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Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves¹

This standard is issued under the fixed designation E11; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This document specifies the technical requirements for; the woven wire test sieve cloth (sieve cloth) used in test sieves, the construction of test sieves, standard and non-standard test sieve frame sizes, and test procedures used to inspect sieve cloth and the test sieves. This Specification applies to test sieves manufactured with sieve cloth having a nominal aperture size ranging from 125 millimetres (mm) down to 20 micrometres (μm).

1.2 Additional reference information can be found in Specifications E161, E323, E2016, and in Test Methods C430 and E2427.

1.3 The values stated in SI units shall be considered standard for the dimensions of the sieve cloth openings and the wire diameters used in the sieve cloth. The values stated in inch-pound units shall be considered standard with regard to the sieve frames, pans, and covers.

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.*

2. Referenced Documents

2.1 ASTM Standards:²

C430 Test Method for Fineness of Hydraulic Cement by the 45- μm (No. 325) Sieve

E161 Specification for Precision Electroformed Sieves

E323 Specification for Perforated-Plate Sieves for Testing Purposes

E1638 Terminology Relating to Sieves, Sieving Methods, and Screening Media

¹ This specification 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.

E2016 Specification for Industrial Woven Wire Cloth

E2427 Test Method for Acceptance by Performance Testing for Sieves

2.2 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)³

2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage³

2.4 ISO Standard:

ISO 3310-1 Test Sieves—Technical Requirements and Testing – Part 1: Test Sieves of Metal Wire Cloth⁴

3. Terminology

3.1 Definitions:

3.1.1 *aperture*—the dimension defining an opening in a screening surface.

3.1.2 *crimp*—the corrugation in the warp and shute wire, or both. The crimp in the wires is formed either during the weaving process, or with a crimping machine prior to weaving. If formed during the weaving process, the tension existing between the warp and shute wires fundamentally determines the respective amount or depth of crimp, which locks the wires in place, and in part establishes the firmness of the sieve cloth.

3.1.3 *firmness*—a subjective term referring to the planar rigidity of sieve cloth (as a roll good, not mounted in a test sieve frame), established by the tensile strength of the material, the relationship of the mesh to wire diameters, the type of weave, and amount of crimp in the wires. The absence of firmness in sieve cloth is termed *sleaziness*.

3.1.4 *matched test sieve*—a test sieve that reproduces the performance results of another test sieve within user defined limits for a designated material (for information only and may not be in compliance with this Specification).

3.1.5 *mesh*—the number of wires or openings per linear inch (25.4 mm) counted from the center of any wire to a point exactly 1 in. (25.4 mm) distant, including the fractional distance between either thereof.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

3.1.6 *plain weave*—sieve cloth in which the warp wires and shute wires pass over one and under one in both directions.

3.1.7 *shute wires*—the wires running the short way of, or across the cloth as woven (also referred to as the shoot, fill, or weft wires).

3.1.8 *sieve*—an apparatus for the purpose of sieving, consisting of a separating media mounted in a frame.

3.1.9 *sieve cloth*—woven wire cloth conforming to this specification.

3.1.10 *test sieve (wire cloth)*—a sieve manufactured by mounting sieve cloth in a frame, designed for use in particle size analysis by sieving.

3.1.11 *compliance test sieve*—a test sieve manufactured using sieve cloth which has been inspected prior to being mounted in the sieve frame; and that meets the requirements of **Table 1** in part based on the standard deviation of the required number of sample openings per 100 square feet of sieve cloth (Column 7) not exceeding the maximum allowable for a confidence level of 66 % (Column 8).

3.1.12 *inspection test sieve*—a test sieve manufactured using sieve cloth which has been inspected after being mounted in the sieve frame; and that meets the requirements of **Table 1** in part based on the standard deviation of the required number of sample openings in the test sieve (Column 9) not exceeding the maximum allowable for a confidence level of 99 % (Column 10).

3.1.13 *calibration test sieve*—a test sieve manufactured using sieve cloth which has been inspected after being mounted in the sieve frame; and that meets the requirements of **Table 1** in part based on the standard deviation of the required number of sample openings in the test sieve (Column 11) not exceeding the maximum allowable for a confidence level of 99.73 % (Column 12).

3.1.14 *twill weave*—sieve cloth in which the warp wires and shute wires pass over two and under two wires in both directions.

3.1.15 *warp wires*—the wires running the long way of the cloth as woven.

