

The image displays a variety of carbon and graphite felt products. In the center, there is a roll of dark, woven material. To its left, a roll of lighter-colored felt is partially unrolled, showing a red backing. To the right, another roll of dark felt is visible. In the foreground, there are several circular and rectangular pieces of felt, some with holes, and a large, flat sheet of red felt. The background is a blue gradient with a large, stylized 'N' logo.

Carbon and Graphite Felt



NATIONAL[®]

NATIONAL SPECIALTY PRODUCTS



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Flexible Carbon & Graphite Felt Products—Rayon Precursor



General

NATIONAL[®] carbon and graphite felts are designed for use as high temperature insulation in resistance or induction heated vacuum furnaces and inert gas furnaces. Made of carbon or graphite fibers, these materials have low thermal conductivity and vapor pressure. They are used in oxidizing atmospheres up to 350°C (662°F) and in protective atmosphere or vacuum up to 3000°C (5432°F).

NATIONAL[®] carbon and graphite felts are considerably less expensive and more effective than metallic radiation shields and may be used to replace them, with power savings of up to 75%. The low specific heat and low density permit rapid heating and cooling of furnaces.



Although carbon and graphite felts are slight electrical conductors, in a inductive field under 12 kilohertz, they do not couple and heat up. At higher frequencies, the tendency to couple can be reached by placing longitudinal slits in the felt.

NATIONAL[®] carbon and graphite felts are used as backing strips for soldering and welding. Carbon and graphite felts are easy to cut using scissors or knife and have small bending radii. NATIONAL[®] FELTS have high purity levels with low sulfur content. NATIONAL[®] FELTS have virtually no outgassing and are not wetted by most molten metals.

NATIONAL[®] FELTS are available in a variety of thicknesses and widths.

Grade WDF

Graphite Felt grade WDF is preferred for vacuum service because of its negligible gas evolution when heated to 3,000°C. It also exhibits the greatest oxidation resistance in the presence of trace oxidizing elements in the atmosphere. Shrinkage and water absorption are negligible. Grade WDF has been processed to a minimum temperature of 2,500° C.

Grade VDG

Carbon Felt grade VDG is premium quality carbon felt exhibiting greatly reduced gas evolution and higher oxidation resistance than standard carbon grades. It is not equal to graphite in these respects, but it is a lower cost solution for applications of lower temperatures where chemical purity is not as critical. Grade VDG is processed to a minimum temperature of 1400°C.

Graphite Yarn

Graphite Yarn is used to sew together carbon or graphite felt sections. Grade 99 yarn has a diameter of .025 inches. Each spool contains approximately 2,500 feet of yarn. Minimum order is 1 spool.



National Soft Felt Typical Physical Property Characteristics

PROPERTY	UNITS	DETERMINED AT DEGREES C	CARBON FELT GRADE VDG	GRAPHITE FELT GRADE WDF
Density	Lb / cu ft	20	5.5	5.0
Tensile Strength, Min.	Lb/in-width	20	2	1
Compressive Strength, 10% deformation	Lb/sq.in	20	0.3-1.0	0.2-0.5
Shrinkage, Linear	%	To 3000	1	Nil
Water Absorbtion, in 90% relative humidity	Weight%	20	1	Nil
Carbon Assay, Min	%		99	99.9
Ash	%		.25	.02
Specific Heat	BTU/lb/deg F	20	0.17	0.17
Specific Heat, Mean	BTU/lb/deg F	1400	0.4	0.4
Emissivity, App.			0.99	0.99
Sublimation Temp	Deg C		3600	3600
Surface Area (Via Nitrogen)	S q. m/g	20	0.6	0.7
Thermal Conductivity	BTU in/hr/sq ft/deg F	1000 1400	1.75	2.98
Vapor Pressure, App.	Microns	2270 2440 2620	1 10 100	1 10 100
Min. Process Temp	Deg C		1400	2500

Nominal Dimensional Data

Nominal Thickness			Nominal Width		Nominal Length		Approximate Wgt/Yd	
Size	Inches	mm	Inches	mm	Min. Yard	Typ. Yard	VDG Pounds	WDF Pounds
1/8	0.110	2.8	44	1,118	16	52	0.60	0.55
5 mm	0.200	5.1	44	1,118	16	34	1.22	1.17
			49	1,245	16	34	1.37	1.32
1/4	0.220	5.6	44	1,118	16	34	1.25	1.20
			49	1,245	16	34	1.40	1.35
10 mm	0.394	10	44	1,118	8	17	2.40	2.25
			49	1,245	8	17	2.65	2.50
1/2	0.440	11.2	44	1,118	8	17	2.50	2.35
			49	1,245	8	17	2.75	2.60
1	0.880	22.4	44	1,118	4	8	4.95	4.70

While every care is taken in compiling the information listed here, all compilations and data expressed are typical values and do not constitute a specification.

After manufacture, all felt materials have maximum width variation of +/- 1/4".

