HOW TO OBTAIN PLATEAU FINISHES – SIMPLIFIED

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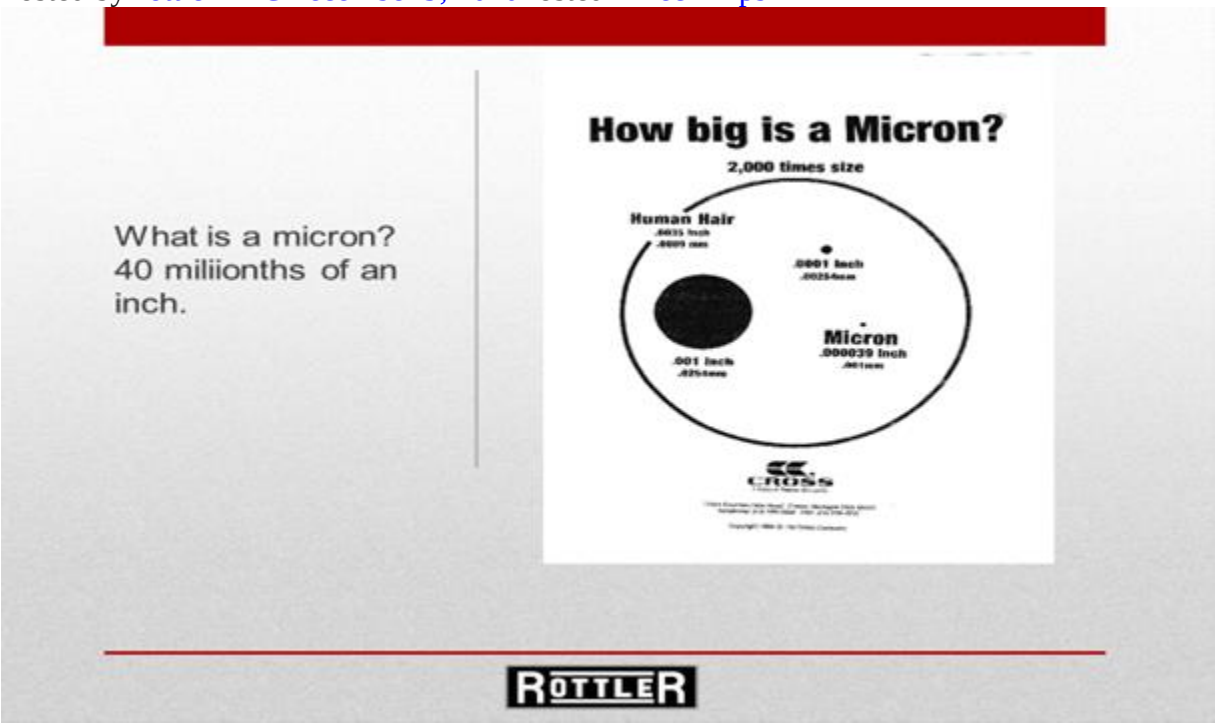

