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DUKE STANDARDS™
Particle Counter Size Standards
NIST Traceable Mean Diameter

1. DESCRIPTION These particle size standards provide accurate and traceable size calibration for particle counters. They are part of a series of polymer microspheres with calibrated mean diameters traceable to the Standard Meter through the National Institute of Standards and Technology (NIST). Diameters from 0.1 to 100 micrometers (µm) are available as aqueous suspensions in dropper-tipped vials, calibrated by transmission electron microscopy (TEM) or optical microscopy. The aqueous medium has been prepared to promote dispersion and reduce clumping of the particles. The certified diameter is traceable to NIST. Other physical data are for information only and should not be used as calibration values.

2. PHYSICAL DATA — Catalog Number: 3K-400, Nominal 0.4 µm

Certified Mean Diameter:	0.401 µm ± 0.006 µm, k=2
Standard Deviation:	0.0050 µm
Coefficient of Variation:	1.3%
Microsphere Composition:	Polystyrene
Microsphere Density:	1.05 g/cm^3
Index of Refraction:	1.59 @ 589 nm
Approximate Concentration:	1 x 10^9 particles per milliliter

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CERTIFICATE OF CALIBRATION AND TRACEABILITY

This certifies that the calibrated mean diameter dimension was transferred by transmission electron microscopy (TEM) from the National Institute of Standards and Technology (NIST) certified microspheres (Standard Reference Material 1963, 1691 or 1690).

Catalog Number: 3K-400, Duke Standards™ Particle Counter Size Standards

Certification Date:	October 2, 2018
Certified Batch:	3K-400-003
Certified Mean Diameter:	0.401 µm
Expanded Uncertainty:	± 0.006 µm, k=2

10-2-18

Joe Vasiliou, Metrologist
Thermo Fisher Scientific Particle Technology

Packaging Lot # 286525

Expiration Date: MAY'26

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3. MEASUREMENT METHODOLOGY The certified mean diameter of this product was obtained using transmission electron microscopy from NIST certified microspheres. The uncertainty is calculated from the calibration transfer uncertainty and the random error of the measurements per NIST Technical Note 1297. The uncertainty listed is the expanded uncertainty with a coverage factor of 2 (k=2). The particle size distribution (standard deviation) was obtained by TEM. 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 For ease of use, these standards are packaged in an aqueous suspension. They must be thoroughly dispersed in the bottle to assure statistically consistent samples. To disperse the particles, gently invert the bottle several times, then immerse in a low power ultrasonic bath (10 seconds). Do not shake the bottle, as the small bubbles formed may introduce statistical artifacts. Before using, clear the tip of residue by dispensing 2 - 3 drops into a waste container. Dispense immediately after dispersion using the dropper tip.

6. SAFETY AND HANDLING PRECAUTIONS Avoid aerosol production in the workplace while handling these products, or wear a suitable filter respirator when necessary. Avoid inhalation or ingestion of the particles. These products should only be used by trained scientific personnel. A Material Safety Data Sheet is included with each package.

7. STORAGE AND DISPOSAL Keep the bottle tightly sealed to avoid contamination. Store aqueous standards upright to prevent clogging the tip with particles. Refrigeration is not required for storage. Do not freeze the particles. In case of spills, wash or wipe the area thoroughly. Caution: surfaces covered with dry spheres may be very slippery. Wipe area with damp cloth. 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.