

(August 7, 1922)

## STANDARD SPECIFICATIONS FOR SIEVES

Paragraph 1. Although it has been recognized for many years that a series of standard sieves should be based upon a definite and logical succession of sieve openings, up to 1916 there was not obtainable in this country a complete series of testing sieves that had been made under published specifications and tolerances with reference to wire diameters and width of opening between the wires. Nevertheless there had been a demand for a long time that the Bureau of Standards certify sieves other than the 100 and 200-mesh cement sieves for which specifications had been adopted.

Paragraph 2. After studying the problem and consulting several manufacturers and users, a conference of representatives of all who were known to be interested in standard sieves was held at the Bureau of Standards on April 20, 1916 at which a tentative standard scale for all testing sieves was adopted. Later it became apparent that certain revisions would increase the usefulness and desirability of this sieve series, and these having been ratified by letter ballot, the Bureau announced that these specifications would in the future be the basis of certification of all sieves submitted to it for test. The relation of sieves of the U. S. Standard Sieve Series to other sieves is shown graphically in the attached drawing. The tolerances for this series of sieves are also indicated.

Paragraph 3. This sieve scale is essentially metric. The sieve having an opening of 1 mm is the basic one, and starting with this sieve the relation of consecutive sieves in the series is one to the fourth root of two. The series has been made large enough, it is hoped, to meet the needs of all industries. Some industries may have occasion to use all the sieves in a certain section of the series and none of the others, while in other industries it may be desirable to use only certain sieves selected from the whole range of the series. In making such selections it is recommended that this be done on some systematic plan, as for example, the selection of every other sieve or of every fourth one in the series. In the former case the ratios of each opening to the next smaller one would be as  $\sqrt[4]{2}:1$ , in the latter case 2:1.



Paragraph 4. Because of the wide range of openings in sieves now manufactured which is possible with a given number of meshes per unit length by the use of wires of different diameters, and the consequent confusion and uncertainty which arises in designating sieves by the number of meshes per unit length, it is recommended that all reference to mesh be avoided in the designation of the sieves, but that for convenience each sieve be given an abstract number which will indicate the approximate position of the sieve in the series. The proper designation of a sieve is the size of the opening, supplemented by the wire diameter, but it is well recognized that few users of sieves will be able to carry the sizes of the various openings in mind without reference to a printed table, and also that few users of sieves will be concerned with the exact sizes of the openings in either metric or English units. All the users of sieves desire to know in general is that the sieves are "standard", that is that they conform to established specifications, and therefore the only designation required is a simple one which will suggest the degree of fineness or coarseness of the material passing or retained upon any given sieve. Such a designation is an abstract number which is approximately the number of meshes per linear inch. The advantage of such a designation is readily apparent. Thus the basic sieve in the series, which has a 1 mm opening, is given the number 18, which may be regarded simply as a fixed arbitrary number indicating that the sieve has approximately 18 meshes per inch. The fact that this sieve has actually 17.2 meshes per inch or 7 meshes per centimeter is of no importance; the number 18 merely indicates to those who are familiar with the old sieves what order of separation this sieve would give in testing any graded material. It is urgently recommended that all users of sieves in the future designate these standard sieves in this way, and that the manufacturers mark and list the sieves in this manner, together with the size of the openings and the wire diameters in both millimeters and inches.

Paragraph 5. In the designation and certification of the sieves these arbitrary numbers and the metric units will be used by the Bureau of Standards. In the accompanying table, however, are also given the equivalents of these metric quantities in inches in order that the series may be more readily related to work previously done. It is, of course, immaterial whether units of the metric system, or of the customary system, or of any system, are used in the manufacture of the sieves, provided they are within the specified tolerances.



Paragraph 6. To meet the need for sieves of this series, at the present time, provision has been made in the specifications for the acceptance of sieves of slightly different opening and wire diameter than that called for in the sieve scale, provided the resultant opening is the same as the nominal opening within a small range of variation. This will make possible the use of sieve cloth now on the market of such variety that nearly all the sieves of the standard sieve scale can be constructed in accordance with the specifications without the immediate necessity for weaving special cloth. Later when sieves can be constructed more nearly in accordance with the specifications, the present tolerances will be reduced, and further restrictions will undoubtedly have to be imposed. A study is being made of the sieving value of the finer meshed sieves with a view to including a sieving value in certificates for such sieves after sufficient information is at hand as to proper material and methods.

Paragraph 7. The Bureau of Standards hereby announces that it will test sieves of this series to determine whether they conform to specifications given below. This test will consist of the examination of the openings of both the warp and shoot of the cloth to ascertain whether they come within the tolerance allowed; also measurements of the diameter of wires in each direction to determine the average diameter and a measurement of any large openings to ascertain whether they exceed the limits of these specifications; also an examination of the sieve to discover any imperfections of the sieve which may seriously affect the sieving value. Sieves which pass the specifications will be stamped with the seal of the Bureau of Standards and will be given an official identification number. A certificate will be furnished for each sieve that passes the requirements. The sieving value of a No. 200 sieve is also given in the certificate.

