
Test sieves — Technical requirements and testing —

**Part 1:
Test sieves of metal wire cloth**

Tamis de contrôle — Exigences techniques et vérifications —

Partie 1: Tamis de contrôle en tissus métalliques



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 3310 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3310-1 was prepared by Technical Committee ISO/TC 24, *Sieves, sieving and other sizing methods*, Subcommittee SC 1, *Test sieves, test sieving*.

This fourth edition cancels and replaces the third edition (ISO 3310-1:1990), of which it constitutes a technical revision.

ISO 3310 consists of the following parts, under the general title *Test sieves — Technical requirements and testing*:

- *Part 1: Test sieves of metal wire cloth*
- *Part 2: Test sieves of perforated metal plate*
- *Part 3: Test sieves of electroformed sheets*

Annexes A and B of this part of ISO 3310 are for information only.

Introduction

As the accuracy of test sieving depends on the dimensional accuracy of the test sieve openings, it is considered necessary in this part of ISO 3310 to keep the tolerances on the apertures in metal wire cloth as close as possible.

Requirements other than tolerances on the apertures, such as requirements for the wire diameter, have not been limited more closely than necessary, since the influence of these criteria on test sieving is of minor importance, and excessively strict requirements may make manufacturing unnecessarily difficult.

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Test sieves — Technical requirements and testing —

Part 1: Test sieves of metal wire cloth

1 Scope

This part of ISO 3310 specifies the technical requirements and corresponding test methods for test sieves of metal wire cloth.

It applies to test sieves having aperture sizes from 125 mm down to 20 μm , in accordance with ISO 565.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 3310. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 3310 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings.*

ISO 2395:1990, *Test sieves and test sieving — Vocabulary.*

ISO 2591-1:1988, *Test sieving — Part 1: Methods using test sieves of woven wire cloth and perforated metal plate.*

3 Terms and definitions

For the purposes of this part of ISO 3310, the terms and definitions given in ISO 2395 apply.

4 Designation

4.1 Test sieves of metal wire cloth shall be designated by the nominal size of the apertures of the metal wire cloth.

4.2 Nominal aperture sizes of 1 mm and above shall be expressed in millimetres (mm); nominal aperture sizes below 1 mm shall be expressed in micrometres (μm).

5 Metal wire cloth

5.1 Requirements

Aperture tolerances and wire diameters shall be as specified in Tables 1 and 2.

Table 1 — Aperture tolerances and wire diameters

Values in millimetres

Nominal aperture sizes, w^a			Tolerances on aperture size			Nominal sizes of wire diameters, d			
Principal sizes	Supplementary sizes		For any aperture size	For average aperture size	Maximum standard deviation	Preferred sizes	Permissible range of choice		
R 20/3	R 20	R 40/3	+ X	± Y	σ_0	d_{nom}	d_{max}	d_{min}	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
125	125	125	4,51	3,66	b	8	9,2	6,8	
	112		4,15	3,29		8	9,2	6,8	
		106	3,99	3,12		6,3	7,2	5,4	
	100		3,82	2,94		6,3	7,2	5,4	
90	90	90	3,53	2,66		6,3	7,2	5,4	
	80		3,24	2,37		6,3	7,2	5,4	
		75	3,09	2,22		6,3	7,2	5,4	
	71		2,97	2,1		5,6	6,4	4,8	
63	63	63	2,71	1,87		5,6	6,4	4,8	
	56		2,49	1,67		5	5,8	4,3	
		53	2,39	1,58		5	5,8	4,3	
	50		2,29	1,49		5	5,8	4,3	
45	45	45	2,12	1,35		1,000	4,5	5,2	3,8
	40		1,94	1,2		1,000	4,5	5,2	3,8
		37,5	1,85	1,13	1,000	4,5	5,2	3,8	
	35,5		1,78	1,07	1,000	4	4,6	3,4	
31,5	31,5	31,5	1,63	0,95	1,000	4	4,6	3,4	
	28		1,5	0,85	1,000	3,55	4,1	3	
		26,5	1,44	0,8	1,000	3,55	4,1	3	
	25		1,38	0,76	1,000	3,55	4,1	3	
22,4	22,4	22,4	1,27	0,68	0,920	3,55	4,1	3	
	20		1,17	0,61	0,780	3,15	3,6	2,7	
		19	1,13	0,58	0,729	3,15	3,6	2,7	
	18		1,08	0,55	0,690	3,15	3,6	2,7	
16	16	16	0,99	0,49	0,610	3,15	3,6	2,7	
	14		0,9	0,43	0,530	2,8	3,2	2,4	
		13,2	0,86	0,41	0,506	2,8	3,2	2,4	
	12,5		0,83	0,39	0,480	2,5	2,9	2,1	
11,2	11,2	11,2	0,77	0,35	0,430	2,5	2,9	2,1	
	10		0,71	0,31	0,385	2,5	2,9	2,1	
		9,5	0,68	0,3	0,372	2,24	2,6	1,9	
	9		0,65	0,28	0,350	2,24	2,6	1,9	

