

MOLDED FIBER GLASS

RESEARCH



Capabilities of Equipment and Testing



Molded Fiber Glass Research

Capabilities of Equipment and Testing

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* - A2LA /ISO/IEC 17025 Accredited Test Method

Molded Fiber Glass Research Lab



Capabilities of Equipment and Testing



TESTING FACILITIES

Library:

This room is equipped with records such as SPI Conference records, Thomas Register, MSDS data sheets, ASTM for all of the procedural methods performed at the lab, and a multitude of engineering texts.

Testing Area:

The lab contains a climate-controlled room that remains at 74°F (+/- 4°F) and 50 % (+/- 5%) relative humidity all year.



TESTING CAPABILITIES

Mechanical Properties

* Barcol Hardness:

A Barber-Coleman Barcol Impresser is used to determine the indentation hardness and is used for estimating the degree of cure of reinforced thermoset plastic. (Lab Manual Procedure #2101)

* Compression Properties of Rigid Plastics:

Using the Sintech Computerized Test Systems, which is capable of applying a constant load of up to 30,000 pounds, the compressive strength (edgewise and flatwise) can be determined by peak load and dimensions. (Lab Manual Procedure # 2106)

Dynatup Impact:

(Most of these tests are customer-specified variations.) This test method is designed to provide load versus deformation response of plastics under essentially multiaxial deformation conditions at impact velocities. (Lab Manual Procedure # 2109)

* Flexural Properties of Plastics:

Using the Sintech Computerized Test Systems, the flexural strength and flexural modulus are determined for thermoset plastic laminates. (Lab Manual Procedure # 2104)

*** In-Plane Shear:**

This test measures the in-plane shear strength of a fiber glass laminate using the Sintech Computerized Test System. (Lab Manual Procedure # 2111)

*** IZOD Impact:**

The impact strength or the resistance to breakage of a fiber glass laminate is determined by means of a pendulum-type hammer in this test (Lab Manual Procedure # 2105) and Un-notched Izod (Lab Manual Procedure # 2114).

Punch Shear:

Using the Sintech Computerized Test System, the punch load necessary to crack a fiberglass-reinforced substrate is determined. (Lab Manual Procedure # 2113)

Short Beam Shear:

A short beam cut from a flat laminate can determine the interlaminar shear strength of fiber reinforced composites using the Sintech Computerized System. A short beam is cut from a flat laminate up to 6.4 mm in thickness, according to ASTM D 2344-84. (Lab Manual Procedure # 2112)

*** Tensile Properties:**

By utilizing the Sintech Computerized Test System (capable of applying a constant rate of pulling force on a specimen held in clamping jaws), the tensile strength and tensile modulus are determined for thermoset laminates (Lab Manual Procedure # 2102), fiber glass preforms (Lab Manual Procedure #2103), or Tensile Properties of Polymer Matrix Composite Materials (Lab Manual Procedure # 2116).

Flame

FMVSS302:

This procedure defines burn resistance used in occupant compartments of motor vehicles. (Lab Manual Procedure # 2206)

Oxygen Index:

This method provides a procedure for measuring the minimum concentration of oxygen in a flowing mixture of oxygen and nitrogen that will just support flaming combustion. (Lab Manual Procedure # 2202)

UL-94 VB, HB & 5V Flame Tests:

These tests provide a simple bench top method for determining the flammability of thermoset plastics. Factors such as ease of ignition, burn time, extent of burn and burn rate are found using a Bunsen Burner. (Lab Manual Procedure #2201)

Environmental

Accelerated Weathering (QUV):

This practice determines the effect that ultraviolet radiation and condensation (i.e. sunlight, rain or dew) have on fiberglass laminates and coatings. (Lab Manual Procedure # 2301)

Alkaline Boil:

Using a heated cylinder with a boiling alkaline solution, the amount of discoloration and degradation of a material due to an alkaline bath can be determined. (Lab Manual Procedure # 2303)

Humidity Conditioning:

This test provides a standard procedure for exposing test specimens to a high humidity environment using a humidity cabinet. Samples are tested at 100°F and 100% relative humidity. (Lab Manual Procedure # 2302)

Coatings Testing

Crosshatch Adhesion:

This test is used to determine the relative adhesion of paint to a sample of fiberglass laminate. This procedure is accomplished by applying and removing pressure-sensitive tape over cuts made in the film. (Lab Manual Procedure # 2305)

Diesel Fuel Immersion Test:

This test is used to determine paint performance on exterior components after exposure to diesel fuel, generally for Freightliner. (Lab Manual Procedure # 2325)

Dry Film Thickness – on Metal Substrates:

This method will measure the thickness of dry paint applied to a substrate by the use of a thin metallic foil shim. (Lab Manual Procedure # 2315)

