

INTERNATIONAL STANDARD

ISO
8178-8

First edition
1996-11-15

**Reciprocating internal combustion
engines — Exhaust emission
measurement —
Part 8:
Engine group determination**

<https://standards.iteh.ai/catalog/standards/sist/00b5a93b-d4c2-4ee4-8420-8463ebd4b470/iso-8178-8-1996>

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

Partie 8: Détermination des groupes de moteurs

INTERNATIONAL

ISO



Reference number
ISO 8178-8:1996(E)

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.

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International Standard ISO 8178-8 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*

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Introduction

Unlike 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 object of ISO 8178 is to rationalize the test methods for off-road engines in order to simplify and make more cost effective the drafting of legislation, the development of engine specifications and the certification of engines to control gaseous and particulate emissions.

In order to achieve its objectives, ISO 8178 embraces four concepts:

- a) grouping of engine applications in order to reduce the number of test cycles as defined in ISO 8178-4;
- b) use of observed brake power as defined in ISO 8178-1 as the basis for the expression of specific emission levels;
- c) incorporation of an "engine family" concept in which engines with similar emission characteristics and design are represented by an engine within the family;
- d) incorporation of an "engine group" concept which assumes that:
 - 1) engines may be adjusted or modified measurement on the test bed;
 - 2) engines of basically the same type or model can be classified within a group even if the engine is adjusted or modified after measurement on the test bed;
 - 3) adjusted or modified engines must comply with the applicable emission limits.

The parameters that define the engine group are more restrictive than those for an engine family.

The group concept is typically applied to large sized and engines produced in small numbers. This concept also provides the possibility for a reduction in approval testing for modifications to engines, either in production or in service.

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Reciprocating internal combustion engines — Exhaust emission measurement —

Part 8: Engine group determination

1 Scope

This part of ISO 8178 specifies the parameters to be applied for the determination of which engine specifications may be included in an engine group and for the selection of the parent engine of the group.

It may be applied for applications that might require modification or adjustment to suit at-site operating conditions. Such applications include stationary engines and auxiliary engines for shipping.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 8178. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

3 Definitions

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

3.1 engine group: Grouping of engines applicable to those engines which require adjustment or modification

after test bed measurement to ensure that they comply with the emissions and performance requirements at site.

NOTE — The engine group is a more restrictive grouping of engines than the engine family specified in ISO 8178-7. The definition of the group and choice of the parent engine should be agreed by the parties involved.

3.2 parent engine: Engine which represents an engine group in terms of emission performance by agreement of the parties involved (see clause 7).

4 General

There are engines, primarily for shipping and stationary applications, that require modification or adjustment to suit the at-site operating conditions. In these situations the option exists for the parties involved to agree to a group of engines with restrictive basic characteristics and specifications to permit limited modification and adjustment.

The selection procedure for the parent engine is preferably such that the selected engine will incorporate those features which will adversely affect the emission level of the relevant exhaust components. On the other hand, the procedure must suit the production volume of the engine manufacturer. Therefore, the parent engine might be the first unit of a production series or, in some cases, a relevant test engine.

The definition of the group and choice of the parent engine shall be agreed by the parties involved.

5 Parameters defining the engine group

The engine group may be defined by basic characteristics and specifications which must be common to engines within the group.

The engine manufacturer is responsible for indicating those engines from his range which are to be included in a group and agreed by the parties involved. In order that engines may be considered to belong to the same engine group, the following list of characteristics and specifications must be common.

a) Combustion cycle:

- two-stroke;
- four-stroke.

b) Cooling medium:

- air;
- water;
- oil.

c) Cylinders:

- bore;
- stroke.

d) Maximum rated power per cylinder at maximum rated speed: the permitted range of derating within the engine group shall be declared by the manufacturer and should be agreed by the parties involved.

e) Method of air aspiration:

- 1) naturally aspirated;
- 2) pressure charged:
 - constant pressure,
 - pulsating system.

f) Method of charge air cooling:

- with/without intercooler;
- number of intercooler stages.

g) Fuel type:

- diesel;
- petrol;
- gas;
- alcohol;

- other fuels.

h) Combustion chamber type:

- open;
- divided.

i) Valve and porting (configuration, size and number):

- cylinder head;
- cylinder wall;
- crankcase.

j) Fuel system type:

- 1) fuel only:
 - combination pump-line-injector,
 - in-line,
 - distributor,
 - single element pump,
 - unit injector,
 - gas valve,

- throttle body injection;

- 2) fuel and air;

- 3) carburettor.

k) Miscellaneous features:

- 1) exhaust gas recirculation;
- 2) water emulsion or injection;
- 3) air injection;
- 4) charge cooling system;
- 5) exhaust after-treatment:
 - oxidation catalyst,
 - reduction catalyst,
 - thermal reactor,
 - particulate trap;

- 6) dual fuel;

7) ignition type:

- compression,
- spark,
- glow plug.

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6 Guidelines for allowable adjustment or modification within an engine group

6.1 Conditions for modification and adjustment

Minor adjustments and modifications are allowed after certification (type approval) or final test bed measurement within an engine group upon agreement of the parties involved.

- a) if at-site measurement confirms that the adjusted or modified engine complies with the applicable emission limits. By agreement between the parties involved, different test conditions and a different number of test points from those specified in ISO 8178-4 may be selected for at-site measurements if the adjustments or modifications are within the provisions of the engine group;
- b) if data provided by the engine manufacturer confirm that the adjusted and modified engine complies with the applicable emission limits.

6.2 Examples of adjustments and modifications

- a) Minor adjustments for at-site conditions:
 - adjustment of injection timing for compensation of fuel property differences;
 - adjustment of injection timing for optimization of maximum cylinder pressure;

- adjustment of fuel delivery differences between cylinders;
- adjustment of miscellaneous features listed in 5 k).

b) Minor modifications for performance optimization:

- modification of turbochargers;
- modification of injection pump components:
 - piston specification,
 - delivery valve specification;
- modification of injection nozzles;
- modification of cam profiles:
 - intake and/or exhaust valve,
 - injection cam;
- modification of the combustion chamber;
- modification of miscellaneous features listed in 5 k).

7 Guidelines for the choice of the parent engine

It is not always possible to select a parent engine from small volume production in the way that is applicable to mass produced engines. Therefore the method used to select the parent engine to represent the engine group shall be declared by the manufacturer and agreed between the parties involved.

NOTE — The guidelines applicable to the engine family are described in ISO 8178-7:1996, clause 5.

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ICS 13.040.50; 27.020

Descriptors: internal combustion engines, reciprocating engines, exhaust gases, tests, measurement, exhaust emissions, steady state.

Price based on 3 pages
