U. S. Department of Commerce
John T. Connor, Secretary
tional Bureau of Standards
A. V. Astin, Director

Certificate of Calibration

Standard Reference Material 1003

Calibrated Glass Spheres

(5 to 30 Microns)

This standard sample of microscopically measured beads is issued for use in calibrating equipment and in evaluating methods for measuring particle size in the 5 to 30 micron range.

The values given are based on measurements of 10,000 particles, of which 96 percent by volume are spheres. Four particle-size distributions are given with this sample in the form of graphs. These graphs represent a distribution according to volume (figure 1), a distribution according to weight (figure 2), and two Stokes' law distributions (figures 3 and 4). The volume distribution permits comparison with electronic particle counters which respond according to the volume of the particle. The weight distribution permits comparison with ultrafine sieves, and the Stokes' law distributions permit comparison with certain types of sedimentation and elutriation methods.

Four distributions instead of one arise from the fact that some of the beads contain spherical gas voids which are large enough to affect the weight and sedimentation rate of the bead. Void diameters have been measured and corrections applied. The diameters given in the weight and volume distribution (figures 1 and 2) are actual physical diameters. Those given in the Stokes' law distributions (figures 3 and 4) are diameters corresponding to an equivalent distribution of solid spheres, which, on a weight basis, would settle at the same rate as the actual sample. Comparison of figures 3 and 4 shows the effect of a comparatively large change in the density of the sedimentation medium on the calculated Stokes' law distribution of the sample.

The vertical lines in the graph are an estimate of reproducibility based on three times the standard error of the mean for ten samples of 1,000 beads, each of which represents ten subsamples of 100 beads. This corresponds to less than ± 4 percent of the particle diameter for particles smaller than 20 microns with somewhat greater uncertainty for particles larger than this size.

The average specific gravity of the beads for purposes of weight-to-volume conversions is 2.39 ± 0.01. The specific gravity of the solid glass for Stokes' law calculations is 2.54 based on measuremens of a single prism of the same glass. The specific surface computed from microscopic measurements is 1730 ± 50 cm^2/g, which corresponds with a specific-surface mean diameter of 14.5 ± 0.4 microns. The sample contains between 500,000 and 600,000 particles per milligram.

Two bottles of beads are provided. It is recommended that each bottle be shaken vigorously for a minute before sampling, and beads be taken from a number of places in each. When the results of the two bottles are analyzed separately, there should be no systematic difference between the two sets of results in excess of the reported reproducibility limits of the sample.

The surface of the glass in these beads can react with atmospheric moisture, which, with time, tends to make them more difficult to disperse. Direct exposure to relative humidities above 90 percent will produce a noticeable effect on dispersibility within three days, whereas the effect is exceedingly slow at relative humidities less than 50 percent, and can be minimized, if not eliminated entirely by storing the beads in a desiccated atmosphere.

Washington, D. C. 20234
July 1, 1965.

