

Product
Data
Booklet

Architectural Specialty Solutions

Interiors + Exteriors

Formglas[®]

Welcome to Endless Design Possibilities



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For Exteriors

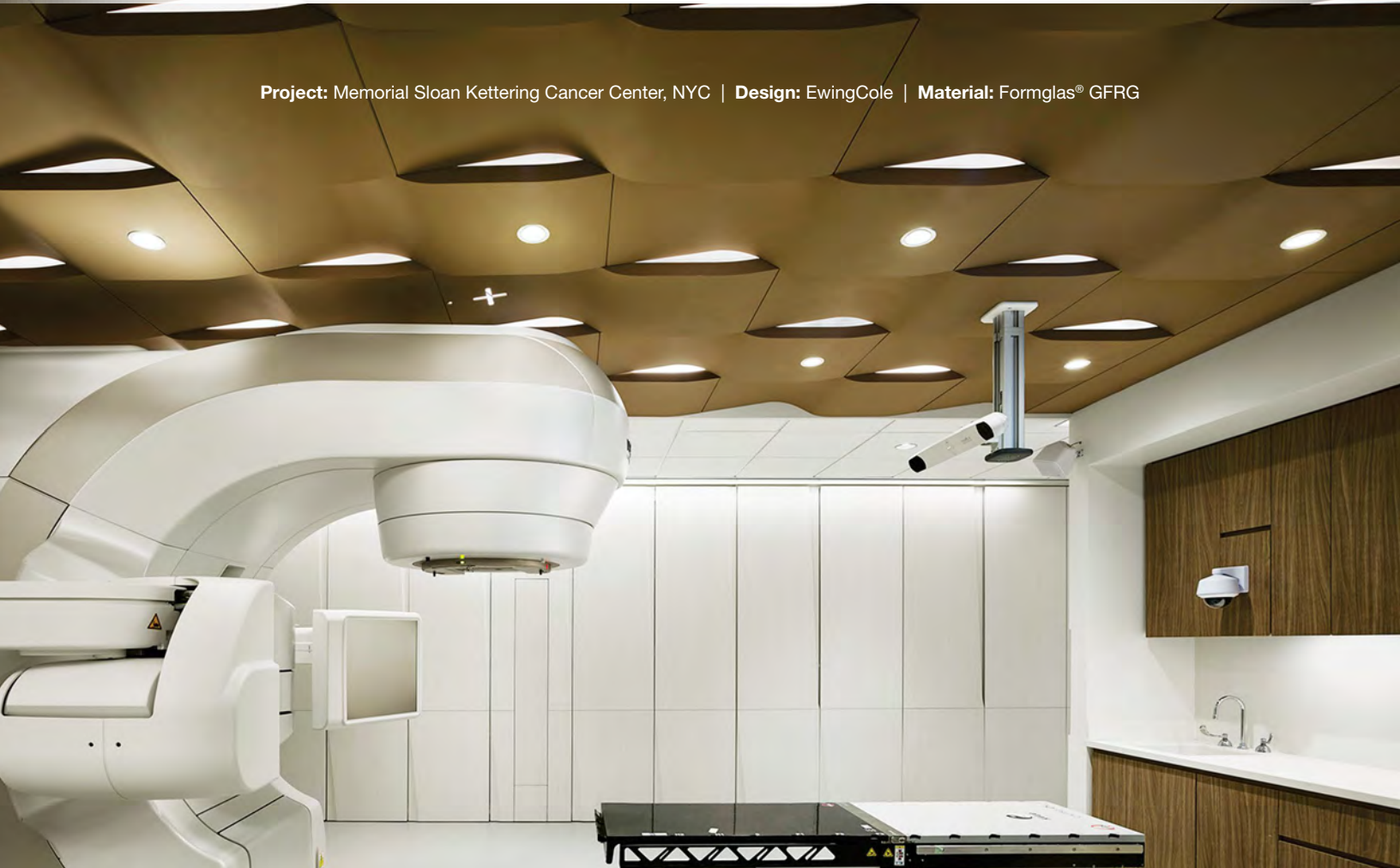
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Project: STK Toronto | Design: DesignAgency | Material: Formglas® GFRG



Formglas® GFRG

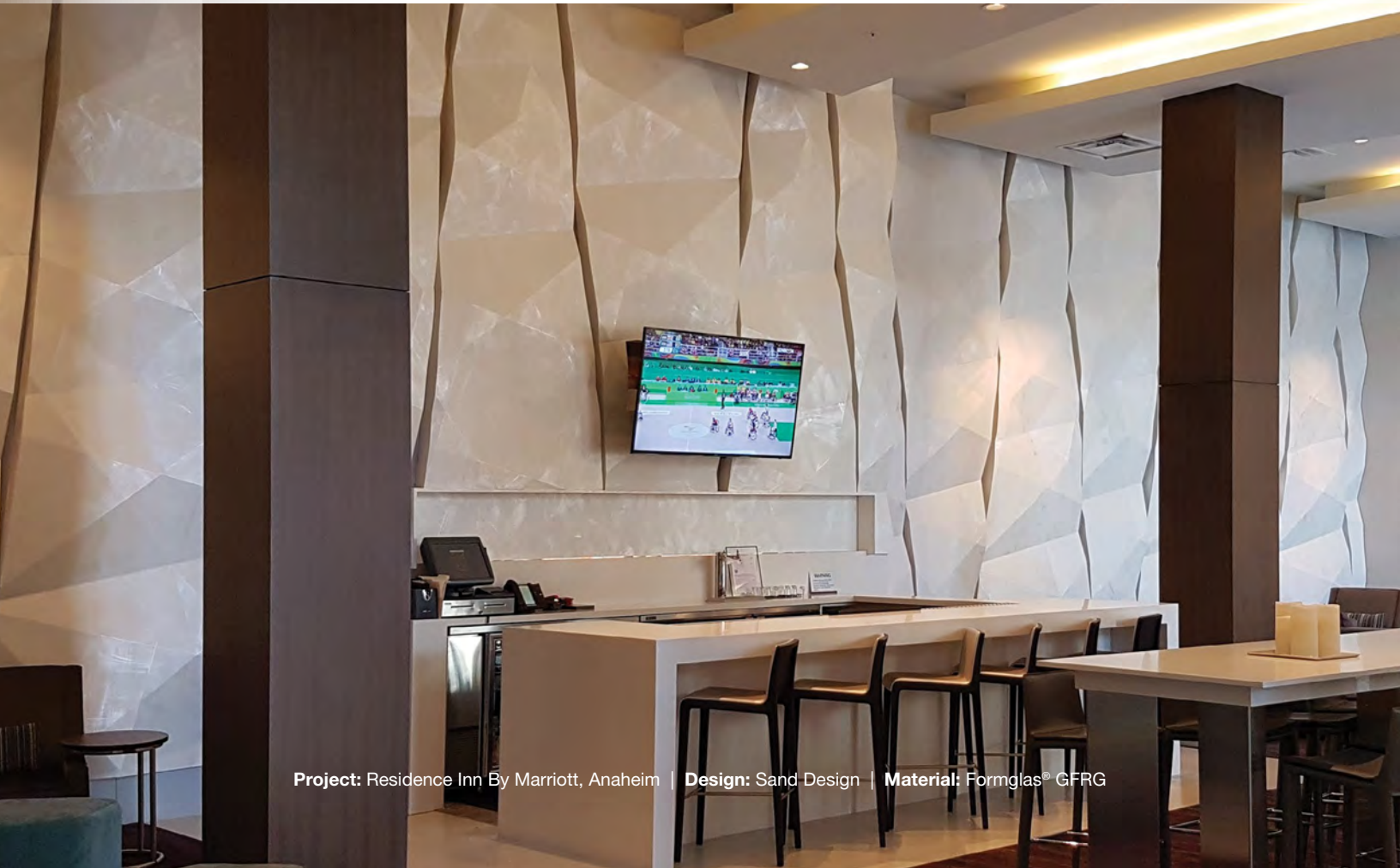
Project: Memorial Sloan Kettering Cancer Center, NYC | Design: EwingCole | Material: Formglas® GFRG



Project: 546 West 44th St., NYC | Design: CetraRuddy Architecture | Material: Formglas® GFRG



Formglas® GFRG



Project: Residence Inn By Marriott, Anaheim | Design: Sand Design | Material: Formglas® GFRG

PRODUCT DATA SHEET

GLASS FIBER REINFORCED GYPSUM FABRICATIONS

Molded Architectural Products and Elements

MasterFormat® 09 27 13

GFRG by **Formglas**®

For Interiors

Trade Name
Formglas® GFRG



Common Names
Glass Fiber Reinforced Gypsum | GFRG
Glassfiber Reinforced Gypsum | GRG
Glass Fiber Reinforced Gypsum Fabrications

Manufacturer
Formglas Products Ltd.
181 Regina Road
Vaughan, Ontario, Canada L4L 8M3
T: 1.866.635.8030 F: 416.635.6588
Web: formglas.com Email: info@formglas.com



DOMES, LIGHT COVES, MOLDINGS, COLUMNS

FALLSVIEW RESORT, ONTARIO

Summary

Formglas® GFRG is a composite of high strength alpha gypsum cement reinforced with glass fibers that can be factory-molded into virtually any shape or size. Glass Fiber Reinforced Gypsum (GFRG) parts are usually provided unfinished for on-site painting. Formglas® was the first manufacturer in North America to produce GFRG and has since evolved into the world's leading manufacturer of this versatile material. Formglas® GFRG has a Class A (or 1) flame-spread rating.

Detailed Description

GFRG is a white gypsum cement material that is molded into architectural elements used for the construction and renovation of interiors. GFRG parts weigh approximately 2 lb/ft² ⇔ 10 kg/m² and are field-finished with paint or, depending on the application, factory pre-finished. Alpha gypsum is a material not to be confused with the softer and lower density gypsum used in drywall (gypsum wallboard) and traditional plaster applications. Where once traditional 'plaster castings' were used, GFRG is now specified because of its light weight, superior strength, sustainability characteristics, and ease of installation.

GFRG composites have enhanced physical properties compared to drywall or plaster, such as hardness and flexural strength. GFRG parts often incorporate embedments of steel or wood for added strength and to provide a means for attachment and suspension. Components are fabricated from precision-made molds, therefore, finished components are dimensionally accurate and can be assembled with ease in the field.

Along with the fact that GFRG fabrications require less supportive framing, the reduced time and cost for installation versus field-constructed shapes and components provides measurable cost benefits to the end user.

From an environmental perspective, GFRG is a lighter, stronger and more durable alternative that dramatically reduces the use of raw materials and the environmental impacts associated with their acquisition and transportation.

GFRG is commonly used to make decorative ceiling coffers, domes and vaults; columns, capitals and bases; wall cladding; pilasters and pediments; moldings, light coves and running trim; brackets and corbels; complicated geometric shapes, sculpted or perforated panels and many other decorative elements. These elements can be fabricated into virtually any shape or scale yielding fine surface detail, textures and patterns.

GFRG ceiling elements are usually wire suspended. Most other parts are face-fastened with screws through embedded reinforcement that are countersunk and filled. Moldings can be supplied with factory-molded corners or they can be miter cut on site. For a monolithic finish, parts are made with tapered edges, and joints are taped in the same manner as gypsum wallboard. Parts are then primed and painted. The application of gloss or high-gloss paint is not recommended unless the entire GFRG component receives a Level 5 finish treatment by the installer or painter in accordance with ASTM Standard C80. However, architects and designers should contact Formglas® to discuss their design intent.

Most items are custom-made to meet project design requirements and specifications. Formglas® uses 5-axis CNC technology to machine precision patterns from which molds are produced to cast the required parts. In situations involving complex design elements or projects, Formglas® will work with architects and designers to develop a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture.

Technical Data

Refer to the following standards:

ASTM International (ASTM)

- C1381 - Standard for Molded Glass Fiber Reinforced Gypsum Parts
- C1467 - Standard for the Installation of Molded Glass Fiber Reinforced Gypsum Parts
- C1355 - Standard for Glass Fiber Reinforced Gypsum Composites

International Standards Organization (ISO)

- 1182 - Reaction to fire tests of products - Non combustibility Test
- 1716 - Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value)

European Standards (EN)

- 13501-1 - Fire classification of construction products and building elements: classification using test data from reaction to fire tests

International Maritime Organization (IMO)

- FTP Code (IMO resolution MSC 61/67)

Physical and Mechanical Properties

Formglas[®] uses alpha gypsum materials that are mined and processed in the USA from some of the world's purest deposits. Throughout the fabrication process, the gypsum material is subjected to strict inspection and testing to guarantee its high level of quality. Our prominent gypsum suppliers certify the raw materials are in compliance with the ASTM Standard C1355.

Matrix:	Alpha Gypsum Cement
Finish:	Standard unfinished, white to off-white. Factory-applied finishes available
Surface:	Standard smooth. Custom-molded textured surfaces available
Density:	~105 lb/ft ³ ⇔ 1675 kg/m ³
Weight:	1½-2 lb/ft ² ⇔ 7-10 kg/m ² *
Shell thickness:	3/16" ⇔ 5 mm nominal **
Edge thickness:	3/4" ⇔ 19 mm typical
Embedments:	Galvanized steel or wood (if required)
Glass Fiber:	5% typical
Max. length moldings:	12' ⇔ 3.6 m
Max. size molded parts:	40 ft ² ⇔ 3.7 m ²

* Typical weights: parts with deep surface relief or required added thickness (e.g. for acoustic mass) will weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances noted below. Weight and measurement conversions may be rounded.

ASTM Standard C1355 and ISO Test Results

Flexural Strength	
Ultimate strength:	4700 psi ⇔ 32 MPa
Yield strength:	1875 psi ⇔ 13 MPa
Flame Spread:	0
Smoke Development:	0
Behavior at 750°C:	Pass
Coefficient of Linear Thermal Expansion:	5.5 x 10 ⁻⁶ in/in/°F ⇔ 9.9 x 10 ⁻⁶ mm/mm/°C
Humidified Deflection:	1/8" ⇔ 3 mm
Nail Pull Resistance:	176 lbf ⇔ 782 N
Impact Resistance:	6.5 ft.lb/in. ⇔ 347 J/m
Barcol Hardness:	60
Rockwell Hardness:	72 M scale
ISO Reaction to Fire Tests	
Mass Loss:	20%
Temperature Difference:	7°F ⇔ 4°C
Duration of Ignition > 5 sec:	0
Gross Heat of Combustion:	300 Btu/lb ⇔ 0.7 MJ/kg

Manufacturing Tolerances

Shell Thickness:	± 1/16" ⇔ 1.5 mm
Dimensional (all directions):	± 1/8" ⇔ 3.2 mm
Parts 8' to 16':	± 3/16" ⇔ 5 mm
Warpage or Bowing:	± 1/16"/ft. ⇔ 1.5 mm/300 mm

LEED[®]



Formglas[®] products contribute toward LEED[®] credits, and have been used in LEED[®] projects worldwide. Since Formglas[®] products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas[®] with specific details of your project and to clarify the version of LEED[®] rating system applicable.

■ Classifications and Approvals

In addition to the ASTM and ISO testing, Formglas® GFRG is classified as “A1” in accordance with the European Standard EN 13501-1. This standard provides the reaction to fire classification procedures for all construction products, including products incorporated within building elements. A1 is the highest classification possible. Class A1 products will not contribute in any stage of the fire.

Formglas® GFRG is approved for use on marine vessels with Module “B” and “F” Certificates of Approval in accordance with the International Maritime Organization (IMO) and Marine Equipment Directive (MED) regulations.

■ Delivery, Storage and Handling

GFRG parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately, and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® of any damage immediately. GFRG parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. To prevent distortion, warping, and other physical damage, GFRG parts shall be kept clean and stored on a dry surface and not stacked or leaned on each other.

■ Preparatory Work

Do not deliver or install GFRG parts until the building is enclosed and weatherproof, wet work is complete, and the HVAC system maintains temperature and humidity at normal occupancy levels. Acclimatize GFRG parts for a minimum of 48 hours to the ambient temperature and humidity levels of spaces in which they are to be installed. It is the installing contractor’s responsibility to order the correct material quantities (including a waste allowance) and verify the field dimensions and conditions for inclusion into the shop drawings.

Site Conditions:

Review the site conditions for compliance with Formglas’ requirements relating to environmental conditions, installation tolerances and other conditions affecting the installation and performance of GFRG parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into Formglas® shop drawings prior to it commencing the manufacture of custom molds and GFRG parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings.

Substrates:

The substrates to accept GFRG parts shall be installed straight and true within 1/8” in 8 linear ft. \leq 3 mm in 2500 mm and shall be free of obstructions and interference that prevent the correct positioning and attachment of the GFRG parts. Metal framing members shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed GFRG parts. Metal framing members shall be installed in accordance with ASTM Standards C754 or C1007, as required. The location and incorporation of control joints is determined by the architect.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

Install GFRG parts as indicated on approved shop drawings, other recommendations and the contract requirements. Comply with ASTM Standard C1467 for the Installation of Molded Glass Fiber Reinforced Gypsum Parts. GFRG parts shall be carefully lifted into place using suitable devices and installed securely. The installing contractor is to supply and install all brackets and shims as required for the installation and proper alignment of the GFRG parts with adjacent parts and materials.

Attach GFRG parts to substrates and framing with screws, bolts or other fasteners as shown on the shop drawings. Countersink screws below the surrounding surface. Where GFRG parts are suspended, use all the suspension points indicated on the shop drawings or on the back of the GFRG parts as a minimum requirement, and use additional support(s) if required. Install control joints between GFRG parts as determined by the architect.

Unfinished GFRG parts may exhibit slight imperfections, normally hidden by a textured finish. To obtain satisfactory results with smooth finishes, filling and sanding will be required to hide imperfections inherent in GFRG. Under certain lighting conditions (e.g. atriums, near reflectors, vaults etc.) fasteners, reinforcement, and joint taping “read-through” may occur. A field applied skim coat may therefore be required. Use joint treatment materials to finish GFRG parts and assemblies to produce surfaces ready to receive primers and paint finishes as

detailed. Countersunk fasteners and damage are to be patched to match the GFRG part surface texture. Note: In accordance with ASTM Standards C1381 and C1467, GFRG parts are provided with a primer-ready surface suitable to receive a flat paint finish. See “Finishing” below for more details.