Table 1 (continued)

Values in millimetres

Nominal aperture sizes, w^a			Tolerances on aperture size			Nominal sizes of wire diameters, d		
Principal sizes	Supplementary sizes		For any aperture size	For average aperture size	Maximum standard deviation	Preferred sizes	Permissible range of choice	
R 20/3	R 20	R 40/3	+ X	$\pm Y$	σ_0	d_{nom}	d_{max}	d_{min}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8	8	8	0,6	0,25	0,315	2	2,3	1,7
	7,1		0,55	0,22	0,280	1,8	2,1	1,5
		6,7	0,53	0,21	0,269	1,8	2,1	1,5
	6,3		0,51	0,2	0,255	1,8	2,1	1,5
5,6	5,6	5,6	0,47	0,18	0,235	1,6	1,9	1,3
	5		0,43	0,16	0,210	1,6	1,9	1,3
		4,75	0,41	0,15	0,199	1,6	1,9	1,3
	4,5		0,4	0,14	0,190	1,4	1,7	1,2
4	4	4	0,37	0,13	0,175	1,4	1,7	1,2
	3,55		0,34	0,11	0,155	1,25	1,5	1,06
		3,35	0,32	0,11	0,151	1,25	1,5	1,06
	3,15		0,31	0,1	0,145	1,25	1,5	1,06
2,8	2,8	2,8	0,29	0,09	0,130	1,12	1,3	0,95
	2,5		0,26	0,08	0,117	1	1,15	0,85
		2,36	0,25	0,08	0,114	1	1,15	0,85
	2,24		0,24	0,07	0,110	0,9	1,04	0,77
2	2	2	0,23	0,07	0,105	0,9	1,04	0,77
	1,8		0,21	0,06	0,092	0,8	0,92	0,68
		1,7	0,2	0,06	0,087	0,8	0,92	0,68
	1,6		0,19	0,05	0,082	0,8	0,92	0,68
1,4	1,4	1,4	0,18	0,05	0,076	0,71	0,82	0,6
	1,25		0,16	0,04	0,069	0,63	0,72	0,54
		1,18	0,16	0,04	0,067	0,63	0,72	0,54
	1,12		0,15	0,04	0,064	0,56	0,64	0,48
1	1	1	0,14	0,03	0,059	0,56	0,64	0,48

NOTE All aperture sizes apply for plain weave.

^a In accordance with ISO 565:1990, Table 1.

^b On account of the small number of apertures to be measured, the calculation of the parameter σ_0 has no physical reality.

