



de Terminator

By:



INSTRUCTION MANUAL

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What Is Mass Bias?

The term “**mass bias**” refers to the fact that the center of mass of a bowling ball is not located directly under the pin of the ball. Having a “mass bias” causes the center of gravity (CG) mark of a ball to move away from the pin, resulting in a pin-out ball. Therefore, all pin-out balls have a mass bias. A **pin-out** ball is one on which the pin is at least one inch from the CG mark on the surface of the ball. Technically speaking the term “mass bias” is actually short for “enhanced mass bias.” Enhanced mass bias refers to increasing the dynamic effect of shifting the center of mass away from the pin by having a specific part of the core present on one side of the ball that is not present on the other side of the ball. Enhancing the mass bias affects the direction and rate at which the ball migrates toward its preferred spin axis. Track flare is caused by the migration of the bowler’s positive axis point (PAP) toward the ball’s preferred spin axis. Knowing the location of the mass bias greatly increases the ball driller’s ability to create the desired ball reaction for every bowler by accurately marking the correct layout for each ball chosen.

Introduction to the DeTerminator

The DeTerminator is designed to accurately find the location of the mass bias on the surface of a bowling ball and to measure the responsiveness of the ball’s design to lane friction. The mass bias location can then be used along with the pin to accurately and reliably lay out a bowling ball to obtain the most appropriate reaction for a bowler. The DeTerminator is the **ONLY** tool available to accurately find the mass bias of a plugged ball.

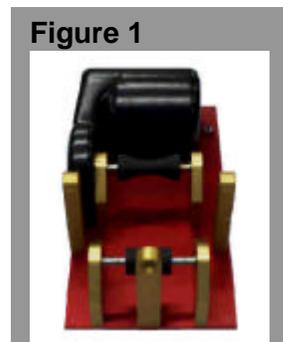
The strength of a ball’s mass bias is measured by finding how long it takes the ball to reach its preferred spin axis from its most dynamic layout position. The faster the ball reaches its preferred spin axis, the stronger its mass bias is, and the stronger the mass bias is, the more dynamic the ball is. The DeTerminator, when used properly, will allow the ball driller to produce the best ball motion for every bowler.

The location of the mass bias on an undrilled ball is found by spinning the ball two times with the DeTerminator from two different starting positions, and then marking the ball’s preferred spin axis on each spin. Using those two marks and the pin, the mass bias can be quickly and accurately located.

The DeTerminator will find the mass bias for almost all pin-out bowling balls. On some balls with weaker core designs, the mass bias cannot be found because the ball will not stabilize on a preferred spin axis. A pin-in ball does not have a mass bias, unless otherwise indicated by the manufacturer.

Setting Up Your DeTerminator

The DeTerminator comes to you fully assembled. To set up the DeTerminator, simply set it on a sturdy table or bench with the motor away from you (see Figure 1), plug it in, and it’s ready to use. **It is very important to make sure the table or bench is solid**, because table movement during operation may cause the ball to wobble slightly, which will affect your measurements or produce inaccurate results.

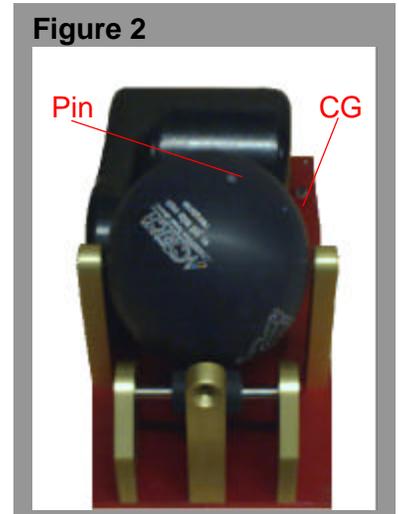


Finding the Mass Bias

The mass bias location of an undrilled ball can easily be found by spinning the ball two times on the DeTerminator. A ball's preferred spin axis on each spin will be either on the mass bias (Y-Spinning), or approximately 90° from both the mass bias and the pin (Z-Spinning). The following explains the step-by-step procedure in detail.

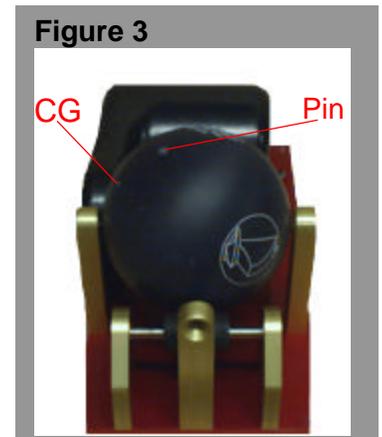
First Spin

1. Place the undrilled ball on the DeTerminator with the pin up, just right of the top of the ball, and the center of gravity (CG) directly between the pin and the spin axis locator on the right side of the Determinator (see Figure 2).
2. Turn on the DeTerminator, and allow the ball to stabilize on its preferred spin axis. This should take from 6 to 30 seconds, for most balls, or even longer for balls with weak cores. The best way to tell that the ball has stabilized is to insert a grease pencil into the right-side axis locator column. If the circle made by the pencil does not move, then the ball has stabilized. If the circle moves on the surface of the ball, then the ball has not yet stabilized. Continue checking in this way until the ball has stabilized.
3. Once you are sure the ball is stable, insert a grease pencil through the hole in the right-side axis indicator column to mark the position of the ball's preferred spin axis.
4. Turn off the DeTerminator. Make sure the mark you made is dark enough that it will not be erased during the second spin. You may find it necessary to mark this spot with a scribe.



