

# ICOMIA Standard No: 48-11 (Ed.1)

## Small craft – Measurement of fuel consumption

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### Foreword

The ICOMIA Technical Committee in co-operation with ICOMIA member organizations has prepared this standard.

The intention of this voluntary standard is to have one single repeatable method for the industry to measure fuel consumption for a complete craft/engine combination. Furthermore, ANNEX A provides guidance how this data can be presented to inform boaters at what speed the craft should be operated for best fuel economy.

Disclaimer: The information provided in ANNEX A is for guidance and is intended to show relative boat performance. A specific boat's performance will be affected by boat, water and weather conditions, altitude, actual load and settings of engine and propeller.

# Small craft – Measurement of fuel consumption

## 1 Scope

This standard specifies the requirements for measurement, documentation and presentation of fuel consumption for small craft of up to 24 m length of hull powered by internal combustion engines using Petrol or Diesel fuels.

This standard may not be practically applied to boats using Outboard engines with power less than 37 kW.

## 2 Normative references

ISO 8666:2002, *Small craft — Principal data*

ISO 8665:2004, *Small craft—Marine propulsion reciprocating internal combustion engines—Power measurements and declarations*

## 3 Terms and definitions

For the purpose of this standard, the following terms and definitions apply

### 3.1

#### **Fuel consumption**

fuel consumption per hour or nautical mile measured at a specific craft speed or engine rpm

### 3.2

#### **Wind speed**

mean wind speed in the test area expressed in meters per second (m/s)

### 3.3

#### **Craft speed**

steady state craft speed through the water expressed in nautical miles per hour (kts)

### 3.4

#### **Maximum depth, $D_{max}$**

the vertical distance between the sheer line and half length of the waterline,  $L_{WL}$ , and the lowest point of the keel according to ISO 8666, clause 5.4.1

### 3.5

#### **Waterline length, $L_{WL}$**

waterline length in "performance test mass" condition. Measured according to ISO 8666 clause 5.2.3

### 3.6

#### **Beam at waterline, $B_{WL}$**

beam at waterline in "performance test mass" condition. Measured according to ISO 8666 clause 5.3.4

### 3.7

#### **Performance test mass, $m_p$**

mass of craft when prepared for test and during execution of the test according to ISO 8666 clause 6.4

### 3.8

#### **Engine speed**

crankshaft revolutions per minute (r/min;  $\text{min}^{-1}$ )

## 4 General craft test conditions

4.1 Craft shall be loaded and equipped at least according to "Performance test mass" in ISO 8666, clause 6.4

4.2 Fuel used for testing shall be a standard petrol or diesel fuel of known quality within the following limits:

Petrol Fuels – Minimum Octane Number of 93,0 (RON) and Reid Vapour Pressure between 56 and 63.4 kPa.

Diesel Fuels – Maximum Cetane Number of 54,0 and a Density between 833 to 865 kg/m<sup>3</sup> (at 15 °C).

4.3 Craft shall be tested with the engine(s) as sold and with propeller(s) providing specified rpm range at wide open throttle recommended by the engine manufacturer.

## 5 Operating conditions

5.1 The engine(s) of the craft shall be raised to normal operating temperature before measurements are taken. Installed engines must be beyond the manufacturer's recommended break-in period or at least 20hrs of operation.

## 6 Test procedure

6.1 Measurements shall be carried out on a straight course and be presented as the average value of at least 2 test runs carried out at 180 degrees to each other. The course shall be with or against predominant current/wind/wave/ direction in order to counteract the speed influence from side forces. Especially important for measurement in the lower speed regions.

NOTE: High wind speeds and high wave heights may influence test results.

6.2 At the test course, the depth of water shall be sufficient for normal operation of the craft.

NOTE Shallow water can increase the drag.

6.3 Measurements shall be carried out starting from the maximum achievable engine revolutions down to engine idling speed. Data sets should contain 8 data points according to RPM, based on set points of 100% (max. achievable revolutions ) 85%, 70%, 60%, 50%, 40%, 25%, and IDLE in gear.

6.4 Before measurements are taken the engine speed shall be stabilised. The craft shall be trimmed to its optimum performance at the desired speed.

