SURFACE VEHICLE RECOMMENDED PRACTICE

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Superseding J442 FEB2013

(R) Test Strip, Holder, and Gage for Shot Peening

RATIONALE

Document revised to include further details about Sub-size Almen strips.

1. SCOPE

This SAE standard defines requirements for equipment and supplies to be used in measuring shot peening arc height and other surface enhancement processes. 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 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J403 Chemical Compositions of SAE Carbon Steels

SAE J443 Procedures for Using Standard Shot Peening Almen Strip

SAE J2597 Computer Generated Shot Peening Saturation Curves

2.1.2 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

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

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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3. EQUIPMENT

3.1 Test Strip

3.1.1 A flat rectangular piece of SAE 1070 cold rolled steel conforming to the description in Figure 1A. Test strips exist in three standard thicknesses designated as N for low, A for medium and C for high intensity applications.

3.1.2 Sub-size strips may be used for intensity measurements in small locations such as holes or slots. These strips shall conform to requirements of Figure 1B. Sub-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. See SAE J443 for additional requirements.

3.1.3 Material

SAE 1070 cold rolled spring steel per SAE J403.

3.1.4 Heat Treatment

All strips shall be uniformly hardened and tempered to produce tempered martensite having a hardness, as measured on the surface, of HRC (44-50) for the A and C strips and HRA (72.5-76.0) for the “N” strips. Hardness shall be measured in accordance with ASTM E18 at approximately 13 mm from either end of the strip on the longitudinal center line of a flat side. Sampling for hardness testing of the strips shall be used. Hardness for sub-size test strips shall be measured in accordance with ASTM E18 at approximately 6.5 mm from either end of the strip on the longitudinal center line of a flat side. Hardness determination precludes other use of the strip.

3.1.5 Surface Carbon

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 two points as measured on the Rockwell 30-N scale. The average of at least four readings in each should be used to make the comparison. Any such determination must be made on strips which 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 which are higher than the corresponding subsurface values indicate carburization. For example: If the average surface hardness in 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 two points would constitute grounds for rejection.

3.1.6 Edge type shall be Number 1 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 shall be the maximum allowed, as measured on the #2 Almen Gage for either side of each strip: N ± 0.025 mm (0.001 inch), A ± 0.025 mm (0.001 inch), and C ± 0.038 mm. (0.0015 inch) Post tempering treatments to achieve pre-bow flatness are not permitted.

3.1.9 Pre-Bow for sub-size strips shall be the maximum allowed, as measured on the devices shown in Figure 4 or Figure 5 for either side of each strip: N ± 0.025 mm (0.001 inch), A ± 0.025 mm (0.001 inch), and C ± 0.038 mm. (0.0015 inch) Post tempering treatments to achieve pre-bow flatness are not permitted.

3.2 Test Strip Holder

A hardened steel holding fixture conforming to the requirements of Figure 2 shall be used when exposing the test strip to a shot stream. Flatness in the contact zone (cross hatched area shown in Figure 2.) 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 test strip holder is any alloy or carbon steel with minimum 57 HRc to a depth of 0.7 mm 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, may be added to facilitate mounting the holder to a fixture. The holes may be threaded or plain and may extend into the strip contact surface of the holder.

3.2.3 Attachment of Sub-Size Strips

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

3.2.4 Screws

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

3.2.5 Alternate Mounting of Test Strips

3.3 Machining of a scrap part to allow mounting the test strip without a conventional holder is acceptable as long as the placement of the four attachment holes is maintained and lateral movement of the test strip is limited to 0.5 mm. It is not recommended that this method be utilized if the hardness of the scrap part is less than 57 HRC Gages.

3.3.1 The test strip gage shall conform to the requirements shown in Figure 3 and shall have a capability resolution of 0.001 mm. It shall have an accuracy of ±0.005 mm (±0.0002 inch). It shall be calibrated IAW ISO10012 or equivalent. Balls and indicator tip shall be inspected and replaced if there are flat spots greater than 1.0 mm. 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 unless otherwise specified.

3.3.1.2 Four (4), 4.76 mm 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.

3.3.1.3 Digital indicator shall have 0.001 mm or 0.0001 inch resolution (minimum).

3.3.2 Gages for measuring the arc height of sub-size test strips shall have a minimum capability resolution of 0.001 mm or 0.0001 inch and a minimum accuracy of ±0.02 mm (0.001 inch). The gages shall be calibrated IAW ISO 10012. Gaging and gaging methods may be as defined in Figures 4 and 5, but alternative methods may be applied. Measurement on the peened side of the sub-size test strip is permissible provided the results are repeatable and reproducible.

