



Standard Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR)¹

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1. Scope

1.1 This test method evaluates the lubricity of diesel fuels using a high-frequency reciprocating rig (HFRR).

1.2 This test method is applicable to middle distillate fuels, such as Grades Low Sulfur No. 1 D, Low Sulfur No. 2 D, No. 1 D, and No. 2 D diesel fuels, in accordance with Specification D 975; and other similar petroleum-based fuels which can be used in diesel engines

NOTE 1—It is not known that this test method will predict the performance of all additive/fuel combinations. Additional work is underway to further establish this correlation and future revisions of this test method may be necessary once this work is complete.

1.3 The values stated in SI units are to be regarded as 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 and health practices and determine the applicable regulatory limitations prior to use.* Specific hazard statements are given in section 7.

2. Referenced Documents

2.1 ASTM Standards:

- D 329 Specification for Acetone²
- D 362 Specification for Industrial Grade Toluene³
- D 975 Specification for Diesel Fuel Oils⁴
- D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products⁵
- D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products⁵
- D 4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination⁵
- D 5290 Test Method for Measurement of Oil Consumption,

Piston Deposits, and Wear in a Heavy-Duty High-Speed Diesel Engine—NTC-400 Procedure⁶

D 6078 Test Method for Evaluating Lubricity of Diesel Fuels by the Scuffing Load Ball-On-Cylinder Lubricity Evaluator (SLBOCLE)⁷

E 18 Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁸

E 92 Test Method for Vickers Hardness of Metallic Materials⁸

2.2 *American Iron and Steel Institute Standard:*⁹

AISI E-52100 Chromium Alloy Steel

2.3 *American National Standards Institute Standard:*¹⁰

ANSI B3.12 Metal Balls

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *lubricity, n*—a qualitative term describing the ability of a fluid to affect friction between, and wear to, surfaces in relative motion under load.

3.1.1.1 *Discussion*—In this test method, the lubricity of a fluid is evaluated by the wear scar, in millimetres, produced on an oscillating ball from contact with a stationary disc immersed in the fluid operating under defined and controlled conditions.

3.1.2 *boundary lubrication, n*—a condition in which the friction and wear between two surfaces in relative motion are determined by the properties of the surfaces and the properties of the contacting fluid, other than bulk viscosity.

3.1.2.1 *Discussion*—Metal to metal contact occurs and the chemistry of the system is involved. Physically adsorbed or chemically reacted soft films (usually very thin) support contact loads. As a result, some wear is inevitable.

4. Summary of Test Method

4.1 A 2-mL test specimen of fuel is placed in the test reservoir of an HFRR and adjusted to either of the standard

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.E2 on Diesel Fuels. This test method was developed by ISO/TC22/SC7/WG6 and is a part of ISO 12156.

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² *Annual Book of ASTM Standards*, Vol 06.04.

³ Discontinued—See 1998 *Annual Book of ASTM Standards*, Vol 06.03.

⁴ *Annual Book of ASTM Standards*, Vol 05.01.

⁵ *Annual Book of ASTM Standards*, Vol 05.02.

⁶ Discontinued—See 1997 *Annual Book of ASTM Standards*, Vol 05.03.

⁷ *Annual Book of ASTM Standards*, Vol 05.04.

⁸ *Annual Book of ASTM Standards*, Vol 03.01.

⁹ Available from American Iron and Steel Institute, 1000 16th St., NW, Washington, DC 20036.

¹⁰ Available from American National Standards Institute, 11 W. 42nd St., NW, Washington, DC 20036.