



Standard Guide for Reporting of Test Performance Data for Oil Spill Response Pumps¹

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1. Scope

1.1 This guide is intended as a guideline for the standardized reporting of performance data of pumps and pump systems that may be considered for use in oil spill response operations. The present objective is to develop a reporting guideline to aid in the comparative evaluation of various devices.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

D2196 Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer

F631 Guide for Collecting Skimmer Performance Data in Controlled Environments

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *oil spill response pump*—devices used to transfer oil, oil and water mixtures, and emulsions. These include centrifugal pumps, positive displacement pumps, vacuum pumps, and other systems.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.2 *pump system*—the principal fluid moving device, including the prime mover, associated hose and fittings, and associated equipment such as debris handling devices that are normally used during oil spill response operations.

4. Significance and Use

4.1 The performance criteria listed in this guide will provide guidance in the selection of oil spill pumping equipment.

4.2 This guide has been developed for use by the following: manufacturers of pumping systems who wish to establish a common means of evaluating and reporting the performance characteristics of their products; and existing or potential users of pumping systems who wish to compare the performance characteristics of various products.

5. Test Fluids: Suggested Test Fluid Viscosities

5.1 A selection of test fluids from the following viscosity ranges is recommended and should include an adequate number of data points to display the pump's performance over the intended range of operation. It is recommended that the test fluids include one selection from each of the four ranges listed in **Table 1**, depending on the intended service of the pump. In particular, three viscosity targets are recommended to allow comparisons with skimmer test data (Guide **F631**), namely, 200, 2000, and 60 000 cSt.

5.2 For the tests described in **6.3 – 6.6**, use hydrocarbon-based single-viscosity oils or mixtures of high- and low-viscosity hydrocarbons, or both, at various temperatures to achieve test viscosities. Higher viscosities, such as those in Category 4, may require the use of emulsions. Note that, when using high-viscosity fluids, care must be taken in interpreting the test results due to two-phase flow considerations. The test fluid viscosity should be identified by measurements at shear rates of 1, 10, and 50 s⁻¹ (Test Method **D2196**).

6. Categories of Tests for Pump Performance

6.1 *Suction and Discharge Hoses*—Each of the following tests (**6.3 – 6.5**) should be conducted using suction and discharge hoses that are the same diameter as the respective pump inlet and discharge fittings.

TABLE 1 Recommended Viscosity Ranges for Test Fluids^A

| Category | Viscosity Range, cSt |
|----------|----------------------|
| 1 | 1 to 1000 |
| 2 | 1001 to 10 000 |
| 3 | 10 001 to 100 000 |
| 4 | 100 001 to 1 000 000 |

^A The values refer to viscosity measured at 10 s⁻¹.

6.2 *Equipment Specifications*—For each of the following performance tests, report the equipment specifications, including the following: pump model; prime mover model; prime mover type (that is, hydraulic, electrical, air, etc.); prime mover characteristics (that is, hydraulic, discharge pressure and flow-rate; electrical, voltage and current; and air, pressure and flowrate) under operating conditions; mechanical efficiency of the prime mover; hose and fitting size(s); and pump speed range (r/min). Also report the physical and operating specifications of the pump, including the following: size, weight, required fuel, ancillary equipment, submersible and non-submersible service, fittings, etc.

6.3 *Capacity Versus Head*—Report the volumetric capacity (m³/h) as a function of test fluid viscosity (measured at the pump inlet) and measured static pressure (measured at the pump discharge). Report a minimum of four data points for each viscosity tested, with the pump operating for a minimum of 30 min for each data point, and report the viscosity of the test fluid. Compare the measured capacity with the calculated displacement (m³/r or m³/cycle) for positive displacement pumps.

6.4 *NPSH Versus Viscosity*—Report the net positive suction head required (m) at the rated differential pressure for the specified test fluid viscosity. Report the equipment specifications in accordance with 6.2.

