the cross-cut or the X-cut might be misleading. The coating manufacturer should be consulted for recommendations.

For the cross-cut test, a matrix of cuts through the film is prepared and then inspected to assess the damage caused. The cross-cut test is performed as described in ISO 2409. The cuts can be made either individually using a cutting tool and a guide or template to achieve the correct spacing or by using a multiple-blade cutter with the correct number and spacing of blades.

For the X-cut test, two cuts are made at an angle to form an X. Adhesive tape is applied with a firm force (e.g. pressure from the thumb) over the cut and then removed at a prescribed angle. The X-cut test is performed as described in ASTM D 3359-02, method A, using Annex A of this document for the rating.

NOTE 1 The order of the ratings in Annex A is the reverse of that published in ASTM D 3359-02.

NOTE 2 The X-cut is also known as the St. Andrew's cross.

4.2 Principle of cross-cut method

The cross-cut method requires that a matrix of cuts be made through the coating to the substrate to produce even squares. The spacing of the cuts and hence the size of the squares is determined according to the thickness of the coating to be assessed. Adhesive tape is applied with a firm force to remove coating squares that are poorly attached after the cuts have been made. The result of the test is expressed as a rating according to the damage observed. For complete details, see ISO 2409.

4.3 Principle of X-cut method

The X-cut method requires that an X-cut be made through the coating using a sharp blade. Adhesive tape is applied with a firm force to remove coating that is poorly attached. The result of the test is expressed as a rating according to the damage observed. For the rating scale, see Annex A.

5 Apparatus and materials

5.1 Cross-cut test

Details of the required apparatus and materials are given in ISO 2409.

5.2 X-cut test

5.2.1 Template, to produce a straight edge.

5.2.2 Single-blade cutter, in accordance with ISO 2409.

5.2.3 Transparent pressure-sensitive adhesive tape, in accordance with ISO 2409.