Elcometer Adhesion:

This test uses an Elcometer to find the adhesion properties (including pull-off strength) of a coating. (Lab Manual Procedure # 2313)

Engine Oil Immersion Test:

This test is used to determine paint performance on exterior components after exposure to engine oil, generally for Freightliner. (Lab Manual Procedure # 2324)

Ethylene Glycol Immersion:

This test is used to determine paint performance on exterior components after exposure to ethylene glycol, generally for Freightliner. (Lab Manual Procedure # 2323)

Gardner Gloss:

This procedure is used to measure the specular gloss of non-metallic paint using the Micro-Tri-Gloss Glossmeter at geometries of 20°, 60°, or 85°. (Lab Manual Procedure # 2309)

Gravelometer:

This test is used to determine the resistance of surface coatings to chipping by gravel impact. This test is designed to reproduce the effect of gravel striking exposed painted or coated surfaces of an automobile. (Lab Manual Procedure # 2311)

Heat Aging Test:

This procedure is used to observe the effect of heat on coatings by placing samples in an air-circulating oven set to 70°C for seven days. (Lab Manual Procedure # 2321)

Moisture Cold Cycle Test:

This test is used to observe how coatings respond to cycling through humidity, cold and room temperatures. (Lab Manual Procedure # 2322)

Pencil Hardness:

This method will describe the measurement of film hardness using drawing leads of known hardness. (Lab Manual Procedure # 2312)

Radius Bend Test:

This test will determine the flexibility of a fiber glass laminate by bending the sample around a ¼” mandrel. At the first audible cracking, load and ultimate failure are determined. (Lab Manual Procedure # 2316)

Spectrophotometer:

The Minolta Spectrophotometer is used to test the color qualities of a molded part. (Lab Manual Procedure # 2527)

Water Immersion (7 Day Soak):

This method determines the effects that constant exposure to water over a set amount of time would generate in a coating or substrate. (Lab Manual Procedure # 2310)

Wave Scan:

Using the Wave Scan from Byk-Gardner, this test can detect the degree of surface roughness on any of six scales. (Lab Manual Procedure # 2308)

X-Cut Tape Adhesion:

The method is used to determine paint adhesion by applying and removing pressure-sensitive tape over cuts made in the film. Note: 5.0 mils and above of dry film thickness should be used for this test. (Lab Manual Procedure # 2305)

Zahn Cup Viscosity:

This test is used to determine the viscosity of a liquid using a Zahn cup with a specified orifice and a stopwatch. (Lab Manual Procedure # 2516)

Surface Testing

Crack/Craze of Fiber Glass Laminate:

Using a lapstrake mold, panels are molded with sharp radii on the male and female surfaces. These panels are then subjected to a series of postbake cycles to evaluate the crack/craze resistance of a cured resin system. (Lab Manual Procedure # 2318)

Scratch Resistance (Hoffman):

By utilizing a Hoffman Scratch, Adhesion, and Mar (S.A.M.) Tester, the scratch resistance of a surface is determined. (Lab Manual Procedure # 2304)

Stain Resistance:

Using reagents known for their staining characteristics, the resistance to staining of a coating on a material can be determined. Crayons, shoe polish, washable ink, gentian violet solution, lipstick, hair dye, and iodine are the reagents used. (Lab Manual Procedure # 2319)

Taber Abrasion:

Using a set weight with a grinding wheel of known hardness, the abrasive resistance of a material using a percentage loss method can be determined. (Lab Manual Procedure # 2307)

Video Imaging Microscope:

Through this procedure, microscopic images can be captured and placed into computerized files. These images are then used to identify surface defects such as porosity, cratering, contamination, and others. (Lab Manual Procedure # 2306)

Physical Properties

Binder Content of Preforms:

Using this test method, the percentage of binder in a 4" preform sample can be obtained. (Lab Manual Procedure # 2501)

*** Brookfield Viscosity:**

Using either an HBT or a RVT Viscometer, the viscosity of a sample material can be determined. (Lab Manual Procedure # 2515)

*** Glass Content and Filler Content:**

This test is used to determine the percentage of glass reinforcement in a filled fiberglass reinforced plastic laminate. This method is not recommended for low-density laminates. (Lab Manual Procedure # 2503).

