PQ® Potassium Silicates

Liquids, powders, and flake glass

PQ Corporation

Advancing the art of silicate chemistry

INDUSTRIAL CHEMICALS DIVISION

PQ® Soluble Silicates

SS®
SS-C™
G®
GD®

Sodium Silicates - Solids

Available in a variety of weight ratios and particle size distributions.

N®
N-CLEAR™
RU™
O®
D™

Sodium Silicates - Solutions

Available in a variety of weight ratios and viscosities.

METSO BEADS®
METSO PENTABEAD®
BRITESIL®

Sodium Metasilicates and Polysilicates

METSO® products come in both anhydrous and pentahydrate forms. BRITESIL® products are hydrous powders.

KASIL®
KASOLV®

Potassium Silicates

Available in solids and solutions, as well as flake glass, hydrated, and anhydrous powder forms.

Magnesium Sulfate

PQ® Magnesium Sulfate
MagnaBrite™
MagnaGrow®
Go Soak Yourself®

Magnesium Sulfate Heptahydrate

Available in crystal and liquid solutions and special formulations for different applications.

Advancing the Art of Silicate Chemistry™

PQ first produced soluble silicates for commercial applications more than 135 years ago and has been *advancing the art of silicate chemistry*™ ever since. Simply stated, PQ is silicate chemistry.

Over the years, PQ has grown from a family soap and candle business into the world's leading manufacturer of silicates and silica-based inorganic chemicals and the world's largest volume producer of sodium silicates, synthetic zeolites, and solid glass beads. PQ has earned its reputation as the driving force in silicate chemistry by pioneering many industry innovations – from the first patented silicate furnace in the U.S. to the first high-value specialty silica-based derivatives, such as zeolite-based catalysts.

PQ innovation goes beyond products. We are continually developing new ways to help you improve your processes and increase the quality of your products in applications as diverse as soaps and detergents, protective coatings, cements, CRT coatings, and automotive antifreeze. In fact, every time you turn on your computer, wash your clothes, or drive your car…you benefit from PQ chemistry.

PQ's Industrial Chemicals Division (ICD) – our largest manufacturing group – has the muscle to support all of your potassium silicate needs whether you're manufacturing welding rods, detergents, refractory binders, or specialty coatings. In fact, PQ supplies potassium silicate to customers around the globe.

On the world stage, PQ's presence extends to more than 65 manufacturing facilities in 19 countries on five continents. Strategic international partnerships allow us to serve you even in the most remote areas. Regional customer service centers support you from the lab to the plant. So no matter where you are, PQ is there – prepared to be your global potassium silicates supplier.

Strength in Silicates

Supplying the World with Quality Potassium Silicates

At PQ, we combine our strength in silicates with a close customer relationship to cultivate inventive solutions for application challenges. Our broad KASIL® and KASOLV® potassium silicate product lines have been engineered for versatility. Our potassium silicates offer a wide spectrum of performance properties and physical characteristics, including weight ratios that range from 1.6 to 2.5 SiO_2:K_2O, and densities from 10.15 to 11.6 lb/gal (at 68˚F).

By adhering to high product-quality standards, PQ provides you with superior potassium silicates. All of our manufacturing plants are ISO certified. Plus, our unique quality assurance program identifies parameters to control silicate clarity – an industry benchmark for quality potassium silicate.

To provide you with extensive formulating flexibility, we supply PQ potassium silicates in a wider variety of forms than any other manufacturer, including liquid, flake glass, and hydrated powder. Our liquid potassium silicates are available in standard- as well as electronic-grade varieties for use in phosphor binders and as settling agents in computer screens – a mainstay of today's information technology age.

By using pure raw materials, PQ delivers unmatched clarity and quality consistency.

KASIL® liquid potassium silicates offer unique viscosity characteristics and other physical properties to enhance a wide range of industrial products. KASIL 1, for example, is perfect for protective coatings; KASIL 6, for welding electrodes.

KASIL® flake glass potassium silicates are an economical alternative to our liquid product line. Looking exactly as they sound: the clear, 1-inch plate-like pieces of KASIL flake glass potassium silicates dissolve easily in water. Their compact form offers high-volume purchasers substantial savings in shipping costs.

KASOLV® – spray-dried, hydrated, rapidly soluble potassium silicate powder – has been specifically designed for applications where either cold-water solubility or dry blending is required. As a powder, KASOLV potassium silicate is easy to ship, store, and handle.

