GNPGraystar

Specialty Materials

An ISO 9001:2015 Certified Company

www.GNPGraystar.com

Imperial & Metric Conversions

LINEAR MEASUREMENTS

1 cm =	0.3937 in.	1 in. =	2.540 cm
1 m =	3.2808 ft.	1 ft. =	30.48 cm
	1.0936 yd.	1 yd. =	91.44 cm
1 km =	0.6214 Mile (Mi.)	1 Mi. =	1.6093 km

SURFACE AREA MEASUREMENTS

1 m^2 =	10.7639 sq. ft.	1 sq. ft. =	0.0929 m^2
	1.1960 sq. yd.	1 sq. yd. =	0.8361 m^2

VOLUME & LIQUID MEASUREMENTS

1 l =	1.76 pints	1 pint =	0.5683 l
	0.22 imperial gallon	1 Imp.gal.=	4.5461 l
	0.2642 US gallon	1 US gal. =	3.7854 l
1 m^3 =	35.314 cu. ft.	1 cu. ft =	0.0283 m^3
	1.3079 cu. yd.	1 cu. yd. =	0.7645 m^3

DENSITY MEASUREMENTS

1 g/cm^3 =	62.428 $lb./ft^3$	1 $lb./ft^3$ =	0.016 g/cm^3

WEIGHT MEASUREMENTS

1 kg =	2.2046 lb.	1 lb. =	0.4536 kg
1 metric ton, t (1000 kg) =		1 sh. tn (2000 lb.) =	
	1.1023 short tons		0.9072 t

GNPGraystar Product Lines

ALUMINA
- Tabular Alumina
- Calcined Alumina
- Precision Calcined Alumina
- Bubble Alumina
- Spherical Alumina
- Alumina Tri-Hydrate
- Zeolite
- Boehmite
- Fused Aluminum Oxide
- Calcined Bauxite

SILICON CARBIDE
- Green Silicon Carbide
- Black Silicon Carbide
- Ready-to-Press Powders
- Submicron Powders
- Beta Silicon Carbide

BORON CARBIDE
- Micro and Macro Grit
- Refractory 325/F
- Submicron Powder
- Sintering Aid Powders
- Nuclear Grade Powders

BORIDES & NITRIDES
- Aluminum Nitride
- Boron Nitride
- Silicon Nitride
- Titanium Diboride

SPINEL & MULLITE
- Fused Magnesia-Alumina Spinel
- Sintered Magnesia-Alumina Spinel
- White Fused Mullite
- Fused Zirconia Mullite

GRINDING MEDIA
- Alumina Grinding Media
- Zirconia Grinding Media
- Silicon Carbide Grinding Media

ZIRCONIA
FUSED ZIRCONIA
- Magnesia-Stabilized
- Calcia-Stabilized
- Yttria-Stabilized
- Monoclinic
- Bubble Zirconia

CHEMICAL GRADE ZIRCONIA
- Magnesia-Stabilized
- Yttria-Stabilized
- Monoclinic

ALUMINA ZIRCONIA
- Alumina Zirconia 25%
- Alumina Zirconia 40%

ZIRCONIA-SILICATE CERAMIC BEADS

RARE EARTHS
- Calcined Yttrium Oxide
- Ytterbium Oxide
- Fused Yttria

SPECIALTY SILICA
- Fused Silica
- High-Purity Milled Silica Powder
- Silica Fume
- Spherical Fused Silica

