

Methods of test for

Paints —

**Part C5: Determination of film
thickness**

NOTE It is recommended that this Part be read in conjunction with BS 3900-0, issued separately.

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Pigments, Paints and Varnishes Standards Policy Committee (PVC/-) to Technical Committee PVC/10, upon which the following bodies were represented:

- British Gas plc
- Health and Safety Executive
- Institute of Metal Finishing
- Ministry of Defence
- Oil and Colour Chemists Association
- Paint Research Association
- Paintmakers Association of Great Britain Ltd.
- Titanium Pigment Manufacturers Technical Committee

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National foreword

This revision of this Part of BS 3900 has been prepared under the direction of Pigments, Paints and Varnishes Standards Policy Committee. It is identical with ISO 2808:1991 "Paints and varnishes — Determination of film thickness", published by the International Organization for Standardization (ISO).

This Part of BS 3900 supersedes BS 3900-C5:1975, which is withdrawn.

The main differences from the 1975 edition of this Part of BS 3900 are as follows:

- a) the inclusion of profilometric method for measurement of dry film thickness;
- b) the inclusion of an additional microscope method for measurement of dry film thickness;
- c) the inclusion of an additional method using the dielectric principle for measurement of dry film thickness by non-destructive instrumental methods; and
- d) the inclusion of a beta-particle backscatter method and an x-ray fluorescence method for measurement of dry film thickness without contact with the surface.

Cross-references

International standard	Corresponding British Standard
ISO 1514:1984	BS 3900 Methods of test for paints Part A3:1986 Standard panels for paint testing (Identical) BS 5411 Methods of test for metallic and related coatings
ISO 2178:1987	Part 11:1984 Measurement of coating thickness of non-magnetic metallic and vitreous or porcelain enamel coatings on magnetic basis metals: magnetic method (Identical)
ISO 2360:1982	Part 3:1984 Eddy current method for measurement of coating thickness of non-conductive coatings on non-magnetic basis metals (Identical)
ISO 3543:1981	Part 12:1981 Beta backscatter method for measurement of thickness (Identical)
ISO 4518:1980	Part 7:1981 Profilometric method for measurement of coating thickness (Identical)
ISO 8503-4:1988	BS 7079 Preparation of steel substrates before application of paints and related products Part C4:1989 Method for the calibration of surface profile comparators and for the determination of surface profile using a stylus instrument (Identical)

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This International Standard is one of a series of standards dealing with the sampling and testing of paints, varnishes and related products. It describes a number of methods that are applicable to the measurement of the thickness of coatings applied to a substrate. Some of the techniques described can be adopted for the measurement of the thickness of detached coatings. Details of the methods, their particular field of application and the expected precision are given in Table 1.

NOTE 1 Many of the methods referred to in Table 1 may be adapted for use with detached films.

Table 1 — Methods of film thickness measurement

Number and description	Applications	Remarks
Method No. 1 Determination of dry film thickness by relating dry film mass to dry film thickness	For use on films too soft to be measured by instrumental methods.	Measurements are not precise but provide a check that the mean thickness lies between specified limits. The test film remains undamaged.
Method No. 2 Measurement of dry film thickness by the micrometer method	Test panels or painted surfaces that are substantially flat.	The film has to be hard enough to resist indentation on closing the micrometer jaws. Uncertainty is $\pm 5 \mu\text{m}$: the method is therefore not normally suitable for films less than $25 \mu\text{m}$ thick. The film is damaged in the test.
Method No. 3 Measurement of dry film thickness by a dial gauge method	Test panels or painted surfaces that are substantially flat.	The film has to be hard enough to resist indentation on lowering the gauge presser foot. Uncertainty is $\pm 2 \mu\text{m}$: the method is therefore not normally suitable for films less than $15 \mu\text{m}$ thick. The film is damaged in the test. May be used on site.

Table 1 — Methods of film thickness measurement

Number and description	Applications	Remarks
Method No. 4 Measurement of dry film thickness by the profilometric method	Recommended as a referee method for test panels or painted surfaces that are substantially flat. By taking suitable precautions determinations may be made on curved surfaces.	The film has to be hard enough to resist indentation by the profile-tracing stylus. Uncertainty is $\pm 2 \mu\text{m}$: the method is therefore not normally suitable for films less than $15 \mu\text{m}$ thick. The film is damaged in the test.
Method No. 5 Measurement of dry film thickness: microscope methods	A Recommended as a referee method and for films on substrates of varying profile, for example, grit-blasted steel. B Not applicable to brittle or friable films. C Applies to a film cleanly removed from the substrate.	A portion of the panel or painted article is cut out and mounted in resin. Uncertainty is normally less than $2 \mu\text{m}$, but is dependent on the degree of substrate preparation and the type of microscope used. A special cutting tool is required to cut through the film and into the substrate. May be used on site. Uncertainty is normally less than $2 \mu\text{m}$, but is dependent on the degree of substrate preparation and the type of microscope used. A special microscope is used to examine the profile of the film from which a small portion has been removed down to the substrate. Uncertainty is normally less than $2 \mu\text{m}$, but is dependent on the degree of substrate preparation and the type of microscope used.

Table 1 — Methods of film thickness measurement

Number and description	Applications	Remarks
Method No. 6 Measurement of dry film thickness: non-destructive instrumental	A For magnetic metallic substrates. B For non-magnetic metallic substrates. C Applied where contact by the measuring instrument with the coating is avoided.	Instruments operate on the a) electromagnetic induction principle, or b) permanent magnet pull-off principle mounted in resin. May be used on site. Uncertainty is a) $\pm 1,5 \mu\text{m}$ or $\pm 10 \%$ whichever is the greater; b) $\pm 2 \mu\text{m}$ or $\pm 12 \%$ whichever is the greater. May be used on site. a) Instruments operate on the eddy current principle. Uncertainty is $\pm 1,5 \mu\text{m}$ or $\pm 10 \%$ whichever is the greater. May be used on site. b) Instruments operate on the dielectric principle. Uncertainty is $\pm 1 \mu\text{m}$ or $\pm 10 \%$ whichever is the greater. May be used on site. Instruments operate on the a) beta-particle back-scatter principle, or b) X-ray fluorescence principle. Paint films have to be homogeneous for measurements to be accurate. Uncertainty is $\pm 2 \mu\text{m}$ or $\pm 10 \%$ whichever is the greater.
Method No. 7 Assessment of wet film thickness	A Wheel gauge For measurement of wet film thickness on laboratory test panels or freshly painted surfaces. B Comb gauge For measurement of wet film thickness during painting operations on site.	Measurements are not precise but enable an estimate to be made of the approximate thickness the film will have when dry. Measurements give an approximate indication of thickness of the wet film. May be used on site.