High-performing industrial

plasters and gypsum cements

Industrial Plasters

and Gypsum Cements

Versatility and Ease of Use

Gypsum is a low-cost solution to industrial product and process problems or product development opportunities. Easy to use and handle, gypsum products can simplify a variety of manufacturing applications while retaining desirable physical properties.

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Overview

A Versatile Medium

Gypsum cements and industrial plasters differ chiefly in the size and shape of crystals formed during the manufacturing process. Each requires a different amount of water to gain good workability making each product more suitable to a particular type of product application.

Gypsum Cement

Gypsum cement can be formulated to meet different requirements. Gypsum, the base mineral of USG's high-performing industrial plasters and gypsum cements, is a highly versatile mineral that is finely ground and *calcined* to produce a powder with uniform chemical and physical properties. *Calcination* is the heating process through which a portion of the chemically combined water is removed. Since water can be added or removed, gypsum cement is extremely flexible, making it useful in a broad range of product applications.

Industrial Plaster

Industrial plaster provides a controllable setting performance few other materials can offer. Plaster sets with a sharp, definable, measurable action. It sets fast—faster than typical Portland cements and other cementitious materials. When combined with accelerators or retarders, the setting time can be manipulated to create working times ranging from 3 minutes to 20 hours. The ease of reproducing this setting time from batch to batch maximizes production rates.

Controllable Strength, Absorption, Density

Only gypsum among commercial materials possesses extreme ranges in strength, absorption and density.

- Compressive strength (and hardness) can range from that of weakened chalk to four times greater than concrete.
- Absorption can equal that of a rigid sponge or an impervious surface that sheds water.
- Density can vary from that of popcorn to stone.

Solubility

Due to its solubility, only gypsum among casting materials is self-cleaning in the mold—a basic requirement in the ceramics industry.

Compatibility

Gypsum cements and industrial plasters readily blend with chemicals and aggregates to achieve special properties. Both wet and dry blending are possible with various chemicals, powders, and granular materials, including:

talc	asphalt	vermiculite	powdered glue
iron oxide	perlite	pigments	set-time control additives
kaolin	starches	wood fiber	glass/polymer fibers
resins	sand	polymers	
ball clay	dyes	foaming agents	

Except for special gypsum cement formulations, coarse aggregates such as gravel, stone, rip-rap, or any aggregate larger than 10 mesh should not be used, since gypsum crystals do not readily bond to them.

Fire Resistance and Non-conductivity	Unlike plastics, gypsum is a naturally occurring mineral, making it safe to use and noncombustible. When gypsum rock is heated to 212 °F, three quarters of the chemically combined water is driven off. At about 1800 °F, gypsum chemically breaks down into the non-toxic minerals quicklime (CaO) and sulfur trioxide (SO_3) – with no harmful gases or residues. Dry gypsum is also electrically nonconductive and makes a good insulating medium.
Safety	When properly used, gypsum cements and industrial plasters are safe to handle. With few exceptions, they are nontoxic, non-allergenic, odorless and non-irritating to the skin. They do not attract or support vermin. When dry, gypsum will not support mold, fungus, or bacteria growth.
Shelf Life	To help ensure against user variables, industrial plaster and gypsum cements are stabilized to a large degree. When stored in a dry location, its shelf life ranges between three to six months, depending on how it was formulated.

Gypsum Cements

Tooling

Product Comparison	Typical Physical Characteristics						
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion		Density	
				Maximum	Final	Wet	Dry
	parts of water by weight per 100 parts of plaster	minutes	psi	%	%	lbs./cu. ft.	lbs./cu. ft.
Hydrocal A-11 Gypsum Cement	42	16-20	5,500	0.120	0.080	112.5	93.8
Hydrocal B-11 Gypsum Cement	44	25-35	4,500	0.110	0.080	111.2	91.6
Ultracal 30 Gypsum Cement	38	25-35	6,000	0.080	0.060	115.0	99.0
Ultracal 60 Gypsum Cement	39	75-90	5,000	0.065	0.055	114.4	97.5
Hydroperm Gypsum Cement	100	12-19	—	0.140	—	40.0	—

