

Table of Contents

Compliance Certificate	A
Construction Photographs	B
Mold Construction	B-1
Canoe Construction	B-5
Finishing Techniques.....	B-9
Hull Thickness and Reinforcement Calculations	C
Hull Thickness Calculations	C-1
Percent Open Area Calculations	C-2
Material Technical Data Sheets (MTDS).....	D
Type I White Portland Cement.....	D-1
Lafarge NewCem® Slag Cement.....	D-2
Vitro Minerals VCAS™ Grade 140 White Pozzolans	D-3
Vitro Minerals VCAS™ Grade 160 White Pozzolans	D-4
Poraver® Glass Spheres	D-5
3M™ Scotchlite Glass Bubbles K1	D-6
Nycon® RECS15 (8mm) PVA.....	D-7
Nycon® RF4000 (30mm) PVA.....	D-8
Xypex® Xycrilic Admix	D-9
BASF Glenium® 3030 NS	D-10
Kevlar® 4009-1	D-11
DOW® Extruded Polystyrene Foam Home Insulation Products	D-12
West System® Epoxy System	D-13
Butterfield Color Elements™ Transparent Concrete Stain.....	D-14
ChemMasters® Crystal Clear-A.....	D-15

COMPLIANCE CERTIFICATE

Michigan Technological University's 2014-2015 Concrete Canoe team hereby certifies that the construction and finishing of *Talvi Sielu* has been completed in compliance with the rules and regulations set forth by the National Concrete Canoe Competition. Additionally, the canoe was 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 *Request for Information (RFI) Summary*.


Registered Members of the 2014-2015 Michigan Tech Concrete Canoe Team

Patricia Andersen	9854068	Taylor Hoensheid	1016298
Kathrine Cipriano	9530423	Sean Kuchta	9854800
Philip Doederlein	9920081	Karl Schlicker	9245768
Chelsea Dubreuil	9854805	Violet Thole	9920076
Mitchell Finnegan	9920791	Taylor Wiegand	9921099

Talvi Sielu Dimensions					
Maximum Length			19'0"		
Maximum Width			27.9"		
Maximum Depth			15.6"		
Nominal Thickness			0.375"		
Overall Weight			140 lbs		
Talvi Sielu Concrete Properties					
	Unit Weight (Density)		14-day Compressive Strength	14-day Tensile Strength	Volumetric Air Content
	Wet	Dry			
Structural	53.9 pcf (863 kg/m ³)	51.5 pcf (825 kg/m ³)	1520 psi (10.5 MPa)	340 psi (2.34 MPa)	1.5%
Finishing	70.0 pcf (1121 kg/m ³)	67.6 pcf (1083 kg/m ³)	1250 psi (8.62 MPa)	225 psi (1.55 MPa)	5.5%
Composite Properties					
14-day Flexural Strength			1460 psi (10.1 MPa)		

We certify that the aforementioned information is valid.

 2/24/15
Date

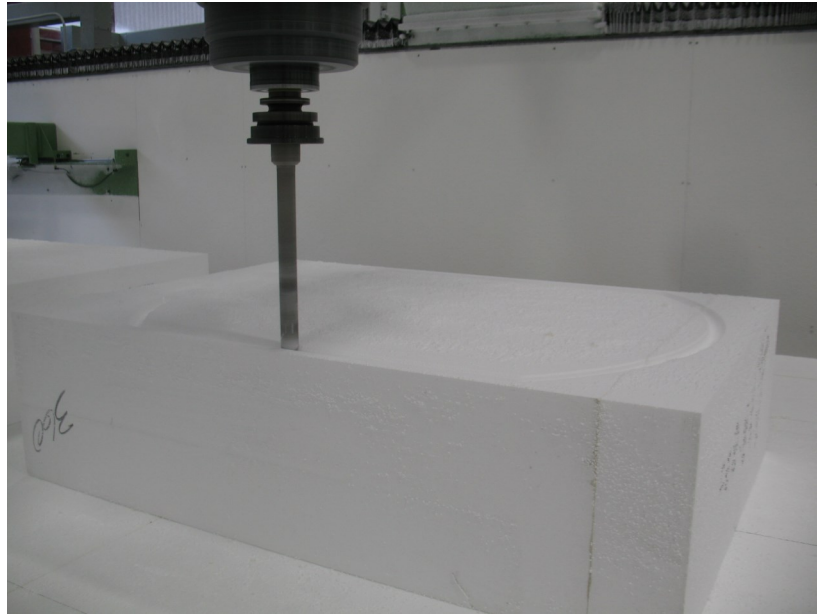
 2/26/15
Date

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MOLD CONSTRUCTION

After engineering the 2014-2015 canoe dimensions, a three-dimensional (3D) model of the canoe was created using NX. The team's CNC milling industry partner used the 3D model to mill a canoe mold to the specified dimensions using 10% pre-consumer recycled high-density polystyrene. The figure to the right demonstrates the milling



The mold was received in six sections and was glued together into two longitudinal sections.



The mold was then properly aligned and secured to a wooden table top to provide stability during casting day.

Epoxy was applied to provide a hardened surface for the application of the release agent and placement of the first layer of concrete.



The figure to the right shows the 1/4" by 8" bolt assembly that was used secure the ends of the mold to prevent centerline separation during



A plywood plate connection was attached to prevent separation of the mold during casting.

Grooves 1" deep were cut into foam strips and a coat of epoxy resin was applied to



Twenty minutes prior to casting, a release agent was applied to the mold.

CANOE CONSTRUCTION



To the left, the troweling team places the first layer of concrete

Four QC/QA members alternated between the eight person troweling team to verify that troweling was to the correct depth. 3D-printed depth gauges were designed to ensure a nominal thickness of 3/8" was met.





Above, the reinforcement team lays the first layer of Kevlar reinforcement. The transverse orientation of the first layer was from gunwale to gunwale.

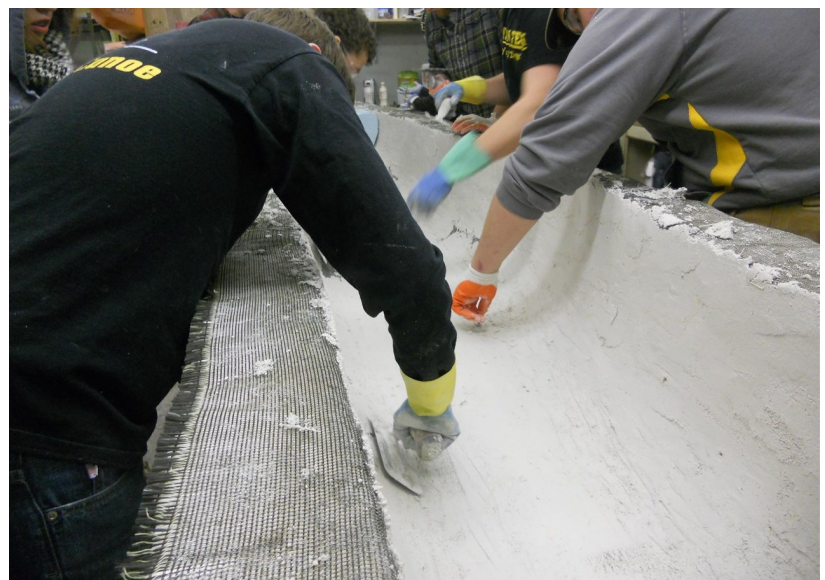
Right, the second layer of concrete is being placed. Concrete was placed over the first layer of reinforcement and then was troweled to the correct





To the left, the second layer of reinforcement is being placed. The second layer of reinforcement was only placed along the bottom to prevent failure from punching shear.

Below, the third layer of concrete is being placed. Concrete was securely placed over the second layer of reinforcement and then troweled to thickness.



The picture to the right shows the construction of the gunwale caps. The foam molds were secured using clamps. The first layer of concrete was placed, followed by a strip of reinforcement, and then a second layer of concrete. Trowels were used to finish the



After construction of the main part of *Talvi Sielu*, foam was inserted into the bow and stern for floatation, as seen in the figure to the left. The foam was then encased in concrete.

FINISHING TECHNIQUES



Once *Talvi Sielu* had cured, the mold was removed and a finishing mix was applied for patching. This was this was also performed to achieve a uniform thickness.

After the finishing mix cured, *Talvi Sielu* was sanded using a technique called honing to provide a smooth canvas for aesthetic staining.





Water based stains were applied to both the interior and exterior of the hull to make *Talvi Sielu* aesthetically pleasing. The designs were created by masking the canoe with tape and cutting out the designs with a knife. The stain was then applied by hand with varying brush sizes or with an air brush.

Image to be inserted
upon completion.

The entire canoe will be sealed according to rules a week before competition to allow a full cure. The aesthetics process will be completed the design and construction of *Talvi Sielu*.

HULL THICKNESS CALCULATIONS

Calculations per Section 4.3.1

Annotation

$T_1 = .013375$ in Average thickness of first layer of reinforcement, Kevlar® 4009-1, measured in accordance with Section 4.3.1

$T_2 = .013375$ in Average thickness of second layer of reinforcement, Kevlar® 4009-1, 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

Within the canoe a maximum of two layers of Kevlar® 4009-1 was used along the bottom of the canoe. The two layers of reinforcement make up approximately 7.13% of the hull. This value is less than the maximum value of 50% outlined in section 4.3.1, demonstrating compliance.

$$\frac{T_1 + T_2}{T_h} * 100 = 7.13 \%$$

GUNNEL CAP THICKNESS CALCULATIONS

Calculations per Section 4.3.1

Annotation

$T_1 = .013375$ in Average thickness of first layer of reinforcement, Kevlar® 4009-1, measured in accordance with Section 4.3.1

$T_h = 1.0$ in Nominal thickness of the gunnel cap

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

Solution

Two layers of Kevlar® 4009-1 were used throughout the gunnel cap.

