GRAPHITE RODS AND TUBES

SPECIALTY GRAPHITE SHAPES

Specialty graphite rods and tubes are available in a wide variety of grades and sizes. Our complete line of graphite rods and tubes is available purified and/or machined to meet your specifications. Graphite provides unique operating characteristics. The strength of this material increases as temperatures rise. It has exceptionally good corrosion resistance and is virtually immune to thermal-shock damage. Dimensional and thermal stability remain constant at temperatures up to 2600°C (4712°F). Because erosion resistance is excellent and this product is non-fatiguing, there are no changes in properties with age or cyclical operation.

HIGH-TEMPERATURE PHYSICAL PROPERTIES OF GRAPHITE

Unlike metals, graphite increases in strength with rising temperatures. Therefore, as a guide to high-temperature strength, the following data for G-Grade graphite is compared at room temperature and 2315°C (4199°F)

G-Grade	At Room Temperature		At 2315°C (4199°F)	
Density (g/cc) (oz/in^3)	1.87	1.08	1.86	1.07
Compressive Strength (psi) (MPa)	10300	71.02	18600	128.24
Flexural Strength (psi) (MPa)	5000	34.47	9000	62.05
Modulus of Elasticity (K10^{-5} psi) (MPa)	14	0.10	27	0.19
Thermal Expansion (in./in./°F x 10^{-7}) (in./in./°C x 10^{-7})	6	10.8	18	32.4
Electrical Resistivity (ohm-in. x 10^{-5}) (ohm-cm x 10^{-5})	29	73.66	33	82.82
Thermal Conductivity (BTU-ft/ft^2/hr°F) (w/(m·K))	101	175	89	154
Ash Content (%)	0.005		0.005	

GSXP—a basic grade of fine grain, purified graphite. It has densities, strengths and resistivities typical of single-step impregnated graphite. Normal ash levels are less than 50 ppm, and the structure is uniform and free of flaws and laminations.

G-83—a high-performance, reduced-permeability graphite grade with uniform structure, produced to a typical density of 1.83 g/cc (1.05 oz/in^3) for aerospace and other selected applications.

G-Grade—graphites produced in this category are reduced in permeability by filling the pores of the base stock with a graphitized material. These graphites have a fine-grain structure, featuring high strength, high density and excellent resistance to erosion.

G-90—similar to G-83, but with a minimum density of 1.90 g/cc (1.1 oz/in^3) and reduced permeability.

TYPICAL PHYSICAL PROPERTIES OF SPECIALTY GRAPHITE

Grade	Product	Dia., inch (cm)		Max Grain Size, in. (mm)		Apparent Density, g/cc (oz/in^3)		Specific Electrical Resistivity, ohm-in x 10^{-5} (ohm-cm x 10^{-5})		Compressive Strength, psi (MPa)		Flexural Strength, psi (MPa)		Coefficient of Thermal Expansion in./in./°F x 10^{-7} (in./in. /°C x10^{-7})	
GSXP	Tubes	0.75–5.25	1.9–13.3	0.008	0.20	1.65	0.9	32	81.28	6000	41.37	3700	25.51	6.0	10.8
	Rods	3/4–4.25	1.9–10.8	0.008	0.20	1.65	0.9	32	81.28	6000	41.37	3700	25.51	6.0	10.8
	Rods	5–12	12.7–30.5	0.033	0.84	1.72	1.0	32	81.28	6500	44.82	2700	18.62	15.0	27
G-83	Rods	3/4–4.25	1.9–10.8	0.008	0.20	1.83	1.06	31	78.74	8000	55.16	4000	27.58	6.0	10.8
	Rods	5–12	12.7–30.5	0.033	0.84	1.83	1.06	30	76.2	7800	53.78	2900	19.99	15.0	27
G-Grade	Rods	3/4–4.25	1.9–10.8	0.008	0.20	1.87	1.08	29	73.66	10300	71.02	5000	34.47	6.0	10.8
	Rods	5–12	12.7–30.5	0.033	0.84	1.87	1.08	27	68.58	9000	62.05	3000	20.68	15.0	27
G-90	Rods	3/4–4.25	1.9–10.8	0.008	0.20	1.90	1.1	29	73.66	10500	72.39	5200	35.85	6.0	10.8
	Rods	5–12	12.7–30.5	0.033	0.84	1.90	1.1	27	68.58	9200	63.43	3100	21.37	15.0	27

*For information on sizes not listed, contact us.

