



SURFACE VEHICLE RECOMMENDED PRACTICE

J442™

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Test Strip, Holder, and Gage for Shot Peening

RATIONALE

The scope now includes the intent of this document as a guide to standard practice.

Test strip requirements are now centralized in this document to prevent misinterpretation. This resulted in a high-grade test strip being added to this document in preparation for test strip requirements being removed from AMS2432. Figures 1A and 1B were re-drawn to support two grades of strips. Tables 1A and 1B were added to clarify test strip requirements. A transition period of 18 months has been noted to allow non-conforming strip manufacturers to make acceptable strips.

Other changes include removal of conflicting and redundant text. Figure 3 was re-drawn to add inch dimensions for reference while maintaining dimension format/method. The analog gage option was removed from the Figure 3 notes due to requirements outlined in 3.3.1. Side positioning posts that center the test strip along its longer dimension are now required. Figure 4 was re-drawn to correct poor dimensioning in Detail A. Figure 2 was re-drawn to match format of other new figures.

1. SCOPE

This SAE Recommended Practice defines requirements for equipment and supplies to be used in measuring shot peening arc height 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 (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 Test Strip

SAE J2597 Computer Generated Shot Peening Saturation Curves

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2.1.2 ASTM Publications

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 A505 Standard Specification for Steel, Sheet and Strip

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

2.1.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

U.S. Patent 2,350,440 - Shot Blasting Test, J.O. Almen

3. EQUIPMENT

3.1 Test Strips - Grade 1 and 1S

3.1.1 A flat rectangular piece of 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. Strip thickness requirements are given in Table 1A.

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. Sub-size 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

All strips shall be uniformly hardened and tempered to produce tempered martensite having a hardness, as measured on the surface. Strip hardness requirements are given in Table 1A. Sub-size strip hardness requirements are given in Table 1B. Hardness shall be measured in accordance with ASTM E18 at approximately 13 mm (or 0.50 inch) 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 (or 0.25 inch) 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 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 two 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 standard sized strips and Table 1B for sub-size strips, as measured using gages shown in Figures 3 or 4, for either side of each strip. Post-tempering treatments which may instill substantially unequal stresses on opposite faces (see notes) to achieve pre-bow flatness are not permitted.

3.2 Test Strip Holder

A holding fixture conforming to the requirements of Figure 2 shall be used when exposing a standard size 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 (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 (or 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 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

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. It is not recommended that this method be utilized if the hardness of the scrap part is less than 57 HRC.

3.3 Gages

3.3.1 The standard test strip gage shall conform to the requirements shown in Figure 3. A digital indicator shall have a minimum resolution of 0.001 mm (or 0.0001 inch). It shall have an accuracy of ± 0.005 mm (or ± 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 (or 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 (or ± 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 sub-size test strip gage shall conform to the requirements shown in Figure 4 and shall have a minimum resolution of 0.001 mm (or 0.0001 inch), and it shall have a minimum accuracy of ± 0.005 mm (or ± 0.0002 inch). Alternative methods may be applied when approved.

3.3.1.4 The dimensional tolerances shall be ± 0.5 mm (or ± 0.02 inch) unless otherwise specified.

3.4 Zero Block

3.4.1 A zero block for the standard gage with a certified flat surface of 0.005 mm (or 0.0002 inch) or less 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 of 0.005 mm (or 0.0002 inch) or less 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.

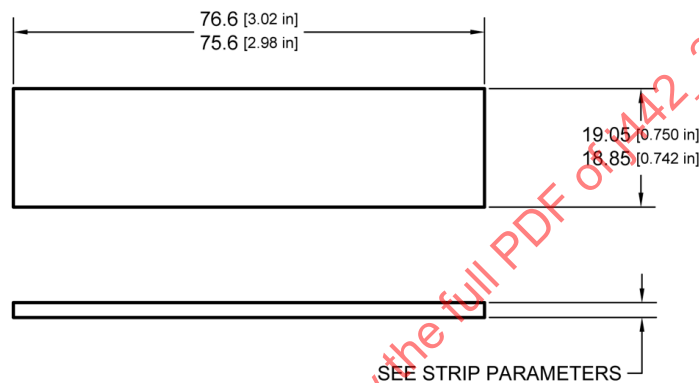


Figure 1A - Standard size test strip

Table 1A - Standard size test strip

GRADE 1	STRIP	N	A	C
	THICKNESS	0.76 [0.030 in] - 0.81 [0.032 in]	1.27 [0.050 in] - 1.32 [0.052 in]	2.36 [0.093 in] - 2.41 [0.095 in]
	HARDNESS	72.5-76 HRA 44-50 HRC		
	MAX PREBOW	+/- 0.025 [0.001 in] +/- 0.038 [0.0015 in]		
GRADE 1S	STRIP	N	A	C
	THICKNESS	0.77 [0.0304 in] - 0.80 [0.0314 in]	1.28 [0.0505 in] - 1.31 [0.0515 in]	2.37 [0.0934 in] - 2.40 [0.0944 in]
	HARDNESS	73-74.5 HRA 45-48 HRC		
	MAX PREBOW	+/- 0.013 [0.0005 in]		

