
Technical

Specifications

Industrial Plasters and Gypsum Cements for Tooling Applications

ULTRACAL 30 Gypsum Cement

Super-strength gypsum cement recommended where extreme accuracy and greater surface hardness are required, as in duplicator models. Harder and stronger than HYDROCAL A-11 and HYDROCAL B-11 cements, ULTRACAL 30 cement has the lowest expansion of any rapid-setting gypsum cement available. Has a gradual set and long period of plasticity. Ideal for splash-casting molds and models for phenolic, polyester and epoxy resins. It was designed to give the patternmaking industry the ultimate in a gypsum cement tooling medium.

ULTRACAL 60 Gypsum Cement

Similar in all respects to ULTRACAL 30 cement except that it sets in about one hour. Designed for very large models where additional working time and highest possible degree of accuracy are required.

HYDROCAL A-11 Gypsum Cement

A high-strength gypsum cement with a low setting expansion. Adaptable to the productions of hard, strong, tough patterns, and duplicator models. Has a shorter period of plasticity, stiffens more rapidly than B-11, sets in about 15-20 minutes after mixing.

ULTRACAL B-11 Gypsum Cement

A gypsum cement with low setting expansion, a high degree of plasticity and gradual setting action. Specifically designed for making die-sinking patterns by the splash-cast technique and original loft template models. Sets in approximately 30 minutes after mixing, which provides ample time for built-up work.

Medium High-Expansion HYDROCAL Gypsum Cement

A product formulated to give a uniform expansion of a pattern in all directions equal to shrinkage of aluminum or zinc alloy metals (Kirksite, Zamac, etc.). Normal range is $\frac{1}{16}$ -in. to $\frac{3}{16}$ -in. growth per foot. Colored yellow for identification.

HYDRO-STONE Gypsum Cement

One of the hardest and strongest of all gypsum cements. When mixed properly, has a heavy, syrupy consistency ideal for pouring solid models or patterns. Recommended for stretch-press dies where extreme surface hardness is required; also used successfully for making cope-and-drag equipment. Expansion is greater than HYDROCAL A-11 or B-11 cements.

HYDROCAL White Gypsum Cement

A neutral gypsum cement having a normal set of 25 minutes. When formed under a template it is slightly on "short side" and has a tendency to tear. The setting expansion is somewhat greater than with A-11 or B-11 cements, but higher wet and dry strength is provided.

Moulding Plaster

Often referred to as "plaster of Paris" or soft plaster. Used for waste molds or temporary patterns where surface hardness and strength are not important. Screeds well under a template but is not as hard or strong as HYDROCAL cement. The expansion is greater than with A-11 or B-11 cements.

Typical Physical Properties

Product	Use Consistency (lb. water per 100 lb . gypsum cement)	Setting Range min. (Vicat)	% Setting Expansion final	Minimum Compressive Strength (lb. per sq. in., dry ⁽¹⁾)	pH Reaction
ULTRACAL 30 Gypsum Cement	38	25-35	0.080	6,000	Alkaline
ULTRACAL 60 Gypsum Cement	39	75-90	0.065	5,000	Alkaline
HYDROCAL A-11 Gypsum Cement	42	16-20	0.080	5,500	Alkaline
HYDROCAL B-11 Gypsum Cement	44	25-35	0.080	4,500	Alkaline
Medium High-Expansion HYRDOCAL Gypsum Cement	48-50 44-45	25-35	1/8"/ft. 3/8"/ft.	—	Slightly acid
HYDRO-STONE Cement	32	17-20	0.240 (maximum)	10,000	Alkaline
Industrial White HYDROCAL Cement	45	25-35	0.390 (maximum)	5,000	Neutral
Industrial Moulding Plaster	70	27-37	0.200 (maximum)	2,000	Neutral

(1) Wet strength is about half that for dry strength.

Trademarks: The following trademarks used herein are owned by USG Corporation or its subsidiaries: USG, ULTRACAL, A-11, B-11, HYDROCAL, HYDRO-STONE.

Note: Products described here may not be available in all geographic markets. Consult your local representative for information.

Notice: We shall not be liable for incidental and consequential damages, directly or indirectly sustained, nor for any loss caused by application of these goods not in accordance with current printed instructions or for other than the intended use. Our liability is expressly limited to replacement of defective goods. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from date it was or reasonably should have been discovered.

USG No. 1 Casting Plaster



- Industry standard for figurines, plaques and lamp bases.
- Hard working surface with reduced paint absorption.