The two layers of reinforcement make up approximately 1.33% of the gunnel cap. This value is less than the maximum value of 50% outlined in section 4.3.1, demonstrating compliance.

$$\frac{T_1}{T_h} * 100 = 1.33\%$$

PERCENT OPEN AREA CALCULATIONS

Calculations per Section 4.3.2

Sample: Kevlar® 4009-1

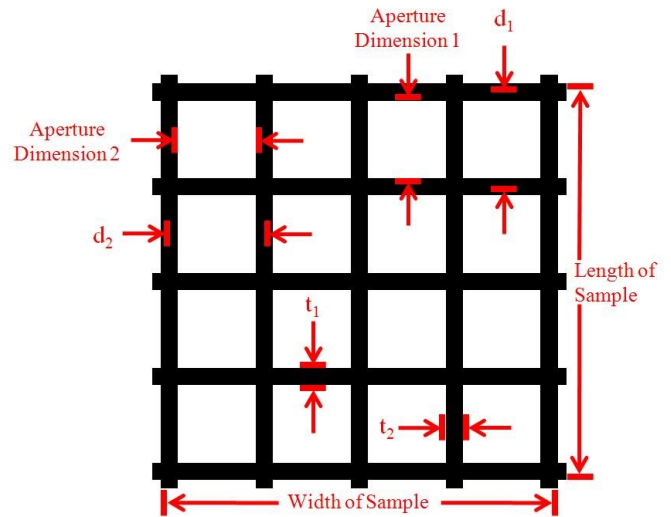
Given

$n_1 = 6$ Number of apertures along length

$n_2 = 6$ Number of apertures along width

$t_1 = .03675$ in Average thickness of reinforcement along length

$t_2 = .04283$ in Average thickness of reinforcement along width



Sample of Reinforcement

Aperture_Dimension_1 = .08617 in

Aperture_Dimension_2 = .09492 in

$d_1 = \text{Aperture_Dimension_1} + 2*(t_1/2)$ $d_1 = .12292$ in

Average spacing of reinforcement (center-to-center) along the sample length.

$d_2 = \text{Aperture_Dimension_2} + 2*(t_2/2)$ $d_2 = .13775$ in

Average spacing of reinforcement (center-to-center) along the sample width.

Determine Percent Open Area (POA) for the Kevlar® 4009-1 reinforcement.

Solution

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

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

$$\text{Length}_{\text{Sample}} = .7375 \text{ in}$$

$$\text{Width}_{\text{Sample}} = .8265 \text{ in}$$

$$\text{Area}_{\text{Open}} = n_1 * n_2 * \text{Aperture_Dimension_1} * \text{Aperture_Dimension_2}$$

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

$$\text{Area}_{\text{Open}} = .2944 \text{ in}^2$$

$$\text{Area}_{\text{Total}} = .6095 \text{ in}^2$$

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

$$\text{POA} = 48.30\%$$

The POA is greater than the 40% minimum required, demonstrating compliance.



NewCem[®] Brand Slag Cement

LAFARGE

NewCem slag cement is engineered for strength and durability. Benefits start at the pour with easier workability, improved pumpability and less heat at hydration. NewCem delivers higher 28-day strengths, reduced permeability and increased resistance to chemical attack. As a "green" product, NewCem is also the environmentally friendly choice.

Product Description

NewCem is a ground granulated blast furnace slag (GGBFS).

Applicable Specifications

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*.

General Statement

NewCem is generally used in varying percentages as a portland cement replacement in concrete and mortars. Higher ultimate strengths, improved durability, economics and aesthetics are potential reasons for using NewCem. As with most cementitious products, care is needed when proportioning, batching, placing, finishing and curing concrete containing this product.

NewCem and the Environment

NewCem is a by-product material that is derived from the iron-making process. 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 partly replaces portland cement in concrete. NewCem can also be used to achieve LEED (Leadership in Energy and Environmental Design) points in the USGBC's (U.S. Green Building Council) LEED Program.





NEWCEM®

Properties of "Fresh Concrete"

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 above 60% 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* be followed.

Properties of "Hardened Concrete"

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.

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* and ACI 301 *Specifications for Structural Concrete* 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.

Product Name

NewCem®

Manufacturer

Lafarge North America Inc.
12950 Worldgate Drive, Suite 500
Herndon, Virginia 20170
www.lafargenorthamerica.com

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.

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 NewCem meets the requirements of ASTM C 989, AASHTO M302 and CSA A3000. Lafarge makes no other warranty, whether of merchantability, or fitness for a particular purpose with respect to Lafarge NewCem. Having no control over its use, Lafarge will not guarantee finished work in which Lafarge NewCem is used.



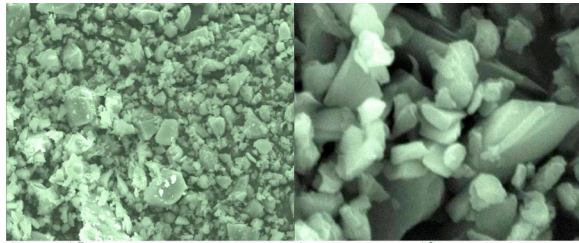
**Custom-engineered, high performance, pozzolanic mineral additives
for use in white cement, mortar, and concrete products**

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.

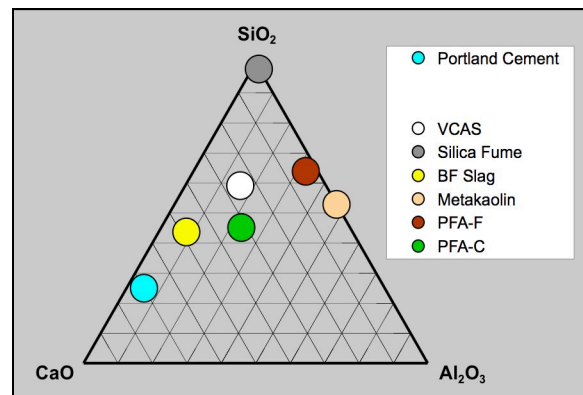


Unlike silica fume, coal fly ash, ground granulated blast furnace slag, and other by-products, VCAS™ pozzolans are free of iron, manganese, and other undesirable color-inducing impurities, making them ideally suited for all applications using white cement and in pigmented concrete.

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 ₂	50–55%	Titania, TiO ₂	< 1%
Alumina, Al ₂ O ₃	15–20%	Phosphorus oxide, P ₂ O ₅	< 0.1%
Iron oxide, Fe ₂ O ₃	< 1%	Manganese oxide, MnO	< 0.01%
Calcium, CaO	20–25%	Boron oxide, B ₂ O ₃	0–6%
Magnesia, MgO	< 1%	Sulphur oxide, SO ₃	< 0.1%
Sodium oxide, Na ₂ O	< 1%	Chloride, Cl	< 0.01%
Potassium oxide, K ₂ 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-SiO₂-Al₂O₃ 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-SiO₂-Al₂O₃) 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 ³	50-55	50-55	45-50
Passing No. 325 Mesh, %	95	95	98
Specific Surface Area, cm ² /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:

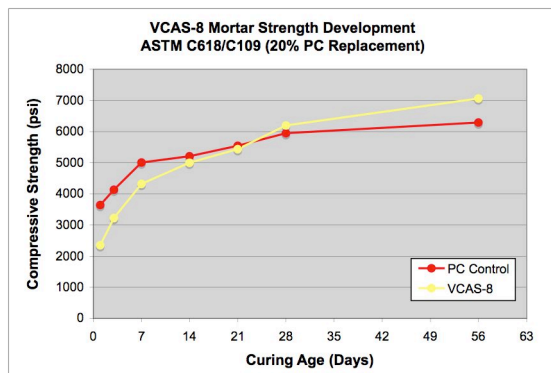
- Increased compressive strength
- Decreased permeability
- Increased durability

Added-Value:

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

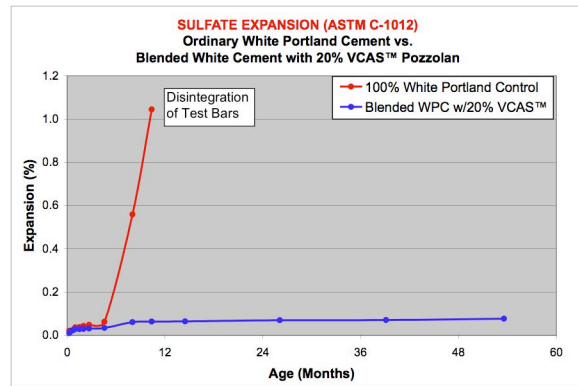
Performance

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.

