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Standard Test Methods for Particle Size (Sieve Analysis) of Plastic Materials[1]

This standard is issued under the fixed designation D 1921; 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 These test methods cover the measurement of the particle size of plastic materials in the powdered, granular, or pelleted forms in which they are commonly supplied. As these test methods utilize dry sieving, the lower limit of measurement is considered to be about 38 µm (No. 400 sieve). For smaller particle sizes, sedimentation test methods are recommended.

1.2 Two test methods are described:

1.2.1 *Test Method A*—This test method uses multiple sieves selected to span the particle size of the material. The mean particle diameter and distribution can be determined by this test method.

1.2.2 *Test Method B*—This test method is an abbreviated version of Test Method A conducted with a few specific sieves. This test method determines "percent passing" or "percent retained" on a given sieve. Test Method B is applicable to materials which do not have a normal particle size distribution such as pellets and cubes.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are given for information only.

1.4 *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.*

NOTE 1—There is no technically equivalent ISO standard.

2. Referenced Documents

2.1 *ASTM Standards:*

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[2]

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[2]

3. Summary of Test Methods

3.1 A dry mass of plastic material is placed on a series of sieves arranged in order of increasing fineness and the mass is divided into fractions corresponding to the sieve opening.

4. Significance and Use

4.1 These test methods can be used to determine particle size distribution and therefore are useful for determining lot-to-lot uniformity.

4.2 The particle sizes of plastic materials affect the handling characteristics and may affect the processing characteristics of some polymers.

5. Interferences

5.1 Some materials develop a static charge during sieving. This charge interferes with the sieving process and results in a coarse bias. Use of an antistat is necessary to obtain meaningful results.

5.2 The choice of antistat (or slip agent) will affect the coarse bias. Some materials are more effective in aiding the fines to separate from the mass.

5.3 Too much material on a sieve causes mass blinding and results in a coarse bias. The sieve selection and charge weight must be chosen to avoid overloading any sieve.

5.4 Wavy, improperly stretched wire-cloth may allow wires to separate without being visually damaged. Sieves with wavy or torn wires should be discarded, as they no longer conform to Specification E 11.

6. Apparatus

6.1 *Balance*, 500-g minimum capacity with 1/10-g sensitivity.

6.2 *Mechanical Sieving Device and Time Switch*—A mechanical sieve-shaking device equipped with an automatic time switch. This device shall be capable of imparting uniform rotary motion and a tapping action at a rate of 150 ± 10 taps/min.

6.3 *Wire Cloth Sieves*, woven wire cloth conforming to Specification E 11, as shown in Table 1, mounted in 8-in. (203-mm) frames. The number of sieves and the choice of sizes shall be selected for the material being tested. A cover and a bottom pan are also required.

6.4 *Accessories for Cleaning the Screens*:

[1] These test methods are under the jurisdiction of ASTM Committee D-20 on Plastics and are the direct responsibility of Subcommittee D20.70 on Analytic Methods (Section D20.70.01).

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This revision adds an ISO equivalency statement, includes Table 1 showing sieve size openings, and has wording changes in Sections 10, 12, 13, and 15.

[2] *Annual Book of ASTM Standards*, Vol 14.02.

TABLE 1 Nominal Dimensions, Permissible Variations for Wire Cloth of Standard Test Sieves (U.S.A.) Standard Series

