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# Standard Guide for Qualitative Observations of Skimmer Performance[1]

This standard is issued under the fixed designation F 2008; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This guide covers evaluating a number of qualitative performance parameters for full-scale oil spill removal systems or individual components of those systems. It is intended to complement the quantitative testing covered in Guide F 631.

1.2 This guide is intended for potential purchasers of oil spill removal equipment to ensure that suppliers meet their needs and expectations.

1.3 This guide requires a subjective evaluation that could vary widely when completed by different organizations. As such, its main use would be as a means of comparing different skimmers for a particular organization or application.

1.4 Not all of the items in this guide would apply to a particular skimmer or to a particular cleanup application. Prior to using this guide, users should carefully review the entire contents and note those areas that are most important to their needs. In particular, qualitative evaluation of items such as workmanship of construction may not be applicable to prototype skimmers.

1.5 *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.* Specific safety precautions are given in Section 9.

## 2. Referenced Documents

2.1 *ASTM Standards:*

F 625 Practice for Classifying Water Bodies for Spill Control Systems[2]

F 631 Guide for Collecting Skimmer Performance Data in Controlled Environments[2]

F 1607 Guide for Reporting of Test Performance Data for Oil Spill Response Pumps[2]

## 3. Terminology

3.1 *Definitions:*

3.1.1 *production skimmer*—full-scale device supplied for testing and indicated by the manufacturer to be commercially available.

3.1.2 *prototype skimmer*—device indicated by the developer or manufacturer, or both, as being in the developmental stage and not for sale on the commercial market.

3.1.3 *qualitative performance data*—characteristics recorded during the evaluation period other than those specified by Guide F 631.

## 4. Significance and Use

4.1 This guide provides procedures enabling the recording of qualitative performance information under controlled test conditions. This information can be used together with quantitative data to comprehensively evaluate a particular spill removal device or as a means of comparing two or more devices.

4.2 Although the qualitative assessment described in this guide can be somewhat subjective, it is an important part of the overall evaluation of a spill removal device. This guide covers performance factors other than recovery rate and efficiency that will affect the device's performance in an actual spill. Their consideration allows the comprehensive evaluation or comparison of spill removal devices.

4.3 Caution must be exercised whenever test data are used to predict performance in actual spill situations as the uncontrolled environmental conditions that affect performance in the field are rarely identical to conditions in the test tank.

4.4 Portions of this guide are specifically intended for skimmers with hydraulic power supplies. This is not intended to limit application of this guide to skimmers with other power supplies such as electric or pneumatic.

## 5. Summary of Guide

5.1 The spill removal device may be tested in a wave/tow tank, flume or other facility that is suitable for observing and recording appropriate operational performance factors. Significant testing results can be obtained using simple test tanks or ponds, particularly when calm water, stationary or low velocity advancing tests are desired as an economical means to screen or compare devices.

5.2 It is essential that the test device be operated in a steady-state condition during the evaluation period so that operational performance factors can be consistently monitored, evaluated and recorded.

5.3 Examination of qualitative performance factors can be obtained at any of the facilities described above and will entail assessment before, during and after quantitative testing.

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[2] *Annual Book of ASTM Standards*, Vol 11.04.

## 6. Interferences

6.1 The reporting of results shall address the possibility of test facility effects. For example, wall effects may interfere hydrodynamically with the performance of a device.

6.2 Care should be taken so that any containment apparatus not designed specifically for the skimming device does not affect the distribution of test fluid to the device or its ability to recover the test slick. Similarly, skimmers should be tethered in a way that does not interfere with performance.

## 7. Test Facilities

7.1 Several types of test facilities can be used to carry out the performance evaluations outlined in this guide.

7.1.1 *Wave/Tow Tank*—A wave/tow tank has a movable bridge or other mechanism for towing the test device through water for the length of the facility. A wave generator may be installed on one end, or on the side of the facility, or both.

7.1.2 *Current Tank*—A current tank is a water-filled tank equipped with a pump or other propulsion system for moving the water through a test section where the test device is mounted. A wave generator may be installed on this type of test facility.

7.1.3 Other facilities, such as private ponds, tanks, or flumes may also be used, provided the test parameters can be suitably controlled.

7.2 Ancillary systems for facilities include, but are not limited to, a distribution system for accurately delivering test fluids to the water surface, skimming systems to assist in cleaning the facility between tests, and adequate tankage for storing the test fluids.

7.3 Additional capabilities at the test facility should also include: the space, materials and tools necessary to effect assembly, maintenance and minor repairs of test devices; the means to safely lift test devices for deployment and retrieval; and platforms and walkways to facilitate observation, sampling, and written, photographic and video recording.