■ **Finishing**

Finishing is typically completed by others, unless specialty pre-finished GFRG components such as Woodgrane™ by Formglas[®] is used. Proper priming of the GFRG assemblies must be provided to avoid joint tape “read-through” due to the differences in porosity and absorption between the GFRG parts and the joint compound material. In accordance with ASTM Standard C1467, GFRG parts subject to critical lighting or scheduled to receive a semi-gloss finish shall be prepared as a level 5 finish in accordance with ASTM Standard C840. Gloss or high-gloss paints are not recommended. Care should be exercised in the selection of primer and sealers to make sure they will perform satisfactorily and fulfill the following functions:

- Provide a bonding surface for the paint to be used
- Equalize variations of suction over the entire surface
- Avoid nap raising

Before applying the primer, make sure the GFRG surface is clean and the joint treatment material is thoroughly dry. Apply a sufficient quantity of primer or sealer in accordance to the paint manufacturer’s instructions. More than one coat may be necessary. Ensure that the primer is fully dried before applying paint. No less than two coats of paint should be applied.

See ASTM Standard C840 for other important finishing recommendations.

Note: Formglas[®] also offers factory finishing for certain component types such as ceiling tiles. Be sure to ask your local Formglas[®] representative for further information.

■ **Applications**

To view photos of Formglas[®] GFRG applications, or to contact a local Formglas[®] representative, visit www.formglas.com.



FACETED COLUMNS

STEELCASE WORKLIFE CENTER, ILLINOIS



ORGANIC COLUMN AND CEILING WITH INTEGRATED LIGHTING

CORPORATE CAFETERIA, NYC



DECORATIVE FISHNET CEILING

KOI RESTAURANT, NYC

PRODUCT DATA SHEET

GLASS FIBER REINFORCED GYPSUM FABRICATIONS

Molded Architectural Products and Elements

MasterFormat® 09 27 13

GFRG[®] by Formglas[®]

For Interiors



GFRG CONTOURED COLUMNS, CEILING FINIS, 3D WALL PANELS

STK MIDTOWN, NYC

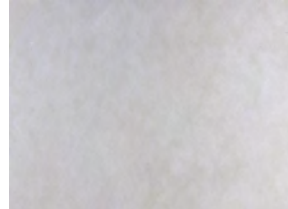


OPEN GRILLE LOOP CEILING WITH ACOUSTICAL PLASTER

TRUMP SOHO HOTEL, NYC

■ Samples Available

Formglas[®] is able to custom-fabricate GFRG in a number of textures or patterns, and some may be available pre-finished. In addition, Formglas[®] maintains an inventory of five standard samples to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas[®] representative to discuss your specific project requirements.



Formglas[®] GFRG

Color: Paint-Ready
Surface: Smooth
Pattern: NA
Sample Size: 4" x 5"
Sample Code: 98127



Formglas[®] GFRG

Color: Paint-Ready
Surface: Smooth
Pattern: 3D Recessed Ovals
Sample Size: 3 1/2" x 5"
Sample Code: 98129



Formglas[®] GFRG

Color: Paint-Ready
Surface: Smooth
Pattern: Elongated Perforation
Sample Size: 5 3/4" x 7 1/2"
Sample Code: 98128



Formglas[®] GFRG

Color: Paint-Ready
Surface: Smooth
Pattern: Formglas[®] Engraved Logo
Sample Size: 3.375" x 5"
Sample Code: 98100



Formglas[®] GFRG

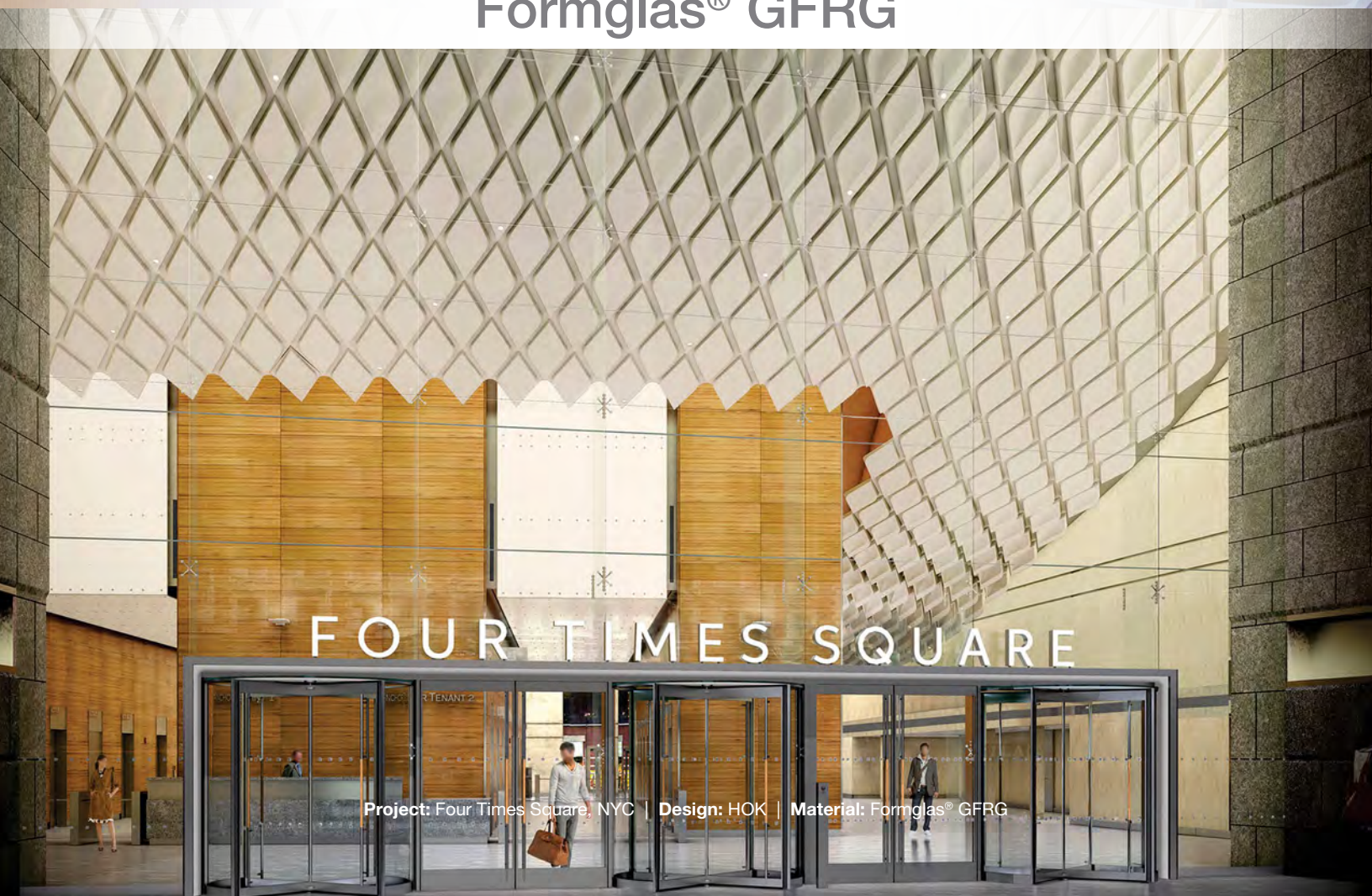
Color: Paint-Ready
Surface: Smooth
Pattern: Column Cover Joint Detail
Sample Size: 5" x 9.625"
Sample Code: 98064

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.

Project: Four Times Square, NYC | Design: HOK | Material: Formglas® GFRG



Formglas® GFRG



Project: Four Times Square, NYC | Design: HOK | Material: Formglas® GFRG

PRODUCT DATA SHEET

WOOD GRAIN TEXTURED GFRG

Molded Architectural Products and Elements

MasterFormat® 09 27 13

Woodgrane™ by Formglas®

For Interiors

Trade Name

Formglas® Woodgrane™



Common Names

Wood Grain Textured GFRG

Wood-Textured Glass Fiber Reinforced Gypsum

Manufacturer

Formglas Products Ltd.

181 Regina Road

Vaughan, Ontario, Canada L4L 8M3

T: 1.866.635.8030 F: 416.635.6588

Web: formglas.com Email: info@formglas.com



CURVED FEATURE WALL

ST. JOSEPH'S REGIONAL MEDICAL CENTER, NEW JERSEY

Summary

Woodgrane™ is a pre-finished alpha gypsum cement based material that replicates varieties of wood including oak, mahogany, walnut and pine. Factory-finishing is performed by a unique method of applying low VOC stains and washes that accentuate the textural detail and depth of the molded grain. Non-combustible Woodgrane™ components may be cast in a wide range of shapes allowing for design possibilities that may not be practical when using real wood due to size, shape, weight or building code limitations on the use of combustible materials. Formglas® Woodgrane™ has a Class A (or 1) flame-spread rating.

Detailed Description

Woodgrane™ is a material based on Formglas® Glass Fiber Reinforced Gypsum (GFRG). GFRG is a composite of high density, alpha gypsum cement material and glass fiber for reinforcement that is molded into architectural elements used for interior applications. Woodgrane™ parts weigh approximately 2 lb/ft² ⇔ 10 kg/m², depending on the depth of grain and profile. Composites have enhanced physical properties such as high surface hardness and flexural strength.

Woodgrane™ fabrications are installed with less supportive framing and a finished installation is almost always faster than a comparable installation of natural wood elements by finish carpenters. This provides measurable cost benefits and minimizes disruption, particularly when Woodgrane™ components are chosen for renovation of existing spaces. From an environmental perspective, the choice of Woodgrane™ yields benefits in support of sustainable construction such as a reduced use of raw materials.

Woodgrane™ is commonly used to make ceiling beams, bulkheads, coffers, vaults, feature walls and cornice moldings. These elements can be fabricated into larger shapes more quickly than elements built by finish carpenters. The ability to make large curved components and options for a vast range of wood grain simulations and colors provides tremendous design flexibility.

Lightweight Woodgrane™ ceiling elements are usually wire-suspended. Other parts are attached with concealed fastening in order to provide a superior finished appearance. Between parts, joints are finished with a closely matching caulk or are designed to conceal joints. Moldings can be supplied with pre-made corners to streamline installation. Woodgrane™ parts are factory pre-finished to match the control sample approved by the architect and designer. There may be situations where it is desirable for Woodgrane™ components to be provided unfinished such as when components need to be field-finished to match existing wood pieces at the job site.

Woodgrane™ components are custom-made to project design requirements and specifications. Formglas® uses a combination of 5-axis CNC technology, in-house sculpting, and expert pattern making skills to make authentic and precision master models from which molds are produced to make the required parts. In situations involving complex design elements or projects, Formglas® will work with architects and designers to develop a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture.

Technical Data

Refer to the following standards:

ASTM International (ASTM)

- C1381 - Standard for Molded Glass Fiber Reinforced Gypsum Parts
- C1467 - Standard for the Installation of Molded Glass Fiber Reinforced Gypsum Parts
- C1355 - Standard for Glass Fiber Reinforced Gypsum Composites

International Standards Organization (ISO)

- 1182 - Reaction to fire tests of products - Non combustibility Test
- 1716 - Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value)

European Standards (EN)

- 13501-1 - Fire classification of construction products and building elements: classification using test data from reaction to fire tests

International Maritime Organization (IMO)

- FTP Code (IMO resolution MSC 61/67)

Physical and Mechanical Properties

Formglas® uses alpha gypsum cement that is mined and processed in the USA from some of the world's purest deposits. Throughout the fabrication process, the gypsum material is subjected to strict inspections and testing to guarantee its high level of quality. Our prominent gypsum suppliers certify the raw materials are in compliance with the ASTM Standard C1355.

Matrix:	Alpha Gypsum Cement
Finish:	Standard and custom factory-applied finishes available.
Surface:	Standard replication of oak, mahogany, walnut, teak and pine. Custom wood finishes available.
Density:	~105 lb/ft³ ⇔ 1675 kg/m³
Weight:	1½-2 lb/ft² ⇔ 7-10 kg/m² *
Shell thickness:	3/16" ⇔ 5 mm nominal **
Edge thickness:	3/4" ⇔ 19 mm typical
Embedments:	Galvanized steel or wood (if required)
Glass Fiber:	5% typical
Max. length moldings:	12' ⇔ 3.6 m
Max. size molded parts:	40 ft² ⇔ 3.7 m²

* Typical weights: parts with deep surface relief or required added thickness (e.g. for acoustic mass) will weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances noted below. Weight and measurement conversions may be rounded.

ASTM Standard C1355 and ISO Test Results

Flexural Strength	
Ultimate strength:	4700 psi ⇔ 32 MPa
Yield strength:	1875 psi ⇔ 13 MPa
Flame Spread:	0
Smoke Development:	0
Behavior at 750°C:	Pass
Coefficient of Linear Thermal Expansion:	5.5 x 10 ⁻⁶ in/in/°F ⇔ 9.9 x 10 ⁻⁶ mm/mm/°C
Humidified Deflection:	1/8" ⇔ 3 mm
Nail Pull Resistance:	176 lbf ⇔ 782 N
Impact Resistance:	6.5 ft.lb/in. ⇔ 347 J/m
Barcol Hardness:	60
Rockwell Hardness:	72 M scale
ISO Reaction to Fire Tests	
Mass Loss:	20%
Temperature Difference:	7°F ⇔ 4°C
Duration of Ignition > 5 sec:	0
Gross Heat of Combustion:	300 Btu/lb ⇔ 0.7 MJ/kg

Manufacturing Tolerances

Shell Thickness:	± 1/16" ⇔ 1.5 mm
Dimensional (all directions):	± 1/8" ⇔ 3.2 mm
Parts 8" to 16":	± 3/16" ⇔ 5 mm
Warpage or Bowing:	± 1/16"/ft. ⇔ 1.5 mm/300 mm

LEED®



Formglas® products contribute toward LEED® credits, and have been used in LEED® projects worldwide. Since Formglas® products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas® with specific details of your project and to clarify the version of LEED® rating system applicable.

■ Classifications and Approvals

In addition to the ASTM and ISO testing, Woodgrane™, a derivative of Formglas® GFRG, is classified as “A1” in accordance with the European Standard EN 13501-1. This standard provides the reaction to fire classification procedures for all construction products, including products incorporated within building elements. A1 is the highest classification possible. Class A1 products will not contribute in any stage of the fire including the fully developed fire.

GFRG Fabrications are approved for use on marine vessels with Module “B” and “F” Certificates of Approval in accordance with the International Maritime Organization (IMO) and Marine Equipment Directive (MED) regulations.

■ Delivery, Storage and Handling

Woodgrane™ parts shall be transported and handled in a manner that avoids damage to the finished surface or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately, and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® of any damage immediately. Woodgrane™ parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. To prevent distortion, warping, and other physical damage, Woodgrane™ parts shall be kept clean and stored on a dry surface, ideally in the originally factory packaging until parts are ready to be installed, and not stacked or leaned on each other. Use clean gloves as required to ensure oils, adhesive and other contaminants are not transferred onto the pre-finished surface.

■ Preparatory Work

Do not deliver or install Woodgrane™ parts until the building is enclosed and weatherproof, wet work is complete, and the HVAC system maintains temperature and humidity at normal occupancy levels. Acclimatize Woodgrane™ parts for a minimum of 48 hours to the ambient temperature and humidity levels of spaces in which they are to be installed. It is the installing contractor’s responsibility to order the correct material quantities (including a waste allowance) and verify the field dimensions and conditions for inclusion into the shop drawings.

Site Conditions:

Review the site conditions for compliance with Formglas’ requirements relating to environmental conditions, installation tolerances and other conditions affecting the installation and performance of Woodgrane™ parts. Any unsatisfactory conditions are to be corrected prior to installation. Field

measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into Formglas® shop drawings prior to it commencing the manufacture of custom molds and Woodgrane™ parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings.

Substrates:

The substrates to accept Woodgrane™ parts shall be installed straight and true within 1/8” in 8 linear ft. ± 3 mm in 2500 mm and shall be free of obstructions and interference that prevents the correct positioning and attachment of the Woodgrane™ parts. Metal framing members shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed Woodgrane™ parts. Metal framing members shall be installed in accordance with ASTM Standards C754 or C1007, as required.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

Install Woodgrane™ parts as indicated on approved shop drawings, other recommendations and the contract requirements. Comply with ASTM Standard C1467 for the Installation of Molded Glass Fiber Reinforced Gypsum Parts, as applicable. Woodgrane™ parts shall be carefully lifted into place using suitable devices and installed securely. The installing contractor is to supply and install all brackets and shims as required for the installation and proper alignment of the Woodgrane™ parts with adjacent parts and materials.

Attach Woodgrane™ parts to substrates and framing following the directions provided on the shop drawings. Where screws are required, they are to be countersunk and holes shall be patched and touched up with the factory-supplied stain. Where Woodgrane™ parts are suspended, use all suspension points indicated on the shop drawings or on the back of Woodgrane™ parts, as a minimum requirement. Use additional support(s) if required.

■ **Finishing**

Woodgrane™ components are commonly factory-finished. Joints are normally caulked with a closely matching caulk as recommended by Formglas, or have been concealed through the design of parts. Where patching or touch up is required, careful application of drywall compound that is applied to simulate the finished grain texture and factory-supplied wash/stain is required. Technical support from Formglas® is always available to the installing contractor.

■ **Applications**

To view photos of Woodgrane™ applications, or to contact a local Formglas® representative, visit www.formglas.com.

■ **Samples Available**

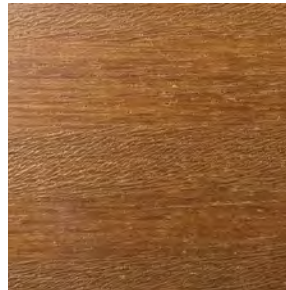
Formglas® is able to custom-fabricate Woodgrane™ to match a variety of wood species and colors. In addition, Formglas® maintains an inventory of four standard samples to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.



