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

Part 1:

Pull-off testing

(standards.iteh.ai)

Anticorrosion des structures en acier par systèmes de peinture —

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

<https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2->

[f0e0016-1-2007](https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-)
Partie 1: Essai de traction



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 16276-1:2007

<https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-fdeb8d5dd623/iso-16276-1-2007>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2007

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Principle	2
5 Apparatus and materials	3
6 Procedure	3
6.1 General.....	3
6.2 Field tests on coated structures	4
6.3 Preparation	4
6.4 Testing	5
6.5 Interpretation of results.....	6
7 Expression of results	7
8 Acceptance criteria.....	8
9 Test report	8
Bibliography	9

[ISO 16276-1:2007](https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-fdeb8d5dd623/iso-16276-1-2007)

<https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-fdeb8d5dd623/iso-16276-1-2007>

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 16276-1 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 16276-1:2007
- *Part 1: Pull-off testing* <https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-fdeb8d5dd623/iso-16276-1-2007>
 - *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.

To comply with this part of ISO 16276, laboratory testing of panels might be required.

This part of ISO 16276 introduces the term “fracture strength” which includes both adhesion and cohesion. Adhesion and cohesion are defined in ISO 4618, whereas the ISO 12944 series uses the term “adhesion” only.

NOTE This part of ISO 16276 is intended for the assessment of pull-off testing of paint coatings on steel structures on site. ISO 4624 specifies a pull-off test for laboratory use, 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 provide uniformity in the assessment of the fracture strength of a coating and to establish acceptance/rejection criteria for protective paint coatings. The method uses test equipment based on the pull-off principle.

Protective paint systems which have poor adhesion/cohesion will normally fail at fracture strength values significantly lower than the values quoted in the specification.

For a protective paint system with a particular fracture strength, a range of test values will be obtained from different types of equipment.

[ISO 16276-1:2007](https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-15416271c627/iso-16276-1-2007)

[https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-](https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-15416271c627/iso-16276-1-2007)

Specifying test equipment that gives, for a particular fracture strength, the highest test values does not necessarily indicate a higher durability for that protective paint system. Also, high test values for a particular fracture strength do not necessarily indicate a high durability for that protective paint system.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 16276-1:2007

<https://standards.iteh.ai/catalog/standards/sist/c0ab0668-85b3-4bc3-a9d2-fdeb8d5dd623/iso-16276-1-2007>

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

Part 1: Pull-off testing

1 Scope

This part of ISO 16276 specifies procedures for assessing the fracture strength of a protective paint coating of any thickness on a steel substrate of thickness not less than 10 mm. The procedures given in this part of ISO 16276 are based on methods used with different types of pull-off test equipment. The results obtained using such different types of equipment are not comparable.

NOTE 1 Substrates of less than 10 mm in thickness can be tested if they are strengthened by the sandwich technique (see ISO 4624) or by the nature of the structure (e.g. I-beam or backing-plate). Otherwise, test panels with a thickness of at least 10 mm coated in the same way as the structure can be used, or the method specified ISO 16276-2 can be used.

This part of ISO 16276 is only applicable if a fracture strength value is specified, together with the type of test equipment and the manufacturer of the equipment. Usually, this information is included in contract documentation.

NOTE 2 A value for the fracture strength is only meaningful if the requirements concerning the ambient conditions (see 6.4.2) are met.

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

It does not give any values of the fracture strength of different protective paint coatings.

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 4624, *Paints and varnishes — Pull-off test for adhesion*

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*

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)

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

Test cylinders (dollies) are fixed to the coating using a suitable adhesive and a force is exerted in order to cause a fracture. This force is measured by the equipment.

5 Apparatus and materials

5.1 Tensile/pull-off test apparatus, meeting the requirements specified in 6.1.6. The manufacturer and the model of the apparatus shall be as specified or as agreed between the interested parties.

5.2 Test cylinders (dollies), made of stainless steel or aluminium alloy, of suitable diameter (normally 20 mm), of sufficient thickness to ensure freedom from distortion during the test and suitable for use with the test apparatus. It is recommended that the length of the test cylinder be not less than half its diameter. The end faces shall be machined perpendicular to the long axis of the cylinder.

5.3 Adhesives, suitable for use with both the test cylinder and the protective paint system, e.g. 2-pack epoxy or 1-pack cyanoacrylate (see ISO 4624). Care shall be taken to avoid adhesives which might damage, or penetrate through, the coating.

5.4 Circular cutting device, the internal diameter of which shall not exceed the diameter of the test cylinder by more than 2 mm.

6 Procedure

6.1 General

6.1.1 As pull-off tests are destructive test methods, repair work will be necessary when they are used on coated structures.

NOTE To avoid damage to the coated structure, test panels can be used (see 6.4.2).

6.1.2 The results of each of the procedures described are influenced by different aspects of the test conditions. There are some aspects that are common to all the procedures, and these are described below.

6.1.3 The test cylinders are supplied in various shapes and the force can be applied in various ways, such as hydraulic pressure, pneumatic pressure or using compressed-spring assemblies.

6.1.4 The measurement equipment used shall be calibrated. If a calibration certificate is required, it shall be checked to ensure that it is current and relates to the instrument in use, i.e. has the same serial number.

NOTE Adjustment and calibration are carried out by the manufacturer or by an authorized organisation.

6.1.5 Prior to testing, a recently applied coating shall be dried/cured in accordance with the manufacturer's recommendations.

In the absence of manufacturer's recommendations, the coating shall be dried/cured for at least 10 days in well-ventilated conditions and at a substrate temperature in excess of 15 °C and a relative humidity of less than 80 % prior to testing.

NOTE 1 The age of the coating can affect the result of the test. Freshly applied coatings can have a lower fracture strength than those tested two or three months after application. The temperature, humidity and ventilation during drying/curing of the coating will also affect the fracture strength obtained.

NOTE 2 If a coating is exposed to high humidity or water, it will absorb water, which can reduce its fracture strength. Upon drying, the strength will increase again to a certain extent, unless the coating has started to degrade or corrosion of the substrate has occurred.

6.1.6 The rate at which the force is applied to remove the test cylinder will affect the fracture strength obtained. The tensile stress shall therefore be applied in a direction perpendicular to the plane of the coated substrate and shall be increased at a uniform rate, not greater than 1 MPa/s, such that fracture occurs within 90 s. Test equipment which does not meet this requirement is not suitable.