Designation: E11 – 13

Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves[1]

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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the 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

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 Storage[3]

2.4 *ISO Standard:*

ISO 3310-1 Test Sieves—Technical Requirements and Testing – Part 1: Test Sieves of Metal Wire Cloth[4]

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.

[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.

[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):

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

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	⅞ 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	7⁄16 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	5⁄16 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]
	Inside at Top[B]	Outside on Skirt	Nominal Height, in. (mm)
3	3.000 + 0.030/–0.000	3.000 + 0.000/–0.030	1¼ (32) FH[C]
	(76 + 0.76/ –0.00)	(76 + 0.00/ –0.76)	⅝ (16) HH
6	6.000 + 0.030/–0.000	6.000 + 0.000/–0.030	1¾ (45) FH
	(152 + 0.76/ –0.00)	(152 + 0.00/ –0.76)	1 (25) HH
8	8.000 + 0.030/–0.000	8.000 + 0.000/–0.030)	2 (50) FH
	(203 + 0.76/ –0.00	(203 + 0.00/ –0.76)	1 (25) HH
10	10.000 + 0.030/–0.000	10.000 + 0.000/–0.030	3 (76) FH
	(254 + 0.76/ –0.00)	(254 + 0.00/ –0.76)	1½ (38) HH
12	12.000 + 0.030/–0.000	12.000 + 0.000/–0.030	3¼ (83) FH
	(305 + 0.76/ –0.00)	(305 + 0.00/ –0.76)	2 (50) IH
			1⅝ (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.

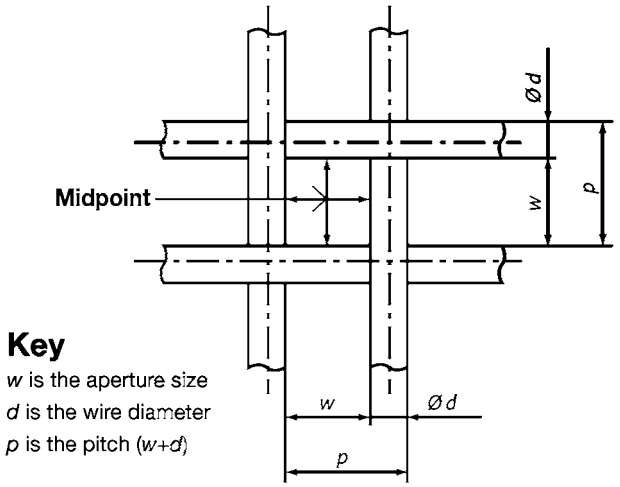


FIG. 1 Aperture Size

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 % (2.58σ) and 99.73 % (3σ) 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.

7. Test Sieve and Sieve Cloth Documentation and Certification

7.1 Documentation of the measurement of the openings in the sieve cloth must assure that the test sieve is traceable and certifiable. All test sieve certificates must be traceable by the test sieve serial number. Inspection and Calibration sieves must also include the date, name and signature of the person certifying to the test sieve quality.

7.2 Test sieves may be supplied as Compliance, Inspection or Calibration Sieves.

7.2.1 A Compliance sieve certificate shall state that the test sieve has been manufactured with sieve cloth that has been inspected and found to be in compliance with the requirements of Specification E11. The Certificate does not require any statistical documentation.

7.2.2 An Inspection sieve certificate shall state at a minimum the value for the average aperture size, separately in both the warp and shute direction of the sieve cloth. A Certificate with this inspection data must be supplied.

7.2.3 A Calibration sieve certificate shall state at a minimum the number of aperture and wire diameters measured, the average aperture size, standard deviation and average wire diameter, separately in both the warp and shute directions of the sieve cloth. A Certificate with this inspection data must be supplied.

8. Marking or Labeling of Test Sieves

8.1 Each test sieve supplied shall bear a label marked with the following information:

8.1.1 "Test Sieve,"

8.1.2 The "ASTM E11" designation,

8.1.3 Name of the manufacturer or distributor,

8.1.4 Test sieve designation from Table 1, Column 1, and

8.1.5 Alternate test sieve designation from Table 1, Column 2 (optional).

8.1.6 Each test sieve shall have a unique serial number permanently marked onto the sieve frame, skirt or nameplate.

8.1.7 The test sieve may also be labeled with the Grade designation.

9. Keywords

9.1 aperture; calibration sieve; compliance sieve; inspection sieve; opening; particle size; sieve; sieve analysis; sieve cloth; sieve designation; test sieve; woven wire test sieve cloth

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the contract or order.