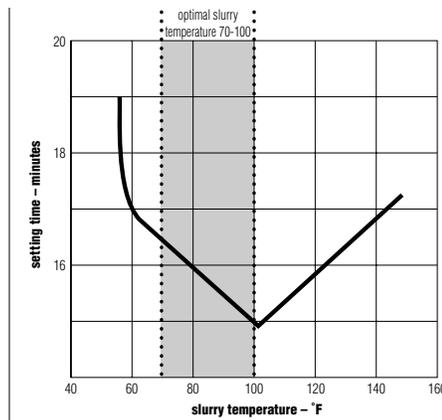
Technical Properties	English	Metric
Use Consistency (parts of water by weight per 100 parts plaster)	65	65
1 Hr. Compressive Strength	1,200 psi	8.27 MN/m ²
Dry Compressive Strength	2,400 psi	16.55 MN/m ²
Maximum Setting Expansion	0.210%	0.210%
Density Wet	100.0 lb/ft ³	1.60 g/cm ³
Dry	72.5 lb/ft ³	1.16 g/cm ³
Set Time*	27-37 min.	27-37 min.

*Other set times may also be available. Call your sales representative for more information.

General Directions and Guidelines

Preparing the Mix

Use potable water at temperatures between 70 and 100 °F (21 and 38 °C). Since variations in slurry (the plaster and water mixture) temperature produce variations in setting time, it is important to keep both the plaster and water in a stable temperature environment prior to use. The higher the temperature of the water, the shorter the set time. See the graph below.



Measuring

Weigh both the plaster and water for each mix. The water-to-plaster ratio is critical because it governs the strength and the density of the final cast.

Soaking

Sift or strew the plaster into water slowly and evenly. Do not drop handfuls of plaster directly into the water. Allow soaking for 1-2 minutes. The plaster should be fully dispersed in the water prior to mixing. Small batches require less soaking than large batches. See bulletin IG503 for specific soaking instructions.

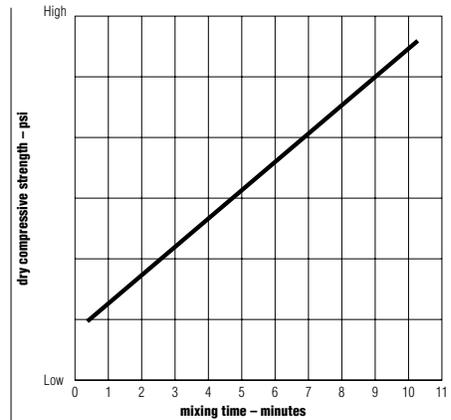
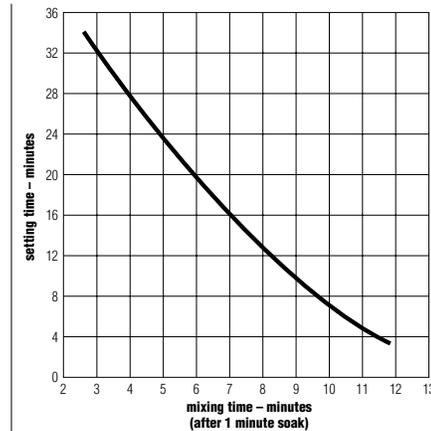
Mixing

Mixing the plaster slurry is one of the most important steps in producing plaster casts with maximum strength, hardness, and other important properties.

Mechanically mixed plasters develop uniform casts with optimal strengths. Plasters can be mechanically mixed through both batch and continuous processes. Proper blade and bucket dimensions are important for obtaining the best batch mix (see IG503 for details).

**Mixing
(continued)**

Longer mixing times result in higher cast strength and shorter setting times. The relationship between mixing time and both compressive strength and setting time is shown below.



Pouring

To prevent air entrainment and provide a uniform, smooth surface, careful pouring of the slurry is necessary. Agitation of the filled mold is a further step used to prevent air at or near the surface of the cast piece. Whenever possible, the slurry should be poured carefully in the deepest area so the slurry flows evenly across the surface of the mold.