3.2 Additional terms can be found in Terminology **E1638**.

4. Ordering Information

4.1 Orders for items under this specification should include the following information as required:

4.1.1 Description of item(s) (Test Sieve or Sieve Cloth),

4.1.2 ASTM E11 designation and year of issue,

4.1.3 Quantity of each item, and

4.1.4 Sieve designation (**Table 1**, Standard Column 1, Alternate Column 2).

4.2 Test sieves in standard circular frame:

4.2.1 Nominal sieve frame diameter (see **Table 2**), and

4.2.2 Nominal sieve frame height (see **Table 2**).

4.3 For sieve cloth not in frames or in *nonstandard* frames:

4.3.1 Sieve cloth designation, and

4.3.2 Description of nonstandard frame.

4.4 For U.S. Government purchases, if supplementary requirements apply:

4.4.1 Compatible sieve pans and covers, and

4.4.2 Special requirements (specific type of metal for sieve cloth and frames, test sieve designation and or matched sieves for example).

5. Sieve Cloth Requirements

5.1 The sieve cloth used in test sieves shall meet the requirements of **Table 1** and shall be designated Specification E11 Sieve Cloth. The number of inspected apertures shall be in accordance with **Table 1** (Column 7). Sieve cloth conforming to this specification shall be woven from stainless steel, brass, or bronze. Sieve cloth with openings greater than or equal to 75 micrometres shall be woven using a plain weave. For sieve cloth with openings equal to or less than 63 micrometres the sieve cloth may be supplied using a twill weave. The sieve cloth shall not be coated or plated.

5.2 All measurements of openings and wire diameters shall be made along the midpoints of the openings as shown in **Fig. 1**.

5.3 There shall be no punctures or obvious defects in the sieve cloth.

5.4 Test sieves can be supplied based on different levels of confidence as Compliance Sieves, Inspection Sieves, and Calibration Sieves. Calibration sieves have had at least twice as many openings measured as Inspection sieves.

5.5 Each test sieve must be examined and found to be free of manufacturing defects.

6. Technical Requirements

6.1 *Opening Sizes, Tolerances, and Standard Deviation:*

6.1.1 Four tolerances shall be applied: the variation for average opening (Y), the maximum variation (X), the maximum standard deviation and the wire diameter. The opening tolerances apply to the opening sizes, measured on the midpoint of the opening (see **Fig. 1**), and applied separately in both the warp and shute directions.

6.1.2 The average opening size shall not exceed the sieve designation by more than $\pm Y$ (**Table 1**, Column 4):

$$Y = \frac{w^{0.98}}{27} + 1.6 \quad (1)$$

where Y and w are expressed in micrometres.

6.1.3 The maximum opening size measured shall not exceed the nominal opening size w (**Table 1**, Column 1), by more than X (**Table 1**, Column 5):

$$X = \frac{2(w^{0.75})}{3} + 4w^{0.25} \quad (2)$$

where X and w are expressed in micrometres.

6.1.4 The intermediate value Z shall be stated as follows:

$$Z = (X + Y)/2 \quad (3)$$

6.1.5 The maximum standard deviation is calculated based on the Gaussian normal distribution curve, where the area under the curve to the maximum value X minus the area under the curve to the intermediate value Z , is equal to this critical

TABLE 1 Nominal Dimensions and Permissible Variations for Sieve Cloth and Compliance, Inspection and Calibration Test Sieves