S1. Responsibility for Inspection

S1.1 Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. Except as otherwise specified in the contract or order, the producer may use his own or any other suitable facilities for the performance of the inspections and tests requirements specified herein, unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that materials meet the specification.

S2. Government Procurement

S2.1 Unless otherwise specified in the contract, the material shall be in packaged in accordance with the suppliers' standard practice that will be acceptable to the carrier at lowest rates. Containers and packing shall comply with the Uniform Freight Classification rules or National Motor Classification rules. Marking for shipment of such materials shall be in accordance with Fed. Std. No. 123 for civil agencies, and MIL-STD-129 for military agencies.

ANNEX

(Mandatory Information)

A1. PROCEDURE FOR INSPECTING SIEVE CLOTH AND TEST SIEVES

A1.1 Every opening in the sieve cloth or test sieve shall have the same probability of being inspected for compliance with the requirements shown in Table 1. For sieve cloth and test sieves having 15 openings or less, measure all full openings (see Fig. A1.1). For sieve cloth and test sieves having more than 15 openings, carry out the inspection using the following three procedures:

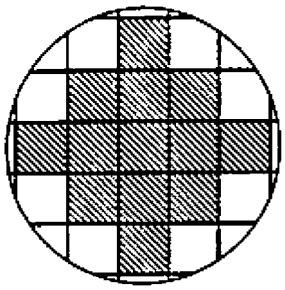
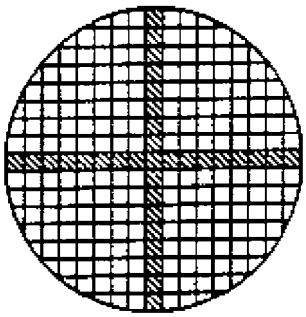
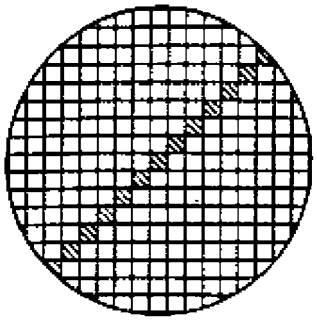


FIG. A1.1 All Full Apertures Measure up to 15 Apertures



NOTE 1—Apertures randomly spaced over the full diameter at irregular intervals, measurement for warp and shute dimension, only one measurement per aperture.

FIG. A1.2 Example for Crosswise Spot Check



NOTE 1—Apertures randomly spaced over the full diameter at irregular intervals, measurements for both warp and shute dimensions shall be made in any one aperture.

FIG. A1.3 Example for Diagonal Spot Check

A1.1.1 Visually inspect the condition of the sieve cloth against a uniformly illuminated background. If obvious deviations from uniformity of appearance are found (weaving defects, creases, wrinkles, etc.) the sieve cloth or test sieve, or both, is unacceptable.

A1.1.2 Inspect for oversize openings per tolerance *X* given in Table 1 (Column 5); carefully and methodically examine the appearance of all openings in order to detect oversize openings for subsequent measurements. Openings in fine mesh sieves

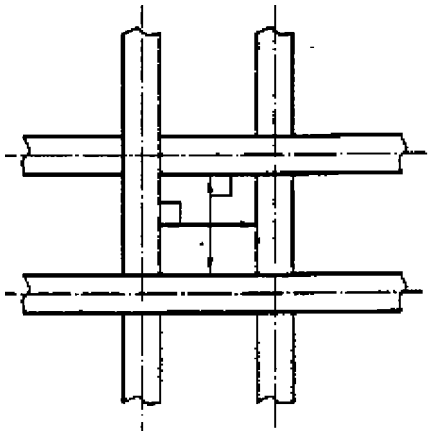


FIG. A1.4 Configuration of Twilled Weaves

are best viewed when magnified optically. In the optical method, the minimum number of apertures examined shall be in accordance with Table 1 (Columns 9 or 11) for sieves and (Column 7) for sieve cloth. The magnifications listed in Table A1.1 may be used. If any opening is found to be oversize by more than tolerance *X*, the sieve cloth or test sieve is unacceptable.