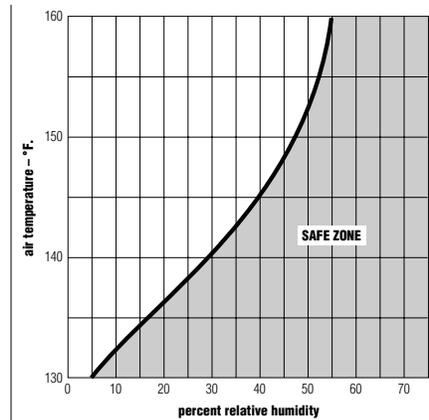
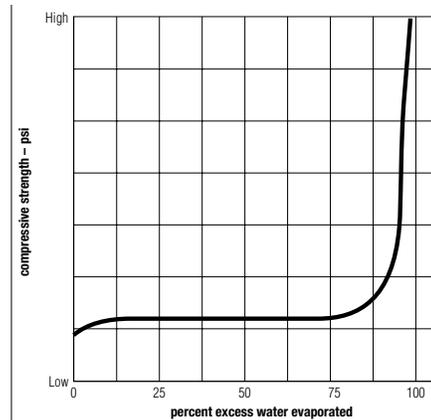
Pouring a large amount of slurry directly on the face of the mold may result in slight densification of the cast at the point where the slurry strikes the surface of the mold.

Drying

All plaster casts should be dried as quickly as is safely possible after manufacture so that maximum physical properties can develop. Dry to a constant weight.

The best drying rooms or ovens provide (1) uniform and rapid circulation (minimum of 15-30 fps) of air with no "dead spots" having little or no air movement, (2) equal temperatures throughout the entire area, and (3) provisions for exhausting a portion of the air while replacing it with fresh air. High humidity surrounding the drying room or oven inhibits the efficiency of the drying because the air pulled into the room is incapable of picking up much moisture from the molds.

The maximum temperature at which plaster casts are safe from calcination is 120 °F (49 °C). With substantial free water in the cast piece, higher drying temperatures can be used without difficulty. As drying progresses, the temperature must be reduced to prevent calcination. The safe drying zone is in the shaded area of graph (below, right). Before removing casts from the dryer, the temperature should approach that of the area around the dryer to prevent thermal shock. See IG502 for more details on proper drying.



Storage

Keep in a dry, stable environment indoors. Do not stack more than 2 pallets high. Keep from drafts. Rotate stock.

Warning

When mixed with water, this material hardens and becomes very hot—sometimes quickly. DO NOT attempt to make a cast enclosing any part of the body using this material. Failure to follow these instructions can cause severe burns that may require surgical removal of affected tissue or amputation of limb. Dust can cause eye, skin, nose, throat, or respira-

tory irritation. Avoid eye contact and inhalation of dust. Wear eye protection. If eye contact occurs, flush thoroughly with water. If dusty, wear a NIOSH/MSHA-approved respirator. Use proper ventilation to reduce dust exposure. Do not ingest. If ingested call physician. Product safety information: USA (800) 507-8899. **KEEP OUT OF REACH OF CHILDREN.**

Trademarks

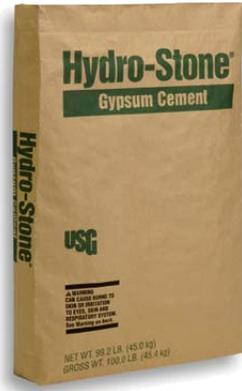
The following trademark used herein is owned by USG Corporation or its subsidiaries: USG.

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tion or for other than the intended use. Our liability is expressly limited to replacement of defective goods. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from date it was or reasonably should have been discovered.

HYDRO-STONE[®] Gypsum Cement



- Hard and strong with high water absorption resistance.
- Works well in plaster and most flexible moulding compounds.
- Used in high-quality art novelty and statuary castings.
- Extremely fine detail duplication.
- Low viscosity slurry for filling multiple molds at one time.

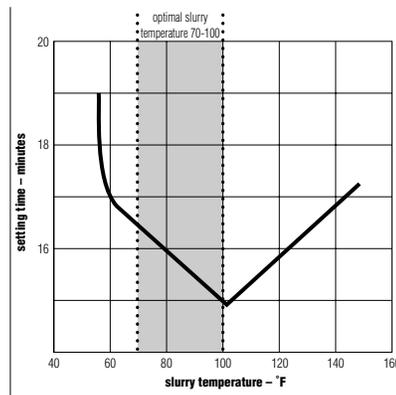
Technical Properties	English	Metric
Use Consistency (parts of water by weight per 100 parts plaster)	32	32
1 Hr. Compressive Strength	4,000 psi	27.6 MN/m ²
Dry Compressive Strength	10,000 psi	69.0 MN/m ²
Maximum Setting Expansion	0.240%	0.240%
Density Wet	119.0 lb/ft ³	1.91 g/cm ³
Dry	108.0 lb/ft ³	1.73 g/cm ³
Set Time (Machine Mix)*	17-20 min.	17-20 min.

*Other set times may also be available. Call your sales representative for more information. Hand mix times will be longer.

