



Standard Guide for Measuring the Wear Volumes of Piston Ring Segments Run against Flat Coupons in Reciprocating Wear Tests¹

This standard is issued under the fixed designation G206; 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 and describes a profiling method for use accurately measuring the wear loss of compound-curved (crowned) piston ring specimens that run against flat counter-faces. It does not assume that the wear scars are ideally flat, as do some alternative measurement methods. Laboratory-scale wear tests have been used to evaluate the wear of materials, coatings, and surface treatments that are candidates for piston rings and cylinder liners in diesel engines or spark ignition engines. Various loads, temperatures, speeds, lubricants, and durations are used for such tests, but some of them use a curved piston ring segment as one sliding partner and a flat or curved specimen (simulating the cylinder liner) as its counterface. The goal of this guide is to provide more accurate wear measurements than alternative approaches involving weight loss or simply measuring the length and width of the wear marks.

1.2 *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:*²

G40 Terminology Relating to Wear and Erosion

G181 Test Method for Conducting Friction Tests of Piston Ring and Cylinder Liner Materials Under Lubricated Conditions

3. Terminology

3.1 *Definitions*—See Terminology G40.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *conformal contact, n—in friction and wear testing*, any macro-geometric specimen configuration in which the curvature of one contact surface matches that of the counterface.

3.2.1.1 *Discussion*—Examples of conformal contact include a flat surface sliding on a flat surface and a ball rotating in a socket that conforms to the shape of the ball. A pair of surfaces may begin a wear or friction test in a non-conforming contact configuration, but develop a conformal contact as a result of wear.

3.2.2 *cylinder bore/cylinder liner, n—in an internal combustion engine*, the cylindrical cavity in which the piston moves.

3.2.2.1 *Discussion*—The terms cylinder bore and cylinder liner are used interchangeably in the description of this method. Cylinder liners are most commonly used in heavy-duty engines which are intended to be rebuilt. They are sleeves, generally of a cast iron, which are surrounded on their outer surface by coolant for better heat transfer, and meant to be replaced when excessively worn. A cylinder bore is machined directly into an engine block and is more commonly used in light-duty engines which are not meant for rebuilding. The material of the cylinder bore is, therefore, the same material as the engine block, however the inside surface of the bore may or may not have additional surface treatment.

4. Summary of Guide

4.1 A reciprocating wear testing apparatus is used to simulate the back-and-forth motion of a piston ring within a cylinder bore in the presence of a heated lubricant. Depending on the duration and severity of the imposed test conditions, some degree of wear is generally produced on one or both members of the sliding pair. Mathematical models of the wear scar geometry on both the piston ring and cylinder liner surfaces allow the degree of wear to be quantified in terms of volume lost. The contact geometry for such tests, in the context of ring-on-liner frictional behavior, is exemplified in Practice G181. That method uses pre-worn-in surfaces, and therefore it differs from the present case in which wear loss is based on measurements of initial and final profiles of the test specimens.

5. Significance and Use

5.1 The practical life of an internal combustion engine is most often determined by monitoring its oil consumption.

¹ This guide is under the jurisdiction of ASTM Committee G02 on Wear and Erosion and is the direct responsibility of Subcommittee G02.40 on Non-Abrasive Wear.

Current edition approved May 1, 2011. Published May 2011. DOI: 10.1520/G0206-11.

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.