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

*Peintures et vernis — Essai de traction*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is 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 4624:2002), which has been technically revised with the following changes:

- a) detailed information on how to avoid distortion of the substrate during the tensile test has been added;
- b) the three methods using one dolly or two dollies on a painted panel and two dollies, one as painted substrate, have been named methods A, B and C;
- c) the supplementary test conditions previously in Annex A have been integrated in the test report.

## Introduction

This International Standard is one of two standards which describe methods for assessing the adhesion of a single coating or a multi-coat system of paint, varnish or related product by measuring the minimum tensile stress necessary to detach or to rupture the coating in a direction perpendicular to the substrate.

The test result is influenced not only by the mechanical properties of the system under test, but also by the nature and preparation of the substrate, the method of paint application, the drying conditions of the coating, the temperature, the humidity and other factors like the type of test instrument which has been used.

One other International Standard for the evaluation of adhesion characteristics is ISO 2409.



# Paints and varnishes — Pull-off test for adhesion

## 1 Scope

This International Standard specifies three methods (i.e. one dolly or two dollies on a painted panel and two dollies, one as painted substrate) for determining the adhesion by carrying out a pull-off test on a single coating or a multi-coat system of paint, varnish or related product.

These test methods have been found useful in comparing the adhesion behaviour of different coatings. It is most useful in providing relative ratings for a series of coated panels exhibiting significant differences in adhesion.

The test may be applied using a wide range of substrates. Different procedures are given according to whether the substrate is deformable, for example thin metal, plastics and wood, or rigid, for example thick concrete and metal plates. To avoid distortion of the substrate during the tensile test, it is common to use a sandwich construction. For example, for special purposes, the coating may be applied directly to the face of a test dolly.

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

## 3 Principle

The product or system under test is applied at uniform thickness to flat panels of uniform surface texture.

After drying/curing the coating system, dollies are bonded directly to the surface of the coated, cured panel using an adhesive.

After curing of the adhesive, the bonded dolly assemblies are placed in a suitable tensile tester. The bonded assemblies are subjected to a controlled tensile test (pull-off test), and the force required to break the coating/substrate bond is measured.

To avoid possible distortion of the substrate during the tensile test, dollies with a diameter smaller than the 2 cm diameter used for steel substrates may be used to reduce the force introduced.

The test result is the tensile stress necessary to break the weakest interface (adhesive failure) or the weakest component (cohesive failure) of the test assembly. Mixed adhesive/cohesive failures may also occur.