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Sieve Designation		Nominal Sieve Opening (in.)	±Y Variation for Average Opening	+X Maximum Variation for Opening	Resulting Maximum Individual Opening	Compliance Sieves		Inspection Sieves		Calibration Sieves		Typical Wire Diameter	Permissible Range of Choice	
Standard	Alternative					Sample Openings per 100 ft ²	Maximum Standard Deviation	Sample Openings per Sieve	Maximum Standard Deviation	Sample Openings per Sieve	Maximum Standard Deviation		Min	Max
millimetre	inches	millimetre	millimetre	millimetre							millimetre			
125	5 in.	5	3.66	4.51	129.51	20	—	all	—	all	—	8	6.8	9.2
106	4.24 in.	4.24	3.12	3.99	109.99	20	—	all	—	all	—	6.3	5.4	7.2
100	4 in.	4	2.94	3.82	103.82	20	—	all	—	all	—	6.3	5.4	7.2
90	3½ in.	3.5	2.65	3.53	93.53	20	—	all	—	all	—	6.3	5.4	7.2
75	3 in.	3	2.22	3.09	78.09	20	—	all	—	all	—	6.3	5.4	7.2
63	2½ in.	2.5	1.87	2.71	65.71	20	—	all	—	all	—	5.6	4.8	6.4
53	2.12 in.	2.12	1.58	2.39	55.39	20	—	all	—	all	—	5	4.3	5.8
50	2 in.	2	1.49	2.29	52.29	20	—	all	—	all	—	5	4.3	5.8
45	1¾ in.	1.75	1.35	2.12	47.12	20	—	all	—	all	—	4.5	3.8	5.2
37.5	1½ in.	1.5	1.13	1.85	39.35	20	1.374	all	—	all	—	4.5	3.8	5.2
31.5	1¼ in.	1.25	0.95	1.63	33.13	20	1.066	all	—	all	—	4	3.4	4.6
26.5	1.06 in.	1.06	0.802	1.44	27.94	20	0.869	15	0.584	all	—	3.55	3	4.1
25	1.00 in.	1	0.758	1.38	26.38	20	0.823	15	0.553	all	—	3.55	3	4.1
22.4	¾ in.	0.875	0.681	1.27	23.67	150	0.734	15	0.493	all	—	3.55	3	4.1
19	¾ in.	0.750	0.579	1.13	20.13	150	0.622	15	0.418	30	0.446	3.15	2.7	3.5
16	⅝ in.	0.625	0.490	0.99	16.99	150	0.527	15	0.354	30	0.378	3.15	2.7	3.6
13.2	0.530 in.	0.530	0.406	0.86	14.06	150	0.441	15	0.296	30	0.316	2.8	2.4	3.2
12.5	½ in.	0.500	0.385	0.83	13.33	150	0.421	15	0.283	30	0.302	2.5	2.1	2.9
11.2	⅞ in.	0.438	0.346	0.77	11.97	150	0.382	15	0.256	30	0.274	2.5	2.1	2.9
9.5	⅜ in.	0.375	0.295	0.68	10.18	150	0.330	15	0.222	30	0.237	2.24	1.9	2.6
8	⅜ in.	0.312	0.249	0.60	8.60	150	0.284	15	0.191	30	0.204	2	1.7	2.3
6.7	0.265 in.	0.265	0.210	0.53	7.23	150	0.245	15	0.164	30	0.175	1.8	1.5	2.1
6.3	¼ in.	0.250	0.197	0.51	6.81	150	0.233	15	0.157	30	0.167	1.8	1.5	2.1
5.6	No. 3½	0.223	0.176	0.47	6.07	150	0.211	15	0.142	30	0.151	1.6	1.3	1.9
4.75	No. 4	0.187	0.150	0.41	5.16	150	0.182	15	0.123	30	0.131	1.6	1.3	1.9
4	No. 5	0.157	0.127	0.37	4.37	150	0.161	15	0.108	30	0.115	1.4	1.2	1.7
3.35	No. 6	0.132	0.107	0.32	3.67	200	0.138	20	0.097	40	0.103	1.25	1.06	1.5
2.8	No. 7	0.110	0.090	0.29	3.09	200	0.121	20	0.085	40	0.090	1.12	0.95	1.3
2.36	No. 8	0.0937	0.076	0.25	2.61	200	0.104	20	0.073	40	0.077	1	0.85	1.15
2	No. 10	0.0787	0.065	0.23	2.23	250	0.094	25	0.068	50	0.072	0.9	0.77	1.04
1.7	No. 12	0.0661	0.056	0.20	1.90	250	0.081	25	0.059	50	0.062	0.8	0.68	0.92
1.4	No. 14	0.0555	0.046	0.18	1.58	400	0.071	40	0.055	80	0.057	0.71	0.6	0.82
1.18	No. 16	0.0469	0.040	0.16	1.34	400	0.063	40	0.049	80	0.051	0.63	0.54	0.72
1	No. 18	0.0394	0.034	0.14	1.14	400	0.055	40	0.042	80	0.044	0.56	0.48	0.64
micrometre	inches	micrometre	micrometre	micrometre							millimetre			
850	No. 20	0.0331	29.1	127	977	400	48.76	40	37.73	80	39.36	0.5	0.43	0.58
710	No. 25	0.0278	24.7	112	822	500	42.63	50	33.82	100	35.14	0.45	0.38	0.52
600	No. 30	0.0234	21.2	101	701	500	38.00	50	30.14	100	31.32	0.4	0.34	0.46
500	No. 35	0.0197	18.0	89	589	600	33.23	60	26.85	120	27.82	0.315	0.27	0.36
425	No. 40	0.0165	15.5	81	506	600	29.95	60	24.20	120	25.08	0.28	0.24	0.32
355	No. 45	0.0139	13.3	72	427	800	26.45	80	21.95	160	22.64	0.224	0.19	0.26
300	No. 50	0.0117	11.5	65	365	800	23.70	80	19.66	160	20.29	0.2	0.17	0.23
250	No. 60	0.0098	9.9	58	308	800	21.02	80	17.44	160	17.99	0.16	0.13	0.19
212	No. 70	0.0083	8.7	52	264	800	18.79	80	15.59	160	16.08	0.14	0.12	0.17
180	No. 80	0.0070	7.6	47	227	1000	16.85	100	14.24	200	14.65	0.125	0.106	0.15
150	No. 100	0.0059	6.6	43	193	1000	15.30	100	12.93	200	13.30	0.1	0.085	0.115
125	No. 120	0.0049	5.8	38	163	1000	13.51	100	11.41	200	11.74	0.09	0.077	0.104
106	No. 140	0.0041	5.2	35	141	1000	12.39	100	10.47	200	10.77	0.071	0.06	0.082
90	No. 170	0.0035	4.6	32	122	1000	11.27	100	9.53	200	9.80	0.063	0.054	0.072
75	No. 200	0.0029	4.1	29	104	1000	10.23	100	8.64	250	9.02	0.05	0.043	0.058
63	No. 230	0.0025	3.7	26	89	1000	9.18	100	7.76	250	8.09	0.045	0.038	0.052
53	No. 270	0.0021	3.4	24	77	1000	8.44	100	7.13	250	7.44	0.036	0.031	0.041
45	No. 325	0.0017	3.1	22	67	1000	7.76	100	6.56	250	6.84	0.032	0.027	0.037
38	No. 400	0.0015	2.9	20	58	1000	7.09	100	5.99	300	6.31	0.03	0.024	0.035
32	No. 450	0.0012	2.7	18	50	1000	6.42	100	5.42	300	5.71	0.028	0.023	0.033
25	No. 500	0.0010	2.5	16	41	1000	5.71	100	4.82	300	5.06	0.025	0.021	0.029
20	No. 635	0.0008	2.3	15	35	1000	5.33	100	4.51	300	4.75	0.02	0.017	0.023