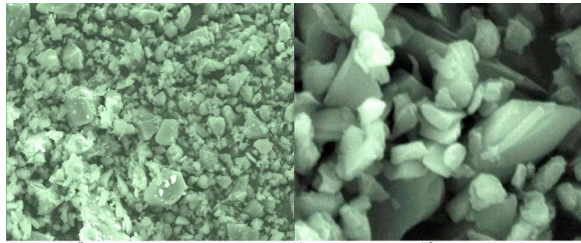
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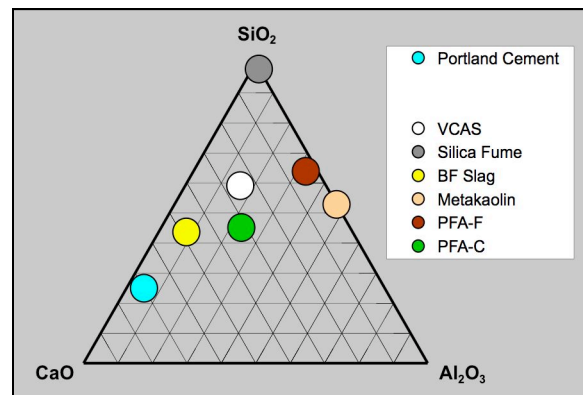


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VCAS™ pozzolans are value-added supplementary cementing materials that exhibit pozzolanic activity comparable to silica fume and metakaolin when tested in accordance with ASTM C618 and ASTM C1240. VCAS™ pozzolans react with calcium hydroxide produced 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.

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Iron oxide, Fe ₂ O ₃	< 1%	Manganese oxide, MnO	< 0.01%
Calcium, CaO	20–25%	Boron oxide, B ₂ O ₃	0–6%
Magnesia, MgO	< 1%	Sulphur oxide, SO ₃	< 0.1%
Sodium oxide, Na ₂ O	< 1%	Chloride, Cl	< 0.01%
Potassium oxide, K ₂ O	< 0.2%	Loss on ignition, LOI	< 0.5%

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Bulk Density, Loose lb/ft ³	50-55	50-55	45-50
Passing No. 325 Mesh, %	95	95	98
Specific Surface Area, cm ² /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:

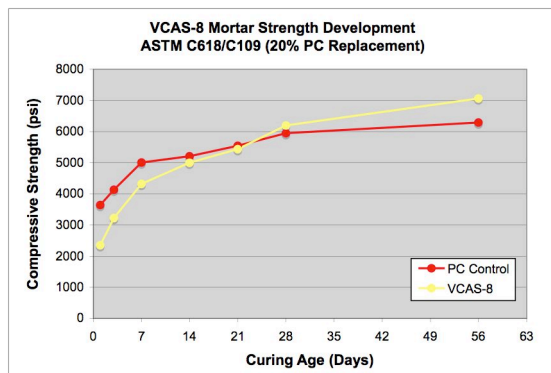
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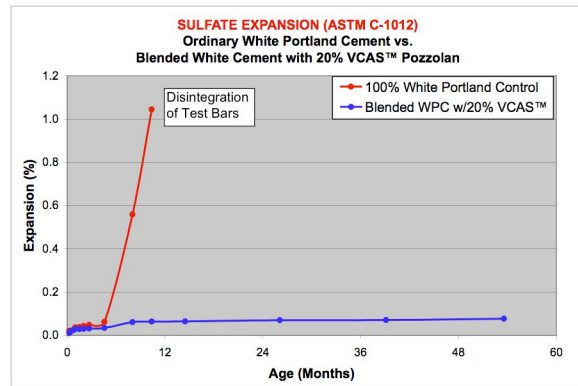
Performance

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										
Bulk density lb/ft ³ 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 ³ 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[®] 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/ft³.

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 ³	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 ³	33.1	33.1	16.2	8.7

The following deviations from the given DIN apply:

- ▶ There is no drying, because Poraver[®] 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 (ρ) 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 (Vs) into the measuring cylinder to prevent granular material from floating to the surface. After reading off the total volume (V) in cm³, you can calculate the granular density in lb/ft³ by using the following formula:

Calculation formula:

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

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 lb/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 lb/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[®] 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[®] 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_w - Mass of water absorbed [g]
M_{tr} - Mass of sample dry [g]
KRD - Apparent granular density [kg/m³]

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[®] 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 ₂	71.7	71.9	
5	Al ₂ O ₃	2.5	2.5	
6	TiO ₂	0.1	0.1	
7	Fe ₂ O ₃	0.4	0.4	
8	Mn ₂ O ₃	0	0	
9	MgO	2.1	2.1	
10	K ₂ O	0.8	0.8	
11	Na ₂ O	13.2	13.2	
12	SO ₃	0.1	0.1	
13	Cl	–	–	argentometric
14	Remaining	– 0.1	– 0.1	–
15	Total 1, 3–14	100.0	100.0	–
16	Na ₂ 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

3M™ Glass Bubbles K Series, S Series and iM Series

Introduction

3M™ Glass Bubbles are engineered hollow glass microspheres that are alternatives to conventional fillers and additives such as silicas, calcium carbonate, talc, clay, etc., for many demanding applications. These low-density particles are used in a wide range of industries to reduce part weight, lower costs and enhance product properties.

The unique spherical shape of 3M glass bubbles offers a number of important benefits, including: higher filler loading, lower viscosity/improved flow and reduced shrinkage and warpage. It also helps the 3M glass bubbles blend readily into compounds and makes them adaptable to a variety of production processes including spraying, casting and molding.

The chemically stable soda-lime-borosilicate glass composition of 3M glass bubbles provides excellent water resistance to create more stable emulsions. They are also non-combustible and non-porous, so they do not absorb resin. And, their low alkalinity gives 3M glass bubbles compatibility with most resins, stable viscosity and long shelf life.

3M Glass Bubbles K Series, S Series and iM Series are specially formulated for a high strength-to-weight ratio. This allows greater survivability under many demanding processing conditions, such as injection molding. They also produce stable voids, which results in low thermal conductivity and a low dielectric constant. 3M glass bubbles are available in a variety of sizes and grades to help you meet your product and processing requirements.

Typical Properties

Not for specification purposes

Isostatic Crush Strength

	Product	Test Pressure (psi)	Target Fractional Survival	Minimum Fractional Survival
K Series	K1	250	90%	80%
	K15	300	90%	80%
	K20	500	90%	80%
	K25	750	90%	80%
	K37	3,000	90%	80%
	K46	6,000	90%	80%
S Series	S15	300	90%	80%
	S22	400	90%	80%
	S32	2,000	90%	80%
	S35	3,000	90%	80%
	S38	4,000	90%	80%
	S38HS	5,500	90%	80%
	S60	10,000	90%	80%
	S60HS	18,000	90%	90%
iM Series	iM16K	16,000	90%	90%
	iM30K	28,000	90%	90%

True Density

	Product	True Density (g/cc)		
		Typical	Minimum	Maximum
K Series	K1	0.125	0.10	0.14
	K15	0.15	0.13	0.17
	K20	0.20	0.18	0.22
	K25	0.25	0.23	0.27
	K37	0.37	0.34	0.40
	K46	0.46	0.43	0.49
S Series	S15	0.15	0.13	0.17
	S22	0.22	0.19	0.25
	S32	0.32	0.29	0.35
	S35	0.35	0.32	0.38
	S38	0.38	0.35	0.41
	S38HS	0.38	0.35	0.41
	S60	0.60	0.57	0.63
	S60HS	0.60	0.57	0.63
iM Series	iM16K	0.46	0.43	0.49
	iM30K	0.60	0.57	0.63



Typical Properties

Chemical Resistance

In general, the chemical properties of 3M™ Glass Bubbles resemble those of a soda-lime-borosilicate glass.

Thermal Conductivity

Product	Calculated Thermal Conductivity (W-m-1-K-1) at 70°F (21°C)	
K Series	K1	0.047
	K15	0.055
	K20	0.070
	K25	0.085
	K37	0.124
	K46	0.153
S Series	S15	0.055
	S22	0.076
	S32	0.108
	S35	0.117
	S38	0.127
	S38HS	0.127
	S60	0.200
	S60HS	0.200
iM Series	iM16K	0.153
	iM30K	0.200

Conductivity increases with temperature and product density. The thermal conductivity of a composite will depend on the matrix material and volume loading of 3M glass bubbles.

Thermal Stability

Appreciable changes in bubble properties may occur above 1112°F (600°C) depending on temperature and duration of exposure.

Flotation

Product	Floaters (% by bulk volume)		
	Typical	Minimum	
K Series	K1	96%	90%
	K15	96%	90%
	K20	96%	90%
	K25	96%	90%
	K37	94%	90%
	K46	92%	90%
S Series	S15	96%	90%
	S22	96%	90%
	S32	94%	90%
	S35	96%	90%
	S38	94%	90%
	S38HS	96%	90%
	S60	92%	90%
	S60HS	92%	90%
iM Series	iM16K	96%	90%
	iM30K	92%	90%

Packing Factor (Ratio of bulk density to true particle density)

Averages about 60%.

Oil Absorption

0.2–0.6 g oil/cc of 3M glass bubbles, per ASTM D281-84.

Volatile Content

Maximum of 0.5 percent by weight.

Alkalinity

Maximum of 0.5 milliequivalents per gram

pH

Because 3M glass bubbles are a dry powder, pH is not defined. The pH effect will be determined by the alkalinity as indicated above.

When 3M glass bubbles are mixed with deionized water at 5% volume loading, the resulting pH of the slurry is typically 9.1 to 9.9, as measured by a pH meter.

Dielectric Constant

K Series: 1.2 to 1.7 @ 100 MHz, based on theoretical calculations.

S Series: 1.2 to 2.0 @ 100 MHz, based on theoretical calculations.

iM Series: 1.2 to 1.7 @ 100 MHz, based on theoretical calculations

The dielectric constant of a composite will depend on the matrix material and volume loading of 3M glass bubbles.

