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An American National Standard

Standard Test Method for Measuring the Coefficient of Restitution (COR) of Baseballs and Softballs[1]

This standard is issued under the fixed designation F 1887; 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 procedure is intended to standardize a method of measuring the coefficient of restitution (COR) of baseballs and softballs.

1.2 This procedure is established to provide a single, repeatable, and uniform test method.

1.3 This procedure is for a ball that is intended for use in the game of baseball or softball.

1.4 The test method is based on ball speed measurements before and after impact with either of two test surfaces: wood or metal.

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. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *baseball and softball, n*—any ball defined by the rules for the game of baseball or softball.

2.1.2 *coefficient of restitution (COR), n*—a numerical value determined by the exit speed of the ball after contact divided by the incoming speed of the ball before contact with a massive, rigid, flat wall of either wood or metal.

3. Summary of Test Method

3.1 *Method A*—The strike plate is a rigid metal surface, and ball speed is measured before and after impact with the strike plate.

3.2 *Method B*—The strike plate is a rigid wood surface, and ball speed is measured before and after impact with the strike plate.

4. Significance and Use

4.1 The ball coefficient of restitution is a ball dynamic property of relative velocity change caused by impact with a rigid wall.

4.2 This test method is suitable for obtaining data in research and development, quality control, and classifying balls by liveliness.

4.3 Sports associations can use coefficient of restitution standards in specifications for official baseballs and softballs.

4.4 This same test procedure can be utilized at impact speeds other then that prescribed in this procedure and so noted in any reported test results.

5. Apparatus

5.1 *Strike Plate, Method A*:

5.1.1 *Material*, 5.08-cm (2-in.) thick steel.

5.1.2 *Size*, 61 by 61 cm (24 by 24 in.).

5.1.3 *Mounting*, secured flush to a massive rigid wall of cinder block or concrete, minimally 20.3-cm (8-in.) thick, and bolted at all four corners sufficiently secure to prevent movement during ball impact.

5.2 *Strike Plate, Method B*:

5.2.1 *Material*, 10.2-cm (4-in.) thick northern white ash wood with moisture content between 10 and 15 % with a flat smooth surface.

5.2.2 Same as 5.1.2.

5.2.3 Same as 5.1.3.

5.3 *Ball Throwing Device*[2]—A ball throwing device capable of delivering the ball through the electronic speed monitor at 26.82 m/s (60 mph) with a maximum tolerance of ±0.30 m/s. The machine should be calibrated using the electronic speed monitor.

5.4 *Electronic Speed Monitors*[3]—An electronic ball speed measuring system consisting of two vertical light screens mounted 30.48 cm (12 in.) apart with a tolerance of ±0.32 cm, and a photoelectric sensor located at each screen that triggers a timing device on ball passage to measure the time for the ball to traverse the distance between the two vertical planes before and after impact with the strike plate. Resolution shall be ±0.03 m/s.

5.5 *Ball Trajectory Target*—A lightweight target with a 30.48-cm (12-in.) diameter circular opening positioned at the

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[2] ATEC, Model "Casey" or equivalent, or a suitable air cannon device, available from Athletic Training Equipment Co., Sparks, NV.

[3] Oehler Research Chronograph, Model 35x2, or equivalent; Oehler Research Skyscreens, Model 55, or equivalent; available from Oehler Research Inc., Austin, TX.

