

3M™ Glass Bubbles K1 for Cryogenic Insulation Applications

Introduction

New insulation technology opens the way to dependable, cost-effective cryogenic systems.

3M™ Glass Bubbles K1 are strong, lightweight, hollow glass spheres used to enhance the thermal properties in cryogenic vessels. The bulk properties of the Glass Bubbles make them an excellent alternative to commonly used filler type materials. 3M Glass Bubbles K1 exhibit a high strength-to-density ratio and low thermal conductivity which results in a high performance and economical insulative system.

Key problems which can be addressed include boil off, corrosion, and tank or trailer design issues. Using 3M Glass Bubbles K1 can reduce system life cycle costs, including costs over the lifetime of the cryogenic tank, such as costs of replacing insulating material, loss during thermal cycling, loss due to “boil-off”, and less tank maintenance or premature replacement due to corrosion. 3M Glass Bubbles K1 when used in the construction of a cryogenic trailer can significantly reduce the weight of the trailer thus allowing higher total pounds of cryogen to be transported. Additionally, because the 3M Glass Bubbles remain fluid with little compaction less pressure is placed on the inner shell support structure helping reduce maintenance requirements.

These engineered, hollow glass spheres are free flowing and easily fill void spaces while reducing “hot” spots. Their low thermal conductivity provides improved thermal insulative properties, while the glass bubbles stay suspended with minimal settling. Additionally, the glass bubbles will not crush or break or degrade over time. Their high strength-to-density ratio allows the glass bubbles to survive thermal cycling during both the filling and the emptying of the tank. The 3M glass bubbles exhibit minimal change to the bulk or packed density over time. There is no additional settling when packed thus eliminating the possibility of voids, which reduces condensation on the external shell of the vessel and minimizes the possibility of corrosion.

Material Description

(Not for specification purposes)

Properties	K1
Shape	Hollow spheres with thin walls
Composition	Soda-lime-borosilicate glass
Color, unaided eye	White, powdery

Typical Physical Properties

(Not for specification purposes)

Properties	3M™ Glass Bubbles K1	Test Method
Isostatic crush strength (psi)	250 psi	3M QCM 14.1.8
True density	0.125 g/cc	3M QCM 14.24.1
Packing factor (bulk density to true particle density)	60%	
Softening point	600°C	
Flotation (density<1.0 g/cc)	96% (in volume)	3M QCM 37.2
Volatile content	0.5% max. (by weight)	3M QCM 1.5.7
Alkalinity	0.5 milliequivalents/gram max.	3M QCM 55.19
pH	9.5 at 5% loading in water	ASTM D3100-1982
Diameter (average)	65 microns	3M QCM 193.0
Thermal Conductivity	0.047 w/MK 0.327 in./hft ² °F	Calculated

3M™ Glass Bubbles K1 Formulating Information

Flow properties: 3M™ Glass Bubbles K1 will remain free flowing for at least one year from the date of manufacture when stored in the original, unopened container in accordance with the recommended storage conditions. (See next page for storage recommendations.)

Packaging

3M Glass Bubbles K1 are packaged in heavy-duty polyethylene bags with cardboard containers designed to prevent damage during normal handling and shipping while maintaining free-flowing properties. Each container is labeled with the following:

- Name of manufacturer
- Product identification
- Lot number
- Quantity in pounds
- Density (average) of the box

Additional information for each shipment is supplied in the form of a Certificate of Analysis.

Product can also be shipped bulk in pressure differential trailers. Please contact your 3M representative for additional information about bulk shipment.



3M™ Glass Bubbles Product Storage, Handling and Safety

Storage: Ideal storage conditions include unopened cartons in a dry and temperature-controlled warehouse.

Extended exposure of K1 glass bubbles boxes to high humidity and/or conditions susceptible to condensation may result in some amount of “caking” of the glass bubbles. To minimize the potential for caking and thereby maximize storage life, the following suggestions are offered:

1. Carefully re-tie opened bags immediately after use.
2. If the polyethylene bag is punctured during shipping or handling, seal the hole as soon as possible or insert the contents into an undamaged bag.
3. During hot and/or humid months, store boxes in the driest, coolest space available.

If controlled storage conditions are unavailable, carry a minimum inventory and process on a first in/first out basis.

Handling: Due to the low weight and small particle size of 3M™ Glass Bubbles K1, dusting may occur while handling and processing. To minimize the dusting potential during handling, consider the following:

- Do not open glass bubbles packages until ready to use.
- Upon opening, have an air siphon near the opening to pull away airborne particles. (Dust collection equipment may be required – check local OSHA regulations.)

- The preferred method to convey glass bubbles is using a suction “wand”, vacuum, and dust collection. A double diaphragm pump is an alternative method.

- Static eliminators should be used to prevent static buildup.

Safety: For worker protection, please consider the following:

- Use safety glasses with side shields for eye protection.
- For respiratory system protection wear an appropriate NIOSH/MSHA approved respirator. (For additional information about personal protective equipment, refer to the Material Safety Data Sheet.)
- Use appropriate ventilation/dust collection in the work area.

3M™ Glass Bubbles K1 Additional Information

For additional information about 3M™ Glass Bubbles K1, or more product information on any 3M Microspheres, please call 1-800-367-8905, or contact your local 3M representative.

United States
3M Energy and Advanced
Materials Division
800 367 8905

Europe
3M Belgium N.V.
32 3 250 7521

China
3M Hong Kong Limited
852 2806 6111

Japan
Sumitomo 3M Limited
813 3709 8250

Malaysia
3M Malaysia Sdn. Berhad
60 3 706 2888

Other Areas
651 736 7123 (U.S.)

Brazil
3M do Brasil Ltda.
5519 3838 7000

India
3M India Limited
Bangalore
9080 2231414

Taiwan
3M Taiwan Limited
886 2 2704 9011

Philippines
3M Philippines, Inc.
63 2 813 3781

New Zealand
3M New Zealand Ltd.
64-9-444-4760

Canada
3M Canada Company
800 364 3577

China
3M China Ltd.
86 21 6275 3535

Korea
3M Korea Limited
82 2 3771 4114

Singapore
3M Singapore Pte. Ltd.
65 454 8611

Australia
3M Australia Pty., Ltd.
61 2 9498 9333

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**Energy and Advanced
Materials Division**

3M Center, Building 223-6S-04
St. Paul, MN 55144-1000
www.3M.com/microspheres

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