Particle Size

Product	Particle Size (microns, by volume) 3M QCM 193.0				
	Distribution			Effective Top Size	
	10th%	50th%	90th%		
K Series	K1	30	65	115	120
	K15	30	60	105	115
	K20	30	60	90	105
	K25	25	55	90	105
	K37	20	45	80	85
	K46	15	40	70	80
S Series	S15	25	55	90	95
	S22	20	35	65	75
	S32	20	40	70	80
	S35	20	40	65	80
	S38	15	40	75	85
	S38HS	19	44	70	85
	S60	15	30	55	65
	S60HS	12	29	48	60
iM Series	iM16K	12	20	30	40
	iM30K	8.6	15.3	23.6	26.7

Particle Size (continued)

Hard Particles (3M QCM 93.4.3)

No hard particles (e.g. glass slag, flow agent, etc.) greater than U.S. number 40 (420 microns) standard sieve will exist.

Oversize Particles (3M QCM 93.4.4)

For *K1*, *K15*, *K20* and *K25* glass bubbles:

Using a 10 gram sample on a U.S. number 80 standard sieve (177 microns), a maximum of five (5) percent by weight glass bubbles will be retained on the sieve.

For *K37* and *K46* glass bubbles:

Using a 10 gram sample on U.S. number 100 standard sieve (149 microns), a maximum of one (1) percent by weight glass bubbles will be retained on the sieve.

For *S15*, *S32*, *S35*, *S38*, *S38HS*, *S60*, *S60HS*, *iM16K* and *iM30K* glass bubbles:

Using a 10 gram sample on a U.S. number 140 standard sieve (105 microns), a maximum of three (3) percent by weight glass bubbles will be retained on the sieve.

For *S22* glass bubbles:

Using a 10 gram sample on a U.S. number 200 standard sieve (74 microns), a maximum of five (5) percent by weight glass bubbles will be retained on the sieve.

Appearance (3M QCM 22.85)

White to the unaided eye.

Flow (3M QCM 22.83)

3M™ Glass Bubbles remain free flowing for at least one year from the date of shipment if stored in the original, unopened container in the minimum storage conditions of an unheated warehouse.

Labeling

3M glass bubbles will be packaged in suitable containers to help prevent damage during normal handling and shipping. Each container will be labeled with:

1. Name of manufacturer
2. Type of 3M glass bubbles
3. Lot number
4. Quantity in pounds

Storage and Handling

To help ensure ease of storage and handling while maintaining free flowing properties, 3M™ Glass Bubbles have been made from a chemically stable glass and are packaged in a heavy-duty polyethylene bag within a cardboard container.

Minimum storage conditions should be unopened cartons in an unheated warehouse.

Under high humidity conditions with an ambient temperature cycling over a wide range, moisture can be drawn into the bag as the temperature drops and the air contracts. The result may be moisture condensation within the bag. Extended exposure to these conditions may result in “caking” of the 3M glass bubbles to various degrees. To minimize the potential for “caking” and prolong the storage life, the following suggestions are made:

1. Carefully re-tie open bags after use.
2. If the polyethylene bag is punctured during shipping or handling, use this bag as soon as possible, patch the hole, or insert the contents into an undamaged bag.
3. During humid summer months, store in the driest, coolest space available.
4. If good storage conditions are unavailable, carry a minimum inventory, and process on a first in/first out basis.

Dusting problems that may occur while handling and processing can be minimized by the following procedures:

1. For eye protection wear chemical safety goggles. For respiratory system protection wear an appropriate NIOSH/MSHA approved respirator. (For additional information about personal protective equipment, refer to Material Safety Data Sheet.)
2. Use appropriate ventilation in the work area.
3. Pneumatic conveyor systems have been used successfully to transport 3M glass bubbles without dusting from shipping containers to batch mixing equipment. Static eliminators should be used to help prevent static charges.

Diaphragm pumps have been used to successfully convey 3M glass bubbles. Vendors should be consulted for specific recommendations.

3M glass bubble breakage may occur if the product is improperly processed. To minimize breakage, avoid high shear processes such as high speed Cowles Dissolvers, point contact shear such as gear pumps or 3-roll mills, and processing pressures above the strength test pressure for each product.

Health and Safety Information

For product Health and Safety Information, refer to product label and Material Safety Data Sheet (MSDS) before using product.

Packaging Information

Small Box (10 Cubic ft.)

A single corrugated box with a plastic liner. All boxes are banded together and to the wooden pallet. 4 boxes per pallet.

Each box inside diameter is 22 in. × 19 in. × 39 in.

Pallet size is 42 in. × 48 in.

Large Box (50 Cubic ft.)*

A single corrugated box with a plastic liner. Top enclosed with interlocking double cover banded. Bottom is normal box closure, entire box banded to wooden pallet.

Each box inside diameter is 48 in. × 42 in. × 44 in. Overall load size is 48³/₄ in. × 42³/₄ in. × 50 in. including pallet.

Pallet size is 42 in. × 48 in.

*S60 and S60HS large boxes are 38 cubic ft.

Resources

3M™ Glass Bubbles are supported by global sales, technical and customer service resources, with fully-staffed technical service laboratories in the U.S., Europe, Japan, Latin America and Southeast Asia. Users benefit from 3M's broad technology base and continuing attention to product development, performance, safety and environmental issues.

For additional technical information on 3M glass bubbles in the United States, call 3M Advanced Materials Division, **800-367-8905**. For other 3M global offices, and information on additional 3M products, visit our website at: www.3M.com/engineeredadditives.

Box Weights

	Product	Small Box	Large Box*	Truckload Large Box* 44 Pallets
K Series	K1	40 lb.	210 lb.	9,240 lb.
	K15	50 lb.	265 lb.	11,660 lb.
	K20	60 lb.	350 lb.	15,400 lb.
	K25	80 lb.	430 lb.	18,920 lb.
	K37	100 lb.	660 lb.	29,040 lb.
	K46	125 lb.	815 lb.	35,860 lb.
S Series	S15	50 lb.	265 lb.	11,660 lb.
	S22	60 lb.	385 lb.	16,940 lb.
	S32	100 lb.	525 lb.	23,100 lb.
	S35	100 lb.	630 lb.	27,720 lb.
	S38	100 lb.	680 lb.	29,920 lb.
	S38HS	100 lb.	680 lb.	29,920 lb.
	S60	125 lb.	850 lb.	37,400 lb.
	S60HS	125 lb.	850 lb.	37,400 lb.
iM Series	iM16K	99 lb.	800 lb.	—
	iM30K	125 lb.	850 lb.	37,400 lb.

*Box weights may vary due to manufacturing tolerances on each product.

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NYCON-PVA RECS15
PVA (Polyvinyl Alcohol), Small Denier, Superior Bond



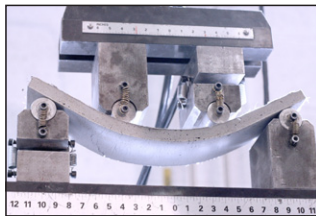
ULTRA-HIGH PERFORMANCE FIBERS

PVA fibers are unique in their ability to create a fully-engaged molecular bond with mortar and concrete that is **300% greater** than other fibers.



NYCON-PVA RECS15 Physical Properties

Filament Diameter	8 Denier (38 Microns)
Fiber Length	0.375" (8mm)
Specific Gravity	1.3
Tensile Strength	240 ksi (1600 MPa)
Flexural Strength	5700 ksi (40 GPa)
Melting Point	435° F (225° C)
Color	White
Water Absorption	<1% by Weight
Alkali Resistance	Excellent
Concrete Surface	Not Fuzzy
Corrosion Resistance	Excellent



Description

NYCON-PVA RECS15 fiber products are 8 denier, monofilament PVA fibers for use in fiber reinforced concrete, stucco and precast. NYCON-PVA RECS15 is specifically designed for use in concrete products for the purpose of controlling plastic shrinkage, thermal cracking and improving abrasion resistance. When NYCON-PVA RECS15 is used at high doses it can dramatically improve flexural characteristics of concrete products.

NYCON-PVA RECS15 meets the requirements of ASTM C-1116, Section 4.1.3 and AC-32 at 1.0 lb (0.45 kg) per CY.

Applications

NYCON-PVA utilizes the mixing activity to disperse the fibers into the mix. NYCON-PVA acts with a molecular bond in the concrete with a multi-dimensional fiber network. NYCON-PVA does not affect curing process chemically.

NYCON-PVA can be used in all types of concrete. Synthetic fibers help the concrete at early ages, which is especially beneficial where stripping time and handling is important.

NYCON-PVA RECS15

PVA (Polyvinyl Alcohol), Small Denier, Superior Bond



Advantages/Benefits	<ul style="list-style-type: none">• Molecular bond with the concrete• Reduces the formation of plastic shrinkage cracking in concrete.• Provides multi-dimensional reinforcement.• Improves impact, shatter and abrasion resistance of concrete.• Enhances durability and toughness of concrete.• Excellent, "no fuzz" finishability
Mixing	NYCON-PVA RECS15 can be added directly to the mixing system during or after the batching of the ingredients and mixed at high speed for a minimum of five minutes. Additional mixing does not adversely affect the distribution or overall performance of NYCON-PVA. The addition of NYCON-PVA at the normal or high dosage rate does not require any mix design or application changes. A water reducer or super-plasticizer is recommended in concrete products where improved workability and finishability are desired.
Tooling & Finishing	Fiber reinforced concrete can be finished by most finishing techniques. NYCON-PVA does not affect the finishing characteristics of concrete. NYCON-PVA can be used in power/hand troweled concrete, colored and broom finished concrete. NYCON-PVA can be pumped and placed using conventional equipment. Hand screeds can be used, but vibratory and laser screeds are recommended to provide added compaction and bury surface fibers.
Packaging	(30) 1 lb (0.45 kg) paper beater bags per box, 600 lbs per pallet (30) 1 lb (0.45 kg) Melt-Away® bags per box, 600 lbs per pallet (21) 40 lb (18 kg) paper bulk bags, 840 lbs per pallet NYCON-PVA Fibers are packaged in pre-measured 1 lb (0.45kg) degradable "toss-in" paper beater bags, Nycon Melt-Away® Bags or bulk bags.
Storage and Shelf Life	NYCON-PVA should be stored in dry warehouse. Protect product from the rain.