Hydrocal® A-11® Gypsum Cement

– High-strength with a very low setting expansion
– Adapts well to production on hard, strong, tough models of uniform and stable dimensional accuracy
– Rapid stiffening rate after setting action begins
– Recommended for use in slurry casting techniques

Hydrocal® B-11® Gypsum Cement

– Similar to Hydrocal A-11 gypsum cement in setting expansion and dimensional accuracy
– Slightly lower strength
– Greater plasticity and more gradual setting action
– Recommended for use in built-up or template-formed models

Ultracal® 30 Gypsum Cement

– Low-absorption for case molds
– Specially designed for the greatest hardness, accuracy and freedom from efflorescence of any gypsum cement on the market
– Recommended for use in close tolerance tooling

Ultracal® 60 Gypsum Cement

– Similar to Ultracal 30 gypsum cement
– Slightly higher consistency provides less surface hardness and lower compressive strength
– Longer set provides less expansion
– Recommended for use where extreme dimensional accuracy is required

Hydroperm® Gypsum Cement

– Permeable metal casting product formulated with Hydrocal gypsum cement
– Smooth mold surface, carvability and controllable permeability
– Recommended for use in nonferrous castings

3-D Casting and Statuary

Product Comparison	Typical Physical Characteristics						
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion		Density	
				Maximum	Final	Wet	Dry
	parts of water by weight per 100 parts of plaster	minutes	psi	%	%	lbs./cu. ft.	lbs./cu. ft.
Fast Cast Exterior Gypsum Cement[a]	12.5	25-35	8,000[b]	0.100	—	135.0	
Gardencast Gypsum Cement	12.5	25-35	2,500	0.100	—	131.0	110.0
Hydro-Stone Gypsum Cement	32	17-20	10,000	0.240	—	119.4	108.7
Tuf-Stone Gypsum Cement	32	25-30	10,000	0.240	—	122.0	112.0

Fastcast™ Exterior Gypsum Cement

– Fast-setting cement that when compared with using Portland cement substantially increases production
– Recommended for use in casting exterior decorative statuary
– Not suitable for products such as bird baths, planters or other objects that hold standing water
– Gray in color

Gardencast™ Gypsum Cement

– Similar to Fastcast, except white in color
– Specially designed for excellent resilience and chip resistance
– Recommended for use in free-standing, exterior casting and decorative exterior figurines

Hydro-Stone® Gypsum Cement

– Hard and strong, especially suitable where high strength and resistance to water absorption are necessary
– Cannot be worked under a template
– Three times greater expansion than Hydrocal A-11 or B-11 gypsum cements
– Works well in plaster and other flexible moulding compounds; not for casting in glue molds
– Recommended for use in high-quality art novelty and statuary castings

Tufstone™ Gypsum Cement

– Polymer-modified, fibered casting material
– Recommended for use in solid cast giftware applications

Notes

(a) Based on Fast Cast exterior gypsum cement mixed at a ratio of 1:1 (cement and sand). Sand should be clean, dry, free from dolomitic contamination, and conform to ASTM C33.
(b) 28-day compressive strength.

Ceramics, Statuary and General Purpose

Product Comparison	Typical Physical Characteristics						
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion		Density	
				Maximum	Final	Wet	Dry
	parts of water by weight per 100 parts of plaster	minutes	psi	%	%	lbs./cu. ft.	lbs./cu. ft.
FAST CAST Exterior Gypsum Cement[a]	12.5	25-35	8,000[b]	0.100	—	135.0	
CERAMICAL Gypsum Cement	40	18-23	6,500	0.165	—	113.7	96.0
HYDROCAL White Gypsum Cement[c]	45	25-35	5,000	0.390	—	110.6	90.0
HYDROCAL Gypsum Cement[d]	45	25-35	5,000	0.390	—	110.6	90.0