7.4 These qualitative observations can be made during quantitative testing in accordance with Guide F 631, or in the field during exercises and response operations provided that appropriate records are kept.

## 8. Test Fluids

8.1 Test fluids for use with this guide should be selected to fall within the parameters of those listed in Guide F 631. These test fluids may be crude, refined, or simulated.

## 9. Safety Precautions

9.1 Test operations shall conform to established safety and regulatory requirements for test facility operations and test fluid handling. Particular caution must be exercised when handling flammable or toxic test fluids, refueling motors, and deploying and retrieving test devices from the test tank.

9.2 Test operations shall also employ the safety precautions recommended by the manufacturers of devices and equipment employed during testing.

## 10. Equipment Operation

10.1 The test device shall be deployed in accordance with facility operating characteristics.

10.2 The device must be operated in accordance with the manufacturer's specified operating instructions with respect to mechanical operations, safety, and established maintenance routines. A representative of the manufacturer should be invited to participate in the initial setup and training of testing personnel.

10.3 Modifications to the device prior to or during the course of testing should not be done except in consultation with the manufacturer.

10.4 Modifications to the device, in any form that differs from the supplied test device, shall be recorded with the test results.

## 11. Test Variables and Qualitative Performance Factors

11.1 The test evaluator shall review and indicate the performance factors and methods selected for evaluation.

11.2 Qualitative performance evaluation should be conducted coincident with quantitative testing. Quantitative test procedures should be followed as specified in 12.1 to 12.4 of Guide F 631 for the operation of the test tank, distribution of test fluid, and collection of numerical data.

## 12. Pre-Deployment

12.1 Prior to testing:

12.1.1 Review the manufacturer's reference materials and all items received for testing.

12.1.2 Verify that supplied components, including fittings, hoses and materials, are in accordance with the manufacturer's specifications. Any adaptations to meet the requirements of the test facility should be noted.

12.1.3 Record in detail all significant differences between the technical specifications of the model tested and those of production models.

12.1.4 Mathematically compute the power balance of major components to determine if the drive provided by the prime mover adequately serves the power needs of the pump, recovery mechanism and other components. Provide specific computations, if possible, indicating total brake horsepower available and needed, system hydraulic pressure, hydraulic fluid flow rate, and operating temperature range.

12.1.5 If the skimmer being tested is designed to operate as a complete system the device should be presented for testing as a 100 % complete system with all of the necessary items for deployment and operation.

12.1.6 List any required modifications necessary to integrate components and render the system fully functional for testing.

12.2 *Reference Materials*:

12.2.1 List all documents received with the skimming system, and assess operation manuals for content, clarity, and practicality of use.

12.2.1.1 Note the use of clearly-labeled graphics and photographs.

12.2.1.2 In cases where the documentation is a translation of the original, note any areas of confusion or contradiction and be alert for any possible errors.

12.2.1.3 Indicate the inclusion of an index, organization of the documents, quality of print and instructions which facilitate use of documents for reference purposes.

12.2.1.4 Determine if a concise, all-weather field guide is available.

12.2.1.5 Ensure that operational and safety placards are appropriate, match operating procedures, and protect the operator.

12.3 Record whether the following items are satisfactorily addressed:

12.3.1 *Components*:

12.3.1.1 Complete listing of all components for specific model provided,

12.3.1.2 Technical specifications, and

12.3.1.3 Spare parts list.

12.3.2 *Assembly and Set-Up*:

12.3.2.1 Detailed and easily understood assembly instructions,

12.3.2.2 Diagrams or photographs to assist in assembly,

12.3.2.3 Standard tools required for assembly,

12.3.2.4 Special tools required for assembly,

12.3.2.5 Preparation required for operation, set-up and deployment,

12.3.2.6 Component and assembly weights, and

12.3.2.7 Lifting and handling requirements.

12.3.3 *Operation*:

12.3.3.1 Proper method of operation, including recommendations for optimal settings or guidance for achieving such settings,

12.3.3.2 Required types and quantities of fuel, oil, and other fluids,

12.3.3.3 Guidelines for safe operations,

12.3.3.4 Required procedures for retrieval, and

12.3.3.5 The appropriate methods for cleaning and decontamination including appropriate cleaning agents and the maximum temperatures or pressures, or both, allowable for hot-water or high-pressure cleaning.