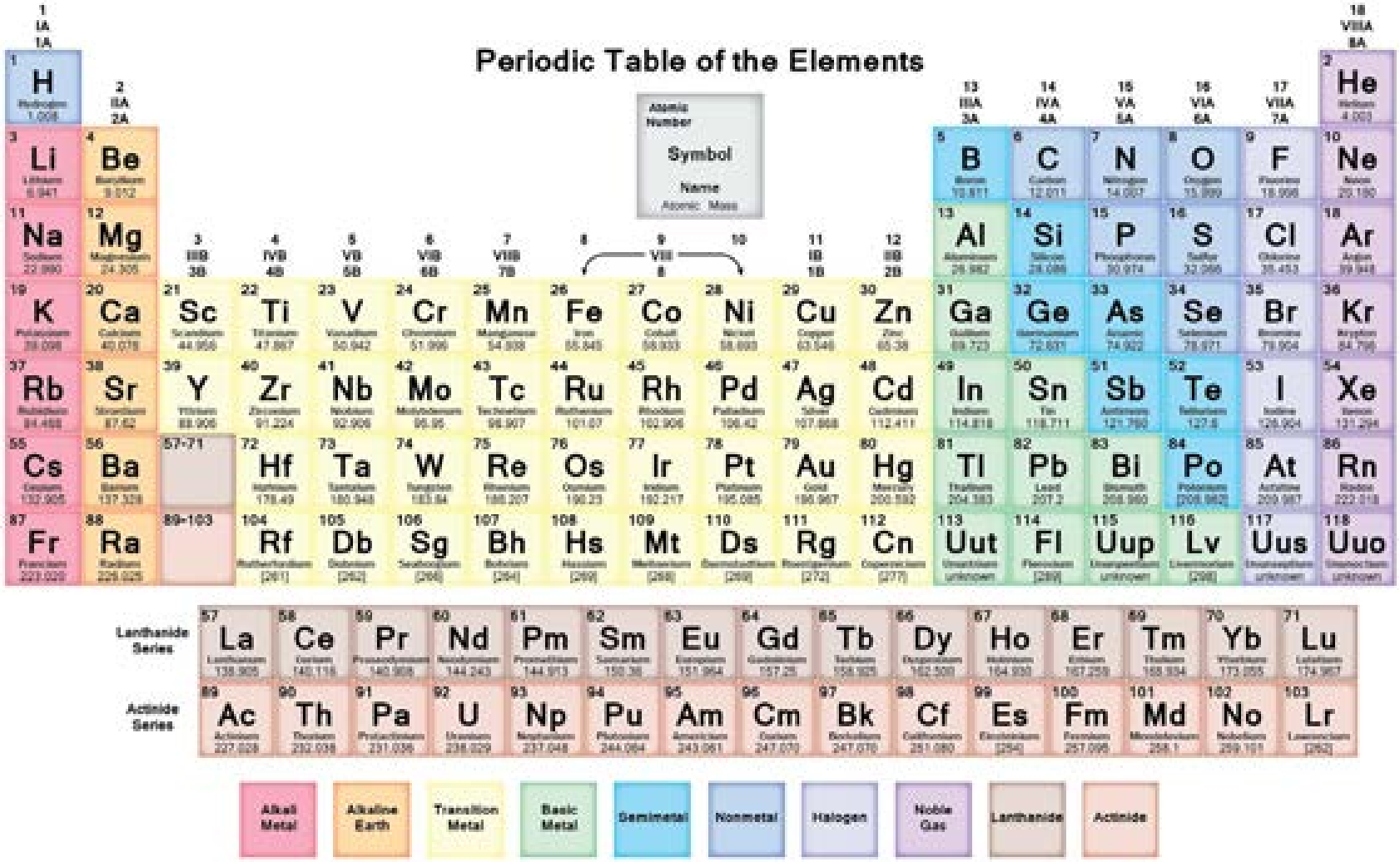
GARNET/WATERJET
- Blasting Abrasives
- Waterjet Abrasives
- Waterjet Spare Parts