Innovative Applications

Cathode Ray Tubes in TVs, ATMs, & PCs
Special Catalyst Binders
Agriculture/Hydroponics
Welding Rods
Soaps & Detergents
Refractory Cements
Adhesive Coatings
Antifreeze

KASIL® Potassium Silicates:

Performance Properties & Physical Characteristics

Performance Properties

Generally, PQ potassium silicates and sodium silicates share similar performance properties. However, in certain applications, there are a number of performance advantages of KASIL potassium silicates over PQ sodium silicates. Some of these include:

High-temperature binding

The violet flame color of potassium versus the blinding, intense yellow color of sodium makes KASIL potassium silicates ideal for high-temperature welding with carbon arc electrodes. The soft violet hue is easier to see through when welding.

Convenient source of potassium

Where potassium is a necessary ingredient, it is often convenient to introduce potassium as a silicate – especially in certain catalyst gels, welding rod coatings, and liquid detergents.

Non-efflorescence

Coatings made with KASIL potassium silicates do not develop a white carbonate film – or efflorescence – on exposure to the atmosphere, making them a preferred choice for decorative coatings, paints, and ceramic binders.

Higher solubility

KASIL potassium silicates are more soluble than PQ sodium silicates. They are also more compatible with many other ingredients and, consequently, ideal for use in the formulation of liquid, heavy-duty detergents, and built liquid and paste soaps, which include many other ingredients in their formulations.

Greater refractoriness

Because KASIL potassium silicates soften and flow at a higher temperature than sodium silicates, they work well in various high-temperature binders such as refractory mortars and specialty cements.

Non-tacky

KASIL potassium silicates' non-tacky properties make them a value-added ingredient for certain mortars. These properties help prevent mortar from sticking to a mason's trowel. This allows for greater bricklaying efficiency and reduced bricklaying labor costs.

Physical Characteristics

KASIL liquid potassium silicates come in both standard- and electronic-grades. Standard-grade KASIL potassium silicate products are offered in SiO_2:K_2O weight ratios of 2.1 and 2.5 and are available in densities that range from 10.5 to 11.6 lbs./gal. (at 68°F).

Electronic-grade KASIL potassium silicate products are offered in SiO_2:K_2O weight ratios, ranging from 1.65 to 2.5 and are available in densities that range from 10.15 to 11.0 lbs./gal. (at 68°F). Electronic-grade KASIL products have a lower viscosity than standard-grade KASIL products, and contain very low levels of iron, copper, and sodium as required for special applications in the electronics industry.

Figure 1

TYPICAL COMPOSITION AND PROPERTIES OF LIQUID KASIL® POTASSIUM SILICATES

	Mole Ratio (SiO_2:K_2O)	Wt. Ratio (SiO_2:K_2O)	Wt. %K_2O	Wt. %SiO_2	All values determined @ 68°F (20°C) Density °Bè	Density lb/gal	Density g/cm³	Viscosity centipoises	pH	Characteristics
KASIL Liquids – Standard Grades										
KASIL 1	3.92	2.50	8.30	20.80	29.80	10.50	1.26	40	11.30	Clear Liquid
KASIL 33	3.29	2.10	11.60	24.40	37.30	11.20	1.34	43	11.70	Clear Liquid
KASIL 6	3.29	2.10	12.65	26.50	40.30	11.60	1.38	1050	11.70	Clear Liquid
KASIL Liquids – Electronic Grades										
KASIL 2130	3.30	2.10	9.5	20.0	—	10.6	1.27	—	11.70	Very Clear
KASIL 2529	3.92	2.50	8.30	20.80	29.80	10.50	1.26	—	11.30	Very Clear

KASIL® Potassium Silicates: Viscosity

Viscosity is one of the most easily stimulated and manipulated physical characteristics of KASIL potassium silicates, affected by ratio, concentration, and temperature. In fact, one key difference between KASIL liquid potassium silicates and PQ sodium silicates is that KASIL products are somewhat more viscous than corresponding PQ sodium silicates at equal concentrations and ratios.

As seen in Figure 2, the lower the ratio (i.e., the more alkaline at a given solids content), the lower the viscosity. For that reason, the relatively alkaline KASIL potassium silicate products can be furnished in a more concentrated form.