W. Wayne Meinke, Chief,
Office of Standard Reference Materials

FIG. 1. VOLUME DISTRIBUTION

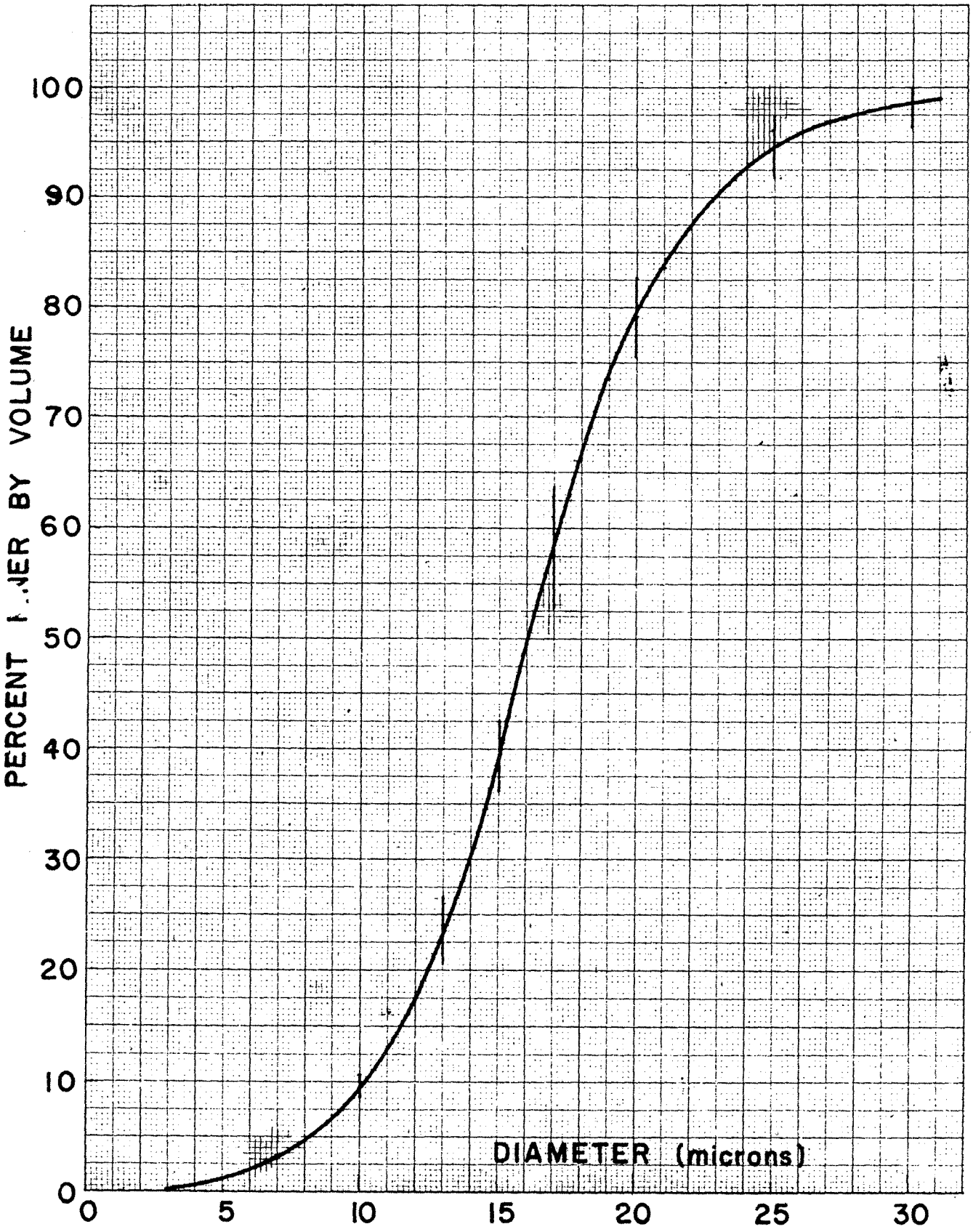

FIG. 2. WEIGHT DISTRIBUTION

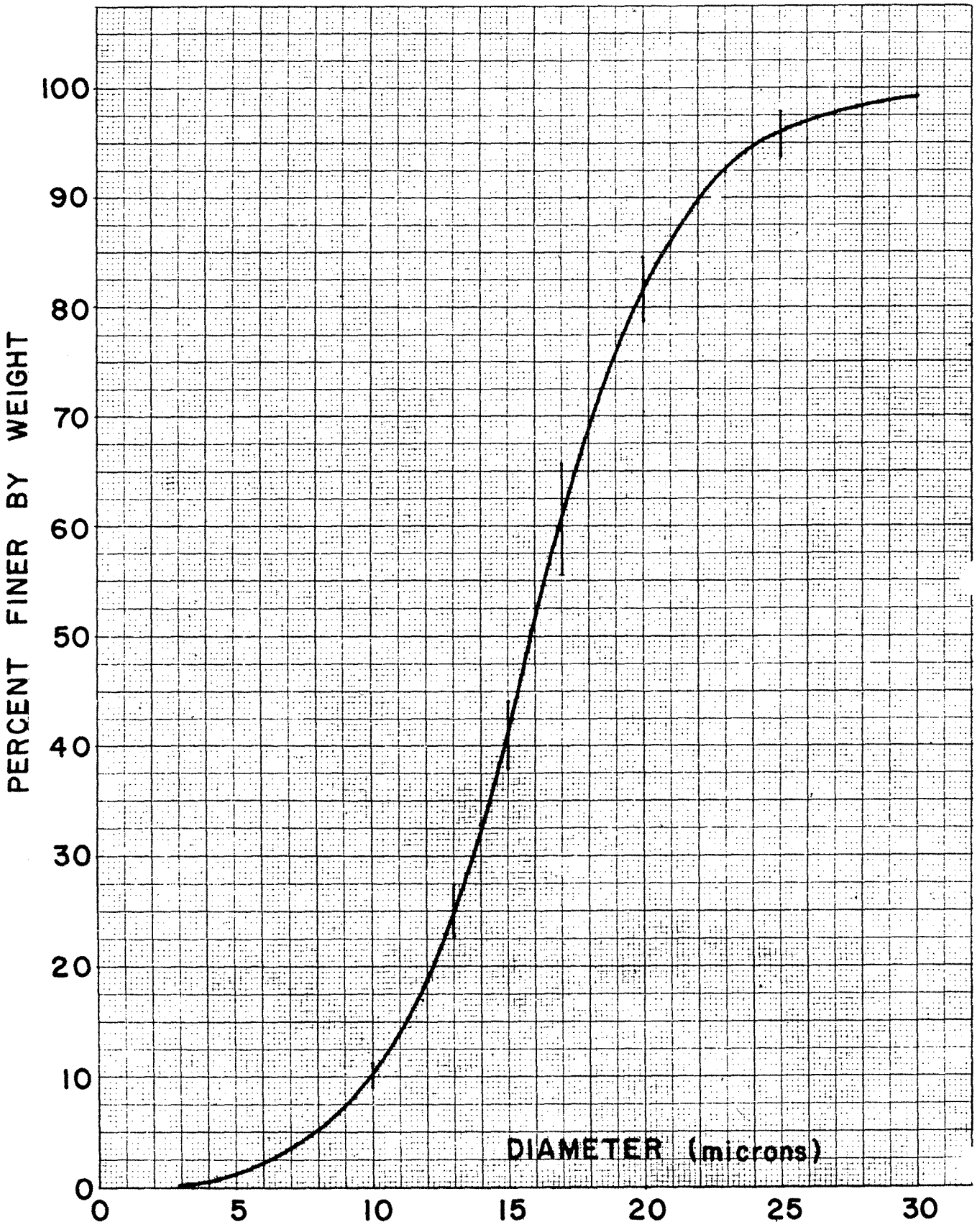