NOZZLES
- Boron Carbide Nozzles
- Tungsten Carbide Nozzles

SILICON METAL
DIAMOND POWDER
GLASS BEADS
COATED ABRASIVES
NON-WOVEN ABRASIVES

GNPGraystar
Specialty Materials

Periodic Table



Incoterms

	Freight Collect Terms				Freight Prepaid Terms						
Groups	Any Mode or Modes of Transport		Sea and Inland Waterway Transport				Any Mode or Modes of Transport				
Incoterm®	EXW	FCA	FAS	FOB	CFR	CIF	CPT	CIP	DAP	DPU	DDP
	Ex Works (Place)	Free Carrier (Place)	Free Alongside Ship (Port)	Free On Board (Port)	Cost and Freight (Port)	Cost, Insurance & Freight (Port)	Carriage Paid To (Place)	Carriage & Insurance Paid (Place)	Delivered at (Place)	Delivered & Unloaded at (Place)	Delivered Duty Paid (Place)
Transfer of Risk	At Buyer's Disposal	On Buyer's Transport	Alongside Ship	On Board Vessel	On Board Vessel	On Board Vessel	At Carrier	At Carrier	At Named Place	At Named Place Unloaded	At Named Placed
Obligations & Charges											
Export Packaging	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Loading Charges	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Delivery to Port/Place	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Export Duty, Taxes & Customs	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Origin Terminal Charges	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Loading on Carriage	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Carriage Charges	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Insurance	Negotiable	Negotiable	Negotiable	Negotiable	Negotiable	Seller	Negotiable	Seller	Negotiable	Negotiable	Negotiable
Destination Terminal Charges	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller
Delivery to Destination	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller
Unloading at Destination	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Buyer
Import Duty, Taxes & Customs Clearance	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller

Hardness Scale Chart

Substance	Mohs Hardness
Talc	1
Gypsum	2
Sodium Bicarbonate	2.5
Calcite	3
Plastic Media	3-4
Fluorite	4
Enamel	5
Glass Bead	5.5
Silica Sand	6-7
Zirconium Silicate	6.5-7.5
Copper Slag	7
Glass	7
Staurolite	7-7.5
Garnet	7-8
Spinel	~8
Steel Shot/Grit	8
Zirconia	8
Aluminum Oxide	9
Tungsten Carbide	9
Silicon Carbide	9-10
Boron Carbide	9-10
Diamond	10

GNPGraystar Tolling & Lab Services

We offer several services to our customers because we know that everyone's products and applications do not always fall within standard product offerings.

CUSTOM BLENDING

CUSTOM SCREENING

MAGNETIC SEPARATION

MAGNETIC ANALYZER

REPACKAGING

SPRAY DRYING

MOISTURE ANALYZER

PARTICLE SIZING

POWDER FLOW

PARTICLE SHAPE

LOSS OF IGNITION

DENSITY MEASURING

SPECIFIC SURFACE AREA

VISCOSITY MEASUREMENT

Thermal Properties

Compound	Density g/cm^3	Specific Heat Capacity J/(gk)	Youngs Modulus Gpa	Thermal Conductivity W/(mK)	Coefficient of Linear Expansion $x10^{-4}/K$	Melting Temp (°C)	Molar Mass (g/mol)
Aluminum Oxide (Al_2O_3)	3.94	0.77	220-350	24-39	5.4	2050	101.96
Yttrium Oxide (Y_2O_3)	5.01	0.45	200-205	8-12	7.3	2410	225.81
Zirconium Dioxide (ZrO_2)	5.7-6.6	0.45	190-210	1.5-3	7-12	2680	123.22
Mullite ($3Al_2O_3 \cdot 2SiO_2$)	3.2	0.75	100-200	2-15	4.5-5.6	1850	426.08
Silicon Dioxide (SiO_2)	2.19-2.66	0.75	30-80	1-11	0.4-10.3	1713	60.1
Silicon Carbide (SiC)	3.21	.066	150-450	100-350	3.3	2300	40.1
Boron Carbide (B_4C)	2.51	0.92	390-440	30-45	6-Apr	2350	195.86
Boron Nitride	2.5-3.45	0.8	14-47	10-35	1.8	2968	24.83
Silicon Nitride (Si_3N_4)	3.44	0.7	80-330	15-25	1.7-3.8	1900	140.28
Aluminum Nitride (AlN)	3.26	0.71	320	70-285	2.5-5.7	2200	40.99
Titanium Diboride (TiB_2)	4.52	0.63	370-570	60-120	5.6-10	2970	69.49
Carbon-Diamond (C)	3.51	6.155	1220	2000	0.9	3550	12.01