CURVED FEATURE CEILING COMPONENTS

REFLECTIONS CAFE, NEW JERSEY



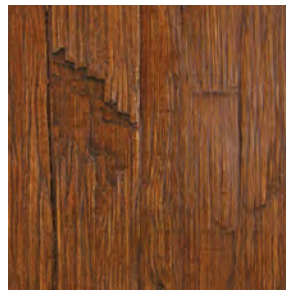
Woodgrane™

Color: Saddle Brown Stain
Surface: African Teak Grain
Sample Size: 4" x 5"
Sample Code: 98175



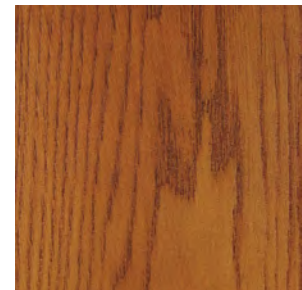
Woodgrane™

Color: Walnut Stain
Surface: Oak Grain
Sample Size: 4" x 5"
Sample Code: 98112



Woodgrane™

Color: Teak Stain
Surface: Rustic Pine Grain
Sample Size: 4" x 5"
Sample Code: 98003



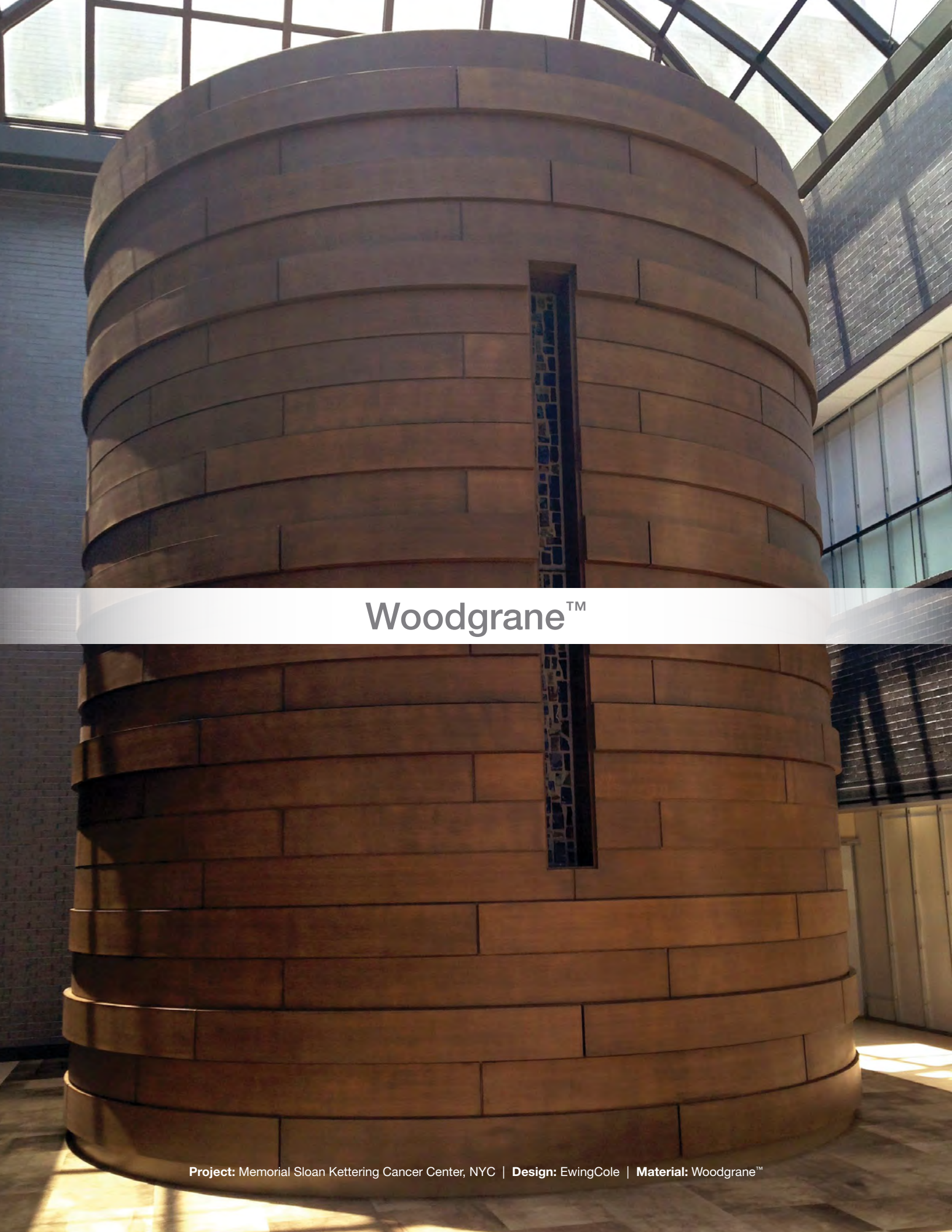
Woodgrane™

Color: Danish Walnut Stain
Surface: Oak Grain
Sample Size: 4" x 5"
Sample Code: 98132



FAUX CEILING BEAMS & TRIM DETAILS

DIAMOND JO CASINO, IOWA



Woodgrane™



Project: Wynn Casino and Spa, Las Vegas | Design: Wynn Design + Development | Material: QuarryCast®

QuarryCast®



Project: Tommy Hilfiger, Toronto | Design: Loda Design | Material: QuarryCast®

PRODUCT DATA SHEET

INTERIOR FINISHED CARPENTRY

Stone-Textured Architectural Elements

MasterFormat® 06 20 23

QuarryCast® by Formglas®

For Interiors

Trade Name

Formglas® QuarryCast®



Common Names

Stone-Textured Architectural Elements
Simulated Stone Fabrications
Interior Molded Stone

Manufacturer

Formglas Products Ltd.
181 Regina Road
Vaughan, Ontario, Canada L4L 8M3
T: 1.866.635.8030 F: 416.635.6588
Web: formglas.com Email: info@formglas.com



COLUMNS, ARCHES, QUOINS & PEDIMENTS

VENETIAN RESORT, MACAU

Summary

QuarryCast® is an alpha gypsum-based composite material resembling natural stone that is factory-molded to make an endless array of interior architectural elements, decorative panels with patterns or reliefs, or thin veneers that are an excellent alternative to natural stone due to its light weight, ease of installation, and appreciably lower installed cost. QuarryCast® is available in several standard stone-textured varieties and colors, however, custom colors and textures are commonly formulated to meet specific project requirements. QuarryCast® has a Class A (or 1) flame-spread rating.

Detailed Description

QuarryCast® stone-textured elements are manufactured with integral color pigments so that the material color extends below the surface. Natural aggregates and minerals are incorporated into a matrix of alpha gypsum cement and glass fiber reinforcement which provides the molded stone elements with added strength and flexibility in addition to an enhanced aesthetic appearance. QuarryCast® stone-textured parts often incorporate embedments of steel or wood for added strength and to provide a means for attachment, suspension and stiffening. Yet, QuarryCast® parts weigh approximately 3 lb/ft² ⇔ 14.6 kg/m² depending upon the design and application. As a result, complex architectural shapes can be made with QuarryCast® that otherwise would not be practical to fabricate with natural stone. QuarryCast® requires no heavy equipment for installation, uses less supportive framing, is quicker to install, and less expensive than the traditional alternatives.

QuarryCast® is commonly used to make decorative wall facades and arches; columns, capitals and bases; retail store fronts and displays (using QuarryCast® veneer panels); pilasters and pediments; moldings, light coves and running trim; brackets, corbels and quoins; ceiling coffers, domes and vaults; complex geometric shapes, sculpted panels, and many other decorative elements. These elements can be fabricated into virtually any shape or scale yielding intricate surface detail, textures, patterns and choice of color. Subtle texture and color variations may occur within and between parts consistent with that of natural stone materials.

QuarryCast® ceiling elements are usually wire-suspended. Most other molded parts are face-fastened with screws through embedded reinforcement, countersunk and filled with a factory-supplied patching compound. Moldings can be supplied with factory-molded corners to streamline installation. Joints are normally caulked or dry-butted, or in some cases (such as column applications), filled with the factory-supplied patching compound.

Most items are custom-made to project design requirements and specifications. Formglas® uses 5-axis CNC technology to machine precision patterns from which molds are produced to make the required parts. In situations involving complex design elements or projects, Formglas® will work with architects and designers to develop a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture.

■ Technical Data

Refer to the following standards:

ASTM International (ASTM)

- E84 Standard Test Method for Surface Burning Characteristics of Building Materials

International Standards Organization (ISO)

- 1182 Reaction to fire tests of products - Non combustibility Test
- 1716 Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value)

International Maritime Organization (IMO)

- FTP Code (IMO resolution MSC 61/67)

■ Physical and Mechanical Properties

Formglas® uses alpha gypsum cement that is mined and processed in the USA from some of the world's purest deposits. Throughout the fabrication process, the gypsum material is subjected to strict inspection and testing to guarantee its high level of quality. Our prominent gypsum suppliers certify the raw materials are in compliance with the ASTM Standard C1355.

Matrix:	Alpha Gypsum Cement and various aggregates
Finish:	Standard colors and color matching available.
Surface:	Standard, sandblasted, coral and Stuc Pierre custom-molded textures available.
Factory Finish:	Clear non-gloss sealer
Density:	~100 lb/ft³ ⇔ 1600 kg/m³
Weight:	
Veneer panels:	2-2½ lb/ft² ⇔ 10-12 kg/m²*
Molded parts:	2½-5 lb/ft² ⇔ 12-24 kg/m²*
Veneer thickness:	5/16" ⇔ 8 mm nominal**
Shell thickness:	5/16" ⇔ 8 mm nominal**
Edge thickness:	¾-1¼" ⇔ 19-32 mm typical
Embedments:	Galvanized steel or wood (if required)
Glass Fiber:	5% typical
Max. length moldings:	8' ⇔ 2.4 m
Max. size veneer panels:	48" x 36" ⇔ 1200 x 900 mm
Max. size molded parts:	40 ft² ⇔ 3.7 m²

* Typical weights – parts with deep surface relief, etc. may weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances. Weight and measurement conversions may be rounded.

ASTM Standard and ISO Test Results

Flame Spread:	0
Smoke Development:	5
Behavior at 750°C:	Pass
ISO Reaction to Fire Tests	
Mass Loss:	20%
Temperature Difference:	2.7°F ⇔ 1.5°C
Duration of Ignition > 5 sec:	0
Gross Heat of Combustion:	258 Btu/lb ⇔ 0.6 MJ/kg

■ Manufacturing Tolerances

Veneer Thickness:	± 1/16" ⇔ 1.5 mm
Dimensional (all directions):	± 1/16" ⇔ 1.5 mm
Bowing, out of plane	3/32"/ft ⇔ 5 mm/300 mm
Molded Part Thickness:	-1/16 to + 3/16" ⇔ -1.5 to +5 mm
Dimensional (all directions):	± 3/16" ⇔ 5 mm
Bowing, out of plane	3/32"/ft ⇔ 2.5 mm/300 mm

■ LEED®



Formglas® products contribute toward LEED® credits, and have been used in LEED® projects worldwide. Since Formglas® products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas® with specific details of your project and to clarify the version of LEED® rating system applicable.

■ Other Classifications and Approvals

In addition to ASTM and ISO testing, QuarryCast® has been tested at the Centre Scientifique et Technique du Bâtiment (CSTB) in France and is classified "M0". This classification refers to building materials that are non-combustible. QuarryCast® has also been tested by SINTEF, which is the largest independent research organization in Scandinavia and classified as a non-combustible material, in accordance to the IMO A.472 standard. QuarryCast® has also been tested in Germany to DIN EN ISO 1182.

QuarryCast® is approved for use on marine vessels with Module "B" and "F" Certificates of Approval in accordance with the International Maritime Organization (IMO) and Marine Equipment Directive (MED) regulations.

■ Delivery, Storage and Handling

QuarryCast® parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately, and

claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® of any damage immediately. QuarryCast® parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. To prevent distortion, warping, and other physical damage, QuarryCast® parts shall be kept clean and stored on a dry surface and not stacked or leaned on each other. Use clean gloves as required to ensure oils, adhesive and other contaminants are not transferred onto the pre-finished surface.

■ Preparatory Work

Do not deliver or install QuarryCast® parts until the building is enclosed and weatherproof, wet work is complete, and the HVAC system maintains temperature and humidity at normal occupancy levels. Acclimatize QuarryCast® parts for a minimum of 48 hours to the ambient temperature and humidity levels of spaces in which they are to be installed. It is the installing contractor's responsibility to order the correct material quantities (including a waste allowance) and verify the field dimensions and conditions for inclusion into the shop drawings.

Site Conditions:

Review the site conditions for compliance with Formglas' requirements relating to environmental conditions, installation tolerances and any other conditions that may affect the installation and performance of QuarryCast® parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into the Formglas® shop drawings prior to it commencing the manufacture of custom molds and QuarryCast® parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings.

Substrates:

The framing and/or substrates to accept QuarryCast® parts shall be surfaced with suitable materials (e.g. plywood for veneer or flat surface solutions) and installed straight and true within 1/8" in 8 linear ft. \leq 3 mm in 2500 mm and shall be free of obstruction and interference that prevents the correct positioning and attachment of the QuarryCast® parts. Metal framing members shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed QuarryCast® parts. Metal framing members shall be installed in accordance with ASTM Standards C754 or C1007, as required.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

General:

Install QuarryCast® parts as indicated on the approved shop drawings, instructions and the contract documents. The installing contractor is to supply and install all brackets, and shims for the installation and proper alignment of the QuarryCast® parts with adjacent parts and materials. Part thicknesses may vary per manufacturing tolerances. Allow for shim spaces between the QuarryCast® and the substrate. Attach the molded stone parts to substrates and framing with screws or other fasteners as shown on the shop drawings. Additional bracing, fastening points etc. not shown on the drawings, may be required to ensure a proper installation. Where QuarryCast® parts are suspended, use all the suspension points indicated on the shop drawings or on the back of QuarryCast® parts as a minimum requirement, and use additional support(s) as required. Columns, large parts and moldings etc. are to be face-fastened with countersunk screws. After, the screw holes are to be filled with Formglas-supplied patching compound. Where QuarryCast® veneer panels are adhered to surfaces, use a nail gun with 18 gauge nails and a Formglas® recommended brand adhesive only (PL® Premium®). See Installation Instructions for more complete details.

Cutting:

When QuarryCast® parts require cutting, use the most suitable cutting method listed below. If circumstances allow, cut parts outdoors or in a well ventilated area. Always wear goggles and a dust mask.

- A miter or table saw with a diamond cutting blade (e.g. 12" \leq 305 mm). Carbide blades with 80+ teeth work well but dull quicker.
- For irregular cuts use a reciprocating saw, such as a jig saw, with tungsten carbide blades.
- For small cutting operations a mini-grinder with a 4" \leq 100 mm diamond blade can be used.

Edge Finishing after Cutting:

For moldings, columns, and other molded components, lightly sand cut edges with a sanding block or mini sander with #80 - #120 grit sanding sheets.

For veneer panels, use a sanding block with #80 - #120 grit sandpaper to produce a 45° bevel to match the edges on parts supplied direct from the factory.

Attachment:

For moldings, columns and other molded components, face fasten with screws. Pre-drill with carbide bits and countersink holes approx. 1/8" ⇔ 3 mm below the surface along the embedded reinforcement and secure with #8 or similar screws 16" ⇔ 400 mm on center. Refer to the shop drawings for specific details and the location of the reinforcement materials. Screw holes are to be filled afterward with Formglas® supplied patching compound. Use joint spacers to maintain a uniform joint spacing of 1/8" ⇔ 3 mm.

For veneer panels, apply walnut-sized dabs of a Formglas® recommended adhesive (PL® Premium®) on the panel back approx. 9" ⇔ 225 mm on center and slide into position. Keep adhesive back from panel edges to prevent the adhesive from being squeezed onto visible surfaces (remove any adhesive immediately from the face of QuarryCast® parts). To hold the panels in position until the adhesive sets, use a nail gun with 18 gauge nails (for this reason, plywood is the preferred substrate).

Adhesive:

Use a Formglas® recommended brand adhesive (PL® Premium®) marketed under Loctite® and LePage® brand names to prevent the possibility of bleed-through. Take precautions to keep the adhesive off the face of the QuarryCast® parts. Refer to the Installation Instructions.

Joint Treatments:

For Dry Joints:

- For veneer panels, butt the QuarryCast® parts and leave the joints dry. Not recommended for columns, cornices or trims.

For Caulked Joints:

- Formglas® does not supply caulk for joints but can recommend a brand and color of caulk for use with specific QuarryCast® colors.
- Use spacers to maintain a uniform gap of approx. 1/8" [3 mm] and apply masking tape on each side of the joint. Do not use wide joints.
- Avoid smearing caulk beyond the joint.
- Veneer panels may have dry joints, open joints with accents strips (e.g. metal or laminate), or caulked joints.
- Caulk between QuarryCast® and different materials.
- Do NOT attempt a monolithic look - joints cannot be hidden.

Hole Filling and Patching:

- Hole Filling:** Finger fill screw holes with matching QuarryCast® patching compound avoiding smearing it beyond the hole. Remove excess compound immediately with a flexible scraper. The compound will blend in after 24 hours.
- Cracks or Chips:** Treat as screw holes (above).
- Minor Scratches and Gouges:** Due to the QuarryCast® texture, minor damage usually does not detract from the general appearance.

**Always use patching compound sparingly
Avoid smearing compound beyond the holes
Always remove excess compound immediately**

Note: Refer to the QuarryCast® Installation Instructions for more complete details.

■ **Cleaning and Maintenance**

- QuarryCast® has a factory-applied clear acrylic sealer to reduce staining and make cleaning easier.
- Clean QuarryCast® parts with water and mild soap solution using a lightly-moistened sponge.
- Excessive dirt, pencil and rubber marks etc. can usually be removed with a multi-purpose spray cleaner such as Spray Nine®. Dilute the cleaner by 50%, increasing the strength as required and wiping afterwards with a lightly-moistened cloth. Do not use powdered cleansers.

