



Standard Test Method for Acceptance by Performance Testing of U.S. Standard Test Sieves¹

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1. Scope

1.1 This test method is a performance test for acceptance of U.S. Standard test sieves. It is an alternative method for checking the accuracy and long term reliability of test sieves by other than the use of Specification E 11 inspection methods. Since it is not possible to adjust the measuring capability of a test sieve, the method is designed to offer a verification procedure based on sieving performance, by comparison to a standard reference. This method is not proposed as an alternative to the inspection methods in accordance with Specifications E 11, E 323, E 454, E 674 or the procedures in Manual 32 to confirm sieve compliance thereto.

1.2 This test method compares the performance of a sieve against a calibration sieve, using a known quantity of reference material such that the long-term stability of sieves can be measured.

1.3 *This test method 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. Referenced Documents

2.1 ASTM Standards:²

E 11 Standard Specification for Wire Cloth and Sieves for testing purposes

E 323 Standard Specification for Perforated-Plate Sieves for Testing Purposes

E 454 Standard Specification for Industrial Perforated Plate and Screens (Square Opening Series)

E 674 Standard Specification for Industrial Perforated Plate and Screens (Round Opening Series)

¹ This test method is under the jurisdiction of ASTM Committee E29 on Particle and Spray Characterization and is the direct responsibility of Subcommittee E29.01 on Sieves, Sieving Methods, and Screening Media.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

E 1638 Standard Terminology Relating to Sieve Analysis
Manual 32 Manual on Test Sieving Methods

3. Terminology

3.1 Definitions of terms relating to sieve analysis can be found in Terminology E 1638.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *Calibration Sieves, n*—Sieves used solely for the purpose of comparison to other sieves. Calibration sieves shall be certified as such by the manufacturer in accordance with Specification E 11 tolerances.

3.2.2 *Sieves, n*—Sieves used for normal sieving, and in accordance with normal Specification E 11 tolerances.

3.2.3 *Sieve shaker, n*—A mechanical device or method used to shake the sieves

3.2.4 *Reference material, n*—The material used to perform the sieve performance test. This material may be either purchased, or can be prepared by the user.

3.2.5 *Percent retained, n*—The mass fraction percentage of material that is left upon or retained by the sieve after the test has been performed.

3.2.6 *Endpoint, n*—The point at which no material falls through the sieve concluding the sieving.

4. Significance and Use

4.1 This test method may be used by producers, users, and general interest parties for research and development or quality control work, and is useful for the comparison of sieves.

4.2 Because the reference material's particle size distribution will affect the acceptance tolerance, the user should determine an acceptance tolerance based on their specific reference material.

5. Interferences

5.1 The long-term use of sieves can compromise the reliability of test results. Depending on the type of materials being measured, wear can occur on the diameter of the wires, causing opening sizes to change and measuring capability to drift.

5.2 The specific particle size distribution of the reference material will affect the acceptance tolerance, which therefore must be developed based on the specific particle size distribution of the chosen reference material and the point on the distribution curve of the reference material where the sieve aperture lies.

5.3 Sieves should be cleaned prior to the test. The apertures should not be blocked by test material as this may contaminate the reference material and produce unreliable measurements. Most particles that block the sieve apertures can usually be removed by inverting the sieve and gently tapping the frame. Alternately, the underside of the sieve may be stroked gently with a soft brush. Washing in warm water or using an ultrasonic cleaner containing a synthetic detergent may also clean sieves. The sieve should be rinsed thoroughly in clean water and dried in a warm atmosphere. To avoid distortion, the sieve should not be heated above 80 degrees Centigrade (176 degrees Fahrenheit). Sieves that have been used for wet sieving should not be allowed to dry-out before attempting to clean, as material caught in the sieve may become permanently trapped. Acid or alkaline cleaning treatment is not generally recommended.

5.4 Care should be taken with the use of the reference materials. Since the same batch of material may be used more than one time, it must not be contaminated as variation in the material could affect the test results.

6. Apparatus

6.1 *Calibration Sieve*—certified as such by the manufacturer in accordance with Specification E 11 tolerances.

6.2 *Sieve*—in accordance with normal Specification E 11 tolerances.

