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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Method for DIAMETRAL COMPRESSION TESTING OF CEMENTED CARBIDES[1]

This Standard is issued under the fixed designation B 485; 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.

1. Scope

1.1 This method provides a procedure for determining the diametral compression (radial crushing) strength of cemented carbides which is a measure of tensile strength.[2]

NOTE—The values stated in U.S. customary units are to be regarded as the standard.

2. Apparatus

2.1 Either a specially adapted machine for applying the load or a fixture suitable for use with a conventional load-applying machine may be used. In either case, the apparatus shall have the following parts:

2.1.1 Two ground, cemented-carbide plates 1.000 in. (25 mm) in diameter and at least $^3/_8$ in. (10 mm) thick. These are mounted in opposite members of the assembly to provide the pressure pads.

2.1.2 One fixed and one movable member (free to move substantially only in a line perpendicular to the plane of the pressure pads).

2.2 The apparatus shall be so constructed that the application of a sufficient load to the movable member, to effect breaking of the specimen, will not cause appreciable deflection of the line of movement of the movable member and the plane of the cemented carbide pads. The apparatus shall be capable of registering the load required to break the specimen within ±1 %. The cemented carbide pads shall not show permanent deformation after use.

2.3 Each specimen shall be cushioned on both sides by a strip of cold-rolled steel approximately 0.015 in. (0.4 mm) thick, at least $^3/_8$ in. (10 mm) wide, and $^1/_2$ in. (13 mm) long. The cushions shall be replaced for each specimen and must be discarded after use.

3. Test Specimens

3.1 The cemented carbide specimens shall be unground and shall have the following dimensions: 0.750 ± 0.005 in. (19.0 ± 0.15 mm) outer diameter by 0.450 ± 0.005 in. (11.5 ± 0.15 mm) inside diameter by 0.250 ± 0.005 in. (6.5 ± 0.15 mm) thick. The taper on any dimension shall not exceed 0.002 in. (0.05 mm). The specimens shall be cleaned of furnace residue by a light sandblasting operation or similar treatment.

3.2 Visually examine the specimens for obvious defects such as cracks, chips, excessive distortion or taper, and adhering foreign material. Reject defective specimens.

3.3 Each specimen shall be measured on all dimensions to within ±0.001 in. (0.03 mm).

4. Procedure

4.1 Place a specimen into the fixture so that it is held lightly on edge between the two cushion strips. Then adjust the movable member so that the specimen assembly is held without pressure between the two cemented carbide pads.

4.2 Apply the load at a rate not exceeding 350 lbf (1.5 kN)/s. Remove the load immediately after fracture has occurred. The normal tensile fracture is in the direction of the applied load. A secondary transverse fracture may occur, but will not affect the reading of

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[2] Bortz, S. A., and Lund, H. H., "The Brittle Ring Test," *Mechanical Properties of Engineering Ceramics*, Interscience Publishers, New York, N.Y., 1961, pp. 383–406.

the maximum load pointer. Record the number of pounds required to cause the tensile fracture.

4.3 Perform all tests at room temperature, but not lower than 65°F (18°C).

5. Calculations

5.1 Calculate the average tensile strength as follows:

$$S_{dc} = KP/(D_1 - D_2)t$$

where:

S_{dc} = diametral compression tensile strength, psi (or MPa),
P = load required to fracture, lbf (or N),
D_1 = outside diameter, (see 3.3), in. (or mm),
D_2 = inside diameter, (see 3.3) in. (or mm),
t = thickness (see 3.1), in. (or mm), and
K = ring stress factor (according to Frocht)[3] dependent on the ratio of inside to outside diameters. Values for the pertinent range are listed in Table 1.

[3] Frocht, Max M., *Strength of Materials*, Ronald Press, New York, N.Y., 1951, pp. 175–176.

TABLE 1 Ring Stress Factors

D_2/D_1	K
0.570	8.17
0.575	8.28
0.580	8.40
0.585	8.52
0.590	8.64
0.595	8.77
0.600	8.90
0.605	9.03
0.610	9.17
0.615	9.31
0.620	9.46
0.625	9.61
0.630	9.77