Table 2 — Aperture tolerances and wire diameters

Values in micrometres

Nominal aperture sizes, w^a			Tolerances on aperture size			Nominal sizes of wire diameters, d		
Principal sizes	Supplementary sizes		For any aperture size	For average aperture size	Maximum standard deviation	Preferred sizes	Permissible range of choice	
R 20/3	R 20	R 40/3	+ X	± Y	σ_0	d_{nom}	d_{max}	d_{min}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	900		131	31	54,2	500	580	430
		850	127	29	52,2	500	580	430
	800		122	28	50,2	450	520	380
710	710	710	112	25	45,8	450	520	380
	630		104	22	42	400	460	340
		600	101	21	40,5	400	460	340
	560		96	20	38,7	355	410	300
500	500	500	89	18	35,9	315	360	270
	450		84	16	33,2	280	320	240
		425	81	16	32,2	280	320	240
	400		78	15	30,9	250	290	210
355	355	355	72	13	28,2	224	260	190
	315		67	12	26,1	200	230	170
		300	65	12	25,4	200	230	170
	280		62	11	24,2	180	210	150
250	250	250	58	9,9	22,4	160	190	130
	224		54	9	20,8	160	190	130
		212	52	8,7	20	140	170	120
	200		50	8,3	19,4	140	170	120
180	180	180	47	7,6	18	125	150	106
	160		44	6,9	16,8	112	130	95
		150	43	6,6	16,3	100	115	85
	140		41	6,3	15,6	100	115	85
125	125	125	38	5,8	14,4	90	104	77
	112		36	5,4	13,6	80	92	68
		106	35	5,2	13,2	71	82	60
	100		34	5	12,8	71	82	60
90	90	90	32	4,6	12	63	72	54
	80		30	4,3	11,3	56	64	48
		75	29	4,1	10,9	50	58	43
	71		28	4	10,5	50	58	43

Table 2 (continued)

Values in micrometres

Nominal aperture sizes, w^a			Tolerances on aperture size			Nominal sizes of wire diameters, d		
Principal sizes	Supplementary sizes		For any aperture size	For average aperture size	Maximum standard deviation	Preferred sizes	Permissible range of choice	
R 20/3	R 20	R 40/3	+ X	$\pm Y$	σ_0	d_{nom}	d_{max}	d_{min}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
63	63	63	26	3,7	9,9	45	52	38
	56		25	3,5	9,3	40	46	34
		53	24	3,4	9	36	41	31
	50		23	3,3	8,7	36	41	31
45	45	45	22	3,1	8,3	32	37	27
	40		21	3	7,9	32	37	27
		38	20	2,9	7,7	30	35	24
R'10	36		20	2,8	7,5	30	35	24
32			19	2,7	6,8	28	33	23
25			16	2,5	6,1	25	29	21
20			14	2,3	5,7	20	23	17

NOTE All aperture sizes apply for plain weave. Aperture sizes of 45 μm and smaller apply also for twilled weave. It should be noted, however, that plain and twilled weave sieves can have different sieving characteristics.

^a In accordance with ISO 565:1990, Table 2.

5.1.1 Aperture tolerances and standard deviations

5.1.1.1 The aperture tolerances X , Y and σ_0 as given in Tables 1 and 2, Columns 4, 5 and 6, apply to the aperture sizes as measured on the centre-lines of the aperture (see Figure 1) separately in warp and weft directions.

5.1.1.2 No aperture size shall exceed the nominal size w by more than X .

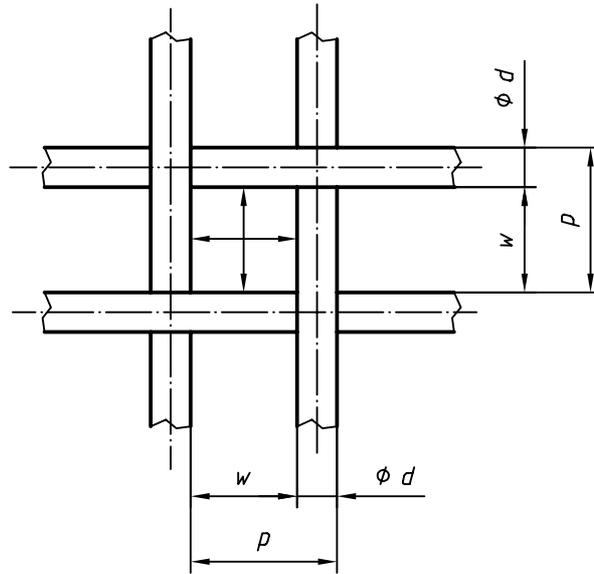
$$X = \frac{2w^{0,75}}{3} + 4w^{0,25} \quad (1)$$

where X and w are expressed in micrometres.

