

Surface Finish Cross Reference Chart

Grit Number	USA Finish #	Common Name	Ra Microinch	E/P Range Ra Microinch	Ra Micron	Rmax Microinch	Rmax Micron	Approx. RMS Microinch	ISO Number	ASTM STD Ra Microinch	Japanese STD
			2000		50	7875	200		N12		
			1000		25	3940	100		N11		
			500		12.5	1968	50		N10		
60	#1	Mill Plate	250	50 Max.	6.3	985	25		N9	140 Max.	
			125		3.2	492	12.5		N8		
80	#2	Satin Sheet	70 Max. 40-60					80			
			63		1.6		6.3		N7		
100 to 120	#3		52					58			
120	#4	Commerical #4	40-60 typ.								
150	#4	Sanitary Finish	42 Max 30-35					42-47		45 Max	
		ANSI #4	32		0.80	126	3.2		N6		
180	#4	3A Sanitary Finish	32 Max 20-32	15-20				34		25 Max.	Buff #100
200 to 220	#4	"Biotech" Finish	25 Max. 20-25								
240	#6		15-20	10-15				17		8-20	
			16		0.40	63	1.6	17 Max.	N5	6-15	
320	#7		12 Max. 8-12					14			
			12		0.30	59	1.5	13-14			Buff #200
			8		0.20	31	0.80	9	N4		Buff #300
400	#8	Mirror Finish	4-8								
500	#8	Supermirror Finish	<4 3-8								
500	#8	Supermirror Finish	4		0.10	16	0.40	4-10	N3		Buff #400 (approx)
			2		0.050	8	0.20		N2		
			1		0.025	4	0.10		N1		

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INCHES

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1 2 3 4 5 6 7 8 9 10

Friction Loss in Sanitary OD Tubing and Fittings																		
Capacity in U.S. G.P.M.	O.D. Tube Size																	
	1"			1.5"			2"			2.5"			3"			4"		
	I.D. - .902"			I.D. - 1.402"			I.D. - 1.402"			I.D. - 1.402"			I.D. - 1.402"			I.D. - 1.402"		
	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee	Tubing	Elbow	Tee
2	.01	.01	.1															
4	.025	.02	.2															
5	.035	.025	.25															
10	.12	.06	.4	.02	.01	.15	.005	.015	.1									
15	.25	.1	.8	.04	.02	.25	.013	.02	.15									
20	.43	.22	1.5	.06	.03	.3	.02	.025	.2	.005	.02	.1	.003	.02	.06			
25	.66	.4	2.3	.08	.04	.4	.025	.03	.25	.006	.03	.15	.004	.03	.08			
30	.93	.7	3.3	.105	.06	.55	.035	.05	.3	.008	.05	.2	.005	.04	.1			
35	1.22	1.25	5.2	.135	.09	.8	.04	.06	.4	.011	.06	.25	.006	.05	.13			
40				.17	.11	1.0	.05	.08	.5	.015	.07	.3	.007	.06	.15			
45				.21	.16	1.3	.063	.1	.6	.02	.09	.35	.008	.065	.18			
50				.25	.2	1.6	.073	.12	.7	.022	.1	.4	.01	.07	.2			
60				.34	.35	2.2	.1	.18	.9	.03	.12	.45	.015	.08	.25			
80				.57	.76	3.7	.16	.3	1.5	.05	.15	.55	.02	.1	.4			
100				.85	1.35	5.8	.23	.44	2.3	.075	.18	.6	.03	.11	.5	.008	.04	.1
120				1.18	2.05	9.1	.32	.64	3.3	.105	.21	1.0	.04	.13	.6	.01	.05	.15
140							.42	.85	4.5	.14	.23	1.25	.05	.16	.8	.013	.06	.2
160							.54	1.13	5.8	.17	.28	1.6	.07	.2	1.1	.015	.07	.25
180							.67	1.45	7.4	.205	.31	2.0	.08	.21	1.3	.02	.08	.3
200							.81	1.82	9.0	.245	.35	2.5	.1	.26	1.6	.025	.09	.4
220							.95	2.22	11.0	.29	.41	3.0	.12	.3	1.9	.028	.1	.5
240							1.10	2.63	13.5	.34	.48	3.7	.14	.33	2.2	.035	.11	.55
260										.39	.53	4.5	.165	.39	2.5	.04	.115	.6
280										.45	.61	5.3	.19	.42	2.8	.045	.12	.65
300										.515	.7	6.2	.22	.5	3.1	.05	.13	.7
350										.68	1.05	8.5	.28	.67	4.1	.07	.15	.9
400										.86	1.55	11.0	.36	.88	5.2	.085	.18	1.2
450										1.05	2.25	13.5	.44	1.1	6.6	.105	.2	1.5
500													.54	1.4	8.0	.13	.23	1.75
550													.64	1.7	9.5	.15	.27	2.1
600													.75	2.05	10.2	.175	.3	2.5
650													.87	2.41	13.0	.2	.34	2.8
700													1.0	2.8	15.0	.23	.4	3.4
750																.26	.43	3.8
800																.3	.5	4.4
850																.33	.56	5.0
900																.37	.62	5.7
950																.41	.7	6.3
1000																.45	.8	7.0
1100																.53	1.06	8.6