CERAMICAL® Gypsum Cement

– Low consistency, smooth-wearing mold material
– Low absorption
– Recommended for use in pressing clayware and with RAM® automatic clay-forming equipment

HYDROCAL® White Gypsum Cement

– Basic HYDROCAL gypsum cement with a use consistency of 45 lbs. of water per 100 lbs. of gypsum cement resulting in higher strengths than typical plaster products
– Specially designed for thin sections requiring high early "green strength" to minimize breakage during removal from intricate rubber molds
– Twice the setting expansion of USG moulding plaster or USG pottery plaster
– Recommended for use in arts and crafts applications such as statuary, figurines and lamp bases

HYDROCAL® Gypsum Cement

– Offers the same characteristics as HYDROCAL white gypsum cement, except for color
– Manufactured only at Ft. Dodge, Iowa

Notes

(a) Based on FAST CAST exterior gypsum cement mixed at a ratio of 1:1 (cement and sand). Sand should be clean, dry, free from dolomitic contamination, and conform to ASTM C33.
(b) 28-day compressive strength.
(c) Southard plant only.
(d) Ft. Dodge plant only.

Statuary

Product Comparison	Typical Physical Characteristics						
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion		Density	
				Maximum	Final	Wet	Dry
	parts of water by weight per 100 parts of plaster	minutes	psi	%	%	lbs./cu. ft.	lbs./cu. ft.
HYDROCAL Gypsum Cement	40	25-35	6,500	0.250	—	113.7	96.0
HYDRO-STONE Super-X Gypsum Cement	22	17-20	13,500	0.300	—	129.0	127.1
READYROCK Liquid Gypsum	N/A	6-65	3,000-3,500	0.197	?	N/A?	110-112

HYDROCAL® Gypsum Cement

– Basic HYDROCAL gypsum cement with a lower use consistency of about 40 lbs. of water per 100 lbs. of gypsum cement
– Extremely hard and strong
– Recommended for use in solid and slush casting

HYDRO-STONE® Super-X Gypsum Cement

– One of the strongest and hardest gypsum cements available
– Designed for use at a consistency of 21 to 23 parts of water per 100 parts gypsum cement by weight

READYROCK™ Liquid Gypsum

– Convenient, easy-to-use pre-formulated HYDROCAL-based slurry
– Controllable setting time with use of READYROCK™ zinc formula liquid activator increases productivity
– Recommended for all interior statuary solid castings

Product Comparison	Typical Physical Characteristics						
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion		Density	
				Maximum	Final	Wet	Dry
	parts of water by weight per 100 parts of plaster	minutes	psi	%	%	lbs./cu. ft.	lbs./cu. ft.
HYDROCAL FGR Gypsum Cement	30	50-70	—	—	—	112.0[a]	101.6[a]
ENDURACAST Gypsum Matrix	Info Needed						

HYDROCAL® FGR Gypsum Cement

– High-strength gypsum cement for use with glass fiber
– Specially designed for fabricating glass-reinforced architectural details that are lightweight, fire-resistant and thin-cast
– Can be hand-applied or sprayed on as thin as 0.1 inch

ENDURACAST™ Gypsum Matrix

– One of the strongest and hardest available resulting in high early strength for reduced product breakage
– Specially designed to be sprayed, especially with RIMCRAFT™ GS500 or RAYITE 200 spray machines
– Recommended for interior, abuse-resistant products

Notes
(a) Based on spray application using 6% glass fiber by weight.

Product Comparison

	Typical Physical Characteristics						
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion		Density	
				Maximum	Final	Wet	Dry
	parts of water by weight per 100 parts of plaster	minutes	psi	%	%	lbs./cu. ft.	lbs./cu. ft.
DURACAL Cement[a]	13	25-35	8,000[b]	0.100	—	140.0	135.0

DURACAL® Cement

– Fast-setting, high early-strength, gypsum cement-based product with a positive expansion

– Specially designed for concrete patching of highways, bridges, loading docks, etc.