5.1.1.3 The average aperture size \bar{w} shall not depart from the nominal size w by more than $\pm Y$.

$$Y = \frac{w^{0,98}}{27} + 1,6 \quad (2)$$

where Y and w are expressed in micrometres.



Key

- w is the aperture size
- d is the wire diameter
- p is the pitch ($w + d$)

Figure 1 — Aperture size

5.1.1.4 The maximum standard deviation of the aperture sizes in warp and weft directions taken separately shall not exceed the values of σ_0 in Tables 1 and 2, Column 6.

The standard deviation σ is obtained by measurement of all full apertures, N , in the test sieve and is calculated from equation (3):

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (w_i - \bar{w})^2} \tag{3}$$

The standard deviation s is calculated from the measurement of the number of apertures, n , listed in Table 4, using equation (4):

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (w_i - \bar{w})^2} \tag{4}$$

The predicted value, σ_s , of the standard deviation may be calculated from equation (5):

$$\sigma_s = K \cdot s \tag{5}$$

where values of K are obtained from Columns 3 or 5 in Table 4.

Values of K for compliance and inspection may also be calculated from equation (6):

$$K = 1,2 + \frac{2,5}{\sqrt{2n}} \tag{6}$$

Values of K for calibration may also be calculated from equation (7):

$$K = 1,2 + \frac{3,0}{\sqrt{2n}} \quad (7)$$

NOTE An example of the evaluation of the standard deviation is given in annex A.

5.1.2 Wire diameter

5.1.2.1 The wire diameters given in Tables 1 and 2 apply to metal wire cloth mounted in a frame.

5.1.2.2 The nominal wire diameters given in Tables 1 and 2, Column 7, are preferred.

The nominal wire diameters may, however, depart from these values within the limits d_{\max} and d_{\min} in Tables 1 and 2, Columns 8 and 9. These limits define the permissible range of choice, approximately $\pm 15\%$ of the preferred sizes d_{nom} given in Tables 1 and 2, Column 7.

5.1.2.3 The wires in a test sieve shall have a similar diameter in the warp and weft directions.

5.2 Test methods

Every aperture in the metal wire cloth in a test sieve shall have the same probability of being inspected for compliance with the requirements listed in 5.1.

For sieves having 20 apertures or less, measure all full apertures (see Figure 2). For sieves having more than 20 apertures, carry out the examination by the following three tests.

In tests 2 and 3 below, measure the aperture sizes using appropriate equipment having a precision of reading of $1 \mu\text{m}$ or $1/4$ of the tolerance for the average aperture size, Y , whichever is the greater.

Test 1 — Visual examination of general condition of the wire cloth

View the wire cloth against a uniformly illuminated background. If obvious deviations from uniformity of appearance are found, for example weaving defects, creases and wrinkles, the sieve is unacceptable.

Test 2 — Inspection for oversize apertures (tolerance X)

Carefully and methodically examine the appearance of all the apertures in order to detect oversize apertures for subsequent measurement. Apertures in fine sieves are best viewed when magnified optically. In the optical method, the magnifications listed in Table 3 may be used.

Table 3 — Magnifying power in optical method

Nominal aperture size	5 mm to 500 μm	500 μm to 250 μm	250 μm to 20 μm
Magnification	5 to 20	20 to 50	50 to 500

If any aperture is found to be oversize by more than tolerance X , the sieve is unacceptable.

Test 3 — Measurement of average aperture size \bar{w} for tolerance Y , standard deviation for tolerance σ_0 and wire diameter d

Figures 2 to 4 show where to measure the individual apertures in a 200 mm test sieve.

