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Industrial woven wire cloth — Technical requirements and testing

Tissus métalliques industriels — Exigences techniques et vérifications

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Foreword

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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.

International Standard ISO 9044 was prepared by Technical Committee ISO/TC 24, *Sieves, sieving and other sizing methods*, Subcommittee SC 3, *Industrial wire screens*.

This second edition cancels and replaces the first edition (ISO 9044:1990) of which it constitutes a technical revision.

Annex A of this International Standard is for information only.

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Industrial woven wire cloth — Technical requirements and testing

1 Scope

This International Standard defines terms regarding industrial woven wire cloth for screening purposes and specifies tolerances, requirements and test methods.

It applies to industrial woven wire cloth with square apertures, made of steel, stainless steel or non-ferrous metals, (see ISO 4783-2). It does not apply to woven wire cloth coated after weaving nor does it apply to pre-crimped and welded wire screens which are covered in ISO 4783-3 and ISO 14315.

It is of limited application to woven wire cloth used for purposes other than screening which may necessitate other requirements. The alternative requirements may be agreed between the purchaser and the supplier at the time of placing the order.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. 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 the ISO/IEC Directives 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 the IEC and ISO maintain registers of currently valid International Standards.

ISO 2194:1991, *Industrial screens — Woven wire cloth, perforated plate and electroformed sheet — Designation and nominal sizes of openings.*

ISO 4782:1987, *Metal wire for industrial wire screens and woven wire cloth.*

ISO 4783-1:1989, *Industrial wire screens and woven wire cloth — Guide to the choice of aperture size and wire diameter combinations — Part 1: Generalities.*

ISO 4783-2:1989, *Industrial wire screens and woven wire cloth — Guide to the choice of aperture size and wire diameter combinations — Part 2: Preferred combinations for woven wire cloth.*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
aperture width
w
distance between two adjacent warp or weft wires, measured in the projected plane at the mid-positions

NOTE See Figure 1.

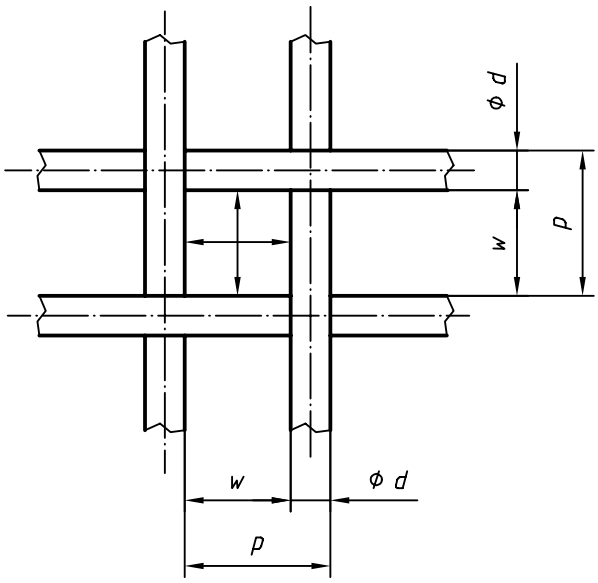


Figure 1 — Aperture width, wire diameter and pitch

3.2
wire diameter
d
diameter of the wire in the wire screen

NOTE The wire diameter may be altered slightly during the weaving process. See Figure 1.

3.3
pitch
p
distance between the mid-points of two adjacent wires

NOTE The pitch is the sum of the aperture width w and the wire diameter d . See Figure 1.

3.4
warp
all wires running lengthwise in the cloth as woven

3.5
weft
all wires running crosswise in the cloth as woven

3.6
number of apertures per unit length
n
number of apertures which are counted in a row one behind the other on a given unit length

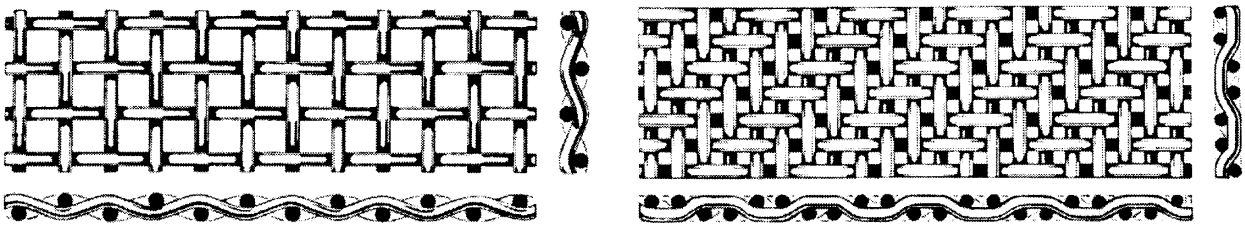
3.7
open screening area
A_0
percentage of the surface of all the apertures in the total screening surface

