
**Ships and marine technology — Marine
environment protection: performance
testing of oil skimmers —**

**Part 1:
Moving water conditions**

*Navires et technologie marine — Protection de l'environnement marin:
essai de performance des écumeurs de pétrole —
Partie 1. Conditions en eau agitée*

ISO 21072-1:2009

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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 21072-1 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 2, *Marine environment protection*.

ISO 21072 consists of the following parts, under the general title *Ships and marine technology — Marine environment protection: performance testing of oil skimmers*.

— *Part 1: Moving water conditions*

— *Part 2: Static water conditions*

— *Part 3: High viscosity oil*

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Introduction

ISO 21072 standardizes the performance of oil skimmers used in marine pollution control.

Some oil skimmers have previously been performance-tested under non-standard conditions and procedures, with declared performance parameters being of limited value to the end user, especially under field conditions.

ISO 21072 provides for carrying out and recording the results of full-scale tests for a skimmer under a variety of test conditions.

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Ships and marine technology — Marine environment protection: performance testing of oil skimmers —

Part 1: Moving water conditions

1 Scope

This part of ISO 21072 provides a methodology for establishing quantitative performance data for oil skimmers under moving water conditions, so that the end user can objectively judge, compare and evaluate the design and performance of different skimmer units. The methodology applies to testing in a basin and requires control of oil properties and oil slick characteristics.

The method is applicable to all types of skimmers, provided that the equipment dimensions are within the physical limitations of the test basin. The test procedure provides full-scale test results for the unit tested, under controlled conditions, and for one or more classes of oil.

NOTE Care will need to be taken when applying the test results to the prediction of skimmer performance under field conditions.

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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 16165, *Ships and marine technology — Marine environment protection — Terminology relating to oil spill response*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16165 and the following apply.

3.1

data collection period

period of time within the steady-state period when recovered fluid is collected for establishing performance data

3.2

debris

solid or semi-solid substance that could interfere with the operation of a spill control system

3.3
emulsification factor
EF

amount of water emulsified into the oil as a result of the skimming/pumping process, not including water originally in the test fluid

NOTE It is expressed as a decimal fraction between 0 and 1.

3.4
fluid recovery rate
FRR

total volume of fluid recovered per unit time

NOTE It is expressed in cubic metres per hour (m³/h).

3.5
recovery efficiency
RE

ratio of test fluid (oil or emulsion) recovered to the total volume of fluid recovered

NOTE It is expressed as a percentage.

3.6
oil recovery rate
ORR

volume of test fluid (oil or emulsion) recovered per unit time

NOTE It is expressed in cubic metres per hour (m³/h).

3.7
oily phase

oil that is water-free or incorporates emulsified or encapsulated water that does not readily separate out

3.8
oil skimmer
skimmer

mechanical device used to remove oil from the water surface

3.9
slick length

average distance from the boom apex to the leading edge of the slick

3.10
slick leading edge

upstream end of the slick; location where inflowing oil encounters the accumulated slick

3.11
steady-state period

period of time during which the test conditions and operating parameters are constant or within acceptable variability ranges

4 Test facility requirements

This part of ISO 21072 is applicable to any test arrangement that allows for the control and monitoring of the test conditions.

Possible arrangements may include, but are not limited to, one or another of the following:

- a vertical flume tank;
- a horizontal flume tank or tow tank;
- any other such test facility that allows for the control and monitoring of the test conditions.

Examples are shown in Figures 1, 2 and 3.

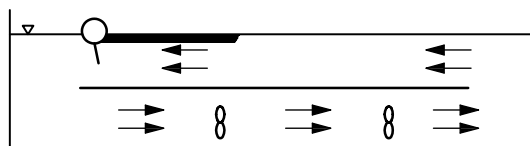


Figure 1 — Vertical flume

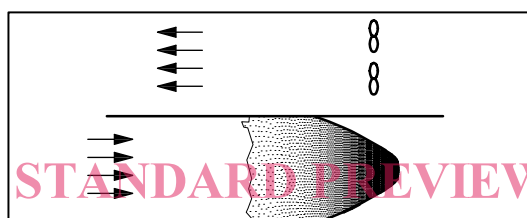
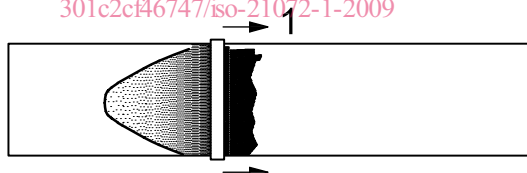


Figure 2 — Horizontal flume



Key

- 1 towing bridge

Figure 3 — Tow tank

The test facility shall be designed and equipped to control the following parameters.

