Designation: E1037 – 15

Standard Test Method for Measuring Particle Size Distribution of RDF-5[1]

This standard is issued under the fixed designation E1037; 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.

1. Scope

1.1 This test method is used to determine the size distribution of a RDF-5 sample. Size is defined as the maximum length of the particle, where length is determined by the RDF-5 manufacturing process. That is, a pellet, cubette, or briquette all have a recognizable length. Fig. 1 displays the sizes and shapes of some RDF-5 particles.

1.2 An air dried RDF-5 sample is separated into categories of differing particle sizes. The size distribution is measured as the weight percentage of each size category. A graph of a function of the cumulative fraction of material by weight finer than particle size versus particle size is plotted. From this plot are taken values which describe the size distribution—the uniformity constant and the characteristic particle size.

1.3 *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:*

2.1.1 *RDF-5*—solid fuel derived from municipal solid waste in which the processed combustible fraction is densified (compressed) into the form of pellets, cubettes or briquettes.

3. Significance and Use

3.1 The particle size distribution of RDF-5 strongly influences the storage and handling characteristics of the fuel. Small particles tend to block flow through storage bins and feed hoppers, although correct bin and hopper designs will alleviate this problem of blockage.

3.2 This test method of measuring size manually allows accurate description of RDF-5 particle size distribution. Manual measurement is superior to sieving techniques, wherein particles may be broken by the size separation technique itself. However, hand measurement is more time-consuming than sieving techniques.

4. Apparatus

4.1 *Labelled Containers,* used to hold the particles which are separated by size. Appropriate containers are beakers or pans labelled "≥70 mm", "≥60 mm – <70 mm", etc. The tare weight of each container shall be recorded to 0.1 g.

4.2 *Scale,* capable of weighing the sample and container with an accuracy of 0.1 g.

4.3 *Vernier Calipers,* a length-measuring instrument having an accuracy of 0.1 mm.

5. Procedure

5.1 The sample shall weigh 1.0 ± 0.1 kg (2.2 ± 0.2 lb) unless otherwise specified. Record the weight of the sample to the nearest 0.1 g.

5.2 Beginning with the largest particles, measure the length of each particle in the sample. Separate the particles into containers labelled as the size categories of less than 10 mm, 10 to less than 20 mm, 20 to less than 30 mm, 30 to less than 40 mm, etc. as needed.

5.3 Record the weight of each size category to 0.1 g.

5.4 Add the weights of the size components. If this sum differs by more than 2 % from the sample weight recorded initially, then reject the analysis and begin another test.

5.5 Use the sum of the separate size categories as the total weight to determine weight percentages of each size fraction. If the weight percentage of any fraction is greater than or equal to 25 %, then separate that fraction into two portions of 5-mm size categories. Continue separating the size fraction into categories of 2.5 mm, 1.25 mm, etc., until the weight percentage of each fraction is less than 25 %.

6. Calculation

6.1 With each particle size for which there is data, calculate y, the cumulative fraction of the sample less than that particle size. This is found by summing the weight percentages of all fractions less than that size. Also calculate the value of the Rosin-Rammler function for each particle size, as follows:

$$ln\left(\frac{1}{1-y}\right) \quad (1)$$

[1] This test method is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.03 on Treatment, Recovery and Reuse.

Current edition approved Sept. 1, 2015. Published September 2015 Originally approved in 1984. Last previous edition approved in 2009 as E1037 – 84 (2009). DOI: 10.1520/E1037-15.

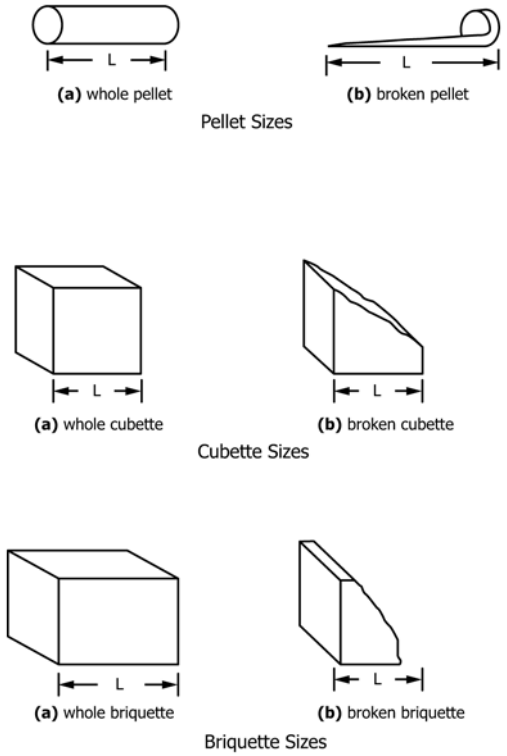

FIG. 1 RDF-5 Sizes

6.2 Plot ln[1/(1 − *y*)] versus particle size on log-log paper. Data points will yield a straight line.

6.3 Determine two values which characterize this line—the uniformity constant and the characteristic particle size. The uniformity constant, *n*, is defined as the slope of the line. The characteristic particle size, x_0, is defined as the size at which 63.2 % of the particles (by weight) are smaller. The characteristic particle size is the size corresponding to $ln[1/(1 - y)] = 1.0$. Fig. 2 is an example of this plot.

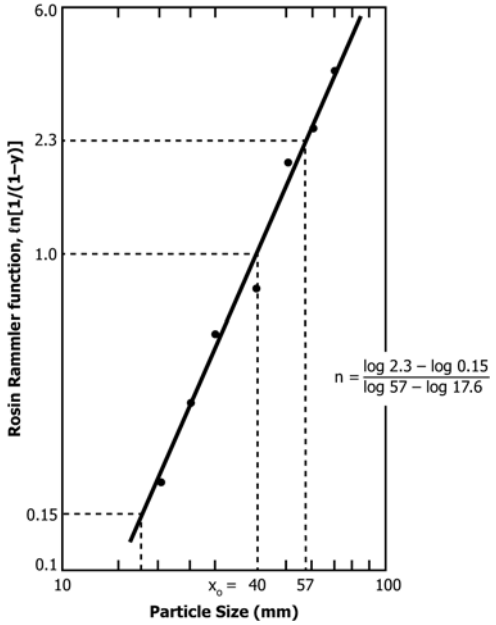

FIG. 2 Size Distribution Example—Test Number 1

7. Report

7.1 Report the uniformity constant, *n* (a dimensionless number), and the characteristic particle, x_0 (millimeters).

8. Precision

8.1 Table 1 presents the results of intra- and inter-laboratory precision testing. Intra-laboratory and inter-laboratory tests were performed on different populations of RDF-5.

TABLE 1 Results of Precision Testing

		Uniformity Constant	Characteristic Size
Intra-laboratory	Sample mean	2.42	3 g
	Standard deviation	0.16	2 mm
Inter-laboratory	Sample mean	2.65	36 mm
	Standard deviation	0.18	2 mm