

Beyond pretreatment: Simultaneous edge radiusing, deburring and coating preparation with exceptional edge radiusing and K-Factor accuracy

This case study highlights Vapormatt’s edge radiusing and K-factor control for end mills, taps, and drills with Alicona-verified measurements.

Below is a collection of 3 tests carried out for major tool manufacturers using Vapormatt wet blasting equipment. All tests required the creation of a specific edge radius on the cutting edge of a round tool. All measurements were taken using an Alicona Edgmaster.

End Mills

Test details

- **Samples** - 30 X carbide end mills. These end mills had four flutes (see Figure 1).
- **Aim of testing** - 15µm edge radius, 2 edge geometries were required- waterfall and symmetric.
- **Machine type** - Oncilla.
- **Abrasive** - 320 mesh aluminium oxide.



Figure 1: A sample end mill

Results

10 tools were processed to each wet blast recipe. A measurement was taken of the four radial cutting edges on each tool, giving a total of 40 readings. The results are as follows:

Aim		Symmetrical	Waterfall
Edge Radius (µm)	Min	14.3	15.9
	Average	15.4	16.4
	Max	17.5	16.9
K factor	Min	0.95	0.70
	Average	0.99	0.78
	Max	1.05	0.84

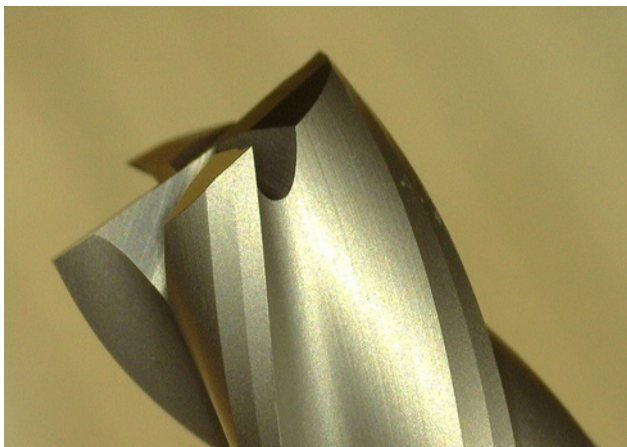


Figure 2: Flutes of a sample end mill after processing

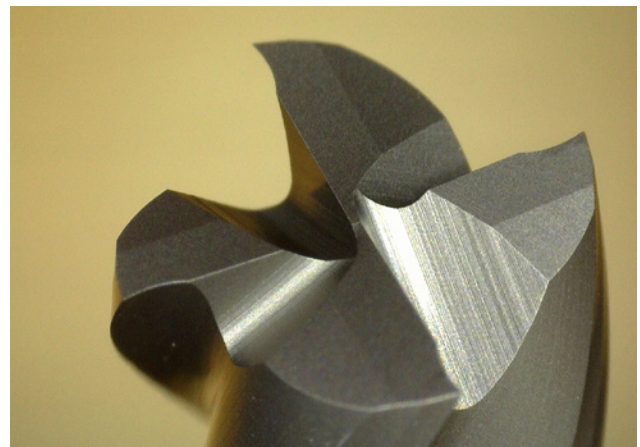


Figure 3: End of a sample end mill after processing

Taps

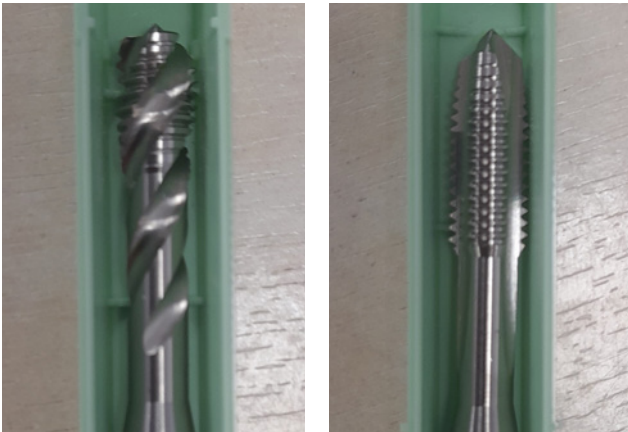


Figure 1: Tap samples. Spiral flute tap (L) and straight flute tap (R)

Test details

- **Samples** – Type 1: 15 X spiral flute M8 HSS cutting tap.
Type 2: 15 X straight flute M8 HSS cutting tap.
- **Aim of testing** - Complete removal of the grinding burrs whilst creating a homogenous edge radius along the whole cutting edge. The desired edge radii are 6, 9, 12, 15 and 18µm for both types of tap.
- **Machine type** – Puma + Vertical.
- **Abrasive** – Various.

Results

One tool was processed for each required edge radius. Nine measurements were taken from each tool on various teeth along the tool.

