

Product Data Sheet

First created on: 2016-08-01

Updated on: 2016-08-01

Next inspection on: 2017-06-30

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|--|---|
| Product | SiLibeads Glass beads Type P Borosilicate |
| Material | Precision Glass beads made of Borosilicate glass with polished or (fine-)matt surface Specific weight: 2.23 kg/l Hydrolytic resistance on Glass beads: HGB 1 (based on DIN ISO 720) Acidic resistance on Glass beads: S1 (according to DIN 12116) Alcaline resistance on Glass beads: A2 (according to DIN ISO 695) |
| Application | Glass beads are used as high precision beads for ball bearings in aggressive and corrosive media (solutions). Mixing bead in insulin cartridges, Valves of dosage pumps and dispensers in the cosmetic- and food industry and many other special applications in the optical and medical technique. |
| Technical Data | |
| Roundness | ≥ 0.99 (ratio width/length (x_{min}/x_{max})) |
| Compressive strength | mean value 1.10 kg/l (belonging to diameter) |
| Refractive index | 1.46 |
| Size (Diameter) | see table Standard Sizes |
| Transformation temperature | 586 °C |
| Softening point (Littleton point) | 787 °C |
| Melting point | 1663 °C |
| Specific thermal Conductivity | 1.268 W/km |
| Thermal expansion | $3.35 \cdot 10^{-6} \text{ K}^{-1}$ [20 °C] (Coefficient of linear expansion α) |
| Specific thermal capacity | 1.447 kJ/kg K [$>600 \text{ °C}$] |
| Youngs-Module | 64 GPa |
| Hardness according to Mohs | 7 |
| Linear thermal expansion, α (20-300 °C) | $3.25 \cdot 10^{-6} \text{ K}^{-1}$ |

Assessment acc. to Food Legislation

The Glass beads are a consumer good in the sense of §2 clause 6 no. 1 German Code for Food Stuff (LFGB), Commodities and Feeding Stuff. Therefore they have to comply with the legal requirements.

The Glass beads comply with the requirements § 31 of the German Food and Feed Code (LFGB) and of the European Food Regulation 1935/2004/EC, Article 3.

Conformity to Pharmacopoeia

The Glass beads are in accordance with the current versions of Pharmacopoeia Ph.Eur., USP and JP.

Chemical Analysis; Glass beads made of Borosilicate glass; CAS-No. 65997-17-3 / EINECS 266-046-0

| Name | Method | Weight (Reference values) | CAS-No. | EINECS |
|--|-------------|---------------------------|------------|-----------|
| Silicon dioxide SiO ₂ | DIN 51001 | 81 % | 7631-86-9 | 231-545-4 |
| Boric oxide B ₂ O ₃ | DIN 51086-1 | 13 % | 1303-86-2 | 215-125-8 |
| Sodium oxide Na ₂ O + | DIN 51001 | } 4 % | 1313-59-3 | 215-208-9 |
| Potassium oxide K ₂ O | DIN 51001 | | 12136-45-7 | 235-227-6 |
| Aluminium oxide Al ₂ O ₃ | DIN 51001 | 2 % | 1344-28-1 | 215-691-6 |

The heavy metal content of the Glass beads keeps the permitted limits of EU directive 2011/65/EC (RoHS).

| | | | |
|-----------------|-------------------|----------------------|--------------------|
| Lead < 1000 ppm | Cadmium < 100 ppm | Chrome VI < 1000 ppm | Mercury < 1000 ppm |
|-----------------|-------------------|----------------------|--------------------|

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Standard Sizes (special diameters by request)

