R&A Rules Limited

and

United States Golf Association

PROTOCOL FOR MEASURING THE COEFFICIENT OF RESTITUTION OF A CLUBHEAD RELATIVE TO A BASELINE PLATE

TPX3009

Rev. 2.0

9 April 2019

Revision	Date	Details of Revision
2.0	9-Apr-2019	New major revision based on adoption of the updated interpretation of Equipment Rules Part 2, Section 4c, published January 2016.

1 Scope

This protocol describes the method used to test golf clubheads with a loft of 35 degrees or lower, other than putters, which have:

a. a depth of less than or equal to 1.5 inches (see fig. 1),

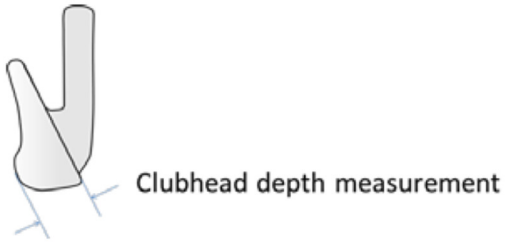

Figure 1: Definition of the clubhead depth for this test protocol.

b. a radius of curvature of the face of greater than 30 inches, and

c. a Characteristic Time (CT) which would be non-conforming per the Protocol for Measuring the Flexibility of a Golf Clubhead.

for conformance to the Equipment Rules Part 2, Section 4c as administered by R&A Rules Ltd. (The R&A) and the United States Golf Association (USGA).

2 Test Protocol

2.1 Preparation of the Golf Clubhead and golf balls

a. If the golf clubhead is provided with a shaft, remove the shaft

b. Measure and record the mass of the clubhead (m_c)

c. Use a centre of mass balance indicator to determine the projection of the centre of mass of the clubhead through the face of the club

d. Measure and record the mass of at least 12 golf balls of the same model (m_b)

e. Golf balls shall be maintained at 75° F +/- 1° F (23.9° C +/- 0.6° C) for a minimum of three hours prior to testing.

2.2 Coefficient of Restitution determination of the Baseline Plate

a. The baseline plate of mass m_p, (Appendix A) shall be supported such that may move freely after impact with the ball.

b. Propel a USGA/R&A calibration ball (as described in "Overall Distance and Symmetry Test Protocol") or equivalent into the baseline plate ensuring that:

   i. the resultant impact is completely within the target circle

   ii. the impact occurs within 2° of normal to the surface of the plate

   iii. the impact velocity is 133 $\pm$ 0.5 fps. (Note: This impact velocity may be reduced to mitigate for potential damage to the clubhead)

c. Record the inbound ball velocity (V_{in}) and outbound ball velocity (V_{out})

d. Calculate the coefficient of restitution (e) of the impact per the equation:

$$e = \left[\left(\frac{V_{out}}{V_{in}}\right)(m_p + m_b) + m_b\right]/m_p$$

e. Repeat steps 2.2a - 2.2c until valid data are obtained from 12 impacts.

f. Discard the data with the highest and lowest coefficients of restitution.

g. Calculate the mean of the remaining ten data points. This value is the coefficient of restitution of the Baseline Plate (e_{BP}).

2.3 Coefficient of Restitution determination of the Clubhead

a. The same balls identified in step 2.2 shall be used to determine the coefficient of restitution of the clubhead

b. The clubhead shall be supported such that it may move freely after impact with the ball.

c. Propel a ball into clubhead ensuring that:

   i. the resultant impact is centered at the projection of the clubhead Centre of Mass through the club face as determined in step 2.1c. (Note: Indicative means such as a marked circle may be employed to assist in the determination of impact location),

   ii. the impact occurred within 2° of normal to the surface of the club face,

   iii. the impact velocity is as in 2.2b.iii.

d. Record the inbound ball velocity (V_{in}) and outbound ball velocity (V_{out}).

e. Calculate the coefficient of restitution (e) of the impact per the equation:

$$e = \left[\left(\frac{V_{out}}{V_{in}}\right)(m_C + m_b) + m_b\right]/m_C$$

f. Repeat steps 2.3c - 2.3d until valid data are obtained from 10 impacts.

g. Discard the data with the highest and lowest coefficients of restitution.

h. Calculate the mean of the remaining eight data. This value is the coefficient of restitution of the Clubhead (e_C).