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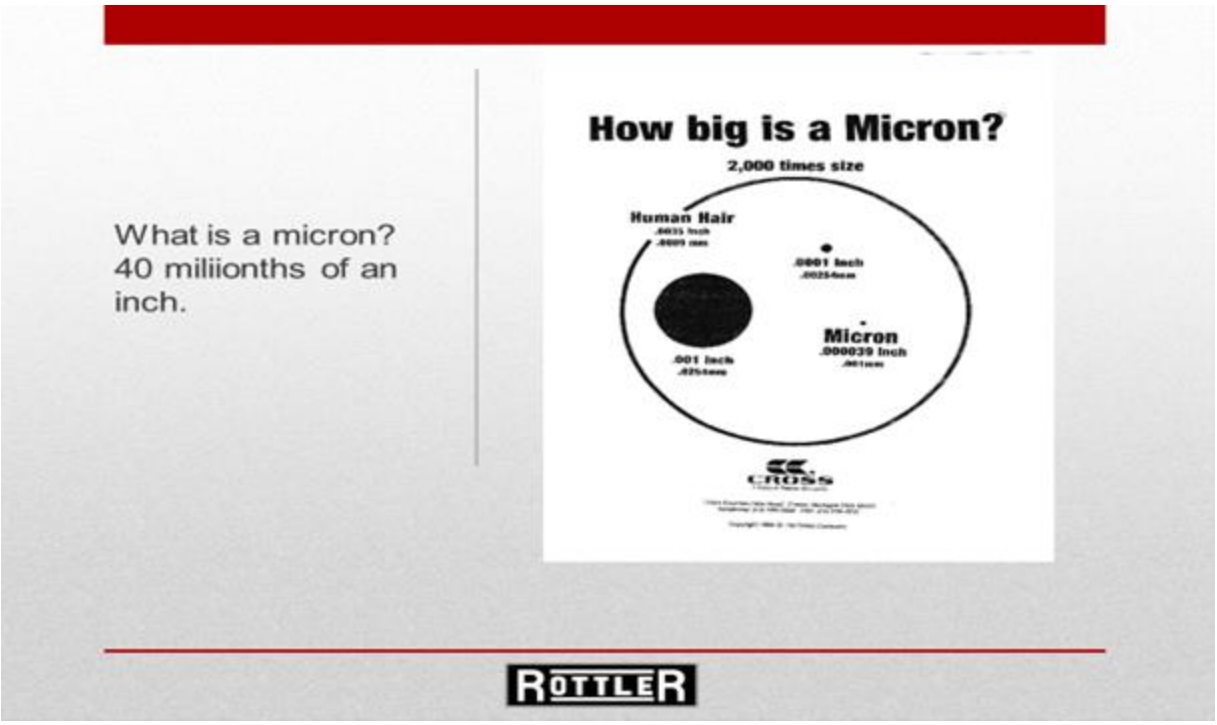
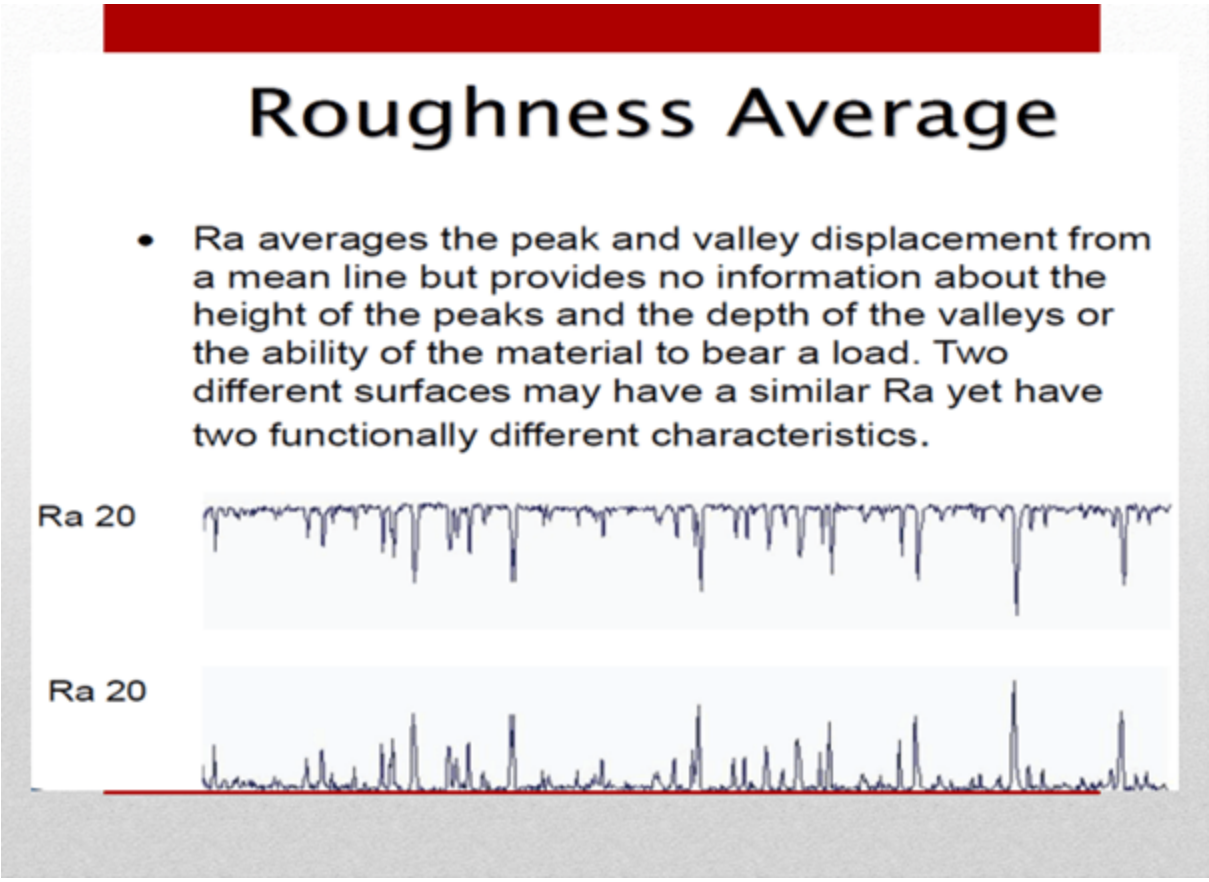
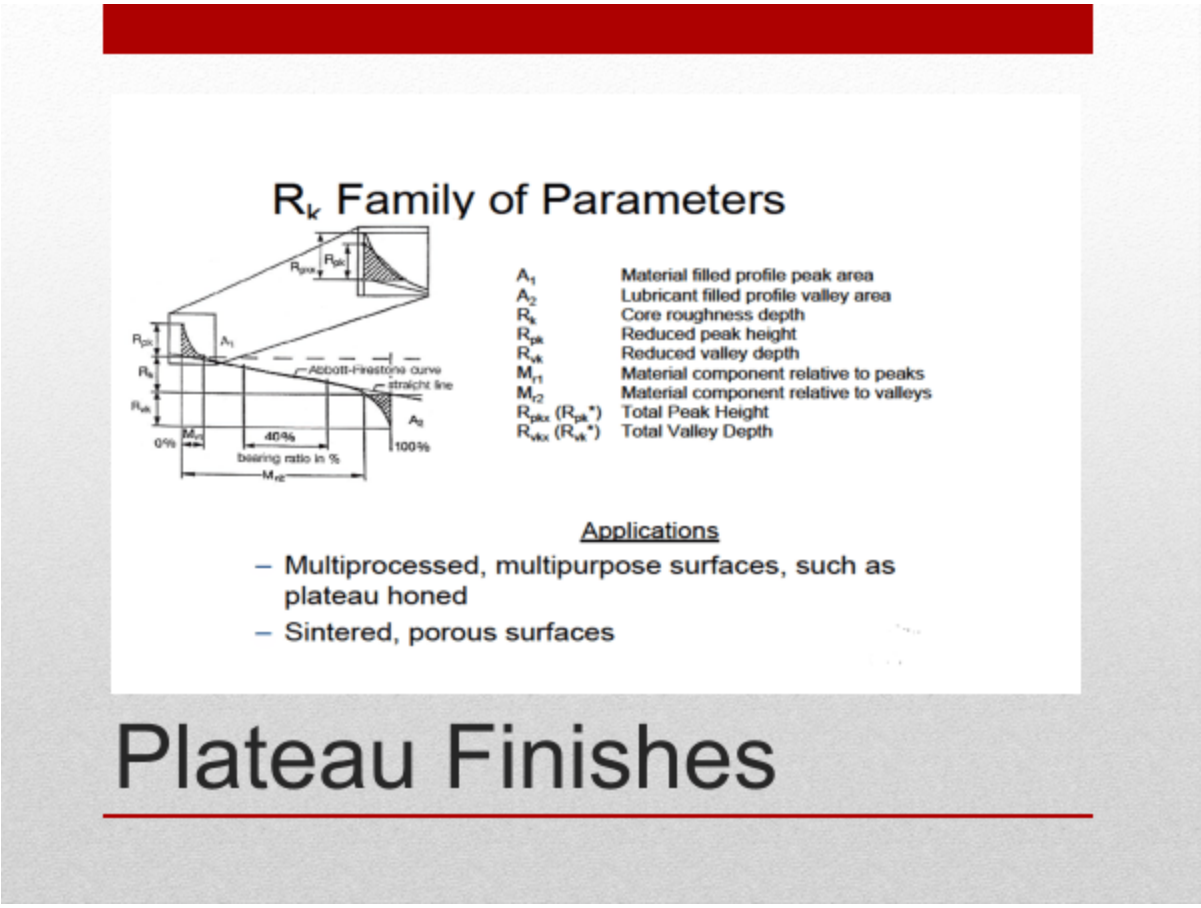
To start this article, it is important to emphasize the extremely precise tolerances that surface finish is measured in. When we talk surface finish, we are talking in microns or 40 millionths of an inch! The example in this article puts that in relationship. The reason we need to understand this is that when you are getting weird or crazy readings on your profilometer you will understand that tiny things (a spec of dirt or lent or one larger than normal scratch) can affect these readings.