12.3.4 *Storage, Maintenance, and Repair*:

12.3.4.1 Required procedures for storage,

12.3.4.2 Required procedures and recommended time intervals for maintenance and repair,

12.3.4.3 Guidelines for troubleshooting and suggested repair for major and minor problems, and

12.3.4.4 Disassembly and assembly procedures.

12.4 *Manufacturer Representation and Support Services*—Record and verify the terms and conditions of the warranty, and the availability of parts and service within the region. List all support services available through the manufacturer or regional distributor.

12.5 *Owners Survey*—For tests warranting a detailed assessment of operational and mechanical reliability, conduct a survey of past and present owners of the system being tested; this will provide a comprehensive account of performance to complement results achieved during short-term tank testing.

12.6 *Existing Test Reports*—Prior to testing, obtain and review any previously written evaluations of the test device, paying particular attention to test fluid types, methodologies, and qualitative/quantitative assessment criteria utilized. Where possible, consult with operational groups on short- and long-term findings relevant to the subject areas covered in this Guide.

## 13. Construction and Assembly

13.1 During initial assembly and set-up, evaluate the overall quality of construction and design, materials and fittings, overall ruggedness, assembly, and maintenance and repair.

13.2 *Overall Quality of Construction and Design*—Test personnel should be critical of any design features that could result in diminished skimmer performance or operator control. Pay particular attention to features that could create a safety hazard for operators or others working in the immediate vicinity such as exposed rotating parts, or hot surfaces.

13.2.1 Assess the overall quality of workmanship of the system during the test by visual inspection and reporting of the following:

13.2.1.1 Relative simplicity or complexity of design,

13.2.1.2 Potential safety hazards such as sharp protrusions, rough edges, weak lifting points or unsafe pump/powerpack configuration or design,

13.2.1.3 Overall size re: transportation and operation,

13.2.1.4 Logical placement and reasonable access to components for inspection and service, and

13.2.1.5 Compatibility of system components: do they work well together, or are they mismatched and inappropriate. (For example: skimmers designed for light oil recovery should not be equipped with a (sparking) gasoline engine; an oversized discharge port and bulky hose may lead to difficulties in handling, tethering and priming; skimmers intended for use with highly viscous oil should have a large diameter transfer hose).

13.2.2 If appropriate, use non-destructive testing or quality assurance system or regulatory certification to assess the structural integrity of the skimmer.

13.3 Design criteria should be considered when assessing equipment as follows:

13.3.1 *Safety-Related*:

13.3.1.1 The location of the exhaust in relation to the operator's position and reach,

13.3.1.2 The location of hot surfaces in relation to the operator,

13.3.1.3 Fueling access point for convenience and safety,

13.3.1.4 Covers fitting appropriately over all exposed moving parts such as belts, chains, or couplings,

13.3.1.5 Battery and controls enclosures that are effectively weatherproofed and vented, and

13.3.1.6 Non-flexible fuel lines must be well fastened, and properly protected.

13.3.2 *Operational*:

13.3.2.1 The markings for controls must be clear and easily understood,

13.3.2.2 An hour counter to track powerpack usage for maintenance,

13.3.2.3 An adequately sized hydraulic reservoir, or hydraulic cooling system, to avoid overheating,

13.3.2.4 Gages showing the levels of hydraulic fluid and diesel fuel that are clearly visible to the operator,

13.3.2.5 A bypass on the hydraulic system that allows warm-up so that hydraulic fluid does not load the system or spill over a relief valve,

13.3.2.6 One or more of: automatic shutoff, audible alarm,

or warning lights to indicate high engine temperature, low engine lubrication pressure, charging, or other problems,

13.3.2.7 Lubrication points that are safe and easily accessible to the operator,

13.3.2.8 A hydraulic pressure compensator to provide pressure balancing when setting either pump speed or pickup mechanism rates,

13.3.2.9 Corrosion protection for equipment with dissimilar metals, and

13.3.2.10 Rubber mounting on engine and pumps to minimize vibration.

13.3.3 *Handling and Storage*:

13.3.3.1 Devices that have tires must include a stop mechanism to limit movement,

13.3.3.2 Tire stops should not interfere with forklift pickup sockets or with uneven terrain,

13.3.3.3 Adequate side cover panels to avoid damage for powerpacks,

13.3.3.4 Tethering cleats to allow securing on board a vessel, and

13.3.3.5 Covers and enclosures that are easily removed and installed.

13.3.4 Note the method of starting diesel engines:

13.3.4.1 Note ease and reliability of starting (electric start vs. hand crank or hydraulic accumulator),

13.3.4.2 Depending on the application, assess the ability for cold-weather starting and/or long-term operation in hot weather,

13.3.4.3 Engines requiring a crank start usually include a decompression lever. Preferred models do not require the simultaneous turning of the crank and manual depression of the lever, and

13.3.4.4 In some cases, hydraulic or mechanical start systems would be better suited to the operational requirement, and would eliminate the need for battery maintenance.