6.5 The following quantities shall be recorded:

- craft speed (instrument uncertainty of less than +/- 3%),
- engine speed (instrument uncertainty of less than +/- 2%),
- fuel consumption (fuel flow measured in l/h or l/s; instrument uncertainty of less than +/- 3%)

## 7 Documentation

To secure repeatability the craft shall be weighted and information of fuel quantities, persons onboard during test, equipment etc shall be recorded as described below:

- Type of craft (e.g. monohull, displacement, planning, etc.)
- Builder of the craft
- CIN Code
- Mass of the craft in test condition (re. ISO 8666)
- Craft waterline length  $L_{WL}$  (re. ISO 8666)
- Waterline beam of craft (re. ISO 8666)
- Engine type (suggestion to state examples IB, OB, ..)
- Engine installation (e.g. OB engine installed on transom and bracket including dimensions)
- Power rating of each engine according to ISO 8665
- Number of engines
- Type of transmission incl. gear ratio
- Type of propeller and manufacturer
- Size of propeller (diameter, pitch and number of blades)
- Fuel type and specification according to clause 4.2 (for petrol fuels add ethanol content)
- Fuel inlet temperature (for Diesel engines)
- Wind speed and direction relative to the test course
- Wave height and direction during test relative to the test course
- Salt or fresh water
- Bottom condition/type of antifouling
- Name of institution performing tests
- Name and contact information of responsible person
- Date and place where measurements are taken
- Listing of additional load onboard not included in "Performance test mass" (such as:, waste in tanks, provisions etc)
- Specify measurement instruments used
- Atmospheric conditions: humidity, air pressure and temperature.

## **8 Presentation of fuel consumption**

- ANNEX A provides examples how to present fuel consumption if desired to publish the test results.

**ANNEX A**  
**(informative)**

**Presentation of fuel consumption**

When publishing test results with reference to this standard, fuel consumption shall be presented in chart form displaying normalised values. These can be e.g. fuel consumption per nautical mile as function of boat speed, if no speedometer fitted as function of RPM.

**Sample charts how to present fuel consumption**

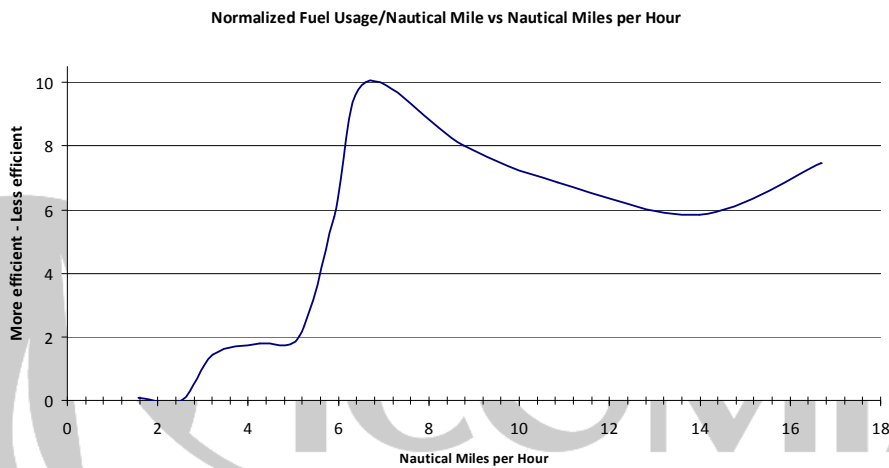


Fig. 1. normalised values, e.g. fuel consumption per nautical mile as function of boat speed

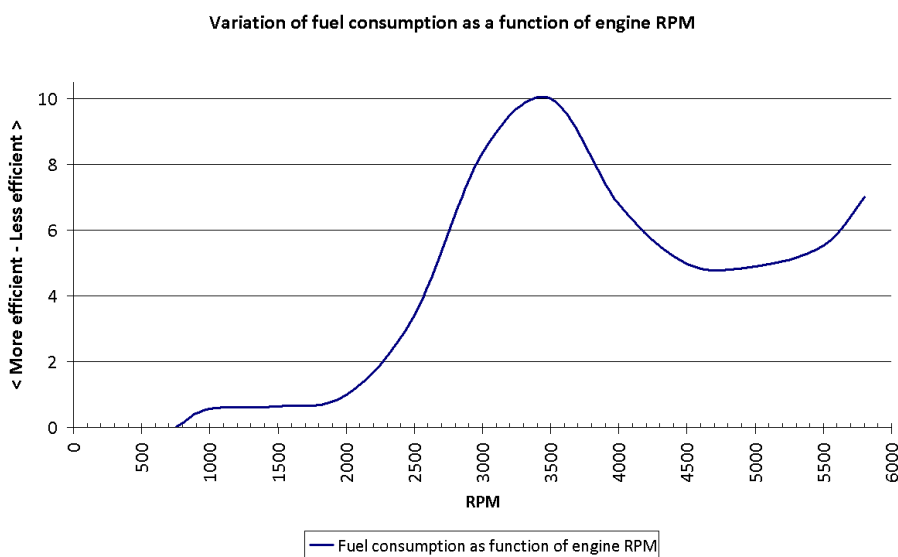


Fig. 2. normalised values, e.g. fuel consumption per nautical mile as function of RPM