Ignition Loss of Cured Reinforced Resins:

Using a high temperature burn-off and a pre-weighed specimen, a sample of fiber glass reinforced plastic laminate is reduced to glass fibers from which the percentage of glass reinforcement is determined. (Lab Manual Procedure # 2505)

Micromet:

The Micromet 1500 Cure Analyzer with ICAM software is used in determining the cure behavior of SMC, BMC, and wet mix. (Lab Manual Procedure # 2526)

Oil Absorption of Fillers:

An indication of the particle size of the filler can be found by determining the oil absorption of fillers. (Lab Manual Procedure # 2518)

Pot Gel Time:

In this test, a Shyodu Gel Timer is used to determine the gel time of resinous plastics. (Lab Manual Procedure # 2510)

SPI Gel Time:

This method is used to obtain the gel, cure and maximum exothermic temperature characteristics of a resin. (Lab Manual Procedure # 2509)

Solids Content of Resins:

This procedure is used to determine the solids content of a resin, a dispersion, or an emulsion. (Lab Manual Procedure # 2502)

*** Specific Gravity:**

This method covers the determination of the specific gravity and density of solid plastics by displacement of liquid and determination of the change in weight. (Lab Manual Procedure # 2506)

Spiral Flow SMC Test Mold:

The spiral flow test mold is used in a standard 50-ton hydraulic press. It tests the flow properties of SMC. (Lab Manual Procedure # 2525)

*** Water Absorption:**

This test method uses specific gravity and a scale to accurately determine the amount of water that is absorbed into a sample. (Lab Manual Procedure # 2507)

Thermal

*** Deflection Temperature Under Load (DTUL):**

DTUL is the temperature at which a specified deformation occurs in a specimen when heated at a specified rate of increase and subjected to a specified flexural load. This procedure applies to cast, molded and laminated plastics that are rigid at room temperature. (Lab Manual Procedure #2005)

*** Differential Scanning Calorimetry (DSC):**

The DSC is used to determine the degree of cure and glass transition temperature of a fiberglass reinforced plastic. (Lab Manual Procedure # 2002)

*** Dynamic Mechanical Analyzer (DMA):**

This test is intended to provide a means for determining the transition temperatures, elastic and loss moduli of plastics over a range of temperatures, frequencies or time by free vibrations and resonant or nonresonant forced vibration techniques. (Lab Manual Procedure # 2001)

*** Thermogravimetric Analysis (TGA):**

This method covers the procedure by which the TGA measures weight changes resulting from chemical reactions, decomposition, solvent and water evolution and oxidation in sample materials. (Lab Manual Procedure # 2003)

*** Thermomechanical Analysis (TMA)**

This method covers the procedure by which dimensional and viscoelastic changes such as the coefficient of thermal expansion, softening point, melting point and glass transition temperatures are measured. (Lab Manual Procedure # 2004)

Adhesives

*Cross Peel:

This test is used to determine the adhesive strength of a rigid plastic bonded in a cross peel configuration. (Lab Manual Procedure # 2108)

*Lap Shear:

This test is used to determine the adhesive strength of a rigid plastic bonded in a lap shear configuration. (Lab Manual Procedure # 2107)

Chemical

Acid Number:

A sample of resin is dissolved in Methyl Cellusolve. The solution is then titrated with 0.1 N alcoholic Potassium Hydroxide solution to a color change end point. This test is used to determine the acid number of a polyester resin. (Lab Manual Procedure # 2401)

* FTIR Analysis:

The FTIR is the Fourier Transform Infrared Spectrometer. It is used in the analysis of various compounds and materials. (Lab Manual Procedure # 2407)

* Gas Chromatography:

This instrument is used to measure the residual volatile components of a compound. (Lab Manual Procedure # 2408)

Moisture Content – Karl Fisher:

This test provides a means for determining the moisture content of fillers. (Lab Manual Procedure # 2404)

Pensky-Martens Flash Point:

This procedure covers the methods of determining the flash point of materials using a manual, gas-heated Pensky-Martens closed-cup tester. This procedure can be used on liquids with flash points of 104°F or higher and with viscosities of 9.5 cP or more at 77°F. (Lab Manual Procedure # 2409)

Polymer Content in Styrene:

This test precipitates polystyrene from a sample of styrene monomer and determines whether the polymer content exceeds the allowable maximum of 10 ppm. (Lab Manual Procedure # 2410)

Styrene Emission:

This is a procedure for testing the amount of styrene emitted from a catalyzed resin. (Lab Manual Procedure # 2405)

Styrene Odor:

This is a simple, subjective test to determine the presence of Styrene odor in a cured thermoset polyester laminate. (Lab Manual Procedure # 2406)

Composite Processing

Resin Systems Testing

- BMC
- SMC
- Wet Mixes

Glass Systems Used

- Glass Mat
- Directed Fiber Preforming
- Carbon Fiber
- Needle Mat

Molding Abilities

- Low Temperature Composite Molding
- Vacuum Bag
- Hand Lay Up
- Matched Metal Die Compression Molding
 - 3 Eemco 50-ton presses
 - 1 Eemco 113-ton press
 - 1 Hannifin 150-ton press
 - 1 Version 250-ton press

Specialty Equipment

- Penco SMC Spiral Flow Tool
- Finn and Fram Sheet Molding Compounding Machine
- Bulk Molding Compound Mixer

- - **A2LA/ISO/IEC 17025 Accredited Test Method**



**THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION**

ACCREDITED LABORATORY

A2LA has accredited

**MOLDED FIBER GLASS RESEARCH
COMPANY**
Ashtabula, OH

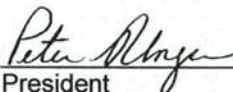
for technical competence in the field of

Mechanical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 16th day of June 2005.





