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Industrial plate screens — Specifications and test methods

Tôles perforées pour tamisage industriel — Exigences techniques et méthodes d'essai

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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.

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 10630 was prepared by Technical Committee ISO/TC 24, *Sieves, sieving and other sizing methods*, Subcommittee SC 7, *Industrial plate screens*.

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Industrial plate screens — Specifications and test methods

1 Scope

This International Standard specifies technical requirements and test methods for perforated metal plate used for industrial screening purposes and supplied in flat or coiled form.

It applies to perforated plates of low carbon steel according to ISO 7805-1 and ISO 7805-2 with nominal sizes of holes from 1 mm for round holes and 4 mm for square holes up to 125 mm according to ISO 2194, and with a maximum plate thickness of 12,5 mm.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of 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 7805-1:1984, *Industrial plate screens — Part 1: Thickness of 3 mm and above.*

ISO 7805-2:1987, *Industrial plate screens — Part 2: Thickness below 3 mm.*

3 Definitions

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

3.1 plate: Flat rolled material for the manufacture of perforated metal plate, 3 mm to 12,5 mm thick, the edges of which are allowed to deform freely during rolling, supplied in flat form and generally in rectangular shape, but also in any other shape according to a design sketch.[1)]

3.2 sheet: Flat rolled material for the manufacture of perforated metal plate, less than 3 mm thick, the edges of which are allowed to deform freely during rolling, supplied in flat form and generally in rectangular shape, but also in any other shape according to a design sketch.[1)]

3.3 coil: Flat rolled sheet for the manufacture of perforated metal plate, the edges of which are allowed to deform freely during rolling and which immediately after the final rolling pass is wound into regular superimposed laps.

3.4 perforated plate: Screening surface consisting of a plate with uniform holes in symmetrical arrangement. The holes may be square, slotted, circular or of other regular geometrical shape.

3.5 plate thickness: Thickness of the plate before perforation.

3.6 feed direction: Direction in which a plate or sheet was fed through the perforating press.

3.7 punch side: Surface of a perforated plate which the punch entered.

1) After perforation, plates and sheets are both designated as "perforated plate", see 3.4.

3.8 hole size: Diameter of a round hole or distance between opposite sides of a square hole of a perforated metal plate.

3.9 pitch: Distance between corresponding points of two adjacent holes in a perforated plate.

3.10 bridge width; bar: Distance between the nearest edges of two adjacent holes in a perforated plate.

3.11 margin: Distance between the outside edges of the outside rows of holes and the edges of a perforated plate.

3.12 percentage open area: Ratio, expressed as a percentage, of the total area of the holes to the total area of the perforated part of the plate (excluding any non-perforated parts).

3.13 roller levelling: Cold mechanical operation on a perforated metal plate to promote flattening.

4 Symbols

See table 1.

Table 1 — Symbols used to describe perforated metal plate

Symbol	Interpretation	Figure reference
a_1	overall length of the short side of a plate (plate width)	2
a_2	length of the short side of the perforated area of a plate	2
b_1	overall length of the long side of a plate (plate length)	2
b_2	length of the long side of the perforated area of a plate	2
c	amount out-of-square of a rectangular plate	3
e	width of the margins on the long sides of a plate	2
e_1	width of the larger e-margin, if not equal	2
e_2	width of the smaller e-margin, if not equal	2
f	width of the margins at the short sides of a plate	2
f_1	width of the larger f-margin, if not equal	2
f_2	width of the smaller f-margin, if not equal	2
g	deviation from edge flatness	5
h	deviation from edge straightness	6
p	pitch of holes	1
t	plate thickness	2
t_1	height of turn-in zone of hole	4
t_2	height of cutting zone of hole	4
t_3	height of breakaway zone of hole	4
t_4	height of burr on hole	4
w	hole size, measured on punch side	1
w_b	hole size, measured on reverse (burr) side	4

5 Requirements

5.1 Hole size and pitch (see figure 1)

The tolerances on the hole size and the pitch of both round and square holes are specified in ISO 7805-1 for perforated plate of thickness of 3 mm and above, and in ISO 7805-2 for perforated plate of thickness below 3 mm.

