

IMAROS 2

Procedure for testing oil skimmers in the National Centre for Testing of Oil Spill Response Equipment

Work Package 4



Introduction and purpose

The test procedure describes how to approach testing oil skimmers in the National Centre for Oil spill response located in Horten, Norway. The Centre consists of an indoor saltwater basin where equipment can be tested in almost realistic surroundings by adding waves and current in the basin. The basin makes it possible to test oil skimmers in full scale. The Centre also contains a laboratory where the water content, viscosity and density of the oil can be measured. Testing makes it possible to test oil skimmers under controlled conditions with almost realistic conditions, including waves and currents. The tests can be versatile and vary, possible tests are for example function testing, efficiency testing, testing of capacity and they all may give input for operational use.

The purpose of the procedure is to ensure quality and verifiability of the testing. The procedure describes how to test the capacity and efficiency of the skimmers. However, it will be necessary to take experiment-specific considerations into account, depending on factors such as the purpose of the testing, the type of oil and the nature of the oil skimmer.

Following the procedure also facilitates comparison of the results of different skimmers from different tests, even though test-specific deviations from the procedure may occur.

The approach of this procedure to test the capacity and efficiency of the oil skimmers capacity is the following steps:

Skimmer capacity: Recovery rate of oil (m³/h.)

Skimmer efficiency: The relationship between the recovered oil and the total volume recovered (by percent volume of oil) (%)

Furthermore, the testing will contribute to evaluate the oils viscosity, thickness and so forth. The testing will also allow you to discover weaknesses and strengths of the oil skimmer and uncover operational considerations.

The test done in the test centre will demonstrate how the oil skimmers function in a controlled environment. In an actual situation in the nature, several condition may influence the skimmers' function. This may be weather conditions, type of oil and other debris in the oil. The test in the Test Centre will never be able to recreate the environment accurately to the actual oil spill. The result of the test gives a solid basis for assessment but can't be uncritically transferred to real situations.

HSE in the test facility

Before start-up, risk factors must be highlighted by conducting a risk assessment or a Safe Job Analysis. Training shall be provided to internal personnel at the Norwegian Coastal Administration as well as external parties who rent the test facilities. External parties who rent the test facility must complete the Self-declaration form – HSE in the test facilities.

The overview of which protective clothing is to be used in the test facilities is reviewed and everyone must always wear the required protective clothing.

When testing in new, unknown oil types, exposure measurements must be carried out to identify chemical health hazards. Exposure should not pose a danger to life and health.

The use of a respirator should be worn when; It is tested in new unknown oil types, exposure measurements so indicate, or when exposure measurements are in progress and results are not available. Respirators can also be used for discomfort with odours. See separate instructions.

Different configurations for testing

Layout:

Test 1:	<p><u>Capacity test of oil in confined basin:</u> Oil emulsion and oil skimmer placed in a confined basin (4*4m). This is done to control the oil thickness. This makes it possible to build up the desired thickness of oil (12,5 cm with 2000 liters of oil).</p> <p>Capacity test is how much oil a skimmer can recover measured in m³/h. The experiment is carried out with a thick layer of oil, which corresponds to the skimmer being in oil emulsion (minimum 7.5 cm at start-up, at least 5 cm when it ends).</p>
Test 2:	<p><u>Capacity test of oil in confined basin with waves:</u> Similar setup as test 1, in addition with waves.</p>
Test 3:	<p><u>Capacity test of oil in boom with current:</u> Oil emulsion and skimmer placed in the boom, with current simulating towing of boom. The current is used without the oil going under the boom, and the speed of the current is documented. Approximately 0.6-0.8 knots. We will be using 2000 liters of oil emulsion.</p>
Test 4:	<p><u>Capacity test of oil in boom with current and waves:</u> Similar setup as test 3, in addition with waves.</p>

Operation of skimmer:

Test 1 and 2: Optimize the skimmer towards recovering as much oil as possible, while minimizing recovery of water. Before starting the test run, the skimmer will be adjusted until optimal recovery is achieved.

Test 3 and 4: Optimize the skimmer to recover as much oil as possible, without considering that some water is also added. Before starting the test run, the skimmer will be adjusted until optimal recovery is achieved. After the test run, minimum 25 % of the supplied oil should remain in the boom.

Oil type:

The chosen oil emulsion is determined based on which LSFOs the IMAROS 2 project can provide. The properties of the oil type must be documented in the test plan and report.

