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Paints and varnishes — Determination of volatile organic compound (VOC) and/or semi-volatile organic compound (SVOC) content — Best practices for the selection of test methods

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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 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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 16, *Chemical analysis*.

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.

Paints and varnishes — Determination of volatile organic compound (VOC) and/or semi-volatile organic compound (SVOC) content — Best practices for the selection of test methods

1 Scope

This document aims to enable users to identify an appropriate method for the determination of volatile organic compounds (VOC) content and/or the semi-volatile organic compounds (SVOC) content of coating materials and their raw materials. This document provides a step-by-step procedure for identifying appropriate tests. This document is intended to be used in conjunction with ISO 11890-1, ISO 11890-2 and ISO 17895, to help users select an appropriate analytical method for their analytical problem.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
volatile organic compound
VOC
organic liquid and/or solid that evaporates spontaneously at the prevailing temperature and pressure of the atmosphere with which it is in contact

Note 1 to entry: As to current usage of the term VOC in the field of *coating materials* (3.11), see *volatile organic compound content* (3.4).

Note 2 to entry: Under US government legislation, the term VOC is restricted solely to those compounds that are photochemically active in the atmosphere (see ASTM D3960). Any other compound is then defined as being an exempt compound.

[SOURCE: ISO 4618:2023, 3.266, modified — Note 3 to entry has been deleted]

3.2
semi-volatile organic compound
SVOC
organic liquid and/or solid that evaporates spontaneously but slower in comparison to volatile organic compound at the prevailing temperature and pressure of the atmosphere with which it is in contact

Note 1 to entry: As to current usage of the term SVOC in the field of *coating materials* (3.11), see *semi-volatile organic compounds content* (3.5).

[SOURCE: ISO 11890-2:2020, 3.2]

3.4
volatile organic compound content
VOC content
mass of the volatile organic compounds present in a *coating material* (3.11), as determined under specified conditions

Note 1 to entry: The properties and the amounts of compounds to be taken into account will depend on the field of application of the coating material. For each field of application, the limiting values and the methods of determination or calculation are stipulated by regulations or by agreement.

[SOURCE: ISO 4618:2023, 3.267]

3.5
semi-volatile organic compounds content
SVOC content
mass of the *semi-volatile organic compounds* (3.2) present in a coating material, as determined under specified conditions

Note 1 to entry: The properties and the amounts of the compounds to be taken into account will depend on the field of application of the *coating material* (3.11). For each field of application, the limiting values and the methods of determination or calculation are stipulated by regulations or by agreement.

Note 2 to entry: If the term SVOC refers to compounds with a defined maximum boiling point and minimum boiling point, the compounds considered to be part of the SVOC content are those with boiling points below and including the upper and above the lower limit, and compounds with higher boiling points are considered to be non-volatile organic compounds.

[SOURCE: ISO 11890-2:2020, 3.5]

3.7
ready for use
state of a product when it is mixed in accordance with the manufacturer's instructions in the correct proportions and thinned if required using the correct thinners so that it is ready for application by the approved method

[SOURCE: ISO 11890-2:2020, 3.7]

3.8
surrogate standard
compound of known purity which is used to quantify unidentified *volatile organic compounds* (3.1) and *semi-volatile organic compounds* (3.2)

[SOURCE: ISO 11890-2:2020, 3.9]

3.11
coating material
product, in liquid, paste or powder form, that, when applied to a substrate, forms a layer possessing protective, decorative and/or other specific properties

[SOURCE: ISO 4618:2023, 3.48]

3.12
multi-pack product
coating material (3.11) that is supplied in two or more separate components which have to be mixed before use in the proportions specified by the manufacturer

[SOURCE: ISO 4618:2023, 3.159]

4 Determination of the appropriate test method

4.1 Sampling

A representative sample of the product to be tested (or of each product in the case of a multi-pack products), is taken as specified in ISO 15528.

The sample is prepared as specified in ISO 1513 for testing in the “ready for use” state.

4.2 Selection of method

If the customer requests a specific method, e.g. because regulations or labels require this method, it is checked whether the samples are suitable for this method.

If no analytical method is specified by the customer, the appropriate analytical method for determination of VOC and/or SVOC content can be selected according to the following priority list.

In general, ISO 11890-2 can be used for the determination of VOC and/or SVOC content. ISO 11890-2 is applicable if the expected VOC and/or SVOC content is greater than 0,01 % (mass fraction) up to 100 % (mass fraction).

For determination of the SVOC content, the method according to ISO 11890-2 can be applied.

For the determination of VOC content, alternative methods can be applied depending on the VOC content expected and on the presence of SVOC in addition to VOC.

If the VOC content is greater than 15 % (mass fraction) and SVOC is either not present or the differentiation of VOC and SVOC is neglectable or irrelevant for the customer, the gravimetric method given in ISO 11890-1 can be used. If the system contains VOC and SVOC, the VOC result of ISO 11890-1 can be influenced by SVOC. For multi-pack coatings, radiation curable and coating materials with reactive diluents, only ISO 11890-1 can be used for VOC.

For VOC content smaller than 0,1 % (mass fraction) and when no SVOC content determination is required, the head space method described in ISO 17895 can be used.

Figure 1 and Table 1 provide an overview of all available ISO methods for the determination of VOC and SVOC content.

Figure 1 shows the possible options of using ISO 11890-1 or ISO 17895, alongside ISO 11890-2.