General Directions and Guidelines

Preparing the Mix

Use potable water at temperatures between 70 and 100 °F (21 and 38 °C). Since variations in slurry (HYDRO-STONE[®] Gypsum Cement and water mixture) temperature produce variations in setting time, it is important to keep both HYDRO-STONE Gypsum Cement and water in a stable temperature environment prior to use. The higher the temperature of the slurry, the shorter the set time. See the graph below.



Measuring

Weigh both HYDRO-STONE Gypsum Cement and water at the recommended use consistency for each mix (see technical properties above). The water-to-HYDRO-STONE Gypsum Cement ratio is critical because it governs all physical properties of the final cast piece.

Soaking

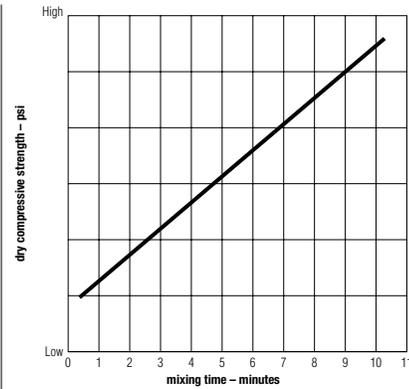
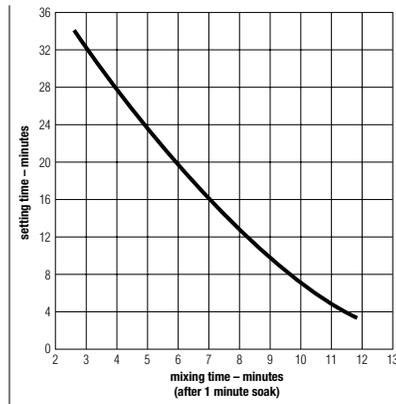
Sift or strew HYDRO-STONE Gypsum Cement into water slowly and evenly. Do not drop handfuls of HYDRO-STONE Gypsum Cement directly into the water. Allow soaking for 1-2 minutes. HYDRO-STONE Gypsum Cement should be fully dispersed in the water prior to mixing. Small batches require less soaking than large batches. See bulletin IG503 for specific soaking instructions.

Mixing

Properly mixing HYDRO-STONE Gypsum Cement is the most important step to producing casts with maximum strength, hardness, and other important properties. Unlike other plasters and gypsum cements, HYDRO-STONE Gypsum Cement cannot be mixed by hand and *must* be mixed mechanically. Additionally, HYDRO-STONE Gypsum Cement can only be mixed by a batch process, not by a continuous process mixer. See IG503 for recommendations on proper bucket size, mixing blades, and mixing speeds which are essential to mixing HYDRO-STONE Gypsum Cement properly via the mechanical/batch process.

**Mixing
(continued)**

Longer mixing times result in higher cast strength and shorter setting times. The relationship between mixing time and both compressive strength and setting time is shown below.



Pouring

To prevent air entrainment and provide a uniform, smooth surface, careful pouring of the slurry is necessary. Agitation of the filled mold is a further step used to prevent air at or near the surface of the cast piece. Whenever possible, the slurry should be poured carefully in the deepest area so the slurry flows evenly across the surface of the mold.

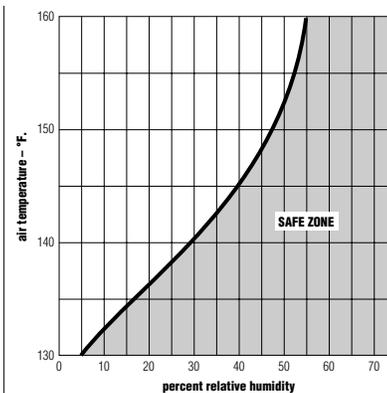
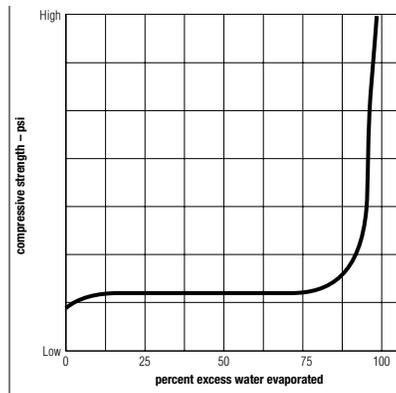
Pouring a large amount of slurry directly on the face of the mold may result in slight densification of the cast at the point where the slurry strikes the surface of the mold.

Drying

All casts should be dried as quickly as is safely possible after manufacture so that maximum physical properties can develop. Dry to a constant weight.

