

▶ 3M™ Glass Bubbles

All-round multifaceted.

Properties, specifications,
and usage.

One product, countless solutions.

Welcome to the world of 3M™ Glass Bubbles – microscopically small hollow spheres made of water-insoluble, chemically stable borosilicate glass that can be used in numerous areas to optimise components and products as well as costs and processes.

3M™ Glass Bubbles offer an innovative alternative to or supplement for irregularly shaped mineral fillers used in the automotive, aviation, and space industry, the construction sector, and the plastics and chemicals industry. Weight reduction, process optimisation, improved dimensional stability and thermal insulation are just a few of the reasons for using Glass Bubbles in these areas.

3M™ Glass Bubbles have established themselves as indispensable components for realising innovative projects in a wide variety of application areas and are continuously further developed to cater for the requirements of diverse industries. Thus, our current range of 3M™ Glass Bubbles today comprises more than 20 different product types.

This brochure is intended to provide all the necessary information and specifications as well as important tips on handling and processing for the various 3M™ Glass Bubbles models.

Product information

Properties of our 3M™ Glass Bubbles at a glance.

Product characteristics	Benefits
Clearly defined product specification (e.g. closely packed particle distribution)	Measurable and constant product parameters
Hollow (low density)	Weight reduction
Closed, perfectly spherical form (unicellular)	- Isotropic material behaviour - No material absorption
High isostatic crush strength	Excellent survival rate of hollow spheres
Low-alkaline borosilicate glass	- Water-resistant - Chemical-resistant - Non-flammable
Low thermal conductivity	Thermal insulation
Surface treatment possible	Improved adherence to the matrix
Low thermal capacity	Fast temperature regulation

3M™ Glass Bubbles offer countless technical benefits in production, such as increased process stability, lower CO₂ emissions, and product reproducibility.

If you would like to find out more about how 3M™ Glass Bubbles can be used in your project, just get in touch with us. We would be glad to advise you!

specialmarkets@mmm.com

1. Physical properties.

Product number	Average particle density*		Bulk density	Isostatic crush strength**			Float rate		
	Rated density in g/cm ³	Tolerance range in g/cm ³	Tolerance range (calculated) in g/cm ³	Test pressure			Proportion of intact Glass Bubbles in % under test pressure		Typical values in % of the volume
				bar	MPa	psi	Min.	Typical	
K1	0.125	0.10 – 0.14	0.05 – 0.10	17	1.7	250	80	90	96
K15	0.15	0.13 – 0.17	0.07 – 0.12	21	2.1	300	80	90	96
K20	0.20	0.18 – 0.22	0.10 – 0.15	34	3.4	500	80	90	96
K25	0.25	0.23 – 0.27	0.13 – 0.18	52	5.2	750	80	90	96
K37	0.37	0.34 – 0.40	0.19 – 0.27	210	21.0	3,000	80	90	94
K42HS	0.42	0.40 – 0.45	0.40 – 0.45	517	51.7	7,500	80	90	92
K46	0.46	0.43 – 0.49	0.28 – 0.32	420	42.0	6,000	80	90	92
S15	0.15	0.13 – 0.17	0.07 – 0.12	21	2.1	300	80	90	96
S22	0.22	0.19 – 0.25	0.09 – 0.17	28	2.8	400	80	90	96
S32LD	0.29	0.26 – 0.32	0.14 – 0.22	103	10.3	1,500	80	90	94
S32	0.32	0.29 – 0.35	0.16 – 0.24	140	14.0	2,000	80	90	94
S38	0.38	0.35 – 0.41	0.19 – 0.28	280	28.0	4,000	80	90	94
S38HS	0.38	0.35 – 0.41	0.19 – 0.28	385	38.5	5,500	80	90	94
S60	0.60	0.57 – 0.63	0.31 – 0.43	690***	69.0	10,000	80	90	92
iM16K	0.46	0.43 – 0.49	0.27 – 0.32	1,100	110.0	16,000	90	90	96
iM30K	0.60	0.57 – 0.63	0.30 – 0.40	2,000***	200.0	30,000	90	90	90

* 3M QCM 14.24.1 ** 3M QCM 14.1.5. *** 3M QCM 14.1.8.