PRODUCT DATA SHEET

INTERIOR FINISHED CARPENTRY

Stone-Textured Architectural Elements

MasterFormat® 06 20 23

QuarryCast® by Formglas®

For Interiors

Applications

To view photos of QuarryCast® applications, or to contact a local Formglas® representative, visit www.formglas.com.



SCULPTED COLUMNS, DOME & MOLDINGS

ATLANTIS, DUBAI



ALL MOLDED ELEMENTS

FALLSVIEW CASINO, NIAGARA FALLS



WALL VENEER PANELS

H&M STORES, ACROSS CANADA



INTEGRALLY COLORED & TEXTURED CURVED & ANGULAR PANELS

RBC CENTRE, TORONTO

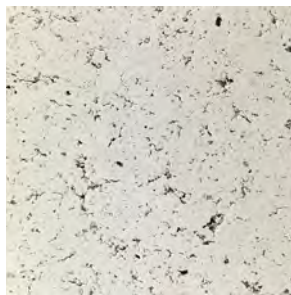
■ **Samples Available**

Formglas® is able to custom-formulate QuarryCast® to match an array of colors, textures or finishes. In addition, Formglas® maintains an inventory of nine standard samples, in various finishes and surfaces, to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.



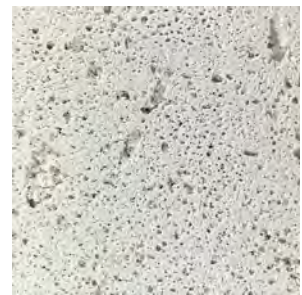
QuarryCast®
Color: Seattle Sand
Surface: Stuc Pierre
Sample Size: 4" x 5"
Sample Code: 98179



QuarryCast®
Color: Seattle Sand
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98004



QuarryCast®
Color: Seattle Sand
Surface: Sandblasted
Sample Size: 4" x 5"
Sample Code: 98181



QuarryCast®
Color: Seattle Sand
Surface: Coral
Sample Size: 4" x 5"
Sample Code: 98182



QuarryCast®
Color: Galveston Grey
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98007



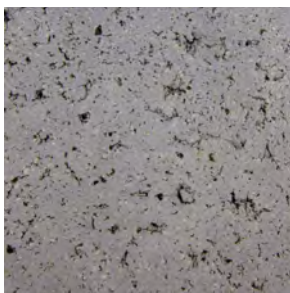
QuarryCast®
Color: Boise Buff
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98005



QuarryCast®
Color: Kyoto Coffee
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98006

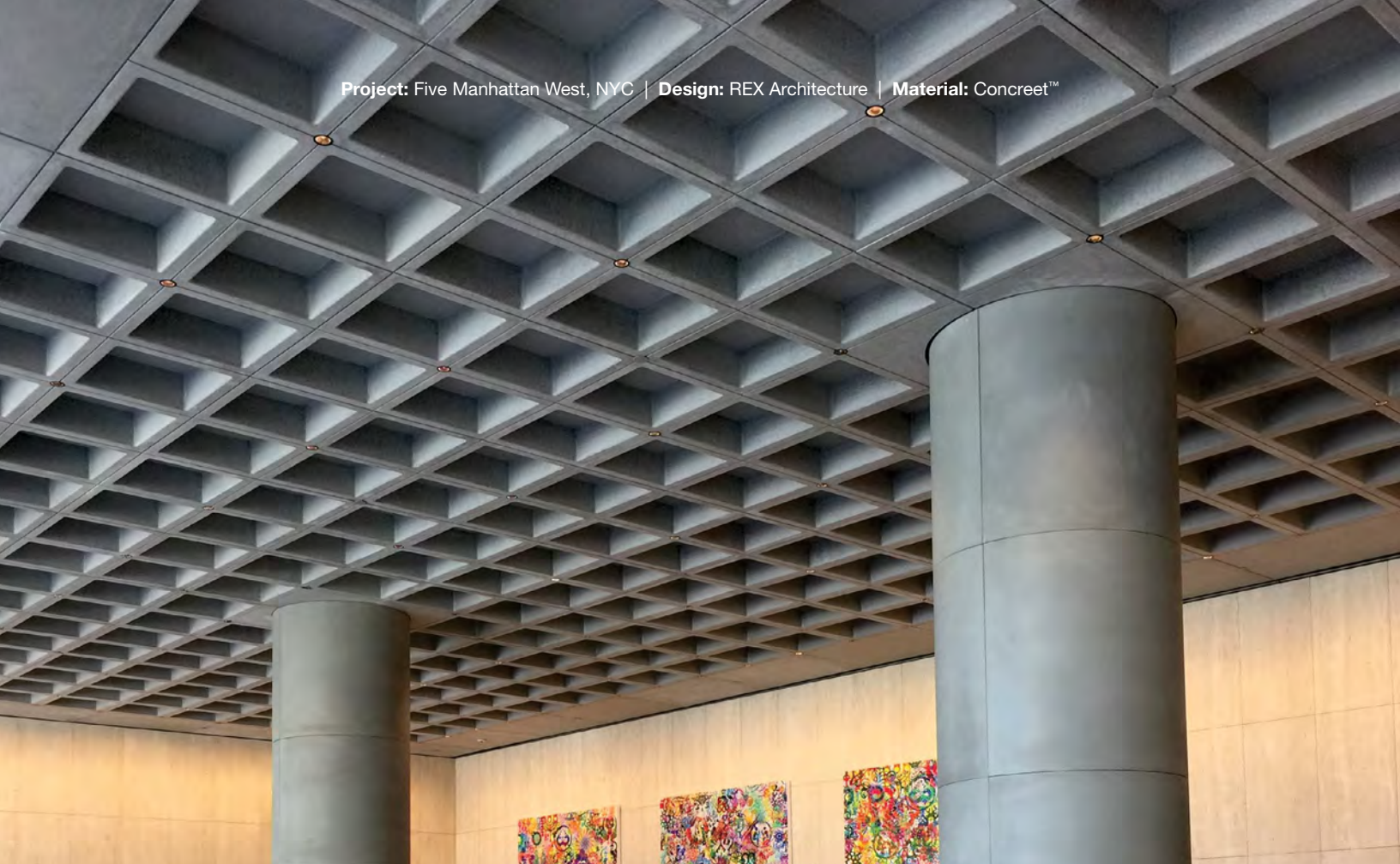


QuarryCast®
Color: Canyon Clay
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98009

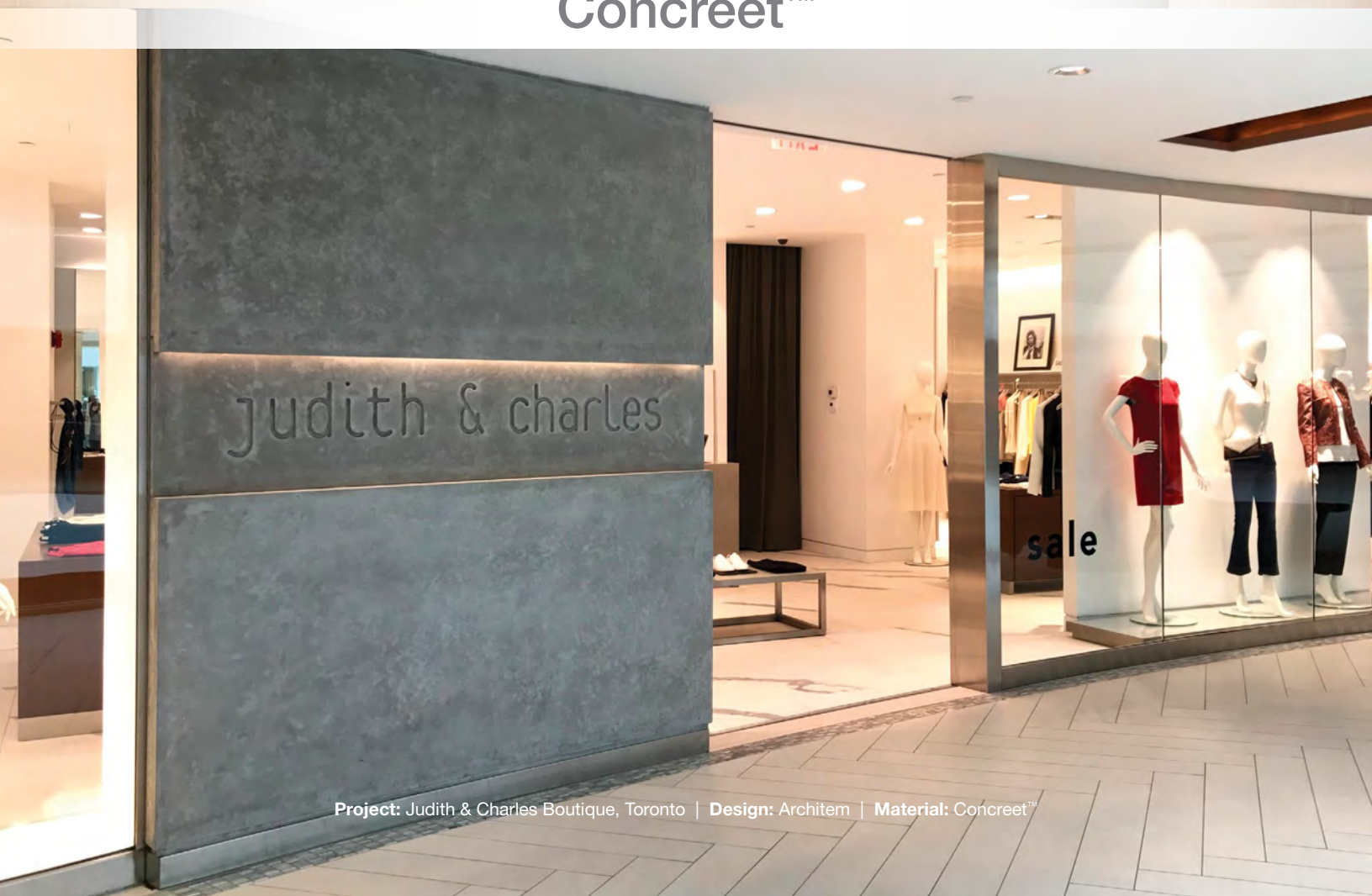


QuarryCast®
Color: Mountain Grey
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98013

Project: Five Manhattan West, NYC | Design: REX Architecture | Material: Concreet™



Concreet™



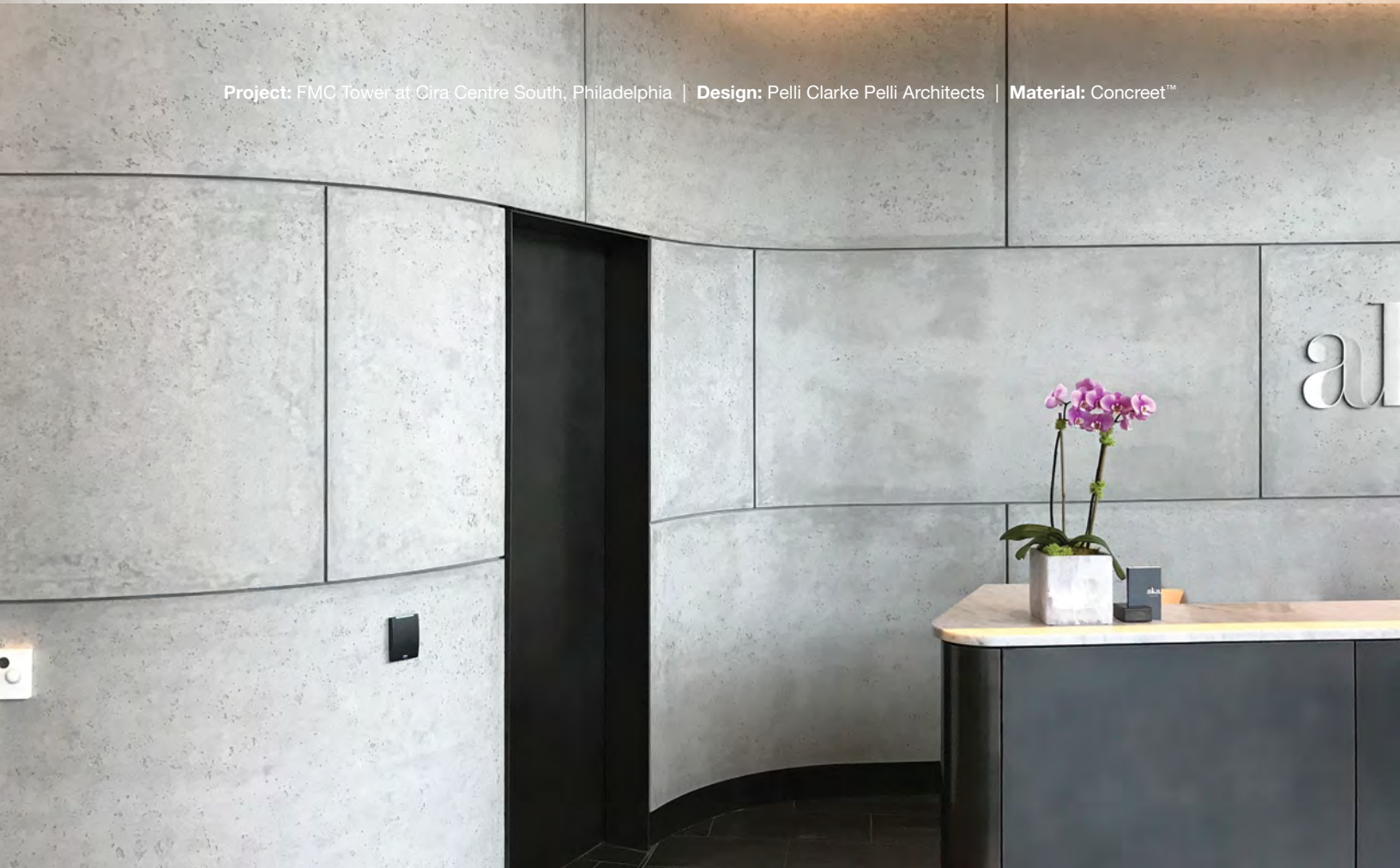
Project: Judith & Charles Boutique, Toronto | Design: Architem | Material: Concreet™

Project: FMC Tower at Cira Centre South, Philadelphia | Design: Pelli Clarke Pelli Architects | Material: Concreet™



Concreet™

Project: FMC Tower at Cira Centre South, Philadelphia | Design: Pelli Clarke Pelli Architects | Material: Concreet™



PRODUCT DATA SHEET

INTERIOR FINISHED CARPENTRY

Faux Concrete Gypsum Castings
MasterFormat® 06 20 23

Concreeet™ by Formglas®

For Interiors

Trade Name

Formglas® Concreeet™



Common Names

Faux Concrete Gypsum Castings
Faux Concrete Castings
Simulated Concrete Finishes

Manufacturer

Formglas Products Ltd.
181 Regina Road
Vaughan, Ontario, Canada L4L 8M3
T: 1.866.635.8030 F: 416.635.6588
Web: formglas.com Email: info@formglas.com



CONCREEET™ VENEER WALL PANELS

CALVIN KLEIN, NEWPORT BEACH

Summary

Concreeet™ is a lightweight pre-finished alpha gypsum cement-based material used to fabricate panels and elements that simulate the appearance of poured-in-place or trowelled concrete. Used in interiors as feature walls, beams, ceiling elements and column cladding, Concreeet™ is supplied in components that are easy-to-handle and install on common interior wall substrate and framing. This allows architects and designers to introduce contemporary concrete finishes where desired. Concreeet™ has a Class A (or 1) flame-spread rating.

Detailed Description

Concreeet™, is a proprietary GFRG-based material solution for adding concrete finishes into existing interior spaces, or extending the use of concrete finishes where existing concrete walls and columns are exposed and featured. Concreeet™ elements are manufactured with integral color pigments so that the material color extends below the surface. Natural aggregates are incorporated into a matrix of alpha gypsum cement and glass fiber reinforcement. This provides the molded Concreeet™ elements with added strength and flexibility in addition to an enhanced aesthetic appearance. Concreeet™ parts may incorporate embedments of steel or wood for added strength and to provide a means for attachment, suspension and stiffening. Yet, the final material is extremely lightweight ranging from 2-5 lb/ft² ⇔ 10-24 kg/m³, depending on the design and application. Concreeet™ components are lighter than real concrete elements that require weeks of curing and may yield a final finish or color that does not meet the desired aesthetic intent.

Concreeet™ is also a superior alternative to the wet, multi-step and multi-day in the field applications of trowelled on faux concrete finishes. Pre-finished Concreeet™ components are erected in hours in a manner similar to installing finished carpentry.

Concreeet™ is commonly used for interior wall cladding, beams, columns, retail store fronts and displays, and other decorative elements. The material is available in a variety of natural color tones and finishes including poured concrete (our standard) and planked. Designers may specify a custom finish to incorporate additional variations that match existing concrete surfaces in the field. Natural surface and color variations may occur within and between parts consistent with that of poured-in-place concrete.

Most Concreeet™ parts are fastened with adhesive, clips or other methods of concealed mechanical fastening. Ceiling elements are usually wire-suspended. Depending on the design, joints may be dry-buttet or caulked.

Concreeet™ components are custom-made to project design requirements and specifications. Formglas® uses a combination of 5-axis CNC technology, in-house sculpting, and expert pattern making skills to make authentic and precision master models from which molds are produced to make the required parts. In situations involving complex design elements or projects, Formglas® will work with architects and designers to develop a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture.

■ Technical Data

Refer to the following standards:

ASTM International (ASTM)

- E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

International Standards Organization (ISO)

- 1182 - Reaction to fire tests of products - Non combustibility Test
- 1716 - Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value)

International Maritime Organization (IMO)

- FTP Code (IMO resolution MSC 61/67)

■ Physical and Mechanical Properties

Formglas® uses alpha gypsum cement that is mined and processed in the USA from some of the world's purest deposits. Throughout the fabrication process, the gypsum material is subjected to strict inspection and testing to guarantee its high level of quality. Our prominent gypsum suppliers certify the raw materials are in compliance with the ASTM Standard C1355.