Second Spin

1. Once again, place the ball on the DeTerminator, this time with the pin just left of the top of the ball, and the CG directly between the pin and the left-side axis locator (see Figure 3).
2. Turn on the DeTerminator, and allow the ball to stabilize on its preferred spin axis as you did on the first spin.
3. With the ball still spinning on its preferred spin axis, mark the position of the ball's preferred spin axis by inserting the grease pencil through the hole in the left-side axis locator column on the DeTerminator, making sure the ball has stabilized on its preferred spin axis.
4. Turn off the DeTerminator. You are now ready to pinpoint the location of the mass bias.



Locating the Mass Bias

Once you have located the preferred spin axis from each side of the ball, you can find the exact location of the ball's mass bias. There are two possible scenarios for finding the mass bias location on the surface of the ball.

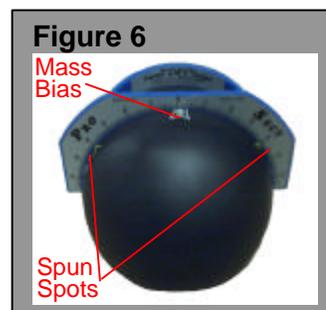
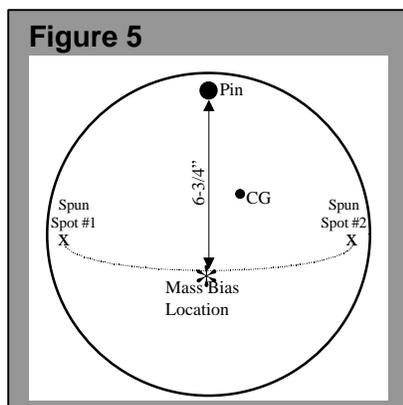
First Scenario—Two Marks Are Very Close To Each Other or on the Same Point

If the two marks, or “spun spots,” are on the same point or within a few inches of each other, then the ball has a **Y-Spinning** core. A ball with a Y-Spinning core spins on its mass bias. This is an indication that the ball is high revving, and that the mass bias is strong. The reason the two spun spots may not be the same for a Y-Spinning core design is because the force of gravity is pulling to the right side of the ball on the first spin and to the left side of the ball on the second spin. This causes the two spots to be slightly separated. The closer the spun spots are to each other, the stronger the mass bias is, because the ball's mass bias is able to overcome more of the force of gravity.

In the case of a Y-Spinning core, the mass bias is located exactly between the two spots. If the spots are in the same place, then that is where the mass bias is located. The marks may be up to as much as eight inches apart on a Y-Spinning core. A Y-Spinning core with preferred spin axes more than two or three inches apart is considered to be a weak Y-Spinner.

Second Scenario—Two Marks Are Far Apart

If the two marks are not close to each other (approximately 11-16” apart measured on the side of the ball with the CG), then the ball has a **Z-Spinning** core. The mass bias for a ball with a Z-Spinning core is found using a Pro-Sect™. Place the rib intersection of the Pro-Sect™ on the pin (see Figure 4), and align the Pro-Sect™ so that the two spun spots are equal distances from the “0” position on the scale. The ball's mass bias is located at this “0” mark (see Figures 5 and 6).

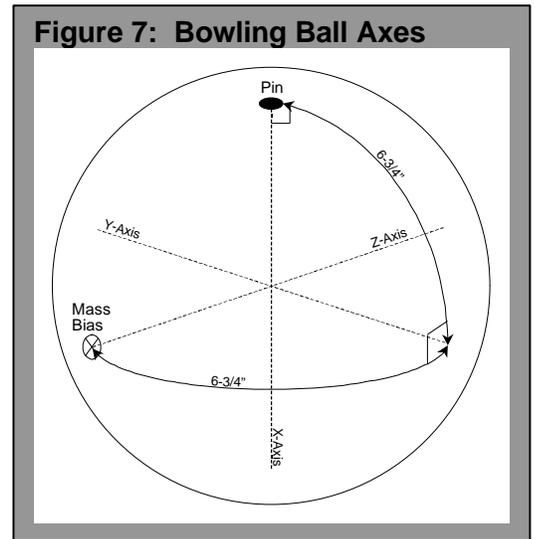


Layouts for Balls With Factory-Marked Mass Bias

Use drilling instructions for marked mass bias balls supplied by manufacturers to lay out the ball. Both Ebonite and Track have a line of balls with the mass bias marked on the opposite side of the ball from the CG. For these balls, use the point 13 1/2” from the mass bias you find using the DeTerminator, and follow the manufacturer's drilling instructions.

