



Designation: B968/B968M – 16 (Reapproved 2022)

Standard Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube¹

This standard is issued under the fixed designation B968/B968M; 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 test method establishes the requirements for the flattening test for copper and copper alloy pipe and tube of all sizes. The method addresses both inch-pound and metric considerations, and both seamless and welded product.

1.2 *Units*—The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

B153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing

B846 Terminology for Copper and Copper Alloys

3. Terminology

3.1 For definitions of terms related to copper and copper alloys, refer to Terminology **B846**.

¹ This test method is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.06 on Methods of Test.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Summary of Test Method

4.1 The prepared test sample is flattened in a press to a specified maximum thickness, and then inspected for defects of a size and nature that would interfere with the intended application of the product specification.

5. Significance and Use

5.1 When properly performed and interpreted, the flattening test will provide information about the relative ductility of a tube and presence of surface defects. For welded tube products, the test will provide information on the integrity of the weld seam.

5.2 In certain product specifications which establish requirements for tubes of sizes greater than 4 in. [100 mm], the test may be allowed as a substitute to the expansion pin test in Test Method **B153**.

6. Apparatus

6.1 *Testing Machine (Press)*—Any type of testing machine; either hydraulically or mechanically operated, that will exert pressure sufficient to flatten the pipe or tube to the required degree.

6.2 *Micrometer Caliper*—Any measuring device that has the capability to measure a flattened sample approximately three (3) times the product wall thickness.

7. Sampling and Test Specimen Preparation

7.1 For seamless product up to and including 4 in. [100 mm] outside diameter:

7.1.1 A test specimen shall be cut to a length that will allow the tube to be flattened at three (3) places along the length, with each flattened area to be at least 2 in. [50 mm] in length. When the temper is other than annealed, the sample may be annealed prior to testing.

7.2 For welded product up to and including 4 in. [100 mm] in outside diameter:

7.2.1 A test specimen shall be cut to a length that will allow the tube to be flattened along the length, so a total of at least 12 in. [305 mm] is flattened. When the temper is other than annealed, the sample is allowed to be annealed prior to testing.

*A Summary of Changes section appears at the end of this standard

7.3 For seamless product over 4 in. [100 mm] in outside diameter:

7.3.1 A test specimen shall be cut to a length that will allow the tube to be flattened once, with the flattened area to be at least 4 in. [100 mm] in length. When the temper is other than annealed, the sample is allowed to be annealed prior to testing.

7.3.2 Both ends of the test specimen may be prepared by filing or cutting to provide smooth end surfaces, free from scratches or burrs which might interfere with the test.

8. Procedure

8.1 For seamless product up to and including 4 in. [100 mm] outside diameter:

8.1.1 Each test specimen shall be flattened in a press at three (3) places along the length, each new place to be rotated on its axis approximately one-third turn from the last flattened area. Each flattened area shall be at least 2 in. [50 mm] in length. A flattened test specimen shall allow a micrometer caliper set at three (3) times the wall thickness to pass freely over the flattened area. The flattened areas of the test specimen shall be inspected for surface defects.

8.2 For welded product up to and including 4 in. [100 mm] in outside diameter:

8.2.1 Each test specimen shall be flattened in a press so a total of at least 12 in. [305 mm] is flattened along the length. The weld shall be placed in the position of maximum bend on all of the flattened areas. Each flattened area shall be at least 2 in. [50 mm] in length. Transition areas are allowed in-between flattening areas. A flattened test specimen shall allow a micrometer caliper set at three (3) times the wall thickness to pass freely over the flattened area. The flattened areas of the test specimen shall be inspected for surface defects.

8.2.2 For welded and fully finished product, where the weld zone is no longer distinguishable due to subsequent processing, it is permissible to conduct the flattening test according to 8.1.1.

8.3 For seamless product over 4 in. [100 mm] in outside diameter:

8.3.1 Each test specimen shall be flattened once in a press. The flattened area shall be at least 4 in. [100 mm] in length. An acceptably flattened tube specimen shall allow a micrometer caliper set at three (3) times the wall thickness to pass freely over the flattened area. The flattened areas of the test specimen shall be inspected for surface defects.

8.4 In case there is an indication that the specimen was not properly prepared or tested, a new specimen from the same sample shall be selected and tested.

8.5 During inspection, the flattened areas of the test specimen shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

9. Report

9.1 When testing is completed by an independent third-party laboratory, the test report shall include the following information. In-house captive laboratories shall only report 9.1.1, 9.1.2, and 9.1.5:

9.1.1 The date of the test,

9.1.2 Sample identification,

9.1.3 Reference to the test method,

9.1.4 The number of replicate test pieces used,

9.1.5 The test results: Pass or Fail (relative to presence of defects) as required above and by the appropriate product specification, and

9.1.6 Any other features of the material noted during the inspection.

10. Precision and Bias

10.1 No statement is made about either the precision or bias of this test method since the result merely indicates whether there is conformance to the acceptance criteria specified in the procedure and the product specification.

11. Keywords

11.1 copper; copper alloy; flattening test; pipe; tube; welded pipe; welded tube

APPENDIX

(Nonmandatory Information)

X1. RATIONALE (COMMENTARY)

X1.1 Subcommittee B05.04 over a period of years standardized by ballot wording to cover the flattening test, which is in numerous pipe and tube specifications. Subcommittee B05.06 began this task group to extend that wording to a test method.

X1.2 As a separate test method it will standardize the test and avoid the need to include numerous paragraphs in the various pipe and tube specifications. It is similar to and related to Test Method B153.