The best drying rooms or ovens provide (1) uniform and rapid circulation (minimum of 15-30 fps) of air with no "dead spots" having little or no air movement, (2) equal temperatures throughout the entire area, and (3) provisions for exhausting a portion of the air while replacing it with fresh air. High humidity surrounding the drying room or oven inhibits the efficiency of the drying because the air pulled into the room is incapable of picking up much moisture from the cast pieces.

The maximum temperature at which HYDRO-STONE Gypsum Cement casts are safe from calcination is 120 °F (49 °C). With substantial free water in the cast piece, higher drying temperatures can be used without difficulty. As drying progresses, the temperature must be reduced to prevent calcination. The safe drying zone is in the shaded area of graph (below, right). Before removing casts from the dryer, the temperature should approach that of the area around the dryer to prevent thermal shock. See IG502 for more details on proper drying.



Storage

Keep in a dry, stable environment indoors. Do not stack more than 2 pallets high. Keep from drafts. Rotate stock.

Warning

When mixed with water, this material hardens and becomes very hot—sometimes quickly. DO NOT attempt to make a cast enclosing any part of the body using this material. Failure to follow these instructions can cause severe burns that may require surgical removal of affected tissue or amputation of limb. Portland cement is strongly alkaline and contact with

dust or when wetted can cause burns or irritation to the skin, eyes, nose, throat, or respiratory system. Avoid dust inhalation and eye/skin contact. Wear eye and skin protection. If eye contact occurs, immediately flush thoroughly with water for 15 minutes and get medical attention. If dusty, wear a NIOSH/MSHA-approved respirator. Use proper

ventilation to reduce dust exposure. Do not ingest. If ingested call physician. Product safety information: USA (800) 507-8899. **KEEP OUT OF REACH OF CHILDREN.**

Trademarks

The following trademarks used herein are owned by United States Gypsum or a related company: HYDRO-STONE, USG.

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Creative Possibilities



USG

Industrial Plasters &
HYDROCAL[®] Brand
Gypsum Cements



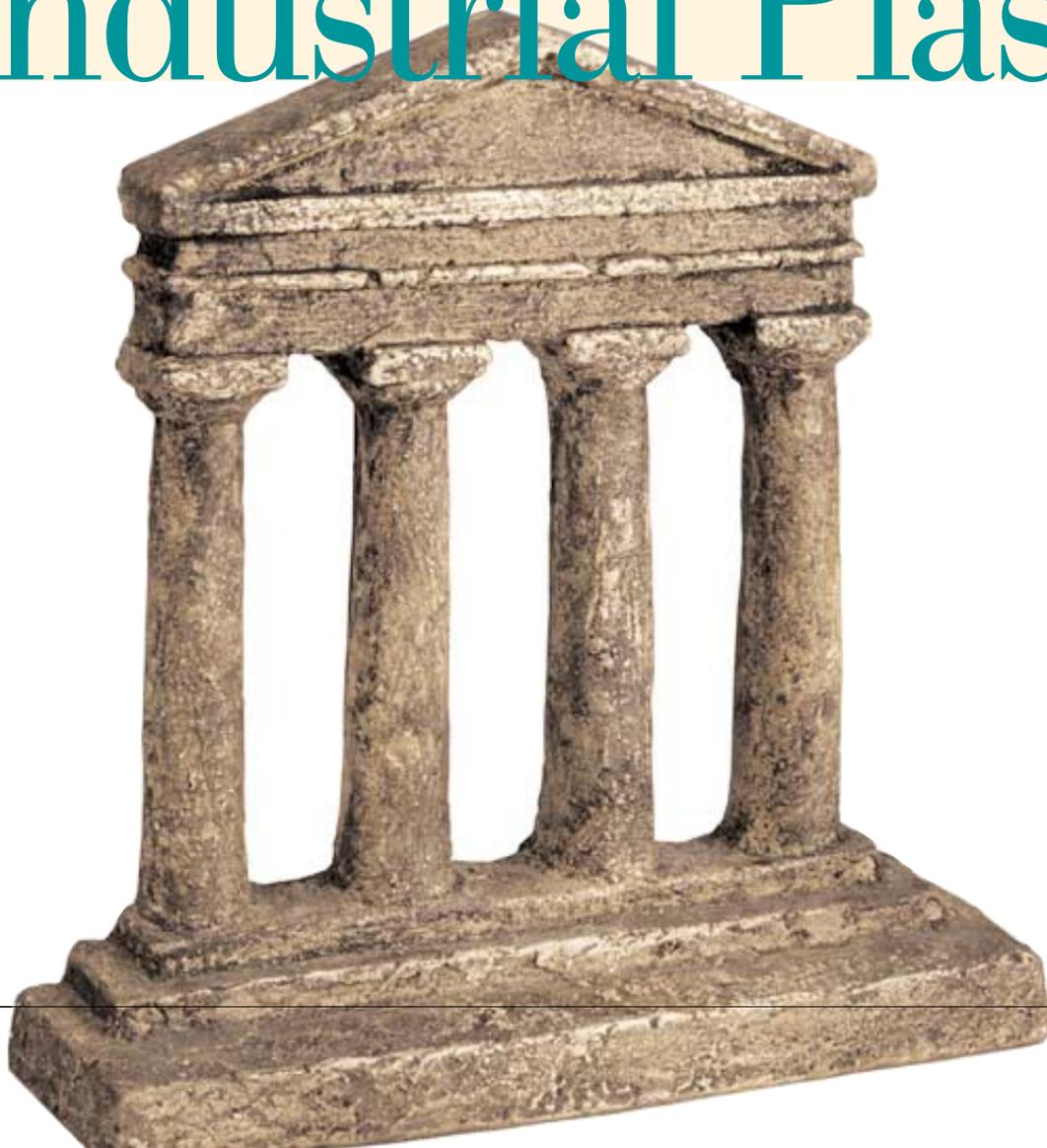
United States Gypsum Company offers a complete line of Industrial



