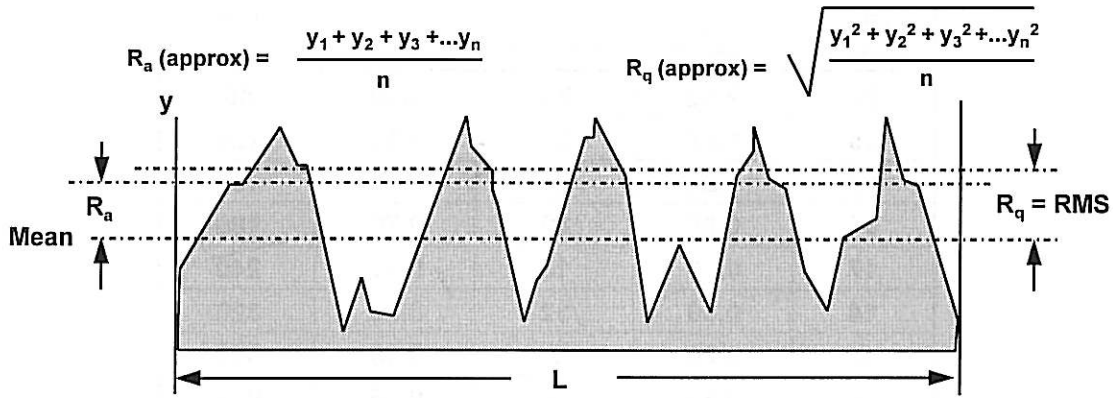


Surface Roughness Measurements



SURFACE ROUGHNESS MEASUREMENTS

In the U.S., the " R_a ", or roughness average, is the most commonly used parameter for expressing measurements of surface contour. The value represents the arithmetic average of the height of the roughness irregularities above the mean line along the sampling length, L . The value of R_a is normally measured in the microinches or in microns in the metric system.

The roughness parameter, R_q , represents the root mean square (RMS) of the peak heights and is more sensitive to the occurrence of occasional high and low points. The RMS is the geometric average height of roughness irregularities over the sampling length, L . RMS is normally expressed in either microns or microinches.

Although both R_a is universally accepted as a means of expressing surface roughness, this parameters can often be misleading. It is possible that two surfaces having widely different profiles could have the same R_a , but perform quite differently.

For this reason, the use of instruments such as the Atomic Force Microscope (AFM) has increased. AFM instruments, combined with specialized computer programs, produces a three-dimensional image of the actual surface morphology. The images produced provide additional insight into the performance characteristics of the surface, which cannot be obtained through the measurement of R_a alone.

Comparison of Surface Measurements

RMS Micro-Inch	RMS Micron	R _a Micro-Inch	R _a Micron	Grit Size
80	2.02	71	1.80	80
58	1.47	52	1.32	120
47	1.20	42	1.06	150
34	0.86	30	0.76	180
17	0.43	15	0.38	240
14	0.36	12	0.30	320
8	0.20	7	0.18	500
6	0.15	5	0.13	600

COMPARISON OF SURFACE MEASUREMENTS

The chart on this page lists comparable RMS and R_a measurements for grit sizes from 80 to 600. Values are given in both English units (microinches) and metric (micron) units. The RMS value of a given finish is slightly higher than the equivalent R_a measurement.

In general, electropolishing can remove visual sanding lines produced with grit number 320 and higher (that is, having abrasive particle sizes of 320 mesh and smaller). Surface improvement should average about 50% of the initial R_a value after electropolishing.

The rate of metal removal varies with the type of bath and the processing conditions. For the Hydrite baths, 1500 ampere-minutes per square foot per side is used as a basis for comparison. Typical metal removal rates at this condition are estimated as follows for the common Hydrite products used to electropolish stainless steels:

Hydrite 1000:	0.0004 inches/side = 0.0008 inches on a diameter
Hydrite 2500:	0.0004 inches/side = 0.0008 inches on a diameter
Hydrite 4000:	0.0005 inches/side = 0.0010 inches on a diameter