– Can be driven on 60 minutes after set

Notes

(a) Based on DURACAL cement mixed at a ratio of 1:1:1 (cement, sand, coarse aggregate). Sand should be clean, dry, properly sized, free from dolomitic contamination, and conform to ASTM C33. Coarse aggregate should be clean, ASTM size no. 8, free from dolomitic contamination, and conform to ASTM C33.

(b) 28-day compressive strength.

Industrial Plasters

Ceramics

Product Comparison	Typical Physical Characteristics					
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion	Density	
					Wet	Dry
	Parts of water by weight per 100 parts of plaster	minutes	psi	%	lbs./cu. ft.	lbs./cu. ft.
USG Pottery Plaster	74	27-37	1,800	0.190	97.6	66.0
USG No. 1 Pottery Plaster	70	27-37	2,000	0.210	99.0	69.0
PURITAN Pottery Plaster	66	27-37	2,400	0.220	101.0	72.0
DURAMOLD Pottery Plaster	62	27-37	2,900	0.220	102.5	75.0

USG® Pottery Plaster

– General-purpose, industry-preferred product for working reliability, productivity and highly successful results
– Specially designed for long life and reduced breakage (stronger molds)
– Recommended for use in all types of ceramic slip casting applications

USG® No. 1 Pottery Plaster

– Specially designed to provide stronger, longer-lasting ceramic slip cast molds
– Industry standard

PURITAN® Pottery Plaster

– Slightly denser, longer-wearing mold material
– Recommended for use in jiggering applications in the ceramics industry

DURAMOLD™ Pottery Plaster

– Formulated to provide a longer-lasting, more durable gravity slip-casting mold
– Recommended for uses requiring a lower consistency than conventional pottery plasters

3-D Casting and Statuary

Product Comparison	Typical Physical Characteristics					
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion	Density	
					Wet	Dry
	Parts of water by weight per 100 parts of plaster	minutes	psi	%	lbs./cu. ft.	lbs./cu. ft.
Drystone Casting Media	18-20 cc	5-10	8,000	0.275	130	128
USG Moulding Plaster	70	27-37	2,000	0.200	99.0	69.0
USG Industrial Gauging Plaster	62	27-37	2,400	0.220	102.0	75.0
USG White Art Plaster	70	27-37	2,000	0.200	99.0	69.0
USG No. 1 Casting Plaster	65	27-37	2,400	0.220	100.0	72.5
Tuf Cal Plaster	50	27-37	3,500	0.220	108.0	85.0

Drystone™ Casting Media

– No drying required – cast, paint, package and ship in one day
– Highest early "green strength" and highest compressive strength of any product offered
– Excellent alternative to polyester resin
– Formulations for both solid and hollow cast pieces

USG® Moulding Plaster

– All-purpose utility plaster
– Produces casts of nominal strength and hardness
– Recommended for use in faithfully reproducing the most intricate details
– Porous quality requires a careful seal before adding decoration

USG® Industrial Gauging Plaster

– Coarser-grind product than USG moulding plaster
– Lower water demand for mixing

USG® White Art Plaster

– Contains a surface hardening agent that reduces paint absorption when the dried cast is finished
– Specially designed for hollow and solid novelty art castings such as statues and lamps

USG® No. 1 Casting Plaster

– Similar to USG white art plaster except mixed at a lower use consistency
– Increases strength and chip resistance
– Reduces paint absorption

Tuf-Cal™ Plaster

– Polymer-modified, high early-strength fibered plaster
– Higher early "green strength" and greater chip and impact resistance than USG white art plaster, USG No. 1 casting plaster or Hydrocal white gypsum cement
– Recommended for use in hollow cast products

