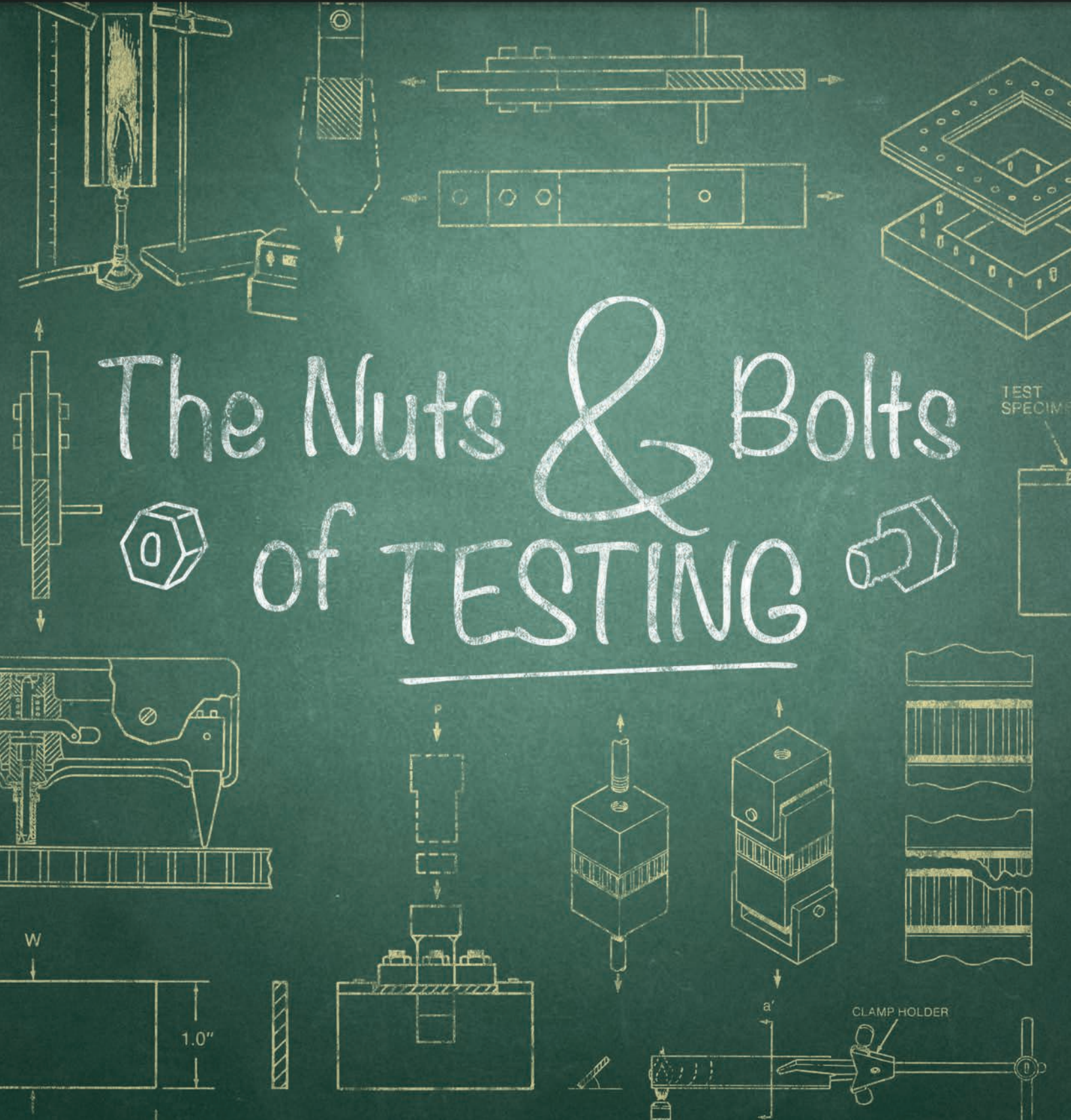


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The Nuts & Bolts of TESTING



The Nuts & Bolts of TESTING

Ask any child what they dislike most about school and their reply will most likely be "tests." We've all experienced the anxiety that comes right before you take a test. It doesn't matter if it's a medical exam, a classroom test or a test of physical ability. Even when you feel certain of the outcome, there's a part of you that feels anxious until you get the results. Yet tests are the best method of determining whether your health is good, you learned the lesson or can meet the challenge put before you.