FIG. 3. STOKES' LAW DISTRIBUTION (CALCULATED FOR WATER)

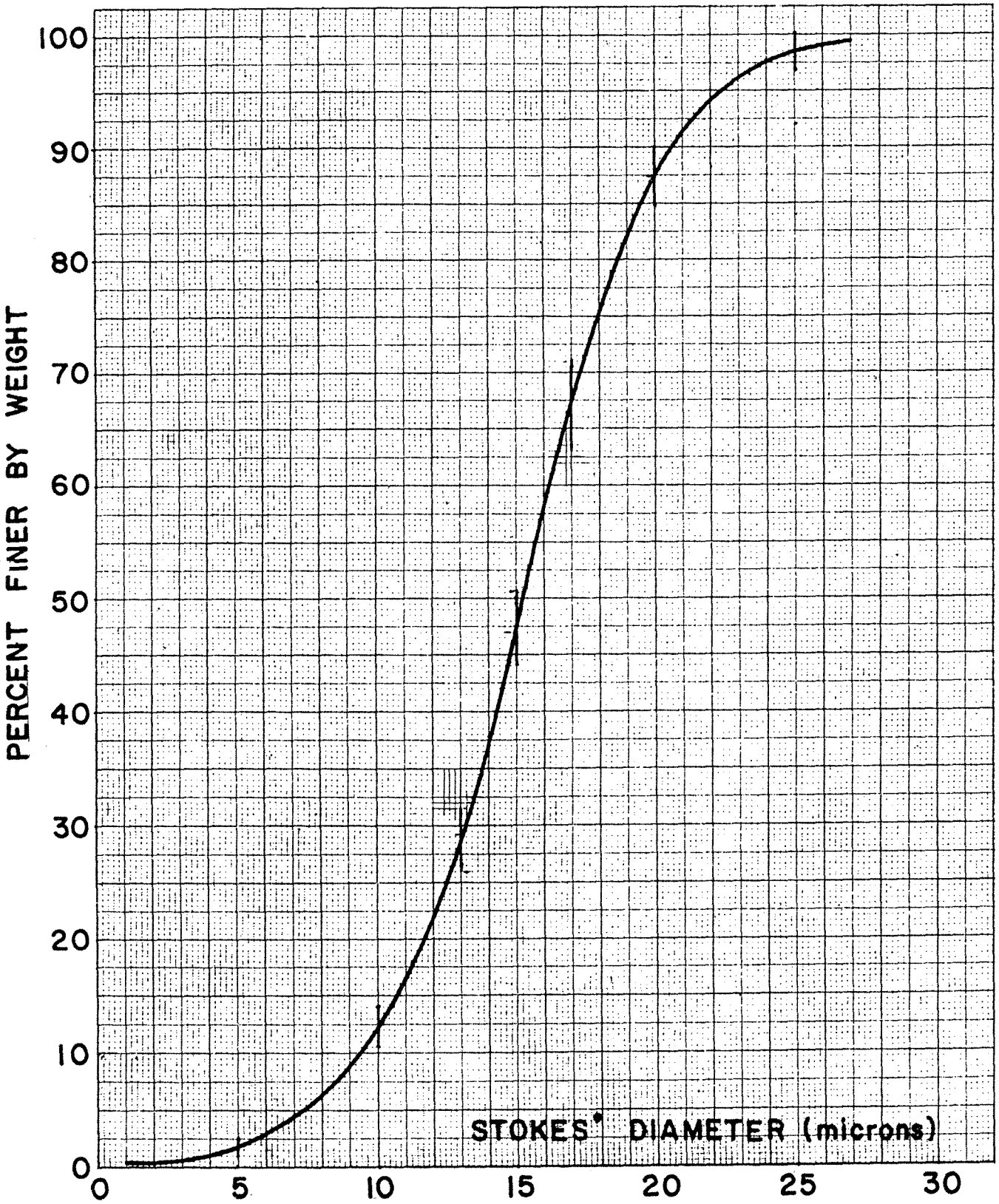

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FIG. 4. STOKES' LAW DISTRIBUTION (CALCULATED FOR AIR)