ANSI Table 2 & FEPA F Specifications - Macrogrit

Grit No.	Sieve through which 100% must pass	Control Sieve		Max. of oversize on control *sieve (%)	Min. through control *sieve and retained		Cumulative min. through control sieve and retained		Max. of 3% thru *sieve No.
		No.	Opening (in.)		%	on sieve No.	%	on sieve No.	
4	5/16	3.5	0.223	20	40	4	70	4 & 5	6
5	.266	4	0.187	20	40	5	70	5 & 6	7
6	3.5	5	0.157	20	40	6	70	6 & 7	8
7	4	6	0.132	20	40	7	70	7 & 8	10
8	5	7	0.111	20	45	8	70	8 & 10	12
10	6	8	.0937	20	45	10	70	10 & 12	14
12	7	10	.0787	20	45	12	70	12 & 14	16
14	8	12	.0661	20	45	14	70	14 & 16	18
16	10	14	.0555	20	45	16	70	16 & 18	20
20	12	16	.0469	20	45	18	70	18 & 20	25
24	16	20	.0331	25	45	25	65	25 & 30	35
30	18	25	.0278	25	45	30	65	30 & 35	40
36	20	30	.0234	25	45	35	65	35 & 40	45
46	30	40	.0165	30	40	45	65	45 & 50	60
54	35	45	.0139	30	40	50	65	50 & 60	70
60	40	50	.0117	30	40	60	65	60 & 70	80
70	45	60	.0098	25	40	70	65	70 & 80	100
80	50	70	.0083	25	40	80	65	80 & 100	120
90	60	80	.0070	20	40	100	65	100 & 120	140
100	70	100	.0059	20	40	120	65	120 & 140	200
120	80	120	.0049	20	40	140	65	140 & 170	230
150	100	140	.0041	15	40	200	65	200 & 230	325
180	120	170	.0036	15	40	200&230	65	200, 230, 270	-
220	140	200	.0029	15	40	230&270	65	230, 270, 325	-
240	170	200	.0029	5	8	230&270	38	230, 270, 325	-

Table 2: Is the allowable limits for the sizing of abrasive grain for grinding wheel manufacturer and general polishing purposes, as taken from the ANSI B74.12 - 2018 Specifications for Macrogrit abrasive grain sizing.

**Sieves are those from the United States Sieves Series.*

Blasting Abrasive Profile Chart

The following chart should be used only for approximating the abrasive size required to obtain a specified anchor pattern. The standard metal used to obtain these results was hot rolled steel with tightly adhering mill scale. The resulting anchor pattern will vary with the method used for measuring depths as well as any one of numerous other variables (type and hardness of steel, thickness of mill scale, degree of cleaning specified, etc...). This information can be used for centrifugal wheel as well as pressure blasting. Pressure blasting should be done using a 90 - 100 psi nozzle pressure. The depth of anchor pattern used in this chart is an average and not a minimum or maximum depth obtainable.

1.0 mil = 25 microns

Abrasive	PROFILE				
	Grade 1 0.5 - 1.5 mils	Grade 2 1.0 - 2.5 mils	Grade 3 2.0 - 3.5 mils	Grade 4 3.0 - 5.0 mils	Grade 5 4.0 - 6.0 mils
Garnet (Type I, Class A)	150	150	120, 80, 30/60	30/60, 36	16
Aluminum Oxide (Type II, Class A)	70, 80, 90, 100, 120, 150, 180	46, 54, 60, 70, 80, 90	24, 30, 36, 46, 54	16, 20, 24, 30	10, 12, 14, 16
Silicon Carbide (Type II, Class A)	100, 120	60, 80, 90	46, 54	30, 36	16, 20, 24
Steel Grit (Type II, Class A)	G80, G120	G50	G40	G25	G12, G16, G18