For a manufacturer, testing is a critical step in the process of establishing acceptability of a product before it reaches the market. Test results tell the customer he is getting a product that meets or exceeds his requirements. At M.C. Gill Corporation we've built a reputation around 68 years of manufacturing excellence, and at the core of our business is product testing.

A good scientist will tell you that a well-designed test will determine whether a product or process is sound. M.C. Gill Corporation places special emphasis on proving the products it manufactures meet all of the mechanical properties required by customers as well as regulatory agencies.

Test methods are designed to establish comparative values of a given material. Obviously, there are numerous tests used by manufacturers within the aerospace industry to determine a product's viability. Most often tests are run to guarantee a product meets an OEM's specifications. Specifications detail how a material must perform under controlled conditions and specifications are strictly enforced. In addition, most products must pass the Federal Aviation Administration's Federal Airworthiness Requirements (FAR) before installation.

Virtually every product M.C. Gill Corporation manufactures is made to OEM or military specifications which encompass several mechanical, physical and/or electrical properties. The correlation between these specifications and aircraft design becomes clearer by examining where certain products are used.

M.C. Gill Corporation products are classified into several major product families: cargo liners,

floor panels, interior panels, honeycomb core and specialty products. So why do performance properties for these products play such a critical role in aircraft design?

For example, cargo liners cover the lower and upper sidewall, ceilings and sometimes part of the floor of the cargo hold. There are literally miles and miles of hydraulic lines, wiring, tubing and ducting that run through the structural members along the inner side of the outer skin of an aircraft. A cargo liner's primary function is to serve as a barrier to protect those conduits from shifting cargo, the impact of loading or mishandling of baggage and to protect the outer skin of the aircraft. Cargo liners are the barrier that will prevent flame penetration if a fire occurs, making stringent burn-through requirements obvious. Qualifying criteria also demand installation of a liner with high-impact (puncture) and pullout resistance with consistently uniform quality.

As expected, safety is the driving force behind many requirements. Protecting passengers from fire, smoke, toxic fumes, etc., may seem obvious but these concerns had no firm guidelines (and resulting punitive action) until after a series of tragic accidents in the 1980s and 1990s. Fortunately today, safety in the air has a global commitment from military and private providers alike.

The first group of tests involve how materials react when exposed to fire, and the smoke that would result, under controlled conditions. Most of these tests are routinely used on all cargo liners, floor and interior panels.

Flammability Tests

Both laminates and sandwich panels must conform to fire safety standards in all parts of an aircraft when installed in any structure occupied by humans. Flammability tests can be used for assessing the risks and impact of a fire. Tests will measure the heat and smoke release rates by materials and products when exposed to a set level of radiant heat. The results reveal how the material will perform under laboratory conditions in response to heat and flame. The tests also measure heat release from ignition, duration before ignition and progressive flame involvement on the surface of a material. Common flammability tests include:

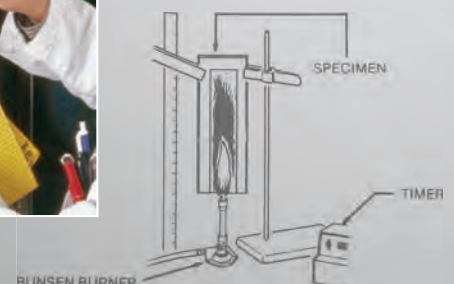
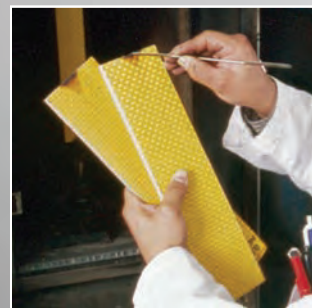
Vertical Flame Test

Appendix F in 14CFR25 divides aircraft components into two classes:

Type A – Galley and cabin interior panels, structural flooring in passenger-occupied compartments, Type B – Cargo compartment liners, air ducts, textiles, trays, molded and thermoformed parts used in compartments occupied by passengers and crew.

Type A materials are subjected to a 60-second exposure to flame while Type B panels are exposed to only 12 seconds of flame.

