



## Standard Test Method for Green Strength for Compacted Metal Powder Specimens<sup>1</sup>

This standard is issued under the fixed designation B 312; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers determination of the green strength of unsintered compacted metal powder specimens by subjecting them to a uniformly increasing transverse loading under controlled conditions. The term green strength, as used herein, defines the stress, calculated from the flexure formula, required to break a specimen as a simple beam supported near the ends and applying the force midway between the fixed line center of the supports.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI equivalents are in parentheses and may be approximate.

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 243 Terminology of Powder Metallurgy<sup>2</sup>

### 3. Terminology

3.1 Definitions of powder metallurgy (P/M) terms can be found in Terminology B 243. Additional descriptive information is available in the Related Material section of Vol 02.05 of the *Annual Book of ASTM Standards*.

### 4. Summary of Test Method

4.1 The powder to be tested is pressed in a die to the configuration of a bar having a standard rectangular shape in the pressing direction and to one of two thicknesses. Either the powder to be pressed contains lubricant or the surfaces of the die are lubricated at each pressing.

4.2 The pressed test specimen's width, thickness, and density are determined. The load necessary to fracture the bar is determined by applying a uniformly increasing force to the specimen while supporting it in the prescribed three-point bend test fixture.

4.3 Green strength or maximum fiber stress of the material under test is determined by calculation using the equation for a simply supported beam with a concentrated load.

### 5. Significance and Use

5.1 The test for green strength of a compacted metal powder is useful as a:

5.1.1 Method to relate the resistance of a pressed compact to breakage or damage due to handling.

5.1.2 Means of quality comparison of metal powder, lot to lot.

5.1.3 Method of determining the effect of additions to a base powder.

5.2 Significant variations in green strength will occur if the density tolerance of the pressed bar is exceeded.

### 6. Apparatus

6.1 *Punches and Die* (see Fig. 1), for producing a test specimen having a nominal die dimension of 0.500 in. (12.70 mm) wide by 1.250 in. (31.75 mm) long.

6.2 *Compression Testing Machine or Powder Press*, capable of applying the required pressure to produce, and break if desired, the standard test specimen.

6.3 *Balance*, suitable for weighing to an accuracy of 0.01 g.

6.4 *Micrometers*, capable of measuring from 0.0 to 1.25 in. (0.0 to 31.8 mm) with an accuracy of 0.001 in. (0.03 mm).

6.5 Either of the following testing apparatus:

6.5.1 *Constant Loading Beam Device* as shown in Fig. 2, capable of measuring the breaking force on the test specimen to the nearest 0.1 lbf (0.5 N).

6.5.2 *Transverse Rupture Test Fixture* as shown in Fig. 3, for use with a compression testing machine to locate the test bar so the breaking force can be measured to the nearest 0.1 lbf (0.5 N).

### 7. Test Specimen

7.1 The test specimen has nominal dimensions of 0.500 in. (12.70 mm) wide by 1.250 in. (31.75 mm) long by either 0.250 in. (6.35 mm) or 0.500 in. (12.70 mm) thick. The green density shall be within  $\pm 0.05$  g/cm<sup>3</sup> of the target.

### 8. Procedure

8.1 For lubricated powders follow the instructions starting in Section 8.2. The method of lubrication of the powders shall

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.05.