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# COMPLIANCE CERTIFICATE

Michigan Technological University's 2009-2010 Concrete Canoe team hereby certifies that the construction and finishing of the canoe, **YOOPER**, has been completed in compliance with the rules and regulations set forth by the National Concrete Canoe Competition. Additionally, the canoe has been completely built within the current academic year of the competition. The ten (10) registered participants are qualified, eligible student members and National Student Members of ASCE as specified in the rules and regulations of the National Competition. The team acknowledges that all material safety data sheets (MSDS) have been read by the project management team and acknowledges receipt of the *Frequently Asked Questions* (FAQ).

## Registered Members of the 2009-2010 Michigan Tech Concrete Canoe Team

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Amanda Malburg	938719	Ryan Hoensheid	938430
Jill Sanderson	960778	Lars Leemkuil	499691
Ashley Smokoska	968568	Jonathan Zalud	968666
Katherine Zimmerman	495879	Michael Zukoff	936415

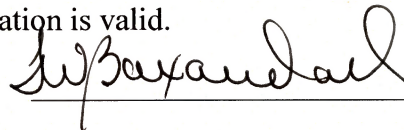
Table 1: **YOOPER** Characteristics

<b>YOOPER</b> Dimensions	
Maximum Length	19' 11.375"
Maximum Width	31.625"
Maximum Depth	16.0"
Nominal Thickness	0.375"
Overall Weight	162 lbs
<b>Kippis Structural Mix Properties</b>	
Concrete Density (Unit Weight)	53.0 pcf (849.0 kg/m <sup>3</sup> )
14 day Compressive Strength	2255 psi (15.5 MPa)
14 day Tensile Strength	385 psi (2.65 MPa)
Gravimetric Air Content	25.91%
<b>Composite Properties</b>	
14 day Flexural Strength	122 in-lbs/in (542.7 m-N/m)

We certify that the aforementioned information is valid.

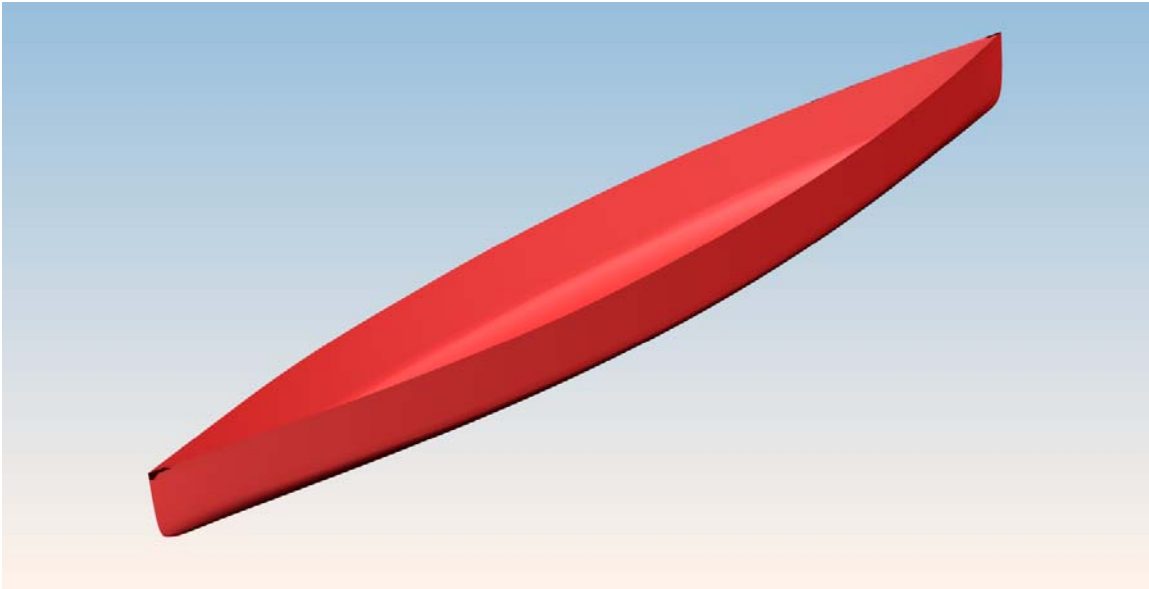
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## MOLD CONSTRUCTION



After receiving the 2009-2010 canoe dimensions, a Unigraphics model of the canoe was created. The team's CNC milling industry partner used the model to mill the 10% pre-consumer recycled high-density polystyrene mold to the canoe dimensions.



Two coats of epoxy were applied to the interior of the mold and a fine aggregate was spread onto the wet epoxy to create the desired texture. The textured surface prevented concrete from sloughing off the gunwales during casting.



The six mold pieces were glued together and attached to a custom table top to provide stability during casting.



Exterior inlays were cut from vinyl placemats and secured to the mold using staples.



To prevent the two layers of reinforcement from floating on casting day, approximately two hundred anchor holes were drilled along the mold's gunwales, chines, and keel. More details on the anchoring process can be found in the Canoe Construction section, page B-4.



An oil-based release aid was applied to the assembled mold prior to casting.

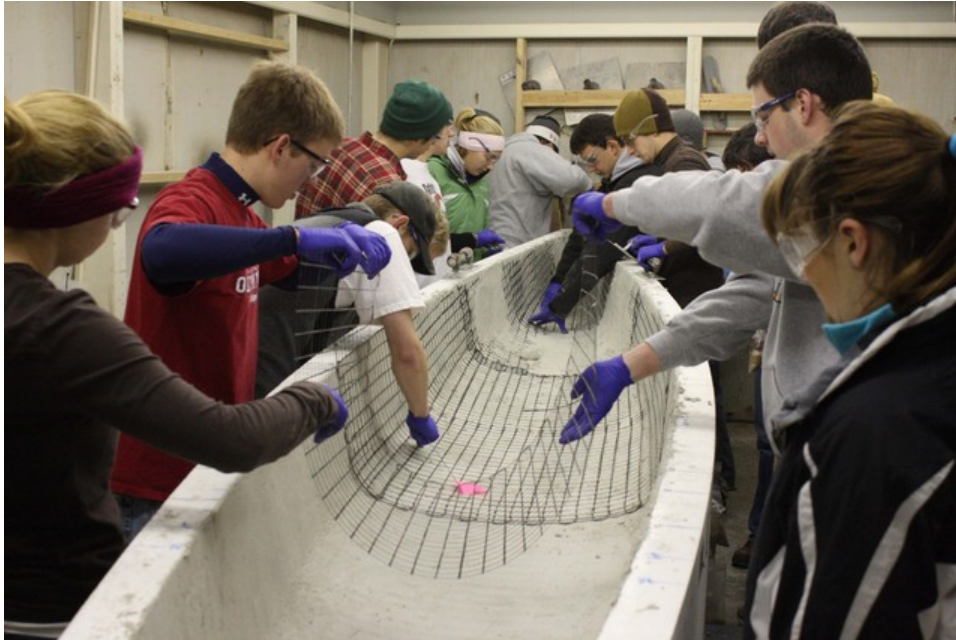
## CANOE CONSTRUCTION



On casting day, a hand drill and mixing paddle were used to mix pre-batched concrete mixes at the rate trowelers were placing. This prevented premature setting of the concrete before it could be troweled and also minimized excess concrete production.

Concrete was applied to the mold in three separate layers, each  $\frac{1}{8}$ " thick. Steel trowels, magnesium floats, and steel hawks aided trowelers in placing the concrete. A quality control supervisor was assigned to each troweler and used custom depth gauges to monitor the hull thickness.





Two continuous layers of reinforcement separated the three layers of concrete. The first layer of reinforcement was C-Grid<sup>®</sup> CT300 and the second was C-Grid<sup>®</sup> CT275. In both layers, three-foot wide sections were placed side-by-side with a two- and three-inch development length, respectively.



To prevent the reinforcement from floating during troweling, the two layers of reinforcement were anchored in key locations by attaching fishing line to the reinforcement and passing it through the predrilled holes in the mold and casting table. The fishing line was held down by attaching weights.



End caps were cast into both ends of the canoe for strength and aesthetic appeal; a laser level was used to ensure symmetrical placement of the concrete.



After full cure of the canoe, concrete inlays were placed in the hull by casting pigmented concrete into the voids left by the vinyl inlays. Outlays were formed on the inner gunwales to create distinct raised images of scenes from Michigan's Upper Peninsula.



## FINISHING TECHNIQUES



The exterior of the hull was patched with Kippis Endcap mix, filling any minor defects and voids formed during the placing and de-molding processes.



The exterior of **YOOPER** was honed using a Flex<sup>®</sup> water-cooled angle grinder/polisher. Diamond embedded honing pads from 40 to 3000 grit, were used to create a smooth finish. The interior of the hull was then hand sanded to 220 grit.



Water based stains were applied to both the interior and exterior of the hull to make **YOOPER** aesthetically pleasing. The exterior designs were created by masking the canoe with tape and cutting out the designs with a knife. The stain was then applied using both manual and air-powered brushes.



The entire canoe was then sealed using Crystal Clear-A, completing **YOOPER**.

# HULL THICKNESS CALCULATIONS

## Calculations per Section 4.3.1

### Annotation

$T_1 = .0323$ in	Average thickness of first layer of reinforcement, C-Grid <sup>®</sup> CT300, measured in accordance with Section 4.3.1
$T_2 = .0425$ in	Average thickness of second layer of reinforcement, C-Grid <sup>®</sup> CT275, measured in accordance with Section 4.3.1
$T_h = .375$ in	Nominal thickness of the canoe hull

**Determine** that the reinforcement at any point in the canoe will not exceed 50% of the total hull thickness.

### Solution

Two layers of mesh were used throughout the entire hull.

$$\frac{T_1 + T_2}{T_h} = 19.95\%$$

The two layers of reinforcement make up approximately 19.95% of the hull. This value is less than the maximum value of 50% outlined in section 4.3.1, demonstrating compliance.

# PERCENT OPEN AREA CALCULATIONS

## Calculations per Section 4.3.2

### Sample 1: C-Grid<sup>®</sup> CT300

#### Given

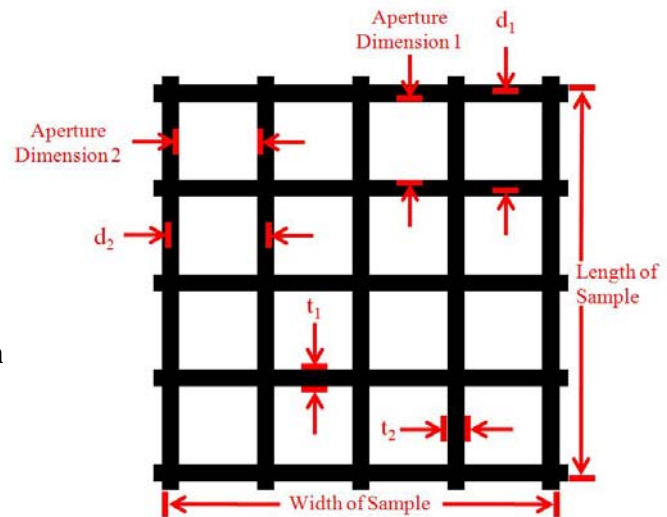
$n_1 = 4$	Number of apertures along length
$n_2 = 4$	Number of apertures along width
$t_1 = .151$ in	Average thickness of reinforcement along length
$t_2 = .119$ in	Average thickness of reinforcement along width

$$\text{Aperture\_Dimension\_1} = 1.003 \text{ in}$$

$$\text{Aperture\_Dimension\_2} = .951 \text{ in}$$

$$d_1 = \text{Aperture\_Dimension\_1} + 2 \cdot (t_1/2) \quad d_1 = 1.154 \text{ in} \quad \text{Average spacing of reinforcement (center-to-center) along the sample length.}$$

$$d_2 = \text{Aperture\_Dimension\_2} + 2 \cdot (t_2/2) \quad d_2 = 1.070 \text{ in} \quad \text{Average spacing of reinforcement (center-to-center) along the sample width.}$$



Sample of Reinforcement

**Determine** Percent Open Area for the first layer of reinforcement, C-Grid<sup>®</sup> CT300.

#### Solution

$$\text{Length}_{\text{Sample}} = n_1 \cdot d_1$$

$$\text{Width}_{\text{Sample}} = n_2 \cdot d_2$$

$$\text{Length}_{\text{Sample}} = 4.616 \text{ in}$$

$$\text{Width}_{\text{Sample}} = 4.280 \text{ in}$$

$$\text{Area}_{\text{Open}} = n_1 \cdot n_2 \cdot \text{Aperture\_Dimension\_1} \cdot \text{Aperture\_Dimension\_2}$$

$$\text{Area}_{\text{Total}} = \text{Length}_{\text{Sample}} \cdot \text{Width}_{\text{Sample}}$$

$$\text{Area}_{\text{Open}} = 15.262 \text{ in}^2$$

$$\text{Area}_{\text{Total}} = 19.756 \text{ in}^2$$

$$\text{POA} = (\text{Area}_{\text{Open}} / \text{Area}_{\text{Total}}) \cdot 100\%$$

$$\text{POA} = 77.25\%$$

The POA is greater than the 30% minimum required, demonstrating compliance.

Sample 2: C-Grid<sup>®</sup> CT275**Given**

$n_1 = 4$	Number of apertures along length	$t_1 = .150$ in	Average thickness of reinforcement along length
$n_2 = 4$	Number of apertures along width	$t_2 = .107$ in	Average thickness of reinforcement along width

$$\text{Aperture\_Dimension\_1} = 1.492 \text{ in}$$

$$\text{Aperture\_Dimension\_2} = 1.482 \text{ in}$$

$$d_1 = \text{Aperture\_Dimension\_1} + 2 \cdot (t_1/2) \quad d_1 = 1.642 \text{ in} \quad \text{Average spacing of reinforcement (center-to-center) along the sample length.}$$

$$d_2 = \text{Aperture\_Dimension\_2} + 2 \cdot (t_2/2) \quad d_2 = 1.589 \text{ in} \quad \text{Average spacing of reinforcement (center-to-center) along the sample width.}$$

**Determine** Percent Open Area for the second layer of reinforcement, C-Grid<sup>®</sup> CT275.

**Solution**

$$\text{Length}_{\text{Sample}} = n_1 \cdot d_1$$

$$\text{Width}_{\text{Sample}} = n_2 \cdot d_2$$

$$\text{Length}_{\text{Sample}} = 6.568 \text{ in}$$

$$\text{Width}_{\text{Sample}} = 6.356 \text{ in}$$

$$\text{Area}_{\text{Open}} = n_1 \cdot n_2 \cdot \text{Aperture\_Dimension\_1} \cdot \text{Aperture\_Dimension\_2}$$

$$\text{Area}_{\text{Total}} = \text{Length}_{\text{Sample}} \cdot \text{Width}_{\text{Sample}}$$

$$\text{Area}_{\text{Open}} = 35.378 \text{ in}^2$$

$$\text{Area}_{\text{Total}} = 41.746 \text{ in}^2$$

$$\text{POA} = (\text{Area}_{\text{Open}}/\text{Area}_{\text{Total}}) \cdot 100\%$$

$\text{POA} = 84.75\%$
------------------------

The POA is greater than the 30% minimum required, demonstrating compliance.