6.3 *A Sieve Shaker*, capable of holding a stack of at least two test sieves and a collection pan, is recommended. It must have the capability to shake the sieves in both a rotating and vertical motion. Ideally, the shaker will be designed to operate in a manner that will minimize blinding of the apertures. If the shaker does not have an integral timer, a separate timer is required. Alternatively, the sieving operation may be performed manually by experienced technicians, but care must be exercised to ensure that the test is carried to completion. The use of forced sieving methods, such as air jets, vacuum and water, is not recommended.

6.4 *Balance*—having the capacity to weigh the appropriate sample sizes per Annex A1, with a sensitivity of one part in a hundred, or better.

7. Hazards

7.1 Manufacturers' procedures should be followed when operating machinery such as sieve shaking devices. The testing of some materials may produce dust. Proper procedures for minimizing dust inhalation and working with hazardous materials should be followed at all times. Materials likely to produce high levels of dust may not be appropriate for use without special precautions.

8. Preparation of Apparatus

8.1 *Calibration Sieve*: A calibration sieve of the same nominal aperture size as the sieve to be tested for acceptance is required.

8.2 *Sieve*: The sieve to be tested must be physically sound. The sieve cloth must be taut and free of broken or distorted wires. Solder joints must be intact. Sieve frames must be cylindrical and nest easily with other sieves.

8.3 *Reference material*: Used to conduct the test, reference materials can be either certified standard test materials that are purchased or can be prepared by the user. It may be desirable to prepare reference material of the same composition as the production material. If less than the entire batch is used, acquire a representative sample. If possible, the batch should be homogenized prior to sampling.

The recommended quantity (grams) of reference material may be determined using Annex A1 or calculated based on the actual sieving area (mm²) and aperture size (mm), per the following calculation:

$$\text{Quantity} = (\text{Area} * (\text{aperture})^{1/2})/200 \quad (1)$$

9. Preparation of Reference Material

9.1 *User Prepared Reference Material*: The reference material may be prepared from the production material being tested, provided that the material will not blind or adhere to the sieve apertures, nor break down during the test procedure. It should be noted that user prepared reference material will not be traceable, and is only to be used internally for this comparative test. If certified reference material is to be used, no preparation of reference material is required.

9.2 In accordance with the size of the reference material to be produced, a calibration sieve of the same size, and a sieve that is one size coarser and collection pan are required. For example, if 125 micrometer reference material is to be produced a No. 120 sieve (125 micrometer), a No. 100 sieve (150 micrometer) and collection pan are used.

9.3 Nest the sieves in the shaker with the coarser sieve in the top position, the finer sieve in the second position, and the collection pan in the bottom position. Any additional shaker positions are not used.

9.4 In this example add all the material to the coarser sieve. Continue sieving raw material until at least half the total amount of reference material required is retained on the finer sieve, and at least half is in the collection pan. In this example used above, all the material retained on the finer No.120 sieve will become reference material, as well as an equal amount by weight of the material in the collection pan. The material retained on the larger No.100 sieve (150 micrometer) is discarded. Combine the materials from the finer sieve and the collection pan in equal proportions to produce the amount of reference material required per Annex A1 for the performance testing.

10. Calibration and Standardization

10.1 A sieve may be evaluated for acceptance based on this standard comparative test method. The resulting calibration

records should be retained for the life of the sieve, with its traceable number in accordance with Specification **E 11** marking requirements.

10.2 If certified reference material is to be used, it may not be required to determine the proportion of material retained on a calibration sieve. The test results from the supplier should provide this information.

11. Procedure

11.1 Measure the reference material that will be used to perform the test on a calibrated scale or balance; the recommended quantity may be referenced per **Annex A1**

11.2 Set the calibration sieve to be tested in the second position in the shaker. The sieve in the top position should be the next coarser size using U.S. Standard sieve designations. For example, if a No. 120 sieve is in second position, the top position sieve would be a No. 100 sieve. A collection pan will be in the bottom position.

11.3 Place the reference material on the coarser sieve in the top position and run the sieve shaker until endpoint, typically ten minutes. All of the reference material should pass the coarser sieve, which aids in it being evenly distributed over the finer sieve.

11.4 Weigh the reference material retained on the calibration sieve in the second position. The remainder of the reference material should pass into the collection pan in the bottom position. The proportion of the retained material to the total starting material will be used for comparison to the sieves. It is not necessary to repeat this procedure on the calibration sieve each time a sieve comparison is performed, unless the material degraded during the sieving process. The calibration sieve proportion will remain the constant for comparison, provided the same batch of reference material is used.