KEEP CONTAINER TIGHTLY CLOSED - KEEP OUT OF REACH OF CHILDREN - NOT FOR INTERNAL CONSUMPTION - FOR INDUSTRIAL USE ONLY

All information provided by Nycon Corporation concerning Nycon products, including but not limited to, any recommendations and advice relating to the application and use of Nycon products, is given in good faith based on Nycon's current experience and knowledge of its products when properly stored, handled and applied under normal conditions in accordance with Nycon's instructions. In practice, the differences in materials, substrates, storage and handling conditions, actual site conditions and other factors outside of Nycon's control are such that Nycon assumes no liability for the provision of such information, advice, recommendations or instructions related to its products, nor shall any legal relationship be created by or arise from the provision of such information, advice, recommendations or instructions related to its products. The user of the Nycon product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with the full application of the product(s).

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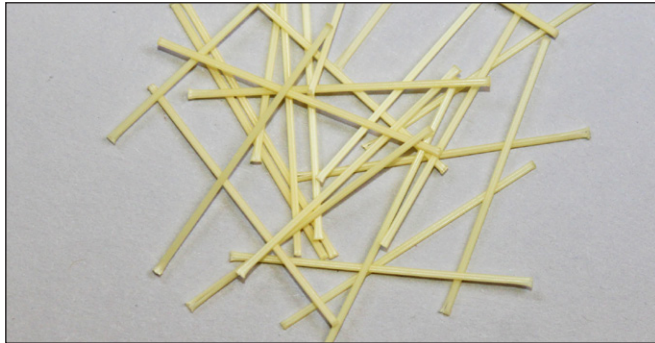
Nycon warrants this product for one year from date of shipment to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor.

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NYCON-PVA RF4000

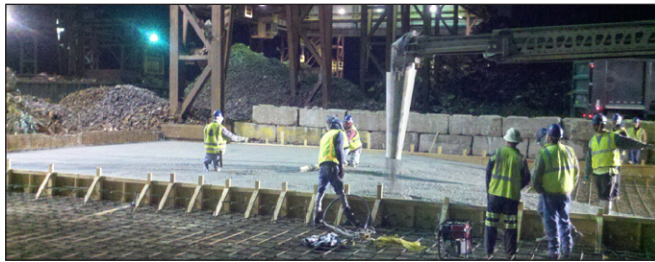
PVA (Polyvinyl Alcohol), Large Denier Macro, Superior Bond



ULTRA-HIGH PERFORMANCE FIBERS

PVA fibers are unique in their ability to create a fully-engaged molecular bond with mortar and concrete that is **300% greater** than other fibers.

Nycon-PVA RF4000 is a component of the Nycon TUFF-SLAB™ blend.



NYCON-PVA RF4000 Physical Properties

Filament Diameter	130 Denier (660 Microns)
Fiber Length	1.25" (30 mm)
Specific Gravity	1.3
Tensile Strength	120 ksi (800 MPa)
Flexural Strength	3300 ksi (23 GPa)
Melting Point	435° F (225° C)
Color	Yellow
Water Absorption	<1% by Weight
Alkali Resistance	Excellent
Concrete Surface	Not Fuzzy
Corrosion Resistance	Excellent



Description

NYCON-PVA RF4000 fiber products are 130 denier, monofilament PVA fibers for use in fiber reinforced concrete, shotcrete, TUFF-SLAB™ and precast. NYCON-PVA RF4000 is specifically designed for use in concrete products for the purpose of controlling plastic shrinkage, thermal cracking and improving abrasion resistance.

NYCON-PVA RF4000 meets the requirements of ASTM C-1116, Section 4.1.3 and AC-32 at 1.0 lb (0.45 kg) per CY.

Applications

NYCON-PVA utilizes the mixing activity to disperse the fibers into the mix. NYCON-PVA acts with a molecular bond in the concrete with a multi-dimensional fiber network. NYCON-PVA does not affect curing process chemically.

NYCON-PVA can be used in all types of concrete. NYCON-PVA RF4000 at 6 lb (2.7 kg) per CY is the macro fiber and NYCON-PVA RSC15 at 3 lbs (1.35 kg) per CY is the micro fiber used together in Nycon's TUFF-SLAB™ product.

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NYCON-PVA RF4000

PVA (Polyvinyl Alcohol), Large Denier Macro, Superior Bond



Advantages/Benefits	<ul style="list-style-type: none">• Molecular bond with the concrete• Reduces the formation of plastic shrinkage cracking in concrete.• Provides multi-dimensional reinforcement.• Improves impact, shatter and abrasion resistance of concrete.• Enhances durability and toughness of concrete.• Excellent, "no fuzz" finishability
Mixing	NYCON-PVA RF4000 can be added directly to the mixing system during or after the batching of the ingredients and mixed at high speed for a minimum of five minutes. Additional mixing does not adversely affect the distribution or overall performance of NYCON-PVA. The addition of NYCON-PVA at the normal or high dosage rate does not require any mix design or application changes. A water reducer or super-plasticizer is recommended in concrete products where improved workability and finishability are desired.
Tooling & Finishing	Fiber reinforced concrete can be finished by most finishing techniques. NYCON-PVA does not affect the finishing characteristics of concrete. NYCON-PVA can be used in power/hand troweled concrete, colored and broom finished concrete. NYCON-PVA can be pumped and placed using conventional equipment. Hand screeds can be used, but vibratory and laser screeds are recommended to provide added compaction and bury surface fibers.
Packaging	(30) 1 lb (0.45 kg) paper beater bags per box, 600 lbs per pallet (30) 1 lb (0.45 kg) Melt-Away® bags per box, 600 lbs per pallet (21) 22 lb (10 kg) paper bulk bags, 462 lbs per pallet
Storage and Shelf Life	NYCON products should be stored in dry warehouse. Protect product from the rain.

KEEP CONTAINER TIGHTLY CLOSED - KEEP OUT OF REACH OF CHILDREN - NOT FOR INTERNAL CONSUMPTION - FOR INDUSTRIAL USE ONLY

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Nycon warrants this product for one year from date of shipment to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor.

NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Nycon SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. Nycon SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.

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XYCRYLIC ADMIX

03900 | PATCHING & RESURFACING

Concrete Restoration

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 1 U.S. gallon (3.79 litre) bottles and 5 U.S. gallon (18.95 litre) pails.

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	
C-190-85 Tensile Strength	610 4.2	440 3.0	375 2.6	235 1.6	psi MPa
C-109-88 Compressive Strength	5700 39.3	4530 31.2	3830 26.4	2390 16.5	psi MPa
C-348-86 Flexural Strength	1570 10.8	1130 7.8	960 6.6	610 4.2	psi MPa
Shear Bond Adhesion	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 Services 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.



13731 Mayfield Place, Richmond, BC, Canada V6V 2G9 Toll-free: 1.800.961.4477
Tel: 604.273.5265 Fax: 604.270.0451 E-mail: info@xypex.com Web: www.xypex.com
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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/yd³ of Type I cement (360 kg/m³); 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.

BASF Construction Chemicals
Admixture Systems

www.masterbuilders.com

United States 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5544 • Tel: 800 628-9990 • Fax: 216 839-8821
Canada 1800 Clark Boulevard, Brampton, Ontario L6T 4M7 • Tel: 800 387-5862 • Fax: 905 792-0651

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**Master
Builders**



2512 - 2516 - 2520 W. WOODLAND DRIVE • ANAHEIM, CA, 92801

DATE : November 14, 2011

CERTIFICATION OF CONFORMANCE No. 11- 1284

CUSTOMER:	MICHIGAN TECHNOLOGICAL UNIVERSITY
P.O.#:	VERBAL - ANGELA
SPECIFICATION #:	MS80002 REV. N/C
TPI STYLE #:	4009-1
TPI LOT#:	10844
WARP & FILL FIBER:	T300B-3K-40A TWISTED KEVLAR 49 195 DN. / T300B-3K-40B
WARP & FILL LOTS #:	J4111F2, J4111G1
LENO FIBER:	195 DN. KEVLAR
FABRIC CONSTRUCTION:	LENO
COUNT:	8.1 X 8.0
AREAL WEIGHT (G/M ²):	135
FABRIC WIDTH (IN.):	51.19
ROLL #s:	24
ROLL LENGTH (YARDS):	20
TOTAL YARDS:	20

BY:
Quality Control Manager *For*



Toray Carbon Fibers America, Inc.

P.O. Box 248
 Decatur, Alabama 35602
 TEL: (256) 260-2626
 FAX: (256) 260-2627

CERTIFICATE

Torayca Carbon Fiber

CUSTOMER	: CYTEC ENGINEERED MATERIALS
CFA REFERENCE NO.	: A-TC-11-1032
CUSTOMER ORDER NUMBER	: 305025399 ✓
PRODUCT	: T300-3000-40A 200KE3 A ✓
QUANTITY (KG)	: 1824
PLACE MANUFACTURED	: Japan <i>5/2 2YR'S DOM</i>
MFG DATE	: Jul-11 <i>7-1-13 ✓</i>

Based on random samplings, listed are the average physical properties of the lots included in this shipment.