Friction Loss in Sanitary OD Tubing and Fittings						
Capacity in U.S. G.P.M.	O.D. Tube Size					
	0.5"			0.75"		
	I.D. - .375"			I.D. - .625"		
	Tubing	Elbow	Tee	Tubing	Elbow	Tee
0.1	.0021	.002	.001			
0.2	.0074	.083	.006			.002
0.3	.016	.015	.013	.001	.004	.005
0.4	.027	.025	.024	.0019	.006	.008
0.5	.041	.037	.037	.0029	.008	.011
0.6	.057	.052	.052	.0042	.011	.013
0.7	.076	0.68	.072	.0056	.014	.02
0.8	.098	.087	.09	.007	.017	.025
0.9	.12	.107	.12	.009	.021	.032
1.0	.145	.13	.15	.011	.025	.038
1.5	.34	.3	.32	.027	.05	.1
2.0	.53	.5	.58	.04	.07	.15
2.5	.82	.7	.9	.06	.08	.2
3.0	1.12	1.0	1.4	.085	.1	.25
4.0	2.0	1.6	2.5	.14	.2	.4
6.0	4.3	3.5	5.5	.32	.4	.8
8.0	7.2	5.8	10.1	.53	.6	1.5
10.0		8.4	15.7	.80	.9	2.2
12.0		11.3	22.5	1.15	1.2	3.0
14.0		14.7		1.5	1.5	3.8
16.0		18.3		2.0	1.85	4.7
18.0				2.45	2.25	5.8
20.0				2.9	2.7	7.0
25.0				4.5	3.95	10.7

Useful Pump Conversion Factors	
LENGTH Meters	x 3.281 = Feet
MASS Kilograms	x 2.2 = Lbs.
Gals. of Water	x 8.34 = Lbs.
Cubic Ft. of Water	x 62.4 = Lbs.
Pounds	x .454 = Kilograms
VOLUME Liter	x .264 = Gallon
Cubic Feet	x 7.48 = Gallon
Lbs. of Water	x .119 = Gallon
Imperial Gallon (British)	x 1.2 = Gal. (U.S.)
U.S. Gallon	x 3.785 = Liter
PRESSURE Feet of Water	x .433 = PSI
Inches Hg.	x .491 = PSI
Atmosphere	x 14.7 = PSI
Meters of Water	x 1.42 = PSI
Kg/cm ²	x 14.22 = PSI
Atmosphere	x 33.9 = Ft. of Water
PSI	x 2.31 = Ft. of Water
Inches of Hg.	x 1.13 = Ft. of Water
FLOW Lbs. of Water/Hr.	x .002 = GPM
Lbs. of Fluid/Hr.	x .002 = GPM
Specific Gravity	
Cu Meter/Hour	x 4.4 = GPM
Liters/Minute	x .264 = GPM
GPM	x 3.785 = Liters/Min.
POWER BHP = $\frac{\text{GPM} \times \text{Head Ft.} \times \text{Specific Gravity}}{3960 \times \text{Pump Efficiency}}$	
VISCOSITY Centipoise	= Centistokes
Specific Gravity	
Centistokes	x 4.64 = SSU (Approx.)

C.I.P. Solution Flow Guidelines						
	Tubing OD (In.)	Tubing Wall Thickness (In.)	GPM @ 5.0 Ft./Sec.*	LPM @ 5.0 Ft./Sec.	GPM @ 10.0 Ft./Sec.**	LPM @ 10.0 Ft./Sec.
TUBE SIZE	0.50	0.049	1.98	7.49	3.96	14.97
	0.75	0.049	5.20	19.69	10.41	39.39
	1.00	0.065	9.26	35.07	18.53	70.13
	1.50	0.065	22.97	86.95	45.95	173.91
	2.00	0.065	42.80	162.01	85.60	324.01
	2.50	0.065	68.75	260.22	137.50	520.44
	3.00	0.065	100.82	381.60	201.64	763.20
4.00	0.083	179.92	681.01	359.84	1362.01	
6.00	0.134	402.15	1522.15	804.31	3044.31	



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* 5'/second as recommended within 3A Guidelines and Acceptable Practices.
** 10'/second as seen on select pharmaceutical cleaning applications.

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