



SLOVENSKI STANDARD SIST EN ISO 8178-4:2000

01-december-2000

Reciprocating internal combustion engines - Exhaust emission measurement - Part 4: Test cycles for different engine applications (ISO 8178-4:1996)

Reciprocating internal combustion engines - Exhaust emission measurement - Part 4: Test cycles for different engine applications (ISO 8178-4:1996)

Hubkolben-Verbrennungsmotoren - Abgasmessung - Teil 4: Prüfzyklen für verschiedene Motorverwendungen (ISO 8178-4:1996)

Moteurs alternatifs a combustion interne - Mesurage des émissions de gaz s'échappement - Partie 4: Cycles d'essais pour différentes applications des moteurs (ISO 8178-4:1996)

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ICS:

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27.020	Motorji z notranjim zgorevanjem	Internal combustion engines

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English version

**Reciprocating internal combustion engines -
Exhaust emission measurement - Part 4: Test
cycles for different engine applications
(ISO 8178-4:1996)**

Moteurs alternatifs à combustion interne -
Mesurage des émissions de gaz d'échappement -
Partie 4: Cycles d'essais pour différentes
applications des moteurs (ISO 8178-4:1996)

Hubkolben-Verbrennungsmotoren - Abgasmessung -
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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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EN ISO 8178-4:1996

Foreword

The text of the International Standard ISO 8178-4:1996 has been prepared by Technical Committee ISO/TC 70 "Internal combustion engines" in collaboration with Technical Committee CEN/TC 270 "Internal combustion engines", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 1997, and conflicting national standards shall be withdrawn at the latest by February 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 8178-4:1996 was approved by CEN as a European Standard without any modification.

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INTERNATIONAL
STANDARD

ISO
8178-4

First edition
1996-08-15

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

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Part 4:

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Test cycles for different engine applications

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~~d3 Moteurs alternatifs à combustion interne — Mesure des émissions de gaz d'échappement —~~

Partie 4: Cycles d'essai pour différentes applications des moteurs



Reference number
ISO 8178-4:1996(E)

ISO 8178-4:1996(E)

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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.

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.

International Standard ISO 8178-4 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*, Subcommittee SC 8, *Exhaust gas emission measurement*.

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 at site*
- *Part 3: Definitions and methods of measurement of exhaust gas smoke under steady-state conditions*
- *Part 4: Test cycles for different engine applications*
- *Part 5: Test fuels*
- *Part 6: Test report*
- *Part 7: Engine family determination*
- *Part 8: Engine group determination*
- *Part 9: Test bed measurement of exhaust gas smoke emissions from engines used in non-road mobile machinery*

Annexes A, B and C of this part of ISO 8178 are for information only.

Introduction

In comparison with engines for on-road applications, engines for off-road use are made in a much wider range of power output and configuration and are used in a great number of different applications.

The objective of this part of ISO 8178 is to rationalize the test procedures for off-road engines in order to simplify and make cost effective the drafting of legislation, the development of engine specifications and the certification of engines to control gaseous and particulate emissions.

This part of ISO 8178 embraces three principles in order achieve the objectives.

The first principle is to group applications with similar engine operating characteristics in order to reduce the number of test cycles to a minimum, but ensuring that the test cycles are representative of actual engine operation. The modes of these cycles have been selected so that the majority of test cycles are sub-sets of a universal test cycle.

The second principle is to express the emissions results on the basis of brake power as defined in ISO 8178-1:1996, 3.9. This ensures that alternative engine applications do not result in a multiplicity of tests.

The third principle is the incorporation of an engine family concept in which engines with similar emission characteristics and of similar design may be represented by the highest emitting engine within the group.

Reciprocating internal combustion engines — Exhaust emission measurement —

Part 4:

Test cycles for different engine applications

1 Scope

This part of ISO 8178 specifies the test cycles for the measurement and the evaluation of gaseous and particulate exhaust emissions from reciprocating internal combustion (RIC) engines coupled to a dynamometer. With some certain restrictions this part of ISO 8178 can also be used for measurements at site. The tests are to be carried out under steady-state operation using test cycles which are representative of given applications.

This part of ISO 8178 is applicable to RIC engines for mobile, transportable and stationary use, excluding engines for motor vehicles primarily designed for road use. It may be applied to engines used, e.g., for earth-moving machines, generating sets and for other applications.

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.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8178. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8178 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8178-1:1996, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test-bed measurement of gaseous and particulate exhaust emissions.*

ISO 8178-2:1996, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 2: Measurement of gaseous and particulate exhaust emissions at site.*

ISO 8178-3:1994, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 3: Definitions and methods of measurement of exhaust gas smoke under steady-state conditions.*

ISO 8178-5:—¹⁾, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 5: Test fuels.*

1) To be published.

ISO 8178-6:—¹⁾, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 6: Test report.*

ISO 8178-7:—¹⁾, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 7: Engine family determination.*

ISO 8178-8:—¹⁾, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 8: Engine group determination.*

ISO 8528-1:1993, *Reciprocating internal combustion engine driven alternating current generating sets — Part 1: Application, ratings and performance.*

3 Definitions

For the purposes of this part of ISO 8178, the following definitions apply.

