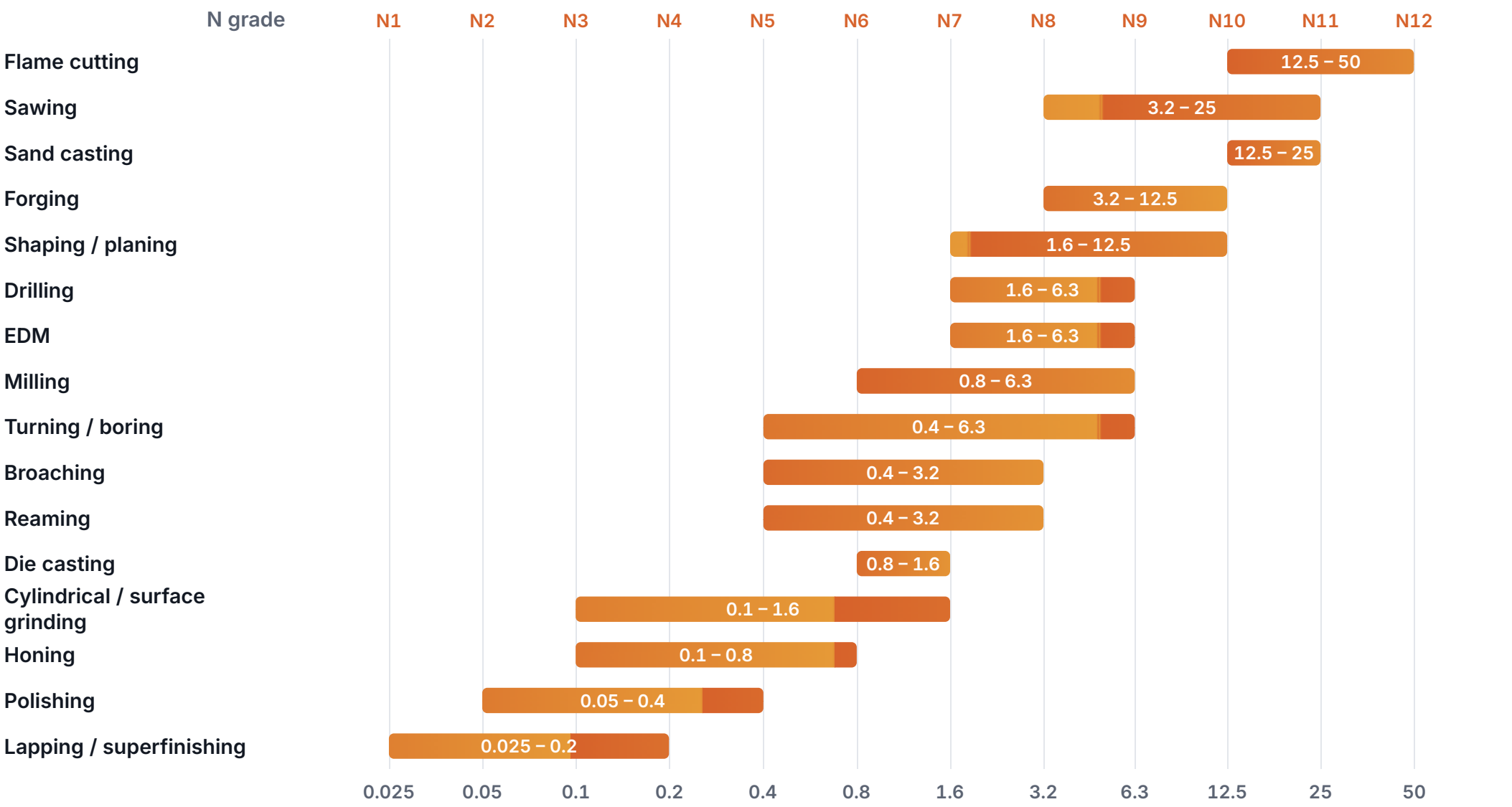
WORKSHOP REFERENCE · 08

Surface Finish

Roughness grades, what each process can achieve, drawing symbols, and the finish to expect from an insert's feed and nose radius.

Finish by process

typical Ra range in µm



Typical production ranges. Finer finishes are possible with extra care and cost; rougher results come from worn tools or unstable set-ups.

Roughness grades

ISO 1302

N grade	Ra µm	Ra µin
N12	50	2000
N11	25	1000
N10	12.5	500
N9	6.3	250
N8	3.2	125
N7	1.6	63
N6	0.8	32
N5	0.4	16
N4	0.2	8
N3	0.1	4
N2	0.05	2
N1	0.025	1

Ra (arithmetic mean roughness) is also called CLA or AA. Rz is typically 4 to 7 times Ra, depending on the process.

Drawing symbols

ISO 1302 · ISO 21920-1



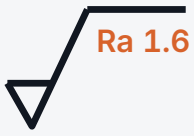
Basic symbol
Any process allowed



Machined
Material removal required



Not machined
Material removal not allowed



With a value
Ra 1.6 µm maximum, machined

Turning finish from feed and nose radius

theoretical Ra in µm

Feed mm/rev	0.2	0.4	0.8	1.2	1.6	2.4
	Insert nose radius rε (mm) →					
0.05	0.40	0.20	0.10	0.07	0.05	0.03
0.08	1.03	0.51	0.26	0.17	0.13	0.09
0.10	1.60	0.80	0.40	0.27	0.20	0.13
0.12	2.31	1.15	0.58	0.38	0.29	0.19
0.15	3.61	1.80	0.90	0.60	0.45	0.30
0.18	5.20	2.60	1.30	0.87	0.65	0.43
0.20	6.42	3.21	1.60	1.07	0.80	0.53
0.25	10.02	5.01	2.51	1.67	1.25	0.84
0.30	14.43	7.22	3.61	2.41	1.80	1.20
0.35	19.65	9.82	4.91	3.27	2.46	1.64
0.40	25.66	12.83	6.42	4.28	3.21	2.14
0.50	40.09	20.05	10.02	6.68	5.01	3.34

Geometric values for a sharp insert. Real finish is usually worse because of wear, built-up edge and vibration. Wiper inserts give roughly half the Ra at the same feed.

Formulas

Peak to valley $Rt = f^2 \div (8 \times r\varepsilon) \times 1000$
Average $Ra \approx f^2 \div (31.2 \times r\varepsilon) \times 1000$
µin to µm $\mu m = \mu in \times 0.0254$

f is the feed in mm/rev, rε the nose radius in mm; results in µm. Double the nose radius and Ra halves; double the feed and Ra goes up four times.

Process ranges are typical values compiled from ISO 1302 and ASME B46.1 guidance. Theoretical turning values are geometric and assume a sharp tool.

A guide only. Always check against the tool maker's data and your machine and set-up, and talk to your Teravin sales engineer before relying on it. Terms: teravin.tools/terms