Viscosity is also a function of concentration. As you increase concentration, you increase viscosity. Figure 3 shows how quickly the addition of even a small amount of water changes a syrupy KASIL product to a solution approaching water in viscosity. This ability to easily manipulate the viscosity of KASIL potassium silicates provides chemists with greater formulating flexibility.

Increasing the temperature will cause a significant drop in the viscosity of KASIL potassium silicates, as illustrated in Figure 4. For example, at 20°C, a sample of KASIL 6 has a viscosity of 1050 centipoises. At 25°C, the viscosity plunges to 370 centipoises, and at 30°C it nose-dives to 200 centipoises.

Figure 2

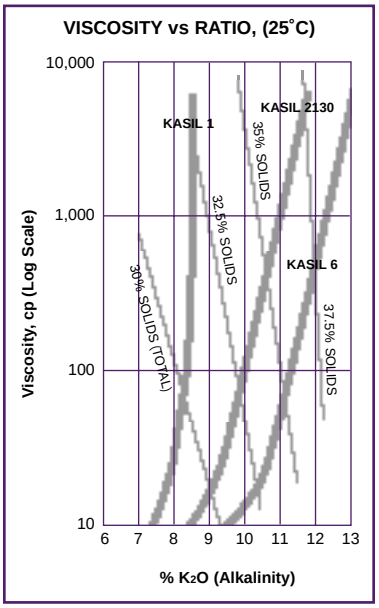


Figure 3

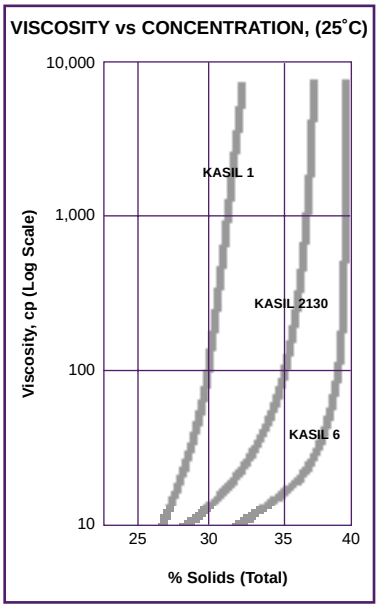


Figure 4

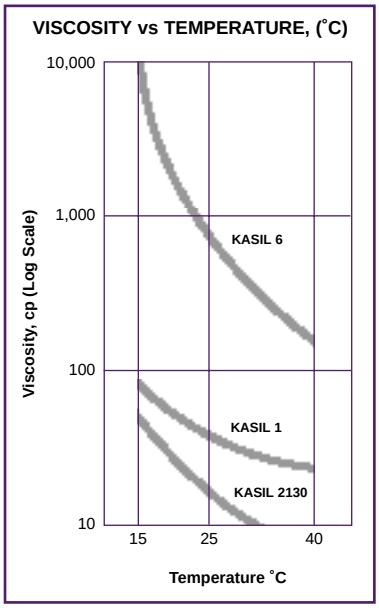
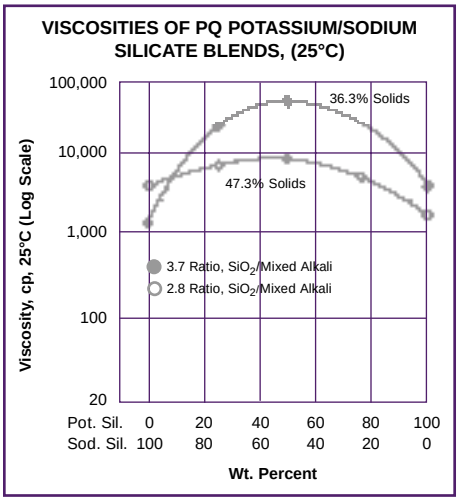


Figure 5



Unique physical characteristics are exhibited when PQ sodium and potassium silicates are combined. For example, in liquid mixed systems, it's possible to vary the total solids content or the overall silica/alkali mole ratio.

KASIL® Potassium Silicates:

Industrial, Agricultural, & Electronic Applications

Standard Grades

Welding Rods

KASIL potassium silicates produce a smoother, quieter burning arc for stable welding than PQ sodium silicates. This is particularly important for stainless steel and AC welding. KASIL potassium silicates combined with PQ sodium silicates are used when a controlled amount of arc sputtering is acceptable.