NOTE The open screening area is calculated as the ratio of the square of the nominal aperture width w and the square of the nominal pitch $p = w + d$, rounded to a full percentage value:

$$A_0 = 100 \frac{w^2}{(w+d)^2} \quad (1)$$

3.8
type of weave
way in which the warp and weft wires cross each other

NOTE Industrial woven wire cloth is manufactured with square apertures in plain or twilled weave (see Figure 2).



a) Plain weave **b) Twilled weave**

Figure 2 — Types of weave

3.9
firmness of woven wire cloth
tension existing between the crossing warp and weft wires and which determines the firmness of the wire cloth

NOTE It is affected by the relationship of w to d and by the type of weave.

3.10
mass per unit area
ρ_A
quantity calculated using the following equation:

$$\rho_A = \frac{d^2 \rho}{618{,}1(w + d)} \tag{2}$$

where

d is the wire diameter, in millimetres;

w is the aperture width, in millimetres;

ρ is the material density, in kilograms per cubic metre;

ρ_A is the mass per unit area, in kilograms per square metre.

Equation (2) gives the calculated mass per unit area, although the actual value can be up to 3 % lower.

NOTE Typical values of ρ for various materials are given in ISO 4783-2:1989, Table 2. For example, the mass per unit area for plain or carbon steel with a density of 7 850 kg/m^3 can be calculated using equation (2) as follows:

$$\rho_A = \frac{d^2 \times 7\,850}{618{,}1(w + d)} = \frac{12{,}7\, d^2}{w + d}$$

Equation (2) can also be used to calculate the wire diameter d when the pitch p, or $(w + d)$, and the mass per unit area ρ_A are known. In the case of plain or carbon steel (ρ = 7 850 kg/m^3), see equation (3).

$$d = \sqrt{\frac{\rho_A \times p}{12{,}7}} \tag{3}$$

3.11
major blemishes
production defects which significantly affect the aperture width or surface quality of the wire cloth

NOTE See annex A for information.

4 Requirements

4.1 Aperture width and wire diameter combination

Unless otherwise agreed between the supplier and the purchaser, the aperture width and wire diameter combination shall be selected from ISO 2194, ISO 4782, ISO 4783-1 or ISO 4783-2, as appropriate.

4.2 Percentage tolerances on aperture width

The tolerances on aperture width are given in Table 1.

In Table 1 and equations (4) to (6), the suffix "i", used with the symbols denotes "industrial wire cloth". In equations (4) to (6), X_i, Y_i, Z_i and w are expressed in micrometres.

Table 1 — Percentage tolerances on aperture width

Nominal aperture width, w	**Tolerances on aperture width,** w **for woven wire cloth made of**					
	stainless steel or non-ferrous metals (except copper and aluminium)			**steel, copper or aluminium**		
mm	$\pm Y_i$	$+ Z_i$	$+ X_i$	$\pm Y_i$	$+ Z_i$	$+ X_i$
16	5	9	12	6	10	14
12,5	5	9	13	6	10	15
10	5	9	14	6	11	16
8	5	10	15	6	12	18
6,3	5	10	16	6	12	19
5	5	11	17	6	13	20
4	5	12	18	6	14	22
3,15	5	12	20	6	14	23
2,5	5	13	21	6	15	25
2	5	14	23	6	16	27
1,6	5	15	24	6	17	29
1,25	5	16	26	6	18	31
1	5	17	28	6	19	33
0,8	5	18	30	6	21	36
0,63	5	19	33	6	22	39
0,5	5	21	36	7	24	42
0,4	6	22	39	7	26	46
0,315	6	24	42	7	28	50
0,25	6	26	46	7	31	55

Nominal aperture width, w	Tolerances on aperture width, w for woven wire cloth made of					
	stainless steel or non-ferrous metals (except copper and aluminium)			steel, copper or aluminium		
mm	$\pm Y_i$	$+ Z_i$	$+ X_i$	$\pm Y_i$	$+ Z_i$	$+ X_i$
0,2	6	28	50	8	34	60
0,16	7	31	55	8	37	66
0,125	7	34	61	9	41	73
0,1	7	37	67	9	45	80
0,08	8	41	74	9	49	89
0,063	9	46	83	10	55	99
0,05	10	51	93	—	—	—
0,04	11	56	100	—	—	—
0,032	13	56	100	—	—	—
0,025	15	57	100	—	—	—
0,02	17	59	100	—	—	—

