

## Product Name

# FORTON MG

## Forton Modified Gypsum (FMG)

## Product Description

Forton MG is a two-component system consisting of an Alpha-Hemihydrate Gypsum (USG FGR-95) and a Water Based Polymer Emulsion with 50% solids (Forton VF-812). VF-812 greatly enhances the physical properties of the standard a-gypsum product and the addition of glass fibers into the system allows for a wide variety of applications including architectural elements and mouldings, decorative art objects & sculptures, internal facade panels, displays & special effects, case/mother moulds, home furnishings and items yielding far less weight than standard gypsum, plaster or concrete casts. The system is easy to use and offers a wide range of aesthetically pleasing finishes and surface textures.

Features include:

- Non-toxic mix design
- Economical & easy to use
- Fast processing and demould
- Solvent free water-based system
- Higher strength than traditional gypsum systems
- 50% Polymer Solids making it ideal for metal and aggregate mixes.
- A wide variety of casting methods can be used such as:
  - Solid casting
  - Hand lay-Up
  - Spray application
  - Rotational casting and slush casting

## Physical Properties of FMG Composite

		Result / Range		Result / Range
Density	Kg/m <sup>3</sup>	1,500	lbs/ft <sup>3</sup>	95-100
Working Time	Minutes	20-30*		
Demould Time	Minutes	90+*		
Colour	Visual	White		
Tensile Ultimate	MPa	24 - 35	psi	3,500 - 5100
Flexural Ultimate	MPa	24 - 65	psi	3,500 - 9,400
E-Modulus of Elasticity	N/mm <sup>2</sup>	7	psi	1,015
Compressive Strength	MPa	41 - 62	psi	6,000 - 9,000
Impact Resistance	ATSM D256		in.lb./in <sup>2</sup>	170
Coeffecient of Thermal Expansion			in/in/°F	11.1 x 10(-6)
Water Vapor Diffusion Coeffecient		250µ		

All values measured after 14 days air cure. Values were obtained using 11.7% glass fibers.

To achieve optimum flexural and impact strengths, it is necessary to reinforce the Forton MG matrix with glass fibers. The degree of flexural and impact strength is dependant on the type and amount of glass fiber reinforcement used.

\*Dependent on mass and environmental conditions.

## Manufacturing Methods

Forton MG has a variable mix ratio which can become handy in certain part designs or production methods. As listed in the chart below the mix ratios by weight can be varied between two levels. For most general applications, a simplified approach to measuring is used, that being a simple 2:1 or 100:50 ratio by volume. This enables the user to use level scoops rather than measuring scales.

Throughout the following processes a standard mix composition is used, being:

Material	Method	Mix Ratio
FGR95 : VF812	Parts by weight (PBW)	60 : 40
FGR95 : VF812	Parts by weight (PBW)	70 : 30
FGR95 : VF812	Parts by volume (PBV)	100 : 50

An increase in the polymer content, up to 40% weight (60 parts FGR95), results in a higher flexural strength.

Most typical manufacturing processes are possible using the Forton MG system depending on the type of mould, complexity, surface finish and quantity required. Attention should always be paid to the expansion during hydration to prevent buckling of the cast or mould damage.

Note – where a face mix is used, it should be allowed to harden to the touch before applying backup mixes.

## **Solid Casting**

A face mix without fibers should be brushed, slushed or sprayed into a properly released mould. Any entrapped air is removed by chasing the slurry with a brush into difficult parts of the mould. After the face mix firms up, the backup mix containing the desired amount and type of fibers (glass/other), if required, is poured into the mould. It is advisable to fill the mould half way full with the backup mix and rotate or slush the backup mix to remove any entrapped air. The mould can then be filled to the top and allowed to cure. A plug may be used to displace some of the backup mix to provide a lightweight hollow casting.

## **Hand Lamination | Lay-up | Spray-up**

A face mix without fibers is applied to the properly released mould and allowed to begin to set. A freshly mixed batch of Forton MG is then applied and a layer of fiberglass (chopped strand or woven) is placed into the slurry. The slurry is worked into the reinforcing mat by brush or compacting roller to wet-out the mat and to remove entrapped air. This process is repeated until a sufficient amount of reinforcement had been laid and the proper thickness achieved. A mixture of slurry and chopped glass fibers (up to 10% pbw) can also be used and compacted by hand for complex shapes.

The spray-up process is most suitable for large and complex parts. A peristaltic pump with an accelerator line is recommended along with a boom and glass fiber chopper gun. The freshly sprayed Forton MG with glass fiber is compacted by rolling or troweling.

## **Rotational Casting (mechanical) | Slush Casting**

A face mix without fibers is placed into the mould and the mould is closed. After rotating the proper amount of time for the piece and the amount of gypsum used, the mould is set aside for proper setting. This process allows the production of complex yet lightweight parts.

Note – for rotational casting an accelerated mix design is normally used.

Slush casting is similar to rotational casting but this is done manually. It can also be used for a repair/backing mix.

## **Admixtures | Fillers | Fibers | Retarders & Accelerators**

The addition of fillers such as calcium carbonate or fine sand results in a material with reduced mechanical properties. For those applications which do not demand high material properties of the standard Forton MG composite, the use of low-cost fillers with the FGR95 is possible to reduce overall mix costs.

The influence of the glass fiber content on the bending strength and yield strength is significant, whereas the influence of glass fiber length is not as pronounced.

Sodium Citrate can be used to retard the setting time of the Forton MG mix, likewise Aluminium Sulfate is a good accelerator. Potassium Sulfate can also be used as an accelerator. Dissolve 450g of Aluminum Sulfate into 4L of water and label Forton Accelerator. Mix the Forton MG slurry until creamy and then add and mix Accelerator thoroughly, small amounts should be used.

