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**Sea-going vessels and marine  
technology — Instructions for planning,  
carrying out and reporting sea trials**

*Navires de haute mer et technologie marine — Instructions pour la  
planification, l'exécution et le compte rendu d'essais en mer*

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Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

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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 19019 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 300, *Sea-going vessels and marine technology*, in collaboration with Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 9, *General requirements*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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# Sea-going vessels and marine technology — Instructions for planning, carrying out and reporting sea trials

## 1 Scope

This International Standard provides ship owners, designers, shipbuilders and trial crew with basic instructions for the planning, carrying out and reporting of sea trials.

This International Standard provides general information for achieving a unified format for sea trials to be executed as identified in the contract.

This International Standard is applicable to sea trials generally adopted for types of mechanically propelled vessels as indicated in Annex B.

This International Standard is not applicable to submarines.

## 2 Normative references

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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 2923, *Acoustics — Measurement of noise on board vessels*

ISO 3046 (all parts), *Reciprocating internal combustion engines — Performance*

ISO 4867, *Code for the measurement and reporting of shipboard vibration data*

ISO 4868, *Code for the measurement and reporting of local vibration data of ship structures and equipment*

ISO 6954, *Mechanical vibration — Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships*

ISO 15016, *Ships and marine technology — Guidelines for the assessment of speed and power performance by analysis of speed trial data*

DIN 81208-2, *Manoeuvring of ships — Part 2: Coasting stop trial*

DIN 81208-3, *Manoeuvring of ships — Part 3: Pull-out trial*

DIN 81208-4, *Manoeuvring of ships — Part 4: Acceleration trial*

DIN 81208-5, *Manoeuvring of ships — Part 5: Turning circle test/trial*

DIN 81208-6, *Manoeuvring of ships — Part 6: Accelerating turn test/trial*

DIN 81208-8, *Manoeuvring of ships — Part 8: Zig-zag test/trial (Z-test/trial)*

DIN 81208-10, *Manoeuvring of ships — Part 10: Reverse spiral test/trial (according to Bech)*

DIN 81208-11, *Manoeuvring of ships — Part 11: Direct spiral test/trial (according to Dieudonné)*

DIN 81208-12, *Manoeuvring of ships — Part 12: Stopping trial*

DIN 81208-13, *Manoeuvring of ships — Part 13: Traversing test/trial*

DIN 81208-23, *Manoeuvring of ships — Part 23: Turning test/trial with thrusters*

DIN 81208-24, *Manoeuvring of ships — Part 24: Course change test/trial*

DIN 81208-25, *Manoeuvring of ships — Part 25: Parallel track test/trial*

DIN 81208-26, *Manoeuvring of ships — Part 26: Man-overboard trial*

IMO Resolution A.468 (XII), Code on Noise Levels on Board Ships

International Convention for the Safety of Life at Sea (SOLAS), 1974

### **3 General information on sea trials**

#### **3.1 General**

The aim of sea trials is to demonstrate that the vessel is in conformity with contract and with requirements of classification societies and flag authorities.

Sea trials are mainly functional, to demonstrate operation, behaviour, energy consumption and required power of the vessel, her systems, equipment and components. Sea trials shall be executed in a suitable area in order to avoid risks of collisions, damages and interruptions.

Sea trials are of two sorts: <https://standards.iteh.ai/catalog/standards/sist/0d5acfd6-8d53-42bd-85d6-12e36e34fea5/iso-19019-2005>

a) global trials, which include propulsion trials, manoeuvring trials, structure vibration tests and noise level tests;

and

b) system trials, which include those non-global trials that cannot be done as quay trials, e.g. anchor-handling tests.

Only global trials and certain system trials are covered by this International Standard.

If necessary, the measured data should be recorded continuously, e.g. using a computer with a certain frequency of sampling (e.g. frequency of 1 Hz for speed trials). It is important to carry out an uncertainty analysis.

#### **3.2 Responsibility for sea trials**

The shipbuilder is responsible for planning, conducting and evaluating the sea trials.

Trials may be conducted by institutions acknowledged as competent to perform those trials, as agreed between the shipbuilder and the owner.

Instruments and equipment to be used on trials shall be calibrated and documented as traceable to international standards of measurement.

A trials report shall be prepared with necessary recorded data sheets, as well as all terms of acceptance, in accordance with Annex A.



The individual sheets of the trials report shall be signed by the participants, confirming that it correctly reports the trials results.

The trials report original shall remain in possession of the shipbuilder, and authentic copies shall be delivered to the owner and the Classification Society, as applicable.