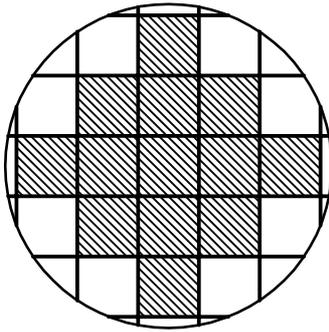
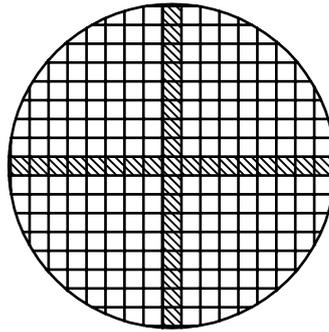
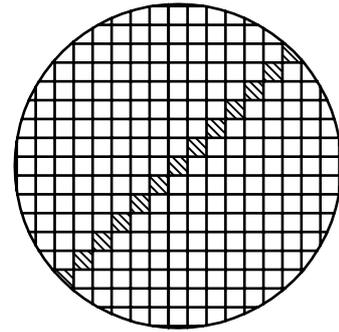


Figure 2 — All full apertures, measure up to 20 apertures



Apertures randomly spaced over the full diameter irregular intervals; measurements for warp (horizontal) and weft (vertical) dimension. Only one measurement per aperture.

Figure 3 — Example for crosswise spot check



Apertures randomly spaced over the full diameter irregular intervals; measurements for both warp and weft dimensions may be made in any one aperture.

Figure 4 — Example for diagonal spot check

After a sieve has been found to be acceptable in accordance with tests 1 and 2, carry out measurements of the average aperture size as follows.

The minimum number of apertures to be measured in both warp and weft directions in a 200 mm diameter test sieve shall be as listed in Table 4, separately for compliance, certification or calibration. For test sieves of sizes other than 200 mm diameter, the values in Table 4 should be modified in proportion to the sieving area.

Measure the average aperture size along the centre-line of the metal wire cloth separately in two directions, parallel to the warp and weft wires respectively. The measured apertures shall be spaced over the full diameter of the sieve (see Figures 3 and 4). If the metal wire cloth is woven in twilled weave (apertures $\leq 45 \mu\text{m}$), the configuration shall be as shown in Figure 5 and the measurements shall be made vertically to the wire.

If the wire diameter is measured separately and not together with the aperture size, measure at least 10 wire diameters, if available, in each direction.

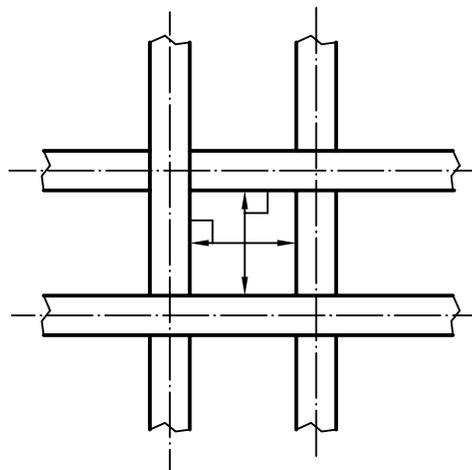


Figure 5 — Configuration of twilled weave

For compliance (5.3.2.1) and inspection (5.3.2.2) compare σ with σ_0 if all full apertures have been measured, or σ_s with σ_0 if a smaller number of full apertures has been measured.

For calibration (5.3.2.3) compare σ with σ_0 if all full apertures have been measured, or σ_s with σ_0 if a smaller number of full apertures have been measured.

If the average aperture size \bar{w} , the standard deviation σ_s or the wire diameter d , are not in accordance with the appropriate values given in Tables 1 and 2, Columns 5, 6, 8 and 9, the sieve is unacceptable.

5.3 Documentation for sieve conformity

5.3.1 Test sieve record card

The manufacturer may provide a record card (see annex B) with each new sieve, confirming that it has been inspected by the procedures described in 5.2. This card can be used subsequently to record the results of periodic tests and performance checks.

5.3.2 Certificates

All certificates shall mention the manufacturer's sieve serial number, date and name or signature.