Dental

Product Comparison	Typical Physical Characteristics					
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion	Density	
					Wet	Dry
	Parts of water by weight per 100 parts of plaster	minutes	psi	%	lbs./cu. ft.	lbs./cu. ft.
USG Regular Dental Plaster	70	19-22	2,000	0.200	99.0	69.0
USG Laboratory Dental Plaster	70	6-9	2,000	—	99.0	69.0
USG Impression Dental Plaster	70	3-1/2 – 5	2,000	—	99.0	69.0

USG® Regular Dental Plaster

– Similar to USG moulding plaster

– Normal-set dental plaster

– Recommended for use in general purpose applications

USG® Laboratory Dental Plaster

– Faster set (6-9 min.) than USG regular dental plaster

USG® Impression Dental Plaster

– Fastest setting of all dental plasters (3-1⁄2 to 5 min.)

– Specially designed for mouth impression work

Specialty

Product Comparison	Typical Physical Characteristics					
	Use Consistency	Approximate Hand Mix VICAT Set	Minimum Dry Compressive Strength	Setting Expansion	Density	
					Wet	Dry
	Parts of water by weight per 100 parts of plaster	minutes	psi	%	lbs./cu. ft.	lbs./cu. ft.
Airtrol Geobinder	—	300-420	—	—	—	—
Enviro-Shield Bonded Fiber Matrix	Need Info					
USG Metal Casting Plaster	130	25-30	—	0.100	84.0	41.0
Rayite 100 Machinable Media	Need Info					
Rayite 200 Machinable Media	Need Info					
Rayite Model Duplicating Media	Need Info					

Airtrol® Geobinder

– Environmentally safe to use
– Properly mixed creates an erosion-resistant crust
– Easily applied with conventional hydroseeding equipment
– Specially designed for quick and effective germination of plant cover
– Recommended uses also include dust control and spraying over coal refuse piles to smother spontaneous combustion fires

Enviro-Shield™ Bonded Fiber Matrix

– Simple, safe and easy-to-use; just add water to a unique blend of gypsum plaster, fibers and other special ingredients
– The only BFM on the market that supplies calcium and sulfur to the soil and improves heavy clay soils while buffering the soil PH level
– Biodegradable and harmless to fish, birds, plants and animals
– Easily applied with conventional hydroseeding equipment
– Specially designed for quick and effective germination of plant cover

USG® Metal Casting Plaster

– Greater strength and dimensional accuracy for high precision foundry castings
– Blend of plaster and refractory materials formulated for producing low-permeability plaster molds
– Specially designed for use in casting aluminum matchplates, cope-and-drag sets, core boxes, loose patterns, prototypes, housings and plastic mold tooling

Rayite™ 100 Machinable Media

– Super tough material that machines smooth with outstanding edge definition
– Easy to use – mix it, cast it and machine it
– Specially designed for use with CNC milling machines
– Eliminates labor-intensive gluing and clamping of board-type machinable products
– Recommended for use in prototyping, models and tooling aids

Rayite™ 200 Machinable Media

– Similar to Rayite 100
– Specially designed for spray applications

RAYITE™ Model Duplicating Media

– Unique two-component duplicating process that minimizes model distortion normally associated with heat-generating duplication products
– Forms a lightweight and strong casting from a variety of pattern materials with minimal model preparation
– Unique "self-releasing" properties allow the cast to virtually pop off the model or pattern
– Specially designed for use with a variety of model and pattern materials

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Metric Specifications
USG Corporation, through its operating subsidiaries, will provide metric conversions on its products and systems to help specifiers match metric design sizes. In addition, some products are available in metric dimensions from selected manufacturing plants. Refer to SA100, *Fire-Resistant Assemblies,* for additional information and a Table of Metric Equivalents.

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Safety First!
Follow good safety and industrial hygiene practices during handling and installation of all products and systems. Take necessary precautions and wear the appropriate personal protective equipment as needed. Read material safety data sheets and related literature on products before specification and/or installation.

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