Column 3—These numbers are only approximate but are in use for reference; the sieve shall be identified by the standard designation in millimetres or micrometres.

Columns 9 and 11—See **Annex A1**, which specifies that all openings will be inspected for test sieves having 15 openings or less.

Columns 9 and 11—These number of sample openings are based on an 8-in. diameter test sieve.

TABLE 2 Dimensions of Standard Frames

Nominal Diameter, in.	Mean Diameter, in. (mm)		Typical Frame ^A Nominal Height, in. (mm)
	Inside at Top ^B	Outside on Skirt	
3	3.000 + 0.030 / -0.000 (76 + 0.76 / -0.00)	3.000 + 0.000 / -0.030 (76 + 0.00 / -0.76)	1¼ (32) FH ^C 5/8 (16) HH
6	6.000 + 0.030 / -0.000 (152 + 0.76 / -0.00)	6.000 + 0.000 / -0.030 (152 + 0.00 / -0.76)	1¾ (45) FH 1 (25) HH
8	8.000 + 0.030 / -0.000 (203 + 0.76 / -0.00)	8.000 + 0.000 / -0.030 (203 + 0.00 / -0.76)	2 (50) FH 1 (25) HH
10	10.000 + 0.030 / -0.000 (254 + 0.76 / -0.00)	10.000 + 0.000 / -0.030 (254 + 0.00 / -0.76)	3 (76) FH 1½ (38) HH
12	12.000 + 0.030 / -0.000 (305 + 0.76 / -0.00)	12.000 + 0.000 / -0.030 (305 + 0.00 / -0.76)	3¾ (83) FH 2 (50) IH 1½ (41) HH

^A Frame height measured from top of frame to top of sieve cloth.

^B Measured 0.2 in. (5 mm) below the top of the frame.

^C FH = full height; HH = half height; IH = intermediate height.

^D Distance from the top of the frame to the sieve cloth surface.

