NCAA NEWS RELEASE

NATIONAL COLLEGIATE ATHLETIC ASSOCIATION PROVISIONAL STANDARD FOR TESTING BASEBALL BAT PERFORMANCE

September 27, 1999

[The following protocol has been adopted by the NCAA and must be followed when baseball bats are submitted for certification. This protocol has been adopted as an addendum to NCAA baseball rules and does not supersede the rules. In short, NCAA Baseball Rules must be followed.]

Certification Protocol

Initial Written Notification

To initiate the certification process for all baseball bats that are constructed with materials other than one-piece solid white ash, an interested bat manufacturer must send the NCAA written notice of its intent to conduct certification testing on specific models it deems appropriate for testing. The notice to conduct testing must contain a detailed description of all models to be used in NCAA competition, the date of first production, the model number, the bat length and weight combinations of each model to be manufactured, the maximum diameter, the handle diameter, location of the center of gravity (balance point), the nominal wall thickness of the barrel and of any other part of the bat with a wall thickness that differs from the barrel, the ultrasonic setting used to determine wall thickness, and the materials (e.g., alloys, composites, any filling or deadening materials) used to make the product (including, without limitation, any materials used inside the bat and the materials composing and/or contained in the bat's end cap). Such information shall not be confidential, and shall be available on request. In addition, an 8" x 10" color photograph of each model to be certified shall be provided to the NCAA. At that time, the NCAA will provide the manufacturer with a testing reference number, e.g. NCAA-1999-0001, in writing, and only those bat models will be cleared for testing.

Certification Process

The NCAA then will require that a manufacturer supply a minimum of two typical bats of every length class (per Table 1), weight class (per Table 2), and model combination for certification to James A. Sherwood, University of Massachusetts at Lowell, James B. Francis College of Engineering, Department of Mechanical Engineering, One University Avenue, Lowell, Massachusetts 01854 (978/934-3313, james_sherwood@uml.edu). Dr. Sherwood and his research team will conduct the certification tests as stated in the testing protocol on one of the bats for each length, weight and model combination. All bats of each particular combination which are sold or otherwise provided for NCAA play by the manufacturer must meet the specifications of the new standard in order for that combination to be certified for NCAA competition. If approved, the NCAA will provide written confirmation for each approved combination bat and will issue a certification number for each approved combination bat.

Table 1. Length classes for bats

Length Class (In.)
32.0 -0.25/+0.24
32.5 -0.25/+0.24
33.0 -0.25/+0.24
33.5 -0.25/+0.24
34.0 -0.25/+0.24
34.5 -0.25/+0.24
35.0 -0.25/+0.24

Table 2. Weight classes for bats without grip

Weight Class **(Unit difference, weight from length)**
-3.00 to -2.10
-2.09 to -1.10
-1.09 to -0.10

A mandatory silk-screen or other permanent certification mark shall consist of the phrase "BESR Certified" and must be clearly displayed on the barrel end of the bat. The manufacturer may use the certification mark in descriptive materials (such as catalogs) to identify bats that comply with this testing standard, but may make no other use of the mark. Use of the certification mark to advertise or promote the sale or distribution of bats is expressly prohibited. There shall be no charge for the use of the certification mark in accordance with this protocol.

In the event that all bats submitted for testing become damaged and unusable for testing, the manufacturer will be notified by the Certification Center and requested to submit at least two more bats for certification. The certification of that length, weight and model combination will then go to the next open position in the certification queue, i.e. end of the line, upon receipt of the new bats.

All bats will be returned except for the tested bat(s) and one for record purposes. The retained bats will be stored in a secure area and only Certification Center personnel will have access to the secure area. The manufacturer will be assured that the confidentiality of its bat is protected.

Test Results

Dr. Sherwood will simultaneously provide the NCAA and the manufacturer in writing with the test results of each length and weight combination for each model submitted by the manufacturer for certification. If a bat is submitted for testing by a sponsor other than the manufacturer, Dr. Sherwood will provide the test results in writing to the NCAA and the sponsoring party. If a bat submitted by a sponsor other than the manufacturer fails the certification test, copies of the test results will also be provided in writing to the manufacturer.

Copies of all *confidential* data sheets will be supplied to the NCAA and to the test sponsor for every hit. If a bat that has been submitted for testing by a sponsor other than the manufacturer fails the certification test, copies of all confidential data sheets will also be supplied to the manufacturer. The original data sheets will be filed in hard copy and digital form at the Certification Center and in digital form at a secure off-site location. Information on the data sheet belongs to each test sponsor (and the manufacturer, if the test sponsor is not the manufacturer and the bat fails the certification test), for internal purposes only and shall be kept confidential by the certification center and the NCAA unless otherwise provided herein. The NCAA will retain the right to announce publicly that a bat has failed the certification test.