LOT NO. ✓	YIELD G/M ✓	FIBER	TENSILE STRENGTH KSI ✓	*SACMA - YOUNG'S	YOUNG'S	ELONGATION % ✓	SIZING (WT %) ✓
		DENSITY G/CC ✓		MODULUS MSI ✓	MODULUS MSI ✓		
J4111G1 ✓	Avg 0.199 ✓	1.77 ✓	566 ✓	33.1 ✓	34.3 ✓	1.7 ✓	1.0 ✓
	CV% 1.1	0.2	2.5		1.0	2.3	5.2
	N = 65	65	65		65	65	65
	Min 0.194	1.76	530 ✓		33.6	1.6 ✓	0.9
	Max 0.204	1.78	596 ✓		34.8	1.7	1.2

* SACMA - YOUNG'S MODULUS IS FOR REFERENCE.

The material shipped on this order is in compliance with:
 PRS 30101853 Rev B, SMS 47 Issue 5, (Type 1/Class 1/Grade 3);
 BMS 9-8 Rev.K, (Type 1/Class 1/Grade 3) ✓

The specified Lot(s) meet the twist requirement of 0 - 0.8 tpi ✓
 Sizing Type 4 is equivalent to UC-309. ✓
 The material was tested in a GE approved S450 lab. ✓



Nancy E. Vancil
 Nancy E. Vancil

300034062
 0001-0013



Manager, Quality Assurance
 Decatur, Toray Carbon Fibers America

AUG 22 2011



Manufacturer's Insulation Fact Sheet

Extruded Polystyrene Foam Home Insulation Products

This fact sheet contains important information about STYROFOAM™ brand insulation, BLUECOR™ brand Underlayment and DOW High Performance Underlayment insulation. These products, available from Dow Building Solutions, are made of extruded polystyrene foam insulation and are clearly identified by the DOW Diamond Logo.

Aged R-Value (Measured at 75° Mean Temperature)

Product Thickness (nominal inches)	0.38	1/4	3/8	1/2	0.55	5/8	3/4	0.78	1	1 1/2	2	2 1/2	3
STYROFOAM™ Brand Square Edge Insulation	-	-	-	-	2.8*	-	3.8	4.0*	5.0	7.5	10.0	-	-
STYROFOAM™ Brand Tongue & Groove Insulation	-	-	-	-	-	-	3.8	-	5.0	7.5	10.0	-	-
STYROFOAM™ Brand Residential Sheathing	-	-	-	3.0	-	-	4.0	-	5.0	-	-	-	-
STYROFOAM™ Brand Residing Board	-	-	-	2.8	-	-	-	-	-	-	-	-	-
STYROFOAM™ UTILITYFIT™ PSI 15	-	-	-	-	-	-	-	-	5.0	7.5	10.0	-	-
STYROFOAM™ DURAMATE™ Plus Brand Insulation	2.0	-	-	3.0	-	-	-	-	-	-	-	-	-
STYROFOAM™ WALLMATE™ Brand Insulation	-	-	-	-	-	-	-	-	-	7.5	10.0	-	-
STYROFOAM™ PERIMATE™ Brand Insulation	-	-	-	-	-	-	-	-	-	7.0	10.0 ¹	-	-
STYROFOAM™ STUCCOMATE™ Brand Insulation	-	-	-	-	-	-	-	-	5.0	-	-	-	-
STYROFOAM™ Scoreboard Brand Insulation	-	-	-	-	-	-	3.8	-	5.0	7.5	10.0	12.5	15
STYROFOAM™ BLUEGUARD™ Brand Insulation	-	-	-	-	-	-	-	-	5.0	7.5	10.0	-	-
BLUECOR™ Brand Underlayment	-	1.0	-	-	-	-	-	-	-	-	-	-	-
DOW™ High Performance Underlayment	-	1.0	1.5	-	-	-	-	-	-	-	-	-	-

¹ Nominal 2" thickness. * Available in Florida only

Board Coverage Area

Standard Size (feet) sizes vary by product	2 x 8	4 x 8	4 x 9	4 x 50
Coverage per board (sq. ft.)	16	32	36	200

READ THIS BEFORE YOU BUY

The chart shows the R-value of this insulation. R means resistance to heat flow. The higher the R-value, the greater the insulating power. Compare insulation R-values before you buy.

There are other factors to consider. The amount of insulation you need depends mainly on the climate you live in. Also, your fuel savings from insulation will depend upon the climate, the type and size of your house, amount of insulation already in your house, and your fuel use patterns and family size. If you buy too much insulation, it will cost you more than what you'll save on fuel.

To get the marked R-value, it is essential that this insulation be installed properly.

NOTICE: No freedom from any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. Dow assumes no obligation or liability for the information in this document. NO WARRANTIES ARE GIVEN; EXCEPT FOR LIMITED PERFORMANCE WARRANTIES SPECIFICALLY PROVIDED BY DOW. ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

NOTICE: Changes to the International Residential Code require the installation of a weather-resistive barrier (WRB) within most exterior wall assemblies in residential construction. The following Dow insulated sheathing products qualify as a WRB when installed according to the installation instructions developed for "installation of foam sheathing as a weather-resistive barrier": STYROFOAM™ DURAMATE™ Brand Plus, STYROFOAM™ Brand Residential Sheathing, STYROFOAM™ Brand Tongue and Groove, STYROFOAM™ Brand Square Edge, STYROFOAM™ Brand Residing Board, DOW™ High Performance Underlayment, THERMAX™ Sheathing, TUFF-R™ and Super TUFF-R™ and therefore do not require the use of a building paper or a housewrap as a WRB. When a WRB is not needed, these Dow foam sheathings may be installed according to standard installation instructions for foam sheathing from Dow. Be sure products and installation instructions meet code requirements for your particular location. Note: WEATHERMATE™ and WEATHERMATE™ Plus housewraps have already qualified as weather-resistive alternatives to the prescribed felt (see Evaluation Reports NER-593 and NER-640 for approved alternative).

COMBUSTIBLE: Protect from high heat sources. Local building codes may require a protective or thermal barrier. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No material supplier including Dow can give assurance that mold will not develop in any specific system.

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Manufacturer's Insulation Fact Sheet

Polyisocyanurate Foam Home Insulation Products

This fact sheet contains important information about DOW Polyisocyanurate insulation. These products, available from Dow Building Solutions, are clearly identified by the DOW Diamond Logo.

Product R-Value

Product Thickness (nominal inches)	0.38	0.5	0.59	0.625	0.75	1.0	1.25	1.5	1.55	1.75	2.0
THERMAX™ Sheathing	-	3.3	-		5.0	6.5	-	9.8	10.1	-	13.0
Reflective system R-Value with 3/4" vertical air space	-	6.1	-	6.9	7.8	9.3	-	12.6	-	-	15.8
THERMAX™ White Finish	-	3.3	-	-	5.0	6.5	-	9.8	10.1 [†]	-	13.0
TUFF-R™	-	3.3	-	4.1 ^{††}	5.0	6.5	-	9.8	-	-	-
Reflective system R-Value with 3/4" vertical air space	-	6.1	-	6.9	7.8	9.3	-	12.6	-	-	-
TUFF-R™ C	-	-	-	-	-	-	-	9.8	-	-	13.0
Reflective system R-Value with 3/4" vertical air space	-	-	-	-	-	-	-	12.6 ^{†††}	-	-	15.8
Super TUFF-R™	2.0	3.3	-	4.1 ^{††}	5.0	6.5	-	9.8	-	-	-
STURDY-R™	-	2.5	3.0	-	4.0	5.0	-	-	-	-	-
QUIK-R™	-	-	3.0	-	4.0	5.0	-	-	-	-	-

[†] Only 1.55" THERMAX™ White Finish standard offering. All other sizes available under non-standard business rules.

^{††} Available under non-standard business rules.

^{†††} Reflective System R-value is the sum of the product R-value plus additional R-value calculated when the aluminum foil surface is installed next to a non-ventilated 3/4" air space (R-value = 2.8). All values from the ASHRAE Fundamentals Handbook.

Board Coverage Area

Standard Size (feet) sizes vary by product	4x8	4x9	4x10	4x12
Coverage per board (sq. ft.)	32	36	40	48

READ THIS BEFORE YOU BUY

The chart shows the R-value of this insulation. R means resistance to heat flow. The higher the R-value, the greater the insulating power. Compare insulation R-values before you buy.

There are other factors to consider. The amount of insulation you need depends mainly on the climate you live in. Also, your fuel savings from insulation will depend upon the climate, the type and size of your house, amount of insulation already in your house, and your fuel use patterns and family size. If you buy too much insulation, it will cost you more than what you'll save on fuel.

To get the marked R-value, it is essential that this insulation be installed properly.

