

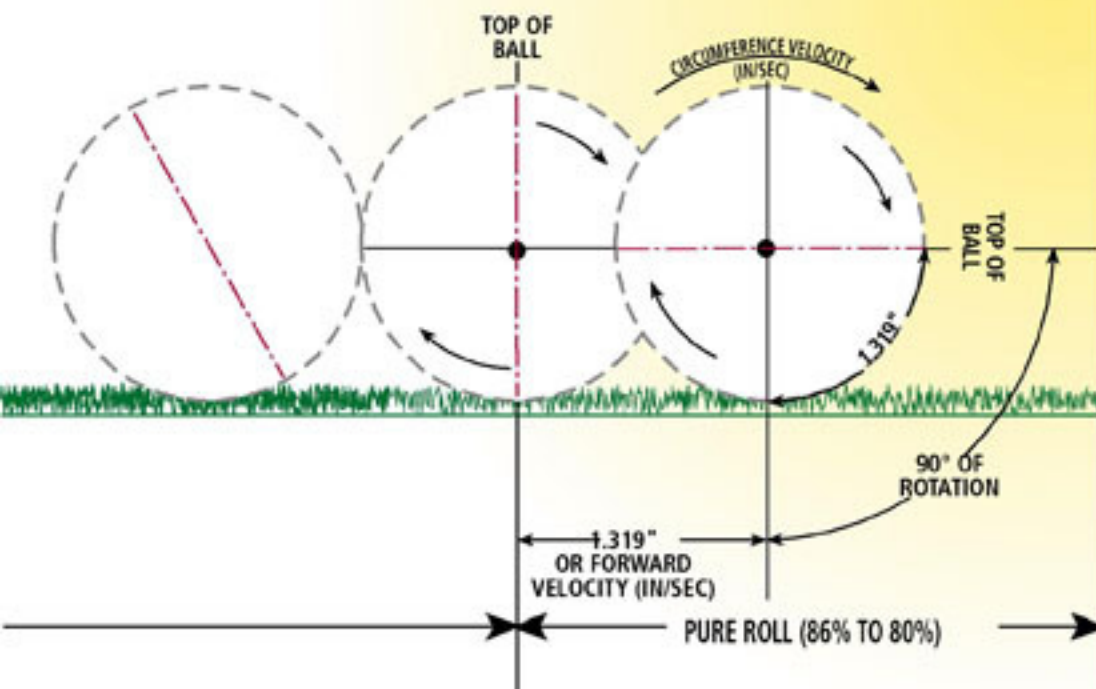
NOTES:

1. A putter with 4° of loft will always impact the ball .060" below the golf ball's center.
2. At impact a certain force is applied to the ball. The force path should be horizontal and the loft impact vector should be 4°. This difference causes the ball to rise up .075" (range .050" to .100" on a 10 foot putt) it usually causes backspin rotation also. The ball rises higher and has greater backspin rotation as the length of the putt increases. This gets the ball out of its depression from sitting in the grass to more on top of the grass.
3. The rise of the ball after impact is gradual and its decent back into the grass is gradual. This all takes place in the skid phase of the putt. It does not however descend to its lowest position when it was at rest at any time during the putt except when it stops again.
4. At impact the putter face should make contact with the ball at approximately 1/2 its face height (this will usually keep the putter head center of gravity equal to or preferably below that of the ball in most cases. However, it is usually best to impact the ball slightly higher on the club face (this is determined by the individual design C.G. of the putter) but this requires a higher skill level because the putter sole comes closer and closer to the grass. My personal opinion is that if you can repeatedly hit the ball at 1/2 the putter face height and consistently within a range of plus or minus 1/8" you will be consistent. I say my personal opinion because the research I have done to date does not show a significant measurable difference in distance control within this range. Finally on this subject, the rule of thumb should be to keep the putter head as low as possible with the shallowest vertical arc for ultimate consistency.