The results are as follows (note only average radii are shown, all results were within $\pm 1.5\mu\text{m}$ from the average):

Target Edge Radius (μm)	Media type	Average ER achieved (μm)	
		Spiral flute	Straight flute
6	Glass beads	N/A	7.8
9	Aluminium Oxide	8.9	9.5
12	Aluminium Oxide	12.5	12.8
15	Aluminium Oxide	15.0	14.4
18	Aluminium Oxide	17.6	17.7

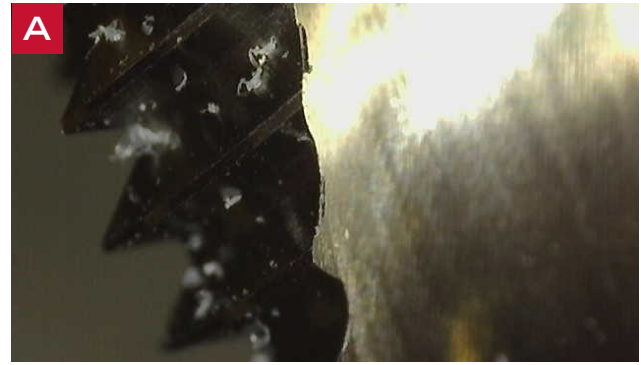


Figure 5: Spiral flute cutting edges before (A) and after (B) processing

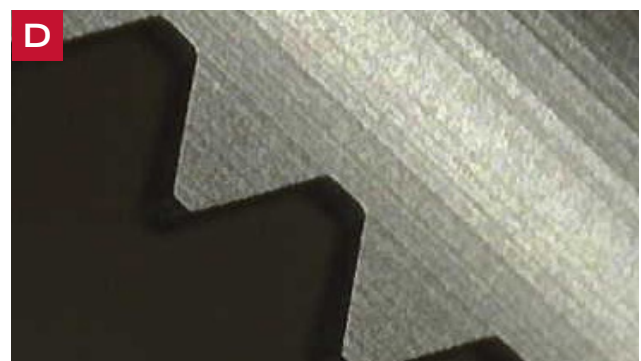
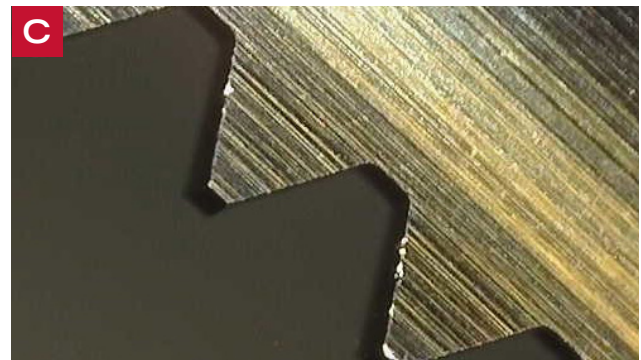


Figure 6: Straight flute cutting edges before (C) and after (D) processing

Drills

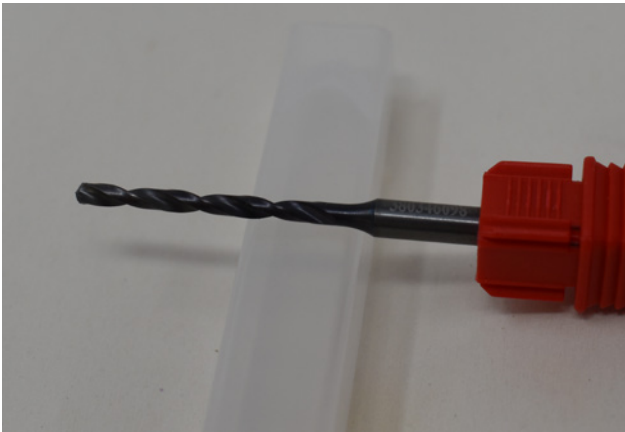


Figure 7: Drill before processing

Test details

- **Samples** – 10 X carbide drills.
- **Aim of testing** - replicate the edge radius on the reference samples.
- **Machine type** – Oncilla.
- **Abrasive** – 150 mesh aluminium oxide.



Figure 8: Microscope photo of drill from after processing

Results

Two tools were used for setup, then eight tools were processed with the successful recipe. Three reference samples were provided. Two measurements from each drill (both processed and reference) were taken. The results are as follows:

		Reference Sample	Vapormatt Sample
Edge Radius (µm)	Min	20.3	22.8
	Average	24.4	24.5
	Max	28.2	25.6
K factor	Min	0.92	0.95
	Average	0.99	1.01
	Max	1.07	1.08

Conclusion

The results of these tests demonstrate Vapormatt's ability to achieve exceptional edge precision and consistency across end mills, taps, and drills - critical factors in tool life and cutting performance.

Key Benefits of Vapormatt wet blasting for round shank tools:

- Beyond pretreatment: Simultaneously performs deburring, precision edge radiusing, and coating pretreatment - three operations in one process.
- Exceptional edge radius precision: Achieves ± 1 micron tolerance on target radii below 10 microns.
- Superior K-factor control: Maintains K-factor variation within ± 0.1 for predictable edge geometry.
- Complete tool processing: Uniform treatment from cutting tip to shank.
- Ideal for complex geometries: Particularly effective for multi-flute tools and fragile micro-tools.

Vapormatt's Oncilla and Puma+ wet blasting machines repeatably deliver the clean, precise edges that drive extended tool life.



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