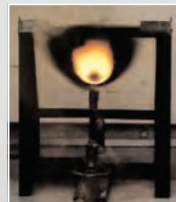
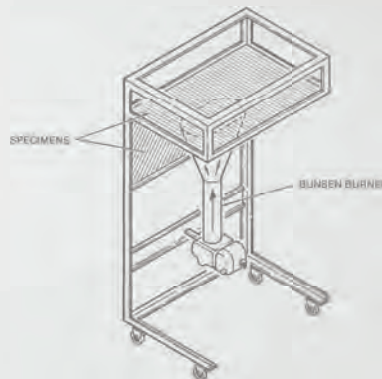
The specimens are brought to moisture equilibrium then placed in a fixture for the vertical flame test



Burn-Through Resistance Test

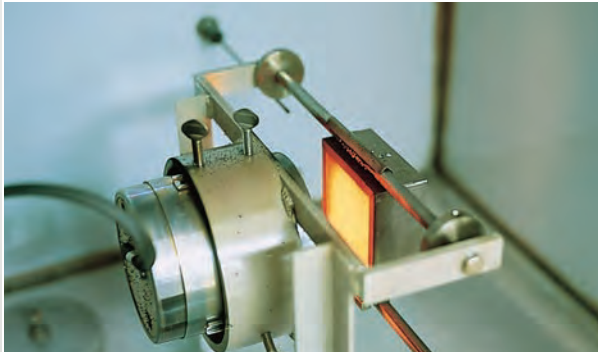
The **Burn-Through Resistance** test specifically applies to materials used in cargo compartment areas. The purpose of the test is to measure how well a material will prevent fire from spreading (either in or out) in the cargo compartment hold in the event of an in-flight fire. If a 1,700° F flame does not burn a hole through the product within five minutes and the temperature above the product does not exceed 400° F, the product passes.

As stated above, protecting passengers from the danger of an in-flight fire, and the resulting smoke and toxic fumes, is at the core of material requirements by the FAA, aircraft manufacturers and commercial airline operators. In addition to cargo liners, floor and interior panels, the **Smoke Density Test** is also conducted on honeycomb materials when used in the interior of an aircraft (per FAA).

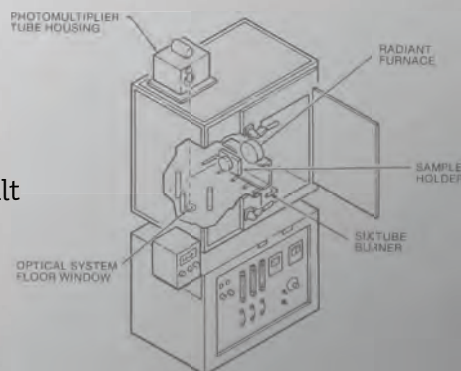


45° Flame Test

The 45° flame test applies to insulation and liners used in cargo and baggage compartments as well as locations not occupied by passengers or crew. These materials also must meet the requirements for Type B Interior materials.



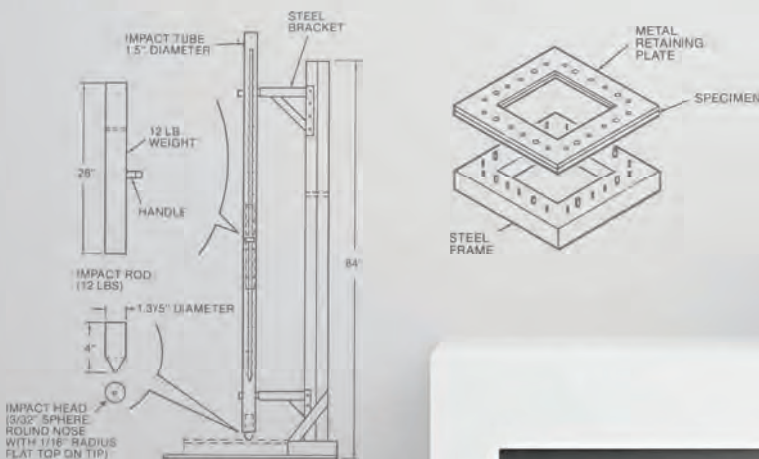
This test measures the amount of smoke produced by a material when it burns. During a fire, dense and noxious smoke can make it difficult or impossible to see and breathe, so designing a material that emits less smoke is critical.



The next group of tests typically applies to floor panel performance. Floor panels are subject to many of the same concerns as cargo liner materials. While fire safety is paramount, another common material concern is the damage created by impact, punctures and/or repeated wear. Commercial aircraft are usually in service for many years, which creates an environment highly susceptible to damage. Airlines must be aware of how extensive passenger wear and tear will affect a materials performance under “in-service” conditions. Supplemental to the fire safety and wear concerns, commercial airlines must also be alert to potential damage to walls and interior structures. When an aircraft suffers significant damage, it may be grounded until repairs can be completed. Every second on the ground not only creates disruption to flight schedules but it also eats into operating profits.