When we measure plateau finishes, the common Ra measurement isn't anywhere near enough to understand the quality of the cylinder finish. First, it doesn't give us enough information. Second, Ra only measures the average height and valley from the mean line. The example pictured demonstrates why we cannot use the Ra measurement as our measurement for plateau finishes.



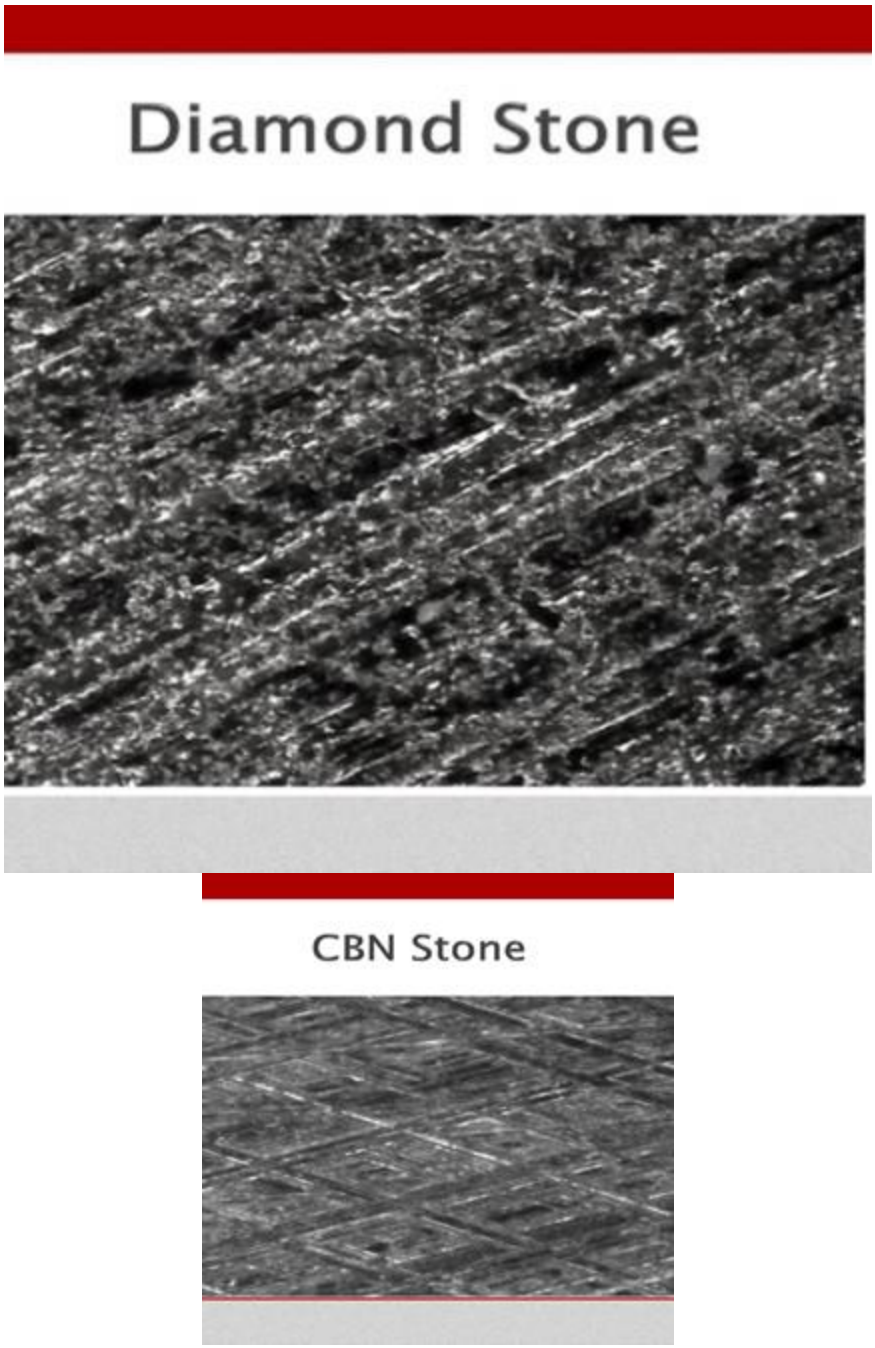
For a clear and accurate understanding of plateau cylinder wall finishes we use the Rk family of parameters. These included RpK, Rvk and Rk which help define the proper surface finish or plateau finish we need for the application the engine is being used in. The example here shows the main three parameters used in plateau finish measurements.



