



Method for Determining Hardness of Radial; Lip Seal Materials

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

Note: The words **must**, **shall**, or **will**, as used in this document mean a mandatory requirement.

1.1 Purpose. This standard provides a method of measuring accurately, by microhardness instrumentation, the hardness of seal materials which are small, thin, or irregular in shape.

1.2 Applicability. Radial lip rotating shaft seals with spring or springless designs. This test procedure is applicable to specimens of thickness described in 3.3.1 and elastomers of 30 International Rubber Hardness Degree (IRHD) to 95 IRHD.

1.2.1 Seal Condition for Measurement. This test procedure is used for new and used seals. See 3.3.2 and 3.3.3.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D1415 ISO 48 ISO/IEC 17025 ISO/TS 16949

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- ARPM OS-8 – Visual Variations Guide for Rotating Shaft Seals - located at: <http://www.arpminc.com/index.php?pg=publications&name=10>.
- Global Document Management (GDM).
- Permabond LLC, 14 Robinson St., Pottstown, PA 19464 U.S.A – located at info.americas@permabond.com.
- Wallace, 11930 Hamden Place, Santa Fe Springs, CA 90670 - located at info@wallaceinstruments.co.uk.

3 Resources

3.1 Facilities. GM North America Powertrain only. All data must be generated by an ISO/IEC 17025, ISO/TS 16949 or GM accredited laboratory. See 3.1.2.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Microhardness Tester. Use equipment for microhardness (Type M) measurements, described in ASTM D1415 or ISO 48. A friction free, dead load tester, e.g., Wallace (Elektron Technology) Model H14.

3.2.2 Timer with one-tenth of a second capability.

3.2.3 IHRD Micro Test Blocks. Four (4) blocks cover the range of approximately, 35 IRHD to 95 IRHD with a tolerance of ± 2 IRHD. The test blocks are intended to be used as a check to ensure that instruments function properly and read correctly. They are not intended as standards with specific hardness values.

3.2.4 Specimen Mounting Adhesive. Cyanoacrylate, e.g., Permabond (Eastman) 910 adhesive or equivalent. The adhesive must be fast drying, non-resilient, and nondestructive to the elastomer specimen. The adhesive secures the test specimen from lateral movement during measurement and does not influence the measurement.

3.2.5 Specimen Mounting Surfaces. Steel mounting discs, 25 mm in diameter $\times$ 6 mm thick minimum. Surfaces must be ground reasonably parallel and flat. Glass mounting discs may be used as an alternate to the steel discs where an evaluation of specimen adhesion to the mounting disc is required.

3.2.6 Vibration Isolation Table or Platform. Sufficient size for supporting the microhardness tester. Measurements must be free from external vibration sources.

3.3 Test Vehicle/Test Piece.

3.3.1 Specimen Thickness. The desired specimen thickness is 2 mm $\pm$ 0.5 mm. Seal specimens may be either thicker or thinner but in no case <1 mm thick. The lateral dimensions of specimens shall permit indenter measurement 2 mm from any edge. If the specimen area of flatness does not permit testing on a standard tester, the test shall be made at a distance from the edge as great as possible.

3.3.2 New Production Parts. Specimens that are taken from parts shall be free of defects as described in ARPM OS-8 - Visual Variations Guide for Rotating Shaft Seals. Seals prior to cutting, shall meet their production part print dimensions.

3.3.3 Aged Seals. Testing used seals requires care and preparation. Select undamaged areas of the seal lip. Remove any debris and other surface contaminants after cutting. Do not use any solvents or fluids that would soften the measured surface. Use a lint free, absorption media to collect and remove oil and grease that may be on the specimen surface. Be mindful of the handling force applied to soft parts and try not to permanently distort the specimen.

3.4 Test Time. The longest test condition for one (1) sample.

Calendar time: 2 days

Test hours: 0.5 hours

Coordination hours: 24 hours

3.5 Test Required Information.

3.5.1 Hardness expressed in IRHD. Values from curved or irregularly shaped specimens shall be quoted as apparent hardness.

3.5.2 Dimensions in millimeters of the test specimen(s), in length, width, and thickness; the number of test pieces. In the case of curved or irregularly shaped specimens: specimen description, method of mounting, and method of applying test.

3.5.3 Type of specimen surface tested as molded, buffed, or otherwise.

3.5.4 Type of tester used.

3.5.5 Date, time in seconds, Relative Humidity (RH) in percent, and temperature in centigrade of test.

3.5.6 Relevant details important to future replication of the test or as agreed upon between customer and supplier. Examples include but are not limited to seal production lot, measurement location, etc.

3.6 Personnel/Skills. Laboratory measurement personnel must have experience using this technique, an acquired skill through application.

4 Procedure

4.1 Preparation.

4.1.1 Cut and Mounted Lip Specimens. Cut specimens from the product (e.g., the seal lip), no <1 mm thick $\times$ 3 mm wide $\times$ 8 mm long (see Figure 1). Caution should be exercised to avoid flexing the specimen during cutting or mounting operations. See Figure 2 for the cut location.