Y-Spinning Versus Z-Spinning Balls

This manual mentions that a ball with a mass bias has either a Y-Spinning core or a Z-spinning core. The difference between the two is where the ball's preferred spin axis is on the ball. The ball can be imagined to have three axes (see Figure 7). The X-axis goes directly through the pin and the center of the ball. The Y-axis runs perpendicular to the X-axis, and goes directly through the mass bias mark on the surface of the ball and through the center of the ball. Hence a ball that spins around its mass bias has a Y-Spinning core. The Z-axis also goes through the center of the ball, and runs perpendicular to both the X and Y-axes. A Z-Spinning core spins 90° from both the mass bias and the pin.



Measuring the Motion Potential of a Bowling Ball

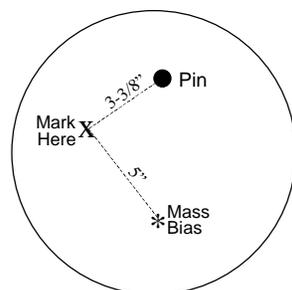
Once you have located the mass bias, you can find out how “strong” a ball is by measuring its relative motion potential. Motion potential of a bowling ball is defined as the ball's ability to respond to changes in friction between the surface of the ball and the lane and the shape of the resulting breakpoint. The best way to measure the strength of the core design is to time how long it takes a ball to reach its preferred spin axis from its specified most dynamic layout. This measurement is a result of the combination of core design and the cover stock material. The DeTerminator is the only tool designed to accurately measure a ball's relative motion potential.

Measuring the Time For a Ball To Reach Its Preferred Spin Axis

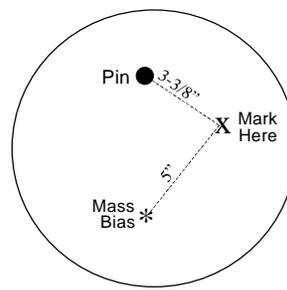
1. Locate and mark the mass bias on the bowling ball.
2. Using the pin and mass bias as reference points, mark a point 3-3/8 inches from the pin and 5 inches from the mass bias, following the diagrams below. When you make this mark, be sure you have the pin above the mass bias.

NOTE: The mark is on a different side of the ball for left and right handed bowlers!

Figure 8: Making New Mark

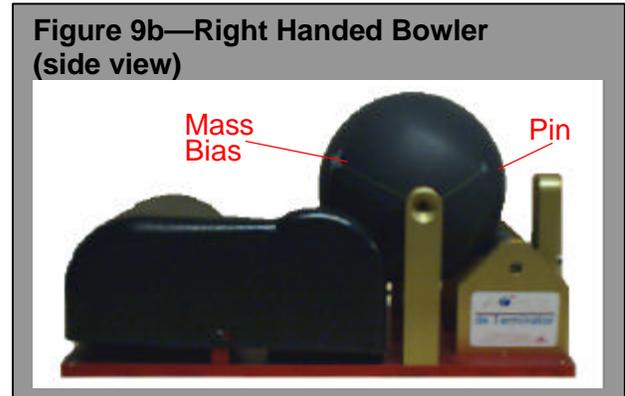
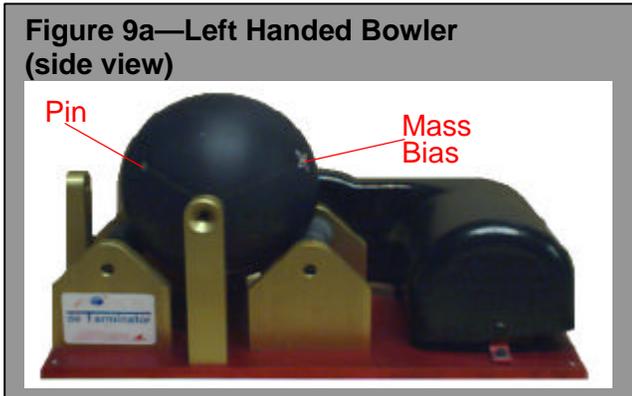


Left Handed Bowler



Right Handed Bowler

3. After you have marked this spot place the ball on the DeTerminator with the mass bias toward the motor and the marked spot on the spin axis of the DeTerminator (see Figure 9). **Use the right axis locator column for a left handed bowler and the left axis locator column for a right handed bowler.**
4. Turn on the DeTerminator, and measure the time it takes for the ball to reach its preferred spin axis.
5. Repeat this procedure several times (at least three), and find the average time. You may choose to record the time on the chart on page 6, to easily compare a ball's motion potential to other balls.



Analyzing a Ball's Relative Motion Potential

The faster a ball reaches its preferred spin axis, the stronger and more dynamic the core design is. Remember that the DeTerminator only measures the motion potential of the core. You will need to consider the shell material information provided by the manufacturer, along with the motion potential measurements you found for the core using the DeTerminator to accurately evaluate the motion potential of the ball. You can now select the best way to lay out a ball. Remember that a more aggressive cover stock will cause the ball to hook earlier, and milder, less aggressive cover stocks delay the ball's reaction to friction with the lane surface, causing it to start hooking later.

