



# Standard Test Method for Measuring and Recording the Deviations from Flatness in Copper and Copper Alloy Strip<sup>1</sup>

This standard is issued under the fixed designation B 754; 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.

<sup>ε1</sup> NOTE—Editorial changes were made throughout this standard in March 2000.

## 1. Scope \*

1.1 This test method describes a procedure for the measurement of distortions in thin metal strip and the application of these measurements to an equation that will indicate the deviation from flatness.

1.2 The distortions to be measured in this test method are dish, wavy edges, buckle, longitudinal corrugation, and herringbone.

1.3 This test method is not intended to include the measurement of coil set or longitudinal curl, camber or edgewise curvature, or twist.

1.4 This test method is limited to metal strip 0.003 to 0.020 in. (0.08 to 0.50 mm) thick and not more than 6.0 in. (150.0 mm) wide.

1.5 The values stated in inch-pound units are the standard. The values given in parentheses are for information only.

1.6 *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. Terminology

### 2.1 Definitions of Terms Specific to This Standard:

2.1.1 *buckle (center bulge or oil can)*—alternate bulges and hollows recurring along the length of a strip with the edges remaining relatively flat.

2.1.2 *dish (cross or transverse bow)*—the departure from flatness across the full width of the strip in the form of a single arc, excluding burrs.

2.1.3 *herringbone*—a series of long continuous waves running at various angles to the rolling direction.

2.1.4 *longitudinal corrugation*—a condition similar to dish except that the sense of curvature changes sign at least once across the width of the strip.

2.1.5 *wavy edges (waves—edge wave)*—a continuous pattern of waves or wrinkles along the edges of the strip, with a relatively flat center portion.

## 3. Significance and Use

3.1 This test method is intended for measuring distortion in strip used for making close tolerance parts. Since distortion in this strip would influence the shape of the part being produced and cause difficulties in feeding through close-fitting dies and other manufacturing equipment, it is important that this material be flat.

3.2 This test method provides a universal procedure for measuring the irregularities that cause the deviation from flatness.

3.3 This test method allows the purchaser and manufacturer to inspect strip with a standard technique to a mutually agreed upon and acceptable percentage deviation from flatness.

## 4. Apparatus

4.1 *Surface Plate*, to be used as a reference flat. It must have a large enough surface area to accommodate the maximum size test specimen. It shall be flat within 0.0002 in. (0.005 mm) per 1 in. (25 mm).

4.2 *Micrometer*, for measuring metal thickness. It shall be graduated in 0.0001-in. (0.0025-mm) increments.

4.3 *Height Gage*, for measuring the height of irregularities. The arm of this gage must be long enough to extend beyond the center of the widest strip to be measured. It shall be graduated in 0.001-in. (0.025-mm) increments.<sup>2</sup>

4.4 *Steel Rule*, for measuring the lengths of the irregularities. It shall be graduated in 0.02-in. (0.50-mm) increments.

## 5. Test Specimens

5.1 The test specimen shall be the full-finished slit width of the strip and cut long enough so that measurement will not be influenced by the distortions referred to in 1.3.

5.2 When cutting specimens, caution must be taken to prevent additional distortion.

<sup>1</sup> 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.

Current edition approved June 30, 1989. Published August 1989. Originally published as B 754 – 86. Last previous edition B 754 – 89 (1994)<sup>ε1</sup>.

<sup>2</sup> An electronic touch sensitive system, which will not distort the sample, has been found to be acceptable.

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

**6. Procedure**

6.1 Measure the thickness of the specimen at six locations, near each corner and at midwidth at each end, to the nearest 0.001 in. (0.03 mm) using the micrometer. The average of these six readings will be used as *T*.

6.2 Place the test strip unrestrained on the surface plate. If the specimen is not flat, compare the irregularities observed with the illustrations shown in Figs. 1-5 to determine the type of distortion and how it should be measured.

6.3 Using the height gage, measure the highest point *H* of each of the irregularities to the nearest 0.001 in. (0.03 mm). See Figs. 1-6.

6.4 Using the steel rule, measure the length *L* between the points where the outer radii of the most significant irregularity touches the surface plate, to the nearest 0.02 in. (0.50 mm). See Figs. 1-7.

6.5 Repeat this procedure as often as necessary to satisfy quality level requirements, recording each measurement.

**7. Calculation or Interpretation of Results**

7.1 Apply the values for *T*, *H*, and *L* obtained for each irregularity to the following equation to determine the percentage of deviation from flat.

$$\text{Deviation from flat, \%} = \frac{H - T}{L} \times 100 \tag{1}$$

Compare the results to the agreed upon limits. The larger the percentage, the greater the deviation from flat.

**8. Report**

8.1 The nominal thickness, width, temper, alloy number, and form of product should be reported.

8.2 The number and type of distortions measured and the thickness, height, length, and percent deviation from flatness for each should be reported.

**9. Precision and Bias**

9.1 The precision of this test method is dependent upon the sensitivity of the measuring apparatus.

9.2 This test method has no bias because the values of deviation from flatness are direct measurements based on the accuracy of the test apparatus and the observations of the inspector.

**10. Keywords**

10.1 flatness measurement; strip flatness

**SUMMARY OF CHANGES**

Committee B05 has identified the location of selected changes to this standard since the last issue of B 754 - 89 (Reapproved 1994)<sup>e1</sup> that may impact the use of this standard.

(1) No technical changes have been made to this standard. Incidental wording changes have been inserted to comply with the new Outline of Form.