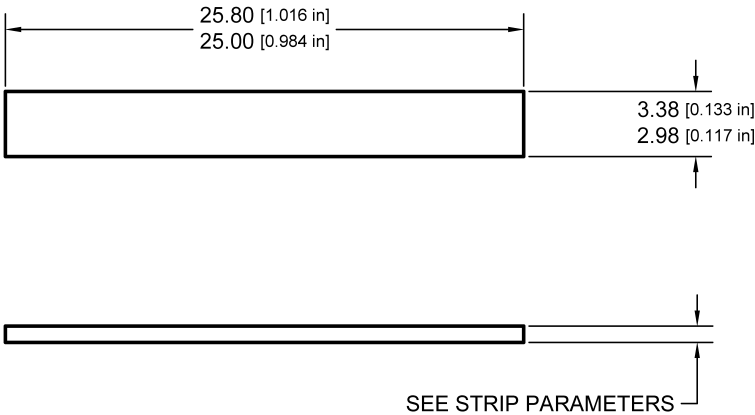


Figure 1B - Sub-size test strip

Table 1B - Sub-size test strip

STRIP	N	A
THICKNESS	0.76 [0.030 in] - 0.81 [0.032 in]	1.27 [0.050 in] - 1.32 [0.052 in]
HARDNESS	72.5-76 HRA	44-50 HRC
MAX PREBOW	+/- 0.025 [0.001 in]	