13.3.5 Assess the suitability and design of hydraulic hoses, discharge/suction hoses, and connectors:

13.3.5.1 Lengths, weight, type, and durability,

13.3.5.2 Protectors attached to hydraulic connectors,

13.3.5.3 Quality of hydraulic connectors,

13.3.5.4 Means of relieving pressure when joining hydraulic connectors,

13.3.5.5 Diameter of hydraulic hoses re: heat development and pressure loss,

13.3.5.6 Use of layflat or semi-rigid discharge hose,

13.3.5.7 Compatibility of suction and discharge hoses re: chemical, oil, salt water, service temperatures,

13.3.5.8 Use of adapters to effect connections, and

13.3.5.9 Connection/disconnection of discharge & hydraulic lines above water, and

13.3.5.10 Type and size of connectors (Camlock, screw-on, other).

13.4 *Materials and Fittings*:

13.4.1 Assess the quality, durability and compatibility of materials:

13.4.1.1 Visually inspect all components prior and subsequent to quantitative testing. Identify any components that are poorly constructed, selected or fitted.

13.4.1.2 List and evaluate the location number and size of all critical fittings such as forklift sockets, eyebolts, tethering cleats, handles, boom attachments, and line/hose connections for each component including the skimming head, powerpack and pump.

13.4.1.3 Unique design features should also be specifically indicated.

13.4.2 Note specific features that appear to be unsafe, prone to damage or deterioration, difficult to assemble, or otherwise inappropriate. For example, thumbscrews used to position flotation buoys, rope handles, or spot-welding to fasten critical (high stress) joints should be clearly identified if they have the potential to fail during deployment and operation.

13.4.3 Identify any points within the system subject to electro-chemical corrosive action, particularly at fittings that require connection, disconnection or periodic adjustment.

13.4.4 There should be no damage or wear to moving parts evident prior to testing, particularly with the oil pickup mechanism and associated hardware. Bolts in the frame, scrapers, and pumps should be checked for tightness. The alignment of any couplings, belts, and chains should be checked. Hydraulic motors and pumps should be run in prior to testing.

13.5 *Overall Ruggedness*:

13.5.1 Assess potential resistance to damage under typical spill response conditions. Note features that appear susceptible to impact or abrasion, or to deterioration due to exposure to UV light, hydrocarbons, chemicals, saltwater, extreme temperatures, humidity, dirt, dust or debris:

13.5.1.1 Expose skimmer to oil, saltwater and sunlight for a continuous period, not less than five days.

13.5.1.2 Do not wipe down exposed skimmer surfaces during the five-day period.

13.5.1.3 Record all instances of deterioration immediately following the five-day period of exposure and subsequent to cleaning.

13.5.2 Examples of materials prone to degradation include:

13.5.2.1 Flexing rubber parts (which can deteriorate during use and storage),

13.5.2.2 Metal combinations (which react electrochemically and corrode). Valves, seals and O-rings (which can be degraded by hydrocarbons), and

13.5.2.3 Other components that move or contact moving parts (discs, belts, scrapers, wipers, rollers, wringers, self-leveling weirs).

13.5.3 List all features designed to prevent damage to the skimmer body or oil pickup mechanism such as bumper rails, impact guards, protective covers, transport cases or debris screens. Note whether debris screens are easily removable to allow operation without them if desired.

13.5.4 Estimate durability and approximate life-span of minor and major system components in terms of hours, days, months, or years, or all of these, as appropriate.

13.5.5 List the critical spare parts that would be needed to allow operation over an extended period.

13.6 *Assembly*:

13.6.1 Record the relative ease with which the system can be assembled, and note whether the device could be assembled

with or without the instructions provided.

13.6.2 Record the approximate amount of time (hours/minutes) and the minimum number of persons required to fully assemble the system.

13.6.3 List all tools and equipment required to fully assemble the system. Note both standard and special tools necessary for assembly but not supplied.

13.6.4 Record any problems encountered during assembly.

13.6.5 List all items such as locking nuts, washers, bolts, pins and screws critical to field assembly that might easily be lost. Determine if there are replacements provided with the system and list these.

13.6.6 Comment on any system tolerances that restrict interchangeable use of duplicate components. For example, flotation buoys, support posts, banks of discs, etc. should be clearly marked if they can only be assembled or inserted one particular way.