Paragraph 8. For each sieve which fails to meet the specifications, a report will be rendered showing wherein the sieve does not conform to the standard.

Paragraph 9. A fee of \$2.00 will be charged for the test of each sieve tested. Each sieve submitted for test should bear a permanent and plainly legible identification number. Sieves which do not bear such identification number will be numbered by the Bureau prior to the test and an extra charge of 10 cents will be made for each sieve so numbered. This number should not be confused with the certification number which is stamped by this Bureau on sieves which conform to the specifications. This latter number is combined with the Bureau seal, as for example: B. S. No. (Seal) 876.



Paragraph 10. In the table attached hereto are given in the first column the arbitrary designation numbers of the sieves, as explained in Paragraph 4. It may be noted that the series contains 31 sieves which may be conveniently divided into five groups, the first containing 7 sieves, and the other four containing 6 sieves each. The designation of the first three sieves is necessarily irregular, but the others of the first group number consecutively up to and including No. 7. In the second group, beginning with No. 8, the designation numbers are the successive even numbers; in the third group, beginning with No. 20, the designation numbers are the successive multiples of five; in the fourth group, beginning with No. 50, the designation numbers are multiples of ten, as are also those in the fifth group, except the last sieve in the series. These relations will assist the user of the sieves to readily memorize all the designation numbers, and by memorizing the openings of the first four sieves in the series all the others can be reproduced by successive division of those numbers by multiples of 2. It will be observed, also, that all the imposed tolerances hold without change for any given group. In columns 2 and 3 are given the width of the sieve openings, and in columns 4 and 5 the wire diameters, in millimeters and inches respectively. Columns 6, 7, and 8 give the tolerances that will be allowed in the width of average opening, in wire diameter, and in the width of maximum opening respectively. These tolerances will be subject to change later as may seem desirable or necessary from experience with the new sieves. It may be remarked, however, that the tolerances in openings have been made as small as wire cloth now on the market will permit. The tolerance in maximum opening is believed to be sufficient to meet the accidental variations in weaving cloth, and is designed to eliminate cloth of non-uniform quality.

Paragraph 11. As stated in an earlier paragraph, the sieve scale is essentially metric, and sieves will be certified in the metric dimensions. This is merely a matter of convenience and is not in any sense an attempt to introduce the metric system where the English system might be preferred by some. Rarely would a case be found, however, in which the transition from English to metric units would be more convenient than in the adoption of this standard screen scale. Thus, users of sieves will appreciate that for most purposes a very complete mechanical analysis of a graded material could be obtained by the use of every other sieve in the series, and that if the results of a mechanical analysis were plotted by any one of the usual methods, the same curve would result whether the odd sieves or the even sieves were used. Fortunately for those who prefer not to depart from the English system, it happens that the opening of the No. 3 sieve is almost exactly (well within the tolerance specified) one-fourth inch, similarly the opening of the No. 6 sieve is one-eighth inch, the opening of the No. 12 sieve is one-sixteenth, and so on. Thus, one may use the new





sieve scale, and readily correlate it with all that he has been familiar with in the use of the old sieves. To those who prefer to work in the metric units the basic 1 mm sieve, or No. 18, would naturally be included in their selection of sieves from the scale, and this would involve every alternate, or every fourth sieve above and below the basic sieve, but would not include those sieves of which the openings are very nearly even fractions of an inch. For many purposes either of these series of alternate sieves would serve equally well, but in many cases there would be a decided advantage in employing those sieves of which the openings involve even fractions or multiples of the millimeter. Whatever the selection made, however, and for whatever purpose, the advantage of the fixed ratio in the successive sieve openings is well established, and there is every reason to believe that the sieves are sufficient in number and sufficiently close together to meet every testing requirement.

Paragraph 12. Experience has demonstrated the advantage of having standard testing sieves so designed and constructed that they meet the following requirements:

- (a) They should be of sufficient depth to minimize the loss of material during test.
- (b) The total height of sieve and pan should be such as to allow the operator to hold the combination firmly in one hand without undue fatigue during test.
- (c) The sieve and pan should preferably be of copper or brass and seamless, and sufficiently strong and rigid to stand ordinary laboratory treatment.
- (d) All crevices in sieve, pan, and cover, where material might lodge, should be smoothly soldered.
- (e) All sieves, pans, and covers furnished by different manufacturers should be interchangeable, and therefore preferably of the same pattern.
- (f) Standard testing sieves should be preferably 20 cm in diameter, this being the inside dimension of top of sieve, and the outside dimension of bottom of sieve.
- (g) Covers, sieves and nesting pans should be an easy fit, and should have rims of sufficient depth to prevent accidental loss of material during test.