President

For the Accreditation Council
Certificate Number 1280.01
Valid to May 31, 2007

For tests or types of tests to which this accreditation applies,
please refer to the laboratory's Mechanical Scope of Accreditation.

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

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MECHANICAL

Valid To: May 31, 2007

Certificate Number: 1280-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests on plastics:

<u>Test Method</u>	<u>Test</u>
ASTM C393	Flexural Properties of Sandwich Constructions
ASTM C297	Flatwise Tensile Strength of Sandwich Constructions
ASTM D256	Determining the Pendulum Impact Resistance of Notched Specimens of Plastics
ASTM D570	Water Absorption of Plastics
ASTM D638	Tensile Properties of Plastics
ASTM D648-A	Deflection Temperature Under Load
ASTM D695	Compression Properties of Rigid Plastics
ASTM D790	Flexural Properties of Unreinforced and Reinforced Plastics & Electrical Insulating Materials
ASTM D792-A	Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D1824	Apparent Viscosity of Plasticsols and Organosols at Low Shear Rates
ASTM D2196	Brookfield Viscosity
ASTM D2583	Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser
ASTM D2584	Glass Content and/or Filler Content

(A2LA Cert. No. 1280-01) 06/16/2005 – Revised

<u>Test Method</u>	<u>Test</u>
ASTM D3039	Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials
ASTM D3163	Lap Shear (Adhesive Test) and/or Cross Peel (Adhesive Test)
ASTM D3410	Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading
ASTM D-3518	In Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a $\pm 45^\circ$ Laminate
ASTM D3846	In-plane Shear Strength of Reinforced Plastics
ASTM D4526	Determination of Volatiles in Polymers by Headspace Gas Chromatography - Procedure A
ASTM D4812	Standard Test Method for Un-Notched Cantilever Beam Impact Resistance of Plastics
ASTM D5083	Standard Test Method for Tensile Properties of Reinforced Thermosetting Plastics Using Straight-Sided Specimens
ASTM D5279	Measuring the Dynamic Mechanical Properties of Plastic in Torsion Test Method Test
ASTM E831	Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM E1131	Thermogravimetry
ASTM E1356	Differential Scanning Calorimetry
DIN EN 1465	Determination of Tensile Lap-Shear Strength of Rigid-to-Rigid Bonded Assemblies
DIN EN 2746	Determination of the Flexural Properties of Glass Fiber Reinforced Plastics for Aerospace Applications
DIN EN 2747	Tensile Properties of Glass Fiber Reinforced Plastics for Aerospace Applications
ISO/FDIS 75-1	Plastics-Determination of Temperature of Deflection Under Load – General Test Method
ISO/FDIS 75- 2	Plastics-Determination of Temperature of Deflection Under Load – Plastics, Ebonite and Long Fiber Reinforced Composites
ISO/FDIS 75-3	Plastics-Determination of Temperature of Deflection Under Load – High Strength Thermosetting Laminates

<u>Test Method</u>	<u>Test</u>
ISO 92	Determination of Water Absorption
ISO 178	Plastics-Determination Flexural Properties
ISO 291	Standard Atmospheres for conditioning and Testing
ISO 527-2	Test Conditions for Molding and Extrusion Plastics
ISO 527-4	Test conditions for Isotropic & Orthotropic Fiber Reinforced Plastic Composites
ISO 527-5	Test Conditions for Unidirectional Fiber Reinforced Plastic Composites
ISO 1172	Textile Glass Reinforced Plastics-Determination of the Textile-Glass and Mineral-Filler Content-Calcination Methods
ISO 2555	Plastic - Resins in the Liquid State or as Emulsions or Dispersions – Determination of Apparent Viscosity by the Brookfield Test Method
ISO 6721-2	Determination of Dynamic Mechanical Properties – Torsion Pendulum Method
ISO 14126	Fiber Reinforced Plastic Composites - Determination of Compressive Properties in the In-Plane Direction
ISO 14129	Fiber Reinforced Plastic Composites – Determination of the In-Plane Shear Stress/Shear Strain Response, Including the In-Plane Shear Modulus and Strength, By the $\pm 45^\circ$ Tension Test Method
MFG 2407	FTIR Analysis