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**Petroleum products — Determination of  
knock characteristics of motor fuels —  
Research method**

*Produits pétroliers — Détermination des caractéristiques antidétonantes  
des carburants pour moteurs automobile — Méthode recherche*



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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 5164 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

This third edition cancels and replaces the second edition (ISO 5164:1990), which has been technically revised.

## Introduction

The purpose of this International Standard is to accord ISO status to a test procedure that is already used in a standardized form all over the world. The procedure in question is published by ASTM International as Standard Test Method D 2699-01a.

By publishing this International Standard, ISO recognizes that this method is used in its original text in many member countries and that the standard equipment and many of the accessories and materials required for the method are obtainable only from specific manufacturers or suppliers. To carry out the procedure requires reference to six annexes and three appendices of ASTM D 2699-01a, contained in the Annual Book of ASTM Standards, Section 5<sup>1)</sup>. The annexes detail the specific equipment and instrumentation required, the critical component settings and adjustments, and include the working tables of referenced settings. The appendices provide background and additional insight about auxiliary equipment, operational techniques and the concepts relative to proper maintenance of the engine and instrumentation items.

The accumulated motor fuel data relating to knock characteristics determined in many countries has, for many years, been based on the use of the CFR engine<sup>2)</sup> and the ASTM octane test methods. Accepted worldwide, petroleum industry octane number requirements for motor fuels are defined by the research method and associated CFR F-1 Octane Rating Unit, which emphasizes the need for this method and test equipment to be standardized. The initiation of studies to use a different engine for ISO purposes has therefore been considered an unnecessary duplication of effort.

It is further recognized that this method for rating motor fuels, which does include metric operating conditions, is nevertheless an exceptional case in that the CFR engine is manufactured to inch dimensions and requires numerous settings and adjustments to inch dimensions. Application of metrication to these dimensions and tolerances can only be accomplished by strict numerical conversion which would not reflect proper metric engineering practice. Attempts to utilize metric measurement instruments for checking component dimensions to the numerically converted metric values would only introduce an additional source of test variability.

For these reasons, it has been considered desirable by ISO Technical Committee 28, *Petroleum products and lubricants*, to adopt the ASTM D 2699 standard rewritten to comply with the ISO Directives, Part 2, *Rules for the structure and drafting of International Standards*. However, this International Standard refers to annexes and appendices of ASTM D 2699 without change because of their extensive detail. These annexes and appendices are not included in this International Standard because they are published in the Annual Book of ASTM Standards, Section 5.

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1) Copies may be purchased directly from the publisher, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA, telephone: +1 610-832-9585, fax: +1 610-832-9555, e-mail: [service@astm.org](mailto:service@astm.org), website: [www.astm.org](http://www.astm.org).

2) The sole manufacturer of the Model CFR F-1 Octane Rating Unit is Waukesha Engine, Dresser, Inc., 1000 West St. Paul Avenue, Waukesha, WI 53188, USA.

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# Petroleum products — Determination of knock characteristics of motor fuels — Research method

**WARNING** — The use of this International Standard may involve hazardous materials, operations and equipment. This International Standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 1 Scope

This International Standard establishes the rating of liquid spark-ignition engine fuel in terms of an arbitrary scale of octane numbers using a standard single-cylinder, four-stroke cycle, variable compression ratio, carburetted, CFR engine operated at constant speed. Research octane number (RON) provides a measure of the knock characteristics of motor fuels in automotive engines under mild conditions of operation.

This International Standard is applicable for the entire scale range from 0 RON to 120 RON, but the working range is 40 RON to 120 RON. Typical motor fuel testing is in the range of 88 RON to 101 RON.

This International Standard can be used for oxygenate-containing fuels containing up to 4,0 % (m/m) oxygen.

Certain gases and fumes, such as halogenated refrigerants used in air-conditioning equipment, that can be present in the area where the CFR engine is located, may have a measurable effect on the RON rating. Electrical power transient voltage or frequency surges or distortion can affect RON ratings.

**NOTE 1** This International Standard specifies operating conditions in SI units but engine measurements are specified in inch-pound units because these are the units used in the manufacture of the equipment, and thus some references in this International Standard include these units in parenthesis.

**NOTE 2** For the purposes of this International Standard, the expressions “% (m/m)” and “% (V/V)” are used to represent the mass and volume fractions of a material, respectively.

## 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 3170:2004, *Petroleum liquids — Manual sampling*

ISO 3171:1988, *Petroleum liquids — Automatic pipeline sampling*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 4787:1984, *Laboratory glassware — Volumetric glassware — Methods for use and testing of capacity*

ASTM D 2699-01a, *Standard Test Method for Research Octane Number of Spark-Ignition Engine Fuel*