### 3.3 Demonstration of operability

Some systems, such as ship propulsion and control systems, can be shown to operate in their design modes only at sea. This demonstration of operability verifies that

- a) all systems are correctly connected,
- b) the mode of operation and conduct of the systems agree with specifications,
- c) there are no obstructions, leakage or other symptoms of malfunction.

### 3.4 Demonstration of performance and economy

During sea trials concerning the propulsion system, the aim is to confirm that the agreed power rating is attained and that the corresponding ship speed and propulsion engine output are those stipulated by the contract and correspond to speed and power of propulsion model tests, if available.

These trials shall be carried out in a specified reference load condition.

### 3.5 Demonstration of endurance

During endurance trials, the aim is to verify the ability of the system to operate in the specified mode for the time necessary to develop thermal equilibrium conditions and to allow detection of any inadequacies.

### 3.6 Applicability

For economic reasons and technical interest, it is convenient to analyse which trials should be performed on each type or series of ships (sister ships in series).

Lists of trials recommended for first-of-a-class that can be omitted for sister ships shall be specified in the contract.

Annex B presents Table B.3 which indicates in general the trials for different types of ship. In each case and taking into account specific conditions of each ship, those trials which are to be conducted shall be specifically defined in the contract.

## 4 Planning of sea trials

### 4.1 Actions required in preparing for sea trials

The shipbuilder responsible for sea trials shall carefully plan these trials, so they are carried out with the necessary safety measures in an accessible and adequate geographic area, in the strict minimum period of time and with unequivocal results accepted by all participants.

Planning shall assure that trials are carried out with respect to the following items.

- a) All permits and certificates needed to go to sea have been obtained.
- b) All needed insurance policies have been obtained.

- c) All qualified personnel needed for operating the ship, and all engines, systems and equipment needed during the trials, have been ordered.
- d) All regulatory bodies, Classification Society, ship owner, ship agents, suppliers, subcontractors, harbour facilities, departments delivering provisions, fuel, water, towing, etc., needed for conducting the sea trials, have been informed.
- e) All safety measures have been checked and all fixed, portable and individual material (for crew, trial personnel and guests) is on board and operative.
- f) Dock trials of all systems, as well as all tests of alarms, warning and safety systems, have been executed.
- g) An inclining test has been performed, or at least a preliminary stability book has been approved, covering the sea trials condition, in accordance with 74 SOLAS Convention, as amended.
- h) Provisional calibration of magnetic compass has been completed.
- i) Calibration of the radio direction finder has been completed, if installed.

The actions indicated in h) and i) may be performed just before all other sea trials.

#### 4.2 Sequence of sea trials

An example of sequence of sea trials is given in Annex C.

#### 4.3 Safety precautions

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Sea trials shall be held only after a careful check of all ship safety devices.

There shall be sufficient lifeboats and/or life-rafts and lifejackets for all personnel on board, their number and make shall be in accordance with the requirements of the Maritime Authority of the trial area.

All personnel on board shall be told what to do in case of abandoning ship, in particular how to use lifejackets.

A list of all personnel on board shall be communicated to the Maritime Authority of the trial area.

Everyone on board shall be assigned a station in case of fire alarm, flooding and abandoning ship; all these details shall be indicated in a provisional muster list.

All fire detection and fighting systems shall be installed and operative.

All bilge systems, fixed and portable, shall be installed, tested and operative.

All alarm, safety and warning devices shall be installed, tested and duly identified.

All external communication devices, both normal and emergency, and corresponding power feeders shall be installed, tested and operative.

All lifeboat and life-raft launching systems shall be installed, tested and operative.

Sea-trial crew shall be well aware of all safety devices and shall have specific instructions for acting in an emergency or abandonment, with special attention to assist all persons on board not belonging to the crew.

#### 4.4 Trials which shall be completed before sea trials

Sea trials shall be executed after completion of all installations, builder's trials, dock tests and trials, in particular for the following:

- main engines and all their command, control, alarm, safety and warning devices;
- electric generators, including emergency generator, and their command, control, alarm, safety and warning devices;
- steering gear and its emergency and alarm devices;
- navigation and signal light systems;
- whistle;
- signalling lamps;
- power, lighting and emergency electric installations;
- normal and emergency radio external communications;
- magnetic compass;
- flags, shapes, pyrotechnics and cable gear for seesaw;
- gyrocompass, radar, radio direction finder and depth sounding device and navigation platform (if installed);
- compressed air system (if installed);
- internal telephone network, voice pipes and intercommunicators (as appropriate);
- winches and capstans;
- anchors and chains.

The use of a previously fixed check list is recommended, including all systems and equipment that are required to be installed and tested before sea trials.

