



Standard Guide for Microscopic Characterization of Particles from In-Service Lubricants¹

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1. Scope

1.1 This guide covers the classification and reporting of results from in-service lubricant particulate debris analysis obtained by microscopic inspection of wear and contaminant particles extracted from in-service lubricant and hydraulic oil samples. This guide suggests standardized terminology to promote consistent reporting, provides logical framework to document likely or possible root causes, and supports inference associated machinery health condition or severity based on available debris analysis information.

1.2 This guide shall be used in conjunction with an appropriate wear debris analysis sample preparation and inspection technique including, but not limited to, one of the following:

- 1.2.1 Ferrography using linear glass slides,
- 1.2.2 Ferrography using rotary glass slides,
- 1.2.3 Patch analysis using patch makers (filtration through membrane filters),
- 1.2.4 Filter debris analysis,
- 1.2.5 Magnetic plug inspection, or
- 1.2.6 Other means used to extract and inspect particulate debris from in-service lubricants.

1.3 This standard is not intended to evaluate or characterize the advantage or disadvantage of one or another of these particular particle extraction and inspection methods.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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.*

¹ This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.96.06 on Practices and Techniques for Prediction and Determination of Microscopic Wear and Wear-related Properties.

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2. Referenced Documents

2.1 ASTM Standards:²

D4130 Test Method for Sulfate Ion in Brackish Water, Seawater, and Brines

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D7416 Practice for Analysis of In-Service Lubricants Using a Particular Five-Part (Dielectric Permittivity, Time-Resolved Dielectric Permittivity with Switching Magnetic Fields, Laser Particle Counter, Microscopic Debris Analysis, and Orbital Viscometer) Integrated Tester

D7596 Test Method for Automatic Particle Counting and Particle Shape Classification of Oils Using a Direct Imaging Integrated Tester

D7647 Test Method for Automatic Particle Counting of Lubricating and Hydraulic Fluids Using Dilution Techniques to Eliminate the Contribution of Water and Interfering Soft Particles by Light Extinction

D7690 Practice for Microscopic Characterization of Particles from In-Service Lubricants by Analytical Ferrography

G40 Terminology Relating to Wear and Erosion

2.2 ISO Standard:³

ISO 11171 Hydraulic fluid power – Calibration of automatic particle counters for liquids

3. Terminology

3.1 Definitions:

3.1.1 *abrasive wear, n*—wear due to hard particles or hard protuberances forced against and moving along a solid surface. **G40**

3.1.2 *abrasion, n*—wear by displacement of material caused by hard particles or hard protuberances. **D4175**

3.1.3 *break-in, n*—see *run-in*. **G40**

3.1.4 *fatigue wear, n*—wear of a solid surface caused by fracture arising from material fatigue. **G40**

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 Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.