



SURFACE VEHICLE RECOMMENDED PRACTICE

J442™

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(R) Tools for Peening Intensity Determination and Verification

RATIONALE

Revised to include the use of electronic devices as well as various other changes to clarify and improve wording.

1. SCOPE

This SAE Recommended Practice defines requirements for equipment and supplies to be used in measuring shot peening intensity and other surface enhancement processes. It is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances. Guidelines for use of these items can be found in SAE J443 and SAE J2597.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), www.sae.org.

SAE J403 Chemical Compositions of SAE Carbon Steels

SAE J443 Procedures for Determining and Verifying Peening Intensity

SAE J2597 Computer Generated Shot Peening Saturation Curves

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9500, www.astm.org.

ASTM A505 Standard Specification for Steel, Sheet and Strip

ASTM E18 Standard Test Method for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

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3. EQUIPMENT

3.1 Almen Test Strips - Grades 1 and 1S

3.1.1 A flat, rectangular piece of steel conforming to the description in Figure 1A. Almen test strips exist in three standard thicknesses, designated as N for low-, A for medium-, and C for high-intensity applications. Almen test strip thickness requirements are given in Table 1A.

3.1.2 Subsize Almen test strips may be used for arc height measurements in small locations such as holes or slots. These strips shall conform to requirements of Figure 1B. Subsize Almen test strips exist in two standard thicknesses designated as N for low- and A for medium-intensity applications. The rolling direction shall be along the length of the test strip. Subsize Almen test strip thickness requirements are given in Table 1B. Refer to SAE J443 for additional requirements.

3.1.3 Material

SAE 1070 cold-rolled spring steel per SAE J403.

3.1.4 Heat Treatment

Almen and subsize Almen test strips shall be uniformly hardened and tempered to produce tempered martensite having a hardness as measured on the surface. Almen test strip hardness requirements are given in Table 1A. Subsize Almen test strip hardness requirements are given in Table 1B. Hardness shall be measured in accordance with ASTM E18 at approximately 13 mm (0.50 inch) from either end of the strip on the longitudinal centerline of a flat side. Using other hardness scales, such as Vickers conversion, is not allowed. Sampling for hardness testing of the strips shall be used. Hardness for subsize test strips shall be measured in accordance with ASTM E18 at approximately 6.5 mm (0.25 inch) from either end of the strip on the longitudinal centerline of a flat side. Hardness determination precludes other use of the tested strip.

3.1.5 Surface Carbon

Almen and subsize Almen test strips shall be free from alteration of surface carbon level to the degree that any difference in average hardness between the surface and subsurface material shall not exceed 2 points, as measured on the Rockwell 30-N scale. The average of at least four readings in each shall be used to make the comparison. Any such determination must be made on strips that have not been shot peened; hardness determination will preclude other use of the strip. Surface hardness readings that are less than subsurface readings indicate evidence of decarburization. Surface readings that are higher than the corresponding subsurface values indicate carburization. For example, if the average surface hardness is 62.5 on the Rockwell 30-N scale and, after careful grinding, a region below the surface is found to be 64.0 on the Rockwell 30-N scale, the strip is acceptable. If the subsurface reading had been 65.0 on the Rockwell 30-N scale, the difference (2.5 points) being over 2 points would constitute grounds for rejection.

3.1.6 Long edge type shall be number 1 edge per ASTM A505 and does not apply to ends of strip.

3.1.7 Finish shall be free of any deformed metal (burrs) that projects above the plane of the test strip top or bottom surfaces.

3.1.8 Pre-bow (flatness) requirements are shown in Table 1A for Almen test strips and Table 1B for subsize Almen test strips, as measured using gages shown in Figures 3 or 4, for either side of each strip. Post-tempering treatments, which instill unequal stresses on opposite faces (see Figure 3 notes) to achieve pre-bow flatness, are not permitted.

3.2 Almen Test Strip Holder

A holding fixture conforming to the requirements of Figure 2 shall be used when exposing an Almen test strip to a shot stream. Flatness in the Almen test strip contact zone (cross-hatched area shown in Figure 2 and reference dimensions in Figure 1A) shall be maintained to 0.025 mm (0.001 inch). The contact zone must be free of any deformed metal, such as burrs, that project above the surface.

3.2.1 Material

The recommended material for the Almen test strip holder is any alloy or carbon steel with minimum 57 HRC to a depth of 0.7 mm (0.027 inch) or greater. Alternate materials (and hardness) and exterior dimensions may be used when their wear and deformation characteristics do not adversely affect the performance of the test strip.

3.2.2 Attachment Holes

One or two additional holes, each with a maximum diameter of 18 mm (0.70 inch), may be added to facilitate mounting the holder to a fixture. The holes may be threaded or plain and may extend into the contact surface of the holder. External feet may be used to extend the length of the holder to provide external mounting holes.

3.2.3 Attachment of Subsize Almen Test Strips

Subsize Almen test strips shall be attached using adhesive material, such as contact cement or double-sided tape, across the entire length of the subsize Almen test strip or by screw heads at either end of the length of the subsize Almen test strip. The method of attachment shall be held consistent for the development of the correlation chart between subsize intensity and true intensity, as well as for testing saturation curve development using subsize test strips in the area of question.

3.2.4 Screws

Use a pan-head (or smaller head diameter) style screw of size M5. No washers are allowed under the screw head to clamp the Almen test strip to the holder. Alternate fasteners may be used with cognizant engineering organization (CEO) approval.

3.2.5 Alternate Mounting of Almen Test Strips

Alternate methods of mounting the Almen test strip without a conventional holder is acceptable with CEO approval as long as the placement of the four attachment holes is maintained. This may include machining of a scrap part to allow mounting of Almen test strips. Mounting an Almen strip against a backing surface with a hardness of less than 57 HRC is not recommended.

3.3 Almen Test Strip Gages

3.3.1 The Almen test strip gage shall conform to the requirements shown in Figure 3. A digital indicator shall have a minimum resolution of 0.001 mm (0.00005 inch). It shall have an accuracy of 0.005 mm (0.0002 inch). Balls and indicator tip shall be inspected and replaced if there are visual indications of flat spots greater than 1.0 mm (0.04 inch). Positioning posts shall be replaced or rotated if grooves would interfere with proper seating of the strip onto the gage.

3.3.1.1 The dimensional tolerances shall be 0.5 mm (0.02 inch) unless otherwise specified.

3.3.1.2 Four 4.76-mm (0.1874-inch) diameter precision balls shall be installed in the test strip locating base. Balls shall be in the same plane (perpendicular to the indicator stem) within 0.05 mm (0.0020 inch).

3.3.1.3 The Almen subsize test strip gage shall conform to the requirements shown in Figure 4 and shall have a minimum resolution of 0.001 mm (0.00005 inch), and it shall have a minimum accuracy of 0.005 mm (0.0002 inch). Alternative methods may be applied with CEO approval.