International Standard

ISO 19397

Paints and varnishes — Determination of the film thickness of coatings using an ultrasonic gauge

Peintures et vernis — Détermination de l'épaisseur du feuil de revêtements par mesurage par ultrasons

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Foreword

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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 document 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).

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This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 139, *Paints and varnishes,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO/TS 19397:2015, which has been technically revised.

The main changes are as follows:

— an introduction has been added;

— the normative references have been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document consistently enumerates the individual coatings applied in a multi-layer system by referring to the first coating applied on the substrate as coating 1. Some other standards referring to individual test methods enumerate in reverse order. See ISO 2808 for example.

Paints and varnishes — Determination of the film thickness of coatings using an ultrasonic gauge

1 Scope

This document specifies a method for determining the film thickness of coatings on metallic and non-metallic substrates using an ultrasonic gauge.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4618, *Paints and varnishes — Vocabulary*

ISO Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
ultrasonic wave
acoustic wave having a frequency higher than the audible range of the human ear, generally taken as higher than 20 kHz

[SOURCE: ISO 5577:2017, 3.2.1]

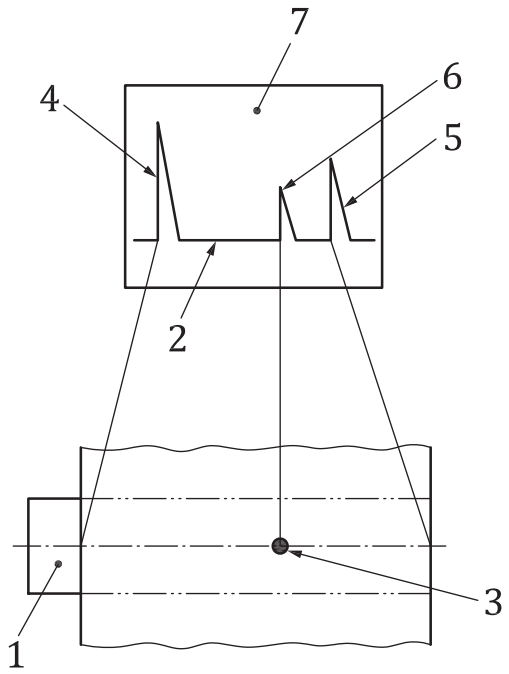
3.2
longitudinal wave
compressional wave
wave in which the direction of displacement of particles is in the same direction as the propagation of the wave

[SOURCE: ISO 5577:2017, 3.3.1, modified — Note 1 to entry has been removed.]

3.3
echo
signal on the display of the ultrasonic instrument received from the test object

Note 1 to entry: See Figure 1 for an *A-scan presentation* (3.13) where the echo can be seen in the key, references 5 and 6.

Note 2 to entry: Depending on the test setup, additional echoes can be received.



Key

1	straight-beam probe	5	back-wall echo
2	time base	6	reflector echo
3	reflector	7	A-scan presentation
4	transmitter pulse indication		

Figure 1 — A-scan presentation

[SOURCE: ISO 5577:2017, 6.5.1 modified – Note 1 to entry has been amended.]

3.4
echo height
height of an *echo* (3.3) indication on the display

[SOURCE: ISO 5577:2017, 6.5.6]

3.5
ultrasonic impulse
short-lived ultrasound signal

3.6
ultrasonic sensor
ultrasonic probe
device for sending and receiving *ultrasonic waves* (3.1), mostly based on piezoelectric materials

3.7
acoustic impedance
Z
product of sound velocity and density of a material

3.8
reflection coefficient
ratio of reflected sound pressure to incident sound pressure at a reflecting surface

Note 1 to entry: For a wave, the reflection coefficient R is calculated from the *acoustic impedances* (3.7) Z_1 and Z_2 of the bordering media, for which 1 is the medium of the incoming sound:

$$R = \frac{Z_2 - Z_1}{Z_2 + Z_1}$$

For a negative reflection coefficient, the *phase* (3.9) of the reflected signal is changed by 180°.

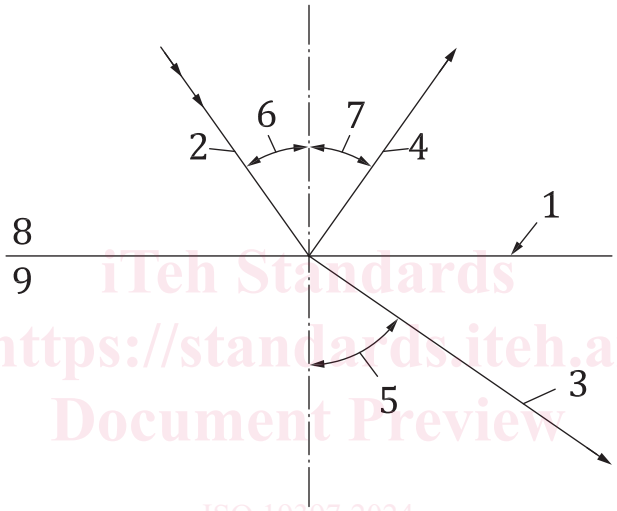
[SOURCE: ISO 5577:2017, 4.4.8, modified — Note 1 to entry has been replaced.]

3.9
phase
momentary condition of a vibration expressed as an arc measurement or an angle

[SOURCE: ISO 5577:2017, 3.2.3]

3.10
interface
boundary between two materials, in acoustic contact, having different acoustic properties

Note 1 to entry: See Figure 2.



Key

1	interface	6	angle of incidence
2	direction of incident wave	7	angle of reflection
3	direction of refracted wave	8	medium 1
4	direction of reflected wave	9	medium 2
5	angle of refraction		

Figure 2 — Refraction and reflection of waves

[SOURCE: ISO 5577:2017, 4.4.1]

3.11
sound path travel time
time it takes for ultrasonic pulses to travel along the sound path travel distance

[SOURCE: ISO 5577:2017, 6.7.5]

3.12
couplant
coupling medium
medium interposed between the probe and the test object to enable the passage of ultrasound between them, such as water, glycerine or oil

[SOURCE: ISO 5577:2017, 6.3.3, modified — Note 1 to entry has been removed.]

3.13
A-scan presentation
display of the ultrasonic signals in which the X-axis represents the time and the Y-axis represents the amplitude

Note 1 to entry: See Figure 1.

[SOURCE: ISO 5577:2017, 6.6.1]

3.14
calibration
operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

Note 1 to entry: A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.

Note 2 to entry: Calibration should not be confused with *adjustment of a measuring system* (3.15), often mistakenly called "self-calibration", nor with verification of calibration.

Note 3 to entry: Often, the first step alone in the above definition is perceived as being calibration.

[SOURCE: ISO/IEC Guide 99:2007, 2.39]

3.15
adjustment
adjustment of a measuring system
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

Note 1 to entry: Types of adjustment of a measuring system include zero adjustment of a measuring system, offset adjustment and span adjustment (sometimes called "gain adjustment").

Note 2 to entry: Adjustment of a measuring system should not be confused with *calibration* (3.14), which is a prerequisite for adjustment.

Note 3 to entry: After adjustment of a measuring system, the measuring system should only be recalibrated if the tolerance values specified for the gauge are no longer met.

[SOURCE: ISO/IEC Guide 99:2007, 3.11 modified — Note 3 to entry has been changed]

3.16
working standard
standard which is traceable to the national standard

[SOURCE: EN 60731:2012, 3.4.1.2]

4 Principle

The method described in this document determines single film thicknesses from the times of flight of an ultrasonic impulse that is partially reflected at the interfaces of the coating system. The strengths and