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Färg och lack – Bestämning av volymtorrhalt – Del 3: Beräkning av volymtorrhalten genom en ISO 3251 bestämd vikttorrhalt, produktens densitet och lösningsmedlens densitet (ISO 3233-3:2015)

**Paints and varnishes – Determination of the percentage volume
of non-volatile matter –
Part 3: Determination by calculation from the non-volatile-matter
content determined in accordance with ISO 3251, the density of
the coating material and the density of the solvent in the coating
material (ISO 3233-3:2015)**

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Denna standard ersätter SS-EN ISO 23811:2009, utgåva 1.

The European Standard EN ISO 3233-3:2015 has the status of a Swedish Standard. This document contains the official English version of EN ISO 3233-3:2015.

This standard supersedes the Swedish Standard SS-EN ISO 23811:2009, edition 1.

**Förhållandet till övriga delar under samma huvudtitel - Utdrag ur Förord i ISO 3233-3:2015/
Relations to other parts under the same general title - Extract from the Foreword of ISO 3233-3:2015**

ISO 3233 consists of the following parts, under the general title *Paints and varnishes — Determination of percentage volume of non-volatile matter*:

- *Part 1: Method using a coated test panel to determine non-volatile matter and to determine dry film density by the Archimedes principle*
- *Part 2: Method using the determination of non-volatile-matter content in accordance with ISO 3251 and determination of dry film density on coated test panels by the Archimedes principle*
- *Part 3: Determination by calculation from the non-volatile-matter content determined in accordance with ISO 3251, the density of the coating material and the density of the solvent in the coating material*

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Denna standard är framtagen av kommittén för Färg och lack, SIS/TK 433.

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EUROPEAN STANDARD

EN ISO 3233-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

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Supersedes EN ISO 23811:2009

English Version

Paints and varnishes - Determination of the percentage volume of non-volatile matter - Part 3: Determination by calculation from the non-volatile-matter content determined in accordance with ISO 3251, the density of the coating material and the density of the solvent in the coating material (ISO 3233-3:2015)

Peintures et vernis - Détermination du pourcentage en volume de matière non volatile - Partie 3: Détermination par calcul à partir de la teneur en matière non volatile déterminée conformément à l'ISO 3251, de la masse volumique du produit de peinture et de la masse volumique du solvant du produit de peinture (ISO 3233-3:2015)

Beschichtungsstoffe - Bestimmung des Volumens nichtflüchtiger Anteile - Teil 3: Bestimmung durch Berechnung des nach ISO 3251 bestimmten Gehaltes an nichtflüchtigen Anteilen, der Dichte des Beschichtungsstoffes und der Dichte des Lösemittels im Beschichtungsstoff (ISO 3233-3:2015)

This European Standard was approved by CEN on 24 January 2015.

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Foreword

This document (EN ISO 3233-3:2015) has been prepared by Technical Committee ISO/TC 35 "Paints and varnishes" in collaboration with Technical Committee CEN/TC 139 "Paints and varnishes" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2015, and conflicting national standards shall be withdrawn at the latest by November 2015.

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Endorsement notice

The text of ISO 3233:2015 has been approved by CEN as EN ISO 3233:2015 without any modification.

Introduction

This method is used to determine the volume of the dry coating obtainable using a coating material by calculation of the percentage volume of non-volatile matter. The value obtained by this method might not be the same as that measured or calculated by adding together the masses and volumes of the raw materials in a formulation. The volume occupied by a combination of resin and solvent might be the same as, greater than, or less than the combined volume of the separate components, since contraction or expansion of resin and the solvent can occur. A second factor affecting the volume of a dry coating is the degree to which the spaces between pigment particles are filled with binder. A third factor is the use of volatile components in reactive systems that, by their reaction, change into non-volatile film-building materials, i.e. amines and reactive solvents in high-build two-component coating materials.

Above and close to the critical pigment volume concentration, the volume of a dry paint film is greater than the theoretical volume, due to an increase in unfilled voids between pigment particles. The porosity of the film means that this method is unsuitable.

Other methods for determination of the percentage volume of non-volatile matter are described in ISO 3233-1 and ISO 3233-2. The method described in this part of ISO 3233 is a quick method which needs only the results of the non-volatile matter and the density of the coating material and the density of the solvents for the calculation. The precision of the method depends mainly on the determination of the non-volatile matter content and the unknown densities. But the precision of the combination of measurements and calculation is better than the precision of pure calculation methods with no measurements. The simple practical method is often used in the automotive industry, especially for commercial vehicles.

The method described in this part of ISO 3233 differs from the methods described in ASTM D 2697 and ASTM D 5201-05, 5.5 and gives different results.