3.3.2.1 The dimensional tolerances shall be ±0.5 mm unless otherwise specified.

3.3.2.2 Digital indicator shall have 0.001 mm or 0.0001 inch resolution (minimum).

3.3.2.3 The optional configuration with one or two end stops (posts) is preferred because the stops promote uniformity of testing by ensuring consistent strip placement upon the gage.

3.4 Zero Block

3.4.1 A zero block with a certified flat surface (0.005 mm) shall be used to set the zero datum of the gage. The block shall be shaped such that it rests upon the surface of the four support balls.

3.4.2 A zero block for the sub-size gage with a certified flat surface (0.005 mm) shall be used to set the zero datum of the gage. The sub-size block shall be shaped such that it rests upon the surface of the two support points on the gage.

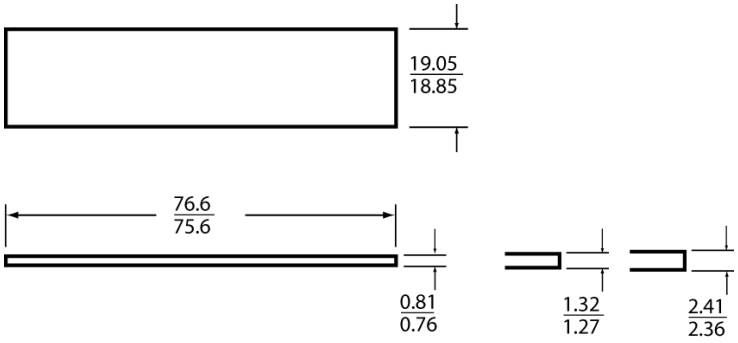

Figure 1A - Test strips

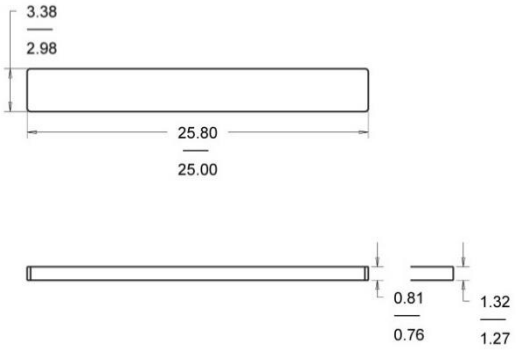

Figure 1B - Sub-size test strips

Figure 1

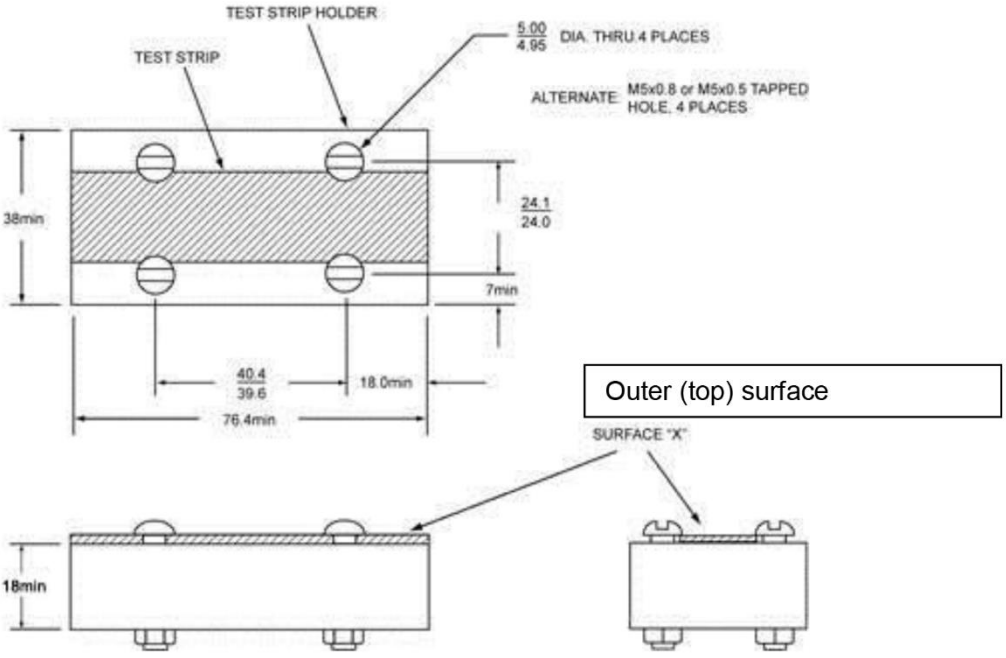

Figure 2 - Assembled test strip and holder

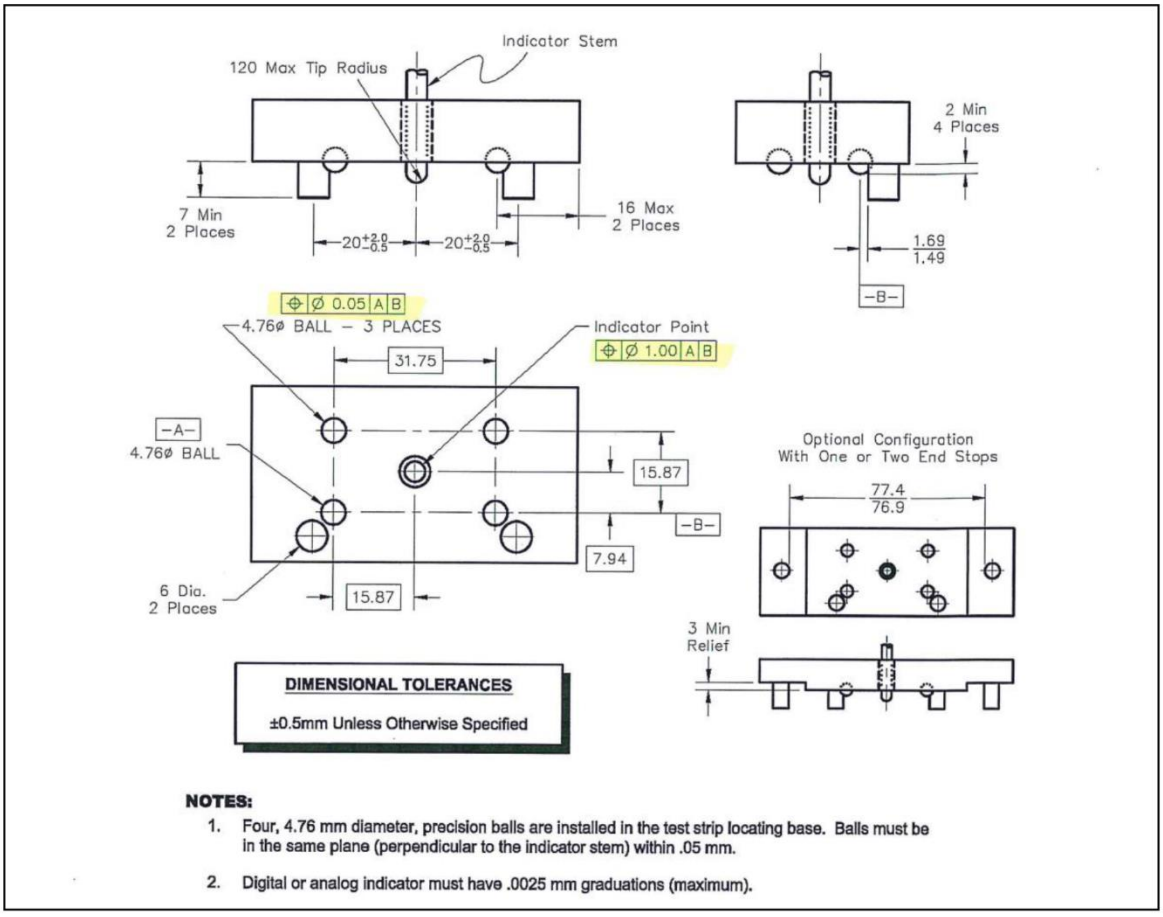

Figure 3 - Test strip gage

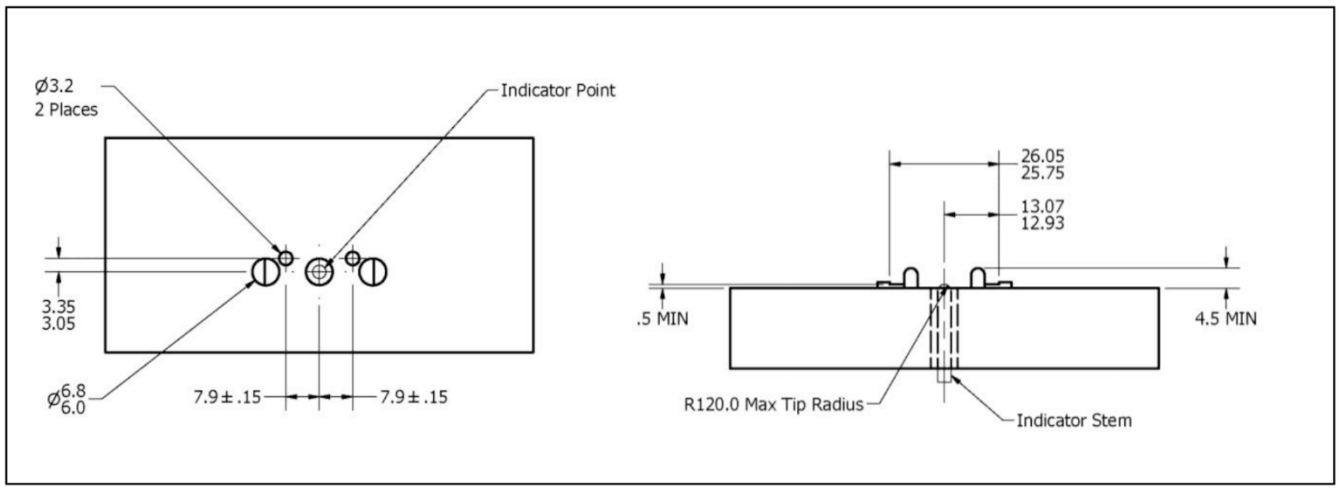

Figure 4 - Sub-size test strip gaging method 1

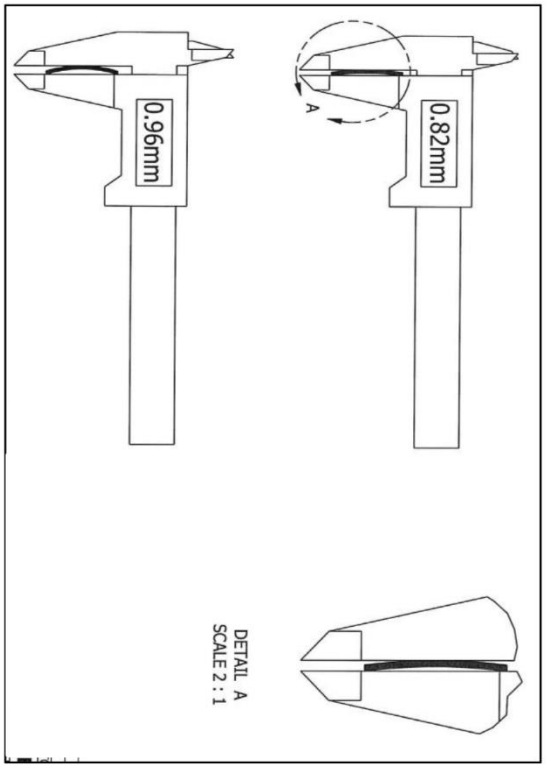

Figure 5 - Sub-size test strip gaging method 2

4. NOTES

4.1 Superseded Gage Designation

Two types of gages were formerly used to measure the arc height of test strips. The number 1 gage, which is obsolete, employed two knife edges to support the test strip; the number 2 gage (developed in 1943) uses four balls to locate the test strip in relation to the indicator stem. Some engineering criteria may continue to show the numeral "2" after the test strip letter, designating the use of a number 2 gage. This designation (such as A2) is neither required nor recommended. The gage defined by this SAE Standard uses the same locating scheme as the number 2 gage, and therefore will yield an equivalent reading.

4.2 Superseded Intensity Designation

The prior "dimensionless" value relating to the number of graduations on the dial indicator has been discontinued in favor of direct reading in millimeters.

4.3 Dimensions

Unless otherwise indicated all dimensions are in millimeters (mm). Inch dimensions are listed for convenience only and placed within parenthesis.

4.4 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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