2. Chemical composition.

3M™ Glass Bubbles are made of high-quality low-alkaline borosilicate glass.

Properties:

- A. Alkalinity:** ≤ 0.5 milliequivalent/g according to 3M QCM 55.19
- B. Flow:** When stored at room temperature unopened in their original packaging, 3M™ Glass Bubbles retain their flow properties for at least two years after delivery.
- C. Volatile components:** ≤ 0.5% of weight

3. Particle size.

Particle size (micrometres [μm])			
Product number	Distribution by volume		
	10%	50%	90%
K1	30	65	110
K15	30	60	105
K20	30	65	110
K25	25	55	95
K37	20	40	80
K42HS	11	22	37
K46	15	40	70
S15	25	55	90
S22	20	35	60
S32LD	20	40	75
S32	20	40	75
S38	15	40	75
S38HS	20	45	75
S60	15	30	55
iM16K	12	20	30
iM30K	9	17	25

4. Colour/appearance.

3M™ Glass Bubbles have a uniformly white/opaque appearance and contain less than 100 ppm non-white components.

5. Oil absorption.

0.2–0.6 g oil/cm³ with 3M™ Glass Bubbles (ASTM S281-12).

6. Thermal characteristics.

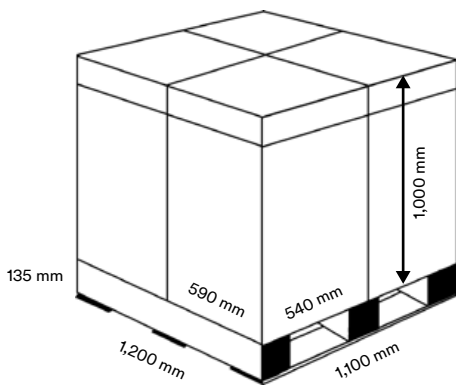
- A. Thermal conductivity:** 0.05–0.26 W/mK according to theoretical calculation at 0 °C. Conductivity increases with temperature and product density.
- B. Softening temperature:** After 2 hours' storage at 600 °C: slight densification of 3M™ Glass Bubbles and increase in density of around 10%.

7. Packing density.

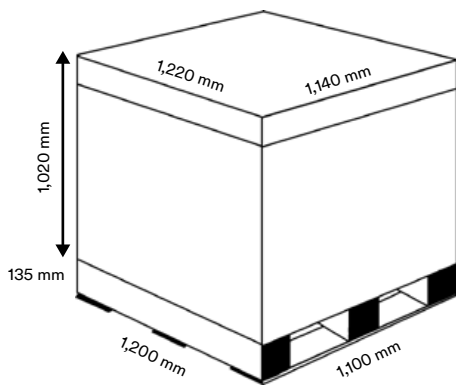
Is between 55% and 68% (ratio of bulk density to particle density).