Matrix:	Alpha Gypsum Cement and various aggregates
Finish:	Standard colors and color matching available.
Surface:	Standard, fine and molded textures available.
Factory Finish:	Clear non-gloss sealer
Density:	~100 lb/ft ³ ⇔ 1600 kg/m ³
Weight:	
Veneer panels:	2-2½ lb/ft ² ⇔ 10-12 kg/m ² *
Molded parts:	2½-5 lb/ft ² ⇔ 10-24 kg/m ² *
Veneer thickness:	5/16" ⇔ 8 mm nominal
Shell thickness:	5/16" ⇔ 8 mm nominal**
Edge thickness:	¾-1¼" ⇔ 19-32 mm typical
Embedments:	Galvanized steel or wood (if required)
Glass Fiber:	5% typical
Max. length moldings:	8' ⇔ 2.4 m
Max. size veneer panels:	48" x 36" ⇔ 1200 x 900 mm
Max. size molded parts:	40 ft ² ⇔ 3.7 m ²

* Typical weights – parts with deep surface relief, etc. may weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances. Weight and measurement conversions may be rounded.

ASTM Standard and ISO Test Results

Flame Spread:	0
Smoke Development:	5
Behavior at 750°C:	Pass
ISO Reaction to Fire Tests	
Mass Loss:	20%
Temperature Difference:	2.7°F ⇔ 1.5°C
Duration of Ignition > 5 sec:	0
Gross Heat of Combustion:	258 Btu/lb ⇔ 0.6 MJ/kg

■ Manufacturing Tolerances

Veneer Thickness:	± 1/16" ⇔ 1.5 mm
Dimensional (all directions):	± 1/16" ⇔ 1.5 mm
Bowing, out of plane	3/32"/ft ⇔ 5 mm/300 mm
Molded Part Thickness:	-1/16 to + 3/16" ⇔ -1.5 to +5 mm
Dimensional (all directions):	± 3/16" ⇔ 5 mm
Bowing, out of plane	3/32"/ft ⇔ 2.5 mm / 300 mm

■ LEED®



Formglas® products contribute toward LEED® credits, and have been used in LEED® projects worldwide. Since Formglas® products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas® with specific details of your project and to clarify the version of LEED® rating system applicable.

■ Other Classifications and Approvals

In addition to ASTM and ISO testing, Concreet™, as a derivative of QuarryCast® and Formglas® GFRG, has been tested at the Centre Scientifique et Technique du Bâtiment (CSTB) in France and is classified "M0". This classification refers to building materials that are non-combustible. The material has also been tested by SINTEF, which is the largest independent research organization in Scandinavia and classified as a non-combustible material, in accordance to the IMO A.472 standard, and in Germany to DIN EN ISO 1182.

It is also approved for use on marine vessels with Module "B" and "F" Certificates of Approval in accordance with the International Maritime Organization (IMO) and Marine Equipment Directive (MED) regulations.

■ Delivery, Storage and Handling

Concree™ parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately, and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® of any damage immediately. Concree™ parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. To prevent distortion, warping, and other physical damage, Concree™ parts shall be kept clean and stored on a dry surface and not stacked or leaned on each other. Use clean gloves as required to ensure oils, adhesive and other contaminants are not transferred onto the pre-finished surface.

■ Preparatory Work

Do not deliver or install Concree™ parts until the building is enclosed and weatherproof, wet work is complete, and the HVAC system maintains temperature and humidity at normal occupancy levels. Acclimatize Concree™ parts for a minimum of 48 hours to the ambient temperature and humidity levels of spaces in which they are to be installed. It is the installing contractor's responsibility to order the correct material quantities (including a waste allowance) and verify the field dimensions and conditions for inclusion into the shop drawings.

Site Conditions:

Review the site conditions for compliance with Formglas' requirements relating to environmental conditions, installation tolerances and any other conditions that may affect the installation and performance of Concree™ parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into Formglas® shop drawings prior to it commencing the manufacture of custom molds and Concree™ parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings.

Substrates:

The framing and/or substrates to accept Concree™ parts shall be surfaced with suitable materials (e.g. plywood for veneer or flat surface solutions) and installed straight and true within 1/8" in 8 linear ft. ⇔ 3 mm in 2500 mm and shall be free of obstruction and interference that prevents the correct positioning and attachment of the

Concree™ parts. Metal framing members shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed Concree™ parts. Metal framing members shall be installed in accordance with ASTM Standards C754 or C1007, as required.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

General:

Install Concree™ parts as indicated on the approved shop drawings, instructions and the contract documents. The installing contractor is to supply and install all brackets, and shims for the installation and proper alignment of the Concree™ parts with adjacent parts and materials. Part thicknesses may vary per manufacturing tolerances. Allow for shim spaces between the Concree™ and the substrate. Attach the molded Concree™ parts to substrates and framing with screws or other fasteners as shown on the shop drawings. Additional bracing, fastening points etc. not shown on the drawings, may be required to ensure a proper installation. Where Concree™ parts are suspended use all the suspension points indicated on the shop drawings or on the back of Concree™ parts as a minimum requirement, and use additional support(s) as required. Columns, large parts etc. are to be face-fastened as shown on shop drawings. Any screw holes are to be filled with Formglas-supplied patching compound. Where Concree™ veneer panels are adhered to surfaces, use a nail gun with 18 gauge nails and a Formglas® recommended brand adhesive only (PL® Premium®). See Installation Instructions for Formglas® QuarryCast® for complete details.

Cutting:

When Concree™ parts require cutting, use the most suitable cutting method listed below. If circumstances allow, cut parts outdoors or in a well ventilated area. Always wear goggles and a dust mask.

- A miter or table saw with a diamond or "abrasive" cutting blades (e.g. 12" ⇔ 305 mm Makita® A.01345). Carbide blades with 80+ teeth work well but dull quicker.

- For irregular cuts use a reciprocating saw, such as a jig saw, with tungsten carbide blades (e.g. Milwaukee® 48-00-1420)
- For small cutting operations a mini grinder with a 4" ⇄ 100 mm diamond blade can be used.

Edge Finishing after Cutting:

For moldings, columns, and other molded components, lightly sand cut edges with a sanding block or mini sander with #80 - #120 grit sanding sheets.

For veneer panels, use a sanding block with #80 - #120 grit sandpaper to produce a 45° bevel to match the edges supplied direct from the factory.

Attachment:

For moldings, columns and other molded components, face fasten with screws. Pre-drill with carbide bits and countersink holes approx. 1/8" ⇄ 3 mm below the surface along the embedded reinforcement and secure with #8 or similar screws on 16" ⇄ 400 mm o.c. Refer to the shop drawings for specific details and the location of the reinforcement materials. Screw holes are to be filled afterward with Formglas-supplied patching compound. Use joint spacers to maintain a uniform joint spacing of 1/8" ⇄ 3 mm.

For veneer panels, apply walnut-sized dabs of a Formglas® recommended adhesive (PL® Premium®) on the panel back approx. 9" ⇄ 225 mm o.c. and slide into position. Keep adhesive back from panel edges to prevent the adhesive from being squeezed onto visible surfaces (remove any adhesive immediately from the face of Concree™ parts). To hold the panels in position until the adhesive sets, use a nail gun with 18 gauge nails (plywood is the preferred substrate for this purpose).

Adhesive:

Use a Formglas® recommended brand adhesive (PL® Premium®) marketed under Loctite® and LePage® brand names to prevent the possibility of bleed-through. Take precautions to keep the adhesive off the face of the Concree™ parts. Refer to the Installation Instructions.

Joint Treatments:

For Dry Joints:

- For veneer panels, butt the Concree™ parts and leave the joints dry. Not recommended for columns, cornices, or trims.

For Caulked Joints:

- Formglas® does not supply caulk for joints but can recommend a brand and color of caulk for use with specific Concree™ colors.
- Use spacers to maintain a uniform gap of approx. 1/8" ⇄ 3 mm and apply masking tape on each side of the joint. Do not use wide joints.
- Avoid smearing caulk beyond the joint and remove any excess immediately with flexible scraper.
- Veneer panels may have dry joints, open joints with accents strips (e.g. metal or laminate), or caulked joints.
- Caulk between Concree™ and different materials.
- Do NOT attempt a monolithic look - joints cannot be hidden.

Hole Filling and Patching:

- **Hole Filling:** Finger fill screw holes with matching Concree™ patching compound avoiding smearing it beyond the hole. Remove excess compound immediately with a flexible scraper. The compound will blend in after 24 hours.
- **Cracks or Chips:** Treat as screw holes (above).
- **Minor Scratches and Gouges:** Due to the Concree™ texture, minor damage usually does not detract from the general appearance.

Always use patching compound sparingly

Avoid smearing compound beyond the holes

Always remove excess compound immediately

■ **Cleaning and Maintenance**

- Concree™ has a factory-applied clear acrylic sealer to reduce staining and make cleaning easier.
- Clean Concree™ parts with water and mild soap solution using a lightly-moistened sponge.
- Excessive dirt, pencil and rubber marks etc. can usually be removed with a multi-purpose spray cleaner such as Spray Nine®. Begin with a diluted cleaner, increasing the strength as required and wiping afterwards with a lightly-moistened cloth. Do not use powdered cleansers.

PRODUCT DATA SHEET

INTERIOR FINISHED CARPENTRY

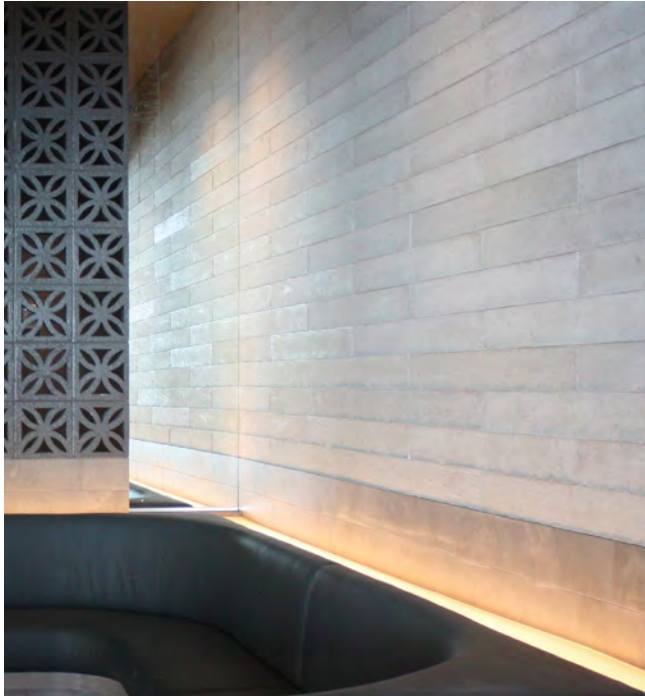
Faux Concrete Gypsum Castings
MasterFormat® 06 20 23

Concree™ by **Formglas®**

For Interiors

Applications

To view photos of Concree™ applications, or to contact a local Formglas® representative, visit www.formglas.com.



PLANKED VENEER FEATURE WALL

ONE RESTAURANT, NEW JERSEY



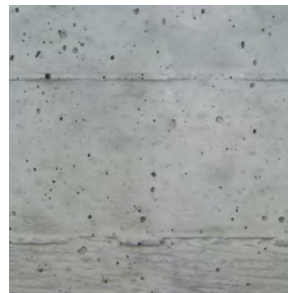
COLUMNS, ENTRANCEWAYS, MOLDINGS

ASELLINA RISTORANTE, NYC

Samples Available

Formglas® is able to custom-formulate Concree™ to match an array of colors, textures or finishes. In addition, Formglas® maintains an inventory of four standard samples to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.



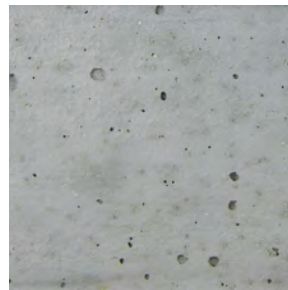
Concree™

Color: Concrete Grey
Surface: Standard
Pattern: Board-formed Planking
Sample Size: 4" x 5"
Sample Code: 98070



Concree™

Color: Light Grey
Surface: Fine
Pattern: Displaced Planking
Sample Size: 4" x 5"
Sample Code: 98192



Concree™

Color: Concrete Grey
Surface: Standard
Sample Size: 4" x 5"
Sample Code: 98144



Concree™

Color: Concrete Grey
Surface: Fine
Sample Size: 4" x 5"
Sample Code: 98196



Project: Conestoga Mall, Waterloo | Design: Pellow & Associates Inc. | Material: MetalCast®

MetalCast®



Project: DFS at JFK Airport T1, NYC | Design: TranSystems | Material: MetalCast®

PRODUCT DATA SHEET

INTERIOR FINISHED CARPENTRY

Architectural Elements made of Cold Cast Metal

MasterFormat® 06 20 23

MetalCast® by **Formglas®**

For Interiors

Trade Name

Formglas® MetalCast®



Common Names

Cold Cast Metal

GFRG with a Metallic Finish

Manufacturer

Formglas Products Ltd.

181 Regina Road

Vaughan, Ontario, Canada L4L 8M3

T: 1.866.635.8030 F: 416.635.6588

Web: formglas.com Email: info@formglas.com



COPPER BRICK-PATTERNED VENEER PANELS

CREDIT SUISSE, FLORIDA

Summary

MetalCast® is a proprietary cold-cast metal material made with real metal powders incorporated into a glass fiber reinforced gypsum composite. This metal composite is cast into shapes, without the application of heat, by placing the material into molds in a hand lay-up process. After removal from the molds, parts are buffed and coated with a protective coating to reduce oxidation, and protect the burnished and/or patina finish. The bronze, copper, brass, and nickel silver metal elements are for interior use only and are custom manufactured into virtually any shape with precise detail. MetalCast® is a premium product but is usually more economical than using conventional metal castings.

Detailed Description

MetalCast® elements are typically used to provide rich decorative embellishments for interior applications. MetalCast® is used to make complete architectural elements, but also frequently used as trim, inlays and appliques to enhance other materials. The molded parts have a shell thickness of approximately 1/4" ⇔ 6 mm and weigh 2.5 to 4 lbs/ft.² ⇔ 12 to 20 kgs/m².

MetalCast® parts often incorporate embedments of steel or wood to add strength and provide a means for attachment, suspension and stiffening. As a result, complex architectural shapes can be made with MetalCast® which would be otherwise impractical or cost prohibitive to produce with conventional metal castings. In most instances, MetalCast® elements require less support framing for their installation and offer a more economical solution than conventional metal castings.

Typical architectural applications of MetalCast® include: moldings, trim and light coves; pediments and pilasters; capitals; appliques, plaques and inlays; decorative frames and displays; and other decorative elements. Ideally, components are reserved for installations at or higher than 3 ft ⇔ 900 mm AFF to reduce the potential for scuffs or scratches which cannot be easily repaired. All of the aforementioned items can be molded into shapes yielding fine surface detail, textures, patterns and choice of metal finishes. Shade and brightness variations will occur within and between parts. MetalCast® should not be used where it is subjected to mechanical abuse, water or high levels of humidity.

MetalCast® molded parts are to be installed with concealed fasteners and/or adhesive wherever possible. Parts other than veneer panels are made with embedded reinforcement for attachment purposes. Moldings are typically supplied with factory-molded corners.

Most MetalCast® items are custom-made to meet project design requirements and specifications. Formglas® uses 5-axis CNC technology to machine precision patterns from which molds are produced to make the required parts. In situations involving complex design elements or projects, Formglas® will work with architects and designers to develop a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings are prepared for approval prior to manufacture. MetalCast® interior elements have been used in numerous world class buildings around the globe.

Technical Data

Refer to the following standards:

ASTM International (ASTM)

- E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

International Standards Organization (ISO)

- 1716 - Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value)

International Maritime Organization (IMO)

- FTP Code (IMO resolution MSC 61/67)

Physical and Mechanical Properties

The metal powders used in MetalCast® are highly refined and also used in powder metallurgy parts production. The alpha gypsum cement materials used as the matrix are mined and processed in the USA from some of the world's purest deposits. Our prominent gypsum suppliers certify the raw materials are in compliance with the ASTM Standard C1355.

Matrix:	Metal and Gypsum Cement
Finish:	Bronze, Copper, Brass, Nickel Silver
Surface:	Polished, custom-molded textures available.
Factory Finish:	Clear non-gloss lacquer
Density:	120 lbs/ft. ³ ⇔ 1920 kg/m ³
Weight: Veneer panels: Molded parts:	2.5-3 lbs/ft ² ⇔ 12-15 kg/m ² * 2.5-4 lbs/ft ² ⇔ 12-20 kg/ m ² *
Veneer thickness:	1/4" ⇔ 6 mm nominal**
Shell thickness:	1/4" ⇔ 6 mm nominal**
Edge thickness:	3/4-1 1/4" ⇔ 19-32 mm typical
Embedments:	Galvanized steel or wood (if required)
Glass Fiber:	5% typical
Max. length moldings:	4' ⇔ 1.2 m
Max. size veneer panels:	48" x 36" ⇔ 1200 x 900 mm
Max. size molded parts:	20 ft ² ⇔ 1.8 m ²

* Typical weights – parts with deep surface relief, etc. may weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances. Weight and measurement conversions may be rounded.

ASTM Standard and ISO Test Results

Flame Spread:	0
Smoke Development:	≤10
Behavior at 750°C:	Pass
ISO Reaction to Fire Tests Temperature Difference: Duration of Ignition > 5 sec:	2.7°F ⇔ 1.5°C 0
Gross Heat of Combustion:	378 Btu/lb ⇔ 0.9 MJ/kg

Manufacturing Tolerances

Veneer Thickness:	± 1/16" ⇔ 1.5 mm
Dimensional (all directions):	± 1/16" ⇔ 1.5 mm
Bowing, out of plane	3/32"/ft ⇔ 2.5 mm/300 mm
Molded Part Thickness:	-1/16 to + 3/16" ⇔ -1.5 to +5 mm
Dimensional (all directions):	± 3/16" ⇔ 5 mm
Bowing, out of plane	1/8"/ft ⇔ 3 mm / 300 mm

LEED®



Formglas® products contribute toward LEED® credits, and have been used in LEED® projects worldwide. Since Formglas® products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas® with specific details of your project and to clarify the version of LEED® rating system applicable.