# Lafarge Portland Cement

# LAFARGE

Lafarge Portland Cement is a high quality, cost-effective basic building material used in virtually all forms of construction, from hospitals and homes to schools, tunnels and airports. Lafarge Portland Cement meets or exceeds all applicable chemical and physical requirements of ASTM C 150.

## Product Description

### Portland Cement

ASTM C 150 Type I, Type IA, Type II, Type III, Type V

**Basic Use:** Lafarge Portland Cement is a cost-effective basic building material. It can be used in a wide variety of commercial and architectural concrete construction applications. Uses include cast-in-place, pre-cast, tilt-up, water tanks, drains, bridges, roads, pipes, concrete masonry units, pre-stressed concrete members, masonry mortars and grouts.





# LAFARGE PORTLAND CEMENT

- Type I** – This is a general-purpose cement suitable for all uses where the special properties of other types of portland cement are not required.
- Type IA** – This cement contains an additive that will entrain air bubbles to aid in durability when concrete is exposed to freezing temperatures.
- Type II** – For general use, especially when moderate sulfate resistance or moderate heat of hydration is desired.
- Type III** – This cement provides high early strength when compared with Type I.
- Type V** – This is for use when high sulfate resistance is desired. Type V generally gains strength more slowly than Type I.

## Options

Select Lafarge North America manufacturing plants produce air-entrained (Type IA) portland cement that contains an additive that will entrain air bubbles to aid in durability when concrete is exposed to freezing temperatures. Certain locations manufacture cements meeting the optional physical and chemical requirements of ASTM. AASHTO cements are available in certain geographic areas. Contact your Lafarge Cement representative for product use and availability.

## Technical data

Lafarge Portland Cement meets or exceeds all applicable chemical and physical requirements of ASTM C 150.

## Use and limitations

Lafarge North America manufactures all products in accordance with strict QA/QC (quality assurance and quality control) procedures to ensure optimum product performance and uniformity. There are many variables that affect concrete performance that are beyond the control of the cement manufacturer. Good concreting practices in accordance with the American Concrete Institute are required to achieve desired results. Skilled persons should use these products with special attention given to formwork, batching, mixing, placing, finishing and curing. In most applications, quality aggregates, admixtures and additives should be utilized. For detailed information, contact your Lafarge North America sales office.

## Precautions

Direct contact with wet cement should be avoided. If contact occurs, the skin should be washed with water as soon as possible. Exposure can cause serious, potentially irreversible tissue destruction in the form of chemical (caustic) burns. If cement gets into the eyes, immediately rinse thoroughly with water and seek medical attention. For more information, reference the applicable Lafarge Material Safety Data Sheet (MSDS). The MSDS should be consulted prior to use of this product and is available upon request and online at [www.lafargenorthamerica.com](http://www.lafargenorthamerica.com).

## Product Name

Lafarge Portland Cement

## Manufacturer

Lafarge North America Inc.  
12950 Worldgate Drive, Suite 500  
Herndon, Virginia 20170  
[www.lafargenorthamerica.com](http://www.lafargenorthamerica.com)

**Contact your Lafarge Regional Office for specific product information, availability and ordering.**

## Great Lakes Region

Bingham Farms, Michigan  
Phone: 248-594-1991

## Northeast Region

Montréal, Québec  
Phone: 514-861-1411

## River Region

Lee's Summit, Missouri  
Phone: 816-251-2100

## Southeast Region

Alpharetta, Georgia  
Phone: 678-746-2000

## Western Region

Calgary, Alberta  
Phone: 403-271-9110

## Limited Warranty

Lafarge warrants that Lafarge Portland Cement meets all applicable requirements of ASTM C 150. Lafarge makes no other warranty, whether of merchantability or fitness for a particular purpose, with respect to Lafarge Portland Cement. Having no control over its use, Lafarge will not guarantee finished work in which Lafarge Portland Cement is used.



## Description

MB-AE 90 air-entraining admixture is for use in concrete mixtures. It meets the requirements of ASTM C 260, AASHTO M 154 and CRD-C 13.

## Applications

Recommended for use in:

- Concrete exposed to cyclic freezing and thawing
- Production of high-quality normal or lightweight concrete (heavyweight concrete normally does not contain entrained air)

# MB-AE™ 90

## Air-Entraining Admixture

### Features

- Ready-to-use in the proper concentration for rapid, accurate dispensing

### Benefits

- Improved resistance to damage from cyclic freezing and thawing
- Improved resistance to scaling from deicing salts
- Improved plasticity and workability
- Reduced permeability – increased watertightness
- Reduced segregation and bleeding

### Performance Characteristics

Concrete durability research has established that the best protection for concrete from the adverse effects of freezing and thawing cycles and deicing salts results from: proper air content in the hardened concrete, a suitable air-void system in terms of bubble size and spacing, and adequate concrete strength, assuming the use of sound aggregates and proper mixing, transporting, placing, consolidation, finishing and curing techniques. MB-AE 90 admixture can be used to obtain adequate freeze-thaw durability in a properly proportioned concrete mixture, if standard industry practices are followed.

**Air Content Determination:** The total air content of normal weight concrete should be measured in strict accordance with ASTM C 231, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method” or ASTM C 173/C 173M, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.”

The air content of lightweight concrete should only be determined using the Volumetric Method. The air content should be verified by calculating the gravimetric air content in accordance with ASTM C 138/C 138M, “Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.” If the total air content, as measured by the Pressure Method or Volumetric Method and as verified by the Gravimetric Method, deviates by more than 1-1/2%, the cause should be determined and corrected through equipment calibration or by whatever process is deemed necessary.

### Guidelines for Use

**Dosage:** There is no standard dosage for MB-AE 90 admixture. The exact quantity of air-entraining admixture needed for a given air content of concrete varies because of differences in concrete-making materials and ambient conditions. Typical factors that might influence the amount of air entrained include: temperature, cementitious materials, sand gradation, sand-aggregate ratio, mixture proportions, slump, means of conveying and placement, consolidation and finishing technique.



## Product Data: MB-AE™ 90

The amount of MB-AE 90 admixture used will depend upon the amount of entrained air required under actual job conditions. In a trial mixture, use 1/4 to 4 fl oz/cwt (16-260 mL/100 kg) of cementitious material. Measure the air content of the trial mixture, and, if needed, either increase or decrease the quantity of MB-AE 90 admixture to obtain the desired air content.

In mixtures containing water-reducing or set-control admixtures, the amount of MB-AE 90 admixture needed may be somewhat less than the amount required in plain concrete.

Due to possible changes in the factors that can affect the dosage of MB-AE 90 admixture, frequent air content checks should be made during the course of the work. Adjustments to the dosage should be based on the amount of entrained air required in the mixture at the point of placement.

If an unusually high or low dosage of MB-AE 90 admixture is required to obtain the desired air content, consult your BASF Construction Chemicals representative. In such cases, it may be necessary to determine that, in addition to a proper air content in the fresh concrete, a suitable air-void system is achieved in the hardened concrete.

**Dispensing and Mixing:** Add MB-AE 90 admixture to the concrete mixture using a dispenser designed for air-entraining admixtures, or add manually using a suitable measuring device that ensures accuracy within plus or minus 3% of the required amount.

For optimum, consistent performance, the air-entraining admixture should be dispensed on damp, fine aggregate. If the concrete mixture contains fine lightweight aggregate, field evaluations should be conducted to determine the best method to dispense the air-entraining admixture.

### Precaution

In a 2005 publication from the Portland Cement Association (PCA R&D Serial No. 2789), it was reported that problematic air-void clustering that can potentially lead to above normal decreases in strength was found to coincide with late additions of water to air-entrained concretes. Late additions of water include the conventional practice of holding back water during batching for addition at the jobsite. Therefore, caution should be exercised with delayed additions of water to air-entrained concrete. Furthermore, an air content check should be performed after any post-batching addition to an air-entrained concrete mixture.

### Product Notes

**Corrosivity – Non-Chloride, Non-Corrosive:** MB-AE 90 admixture will neither initiate nor promote corrosion of reinforcing and prestressing steel embedded in concrete, or of galvanized floor and roof systems. No calcium chloride or other chloride-based ingredients are used in the manufacture of this admixture.

**Compatibility:** MB-AE 90 admixture may be used in combination with any BASF Construction Chemicals admixture, unless stated otherwise on the data sheet for the other product. When used in conjunction with other admixtures, each admixture must be dispensed separately into the concrete mixture.

### Storage and Handling

**Storage Temperature:** MB-AE 90 admixture should be stored and dispensed at 31 °F (-0.5 °C) or higher. Although freezing does not harm this product, precautions should be taken to protect it from freezing. If MB-AE 90 admixture freezes, thaw at 35 °F (2 °C) or above and completely reconstitute by mild mechanical agitation. **Do not use pressurized air for agitation.**

**Shelf Life:** MB-AE 90 admixture has a minimum shelf life of 18 months. Depending on storage conditions, the shelf life may be greater than stated. Please contact your BASF Construction Chemicals representative regarding suitability for use and dosage recommendations if the shelf life of MB-AE 90 admixture has been exceeded.

**Safety:** Chemical goggles and gloves are recommended when transferring or handling this material.

### Packaging

MB-AE 90 admixture is supplied in 55 gal (208 L) drums, 275 gal (1040 L) totes and by bulk delivery.

### Related Documents

Material Safety Data Sheets: MB-AE 90 admixture.

### Additional Information

For additional information on MB-AE 90 admixture, or its use in developing a concrete mixture with special performance characteristics, contact your BASF Construction Chemicals representative.

*The Admixture Systems business of BASF Construction Chemicals is a leading provider of innovative additives for specialty concrete used in the ready mix, precast, manufactured concrete products, underground construction and paving markets throughout the NAFTA region. The Company's respected Master Builders brand products are used to improve the placing, pumping, finishing, appearance and performance characteristics of concrete.*

**BASF Construction Chemicals, LLC**  
Admixture Systems

[www.masterbuilders.com](http://www.masterbuilders.com)

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Canada 1800 Clark Boulevard, Brampton, Ontario L6T 4M7 ■ Tel: 800 387-5862 ■ Fax: 905 792-0651

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**Master  
Builders**

### Description

Glenium 3030 NS ready-to-use full-range water-reducing admixture is a patented new generation of admixture based on polycarboxylate chemistry. Glenium 3030 NS admixture is very effective in producing concretes with different levels of workability including applications that require the use of Rheodynamic® Self-Consolidating Concrete (SCC). Glenium 3030 NS admixture meets ASTM C 494/C 494M requirements for Type A, water-reducing, and Type F, high-range water-reducing, admixtures.

### Applications

Recommended for use in:

- Concrete where high flowability, high-early and ultimate strengths and increased durability are needed
- Self-consolidating concrete
- Concrete where normal, mid-range, or high-range water-reduction is desired
- Concrete where normal setting times are required
- 4x4™ Concrete for fast track construction
- Pervious Concrete
- Self-consolidating grout

# GLENIUM® 3030 NS

## Full-Range Water-Reducing Admixture

### Features

- Reduced water content for a given slump
- Dosage flexibility for normal, mid and high-range water reduction
- Produces cohesive and non-segregating concrete mixture
- Increased compressive strength and flexural strength performance at all ages
- Providing faster setting times and strength development
- Enhanced finishability and pumpability

### Benefits

- Providing economic benefits to the entire construction team through higher productivity and reduced variable costs

### Performance Characteristics

**Mixture Data:** 600 lb/yd<sup>3</sup> of Type I cement (360 kg/m<sup>3</sup>); slump, 8.5-9.25 in. (210-235 mm); non-air-entrained concrete; dosage rate adjusted to obtain 25-30% water reduction.

#### Setting Time

Mixture	Initial Set (h:min)	Difference (h:min)
Plain	4:24	–
Conventional Superplasticizer	6:00	+ 1.36
Glenium 3030 NS admixture	5:00	+0.36

#### Compressive Strength

Mixture	1 day		7 days	
	psi	MPa	psi	MPa
Plain	1700	12	4040	28
Conventional Superplasticizer	3460	24	6380	44
Glenium 3030 NS admixture	4120	28	7580	52

#### Slump Retention - in. (mm)

Mixture	Minutes		
	15	30	45
Plain	8.5 (215)	8.5 (215)	7.5 (200)
Conventional Superplasticizer	8.5 (215)	4.25 (110)	3.5 (90)
Glenium 3030 NS admixture	9.25 (235)	9.25 (235)	8.25 (210)

# Product Data: GLENIUM® 3030 NS

**Rate of Hardening:** Glenium 3030 NS admixture is formulated to produce normal setting characteristics throughout its recommended dosage range. Setting time of concrete is influenced by the chemical and physical composition of the basic ingredients of the concrete, temperature of the concrete and ambient conditions. Trial mixtures should be made with actual job materials to determine the dosage required for a specified setting time and a given strength requirement.

## Guidelines for Use

**Dosage:** Glenium 3030 NS admixture has a recommended dosage range of up to 3 fl oz/cwt (195 mL/100 kg) for Type A applications, 3-6 fl oz/cwt (195-390 mL/100 kg) for mid-range use and up to 18 fl oz/cwt (1,170 mL/100 kg) for Type F applications. The dosage range is applicable to most concrete mixtures using typical concrete ingredients. However, variations in job conditions and concrete materials, such as silica fume, may require dosages outside the recommended range. In such cases, contact your local BASF Construction Chemicals representative.

**Mixing:** Glenium 3030 NS admixture can be batched with the initial mixing water or as a delayed addition. However, optimum water reduction is generally obtained with a delayed addition.

## Product Notes

**Corrosivity – Non-Chloride, Non-Corrosive:** Glenium 3030 NS admixture will neither initiate nor promote corrosion of reinforcing steel embedded in concrete, prestressed concrete or of galvanized steel floor and roof systems. Neither calcium chloride nor other chloride-based ingredients are used in the manufacture of Glenium 3030 NS admixture.

**Compatibility:** Glenium 3030 NS admixture is compatible with most admixtures used in the production of quality concrete, including normal, mid-range and high-range water-reducing admixtures, air-entrainers, accelerators, retarders, extended set control admixtures, corrosion inhibitors, and shrinkage reducers.

**Do not use Glenium 3030 NS admixture with admixtures containing beta-naphthalene-sulfonate. Erratic behaviors in slump, slump flow, and pumpability may be experienced.**

For directions on the proper evaluation of Glenium 3030 NS admixture in specific applications, contact your BASF Construction Chemicals representative.