4.2.1 Y_i is the tolerance of the arithmetical mean value of the aperture widths measured and calculated separately in both warp and weft directions. The arithmetical average aperture width shall not deviate from the nominal size by more than $\pm Y_i$, where

$$Y_i = \left[\frac{w^{0,98}}{27} + 1,6 \right] \times 1,5 \tag{4}$$

4.2.2 Z_i is the arithmetical mean of X_i and Y_i:

$$Z_i = \frac{X_i + Y_i}{2} \tag{5}$$

Not more than 6 % of the total number of apertures measured shall have sizes between

"nominal + X_i" and "nominal + Z_i".

4.2.3 No aperture width shall exceed the nominal size by more than the value X_i. It is the maximum permissible deviation of a single aperture measured in one direction (warp or weft) and is calculated using the formula:

$$X_i = \left[\frac{2w^{0,75}}{3} + 4w^{0,25} \right] \times 2 \tag{6}$$

but with a maximum value of $X_i = w$.

A line of apertures exceeding the value X_i is deemed to be a major blemish (see annex A).

As, on the basis of experience, negative deviations of single aperture widths do not affect the screening process, values for Z_i and X_i have only positive deviations.

4.3 Permissible number of major blemishes

4.3.1 Woven wire cloth cannot be produced commercially without there being some manufacturing blemishes. The supplier and the purchaser shall agree upon the number and nature of major blemishes which are permissible per unit area of the wire screen. The percentage yield of the wire cloth shall be agreed on with the purchaser and will vary according to the aperture width and size of the piece of woven wire cloth.

Unless otherwise agreed between the supplier and purchaser, the maximum number of major weaving blemishes (see annex A), in any roll or roll piece of wire cloth shall not exceed the values given in Table 2.

Table 2 — Permissible number of major blemishes

Nominal aperture width, w, mm	Maximum number of major blemishes per 10 m^2
$1 \leqslant w \leqslant 16$	3
$0{,}25 \leqslant w < 1$	5
$0{,}125 \leqslant w < 0{,}25$	6
$0{,}063 \leqslant w < 0{,}125$	9
$w < 0{,}063$	10

4.3.2 Minor manufacturing blemishes which do not produce oversize apertures or do not significantly affect the surface quality of the wire screen shall be acceptable, unless otherwise specified.

4.4 Tolerances on overall size

When measured as specified in 5.4, the overall size of pieces of wire cloth shall conform to the following requirements.

4.4.1 The tolerance on width, of trimmed wire cloth rolls and roll lengths, shall be $^{+2}_{0}$ % of nominal.

4.4.2 The tolerance on length and width, of square and rectangular pieces, shall be the larger of $\pm 0{,}5$ % or $\pm$ 1 pitch.

4.4.3 For cut-to-size pieces, the permissible number of major blemishes and their positions shall be agreed with the purchaser. Otherwise, the permissible number of major blemishes in cut-to-size pieces shall be determined according to Table 2.

4.5 Flatness

Unless otherwise agreed between the supplier and purchaser, wire cloth rolls and pieces shall not necessarily be supplied to lie flat.

If the purchaser requires flat wire cloth, the means of verifying flatness shall be agreed with the supplier.

4.6 Surface conditions

Woven wire cloth may be covered with a film of oil as a result of the weaving process.

The wires may show traces of auxiliary materials used in the drawing process. Depending on the wire material, there may be traces of corrosion.

The surface may show markings caused by the drawing and/or weaving process.

NOTE The depth of crimp generally differs between warp and weft wires.

4.7 Weaving wire

4.7.1 Material

The purchaser shall specify the choice of material with respect to

a) the final application of the woven wire cloth, e.g. resistance to environmental corrosion, compatibility with food products, etc.;

b) further processing, e.g. suitability for shaping, welding and surface treatment.

Materials shall be designated in accordance with appropriate standards or, if none exist, in accordance with commercial specifications.

4.7.2 Tolerance on wire diameter

Prior to weaving, the tolerance on wire diameter shall be as specified in ISO 4782. The weaving process normally distorts the wire and affects its diameter, which is no longer toleranced after weaving. The wire diameter is measured as specified in 5.1.

5 Test methods

5.1 Wire diameter, d (see 4.7.2)

Prior to weaving, the diameter of the wire shall be calculated as the mean of any two measurements taken at right angles at the same cross-section.