#### 4.5 Pre-trial meeting

Before commencing sea trials, the following matters shall be addressed and agreed upon and, if considered necessary, shall be discussed in a pre-trial meeting:

- a) objectives to be attained by executing sea trials;
- b) execution details;
- c) selection, approval, installation and definition of calibration standards of measurement equipment and instruments;
- d) partition of responsibilities and execution of operational and control tasks of trials;
- e) programme, area, duration and timetable of trials;
- f) conditions and operating methods during trials;
- g) correction methods to be used due to differences between specified conditions and conditions during execution;
- h) acknowledgement and approval of records procedures.

## 4.6 Final meeting

A final meeting involving the owner, the shipbuilder and all concerned authorities, shall be held after sea trials are completed, in order to finalise the acceptance protocol.

## 5 Propulsion trials

### 5.1 Speed trial

#### 5.1.1 Purpose

A speed trial is held to verify fulfilment of contractual obligations regarding ship speed and shaft power at certain draughts (preferably related to ship model test draughts). The relationship between ship speed, shaft power, shaft revolutions per minute and/or propeller pitch settings for controllable-pitch propellers should take the form of plots or tables.

#### 5.1.2 Trial specification

Whenever possible, execution and analysis shall be in accordance with ISO 15016.

If no specific conditions are invoked by the contract, speed trials shall be conducted with propulsion engines delivering normal continuous power, and at other speed points corresponding to lower powers which are intended to be used in future operation of the ship, and which may be used to work out shaft rotational speed tables and/or propeller pitch settings, as appropriate. Reduced loading of the propeller shall be taken into account.

When an overload trial of main engines has not been held during factory acceptance tests, it may be held during this trial if the requested technical conditions are met. Reduced loading of the propeller shall be taken into account.

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Corrections on main engine performance due to differences between trial conditions and contract reference conditions shall be established in accordance with ISO 3046 (all parts).

During speed trials, any propulsion engine power take-off for auxiliaries which are not part of the propulsion system shall be clearly identified.

For propulsion engines with maximum continuous power above 2 000 kW, a torsion meter is recommended for measuring power output.

#### 5.1.3 Restrictions to the execution of the trial

Whenever possible, water depth in the trial area shall be in accordance with ISO 15016.

Whenever possible, conditions of wind and sea state shall be in accordance with ISO 15016.

#### 5.1.4 Instrumentation required for the trial

The following instruments are needed in particular for this trial:

- a) torsion meter, duly calibrated and zero setting checked before and after test (if propulsion system power  $\geq 2\,000$  kW);
- b) stop watches;
- c) tachometer;

- d) electronic positioning system (DGPS, GPS, trisponder or equivalent);
- e) anemometer.

#### 5.1.5 Trial execution

The following provisions shall be respected.

- a) Speed trials shall be executed in an area with sufficient depth of water. In the case of limited water depth, depth changes in the trial area shall be avoided.
- b) A well-defined length and trajectory of the runs for the trial shall be established. Double runs should preferably be made with head and tail winds.
- c) The chosen runs shall not cross navigation routes or active fishing grounds.
- d) The length of the runs established by location of land markers shall be between half a mile (for small craft only) and two miles. Reference bearings should preferably be defined by parallel alignments, themselves perpendicular to the defined runs.
- e) The length of the runs established by electronic positioning systems shall preferably be equivalent to between 5 min and 10 min measuring time or to between 1 mile and 2 miles measuring distance, the measuring point of all double runs being the same as far as possible and the chosen measurement system having a precision deviance of less than 20 m.
- f) Since in case e) the course of the runs is more flexible, a course shall be chosen such that wind effects are less important. Beam-relative wind is not recommended, because this could cause yawing and pronounced rolling. As discussed in b) above, head and tail winds are preferable.
- g) Independently of the speed to be verified by contractual obligation, the number of runs executed shall be in accordance with ISO 15016.
- h) For ships fitted with controllable-pitch propellers, speed trial(s) may normally be executed for more than one propeller-pitch setting.
- i) Each chosen speed condition shall correspond to normal ship operating conditions; in the case of ships with more than one shaft, a speed condition corresponding to only one driven shaft may be chosen in addition.
- j) Shaft rotational speed should be obtained from readings of the revolution counter at the beginning and at the end of each run.
- k) The approach run to the measured course shall be long enough to give steady conditions of course, shaft rotational speed and ship speed before commencing measurements.
- l) As far as practicable, speed trials should be performed at displacement and draught conditions which are comparable to those of a model test, provided such test results are available.

#### 5.1.6 Data to be monitored and recorded

During the trial, the following data shall be monitored and recorded:

- area of trial;
- date, time and duration of trial, for each run;
- mean water depth in area of trial, for each run;