Other Classifications and Approvals

In addition to ASTM and ISO testing, MetalCast® has been tested at the Centre Scientifique et Technique du Bâtiment (CSTB) in France and is classified "M0". This classification refers to building materials that are non-combustible. MetalCast® has also been tested to the German Standard DIN 4102-1 and classified as an A2 non-combustible material.

MetalCast® is approved for use on marine vessels with Module "B" and "F" Certificates of Approval in accordance with the International Maritime Organization (IMO) and Marine Equipment Directive (MED) regulations.

■ Delivery, Storage and Handling

MetalCast® parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately, and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® of any damage immediately. MetalCast® parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. To prevent distortion, warping, and other physical damage, MetalCast® parts shall be kept clean and stored on a dry surface, in a dry area, and not stacked or leaned on each other. Parts should be handled with clean gloves to ensure that oils, adhesive, and other contaminants are not transferred onto the parts. **Failure to observe delivery, storage and handling instructions may result in irreparable damage to parts.**

■ Preparatory Work

Do not deliver or install MetalCast® parts until the building is enclosed and weatherproof, wet work is complete, and the HVAC system maintains temperature and humidity at normal occupancy levels. Acclimatize MetalCast® parts for a minimum of 48 hours to the ambient temperature and humidity levels of spaces in which they are to be installed. It is the installing contractor's responsibility to order the correct material quantities (including a waste allowance) and verify the field dimensions and conditions for inclusion into the shop drawings.

Site Conditions:

Review the site conditions for compliance with Formglas' requirements relating to environmental conditions, installation tolerances and any other conditions that may affect the installation and performance of MetalCast® parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into the Formglas® shop drawings prior to it commencing the manufacture of custom molds and MetalCast® parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings.

Substrates:

In the case of flat veneer surface cladding solutions only, the substrates to accept MetalCast® parts shall be surfaced with drywall or plywood (preferred) that is installed straight and true within 1/8" in 8 linear ft. ⇔ 3 mm in 2500 mm. This is not required for columns, cornices, friezes or other such applications. The substrate shall be free of obstructions and

interference that prevents the correct positioning and attachment of the MetalCast® parts. Metal framing members shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed MetalCast® parts.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

General:

Install MetalCast® parts as indicated on the approved shop drawings, instructions and the contract documents. The installing contractor is to supply and install all brackets and shims as required for the installation and proper alignment of the MetalCast® parts with adjacent parts and materials. Part thicknesses may vary. Allow for shim spaces between the MetalCast® parts and the substrate. Attach the parts to substrates and framing with concealed fasteners wherever possible, as shown on the shop drawings. Additional bracing, fastening points etc. not shown on the drawings, may be required to ensure a proper installation. Where MetalCast® parts are suspended, use all the suspension points indicated on the shop drawings or on the back of MetalCast® parts as a minimum requirement, and use additional support(s) if required. Where MetalCast® veneer panels are adhered to surfaces - use a Formglas® recommended brand adhesive only (PL® Premium®) marketed under Loctite® and LePage® brand names.

MetalCast® is not as impact or scratch resistant as stainless steel and is therefore not suitable for baseboards or other areas subject to wear or abuse.

Cutting:

If field conditions require MetalCast® components to be cut, please contact Formglas® to discuss special considerations and instructions.

Attachment:

For moldings, columns, other parts, wherever possible, MetalCast® is to be installed with concealed fastening methods. If face fastening is necessary, plan in advance to use MetalCast® matching screw covers. Pre-drill countersunk holes evenly spaced apart and secure with #8 or similar screws along embedded reinforcement. Refer to the shop drawings for specific details and the location of the reinforcement materials.

Where possible, position screw holes to be inconspicuous. Use a Formglas® recommended construction adhesive (PL® Premium®) to minimize the number of face fasteners.

For veneer panels, apply walnut-sized dabs of adhesive on the panel back approx. 9" \approx 225 mm o.c. and slide into position. Keep adhesive back from panel edges to prevent oozing onto visible surfaces. A hot-melt adhesive can be used **in conjunction** with construction adhesive to provide a quick bond. Apply a few spots of quick-set hot-melt adhesive near the corners, or where required, just before installation and press panel into place. Use joint spacers between parts to maintain a uniform joint spacing of 1/16" \approx 1.5 mm.

Adhesive:

Use a Formglas® recommended brand adhesive (PL® Premium®) marketed under Loctite® and LePage® brand names to prevent the possibility of bleed-through. Take precautions to keep the adhesive off the face of the MetalCast® parts. Refer to the installation Instructions.

Joint Treatments:

For Caulked Joints:

- Joints are to be 1/16" \approx 1.5 mm wide and caulked. Exact caulk matches are not available. Formglas® does not supply caulk but can recommend a specific type and color.
- Do NOT attempt a monolithic look - joints cannot be hidden.
- Caulk between MetalCast® and different materials.

Cleaning and Maintenance

- MetalCast® has a factory-applied clear coat to reduce oxidation.
- Surface dirt, fingerprints and water stains can be removed with a clean, damp, soft cloth and gently wiped dry.
- Do not use any type of household or solvent based cleaners or abrasives. USE MILD SOAP AND WATER ONLY.
- Similar to actual bronze or brass castings etc., superficial scratches on the protective lacquer will not detract from the overall appearance, but severe damage cannot be repaired.
- Field polishing is not possible because of the lacquer coating required to reduce oxidation.

Note: Refer to the MetalCast® Installation Instructions for more complete details.

Applications

To view photos of Formglas® MetalCast® applications, or to contact a local Formglas® representative, visit www.formglas.com.



CLOSE-UP OF COLUMN WITH QUARRYCAST® MOSAIC TILE INLAYS CONESTOGA MALL, WATERLOO

PRODUCT DATA SHEET

INTERIOR FINISHED CARPENTRY

Architectural Elements made of Cold Cast Metal
MasterFormat® 06 20 23

MetalCast® by **Formglas®**

For Interiors



CEILING BEAMS AND COLUMNS

ONE FREEDOM SQUARE, RESTON



SCULPTED COLUMNS AND CAPITALS

ATLANTIS, DUBAI



CEILING BEAMS AND BRACKETS

CORPORATE LOBBY, WASHINGTON



DECORATIVE GRILLES

PRIVATE THEATRE BY TK THEATERS



PILASTERS, MOLDINGS, TRIM

BOMBAY COMPANY, USA

Samples Available

The beauty of MetalCast® is realized when Formglas® is called upon, for custom applications, to mold custom textures into the parts it manufactures. Please note that Formglas® is not able to formulate MetalCast® to match any others colors. Formglas® maintains an inventory of five standard samples to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.



MetalCast®

Color: Bronze
Surface: Polished
Pattern: Decorative Trim
Sample Size: 5 ½" x 6 ½"
Sample Code: 98135



MetalCast®

Color: Copper
Surface: Polished
Pattern: Decorative Trim
Sample Size: 5 ½" x 6 ½"
Sample Code: 98136



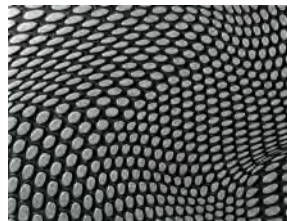
MetalCast®

Color: Brass
Surface: Polished
Pattern: Decorative Trim
Sample Size: 5 ½" x 6 ½"
Sample Code: 98137



MetalCast®

Color: Nickel Silver
Surface: Polished
Pattern: Decorative Trim
Sample Size: 5 ½" x 6 ½"
Sample Code: 98138



MetalCast®

Color: Nickel Silver
Surface: Polished
Pattern: 3D Pattern
Sample Size: 3" x 6 ¾"
Sample Code: 98185

PRODUCT DATA SHEET

GLASS FIBER REINFORCED POLYMER

Molded Architectural Products and Elements
MasterFormat® 06 82 00

FRP by **Formglas**®

For Exteriors or Interiors

Trade Name

Formglas® FRP



Common Names

Fiberglass Reinforced Polymer | FRP
Glass Fiber Reinforced Polymer | GFRP
Fiber-Reinforced Polymer
Glassfiber Reinforced Plastic

Manufacturer

Formglas Products Ltd.
181 Regina Road
Vaughan, Ontario, Canada L4L 8M3
T: 1.866.635.8030 F: 416.635.6588
Web: formglas.com Email: info@formglas.com



PRE-FINISHED GOLD + SILVER METALLIC FRP LINKED SCREEN

THE GALLERIA, HOUSTON

Summary

Formglas® FRP is a fiber-reinforced polymer composite that is lightweight, high strength, and durable. This composite has a Class A (or 1) flame spread rating and is primarily used as building ornamentation in architectural applications. It can be produced in virtually any shape and with smooth, textured, perforated or patterned surfaces providing architects with abundant design flexibility. Formglas® FRP is commonly supplied pre-finished with integral cast in color, or paint-ready for on-site painting, depending on the application.

Detailed Description

Formglas® FRP is a catalyzed thermoset polymer composite with glass fiber reinforcement. It uses layers of chopped strand glass mat and polymer resin that provide material consistency throughout which provides strong, durable, chemical resistant parts. Additional reinforcement materials are strategically wetted into the parts to provide additional strength where needed and for attachment purposes. Formglas® FRP has excellent weathering, flexural and tensile physical properties. This versatile material provides cost effective solutions for use on new or renovated buildings, particularly with respect to exterior applications. It is also a relatively lightweight material, weighing approximately 2 lb/ft² ⇔ 10 kg/m² which reduces transportation, handling and installation costs.

The standard FRP surface consists of a UV stabilized polymer gelcoat which is provided in a white color for field finishing. The back-up laminate consists of layers of glass fiber and polymer resin. The Formglas® FRP composite material has a Class A (or 1) flame-spread rating. When FRP is molded into shapes, the geometry of the shape imparts physical properties to the parts, such as strength and stiffness. For example, the design profiles of FRP parts that include recesses, projections, grooves, curves or ornamentation make the parts stronger. The nominal shell

thickness of parts is 3/16". However, areas of parts that have flat regions are cast thicker by encapsulating core materials into the laminate that provide added strength and stiffness.

FRP offers some unique advantages for architects and designers in providing more design flexibility due to the much lighter nature of this material. Parts can be made in almost any shape and in sizes that would otherwise require more costly support structures or increased installation costs (as compared to other materials such as precast concrete).

In most cases, FRP molded parts are secured to the building's structural framing and substrate with concealed fasteners. Joints between parts should be minimized and favorably positioned in consideration of part size and design, overall appearance, and installation. FRP parts are typically supplied with factory-molded corners to minimize field-mitering.

Typical architectural applications of FRP include building ornamentation such as cornices, columns, pediments, moldings, storefront entries, and other architectural elements such as friezes and signage. Molded FRP products can replicate many common materials such as slate, cast iron, and wood grained surfaces to name just a few. FRP is primarily used on exterior wall surfaces and noncombustible substrates, and some interior applications, subject to local building code requirements which may limit the amount of FRP to a percentage of the wall surface to which it is applied.

Most items are custom-made to meet project design requirements and specifications. Formglas® uses 5-axis CNC technology to machine precision patterns from which molds are produced to make the required parts. In situations involving complicated design elements or projects, Formglas® will work with architects and designers to create a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture of molds or custom parts.

Technical Data

Refer to the following standards:

ASTM International (ASTM)

- E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics
- D638 - Standard Test Method for Tensile Properties of Plastics
- D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics
- D570 - Standard Test Method for Water Absorption of Plastics
- D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- E331 - Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
- E330 - Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference (Modified)

Physical and Mechanical Properties

FRP is a fiberglass reinforced polymer resin composite with a nominal thickness of 3/16" \approx 5 mm. It has 25 to 30% glass fiber content (by weight) in the form of multiple layers of chopped strand mat.

Matrix:	ISO/PNG Polymer Resin
Finish:	White, ready for field paint standard. Custom-colored gel coat matching available.
Surface:	Smooth is standard. Molded textures available.
Density:	~110 lb/ft ³ \approx 1760 kg/m ³
Weight:	1.75-2.25 lbs/ft ² \approx 8.5-11 kg/m ^{2*}
Shell thickness:	3/16" \approx 5 mm nominal**
Embedments:	Core mat or other reinforcement as profile, shape or design requires
Glass Fiber:	25-30% typical
Reveals/setbacks:	3° draft minimum
All outside corners:	1/16"-1/8" \approx 1.5-3 mm radius
Max. length moldings:	16' \approx 4.8 m
Max. size molded parts:	70 ft ² \approx 6.5 m ²

* Typical weights – parts with deep surface relief, etc. may weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances. Weight and measurement conversions may be rounded.

ASTM Standard and ISO Test Results

Flame Spread:	\leq 25 (Class A)
Smoke Development:	\leq 450 (Class A)
Flexural Strength:	32,100 psi \approx 221 MPa
Tensile Strength:	15,950 psi \approx 110 MPa
Modulus of Elasticity:	1,080,000 PSI (7.45 Gpa)
Compressive Strength:	33,100 psi \approx 228 MPa
Impact Resistance:	12 ft-lb/in \approx 643 J/m
Barcol Hardness:	44
Heat Deflection:	$>$ 513°F \approx 285°C
Coefficient of Linear Thermal Expansion:	2.73×10^{-5} in/in/°F \approx 1.5×10^{-6} mm/mm/°C
Water Absorption:	0.3%
Abrasion Resistance:	85 mg
Nail push-through:	1050 lb force \approx 4,670 N
FRP Wall Assemblies	
Air Leakage	0.02 cfm/ft ²
Water Penetration	Nil
Structural Test (90 mph x 1141 Pa x 1.5 safety factor)	Pass

Manufacturing Tolerances

Dimensional (all directions):	\pm 1/8", 0-10 ft \approx 3 mm in 3 m
Thickness:	\pm 1/8" \approx 3 mm
Variation from square:	\pm 1/8", 0-10 ft \approx 3 mm in 3 m
Bowing, out of plane	\pm 1/16"/ft \approx 3 mm/300 mm

LEED[®]



Formglas[®] products contribute toward LEED[®] credits, and have been used in LEED[®] projects worldwide. Since Formglas[®] products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas[®] with specific details of your project and to clarify the version of LEED[®] rating system applicable.

Delivery, Storage and Handling

FRP parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas[®] of any damage immediately. FRP parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. Place non-staining resilient spacers between parts and support parts during shipment and subsequent unloading and storage. Protect parts from

dirt and damage during handling, transport and storage. Store unpackaged parts indoors on firm, level and smooth surfaces with part identification labels clearly visible.

■ Preparatory Work

Site Conditions:

The site conditions are to be reviewed for compliance with Formglas' requirements relating to installation tolerances and any other conditions that may affect the installation and performance of FRP parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into Formglas® shop drawings prior to it commencing the manufacture of custom molds and FRP parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings. It is the installing contractor's responsibility to order the correct quantities of parts including a waste allowance, if applicable.

Substrates:

The framing and/or substrates to accept FRP parts shall be surfaced with suitable materials and weather barrier as applicable and installed straight and true within 1/8" in 8 linear ft. ⇔ 3 mm in 2500 mm. The substrate shall be free of obstruction and interference that prevents the correct positioning and attachment of the FRP parts. Structural framing and substrate shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed FRP parts and meet applicable building codes.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

General:

Install FRP parts as indicated on the approved shop drawings, instructions and the contract documents. The installing contractor is to supply and install all brackets, shims, other hardware and adhesives as required for the installation

and proper alignment of the FRP parts with adjacent parts and materials. Part thicknesses may vary. Allow for shim spaces between the FRP and the substrate. Attach the FRP parts using corrosion resistant screws, bolts or other fasteners as shown on the shop drawings. Additional bracing, fastening points etc. not shown on the drawings, may be required to ensure a proper installation. Do not over-torque screws otherwise damage to material flanges may occur.

Cutting:

When cutting parts is required, use the most suitable cutting method listed below. Always wear goggles and a dust mask.

- A reciprocating saw with a medium grit composite blade.
- A mini grinder with 4" ⇔ 100 mm medium grit composite blade or diamond blade.
- A chop saw with a diamond blade for smaller moldings etc.
- Formglas® to supply 1½" batten strips for field cut parts. Refer to Formglas® shop drawings for more information.

Attachment:

Wherever possible, FRP parts are to be installed with concealed fastening methods such as beneath flashings or behind caulked joints. Parts should have pre-drilled oversize clearance holes for fasteners and neoprene shims (or equivalent) installed behind the panel edges being fastened to facilitate movement due to expansion and contraction. A bond breaker tape should be applied inside the joint over the top of the fasteners prior to caulking the joint. Stainless steel fasteners are recommended. Do not over-torque screws otherwise damage to material flanges may occur.

Monolithic joints used to make two or more parts appear as one continuous piece are generally NOT recommended except for specific interior applications as detailed on the drawings.

Joint Treatments:

- All joints must be caulked
- Formglas® does not supply caulk for joints but can recommend a type and specific brand for use with FRP. Follow all recommendations for joint preparation by caulk supplier.
- A paintable, one-compound elastomeric low modulus urethane sealant is recommended. (e.g. Sonolastic® Ultra or equivalent)
- Use spacers to maintain a uniform gap between parts and install a bond breaker tape inside the joint over top of the fasteners.
- Apply low tack masking tape on either side of the joint and avoid smearing caulk beyond the joint and remove any excess immediately.
- Do NOT attempt a monolithic look - joints cannot be hidden.

Hole Filling and Patching:

- Hole Repair: Sand only the immediate area to be patched. Clean the surface with acetone or methylene chloride. Mix only as much gelcoat putty as can be applied in 15-20 minutes.
- Apply the gelcoat putty to the hole or void. Overfill the hole above the surface as it will shrink nominally as it cures. Allow 3-4 hours to cure before sanding.
- Prior to curing, gelcoat putty on paint-ready parts can be removed using acetone or methylene chloride. This is not recommended on pre-finished parts.
- For paint-ready parts, screw holes (other than those at overlap joints) should be filled with Bondo[®], sanded and then painted to achieve the desired field finish.
- For pre-finished parts, screw holes should be filled with a color-matching gelcoat putty (supplied by Formglas) and then sanded, and touched up with a matching color gelcoat (supplied by Formglas).

Always use Gelcoat putty sparingly

Avoid smearing it beyond the holes

Always remove excess putty immediately

For more details, refer to the installation instructions and project drawings.

