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THE USGA

Notice to Manufacturers

Subject: Rule 4-1e Appendix II: Spring-like Effect Standard (SLES)

Ref: Notice to Manufacturers dated April 27, 1999 and Notice to Manufacturers dated February 8, 1999 Subject: Testing of Clubs for Spring-like Effect

The SLES protocol provides that in the event of structural failure, a club will be tested further at lower impact speeds, but it does not specify the criteria for ultimately determining whether or not the club conforms.

To further advise manufacturers so they can plan future design and production, the USGA is publishing a graph that specifies what the rebound velocity limit would be over a range of velocities that may be used in the event of structural damage to a club during testing, or in cases where there is reason to believe that a club may exhibit excessive rebound velocities at other impact speeds. In this regard, the Preamble to Rule 4 states, in part:

> …Where a club, or part of club, is required to have some specific property, this means that it must be designed and manufactured with the intention of having that property…

Please substitute the attached pages for the current page 8 in the SLES Test Protocol, dated February 8, 1999.

Yours sincerely,

Frank W. Thomas
Technical Director

November 5, 1999
Attachments

Appendix B - Velocity Ratio Baseline

1.0 Velocity Ratio Baseline

The velocity ratio baseline represents a constant coefficient of restitution curve as a function of the club head mass. The baseline value for the coefficient of restitution has been established at e= 0.822. Using this value of e, the baseline velocity ratio for a given club head mass is calculated using the following equation:

$$V_{out}/V_{in} = \frac{eM - m}{M + m}$$

Where:
V_{out}/V_{in} is the velocity ratio,
M is the mass of the club head, and
m is the average mass of the ball population.

Club head conformance is determined by comparing the measured velocity ratio of a club head to the baseline velocity ratio at the measured club head mass.

2.0 Test Tolerance

The test tolerance on the measured velocity ratio for club head testing has been set to a value 0.007. This value is determined from the statistical variations associated and with the errors associated with actual club head testing, including variations in ball launch velocity and the variability in the initial velocities and masses of the balls. The baseline and tolerance are shown in Figure B-1. Lines indicating constant coefficient of restitution versus mass are also shown on the figure.

3.0 Modification of the Baseline

The intent of the rule is to prohibit a spring-like effect by design or manufacture. The baseline described above is derived from tests that measured the rebound velocity ratio using an initial closing velocity of 160 fps.

If damage to the club face or the club head (e.g. plastic deformation) occurs at a closing velocity of 160 fps, another sample will be tested at the highest velocity at which reliable data can be obtained. Conformance will be based on equivalent limits at those velocities, as specified in Figure B-2.

The USGA reserves the right to modify the test procedure at any time to ensure compliance with the intent of the rule.

FIGURE B-2 - Equivalent Coefficient of Restitution Limit at Various Impact Velocities