SCHEDULE OF FEES

Schedule 9. Standard Sieves and Sieve Cloth

9 (a)	Test and certification or report on any testing sieve - - - - -	\$2.00
9 (b)	Extra charge for placing a preliminary identification number on sieves not otherwise identified - - - - -	.10
9 (c)	Test and report on a piece of sieve cloth, per square foot - - - - -	3.00

STANDARD SPECIFICATIONS FOR SIEVES

Paragraph 1. Wire cloth for standard sieves shall be woven (not twilled, except that the cloth of No. 230, (.062 mm), No. 270 (.053 mm), and the No. 325 (.044 mm) sieve, may be twilled until further notice), from brass, bronze, or other suitable wire and mounted on the frames without distortion. To prevent the material being sieved from catching in the joint between the cloth and the frame, the joint shall be smoothly filled with solder, or so made that the material will not catch. The sieve frames should be circular, about 20 cm (7.87 inches) in diameter and about 5 cm (1.97 inches) between the top of the frame and the cloth.

Paragraph 2. The average opening between the adjacent warp and the adjacent shoot wires, taken separately, shall be that given in column 2 of the attached table, within the "Tolerance in average opening" given in column 6. The average diameter of the warp and of the shoot wires, taken separately, of the cloth of any given sieve shall be that given in column 4 of the attached table within the "Tolerance in wire diameter" given in column 7. The maximum opening between adjacent parallel wires shall not exceed the nominal width of opening for that sieve by more than the "Tolerance in maximum opening" given in column 8 of the attached table.

Paragraph 3. The Bureau of Standards reserves the right to reject sieves for obvious imperfections in the sieve cloth or its mounting, as for example, punctured, loose, or wavy cloth, imperfections in soldering, etc.

Paragraph 4. Number 200 sieves will be given a sieving test with a standard sample of cement and the sieving correction thus obtained will be incorporated in the certificate or report unless it is indicated in the request for the test of the sieves that they are not intended for cement testing and that the sieving test is not required.



U. S. STANDARD SIEVE SERIES

TABLE OF FUNDAMENTAL DATA

STANDARD SPECIFICATIONS FOR SIEVES

Sieve No.	Sieve Opening Milli- meters	Sieve Opening Inches	Wire Diam- eter Milli- meters	Wire Diam- eter Inches	Toler- ance in av- erage open- ing	Toler- ance in Wire Diam- eter	Toler- ance in max- imum Open- ing
2-1/2	8.00	.315	1.85	.073	1%	5%	10%
3	6.73	.265	1.65	.065	1%	5%	10%
3-1/2	5.66	.223	1.45	.057	1%	5%	10%
4	4.76	.187	1.27	.050	1%	5%	10%
5	4.00	.157	1.12	.044	1%	5%	10%
6	3.36	.132	1.02	.040	1%	5%	10%
7	2.83	.111	.92	.036	1%	5%	10%
8	2.38	.0937	.84	.0331	2%	5%	10%
10	2.00	.0787	.76	.0299	2%	5%	10%
12	1.68	.0661	.69	.0272	2%	5%	10%
14	1.41	.0555	.61	.0240	2%	5%	10%
16	1.19	.0469	.54	.0213	2%	5%	10%
18	1.00	.0394	.48	.0189	2%	5%	10%
20	.84	.0331	.42	.0165	3%	5%	25%
25	.71	.0280	.37	.0146	3%	5%	25%
30	.59	.0232	.33	.0130	3%	5%	25%
35	.50	.0197	.29	.0114	3%	5%	25%
40	.42	.0165	.25	.0098	3%	5%	25%
45	.35	.0138	.22	.0087	3%	5%	25%
50	.297	.0117	.190	.0074	4%	10%	40%
60	.250	.0098	.162	.0064	4%	10%	40%
70	.210	.0083	.140	.0055	4%	10%	40%
80	.177	.0070	.119	.0047	4%	10%	40%
100	.149	.0059	.102	.0040	4%	10%	40%
120	.125	.0049	.086	.0034	4%	10%	40%
140	.105	.0041	.074	.0029	5%	15%	60%
170	.088	.0035	.063	.0025	5%	15%	60%
200	.074	.0029	.053	.0021	5%	15%	60%
230	.062	.0024	.046	.0018	5%	15%	60%
270	.053	.0021	.041	.0016	5%	15%	60%
325	.044	.0017	.036	.0014	5%	15%	60%

Note: In order to utilize cloth now on the market, it will be permissible, until further notice is given to the contrary, to use wire whose diameter is within a tolerance of 10% for the first three groups and 20% for the last two groups. Until notice is given to the contrary, the allowable tolerances on average openings will be 50% more than those given in the above table.