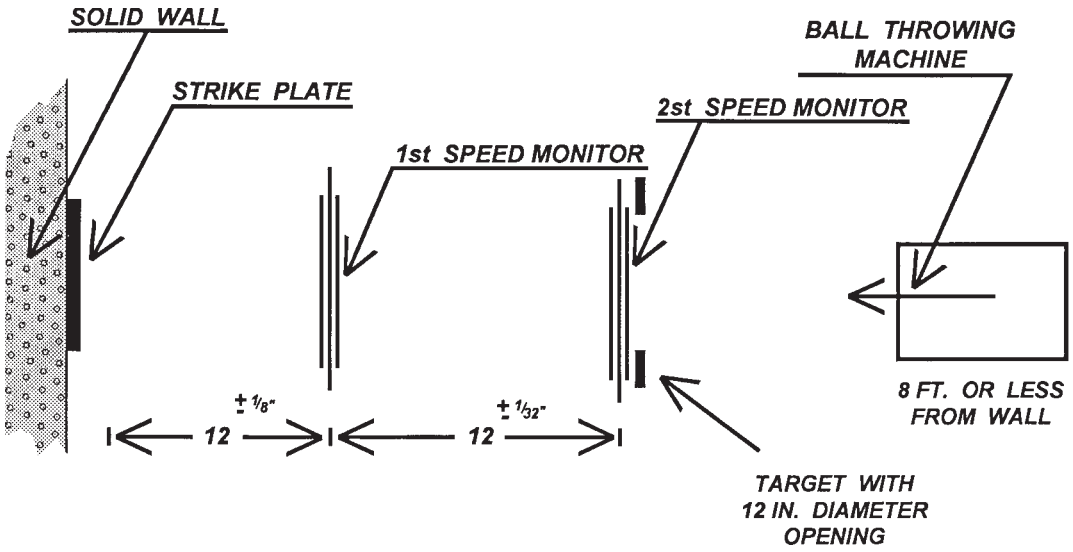

FIG. 1 Test Apparatus

second light screen and centered on the ball line of travel between the throwing device and the center of the strike plate.

6. Preparation of Apparatus

6.1 Mount the strike plate on a rigid wall such that the center is approximately 1.22 cm (4 ft) from the floor. Tighten all mounting bolts before each test. Torque to 81.35 N-m (60 ft-lbs) min.

6.2 Position the first speed monitor (light screen) 30.48 ± 0.32 cm (12 ± 0.125 in.) from the strike plate (see Fig. 1).

6.3 Position the second speed monitor (light screen) 30.48 ± 0.079 cm (12 ± 0.312 in.) from the first speed monitor.

6.4 Position the ball throwing device such that the ball impacts the strike plate within 15.24 cm (6 in.) of the center and on rebound, passes through the 30.48 cm (12 in.) target mounted at the second light screen.

7. Conditioning

7.1 *Ball Conditioning*:

7.1.1 Test balls shall be placed in an environmentally controlled space for at least 24 h immediately before testing.

7.1.2 Temperature is to be maintained at 22 ± 2°C (72 ± 4°F).

7.1.3 Relative humidity is to be maintained at 50 ± 10 %.

7.1.4 Balls are to be tested within 20 min after removal from controlled storage area.

7.2 *Test Room Conditioning*:

7.2.1 The test room is to be environmentally controlled.

7.2.2 Temperature will be 22 ± 2°C (72 ± 4°F).

7.2.3 Relative humidity will be between 20 and 60 %.

8. Procedure

8.1 The ball throwing device is set to deliver the ball at 26.82 ± 0.305 m/s (60 mph). All shots above or below this tolerance range will not be used.

8.2 Each ball is shot at the strike plate a minimum of six times to a maximum of 12 times. A minimum 30-s rest period is required between each shot.

8.3 Only those speed readings for impacts falling within the 6-in. target at the strike plate, within the 12-in. target at the second speed monitor, and thrown within the prescribed speed range will be used in the calculation of COR.

8.4 The average of the six acceptable COR values for each ball is used to determine the ball COR.

8.4.1 Formulae:

$$\mathrm{COR} = Vb/Va = \frac{1}{6}\left[\frac{Vb1}{Va1} + \frac{Vb2}{Va2} + \frac{Vb3}{Va3} + \frac{Vb4}{Va4} + \frac{Vb5}{Va5} + \frac{Vb6}{Va6}\right] \quad (1)$$

where:

Va = incoming speed, and

Vb = exit speed.

9. Precision and Bias

9.1 Precision and bias evaluations have not been conducted for these test methods. When such data are available, a precision and bias section will be added.

9.2 Report COR values to three digits (that is, x.xxx).

10. Keywords

10.1 ball liveliness; ball resilience; baseball; coefficient of restitution; softball