Example

Preparing for testing:

Test Plan:

For each test, a test plan must be drawn up describing the purpose and planned implementation of the individual test. The test plan should also describe all configurations and settings, as well as include forms to document the results along the way. Special circumstances may necessitate deviations from the procedure described in this procedure. This must be justified and documented for the individual test.

Practical preparations made before conducting the test:

Make sure that the test facility and necessary equipment are prepared and functional.

- Filling oil in the basin
- Location of skimmer in the basin (float freely, optimize the system and more).
- Collecting tank with valves
- Measurements (thickness of the oil temperature oil/water)
- Current in the basin
- Wave program

Conducting tests

- Each test is conducted three times, (three separate runs). It is accepted that the three runs deviate a maximum of 20% from the average. In the event of major deviations, the driving must be carried out again.
- Each test is run with a minimum duration of 30 seconds and at least 500 litres must be recovered.
- The system should be in continuous stable operation throughout the test, (settings should not be changed along the way).
- The test ends by connecting in the by-pass valve and then shutting down the system.
- Metrics/readings of results:
 - Oil thickness is measured at the collecting tank.
 - Hydraulic pressure for generator and pump.
 - Read/calculate total recovered volume.
 - Let settle for as long as necessary to separate oil and water phase (15min)

Expected flow recovery rate (m ³ /h)	Minimum oil volume (m ³)	Minimum measuring Period (minutes)
5	0,5	6
10	0,5	3
20	0,5	1,5
50	0,8	1,0
100	1,7	1,0

Table 1. Minimum oil volumes and duration of test periods (per measuring tank)

Sampling

For each test attempt, samples must be taken before and after the attempt. In order to provide representative samples, these must be taken from the basin, as close to the skimmer as possible, just before recording starts and in the collecting tank immediately after stopping recovery. Two parallel oil samples will be taken, one for analysis in the laboratory and one for storage.

Example

Setup of the oil recovery equipment

Hydraulic hoses

Hoses with different dimensions that are adapted to thematic couplings of type 7500 (3/4), 5000 (1/2) and 3800 (1/4) were used. Length of the hoses is approx. 15 meters. This was used for all the skimmers that were tested.

Power pack

The NCA's test facilities own fixed unit was used for running pumps and skimmers. The unit has a power of 90 kW, with variable pump.

Pressure/discharge hoses

The individual skimmer's original hose package was used:

Skimmer	Hoses
Drum skimmer	Discharge hose: 4" 15 meters
Belt skimmer	Discharge hose: 4" 15 meters
Adhesion band skimmer	Discharge spiro hose: 2" 15 meters Pressure spiro hose: 2" 15 meters
Brush skimmer	Discharge hose: 4" 15 meters
Weir skimmer	Discharge hose: 2,5" 15 meters

Test results

IM-20: XXX SKIMMER

Purpose	Test 1 – oil emulsion in enclosed basin		Date	25.09.2024
Oil	VLSFO IM-20			
Skimmer	xxx skimmer			
Oil temperature	17°C			
Air temperature	15.5°C			
Water temperature	15.8°C			
Salinity	1.03			
	Run 1	Run 2	Run 3	
Total volume of oil in basin	2000 L	2000 L	2000 L	
Oil thickness	12 cm	12 cm	12 cm	
Volume of oil collected	480 L	450 L	490 L	
Volume of free water collected	0 L	0 L	0 L	
Time elapsed	04:45	02:10	02:02	
Oil uptake rate	6 m ³ /h	12.5 m ³ /h	14.5 m ³ /h	
Oil sample	x	x	x	
Deviation from procedure				

Example

Purpose	Test 3 - oil emulsion in boom with current		Date	28.09.2024
Oil	VLSFO IM-20			
Skimmer	xxx skimmer			
Oil temperature	19°C			
Air temperature	15.7°C			
Water temperature	15.7°C			
Salinity	1.03°C			
	Run 1	Run 2	Run 3	
Current	0.6 kn	0.6 kn	0.6 kn	
Total volume of oil emulsion in basin	2000 L	2000 L	2000 L	
Oil thickness	10 cm	10 cm	10 cm	
Volume of oil collected	691 L	674 L	690 L	
Volume of free water collected	109 L	126 L	110 L	
Time elapsed	02:52	02:33	01:46	
Oil uptake rate	14.5 m ³ /h	15.8 m ³ /h	23.5 m ³ /h	
Oil sample	X	x	x	
Deviation from procedure				