A1.1.3 Determine the average opening size (*w* in millimetres), and for apertures less than one millimetre, in micrometres, the standard deviation and wire diameter. The measured openings shall be spaced over the full diameter of the test sieve. Figs. A1.1 and A1.2 indicate options to measure the individual openings in an 8 in. (203 mm) diameter test sieve. The minimum number of openings to be measured, in both the warp and shute direction, in an 8 in. diameter test sieve for Inspection and Calibration grades are shown in Table 1, Columns 9 or 11 respectively. For test sieve sizes other than the 8 in. diameter, the values shown in this table should be modified in proportion to the sieving area. Determine the average opening along the center line of the sieve cloth separately in two directions, parallel to the warp and shute wires respectively (see Figs. A1.2 and A1.3). If the sieve cloth is a twill weave (openings less than or equal to 63 micrometre), the configuration shall be as shown in Fig. A1.4 and the measurements shall be made vertically, to the wire.

A1.1.4 To determine the average opening in sieve cloth refer to Table 1 for the minimum number of sample openings to be measured. Calculate the standard deviation as in accordance with 6.1.6.2. If the wire diameter is measured separately, not at the same time the opening is measured, measure at least 10 wire diameters, if available, in each direction.

TABLE A1.1 Magnifying Power in Optical Method

Nominal Aperture Size	5 mm to 500 µm	500 to 250 µm	250 to 20 µm
Magnification	5 to 20	20 to 50	50 to 500

APPENDIXES

(Nonmandatory Information)

X1. DETERMINATION OF THE STANDARD DEVIATION ON AVERAGE APERTURE SIZE

The standard deviation is calculated using equations as illustrated by the following two examples.

X1.1 Example 1

X1.1.1 Test for Inspection Grade sieve (n = 25, nominal aperture size w = 2 mm):

w_i	n_i	$n_i \times w_i$	$(w_i - \bar{w})$	$(w_i - \bar{w})^2$	$n \times (w_i - \bar{w})^2$
1.812	0	0.000	–0.132	0.017	0.000
1.859	3	5.577	–0.085	0.007	0.021
1.906	5	9.530	–0.038	0.001	0.007
1.953	11	21.483	0.009	0.000	0.001
2.000	6	12.000	0.056	0.003	0.019
2.047	0	0.000	0.103	0.011	0.000
2.094	0	0.000	0.150	0.023	0.000
2.141	0	0.000	0.197	0.039	0.000
2.188	0	0.000	0.244	0.060	0.000
n =	25	48.590			0.049

$$\bar{w} = \frac{\sum_{r=1}^{n} n_i - w_i}{n}$$

$$\bar{w} = \frac{48.590}{25} = 1.944 \text{ mm}$$

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

$$s = \sqrt{\frac{1}{24} \times 0.049} = 0.045 \text{ mm}$$

X1.1.2 Standard deviation $\sigma s = 0.045$ shall be compared with the value of $\sigma_x = 0.070$ given in Table 1, Column 10.

X1.2 Example 2

X1.2.1 Test for Calibration Grade sieve (n = 50, nominal aperture size w = 2 mm):

w_i	n_i	$n_i \times w_i$	$(w_i - \bar{w})$	$(w_i - \bar{w})^2$	$n \times (w_i - \bar{w})^2$
1.812	0	0.000	–0.187	0.035	0.000
1.859	2	3.718	–0.140	0.020	0.039
1.906	4	7.624	–0.093	0.009	0.035
1.953	9	17.577	–0.046	0.002	0.019
2.000	20	40.000	0.001	0.000	0.000
2.047	10	20.470	0.048	0.002	0.023
2.094	3	6.282	0.095	0.009	0.027
2.141	2	4.282	0.142	0.020	0.040
2.188	0	0.000	0.189	0.036	0.000
n =	50	99.953			0.183

$$\bar{w} = \frac{\sum_{r=1}^{n} n_i - w_i}{n}$$

$$\bar{w} = \frac{99.953}{50} = 1.999 \text{ mm}$$

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

$$s = \sqrt{\frac{1}{49} \times 0.183} = 0.061 \text{ mm}$$

X1.2.2 Standard deviation $\sigma s = 0.061$ shall be compared with the value of $\sigma_x = 0.072$ given in Table 1, Column 12.

