3M

Product Information

Scotchlite™ Glass Bubbles

K Series
S Series

Introduction

3M™ Scotchlite™ 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 Scotchlite 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 Scotchlite 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 Scotchlite 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 Scotchlite glass bubbles compatibility with most resins, stable viscosity and long shelf life.

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

Typical Properties (Not for Specification Purposes)

Nitrogen Isostatic Crush Strength (3M QCM 14.1.5)

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%
	S38	4,000	90%	80%
	S60/10,000*	10,000	90%	80%

*Per ASTM D3102-78 in glycerol.

True Density (3M QCM 14.24.1)

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
	S38	0.38	0.35	0.41
	S60/10,000	0.60	0.57	0.63

Typical Properties (continued)

Chemical Resistance

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

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

Varies from 55% to 68%.

Oil Absorption

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

Thermal Properties

Conductivity

K Series: 0.06–0.02 W/m·K at 32°F (0°C), based on theoretical calculations.

S Series: 0.07–0.26 W/m·K at 32°F (0°C), based on theoretical calculations.

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

Stability

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

Flotation (3M QCM 37.2)

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%
	S38	94%	90%
	S60/10,000	92%	90%

Typical Properties (continued)

Volatile Content (3M QCM 1.5.7)

Maximum of 0.5 percent by weight.

Alkalinity (3M QCM 55.19)

Maximum of 0.5 milliequivalents per gram.

pH

Because 3M™ Scotchlite™ Glass Bubbles are a dry powder, pH is not defined. The pH effect will be determined by the alkalinity as indicated above. When Scotchlite glass bubbles are mixed with deionized water at 5 volume percent 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 Scotchlite glass bubbles.

Particle Size

Product		Particle Size (microns, by volume) (3M QCM 193.0)			
		Distribution			Effective Top Size
		10th%	50th%	90th%	95th%
K Series	K1	30	65	110	120
	K15	30	60	105	115
	K20	30	65	110	120
	K25	25	55	95	105
	K37	20	40	80	85
	K46	15	40	70	80
S Series	S15	25	55	90	95
	S22	20	35	60	75
	S32	20	40	75	80
	S38	15	40	75	85
	S60/10,000	15	30	55	65

Typical Properties (continued)

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.

Sieve Analysis (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, S38 and S60/10,000* 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.

Flowability (3M QCM 22.83)
3M™ Scotchlite™ 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
Scotchlite 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 Scotchlite 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™ Scotchlite™ 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 Scotchlite 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 Scotchlite 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 Scotchlite glass bubbles. Vendors should be consulted for specific recommendations.

Scotchlite 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.

Box dimensions are 22 in. x 19 in. x 39 in.
Pallet size is 42 in. x 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.

Inside box dimensions are 48 in. x 42 in. x 44 in. Overall load size is 48¾ in. x 42¾ in. x 50 in. including pallet. Pallet size is 42 in. x 48 in.

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.
	S38	100 lb.	680 lb.	29,920 lb.
	S60/10,000	125 lb.	850 lb.	37,400 lb.

*Box weights may vary due to manufacturing tolerances on each product. S60/10,000 large box is a 38 cubic ft. box.

For Additional Information or Sales Assistance	**3M Specialty Materials** **3M Center** Building 223-6S-04 St. Paul, MN 55144-1000 **800 367 8905** **800 810 8514** (FAX) In Canada, **800 410 6880** ext. **6019** In Puerto Rico, **787 750 3000**
For Product Specifications and Test Methods	**3M Technical Service** **651 736 6018**

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