1) Values shown in htis table are typical. Within each grade, values will vary as the product diameter varies. The coefficient of variation of the values shown in this table may be as high as 10%. 2) Where appropriate all properties shown in this table have been measured with grain.

3) The typical ash level will be less than 0.005% for all products shown in this table. 4) The typical wall –lerance of GSXP tube products will be +/- 0.030 in (0.076 cm). 5) The typical curvature of small-diameter s–ck will be +/- 0.5% arc – cord or 0.5 inch (1.27 cm) over 100 inches (254 cm).

GRAPHITE FLUX TUBE DATA

We are now introducing a full line of graphite fluxing tubes with three different grades:
SST™—The best standard oxidation resistant tube in the industry by our tests.
ZX™—An upgraded tube with twice the oxidation resistance of SST.
ROX COAT™—Brand new solution to chlorine pollution! This tube is nearly impervious at gas pressures normally used with flux tubes. As a bonus, this tube has about four times the oxidation resistance of SST.

Our objective in offering the above family of tubes is to save you, the customer, money. If breakage is often your tube failure mode, our competitively priced SST is the best choice without sacrificing oxidation resistance. If oxidation is your tube failure mode, ZX or ROX can save you money even though each tube costs more.

	GSXP Untreated		SST Treated		ZX Treated		ROX COAT Treated	
Density (g/cc) (oz/in^3)	1.65	0.9	1.75	1.01	1.79	1.03	1.81	1.05
Oxidative Weight Loss (24 hrs @ 1400°F in 3000 cc/min air flow)	70%		7%		3%		2%	
Flexural Strength (psi) (MPa)	3500	24.13	3700	25.51	3700	25.51	3800	26.20

RASCHIG RING

We offer both carbon and graphite raschig rings in six (6) standard sizes to meet most of your packed tower requirements.

Porosity	Density	Carbon	Ash	Length	Diameter	Max Temperature
25%	1.45 gm/cc 0.83 oz/in^3	>99.5%	<0.5%	+/- 1/8 inch (3.175 mm) of Diameter	typical +/- 1/16 inch (1.59 mm)	400°C 752°F

Flux Tubes	ID		OD		LNG	
	inch	mm	inch	mm	inch	cm
62**X**B-000S	1/2	12.7	2	50.8	24"	61.0
62**X**C-000S	1/2	12.7	2	50.8	36"	91.4
62**X**D-000S	1/2	12.7	2	50.8	48"	121.9
62**X**L-000S	1/2	12.7	2	50.8	54"	137.2
62**X**O-000S	1/2	12.7	2	50.8	65"	165.1
62**X**F-000S	1/2	12.7	2	50.8	72"	182.9
62**X**G-001S	1/2	12.7	2	50.8	80"	203.2
62**X**G-000S	1/2	12.7	2	50.8	84"	213.4
62**X**H-000S	1/2	12.7	2	50.8	96"	243.8
62**X**M-000S	1/2	12.7	2	50.8	100"	254.0
62**X**I-000S	1/2	12.7	2	50.8	108"	274.3
62**X**J-000S	1/2	12.7	2	50.8	120"	304.8
62**X**N-000S	1/2	12.7	2	50.8	122"	309.9
62**X**K-002S	1/2	12.7	2	50.8	130"	330.2
63**X**F-000S	3/4	19.05	3	76.2	72"	182.9
63**X**H-000S	3/4	19.05	3	76.2	96"	243.8
To specify treatment, replace **X** with: **GSXP=U, SST=S, ZX=Z, ROX=R**						