Protective and Decorative Coatings

Because KASIL potassium silicate coatings do not form white carbonate films, they do not hide pigments. As a result, KASIL potassium silicates yield clear, rich colors with a soft quality – perfect for decorative pigments that are applied to stone, concrete, stucco, brick, and metal surfaces.

KASIL 1, for example, can be used to create zinc-rich protective coatings. Zinc dust is mixed with the silicate component of KASIL, yielding a coating that resists water, rain, condensation, and corrosion upon curing.

Soaps and Detergents

Liquid KASIL potassium silicates provide increased solubility and phosphate reversion resistance in detergent and hard surface cleaner formulations. As a source of K_2O, they enhance liquid detergents with acid soil neutralization, oil saponification, and anti-redeposition benefits.

In phosphate-built hard surface cleaners, SiO_2 and K_2O stabilize poly- and pyro-phosphates. Plus, when KASIL liquid potassium silicates are used in place of sodium alkali sources, high-solid liquid detergent formulations can be produced without stability problems. In fact, only KASIL potassium silicates provide the benefits of K_2O solubility, alkalinity, and silicate corrosion inhibition in a single, raw material.

Refractory Cements

Due to high refractory properties, KASIL potassium silicates mix with silica flour, clay, and grog to be utilized in refractory and chemical-resistant mortars.

Silica Gels

KASIL potassium silicates are ideal for use in special catalysts when the presence of the sodium ion is undesirable. These gels can also be used as culture media in connection with plant physiology, mycology, etc.

Antifreeze

Because KASIL potassium silicates have a strong tolerance for glycol, they are preferred over other forms of silicate for ethylene glycol automotive antifreeze formulations.

Hydroponics/Plant Health

KASIL potassium silicates are a convenient source of potassium – a primary nutrient for good plant health.

Electronic Grades

Monitors and Screens

Low levels of iron, copper, and sodium in electronic-grade KASIL products* make them compatible with phosphor compounds and perfect as settling agents for use in CRT manufacturing of computer monitors, oscilloscopes, radar screens, and automated teller machine (ATM) monitors. The absence of magnetic metals in KASIL potassium silicates helps ensure that no “pinholing” or clumping occurs on the inside surface of screens, leaving a smooth, continuous layer of phosphor particles for consistent color reproduction.

Adhesive Coatings

As an adhesive, KASIL potassium silicates bond the phosphor to the glass in screen/monitor applications. The lower-ratio potassium silicate also helps to etch the glass surface more easily. The higher-ratio potassium silicate, however, offers more silicate for binding.

**All electronic grades of KASIL potassium silicates contain less than 30 p.p.m. iron and 1 p.p.m. copper.*

KASIL® Potassium Silicates:

Shipping, Handling, Storage, & Safety

Trucks

Shipments of KASIL potassium silicates are to be unloaded by the truck driver. All that is usually required of the customer is a three-inch (7.6 cm) diameter freeze-protected fill pipe. Three reminders include:

1) The connecting end of pipe should be threaded and capped to prevent entry of foreign material.

2) The fill line should be equipped with a shut-off valve located close to the capped end.

3) The fill line connection should be no more than three feet above ground level.

Drums

PQ offers KASIL potassium silicates in 55-gallon (208 liter) non-returnable drums. For information concerning the availability of these products and their handling, contact PQ's Industrial Chemicals Division Technical Support Group at **610-651-4507**.

Pumps, Valves, and Piping

Rotary or centrifugal pumps used as valves are satisfactory. Gate valves are often used, but globe valves should usually be avoided.

Silicate tanks should be large enough so that sufficient reserve stock can be maintained. For tank car deliveries, the recommended tank capacity is between 12,000 and 15,000 gallons (45,000 to 55,000 liters). Greater convenience and flexibility are possible if silicate inventory is distributed between two 10,000-gallon (37,500-liter) tanks. This permits isolation of either unit for cleaning and maintenance.

For truck deliveries, a storage tank large enough to handle at least one truck load, plus a safe inventory – not less than 6,000 gallons (22,500 liters) – is recommended.

KASIL potassium silicates evaporate slowly when exposed to air, so tanks should be closed, but vented. The tanks may be constructed of carbon steel or concrete and should have a manhole to provide access for inspection and maintenance.

If heating is required, conventional steam coils or electric tape may be used. External heating is preferred over internal heating because it minimizes localized overheating and helps prevent troublesome variations in silicate concentrations within the tank. Prolonged heating can cause evaporation and should be avoided.

