



## Standard Practice for Determining the Performance of Oil/Water Separators Subjected to Surface Run-Off<sup>1</sup>

This standard is issued under the fixed designation D 6104; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This practice covers the procedure, any necessary related apparatus and the sampling technique to be used in determining the performance characteristics of oil/water separators subjected to contaminated run-off.

1.2 This practice does not address determining the performance characteristics of an oil/water separator subjected to the sudden release of a relatively large quantity of hydrocarbons that may appear, in pure form or at high concentration, in the influent to the separator. In this case, refer to Practice D 6157.

1.3 This practice does not address determining the performance characteristics of an oil/water separator subjected to a mechanically emulsified influent such as provided by a pump.

1.4 This practice does not investigate the ability of the separator to handle debris or suspended solids, that is, grit or tree leaves.

1.5 While the effluent may meet code requirements for total oil and grease content, this practice does not address the presence of soluble organics, i.e., Benzene, Toluene, Ethylbenzene and Xylene (BTEX's) which may be detected in the effluent. It also does not make any provisions for the effects of detergents, surfactants, soaps, or any water soluble matter (that is, salts), or any portion of an essentially insoluble matter that may be found in solution on separation. (Effects of certain water soluble chemicals or solids may be investigated by adding them to the water at predetermined constant concentrations.)

1.6 In order to estimate the effect of water temperature on the performance of the separator, the tests described in this practice must be performed at two water temperatures. The selected temperatures must be at least 10°C (18°F) apart, with the temperature ranging from a minimum of 0°C (32°F) to a maximum of 50°C (122°F).

1.7 This practice does not make any provisions for the variation of pH or temperature during a test run. Refer to Appendix X1 for further detail.

1.8 This practice can be used with a variety of hydrocarbons. It adopts No. 2 fuel oil with a density<sup>2</sup> of 845 kg/m

3(52.73 lb<sub>m</sub>/ft<sup>3</sup>) and a viscosity<sup>2</sup> of 1.9 to 4.1 centistokes at 40°C (104°F) and SAE 90 lubricating oil with a density<sup>2</sup> of 930 kg/m<sup>3</sup> (58 lb<sub>m</sub>/ft<sup>3</sup>) at 15.5°C (60°F) and a viscosity (see SAE J313) of 13.5- < 24 centistokes at 100°C (212°F) as the comparative testing media. It is understood that the results obtained from this practice are only directly applicable to No. 2 fuel oil and SAE 90 lubricating oil for the tested concentrations and only careful interpolation or extrapolation, or both, is allowed to other hydrocarbons. Low viscosity or high density hydrocarbons or hydrocarbons that contain a larger fraction of highly soluble compounds may need to be tested separately.

NOTE 1—No extrapolation outside the range of the tested influent or effluent oil concentrations is allowed as performance may not be linear. Hence, to establish performance at a higher or lower concentration, the separator shall be tested for that specific condition. In addition, linearity must be established prior to using linear interpolation.

1.9 Since regulations are based on effluent total hydrocarbon content, this practice does not set forth any lower limits on oil particle size for the evaluation of separator efficiency. However, a standardized means for mixing oil and water shall be specified to ensure repeatability. It must be noted however that smaller particles, having a greater surface area to volume ratio, rise at a slower rate than their larger counterparts. (Guide F 933 requires that 20 % of all oil particles be smaller than or equal to 50 μm and IMO MEPC 60 (30) does not mention any particle size requirements but asks the user to avoid emulsion causing chemicals.)

1.10 Although the tests described in this practice intend to simulate contaminated storm water run-off separation requirements, they do not cover all possible applications. It is the end user's responsibility to determine whether his separation requirements are within the scope of this practice.

1.11 A product different from the general description herein may be tested and found to be in compliance with the performance criteria set forth.

1.12 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the inch-pound units are shown in parentheses. The values stated in each system are not exact equivalents. Therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.

1.13 *This practice does not purport to address all the environmental hazards, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate environmentally responsible practices and to determine*

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of D19.06 on Methods for Analysis for Organic Substances in Water.

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<sup>2</sup> Ray E. Bolz and George L. Tuve, *CRC Handbook of tables for Applied Engineering Science*, 2<sup>nd</sup> Edition, CRC Press, 1981.

the applicability of regulatory limitations prior to use.