CONDITIONS TO ACHIEVE PURE ROLL

CIRCUMFERENCE VELOCITY (IN/SEC) = FORWARD VELOCITY (IN/SEC)

CIRCUMFERENCE OR SURFACE ROTATION (INCHES) = FORWARD MOVEMENT (INCHES)



PUTTER LOFT AT IMPACT A TECHNICAL DISCUSSION OF SKID VS. ROLL

It is important to understand what happens when a ball is putted. This helps in the putter fitting process and ultimately to have golfers putt better. First of all every putt skids before it begins pure roll regardless of what the advertising says. When you analyze what happens to a ball after it is putted, you would come to the conclusion that a minimum percentage of skid and a maximum percentage of roll would be the best situation to control direction and especially distance. This is only true if the ball is putted correctly.

Here is the explanation: Minimum skid can be obtained by striking the top of the ball with the bottom of the putter face (topped). This situation gets the ball into pure roll rather quickly, but the impact imparted no loft to the putt so the result is quite bad. The ball bounces because it was driven into the ground and not lifted slightly up and onto the grass. The final result is that direction probably suffers somewhat, but distance control is very poor. A similar result, although not quite as bad would be to strike the putt with 0° loft.

Research done in my golf club design studio shows that a putted ball performs more consistently when it is struck with approximately 4° of loft. This has also been proven and concluded by other knowledgeable putter research people in the golf industry. Here is what happens when a ball is struck properly. The ball, at rest on the green, is sitting slightly below the top surface of the grass. When it is struck with 4° loft, it is lifted up approximately .050" to .100" (10 foot putt) which places it near the top of the grass. By raising the ball with the 4° loft, it is not driven through the grass which could and usually does have a tendency to make it bounce as it tries to get back up on the grass. Any bounce whatsoever, whether you can see it or not, will cause inconsistency with distance control. Usually, some backspin angle can be measured after the initial hit to be somewhere between 0° to 10° (10 foot putt). 0° is the best situation because the ball will skid less and roll more, however, testing shows that some backspin angle will usually occur. On a 10 foot putt, the ball does not begin to rotate forward until it is at least 2" from the point of impact.

As the putt skids along on top of the grass, the ball and the grass are creating a friction between them which keeps increasing the forward spin rate until the ball is in a "pure roll" state. The pure roll state is determined in my studio by using high speed cameras that record the impact. Pure roll is achieved when the circumference velocity of the ball (inches/second) is equal to the forward velocity of the ball (inches/second). Since the ball is marked in four quadrants intersecting at the ball's center, the forward movement can also be measured in inches. When this distance is equal to the circumference or surface movement through 90° of rotation, this is also pure roll. This number happens to be 1.319" forward movement to equal 1.319" circumference rotation through 90° for a 1.68" golf ball. If a golf ball is struck with too much loft, it will skid more and it will also have a tendency to bounce. We now know that this is not good. Once again, directional control and especially distance control will suffer. Remember, we said earlier that the best putt has minimum skid and maximum roll. This is a very important statement if you add that the putt must be struck correctly (has no tendency to bounce) or with approximately 4° of loft. A correctly putted ball will skid anywhere from 14% to 20% of the total distance of the putt (usually 16% to 18% for better putters) and conversely it will be in pure roll 86% to 80% of the total distance. Of course, skid vs. roll percentage has a lot to do with the type of grass and the putting surface. The goal is to be consistent from green to green on the surface you are putting on at the time. The point here is not to worry about the exact amount of skid you get, although the less the better, but to be as consistent as possible in the amount of skid. It is most important to realize that at impact the golfer needs the correct effective loft of 4° and a very consistent putting arc coming into the ball. Another reason to develop this consistency of skid on every putt is that the putted ball is actually slowing down at a faster rate in skid (more friction) than it is when it is rolling (less friction). Here is the bottom line: if you can be consistent in skid percentage vs. roll percentage you will be more consistent in distance control on the greens. Putting is very important and this is just one area of understanding that can help golfers putt better.

Ask yourself this question. How many putts have you hit in your life where you comment that you pulled it or you didn't hit it or you pushed it? Wouldn't you like to really know if it was you or your equipment? The proper launch angle of 4° to obtain minimum skid and maximum roll is only one part to answering this question. All the parts include loft, lie, length, swingweight and the proper putter head playability factor. When you put them all together properly, then the answer should be, "it was me".