



Coating Thickness Measurements for Weatherstrips

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.

1.1 Purpose. This test procedure describes two (2) methods for determining the coating thickness on sponge and dense weatherstrips:

- **Method A:** Optical microscope technique.
- **Method B:** Scanning electron microscope technique.

1.2 Applicability. These test methods are applicable to all coated weatherstrips including extrusion profiles and molded sections.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities. See 3.1.1 and 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 Microscope imaging system capable of capturing crisp images at high full screen magnifications within the range of 600x to 1400x and minimum optical magnification 50x. It should be a tri-ocular microscope with long working distance objectives, brightfield/darkfield lighting, oblique lighting, a 1+ megapixel digital camera with software and computer/monitor, and an XY moveable stage.

3.2.2 Scanning Electron Microscope (SEM) capable of full screen magnification range, 600x to 1400x, equipped with image capture and dimensional measurement software.

3.2.3 Cutting tool such as dual blade cutter, sharp scalpel or microtome.

3.2.4 Gold or Gold/Palladium sputter coater for preparation of SEM specimens.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Specimens. Test specimens shall be cut from finished production parts.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Per laboratory accreditation requirements.

4 Procedure

4.1 Preparation.

4.1.1 Test Sample Preparation.

4.1.1.1 From the weatherstrip section, prepare a distortion free, parallel cut specimen suitable for mounting in either the SEM or the tri-ocular compound microscope. It is important that compression of the coating is minimized during the cutting procedure. Suggestions to optimize the cutting procedure include: Use of new sharp blades, freezing the sample (using liquid nitrogen) and cutting in a direction out from coating surface. Parallel cuts are assisted by the use of dual blade cutters or use of microtomes.

4.1.1.2 For microscopic technique (Method A), place the cut specimen on a glass slide or plate, then place slide or plate onto the stage of the microscope. For SEM technique (Method B), mount the specimen on the SEM specimen stub, then apply a minimum of gold or gold/palladium coating to the specimen to achieve adequate conductivity for SEM imaging.

4.2 Conditions.

4.2.1 Environmental Conditions. The minimum time between manufacturing and testing shall be 72 h. The test pieces shall be maintained at a temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and $50\% \pm 5\%$ relative humidity for at least 24 h prior to test, and shall be free from strain during this period.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Microscope Technique (Method A).

4.3.1.1 Obtain a suitable specimen image using the microscope eye pieces and then present this image to the camera. Eye piece magnification should be 50x minimum.

4.3.1.2 Using the imaging software, present the live image of the specimen onto the computer screen. The system should be configured such that the full screen magnification of the image should be within the range 600x to 1400x. Position the image to the desired measuring position and optimize the focus. Use the software to capture the image for measurement purposes.

4.3.1.3 Ensure the spatial measurement part of the image software has been set up for calibrated measurements with calibrations made to a traceable standard.

4.3.1.4 Calibration Marker. For all images, a marker option (if available on the software) shall be used to place a calibration marker on the image. For example, a line showing a value of 20 microns could be selected and placed close to the coating for comparative purposes.

4.3.2 SEM Technique (Method B).

4.3.2.1 Assemble the specimen stub into the sample compartment and acquire the image. Adjust the SEM image of the specimen to bring a full screen magnification within the range 600x to 1400x. Manipulate the sample stage to get the desired measuring position and optimize the focus. Use the SEM software to capture the image for dimensional measurement purposes.

4.3.2.2 Ensure the dimensional measurement module of the SEM image software has been set up for calibrated measurements with calibrations made to a traceable standard.

4.3.2.3 Calibration Marker. For all images, a marker option (if available on the software), should be used to place a calibration marker on the image. For example, a line showing a value of 20 microns could be selected and placed close to the coating for comparative purposes.

4.3.3 Measurements.

4.3.3.1 For measurements, the full screen magnification should be within the range 600x to 1400x. This allows a length of specimen coating approximately 150 microns to 250 microns to be displayed vertically on the screen, depending on the full screen magnification (see Appendix A, Figure A1). Use the software length measurement facility to take ten (10) evenly spaced coating thickness measurements. The spacing between measurements will be approximately 12 microns to 16 microns.