

Hex-3R[®] Composite Strengthening Systems

Wrap 230[™]

The Hex-3R[®] Composite Strengthening System is a carefully designed portfolio of high strength and modulus fabrics that are rugged, flexible and easy to field fit for efficient application. Hexcel Corporation's expertise in fabric architecture uses E-glass and carbon fibers to provide a range of durability, strength and modulus to meet engineering and aesthetic requirements.

Wrap 230[™] is a 6 oz/yd² (230 gsm) carbon unidirectional fabric. Wrap 230[™] is used where additional strength, modulus or environmental durability is required and is compatible with any of the Hex-3R Epoxy[™] 300 series epoxy resins. This fabric is registered with ICBO.

Where to Use

- Loading increases
- Seismic strengthening
- Temporary strengthening
- Change in structural system
- Design or construction defects

Advantages

- Used for shear, confinement or flexural strengthening
- Flexible, can be wrapped around complex shapes
- Lightweight
- Non-corrosive
- Acid resistant
- Low aesthetic impact
- Economical

Packaging

Rolls: 12 or 24 in. x 150 linear feet

Carbon Fiber Properties:

Number of Filaments	12,000
Tensile strength (psi)	560,000
Tensile modulus (msi)	33
Density (g/cc)	1.77
Elongation (%)	1.6

Hex-3R® Composite Strengthening Systems

Wrap 230™

Hex-3R Epoxy 300™ and Wrap 230™ Laminate Properties

Properties after standard cure (70-75°F – 5 days)

Property	Average Value ¹		Design Value ²		ASTM Test Method
	US Units	SI Units	US Units	SI Units	
	psi	MPa	psi	MPa	
Tensile Strength*	138,400	954	109,300	753	D3039
Tensile Modulus*	9,626,600	66,327	8,518,700	58,698	D3039
Tensile % Elongation *	1.33	1.33	1.12	1.12	D3039
140F - Tensile Strength	137,600	948	125,000	861	D3039
140F - Tensile Modulus	10,210,400	70,349	9,333,800	64,310	D3039
140F - % Elongation	1.25	1.25	1.1	1.1	D3039
Compressive Strength	101,100	696	91,200	629	D695
Compressive Modulus	9,446,500	65,086	8,221,600	56,647	D695
90 deg Tensile Strength	3,500	24	2,000	13.5	D3039
90 deg Tensile Modulus	748,200	5,155	680,400	4,687	D3039
90 deg %Tensile Elongation	0.48	0.48	0.33	0.33	D3039
Shear Strength+/-45 In Plane	9,800	67	8,600	67	D3518
Shear Modulus +/-45 In Plane	340,100	2,343	321,200	2,213	D3518
Ply Thickness (inches/mm)	0.015	0.381			

Hex-3R Epoxy 306XR™ and Wrap 230™ Laminate Properties

Properties after standard cure (70-75°F – 5 days)

Property	Average Value ¹		Design Value ²		ASTM Test Method
	US Units	SI Units	US Units	SI Units	
	psi	MPa	psi	MPa	
Tensile Strength*	131,000	903	104,000	713	D3039
Tensile Modulus*	9,826,700	67,706	8,825,150	60,806	D3039
Tensile % Elongation *	1.23	1.23	0.99	0.99	D3039
140F - Tensile Strength	96,300	664	83,850	577	D3039
140F - Tensile Modulus	7,982,000	54,996	7,311,500	50,376	D3039
140F - % Elongation	1.17	1.17	0.72	0.72	D3039
Compressive Strength	89,900	619	73,550	504	D695
Compressive Modulus	7,998,200	55,108	7,610,900	52443	D695
90 deg Tensile Strength	600	41	450	35	D3039
90 deg Tensile Modulus	740,100	5,099	667,950	4,601	D3039
90 deg Tensile Elongation	0.85	0.85	0.64	0.64	D3039
Shear Strength+/-45 In Plane	10,700	74	8,150	59	D3518
Shear Modulus +/-45 In Plane	403,600	2,781	356,200	2,450	D3518
Ply Thickness	0.015	0.381			



Hex-3R® Composite Strengthening Systems

Wrap 230™

Sikadur 330 and Wrap 230™ Laminate Properties

Properties after standard cure (70-75°F – 5 days)

Property	Average Value ¹		Design Value ²		ASTM Test Method
	US Units	SI Units	US Units	SI Units	
	psi	MPa	psi	MPa	
Tensile Strength*	129,800	894	91,100	626	D3039
Tensile Modulus*	9,492,300	65,402	8,536,350	58,817	D3039
Tensile % Elongation *	1.33	1.33	0.97	0.97	D3039
140F - Tensile Strength	118,200	814	93,900	648	D3039
140F - Tensile Modulus	9,680,200	66,697	8,199,400	56,496	D3039
140F - % Elongation	1.16	1.16	0.92	0.92	D3039
Compressive Strength	113,000	779	89,000	613	D695
Compressive Modulus	9,724,700	67,003	8,982,650	61,894	D695
90 deg Tensile Strength	390	27	390	21	D3039
90 deg Tensile Modulus	852,800	5,876	772,100	5,315	D3039
90 deg Tensile Elongation	0.46	0.46	0.37	0.37	D3039
Shear Strength +/- 45 In Plane	9,100	63	7,450	53	D3518
Shear Modulus +/- 45 In Plane	421,200	2,902	398,400	2,749	D3518
Ply Thickness	0.015	0.381			

*Properties determined by testing 24 samples prepared per the applicable ASTM procedure. All other tests were based on 6 coupon samples. All data relates to the test program run in 2000 on specific Hexcel Hex-3R products and is expected to be representative of the product produced during that time period.

¹ Average data is typical of the results found in the year 2000 testing program

² Design data is defined as the average value minus 3 standard deviations – based on year 2000 test program.

