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

**Part 5:
Test fuels**

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

Partie 5: Carburants d'essai



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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 8178-5 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 8178-5:1997), 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 conditions*

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.

Since fuel properties vary widely from country to country a broad range of different fuels is listed in this part of ISO 8178 — both reference fuels and commercial fuels.

Reference fuels are usually representative of specific commercial fuels but with considerably tighter specifications. Their use is primarily recommended for test bed measurements described in ISO 8178-1 and ISO 8178-11.

For measurements typically at site where emissions with commercial fuels, whether listed or not in this part of ISO 8178 are to be determined, uniform analytical data sheets (see Clause 5) are recommended for the determination of the fuel properties to be declared with the exhaust emission results.

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Reciprocating internal combustion engines — Exhaust emission measurement —

Part 5: Test fuels

1 Scope

This part of ISO 8178 specifies fuels whose use is recommended for performing the exhaust emission test cycles given in ISO 8178-4 and ISO 8178-11.

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

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 2160:1998, *Petroleum products — Corrosiveness to copper — Copper strip test*

ISO 2719:2002, *Determination of flash point — Pensky-Martens closed cup method*

ISO 3007:1999, *Petroleum products and crude petroleum — Determination of vapour pressure — Reid method*

ISO 3015:1992, *Petroleum products — Determination of cloud point*

ISO 3016:1994, *Petroleum products — Determination of pour point*

ISO 3104:1994, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 3105:1994, *Glass capillary kinematic viscometers — Specifications and operating instructions*

ISO 3405:2000, *Petroleum products — Determination of distillation characteristics at atmospheric pressure*

ISO 3675:1998, *Crude petroleum and liquid petroleum products — Laboratory determination of density or relative density — Hydrometer method*

ISO 3733:1999, *Petroleum products and bituminous materials — Determination of water — Distillation method*

ISO 3735:1999, *Crude petroleum and fuel oils — Determination of sediment — Extraction method*

ISO 3830:1993, *Petroleum products — Determination of lead content of gasoline — Iodine monochloride method*

ISO 3837:1993, *Liquid petroleum products — Determination of hydrocarbon types — Fluorescent indicator absorption method*

ISO 3993:1984, *Liquefied petroleum gas and light hydrocarbons — Determination of density or relative density — Pressure hydrometer method*

ISO 4256:1996, *Liquefied petroleum gases — Determination of gauge vapour pressure — LPG method*

ISO 4260:1987, *Petroleum products and hydrocarbons — Determination of sulfur content — Wickbold combustion method*

ISO 4262:1993, *Petroleum products — Determination of carbon residue — Ramsbottom method*

ISO 4264:2007, *Petroleum products — Calculation of cetane index of middle-distillate fuels by the four-variable equation*

ISO 5163:2005, *Petroleum products — Determination of knock characteristics of motor and aviation fuels — Motor method*

ISO 5164:2005, *Petroleum products — Determination of knock characteristics of motor fuels — Research method*

ISO 5165:1998, *Petroleum products — Determination of the ignition quality of diesel fuels — Cetane engine method*

ISO 6245:2001, *Petroleum products — Determination of ash*

ISO 6246:1995, *Petroleum products — Gum content of light and middle distillate fuels — Jet evaporation method*

ISO 6326-5:1989, *Natural gas — Determination of sulfur compounds — Part 5: Lingener combustion method*

ISO 6615:1993, *Petroleum products — Determination of carbon residue — Conradson method*

ISO 6974 (all parts), *Natural gas — Determination of composition with defined uncertainty by gas chromatography*

ISO 7536:1994, *Petroleum products — Determination of oxidation stability of gasoline — Induction period method*

ISO 7941:1988, *Commercial propane and butane — Analysis by gas chromatography*

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

ISO 8216-1:2005, *Petroleum products — Fuels (class F) — Classification — Part 1: Categories of marine fuels*

ISO 8217:2005, *Petroleum products — Fuels (class F) — Specifications of marine fuels*

ISO 8691:1994, *Petroleum products — Low levels of vanadium in liquid fuels — Determination by flameless atomic absorption spectrometry after ashing*

ISO 8754:2003, *Petroleum products — Determination of sulfur content — Energy-dispersive X-ray fluorescence spectrometry*

ISO 8973:1997, *Liquefied petroleum gases — Calculation for density and vapour pressure*

ISO 10307-1, *Petroleum products — Total sediment in residual fuel oils — Part 1: Determination by hot filtration*

ISO 10307-2, *Petroleum products — Total sediment in residual fuel oils — Part 2: Determination using standard procedures for ageing*

ISO 10370, *Petroleum products — Determination of carbon residue — Micro method*

ISO 10478:1994, *Petroleum products — Determination of aluminium and silicon in fuel oils — Inductively coupled plasma emission and atomic absorption spectroscopy methods*

ISO 13757:1996, *Liquefied petroleum gases — Determination of oily residues — High-temperature method*

ISO 14597:1997, *Petroleum products — Determination of vanadium and nickel content — Wavelength-dispersive X-ray fluorescence spectrometry*

EN 116:1997, *Diesel and domestic heating fuels — Determination of cold filter plugging point*

EN 238:1996, *Liquid petroleum products — Determination of the benzene content by infrared spectrometry*

3 Terms and definitions

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

NOTE Also see any applicable definitions contained in the standards listed in the tables in Annex B.

3.1

carbon residue

residue remaining after controlled thermal decomposition of a product under a restricted supply of oxygen (air)

NOTE The historical methods of Conradson and Ramsbottom have largely been replaced by the carbon residue (micro) method.

[ISO 1998-2:1998, 2.50.001]

3.2

cetane index

number, calculated to represent the approximate cetane number of a product from its density and distillation characteristics

NOTE The formula used for calculation is reproduced from statistical analysis of a very large representative sample of world-wide diesel fuels, on which cetane number and distillation data are known, and thus is subject to change at 5 to 10 year intervals. The current formula is given in ISO 4264. It is not applicable to fuels containing an ignition-improving additive.

[ISO 1998-2:1998, 2.30.111]

3.3

cetane number

number on a conventional scale, indicating the ignition quality of a diesel fuel under standardized conditions

NOTE It is expressed as the percentage by volume of hexadecane (cetane) in a reference mixture having the same ignition delay as the fuel for analysis. The higher the cetane number, the shorter the delay.

[ISO 1998-2:1998, 2.30.110]