8. Packing.

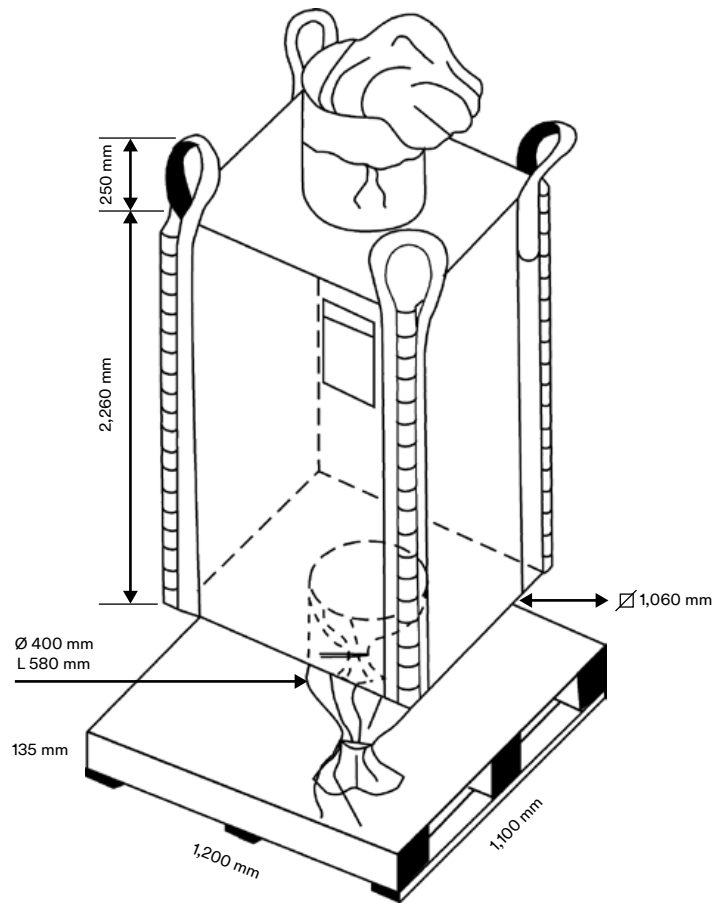
Product number	(1) Net weight of small carton	(2) Net weight of large carton	(3) Net weight of bulk bag	(4) Net weight of hopper bag
K1	20 kg	80 kg	180 kg	4,200 kg
K15	25 kg	100 kg	220 kg	4,200 kg
K20	30 kg	135 kg	300 kg	6,000 kg
K25	40 kg	175 kg	380 kg	7,900 kg
K37	50 kg	260 kg	560 kg	12,000 kg
K42HS	50 kg	280 kg	640 kg	13,000 kg
K46	60 kg	320 kg	700 kg	15,000 kg
S15	25 kg	120 kg	On request	4,700 kg
S22	25 kg	150 kg	320 kg	6,800 kg
S32LD	45 kg	180 kg	440 kg	9,200 kg
S32	45 kg	200 kg	480 kg	10,000 kg
S38	50 kg	260 kg	560 kg	12,000 kg
S38HS	50 kg	260 kg	560 kg	12,000 kg
S60	60 kg	400 kg	900 kg	20,000 kg
iM30K	57 kg	400 kg	900 kg	20,000 kg
iM16K	45 kg	260 kg	600 kg	14,500 kg



1.



2.



3.

9. Specifications.

The values listed above are typical test results and are not suited for specification purpose. Product specifications are listed on the pages which follow.

10. Handling.

Before using 3M™ Glass Bubbles together with other products, please be sure to follow the processing guidelines of the respective product exactly. Also see the sections “Storage” and “Processing”.

11. Hazard warnings.

3M™ Glass Bubbles can be considered respirable particulates. It is recommended that industry safety standards for working with respirable particulates be adhered to. For further information, please contact our Product Safety department in Neuss at +49 (0) 2131 14 2914.

Product data sheet.

These specifications only apply to glass microspheres with the product name 3M™ Glass Bubbles.

These are made of a low-alkaline borosilicate glass.

Requirements.

If samples are taken in accordance with ASTM D2841, the 3M™ Glass Bubbles will comply with the following requirements:

1. Colour and appearance.

The 3M™ Glass Bubbles have a uniform appearance.

2. Rated density.

If testing has been carried out in accordance with 3M QMC 14.24.1, the average rated density is as listed under “Physical properties” in the “Production information” section on page 4.

3. Crush strength.

If testing has been carried out in accordance with 3M QCM 14.1.5 with the corresponding test pressure, the minimum amount of intact 3M™ Glass Bubbles (%) is as listed under “Physical properties” in the “Production information” section on page 4.

4. Particle size.

All 3M™ Glass Bubbles are tested in accordance with the 3M QCM 93.4.4 testing method. With this method, sieves in various sizes are used and the percentage of Glass Bubbles that remain in the sieve is determined.

5. Alkalinity.

Maximum of 0.5 milliequivalent/g according to 3M QCM 55.19.

6. Float rate.

Using the 3M QCM 37.2 testing method, the float rate is at least 90% by volume.

7. Volatile components.

As delivered, the proportion of volatile components in 3M™ Glass Bubbles is a maximum of 0.5% by weight, if tested according to 3M QCM 1.5.7.

8. Flow.

3M™ Glass Bubbles retain their flow properties for at least two years after delivery if stored unopened in their original packaging under normal storage conditions (constant room temperature, low humidity).

9. Packaging.

3M™ Glass Bubbles are delivered in suitable containers with tear-resistant polyethylene bags on the inside.