NOTICE: No freedom from any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. Dow assumes no obligation or liability for the information in this document. NO WARRANTIES ARE GIVEN; EXCEPT FOR LIMITED PERFORMANCE WARRANTIES SPECIFICALLY PROVIDED BY DOW. ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

NOTICE: Changes to the International Residential Code require the installation of a weather-resistive barrier (WRB) within most exterior wall assemblies in residential construction. The following Dow insulated sheathing products qualify as a WRB when installed according to the installation instructions developed for "installation of foam sheathing as a weather-resistive barrier": STYROFOAM™ DURAMATE™ Brand Plus, STYROFOAM™ Brand Residential Sheathing, STYROFOAM™ Brand Tongue and Groove, STYROFOAM™ Brand Square Edge, STYROFOAM™ Brand Residing Board, DOW™ High Performance Underlayment, THERMAX™ Sheathing, TUFF-R™ and Super TUFF-R™ and therefore do not require the use of a building paper or a housewrap as a WRB. When a WRB is not needed, these Dow foam sheathings may be installed according to standard installation instructions for foam sheathing from Dow. Be sure products and installation instructions meet code requirements for your particular location. Note: WEATHERMATE™ and WEATHERMATE™ Plus housewraps have already qualified as weather-resistive alternatives to the prescribed felt (see Evaluation Reports NER-593 and NER-640 for approved alternative).

THERMAX Products

COMBUSTIBLE: THERMAX products should be used only in strict accordance with product application instructions. THERMAX products, when used in a building containing combustible materials, may contribute to the spread of fire. For more information, consult MSDS and/or call Dow at 1-866-583-BLUE (2583). In an emergency, call 1-989-636-4400.

Dow Polyisocyanurate Insulation Other than THERMAX™ Products

COMBUSTIBLE: Protect from high heat sources. Local building codes may require a protective or thermal barrier. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No material supplier including Dow can give assurance that mold will not develop in any specific system.

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105 Epoxy Resin® / 206 Slow Hardener®

Technical Data Sheet

105 System 105/206

General description

105/206 Epoxy is used for general coating and bonding applications when extended working and cure time are needed or to provide adequate working time at higher temperatures.

105/206 forms a high-strength, moisture-resistant solid with excellent bonding and barrier coating properties. It will wet out and bond to wood fiber, fiberglass, reinforcing fabrics, foam and other composite materials, and a variety of metals.

105/206 Epoxy can be thickened with WEST SYSTEM fillers to bridge gaps and fill voids and can be sanded and shaped when cured. With roller applications, it has excellent thin-film characteristics, allowing it to flow out and self-level without “fish-eyeing.” Multiple coats of 105/206 Epoxy create a superior moisture barrier and a tough, stable base for paints and varnishes. It is formulated without volatile solvents resulting in a very low VOC content. It has a relatively high flash point, no strong solvent odor and does not shrink after curing. It is not intended for clear coating natural finished wood.

Handling characteristics

Mix ratio by volume (300 Mini Pump ratio)	· · ·	5 parts resin : 1 part hardener
by weight	· · · · ·	5.36 : 1
Acceptable ratio range by weight	· · · · ·	4.83 : 1 to 6.01 : 1
Mix viscosity (at 72°F) ASTM D-2393	· · · · ·	725 cps
Pot life (100g at 72°F)	· · · · ·	20 to 25 minutes
Working time, thin film*	· · · · ·	90 to 110 minutes
Cure to a solid, thin film*	· · · · ·	10 to 15 hours
Cure to working strength	· · · · ·	1 to 4 days
Minimum recommended temperature	· · · · ·	60°F (16°C)

**Epoxy cures faster at higher temperatures and in thicker applications.*

Physical properties of cured epoxy

Specific gravity	· · · · ·	1.18
Hardness (Shore D) ASTM D-2240	· · · · ·	82
Compression yield ASTM D-695	· · · · ·	11,500 psi
Tensile strength ASTM D638	· · · · ·	7,300 psi
Tensile elongation ASTM D-638	· · · · ·	4.5%
Tensile modulus ASTM D-638	· · · · ·	4.60E+05
Flexural strength ASTM D-790	· · · · ·	11,800 psi
Flexural modulus ASTM D-790	· · · · ·	4.50E+05
Heat deflection temperature ASTM D-648	· · · · ·	123°F
Onset of Tg by DSC	· · · · ·	126°F
Ultimate Tg	· · · · ·	139°F
Annular shear fatigue @ 100,000 cycles	· · · · ·	10,100 lb

Storage/Shelf life

Store at room temperature. Keep containers closed to prevent contamination. With proper storage, resin and hardeners should remain usable for many years. After a long storage, verify the metering accuracy of the pumps. Mix a small test batch to assure proper curing.

Over time, 105 Resin will thicken slightly and will therefore require extra care when mixing. Repeated freeze/thaw cycles during storage may cause crystallization of 105 Resin. Warm resin to 125°F and stir to dissolve crystals. Hardener may darken with age, but physical properties are not affected by color. Be aware of a possible color shift if very old and new hardener are used on the same project.

Manufactured for
WEST SYSTEM by:



Gougeon Brothers Inc.
P.O. Box 908
Bay City, MI 48707

866-937-8797

www.westsystem.com

March, 2013



Elements™ Transparent Concrete Stain

Technical Data Sheet ELE-02

FOR PROFESSIONAL USE ONLY. Read all applicable and current product information for your project: Technical Data Sheet (TDS), Color Chart, Installation Guide, Material Safety Data Sheet (MSDS). All information is available for download online at www.butterfieldcolor.com

MasterFormat™ Guide Specifications, and Butterfield Color® Architectural Details and Specifications are available for the specifier/designer. All information is available for download online at www.butterfieldcolor.com

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1. Description: Elements™ Transparent Concrete Stain represents the latest in nanopigment technology. It is formulated to readily permeate a properly prepared concrete surface and create translucent color variations similar to reactive acid stain. Most colors are resistant to fading from sunlight (see note on color chart for colors not to be used exterior). It can be used on interior concrete floors and exterior concrete hardscapes. It may also be applied to Butterfield Color® cementitious overlays. Elements™ Transparent Concrete Stain is breathable. It is a low odor, water-based, low VOC (15-45 g/L depending on color selection), environmentally and user-friendly concrete staining system. It does not contain acid.

Elements™ Transparent Concrete Stain can be applied as the primary coloring material over uncolored concrete and other compatible substrates. It may also be applied over, integrally colored concrete, color hardened (shake-on) concrete, stamped, or stenciled concrete, Butterfield Color® cementitious overlays, and reactive chemical stains once neutralized. It is an excellent substitute for reactive chemical stains on substrates that are minimally reactive with acid stains or when a color is desired that cannot be produced by an acid stain.

Elements™ Transparent Concrete Stain is compatible with concrete colored with Uni-Mix® Integral Concrete Colorant and Uni-Mix® Liquid Integral Concrete Colorant coloring systems, Perma-Cast® Shake-on Color Hardener and Perma-Cast® Sierra Stain™ once neutralized. It is also compatible with T1000™ Fine Overlay, T1000™ Stampable Overlay, Micro-Cem™ Ultra-Thin Overlay, MT Resurfacer™ and Cantera™ Vertical Wall Mix. Elements™ Transparent Concrete Stain is available in 18

standard colors. Multiple colors may be used for a more creative effect.

2. Limitations: Elements™ Transparent Concrete Stain must be applied to clean concrete. New concrete must be fully cured (28 days), free from laitance, dust, film forming curing compounds, and other contamination that will minimize penetration. Existing concrete must be unsealed, clean and structurally sound. **All surfaces must be cleaned with CHO™ Cleaner and neutralized before applying Elements™ Transparent Concrete Stain (refer to section 7, paragraph 2).** T1000™ Fine Overlay and T1000™ Stampable Overlay should cure for a minimum of 72 hours at 70° F (21° C) before applying Elements™ Transparent Concrete Stain. Do not apply when substrate, product or ambient temperatures are below 50°F (10°C) or above 85°F (29.5°C) or relative humidity is above 85% or when such temperatures are expected within 72 hours following application. Do not apply to wet, damp, or frozen surfaces. Do not use material if it has been frozen. Elements™ Transparent Concrete Stain should not be used in areas subject to vehicular traffic.

Do not use ELE-124 Red or ELE-127 Purple for exterior or interior applications exposed to sunlight.

All surfaces colored with Elements™ Transparent Concrete Stain must be sealed with Clear Guard® Cure and Seal, Clear Guard® PRO 350 Cure and Seal or Clear Guard® H₂O Wet Look sealer. Before applying sealer, read the current technical data sheets available at www.butterfieldcolor.com. The colorations produced are translucent. Do not use Elements™ Transparent Concrete Stain to hide surface blemishes or construction problems. Patching materials may produce colorations distinctly differ-

ent from the adjacent surfaces. Elements™ Transparent Concrete Stain will not color exposed sand or aggregate. Do not use on vinyl, asphalt rubber, glazed tile or similar materials. **Note: Elements™ is not recommended for high traffic areas, areas subject to abrasion, areas subject to hydrostatic pressure or emersion in water.**

All furniture used on Elements™ stained surfaces must be affixed with some form of floor protection pads. Do not subject Elements™ stained surfaces to construction equipment and/or machinery.

3. Cautions: May cause eye, skin, and respiratory irritation. Do not take internally. Keep out of reach of children and animals. Wear eye protection, protective clothing and a P100/organic vapor respirator (NIOSH TC-84A approved) during mixing and application. For respiratory protection guidelines refer to OSHA 29 CFR 1910.134. Cover plant material. Ensure adequate ventilation during and after application. In case of spillage, absorb and dispose of material in accordance with local, state, and federal regulations. Before use, read the Material Safety Data Sheet (MSDS).

4. Packaging: Plastic bottle, liquid concentrate
 4 ounce (118 ml)
 32 ounce (1 L)

5. Shelf Life: 1 year, when stored in original, unopened containers, in dry storage, between 60°- 80°F. Do not use material that has been frozen.