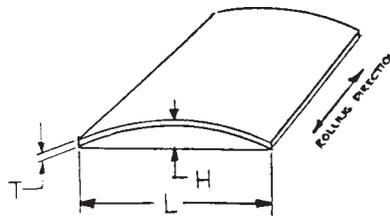


FIG. 1 Dish

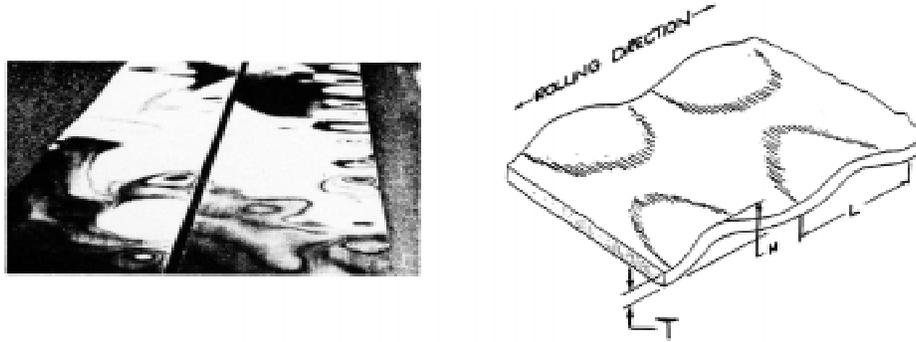
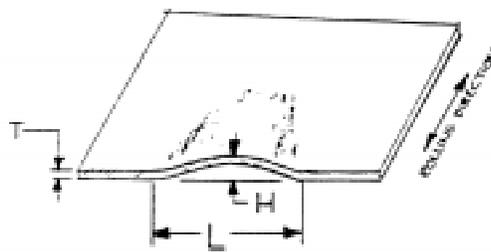
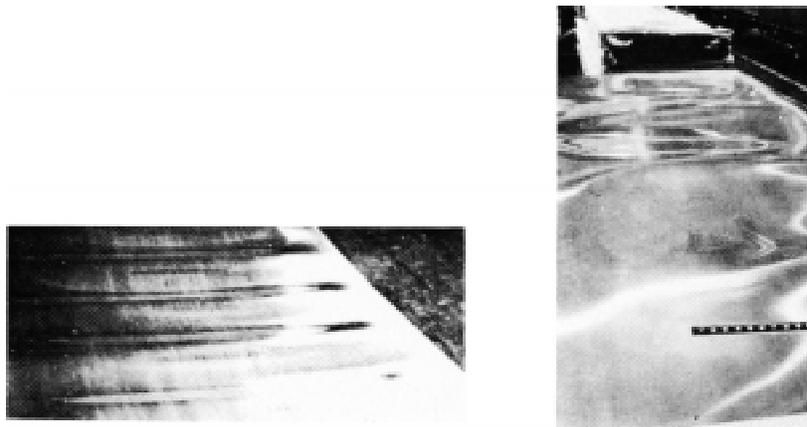


FIG. 2 Wavy Edges



NOTE 1—For illustration only. Section to show measuring.

FIG. 3 Buckle

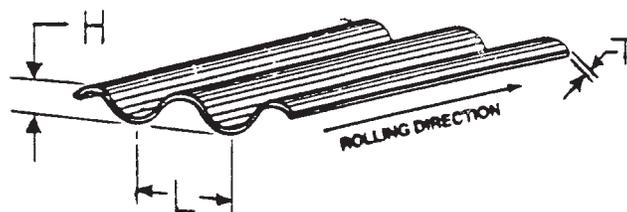


FIG. 4 Longitudinal Corrugation



FIG. 5 Herringbone

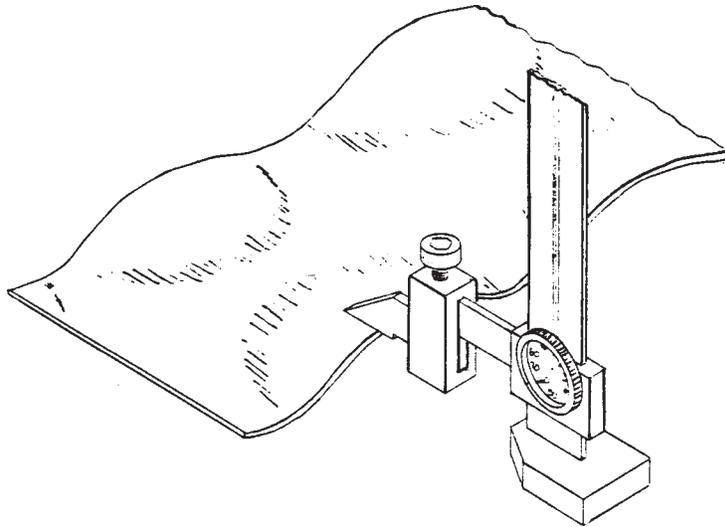


FIG. 6 Measuring Height of Irregularity With Height Gage

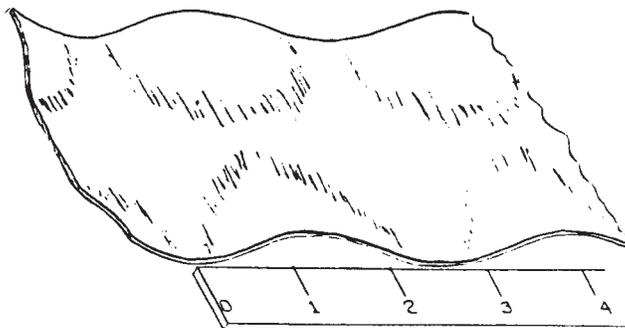


FIG. 7 Measuring Length of Irregularity With Steel Rule

 **B 754 – 89 (1999)<sup>e1</sup>**

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