Grit No.	*Sieve through which 100% must pass	Control *Sieve		Max. of oversize on Control *Sieve (%)	Min. through Control *Sieve and Retained		Cumulative Min. through Control *Sieve and Retained		Max of 5% through *Sieve No.
		No.	Opening (inches)		%	On Sieve No.	%	On Sieve No.	
16	8	14	0.0555	25	35	16	70	16 & 18	25
20	10	16	0.0469	25	35	18	70	18 & 20	30
24	14	18	0.0394	25	35	20	60	20 & 25	40
30	16	20	0.0331	30	45	30	60	30 & 35	45
36	18	25	0.0278	15	50	35	80	35 & 40	50
46	25	40	0.0165	30	30	45	55	45 & 50	70
54	30	45	0.0139	35	25	50	60	50 & 60	80
60	35	50	0.0117	35	35	60	60	60 & 70	100
70	40	60	0.0098	25	35	70	65	70 & 80	120
80	45	70	0.0083	35	30	80	60	80 & 100	140
90	50	80	0.0070	25	35	100	60	100 & 120	170
100	60	100	0.0059	25	30	120	55	120 & 140	230
120	70	120	0.0049	25	20	140	50	140 & 170	270
150	80	140	0.0041	25	30	200	60	200 & 230	325
180	80	170	0.0035	20	30	200 & 230	60	200, 230, & 270	-
220	100	200	0.0029	15	30	230 & 270	50	230, 270, & 325	-
240	120	200	0.0029	10	5	230 & 270	30	230, 270, & 325	-

Table 3 is the allowable limits for the sizing of abrasive grain for use in other general industrial uses such as pressure blasting and Lithoplate graining, as taken from the ANSI B74.12 - 2018 Specifications for Macrogrit abrasive grain sizing.
*Sieves are those from the United States Sieves Series

ANSI Table 3

Glass Bead Sizing Chart

US Sieve	MIL Spec (PRF-9954D)	MIL Spec (S-13165C)	SAE Intl. (J1173)	Inches Max-Min	Micron Max-Min
12-14	No.1			0.0661-0.0555	1679-1410
14-20	No. 2			0.0555-0.0331	1410-841
20-30	No. 3	331	GB-70	0.0331-0.0234	841-594
25-35		280		0.0283-0.0197	719-500
25-45				0.0278-0.0139	706-353
30-40	No. 4	232	GB-50	0.0234-0.0165	594-419
35-45		197		0.0197-0.0171	500-434
40-50	No.5	165	GB-35	0.0165-0.0117	419-297
40-60				0.0165-0.0098	419-249
40-70				0.0165-0.0083	419-211
45-60		138		0.0171-0.0098	434-249
50-70	No. 6	117	GB-25	0.0117-0.0083	297-211
50-80				0.0117-0.007	297-178
60-80	No. 7	98	GB-20	0.0098-0.007	249-178
60-100				0.0098-0.0059	249-150
60-120				0.0098-0.0049	249-124
70-100	No. 8	83	GB-18	0.0083-0.0059	211-150
70-140				0.0083-0.0041	211-104
80-120	No. 9	70	GB-15	0.007-0.0049	178-124
100-170	No. 10			0.0059-0.0035	150-89
100-200				0.0059-0.0029	150-74
120-170				0.0049-0.0035	124-89
120-200	No. 11			0.0049-0.0029	124-74
120-270				0.0049-0.0021	124-53
140-230	No. 12			0.0041-0.0025	104-64
140-270				0.0041-0.0021	104-53
170-230				0.0035-0.0025	89-64
170-325	No. 13			0.0035-0.0017	89-43
200-325				0.0029-0.0017	74-43
230-325		24		0.0025-0.0017	64-43

