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Small craft — Power measurements and declarations —

Part 2: Electric marine propulsion

Petits navires — Mesurage et déclaration de la puissance —
Partie 2: Propulsion électrique à usage marin

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Foreword

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This document was prepared by Technical Committee ISO/TC 188, *Small craft*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 464, *Small Craft*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 8665 series can be found on the ISO website.

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Introduction

This document was developed due to the need for a consistent method of measuring and declaring power for electric and hybrid electric propulsion systems for small crafts.

Small craft — Power measurements and declarations —

Part 2: Electric marine propulsion

1 Scope

This document specifies the requirements for the determination of the power of electric marine propulsion systems when presented for documenting and checking of the declared (rated) power published by the manufacturer.

This document is applicable to electric systems used for propulsion of recreational craft and other small craft of up to 24 m of hull length.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
power
rate of energy per time unit

Note 1 to entry: Power is expressed in kilowatts (kW).

3.2
declared power
value of the *power* (3.1), declared by the manufacturer, which a motor will deliver under a given set of circumstances

Note 1 to entry: Declared power is expressed in kilowatts (kW).

3.3
declared propeller shaft power
value of the *power* (3.1), declared by the manufacturer, at the propeller shaft of an electric propulsion system sold with complete propulsion units or at the coupling to the propeller shaft of a motor sold with reduction and/or reversing gears

Note 1 to entry: Declared propeller shaft power is expressed in kilowatts (kW).

3.4
brake power
total system *power* (3.1) delivered at the end of the motor shaft or propeller shaft

Note 1 to entry: Brake power is expressed in kilowatts (kW).

3.5
net torque
torque transmitted on a test bed at the end of the crankshaft or its equivalent at the corresponding motor speed

4 Declaration of power

4.1 General

A statement of a single value of declared power shall be accompanied by a statement of the declared motor speed. The declaration of power shall always indicate whether the power is propeller shaft power or motor power.

4.2 Declaration of propeller shaft power

The propeller shaft power shall be declared for propulsion motors sold as a complete propulsion unit or at the coupling to the propeller shaft of motors sold with reduction and/or reversing gear.

NOTE Propeller shaft power can be either measured according to Clause 5 or disclosed as motor power minus transmission losses.

4.3 Declaration of motor power

For units intended to be integrated with but sold without reduction and/or reversing gear, motor power shall be the shaft power of the motor as measured in accordance with Clause 5.

NOTE Motor power measurements can be found and declared according to IEC 60034-1.

5 Test methods

5.1 Test conditions

5.1.1 The test motor or propulsion system shall be representative of the manufacturer's production units. All auxiliaries fitted and intended to be sold with the motor shall be listed and described.

5.1.2 Equipment not necessary for propulsion of the craft in which the system is intended to be installed and which can be mounted on the system shall be removed for the test.

5.1.3 For the purpose of determining the power of a motor, the following standard reference conditions shall be used:

— air temperature: 25 °C ± 5 °C;

— relative humidity: 30 %;

— system coolant temperature for liquid cooled systems: 25 °C ± 5 °C.

NOTE A relative humidity of 30 % at a temperature of 25 °C corresponds to a water pressure of 1 kPa. The corresponding dry barometric pressure is 99 kPa.

5.1.4 The power for the electric drive train shall be supplied from a DC voltage source with a maximum voltage drop of 5 % depending on time and current (excluding periods of less than 10 s). The supply voltage

of the test shall be given by the propulsion manufacturer. The power test shall consist of a run at full setting of the power controller.

5.1.5 The performance data shall be obtained under thermal equilibrium operating conditions. Thermal equilibrium is the state reached when the temperature rise of any part of the motor does not vary by more than a gradient of 2 K/h.

5.1.6 An instantaneous initial performance at the rated motor speed shall be measured at the start of the test with all components at the standard reference conditions.

5.1.7 The temperature of the inlet air to an air-cooled motor shall be measured within the inlet ductwork.

5.1.8 For air-cooled systems, the temperature at a point indicated by the manufacturer shall be kept within the value specified by the manufacturer for the reference conditions. If necessary, an auxiliary temperature regulation system can be used to maintain the temperatures within the limits specified by the manufacturer. The inlet air for any cooling shall be in accordance with the standard reference conditions in 5.1.3.

5.1.9 If the drive system is cooled by a closed liquid circulatory system, the temperature of the coolant at the outlet from the motor shall be maintained within ±5 °C from the upper thermostatically controlled temperature specified by the manufacturer. If the drive is cooled by immersion, then the temperature of the coolant shall be maintained as specified in 5.1.3.

5.1.10 The motor speed during a test run or reading shall not deviate from the selected speed by more than ±1 % or ±10 min^{-1}, whichever is greater.

5.1.11 Both observed brake power and temperature data shall be taken simultaneously and shall, in each case, be the average of at least two stabilized consecutive readings. No adjustment shall be made to the motor between these readings.

5.2 Production conformity test/manufacturing tolerance

In a production conformity test, the measured power at the declared speed of any individual marine propulsion motor or propulsion system shall not deviate from the declared propeller shaft power by more than ±5 % or ±0,45 kW, whichever is greater.

6 Test report

6.1 Measurements shall be taken at a sufficient number of system speeds to completely define the performance between the lowest and the highest speeds recommended by the manufacturer. The speed range shall include the point at which the motor produces its maximum power and torque.

6.2 The test report shall include the following information:

a) motor speed;

b) voltage and current measured as close as practicable to the motor;

c) net torque at rated output;

d) torque curve measured in accordance with 5.1.5;

e) instantaneous initial performance as measured in 5.1.6;

f) ambient air temperature in which the test was conducted;

g) barometric pressure in which the test was conducted;