The full range of "E" glass fiber reinforcement can be used with Forton MG depending on the production technique and properties required. Chopped strands, chopped strand mat, rovings, continuous strand mats and woven fabrics can all be used. In some cases, other fibers such as nylon, polyester, polypropylene, acrylic, scrim and the like may also be used.

## Surface Finishes

For most Forton MG applications an aesthetic surface finish is required. A wide variety of surface finishes are achievable using face mixes and quality moulds. The face mixes are applied in a layer and backed up by Forton MG composite as previously discussed. Some of the face mix options and finishing techniques may be achieved using:

- Metal powders with patinas & polishes
- Intrinsic pigments
- Aggregates and fillers
- Painting
- Sandblasting or abrasion
- Polishing

## **Metal Powders**

The addition of the proper copper, bronze, brass or iron metal powders into the Forton MG slurry when used as a face mix or a solid casting will give a recognizable replication of the respective metal. After demoulding these pieces can be patinated with the same cold applied patinas used on traditional foundry cast metals. A modest amount of heat such as a hair dryer or heat gun may be used but no flame torches or excess heat should be employed. After the patina reacts and dries, the polishing instructions can be followed.

**With Patina** - Remove casting from the mould using clean gloves and allow to dry for 20-30 minutes. Apply a cold patina and allow to dry. Burnish with Grade 4/0 Steel Wool before or after patina. If the casting is left overnight to dry it will have increased surface hardness and power buffing can be used the following day with water-based compounds. Use waxes or Clear Guard to seal the surface. DO NOT sand metal finishes.

**No Patina** - Remove casting from the mould using clean gloves and allow to dry overnight, then polish/burnish with 4/0 Steel Wool. If the casting is left to dry for longer periods then power buffing can be used with water based compounds. DO NOT sand metal finishes.

## **Intrinsic Pigmentation**

Water based dispersible pigments or dry inorganic pigments may be used to intrinsically pigment Forton MG. However, the pigments must not have a high pH value. The most successful shades are the paler pigments. The best results are obtained when the pigments are pre-dispersed in the VF812 polymer.

## **Aggregates | Fillers**

Aggregates may also be added to the mix and used in conjunction with pigments. The aggregates should be evaluated for their auditability in the Forton MG mix and their process ability in the production process used. Aggregates should be dried, clean and free from alkali. This may include such products as vermiculite, perlite, calcium carbonate, sand, commercially available countertop and flooring chips, marble chips and pool dust.

## **Painting**

Paint grade parts can be primed and painted with most breathable high quality paint systems. Acrylic based systems are recommended. Care must be taken in preparing a tight Forton MG surface before coating, including removal of any residual mould release or oil contamination. The surface can be wiped clean with Acetone. VF812 itself can be used as a sealer if diluted at a ratio between (5-10 parts) Water : (1 part) VF812

## **Sandblasting | Grinding**

For architectural applications with Forton MG exposed aggregate or sandblasted surfaces are often required. The appropriate aggregates are added to the face mix during production. After demoulding the piece is placed aside to sufficiently harden. Typically, two-three days is adequate to develop a hardness that will permit uniform sand or grit blasting using a small nozzle at 40psi in a circular motion. The depth of the blast will be controlled by the aggregate/particle size. After sand blasting the piece must be sealed with a clear acrylic sealer. Typical concrete sealers may also be used or VF812 itself if diluted at a ratio between (5-10 parts) Water : (1 part) VF812.

Grinding will give a smooth surface at the same time exposing the aggregate or stone dust filler.

## Polishing

For pieces which have a face mix containing aggregate, immediately upon demoulding they can be wet sanded or wet polished using for example a 3M pad to expose the aggregate. For pieces containing metal powders, after the applied patina dries and the piece has cured overnight, polishing may be completed. Normally cutting and polishing compounds, either wax or water-based, may be used on cloth buffs to bring out the desired look.

## Hints | Tips | Keypoints

These hints and tips will simplify what can sound like a complicated mix procedure

- All **Dry Blend Premixes** must be **measured** and premixed by **weight** (using accurate scales).
- The **Dry Blends & VF812** are **measured** and mixed by **volume** (accurate level scoops).
- Forton MG must be **high shear mixed** with a mechanical stirrer, hand mixing is not appropriate.

## The 2 Basic Mix Designs

### Natural | Paint Grade

The mix design for Forton MG paint grade is a 2:1 ratio, powder to polymer, measured by volume.

FGR95 (Powder)	100 parts by volume (level scoops)
VF812 (Liquid)	50 parts by volume (level scoops)

### Metal Face Mix | Dry Blends

When using a metal face mix, the metal powders are first measured and premixed through the FGR95 powder. They are thoroughly combined to give a homogenous result and finished effect.

#### Metal Premix | Dry Blend

FGR95 (Powder)	100 parts by weight (accurately weighed)
Metal (Powder)	150 parts by weight (accurately weighed)

This dry blend can be stored in a sealed airtight container until you are ready to use it. When mixing the dry blend with the VF812 polymer, we revert back to the standard mix ratio.

Dry Blend (Powder)	100 parts by volume (level scoops)
VF812 (Liquid)	50 parts by volume (level scoops)

## General Alerts

- No black metals in contact with matrix. Use zinc coated or galvanized attachments and screws
- Allow for flexible connections on panels and architectural elements
- DO NOT use with Aluminum Powders
- For joints use FMG itself or a quality epoxy

## Handling & Storage

Store and use material at room temperature (23°C). Colder temperatures will slow the working /curing times, while warmer temperatures will reduce working times. Do not allow the liquid VF-812 to freeze.

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### Disclaimer

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