



Standard Test Method for Particle Size Measurement of Dry Toners¹

This standard is issued under the fixed designation F 577; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε¹ NOTE—Better quality figures were added in March 2004.

1. Scope

1.1 This test method covers aperture particle size analysis using an electronic sensing zone apparatus provided with a digital pulse processor. Dry inks, toners, and so forth, are covered. Particles as small as 1 μm and as large as 120 μm can be analyzed.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 Definitions of Terms Specific to This Standard:

2.1.1 *channel*—a size subgroup that has been obtained by dividing the range of the analysis into a certain number of size categories. The resolution of the analysis is increased when the number of channels is increased.

2.1.2 *dynamic range*—the ratio between the upper and lower limit of an analysis.

2.1.3 *number size distribution*—the number size distribution is measured and may be represented in a number percent curve as differential, cumulative larger than or cumulative smaller than. (Figs. 1-3).

2.1.4 *pulse (man height average) by sequence*—the max pulse height average is calculated from the pulses generated during the analysis (Fig. 4).

2.1.5 *median particle size*—the median size (50 % oversize or undersize) is a convenient value for the central tendency of a size distribution curve. For a distribution derived by number of particles, it is called the number median size.

2.1.6 *volume size distribution*—the volume size distribution is calculated by the instrument's software and may be represented in a volume percent curve as differential, cumulative larger than or, cumulative smaller than. (Figs. 5-7).

3. Summary of Test Method

3.1 This technique **(1)**² determines the number and size of particles suspended in an electrolyte by causing them to flow through a small orifice on both sides of which are immersed electrodes. Voltage pulses, whose amplitudes are proportional to the particle volumes, are generated by changes in resistance as the particles pass through the orifice. The signal generated is scanned, digitized and integrated in pulses. These pulses are processed yielding size and pulse distributions. The pulse data is saved and may be reprocessed at a later time for a different analysis range or resolution.

3.2 This test method covers the size range from 2 % to 60 % of the aperture diameter chosen as being appropriate to the expected particle size range.

Aperture Diameter, μm	Particle Size Range, μm
50	1 to 30
70	1.4 to 42
100	2.0 to 60
140	2.8 to 84
200	4 to 200

For broader size ranges two aperture tubes may be used and both results are combined by the instrument's software into a single size distribution.

4. Significance and Use

4.1 This test is useful in determining particle size characteristics of dry toners used in electrostatic imaging devices such as copiers and laser printers. It is a practiced method for use in quality control of toner particle size.

5. Apparatus

5.1 *Electrical Sensing Zone Instrumentation* **(2)**, equipped with a minimum capability of 256 size channels, a digital pulse processor and 50, 70, 100, 140, or 200-μm aperture tubes.

5.2 *Software*, capable of processing the pulse data to yield size distribution graphs and statistics.

5.3 *Ultrasonic Dispersing Probe*, or alternative equipment suitable for dispersing the dry toner in an aqueous electrolyte.

¹ This test method is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.04 on Electrostatic Imaging Products.

Current edition approved Jan. 10, 2003. Published March 2003. Originally approved in 1978. Last previous edition approved in 1983 as F 577 – 83 (1997).

² The boldface numbers in parentheses refer to the list of references at the end of the test method.