X2. CRITICAL AREA OF NORMAL DISTRIBUTION CURVE

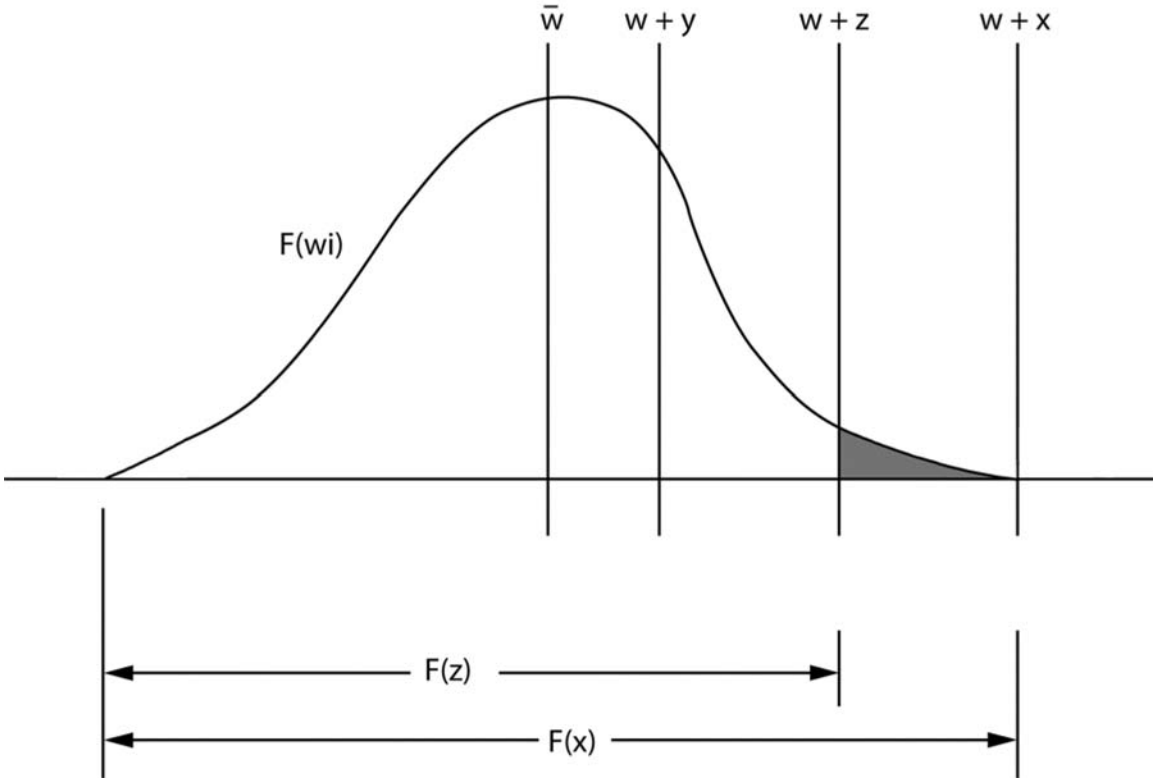


FIG. X2.1 Critical Area of Normal Distribution Curve

X3. K-FACTORS

TABLE X3.1 K Factors

Samples *n*	Xσ K-factors	
	2.58 99 %	3.00 99.73 %
15	1.49	1.57
20	1.42	1.49
25	1.37	1.43
30	1.34	1.39
40	1.29	1.34
50	1.26	1.30
60	1.24	1.28
80	1.21	1.24
100	1.18	1.21
120	1.17	1.19
160	1.14	1.17
200	1.13	1.15
250	1.12	1.13
300	1.11	1.12

Reference: Courtesy of Professor Aridaman K. Jain, New Jersey Institute of Technology, 2008. The acceptance confidence levels 2.58 and 3.00 are conservative as applied to the inspection of sieves, and the large sample K-factors are derived by using the normal distribution as an approximation to a Chi-square distribution for the sample variance.