6.5 *Self-Priming Versus Viscosity*—For pumps capable of self-priming, report the maximum suction lift (m) for self-priming; also report the time required to establish prime starting with the pump and suction hose initially empty.

NOTE 1—The pump internals may be wetted prior to this test; any initial wetting of internals should be reported.

6.5.1 A suction hose length of 8 m (25 ft) is recommended for the sake of comparability. Report the equipment specifications in accordance with 6.2.

6.6 *Discharge Pressure*—Report the maximum discharge pressure (kPa), measured at the pump discharge, and the mechanism by which it is limited (for example, relief valve or power limiter) for use in determining appropriate hose ratings (conversion: 1 bar = 14.5 psi = 100 kPa).

6.7 *Ability to Run Dry*—Describe how the pump is degraded by running dry.

6.8 *Starting Pressure*—Report the static head (m) that can be overcome by the pump when restarting with hoses full of water.

6.9 *Operational Features*—Describe any pump features pertaining to ease of handling and operation, for example:

- 6.9.1 Presence and accessibility of drain plugs to facilitate draining and cleaning;
- 6.9.2 Portability, the presence of lifting points;
- 6.9.3 Ability to insert into standard tanker/ship holds/tanks;
- 6.9.4 Operational run time of the pump per refueling;
- 6.9.5 Stability of the pump in operation regarding torque reaction (twisting of submersible pumps);
- 6.9.6 Bearings: for example, sealed, pumped fluid lubricated, hydraulic fluid lubricated, or grease lubricated;
- 6.9.7 Maximum routine maintenance interval; and
- 6.9.8 Field repair capability.

6.10 *Safety*—Report any pump features pertaining to safety concerns, such as the following:

- 6.10.1 Capability to ground the pump to prevent the accumulation of static electricity;
- 6.10.2 Inclusion of pressure relief valves or other pressure limiting devices (positive displacement pumps);
- 6.10.3 Protection of operators from moving parts; and
- 6.10.4 Conformance to general industrial safety standards.

6.11 *Debris Tolerance*—Report on the pump's tolerance to debris and resistance to clogging. Identify the maximum size and aspect ratio and concentration of debris that can be passed. Identify any problems with abrasion when pumping abrasive materials; identify any problems related to the consistency of debris material (that is, sand versus seaweed, rope, or plastics-floresam) (see Guide F631 for recommended materials for debris tolerance testing); and identify whether the pump has a backflushing or reversing capability or debris processing capability, or both (that is, chopper knives).

6.12 *Compatibility*—Report on the pump's compatibility with seawater and a range of oil types; report the test standard used:

- 6.12.1 Seals, packing, gaskets, and other wetted components suitable for use with pumped fluids;
- 6.12.2 Chemical compatibility list; and
- 6.12.3 Coatings for wetted parts to increase durability.

6.13 *Reliability*—Report the hours of continuous service of the pumping system and observations of continuous pumping of water, with interruption of the test only for routine preventive maintenance (that is, change of fuel, air, oil, or hydraulic filters; change of oil; adjustments to belt tension; and other routine preventive maintenance specified by the manufacturer).

6.14 *Maintenance and Preservation*—Report the pump's recommended schedule of maintenance, list the recommended spare parts, and report the recommended procedure for preservation after use.

7. Report

7.1 Report the following information:

- 7.1.1 Place and date of the tests,
- 7.1.2 Manufacturer's name, type of pump, serial number, and year of construction,
- 7.1.3 Specification of the pump's drive,
- 7.1.4 Description of the test procedure used and the sensors and measuring apparatus used, including calibration data,
- 7.1.5 Type and viscosity of the fluids used in the performance tests, and

7.1.6 Observations from the performance tests.

8. Keywords

8.1 oil recovery; oil recovery pumps; oil spill; oil spill response pumps; pumps; pump systems; skimmers; skimmer pumps; viscosities

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