Manufacturers may, at their discretion, disclose the results, including test data, of testing on bats that they have manufactured. If a manufacturer discloses such information, however, the NCAA may make any additional disclosure of information from the same test that it deems appropriate.

Testing Expenses
All of the expenses to conduct the testing at the University of Massachusetts at Lowell Baseball Research Center will be funded by the manufacturer or test sponsor for which certification testing will be conducted. All manufacturers should deal directly with Dr. Sherwood regarding the testing expenses.

Implementation Timeline
Beginning January 1, 2000, only baseball bats that display an official NCAA certification mark on the barrel-end of the bat signifying compliance with the NCAA's bat performance standard will be allowed in regular-season and post-season competition. Solid white ash bats will be allowed for NCAA competition.

Compliance with the Performance Standard
The NCAA will conduct discretionary periodic testing of certified baseball bats at its expense to ensure compliance with the standard. This testing is intended to fairly sample the bats used in NCAA play at the time of the testing. Bats will be obtained from both dealer stock and field service. If any nonconforming bats are identified, the NCAA will notify the manufacturer in writing of its findings. A bat length, weight and model combination will not be declared nonconforming unless three different bats with that length, weight and model combination have failed the certification test. The manufacturer will be given the opportunity to review the compliance report and will be allowed an appeal in writing of the findings to the NCAA Baseball Rules Committee within fourteen (14) days upon receipt of the notice of findings. This right to appeal shall include a right to retest the bat or bats in question at the manufacturer’s expense, and the results of any retest shall be simultaneously provided to the manufacturer and the NCAA. Once any retesting is complete, the rules committee will act on the appeal and notify the manufacturer of its decision within seven (7) days. The rules committee shall disallow any bat for regular-season or post-season competition that does not meet the standard.

Manufacturer Right to Submit a Competitor's Bat for Compliance
Manufacturer A is permitted to submit Manufacturer B's bat for testing and A pays for the testing regardless of outcome. If B's bat does not comply, then the Certification Center will notify the NCAA and the NCAA will take appropriate steps for noncompliance as described above. The

same appeal procedures as described above shall apply in this circumstance, and the test sponsor shall be entitled to the results of any retest and appeal. The results of the test (including all test data) will be shared with the NCAA and the test sponsor in the manner described above. If the bat fails the certification test, the test results will also be shared with the manufacturer.

Penalty for Modification of Bat after it leaves the OEM
A manufacturer will not be held responsible for noncompliance in the event that an aftermarket party alters the bat in any manner. The NCAA will deal directly with the team that collaborated with the aftermarket party. The manufacturer should make a best effort to produce a tamperproof bat, e.g. no screw-on endcap.

Testing Protocol

Bat Preparation Procedures

1. Measure and record model, length, weight and location of balance point.
2. Draw impact lines and axis line.
3. Measure and record diameter at 3", 4", 5", 6", 7", 8" and 9" from the tip of the barrel and 8" from the base of the knob.
4. Drill safety-pin hole at 1-7/16" from the base of the knob.

Mounting in the BHM
Mount in grip, lock with safety pin 1-7/16" from base of the knob such that the rotation axis is 5-7/16" from the base of the knob, and align axis of bat with ball center. The grip material will be astroturf. The grip material will be uniform from test to test, and no set of grip material will be used for more than 8 hours of continuous testing. The grip material will be allowed to relax for a minimum of 8 hours before being reused.

Bat-Swing and Ball Pitch Speeds
Input target speeds of 66$\pm$1 mph for the bat swing speed (velocity measured at a point 6 inches from the barrel end) and 70$\pm$2 mph ball speed to yield a combined speed of 136 $\pm$ 3 mph. The tolerance on individual input speeds is to allow for test variance on a dynamic hitting machine (Baum Hitting Machine).

Torque Cutoff to Coast
The torque supplied to the bat by the servo is cutoff 12.8 inches prior to impact. This torque cutoff ensures that the bat is coasting through the bat/ball collision as opposed to being powered through the collision. This 12.8-in. specification is accomplished by using a pot value of 0.32 in the servo-control program, where each 0.01 of pot setting equates to 0.4-in. Therefore, because the bat speed may vary from test to test, the coast time will likewise vary from test to test, but the coast distance is fixed to be 12.8-in.

Determination of a Valid Hit
For a reading to be valid, ball exit speed as measured at the 72" speed-gate location must be less than the higher of the speeds as measured at the 9" and 13" light-cell positions. The pitch speed

must be within $\pm$2 mph and the swing speed must be within $\pm$1 mph of their respectively prescribed values. The combined speed must be within $\pm$3 mph of its prescribed value.

