



**International
Standard**

ISO 5011

**Inlet air cleaning equipment for
internal combustion engines and
compressors — Performance testing**

*Séparateurs aérauliques placés à l'entrée des moteurs à
combustion interne et des compresseurs — Détermination des
performances*

**Fifth edition
2025-09**

This document is a preview generated by EMS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
1 Scope	1
2 Normative references	1
3 Terms, definitions and symbols	1
3.1 Terms and definitions.....	1
3.2 Symbols.....	3
4 Measurement accuracy and standard conditions	4
4.1 Measurement accuracy and precision.....	4
4.2 Standard conditions.....	4
5 Test materials and test conditions	4
5.1 Test dust.....	4
5.1.1 Grade.....	4
5.1.2 Preparation.....	5
5.2 Test oil for oil bath air cleaners.....	5
5.3 Absolute filter materials.....	5
5.3.1 Filter media.....	5
5.3.2 Validation of absolute filter media efficiency, E_a	5
5.4 Absolute filter mass.....	6
5.4.1 Validation of the absolute filter weighing method.....	6
5.5 Temperature and humidity.....	6
6 Test procedure for dry-type single-stage air cleaners	6
6.1 General.....	6
6.2 Test equipment.....	6
6.3 Restriction and differential pressure test.....	8
6.4 Efficiency test.....	8
6.4.1 Purpose.....	8
6.4.2 Types.....	8
6.4.3 Test procedure — Absolute filter method.....	9
6.4.4 Test procedure — Direct weighing method.....	10
6.5 Capacity test.....	10
6.6 Filter element pressure collapse test.....	11
6.7 Variable airflow test.....	11
6.8 Presentation of data.....	12
7 Test procedure for dry-type multistage air cleaners	12
7.1 General.....	12
7.2 Test equipment.....	12
7.3 Restriction and differential pressure test.....	13
7.4 Initial efficiency test procedure — Absolute filter method.....	13
7.5 Full-life efficiency and capacity test.....	14
7.5.1 Air cleaner dust capacity.....	14
7.5.2 Test procedure — Absolute filter method.....	14
7.5.3 Test procedure — Direct weighing method.....	15
7.6 Presentation of data.....	16
7.7 Variations for scavenged airflow performance testing.....	16
7.7.1 General.....	16
7.7.2 Additional equipment.....	16
7.7.3 Restriction and differential pressure test.....	17
7.7.4 Full-life efficiency and capacity test.....	17
7.7.5 Presentation of data.....	17
7.8 Precleaner performance test.....	17
7.8.1 Precleaner dust removal.....	17
7.8.2 Precleaner efficiency.....	18
7.8.3 Presentation of data.....	18

7.9	Secondary element test procedure.....	18
7.9.1	General.....	18
7.9.2	Specific efficiency test.....	18
7.9.3	Expression of results.....	19
8	Test procedure for oil bath air cleaners.....	19
8.1	General.....	19
8.2	Test equipment and conditions.....	19
8.3	Restriction and differential pressure test.....	20
8.4	Oil carry-over test.....	20
8.5	Full life efficiency and capacity test.....	20
8.6	Recovery test.....	21
8.7	Presentation of data.....	21
Annex A	(normative) Explanation of restriction, differential pressure and pressure loss of an air cleaner.....	22
Annex B	(normative) Test equipment.....	24
Annex C	(informative) Report sheet on performance testing of air cleaner equipment according to ISO 5011 — Dry-type single-stage air cleaners.....	36
Annex D	(informative) Report sheet on performance testing of air cleaner equipment according to ISO 5011 — Dry-type multistage air cleaners.....	38
Annex E	(informative) Presentation of results — Air cleaner restriction/differential pressure versus flow.....	40
Annex F	(informative) Presentation of results — Air cleaner capacity.....	41
Annex G	(normative) Airflow and resistance corrections to standard conditions.....	42
Annex H	(normative) Penetration sensitivity.....	43
Bibliography	50

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This fifth edition cancels and replaces the fourth edition (ISO 5011:2020), which has been technically revised.

The main changes are as follows:

- capacity of UUT is no longer dependent on scavenge flow rate;
- “air cleaner” used instead of “air filter” where warranted;
- edited list of symbols to meet ISO specifications;
- significant editorial modifications to [Annex H](#).

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.

Inlet air cleaning equipment for internal combustion engines and compressors — Performance testing

1 Scope

This document establishes and specifies uniform test procedures, conditions, equipment and a performance report to permit the direct laboratory performance comparison of air cleaners.

The basic performance characteristics of greatest interest are airflow restriction or differential pressure, dust collection efficiency, dust capacity and oil carry-over on oil bath air cleaners. This test code therefore deals with the measurement of these parameters.

This document is applicable to air cleaners used on internal combustion engines and compressors generally used in automotive and industrial applications.

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 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

ISO 12103-1, *Road vehicles — Test contaminants for filter evaluation — Part 1: Arizona test dust*

3 Terms, definitions and symbols

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 Terms and definitions

3.1.1

air cleaner

device which removes particles suspended in the intake air as it is drawn into the engine

3.1.2

filter element

replaceable part of the *air cleaner* (3.1.1), consisting of the filter material and carrying frame

3.1.3

secondary element

air cleaner (3.1.1) element fitted downstream of the primary element for the purpose of providing the engine with protection against dust in the event of

- a) certain types of primary element failure, or
- b) dust being present during the removal of the primary element for servicing