The wire diameter may be determined after weaving by using one of the following procedures:

a) by measuring wires which have been loosened from the woven wire cloth (see Figure 3);

b) by measuring the wires in the cloth, if there is sufficient space for the measuring instrument;

c) by calculation from the mass per unit area using equation (3);

d) by an optical projection or scanning method.

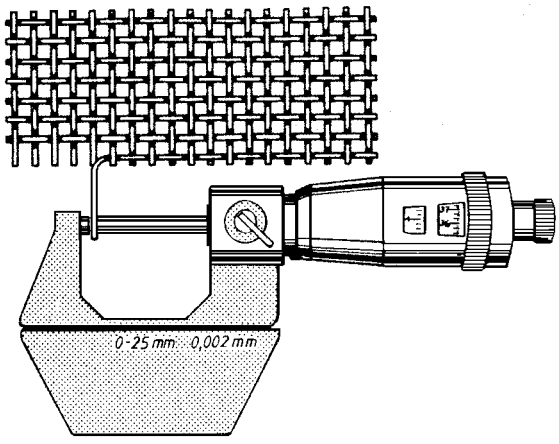


Figure 3 — Example of method for measuring wire diameters

5.2 Aperture width, *w*

5.2.1 Average aperture width tolerance, Y_i (see 4.2.1)

5.2.1.1 Aperture widths greater than 4,0 mm

A steel rule, graduated in millimetres, shall be laid along the warp and weft direction of the wire cloth. The span of ten pitches shall be measured to the nearest millimetre. The test result shall be divided by ten, to give the average pitch, from which shall be deducted the wire diameter to give average width (see Figure 4).

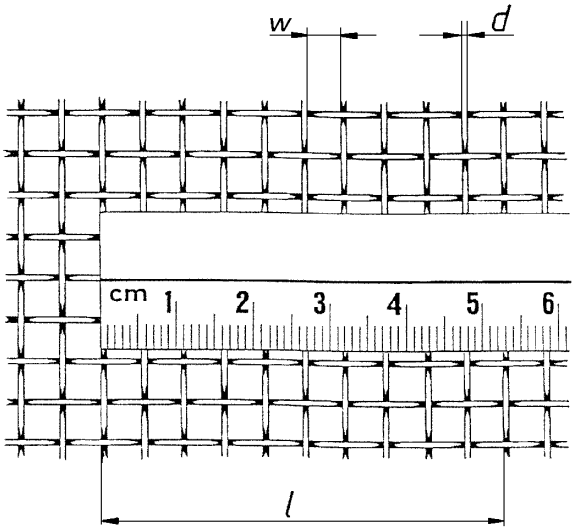


Figure 4 — Measured row with 10 pitches and 52,5 mm length

5.2.1.2 Aperture widths from 1 mm up to 4 mm

The test procedure shall be as in 5.2.1.1 but the span of 20 pitches shall be measured and the test result divided by 20, to give the average pitch.

5.2.1.3 Aperture widths less than 1 mm

Each of the following is a possible test procedure.

a) The number of wires visible under low-powered magnification over a known distance (counting glass) may be counted (see Figure 5). The average aperture width may be calculated by deducting the wire diameter from the average pitch.

b) The number of wires per unit length in the warp or weft direction may be counted by using a microscope.

c) An optical interference method may be used to determine the number of pitches per unit length.

d) Profile projector, image analyser or optical scanning instruments may be used. On these instruments, a span of five times ten pitches is recommended for both warp and weft directions.

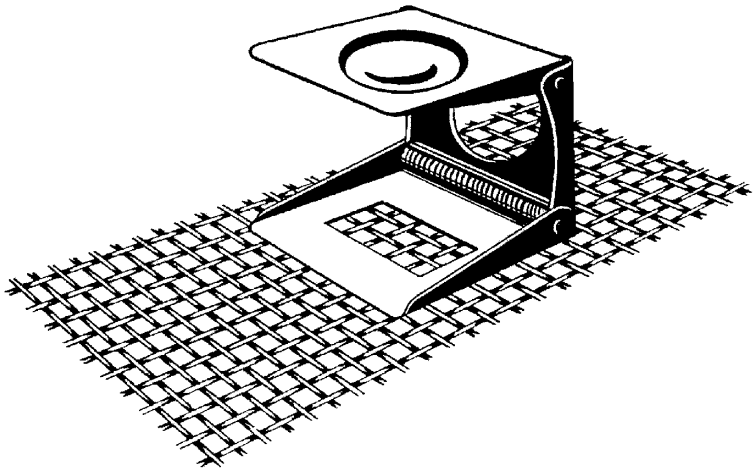


Figure 5 — Counting glass for measuring aperture widths less than 1 mm

5.2.2 Maximum aperture width tolerance, X_i (see 4.2.3)

When evaluating the test results, a margin of 10 mm on both sides of the roll and, for an aperture width exceeding 5 mm, a margin equivalent to two apertures on each side shall be disregarded.