Sieve Designation		Nominal Sieve Opening, in.[A]	Permissible Variation of Average Opening from the Standard Sieve Designation	Opening Dimension Exceeded By Not More Than 5 % of the Openings	Maximum Individual Opening	Nominal Wire Diameter, mm[B]
Standard[C]	Alternative					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
125 mm	5 in.	5	±3.70 mm	130.0 mm	130.9 mm	8.00
106 mm	4.24 in.	4.24	±3.20 mm	110.2 mm	111.1 mm	6.30
100 mm[D]	4 in.[D]	4	±3.00 mm	104.0 mm	104.8 mm	6.30
90 mm	3½ in.	3.5	±2.70 mm	93.6 mm	94.4 mm	6.30
75 mm	3 in.	3	±2.20 mm	78.1 mm	78.7 mm	6.30
63 mm	2½ in.	2.5	±1.90 mm	65.6 mm	66.2 mm	5.80
53 mm	2.12 in.	2.12	±1.60 mm	55.2 mm	55.7 mm	5.00
50 mm[D]	2 in.[D]	2	±1.50 mm	52.1 mm	52.6 mm	5.00
45 mm	1¾ in.	1.75	±1.40 mm	46.9 mm	47.4 mm	4.50
37.5 mm	1½ in.	1.5	±1.10 mm	39.1 mm	39.5 mm	4.50
31.5 mm	1¼ in.	1.25	±1.00 mm	32.9 mm	33.2 mm	4.00
26.5 mm	1.06 in.	1.06	±800 mm	27.7 mm	28.0 mm	3.55
25.0 mm[D]	1.00 in.[D]	1	±800 mm	26.1 mm	26.4 mm	3.55
22.4 mm	⅞ in.	0.875	±700 mm	23.4 mm	23.7 mm	3.56
19.0 mm	¾ in.	0.750	±600 mm	19.9 mm	20.1 mm	3.15
16.0 mm	⅝ in.	0.625	±500 mm	16.7 mm	17.0 mm	3.15
13.2 mm	0.530 in.	0.530	±410 mm	13.83 mm	14.05 mm	2.80
12.5 mm[D]	½in.[D]	0.500	±390 mm	13.10 mm	13.31 mm	2.50
11.2 mm	7⁄16 in.	0.438	±350 mm	11.75 mm	11.94 mm	2.50
9.5 mm	⅜ in.	0.375	±300 mm	9.97 mm	10.16 mm	2.24
8.0 mm	5⁄16 in.	0.312	±250 mm	8.41 mm	8.58 mm	2.00
6.7 mm	0.265 in.	0.265	±210 mm	7.05 mm	7.20 mm	1.80
6.3 mm[D]	¼in.[D]	0.250	±200 mm	6.64 mm	6.78 mm	1.80
5.6 mm	No. 3½[E]	0.223	±180 mm	5.90 mm	6.04 mm	1.60
4.75 mm	No. 4	0.187	±.150 mm	5.02 mm	5.14 mm	1.60
4.00 mm	No. 5	0.157	±.130 mm	4.23 mm	4.35 mm	1.40
3.35 mm	No. 6	0.132	±.110 mm	3.55 mm	3.66 mm	1.25
2.80 mm	No. 7	0.110	±.095 mm	2.975 mm	3.070 mm	1.12
2.36 mm	No. 8	0.0937	±.080 mm	2.515 mm	2.800 mm	1.00
2.00 mm	No. 10	0.0787	±.070 mm	2.135 mm	2.215 mm	0.900
1.7 mm	No. 12	0.0661	±.060 mm	1.820 mm	1.890 mm	0.800
1.4 mm	No. 14	0.0556	±.050 mm	1.505 mm	1.565 mm	0.710
1.18 mm	No. 16	0.0469	±.045 mm	1.270 mm	1.330 mm	0.830
1.00 mm	No. 18	0.0394	±.040 mm	1.080 mm	1.135 mm	0.560
850 µm[F]	No. 20	0.0331	±35 µm	925 µm	970 µm	0.500
710 µm	No. 25	0.0278	±30 µm	775 µm	815 µm	0.450
600 µm	No. 30	0.0234	±25 µm	660 µm	695 µm	0.400
500 µm	No. 35	0.0197	±20 µm	550 µm	585 µm	0.315
425 µm	No. 40	0.0165	±19 µm	471 µm	502 µm	0.280
355 µm	No. 45	0.0139	±16 µm	396 µm	426 µm	0.224
300 µm	No. 50	0.0117	±14 µm	337 µm	363 µm	0.200
250 µm	No. 60	0.0098	±12 µm	283 µm	306 µm	0.160
212 µm	No. 70	0.0083	±10 µm	242 µm	263 µm	0.140
180 µm	No. 80	0.0070	±9 µm	207 µm	227 µm	0.125
150 µm	No. 100	0.0059	±8 µm	174 µm	192 µm	0.100
125 µm	No. 120	0.0049	±7 µm	147 µm	163 µm	0.090
106 µm	No. 140	0.0041	±6 µm	126 µm	141 µm	0.071
90 µm	No. 170	0.0035	±5 µm	108 µm	122 µm	0.063
75 µm	No. 200	0.0029	±5 µm	91 µm	103 µm	0.050
63 µm	No. 230	0.0025	±4 µm	77 µm	89 µm	0.045
53 µm	No. 270	0.0021	±4 µm	66 µm	76 µm	0.036
45 µm	No. 325	0.0017	±3 µm	57 µm	66 µm	0.032
38 µm	No. 400	0.0015	±3 µm	48 µm	57 µm	0.030
32 µm	No. 450	0.0012	±3 µm	42 µm	50 µm	0.028
25 µm[D]	No. 500	0.0010	±3 µm	34 µm	41 µm	0.025
20 µm[D]	No. 635	0.0008	±3 µm	29 µm	35 µm	0.020

[A] Only approximately equivalent to the metric values in Column 1.

[B] The average diameter of the wires in the *x* and *y* direction, measured separately, of any wire cloth shall not deviate from the nominal values by more than ±15 %.

[C] These standard designations correspond to the values for test sieve openings recommended by the International Standards Organization, Geneva, Switzerland, except where noted.

[D] These sieves are not in the standard series, but they have been included because they are in common usage.

[E] These numbers (3½ to 635) are the approximate number of openings per linear inch, but it is preferred that the sieve be identified by the standard designation in millimetres or micrometres.

[F] 1000 µm—1 mm.