Grain Size Chart

mm	microns	in.	ASTM sieve	Tyler sieve	Grit Size
5.6	5600	0.22	3½	3½	-
4.75	4750	0.187	4	4	4
4	4000	0.157	5	5	5
3.35	3350	0.132	6	6	6
2.8	2800	0.11	7	7	7
2.36	2360	0.093	8	8	8
2	2000	0.079	10	9	10
1.7	1700	0.067	12	10	12
1.4	1400	0.055	14	12	14
1.18	1180	0.046	16	14	16
1	1000	0.039	18	16	20
0.85	850	0.033	20	20	22
0.71	710	0.028	25	24	24
0.6	600	0.024	30	28	30
0.5	500	0.02	35	32	36
0.43	425	0.018	40	35	40
0.36	355	0.014	45	42	46
0.3	300	0.012	50	48	54
0.25	250	0.01	60	60	60
0.21	212	0.008	70	65	70
0.18	180	0.007	80	80	80
0.15	150	0.006	100	100	90
0.13	125	0.005	120	115	100
0.11	106	0.004	140	150	120
0.08	75	0.003	200	200	150
0.06	63	0.0025	230	250	180
0.05	53	0.0021	270	270	220
0.05	45	0.0018	325	325	240

The terms sieve and mesh are interchangeable.

Diamond Powder Sizing Chart

Size			D10	D50	D90	D99
0.025			>0.02	0.11-0.13	<0.3	<0.4
0-0.5	W0.5	60000#	>0.05	0.21-0.25	<0.5	<0.7
0-1	W1	28000#	>0.05	0.4-0.5	<1.0	<1.4
0-1.5			>0.1	0.6-0.75	<1.5	<2.1
0.2	W1.5	14000#	>0.1	0.85-1.0	<2.0	<2.8
0.5-1			>0.4	0.65-0.75	<1.2	<1.4
1-2		1300#	>0.90	1.35-1.5	<2.2	<2.8
1-3	W2.5	1200#	>1.0	1.7-1.9	<3.0	<4.2
2-3			>1.4	2.0-2.3	<3.2	<4.2
2-4	W3.5	8000#	>1.7	2.65-3.0	<4.1	<5.6
2.5-5	W5	6000#	>2.3	3.1-3.4	<5.1	<7.0
3-5			>2.5	3.3-3.8	<5.4	<7.5
3-6		5000#	>2.8	4.1-4.4	<6.0	<8.4
4-6			>3.2	4.4-4.8	<6.2	<8.4
5-7	W7	3000#	>3.5	4.9-5.5	<7.2	<9.8
4-8	W7	3000#	>3.8	5.5-5.9	<8.0	>11.2
5-10	W10		>4.8	6.5-7.0	<10.0	>14.0
7-10			>5.5	7.5-8.0	<11.0	<14.0
6-12		1800#	>5.8	8.0-8.5	<12.0	<16.8
7-14	W14	1600#	>7.0	9.5-10.0	<14.0	<19.6
10-15			>7.5	10.0-11.0	<15.5	<20.5
8-16			>8.0	11.0-12.0	<16.0	<22.4
10-20	W20	1200#	>9.8	13.5-14.5	<20.0	<28.0
12-22		1100#	>11.5	15.5-16.0	<22.5	<30.8
15-25		1000#	>13	17.5-18.5	<25.5	<35.0
20-30	W28	800#	>16	21.0-22.5	<31.5	<42.0
20-40			>20.0	25.0-27.0	<40.0	<56.0
22-36		700#	>18.0	26.0-29.0	<36.5	<50.0
30-40	W40	600#	>22.0	30.0-32.0	<42.0	<56.0
36-54		500#	>28.0	36.0-39.0	<54.0	<76.0
40-50	W50	500#	>26.0	36.0-39.0	<51.0	<70.0
4-60	W60	400/500#	>30.0	40.0-44.0	<62.0	<84.0

Microgrits Comparison (50% point for F, P, and JIS)

μm	Median Value of...		
	F	P	JIS
0.4			10000
0.7			9000
1.2			8000
2.0			6000
3.0	1200		4000
4.0			3000
4.5	1000		
5.5			2500
6.5	800		
6.7			2000
8.0			1500
8.4		2500	
9.3	600		
9.5			1200
10.3		2000	
11.5			1000
12.6		1500	
12.8	500		
14.0			800
15.3		1200	
17.0			700

