



Standard Test Method for Compression-Displacement of Baseballs and Softballs¹

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1. Scope

1.1 This test method describes a comparative measurement method for baseballs and softballs as defined by a static compression displacement test.

1.2 This test method is based on a slow rate force-displacement measurement.

1.3 This procedure is for baseballs and softballs meeting standards established by the sports' governing bodies.

NOTE 1—Since the compression-displacement of baseballs and softballs can influence the performance characteristics, this test provides a simple method to compare and categorize such balls based on force levels in a standardized compression-displacement test.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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:*²

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *baseballs and softballs, n*—any such ball defined by the rules of the game as published by the sports' governing bodies.

¹ This test method is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.26 on Baseball and Softball Equipment.

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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.

3.1.2 *compression-displacement, n*—the reduction in ball diameter under a specified compressive load between two flat plates. Synonymous with *compression-deflection*.

3.1.3 *force, n*—the resistance to displacement. The interaction between test machine and ball during compression.

3.1.4 *four seams, n*—plane passing through the middle of the ball intersecting four stitch lines.

3.1.5 *two seams, n*—plane passing through the middle of the ball intersecting two stitch lines.

4. Summary of Test Method

4.1 The baseball or softball is placed between two flat-plate surfaces of a compression machine and then compressed to a standard displacement of 0.25 in. (6.35 mm). The compression load (force) applied at the standard displacement is recorded.

5. Significance and Use

5.1 The static compression-displacement of a baseball or softball is a mechanical property which can correlate to dynamic properties.

5.2 This test method is suitable for obtaining data in research and development, quality control, and classifying balls by the compression-displacement.

5.3 Sports associations can use compression-displacement standards in specifications for official baseballs and softballs for purposes of consistency of performance.

5.4 This same test procedure can be utilized with other compressive forces and the specified force is not necessarily the same as experienced in actual use.

6. Apparatus

6.1 *Compression Device*, to compress the test ball between two flat plates to 0.25 in. (6.35 mm) displacement. Compressive force to 800 lb (3560 N) is sufficient. A means of centering the test ball so that the vertical axis of the ball aligns with the vertical axis of the compression device piston.

6.2 *Compression Force Gauge*, to measure the compressive load in newtons or pounds. Device must be able to measure at least 1000 lb (4448 N).

6.3 *Compression-Displacement Gauge*, to measure the displacement at the prescribed level of 0.25 in. (6.35 mm).

6.4 *Motor, Drive, and Speed Control*, to drive the compression device to 0.25 in. (6.35 mm) displacement in a time of 12 to 18 s at a constant rate.

6.5 *A Steel Tape*, 0.25 in. (6.35 mm) wide, suitable for measuring lengths to the nearest 0.0625 in. (1.5875 mm).

7. Conditioning

7.1 *Ball Conditioning and Test Room Conditions*:

7.1.1 Test balls shall be stored in an environmentally controlled space for at least 14 days immediately before testing.

7.1.2 Temperature is to be maintained at $72 \pm 4^\circ\text{F}$ ($22 \pm 2^\circ\text{C}$).

7.1.3 Relative humidity is to be maintained at between 40 and 60 %.

7.1.4 Temperature and humidity are to be measured and recorded hourly within $\pm 0.5^\circ\text{F}$ ($\pm 0.3^\circ\text{C}$) and $\pm 2\%$ RH over conditioning and test duration.

8. Procedure

8.1 Wrap the steel tape around the middle of the ball to measure the circumference twice over two seams (each measurement taken 90° apart) and once over four seams. Record data to the nearest 0.0625 in. (1.5875 mm). Average the three measurements to obtain the final size measurement.

8.2 Orient the ball in the compression press to align the vertical axis of the ball with the vertical axis of the compressing piston, and orient the ball so that compression occurs between ball seams.

8.3 Activate the compression press until the upper plate is in contact with the ball with a 1-lb (4.45-N) preload for expected compression values less than 150 lb (667.5 N) $\pm 5\%$ and a 4-lb (17.8-N) preload for expected compression values greater than 150 lb (667.5 N) $\pm 5\%$ applied to the ball.

8.4 Set the compression displacement gage reading to zero.

8.5 Compress the ball to a displacement of 0.25 in. (6.35 mm) in 12 to 18 s at a constant rate and record the peak force applied at that level of displacement.

8.6 Release the applied load, rotate the ball 90° and repeat 8.2 – 8.5.

NOTE 2—Depending on the materials of construction, the compression-displacement may change with repeated compressions. For this reason, the procedure is limited to two compressions, on two different axis of the test balls.

9. Calculation

9.1 Ball compression is calculated as the average of the two measured forces required to compress the test ball 0.25 in. (6.35 mm) on two different axis of the ball.

10. Report

10.1 Report the following information:

10.1.1 Name of the test facility and test operator,

10.1.2 Test date,

10.1.3 Hourly measurements of test conditions, including:

10.1.3.1 Relative humidity and temperature of the ball conditioning and test room environments,

10.1.3.2 Number of hours ball was in conditioning environment.

10.1.4 Test equipment used for this test method,

10.1.5 Test ball information, model, weight tested, and any other pertinent data such as condition of the ball,

10.1.6 Average ball compression in accordance with Section 9 of this standard.

10.1.7 Any and all unique observations, including but not exclusively, any damage to the ball, and

10.1.8 Calibration certificate numbers for measurement devices.

11. Precision and Bias³

11.1 The precision of this test method is based on an interlaboratory study conducted in 2008. Each of six laboratories tested ten different baseballs. Every “test result” represents an individual determination. Each laboratory reported three replicate test results for the analyses. Practice E691 was followed for the design and analysis of the data; the details are given in the research report footnoted above.

11.1.1 *Repeatability Limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the “*r*” value for that material; “*r*” is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

11.1.1.1 Repeatability limits are listed in Table 1.

11.1.2 *Reproducibility Limit (R)*—Two test results shall be judged not equivalent if they differ by more than the “*R*” value for that material; “*R*” is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

11.1.2.1 Reproducibility limits are listed in Table 1.

11.1.3 The terms repeatability limit and reproducibility limit are used as specified in Practice E177.

11.1.4 Any judgment in accordance with statements 11.1.1 and 11.1.2 would have an approximate 95 % probability of being correct.

12. Keywords

12.1 baseballs; compression-displacement; softballs

³ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F08-1009.

TABLE 1 Compression (lb)

Ball	Average, x	Repeatability Standard Deviation, S_r	Reproducibility Standard Deviation, S_R	Repeatability Limit, r	Reproducibility Limit, R
Ball 1	206.65	11.95	22.36	33.45	62.61
Ball 2	205.40	13.27	20.52	37.17	57.45
Ball 3	206.50	14.68	27.38	41.11	76.68
Ball 4	203.47	14.30	19.42	40.05	54.37
Ball 5	213.07	14.38	20.01	40.26	56.03
Ball 6	211.52	11.04	25.40	30.92	71.11
Ball 7	225.49	16.86	27.46	47.20	76.88
Ball 8	222.92	12.18	21.43	34.11	60.01
Ball 9	220.54	13.63	26.70	38.18	74.76
Ball 10	219.45	12.50	25.19	35.01	70.52
Average	213.50	13.48	23.59	37.75	66.04

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