## Storage and Handling

**Storage Temperature:** If Glenium 3030 NS admixture freezes, thaw at 45 °F (7 °C) or above and completely reconstitute by mild mechanical agitation. **Do not use pressurized air for agitation.**

**Shelf Life:** Glenium 3030 NS admixture has a minimum shelf life of 12 months. Depending on storage conditions, the shelf life may be greater than stated. Please contact your BASF Construction Chemicals representative regarding suitability for use and dosage recommendations if the shelf life of Glenium 3030 NS admixture has been exceeded.

## Packaging

Glenium 3030 NS admixture is supplied in 55 gal (208 L) drums, 275 gal (1040 L) totes and by bulk delivery.

## Related Documents

Material Safety Data Sheets: Glenium 3030 NS admixture.

## Additional Information

For additional information on Glenium 3030 NS admixture or its use in developing concrete mixes with special performance characteristics, contact your BASF Construction Chemicals representative.

*The Admixture Systems business of BASF Construction Chemicals is a leading provider of innovative admixtures for specialty concrete used in the ready-mixed, precast, manufactured concrete products, underground construction and paving markets throughout the North American region. The Company's respected Master Builders brand products are used to improve the placing, pumping, finishing, appearance and performance characteristics of concrete.*

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XYCRYLIC ADMIX

DESCRIPTION

XYCRYLIC ADMIX is a water-based, high solids, polymer dispersion specifically designed for fortifying portland cement compositions. This liquid is milky-white in color and improves curing qualities, enhances bond, imparts excellent water and weather resistance, and reduces shrinkage cracking. Xycrylic Admix is also used to fortify Xypex Patch'n Plug.

RECOMMENDED FOR:

- Patching and Concrete Repairs
- Resurfacing Floor Underlayments
- Terrazzo Flooring
- Spray and Fill Coats
- Highway and Bridge Deck Repair

ADVANTAGES

- Hardens and toughens cement mortars for improved durability
- Enhances adhesion capabilities to a wide variety of surfaces
- Increases resistance to many industrial chemicals
- Eliminates water curing

DURABILITY AND STRENGTH

Cement mortars modified with Xycrylic Admix are hard, tough and durable. Compared with unmodified mortars, Xycrylic modified mortars have far superior flexural, adhesive and impact strengths as well as excellent abrasion resistance. They are especially useful where thin sections are desirable and where excessive vibration and heavy traffic is encountered.

ADHESION

Xycrylic Admix modified mortars have excellent adhesion to a variety of surfaces such as concrete, masonry, brick, wood, metals and others.

RESISTANCE PROPERTIES

Cement mortars modified with Xycrylic Admix are resistant to many industrial chemicals as well as ultraviolet light and heat. Mortars containing Xycrylic Admix dry to a uniform color.

PACKAGING

Xycrylic Admix is available in 128 fl. oz. (3.79 litre) and 5 gallon (18.95 litre) bottles.

STORAGE

Keep Xycrylic Admix from freezing.

MIXING

Xycrylic Admix may be used full strength or diluted with clean water depending on application requirements.

TEST DATA

PHYSICAL STRENGTH OF CEMENT MORTARS					
ASTM Standard Test Method	Mixing Liquid				
	Full Strength	1:1 Water	1:2 Water	No Xycrylic	
<b>C-190-85 Tensile Strength</b>	610 (4.2)	440 (3.0)	375 (2.6)	235 (1.6)	psi (MPa)
<b>C-109-88 Compressive Strength</b>	5700 (39.3)	4530 (31.2)	3830 (26.4)	2390 (16.5)	psi (MPa)
<b>C-348-86 Flexural Strength</b>	1570 (10.8)	1130 (7.8)	960 (6.6)	610 (4.2)	psi (MPa)
<b>Shear Bond Adhesion</b>	640 (4.4)	360 (2.5)	260 (1.8)	45 (0.31)	psi (MPa)

**Note 1:** Strength properties are based on cement mortar prepared as 3 parts sand to 1 part cement by volume.

**Note 2:** Strengths are based on a 28 day air cure. Wet cure strengths may be less.



## APPLICATION PROCEDURES

Xycrylic Admix may be used full strength or diluted with clean water depending on application requirements.

### FOR USE WITH CEMENT MORTAR

1. Thoroughly premix sand and cement (1 part cement to 2 parts sand).
2. Blend Xycrylic Admix with water according to strength, bonding and resistance requirements.
3. Add the Xycrylic mixing liquid (whether full strength or diluted with water) to the sand and cement.
4. Mix thoroughly until desired workable consistency is reached. Always withhold some Xycrylic mixing liquid so that the mortar will not be too fluid and so that mixing liquid can be carefully gauged near end of mixing cycle (2 - 4 minutes).

### FOR USE WITH PATCH'N PLUG

1. Blend Xycrylic Admix with clean water (1 part Xycrylic to 1 part water by volume).
2. Add Xycrylic mixing liquid to the Patch'n Plug powder at a rate of 1 part liquid to 3.5 parts Patch'n Plug.
3. Mix to a stiff putty consistency. Do not mix more than can be used in three minutes.

## CURING

For optimum physical properties, cement mortars modified with Xycrylic Admix should be air-cured at ambient temperature and relative humidity.

## TECHNICAL SERVICES

For more instructions, alternative application methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Department of Xypex Chemical Corporation or your local Xypex representative.

## SAFE HANDLING INFORMATION

Xycrylic Admix is alkaline and has a slight ammoniacal odor. This product may be a mild to moderate skin and eye irritant. In addition, many of the components of the cementitious products that are used in conjunction with the Xycrylic Admix may also possess significant skin and eye irritation potential. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Material Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of workers and customers. The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex representative to obtain copies of Material Safety Data Sheets prior to product storage or use.

## WARRANTY

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.



ISO 9001:2000  
FM 63167



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E-mail: [info@xypex.com](mailto:info@xypex.com) Website: [www.xypex.com](http://www.xypex.com)  
XYPEX is a registered trademark of Xypex Chemical Corporation.



## E-MAIL TRANSMISSION

March 1, 2010

**To:** Ryan Hoensheid

**From:** Dave Ross – Xypex Chemical Corp.

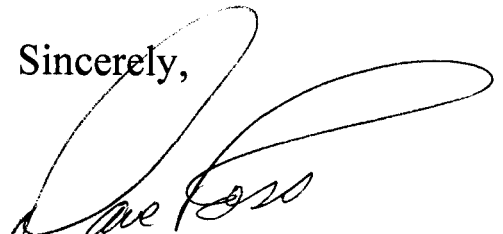
**Re:** Confirmation Regarding ASTM C-1438 Type II for Xycrylic Admix

Dear Ryan,

This letter will confirm that Xypex Xycrylic Admix will meet the requirements of ASTM C-1438 Type II and this has been verified per our material supplier, Rohm and Hass.

I hope that this letter takes care of your concerns.

Sincerely,



Dave Ross  
Technical Services Manager

**CONCRETE WATERPROOFING BY CRYSTALLIZATION**

13731 Mayfield Place, Richmond, British Columbia, Canada V6V 2G9  
Tel: 604 273-5265 Fax: 604 270-0451



**C-GRID® Carbon Grid for Concrete Reinforcement**

**CT300 - Concrete Reinforcement Kit**

C-GRID is a high performance reinforcement made by bonding ultra high-strength carbon tows with epoxy resin in a controlled factory environment.

**Features:**

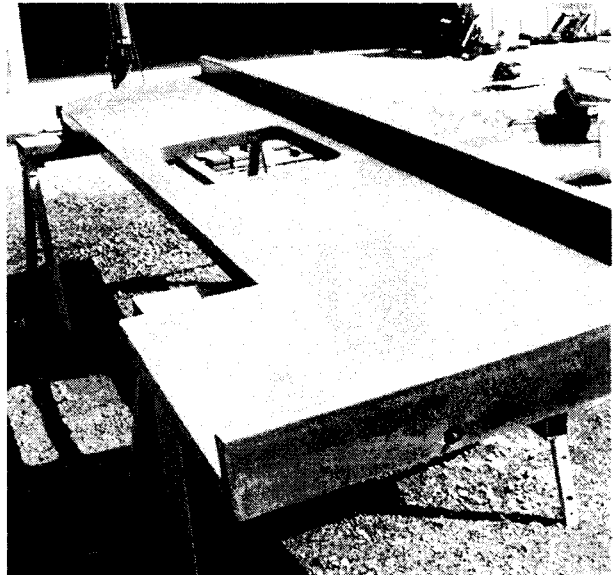
- No corrosion or bleed-through
- Minimizes crack width and crack spread
- Grid design and epoxy chemistry provide excellent bond to concrete
- Easier to cut and handle versus welded wire mesh or fabric
- Available in roll form for ease of use
- Greater tensile strength than steel by weight

**Applications:**

- Concrete counter tops
- Architectural detailing
- Fireplace surrounds and mantels
- Vanity units and bathtubs
- Backsplash walls
- Corporate interiors
- Custom designed products
- Problem cracking areas

**Physical Properties:**

Product Designation:	CT300
Fiber Type:	Carbon
Grid Spacing (in) (longitudinal x transverse):	1.0 x 1.0
% of Grid Openness	80
Nominal Tensile (lbs/strand: warp x fill):	275 x 275
Nominal Tensile (lbs/ft.):	3,300 x 3,300
Crossover Shear Strength (lbs):	36
Resin Type:	Epoxy
Fabric Weight (oz/sq yd):	3
Supply Form (rolls):	41" wide x 25 yds



**Application Use Note:** C-GRID is a new material without the extensive performance history of conventional construction materials. The use of C-GRID in critical life, health-safety applications is not recommended until additional use experience and test data have been obtained. The use of C-GRID for use in fire rated applications is not recommended. C-GRID, like all FRP reinforcements exhibits linear elastic behavior. Accordingly, the appropriate design, safety, load, and strength reduction factors must be considered and applied for specific concrete reinforcement applications. In cases where serviceability or structural performance may be affected, the application should be reviewed and approved by a registered professional engineer. Typical physical properties as reported by the manufacturer are subject to change from time to time.

**TechFab, LLC**

**C-GRID®  
REINFORCED**

PO Box 807      Phone: 864 260-3355  
Anderson,      Fax: 864 260-3364  
SC 29624      [www.techfabllc.com](http://www.techfabllc.com)

In as much as TechFab, LLC has no control over installation design, installation workmanship, accessory materials, or conditions of application, TechFab, LLC does not warrant the performance or results of any installation use of C-GRID®. THIS WARRANTY DISCLAIMER INCLUDES ALL IMPLIED WARRANTIES, STATUTORY OR OTHERWISE, INCLUDING THE WARRANTY OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE. The purchaser and/or user should perform its own tests to determine the suitability and fitness of the product for a particular purpose desired in any given situation.



# CT275 & CT550

Carbon Fiber Reinforcing Grids for Concrete Décor Products



**DESCRIPTION** C-GRID® CT275 and CT550 are high strength carbon fiber grids for reinforcing concrete countertops and other thin concrete décor products.

## FEATURES

- \_\_\_\_\_ No corrosion or bleed-through
- \_\_\_\_\_ Minimizes crack width and crack spread
- \_\_\_\_\_ Grid design and epoxy chemistry provide excellent bond to concrete
- \_\_\_\_\_ Easier to cut and handle versus welded wire mesh or fabric
- \_\_\_\_\_ Available in roll form for ease of use
- \_\_\_\_\_ Greater tensile strength than steel by weight

## APPLICATIONS

- \_\_\_\_\_ Concrete countertops
- \_\_\_\_\_ Architectural detailing
- \_\_\_\_\_ Fireplace surrounds and mantels
- \_\_\_\_\_ Vanity units and bathtubs
- \_\_\_\_\_ Backsplash walls
- \_\_\_\_\_ Corporate interiors
- \_\_\_\_\_ Custom designed products

## CT275 GRID PROPERTIES

Composition	carbon fiber and epoxy resin
Color	black
Grid geometry (longitudinal x transverse spacing)	1.5" x 1.5"
Typical longitudinal tensile strength	2,000 lbs/ft
Typical transverse tensile strength	2,000 lbs/ft
Supply form (rolls)	36" x 25 yds

## CT550 GRID PROPERTIES

Composition	carbon fiber and epoxy resin
Color	black
Grid geometry (longitudinal x transverse spacing)	1.8" x 1.6"
Typical longitudinal tensile strength	4,000 lbs/ft
Typical transverse tensile strength	4,500 lbs/ft
Supply form (rolls)	47.5" x 25 yds

**Notes:**

- 1) Centerline-to-centerline spacing between strands is nominal and based on the average number of strands per unit width. Actual spacing may vary by ± 0.10 inch.
- 2) The longitudinal direction is in the direction of the roll and the transverse direction is across the width of the roll. For example, if a roll of C-GRID® is 47.5" wide the carbon strands in the transverse direction are 47.5" in length. If a roll of C-GRID® is 25 yards long, the longitudinal strands are 25 yards in length.

**Application Use Note:**

C-GRID® is a relatively new material without the extensive performance history of traditional construction materials. For that reason, it is recommended that C-GRID® not be used in critical life-safety applications or fire-rated structures until additional experience and testing are obtained. Reported properties are average values, not design values. Structures and applications using C-GRID® should be designed using appropriate safety factors or load and strength reduction factors. All applications utilizing C-GRID® should be designed and reviewed by a licensed engineer experienced with FRP materials. The data expressed herein is believed to be accurate at the time of publication; however, it is subject to change without notice.



Chomarat North America



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[www.chomaratna.com](http://www.chomaratna.com)



Leed IEQ Credit 4.2 requirements state that:

Concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

According to the Table of Standards for VOC limits for Floor Coverings the requirement is that a finish have 100 grams or less of voc content per liter.

Ameripolish Water-Based Concrete Dye contains 1.8-3.7 grams per liter so therefore conforms to the requirements for application in a LEED certified project.

Ameripolish Solvent-Based Concrete Dye contains 0 grams per liter so therefore conforms to the requirements for application in a LEED certified project.

Solids content present in AmeriPolish Water Based Dye is 2.8% by volume.

Alex Darmstaedter  
Marketing Manager  
American Decorative Concrete Supply Co  
alex@adcsc.com  
479-725-0033



**1. Product Name**

Direct Colors Concrete Pigments

**2. Manufacturer**

Direct Colors, Inc. (DCI)  
 430 East 10th Street  
 Shawnee, OK 74801  
 (877) 255-2656  
 (405) 275-6657  
 Fax: (405) 275-2815  
 E-mail: [info@directcolors.com](mailto:info@directcolors.com)  
[www.directcolors.com](http://www.directcolors.com)

**3. Product Description**

**BASIC USE**

Direct Colors Concrete Pigment, also known as Integral Color, is designed to color concrete, stucco, plaster, mortar, grout, overlay and other cementitious materials. Integral Colors have been used in thousands of different commercial and residential applications to create beautiful and unique surfaces.

DCI Concrete Pigments are widely used to color cultured and architectural stone, statuary and an assortment of other garden decor.

DCI Pigments are also added to tint concrete sealers and Liquid Antique Release Solutions in order to bring rich color to a variety of indoor and outdoor flooring applications. Additionally, concrete dyes made with DCI Concrete Pigments are applied to existing concrete surfaces that cannot be acid stained or colored by any other means.

