
**Reciprocating internal combustion
engines — Exhaust emission
measurement —**

**Part 2:
Measurement of gaseous and particulate
exhaust emissions under field conditions**

*Moteurs alternatifs à combustion interne — Mesurage des émissions de
gaz d'échappement —*

Partie 2: Mesurages des émissions de gaz et de particules sur site



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Published in Switzerland

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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 8178-2 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*, Subcommittee SC 8, *Exhaust gas emission measurement*.

This second edition cancels and replaces the first edition (ISO 8178-2:1996), which has been technically revised.

ISO 8178 consists of the following parts, under the general title *Reciprocating internal combustion engines — Exhaust emission measurement*:

- *Part 1: Test-bed measurement of gaseous and particulate exhaust emissions*
- *Part 2: Measurement of gaseous and particulate exhaust emissions under field conditions*
- *Part 3: Definitions and methods of measurement of exhaust gas smoke under steady-state conditions*
- *Part 4: Steady-state test cycles for different engine applications*
- *Part 5: Test fuels*
- *Part 6: Report of measuring results and test*
- *Part 7: Engine family determination*
- *Part 8: Engine group determination*
- *Part 9: Test cycles and test procedures for test bed measurement of exhaust gas smoke emissions from compression ignition engines operating under transient conditions*
- *Part 10: Test cycles and test procedures for field measurement of exhaust gas smoke emissions from compression ignition engines operating under transient conditions*
- *Part 11: Test-bed measurement of gaseous and particulate exhaust emissions from engines used in nonroad mobile machinery under transient test condition*

Reciprocating internal combustion engines — Exhaust emission measurement —

Part 2:

Measurement of gaseous and particulate exhaust emissions under field conditions

1 Scope

This part of ISO 8178, together with ISO 8178-1 and ISO 8178-11, specifies the measurement and evaluation methods for gaseous and particulate exhaust emissions from reciprocating internal combustion engines (RIC engines) under steady-state and transient conditions for field testing.

This part of ISO 8178 is applied when RIC engines used in off-road vehicles, marine installations, generating sets, diesel rail traction or similar applications need to be measured under field conditions or at site in order to determine the in-use compliance, or when it is not possible to take the measurements under test-bed conditions or to use the test-bed measurement results.

Re-checking or re-certification of engines for off-road vehicles after rebuild should preferably be tested outside the vehicle on a suitable load application and measurement device such as a dynamometer or load bank, but in-use compliance testing may be done on the vehicle.

This method can be used for determining conformity or certification of new, used or rebuilt engines at site or for in-use compliance testing of off-road vehicles. Confirmation of test-bed results with respect to ISO 8178-4 can also be performed within this part of ISO 8178. However, allowances need to be made for differences in engine operating parameters from laboratory conditions and for the accuracy of emission measurement equipment used under field conditions.

For engines used in machinery covered by additional requirements (e.g. occupational health and safety regulations, regulations for powerplants), additional test conditions and special evaluation methods may apply.

NOTE This part of ISO 8178 is intended to specify special requirements for the measurement of gaseous and particulate emissions at site or under field operating conditions. In many cases, the test cycles specified in ISO 8178-4 and ISO 8178-11 cannot be reproduced at site due to constraints of load. For in-use compliance testing, actual in-use operation might be required.

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 3046-3:2006, *Reciprocating internal combustion engines — Performance — Part 3: Test measurements*

ISO 8178-1:2006, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test-bed measurement of gaseous and particulate exhaust emissions*

ISO 8178-4¹⁾, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 4: Steady-state test cycles for different engine applications*

ISO 8178-5, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 5: Test fuels*

ISO 8178-6, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 6: Report of measuring results and test*

ISO 8178-11:2006, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 11: Test-bed measurement of gaseous and particulate exhaust emissions from engines used in nonroad mobile machinery under transient test conditions*

ISO 14396, *Reciprocating internal combustion engines — Determination and method for the measurement of engine power — Additional requirements for exhaust emission tests in accordance with ISO 8178*

ISO 15550:2002, *Internal combustion engines — Determination and method for the measurement of engine power — General requirements*

3 Terms and definitions

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

3.1

particulates

material collected on a specified filter medium after diluting diesel exhaust with clean filtered air to a temperature greater than 315 K (42 °C) and less than or equal to 325 K (52 °C) as measured at a point immediately upstream of the primary filter

EXAMPLE This is primarily carbon, condensed hydrocarbons and sulphates and associated water.

NOTE 1 Particulates defined in this part of ISO 8178 are substantially different in composition and weight from particulates or dust sampled directly from the undiluted exhaust gas using a hot filter method (e.g. ISO 9096). Particulate measurement as described in this part of ISO 8178 is conclusively proven to be effective for fuel sulfur levels up to 0,8 %.

NOTE 2 The filter temperature requirement has been changed compared to ISO 8178-1 to reflect the latest U.S. environmental protection agency (EPA) and EC legal requirements. Existing systems built in compliance with the requirements of ISO 8178-1 can still be used with the agreement of the parties involved.

3.2

partial-flow dilution method

process of separating a part of the raw exhaust from total exhaust flow, then mixing in an appropriate amount of dilution air to this sample prior to the sample filter

NOTE See ISO 8178-1:2006, 17.2.1, Figures 10 to 18.

3.3

full-flow dilution method

process of mixing dilution air with the total exhaust flow prior to separating a fraction of the diluted exhaust stream for analysis

NOTE 1 See ISO 8178-1:2006, 17.2.2, Figure 19.

NOTE 2 It is common in many full-flow dilution systems to dilute this fraction of pre-diluted exhaust a second time to obtain appropriate filter sample temperatures at the particulate filter. (See ISO 8178-1:2006, 17.3, Figures 20 and 21.)

1) To be published. (Revision of ISO 8178-4:1996)