

DUKE STANDARDS™ Dry Microsphere Size Standards NIST Traceable Mean Diameter

1. DESCRIPTION. These particle size standards provide accurate and traceable size calibration of particle size analysis on instrumentation requiring dry particles that meet the requirements of ISO 21501-4. They are part of a series of dry polymer microspheres with calibrated mean diameters traceable to the Standard Meter through the National Institute of Standards and Technology (NIST). Diameters from 3 to 10 micrometers (μm) are conveniently packaged as dry powders in dropper-tipped bottles to enable dispensing the microspheres directly into the sampling chamber. The certified mean diameter is certified as traceable to NIST by optical microscopy. Other values are for information only and should not be used as calibration values.

2. PHYSICAL DATA

Certified Mean Diameter:	Catalog Number: 4D-03, Nominal 3 μm
Standard Deviation:	3.01 $\mu\text{m} \pm 0.04 \mu\text{m}$, $k=2$
Coefficient of Variation:	0.03 μm
Microsphere Composition:	1.0%
Microsphere Density:	Polystyrene
Index of Refraction:	1.05 g/cm^3
Approximate Number:	1.59 @ 589 nm
	6.6 x 10 ¹⁰ per gram

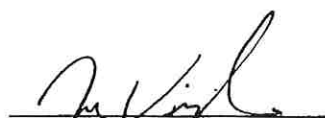
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CERTIFICATE OF CALIBRATION AND TRACEABILITY

This certifies that the calibrated mean diameter dimension of this product was transferred by optical microscopy from a stage micrometer calibrated by the National Institute of Standards and Technology (SRM 2800 SN411). NIST Standard Reference Materials 1690, 1692, 1960, and 1961 were used to validate the accuracy and traceability of the calibration methods.

Catalog Number:	4D-03, Duke Standards™ Dry Microsphere Size Standards
Certification Date:	August 9, 2021
Certified Batch:	4D-03-007
Certified Mean Diameter:	3.01 μm
Standard Uncertainty:	$\pm 0.02 \mu\text{m}$
Expanded Uncertainty:	$\pm 0.04 \mu\text{m}$, $k = 2$



 8.9.21
Joe Vasiliou, Metrologist
Thermo Fisher Scientific Particle Technology

Packaging Lot # 244037

Expiration Date: AUG'24

3. MEASUREMENT METHODOLOGY The certified diameter of this product was transferred by optical microscopy from an stage micrometer, a glass slide with a scale with line spacing calibrated by NIST in micrometers. The uncertainty is calculated from the calibration transfer uncertainty and the standard error of the measurements per NIST Technical Note 1297. Both the Standard Uncertainty and the Expanded Uncertainty, with a coverage factor of 2 ($k=2$), are provided. To validate the accuracy of our optical methods, NIST certified microsphere standards were measured by the same method. The size distribution (standard deviation) was obtained by electrical resistance analysis. The coefficient of variation is the standard deviation as a percentage of the mean diameter.

4. CERTIFICATE Except for the purposes of record keeping, this certificate may not be reproduced. Rebottling or relabeling voids the warranty and invalidates the certification and traceability of these products.

5. OPERATING INSTRUCTIONS Dry standards should not be shaken as this may produce static, making the particles hard to handle and dispense. Dispense the standards directly from the bottle to the sampling equipment.

6. SAFETY AND HANDLING PRECAUTIONS Use caution when opening the bottle, and do not remove the dropper tip. Avoid aerosol production in the workplace while handling these products. Avoid inhalation or ingestion of the particles. These products should only be used by trained scientific personnel using appropriate protective equipment. A Material Safety Data Sheet is available online or on request.

7. STORAGE AND DISPOSAL Keep the bottle tightly sealed to avoid contamination. Store at room temperature in a cool dry location. In case of spills, wash or wipe the area thoroughly with a damp cloth. Caution: surfaces covered with dry spheres may be very slippery. Dispose of as normal laboratory waste. There are no special disposal procedures. Each bottle has a limited shelf life and should not be used after its expiration date.

8. LIMITED WARRANTY These products are intended for laboratory use by trained scientific personnel. Determination of their suitability for a specific end-use is the responsibility of the user, who assumes all liability for loss or damage arising out of the use of the product. Rebottling or relabeling voids the warranty and certification. Microgenics Corporation's warranty is limited to replacement of defective products if returned with our authorization within 60 days of purchase date.

THE FOREGOING WARRANTY SHALL BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MICROGENICS BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.