The bat speed on the datasheet is measured at the impact location. This impact location is not always at the 6-inch position on the bat. Therefore, the swing speed to conclude whether or not the hit was valid needs to reflect the appropriate speed at the point of contact for a swing speed of 66 mph at the 6-inch location. The following formula calculates the ideal swing speed at the point of contact:

$$V_{contact} = 66 \cdot \frac{(Length - 5.375 - Location)}{(Length - 11.375)}$$

Where V is bat speed at the 6-inch location, $V_{contact}$ is the bat speed as recorded on the test datasheet, *Length* is the overall length of the bat, and *Location* is the hit location, e.g. 6.5-inch, or 7.0 inch, etc. A valid swing speed must be within $V_{contact}$ $\pm$1.

The ball must pass through the exit hole and not be too far left or right or high or low. The target is 62-1/16 in. from the impact point. The target is a diamond with equal diagonals of 13-in, i.e. a square, as shown in Fig. 1. One diagonal is horizontal and parallel to the bat axis. Three strings hang in the target for judging ball position manually. One string hangs from the top center of the diamond and extends to the horizontal diagonal. Parallel strings hang $\pm$2 in. on either side of the centerline string. If a ball hits the left string, then it is described as being *"too far left"*. If a ball hits the right string, then it is described to be *"too far right"*. If the center of the ball is judged by the test operator to be >2 in. below the horizontal centerline of the target, then it is described as *"too low"*. If the center of the ball is judged by the test operator to be >2 in. above the horizontal centerline of the target, then it is described as *"too high"*.

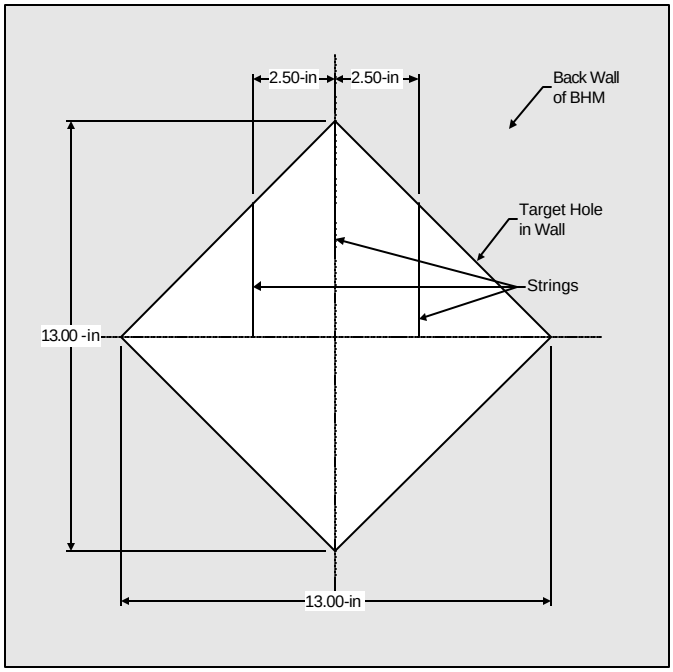

Fig. 1 BHM Target Window

Exit-Velocity Readings and Impact Location

All bat positions are measured with respect to the distance from the tip of the barrel. Raw data exit velocities are to be recorded with testing commencing at the 6" point. Bat profiling will continue with hits at the 5", then the 7" points. If deemed necessary for certification purposes, bat profiling will continue at the discretion of the certification personnel with hits at additional points by using 1" and/or 0.5" increments. Five (5) consecutive valid exit-velocity readings are to be recorded at each of the bat-axis impact locations. Consecutive valid readings will be determined without regard to any interspersed invalid readings; thus, for example, three valid readings, followed by an invalid reading, followed by two valid readings will be considered five consecutive valid readings. The total number of hits may vary from bat to bat.

The ball exit speed ratio (BESR) is defined by:

$$BESR = \frac{\left(v^* - \frac{(V - v)}{2} \right)}{(V + v)}$$

where v and v^* are the ball entry and exit speeds, respectively, and V is the bat entry speed (this is the speed at the 6" point on the bat). Therefore, the measured bat input speed should be adjusted accordingly to reflect the bat input speed at the 6" point by use of the formula:

$$V = V_{contact} \cdot \frac{(Length - 11.375)}{(Length - 5.375 - Location)}$$

Where V is bat entry speed at the 6-inch location, $V_{contact}$ is the bat entry speed as recorded on the test datasheet, *Length* is the overall length of the bat, and *Location* is the hit location, e.g. 6.5 in. or 7.0 in.

This relationship will be used to normalize the data with respect to bat and ball input speed variations. The BESR shall be the average of five valid readings at the point of maximum velocity as discussed above. At the point of maximum exit velocities, an average of 5 valid hits is used to conclude legality. If at anytime during the certification process the average of 5 consecutive valid hits exceeds the limiting BESR, then testing is halted and the bat is concluded to be illegal for NCAA competition. [Note: The wood bat standard will be based on at least three valid hits at each of the three above impact locations.]