Wear and Tear Tests

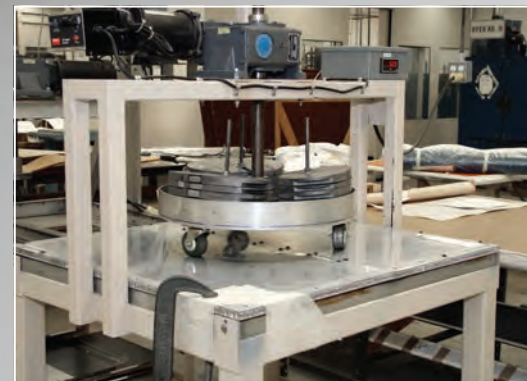
Different wear and tear tests will measure different performance properties to ensure a material can withstand the rigors of daily in-service activity. Not surprisingly, impact testing is conducted on all cargo liners, floor and interior panels.

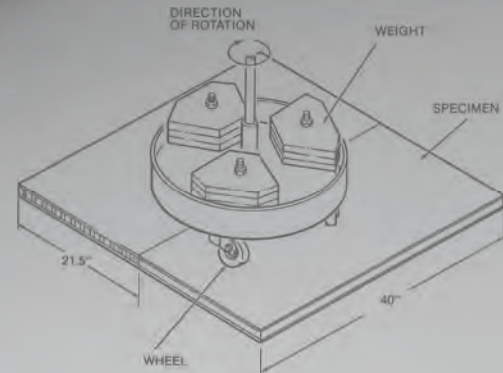


The Impact (Puncture) Test

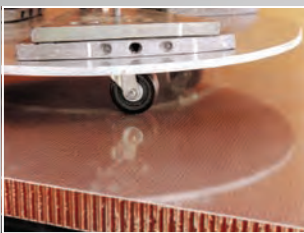
The **Impact (Puncture) Test** applies to liners and panels throughout an aircraft. For example, the results can show a cargo liner's ability to withstand penetration which could expose the area of the aircraft's interior wiring, cable and the ducting behind it. Although there is a redundancy in hydraulic and electrical system; a puncture could disable the aircraft and pose a danger to its passengers. A hole could also allow smoke and toxic fumes to escape if there were a fire in the cargo compartment. The test will measure the material's resistance to puncture, ability to withstand shock loading and possible fractures during shock loading.

The **12 lb. Dart Impact Test** determines how a material reacts when impacted by a narrow pointed object where the damage is focused in a small area like the force created by a woman's stiletto heel.





The **Roller Cart Test** determines how a floor panel resists surface wear by simulating repeated cycles of wear created by metal wheels rolled in a repetitive pattern over the floor panel for an extended period of time. Damage is indicated by subsurface core buckling or skin damage.



The Roller Cart Test

One of the most unique tests M.C. Gill Corporation conducts, originally, the **Roller Cart Test** simulated the repeated wear created by the wheels of the galley carts for food and drinks service that are pushed up and down the passenger aisles during flight. In addition to galley cart wear, today's travelers are circumventing the cost and delays associated with checked bags by using more carry-on rolling baggage. This adds additional wear on passenger aisles and high-traffic areas.

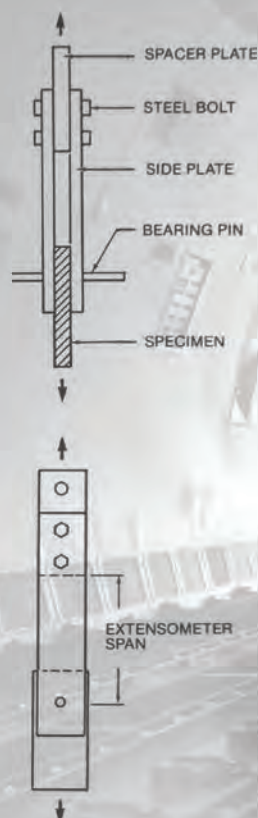


Material Construction Tests

While flammability and wear resistance top the list of critical performance properties M.C. Gill Corporation's products must surpass, it is also imperative the materials maintain their structural integrity. A variety of tests are routinely used to analyze construction issues such as adhesive bond strength, resistance to deformation under load, exposure to moisture and pullout strength.