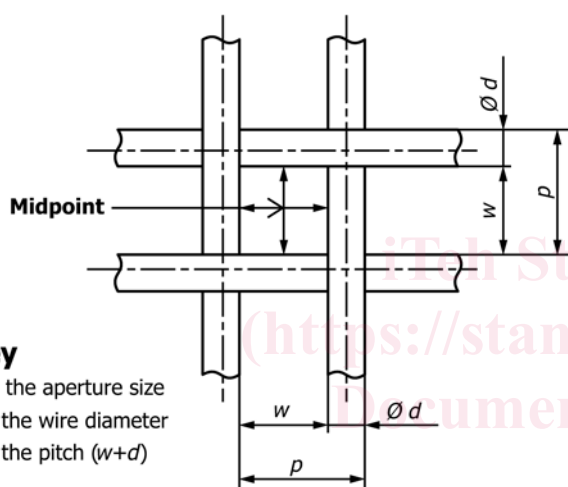


FIG. 1 Aperture Size

area between $(w + Z)$ and $(w + X)$ not exceeding more than 5 % of the openings (see Appendix X2). The resulting tolerances for sigma are given in Table 1 for Compliance sieve cloth (Column 8).

6.1.5.1 In order to increase the probability or acceptance confidence level from 66 % at one-sigma to $X\sigma$, specifically 99 % (2.58 σ) and 99.73 % (3 σ) for Inspection and Calibration sieves respectively, these maximum standard deviation values are determined by dividing sigma by a correction or K-factor. These K-factors are determined based on approximation to a Chi-square distribution for the sample variance as follows:

$$K = 1 + X\sigma / \sqrt{2(n - 1)} \quad (4)$$

6.1.5.2 The applicable resulting K-factors (see Appendix X3) are then applied and the maximum standard deviation tolerances are determined as follows:

$$\sigma_x = \text{sigma} / K \quad (5)$$

6.1.5.3 The resulting tolerances are given in Table 1 for Inspection Sieves (Column 10) and for Calibration Sieves (Column 12).

6.1.6 The actual standard deviation of the openings in the warp and weft directions, when taken separately, shall not

exceed the values shown in Table 1 for each type. If the number of sample openings is less than 15, the maximum standard deviation is not evaluated.

6.1.6.1 The population standard deviation σ is obtained by measuring all of the full openings N found in the test sieve and is calculated from the following equation:

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (w_i - \bar{w})^2} \quad (6)$$

6.1.6.2 The sample standard deviation s is calculated from the measurement of the number of apertures, n as listed in Table 1 (Column 8 for sieve cloth, Column 10 for Inspection Sieves, and Column 12 for Calibration Sieve), using the following equation:

$$s = \sqrt{\frac{1}{n - 1} \sum_{i=1}^n (w_i - \bar{w})^2} \quad (7)$$

6.2 Wire Diameters:

6.2.1 The nominal wire diameters given in Table 1, Column 13 are typical.

6.2.2 The wires in a test sieve or sieve cloth shall fall between the range of choice (d_{min} and d_{max}) given in Table 1, Column 14 and 15, respectively. It is recognized that mechanical deformation of the wire occurs during weaving, and therefore the diameter measured after weaving may be different than the nominal wire diameter.

6.2.3 The wires shall be crimped in such a manner that the cloth exhibits firmness, as agreed between the user and the supplier, as applied to roll goods.

6.3 Test Sieve Frames:

6.3.1 General Requirements—Frames for test sieves shall be constructed in such a manner to be rigid. The sieve cloth shall be mounted on a frame without distortion, looseness, or waviness. The method used to attach the sieve cloth to the frame shall be done so the material being sieved will not become caught in the joint between the sieve cloth and the frame.

6.3.2 Standard Frames—Sieve frames shall be circular. Typical frame sizes are 3 in., 6 in., 8 in., 10 in., and 12 in. diameter (or 76, 152, 203, 254, or 305 mm). Tolerances for dimensions of test sieve frames are given in Table 2. Frames shall be made of a noncorrosive material such as brass or stainless steel. The bottom of the frame shall be constructed so as to provide an easy sliding or nesting fit with any sieve frame of the same nominal diameter conforming to the specified dimensions.

6.3.3 The joint or fillet at the point where the sieve cloth and frame meet will provide a minimum clear sieving surface with a diameter equal to the nominal diameter, less 0.5 in. (13 mm).

6.4 Nonstandard Frames—Other sieve frames may be square, rectangular, circular, or non-metal. The frame may have the sieve cloth permanently attached, or it may be designed so the sieve cloth is replaceable. The provisions of 6.3.1 apply. Nonstandard test sieves may be certified in accordance with Section 7.