

3M™ Glass Bubbles

K Series

S 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 and S 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%
	iM30K	28,000	90%	90%

True Density

	Product	Typical	True Density (g/cc)	
			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
	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
	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

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

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 percent 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.

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

Particle Size

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

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* 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.

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.
	iM30K	125 lb.	850 lb.	37,400 lb.

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

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651 736 7123 (U.S.)

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 Performance Materials Division, **800 367 8905**.

For other 3M global offices, and information on additional 3M products, visit our web site at: **www.3M.com/microspheres**.

Important Notice to Purchaser: The information in this publication is based on tests that we believe are reliable. Your results may vary due to differences in test types and conditions. You must evaluate and determine whether the product is suitable for your intended application. Since conditions of product use are outside of our control and vary widely, the following is made in lieu of all express and implied warranties (including the implied warranties of merchantability and fitness for a particular purpose): Except where prohibited by law, 3M's only obligation and your only remedy, is replacement or, at 3M's option, refund of the original purchase price of product that is shown to have been defective when you received it. In no case will 3M be liable for any direct, indirect, special, incidental, or consequential damages (including, without limitation, lost profits, goodwill, and business opportunity) based on breach of warranty, condition or contract, negligence, strict tort, or any other legal or equitable theory.



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