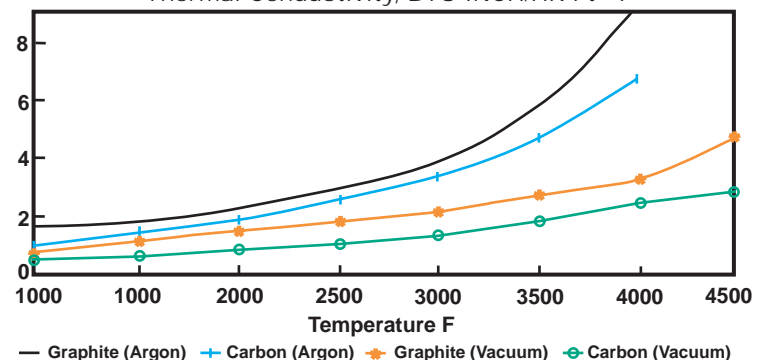
Additional widths, thicknesses, and lengths can be made to order. Density variations can be produced to meet customer needs.

Various shapes and widths can be cut per customer supplied drawings for special applications.

Purified felt to <5ppm can be supplied.

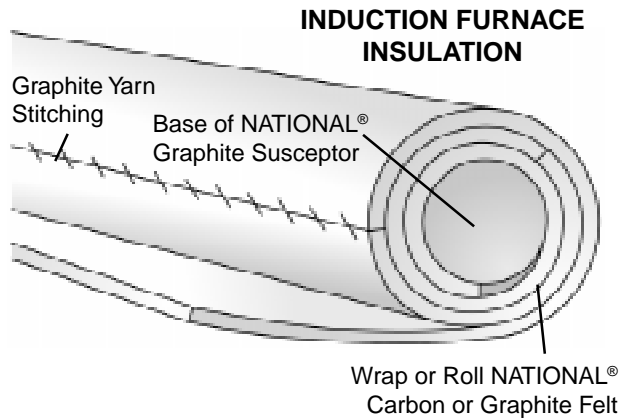
Thermal Conductivity of Felt

Thermal Conductivity, BTU-INCH/HR-Ft²-°F



Fabricating High Temperature Insulation

To install induction furnace insulation, the felt may be wrapped or rolled around the susceptor as shown below. Nine layers make approximately two inches of thickness when 1/4" felt utilized. If more



than one piece is required, butt joints may be sewn together with graphite yarn as indicated. Pressure-sensitive tapes are helpful to hold joints together while sewing.

To facilitate fitting the susceptor with its refractory electrical insulation shell, the assembly may be

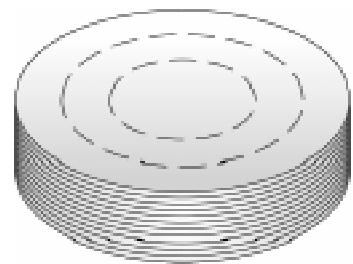
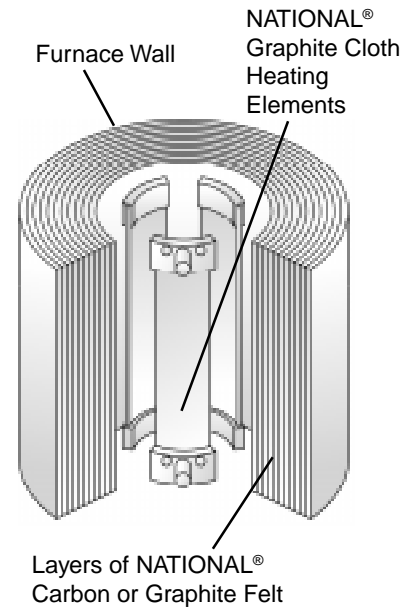
wrapped first with a layer of kraft paper. It is easy to slip this paper out of the furnace after insertion.

In resistance furnaces, radiation shielding, as shown on the right, may be formed around a cardboard or metal mandrel of the desired diameter. After the final turn of felt is made, all the layers should be stitched with graphite yarn at the top and bottom and along the joints.

Support for the felt may be provided internally by a machine graphite sleeve or external by an arrangement of small-diameter graphite rods or a perforated metal sheet. Graphite yarn is used to bind the felt to the support.

Top covers and bottom insulation, shown at lower right, are formed by cutting several discs of felt and sewing them together with graphite yarn.

RESISTANCE FURNACE INSULATION



National Specialty Products offers a wide variety of high quality carbon and graphite products for many applications such as:

ARC CARBONS: Searchlight Advertising, Stage Lighting for Film Production, Movie Production for the Theatre Industry, Plate making for the Printing Industry
PIPE: Heat Exchangers **FLUXING TUBES:** Fluxing Metals **GRAPHITE RODS:** Diamond Synthesis **PARTICLES:** Brake Shoes, Oxygen Getters **POROUS CARBON:** Filters
RASCHIG RINGS: Tower Packing **TAPES:** Heating Elements **ELECTRODES:** Metals, Quartz, Spectroscopic Analysis **CRUCIBLES:** Testing, Melting **FELTS:** Insulation

For more information regarding any of these products, please contact our Customer Service Department at 800-677-6322, Internationally at 419-436-5989, Sales Fax: 419-436-5990



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