Why are there different size circular saw blades?

The larger and wider the blade, the more power is required to drive it through wood. When we are talking about corded tools, this usually translates into a question of weight and over-all size of the saw. Using a very large and heavy saw for light duty work is simply cumbersome and tiring. When we have lighter duty work to accomplish, we can scale down the entire saw by scaling down the size of the blade and as a consequence the power required to drive it.

In recent years another factor has entered into the equation with the advent of cordless or battery operated tools. Here power comes in limited quantities and hence the availability of power begins to dictate the scaling down of the saw blade. In addition to the question of diameter, there are now a whole new range of thinner saw blades, all seeking to allow more cut on a given battery charge.

There are some reasons for the specific diameter of saws that we see, historically and with cordless driven changes.

When power availability was a minor consideration, the standard portable circular saw blade was 7-1/4 inches in diameter. Why? Because it would easily cut through 2x4's at 90 degrees, but it would also easily cut through a 2x4 at a 45 degrees bevel.

On the larger saws, a 10 inch blade will go through a 4x4 at 90 degrees.

The lighter 5-3/8 inch saw blades would cut through that 2x4 at 90 degrees, but could no longer get all the way through the wood at a 45 degree bevel. So they could cut the occasional 2x they were more generally used for 1x stock and panels.

Small panel saws and tile saws, designed for maximum control where little power was required went down into about 3-3/8 inch diameter blades.

Also the depth of cut for a given diameter of saw is limited by the size of the motor itself. The invention of the flat bottom motor many years ago, or the even more compact European induction motor, permitted more saw blade to stick out beyond the motor housing for a deeper cut. With the new battery technology, where diameter of blade becomes critical in the competition for more board feet per battery charge, we are now working with DC motors, which permit those same 45 degree bevel cuts with a smaller diameter blade simply because the motors are smaller. Hence today you will see the standard workhorse for a cordless saw is 6-1/2 inches diameter rather than 7-1/4. It is all a question of getting just barely the depth of cut we need with the narrowest and smallest diameter blade we can manage.

Another interesting note is that with different size blades, the motors turn at different speeds. Conversely, each motor has an ideal sized blade. That is because there is generally an ideal speed at which the cutting tooth should dig into the wood. The larger the diameter of the saw, the fewer revolutions per minute (rpm) it requires to get the tooth moving through space at the same linear speed. So small saws tend to turn faster -- unless they are optimised for cutting hard materials like ceramic tiles, then they may turn slower. You probably didn't realise that the diameter of the blade had so much to do with power and cutting speed.

Follow this link for a discussion and animation on linear speeds of the cutting teeth.

Keywords:
Woodworking, Saws, Cutting, Blades, Power Tools, Techniques, Tools