11.5 After the weight is obtained, mix the retained material with the passed material in the collection pan, which will then become the reference material used to check the performance of subsequent sieves. Before each sieve is tested, the recombined reference material must be weighed to obtain the starting weight for the next test. If the starting weight is less

than 97 % of the original quantity, a new batch of reference material is required, and the sieve must be re-tested.

11.6 Repeat procedures **11.1-11.5** for all subsequent sieves. Record the results for each sieve.

11.7 The complete procedure must be repeated for each different size sieve to be tested, using the corresponding size reference material.

12. Calculation or Interpretation of Results

12.1 Normally, not all of the reference material is salvaged, as some is lost due to retention in the sieve and other losses that occur during testing. Therefore the proportion of retained material, not the actual weight, shall be compared between sieves tested, per the following.

$$\text{Percent Retained} = (\text{Weight Retained} / \text{Starting Weight}) * 100 \quad (2)$$

12.2 Compare the results of the sieve to the calibration sieve by subtracting the % retained on the calibration sieve from the % retained on the sieve. For example, if the calibration sieve retained 50 % of the reference material, and the sieve retained 49 % of the reference material, there is a minus 1 % deviation between the two sieves.

12.3 A sieve is considered acceptable for use if the percent deviation test result is within the user's tolerance for the specific reference material.

13. Report

13.1 The report shall include the following:

13.1.1 The percent of reference material retained on the calibration sieve.

13.1.2 The percent of the reference material retained on the sieve.

13.1.3 The percent deviation, with attention to the sign (plus or minus).

13.1.4 The acceptance status (i.e. accept or reject.)

14. Precision and Bias

14.1 There is no precision and bias information available at this time. However, an inter-laboratory study is pending.

ANNEX

A1. Annex “A”

Nominal Sieve Diameter	Acceptable Sample Size (grams)				Nominal Sieve Diameter	Acceptable Sample Size (grams)			
	3 Inch	6 Inch	8 Inch	12 inch		3 Inch	6 Inch	8 Inch	12 inch
Sieving Diameter (Inches)	2.74	5.63	7.63	11.26	Sieving Diameter (Inches)	2.74	5.63	7.63	11.26
Sieving Area (mm ²)	3804.2	16061.1	29498.9	64244.2	Sieving Area (mm ²)	3804.2	16061.1	29498.9	64244.2
Aperture Size (mm)					Aperture Size (mm)				
125	213	898	1649	3591	2.00	27	114	209	454
106	196	827	1519	3307	1.70	25	105	192	419
100	190	803	1475	3212	1.40	23	95	175	380
90.0	180	762	1399	3047	1.18	21	87	160	349
75.0	165	695	1277	2782	1.00	19	80	147	321
63.0	151	637	1171	2550	0.850	18	74	136	296
53.0	138	585	1074	2339	0.710	16	68	124	271
50.0	134	568	1043	2271	0.600	15	62	114	249
45.0	128	539	989	2155	0.500	13	57	104	227
37.5	116	492	903	1967	0.425	12	52	96	209
31.5	107	451	828	1803	0.355	11	48	88	191
26.5	98	413	759	1654	0.300	10	44	81	176
25.0	95	402	737	1606	0.250	9.5	40	74	161
22.4	90	380	698	1520	0.212	8.8	37	68	148
19.0	83	350	643	1400	0.180	8.1	34	63	136
16.0	76	321	590	1285	0.150	7.4	31	57	124
13.2	69	292	536	1167	0.125	6.7	28	52	114
12.5	67	284	521	1136	0.106	6.2	26	48	105
11.2	64	269	494	1075	0.090	5.7	24	44	96
9.50	59	248	455	990	0.075	5.2	22	40	88
8.00	54	227	417	909	0.063	4.8	20	37	81
6.70	49	208	382	831	0.053	4.4	18	34	74
6.30	48	202	370	806	0.045	4.0	17	31	68
5.60	45	190	349	760	0.038	3.7	16	29	63
4.75	41	175	321	700	0.032	3.4	14	26	57
3.35	35	147	270	588	0.025	3.0	13	23	51
2.80	32	134	247	538	0.020	2.7	11	21	45
2.36	29	123	227	493					

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