5.2 Plate thickness (see figure 2)

The plate thickness shall be less than the nominal hole size and less than the bridge width (bar), unless otherwise agreed between the interested parties.

NOTE 1 The uniformity of the plate thickness before perforation depends on the tolerances applied at the rolling mill which supplies the unperforated material and conforms to the so-called "mill tolerances". Specific tolerances, if required, shall be agreed before ordering.

5.3 Plate width and length (see figure 2)

The tolerances on plate width a_1 and plate length b_1 for plates cut on all edges are given in table 2.

NOTE 2 Stock sizes of perforated plates are usually supplied without cutting after perforation and roller levelling. In these cases, because stretch may occur during perforation, deviations on width and length may be larger than rolling mill tolerances appropriate to the unperforated material supplied. The tolerances in table 2 do not then apply.

5.4 Squareness (see figure 3)

The departure from squareness, c, generally referred to as the "amount out-of-square", of cut perforated metal plates is quantified by the orthogonal projection of a transverse edge (plate width a_1) onto a longitudinal edge (plate length b_1). It is expressed as a percentage of a_1.

$$\text{Percent out-of-square} = \frac{100c}{a_1}$$

The tolerances on squareness are given in table 3.

5.5 Width of margins (see figure 2)

The tolerances on the width of margins e and f are given in table 4.

Table 2 — Tolerances on width and length

Dimensions in millimetres

Nominal width or length a_1 or b_1	Tolerance on a_1 or b_1 for nominal plate and thickness t			
	$t \leqslant 3$	$3 < t \leqslant 5$	$5 < t \leqslant 10$	$10 < t \leqslant 12{,}5$
a_1 or $b_1 \leqslant 100$	± 0,8	± 1,1	± 1,5	± 2
$100 < a_1$ or $b_1 \leqslant 300$	± 1,2	± 1,6	± 2	± 3
$300 < a_1$ or $b_1 \leqslant 1000$	± 2	± 2,5	± 3	± 4
$1000 < a_1$ or $b_1 \leqslant 2000$	± 3	± 4	± 5	± 6
$2000 < a_1$ or $b_1 \leqslant 4000$	± 4	± 6	± 8	± 10
$4000 < a_1$ or b_1	± 5	± 8	± 10	± 12

Table 3 — Tolerances on squareness

Nominal plate thickness, t mm	Tolerance on squareness as a percentage of a_1
$t \leqslant 3$	0,75
$3 < t \leqslant 5$	1,5
$5 < t \leqslant 10$	3
$10 < t \leqslant 12{,}5$	5

Table 4 — Tolerances on width of margins

Dimensions in millimetres

Nominal pitch, p	Tolerance on width of margins e, f
$p \leqslant 5$, open area $\leqslant 25\%$	± 5
$p \leqslant 5$, open area $> 25\ \%$	± 10
$5 < p \leqslant 20$	± 10
$20 < p$	± 0,5 p

5.6 Flatness

The tolerances on the flatness of perforated metal plates, roller-levelled after perforation, as given in table 5, apply for plates

— with a maximum length of 2 000 mm;

— with margins not exceeding plate thickness $t + 0{,}5\ p$; and

— with open areas in the range of 20 % to 40 %.

For perforated metal plates outside these limits, or with unperforated areas, the tolerances on flatness shall be agreed before ordering.

6 Test procedure

6.1 Hole size and pitch (see figure 1)

Measure the hole size and pitch according to ISO 7805-1 or ISO 7805-2, depending on the plate thickness. The measurements shall be taken on the punch side of the plate.

6.2 Plate width and length (see figure 2)

Measure the plate width and length with a scale graduated in millimetres. For dimensions of 300 mm or less, a vernier calliper may be employed. Take the measurement over the entire thickness t.

6.3 Squareness (see figure 3)

If applicable, determine the squareness of cut perforated metal plates by measuring the plate width and length and the amount out-of-square c according to 5.4 and 6.2. Identify the dimension c with the aid of a try square.

6.4 Flatness

Place the plate, punch side uppermost, on a flat reference surface, e.g. a table with a smooth and even top. Use a scale, graduated in millimetres, which does not flatten the plate, to measure the distance from the highest point of the plate to the reference surface.

