

Review of 2009 MLB Baseball Bat Regulations (i.e. What to expect from the bat manufacturers?)

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You probably heard about the MLB Broken Bat Study that was conducted in 2008. On December 9, 2008 MLB announced that they had adopted changes that would affect the 2009 Bat Supplier Regulations.

http://mlb.mlb.com/news/press_releases/press_release.jsp?ymd=20081209&content_id=3708345&vkey=pr_mlb&fext=.jsp&c_id=mlb
The Press Released announced the following:

From July-September 2008, 2,232 bats broke during Major League games - including both cracked bats that stayed in one piece and bats that broke into multiple pieces - and were subsequently collected and submitted to the experts for analysis. Among the 2,232 broken bats, 756 broke into multiple pieces. The two primary modes for the multi-piece breaks were due to poor-quality "**slope of grain**" and/or **ruptures** caused by excessive bending. Slope of grain is a term used in the wood industry to quantify how straight the grain is along the edge (radial) and flat (tangential) faces of a piece of wood. As the straightness of the grain decreases, the durability of the bat decreases.

The study by the Safety and Health Advisory Committee concluded that among the 756 multi-piece broken bats, maple bats were three times more likely than ash bats to break into two or more pieces. The failed bats showed that the maple bats were four times more likely to have broken due to poor-quality slope of grain than the ash bats failing in the same manner.

To address the slope of grain issue, the team of experts compiled nine recommendations to reduce the frequency of multi-piece bat failures, all of which have been adopted for 2009:

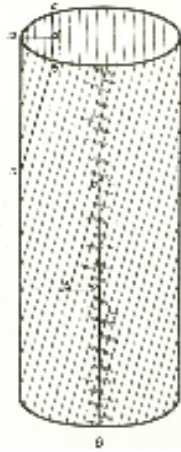
1. All bats must conform to slope of grain wood grading requirements which apply to the 2/3 length of the billet that will constitute the handle and taper regions of the bat. All manufacturers must identify and grade the handle end prior to production of the bat to ensure that its slope of grain satisfies the grading requirement.
 2. All manufacturers must place an ink dot on the tangential face of the handle of sugar maple and yellow birch bats before finishing. Placing an ink dot enables a person to easily view the slope of grain of the wood.
 3. The orientation of the hitting surface on sugar maple and yellow birch [sic] bats should be rotated 90° (one quarter turn of the bat). The edge grain in maple that is currently used as the hitting surface is the weaker of the two choices. To facilitate such a change in the hitting surface, manufacturers must rotate the logos they place on these bats by 90°.
 4. Handles of sugar maple and yellow birch bats must be natural or clear finish to allow for inspection of the slope of grain in the handles.
 5. Manufacturers must implement a method of tracking each bat they supply (e.g., serial number) so that each can be linked back to the manufacturer's production records.
 6. Representatives of each authorized manufacturer should be required to participate in an MLB-sponsored workshop on the engineering properties and grading practices of wood as they relate to the manufacture of solid-wood baseball bats.
 7. Manufacturers should be visited on a regular basis by MLB or its designated representatives to audit each company's manufacturing processes and recordkeeping with respect to bat traceability.
 8. Audits should be randomly conducted of bats by MLB or its designated representatives at the ball parks to ensure that the new bat requirements are being followed.
 9. A formalized third-party bat certification and quality control program should be established to certify new suppliers, approve new species of wood, provide training and education to bat manufactures, and address issues of non-compliance.
- The team of experts believes that implementation of these recommendations will have an immediate impact in the 2009 season on reducing the frequency of bats breaking and the number of bats breaking into multiple pieces.

The purpose of this Technical Note is to provide leagues and teams with a better understanding of the wood science that is described in this Press Release. In particular, an explanation of the "slope-of-grain" and "rupture" types of bat failures. This understanding will help you to better assess the quality of wood bats that are manufactured according to the new 2009 Regulations.

I hope that you will find this Technical Note informative, and decide to forward it to your colleagues and teammates. We feel that it is important for players and teams to understand all of the changes that will occur in the wood bat industry this year.

