



R&A Rules Limited and United States Golf Association

PROCEDURE FOR MEASURING THE FLEXIBILITY OF A DRIVING CLUB

Revision 1.1

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This document is initial release of a procedure for evaluating conformance of drivers using the characteristic time as measured using the portable pendulum device.

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PROCEDURE FOR MEASURING THE FLEXIBILITY OF A DRIVING CLUB

I. Scope

- 1.1 This method covers the procedure for measuring the flexibility of a driving club using a portable pendulum testing apparatus as administered by R&A Rules Limited (R&A) and the United States Golf Association (USGA).
- 1.2 The results of the conformance tests are used in determining conformity of the club to the Rules of Golf, Appendix II, Rule 4c.
- 1.3 The values stated in imperial units are to be regarded as standard. The values stated in SI units are for information only.

2. Applicable Documents

2.1 R&A and USGA documents: Rules of Golf Portable Pendulum Testing Apparatus Technical Description, Revision 1.0

3. Summary of Method

3.1 Using a testing apparatus currently referred to as the portable pendulum tester; Figure 3.1, a driving club is impacted several times by a small steel pendulum. A characteristic time between the club head and pendulum is recorded for each impact. The characteristic time is directly related to the flexibility of the driving clubhead, Ref.; Portable Pendulum Testing Apparatus Technical Description, Revision 1.0.



Figure 3.1 - Portable Pendulum Testing Apparatus

4. Significance

4.1 This method uses the characteristic time to determine the conformity of a driving club to Appendix II, Rule 4c of the Rules of Golf.

The characteristic time of the club shall not be greater than 239 $\mu s.$ A maximum test tolerance of 18 μs is associated with this test.

4.2 Intermediate screening procedures may be used to determine club conformance and increase testing efficiency. However, the USGA and R&A will continue to monitor innovations in design and reserve the right to conduct additional research when appropriate.

5. Testing Apparatus Set-up and Preparation

- 5.1 Connect the ADC/212 digital storage oscilloscope to the computer and its power supply. Turn on the computer and launch the "Pendulum Test Console" by double clicking the icon.
- 5.2 Remove the portable pendulum testing apparatus from the protective shipping container.
- 5.3 Attach the pendulum tower assembly to the base assembly using the thumbscrew, Figure 5.3.



Figure 5.3 - Portable Pendulum Apparatus, Tower and Base Assemblies

5.3.1 Attach the data collection cord to Channel A of the ADC/212 and to the tower at the connection provided. The test apparatus is now assembled and ready for the system check. 5.4 From the Pendulum Test Console use the mouse to launch the System Check. (The System Check is a diagnostic procedure that checks to make sure that the device is performing properly. The computer will guide the user through the System Check.)

6. Club Preparation and Mounting

- 6.1 Determination of Impact Location
- 6.1.1 This test measures the response of a shafted driving club. If there is no shaft in the club head, one must be temporarily installed prior to testing.
- 6.1.2 The normal procedure calls for the measurement to be made at the face centre. Place the centre template on the clubface and move it from side to side along the clubface until the heel and toe measurements at the edges of the face of the club are equal.
- 6.1.3 Repeat step 6.1.2 moving the template up and down along the clubface until the sole and crown measurements at the edges of the face of the club are also equal. Care should be taken to make sure that the heel-toe measurements of step 6.1.2 remain equal during this step.
- 6.1.4 With the template situated such the that the heel and toe measurements are equal and the sole and crown measurements are equal, mark a circle to indicate the impact spot for the test. (Note: the heel-toe measurements do not have to be the same as the sole-crown measurements, Figure 6.1)



Figure 6.1 – Impact Location Template

6.2.1 Once the club impact location has been marked, place the club in the clamp assembly, Figure 6.2.1, such that the club head impact location is situated in the approximate location of the ball of the pendulum and loosely secure the clamp.



Figure 6.2.2 – Pendulum Assembly

6.2.3 With the pendulum assembly out of the way raise the alignment assembly, Figure 6.2.3, to the approximate centre of the clubhead.