3.1 test cycle: A sequence of engine test modes each with defined speed, torque and weighting factor W_F (except cycle B "Universal" without weighting factors), where the weighting factors only apply if the test results are expressed in g/kWh.

3.2 preconditioning of the engine: Warming up of the engine at the rated power used in the test cycle to stabilize the engine parameters according to the recommendations of the manufacturer.

NOTE 1 A preconditioning phase should also protect the actual measurement against the influence of deposits in the exhaust system from a former test.

There is also a period of stabilization in the test modes which has been included to minimize point-to-point influences.

3.3 mode: An engine operating point characterized by a speed and a torque (or an output).

3.4 mode length: The time between leaving the speed and/or torque of the previous mode or the preconditioning phase and the beginning of the following mode. It includes the time during which speed and/or torque is changed and the stabilization at the beginning of each mode.

3.5 rated speed: Speed at which, according to the statement of the engine manufacturer, the rated power is delivered. (For details see ISO 3046-1.)

3.6 intermediate speed: That declared by the manufacturer, taking into account the requirements given in clause 6.

3.7 engine family: A manufacturer's grouping of engines which, through their design, are expected to have similar exhaust emission characteristics where members of the family must comply with the applicable emission limit values. [ISO 8178-7]

4 Symbols and abbreviations

For the use of this part of ISO 8178 the symbols and abbreviations defined in ISO 8178-1, ISO 8178-2, ISO 8178-3, ISO 8178-5, ISO 8178-6, ISO 8178-7 and ISO 8178-8 shall be used.

Essential units for this part of ISO 8178 are:

Symbol	Term	Unit
n	Engine speed	min^{-1}
M	Torque	Nm
P	Uncorrected brake power	kW
W_F	Weighting factor	1

5 Torque

5.1 The torque figures given in the test cycles (B, C1, C2, D1, D2, E1, E2, F, G1, G2 and G3) are percentage values which represent, for a given test mode, the ratio of the required torque to the maximum possible torque at this given speed. (See ISO 8178-1:1996, 11.5.) Figure 1 shows torque scales.

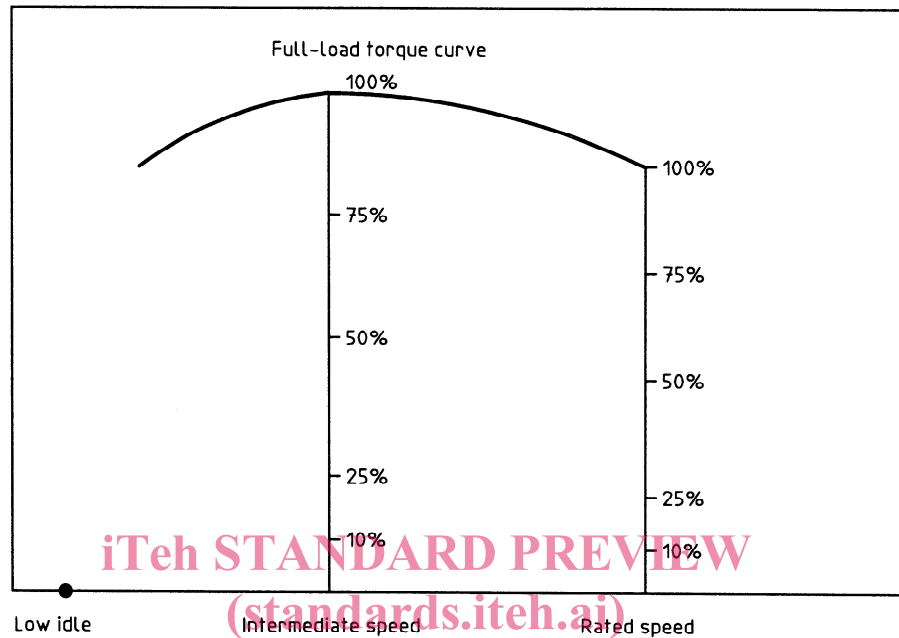


Figure 1 — Torque scales

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5.2 For the test cycle E3 the power figures are percentage values of the maximum rated power at the rated speed as this cycle is based on a theoretical propeller characteristic curve for vessels driven by heavy duty engines without limitation of length.

For the test cycle E4 the torque figures are percentage values of the torque at rated power. This cycle is based on the theoretical propeller characteristic curve representing typical pleasure craft spark ignited engine operation.

For the test cycle E5 the power figures are percentage values of the maximum rated power at the rated speed as this cycle is based on a theoretical propeller characteristic curve for vessels of less than 24 m in length driven by diesel engines.

NOTE 2 Other propeller characteristic curves exist.

Figure 2 shows the two representative curves chosen by ISO TC70/SC8.

6 Intermediate speed

6.1 For engines which are designed to operate over a speed range on a full-load torque curve, the intermediate speed shall be the declared maximum torque speed if it occurs between 60 % and 75 % of rated speed.

If the declared maximum torque speed is less than 60 % of rated speed, then the intermediate speed shall be 60 % of the rated speed.

If the declared maximum torque speed is greater than 75 % of the rated speed then the intermediate speed shall be 75 % of rated speed.