

METROLOGY LAB AND FACILITY TESTING CAPABILITIES

Creative Pultrusions Inc. (CPI), Quality Assurance Department maintains a fully functional and temperature / humidity controlled Metrology Lab. This lab is capable of performing most of the standard material characterization tests necessary to develop mechanical properties for glass reinforced composite materials. These tests are typically performed on one of the two electro-mechanical test machines located in the lab.

- INSTRON 5985 - 50,000 lbs. load cell with Advanced Video Extensometer AVE2, Transverse Strain Measurement Option, and Digital Image Correlation Software (DIC)
- INSTRON 4204 - 10,000 lbs. load cell with standard manual features.

Table A below lists the common material properties and test standards for which these machines are used.

TABLE A:

Test Standard	Material Property
ASTM D2344	Inplane Shear Strength**
ASTM D2344	Interlaminar Shear Strength
ASTM D5379	V-Notch Shear
ASTM D638	Tensile Modulus
ASTM D638	Tensile Strength
ASTM D6641	Combined Loading Compression
ASTM D695	End Loaded Compression Modulus
ASTM D695	End Loaded Compression Strength
ASTM D732	Shear Strength by Punch
ASTM D7332	Fastener Pull Through
ASTM D790	Flexural Modulus
ASTM D790	Flexural Strength
ASTM D953	Pin Bearing Strength

** Follow ASTM D2344, but rotate the coupon 90° (cut section of coupon length faces up)



In addition to the ASTM tests performed on the electro-mechanical testers, other ASTM tests are also performed both in-house and outsourced to secondary test facilities for completion.

Table B below lists some of the additional tests often performed in the CPI laboratory and facility.

TABLE B:

Test Standard	Material Property
ASTM D570	Water Absorption
ASTM D3163	Adhesive Lap Shear
ASTM D2794	Impact Testing for Powder Coatings
ASTM D3359	Adhesion Test Tape Method
ASTM D2583	Barcol Hardness
ASTM D2584	Ignition Loss of Cured Reinforced Resins
ASTM D3914	Inplane Shear (Rod)
ASTM D4476	Flexural Strength (Rod)
ASTM D5117	Dye Penetration
ASTM D635	Burn Rate
ASTM D8019	Crossarm Flexural Modulus
UL 94	Flammability Test

Table C below lists some of the additional testing often outsourced for completion.

TABLE C:

Test Standard	Material Property
ASTM D149	Dielectric Breakdown Voltage and Dielectric Strength
ASTM D150	AC Loss Characteristics and Permittivity (Dielectric Constant)
ASTM D256	Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D495	High-Voltage, Low-Current, Dry Arc Resistance
ASTM D696	Coefficient of Linear Thermal Expansion
ASTM D792	Density and Specific Gravity (Relative Density)
ASTM E662	Specific Optical Density of Smoke Generated by Solid Materials
ASTM E84	Surface Burning Characteristics of Building Materials



CPI also maintains three flexural test units which are used for full scale component testing and/or first article validation.

- The first and smaller of the three test units has a span of 12 feet and a load capacity of 10,000 lbs. This frame is commonly used for small-part full-scale flexural testing. As a result of the lower load capacity the frame also has higher resolution of the load.
- The second mid-range test unit is capable of spans up to 25 feet and parts up to 24 inches wide. The load capacity of this larger frame is 30,000 lbs. and it's capable of failing the majority of the parts produced by CPI. This frame is also used for large scale compression testing of parts and component assemblies.
- The third and largest of the three test units has a load capacity of 50,000 lbs and its frame is used for specialty testing and variable length spans.

CPI offers an on-site QUV accelerated weathering tester. This test unit is used to age coupon level test specimens via ultraviolet light and condensation cycles to determine property knockdowns over the life of a component.

CPI's testing capabilities are virtually unlimited and complimented by other standard laboratory equipment. This includes but is not limited to:

- Furnaces for use in burn-off and volume fraction measurements
- Equipment used for inspection of incoming resins.
- Equipment used to qualify raw materials.
- Contained ignition source for horizontal and vertical burn testing