KASIL liquid potassium silicates freeze and boil at the same temperatures as water. If freezing occurs, the product may separate. Remixing by normal plant procedures may not be sufficient to reconstitute the solution to its original properties. Therefore, drums should not be stored in areas where they may be subjected to temperatures below 40˚F and storage tanks must be equipped so freezing cannot occur.

Silicate solutions can be stored for up to one year in tightly closed drums, steel containers, or other containers made of nonreactive materials. Containers made of aluminum, galvanized steel, or zinc may react with the product, forming hydrogen gas and bursting the container.

Safety Information

Depending on the degree of alkalinity, KASIL liquid potassium silicates may irritate or burn the skin and eyes. In addition, because silica and alkali are dehydrating agents that can adsorb moisture and oils from surfaces, if skin is constantly exposed to silicates, some dehydration of the skin surface can occur. This may cause dryness, rashes, and cracking of the skin. For safety, follow the handling instructions on the labels of the packages, and wear both safety goggles and neoprene gloves while working with the product.

PQ potassium silicates are completely inorganic, and therefore, do not present hazards such as low flash point or flammability. They also do not suffer degradation from molds, nor are they palatable to insects or rodents.

Materials Safety Data Sheets for KASIL potassium silicates are available on our Web site, www.pqcorp.com, or from PQ Customer Service. Call 610-651-4507.

KASIL® Flake Glass Potassium Silicates:

Performance Properties & Physical Characteristics

Performance Properties

KASIL flake glass potassium silicates can be dissolved in water to yield an economical 2.5 ratio solution. Solutions with ratios of 2.2 and 2.1 can be obtained by adding appropriate amounts of caustic potash (KOH) during the dissolving process.

Solutions of KASIL flake glass potassium silicates in three ratios (2.5, 2.2, and 2.1) perform similarly to equivalent ratios of PQ sodium silicates. For example, the viscosity of both dissolved KASIL flake glass and PQ sodium silicates is affected by ratio, concentration, and temperature. However, there is one significant difference: KASIL flake glass solutions are more viscous than corresponding PQ sodium silicate solutions at equal concentrations. See Figures 6 and 7 for details.

KASIL flake glass potassium silicates can be dissolved in less than two hours at atmospheric conditions. And, increasing the temperature will cause a significant drop in viscosity.

Physical Characteristics

Flake glass has evolved from advanced silicate technology in the labs at PQ. The chemical composition of KASIL flake glass potassium silicates are expressed in terms of weight ratio as SiO_2:K_2O. They have a SiO_2:K_2O weight ratio of 2.50 and a pH (of 1% solution) of 10.4. Other physical characteristics are summarized in Figure 8.

KASIL flake glass potassium silicates look exactly as they sound – clear, plate-like pieces of glass produced by the fusion of sand and potassium carbonate. One of the product's most important characteristics is its ability to dissolve easily in water.

Economical Alternative. The flake form offers substantial savings in shipping costs for high-volume purchasers, as well as convenient handling and storage. But, the decision to install a dissolving tank and purchase KASIL flake glass versus purchasing a KASIL liquid potassium silicate product is affected by many factors. These factors vary for each customer, so you must evaluate the economic advantages of switching to flake glass for your specific operation.