**COMPOSITION & MATERIALS**

Direct Colors Pigments are made from metal oxides of iron, chromium, cobalt or titanium. They are man-made, synthetic, inorganic pigments that are tested to and meet ASTM C979 standards. They do not contain carbon black, or other materials that may be unstable or non-lightfast in many cementitious applications.

**SIZES**

Direct Colors Concrete Pigments are available in 1 lb (0.5 kg), 5 lb (2 kg), 10 lb (4.5 kg), 20 lb (9 kg), 50 lb (23 kg), 500 lb (227 kg) and 2000 lb (907 kg) quantities. Custom batch quantities are also available.



Stamped concrete colored with Direct Colors Concrete Pigment dispersed in Antique Release and Tinted Sealer (Photo Courtesy of Decocrete)

**COLOR**

Direct Colors Concrete Pigments deliver superior uniformity in color, strength and lightfastness and are available in over 100 colors. See Tables 1 and 2. Accurate traceability is provided by use of batch identification codes. View visual color representations online at [www.directcolors.com](http://www.directcolors.com).

**BENEFITS**

- High quality pigments at an affordable price
- Superior customer service and technical support
- Free freight in the lower 48 states
- No minimum orders

**ACCESSORIES**

- Concrete sealers
- Multipurpose wax
- Concrete dyes
- DCI overlays
- Colored Liquid Antique
- Release agent
- Decorative aggregates
- Stamps and stencils

**LIMITATIONS**

- Direct Colors, Inc., color charts for integral color/concrete pigments are intended to match what can generally be expected from a final color as closely as possible. However, the color and condition of preexisting concrete will affect the final result of the new concrete color, so color samples are approximations only



Close-up of stamped concrete walkway as shown above (Photo Courtesy of Decocrete)

- Efflorescence, a naturally occurring deposit found on the surface of concrete, is more noticeable on dark colors because of its whitish appearance. Although it will eventually cease, there is no known method to achieve 100% prevention. Efflorescence can quickly be removed by acid washing, but over time, natural weathering will achieve the same effect. See "Reducing Efflorescence" under "Installation" below for techniques to help reduce the occurrence of efflorescence

**TABLE 1 INTEGRAL COLOR CHART, GRAY CEMENT BASE, TO ASTM C979**

Color mixture	Brick Red	Sun Dried Tomato	Merlot	Evening Shadow	Terra Cotta
Pigment type	1835	1835	126	126	560
Pound rating	4 lb	1 lb	3 lb	1 lb	5 lb
Color mixture	Majestic Sunrise	Dawn	Earthen Red	Desert Rouge	Desert Vista
Pigment type	1830	1830	1115	1115	560
Pound rating	4 lb	1 lb	3 lb	1 lb	3 lb
Color mixture	Navajo	Uplands	Caramel	San Juan	Frontier Buff
Pigment type	543	543	543	543	533
Pound rating	5 lb	3 lb	2 lb	1 lb	1 lb
Color mixture	Burnished Copper	Sandstone	Canyon Brown	Santa Fe Tan	Smokestack
Pigment type	553	553	553	533	230
Pound rating	4 lb	1 lb	5 lb	3 lb	5 lb
Color mixture	Weathered Tin	Deep Bronze	Milk Chocolate	Rattan	Golden Buff
Pigment type	230	680	680	609	609
Pound rating	1 lb	3 lb	1 lb	4 lb	2 lb
Color mixture	Cocoa Brown	Walnut	Petrified Wood	Mint Green	Briar Buff
Pigment type	653	649	649	5376	500
Pound rating	3 lb	4 lb	2 lb	3 lb	3 lb
Color mixture	Taupe	Pecan	Maple	Rocky Crag	Wildwood Buff
Pigment type	653	627	627	623	500
Pound rating	1 lb	3 lb	1 lb	3 lb	2 lb
Color mixture	Wheat Buff	Winterfield Buff	Mocha	Tarnished Brass	Sunray
Pigment type	500	1198	623	1311	1311
Pound rating	1 lb	1 lb	1 lb	3 lb	1 lb
Color mixture	Venetian Red	Umber	Slate Blue	Prussian Blue	Sapphire
Pigment type	1880	1880	5151	5151	15.3
Pound rating	5 lb	3 lb	1 lb	3 lb	5 lb
Color mixture	Midnight Blue	Mint Green	Forest Green		
Pigment type	15.3	5376	5376		
Pound rating	5 lb	3 lb	5 lb		



Colors cast in Gray Cement

### 4. Technical Data

#### APPLICABLE STANDARDS

ASTM International (ASTM) - ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete

#### APPROVALS

Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR 1910.1200

#### PHYSICAL/CHEMICAL PROPERTIES

- Lightfast
- Alkali and weather resistant
- UV stable
- Non-hazardous
- Color consistent

**TABLE 2 INTEGRAL COLOR CHART, WHITE CEMENT BASE, TO ASTM C979**

Color mixture	Cayenne	Blush	Sequoia	Plum	Fire Rose
Pigment type	1830	1830	126	126	1115
Pound rating	3 lb	1 lb	3 lb	1 lb	3 lb
Color mixture	Morning Mist	Dusty Rose	Wildflower	Terran	Peach
Pigment type	1115	1835	1835	553	553
Pound rating	1 lb	3 lb	1 lb	3 lb	1 lb
Color mixture	Autumn	Leaf Fall	Pumpkin	Sun Dust	October Bronze
Pigment type	560	560	543	543	533
Pound rating	3 lb	1 lb	3 lb	1 lb	3 lb
Color mixture	Sunwashed Clay	New Bark	Everland Buff	Cake Buff	Beachfront Buff
Pigment type	533	623	623	609	609
Pound rating	1 lb	3 lb	1 lb	3 lb	1 lb
Color mixture	Canyon Wall	Cinnamon	Espresso	Pebble	Camel
Pigment type	627	627	653	653	500
Pound rating	3 lb	1 lb	3 lb	1 lb	3 lb
Color mixture	Sunset Tan	Tawny	Cream Beige	Café	Cottage Brown
Pigment type	500	1198	1198	649	649
Pound rating	1 lb	3 lb	1 lb	3 lb	1 lb
Color mixture	Malayan Buff	Lotus Pond	Crème Mint	Hunter Green	Vineyard
Pigment type	1311	5376	5376	5376	1880
Pound rating	1 lb	3 lb	1 lb	5 lb	5 lb
Color mixture	Vineyard	Mauve	Tea Rose	Prairie Blue	Skye Blue
Pigment type	1880	1880	1880	5151	5151
Pound rating	5 lb	3 lb	1 lb	1 lb	3 lb
Color mixture	Electric Blue	Ultramarine			
Pigment type	15.3	15.3			
Pound rating	3 lb	5 lb			



Colors cast in White Cement

- Chemically inert
- Insoluble in water
- Inorganic
- Synthetic
- Specific gravity - Heavier than water
- Evaporation rate - None
- Reddish-brown appearance
- Odorless

**FIRE PERFORMANCE**

Direct Colors Concrete Pigments are nonflammable, noncombustible and nonexplosive.

**5. Installation**

**PREPARATORY WORK**

Store materials in an area protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

Verify that site conditions are acceptable for installation. Do not proceed with installation until unacceptable conditions are corrected.

**METHODS**

**Mixing**

Color charts and codes are based on pounds of pigment per 94 lb (43 kg) of cement material, including Portland cement, silica fume, fly ash and lime. Sand and aggregates are not used in this ratio. The maximum level of pigment to cement is 10% by weight. Using less than 1% pigment can result in a washed-out appearance. Blue pigments should be mixed dry with any cement-based material to ensure even color distribution.



Stamped walkway colored with Direct Colors Pigment (Photo Courtesy of Mark Douglass)



Swim-up pool bar countertop colored with 1311 Concrete Pigment, English Red Acid Stain and English Red Deco Gel (Photo Courtesy of Susan Turfle)

When an exact color match is required, complete a test pour, mixing the exact ingredients and ratios that will be used onsite. When custom blends are made for countertops, ready mixes, overlays, curbing, mortar, grouts and other concrete based products, the colors hold true within an acceptable range to most users, especially when the mixture has been adjusted to meet the specific needs of the mix and the project application.

**Truck Pours**

For a standard mix, the simplest method to convert the values on the color chart to a specific pour is to multiply the poundage on the chart by 5 to determine how much pigment per yard is needed. Consistency with the pigment per yard ratio is critical in achieving matching pours. The water level and mix ratios in each load are critical as well. It is essential to know how much concrete is in the truck, not just how much will be poured.

Dispense the pigment in the back of the truck, using the hose to clean the fins and ensuring that no loose pigment remains to cause streaking. Spinning the mix for 10 - 15 minutes is generally sufficient to properly disperse the pigment. Place and work the concrete as normal.

As the concrete sets, the color will appear to fade. This is caused by the concrete dispensing powder on the surface and will be resolved by sealing this in the same way as a decorative concrete would be sealed. Once sealed, the

color should be stable and considerably darker than at first appearance pre-seal.

**Color Calculator**

Color calculators and measurement examples are available at [www.directcolors.com](http://www.directcolors.com) to measure required pigment per yard and per custom batch of concrete.

**PRECAUTIONS**

**Safety**

- To avoid inhaling dust and contact with face and eyes, wear full face mask, eye protection and rubber gloves
- Avoid contact with inorganic acids
- Wash with soap and water after exposure. Chronic overexposure can cause slight skin irritation

**Performance**

- For optimal results, use the same brand of cement, aggregates and sand, as well as the same cement to pigment ratio, until project completion
- In order to avoid undesired discoloration, do not use calcium chloride as a set accelerator
- Difference in slump may produce a noticeable difference in color between batches
- Use local exhaust or baghouse for ventilation
- If material is released or spilled, scoop or vacuum the floor and wash with water
- To avoid color variation, be consistent in all stages of the batching, mixing, forming/placing and hardening of concrete



Stairs colored with Direct Colors Black Pigment

**Reducing Efflorescence**

- Ensure that the aggregate-cement ratio is sufficient to enable the cement paste to completely fill the voids between the aggregate particles after compaction
- To minimize air voids that remain after complete cement hydration, add to the concrete mix only the minimum amount of water needed to achieve required workability
- Select sands and aggregates for the mix design carefully, as appropriate particle size and shape can help to improve mechanical compaction, effectively squeezing air voids and allowing them to be replaced with the cement paste
- There is some evidence that certain cement additives and chemical admixtures can help to inhibit efflorescence. Consult Direct Colors, Inc., for more information
- Ensure concrete cures sufficiently to achieve not only strength, durability and reduced cracking, but surfaces that are as dense as possible to limit the concrete's ability to absorb water
- A variety of concrete coatings, including water and solvent based concrete sealers offered by Direct Colors, are available for application to the surface, blocking pores and forming an impermeable barrier at the concrete's exposed surface. This prevents the movement of water to the surface, restricting the migration of efflorescence forming compounds. Consult Direct Colors, Inc., for more information

**BUILDING CODES**

Installation and waste disposal must comply with the requirements of all applicable local, state and federal code jurisdictions.

**6. Availability & Cost**

**AVAILABILITY**

Products can be purchased at [www.directcolors.com](http://www.directcolors.com), or by calling (877) 255-2656. Products are also available from certified distributors. Contact the manufacturer or check online at [www.directcolors.com](http://www.directcolors.com) for local availability information.

**COST**

Current pricing is available online at [www.directcolors.com](http://www.directcolors.com).

**7. Warranty**

The conditions of use and application of concrete pigment products are beyond the control of Direct Colors, Inc. Direct Colors makes no warranty regarding workmanship and other variables that do not involve the performance of pigments. Buyer's sole remedy shall be the purchase price paid by the user or buyer for the quantity of the Direct Colors product involved. For details, consult Direct Colors, Inc.

**8. Maintenance**

None required.

**9. Technical Services**

Technical assistance, including more detailed information, product literature, test results, project lists, assistance in preparing project specifications and arrangements for application supervision, is available by contacting Direct Colors, Inc. For questions or custom solutions, call (877)-255-2656 or email [info@directcolors.com](mailto:info@directcolors.com).

**10. Filing Systems**

- MANU-SPEC®
- Additional product information is available from the manufacturer upon request.



# ChemMasters

SPECIALTY CONSTRUCTION PRODUCTS

## CRYSTAL CLEAR-A

LOW VOC, SOLVENT-BASED  
HIGHEST GLOSS SEALER & CURING  
COMPOUND FOR CONCRETE

### P R O D U C T D A T A

#### DESCRIPTION

Crystal Clear-A is premium quality, super high gloss, non yellowing, curing and sealing compound. Crystal Clear-A is a state-of-the-art proprietary formulation which creates the highest gloss possible on concrete.

Crystal Clear-A is a solvent based product which meets the VOC requirements of the Ozone Transport Commission, in effect as of Jan. 1st, 2005.

Crystal Clear-A coats concrete with a chemically bonded siliconized acrylic film that deepens the color and enhances the look of pigmented or decorative concrete. Crystal Clear-A completely resists discoloration from ultraviolet light exposure. It keeps its high gloss finish much longer than standard concrete sealers. Crystal Clear-A will retard efflorescence while resisting oil, grease and food stains. Crystal Clear-A eliminates concrete dusting, while protecting concrete against salt and water penetration.

#### USES

Use on exterior plain, colored, textured or exposed aggregate concrete to

- Cure freshly poured concrete where superior curing efficiency is required
- Seal, harden and dustproof existing concrete, particularly architectural or residential concrete exposed to freeze-thaw or Ultra Violet light.
- Enhance the color and and gloss of pigmented or stamped concrete

#### ADVANTAGES

- Crystal Clear-A is much tougher than acrylic sealers. The high gloss created by Crystal Clear lasts up to 70% longer.
- Crystal Clear-A completely resists discoloration from ultraviolet light exposure.

- Complies with the VOC standards for concrete sealers in the following states: California, Delaware, New Jersey, New York, Oregon, Pennsylvania, Virginia, Washington and other area that require the VOC limits on curing & sealing compounds to be less than 350 grams per liter
- Crystal Clear-A cures concrete to ASTM C1315 standards to minimize cracking and increase the strength of concrete.
- Protects surfaces against deicing chemicals, fertilizers, salts, grease, oil, alkalies, mild acids and detergents.