5.3.2.1 Compliance certificate

If no specific request has been made, the manufacturer shall provide a certificate of compliance stating that the test sieve has been inspected in accordance with 5.2 and found to be in compliance with this part of ISO 3310. This certificate may be combined with the test sieve record card, see 5.3.1 and annex B.

5.3.2.2 Inspection certificate

The manufacturer may provide, at the specific request of the purchaser, a test sieve inspection certificate stating the values for the average aperture size, separately in both the warp and weft direction of the wire cloth, see Table 4, Column 2.

5.3.2.3 Calibration certificate

The manufacturer may provide, at the specific request of the purchaser, a test sieve calibration certificate stating the results of their assessment. Results shall be stated for the number of apertures and wire diameters measured (see Table 4, Column 4), the average aperture size, standard deviation and average wire diameter, separately for the warp and weft directions. The type of weave, plain or twilled, shall also be stated.

6 Test sieve frames

It is recommended that the 200 mm round metal frame be used as far as possible, especially for metal wire cloth of nominal aperture size up to 4 mm.

Smaller or larger frames may be appropriate for smaller or larger quantities of material to be sieved.

The shape and size of the test sieve frame have little effect on the results of the sieving operation, see ISO 2591-1.

Sieves complete with a lid and receiver in a set, shall be assembled so that escape of sample material during a test sieving operation is prevented.

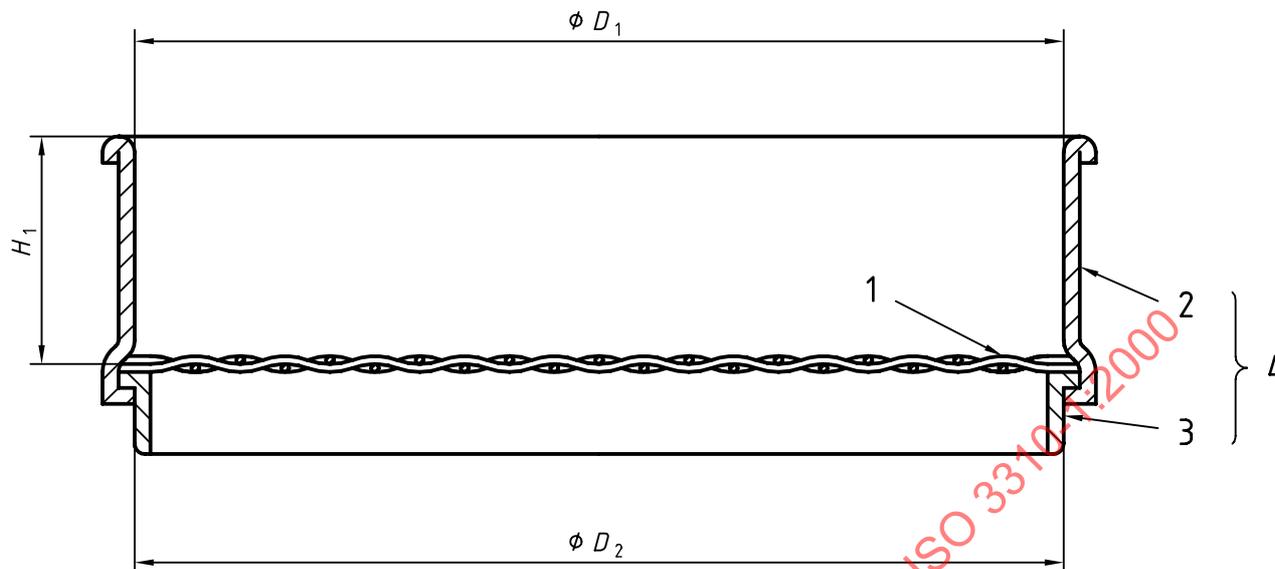
The frames shall be smoothly finished and they shall nest easily with other sieves, lids and receivers of the same nominal frame size.

The seal of the metal wire cloth with the frame shall be so constructed as to prevent lodging of material to be sieved (see Figure 6).

