Designation: F2084/F2084M – 01 (Reapproved 2024)

# Standard Guide for Collecting Containment Boom Performance Data in Controlled Environments[1]

This standard is issued under the fixed designation F2084/F2084M; 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 the evaluation of the effectiveness of full-scale oil spill containment booms in a controlled test facility.

1.2 This guide involves the use of specific test oils that may be considered hazardous materials. It is the responsibility of the user of this guide to procure and abide by the necessary permits for disposal of the used test oil.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D97 Test Method for Pour Point of Petroleum Products

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D971 Test Method for Interfacial Tension of Insulating Liquids Against Water by the Ring Method

D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

D1796 Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)

D2983 Test Method for Low-Temperature Viscosity of Automatic Transmission Fluids, Hydraulic Fluids, and Lubricants using a Rotational Viscometer

D4007 Test Method for Water and Sediment in Crude Oil by the Centrifuge Method (Laboratory Procedure)

D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

F631 Guide for Collecting Skimmer Performance Data in Controlled Environments

F818 Terminology Relating to Spill Response Booms and Barriers

## 3. Terminology

3.1 *Boom Performance Data Terminology*—Terms associated with boom performance tests conducted in controlled environments:

3.1.1 *boom submergence (aka submarining)*—containment failure due to loss of freeboard.

3.1.2 *first-loss tow/current velocity*—minimum tow/current velocity normal to the membrane at which oil continually escapes past a boom This applies to the boom in the catenary position.

3.1.3 *gross loss tow/current velocity*—the minimum speed at which massive continual oil loss is observed escaping past the boom.

3.1.4 *harbor chop*—a condition of the water surface produced by an irregular pattern of waves.

3.1.5 *preload*—during testing, the quantity of test fluid distributed in front of and contained by the boom prior to the onset of a test.

3.1.6 *tow speed*—the relative speed difference between a boom and the water in which the boom is floating. In this standard guide relative current speed is equivalent.

[1] This guide is under the jurisdiction of ASTM Committee F20 on Hazardous Substances and Oil Spill Response and is the direct responsibility of Subcommittee F20.11 on Control.

Current edition approved March 1, 2024. Published March 2024. Originally approved in 2001. Last previous edition approved in 2018 as F2084_F2084 – 01 (2018). DOI: 10.1520/F2084_F2084M-01R24.

[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.

3.1.7 *wave height*—(significant wave height) the average height, measured crest to trough, of the one-third highest waves, considering only short-period waves (that is, period less than 10 s).

3.1.8 *wave period*—(significant wave period) the average period of the one-third highest waves, measured as the elapsed time between crests of succeeding waves.

## 4. Significance and Use

4.1 This guide defines a series of test methods to determine the oil containment effectiveness of containment booms when they are subjected to a variety of towing and wave conditions. The test methods measure the tow speed at which the boom first loses oil (both in calm water and in various wave conditions), the tow speed at which the boom reaches a gross oil loss condition (both in calm water and in various wave conditions), boom conformance to the surface wave conditions for various wave heights, wavelengths and frequencies, (qualitatively), resulting tow forces when encountering various speeds and wave conditions, identifies towing ability at high speeds in calm water and waves, boom sea-worthiness relative to its hardware (that is, connectors, ballast members), and general durability.

4.2 Users of this guide are cautioned that the ratio of boom draft to tank depth can affect test results, in particular the tow loads (see Appendix X1 discussion).

4.3 Other variables such as ease of repair and deployment, required operator training, operator fatigue, and transportability also affect performance in an actual spill but are not measured in this guide. These variables should be considered along with the test data when making comparisons or evaluations of containment booms.

## 5. Summary of Guide

5.1 This guide provides standardized procedures for evaluating any boom system and provides an evaluation of a particular boom's attributes in different environmental conditions and the ability to compare test results of a particular boom type with others having undergone these standard tests.

5.2 The maximum wave and tow speeds at which any boom can effectively gather and contain oil are known as boundary conditions. Booms that cannot maintain their design draft, freeboard, profile, and buoyancy at these conditions may be less effective. The boundary conditions depend on the characteristics of oil viscosity, oil/water interfacial tension and oil/water density gradient.

## 6. Test Facilities

6.1 Several types of test facilities can be used to conduct the tests outlined in this guide:

6.1.1 *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.

6.1.2 *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.

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

6.2 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. Test Configuration and Instrumentation

7.1 The boom should be rigged in a catenary configuration, with the gap equal to 33 % of the length; or boom gap-to-length ratio of 1:3. Towing bridles are generally supplied by the manufacturer for both ends of the boom which provide attachment points for towing (Fig. 1). At each end of the boom, the towing apparatus shall be joined to the tow bridle or tow lead by a single point only. Boom towing force should be measured with in-line load cells positioned between the boom towing bridles and tow points.

7.2 Preload oil should be pumped directly into the boom apex.

7.3 Data obtained during each test should include electronically collected data and manually collected data. Oil and water property data should be based on fluid samples obtained during

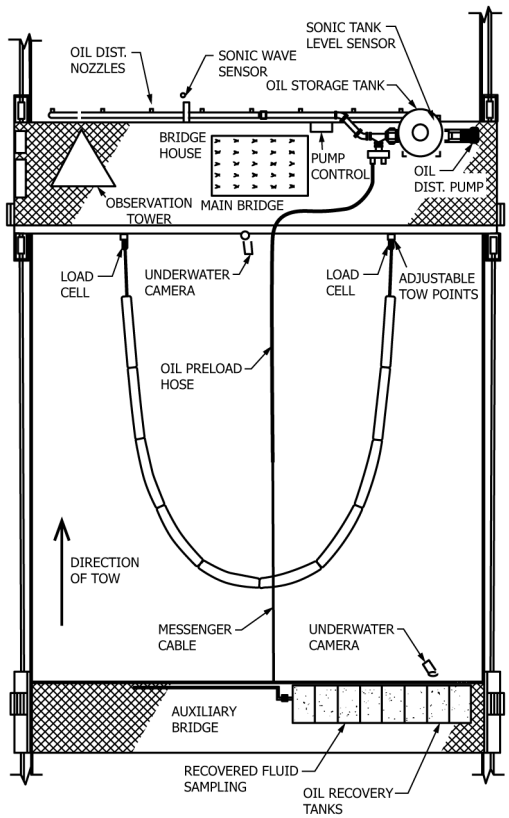


**FIG. 1 Typical Boom Test Setup in Tank**