3 Determination of Conformance Status

If the coefficient of restitution of the clubhead (e_C) is higher than the coefficient of restitution of the baseline plate (e_{BP}) by more than the testing tolerance of 0.008 then the clubhead does not conform to the Equipment Rules Part 2, Section 4c(ii).

Appropriate screening methods may be employed.

Appendix A: Titanium Baseline Calibration Plate

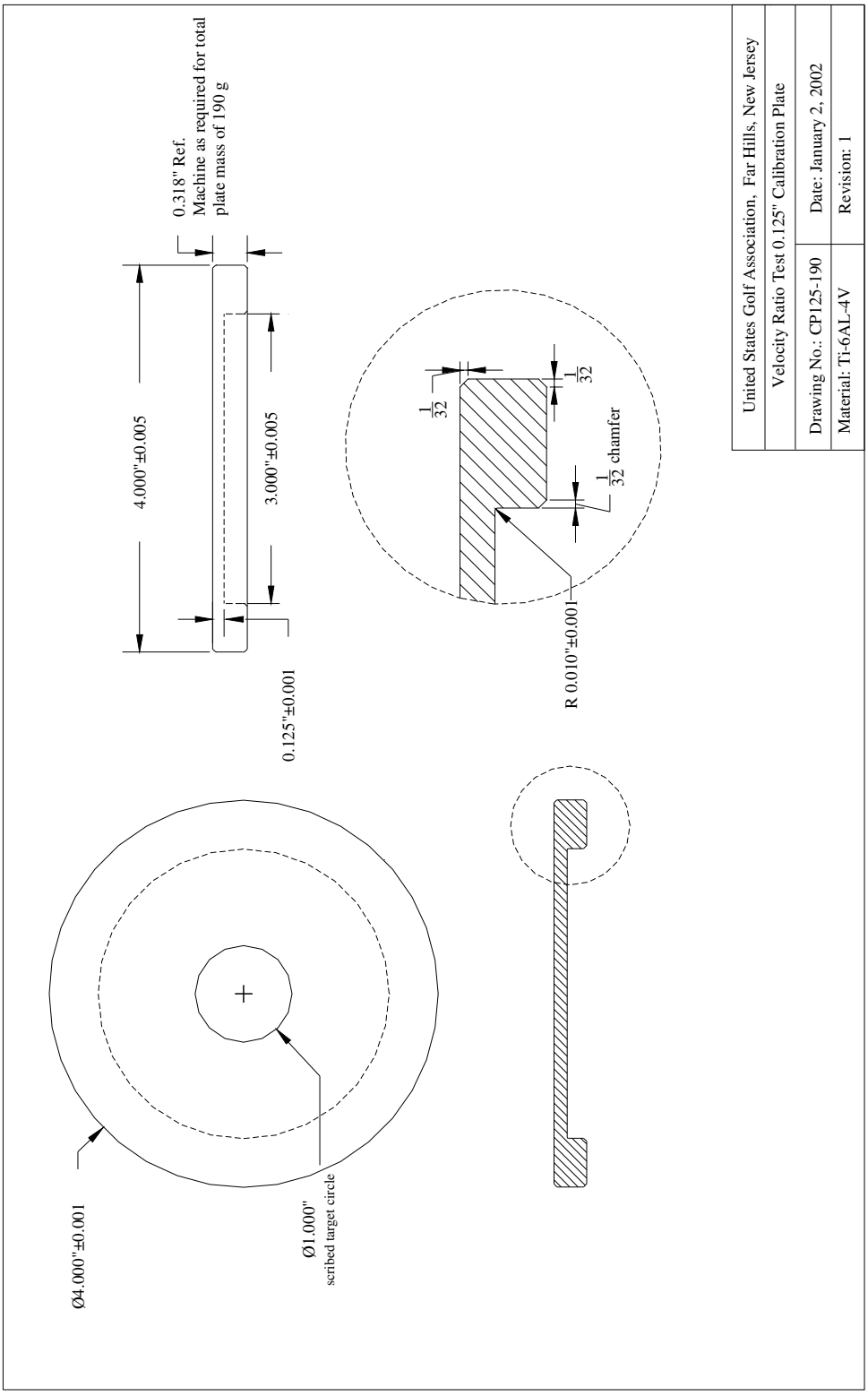

Figure A1 – Titanium Baseline Calibration Plate