- **Oil properties.** The facility shall be able to maintain the oil properties for the duration of the test. Oil analytical equipment shall be available for measuring oil properties (see 9.2).
- **Air and water temperature.** Testing may be carried out at any water temperature, provided that requirements with respect to oil properties are met. The test temperature shall always be well above the pour point of the oil, unless the purpose is to assess the collection of non-flowing/semi-solid oil. The facility shall be able to maintain the water temperature in the test basin at a selected test temperature with maximum variation of $\pm 2,0$ °C.

- **Oil distribution.** The facility shall incorporate the means of providing and maintaining an oil slick of the thickness required for the test.
- **Oil slick thickness.** The test facility shall incorporate means of regularly measuring oil slick thickness throughout the test period, with a proven accuracy of at least $\pm 20\%$.
- **Measuring tanks.** In order to provide for sufficient replicates during the test process, the test facility shall incorporate a sufficient number of calibrated tanks for accurately measuring fluid recovery rate, oil recovery rate and water uptake. The tank volumes shall correspond to the expected recovery rate of the unit to be tested so as to provide data collection periods of sufficient duration and with sufficient measuring accuracy (see 10.1).

5 Clearance requirements

Throughout testing, there shall be sufficient clearance between the skimmer and the tank walls and any containment device, so as not to restrict oil flow to the skimmer or otherwise impede normal operation of the unit.

Since the necessary clearance varies with oil viscosity and unit recovery rate, adequate oil flow shall be demonstrated in each specific case through oil flow observations or slick thickness measurements. The total width of the skimmer (including floats) shall not exceed 50 % of the tank width if oil flow is required to the downstream side of the skimmer.

Clearance between the unit and the tank floor shall be sufficient to not interfere with normal operations of the skimmer.

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6 Test parameters

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6.1 General

Testing shall establish quantitative performance data for the unit as a function of the following parameters:

- the test oil properties;
- the oil slick thickness;
- debris interference;
- the skimmer operating parameters.

6.2 Test oil properties

Testing shall be carried out with oils meeting the specifications given in Table 1.

To minimize problems associated with flow characteristics of waxy oils, testing shall be carried out at water temperatures at least 3 °C above the pour point of the test oil.

Oil and emulsion viscosity shall be reported at shear rates of 1 s⁻¹, 10 s⁻¹ and 100 s⁻¹. At least two of these shall be based on measurements, while the third may be determined by extrapolation.

In this part of ISO 21072, oil is categorized as non-emulsified (fresh) even if it contains up to 20 % water. Such oil may be used for testing as “water-free” oil, provided that the viscosity is within the ranges specified in Table 1.

All oils and emulsions may be reused, provided that the properties of the test fluids remain within the ranges defined in Table 1.

Table 1 — Ranges for oil properties and related slick parameters

Oil Class	Target viscosity cP	Viscosity range cP	Density kg/l	Slick thickness ^{b, c} mm	Example
1	10	5–20	0,85-0,9	10	Fresh crude, very light bunker
2	200	170–230	0,9-0,93	30	Light bunker
				50	Light bunker
3	2 000	1 800–2 200	0,92-0,95	50	Medium bunker
4	20 000	19 000–21 000	0,95-0,98	50	Heavy bunker
5	20 000	19 000–21 000 ^a	0,95-0,98	50	Emulsion of medium bunker
6 ^b	100 000	90 000–110 000 ^a	0,96-0,99	100	Emulsion of heavy bunker

^a At a shear rate of 10 s⁻¹.

^b Acceptable variation ± 10 %.

^c See Appendix A for guidelines on methods for controlling the oil slick thickness (6.3).

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6.3 Oil slick thickness

For each specific test oil, the slick thickness shall be maintained within the ranges defined in Table 1. Thickness shall be measured at a location 1,5 m from the skimmer entrance.

NOTE Annex A provides guidance for combining oil volumes and current speed in order to achieve the desired slick thickness when conducting tests in tow or flume tanks.

The oil slick thickness shall be monitored regularly throughout the test period and any deviations from the desired slick thickness shall be documented. Tests shall be rejected if the time-averaged slick thickness deviates more than 10 % from the specification given in Table 1.

6.4 Skimmer operating parameters

There are a number of operating parameters that can affect the skimmer performance, including adhesion surface speed, inclination angles, pump flow rates, skimmer draft and weir depth.

The main operating parameter shall be identified from the operating parameters.

Testing shall include as a minimum three variations of the main operating parameter — preferably including one above and one below the optimum setting.

6.5 Debris interference

Testing shall be carried out to assess the skimmer's ability to operate in the presence of various forms of debris in the oil slick. This examination will be qualitative in nature and is intended to provide the end user with a general indication of the effects of different materials that are often found in oil spill recovery situations. Of particular interest would be the debris' effects on oil intake, essential mechanical elements of the unit (e.g. scrapers, wringers, pumps) and overall processing of the recovered oil.

The groups of materials given in Table 2 shall be introduced into the oil slick individually. The impact of each group shall be observed and reported, and the group cleared from the test area before introducing the next.