Figure 6.2.1 – Clamp Assembly

6.2.2 With the club loosely secured, raise the pendulum assembly, Figure 6.2.2 to its maximum position and secure.





6.2.4 Insert the plunger in the alignment assembly and gently press it to the club face. Adjust the club head until the plunger seats squarely on the club face and then tighten the clamp. 6.2.5 With the club tightly clamped, place the laser in the plunger and adjust the alignment mechanism (up and down) and the clamping assembly (back and forth), Figure 6.2.5, until the laser shines directly on the impact circle created in step 6.1.4. (Since the beam of the laser may not be perfectly aligned, the laser should be rotated within the plunger assembly to make sure that the beam falls within the circle in all orientations.)



Figure 6.2.5 – Align Impact Position

- 6.2.6 Tighten the thumbscrews on the alignment assembly and the locking screw on the clamping assembly horizontal adjustment.
- 6.2.7 Lower the spacer until it rests on the alignment assembly and tighten in place using the thumbscrew, Figure 6.2.7.



Figure 6.2.7 – Moving Pendulum Assembly into Position

6.2.8Loosen the thumbscrew securing the alignment assembly and lower it until it rests in its lowest position and tighten in place using the thumbscrew. As the alignment assembly is lowered the pendulum assembly will come to rest on the spacer. The club is now ready for testing, Figure 6.2.8.



Figure 6.2.8 – Club Ready for Testing

7. Club Testing

- 7.1 Ensure that the Pendulum Test Console that was started in step 5.1 is running and that the system check was successfully completed.
- 7.1.1 Retract the pendulum until you hear three clicks.
- 7.1.2 Press the pendulum release and allow the pendulum to strike the club face.
- 7.1.3 Repeat steps 7.1.1 and 7.1.2 several times to ensure that the clubhead is tightly secured and that no movement has occurred.
- 7.2 Using the mouse, click on data collection Position Ia in the Pendulum Test Console.
- 7.2.1 Retract the pendulum until you hear three clicks.
- 7.2.2 Press the pendulum release and allow the pendulum to strike the club face.



Figure 7.2.2 – Club Testing

- 7.2.3 Once the data appears, click on data collection Position Ib and repeat steps 7.2.1 and 7.2.2
- 7.2.4 Repeat step 7.2.3 for data collection 1 c.
- 7.3 Repeat step 7.2 collection data for Position 2 a, b and c. The pendulum should be retracted until you hear two clicks in this step.
- 7.4 Once again repeat step 7.2 collection data for Position 3 a, b and c. The pendulum should be retracted until you hear one click in this step.
- 7.5 Once data has been obtained at all nine settings, the software will calculate the characteristic time based on the slope of a line through the nine data points as well as a confidence interval.

8.0 Conformance Determination

- 8.1 If the upper bound of the confidence interval is less than 239 μ s plus the tolerance then the test is over and the club conforms to the Rules of Golf.
- 8.2 If the upper bound of the confidence interval is greater than 239 µs plus the tolerance then repeat steps 7.1 through 7.4. The software will then calculate a characteristic time based on the all eighteen data points
- 8.2.1 If the characteristic time is less than or equal to 239 μ s plus the tolerance then the test is over and the club conforms to the Rules of Golf.
- 8.2.2 If the characteristic time is greater than 239 μs plus the tolerance then the test is over and the club does not conform to the Rules of Golf.
- 8.3 Clubface Coatings

8.3.1 In addition to characteristic time and the confidence interval the software also evaluates the magnitude of the slope of the line. An unusually large slope (greater than 20) indicates the possibility of a secondary coating on the face of the club. In this instance additional evaluations are required. These are described in Appendix A.

Appendix A – Procedure for Evaluating Clubs with Compliant Face Coatings.

Section 8.3 addresses clubs whose clubfaces have a compliant face coating. These are characterized by exhibiting an unusually large slope (greater than 20) for the line that is fit through the measured data points. The flow chart below describes how such clubs will be evaluated for conformance.



From the flowchart it can be seen that if the slope of the line is greater than 20 and the characteristic times at the three test velocities are greater than the limit then a measurement of the coating thickness needs to be made. This measurement is made using an eXacto FN External Coating Thickness Gauge.

Using the measured coating thickness and the natural log of the slope, Figure A-I is used in the pendulum software to determine the appropriate exponent, "k", (rather than the standard value of 0.33) for the equation of the line through the fitted pendulum test data of the form:

$$A + B V^{k}$$



Figure A-I - Variation of Exponent with Slope and Coating Thickness.