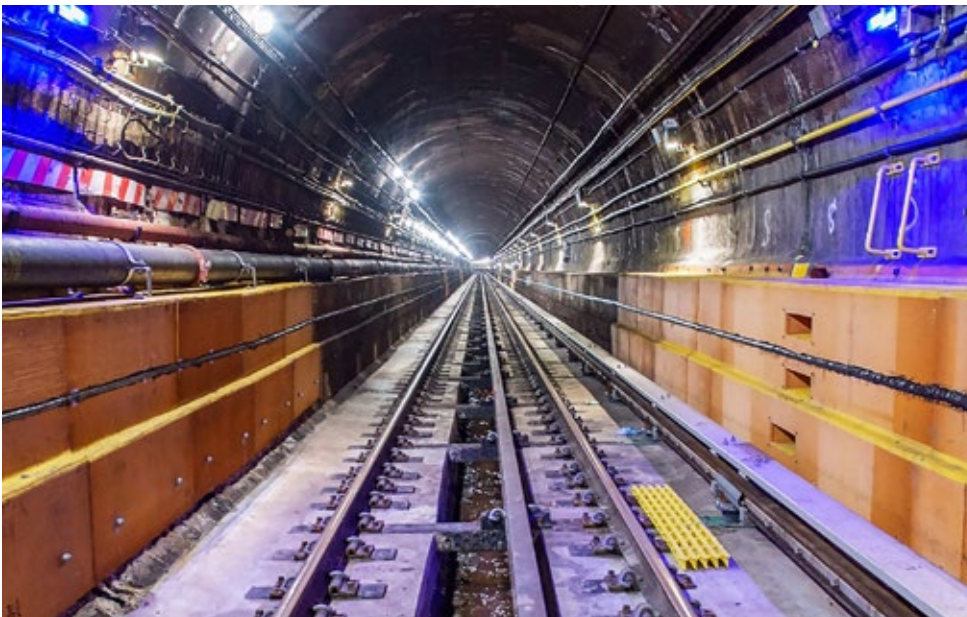




FIRESTRONG® FIRE RESISTANT FRP MATERIALS & PRODUCTS

Withstand Heat and Flame



For applications requiring resistance to fire threats, FireStrong products use specialty resins and additives to ensure that the fiber reinforcements can maintain strength and stiffness. Structural integrity is maintained during and after fire events. Standard resins like polyester, vinyl ester and epoxy can burn resulting in strength loss and creating high levels of smoke. Customized FireStrong or phenolic resin systems can withstand fire and high heat for long time periods while producing very low smoke.

Creative Composites Group manufactures FireStrong products using two of its signature processes: pultrusion and vacuum infusion. Pultrusion provides high volume, cost-effective, constant cross-section parts. Infusion provides medium volume, customized shapes and sizes. FireStrong resin manufacturing requires higher skill levels and more complex processing than typical resins; and CCG has developed this expertise.

FIRESTRONG FIBERGLASS / PHENOLIC DATA

FireStrong materials have been tested for mechanical properties and fire-resistance to industry test methods. Data is presented for phenolic since it is a key resin. Pultruded mechanical properties are for a standard laminate. Infused mechanical properties are developed to create an optimized laminate for each application.

USES

- ▶ Utility Poles
- ▶ Distribution Poles
- ▶ Tunnel Structures
- ▶ Building Products

FEATURES

- ▶ Increased Fire Resistance
- ▶ Increased Heat Resistance
- ▶ Very Low Smoke

BENEFITS

- ▶ Enables FRP Composites to be Used in Hotter Environments
- ▶ Survives Fire Threats
- ▶ Life Cycle Cost Savings

FireStrong Pole System being tested.



FireStrong Typical Mechanical Properties

Mechanical Properties	ASTM Test Method	Units	Pultruded Laminate		Lamina Data for Vacuum Infused Laminates					
			60/20/20 Layout		55 oz Uni Fabric		40 oz Triaxial Fabric		93 oz Quad Fabric	
			Average	Charac-teristic Value	Average	Charac-teristic Value	Average	Charac-teristic Value	Average	Charac-teristic Value
Tensile Strength Lengthwise	D638	psi	58,575	49,363	98,413	89,157	13,779	11,971	85,947	74,629
Tensile Modulus Lengthwise	D638	Msi	3.96	3.58	5.832		1.728		4.640	
Flexural Strength Lengthwise	D790	psi	20,125	12,696						
Flexural Modulus Lengthwise	D790	Msi	2.32	1.96						
Compression Strength Lengthwise	D6641	psi	26,875	20,897	66,668	44,333	15,967	14,093	66,737	53,246
Compression Modulus Lengthwise	D6641	Msi	4.21	3.46	5.480		1.588		4.725	
Tensile Strength Y-direction	D638	psi			0		73.183	56.095	15,433	12,046
Tensile Modulus Y-direction	D638	Msi			0		3.676		1.479	
Compression Strength Y-direction	D6641	psi			15,948	13,031	42,251	32,697	18,919	16,527
Compression Modulus Y-direction	D6641	Msi			1.857		3.418		2.240	
In-Plane Shear Strength		psi			5,315	3,516	24,630	15,929	18,095	14,158
Interlaminar Shear Lengthwise	D2344	psi	1,508	1,168						
Water Absorption	D570	%	1.70%							

Characteristic design values are calculated per ASTM D7290.

Fire Resistance Properties

Test	Pultruded	Infused
UL94 Flammability Rating		
	V0	-
ASTM E-84-23d Standard Test Method for Surface Burning Characteristics of Building Materials		
Rating	A	A
Flame Spread Index (FSI)	5	0
Smoke Density Index (SDI)	50	0
ASTM E-136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C		
		Passed

For UL-94, rating of V0 is No Flaming Time, No Combustion.
ASTM E-84 provides classification per Section 803.1.2 of International Building Code

BSS 7239 Toxic Gas Generation: Pultruded Laminate

Gas	CO	HCN	SO ₂	HCl	HF	(NO+NO ₂) NO _x
Average PPM	13	<1	<1	<1	<1	<1