Each container is marked with the following:

- ▶ Name of manufacturer
- ▶ Product number
- ▶ Lot number
- ▶ Amount in kilogrammes
- ▶ Measured rated density of the packaging unit

10. Information on EU guidelines for foodstuffs contact.

3M™ Glass Bubbles iM16K fulfil the requirements of the directive EU 10/2011 and may be employed in the manufacture of objects that will come into contact with foodstuffs.

The migration tests carried out by an independent institute evidenced that the minimum values of the EU 10/2011 list are maintained with a filling level of up to 10% by weight (or 18% by volume) of iM16K in LDPE. As 3M™ Glass Bubbles are made of borosilicate glass, we recommend reviewing the directive EU 10/2011 limit for boron compounds of 6 mg/kg with regard to your specific application. Additional analyses (determination of proportions soluble in hydrochloric acid as per DIN 53770) of 3M™ Glass Bubbles iM30k and K15 have shown that these are in line with the minimum values according to the BfR.

Safety recommendations

Handling and processing.

Due to the minimal weight and small particle size of 3M™ Glass Bubbles, dust may result during handling and processing. In order to limit this as far as possible, the following measures should be taken:

- ▶ Usage of a 3M™ Respirator Mask Type 8812 or another approved respiratory protection mask as well as protective gloves and protective goggles (additional recommendations regarding personal protective equipment can be found in the safety data sheet).
- ▶ Do not open the packaging until the time of first use and open it in close proximity to its location of use (as needed, also employ a vacuum system to remove dust particles; please comply with local health and safety regulations).
- ▶ Pneumatic conveyance systems have proved advantageous for transporting the hollow glass microspheres from the shipping container to the mixing equipment without dust accumulation. Please contact a corresponding manufacturer or ask your 3M customer advisor.
- ▶ If, in addition to 3M™ Glass Bubbles, flammable substances are used, accumulation of static charge in the system should be avoided.
- ▶ Membrane pumps are already successfully being used for transporting the hollow glass microspheres. Please contact a corresponding manufacturer here as well or ask your 3M customer advisor.
- ▶ Remove the hollow glass microspheres using an air siphon (with slight pressure ventilation) and pump them into a closed mixing tank via a completely closed system of tubing. If such a mixing tank is not available, vacuum equipment should be placed as close as possible to the point of entry of the microspheres.
- ▶ Static eliminators should be employed to prevent accumulation of an electrostatic charge.

Storage and process specifications

Storage.

3M™ Glass Bubbles retain the flow properties for at least two years from the manufacture date insofar they are stored in their container unopened under the recommended storage conditions. Under high humidity and/or other conditions that promote condensation, agglomeration of the hollow glass microspheres may occur. In order to prevent this and to enhance storage suitability, we recommend that:

- ▶ Ideally, the unopened cartons should be stored in a dry and temperature-controlled warehouse.
- ▶ During warm and/or humid months, store the cartons in a place that is as dry and cool as possible.
- ▶ Insofar the storage conditions cannot be controlled, maintain stocks at the lowest level possible and consume the product on a first-in/first-out basis.
- ▶ Unopened bags should be closed carefully immediately after use.
- ▶ Polyethylene bags damaged during handling or transport should be repaired immediately or the contents should be transferred as quickly as possible to an undamaged bag.

Breakage.

To reduce breakage of the hollow glass microspheres, they should only be subjected to pressure less than the minimum value listed under crush strength for their respective type. Aggressive processing conditions may result in breakage of the glass microspheres. We thus recommend avoiding processes that produce high levels of shear stress, such as with high-speed mixers (Cowles dissolvers), geared pumps, and triple-roll mills as far as possible. Aggregates of this kind should only be used following sufficient testing, if at all. When processing using a twin-screw extruder, the hollow glass microspheres should not be added until the final third of the extruder screw's flight. This keeps time and shear stress to a minimum. Additional notes and tips on processing 3M™ Glass Bubbles can be found in our brochure "Compounding and injection moulding guidelines".

Important note:

The specifications listed above represent our current empirical values. It is the user's duty before using the product to check whether it is suitable for his/her intended purpose, including with regard to possible influences on the application.

All questions of liability and warranty are governed by the respective regulations in the purchase contract, provided legal regulations do not prescribe otherwise.

Where to go for more information?

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