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Internal combustion engines — Engine weight (mass) declaration

*Moteurs à combustion interne — Déclaration du poids (de la masse) du
moteur*



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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 21006 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

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0 Introduction

0.1 General

This International Standard has been drawn up to help manufacturers declare the weight (mass) of Reciprocating Internal Combustion (RIC) engines.

This International Standard can be used:

- a) in conjunction with a standard dealing with engine power (e.g. ISO 3046-1, ISO 14396) drafted in accordance with the ISO-Core-Satellite-Concept principle so as to become a complete standard.

NOTE ISO 15550 is the Core Standard and contains the requirements that are common to all engine applications.

- b) as a stand-alone document.

ISO 3046-1 and ISO 14396 have been published as Satellite Standards.

The next editions of ISO 1585, ISO 2534, ISO 8665, ISO 9249 and ISO 4106 will, as Satellite Standards, also belong to the ISO-Core-Satellite family.

0.2 Weight and mass

In science and technology, the weight of a body in a particular reference frame is defined as the force that gives the body an acceleration equal to the local acceleration of free fall in that reference frame (see Item 3-9.2 of ISO 31-3:1992). The SI unit of the quantity weight defined in this way is the newton (N).

However, in commercial and everyday use, and especially in common parlance, weight is usually used as a synonym for mass. The SI unit of the quantity weight used in this sense is the kilogram (kg) and the verb "to weigh" means "to determine the mass of" or "to have a mass of."

As a result, there is often confusion regarding the difference between weight and mass. Weight is the force exerted on a body due to the local gravity field and is measured in newtons. Mass is the amount of matter that a body contains and is measured in kilograms (kg).

Newton's Second Law of Motion states:

$$F = kma \quad (1)$$

For a particular reference frame (e.g. the Earth) the units can be chosen so that $k = 1$ and the formula then becomes:

$$F = ma \quad (2)$$

where

F is the force exerted on the body, in N;

m is the mass of the body, in kg;

a is the local acceleration due to gravity, in $\text{m}\cdot\text{s}^{-2}$.

As a consequence of Newton's second law, weight and mass can be directly related by writing Equation (2) as:

$$w = mg \tag{3}$$

where

w is the weight of the body, in N;

m is the mass of the body, in kg;

g is the local acceleration due to gravity, in $\text{m}\cdot\text{s}^{-2}$.

Internal combustion engines — Engine weight (mass) declaration

1 Scope

This International Standard specifies how to make a declaration of the engine weight (mass) for internal combustion engines.

For the purposes of this International Standard, the word weight is used as the direct equivalent of the word mass.

This International Standard applies to

- reciprocating internal combustion engines (spark-ignition or compression ignition engines) but excluding free piston engines, and
- rotary piston engines.

These engines may be naturally aspirated or pressure-charged, either by a mechanical pressure-charger or a turbo-charger.

This International Standard applies to engines for the following:

- a) land, rail-traction and marine use;
- b) the propulsion of automotive vehicles;
- c) propelling (or powering) non-road mobile machinery;
- d) motorcycles;
- e) the propulsion of agricultural tractors and machines;
- f) the propulsion of earth-moving machinery as defined in ISO 6165;
- g) the propulsion of recreational or other small marine craft of hull length up to 24 m.

This International Standard may be applied to engines used to propel road-construction machines, industrial trucks and for other applications where no suitable International Standard for these engines exists.

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 6165:2001, *Earth moving machinery — Basic types — Vocabulary*

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 terms and definitions given in ISO 15550 apply.

4 Symbols

The symbol EW for engine weight (mass) (kg) applies.

NOTE Other SI units may also be used, and the symbols and subscripts in ISO 15550 apply.

5 Engine Weight (mass) Declaration

The method used for determining engine weight (mass) is the responsibility of the engine manufacturer.

The Engine Weight (mass) Declaration shall be made in either of two ways:

- a) The engine weight (mass) shall be the sum of the weights (masses) of all engine components and its installed additional auxiliaries less fluids, as provided to the customer.

The engine weight (mass) shall be declared by indicating a reference to this International Standard as follows:

EW (ISO 21006) = ... kg

- b) The engine weight (mass) shall be determined with an engine assembled for its power measurement test. Test bed equipment, fluids (i.e. oil, fuel, coolant) and parts to match the engine to its application (i.e. vehicle engine mounts) are excluded.

The engine weight (mass) shall be declared by indicating a reference to this International Standard and the ISO Satellite Standard according to which the engine was tested, as follows:

EW (ISO 21006) = ... kg/ISO ...

EXAMPLE An engine weight (mass) of 500 kg for vehicles with power measurement tests according to ISO 1585:

EW (ISO 21006) = 500 kg/ISO 1585

Where there is no list for assembled equipment parts in the relevant satellite standard, (e.g. in ISO 3046-1), the manufacturer shall declare, in Table A.1, all components and auxiliaries fitted to the engine as tested, which are not specified as required in that satellite standard, and the total weight (mass) of the complete engine.

Where there is a list for assembled equipment parts in the relevant satellite standard, the manufacturer shall declare, in Table A.2, all components and auxiliaries fitted to the engine that are not specified as required in that satellite standard. If there are alternative parts possible for the same engine function (i.e. steel, aluminum or synthetic oil pan), the lightest parts are allowed for the weight (mass) determination. If the engine as delivered has a heavier part than when it was weighed, the additional weight (mass) for that part shall be declared in Table A.2.

NOTE 1 In the case of verification of engine weight (mass), a deviation of $\pm 5\%$ is normally allowed for production tolerance.

NOTE 2 Further requirements are subject to agreement between the manufacturer and the customer.

Annex A (normative)

Weight (mass) Declaration

Table A.1 — Component and/or auxiliary weight (mass) declaration

Component and/or auxiliary	Weight (mass), kg
Weight (mass) of core engine	+
Weight (mass) of complete engine	=

Bibliography

- [1] ISO 31-3:1992, *Quantities and units — Part 3: Mechanics*
- [2] ISO 1585:1992, *Road vehicles — Engine test code — Net power*
- [3] ISO 2534:1998, *Road vehicles — Engine test code — Gross power*
- [4] ISO 3046-1:2002, *Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods — Additional requirements for engines for general use*
- [5] ISO 4106:2004, *Motorcycles — Engine test code — Net power*
- [6] ISO 8665:1994, *Small craft — Marine propulsion engines and systems — Power measurements and declarations*
- [7] ISO 9249:1997, *Earth-moving machinery — Engine test code — Net power*
- [8] ISO 14396:2002, *Reciprocating internal combustion engines — Determination and method for the measurement of engine power — Additional requirements for exhaust emission tests in accordance with ISO 8178*

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