PD ISO/TS 17536-2:2017

BSI Standards Publication

# Road vehicles — Aerosol separator performance test for internal combustion engines

Part 2: Laboratory test method

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# National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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# Road vehicles — Aerosol separator performance test for internal combustion engines —

## Part 2: Laboratory test method

*Véhicules routiers — Essai de performance du séparateur d'aérosols pour les moteurs à combustion interne —*

*Partie 2: Méthode d'essai de laboratoire*

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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.

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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

A list of all parts in the ISO 17536 series can be found on the ISO website.


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# Introduction

The engine crankcase blowby is composed of combustion exhaust gases which have escaped to the crankcase via piston ring seals and lube oil aerosols generated by thermal and mechanical action within the engine. These gases are vented from the crankcase to prevent a build-up of high pressure. The constituents of vented engine blowby gases are recognized as an undesirable contaminant and technology for their containment is therefore evolving.

The device, used to separate oil aerosols from the blowby, typically releases cleaned gases to the atmosphere or alternatively returns the cleaned product to the combustion process by feeding into the engine air intake prior to the turbo compressor (if present). The latter has led to the requirement for a pressure control device to isolate the engine crankcase from air intake pressure.

It is the purpose of this document to define standardized and repeatable test procedures for the evaluation of blowby oil aerosol separators and filtering devices using this laboratory gravimetric test method.

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# Road vehicles — Aerosol separator performance test for internal combustion engines —

## Part 2:
## Laboratory test method

## 1 Scope

This document defines standardized and repeatable test procedures for the evaluation of blowby oil aerosol separators and filtering devices and specifies laboratory gravimetric separation efficiency and system pressure tests in both open and closed crankcase ventilation systems. This document has a limitation of 0 % to 99 % for aerosol gravimetric efficiency.

NOTE Gravimetric efficiencies >99 % may be difficult to measure due to long test durations and absolute filter weight measurements.

Filter life is not evaluated in this document.

This test method only applies to devices that have a defined tubular inlet, outlet and drain that can be connected to the test equipment. For devices that lack such connections, for example, one that is built into a valve cover, see Annex A.

## 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 17536-1:2015, *Road vehicles — Aerosol separator performance test for internal combustion engines — Part 1: General*

## 3 Terms and definitions

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

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

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

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

**3.1**
**standard flow**
flow rate corrected to standard conditions

Note 1 to entry: See 5.3 for details.

## 4 Measurement accuracy

The measurement accuracy of this document shall be in accordance with ISO 17536-1:2015, Clause 3.

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# 5 Test materials and test conditions

## 5.1 Test oil

The test oil to be used shall be an oil of such appropriate viscosity and surface tension that the particle size of 50 % cumulative mass of the generated aerosol exhibits more than 0,85 µm and less than 0,90 µm. The test oil shall meet the aerosol distribution by mass given in Annex B. The challenge aerosol size distribution shall be plotted in Figure C.1.

## 5.2 Absolute filter, wall flow trap and leakage

The provisions related to the absolute filter, the downstream wall flow trap and leakage shall be in accordance with ISO 17536-1:2015, Clause 4.

## 5.3 Standard conditions

The standard condition for temperature, humidity and pressure is 20 °C, 0 % RH and 101,3 kPa (1 013 mbar). Airflow differential pressure, inlet and outlet pressure and pressure loss shall be corrected to that standard condition.

## 5.4 Test temperature

### 5.4.1 Efficiency tests

The volume directly outside of the UUT and internal temperature of the efficiency test shall be either:

Condition A: 80 °C ± 3 °C

Condition B: 23 °C ± 5 °C

The condition that is run shall be documented in the test report (see Table C.1).

### 5.4.2 Differential pressure, pressure loss and crankcase pressure control tests

The flow rate for pressure loss and crankcase pressure control tests shall be corrected to standard flow. The pressure loss and crankcase pressure control tests shall be conducted with air entering the aerosol separator at a temperature of 23 °C ± 5 °C.

# 6 Test procedure

## 6.1 General

Performance tests shall be performed on a complete aerosol separator assembly. The tests shall consist of a pressure loss test, gravimetric efficiency test, conditioned gravimetric efficiency test, crankcase pressure control test (when a pressure regulator is present) and drain interval test (when applicable).

## 6.2 Test equipment

NOTE The definitions of the following terms related to the test equipment are defined in ISO 17536-1:2015, Clause 2: upstream particle counter, particle counter calibration, maximum particle concentration and particle counter flow.

**6.2.1** Typical arrangements to determine the differential pressure or pressure loss to air flow, efficiency and crankcase pressure control are shown in Annex D.

Use an aerosol generator which is capable of dosing oil mist over the range of delivery rates required according to the customers' specification.


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The aerosol generator shall be validated as follows.

— Fill the aerosol generator to a pre-determined level.

— Simultaneously start the aerosol generator and timer.

— At a time interval relative to a mass oil flow of >1 g, determine the amount of aerosol dispersed and particle size distribution. Continue mass oil flow determinations of the aerosol until the desired oil flow deviates by <5 % and shall be >30 min. Continue feeding aerosol until the particle distribution does not meet the Annex B specification (to understand time capability to deliver a distribution as specified in Annex B).

— Adjust the aerosol generator until the average delivery rate is within ±5 % of the desired rate and deviation in the delivery rate from the average is not more than ±5 % for the entire designated test duration.

— After verifying the delivery rate, verify the aerosol delivered from the aerosol generator for the entire test duration is within the Annex B specifications.

**6.2.2** An upstream wall flow trap should be used between the oil mist generator and the inlet tube to eliminate any oil wall flow to the inlet tube. Use a wall flow trap conforming to ISO 17536-1:2015, Annex I.

**6.2.3** Use an inlet piezometer tube conforming to ISO 17536-1:2015, Figure B.2. The cross-section shall be the same as the aerosol separator inlet. In the case of non-uniform flow conditions caused by special inlet tubes, special precautions may be required.

**6.2.4** Use a manometer or other differential pressure measuring device with the specified accuracy described in ISO 17536-1:2015, Clause 3.

**6.2.5** Setup test with no UUT present, e.g. straight pipe.

**6.2.6** A downstream wall flow trap should be used between the unit under test and the outlet piezometer tube described in 6.2.3 to eliminate any oil wall flow. Use a wall flow trap conforming to ISO 17536-1:2015, Annex I.

**6.2.7** Use an outlet tube conforming to ISO 17536-1:2015, Figure B.2. The cross-section shall be the same as the aerosol separator outlet. In the case of non-uniform flow conditions caused by special inlet tubes, special precautions may be required.

**6.2.8** Use an air flow rate measuring system having the accuracy described in ISO 17536-1:2015, Clause 3. The flow rate for differential pressure and crankcase pressure control tests shall be standard flow, which is the volume flow rate corrected to standard conditions, as specified in 5.3.

**6.2.9** Use an air flow rate control system with a refresh rate greater than 2 Hz capable of maintaining the indicated flow rate to within 5 % of the selected value at a minimum data record frequency of 2 Hz during a steady-state and variable air flow operation.

**6.2.10** Use a compressed air/blower/exhauster for controlling the air flow through the system, which has adequate flow rate and pressure characteristics for the oil separators to be tested.

**6.2.11** If the unit under test has a pressure regulator or bypass, the use of a blower/exhauster on the downstream of the system can be used to regulate the pressure on the outlet of the unit under test. Devices with pressure regulators shall have air pushed through the inlet because the pressure regulator device regulates the amount of negative vacuum allowed on the system.

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