Explanation of “Slope of Grain” in Wood

“Slope of grain” is a measurement of the angle at which a piece of wood is cut out of the log. For example, every log has a line running through it that would be the “0-degree line” – in other words, if you SPLIT the log, it will split along this line that represents 0-degrees. However, when you saw the log up into wood blanks for making baseball bats, the saw may not cut perfectly parallel to the 0-degree line. When you have a slope-of-grain angle that is greater than 0-degrees, then your wood is less than perfect.



There are 2 types of slope of grain.

← **Radial** slope of grain is the angle the annual rings make to the 0-degree line.

Tangential slope of grain is the angle of the grain on the flat-grain face. If you split a log into “pie wedges”, it will split along the tangential slope of grain you see here. →



Radial Face grain

Tangential Face grain

The important phenomenon that is important to understand is that the RADIAL PLANE in wood is the WEAKEST plane. This plane runs from the center of the log (pith), to the outside of the log (bark)... and longitudinally, follows the tangential slope of grain that you see on the above right.

An example of this WEAK RADIAL PLANE is easily observed in a round log that has developed a split, as shown below. The radial plane is the weakest plane in all species of wood.



It is also important to understand that when you see a BAT FAILURE like the one shown below, this is a “slope-of-grain” type of failure. We hope that by reading this Technical Note, that you will have a “trained eye” to identify “slope-of-grain” bat failures.



When a bat fails like the one shown above, it is an indication that there is “severe” slope of grain in the wood used to make that bat – **and wood with severe slope of grain is a very weak piece of wood.**

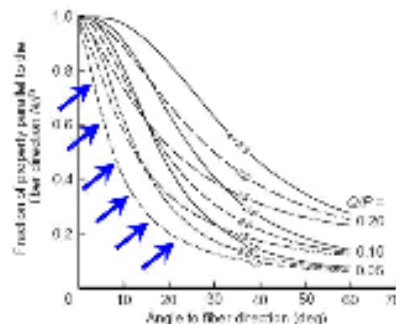
How weak is wood with severe slope of grain?

The relationship of wood strength with respect to slope-of-grain angle is described by an equation called the “Hankinson equation”. Mr. Hankinson probably didn’t know about baseball bats, but what he did know was that when the angle of the grain was less than perfect, the strength of the wood began to drop – very quickly.

The Hankinson equation is represented by the graphs shown to the right. When you want to relate this to baseball bats, the blue arrows show that the absolute bottom curve represents Impact Bending Strength – which is the wood property that would be most related to the strength of baseball bats. “1.0” on the y-axis is 100% strength, and that applies to 0-degrees slope-of-grain (on the x-axis).

- Strength loss due to Slope-of-Grain

100% strength wood is like a piece of wood that has been SPLIT out of a log. What is amazing is that even at small slope-of-grain angles, the strength of the wood quickly decreases. For example, wood with a 10-degree slope-of-grain quickly drops to only about 30% of the strength of perfect straight-grained wood.



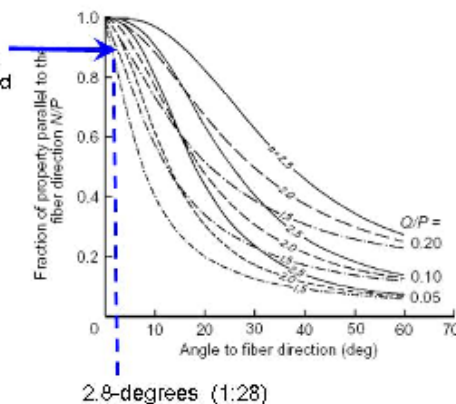
Lowest graph is for **IMPACT BENDING STRENGTH** (wood property most related to baseball bat performance)

An example of how to select wood with “good” slope of grain is shown below. If you decided to select a slope-of-grain angle that will assure that you always maintain at least a 90% strength level, compared to perfect straight-grained wood. The same Hankinson graph shows...

- Strength loss due to Slope-of-Grain

When you pick the 0.9 level on the y-axis, and follow the vertical line to the x-axis – you can read what the required slope-of-grain should be. If wood was graded to have a 2.8-degree slope-of-grain, that results in bats that have at least 90% of the strength of PERFECT straight-grained wood.