Plasters and HYDROCAL Brand Gypsum
Cements for the art and casting markets.

With extensive research facilities and years of
specialized experience, United States Gypsum
Company has developed products ideally
suited for a broad scope of applications.

Industrial Plasters





USG® Moulding and Casting Plasters All USG's Casting and Moulding plasters are similar to Plaster-of-Paris, but may vary by region. These general-purpose plasters produce casts of nominal strength and hardness and faithfully reproduce the most intricate detail. Casts made of Moulding or Casting Plaster are porous and must be carefully sealed before decorating.

USG White Art Plaster Similar in working properties to Moulding Plaster, White Art Plaster contains a surface hardening agent that minimizes paint absorption when the dried cast is finished. White Art Plaster gives excellent detail, provides a harder surface, and has lower paint absorption than Moulding Plaster.

USG No. 1 Casting Plaster The industry standard for figurines, plaques, and lamp bases. Special additives maintain smooth-working qualities and upon drying, result in a hard working surface with reduced paint absorption and a degree of chip-resistance. No. 1 Casting Plaster gives better overall results than White Art Plaster.

TUF CAL™ Plaster A special plaster blended with polymer and synthetic fibers. Ideal for larger items where a high strength-to-weight ratio is required. It provides better chip resistance and impact strength in cast items than either White Art Plaster, No. 1 Casting Plaster, or HYDROCAL® White Gypsum Cement.

United States Gypsum Company offers a full line of HYDROCAL[®]



Brand Gypsum Cements that possess greater strength and hardness than standard industrial plasters. HYDROCAL Brand Gypsum Cements require less water for mixing, producing casts that are less porous, easier to paint, heavier, and more durable.

HYDROCAL[®] Brand



Exterior Products

FAST CAST™ Exterior Gypsum Cement Fast-setting cement formulated for casting non-water bearing exterior decorative statuary. Offers increased casting production of more than 300% versus regular portland cement. *Must be used with sand aggregate.*

GARDENCAST™ Gypsum Cement Specially designed for free-standing, solid cast outdoor statuary. Produces strong, hard casts that set rapidly and can be demolded in one hour, resulting in increased productivity versus conventional cements. Also produces a uniform white color. *Must be used with sand aggregate.*

Gypsum Cements

Interior Products

HYDROCAL® Brand White Gypsum Cement A good general use product that offers a gradual setting time and a long period of plasticity. Recommended for solid and hollow casting of lamp bases and figurines. Designed for thin sections, which require high green strength to minimize breakage during removal from an intricate latex mold.

Statuary HYDROCAL® Brand Gypsum Cement Harder and stronger than HYDROCAL Brand White Gypsum Cement. Offers not only hardness and strength, but excellent plasticity. These properties make it especially adaptable for either solid or hollow-art casting.

HYDRO-STONE® Gypsum Cement One of the hardest and strongest HYDROCAL Brand products, HYDRO-STONE is recommended for producing high-quality novelty and statuary castings requiring extremely hard surfaces. This product is self-leveling when poured and not suitable for hollow cast applications. HYDRO-STONE must be mechanically mixed for best results.

TUF STONE™ Gypsum Cement Polymer-modified, fibered casting material formulated for solid cast giftware applications. Better impact resistance than HYDRO-STONE.

DRYSTONE™ Casting Media This unique product eliminates the need for expensive drying and provides an environmentally sound alternative to resin-based products. DRYSTONE is formulated to increase chip resistance versus HYDRO-STONE and is available in solid cast as well as hollow cast formulas.