#### TECHNICAL DATA

**Crystal Clear-A has been tested for gloss retention and non yellowing against standard concrete sealers with the following results.**

#### Gloss Retention

After 1,000 hours QUV exposure  
(All panels begin with 95 gloss rating)

	Gloss	Percent Original
Crystal Clear-A	89.8	95%
Moisture Cure Urethane	79.1	83%
Pure Acrylic	73.6	77%
Styrene Acrylic	55.4	58%

#### Yellowing Index

After 1,000 hours QUV exposure  
Equivalent to approx 10 years of Florida sunlight  
(All panels begin with 0 yellow rating)

	Yellowing
Crystal Clear-A	0.00
Moisture Cure Urethane	3.00
Pure Acrylic	4.77
Styrene Acrylic	9.48

(Visable yellowing begins at 3.00)



ChemMasters

An American Owned & Operated Company  
300 EDWARDS STREET • MADISON, OHIO 44057-3112  
(440) 428-2105 • FAX (440) 428-7091 • ORDER LINE: (800) 486-7866  
www.chemmasters.net

Revised March 2006

- ASTM C-1315, Type I , Class A & B,
- ASTM C-309, Type I, Class A & B,
- USDA approved, when cured, for incidental contact

V.O.C. content	350 gr/L
Moisture retention (ASTM C-156)	0.035 gms/cm <sup>2</sup>
Flash point	over 0°F (-18°C)
Drying time@70°F (21°C) and 50% RH	
Tack free	2 hours
Light foot traffic	8 hours
Maximum hardness	7 days

#### PACKAGING

Crystal Clear-A is available in 5 gallon (18.9 liter) metal pails and 55 gallon (208 liter) drums.

#### ESTIMATING GUIDE

Coverage is dependent upon surface texture and porosity. These are guidelines only

	Ft. <sup>2</sup> /gal	M <sup>2</sup> /L
Curing	300	7
Sealing Concrete		
First Coat	350	8
Second coat	450	11

#### DIRECTIONS

**MIXING:** Do not dilute. Crystal Clear-A is packaged ready to use and requires no mixing.

**APPLICATION:** Always test application in a small area to verify appearance. In cold temperatures (below 50°F), warm material to room temperature to ease application. In hot weather avoid applying in direct sunlight or in windy conditions. In hot weather, apply Crystal Clear-A early in the morning.

Because Crystal Clear-A dries very quickly, a low pressure, spray application is recommended. A pump up sprayer equipped with a slit-type orifice rated between 0.5 - 1.0 gallons per minute is recommended. If spraying, hold spray tip 6-8 inches from the surface and apply a continuous film leaving no pinholes or gaps. The optimum spray pattern is an 8-12 inch fan. When using a hand pressurized sprayer it is important to maintain as high an air pressure as possible to aid in spraying. Do not allow material to puddle. If roller application is necessary, regularly dip the

roller in a solvent like xylene or Polyseal Solvent to keep the roller from drying. If the roller dries out, cob-webbing or stringiness will result.

**CURING:** Apply Crystal Clear-A after all bleed water has dissipated and application will not mar the surface. For maximum gloss and protection, apply a second sealer coat after curing process is completed (minimum 28 days later).

**SEALING:** When sealing older concrete, clean concrete thoroughly removing any dirt, dust, paints, oil, grease or other contaminants that prevent adhesion. Allow the surface to dry before application of Crystal Clear-A. For best protection and highest gloss, apply two thin coats of Crystal Clear-A. Allow first coat to dry tack free before application of second coat.

#### CLEANUP

Clean tools immediately after use with Polyseal Solvent™ or xylene.

#### STORAGE

Store tightly sealed containers in cool, dry area away from direct sunlight and sources of heat. Shelf life is one year from date of manufacture.

#### LIMITATIONS

- Strong organic solvents, xylene, toluene, lacquer thinner, will lift Crystal Clear-A. Gasoline, hydraulic fluids, peanut oil and cooking oils soften and lift Crystal Clear if spills are not removed quickly.
- Do not apply to joints or channels scheduled to receive elastomeric caulks.
- Do not use if ambient or surface temperature is below 40°F (4°C). For best results, condition material to a minimum of 50°F (10°C) prior to application.
- Quality curing or sealing compounds and floor treatments darken or highlight the subtle color variations naturally present in concrete. When the difference in shading caused by absorptive deviation or finishing techniques is objectionable, consult ChemMasters technical staff prior to concrete placement for recommendations.

#### CAUTION

**FLAMMABLE LIQUID:** Keep away from heat or open flames. Use with adequate ventilation. May cause skin, eye and respiratory tract irritation. Do not take internally.

#### ***This Product is Formulated and Labeled for Industrial and Commercial Use Only***

FOR BEST RESULTS AND SAFEST USAGE, USER IS SPECIFICALLY DIRECTED TO CONSULT THE CURRENT MATERIAL SAFETY DATA SHEET AND PACKAGE LABEL FOR THIS PRODUCT

We warrant our products to meet our published specifications and to be free from defects in materials and workmanship to the acceptable quality levels defined in these specifications. If acceptable quality levels are not specified, the acceptable quality levels will be those normally supplied by us for the product. We make no guarantee of the results to be obtained from the use of our products. The determination as to the adaptability of any of our products to the specific needs of the Buyer is solely Buyer's prerogative and responsibility. We are glad to offer suggestions on the use of our products. Nevertheless, there are no warranties given except such expresses warranties offered in connection with the sale of a particular product. Our liability shall be limited to replacement of, or refund of an amount not to exceed the purchase price attributed to, the goods as to which such claim is made. Our selection of one of these alternatives shall be Buyer's exclusive remedy. IN NO CASE SHALL WE BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES, EVEN IF WE HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, GUARANTEES, CO-CONDITIONS AND REPRESENTATIONS, EITHER EXPRESSED OR IMPLIED, WHETHER ARISING UNDER ANY STATUTE, COMMON LAW, USAGE OR TRADE, COURSE OF DEALING OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

# Technical Data Sheet

## ASTM C-150

### PRODUCT NAME:

**White Portland Cement: Federal White Type I**  
**ASTM Designation C-150**

### MANUFACTURER:

Federal White Cement  
 P.O. Box 548  
 Woodstock, Ontario  
 Canada  
 N4S 7Y5

Phone: 800-265-1806  
 519-485-5410  
 FAX: 519-485-5892

### DESCRIPTION:

**Federal White Type I Cement** is a true portland cement manufactured with selected raw materials to insure negligible amounts of iron and manganese oxides so as not to produce the gray color of normal portland cement.

### BASIC USE:

**Federal White Cement** can be used for all types of architectural or structural concrete construction where a whiter or brighter color may be needed for aesthetic or safety reasons. Such application as pre-cast panels and systems, cast-in-place, masonry units, tilt-up panel systems, roofing tiles, terrazzo floors, highway median barriers, tile grout, swimming pools, stucco, colored masonry products, cement paints and coatings and ornamental precast concrete items lend themselves to using **Federal White Cement**. **Federal White Cement** may also be used to satisfy low alkali requirements.

### INSTALLATION:

Architect should approve the color and surface texture of samples submitted by the contractor or precaster. Contact **Federal White Cement** for further information or assistance.

### TECHNICAL DATA:

Federal White Portland Cement is manufactured to conform to all current requirements of ASTM Designation C-150.

See table for physical properties.



### AVAILABILITY AND COST:

**Federal White Cement** can be shipped to most destinations in the United States and Canada from our manufacturing plant or terminal. Cement shipments can be made by rail or truck in bags or in bulk.

The price, F.O.B. destination, of **Federal White Cement** will be furnished by the manufacturer upon request.

### WARRANTY:

**Federal White Type I Portland Cement** complies with the current ASTM C-150. **Federal White Cement** makes no guarantee or warranty, expressed or implied, including, without limitation, warranties of fitness or merchantability with respect to this product.

### MAINTENANCE:

Concrete and other products manufactured with **Federal White Cement** should require no additional maintenance if designed and constructed following proper and accepted procedures.

### TECHNICAL SERVICES:

Technical service, consultation, and additional product information are available by contacting **Federal White Cement**.

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PHYSICAL PROPERTY	FEDERAL WHITE Typical Type I	ASTM C – 150 Specification Type I
<b>Fineness:</b>		
Specific Surface (sq. m / kg)	400	280 minimum
<b>Setting Time – Vicat</b>		
Minutes	120	
not less than		45
not more than		375
<b>Air Content %</b>	8	12 maximum
<b>Compressive Strength, psi(MPa)</b>		
1 day	2000 (13.8)	--
3 day	3900 (26.9)	1740 (12.0) minimum
7 day	4800 (33.1)	2760 (19.0) minimum
28 day	6500 (44.8)	--



# LAFARGE

## NewCem® Slag Cement

Provides flexibility in concrete proportioning to assist in achieving:

Reduced Permeability

Reduced Ingress of Chlorides

Sulfate Resistance

Resistance to Alkali Silica Reaction

Greater Strength Potential

Lower Temperatures for Mass Concrete

Improved Workability

A Lighter, More Pleasing Color

Reduced Impact on the Environment



**Lafarge NewCem® slag cement** is a finely ground, granulated blast furnace slag (GGBFS), a product of the iron-making process. Through our extensive distribution system, NewCem is available for blending with conventional portland cement at the concrete plant to produce high-quality, durable concrete.



**Front cover photo:**

NewCem was used to construct the thick walls and floor of the Peel Reservoir which serves the Regional Municipality of Peel, Ontario.

**Slag** is produced during the iron-manufacturing process. During the manufacturing process the materials are heated in a blast furnace to a molten state. The slag rises to the top and is separated from the iron for further processing. When slag is separated from iron and rapidly cooled with water (granulated), the morphology of the slag changes. This morphology change provides the slag with its cementitious properties. The granulated slag is then ground to a controlled fineness, typically greater than that of Type I portland cement, and the finished product is ready for shipment to our customers.

**The NewCem® Slag Cement Advantage**

To produce top-quality slag, a producer needs to have slag with an ideal chemistry from a consistent source and needs to have a granulator close to the slag source to provide rapid quenching of the slag. Lafarge plants have been designed with these criteria in mind.

Lafarge engineers and scientists have led North America in the research and development of specifications for slag. Today, Lafarge's knowledge and technical experience is unequalled by any other producer of GGBFS. Lafarge's technical staff is available to ready-mixed concrete producers, engineers and specifiers for questions about the proper use of NewCem in any application.

**NewCem® Slag Cement and the Environment**

NewCem is a product derived from the iron-making process. It makes use of by-product material that might otherwise be landfilled. The use of NewCem in concrete saves virgin raw materials that would otherwise be needed for the production of portland cement. NewCem also requires less energy to produce than portland cement, so the amount of greenhouse gases released into the environment is reduced when NewCem partially replaces portland cement in concrete. The result is superior concrete with less environmental impact.



Lafarge NewCem provides a significant contribution to sustainable construction. The use of NewCem in concrete production consumes less energy and offers improved efficiency and building performance. NewCem can also be used to help achieve LEED (Leadership in Energy and Environmental Design)

points in the USGBC's (U.S. Green Building Council) and CaGBC's (Canada Green Building Council) LEED programs.



# Advantages of Lafarge NewCem® Slag Cement

## Strength

When properly used, NewCem can increase the 28-day strength of the concrete by 5 to 25 percent. The highest strength increases are found when the replacement level approaches 50 percent. High strength for concrete subjected to repeated flexural loads is critical for the long-term service life of highways, roads and airfield runways. NewCem provides strength and enhances the placeability and finishing characteristics of low-slump concrete. NewCem can also improve the consistency of concrete strengths. Most fluctuations in concrete strengths occur in the summer when high temperatures can cause slump loss and increased water demand. NewCem naturally retards the initial setting time of concrete, which leads to more consistent strengths.

## Durability

Long-term durability is a recognized need for all concrete structures. Concrete durability is affected by such variables as strength, permeability, consistency, resistance to extreme environmental conditions and resistance to chemical attack. When properly used, NewCem can increase the durability of concrete by improving resistance to sulfate attack, mitigating alkali silica reactions, reducing concrete permeability and decreasing concrete temperatures. NewCem's ability to dramatically increase the durability of concrete makes it an ideal ingredient for high-performance concrete. Many state DOT's have specified NewCem for their high-performance concrete mixes.

## Permeability

A concern with concrete structures exposed to de-icing salts is deterioration of the structure due to salt-induced corrosion of the reinforcing steel. When reinforcing steel corrodes, it takes up more volume than the original steel. This places the concrete around the reinforcing steel in tension. Because concrete tensile strength is about 1/10 of the compressive strength, the corroding steel can cause the concrete to crack. Once a crack develops, chlorides or other aggressive agents are provided a path to the reinforcing steel and further deterioration can occur. When used properly, concrete containing NewCem can reduce the permeability of the concrete; this reduces the ingress of chlorides and extends the life of the structure.

## ASR

The deterioration of concrete by the action of alkali silica reaction (ASR) is a concern in many areas of North America. ASR is a chemical reaction that occurs between the alkalis in portland cement and certain siliceous aggregates. These aggregates, when placed in a highly alkaline solution and in the presence of moisture, form an expansive gel that can cause the concrete to crack. If the crack reaches the surface of the concrete, a path is opened for the ingress of additional moisture, which will further fuel the reaction.

NewCem can reduce this potential expansion. It reduces the effective alkalis loading of the concrete. It reacts with the effective alkalis in portland cement and makes them unavailable to react with the reactive aggregates. Finally, NewCem can reduce the permeability of the concrete, which reduces the ingress of moisture that is available for the reaction.



Hartsfield International Airport,  
Atlanta, Georgia

## Sulfate Resistance

Sulfates, present in seawater and in some soils and wastewater, react with the alumina in hardened portland cement paste to cause deleterious expansion. Concrete containing NewCem can provide superior resistance to sulfate attack due to a decrease in the cement compounds that can cause expansion. Also contributing to sulfate resistance is the decrease in permeability of the concrete, which reduces the movement of sulfate solutions in the concrete.

*Resistance to sulfate attack may vary according to the chemistry of the cement and the slag cement used. Any combination of these materials should be tested to assure that desired sulfate resistance levels are achieved. Consult a Lafarge Cement Technical Representative before using NewCem in sulfate environments.*



National Archives - Silver Spring, Maryland



Chesapeake Bay Bridge Tunnel, Virginia

# Applications for Lafarge NewCem® Slag Cement

## High-Strength Concrete

In 1995, after the tragedy of the Oklahoma City bombing, engineers had to take a new look at how they designed structures, especially federal buildings. For example, construction was stopped on the new FBI building in Washington, D.C. while engineers and architects worked together to develop a design that would be more resistant to terrorist attack. One of the special designs employed in the FBI building was for a very high-strength blast wall. The concrete producer used a mix of 50 percent NewCem with 50 percent portland cement.

Another high-strength concrete project utilizing 50 percent NewCem and 50 percent portland cement is Lincoln Square in Washington, D.C. The specified strengths for this project ranged on the high end from 8,000 psi to 12,000 psi. Design strengths were usually achieved in about seven days, and 28-day strength results were often over 15,000 psi.

## Precast/Prestress

One of the earliest uses of NewCem was in precast and prestressed concrete. There were some initial concerns with using NewCem for these applications because of NewCem's natural tendency to reduce the early strength of the concrete. It was shown; however, that NewCem can react well when concrete is cured at elevated temperatures.

The light rail tunnels leading to the Minneapolis-St. Paul International Airport are constructed with precast concrete tunnel liners containing NewCem. This concrete met the low-permeability rating specification.