13.6.7 Report any markings that indicate alternative or optimal positioning levels of adjustable components (for example, flotation buoys, weir levels, etc.).

13.7 *Maintenance and Repair*:

13.7.1 Assess the accessibility and relative ease with which major mechanical components within the system can be replaced or repaired. For example, some disc configurations may be more complex and require special tools or more shop time than other configurations, or both. Welded versus bolted joints might preclude quick replacement of components subject to damage.

13.7.1.1 Note the means required to dismantle all major components,

13.7.1.2 Note standard and special tools required, and

13.7.1.3 Estimate the time required to effect major repairs and parts replacement.

13.7.2 Determine if basic repairs to items such as pneumatic tires, discs, rope mops and belts would require facilities/tools not typically available at a spill site.

13.7.3 Evaluate the maintenance and servicing requirements of the system:

13.7.3.1 List the type and volume of all fluids (fuel, lube oils, hydraulic fluid, etc.) required to operate the system and indicate if these fluids are readily available and normally stocked.

13.7.3.2 Note if fluids must be added subsequent to operation of the system.

13.7.3.3 Evaluate the manufacturer's recommended service frequency.

13.7.3.4 Record the approximate time and equipment required at servicing to refuel the prime mover and to change the crankcase oil, air/fuel filter(s) and spark plug(s).

## 14. Deployment and Retrieval

14.1 When deploying, retrieving and demobilizing the system, evaluate:

14.1.1 *Launch*—Record the relative ease with which the skimming system can be safely handled including deployment from various operational situations (for example, from a vessel deck, shoreline or pier) noting the following factors:

14.1.1.1 Ease of maneuvering the system and special equipment required,

14.1.1.2 Approximate amount of time taken for the system to be launched,

14.1.1.3 Minimum number of persons required to fully launch the system, and

14.1.1.4 Ease of handling hydraulic lines during movement of system.

14.1.2 Note mechanical lifting requirements needed to transport the skimming system to the field and to deploy it:

14.1.2.1 Type of lifting equipment required,

14.1.2.2 Ancillary gear required to secure system,

14.1.2.3 Gross weight of system,

14.1.2.4 Vertical lift, and

14.1.2.5 Horizontal extension.

14.1.3 Record any problems encountered during launch. Report any instability of the device upon initial deployment, as well as any actions taken or needed to correct this instability (such as adjusting ballast, flotation, weir depth, etc.).

14.2 *Positioning*:

14.2.1 Record the relative ease with which the device, hoses, powerpack, pump and temporary storage can be arranged and set up.

14.2.1.1 Area needed for deployment of skimming system,

14.2.1.2 Use of guy ropes, cables, other securing devices,

14.2.1.3 Inclusion of boom attachment points and ease of use, and

14.2.1.4 Approximate time required for setting up entire system.

14.2.2 Record how the device can be tethered so that its relative position can be maintained without affecting its potential to conform to waves and skim oil (see 14.3 on Handling and Connection of Hoses).

14.2.3 Assess the effect of hydraulic and discharge hoses on the position and movement of the device once deployed:

14.2.3.1 Note if the hoses sink or float,

14.2.3.2 Record any resultant change in position of device due to hoses,

14.2.3.3 Record additional support (for example, flotation collars, hose tethers) required, and

14.2.3.4 Note if final position of device facilitates oil collection.

14.2.4 Evaluate the accuracy of any markings on the device, flotation buoys or frame structure that indicate optimal flotation depth for the skimmer.

14.3 *Handling and Connection of Hoses*:

14.3.1 Comment on the relative ease with which the hoses can be handled, connected, disconnected, coiled and managed during operation.

14.3.2 Record the minimum number of persons required to lift supplied lengths of hydraulic, discharge and suction hose.

14.3.3 Record any problems encountered during connection of hydraulic and transfer hoses. Note if hydraulic and transfer hoses must be connected prior to skimmer deployment.

14.4 *Retrieval*:

14.4.1 Record the relative ease with which the skimming system can be retrieved. Note the ease with which it can be retrieved from various operational deployment situations:

14.4.1.1 Approximate amount of time required, and

14.4.1.2 Minimum number of persons required to safely retrieve the system.

14.4.2 Record mechanical lifting requirements to retrieve the skimming system. (Note that the gross weight of the system after use may be much greater than the weight when deployed.)

14.4.3 Record any problems encountered during retrieval of the skimmer. For example, report any difficulty in disconnecting hoses, in draining the sump of residual oil, or in safely handling the system.

