Designation: B 489 – 85 (Reapproved 1998)

Standard Practice for Bend Test for Ductility of Electrodeposited and Autocatalytically Deposited Metal Coatings on Metals[1]

This standard is issued under the fixed designation B 489; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers a test procedure for determining the ductility of electrodeposited and autocatalytically deposited coatings on sheet or strip basis metals. The purpose of the test is to determine the resistance of metal coatings to cracking during distortion.[2]

1.2 Test Methods E 8 can be used if the coatings are too ductile and require mandrels too small to be practical.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 177 Guide for Chromium Electroplating on Steel for Engineering Use[3]

D 1193 Specification for Reagent Water[4]

E 8 Test Methods for Tension Testing of Metallic Materials[5]

3. Summary of Practice

3.1 The practice consists of bending a narrow strip of the electroplated or coated article over a mandrel. An elongation measurement is obtained from the smallest diameter mandrel that does not cause the coating to fracture.

4. Significance and Use

4.1 The routine measurement of the ductility of electrodeposited and autocatalytically deposited metal coatings can be useful in process control, especially when the electroplating process is used for decorative and engineering purposes.

5. Apparatus

5.1 *Series of Mandrels,* with diameters from 6 to 50 mm, in 3-mm steps with lengths of 100 to 150 mm so they can be held in a vise.

5.2 *Micrometer,* to measure the thickness of the test specimens.

5.3 *Guillotine Shears* or other device to cut the specimens to size.

5.4 *File or Grinder* to remove burrs and to round or chamfer edges.

5.5 *Vise,* to hold mandrels.

5.6 *Magnifier,* 10×.

6. Test Specimen

6.1 Flat specimens, 10 mm wide, and not less than 150 mm long, shall be cut from the electroplated or coated article if the shape permits, no closer than 25 mm from the edges. Guillotine shears are preferred, but any convenient method may be used. Basis metal thickness and temper shall be suitable to permit bending around the smallest diameter mandrel, if necessary. Low-carbon AISI 1010 to 1025 steel strip or sheet, 0.25 to 1.0 mm thick is usually suitable. Basis metals that have low ductility can initiate cracks that can propagate through the coatings. The procedure indicated in 6.2 shall then be followed.

6.2 When the shape is such that a test specimen cannot be obtained from the part, a test panel may be prepared of appropriate basis metal, such as low-carbon steel (see 6.1), with the same coating system in the same baths. The panel shall be sufficiently large to obtain several pieces after trimming 25 mm from the edges. The specimens shall be prepared in accordance with 6.1. Brass or copper panels may be used instead of copper-electroplated zinc alloy panels.

6.3 The long edges of the test pieces shall be rounded or chamfered by filing or grinding.

7. Procedure

7.1 Place the largest mandrel in the vise. Bend the test specimen, with the coating outward, over the mandrel so that as the bend progresses the test specimen will remain in contact with the top of the mandrel. Continue bending with slow, steadily applied pressure until the two legs are parallel. If there are no cracks visible under a 10× magnifier, repeat the test, using new specimens, on progressively smaller-diameter mandrels, until cracks appear across or through the coating. Take the preceding mandrel diameter as the value for the ductility determination. If the coating is electrodeposited chromium, the

[1] This practice is under the jurisdiction of ASTM Committee B-8 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.10 on General Test Methods.

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[2] For a discussion and theory for this test see Mohrnheim, A. F., "the Bend Test for Measuring the Strain Limit of Surfaces," *Plating,* Vol 50, 1963, pp. 1094 – 1099.

[3] *Annual Book of ASTM Standards,* Vol 02.05.

[4] *Annual Book of ASTM Standards,* Vol 11.01.

[5] *Annual Book of ASTM Standards,* Vol 03.01.