## Mass Concrete

A primary consideration in designing any mass concrete structure is the development of thermal cracks due to temperature differentials within the concrete. Cement produces heat during the hydration process. In the center of a mass concrete section the temperature of the concrete can build up quickly because there is no way for the heat to dissipate. On the exterior of the concrete section the heat dissipates much more rapidly. When the temperature differential between the center of the concrete mass and the exterior of the concrete becomes large enough, thermal cracking can develop.

Used in high percentages, NewCem has been very effective in reducing both the maximum temperature of the concrete and the rate of temperature rise, resulting in a lower temperature differential between the center of the concrete mass and the exterior of the concrete.

NewCem is produced in accordance with ASTM C 989 *Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars*, AASHTO M302 *Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars*, and CSA A3000 *Cementitious Materials Compendium*.



Light rail tunnel leading to the Minneapolis-St. Paul International Airport



FBI Building, Washington, D.C.



Lincoln Square, Washington, D.C.

## Properties of “Fresh Concrete” – NewCem® Slag Cement

**Water Requirements:** Concrete mixes containing NewCem will require about the same amount of water for a given slump as concrete containing only portland cement.

**Air Content:** The use of NewCem as a partial replacement for portland cement will not appreciably change the dosage rate requirements of air entraining agents. When changing mix ingredients, it is recommended to check dosage rates and adjust if necessary.

**Bleeding:** The bleeding characteristics of concrete containing NewCem will not be appreciably affected.

**Segregation:** There is no segregation issue related to the use of NewCem.

**Heat of Hydration:** NewCem can be used to moderate the development of heat in mass concrete. It is recommended that replacement factors of 60% or greater be used for this type of application. It is highly recommended that mix designs be assessed on an individual basis.

**Setting Time:** Concrete containing NewCem may have extended set times compared to straight portland mixes, especially at lower ambient/concrete temperatures and higher replacement levels. At normal summertime temperatures, set times will only be slightly affected.

**Finishability:** The finishability of concrete is generally improved with the use of NewCem.

**Pumping:** Concrete containing NewCem generally has improved pumpability.

**Proportioning:** NewCem has a lower specific gravity than normal portland cement. Consequently, the mix design should be modified to accommodate this change. ACI 211 should be followed for proportioning and mix proportions should be verified.

**Curing:** Proper curing of all concrete is essential. It is recommended that the procedures in ACI 308 *Standard Practice for Curing Concrete* and CSA A23.1 be followed.

## Properties of “Hardened Concrete” – NewCem® Slag Cement

**Strength:** Generally, later strengths (beyond 7 days) both compressive and flexural, are enhanced with NewCem. Early strengths (up to 14 days) can be reduced when compared to straight portland mixes, especially at higher replacement rates and at cooler temperatures.

**Permeability and Absorption:** When properly proportioned, concrete containing NewCem is less permeable and has a lower absorption rate than mixes containing only portland cement.

**Concrete Color:** Concrete made with NewCem as a replacement for portland cement will be lighter in color. A green or blue-green color may occasionally be observed in freshly cured concrete; however, this is very rare and will only occur under certain conditions. This tint normally disappears once the concrete surface is exposed to air and dries out.

**Alkali-Silica Reactivity:** Concrete containing NewCem can help mitigate ASR. This is dependent on the qualities of the aggregate and the replacement rate as well as other variables. Concrete mixtures should be assessed on an individual basis.

**Resistance to Sulfate Attack:** NewCem can be used as part of a system to improve the resistance of concrete to sulfate attack. The degree of resistance achieved is dependent on the replacement rate and other factors. Mixes should be assessed individually.

Resistance to sulfate attack may vary according to the chemistry of the cement and the slag cement used. Any combination of these materials should be tested to assure that desired sulfate resistance levels are achieved. Consult a Lafarge Cement Technical Representative before using NewCem in sulfate environments.

**Corrosion of Embedded Steel:** There is a direct relationship between permeability and corrosion resistance. Corrosion can be reduced by replacing part of the portland cement with NewCem in concrete mixtures.

**Carbonation:** When used in a properly designed concrete mix, and with appropriate finishing and curing procedures applied in the field, the use of NewCem will not significantly affect the depth of carbonation.

**Freeze-Thaw Resistance:** When used in a properly designed concrete mix with an adequate air-void system and with proper finishing and curing procedures applied in the field, the use of NewCem will not detract from the freeze-thaw resistance of concrete.

**Deicer Salt Scaling:** When using NewCem as a replacement for portland cement in concrete that will be exposed to deicing salts, the limits specified in ACI 318 *Building Code Requirements for Structural Concrete*, ACI 301 *Specifications for Structural Concrete* and CSA A23.1 must be followed.

**Chemical Resistance:** Reduced permeability, and therefore improved chemical resistance, can be achieved through the use of NewCem in concrete mixtures.

**Note:** Appropriate testing should be conducted with different NewCem/portland levels to assure desired results are achieved. Results may vary with the use of different portland cements.



I-895 Interchange near Richmond, Virginia



Liberty View Towers - Jersey City, New Jersey



Ravens' Stadium, Baltimore, MD

### Company Profile

Lafarge in North America is part of the Lafarge Group. The world leader in building materials, active on five continents, the Lafarge Group holds top-ranking positions in cement, aggregates, concrete and gypsum.

By focusing on the development and improvement of building materials, Lafarge puts the customer at the core of its strategy and offers the construction industry and the general public innovative solutions that will bring more safety, comfort and beauty to our everyday lives.

**Please consult a Lafarge Cement Technical Representative prior to using NewCem in specialized applications.**

### Precautions

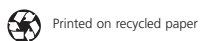
Direct contact with wet cement should be avoided. If contact occurs, the skin should be washed with water as soon as possible. Exposure can cause serious, potentially irreversible tissue destruction in the form of chemical (caustic) burns. If cement gets into the eyes, immediately rinse thoroughly with water and seek medical attention. For more information, reference the applicable Lafarge Material Safety Data Sheet (MSDS). The MSDS should be consulted prior to use of this product and is available upon request and online at [www.lafarge-na.com](http://www.lafarge-na.com).

### Limited Warranty

Lafarge warrants that Lafarge NewCem slag cement meets the requirements of ASTM C 989 and CSA-A3001. Lafarge makes no other warranty, whether of merchantability or fitness for a particular purpose with respect to Lafarge NewCem slag cement. Having no control over its use, Lafarge will not guarantee finished work in which Lafarge NewCem slag cement is used.

PBNCE

1/07



# Lafarge NewCem® Slag Cement

For more than three decades, NewCem has been used in conjunction with regular portland cement to produce improved concrete properties for architects, engineers, contractors, ready-mixed concrete and concrete products producers. Today, Lafarge maintains NewCem's market leadership through consistent product quality backed by solid technical expertise.

Please contact your Lafarge Office for specific product information, availability and ordering.

### Lakes and Seaway Business Unit

Bingham Farms, Michigan  
Phone: 248-594-1991

### U.S. East Business Unit

Alpharetta, Georgia  
Phone: 678-746-2000

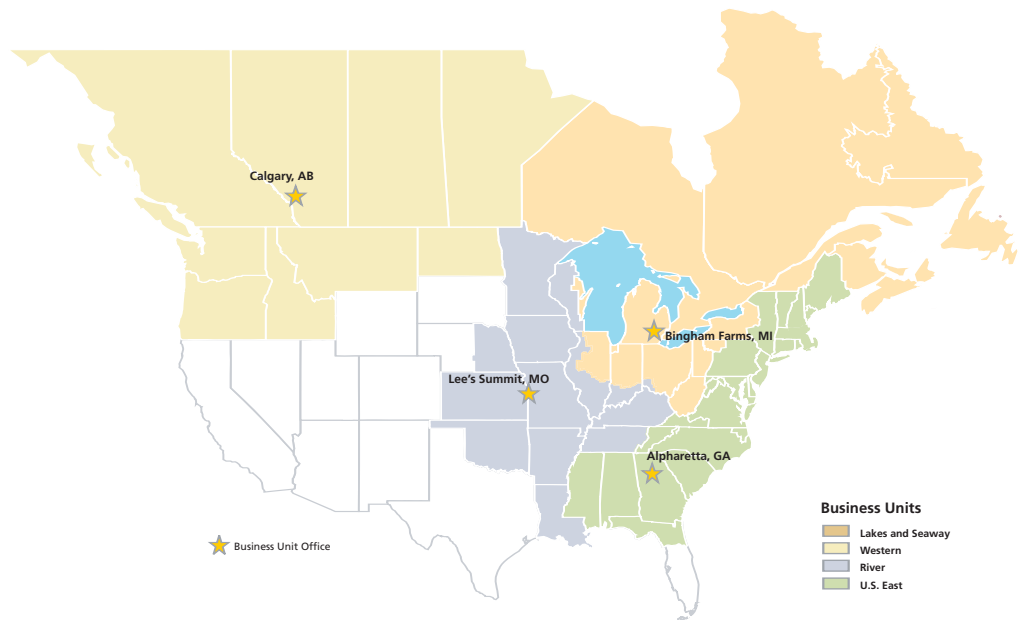
### River Business Unit

Lee's Summit, Missouri  
Phone: 816-251-2100

### Western Business Unit

Calgary, Alberta  
Phone: 403-271-9110

### Lafarge North America Cement Operating Areas



**Lafarge North America Inc.**  
12950 Worldgate Drive, Suite 500  
Herndon, VA 20170

**Lafarge Canada Inc.**  
606 Cathcart Street  
Montréal, Québec H3B 1L7



CEMENT

[www.lafarge-na.com](http://www.lafarge-na.com)

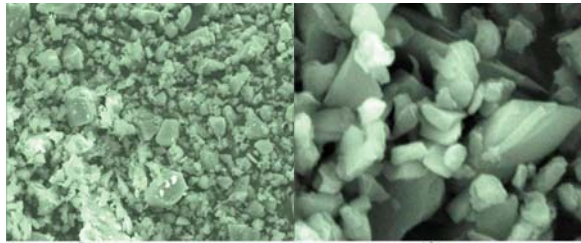
Custom-engineered, high performance, pozzolanic mineral additives for use in white cement, mortar, and concrete products

[www.vitrominerals.com](http://www.vitrominerals.com)

## Product Description

VCAS™ (vitreous calcium aluminosilicate) pozzolans are new custom-engineered, high performance supplementary cementing materials for use in white Portland cement, mortar, and concrete products. They are manufactured by heating a blend of ground silica, lime, and alumina compounds to a molten state which is then solidified by quench cooling, processed, and ground to a fine white powder with highly-reactive pozzolanic characteristics.

After primary sizing and drying, the feedstock is finely ground and processed through high efficiency classifiers to produce a fine bright white powder with quality assured physical properties. The consistent chemical composition and tightly controlled particle size distribution result in highly reactive and superior quality pozzolans for concrete applications. Currently, the VCAS™ patented technology produces pozzolans in three grades, **VCAS-8**, **VCAS-140**, and **VCAS-160**, described in this technical summary.

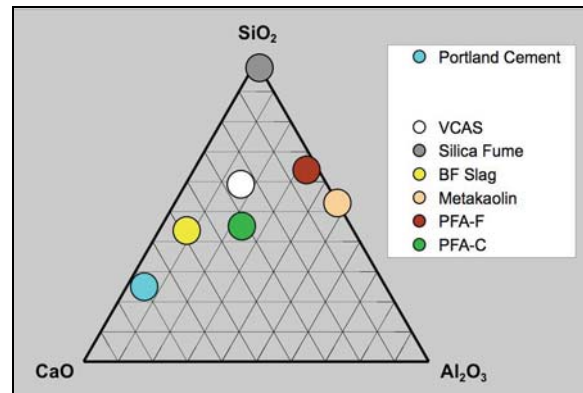


Unlike silica fume, coal fly ash, ground granulated blast furnace slag, and other by-products, VCAS™ pozzolans are free of iron, manganese, and other undesirable color-inducing impurities, making them ideally suited for all applications using white cement and in pigmented concrete.

VCAS™ pozzolans are value-added supplementary cementing materials that exhibit pozzolanic activity comparable to silica fume and metakaolin when tested in accordance with ASTM C618 and ASTM C1240. VCAS™ pozzolans react with calcium hydroxide produced during the hydration of Portland cement to form additional cementitious compounds such as calcium silicate and aluminosilicate hydrates. Pozzolans are widely used in cement and concrete technology to increase concrete strength, density, and resistance to chemical attack as well as control efflorescence.

Chemical Composition of VCAS™ Pozzolans			
Silica, SiO <sub>2</sub>	50–55%	Titania, TiO <sub>2</sub>	< 1%
Alumina, Al <sub>2</sub> O <sub>3</sub>	15–20%	Phosphorus oxide, P <sub>2</sub> O <sub>5</sub>	< 0.1%
Iron oxide, Fe <sub>2</sub> O <sub>3</sub>	< 1%	Manganese oxide, MnO	< 0.01%
Calcium, CaO	20–25%	Boron oxide, B <sub>2</sub> O <sub>3</sub>	0–6%
Magnesia, MgO	< 1%	Sulphur oxide, SO <sub>3</sub>	< 0.1%
Sodium oxide, Na <sub>2</sub> O	< 1%	Chloride, Cl	< 0.01%
Potassium oxide, K <sub>2</sub> O	< 0.2%	Loss on ignition, LOI	< 0.5%

Chemically, VCAS™ pozzolans are comprised largely of oxides of silicon, aluminum and calcium with no deleterious impurities. The CaO-SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> proportions, the low alkali metal content, and the amorphous structure are ideal for a pozzolanic additive in hydraulic concrete. The low iron content makes them particularly well suited for applications using white cement, such as mortars, stuccos, terrazzo, artificial stone, and cast-in-place or precast concrete products.



Ternary diagram (CaO-SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>) for the composition of VCAS™ pozzolans relative to Portland cement and the common pozzolans.

VCAS™ pozzolans have superior powder handling compared with silica fume and metakaolin. Tight process control provides consistent product quality and physical properties.