■ **Cleaning and Maintenance**

- Periodic cleaning is recommended to avoid any build up of dirt and/or acidic pollutants which may affect the color or UV performance of FRP parts. Clean soiled surfaces with water and a mild household dish detergent. Surfaces may require light scrubbing with a soft-bristled brush. To avoid surface damage including etching, use of a pressure washer is not recommended.



FACADE WITH ABSTRACT CRISS CROSS PATTERN CHERRY CREEK SHOPPING CENTER, DENVER

■ **Applications**

To view photos of Formglas[®] FRP applications, or to contact a local Formglas[®] representative, visit www.formglas.com.



CORNICES & PORTAL ENTRY

RBC BANK BRANCH, MISSISSAUGA



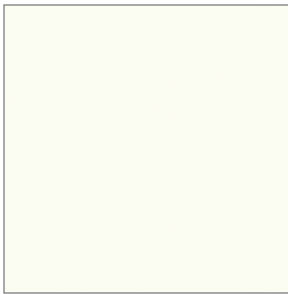
ENTRANCE FACADE

CHAMPAGNE CENTER, TORONTO

■ **Samples Available**

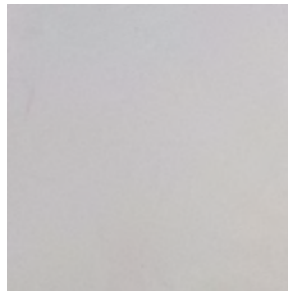
Formglas® is able to fabricate FRP parts with a custom color-matched factory-applied gel coat which lowers the cost of long-term maintenance by avoiding the need to repaint. In addition, Formglas® maintains an inventory of three standard samples to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.



Formglas® FRP

Color: Paint-Ready
Surface: Smooth
Finish: Unfinished
Sample Size: 4" x 5"
Sample Code: 98030



Formglas® FRP

Color: Sky Grey
Surface: Smooth
Finish: Colored Gelcoat
Sample Size: 4" x 5"
Sample Code: 98097



Formglas® FRP

Color: Grey Metallic
Surface: Smooth
Finish: Factory-Painted
Sample Size: 4" x 5"
Sample Code: 98187

Project: Houston Galleria, Houston | Design: GH+A | Material: Formglas® FRP



Formglas® FRP



Project: Cherry Creek, Denver | Design: GH+A | Material: Formglas® FRP

PRODUCT DATA SHEET

EXTERIOR FRP CASTINGS

Stone-Textured FRP Castings

MasterFormat® 06 82 00

CorniceStone™ by Formglas®

For Exteriors

Trade Name

Formglas® CorniceStone™



Common Names

Stone-Textured FRP castings
FRP castings with an aggregate finish

Manufacturer

Formglas Products Ltd.
181 Regina Road
Vaughan, Ontario, Canada L4L 8M3
T: 1.866.635.8030 F: 416.635.6588
Web: formglas.com Email: info@formglas.com



COLUMNS & CORNICES

N. CAROLINA RESEARCH CENTER, KANNAPOLIS

Summary

CorniceStone™ is a pre-finished, lightweight and high strength fiber-reinforced polymer (FRP) composite that incorporates natural aggregates and pigments into molded architectural shapes and elements resembling natural limestone. CorniceStone™ is a Class A (or 1) flame-spread rated product that is ideal for use as building ornamentation for exterior applications such as cornices, column cladding, trim details, spandrels and terracotta replacement, in both new construction and building renovation. CorniceStone™ is an outstanding alternative to GFRC, precast or EIFS because of its high strength, light weight, design flexibility, ease of installation and durability.

Detailed Description

CorniceStone™ is a pre-finished glass fiber reinforced composite used to make architectural elements. It is a catalyzed thermoset plastic composite that is durable, chemical resistant and has excellent weathering, flexural and tensile physical properties. This makes it a versatile material that provides cost effective solutions for the construction of buildings and renovation of existing structures. It is also a lightweight material, weighing approximately 2 lb/ft² ⇔ 10 kg/m² which reduces transportation, handling and installation costs.

The CorniceStone™ surface consists of a UV-stabilized polymer gelcoat and aggregates. The back-up laminate consists of layers of glass fiber and polymer resin. Through a unique and proprietary manufacturing process, it achieves a face finish that resembles a limestone texture. The CorniceStone™ composite material has a Class A (or 1) flame-spread rating. When CorniceStone™ is molded into shapes, the geometry of the shape imparts physical properties such as strength and stiffness. For example, the design of CorniceStone™ parts that include recesses, projections, grooves, curves or ornamentation, make the part stronger.

The nominal shell thickness of parts is 3/16" ⇔ 4.5 mm. However, areas of parts that have flat regions are cast thicker by encapsulating core materials into the laminate that provide added strength and stiffness.

CorniceStone™ offers a wide range of advantages for architects and designers including the capability for it to be made into large parts that would otherwise require costly support structures and increased installation cost (as compared to materials such as precast concrete or GFRC).

In most cases, CorniceStone™ molded parts are secured to the building structural framing or light gauge steel substrate with concealed fasteners. Joints between parts should be minimized and advantageously positioned in consideration of part size and design, overall appearance, and installation. CorniceStone™ parts are typically supplied with pre-made corners to minimize field-mitering.

Some typical architectural applications of CorniceStone™ include building ornamentation such as cornices, columns, pediments, storefront entries, moldings and other decorative elements such as friezes and signage, as well as some interior applications subject to applicable building codes.

Most items are custom-made to project design requirements and specifications. Formglas® uses 5-axis CNC technology to machine precision patterns from which molds are produced to make the required parts. In situations involving complicated design elements or projects, Formglas® will work with architects and designers to create a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture.

Technical Data

Refer to the following standards:

ASTM International (ASTM)

- E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics
- D638 - Standard Test Method for Tensile Properties of Plastics
- D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics
- D570 - Standard Test Method for Water Absorption of Plastics
- D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- E331 - Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
- E330 - Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference (Modified)

Physical and Mechanical Properties

CorniceStone™ is a fiberglass reinforced polymer resin composite with a nominal thickness of 3/16" \approx 5 mm. It has 25 to 30% glass fiber content (by weight) in the form of multiple layers of chopped strand mat.

Matrix:	ISO/PNG Polymer Resin
Finish:	Standard and custom colors available.
Surface:	Fine and medium textures available.
Density:	~110 lb/ft ³ \approx 1760 kg/m ³
Weight:	1.75-2.25 lbs/ft ² \approx 8.5-11 kg/m ² *
Shell thickness:	3/16" \approx 5 mm nominal**
Embedments:	Core mat or other reinforcement as profile, shape or design requires
Glass Fiber:	25-30% typical
Reveals/setbacks:	3° draft minimum
All outside corners:	1/16" - 1/8" \approx 1.5-3 mm radius
Max. length moldings:	16' \approx 4.8 m
Max. size molded parts:	70 ft ² \approx 6.5 m ²

* Typical weights – parts with deep surface relief, etc. may weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances. Weight and measurement conversions may be rounded.

ASTM Standard and ISO Test Results

Flame Spread:	\leq 25 (Class A)
Smoke Development:	\leq 450 (Class A)
Flexural Strength:	32,100 psi \approx 221 MPa
Tensile Strength:	15,950 psi \approx 110 MPa
Modulus of Elasticity:	1,080,000 PSI (7.45 Gpa)
Compressive Strength:	33,100 psi \approx 228 MPa
Impact Resistance:	12 ft-lb/in \approx 643 J/m
Barcol Hardness:	44
Heat Deflection:	$>$ 513°F \approx 285°C
Coefficient of Linear Thermal Expansion:	2.73×10^{-5} in/in/°F \approx 1.5×10^{-6} mm/mm/°C
Water Absorption:	0.3%
Nail push-through:	1050 lb force \approx 4,670 N
FRP Wall Assemblies	
Air Leakage	0.02 cfm/ft ²
Water Penetration	Nil
Structural Test (90 mph x 1141 Pa x 1.5 safety factor)	Pass

Manufacturing Tolerances

Dimensional (all directions):	\pm 1/8", 0-10 ft \approx 3 mm in 3 m
Thickness:	\pm 1/8" \approx 3 mm
Variation from square:	\pm 1/8", 0-10 ft \approx 3 mm in 3 m
Bowing, out of plane	\pm 1/16"/ft \approx 3 mm/300 mm

LEED®



Formglas® products contribute toward LEED® credits, and have been used in LEED® projects worldwide. Since Formglas® products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas® with specific details of your project and to clarify the version of LEED® rating system applicable.

Delivery, Storage and Handling

CorniceStone™ parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® of any damage immediately. CorniceStone™ parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. Place non-staining resilient spacers between parts and support parts during shipment and subsequent unloading and storage. Protect parts from

PRODUCT DATA SHEET

EXTERIOR FRP CASTINGS

Stone-Textured FRP Castings
MasterFormat® 06 82 00

CorniceStone™ by Formglas®

For Exteriors

dirt and damage during handling, transport and storage. Store unpackaged parts indoors on firm, level and smooth surfaces with part identification labels clearly visible.

■ Preparatory Work

Site Conditions:

The site conditions are to be reviewed for compliance with Formglas' requirements relating to installation tolerances and any other conditions that may affect the installation and performance of CorniceStone™ parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into Formglas® shop drawings prior to it commencing the manufacture of custom molds and CorniceStone™ parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings. It is the installing contractor's responsibility to order the correct quantities of parts including a waste allowance, if applicable.

Substrates:

The framing and/or substrates to accept CorniceStone™ parts shall be constructed with suitable materials according to applicable codes and installed straight and true within 1/8" in 8 linear ft. ⇔ 3 mm in 2500 mm. The substrate shall be free of obstructions and interference that prevents the correct positioning and attachment of the CorniceStone™ parts. Structural framing and substrate materials shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed CorniceStone™ parts.

■ Installer Safety

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ Installation

General:

Install CorniceStone™ parts as indicated on the approved shop drawings, instructions and the contract documents. The installing contractor is to supply and install all brackets,

shims, other hardware and adhesives as required for the installation and proper alignment of the CorniceStone™ parts with adjacent parts and materials. Part thicknesses may vary within the manufacturing tolerances. Allow for shim spaces between the CorniceStone™ and the substrate. Attach the CorniceStone™ parts using corrosion-resistant screws, bolts or other fasteners as shown on the shop drawings. Additional bracing, fastening points etc. not shown on the drawings, may be required to ensure a proper installation. Do not over-torque screws otherwise damage to material flanges may occur.

Cutting:

When cutting parts is required, use the most suitable cutting method listed below. Always wear goggles and a dust mask.

- A reciprocating type saw with a medium grit composite type blade.
- A mini grinder with 4" ⇔ 100 mm medium grit composite blade or diamond blade.
- A chop saw with a diamond blade for smaller moldings etc.
- Formglas® to supply 1 1/2" batten strips for field cut parts. Refer to Formglas® shop drawings for more information.

Attachment:

Wherever possible, CorniceStone™ parts are to be installed with concealed fastening methods such as beneath flashings or behind caulked joints. Parts should have pre-drilled oversize clearance holes for fasteners and neoprene shims (or equivalent) installed behind the panel edges being fastened to facilitate movement due to expansion and contraction. A bond breaker tape should be applied inside the joint over the top of the fasteners prior to caulking the joint. Do not over-torque screws otherwise damage to material flanges may occur.

Joint Treatments:

- All joints must be caulked
- Formglas® does not supply caulk for joints but can recommend a type and specific brand for use with CorniceStone™.
- A paintable, one-compound elastomeric low modulus urethane sealant is recommended. (e.g. Sonolastic® Ultra or equivalent)
- Use spacers to maintain a uniform gap between parts and install a bond breaker tape inside the joint over top of the fasteners.
- Apply low tack masking tape on either side of the joint and avoid smearing caulk beyond the joint and remove any excess immediately.
- Do NOT attempt a monolithic look - joints cannot be hidden.

For more details, refer to the installation instructions and project drawings.

■ Cleaning and Maintenance

Periodic cleaning is recommended to avoid any build up of dirt and/or acidic pollutants which may affect the color or UV performance of CorniceStone™ parts. Clean soiled surfaces with water and a mild household dish detergent. Surfaces may require light scrubbing with a soft-bristled brush. To avoid surface damage including etching, use of a pressure washer is not recommended.

■ Samples Available

Formglas® maintains an inventory of four standard samples to demonstrate this material. Due to the limitations on the color palette of sand, Formglas® is unable to custom-formulate CorniceStone™ to match specific colors. Refer to our Standard Color Table for available color options. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.

■ Applications

To view photos of Formglas® CorniceStone™ applications, or to contact a local Formglas® representative, visit www.formglas.com.



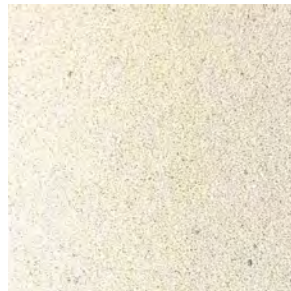
COLUMNS & CORNICES

N. CAROLINA RESEARCH CENTER, KANNAPOLIS



Formglas® CorniceStone™

Color: Coffee
Surface: Medium Sandblasted
Sample Size: 4" x 5"
Sample Code: 98125



Formglas® CorniceStone™

Color: Cream
Surface: Fine Sandblasted
Sample Size: 4" x 5"
Sample Code: 98126



Formglas® CorniceStone™

Color: Wafer
Surface: Fine Sandblasted
Sample Size: 4" x 5"
Sample Code: 98189



Formglas® CorniceStone™

Color: Bone
Surface: Fine Sandblasted
Sample Size: 4" x 5"
Sample Code: 98188



CorniceStone™



Project: Brooks Brothers, Across North America | Design: Permasteelisa Group | Material: Formglas® GFRC-L



Formglas® GFRC-L



Project: Kohl's Department Stores, Across USA | Design: Schroeder & Holt Architects, Ltd. | Material: Formglas® GFRC-L

PRODUCT DATA SHEET

EXTERIOR FINISH CARPENTRY

Molded Architectural Products and Elements

MasterFormat® 06 20 13

GFRC-L by **Formglas®**

For Exteriors

Trade Name

Formglas® GFRC-L



Common Name(s)

Glass Fiber Reinforced Concrete | GFRC
Glassfiber Reinforced Concrete | GFRC

Manufacturer

Formglas Products Ltd.
181 Regina Road
Vaughan, Ontario, Canada L4L 8M3
T: 1.866.635.8030 F: 416.635.6588
Web: formglas.com Email: info@formglas.com



BRANDED ENTRY PEDIMENT

BROOKS BROTHERS, USA

Summary

Formglas® GFRC-L is a Class A (or 1) flame-spread rated composite material made from Portland cement, sand, aggregate and glass fiber that has good flexural strength properties. Parts are factory-molded in a hand lay-up process to make architectural elements in a variety of shapes, patterns, textures and choices of color, or, are available unfinished for on-site painting. After de-molding, unless specified as paint-ready, the exposed face of the parts is finely sandblasted to impart a uniform surface finish. Formglas® GFRC-L parts have a nominal shell thickness of 5/8" ⇔ 19 mm with perimeter edges increased to a minimum thickness of 1" ⇔ 25 mm to provide added strength. Formglas® GFRC-L does not incorporate a factory attached steel panel frame for support commonly used with larger GFRC panels. Formglas® GFRC-L is used for applications where smaller panel and part sizes can be utilized and generally offers appreciable cost advantages compared to conventional GFRC, or natural stone.

Detailed Description

Glass Fiber Reinforced Concrete (GFRC) is a designation used to refer to a broad category of cementitious products manufactured using Portland cement, silica sand, aggregate, alkali-resistant glass fiber and admixtures in different proportions to meet different performance and aesthetic requirements. In architectural applications, GFRC is most commonly associated with the large decorative panels used on building facades and cladding. These large heavy panels require a structural steel panel frame to be bonded to the inside of the molded GFRC composite material for support, which is also used to attach the GFRC panel to the building structure. Cranes are typically used in the installation of these GFRC parts.

Formglas® GFRC-L, however, is used in applications where the attributes of a molded GFRC product are desired for use on smaller panels and parts that do NOT require a steel panel

frame support system. In these applications, Formglas® GFRC-L is lighter, quicker and easier to install and more cost effective than conventional GFRC. Typically, the maximum panel size is 3' x 4' ⇔ 900 mm x 1200 mm weighing approximately 7 lbs/ft² ⇔ 34 kg/m². The cross sectional profile of a part can add strength in and of itself. This can marginally increase the overall part dimensions that can be made. Overall part weight (maximum 100 lbs) is used as a limiting factor to maintain ease of handling and installation. Formglas® GFRC-L uses white Portland cement and color pigments to provide uniform color consistency throughout the material thickness – not just the face mix. As a result of the natural properties of concrete and aggregates, and the touch-up and fine finishing process post production, minor variation in color and texture within and between parts should be expected.

Some typical architectural applications of Formglas® GFRC-L include low-rise exterior facade veneer panels and decorative elements such as cornices; pediments, window and door frames; columns; friezes; and interior elements where a hard non-combustible impact resistant material is desired. Most molded parts are secured to the building's structural framing and substrate with concealed fasteners. Parts can be supplied with factory-molded corners to minimize field cutting. Most items are custom-made to project design requirements and specifications.

Formglas® uses 5-axis CNC technology to machine precision patterns from which molds are produced to make the required parts. In situations involving complex design elements or projects, Formglas® will work with architects and designers to develop a practical plan for the parts and assemblies they envision through 3D modeling and/or scaled or full-size mock-ups. Detailed shop drawings and material samples are prepared for approval prior to manufacture.

Technical Data

Refer to the following standards:

ASTM International (ASTM)

- E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- C947 - Standard Test Method for Flexural Properties of Thin-Section Glass Fiber Reinforced Concrete
- C944 - Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces
- C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
- C518 - Standard Test Method for Steady-State Thermal Transmission by Means of the Heat Flow Meter Apparatus

Physical and Mechanical Properties

Formglas® GFRC-L is a single skin GFRC composite panel made with white Portland cement, silica sand, polymer and alkali-resistant glass fiber with a high Zirconia content (minimum 16%). The composite consists of a 1/8" \pm 3 mm face mix without glass fiber, and 1/2" backing mix with the glass fiber interspersed.