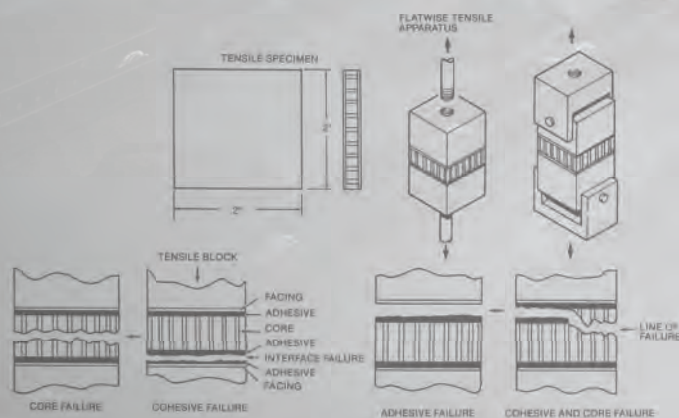


As expected, a series of construction-related tests have been designed to detect specific performance traits unique to the area where a product will be used. The following mechanical tests, commonly called **Material Construction Tests**, measure the viability of a material's construction and how the product reacts when flexed, pulled, twisted, bent and exposed to moisture.



Edge Bearing Test

This test determines the bearing strength of fasteners in a laminate under tension loading. This test is especially important for cargo liners where rivets, bolts or similar fastening systems are used to join sections of material together. The results relate to the cargo liner's resistance to the pressure or force required to elongate a hole at the point where the liner is fastened to a rib. This type of elongation can sometimes be more serious than puncture damage. Higher pullout strength means fewer fasteners are required, thus lowering weight and decreasing installation time.



Tensile Strength and Modulus Test

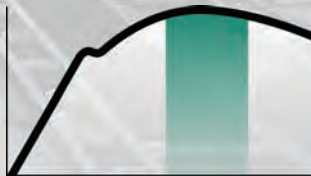


Tensile strength and modulus tests are generally focused on cargo liner materials and measure the strength properties of a laminate under tension. The results tell us three things:



Yield Strength:

the stress a material can withstand without permanent deformation.



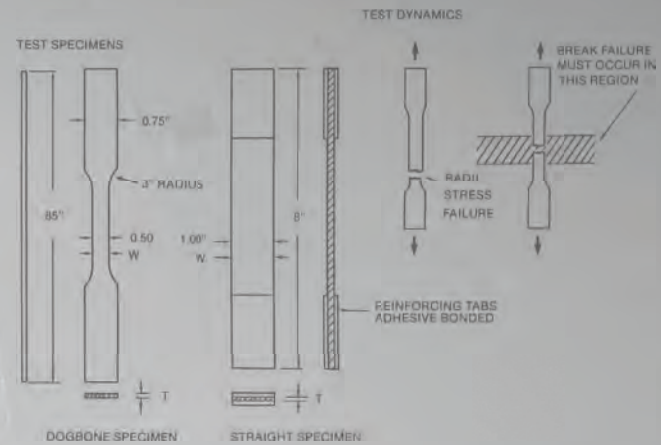
Ultimate Strength:

the maximum stress a material can withstand.



Breaking Strength:

The stress coordinate on the stress-strain curve at the point of rupture.



Shear and Tensile Tests

The **Shear and Flatwise Tensile Tests** apply to floor panels, interior panels and honeycomb core. The **Shear Strength Test** determines the maximum load required to shear or cut a laminate as if cut by a scissor. Imagine how the material would perform if a tear or cut occurred. Would the material maintain its integrity or would the rupture expand and further degrade the panel? The test is conducted at ambient and elevated temperatures. The test measures the type of stress that develops along the longitudinal axis of a specimen.

The **Flatwise Tensile Test** measures the adhesive bond strength of a sandwich panel.

Water Absorption Test

Converse to flame-resistance testing is the **Water Absorption Test**, which applies to cargo liners, floor panels, interior panels and honeycomb.

This test determines the relative rate that water is absorbed by a laminate when immersed in water. The results provide insight into how the material will perform if exposed to liquid or humid conditions.



Strength Tests

Another set of strength tests routinely applied to floor and interior panels are the **Flexural, Flexural Modulus, Bolted Joint and Climbing Drum Peel Tests**.

Flexural Strength and Modulus tests determine the flexibility or ability of a flat laminate material to resist deformation under load. Another way of saying this is stiffness. These tests measure the highest stress experienced within the material at its moment of rupture.