Figure 6

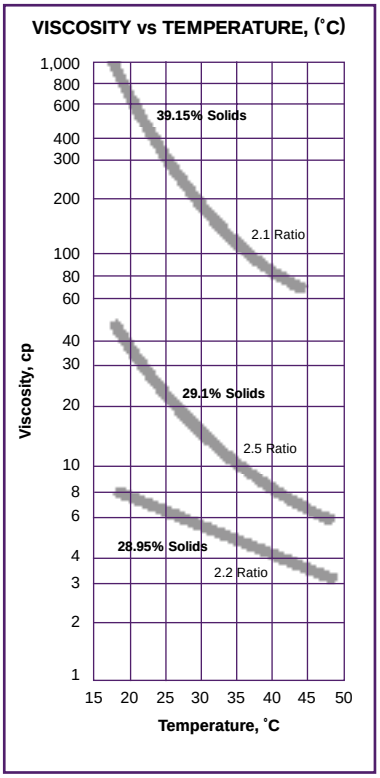


Figure 7

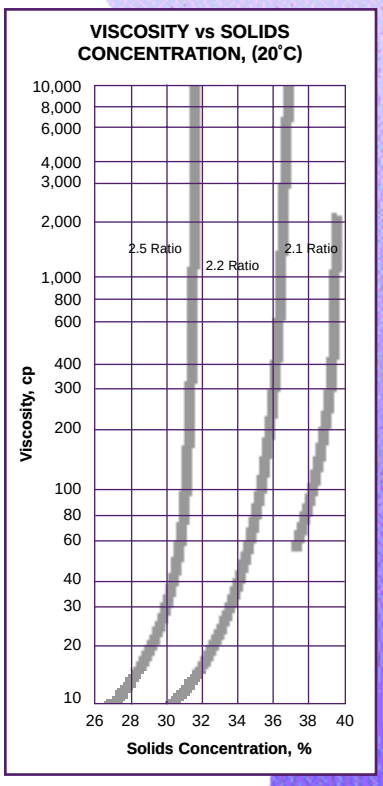


Figure 8

TYPICAL CHARACTERISTICS OF KASIL® FLAKE GLASS POTASSIUM SILICATES	
Weight Ratio SiO_2:K_2O	2.50
Mole Ratio SiO_2:K_2O	3.92
% K_2O	28.4
% SiO_2	71.0
Fe ppm	150 maximum
Sizing: Clear plates 1/6" to 1/8" thick with surface dimensions of approximately 1" x 1" or smaller	
Melting Point	1400˚F (760˚C)
Bulk Density lb/ft³ (gm/cm³)	77.5 (1.24)
Insolubles	nil
pH of 1% solution	10.4

KASIL® Flake Glass Potassium Silicates:

Applications & Safety

Applications

KASIL flake glass potassium silicates are well-suited for use in ceramics, metals, detergent/cleaning compounds, silica gels, and paints/coatings applications. The following are examples of specific applications:

Ceramics

- Chemical-resistant mortars
- Refractory cements
- Slip castings/slurry thinners for clay mortars

Detergent/Cleaning Compounds

- Specialty cleaners and detergents
- Liquid soaps and detergents

Paints/Coatings

- Decorative coatings
- Masonry
- Zinc-rich primers

Metals

- Antifreeze formulations
- Coating welding rods
- Corrosion prevention

Silica Gel

- Catalysts
- Culture media

Shipping, Handling, Storage, and Safety

KASIL flake glass potassium silicates are shipped packaged in steel non-returnable drums (600 pounds each) or in semibulk containers approximately 2,000 pounds each.

Dry KASIL potassium silicates exhibit a natural tendency to adsorb water from the ambient air. The packaging material provides protection for storage at moderate humidity conditions for up to one year. Additional protection should be provided if high humidity conditions are common and/or if the products are to be stored for long periods of time.

KASIL flake glass potassium silicates are alkaline and may irritate or burn the skin and eyes. Care in handling should be exercised to prevent injury or discomfort. Like all PQ products, KASIL flake glass potassium silicate packages have appropriate precautionary labels.

Materials Safety Data Sheets for KASIL flake glass potassium silicates are available on our Web site, www.pqcorp.com, or from PQ Customer Service. Call 610-651-4507.

KASOLV® Potassium Silicate:

Performance Properties & Physical Characteristics

Performance Properties

When dissolved in water, KASOLV potassium silicate offers all the advantages of liquid potassium silicates: excellent adhesive and binder properties; acid resistance; great solubility with detergent ingredients; and high tolerance for certain organic compounds.

KASOLV potassium silicate is readily soluble in water. KASOLV dissolves into solution, as shown in Figure 9. For example, 100% by weight of KASOLV 16 will completely dissolve in less than two minutes.

Please note: As KASOLV potassium silicate dissolves, it forms a milky white suspension which rapidly clears as the powder is completely dissolved. Do not add powder to water too rapidly or with inadequate stirring; this may cause the formation of wet, matted lumps and hinder dissolution.

Physical Characteristics

KASOLV hydrous potassium silicate is a spray-dried, hydrated, rapidly soluble powder. As such, it's easy to ship, store, and handle. Our KASOLV 16 is available in the SiO_2:K_2O weight ratio of 1.6.