Physical Properties of VCAS™ Pozzolans			
	VCAS-8	VCAS-140	VCAS-160
Specific Gravity	2.6	2.6	2.6
Bulk Density, Loose lb/ft <sup>3</sup>	50-55	50-55	45-50
Passing No. 325 Mesh, %	95	95	98
Specific Surface Area, cm <sup>2</sup> /g	4,000	4,000	6,000
Brightness, %	90	86	86
Melting Point, °C	1200	1200	1200
Hardness, Mohs	5.5	5.5	5.5



## Benefits of VCAS™ Pozzolans

### Fresh Concrete:

- Improved workability
- Reduction in water requirements
- Ease of dispersability
- Reduction in superplasticizer
- Reduction in bleeding
- Reduction in aggregate segregation

### Hardened Concrete:

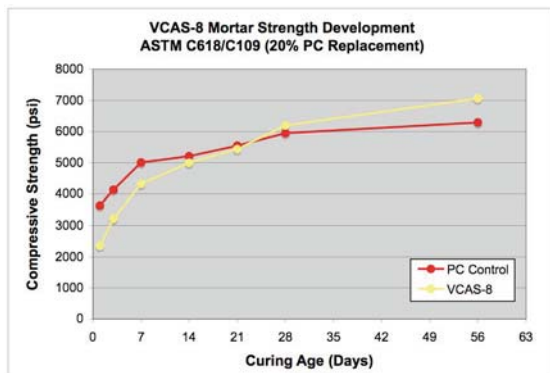
- Increased compressive strength
- Decreased permeability
- Increased durability

### Added-Value:

- Mix-color neutrality and brightness
- Improved retention of mold detail
- Sustainability

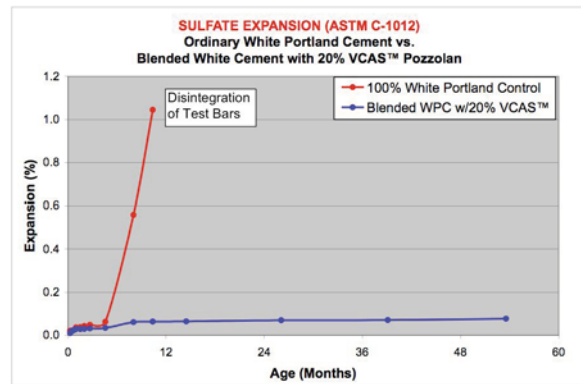
## Performance

VCAS pozzolans meet the technical requirements of ASTM C618 for use as supplementary cementitious materials in concrete. Blended pozzolanic cements produced with VCAS pozzolans also exceed the requirements of ASTM C1157: Standard Performance Specification for Hydraulic Cement. A typical strength curve for VCAS-8 at 20% cement replacement is shown below. Coupled with low water demand, reduced efflorescence, and improved chloride resistance, VCAS™ pozzolans are extremely cost effective.



## Enhanced Durability

VCAS™ pozzolans provide white Portland cement with superior resistance to sulfate attack (ASTM C1012). The graph below shows the excellent dimensional stability of a white cement mortar with 20% VCAS replacement after over 4 years of exposure. Under these harsh test conditions, the 100% white cement control mortar disintegrated in less than 200 days. VCAS is also very effective at controlling expansion due to the alkali-silica reaction (ASTM C441) and reducing chloride ion penetration (ASTM C1202).



## Comparison with Other Pozzolans

VCAS™ pozzolans are excellent high reactivity materials for use with white cement to produce durable, high performance architectural concrete structures and reflective highway barriers.

## Environmental, Health & Safety

VCAS™ pozzolans have an important role to play in sustainable construction by increasing service life and reducing the net greenhouse gas emissions (GHG) for a cubic yard of concrete.

VCAS™ pozzolans are non-toxic, contain no crystalline silica, and are classed as a nuisance dust, in common with other common fine particulate industrial minerals.

## Product Availability

VCAS™ pozzolans are sold in bulk tanker trucks, 1-ton super-sacks, and 50 lb bags.

Disclaimer: The statements in this bulletin are based on data which is believed to be reliable, and is offered in good faith to be applied accordingly to the user's best judgment. Since operating conditions at customer's sites are beyond our control, Vitro Minerals will not assume responsibility for the accuracy of this data, or liability which may result from the use of its products. Likewise, no patent liability is assumed for use of Vitro Mineral products in any manner which could or would infringe on patent rights of others.

## Product specifications

according to DIN EN 13055-1

Designation	Poraver® basic granular sizes						Special granular sizes			
	0.1-0.3	0.25-0.5	0.5-1	1 - 2	2 - 4	4 - 8	0.04-0.125	high-strength 0.2-0.7	0.5-1.25	8 - 16
Granular size mm	0.1-0.3	0.25-0.5	0.5-1	1 - 2	2 - 4	4 - 8	0.04-0.125	high-strength 0.2-0.7	0.5-1.25	8 - 16
Bulk density lb/ft <sup>3</sup> Nominal	25	21.2	16.9	14.4	11.9	11.2	33.1	33.1	16.2	8.7
Apparent granular density lb/ft <sup>3</sup> Nominal	56.2	36.8	29.3	24.3	20	18.8	*	59.3	28.7	16.9
Compressive strength PSI	406	377	290	232	203	174	-	942.5	246.5	116
Oversize grains	≅ 10 M. %									
Undersize grains	≅ 15 M. %									

\* on request

The following data are valid for all grain sizes:

pH value	9 - 12									
Moisture content on delivery	< 0.5 %									
Softening point	approx. 700° C									
Colour	creamy white									
Thermal conductivity W/mK	-	-	-	-	0.07**	0.07**	-	-	-	-

\*\* Calculated values DIBt according to Approval Z-23.11-114

The Poraver® strengths may vary within the tolerance range of the bulk density.

The availability and delivery conditions for special grain sizes will be agreed on an individual basis.





## Apparent bulk density

### How to determine apparent bulk density

in accordance with DIN EN 1097-3

Pour loose Poraver<sup>®</sup> into a 1 litre measuring vessel and carefully level off any test material left on top.  
Then weigh the test material in the vessel. The bulk density is the quotient of the weight and the volumes in lb/ft<sup>3</sup>.

Standard granular size mm	0.1 - 0.3	0.25 - 0.5	0.5 - 1	1 - 2	2 - 4	4 - 8
Apparent bulk density in lb/ft <sup>3</sup>	25	21.2	16.9	14.4	11.9	11.2

Special granular size in mm	0.04 - 0.125	high-strength 0.2 - 0.7	0.5 - 1.25	8 - 16
Apparent bulk density in lb/ft <sup>3</sup>	33.1	33.1	16.2	8.7

The following deviations from the given DIN apply:

- ▶ There is no drying, because Poraver<sup>®</sup> is generally supplied dry.
- ▶ The equilibrium moisture does not require conditioning.
- ▶ The measuring vessel indicates a volume of 1 litre even with granular sizes greater than 4 mm.
- ▶ One measuring value is given for each test.



## Apparent granular density

### How to determine apparent granular density

in accordance with DIN 4226

What is required to determine apparent granular density ( $\rho$ ) is approx. 400ml of material that is weighed (m). Place the granular material into a cylinder with 1 litre nominal capacity and add 0.5 litre of water. Tap the measuring vessel to remove any air bubbles. Push a plunger with known volumes ( $V_s$ ) into the measuring cylinder to prevent granular material from floating to the surface. After reading off the total volume (V) in  $\text{cm}^3$ , you can calculate the granular density in  $\text{lb}/\text{ft}^3$  by using the following formula:

Calculation formula:

$$\rho = \frac{m}{V - (V_s + 500)}$$

Standard granular size in mm	0.1 - 0.3	0.25 - 0.5	0.5 - 1	1 - 2	2 - 4	4 - 8
Apparent granular density in $\text{lb}/\text{ft}^3$	56.2	36.8	29.3	24.3	20	18.8

Special granular size in mm	0.04 - 0.125	high-strength 0.2 - 0.7	0.5 - 1.25	8 - 16
Apparent granular density in $\text{lb}/\text{ft}^3$	*	59.3	28.7	16.9

\* on request

The following deviations from the given DIN apply:

- ▶ There is no drying, because Poraver® is generally supplied dry.
- ▶ This testing method is used for Poraver® granular sizes from 0.1 – 16 mm.
- ▶ One measuring value is given for each test.



## Compressive strength

### How to determine granular compressive strength

in accordance with DIN EN 13055-1

To determine the compressive strength, pour 1 litre of Poraver<sup>®</sup> into a defined steel cylinder and compress. To do this, use an attached plunger to press down the granular material in this cylinder by 20 mm with a compressor. The force required for this is indicated as the granular strength.

Standard granular size in mm	0.1 - 0.3	0.25 - 0.5	0.5 - 1	1 - 2	2 - 4	4 - 8
Compressive strength PSI	406	377	290	232	203	174

Special granular size in mm	0.04 - 0.125	high-strength 0.2 - 0.7	0.5 - 1.25	8 - 16
Compressive strength PSI	-	942.5	246.5	116

The following deviations from the given DIN apply:

- ▶ Undersize and oversize grains are not removed within individual granular groups.
- ▶ Force is applied at a constant speed of 0.15 kN/s for all granular sizes.
- ▶ One measuring value is given for each test.



## Water absorption

### How to determine water absorption

in accordance with DIN V 18004

To determine water absorption, weigh approx. 0.4 litre of Poraver<sup>®</sup> to an accuracy of 0.1 g.

Procedure 1:

For granular sizes below 2 mm, store the water in a suction filter, and extract the water by means of a water-operated vacuum pump to dry the surface.

Procedure 2:

For granular sizes in excess of 2 mm, store the water in a density bottle. Here, dab the sample to dry the surface.

The difference between the mass of the surface-damp condition and the dry sample in relation to the dry sample is water absorption W in M.-%.

### Calculation formula

$$WA [M.-%] = (M_f - M_{tr}) / M_{tr}$$

$$WA [V.-%] = WA [Vol.-%] \times KRD$$

M<sub>w</sub> - Mass of water absorbed [g]

M<sub>tr</sub> - Mass of sample dry [g]

KRD - Apparent granular density [kg/m<sup>3</sup>]

Standard granular size in mm	0.1 - 0.3	0.25 - 0.5	0.5 - 1	1 - 2	2 - 4	4 - 8
Water absorption in WA	35 M.-%	30 M.-%	25 M.-%	20 M.-%	15 M.-%	10 M.-%

Special granular size in mm	0.04 - 0.125	high-strength 0.2 - 0.7	0.5 - 1.25	8 - 16
Water absorption in WA	-	20 M.-%	22 M.-%	15 M.-%

The following deviations from the given DIN apply:

- ▶ There is no drying, because Poraver<sup>®</sup> is generally supplied dry.
- ▶ Procedure 1 is used for granular sizes up to 2 mm, Procedure 2 only being used for granular sizes greater than 2 mm.
- ▶ Water storage of approx. 5 min. is used as standard in both procedures.



## Chemical analysis

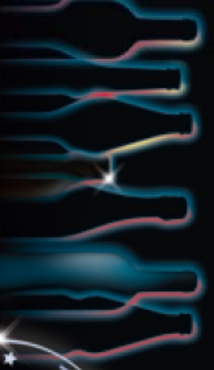
in accordance with test report 043077.1 of the MPA Hanover

Serial No.	Constituent	Applied to the sample dried at 105°C	Heat-loss-free (%)	Analysis method
1	Heat loss	0.3	–	DIN EN 1744-1
2	Insoluble residue	91.5	–	EN 196-2
3	CaO	8.9	9.0	spectrally photometric atomic emission
4	SiO <sub>2</sub>	71.7	71.9	
5	Al <sub>2</sub> O <sub>3</sub>	2.5	2.5	
6	TiO <sub>2</sub>	0.1	0.1	
7	Fe <sub>2</sub> O <sub>3</sub>	0.4	0.4	
8	Mn <sub>2</sub> O <sub>3</sub>	0	0	
9	MgO	2.1	2.1	
10	K <sub>2</sub> O	0.8	0.8	
11	Na <sub>2</sub> O	13.2	13.2	
12	SO <sub>3</sub>	0.1	0.1	
13	Cl	–	–	argentometric
14	Remaining	– 0.1	– 0.1	–
15	Total 1, 3–14	100.0	100.0	–
16	Na <sub>2</sub> O equivalent	13.7	–	calculated from 10+11

The analysis was conducted on a sample ground and dried to a granular size of < 0.125 mm.



The ball that does it all



As an internationally active company we are worldwide on the spot for you.



Poraver® is generated from recycled glass, awarded with the "Blue Angel", and therefore environment-friendly as well as ecological valuable.

### Poraver® is unique!

- The Poraver® benefits:**
- Low density but high compressive strength
  - Highly heatinsulating
  - Alkali-resistant and therefore suitable for working with lime and cement
  - Application friendly because of round shape
  - Noncombustible
  - Excellent sound-absorbing properties
  - Solventfree
  - Odour-neutral
  - Purely mineral
  - Amorphous glass structure preventing risk of silicosis
  - Not offering any breeding grounds for parasites and fungi



### The company.

Poraver® has been developed over several years of research by the **Dennert Poraver GmbH**. New ideas and extraordinary challenges "all about the small ball" are pursued consistently. Since 1984 over 150.000m³ are produced annually for European and international customers with the manufacturing process developed by Poraver.

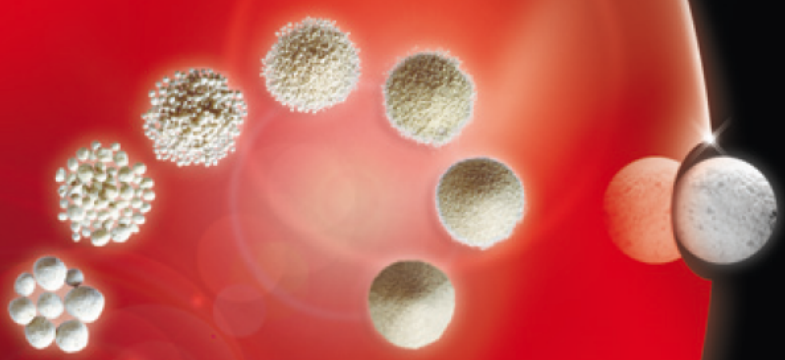


Numerous fields of application are added in cooperations with prestigious institutes, universities and companies. The successful products made by well known manufacturers can be found on the international market. Innovative products enhanced with Poraver® are rewarded with the user seal as a sign of excellent quality. Furthermore Poraver supports its customers in all areas of product development, marketing and sales as well as in practice.

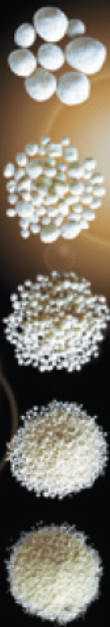


Dennert Poraver GmbH  
Mozartweg 1 · 96132 Schlusselfeld · Germany  
Phone +49 9552 92977-0 · Fax +49 9552 92977-26  
Info@poraver.de · www.poraver.de

The ball that does it all



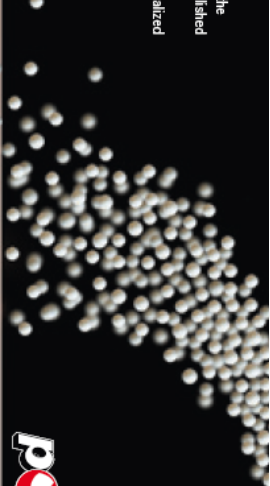




Poraver® is produced in 10 different grain sizes from 0,04 – 16 mm.



The solid wall system **poraFORM** and the insulating block **CALIMAX 11** are established brands in the construction industry and were co-developed and commercialized by Demter Poraver GmbH.