Paints and varnishes — Determination of the percentage volume of non-volatile matter —

Part 3:

Determination by calculation from the non-volatile-matter content determined in accordance with ISO 3251, the density of the coating material and the density of the solvent in the coating material

1 Scope

This part of ISO 3233 a simple practical method for calculating the non-volatile matter by volume, NV_V , of a coating material from the non-volatile-matter content, NV , the density of the coating material, and the density of the solvents. Using the non-volatile matter by volume results and the density obtained in accordance with this part of ISO 3233, it is possible to calculate the theoretical spreading rate of a coating material.

This part of ISO 3233 is not applicable to coating materials which exceed the critical pigment volume concentration (CPVC).

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 2808, *Paints and varnishes — Determination of film thickness*

ISO 2811-1, *Paints and varnishes — Determination of density — Part 1: Pycnometer method*

ISO 2811-2, *Paints and varnishes — Determination of density — Part 2: Immersed body (plummet) method*

ISO 2811-3, *Paints and varnishes — Determination of density — Part 3: Oscillation method*

ISO 2811-4, *Paints and varnishes — Determination of density — Part 4: Pressure cup method*

ISO 3251, *Paints, varnishes and plastics — Determination of non-volatile-matter content*

3 Terms and definitions

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

3.1 spreading rate

surface area that can be covered by a given quantity of coating material to give a dried film of requisite thickness

Note 1 to entry: It is expressed in m^2/l or m^2/kg .

Note 2 to entry: See also practical spreading rate and theoretical spreading rate.

[SOURCE: ISO 4618:2014, 2.238, modified — Application rate was deleted in Note 2.]

3.2 **non-volatile matter** **NV**

residue by mass obtained by evaporation under specified conditions

Note 1 to entry: Instead of the term “non-volatile matter”, different terms, such as solid, dry residue, dry matter, solid matter, and stoving residue, are being used commonly with the respective abbreviations. The term “non-volatile matter”, which is also applied in ISO 3251, should be used together with the abbreviation “NV” instead of these terms.

[SOURCE: ISO 4618:2014, 2.176]

3.3 **practical spreading rate**

spreading rate which is obtained in practice on the particular substrate being coated

[SOURCE: ISO 4618:2014, 2.203]

3.4 **practical dry film density**

practically determined density of a dried and cured coating

3.5 **theoretical spreading rate**

spreading rate calculated solely from the volume of non-volatile matter

[SOURCE: ISO 4618:2014, 2.256]

3.6 **theoretical dry film density**

coating density calculated from the densities of the solvents, coating materials, and the non-volatile-matter content of the coating material

3.7 **non-volatile matter by volume**

NV_v

percentage residue by volume obtained by evaporation under specified conditions

[SOURCE: ISO 4618:2014, 2.177]

4 Principle

The non-volatile matter by volume is calculated from the quotient of the density of the coating material and the density of the dry film, with the dry film density being determined theoretically.

5 Procedure

5.1 Determination of the theoretical dry film density

The dry film density can be determined theoretically, although the density of the solvents and of the coating material and the coating material’s non-volatile matter by mass also has to be determined. Since it is often not possible to specify the density of all the solvents present in the coating material, the density of the solvent in highest proportion is used in the calculation.

Determine the non-volatile matter by mass (NV) as described in ISO 3251.

5.2 Determination of the density

Determine the density of the coating material (ρ_1) and that of the solvents in the coating material (ρ_2) to the nearest 0,001 g/cm³ in accordance with one of the methods specified in the series of standards ISO 2811-1, ISO 2811-2, ISO 2811-3, and ISO 2811-4.

5.3 Determination of film thickness

Determine the dry film thickness using one of the methods described in ISO 2808.

6 Calculation

6.1 Calculation of the theoretical dry film density

Calculate the theoretical dry film density (ρ_t), in grams per cubic centimetre, as given in Formula (1) using the determined non-volatile matter by mass, the density of the coating material, and the density of the solvents or main solvent in the coating material:

$$\rho_t = \frac{\rho_1 \cdot NV}{100 - \frac{\rho_1}{\rho_2} \cdot (100 - NV)} \quad (1)$$

where

ρ_1 is the density of the coating material, in grams per cubic centimetre;

ρ_2 is the density of the solvents or the main solvent in the coating material, in grams per cubic centimetre;

NV is the non-volatile matter of the coating material, expressed as a percentage by mass.

In the case of waterborne coating materials, the density of the solvents (ρ_2) shall be the density of the total solvent composition, including water or the density which is recommended in [Table 1](#).

Table 1 — Recommended density values of solvents in waterborne coating materials

Composition of the solvent	Recommended values for ρ_2 , if the density of the solvents is not known
	g/cm ³
predominantly aliphatic hydrocarbons	0,80
predominantly aromatic hydrocarbons	0,87
water, VOC ≤ 5 % ^a	1,00

^a VOC Volatile organic compound.