Table 4 — Minimum number of apertures in a 200 mm diameter test sieve, to be measured separately in warp and weft directions, randomly spaced over the full diameter

Nominal aperture size w^a	Process for compliance and inspection		Process for calibration	
	K Factor ^{*)}		K Factor ^{**)}	
(1)	(2)	(3)	(4)	(5)
Millimetre sizes				
125 to 25	All in both directions (max. 25 in larger sieves with diameter more than 200 mm)		All in both directions (max. 50 in larger sieves with diameter more than 200 mm)	
22,4 to 4	2 × 15	1,66	2 × 30	1,59
3,55 to 2,24	2 × 20	1,60	2 × 40	1,54
2 to 1,6	2 × 25	1,55	2 × 50	1,50
1,4 to 1	2 × 40	1,48	2 × 80	1,44
Micrometre sizes				
900 to 800	2 × 40	1,48	2 × 80	1,44
710 to 560	2 × 50	1,45	2 × 100	1,41
500 to 400	2 × 60	1,43	2 × 120	1,39
355 to 200	2 × 80	1,40	2 × 160	1,37
180 to 90	2 × 100	1,38	2 × 200	1,35
80 to 45	2 × 100	1,38	2 × 250	1,33
40 to 20	2 × 100	1,38	2 × 300	1,32
NOTE K factors are used in equation (5) for the calculation of the predicted value of the standard deviation σ_s to enhance the confidence level of the standard deviation to ^{*)} 99 % for the process of compliance and inspection, or ^{**)} 99,73 % for the process of calibration (see annex A).				
^a In accordance with ISO 565:1990, Tables 1 and 2.				

The tolerances on test sieves of diameter 200 mm shall comply with Table 5.



Key

- 1 Metal wire cloth
- 2 Main part
- 3 Base
- 4 Frame

Figure 6 — Cross-section of test sieve (diagrammatic)

Table 5 — Tolerances on test sieves of diameter 200 mm

Dimensions in millimetres

Test sieve nominal frame size		Diameter or length of effective sieving surface		Approximate depth
D_1	D_2	min.	max.	H_1
$200_{+0,6}^0$	$200_{-0,7}^{-0,1}$	185	200	50 or 25

NOTE The tolerances on D_1 and D_2 should also apply to other nominal frame sizes, such as 100 mm, 300 mm and 400 mm.

7 Marking of test sieves

A metal label permanently attached to the frame shall give the following information:

- a) the nominal aperture size;
- b) a reference to the standard(s) with which the test sieve is claimed to comply;
- c) the material of the metal wire cloth and the frame;
- d) the name of the party (manufacturer or vendor) that is responsible for the sieve;
- e) the manufacturer's test sieve serial number.

Annex A
(informative)

Determination of the standard deviation on average aperture size

The standard deviation is calculated using equations (3) to (7) of 5.1.1.4, as illustrated by the following two examples.

Table A.1 — Test for compliance and inspection (5.3.2.1 and 5.3.2.2) — Example 1 with $n = 25$ (nominal aperture $w = 2,0$ mm)

w_j	n_j	$n_j \times w_j$	$(w_j - \bar{w})$	$(w_j - \bar{w})^2$	$n_j(w_j - \bar{w})^2$
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

$$\bar{w} = \frac{\sum_{i=1}^n n_i \cdot w_i}{n}$$

$$\bar{w} = \frac{48,590}{25} = 1,944 \text{ mm}$$

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

$$s = \sqrt{\frac{1}{25} \times 0,049} = 0,045 \text{ mm}$$

For the compliance and inspection tests, this value of s shall be multiplied by the factor K [equation (6)] to enhance the confidence level of the standard deviation to 99 %.

$$\sigma_S = K \cdot s$$

$$\sigma_S = 1,55 \times 0,045 = 0,070 \text{ mm}$$

Standard deviation $\sigma_S = 0,070$ shall be compared with the value of $\sigma_0 = 0,105$ given in Table 1, Column 6.