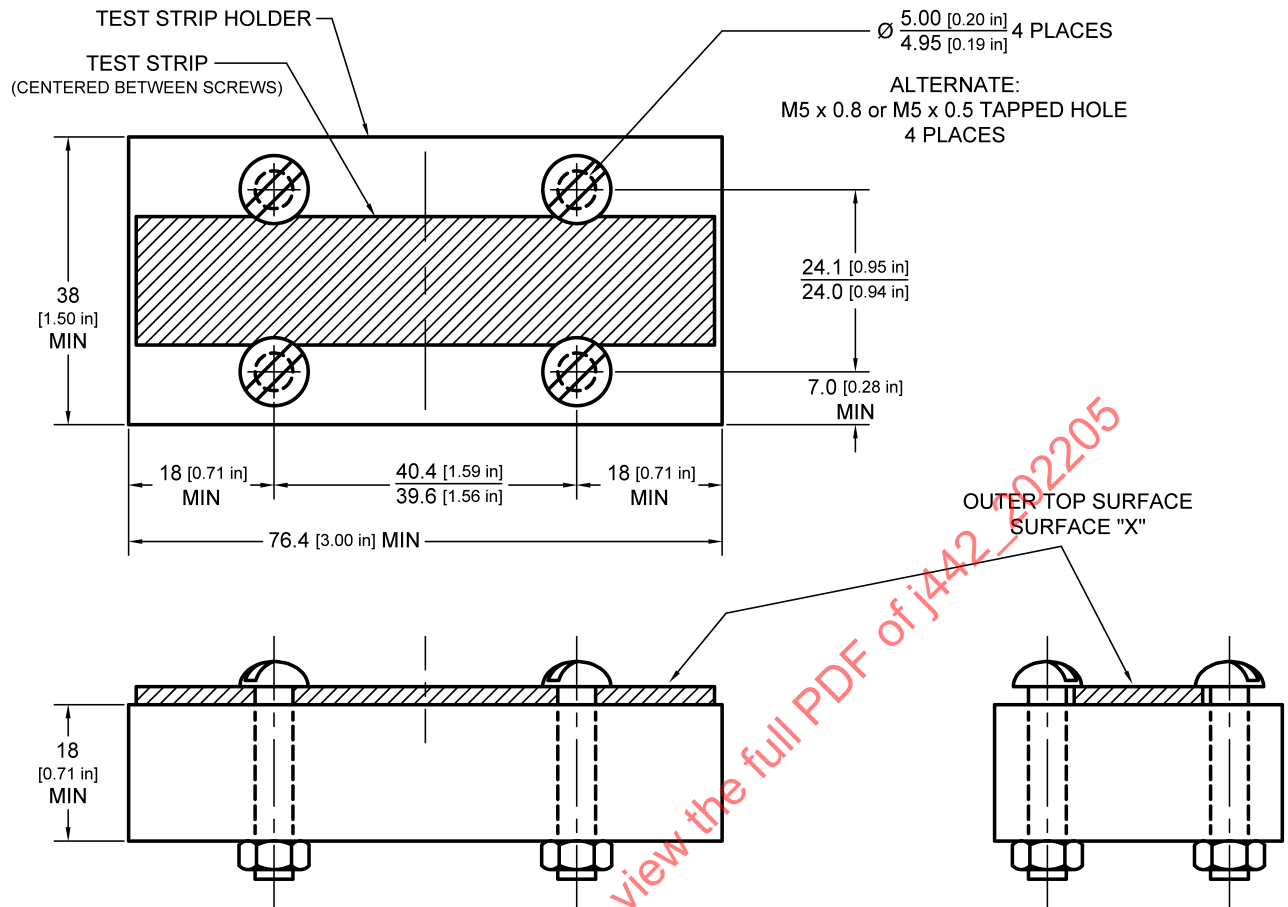
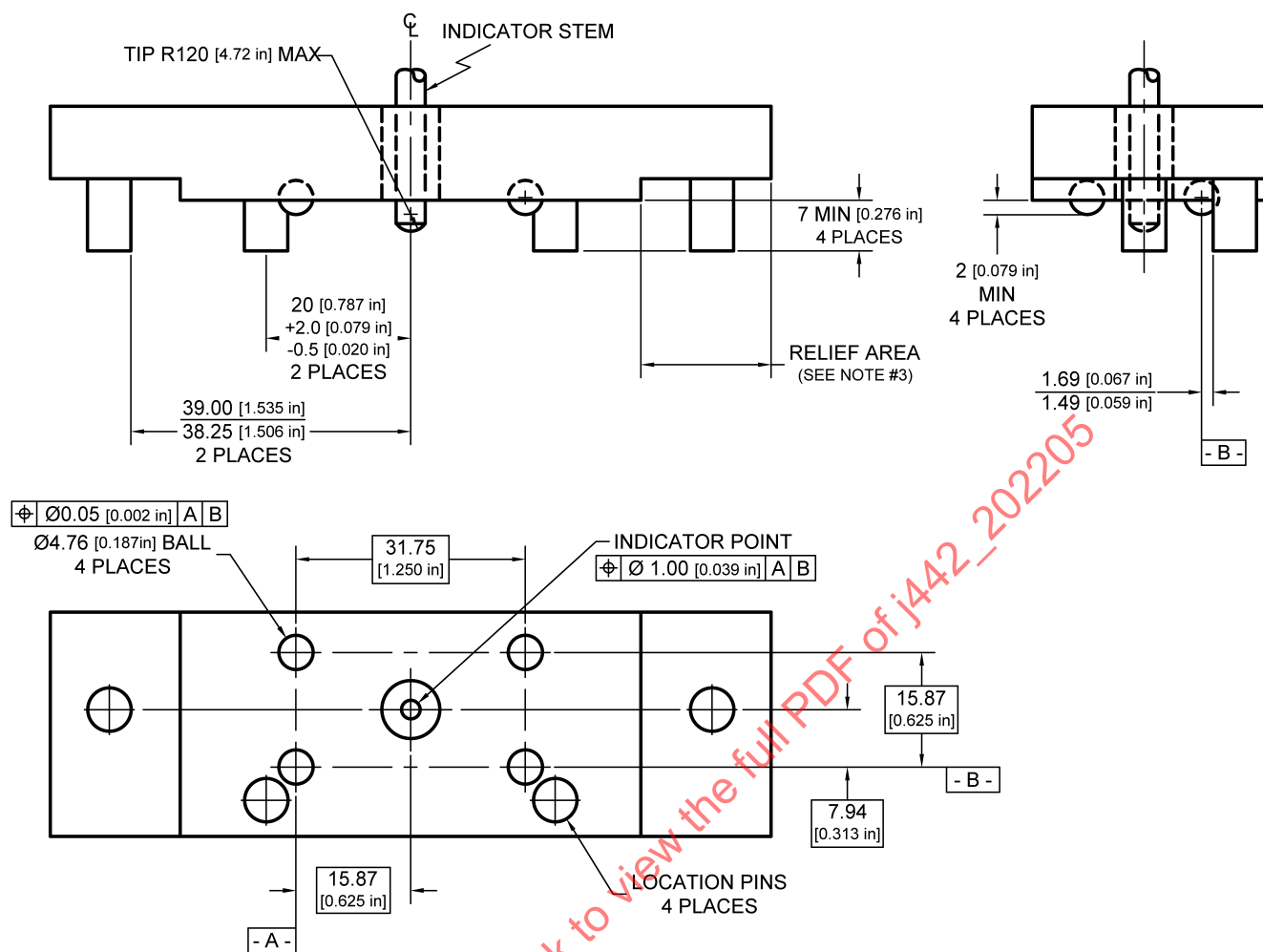


Figure 2 - Assembled standard size strip holder

**NOTES:**

1. ALL DIMENSIONS ARE $\pm 0.5\text{mm}$ [0.020 in] UNLESS OTHERWISE SPECIFIED OR LIMITS GIVEN.
2. FOUR 4.76mm DIAMETER PRECISION BALLS ARE INSTALLED IN THE TEST STRIP LOCATING BASE. BALLS MUST BE IN THE SAME PLANE (PERPENDICULAR TO THE INDICATOR STEM) WITHIN 0.05mm [0.002 in].
3. THE SIZE AND SHAPE OF THE RELIEF AREA MAY VARY AS LONG AS ITS PURPOSE OF PREVENTING A BENT TEST STRIP FROM CONTACTING THE GAGE HEAD IS OBTAINED.
4. INCH (in) NOTATION FOR REFERENCE ONLY.

Figure 3 - Standard size strip gage