14.5 *Cleaning*:

14.5.1 In order to assess cleaning, apply the following test procedures:

14.5.1.1 Immerse the device in test fluid (to its normal operating level) for 30 min.

14.5.1.2 Use two types of test fluids, one in each of two tests, consistent with the candidate test fluids described in Guide F 631 and appropriate to the recovery capability of the test device.

14.5.1.3 Record debris to which the skimmer is exposed.

14.5.1.4 Once removed, estimate the percentage of the skimmer coated with oil/debris residue.

14.5.1.5 Note design features that trap residue or that minimize its build-up.

14.5.1.6 Clean the skimmer using techniques recommended by the manufacturer or use high pressure water as described in 14.5.3 if no method is specified.

14.5.1.7 Record the approximate amount of time taken to clean the skimmer.

14.5.1.8 Record the minimum number of persons required to fully clean the system so that it is ready for storage or transportation.

14.5.2 Comment on the relative ease with which residual oil and debris can be removed from the device, particularly with respect to removing liquid from the sump, pump and intricate spaces.

14.5.3 Cleaning should be done in accordance with manufacturer's recommendations. Note should be made of the technique used, including (where applicable) water temperature and pressure, detergents, etc. On completion, an evaluation should be made of the effectiveness of the cleaning process.

14.6 *Storage and Transportation Requirements*:

14.6.1 Record all pre-storage disassembly and servicing requirements of the system. Include any requirements to:

14.6.1.1 Drain fuel, oil or hydraulic fluids, and

14.6.1.2 Prepare, inspect, and if appropriate, lubricate the device, pump and powerpack.

14.6.2 Record the approximate amount of time and the minimum number of persons required to fully prepare the system so that it is ready for storage or transportation.

14.6.3 Comment on the relative ease with which the system can be prepared for storage and transportation. Record any special packaging required for storage or transport of system components.

14.6.4 List the overall dimensions and weight of the packaged system, noting any restrictions to, or special permits required for, road, rail or air transportation. Assess the potential for two or more systems to be stacked.

## 15. Operational Observations

15.1 In addition to quantitative performance testing (see Guide F 631) visual observation and photographic records should be used to qualitatively assess the operational performance of skimming devices.

15.2 *Recovery Principle*—Indicate if the actual means of oil recovery is consistent with the stated recovery principle. If appropriate, anticipate deployment situations that may limit the application of the skimmer due to the means of recovery.

15.3 *Hydrodynamics*:

15.3.1 Describe flow patterns of test fluid and water around the device that could affect recovery at different skimmer settings (for example, rotational speed of pickup mechanism, weir depth, orientation) and in various wave and debris conditions.

15.3.2 Report on the likely cause of irregular flow patterns (for example, boom connector protrusion, hose connections, location or shape of flotation buoys).

15.4 *Ability of Skimmer to Draw and Recover Oil*:

15.4.1 Assess the ability of the recovery mechanism to evenly and continuously draw in and recover oil.

15.4.1.1 Estimate the percentage of the perimeter of the device through which oil is recovered.

15.4.1.2 Measure and record the percentage of the pickup mechanism that contacts oil (for example, measure the portion of a disc that coats with oil).

15.4.1.3 Assess the effectiveness of scraping, wringing or squeezing mechanisms used to remove oil collected on the recovery surfaces (for example, disc scrapers or bristle combs). Suggest reasons for sub-optimal recovery (for example, freezing of rope mop strands, worn or uneven wiper blades, erratic wave action, incorrectly adjusted roller tension, interference of debris, incorrect setting of disc rotational speed, etc.)

15.5 *Wave Handling and Stability*

15.5.1 Tests should be carried out in waves, selecting a wave height and period appropriate to the intended application of the device. During such tests, observations should be made of the following:

15.5.1.1 Record the approximate percentage of time that the pickup mechanism contacts the slick.

15.5.1.2 Note the effects of the wave on the skimmer including its ability to conform to the wave, the stabilizing effect of outrigger flotation, splashing at the point of entry of oil into the skimmer and other interferences.

15.5.1.3 If selecting other wave forms for quantitative testing, note these and record the capability of the skimmer to respond during oil recovery.

15.5.1.4 Record any water uptake or loss of stability in both calm and wave conditions, noting if the device has self-righting capability.

15.6 *Debris Processing*:

15.6.1 Testing with debris should be carried out according to the test outline described in Guide F 631, with the following two additional observations:

15.6.1.1 Evaluate the ability of the skimmer to handle specific forms of debris, including the mechanism that accounts for processing (see 11.1, Test Variables in Guide F 631). If it is evident that the presence of debris will preclude

skimming, then this should be noted.

