

Surface Finish	Ground * Honed * Skived & Roller Burnished						Turned * Bored * Drilled				Rough Machined	
N Grades Per ISO 1302	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
Micro Meter	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
Micro Inch Ra	1	2	4	8	16	32	63	125	250	500	1000	2000
*Rt	8.7	17.4	34.8	69.6	139	278	548	1,088	2,175	4,350	8,700	17,400
*Rz	7.0	14.0	28.0	56.0	112	224	441	875	1,750	3,500	7,000	14,000
*Rz (ISO)	7.6	15.2	30.4	60.8	122	243	479	950	1,900	3,800	7,600	15,200
*Ry/Rmax	8.0	16.0	32.0	64.0	128	256	504	1,000	2,000	4,000	8,000	16,000

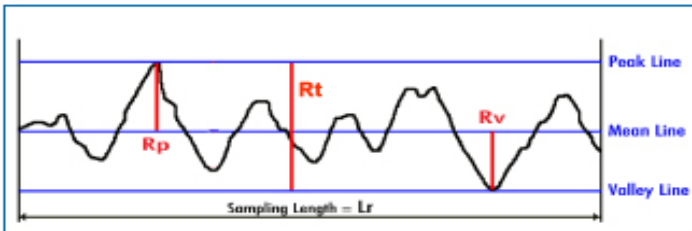
Surface Finishing Costs




←
Lower Ra \$\$\$
→
Higher Ra \$


Honing												
Skive and Roller Burnishing												
Skiving Only												
Boring, Drilling, Trepanning												
Super Finishing Grinding												
Grinding												
Turning												
Flame Cutting												

* Rt, Rz & Ry values-estimated values only. Actual results should be verified with a Surface Analyzer.



- Ra = The average variation from mean line.
- Rt = Distance from the highest peak to the deepest valley.
- Rz = The average R_t over a given length.
- Rp = The highest peak above the mean line.
- Rv = The deepest valley below the mean line.

Surface finish is a key element that weighs heavily on the life, quality and performance of cylinders and cylinder rods. Poor quality surfaces can cause premature cylinder and rod failures. Profilometers or Surface Analyzers have the capability to measure various surface conditions to insure material is suitable for cylinder applications.

These various surface finish callouts Ra, Rt, Rz, Rmax, and others help shape the manufacturing process. Calling out a surface finish determines the manufacturing process. The higher or rougher the Ra call out generally relates to a quicker more economical processing. Smoother Ra conditions require additional finishing steps and consequently higher costs. The key here is to match surface condition to the most economical processing that yields the best field performance.

Ra or Roughness Average is the most widely used description of a surface texture. This reading relates to a theoretical line where the deviation is measured both up and down from this line, peaks and valleys. In the UK **CLA** or Center Line Average is used for calling out surface finish. CLA is equivalent to Ra.