6. Coverage: Coverage will vary widely depending on the porosity and texture of the surface, application method, desired color intensity, and number of applications. Two applications are recommended. Very porous surfaces may require additional ap-

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BUTTERFIELD
COLOR
 3 CONCRETE FINISHES



Elements™ Transparent Concrete Stain

Technical Data Sheet ELE-02

Engineered Concrete Performance
BUTTERFIELD
COLOR
 3 CONCRETE FINISHES

Applications. Deeper colorations may be achieved with multiple applications. Each application must penetrate and be absorbed by the concrete surface. Excessive applications of Elements™ Transparent Concrete Stain that are allowed to form a film, and harden on the concrete surface may delaminate or peel.

32 ounce bottle, after mixing with water, produces 1 gallon of stain: 200-400 square feet

4 ounce bottle, after mixing with water, produces 16 ounces of stain: 25-50 square feet

7. Surface Preparation: The substrate must be free from liquid release agent, powder release agent, curing compounds, sealers, oil, dirt, and other contamination that would impede the penetration of Elements™ Transparent Concrete Stain. Hard-troweled concrete, self-leveling overlays, or similarly dense surfaces require preparation by rotary sanding with a 60-80 grit mesh-sanding screen or grit rotary brush. Avoid sanding too deeply and exposing the aggregate, which will change the surface color and texture. Demonstrate the effects of sanding upon color and texture with a mock up panel prior to starting the installation. Test the surface with water. Random drops of water should quickly penetrate and darken the substrate. If not, additional sanding is necessary.

Once the concrete is clean, sound and contaminant free, it must be washed with Butterfield Color® CHO™ Cleaner. Available in 1 pound (0.45 kg) and 5 pound (2.25 kg) containers, mix 1 pound (0.45 kg) of CHO™ Cleaner with 1 gallon (3.8 L) of clean water. 1 gallon of the solution will clean approximately 100-150 square feet in a single application. Depending on the porosity/density of the concrete, multiple applications of CHO™ Cleaner are sometimes necessary. Spray apply the solution onto the surface and then scrub with a clean bristle brush or rotary scrubbing machine. Do not allow the cleaning solution to dry on the surface. After cleaning with CHO™

Cleaner, neutralize the surface by scrubbing and washing with a solution of 1 pound sodium bicarbonate (baking soda) and 5 gallons of water. Do not allow the neutralizing solution to dry on the surface. Scrubbing may be done manually with a stiff bristled brush or with a white pad mounted on a rotary floor machine. Thoroughly remove residues from the neutralizing and cleaning solutions by flushing with clean water and wet vacuuming. A mop alone will not adequately remove the residues.

Cleaning with muriatic acid is not recommended. The substrate must be dry before applying Elements™ Transparent Concrete Stain.

8. Mixing: Shake the plastic bottle of Elements™ Transparent Concrete Stain. Mix with potable water. Do not use concentrate without diluting with potable water. Do not add any other liquid or chemical to the product. Add concentrate to a clean plastic pail.

32-ounce bottle + 96 ounces (2.9 L) water (1 bottle of concentrate + 3 bottles of water)

4-ounce bottle + 12 ounces (355 ml) water (1 bottle of concentrate + 3 bottles of water)

Ensure that all color concentrate is rinsed from the bottle. Consistently measure the water to ensure color accuracy and coverage. Mix Elements™ Transparent Concrete Stain by hand or with a drill mounted paddle. Once mixed, the working time is indefinite. Periodically agitate the mixed material during the application.

9. Application: The concrete surface and joints must be thoroughly dry before application of Elements™ Transparent Concrete Stain. Do not apply when substrate, product or ambient temperatures are below 50°F (10°C) or above 85°F (29.5°C) or relative humidity is above 85% or when such temperatures are expected within 72 hours following application. Cover and protect adjacent surfaces with plastic during mixing and application. Overspray and spills are dif-

ficult to remove. **Apply Elements™ Transparent Concrete Stain with a clean high volume, low-pressure (HVLP) sprayer. Spray evenly over the prepared substrate in a circular or random motion. For larger applications, an airless sprayer with a .011 tip may be used. A pump up sprayer should not be used since it will not adequately atomize the material and cause excess material to be applied, which can result in failure of application.**

Periodically agitate the product in the mixing pail and sprayer reservoir, as settlement will occur. A shallow saw cut is recommended for effectively separating different colors. More than one application of Elements™ Transparent Concrete Stain may be required on very porous concrete to achieve the desired coloration.

Do not allow material to puddle and dry on the surface or in joints. Depending on surface density and porosity, the substrate will eventually reject excess material. Excess material should be redistributed or wiped up with a clean cloth before it dries, otherwise it will require a more thorough clean up before sealing. If the material appears wet for longer than 1 minute, do not attempt to apply more product. If multiple applications are necessary, the surface may be lightly walked on after the previous application is dry to the touch or tack free. Do not walk on the dry stained surface for approximately 8 hours after the final application. Protect the stained surface from water and other liquids for 36 hours after application. Application tools and equipment can be cleaned with soap and water.

10. Sealing: After Elements™ Transparent Concrete Stain has dried for 24 hours, apply Clear Guard® Cure and Seal, Clear Guard® PRO 350 Cure and Seal, Clear Guard® H₂O Wet Look Water-Based Sealer, or Clear Guard® H₂O Water-Based Cure and Seal. Before applying sealer, read the current Technical Data Sheets available at www.butterfieldcolor.com. Before application of the sealer, the Mois-

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BUTTERFIELD
COLOR
 3 CONCRETE FINISHES



Elements™ Transparent Concrete Stain

Technical Data Sheet ELE-02

ture Vapor Emission Rate (MVER) of the concrete or cementitious topping must be measured and be less than 3.75 pounds per 1000 square feet per 24 hours (1.83 kg/100 m² / 24 hours). **WARNING:** Sealed concrete surfaces will be slippery when wet. If exterior or interior surfaces are subjected to wetting and are not adequately textured enough to provide a non-slip finish after the sealer has been applied, a non-slip additive must be used with the sealer. On interior applications subjected to wetting, where the use of a non-slip additive may not be desirable due to maintenance concerns, a slip resistant floor wax must be applied over the sealer.

11. Maintenance: Periodically inspect sealed surfaces for wear or damage. All concrete sealing compounds will eventually exhibit the affects of weathering and traffic. For maximum coating life and performance, wipe up all chemical solvent or petroleum spills as soon as possible. Remove abrasive debris by sweeping or vacuuming. Do not drag, drop or place sharp edges on sealed surfaces. All furniture used on Elements™ stained surfaces must be affixed with some form of floor protection pads. Do not subject Elements™ stained surfaces to construction equipment and/or machinery.

Periodic washings with mild detergents will help maintain surface lus-

ter. Do not use solvent or acid based cleaning materials for general cleaning. Hot car tires or turning tires while car is standing may damage the sealer. Surfaces that will be subjected to car traffic, de-icing salts or chemical exposure, must receive minimally, two applications of Clear Guard® Cure and Seal or Clear Guard® PRO 350 Cure and Seal. Very porous or rough surfaces may require multiple application of a sealer to ensure protection of the underlying substrate.

Prior to re-coating, the surface and joints must be clean, dry, free from cleaning product residue, other contamination, or loose materials, which will affect the adhesion of Clear Guard™ Cure and Seal. When recoating, a slip resistant additive may be added to the sealer.

12. Interior Floors: Regularly clean by dry and wet mopping. Periodically machine scrub, rinse, and wet vacuum the surface. Apply a maintenance wax or slip resistant wax as directed by the wax manufacturer. This type of periodic maintenance will greatly enhance the appearance of the floor and minimize the need to strip and/or reapply the sealer.

13. Quality Control: Cast a job site sample at least 21 days prior to the installation for approval of color and finish. Utilize all materials, tools, and techniques from the actual job in the

mock-up. Consistent batching, pouring, finishing, curing, sealing, and preparation techniques, will ensure the uniformity of architectural concrete. Verify adequate wet and dry slip resistance. Verify maintenance requirements. Site visits by Butterfield Color, Inc. Personnel are for making technical recommendations only and not for supervising or providing quality control.

LIMITED WARRANTY AND DISCLAIMER – EXCLUSIVE REMEDY:

Butterfield Color, Inc. (“BC”) warrants that this product conforms to its published specifications when it is shipped. THIS LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY AND THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. BC does not warrant any particular method of use or application of the product or its performance under any particular condition. If this product does not conform to its published specifications when shipped, we will replace the product as your exclusive remedy. Any action for breach of the limited warranty or any other liability arising from this product must be brought within 90 days of receiving the product. BC is not liable for consequential damages or personal injury arising from the use, storage or handling of this product.



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

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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 ²
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. ² /gal	M ² /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.


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Technical Data Sheet

ASTM C-150



PRODUCT NAME:

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

MSDS

MANUFACTURER:

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

Phone: 800-265-1806

Phone: 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.

INSTALLATION:

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

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 DATA:

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

See table for physical properties.

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.

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.

TECHNICAL SERVICES:

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

PHYSICAL PROPERTY	FEDERAL WHITE Typical Type I	ASTM C – 150 Specification Type I
Fineness:		
Specific Surface (sq. m / kg)	400	280 minimum
Setting Time – Vicat Minutes	120	
not less than		45
not more than		375
Air Content %	8	12 maximum
Compressive Strength, psi(MPa)		
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)	--