The **Bolted Joint Strength** test determines the bolt pullout strength of laminates bolted together under tension loading.

The **Climbing Drum Peel Test** determines the peel resistance of the adhesive bond between the flexible facing of a sandwich structure and its core, when tested under specified conditions. The proctor looks for two things:

- The peel resistance of adhesive bonds between a sandwich of layers of core and laminate.
- The average torque required to peel the two materials apart.

The Final Analysis

It becomes obvious there is more to the family of M.C. Gill Corporation products than just quality raw materials, unique design and uniform appearance. There are years of serious engineering and scientific study that go into every block, panel and laminate we produce.

The aerospace industry relies on manufacturers to deliver products that will pass their specs. This is a concern to many, but at M.C. Gill Corporation test anxiety isn't a part of our vocabulary. Since we opened our doors, M.C. Gill Corporation has provided 68 years of unmatched quality and reliability.



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panels. Contact M.C. Gill for
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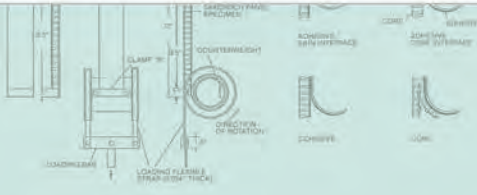
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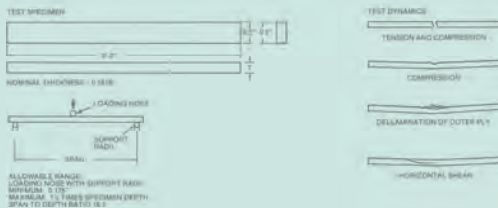
THE DOORWAY IS PRINTED ON 10% POST-CONSUMER RECYCLED PAPER AND SHOULD BE RECYCLED



Climbing Drum Peel Test



Flexural Strength Test



M.C. Gill Corporation is the right choice when you are choosing a cargo liner, floor panel, laminate, or any of the many products we manufacture. For more information about our products and services, visit our website at www.mcgillcorp.com.

THE FUNNY SIDE

Funny One-Liners

I thought I saw an eye doctor on an Alaskan island, but it turned out to be an optical Aleutian.

She was only a whisky maker, but he loved her still.

A rubber band pistol was confiscated from algebra class because it was a weapon of math disruption.

No matter how much you push the envelope, it'll still be stationery.

A dog gave birth to puppies near the road and was cited for littering.

Two silk worms had a race but they ended up in a tie.

A hole has been found in the nudist camp wall. The police are looking into it.

Unusual Facts

Ketchup was sold in the 1830s as a medicine.

An apple is made of 25% air.

A polar bear's fur is not white. Each hair is a clear hollow tube. Polar bears look white because each hollow hair reflects the light.

Hippo milk is pink!

Boron nitride, in cubic form, is the second-hardest material known.

Graphene is the thinnest, strongest material known.

A lemon has more sugar than a strawberry.

In 75% of American households, women manage the money and pay the bills.

John Hanson was the first president of the United States. He served while the Articles of Confederation were in play. The first person to serve as president of the United States under the Constitution was George Washington.



The Philippines is an archipelago comprised of 7,107 islands.

1 in 5,000 north Atlantic lobsters are born bright blue.

The first item ever scanned at a retail checkout using a UPC symbol was a 10-pack of Wrigley's Juicy Fruit gum.

Funny Ads

Believe it or not, these ads actually found their way into newspapers all over the world:

Braille dictionary for sale. Must see to appreciate.

FOR SALE BY OWNER: Complete set of Encyclopedia Britannica. 45 volumes. Excellent condition. \$1,000.00 or best offer. No longer needed. Got married last weekend. Wife knows everything.

Man wanted to work in dynamite factory. Must be willing to travel.

Three-year old teacher needed for pre-school. Experience preferred.

Tired of working for only \$9.75 per hour? We offer profit sharing and flexible hours. Starting pay: \$7-\$9 per hour.

Nordic Track \$300 hardly used, call Chubby.

Joining nudist colony! Must sell washer and dryer \$300.

Open house body shapers toning salon free coffee and donuts.

Free Yorkshire Terrier: 8 years old. Hateful little dog.

Free puppies: 1/2 cocker spaniel, 1/2 sneaky neighbor's dog.

Free puppies: part German Shepherd, part stupid dog.

Snow Blower for sale...only used on snowy days.