Matrix:	Portland cement, sand, and polymer
Finish:	Six standard colors Custom color matching available
Surface:	Lightly sandblasted or smooth if paint-ready
Density:	134 lbs/ft. ³ \pm 2145 kg/m ³
Weight:	7-9 lbs/ft. ² \pm 34-44 kg/m ² *
Shell thickness:	5/8" \pm 16 mm nominal**
Edge thickness:	5/8" \pm 16 mm minimum
Glass Fiber:	4% minimum
Max. length moldings:	4' \pm 1.2 m
Max. size veneer panels:	48" x 36" \pm 1200 x 900 mm
Max. size molded parts:	15 ft ² \pm 1.4 m ²

* Typical weights – parts with deep surface relief, etc. may weigh more. Please submit drawings for a more accurate estimate.

** Subject to manufacturing tolerances. Weight and measurement conversions may be rounded.

ASTM Standard and ISO Test Results

Flame Spread:	0
Smoke Development:	0
Flexural Strength:	1860 psi \pm 12.8 MPa
Tensile Strength:	1260 psi \pm 8.7 MPa
Compressive Strength:	4000 psi \pm 27.6 MPa
Coefficient of Linear Thermal Expansion:	7.6 x 10 ⁻⁶ in/in/°F \pm 13.6 x 10 ⁻⁶ mm/mm/°C
Hardness (Abrasion):	0.37%
Thermal Conductivity	4.3 Btu in/h ft ² °F \pm 0.62 W/m K

Manufacturing Tolerances

Dimensional (all directions):	\pm 3/16" \pm 5 mm
Thickness:	\pm 1/8" \pm 3 mm
Variation from square:	\pm 1/8" \pm 3 mm
Bowing, out of plane	1/8"/ft \pm 3 mm / 300 mm

LEED®



Formglas® products contribute toward LEED® credits, and have been used in LEED® projects worldwide. Since Formglas® products are usually custom-made to project specifications, their contribution to credits may vary. Contact Formglas® with specific details of your project and to clarify the version of LEED® rating system applicable.

Delivery, Storage and Handling

Formglas® GFRC-L parts shall be transported and handled in a manner that avoids damage or excessive stress. Packaging or components showing signs of damage should be marked as such on freight documents, inspected immediately, and claimed for any damage due to shipping with the freight carrier. Advise the carrier and Formglas® immediately of any damage. Formglas® GFRC-L parts shall be protected from rain, snow, sunlight, excessive weather conditions, high levels of humidity, and job site damage. Place non-staining resilient spacers between panels and support panels during storage and handling. Protect panels from dirt and damage during handling, transport and storage. Store panels on firm, level and smooth surfaces with part identification labels clearly visible, and ideally protected from harsh conditions around the job site.

Preparatory Work

Site Conditions:

Site conditions must be reviewed for compliance with Formglas' requirements, installation tolerances and any other conditions that may affect the installation and performance of Formglas® GFRC-L parts. Any unsatisfactory conditions are to be corrected prior to installation. Field measurements are to be taken to verify the dimensions, including those not shown on the drawings, and provide specific details of any changes for inclusion into the Formglas® shop drawings prior to it commencing the manufacture of custom molds and Formglas® GFRC-L parts. Formglas® will produce parts in accordance with the approved shop drawings only, and is NOT responsible for any deviations between the site conditions and the approved drawings.

Substrates:

In the case of flat veneer surface cladding solutions only, the substrates to accept Formglas® GFRC-L parts shall be surfaced with suitable materials (e.g. exterior-grade plywood) and weather barrier as applicable and installed straight and true within 1/8" in 8 linear ft. ⇔ 3 mm in 2500 mm. This is not required for columns, cornices, trims or other such applications. The substrate shall be free of obstruction and interference that prevents the correct positioning and attachment of the Formglas® GFRC-L parts. Structural framing and substrate materials shall be of the proper size and design for the intended use and shall be sufficient to properly support the installed Formglas® GFRC-L parts.

■ **Installer Safety**

Installers are to wear appropriate personal protection equipment when handling or installing Formglas® materials. This should include eye protection, gloves and dust masks. Please adhere to local regulations and rules established at the job site. Before handling and installing Formglas® materials, installers are responsible for reviewing SDS information which is readily available at www.formglas.com, or included with the crate(s) used to ship Formglas® materials, or by calling Formglas® at 1.866.635.8030.

■ **Installation**

General:

Install Formglas® GFRC-L parts as indicated on the approved shop drawings, instructions and the contract documents. The installing contractor is to supply and install all brackets and shims as required for the installation and proper alignment of the Formglas® GFRC-L parts with adjacent parts and materials. Part thicknesses may vary. Allow for shim spaces between the Formglas® GFRC-L and the substrate. Formglas® GFRC-L parts are to be attached to the framing members or substrate using corrosion resistant screws, bolts or other fasteners as shown on the shop drawings. Additional bracing, fastening points etc. not shown on the drawings, may be required to ensure a proper installation.

Cutting:

When cutting parts is required, use the most suitable cutting method listed below. Always wear goggles and a dust mask.

- A miter or table saw with diamond blade for masonry use – dry cut only.
- For small cuts or cut-outs, use a mini-grinder with 4" ⇔ 100 mm diamond blade

Attachment:

Formglas® GFRC-L parts are to be installed with concealed-fastening methods. Face-fastening will always be visible. Typically, metal mounting plates are factory-attached to the backs of panels which extend marginally beyond the part edges into joint spaces where the screws will subsequently be concealed with caulked joints. In some instances where fastening is along a top edge of a panel, flashing materials (installed by others afterward) can conceal face fasteners. Use joint spacers to maintain uniform joint spacing as indicated on the drawings. When directed, use a Formglas® recommended adhesive to prevent bleed-through (PL® Premium® marketed under Loctite® and LePage® brands.)

Joint Treatments:

- Joints must be caulked
- Formglas® does not supply caulk for joints but can recommend a brand and color of caulk for use with specific Formglas® GFRC-L colors.
- Use spacers (min. 3/8" ⇔ 9.5 mm) to maintain a uniform gap and apply masking tape on each side of the joint.
- Avoid smearing caulk beyond the joint and remove any excess immediately with a damp cloth or flexible scraper.
- Caulk between Formglas® GFRC-L and different materials.
- Do NOT attempt a monolithic look - joints cannot be hidden.

Hole Filling and Patching:

- Patch screw holes and chips carefully with matching Formglas® GFRC-L patching compound, and avoid smearing it beyond the hole. Remove excess patching compound immediately with a flexible plastic scraper and a damp cloth. Follow detailed instructions supplied with the patching compound.

**Always use patching compound sparingly
Avoid smearing it beyond the holes
Always remove excess compound immediately**

**For more details, refer to the installation
instructions and project drawings.**

■ **Cleaning and Maintenance**

- Periodic cleaning is recommended to avoid any build up of dirt and/or acidic pollutants which may affect the appearance of GFRC-L parts. Clean soiled surfaces with water and a mild household dish detergent. Surfaces may require light scrubbing with a soft-bristled brush. To avoid surface damage including etching, use of a pressure washer is not recommended.
- Always take precautions to prevent staining of adjacent materials when cleaning.

■ **Applications**

To view photos of Formglas® GFRC-L applications, or to contact a local Formglas® representative, visit www.formglas.com.



PERIMETER BASE

RBC BANK BRANCH, MISSISSAUGA



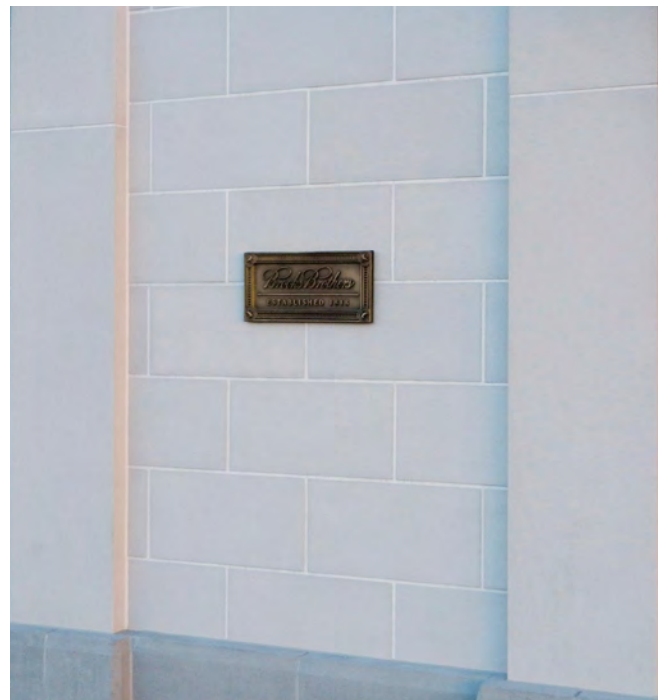
PATTERNED WALL PANELS

BURBERRY, LOS ANGELES



DECORATIVE WISHBONE COLUMNS & BASE PANELS

JOEY RESTAURANT, TORONTO



DECORATIVE WALL PANELS & TRIM ELEMENTS

BROOKS BROTHERS, TORONTO

PRODUCT DATA SHEET

EXTERIOR FINISH CARPENTRY

Molded Architectural Products and Elements

MasterFormat® 06 20 13

GFRC-L by **Formglas®**

For Exteriors

■ Samples Available

Formglas® GFRC-L can be fabricated to match a selection of colors and textures, or can be supplied ready for field painting. In addition, Formglas® maintains an inventory of six standard samples to demonstrate this material. To request a sample, contact samples@formglas.com or your local Formglas® representative to discuss your specific project requirements.

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print.



Formglas® GFRC-L

Color: Buff
Surface: Sandblasted
Sample Size: 4" x 5"
Sample Code: 98027



Formglas® GFRC-L

Color: Tan
Surface: Sandblasted
Sample Size: 4" x 5"
Sample Code: 98028



Formglas® GFRC-L

Color: Desert Sand
Surface: Sandblasted
Sample Size: 4" x 5"
Sample Code: 98029



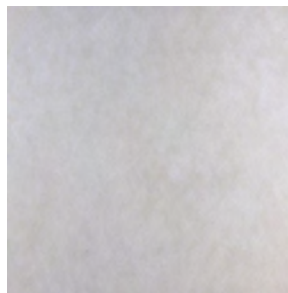
Formglas® GFRC-L

Color: Mountain Grey
Surface: Sandblasted
Sample Size: 4" x 5"
Sample Code: 98143



Formglas® GFRC-L

Color: White Sandstone
Surface: Sandblasted
Sample Size: 4" x 5"
Sample Code: 98026



Formglas® GFRC-L

Color: Paint-Ready
Surface: Smooth
Sample Size: 4" x 5"
Sample Code: 98124

MATERIAL COMPARISON TABLE




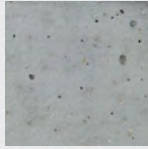
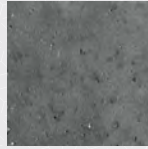




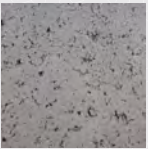


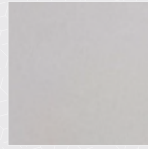
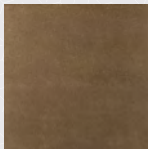
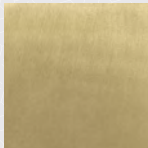




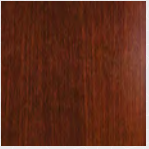
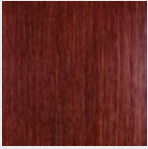
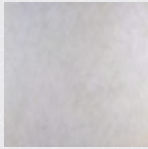
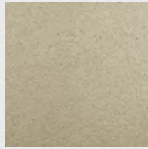

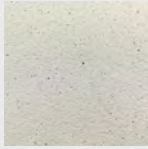
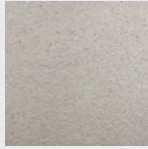

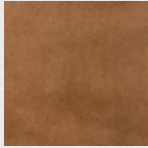
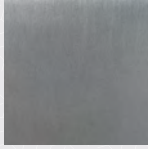

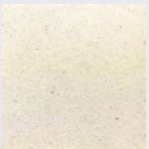
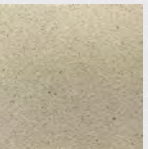
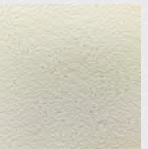
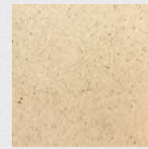
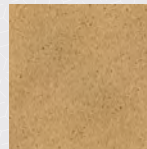
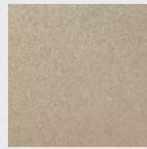
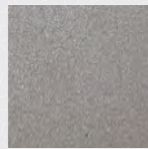
The table below provides an at-a-glance comparison of all our materials for your ease of reference. Quickly and easily compare the relevant technical details for each material and determine the appropriateness for your specific project. If you have any additional questions, please contact your local Formglas® representative, or call us at 1.866.635.8030.

	FOR INTERIORS			FOR EXTERIORS	
	GFRG or Woodgrane™	QuarryCast® or Concreet™	MetalCast®	FRP or CorniceStone™	GFRC-L
Flame / Smoke Indices	0 / 0	0 / 0	0 / 5	< 25 / < 450	0 / 0
Nominal Thickness	3/16" ⇄ 5 mm	5/16" ⇄ 8 mm	1/4" ⇄ 6 mm	FRP - 3/16" ⇄ 5 mm CorniceStone™ - 1/4" ⇄ 6 mm	5/8" ⇄ 16 mm
Weight					
Veneers		2-2½ lb/ft² ⇄ 10-12 kg/m²	2½-3 lb/ft² ⇄ 12-15 kg/m²		7-8 lb/ft² ⇄ 34-40 kg/m²
Molded Parts	1½-2½ lb/ft² ⇄ 7-12 kg/m²	2½-5 lb/ft² ⇄ 10-24 kg/m²	2½-4 lb/ft² ⇄ 12-20 kg/m²	1¾-2½ lb/ft² ⇄ 8½-12 kg/m²	7-9 lb/ft² ⇄ 34-44 kg/m²
Integral Colors					
Standard	GFRG - Paint-Ready Woodgrane™ - 6	QuarryCast® - 6 Concreet™ - 4	4	FRP - 2 CorniceStone™ - 8	6
Custom	Pre-finishing Available	Yes	No	FRP - Yes CorniceStone™ - No	Yes
Cost (Relative to GFRG)	\$	\$\$	\$\$\$	\$\$-\$\$\$	\$\$-\$\$\$
Comparable Material Substitutes	GFRG - Drywall / Plaster Woodgrane™ - Wood	QuarryCast® - Stone / Tile Concreet™ - Poured Concrete	Cast Metal	FRP - Aluminum / EIFS CorniceStone™ - GFRC / Stone	Precast / Cast Stone
Joint Detail	Taped or Caulked	Dry or Caulked	Caulked	Caulked	Caulked
Typical Installing Trade	Carpentry	Carpentry	Carpentry	Carpentry	Carpentry
Applications					
Ceilings	✓	✓	✓	✓	
Walls	✓	✓	✓	✓	✓
Columns / Pilasters	✓	✓	✓	✓	✓
Running Trim	✓	✓	✓	✓	✓
Decorative Shapes	✓	✓	✓	✓	✓
Signage	✓	✓	✓	✓	✓
MasterFormat®	09 27 13	06 20 23	06 20 23	06 82 00	06 20 13

Note: Weight and measurement conversions in this table are rounded. Please refer to individual Product Data Sheets for complete specifications.

STANDARD COLOR TABLE

Formglas® materials enable designers to create architectural shapes featuring an endless range of colors, patterns and textures. In addition to the following standard colors, Formglas® can custom match colors and textures as desired. Please consult your local Formglas® Representative for more information.

<p>QuarryCast® For Interiors</p>  <p>Seattle Sand</p>  <p>Kyoto Coffee</p>	<p>Concreet™ For Interiors</p>  <p>Light Grey</p>  <p>Concrete Grey</p>  <p>Dark Grey</p>  <p>Smoke</p>	<p>GFRG For Interiors</p>  <p>Paint-Ready</p>	
 <p>Galveston Grey</p>  <p>Canyon Clay</p>  <p>Mountain Grey</p>  <p>Boise Buff</p>	<p>FINISHING NOTES</p> <p>GFRG is typically supplied paint-ready for field-finishing. In certain applications, Formglas® can offer factory-finishing using low VOC coatings.</p> <p>FRP is supplied paint-ready, or is manufactured with an integrally colored (monochromatic) gel coat which contain UV inhibitors. To prevent color fading which may occur over time with bold colors, a high UV-resistant coating should be specified. As an alternative to standard integral colors, Formglas® can color match gel coat (for an additional charge) to Benjamin Moore® or Sherwin Williams® paint colors.</p>	<p>FRP For Interiors or Exteriors</p>  <p>Paint-Ready</p>  <p>Sky Grey</p>	<p>MetalCast® For Interiors</p>  <p>Bronze</p>  <p>Brass</p>
<p>Woodgrane™ For Interiors</p>  <p>Danish Walnut</p>  <p>Teak</p>  <p>Dark Oak</p>  <p>Walnut</p>  <p>Dark Mahogany</p>  <p>Rosewood</p>	<p>GFRC-L For Exteriors</p>  <p>Paint-Ready (Smooth)</p>  <p>Buff</p>  <p>Tan</p>  <p>White Sandstone</p>  <p>Desert Sand</p>  <p>Mountain Grey</p>	 <p>Copper</p>  <p>Nickel Silver</p>	
<p>CorniceStone™ For Exteriors</p>  <p>Coffee</p>  <p>Cream</p>  <p>Wafer</p>  <p>Bone</p>  <p>Vanilla</p>  <p>Barley</p>  <p>Makara</p>  <p>Delta</p>			

Please note that images and their color(s) are for general reference and may not be accurately rendered on screen or in print. Please contact your local Formglas® representative to request a physical sample, or visit formglas.com

Shaping Possibilities™

formglas.com

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+1.866.635.8030

International
+1.416.635.8030

Formglas®