| Diameter *) | Tolerance **) | Roundness**) | Surface | Weight per 1000 pieces | Amount (pieces per kg) |
|------------------|---------------|--------------|-------------|------------------------|------------------------|
| 2.000 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 9.34 gr. | 107.055 |
| 2.381 mm 3/32" | +/- 0.02 mm | ≤ 0.02 mm | polished | 15.76 gr. | 63.448 |
| 2.500 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 18.24 gr. | 54.812 |
| 2.700 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 22.98 gr. | 43.512 |
| 2.780 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 25.09 gr. | 39.862 |
| 3.000 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 31.53 gr. | 31.720 |
| 3.175 mm 1/8" | +/- 0.02 mm | ≤ 0.02 mm | polished | 37.37 gr. | 26.759 |
| 3.400 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 45.89 gr. | 21.790 |
| 3.500 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 50.06 gr. | 19.975 |
| 3.969 mm 5/32" | +/- 0.02 mm | ≤ 0.02 mm | polished | 73.00 gr. | 13.698 |
| 4.000 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 74.73 gr. | 13.382 |
| 4.500 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 106.40 gr. | 9.398 |
| 4.762 mm 3/16" | +/- 0.02 mm | ≤ 0.02 mm | polished | 126.09 gr. | 7.931 |
| 5.000 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 145.95 gr. | 6.851 |
| 5.500 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 194.26 gr. | 5.148 |
| 5.556 mm 7/32" | +/- 0.02 mm | ≤ 0.02 mm | polished | 200.26 gr. | 4.994 |
| 5.800 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 227.82 gr. | 4.389 |
| 6.000 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 252.21 gr. | 3.965 |
| 6.350 mm 1/4" | +/- 0.02 mm | ≤ 0.02 mm | polished | 298.97 gr. | 3.345 |
| 6.500 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 320.66 gr. | 3.119 |
| 6.747 mm 17/64" | +/- 0.02 mm | ≤ 0.02 mm | polished | 358.62 gr. | 2.788 |
| 7.000 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 400.50 gr. | 2.497 |
| 7.144 mm 9/32" | +/- 0.02 mm | ≤ 0.02 mm | polished | 425.72 gr. | 2.349 |
| 7.500 mm | +/- 0.02 mm | ≤ 0.02 mm | polished | 492.59 gr. | 2.030 |
| 7.938 mm 5/16" | +/- 0.02 mm | ≤ 0.02 mm | polished | 584.03 gr. | 1.712 |
| 8.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 597.83 gr. | 1.673 |
| 8.500 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 717.07 gr. | 1.395 |
| 8.731 mm 11/32" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 777.14 gr. | 1.287 |
| 9.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 851.20 gr. | 1.175 |
| 9.525 mm 3/8" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1009.02 gr. | 991 |
| 10.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1167.63 gr. | 856 |
| 10.319 mm 13/32" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1282.97 gr. | 779 |
| 10.500 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1351.68 gr. | 740 |
| 11.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1554.11 gr. | 643 |
| 11.112 mm 14/32" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1602.07 gr. | 624 |
| 11.906 mm 15/32" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 1970.62 gr. | 507 |
| 12.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 2017.66 gr. | 496 |
| 12.303 mm 31/64" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 2174.39 gr. | 460 |
| 12.500 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 2280.52 gr. | 438 |
| 12.700 mm 1/2" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 2391.75 gr. | 418 |
| 13.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 2565.28 gr. | 390 |
| 13.494 mm 17/32" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 2868.97 gr. | 349 |
| 14.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 3203.97 gr. | 312 |
| 15.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 3940.74 gr. | 254 |
| 15.081 mm 19/32" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 4004.93 gr. | 250 |
| 15.875 mm 5/8" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 4671.39 gr. | 214 |

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| Diameter ^{*)} | Tolerance ^{**)} | Roundness ^{**)} | Surface | Weight per 1000 pieces | Amount (pieces per kg) |
|------------------------|--------------------------|--------------------------|-------------|------------------------|------------------------|
| 16.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 4782.60 gr. | 209 |
| 17.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 5736.56 gr. | 174 |
| 18.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 6809.61 gr. | 147 |
| 19.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 8008.76 gr. | 125 |
| 19.050 mm 3/4" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 8072.15 gr. | 124 |
| 20.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 9341.02 gr. | 107 |
| 22.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 12432.90 gr. | 80 |
| 24.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 16141.29 gr. | 62 |
| 25.000 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 18244.19 gr. | 55 |
| 25.400 mm 1" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 19133.99 gr. | 52 |
| 31.750 mm 1 1/4" | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 37371.08 gr. | 27 |
| 38.100 mm | +/- 0.02 mm | ≤ 0.02 mm | (fine-)matt | 64577.23 gr. | 15 |

*) special diameters by request

**) for special request tolerance +/- 0.01 mm and roundness ≤ 0.01 mm possible

Chemical resistance of Glass beads Type P (Borosilicate) 2,5 mm Ø, in further media:

| Medium | Concentration | Temperature | Time | Corrosion rate |
|---|---------------|-------------|------|--------------------------------|
| Hydrochlorid Acid (HCl) | 20.4 % | 102 °C | 6 h | 0.001 gr. / m ² / h |
| Nitric Acid (HNO ₃) | 30.0 % | 102 °C | 6 h | 0.010 gr. / m ² / h |
| Sulphuric Acid (H ₂ SO ₄) | 30.0 % | 102 °C | 6 h | 0.040 gr. / m ² / h |
| Oxalic Acid (H ₂ C ₂ O ₄) | 30.0 % | 102 °C | 6 h | 0.005 gr. / m ² / h |
| Formic Acid (H ₂ CO ₂) | 30.0 % | 102 °C | 6 h | 0.000 gr. / m ² / h |
| Sodium Hydroxide (NaOH) | 30.0 % | 102 °C | 6 h | 1.200 gr. / m ² / h |
| Distilled Water (H ₂ O) | 100.0 % | 102 °C | 6 h | 0.002 gr. / m ² / h |

Test Report No. 43383/6/AU-04560 (19.01.2001), Dorfner Analysezentrum, D-92242 Hirschau

Additional Information

| | |
|------------------------------|---|
| Storage indication | Store in a dry manner in closed (original) container by room temperature. |
| Disposal | Please consult national laws and local regulations in force for disposal or landfill. |
| Safety advice | High risk of slipping due to spillage of product |
| Product information | Sample card ... glass beads for technical applications, Safety Data Sheet SiLibeads Type P+M (Borosilicate); Test Reports |
| Manufacturer/Supplier | Sigmund Lindner GmbH; Oberwarmensteinacher Strasse 38; 95485 Warmensteinach / GERMANY Phone: +49-9277-9940 Fax: +49-9277-99499 Web: www.sili.eu E-Mail: sili@sigmund-lindner.com |

All data are reference values – subject to change without prior notice