μm	Median Value of...		
	F	P	JIS
17.3	400		
18.3		1000	
20.0			600
21.8		800	
22.8	360		
25.0			500
25.8		600	
29.2	320		
30			400
30.2		500	
35.0		400	360
36.5	280		
40.0			320
40.5		360	
44.5	240		
56.2		320	
48.0			280
52.2		280	
53.0	230		
57.0			240
58.5		240	

JIS Microgrit Standard

Grit Size	D0% Value Max-microns	D3% Value Max-microns	D50% Value Max-microns	D94% Value Min-microns
# 240	127	103	54.0-60.0	40
# 280	112	87	45.0-51.0	33
# 320	98	74	37.5-42.5	27
# 360	86	66	33.0-37.0	23
# 400	75	58	28.0-32.0	20
# 500	63	50	23.0-27.0	16
# 600	53	43	18.5-21.5	13
# 700	45	37	15.7-18.3	11
# 800	38	31	13.0-15.0	9.0
# 1000	32	27	10.5-12.5	7.0
# 1200	27	23	8.7-10.3	5.5
# 1500	23	20	7.4-8.6	4.5
# 2000	19	17	6.1-7.3	4.0
# 2500	16	14	5.0-6.0	3.0
# 3000	13	11	3.5-4.5	2.0
# 4000	11	8.0	2.6-3.4	1.3
# 6000	8.0	5.0	1.6-2.4	0.8
# 8000	6.0	3.5	0.9-1.5	0.6

JIS Standard (JIS R 6001: 1998): Grain Size Distribution of Microgrits

Values based on Coulter Multisizer in Microns

FEPA F Standard - Microgrits

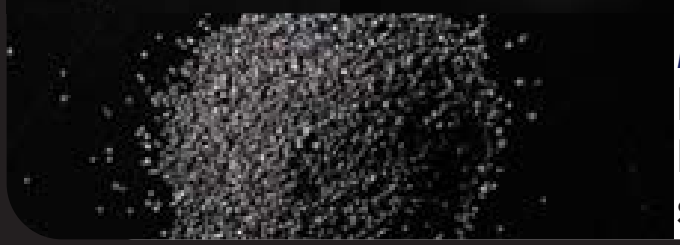
Grit Size Designation	D3% Value Max (microns)	D50% Value (microns)	D94% Value Min (microns)
F 240	70	42.5 - 46.5	28
F 280	59	35.0 - 38.0	22
F 320	49	27.7 - 30.7	16.5
F 360	40	21.3 - 24.3	12
F 400	32	16.3 - 18.3	8
F 500	25	11.8 - 13.8	5
F 600	19	8.3 - 10.3	3
F 800	14	5.5 - 7.5	2
F 1000	10	3.7 - 5.3	1
F 1200	7	2.5 - 3.5	1 (at D80%)

FEPA Standard 42.2: 2006, Table 1: Grain Size Distribution of Microgrits

Values apply to measurements by means of photosedimentometer.

ROCKRIDGE®
ABRASIVES

Loose Abrasives



ROCKRIDGE GARNET is great for blasting and waterjet cutting applications. Their premium garnet is non ferrous and environmentally inert.

Due to their shape, ***ROCKRIDGE*** GLASS BEADS clean, finish, peen, and deburr. They break down slowly allowing for continuous recycling.

ROCKRIDGE BROWN & WHITE ALUMINUM OXIDE is suitable for wet or dry surface preparation, cleaning, deburring, and cutting of a variety of materials.

ROCKRIDGE LOW CARBON STEEL SHOT, with its long life and high hardness, gives excelling performance in most blast cleaning applications.

ROCKRIDGE SILICON CARBIDE, black and green, is an extremely hard abrasive that is useful in blasting applications when high-cutting is desired.

ROCKRIDGE STEEL GRIT meets the highest standard and will improve your blast cleaning process while giving you a superior finish.

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