

INTERNATIONAL
STANDARD

ISO
8665

Second edition
1994-08-01

**Small craft — Marine propulsion engines
and systems — Power measurements and
declarations**

*Navires de plaisance — Moteurs et systèmes de propulsion marins —
Mesurage et déclaration de la puissance*



Reference number
ISO 8665:1994(E)

Foreword

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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 8665 was prepared by Technical Committee ISO/TC 188, *Small craft*.

This second edition cancels and replaces the first edition (ISO 8665:1988), of which it constitutes a technical revision.

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

Printed in Switzerland

Small craft — Marine propulsion engines and systems — Power measurements and declarations

1 Scope

This International Standard specifies the test requirements in addition to those given in ISO 3046-1 for determining the power, at a single point or as a power curve, of marine propulsion engines or systems for recreational craft and other small craft using similar propulsion equipment of up to 24 m hull length.

It also provides the means for documenting and checking the declared (rated) power published by the manufacturer.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 3046-1:—¹⁾, *Reciprocating internal combustion engines — Performance — Part 1: Standard reference conditions, declarations of power, fuel and lubricating oil consumptions, and test methods.*

ISO 3046-3:1989, *Reciprocating internal combustion engines — Performance — Part 3: Test measurements.*

ISO 3675:1993, *Crude petroleum and liquid petroleum products — Laboratory determination of density or relative density — Hydrometer method.*

ISO 5163:1990, *Motor and aviation-type fuels — Determination of knock characteristics — Motor method.*

ISO 5164:1990, *Motor fuels — Determination of knock characteristics — Research method.*

ISO 5165:1992, *Diesel fuels — Determination of ignition quality — Cetane method.*

ISO 8217:1987, *Petroleum products — Fuels (class F) — Specifications of marine fuels.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 declared engine speed; declared crankshaft speed

(1) (for spark-ignition engines without speed governor) Speed at the mid-point of the full throttle speed range recommended by the manufacturer for propeller selection.

(2) (for engines with speed governor) Governed speed chosen by the manufacturer.

3.2 declared power: Net brake power, determined and corrected in accordance with ISO 3046-1, declared for a given engine or propulsion system at its final output shaft when all the auxiliaries which affect the power output are fitted.

3.2.1 declared propeller shaft power: Power at the propeller shaft of an engine sold with complete propulsion units or at the coupling to the propeller shaft

1) To be published. (Revision of ISO 3046-1:1986)

of an engine sold with reduction and/or reversing gears.

3.2.2 declared crankshaft power: Power at the engine output shaft of an engine sold without reduction or reversing gears, or stern drives or sail drive units.

4 Declarations

The declared powers as defined in 3.2 shall be so named in manufacturer's documentation. In the case of declared crankshaft power (3.2.2), the power declaration shall be accompanied by a statement that usable power will be reduced by gear losses.

5 Test preparation

5.1 Engine or propulsion system

5.1.1 The test engine or propulsion system shall be representative of the manufacturer's production units. It shall be run-in according to the manufacturer's recommendations and shall be fitted with an exhaust system. All auxiliaries fitted shall be listed and described.

5.1.2 Carburettor wedges may be removed or added to maintain the carburettors at a normal running angle if the engine is tested in a horizontal position.

5.1.3 If the exhaust system as delivered is not complete, the back-pressure at the declared engine speed shall be within $\pm 0,75$ kPa of the maximum back-pressure specified by the manufacturer at which the declared power can be achieved.

If the exhaust system as-delivered is complete, the laboratory exhaust system shall maintain the exhaust pressure at the unit outlet within $\pm 0,75$ kPa of the barometric pressure at the test bed.

NOTE 1 The maximum permissible back-pressure declaration is required by ISO 3046-1.

5.1.4 If the engine air inlet is connected to a laboratory air system, the system shall supply air to the engine within $\pm 0,75$ kPa of the barometric pressure at the test bed.

5.1.5 For liquid-cooled engines, the temperature of the coolant at the raw-water inlet shall be maintained at $298 \text{ K} \pm 15 \text{ K}$ ($25 \text{ }^\circ\text{C} \pm 15 \text{ }^\circ\text{C}$), except that for engines with charge air cooler the temperature shall be maintained at $298 \text{ K} \pm 5 \text{ K}$ ($25 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$).

The coolant pressure shall not exceed 50 kPa. The coolant outlet temperature shall be within the range specified by the manufacturer if such a range is specified.

5.1.6 Fuel temperature at the inlet of the diesel engine fuel-injection pump shall be maintained at $313 \text{ K} \pm 3 \text{ K}$ ($40 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$).

NOTE 2 These requirements do not apply to diesel engines running on intermediate or heavy fuels.

5.2 Fuels and lubricants

5.2.1 Fuels used shall conform to the manufacturer's specifications.

5.2.2 For spark-ignition engines, record the octane number determined in accordance with ISO 5163 (motor method) and ISO 5164 (research method), and density determined in accordance with ISO 3675.