Raschig Rings	ID		OD	
	inch	mm	inch	mm
CRR 1/4 x 1/2	1/4	6.4	1/2	12.7
CRR 1/2 x 3/4	1/2	12.7	3/4	19.1
CRR 3/4 x 1	3/4	19.1	1	25.4
CRR 1 x 1 1/2	1	25.4	1 1/2	38.4
CRR 1 1/2 x 2	1 1/2	38.4	2	50.8
CRR 2 3/8 x 3	2 3/8	60.3	3	76.2

Rods	OD	
	inch	mm
RF075GS	3/4	19.1
RF010GS	1.10	27.94
RF012GS	1 1/4	31.75
RF014GS	1 1/2	38.4
RF016GS	1 3/4	44.5
RF021GS	2	50.3
RF024GS	2 1/2	63.5
RF026GS	2 3/4	69.85
RF0306S	3	76.2
RF0406S	4	101.6
Lengths: 12–72 inch (304.8–1828.8 mm)		

Tubes	ID		OD		LNG	
	inch	mm	inch	mm	inch	m
T0206072	1/2	12.7	3/4	19.1	72	1.83
T0610072GS	3/4	19.1	1	25.4	72	1.83
T0610108GS	3/4	19.1	1	25.4	108	2.74
T0612072GS	3/4	19.1	1 1/4	31.8	72	1.83
T0613108GS	3/4	19.1	1 1/4	31.8	108	2.74
T0613144GS	3/4	19.1	1 1/4	31.8	144	3.66
T0712072GS	7/8	22.2	1 1/4	31.8	74	1.88
T0712085GS	7/8	22.2	1 1/4	31.8	86	2.18
T0712108GS	7/8	22.2	1 1/4	31.8	110	2.79
T0712145GS	7/8	22.2	1 1/4	31.8	146	3.71
T0714072GS	7/8	22.2	1 1/2	38.1	72	1.83
T0714108GS	7/8	22.2	1 1/2	38.1	108	2.74
T0714144GS	7/8	22.2	1 1/2	38.1	144	3.66
T1014072GS	1	25.4	1 1/2	38.1	72	1.83
T1014084GS	1	25.4	1 1/2	38.1	86	2.18
T1014108GS	1	25.4	1 1/2	38.1	108	2.74
T1014144GS	1	25.4	1 1/2	38.1	144	3.66
T1420065GS	1 1/2	38.1	2	50.8	65	1.65
T1420072GS	1 1/2	38.1	2	50.8	74	1.88
T1420084GS	1 1/2	38.1	2	50.8	86	2.18
T1420108GS	1 1/2	38.1	2	50.8	110	2.79
T1420145GS	1 1/2	38.1	2	50.8	146	3.71
T2024072GS	2	50.8	2 1/2	63.5	72	1.83
T2024080GS	2	50.8	2 1/2	63.5	80	2.03
T2026072GS	2	50.8	2 3/4	69.9	72	1.83

	inch	mm	inch	mm	inch	m
T2024080GS	2	50.8	2 1/2	63.5	80	2.03
T2026072GS	2	50.8	2 3/4	69.9	72	1.83
T2026108GS	2	50.8	2 3/4	69.9	108	2.74
T2026144GS	2	50.8	2 3/4	69.9	144	3.66
T2125262GS	2 1/8	54.0	2 5/8	66.7	80	2.03
T2303108GS	2 3/8	60.3	3	76.2	108	2.74
T2733054GS	2 7/8	73.0	3 3/8	85.7	54	1.37
T2733108GS	2 7/8	73.0	3 3/8	85.7	108	2.74
T3040072GS	3	76.2	4	101.6	72	1.83
T3040108GS	3	76.2	4	101.6	108	2.74
T3040144GS	3	76.2	4	101.6	144	3.66
T4052054GS	3 7/8	98.4	5 1/4	133.4	54	1.37
T4052072GS	3 7/8	98.4	5 1/4	133.4	72	1.83
T4052108GS	3 7/8	98.4	5 1/4	133.4	109	2.77
T4052120GS	3 7/8	98.4	5 1/4	133.4	120	3.05

Note: The physical and chemical properties listed represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice.

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