The NCAA is continuing to study the issue of work-hardening in nonwood bats. At this time, the protocol will not contain specifications that attempt to address the issue of work-hardening, and none will be enforced before Aug. 1, 2000. However, if research reveals solid evidence related to this phenomenon, the protocol may be changed in the future in an effort to take the effects of work-hardening into account in the certification process.

The nonwood bats will be randomly rotated prior to each hit. The wood bats will be rotated 180 degrees prior to each hit according to standard wood bat usage, i.e. label up and label down. Alignment of the bat will be checked before each hit.

Length-to-Weight Unit Differential
The length-to-weight unit differential of each nonwood bat shall not exceed three units without the grip. Each length-class and weight-class combination of a particular model must be certified for compliance.

Bat Surface
The surface of the bat tested for certification must be the same as that of the production bat model which it represents and may exclude graphics.

Bat Diameter
The barrel diameter shall be no greater than 2.625 inches. A certified bat ring (no more than 1/4-inch thick) with an interior diameter of 2.657 inches must pass completely over the length of each bat prior to each hit. If the ring fails to pass over the entire length of the bat, then the bat is concluded to be illegal for NCAA competition.

Balance Point
There is no specification for the center of gravity, a.k.a. the balance point. However, the balance point will be recorded.

Baseball Specifications
The ball shall have a weight of 5.12±0.035 oz. The circumference of the ball shall be 9.05±0.05 in.

In a lot of 144 baseballs, six (6) will be randomly selected and tested to ensure that ball compression is no greater within a reasonable range than the compression characteristics of balls used in previous testing during August and September, 1999. If any one ball fails to meet this compression standard, then the entire lot is concluded to be unusable for certification testing. The six (6) balls tested will not be used for bat testing.

All baseballs to be used for certification will be tested on the BHM and the exit velocity will be recorded. The balls will be hit on the logo panel with the 6-in. point of a 34/31 Baum AAA Pro bat with a 2.5" diameter and a mass moment of inertia greater than 680 lb-in^2 at (70±2 mph pitch)+(68±1 mph swing speed @6" point)=138±3 mph. Baseballs for certification testing must fall within the acceptable exit velocity range (94±1.5 mph).

The initial BESR standard was generated using the Rawlings R100 NCAA ball, which qualified to a nominal speed of 94 mph using the standard bat at 70/68. In the event that the baseball is changed to a nominal speed other than 94 mph by some amount x, then the BESR will be recalculated using the wood-bat database where the batted ball speeds will be adjusted by this amount x, e.g.

$$BESR = \frac{\left(\left(v^* + x\right) - \frac{\left(V - v\right)}{2}\right)}{\left(V + v\right)}$$

X will have a negative value if the nominal speed drops below 94 mph.

If new balls are utilized in future testing, the characteristics of those balls will be taken into consideration to ensure that no bat or type of bat is disadvantaged by the change in balls. Testing of balls to recalculate the maximum BESR shall be performed utilizing Baum bats of the same model and with the same characteristics described above. A change in BESR resulting from a change in balls shall not render previously compliant bats noncompliant. Any such change shall not materially alter the margin of compliance for compliant bats.

Ball Impacts
Each of the test baseballs used during certification tests will be impacted a maximum of eight times (two sets of impacts on four opposite panels). Hitting will commence with the logo panel.

Bat Preparation
Bats will be brought to laboratory environment temperature prior to testing.

Baseball Preparation
Baseballs shall be stored in the laboratory environment for at least 24 hours prior to testing. Baseballs shall be stored in airtight containers. The balls shall be weighed again just prior to testing. Baseballs must meet the weight and circumference specifications in order to be used.

Laboratory Environment
The temperature in the testing lab shall be 75±10°F and a relative humidity of 45±15%.

Manufacturer Attendance
Manufacturer attendance is optional. Outside observers representing the organization that submitted the bat for testing may be present, but must follow the directions of the certification operators.

Pass-Fail Criteria

1. The bat must meet the size and weight specifications.
2. There are no tolerances for length-weight ratio (no greater than three units without the grip) or maximum barrel diameter.
3. The bat ring must pass over the entire length of the bat before and after every hit.
4. The ball exit speed ratio (BESR) as determined from the average of 5 consecutive valid hits at the maximum velocity location as described above must not exceed the stated BESR limit.
5. The bat's BESR must be less than .728 (which corresponds to 97 mph).

Revisions
The NCAA will revise the protocol as needed and reserves the right to change the test equipment, test location and the testing personnel. Any change in the protocol shall not be utilized prior to August 1, 2000 to prohibit the use of any previously certified bats. The NCAA will make every effort to make any future changes to the rule or protocol well in advance of any baseball season, which would be affected by that change.