
Interior air of road vehicles —

Part 1:

**Whole vehicle test chamber —
Specification and method for the
determination of volatile organic
compounds in cabin interiors**

Air intérieur des véhicules routiers —

*Partie 1: Enceinte d'essai pour un véhicule complet — Spécification et
méthode de détermination des composés organiques volatils dans les
habitacles d'automobiles*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 12219-1 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 6, *Indoor air*, in collaboration with Technical Committee ISO/TC 22, *Road vehicles*.

ISO 12219 consists of the following parts, under the general title *Interior air of road vehicles*:

- *Part 1: Whole vehicle test chamber — Specification and method for the determination of volatile organic compounds in cabin interiors*
- *Part 2: Screening method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials — Bag method*
- *Part 3 Screening method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials — Micro-scale chamber method*
- *Part 4: Screening method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials — Small chamber method*

The following part is under preparation:

- *Part 5: Screening method for the determination of the emissions of volatile organic compounds from vehicle interior parts and materials — Static chamber method*

Introduction

Volatile organic compounds (VOCs) are widely used in industry and can be emitted by many everyday products and materials. They have attracted attention in recent years because of their impact on indoor air quality. After homes and workplaces, people spend a lot of time in their vehicles. It is important to determine the material emissions of interior parts and to reduce them to an acceptable level, if required. Therefore it is necessary to obtain comprehensive and reliable information about the types of organic compounds in the interior air of vehicles and also their concentrations.

This part of ISO 12219 outlines a method of measuring the types and levels of VOCs in vehicle cabin air under controlled conditions. It describes requirements for a whole vehicle test chamber and a test protocol. Measurements are carried out according to ISO 16000-6 (VOCs) and ISO 16000-3 (carbonyl compounds).

There are several national test methods available for measuring in-vehicle air quality, e.g. References [2][3]. However, this part of ISO 12219 requires a fixed heating radiation system whereas the methods of References [2][3] define a fixed temperature programme.

Before setting a fixed radiation density for heating the test vehicle, several validation measurements were performed (Reference [1]).

ISO 16000-3, ISO 16000-5,^[6] ISO 16000-6, ISO 16000-9,^[7] ISO 16000-10,^[8] ISO 16000-11,^[9] ISO 16000-24,^[10] ISO 16000-25,^[11] as well as ISO 16017-1 and ISO 16017-2^[12] also focus on volatile organic compound (VOC) measurements.

Interior air of road vehicles

Part 1:

Whole vehicle test chamber — Specification and method for the determination of volatile organic compounds in cabin interiors

WARNING — It is the responsibility of the user of this part of ISO 12219 to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use. National regulations for precautions shall be followed.

1 Scope

This part of ISO 12219 describes and specifies the whole vehicle test chamber, the vapour sampling assembly and the operating conditions for the determination of volatile organic compounds (VOCs), and carbonyl compounds in vehicle cabin air. There are three measurements performed: one (for VOCs and carbonyl compounds) during the simulation of ambient conditions (ambient mode) at standard conditions of 23 °C with no air exchange; a second only for the measurement of formaldehyde at elevated temperatures (parking mode); and a third for VOCs and carbonyl compounds simulating driving after the vehicle has been parked in the sun starting at elevated temperatures (driving mode). For the simulation of the mean sun irradiation, a fixed irradiation in the whole vehicle test chamber is employed.

The VOC method is valid for measurement of non-polar and slightly polar VOCs in a concentration range of sub-micrograms per cubic metre up to several milligrams per cubic metre. Using the principles described in this method, some semi-volatile organic compounds (SVOC) can also be analysed. Compatible compounds are those which can be trapped and released from the Tenax TA^{®1)} sorbent tubes described in ISO 16000-6, which includes VOCs ranging in volatility from *n*-C₆ to *n*-C₁₆.

The sampling and analysis procedure for formaldehyde and other carbonyl compounds is performed by collecting air on to cartridges coated with 2,4-dinitrophenylhydrazine (DNPH) and subsequent analysis by high performance liquid chromatography (HPLC) with detection by ultraviolet absorption. Formaldehyde and other carbonyl compounds can be determined in the approximate concentration range 1 µg/m³ to 1 mg/m³.

The method is valid for passenger cars, as defined in ISO 3833.

This part of ISO 12219 describes:

- a) transport and storage of the test vehicles until the start of the test;
- b) conditioning for the surroundings of the test vehicle and the test vehicle itself as well as the whole vehicle test chamber;
- c) conditioning of the test vehicle prior to measurements;
- d) simulation of ambient air conditions (ambient mode);
- e) formaldehyde sampling at elevated temperatures (parking mode);
- f) simulation of driving after the test vehicle has been parked in the sun (driving mode).

Buses, motor caravans, and trucks, in accordance with the descriptions given in ISO 3833, are excluded.

1) Tenax TA[®] is the trade name of a product supplied by Buchem. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

2 Normative references

The following referenced documents are indispensable for the application 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 3833:1977, *Road vehicles — Types — Terms and definitions*

ISO 9060, *Solar energy — Specification and classification of instruments for measuring hemispherical solar and direct solar radiation*

ISO 16000-3, *Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*

ISO 16000-6:2011, *Indoor air — Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA[®] sorbent, thermal desorption and gas chromatography using MS or MS–FID*

ISO 16017-1, *Indoor, ambient and workplace air — Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography — Part 1: Pumped sampling*

3 Terms and definitions

For the purpose of this document, the terms and definitions of ISO 16000-3, ISO 16000-6 and the following apply.

3.1

background concentration

analyte concentration in the whole-vehicle test chamber when the test vehicle is inside

3.2

test vehicle

new or used vehicle to be tested

NOTE 1 The test vehicle can be of any type specified in ISO 3833:1977, 3.1.1, only.

NOTE 2 See also 4.5.

3.3

total volatile organic compounds

TVOCs

sum of volatile organic compounds sampled on Tenax TA^{®1)} and eluting between and including *n*-hexane and *n*-hexadecane, detected with a flame ionization detector (TVOC_{FID}) or mass spectrometric detector (TVOC_{MS}) and quantified converting the total area of the chromatogram in that analytical window to toluene equivalents

NOTE Adapted from ISO 16000-6:2011, 3.4.

3.4

carbonyl compound

compound containing the functional group C(=O)- determined according to a specified procedure

NOTE For the purposes of this part of ISO 12219, the procedure is that specified in ISO 16000-3.

3.5

ambient mode

mode in which sampling of VOCs and carbonyl compounds in the cabin of a test vehicle under standardized ambient temperature conditions is performed, defined by 23 °C

NOTE Engine off, radiators off, sampling time 30 min.