United States Golf Association
and
R&A Rules Limited

INITIAL VELOCITY TEST
PROCEDURE

USGA-TPX3007 Rev. 2.0

18 October 2017
<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Details of Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>2/28/2011</td>
<td>The referenced changes have been made to reflect current and facilitate future changes made in testing practices to increase test efficiency, as well as equipment and software upgrades. No changes have been made in the criteria for conformance determination. Title: Updated to include document number and revision date. Section 6.1: Updated to reflect change in ball labeling wherein only balls 1 and 24 include the USGA lot number Section 6.7-8: Updated to reflect actual operation of current ITW motor. Section 7: Updated to reflect the automatic recording and analysis of data included in the current IV software. Section A.1: Deleted description of console buttons. Section B.1: Deleted description of IVTEST program</td>
</tr>
<tr>
<td>2.0</td>
<td>18-Oct-2017</td>
<td>New major revision based on the adoption of new test hardware by the USGA and R&amp;A Rules, Ltd. This shall not constitute a change to the Rules, specifically to Appendix III, Rule 5. Accordingly, the alternative test shall reproduce the results of the existing method, in accordance with the Rule.</td>
</tr>
</tbody>
</table>
1 Scope
This protocol describes the method used to test golf balls for conformance to the Rules of Golf, Appendix III, Rule 5, as administered by the United States Golf Association (USGA) and R&A Rules, Ltd., (The R&A).

2 Test Requirements
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.

a. For a given sample, each golf ball shall impact an effectively rigid, fixed barrier.
   i. The barrier shall be set such that the surface normal is inclined at an angle of 5° from the inbound path of the golf ball.
   ii. The ball should be propelled in such a way as not to induce significant spin.

b. The rebound velocity of the ball shall be measured at distance beginning no less than 7 inches, and no more than 9 inches from the impact target. The gauge distance for velocity measurement should be no more than 18 inches.

c. The time of contact between the ball and the barrier shall be measured.

d. The IV of the golf ball (ft/s) shall be calculated according the following:

   \[ IV = 136.8 + 136.3 e + 0.019 t_c \]

Where \( e \) is the coefficient of restitution, and \( t_c \) is the contact time in microseconds at an impact speed of 143.8 ft/s.

e. The pre-impact speeds for the test should enable accurate interpolation at the target speed of 143.8 ft/s.
   i. To this end, each golf ball may be tested over a range of speeds, such that:
      a) The impact speeds should not be different from 143.8 ft/s by more than 15 ft/s.
      b) Sufficient measurements are made at speeds above and below the nominal speed as to allow for linear correction to 143.8 ft/s.

f. The IV of each of 24 balls comprising a sample shall be reported.

The USGA and The R&A reserve the right to employ valid screening methods as appropriate.

3 Interpretation
For each golf ball, the IV shall be compared to the 250 ft/s limit plus a maximum tolerance of 2% (255 ft/s). In a sample of 24 golf balls, if four or more initial velocities exceed 255 ft/s, then the sample shall be ruled nonconforming to Appendix III, Rule 5.
Appendix A: Test Procedure

Apparatus
The Hye PTM3 is used to conduct Initial Velocity testing following the new procedure. The PTM3 machine meets the requirements outlined in Appendix I. The machine comprises an air cannon that launches golf balls vertically at a rigid target plate oriented at 5 degrees to horizontal. Ballistic screens are positioned 7 inches from the target plate, with 12 inches of gauge distance to measure both inbound and outbound velocity. This plate is instrumented with a force transducer to enable the measurement of contact time.

Vendor
Hye Precision Products is a Custom Tool and Automation design specialist based in Perry, GA, USA.

Procedure
a. Use the Hye PTM3.
b. Test each ball at four speeds, two each above and below 143.8. The following nominal speeds should be used:
   1. 150 ft/s
   2. 147 ft/s
   3. 139 ft/s
   4. 136 ft/s
c. Record the coefficient of restitution as the post-impact ball speed divided by the pre-impact ball speed.
d. From the force-time history, record the contact time (in microseconds) as the time at which the impact force (using a 12 kHz low-pass filter) crosses 5% of the peak force falling minus the time at which it crosses 5% of the peak force rising.
e. With the results of four impacts recorded, linearly interpolate the coefficient of restitution, and the contact time to 143.8 ft/s. Calculate the Pearson correlation coefficient.
   i. If the Pearson correlation coefficient for coefficient of restitution as a function of impact speed is less than 0.9, review the data for unusual results. Re-test the golf ball if necessary.
   ii. If the contact time range for four impacts exceeds 11ms, review the data for unusual results. Re-test the golf ball if necessary.
f. For each ball, calculate the Initial Velocity according to the following:
   \[ IV = 136.8 + 136.3 e + 0.019 t_c \]
g. Report the results for golf balls in accordance with Test Protocol for Golf Ball Initial Velocity.

*Note that this procedure may change at any time, subject to notice to manufacturers*