1.14 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:

- D 1129 Terminology Relating to Water<sup>3</sup>
- D 3370 Practices for Sampling Water<sup>3</sup>
- D 4281 Test Method for Oil and Grease (Fluorocarbon Extractable Substances) by Gravimetric Determination<sup>4</sup>
- D 6157 Practice for Determining the Performance of Oil/Water Separators Subjected to a Sudden Release<sup>4</sup>
- F 933 Guide for Evaluation of Oil Water Separation Systems for Spilled Oil Recovery Applications<sup>5</sup>

### 2.2 EPA Standards:

- EPA-413.1 “Methods for Chemical Analysis of Water and Wastes”, EPA 600/4-79-020, revised March 1983<sup>6</sup>
- EPA-413.2 “Methods for Chemical Analysis of Water and Wastes”, EPA 600/4-79-020, revised March 1983<sup>6</sup>
- EPA-1664 H-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons) EPA-821-B-94-004B, April 1995<sup>6</sup>

### 2.3 SAE Standards:

- SAE J306 Axle and Manual Transmission Lubricant Viscosity Classification<sup>7</sup>
- SAE J313 Surface Vehicle Recommended Practice (R) Diesel Fuels<sup>7</sup>

## 3. Terminology

3.1 *Definitions:* For definitions of terms used in this practice, refer to Terminology D 1129.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *calibration*—the certified evaluation of the accuracy of a measuring instrument as performed by its manufacturer or an independent licensed or accredited third party.

3.2.2 *contaminated run-off*—rain water which has collected oily contaminants from the surfaces it came in contact with and which may appear in the influent to a separator. Unlike a release, the level of contamination in this case is much lower.

3.2.3 *effluent*—the aqueous release from a separator.

3.2.4 *flow totalizer*—a counter, usually attached to a flow meter, that evaluates the total volume of the fluid that has flowed through over a given time period.

3.2.5 *influent*—the oily aqueous input to a separator.

3.2.6 *oily discharge*—any release of oily contaminants into the environment that exceeds the allowable limit.

3.2.7 *re-entrainment*—the condition in which the level of contamination of the effluent water of a separator containing oil

is higher than the influent contamination level due to internal remixing. This definition usually applies to situations where clean water passes through a separator that already contains hydrocarbons stored within and atop the water so as to form an interface.

3.2.8 *release*—any sudden discharge of an oily substance from vessels that are specifically designed to store, contain or transfer oily products such as storage tanks, pipelines, diked areas and transfer equipment and which may appear in the influent to a separator.

3.2.9 *separator*—a flow through primary treatment device the primary purpose of which is to separate oil from water.

## 4. Summary of Practice

4.1 The practice evaluates a separator’s ability to reduce the total hydrocarbon content of contaminated run-off. For this, an influent is supplied at the separator’s rated flow for the selected hydrocarbon content (either 350 or 1000 mg/L). The corresponding effluent hydrocarbon content is determined by obtaining and analyzing grab samples.

4.2 The practice also evaluates the effluent of a separator at rated oil storage capacity in relation to a non-contaminated influent and its corresponding rated flow in order to establish its re-entrainment characteristics.

4.3 The data generated in this practice are considered valid for the separators tested only. However, the results of these tests may be extrapolated to smaller or larger size separators provided that applicable geometric and dynamic similitude are maintained. Where the use of extrapolation is not applicable, that size unit must be subjected to testing.

4.4 The flow rate for these tests must equal the manufacturer’s rated flow for the given separator at the given influent contamination level and for the selected effluent peak contamination concentration.

4.5 For the purpose of this test, the water temperature should be between 10°C (50°F) and 21.1°C(70°F) and the pH of the water between 6 and 9.

## 5. Significance and Use

5.1 The Clean Water Act promulgated the implementation of water quality standards and contamination limits for a wide range of pollutants including oil and grease. Specifically, the EPA prohibits “the discharges of oil that cause a film or sheen upon or cause discoloration of the surface of the water”. Several state and local agencies have adopted this statement in addition to setting concentration limits, that is, 15 or even 5mg/L. The purpose of this practice is to evaluate the performance of a separator in regards to the regulations and user requirements.

5.2 Another purpose of this practice is to establish that a separator containing oil at its rated capacity would still be capable of meeting the above criteria when subjected to run-off.

5.3 This practice is not applicable if the influent to a separator contained a sudden release as much higher concentrations would be expected. For this case, see Practice D 6157.

5.4 This practice is not applicable if the influent to a separator is conveyed by a pumping means.

5.5 The data generated in this method is valid for the

<sup>3</sup> Annual Book of ASTM Standards, Vol 11.01.

<sup>4</sup> Annual Book of ASTM Standards, Vol 11.02.

<sup>5</sup> Annual Book of ASTM Standards, Vol 11.04.

<sup>6</sup> Environmental Protection Agency, 40 CFR Ch. 1 (7-1-95 Edition)

<sup>7</sup> Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.