Plaster Properties

United States Gypsum Company Industrial Plasters and HYDROCAL Brand Gypsum Cements are formulated to produce certain unique properties that make them suitable for specific applications. All United States Gypsum Company products are characterized by high quality, purity, and uniformity. The degree of production control used in manufacturing ensures that characteristics and properties are uniform from bag to bag. Reproducible shop results can be obtained when the user of the material maintains a uniform method and procedure for handling each mix.

Factors that distinguish one type of Industrial Plaster or HYDROCAL Brand Gypsum Cement from another include physical properties such as setting time, consistency (water required for mixing), fineness, hardness, strength, workability, and surface characteristics.

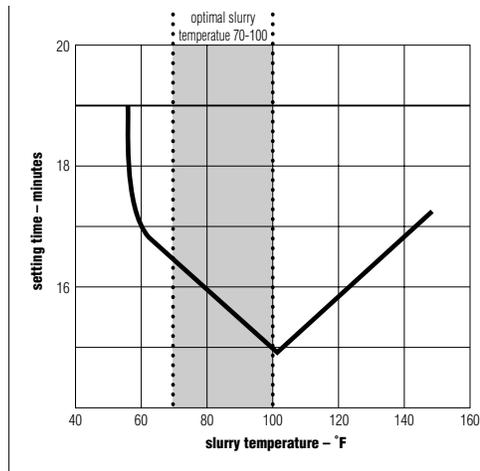
USG Industrial Plasters and Gypsum Cements—	Typical Physical Properties					
		Use Consistency (parts of water by weight per 100 parts of plaster)	Dry Compressive Strength (psi)	Dry Impact Strength (g•cm)	Density At Use Consistency (approx. lb./ft. ³)	
					Wet	Dry
Interior Products	Moulding/Casting Plasters	70	2,000	1,600	99.0	69.0
	White Art Plaster	70	2,000	1,700	99.0	69.0
	No. 1 Casting Plaster	65	2,400	1,700	100.0	72.5
	TUF CAL Plaster	50	4,300	2,430	108.0	85.0
	HYDROCAL White Gypsum Cement	45	5,000	1,750	110.6	90.0
	Statuary HYDROCAL Gypsum Cement	40	6,500	1,700	113.7	96.0
	HYDRO-STONE Gypsum Cement	32	10,000	1,320	119.4	108.7
	TUF STONE Gypsum Cement	32	10,000	3,300	122.0	112.0
Exterior Products	DRYSTONE Casting Media	19-20	16,000	2,800	130.0	128.0
	FAST CAST Exterior Gypsum Cement	12.5	8,000	N/A	131.0	110.0
GARDENCAST Gypsum Cement	12.5	8,000	N/A	145.0	135.0	

General Directions and Guidelines

Recommended Equipment	Measuring	Measuring
		
Sifting	Soaking	Mixing
		
Pouring	Demolding	Finishing
		

Preparing the Mix

Use potable water at temperatures between 70° and 100° F (21° and 38° C). Since variations in slurry (the plaster and water mixture) temperature produce variations in setting time, it is important to keep both the plaster and water in a stable temperature environment prior to use. The higher the temperature of the slurry, the shorter the set time. See chart below.



Weigh both the plaster and water at the recommended use consistency for each mix. The water-to-plaster ratio is critical because it governs all physical properties of the final cast piece.

Soaking

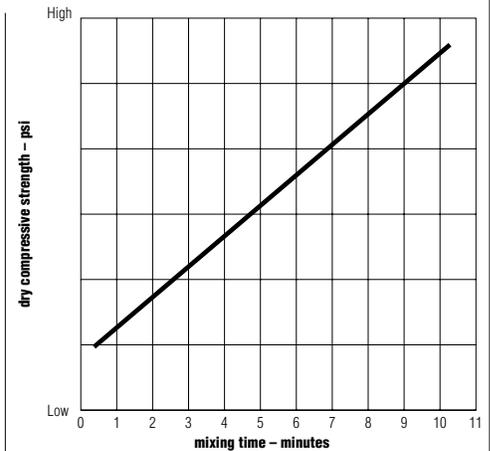
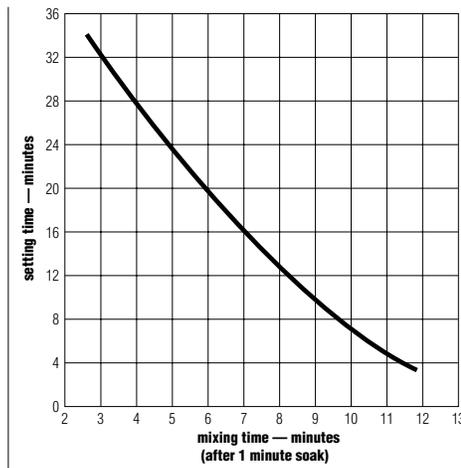
Sift or strew the plaster into water slowly and evenly. Do not drop handfuls of plaster directly into the water. Allow soaking for 1-2 minutes. The plaster should be fully dispersed in the water prior to mixing. Small batches require less soaking than large batches. See bulletin IG503 for specific soaking instructions. DRYSTONE, FAST CAST, and GARDENCAST should not be soaked.