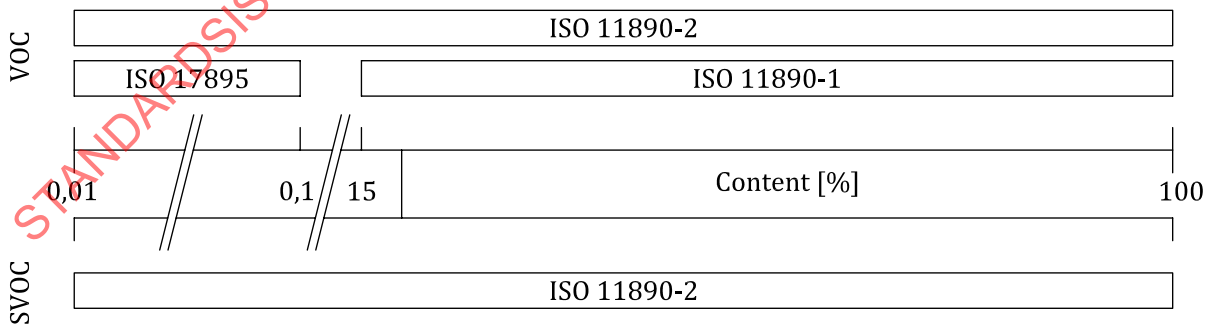

Figure 1 — Overview on existing standards for the determination of VOC and/or SVOC content

The values for VOC content determined according to ISO 17895 are not comparable to the values obtained by using ISO 11890-2. The reason for this is, on the one hand, the different measurement principle and, on the other hand, the different surrogate standard used (i.e. diethyladipate, see ISO 11890-2 and mixture of compound according to ISO 17895).

Table 1 — Overview on test methods and standards

Determination of	Present in sample	Test method	Lower limit	Upper limit	Alternatives
SVOC	VOC and/or SVOC	ISO 11890-2	0,01 %	100 %	None
VOC	VOC and/or SVOC	ISO 11890-2	0,01 %	100 %	ISO 17895 for VOC < 0,1 % ISO 11890-1 for VOC > 15 %
VOC	only VOC	ISO 11890-1	15 %	100 %	ISO 11890-2
VOC	VOC and/or SVOC	ISO 17895	0,01 %	0,10 %	ISO 11890-2 Can be used as an alternative to ISO 11890-2, when the matrix is clogging the GC with direct injection

Figure 2 shows information on choosing the appropriate test method.

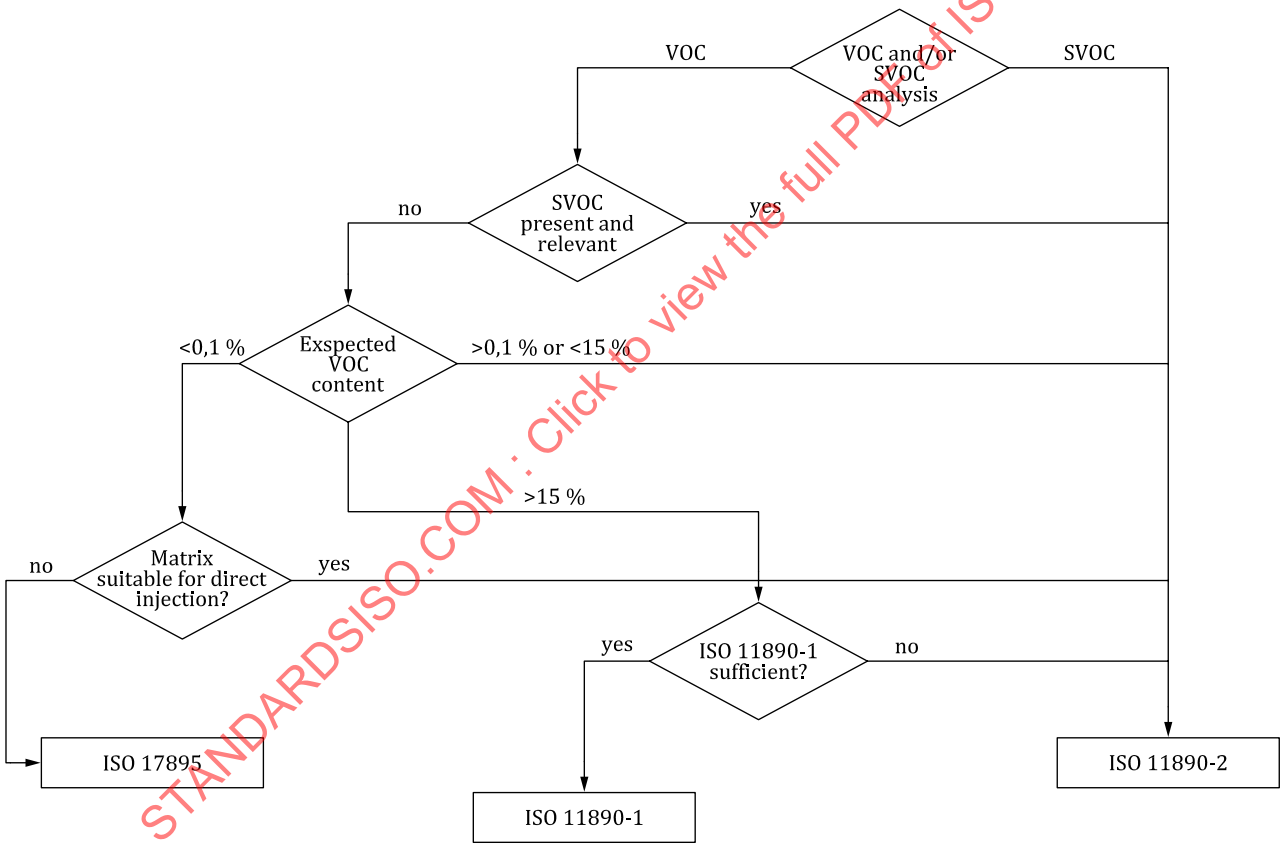

Figure 2 — Information for choosing a method