15.6.1.2 Record intake and pump tolerances to debris, and whether skimmer is capable of self clearing or must be cleared manually.

15.7 *Pump Performance*:

15.7.1 A detailed test standard for pumps is provided in Guide F 1607.

15.7.2 Note added emulsification of the test fluid induced by the pump (where possible).

15.7.3 Additionally, record the following information:

15.7.3.1 Location of pumps internal or external to the device,

15.7.3.2 Pump inlet and outlet easy to recognize,

15.7.3.3 Ability of pump to run dry without damage, and

15.7.3.4 Ease of start-up and control.

15.8 *System Performance*—As a supplement to the testing outlined in Guide F 631, do longer-term testing to evaluate the control and performance of the device in one or more types of test fluid appropriate to the intended application of the device. (Guidance on the selection of test fluids is provided in Guide F 631.)

15.8.1 Evaluate and report performance of the system upon initial start-up, during extended periods of operation, and in various weather conditions. Monitor fuel consumption and rate of depletion of lube and hydraulic oils:

15.8.1.1 Record air temperature, precipitation and wind speed hourly during tests.

15.8.1.2 Note complexity/ease of start-up and any special requirements.

15.8.1.3 Record time for system to reach stable operating conditions.

15.8.1.4 Operate system in one or more test fluids appropriate to its intended application to simulate its use during an 8-h working day.

15.8.2 Once the system has reached operating temperature, run the system for eight hours employing the following methodology for each of the selected test fluids:

15.8.2.1 Note all hydraulic pressure and flow readings hourly.

15.8.2.2 Record hydraulic and other fluid temperature readings half-hourly.

15.8.2.3 Check all fluid levels hourly. Note replenishment volumes.

15.8.2.4 Note fittings, controls or any other items that have vibrated loose including nuts, fuel/hydraulic/discharge lines and couplings, and motor mounts.

15.8.2.5 Check for leaks, evidence of overheating or other damage.

15.8.2.6 Record total hours that system has been operated during testing.

15.8.2.7 List any repairs, replacement parts or modifications either made during testing or required subsequent to testing.

15.8.3 Evaluate the safety and relative ease with which controls can be operated. Estimate the duration of time that the device can be operated unattended. Also note:

15.8.3.1 Location and type of controls, and whether controls are well marked and easy to understand.

15.8.3.2 Additional controls that would facilitate operation.

15.8.3.3 Reliability and consistency of controls.

15.8.3.4 Ease and capability to adjust and maintain selected speeds or settings of the pump and skimmer while in operation. Note whether settings are affected by vibrations (inherent to the device) through the test.

15.9 *Adjusting Skimmer Settings*:

15.9.1 Comment on the capability and relative ease with which skimmer settings (rotational speed of pickup mechanism, pump rate, engine speed, weir depth, level and strength of suction, buoyancy, etc.) can be adjusted before deployment and during operation. Note the ease and accuracy with which settings can be reached and maintained on a repetitive, consistent basis.

15.10 *Ease of Operation*:

15.10.1 Record the number of persons and type of training or skills required to operate the system safely and effectively.

15.10.2 Note operational problems difficult to resolve without reference to the operating manual or consultation with the manufacturer such as the balancing of two or more operational variables. Consider any operational features that might be difficult to trouble-shoot.

15.10.3 Estimate the time the system could be operated continuously without undue operator fatigue.

15.11 *Overall Mechanical Reliability*—Evaluate structural integrity and consistency of performance during start-up and operation under various conditions.

15.12 *Safety Considerations*:

15.12.1 Identify any design or operational features of the system that appear impractical or unsafe. Evaluate all elements of the system; construction, design, assembly, deployment, operation, retrieval, storage and transportation to ensure safety.

15.12.2 Assess the powerpack for:

15.12.2.1 Exhaust emissions,

15.12.2.2 Vibration,

15.12.2.3 Tendency for movement (“walk”), and

15.12.2.4 Operator exposure to moving parts and hot surfaces.

15.12.2.5 Also assess powerpack noise levels at idle and “normal operating speed”, at distances of 1, 3 and 5 m from the powerpack, and at a height of 1.5 m above the ground, on each of the four sides of the powerpack. Noise measurements should be recorded as dB(A) on an integrated sound meter and compared to safety limits.