Mixing

Mixing the plaster slurry is one of the most important steps in producing plaster casts with maximum strength, hardness, and other important properties.

Mechanically mixed plasters and HYDROCAL Brand products develop uniform casts with optimal strengths. Plasters and most HYDROCAL Brand products can be mechanically mixed through both batch and continuous processes. Proper blade and bucket dimensions are important for obtaining the best batch mix (see bulletin IG503 for details).

Longer mixing times result in higher cast strength and shorter setting times. The relationship between mixing time and both compressive strength and setting time is shown below.



Pouring

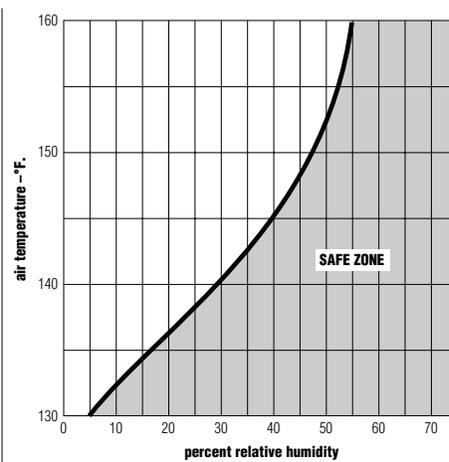
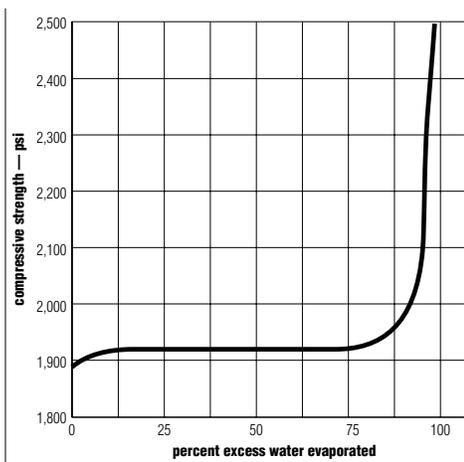
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Drying

All casts should be dried as quickly as is safely possible after manufacture so that maximum physical properties can develop. Dry to a constant weight.

The best drying rooms or ovens provide (1) uniform and rapid circulation (minimum of 15-30 fps) of air with no "dead spots" having little or no air movement, (2) equal temperatures throughout the entire area, and (3) provisions for exhausting a portion of the air while replacing it with fresh air. High humidity surrounding the drying room or oven inhibits the efficiency of the drying because the air pulled into the room is incapable of picking up much moisture from the casts.

The maximum temperature at which plaster casts are safe from calcination is 120° F (49° C). With substantial free water in the cast, higher drying temperatures can be used without difficulty. As drying progresses, the temperature must be reduced to prevent calcination. The safe drying zone is in the shaded area of graph (below, right). Before removing casts from the dryer, the temperature of the cast should approach that of the area around the dryer to prevent thermal shock.



Storage

Keep in a dry, stable environment indoors. Do not stack product more than 2 pallets high. Keep from drafts. Rotate stock.

Warning

When mixed with water, plaster in these products hardens and then slowly becomes hot. DO NOT attempt to make a cast enclosing any part of the body using this material. Failure to follow these instructions can cause severe burns that may require surgical removal of affected tissue. Dust from products may cause eye, skin, nose, throat, or respiratory irritation. Use eye, skin, and respiratory protection in accordance with good industrial hygiene practices. Read MSDS of product for specific details. Product safety information: 800-507-8899.

KEEP OUT OF REACH OF CHILDREN.

Trademarks

The following are trademarks of United States Gypsum Company: DRYSTONE, FAST CAST, GARDENCAST, HYDROCAL, HYDRO-STONE, TUF CAL, TUF STONE, USG.

Note

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Safety First!

Follow good safety and industrial hygiene practices during handling and installing 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.