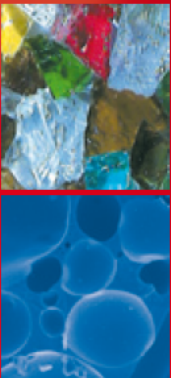


## Poraver® is glass!

Poraver® is pure glass generated from recycling. Poraver® uses only those extremely fine glass fractions that are no longer suitable for the glass industries to produce new glass and bottles.

Today this valuable raw material is refined to the unique **lightweight aggregate Poraver®**.

The product basis of Poraver® is formed by six creamy white standard grain sizes from 0,1 – 8 mm.



Recycled glass 5-fold enlargement

Pore structure Poraver® 150-fold enlargement

Furthermore customized application specific grain sizes are also produced from 0,04 – 16 mm. Poraver®'s ingenious properties remain the same: light as a feather, round, free of broken granules, high compressive strength and its unique benefits of glass.

The market for Poraver® is already embracing our modern life. Where **weight reduction** is of essence but **high compressive strength, acoustic and thermal insulation** is in demand, Poraver® is firmly established.

As lightweight aggregate used by almost the entire dry mortar and construction chemical industry, in acoustic panels, in restoration of old buildings, in solid wall systems up to the latest decor products, it applies: **Poraver® inside!**

## Poraver® is the mineral lightweight aggregate in:

Dry mortar and construction chemical products

### Plasters/renders



### Adhesive and reinforcement mortar



### Adhesives



### Fillings



### Lightweight concrete



### Panel systems



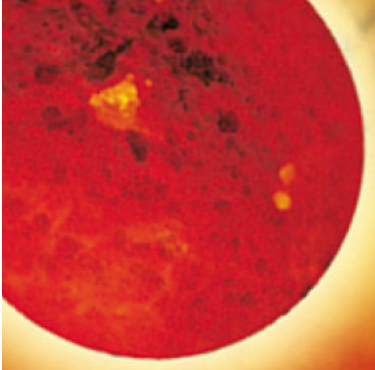
### Plastic applications



### Special applications



Please take into account that we are not producer of the see applications but a manufacturer of expanded glass granulate.





**FOR SALES, SAMPLES OR  
TECHNICAL SERVICE**

Call 1-800-252-0039

1-423-629-7160

Fax 1-423-698-0614

Visit Sphere One at our website:  
[www.sphereone.net](http://www.sphereone.net)

## EXTENDOSPHERES™ SG Hollow Spheres

EXTENDOSPHERES™ hollow spheres are efficient, lightweight additives for most resin systems. The SG series of products replaces heavier, more expensive components on an equivalent volume basis, they can reduce raw material costs as well as density.

EXTENDOSPHERES™ SG represents the general purpose version of hollow spheres. Extendspheres™ SG has a broad particle size distribution. SG makes an excellent choice for insulating roofing materials, cementitious coatings, grouts, synthetic stone, high strength anchoring compounds, and specialty cements. They can also be used in high mil-build industrial coatings, roofing materials, and mastics.

### PACKAGING

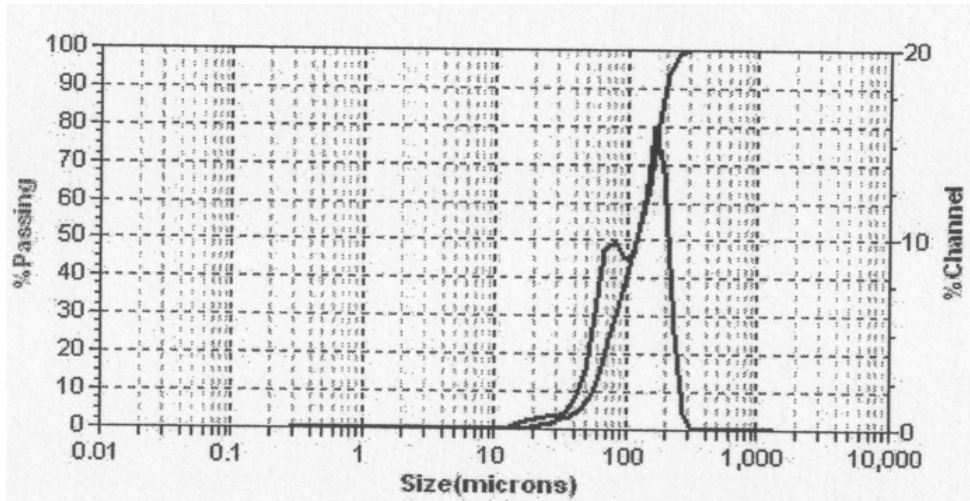
EXTENDOSPHERES™ SG hollow spheres are supplied in 50 lb multi-wall bags, 40 bags per pallet. Samples in sufficient quantity for testing are available upon request.

### SAFETY INFORMATION

In areas where these hollow spheres create a dust, the use of a NIOSH-approved mask or respirator is recommended. Material Safety Data Sheet (MSDS) will be supplied upon request.

### TYPICAL PROPERTIES OF EXTENDOSPHERES™ SG CERAMIC HOLLOW SPHERES

Physical Form	Free-Flowing Powder
Appearance	Gray
Particle Size SG	Microns 10-500 5-10% >150
Average Mean Particle Size SG	Microns 140 +/-30 microns
Density	0.72 +/- .05 g/cc
Bulk Density	<26 lbs/ft <sup>3</sup>
Deformation Temperature	>1500°C
Compressive Strength	<10% @ 2500 psi
Hardness, Moh's Scale	5



Microtrac 3500S

The technical information presented herein represents the best information available to us and is believed to be reliable. Sphere One, Inc. makes no warranties, either expressed or implied, with respect to our materials, including the warranties of merchantability or fitness for any particular purpose. We urge that users of our materials conduct tests to determine suitability for their specific end uses.

April 29, 2010

To: Ryan Hoensheid

From: Mark Bonne- Sphere One

Subject: HA and SG Extendsphere Products



Dear Ryan,

This letter is to confirm that both the HA-350 and SG Extendspheres are manufactured from by-products of coal combustion; as a result they qualify for as post industrial /manufacturer scrap. If you have any further questions feel free to call.

Sincerely

Mark Bonne

Technical Manager

Sphere One

(800) 252 -0039

## SPHERE ONE EXTENDOSPHERES™ 350 Hollow Spheres

**Categories:** [Ceramic](#); [Oxide](#); [Other Engineering Material](#); [Additive/Filler for Polymer](#)

**Material Notes:** EXTENDOSPHERES™ hollow spheres are efficient, lightweight additives for most resin systems. When extensospheres™ replace heavier, more expensive components on an equivalent volume basis, they can reduce raw material costs as well as density.

Applications: EXTENDOSPHERES™ 350 hollow spheres are a standard grade. They are recommended for use in cement, grout, sealants, roofing compounds, PVC and latex flooring. They can also be used in high mil-build industrial coatings and mastics.

Information provided by Sphere One Inc.

**Vendors:** No vendors are listed for this material. Please [click here](#) if you are a supplier and would like information on how to add your listing to this material.

Physical Properties	Metric	English	Comments
Bulk Density	0.400 g/cc	0.0145 lb/in <sup>3</sup>	
Density	0.700 - 0.800 g/cc	0.0253 - 0.0289 lb/in <sup>3</sup>	
Particle Size	150 µm	150 µm	Average Mean
	10.0 - 500 µm	10.0 - 500 µm	

Mechanical Properties	Metric	English	Comments
Hardness, Mohs	5.00	5.00	
Compressive Strength	20.7 MPa	3000 psi	

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	1300 °C	2370 °F	Deformation temp

Component Elements Properties	Metric	English	Comments
Al <sub>2</sub> O <sub>3</sub>	28.0 - 33.0 %	28.0 - 33.0 %	
Fe <sub>2</sub> O <sub>3</sub>	<= 4.0 %	<= 4.0 %	
SiO <sub>2</sub>	58.0 - 65.0 %	58.0 - 65.0 %	

### Descriptive Properties

Color	gray
Physical Form	Free-Flowing Powder
Shell Thickness	Approx. 10% of diameter

Some of the values displayed above may have been converted from their original units and/or rounded in order to display the information in a consistent format. Users requiring more precise data for scientific or engineering calculations can click on the property value to see the original value as well as raw conversions to equivalent units. We advise that you only use the original value or one of its raw conversions in your calculations to minimize rounding error. We also ask that you refer to MatWeb's disclaimer and terms of use regarding this information. [Click here](#) to view all the property values for this datasheet as they were originally entered into MatWeb.

April 29, 2010

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Subject: HA and SG Extendsphere Products



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Sincerely

Mark Bonne

Technical Manager

Sphere One

(800) 252 -0039

<p><b>KURALON™ RF4000</b></p>	<p><b>PVA Fibers for Structural Concrete Reinforcement</b></p>
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Kuralon RF4000 PVA fibers are designed to provide structural reinforcement in concrete applications as a replacement for wire mesh. The unmatched molecular bond strength of PVA fibers with concrete makes Kuralon RF4000 ideal for reinforcement or cracking control. This high bond strength eliminates the need for longer fibers, making mixing easier with less impact on slump. Kuralon RF4000 fibers are suitable for precast, ready mix or shotcrete applications.

**Description:**

Material:	Polyvinyl alcohol
Configuration:	Chopped fiber
Color:	Yellowish white
Specific Gravity:	1.3
Length:	1.18" (30mm)
Tensile Strength:	130,500 psi (0.9GPa)
Chemical Stability:	Stable
Absorption:	Minimal

**Dosage:**

Dosage rates for Kuralon RF4000 vary depending on the results desired. Structural benefits begin to accrue at a dosage of approximately seven pounds per cubic yard, typically for slabs, spalling prevention or precast applications. At more than 10 pounds per cubic yard, Kuralon RF4000 can replace or reduce wire mesh in shotcrete and other applications.

**Benefits of Kuralon RF4000 Fibers in Concrete:**

- Replacement or reduction of wire mesh providing a rust-free solution that is easier on users and equipment and reduces labor and material costs.
- Compared to steel, there are no sharp fiber protrusions.
- They are a more efficient reinforcement system than other conventional synthetic systems.

**Applications:**

- Industrial and warehouse floor slabs, Pavements, etc.
- Slope stabilization, tunnel linings, etc.
- New construction and repair airport aprons and taxiways
- Seismic and security safeguard in new structures, and upgrades to existing structures
- Septic tanks, vaults, and other specialty precast

**Note:**

Complete CSI manu-spec format specification and a material data safety sheet are available from your Nycon representative.

**Support Services:**

Nycon engineers are available for assistance in selecting the appropriate Nycon synthetic fiber product and dosage level for specific applications and for field support.

The information herein is given in good faith, but no warranty, express or implied, is made. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. Final determination of suitability of any material is the sole responsibility of the user. Observing existing regulations and laws have are the responsibility of the user.



*Helping You Build smarter and Better.™*

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Phones  
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401 596 3955

March 24, 2010

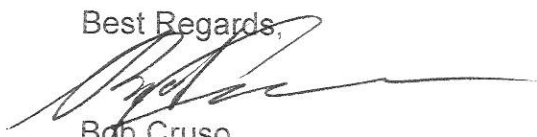
To Whom it May Concern,

We hereby confirm the PVA-fiber product, Kuralon RF4000x30, meets the requirement of ASTM C1116, coming from past technical test data and papers.

The standard specification of this product is as follows:

Material:	Polyvinyl Alcohol
Configuration:	Chopped fiber
Color:	Yellowish White
Specific Gravity:	1.3
Length:	30 mm (1.18")
Tensile Strength:	900 MPa (130,500psi)
Chemical Stability:	Stable
Absorption:	Minimal

Best Regards,



Bob Cruso  
Manager  
New Nycon, Inc.  
Tel 800 456 9266  
[bcruso@nycon.com](mailto:bcruso@nycon.com)



<p><b>KURALON™ RECS15</b></p>	<p><b>PVA Fibers for Structural Reinforcement</b></p>
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Kuralon RECS15 PVA fibers are designed to provide structural performance in a wide array of mortar applications. PVA-ECC (engineered cementitious composite), a customized mix design using inexpensive materials and Kuralon RECS15 PVA fibers, provides more than 200 times tensile strain capacity than other mixes with synthetic fibers. This new class of materials produces a mortar that behaves like aluminum in flexural and tensile deformation.

First developed at the University of Michigan, PVA-ECC with Kuralon RECS15 PVA fibers has characteristics that provide rich opportunity for many applications worldwide. Repair mortars, cement boards, high-rise curtain walls, seismic remediation, ductile pipes, etc., are but a few of the many applications for this innovative material. The unmatched molecular bond strength of PVA fibers with matrix makes Kuralon RECS15 fibers ideal for producing structural mortars like PVA-ECC. This high bond strength eliminates the need for longer fibers, making mixing easier with less impact on slump.

**Description:**

Material:	Polyvinyl alcohol
Configuration:	Resin-bundled chopped fiber
Color:	White or yellowish white
Specific Gravity:	1.3
Length:	1/3" (8mm)
Tensile Strength:	232,000 psi (1600 MPa)
Chemical Stability:	Stable
Absorption:	Minimal

**Dosage:**

The optimum fiber dosage of PVA-ECC at up to 44 lbs per cubic yard offers the possibility of reduced-steel and even steel-free reinforcement. This mix design was developed utilizing micromechanics to deliver tensile strain capacity more than 200 times greater than other synthetic fiber-reinforced mortars. PVA-ECC actually becomes stronger after the first crack is formed. In tensile or flexural deformation, the material more closely resembles the ductility of aluminum.

Dosages of 11-22 lbs per cubic yard of mix can be used to enhance the structural value of steel reinforcement. The use of PVA-ECC combined with steel reinforcement retards the yielding deformation and reduces hoop reinforcement. In addition, PVA-ECC typically produces multiple micro-cracks. Since these are too small for water to permeate, structural durability is enhanced.

**Benefits of Kuralon RECS15 in Mortar:**

Kuralon RECS15 eliminates the need for conventional steel reinforcement, as well as its attendant labor, time, and costs.

**Applications:**

- New construction and repair of airport aprons and taxiways
- Security and seismic safeguards in new structures and upgrades to existing structures
- Industrial and warehouse slabs
- Tunnel linings
- Architectural and specialty precast shapes
- Repair mortars
- Replacement for glass fiber reinforced cement

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*Helping You Build Smarter and Better.™*

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nycon@nycon.com  
Phones  
800 456 9266  
401 596 3955

March 24, 2010

To Whom it May Concern,

We hereby confirm the PVA-fiber product Kuralon RECS15x8 meets the requirement of ASTM C1116 coming from past technical test data and papers.

The standard specification of this product is as follows:

Material: Polyvinyl alcohol  
Configuration: Chopped fiber  
Color: Yellowish White  
Specific Gravity: 1.3  
Length: 8mm (0.375")  
Tensile Strength: 1600MPa (232,000psi)  
Chemical Stability: Stable  
Absorption: Minimal

Best Regards,



Bob Cruso

Manager

New Nycon, Inc.

Tel 800 456 9266

bcruso@nycon.com