Surface Finishes

Tech Talk

Background

The finish quality of a machined surface is very important in industries that require sanitary surfaces such as Food, Biotech, Pharmaceutical, and Semiconductor manufacturing. There are a number of ways to define the Surface Finish, and this *Tech Talk* attempts to give a simple overview of the common terms. Surface finish measurement procedures, general terminology, definitions of most parameters and filtering information can be found in American Standard ASME B46.1 - 2002, Surface Texture, and in International Standards, ISO 4287 and ISO 4288.

Common terms

Ra	The most common surface roughness parameter is Ra, or Arithmetic Average Roughness. It basically reflects the average height of roughness component irregularities from a mean line. Ra provides a simple value for accept/reject decisions. It is a default parameter on a drawing if not otherwise specified, and is available even in the least sophisticated measuring instruments. Ra is not a good discriminator for different types of surfaces as it is incapable of differentiating between “spiky” and “scratched” surfaces having the same Ra.
Rp	Maximum Peak height
Rv	Maximum Valley depth
Ry	maximum Peak-to-Valley Roughness height
Rz	Mean Roughness Depth. It is the average distance between the highest peak and the deepest valley in five sampling lengths, or cutoffs. Rz is more sensitive then Ra to the changes in surface finish because maximum profile heights, and not the averages, are being examined.
Grit	Number of abrasive grains per given area
EP	Electro polish

Polished Finish

The high end of the sanitary finishes is an electro-polished ID which yields a 10 or 15 µ-inch Ra maximum roughness. These electro-polished products are generally used in very high purity applications.

Mill Finish	Industrial
32 Ra	Sanitary
20 & 15 Ra	Pharmaceutical
20 RaEP	Pharmaceutical
15 RaEP	Ultra-Pure Applications

Surface Finishes Cross-Reference Chart

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Common Name	Grit #	USA Finish #	Ra Microinch	EP Range Ra Microinch	Ra Micron	Rmax Microinch	Rmax Micron	Appx RMS Micron	ISO #	ASTM Std Ra Microinch	Japanese Std
			2000		50	7875	200		N12		
			1000		25	3940	100		N11		
			500		12.5	1968	50		N10		
Mill Plate	60	1	250	50 max	6.3	985	25		N9	140 max	
			125		3.2	492	12.5		N8		
Satin Sheet	80	2	40-60 70 max					80			
			63		1.6		6.3		N7		
	100-120	3	52					58			
Commercial #4	120	4	40-60								
3A Sanitary	150	4	30-35 42 max	15-20				42-47		45 max	
ANSI #4			32		0.8	126	3.2		N6		
Sanitary Finish	180	4	20-30 30 max	15-20				34		25 max	Buff #100
Biotech Finish	200-220	4	20-25 25 max								
	240	6	15-20	10-15				17		8-20	
			16		0.4	63	1.6	17 max	N5	6-15	
	320	7	8-12 12 max					14			
			12		0.3	59	1.5	13-14			Buff #200
			8		0.2	31	0.8	9	N4		Buff #300
Mirror Finish	400	8	4-8								
Super Mirror Finish	500	8	3-8 <4								
Super Mirror Finish	500	8	4		0.1	16	0.4	4-10	N3		Buff #400 appx
			2		0.05	8	0.2		N2		
			1		0.025	4	0.1		N1		