90% strength compared to perfect straight-grained wood



If you assure straight-grained wood in your baseball bats, this results in extremely strong bats that should survive longer during the season. If the unfortunate happens, and an inside pitch breaks the bat – the straight-grained wood will likely fail as a “rupture” type of failure – as shown below.



Rupture failures are an indications of straight-grained wood.

Explanation of the 2009 MLB Bat Supplier Regulation changes

The changes announced at the MLB Winter Meetings on December 9, 2008 are a generic listing of requirements that MLB-approved bat manufacturers will have to follow. What we are providing here is a detailed description, so that you will better understand the wood science behind the changes.

1. The specific slope-of-grain requirement for the 2009 Bat Supplier regulations is 1:20 slope of grain (reference: 2009 Bat Supplier Regulations; Dec. 25, 2008). That means that the grain can deviate about 1 inch across in 20 inches of bat length. If all manufacturers produce bats that have a maximum slope of grain of 1:20, this will significantly reduce the number of broken bats flying out into the playing field.



As you can see from the photo above, broken bats were being observed in games that had slope of grain as severe as 1:4 - that means that the oval-shaped failure was only about 4" long. That's about a 14-degree angle, which from the Hankinson graph, means that the bat you see above only had about 25% of the strength of a bat with perfect straight-grained wood.

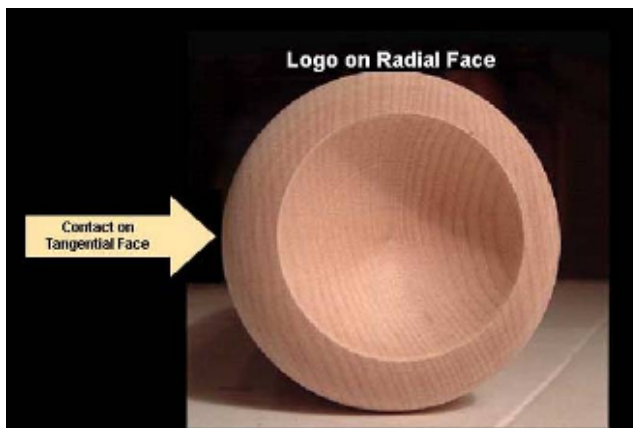
2. Because it can be difficult to see the grain on hard maple, all MLB bat manufacturers will need to place an ink dot on the handle of the bats – 12 inches from the end of the knob. When a drop of ink soaks into the wood, the ink “bleeds” along the grain and this will allow a player, a coach, or inspector to more easily see the grain to determine if it has acceptable slope of grain.



3. For over 100 years, it has been recommended that bats make contact with the edge grain of the wood. That's because the most common wood to use was ash, and that is a **ring-porous** species. A ring-porous species has porous wood cells in every year of growth, and if contact is made too often on the flat-grain, you could experience annual ring separation, as shown to the right.



Wood science shows that flat-grain contact is a stronger orientation compared to edge-grain contact – especially for impact bending strength. This is true of all woods, including ring-porous woods like ash, oak, and elm. Diffuse-porous woods, like maple and birch, do not experience annual ring separation if impact is made on the flat-grain face. Therefore, to take advantage of the extra impact bending strength, MLB is requiring manufacturers in 2009 that hard maple and yellow birch bats are labeled so that contact with the baseball is made on the flat-grain (i.e. the tangential face), as shown below.



4. Because it will be necessary to inspect the handles of bats, MLB will only allow natural-finish handles in 2009. This means that only all-natural and walker-finish bats like the ones shown below will be the only finishes allowed. Black bats will not be allowed in 2009. You will probably still see some players with all-black bats – those will probably be last year's bats.



Changes **5 thru 9** deal with how to “police” the manufacturers. Bats will now have serial numbers to track them all the way back to where the wood came from, bat manufacturers will be required to attend a training workshop on wood science and how that applies to baseball bats, bat suppliers and the bats themselves will have to be inspected to make sure that everyone is following the new standards, and a system will be in place to test and approve any new species that are introduced.

Thank you!

If you have read this far, we thank you for your time, and hope that this Technical Note was informative. Feel free to contact us if you have any questions.

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