Figure 9

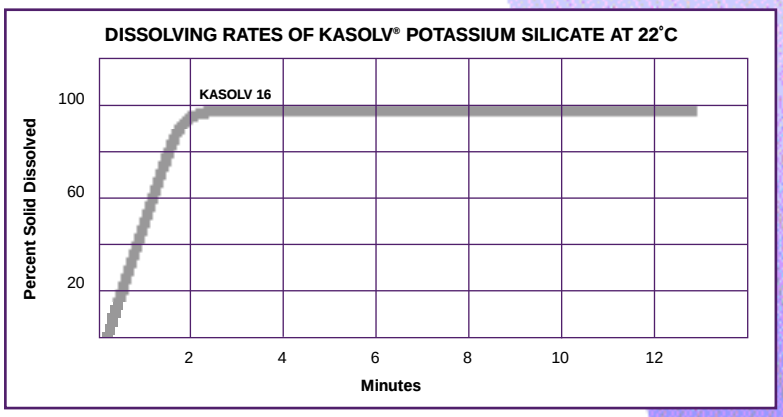


Figure 10

TYPICAL CHARACTERISTICS OF KASOLV® HYDROUS POTASSIUM SILICATE

	KASOLV 16
Weight Ratio SiO_2:K_2O	1.6
Weight % K_2O	32.4
Weight % SiO_2	52.8
LOI, Weight %	14.5
Bulk Density, lb/ft^3	43.0
Particle Size Distribution (Tyler Screen)	99% thru 40 mesh
Density 10% solids solution °Bè	11.1
pH	
1% solids solution	11.3
10% solids solution	12.0

KASOLV® Potassium Silicate:

Applications & Safety

Applications

Like KASIL liquid potassium silicates, KASOLV 16 can be used in applications as diverse as welding rods, soaps, and hard-surface cleaners, but has been designed specifically for applications where either cold-water solubility or dry blending are required, such as specialty refractory applications and oil field service cements.

KASOLV potassium silicate is well-suited for use in the following specific applications:

Detergent/Cleaning Compounds

- Specialty cleaners and detergents
- Liquid soaps and detergents
- Hard-surface cleaners

Metals

- Antifreeze formulations
- Coating welding rods
- Corrosion prevention

Shipping, Handling, Storage, and Safety

Because it is supplied as a powder, KASOLV potassium silicate is easy to ship, store, and handle. KASOLV potassium silicate is packed in 100-pound multi-ply bags. Plys consisting of paper, aluminum, and plastic layers provide protection from the absorption of moisture from ambient air, permitting storage in the most humid conditions for up to one year.

KASOLV potassium silicate is alkaline and may irritate or burn skin and eyes. Precautions on the package label should be observed.

KASOLV potassium silicate is completely inorganic and does not present hazards such as low flash point or flammability. The material does not suffer degradation from molds and is unpalatable to insects and rodents.

Please note: The sole environmental hazard of KASOLV potassium silicate is the alkaline pH. Upon dilution, KASOLV rapidly depolymerizes to chemical species indistinguishable from natural dissolved silica.

A Materials Safety Data Sheet for KASOLV hydrous potassium silicate is available on our Web site, www.pqcorp.com, or from PQ Customer Service. Call 610-651-4507.

The PQ Commitment

Doing all that it takes to support your global potassium silicate needs.

PQ specializes in developing better ways to use our products in your existing applications, and in developing new end uses that add value to your products. With unparalleled expertise in silicate chemistry and extensive experience in the industries PQ serves, our Technical Service Department is a valuable resource to address all of your product, process, and application questions.

PQ operates manufacturing plants in every major industrial region in the U.S., so that we can deliver products to you quickly and efficiently. A team of PQ Customer Service Representatives is available at every plant, providing you with responsive, hands-on support.

PQ also provides emergency information 24 hours a day through our Emergency Response Answering Service. In the event of an emergency involving a PQ potassium silicate product or any other PQ product, please call **610-651-4200**.

When you need technical assistance, information, or product samples of a PQ potassium silicate, talk to PQ Corporation – the world's source for silicate and silica-derived products.

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www.pqcorp.com

PQ Corporation, recently acquired by JPMorgan Partners, is a leading producer of silicate, zeolite, and other performance materials serving the detergent, pulp and paper, chemical, petroleum, catalyst, water treatment, construction, and beverage markets. It is a global enterprise, operating in 19 countries on five continents, and along with its chemical businesses, includes Potters Industries, a wholly owned subsidiary, which is a leading producer of engineered glass materials serving the highway safety, polymer additive, metal finishing, and conductive particle markets.

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