The key to plateau finishes is to determine what grit diamond abrasive or std abrasive you will need for your base finish. For instance if you require a RvK of 50+ a 400 grit diamond or std abrasive wont give you enough deep scratches once you have plateaued the cylinder. So the Rvk is the most important parameter to start with. A 50+ rvk is going to require a grit size ranging from 140 to 200 grit depending on the burnell hardness of the block. *In a nutshell, the harder the Brinell on the block the rougher the grit will need to be to obtain the base Rvk number you desire.* Similarly, To obtain a 50+ RvK in a Dart block, you will need a RvK number of 80+ before you use a fine grit abrasive to get the plateau.

Rvk is what the oil sees. It is important to measure your finish each step of the way. After honing with a rough base diamond, measure your surface finish to determine if you have enough roughness/RvK to obtain the desired RvK number after you plateau. *To reach your Rvk goal, you typically want at minimum 20 to 40 points higher on your roughness readings before plateau honing with a fine abrasive.*

We typically try to keep it to a two-step process when plateau honing which makes it easier and less confusing. It also gives you a true plateau that you can see on the traces of the cylinder finish. I use a 600 grit CBN abrasive to plateau with. *Rpk is what the rings will see.* Most ring manufactures want between 8 to 15 Rpk numbers for their rings. This is why I use 600 grit. The CBN abrasive is a much sharper particle than diamond and cuts much cleaner than a diamond abrasive. With CBN you no longer need to use a brush or plateau brush to help with the finish. The CBN will remove all the torn and smeared metal from the diamond abrasive leaving a very clean and sharp peak and valley pattern.



The biggest misconception in plateau honing is the RpK will continue to get smoother or smaller if I keep honing. That actually isn't true. The 600 grit CBN will leave between a 8 and 15 RpK number whether you hone 6 strokes or 20 strokes. We use the 600 grit CBN to determine RpK so if I wanted a rougher RpK I would use a rougher CBN grit abrasive – say for example

something on the order of 500 or 400 grit. The CBN will also determine RvK numbers. The more strokes I hone with the CBN abrasive the smaller my RvK will get until I reach what I call a base finish which is the actual finish a 600 grit abrasive will create on a cast iron surface. The nice thing about this process is I can take a rougher grit diamond than I really need and simply use more plateau strokes to obtain a smoother or finer finish. This helps prevent the purchase of multiple different grit size of diamond abrasives.

I am typically only worried about the RvK and Rpk numbers. The Rk value is usually a combination of the rough base finish and smooth plateau finish. *We can affect Rk by using a third step in the process*. That can be done if we use a rough (say 140 grit) base finish followed by a medium step (say 400 grit) followed by a plateau finish with 600 grit. This would maintain RvK, maintain RpK but reduce Rk values.

The rough base finish is created simply by using a rough grit abrasive and honing the bore to size making sure it is round and straight. The plateau is a more defined process. We typically use pressure/strokes to determine our finish. So, it is important to apply the same amount of strokes and the same amount of pressure to obtain consistent results when plateauing. We want the hone head to almost immediately have pressure on it before it begins to spin so we maintain even finish thru out the bore. Typical process would be to use 6 strokes at 20% load on the 600 grit CBN abrasive.

A good example is honing a Dart block for general purpose use as defined by Total Seal: I use a 170 grit diamond honed to size. I would then use a 600 grit CBN abrasive for 6 strokes ant

20% load. This should give you the required finish as defined by Total Seal for general purpose use. Those parameters are RpK of 10 to 20, Rk of 35 to 45 and RvK of 45 to 55. If your numbers on RvK are too high then use a couple more strokes with the 600 grit CBN. If they are too low then use a couple less strokes with the CBN abrasive. Its really is that simple.

By using two steps we create a true plateau, we reduce honing time and reduce cost by needing less grit sizes of abrasive.

To serve as example, below are the surface finish parameters required by the ring manufacturers as I know them.

Total Seal

Thin Top ring

RpK 8 to 15

Rk 20 to 30

RvK 30 to 40

General purpose

RpK 10 to 20

Rk 35 to 45

RvK 45 to 55

High pressure/ forced induction

RpK 10 to 20

Rk 55 to 65

RvK 65 to 75

Mahle

All rings

RpK 10 to 20

Rk 25 to 50

RvK 30 to 60

Hastings

Good performance

RpK 8 to 12

Rk 25 to 35

RvK 40 to 50

Pro-stock/Nascar

RpK 3 to 5

Rk 12 to 18

RvK 20 to 50

Some sort of conclusions... something like...

I hope that this helps and gives insight into the critical role that surface finish plays in optimal engine performance. At Rottler, we are always working to improve engine performance thru better machining. I am always looking for new ways to .... etc

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