A line of apertures exceeding the value X_i is deemed to be a major blemish (see annex A).

5.3 Material composition

For chemical analysis of the wire material, the wire drawer's or wire processor's batch or melt number analysis shall be used, if applicable.

When chemical analysis is to be carried out, it shall be performed in accordance with the requirements of the National/International Standard used to designate the material.

5.4 Overall size (see 4.4)

Overall size shall be measured using suitable metal tapes or rules.

5.5 Weaving blemishes

Wire cloth shall be checked visually for blemishes.

6 Inspection documents

6.1 Certificate of compliance with the order

The statement of compliance shall confirm that the goods comply with the requirements of this International Standard.

6.2 Test report

The test report shall confirm that the goods comply with the requirements of this International Standard, as verified by the supplier's independently assessed and approved quality assurance system.

6.3 Inspection certificate

At the specific request of the purchaser, a certificate shall be issued stating separately the test results for the average aperture size and wire diameter, in both the warp and weft direction of the wire cloth.

6.4 Chemical analysis

When a supplier can demonstrate traceability via certified quality assurance system procedures, the results from the identified analysis carried out earlier in the manufacturing process may be used for the purpose of consignment certification.

6.5 Other tests

Dimension or other tests will be carried out in accordance with the supplier's inspection procedures, unless otherwise agreed with the purchaser.

7 Ordering information

7.1 Essential information

It is essential that the following information is given by the purchaser to the supplier at the time of enquiry or order to assist the supplier in providing the correct material:

a) the quantity required;

b) aperture width, w;

c) wire diameter, d;

d) material;

e) type of weave, if not plain;

f) the overall size, including tolerances if other than those specified in 4.4.

7.2 Additonal information

When enquiring or ordering, the purchaser should clearly indicate his specific requirements:

a) type of inspection documents, if demanded (see clause 6);

b) other requirements not specified in this International Standard, if demanded.

8 Delivery

8.1 Rolls

8.1.1 A standard roll shall be 25 m or 30 m long. The length of rolls may have a tolerance of ± 10 %. The delivered length shall be the length invoiced.

8.1.2 A roll of woven wire cloth may consist of a maximum of three roll pieces; the minimum length of a roll piece shall be 2,5 m.

8.1.3 For rolls and roll pieces, the width of the cloth shall not be less than the nominal width, but may be up to 2 % in excess. The overall width shall be measured.

8.2 Packing

Unless otherwise agreed between the supplier and purchaser, the woven wire cloth will be packed at the discretion of the supplier.

8.3 Labelling

Material supplied shall be identified with the following information:

a) supplier's name and/or trademark;

b) aperture width, w (nominal);

c) wire diameter, d (nominal);

d) material designation;

e) type of weave, if not plain;

f) overall sizes and quantity.

NOTE If the material delivered consists of rolls or roll pieces, the length of the pieces and their quantity should be shown. Woven wire cloth can be supplied with or without selvedge. Normal delivery would be without selvedge.

Annex A
(informative)

Major blemishes

Smash: A complex break-up of the weaving pattern.

Burst: A tear of variable length in the cloth arising from unsustainable tension during weaving.

NOTE Bursts normally occur near the edges.

Broken shot (weft): A wide aperture or a line of wide apertures left when a broken weft wire partly blocks the laying of the next weft wire.

Variation in weft count: Irregular weft count over a certain length of the woven wire cloth.

Draw-over: A certain length of cloth containing no weft wires.

Slack shot (weft) or loop: A weft wire which is longer than the neighbouring weft wires.

Creeper: A warp wire which is longer than the neighbouring warp wires.

Reed mark (tramline): Single line of apertures of excessive width in the warp direction.

Bibliography

[1] ISO 4783-3:1981, *Industrial wire screens and woven wire cloth — Guide to the choice of aperture size and wire diameter combinations — Part 3: Preferred combinations for pre-crimped or pressure-welded wire screens.*

[2] EN 10204:1991, *Metallic products — Types of inspection documents.*

[3] ISO 14315:1997, *Industrial wire screens — Technical requirements and testing.*

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