5.2.3 For diesel (compression-ignition) engines, record the cetane number determined in accordance with ISO 5165, the density determined in accordance with ISO 3675 and lower calorific value. Use ISO-F-DMX (see ISO 8217) or equivalent fuel if compatible with the engine.

5.2.4 Lubricating oil used shall conform to the manufacturer's recommendations. Record lubricating oil type, grade and, if applicable, viscosity of the lubricant.

6 Test conditions

6.1 Operating conditions

Test conditions shall be maintained as near to standard reference conditions as possible (see 3.2) in order to minimize the magnitude of the correction factor. Adjustments shall be made before the test in accordance with the manufacturer's instructions. No changes or adjustments shall be made during the test, except as indicated in the test procedure.

6.2 Generator and hydraulic systems

The generator or alternator, hydraulic systems and similar systems intended for intermittent load only shall be operated under no-load conditions.

6.3 Engine stabilization

No data shall be taken until the engine has reached stable operating conditions maintained for at least

2 min within the permissible deviations prescribed in ISO 3046-3:1989, subclause 4.2.

6.4 Engine speed

During a run or reading, the engine speed shall not deviate from the nominal speed by more than $\pm 1\%$ or ± 10 r/min, whichever is greater.

6.5 Fluid levels

All fluid levels shall be within the range specified by the manufacturer.

6.6 Wet exhaust system

Wet exhaust systems shall be operated with the water flow necessary for normal installations.

7 Data acquisition

7.1 Accuracy

Test measurements and their degree of accuracy shall be as specified in ISO 3046-3.

7.2 Air temperature

The temperature of the inlet air to the engine (ambient air) shall be measured so as to obtain a mass average temperature. The temperature shall be taken in the engine inlet air stream or within 150 mm of the air inlet to the air cleaner, silencer or flame arrester.

On outboard engines the cowl, if supplied, shall be regarded as a part of the air inlet system.

7.3 Temperature of coolant

The temperature of the coolant medium shall be measured not further than 150 mm from the raw-water inlet. Water jacket temperatures in liquid-cooled engines and engine temperatures in air-cooled engines shall be measured at point(s) specified by the manufacturer.

7.4 Lubricating oil temperature

Lubricating oil temperatures shall be measured at point(s) specified by the manufacturer.

7.5 Readings

Observed dynamometer load, engine speed, ambient air pressure, wet and dry bulb readings, and fuel con-

sumption data (if recorded) shall be taken simultaneously, and shall be the average of at least two stabilized sustained values which do not vary more than the permissible deviations prescribed in ISO 3046-3:1989, subclause 4.2, except that engine speed shall not vary more than $\pm 1\%$ or ± 10 r/min, whichever is greater.

A measuring interval of not less than 30 s shall be used when measuring engine speed and fuel consumption.

7.6 Recording of results

Power test data given in 7.6.1 and 7.6.2 shall be recorded. Data in 7.6.3 is optional.

7.6.1 The following data shall be recorded simultaneously, within 1 min:

- a) engine speed;
- b) torque or beam load;
- c) intake air temperature and pressure at the point located and specified in 7.2;
- d) fuel temperature [for diesel (compression-ignition) engines only];
- e) ambient air temperature of the atmosphere;
- f) barometric pressure at the test bed;
- g) humidity.

7.6.2 The following data shall also be recorded:

- a) laboratory exhaust system pressure (see 5.1.3);
- b) lubricating oil temperature (see 7.4);
- c) coolant temperature at raw-water inlet and engine outlet (see 5.1.5 and 7.3);
- d) coolant supply pressure (see 5.1.5);
- e) fuel delivery per injection cycle [for diesel (compression-ignition) engines only and if the engine has no acceptance test];
- f) exhaust back-pressure (see 5.1.3).

7.6.3 The following optional data should be recorded where applicable or for safety of operation:

- a) lubricating oil pressure;

- b) intake air temperature and pressure inside the air intake manifold;
- c) exhaust gas temperature;
- d) ignition or injection timing;
- e) fuel supply pressure at supply-pump outlet;
- f) fuel consumption per unit of time.

8 Presentation of data

8.1 Declarations of power and speed

A single value of the declared power shall be accompanied by a statement of the declared engine speed.

Power and engine speed may alternatively be presented as a power curve. Declarations shall indicate whether the power is propeller shaft power (3.2.1) or crankshaft power (3.2.2).

8.2 Engine speed range and declared power

It is recommended to choose the full throttle engine speed range defined in 3.1(1) so that the highest power within this range does not exceed the declared power by more than 6 %. If the highest power exceeds declared power by more than 6 %, both powers shall be stated.

9 Manufacturing tolerance

The measured power at declared engine speed of any individual marine propulsion engine or propulsion system shall not deviate from the declared value by more than:

- a) $\pm 5\%$ for engines or propulsion systems with speed governors of more than 100 kW declared power, or
- b) $\pm 10\%$ or $\pm 0,45$ kW, whichever is greater, for all other engines and propulsion systems.

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