15.12.3 Assess other system safety features during performance testing including:

15.12.3.1 Non-slip walking or climbing surfaces on larger skimmers,

15.12.3.2 Handrails, railings and chain barriers,

15.12.3.3 Protected, vented fuel tanks, and

15.12.3.4 Venting of enclosed areas where oil is handled and personnel are present.

## 16. Report

16.1 Include a summary of key skimmer specifications: model designation, contact information, dimensions, weight, material types, (including pump and powerpack), logistics, and other miscellaneous information (for example, nameplate capacity). Pump performance curves should be supplied and

should indicate performance with water and test fluids of various viscosities.

16.2 A photograph or simplified, three-dimensional schematic should be included with the specifications and should clearly show the skimming mechanism. A schematic of the pump and powerpack should also be included in the report. Information can be based on manufacturer-supplied data but should be verified where possible, particularly when testing modified or updated versions of skimmers.

16.3 Recommended areas of information to be reported are listed below:

16.3.1 Model.

16.3.2 *Manufacturer/Distributor*:

16.3.2.1 Address,

16.3.2.2 Telephone/Facsimile numbers, and

16.3.2.3 Contact person.

16.3.3 Operating Principle.

16.3.4 *Optimum Application*:

16.3.4.1 Operating Environment,

16.3.4.2 Oil type,

16.3.4.3 Sea state,

16.3.4.4 Tow speed (m/s), and

16.3.4.5 Nameplate capacity.

16.3.5 *Dimensions*:

16.3.5.1 Width, height, draft, weight,

16.3.5.2 Discharge hose diameter, and

16.3.5.3 All dimensions, with regard to operating principle (swath width, disc diameter, etc).

16.3.6 *Construction*:

16.3.6.1 Main body material(s),

16.3.6.2 All materials with regard to operating principle (disc material, scraper material, etc.), and

16.3.6.3 Buoyancy mechanism(s).

16.3.7 *Pump*:

16.3.7.1 Manufacturer,

16.3.7.2 Model,

16.3.7.3 Type of Pump, and

16.3.7.4 Nameplate capacity.

16.3.8 *Powerpack*:

16.3.8.1 Manufacturer,

16.3.8.2 Model,

16.3.8.3 Engine,

16.3.8.4 Weight,

16.3.8.5 Dimensions, and

16.3.8.6 Fuel requirements.

16.3.9 *Miscellaneous*:

16.3.9.1 Debris handling,

16.3.9.2 Ignition-proofing, and

16.3.9.3 All key specifications relating to operating principle (Number of discs, etc.).

16.3.10 *Logistics*:

16.3.10.1 Personnel required for operation,

16.3.10.2 Personnel required for deployment/retrieval,

16.3.10.3 Equipment required for deployment/retrieval,

16.3.10.4 Fluid recovery and storage, and

16.3.10.5 Packing and transportation.

16.3.11 *Cost*:

16.3.11.1 Skimmer, powerpack, hoses and fittings.

16.4 The following summarizes key information included in this guide and is intended as a checklist for evaluating skimming systems. Users may wish to design a numerical scoring system with weightings to reflect their particular application.

16.4.1 *Predeployment*:

16.4.1.1 Quality and design of reference materials,

16.4.1.2 Manufacturer representation and support services,

16.4.1.3 Maintenance and repair requirements,

16.4.1.4 Owner survey, and

16.4.1.5 Existing test reports.

16.4.2 *Construction and Assembly*:

16.4.2.1 Overall construction and design,

16.4.2.2 Materials and fittings,

16.4.2.3 Overall ruggedness,

16.4.2.4 Assembly, and

16.4.2.5 Maintenance and repair.

16.4.3 *Deployment and Retrieval*:

16.4.3.1 Setting up,

16.4.3.2 Launching,

16.4.3.3 Positioning,

16.4.3.4 Connection of hydraulic and discharge hoses,

16.4.3.5 Cleaning,

16.4.3.6 Storage and Transportation requirements.

16.4.4 *Operation*:

16.4.4.1 Operating principle,

16.4.4.2 Adjusting skimmer settings,

16.4.4.3 Functionality of pickup mechanism,

16.4.4.4 Reliability of pickup mechanism,

16.4.4.5 Response to waves/stability,

16.4.4.6 Hydrodynamic effects and related interferences,

16.4.4.7 Debris processing,

16.4.4.8 Powerpack performance,

16.4.4.9 Pump performance,

16.4.4.10 Ease of operation,

16.4.4.11 Overall mechanical reliability, and

16.4.4.12 Safety considerations.

## 17. Keywords

17.1 evaluation; oil; oil recovery; qualitative performance; skimmer