7 Irregularities caused by the perforating process

7.1 Breakaway on holes (see figure 4)

When the punch has penetrated deeply into the metal plate from the punch side, material will begin to tear, or break away, mainly from the reverse side of the plate.

It is not possible to predict the precise shape and dimensions of the breakaway zone, but its height t_3 does not usually exceed two-thirds of the plate thickness t. The width of the breakaway w_b is roughly related to the plate thickness t and does not usually exceed the nominal hole size w by an amount of $0{,}15\ t$.

7.2 Burrs on holes and shearing burrs (see figure 4)

Burrs will occur during both the perforating and the cutting (shearing) operations.

While burrs on holes occur on the reverse side of the plate only, shearing burrs may occur on either the punch side or the reverse side, depending on the manufacturing procedure adopted.

Not more than 10 % of the number of holes or 10 % of the length of a cut edge of a perforated metal plate shall have burr heights in excess of the values stated in table 6.

Measure the burrs on holes with a depth micrometer and the shearing burrs with a vernier calliper.

Table 5 — Tolerances on flatness

Dimensions in millimetres

Nominal width or length a_1 or b_1	Tolerance on flatness for nominal plate thickness t				
	$t < 0{,}7$	$0{,}7 \leqslant t < 1{,}2$	$1{,}2 \leqslant t < 3$	$3 \leqslant t < 5$	$5 \leqslant t \leqslant 12{,}5$
a_1 or $b_1 \leqslant 1200$	20	18	15	12	10
$1\,200 < a_1$ or $b_1 \leqslant 1\,500$	28	22	18	16	14
$1\,500 < a_1$ or $b_1 \leqslant 2\,000$	30	25	20	16	14

Table 6 — Maximum height of burrs

Dimensions in millimetres

Nominal plate thickness, t	Maximum height of burr, t_4
$t \leqslant 0,6$	0,15
$0,6 < t \leqslant 1,5$	0,17
$1,5 < t \leqslant 3$	0,2
$3 < t \leqslant 6$	0,28
$6 < t \leqslant 10$	0,5
$10 < t \leqslant 12,5$	0,75

7.3 Wavy edge (see figure 5)

Stresses during perforation can distort the plate and cause variations in flatness in the margin areas, producing a so-called "wavy edge", particularly if the margins on opposite sides are greater than the plate thickness $t + 0,5\ p$.

The maximum permissible deviation from the flatness of edges g shall be agreed before ordering.

7.4 Edge bow (camber) (see figure 6)

Stresses during perforation and subsequent roller levelling processes can distort the plate, producing curving of the edges (edge bow/camber), particularly if the longitudinal margins e_1 and e_2 are unequal and parallel to the direction of perforation.

Edge bow is defined as the greatest deviation h of the edge from a straight line extending over the length of the concave side and shall be measured with the aid of a straightedge of sufficient length having a scale graduated in millimetres.

The maximum permissible edge bow shall be agreed before ordering.

7.5 Missing holes (see figure 7)

Punches may break during the perforation process and fail to perforate in certain positions. The number of holes missed for this reason should not exceed 5 % of the total number of holes in a perforated plate.

When a multitool punch is used, it may not be possible to complete the pattern of perforations. For example, to minimize tool damage, punches of diameter less than 5 mm are usually spaced wider apart than the pitches of the holes. This arrangement, however, unavoidably results in missing holes in one or more rows at both ends of the plate (incomplete rows).

8 Surface characteristics

8.1 Surface finish

Slight damage of the perforated metal plate by mechanical action during the perforation process cannot be excluded. If this is detrimental to the proposed use, the purchaser should consult with the manufacturer before ordering.

8.2 Cleanliness

Perforated metal plates are usually supplied with a light oily film. There should be no excessive seepage of oil after stacking.

Degreased perforated metal plates, e.g. prepared by solvent or steam treatment, may be supplied by agreement. Degreasing is inappropriate for plates of low-carbon steel unless subsequent protection against corrosion is provided.

9 Perforated metal plate in coils

Perforated metal plate in coils is limited to a plate thickness below 3 mm. It shall comply with the requirements of clause 5, with the following exceptions.

9.1 Length

The length of the coil shall be agreed before ordering.

9.2 Width

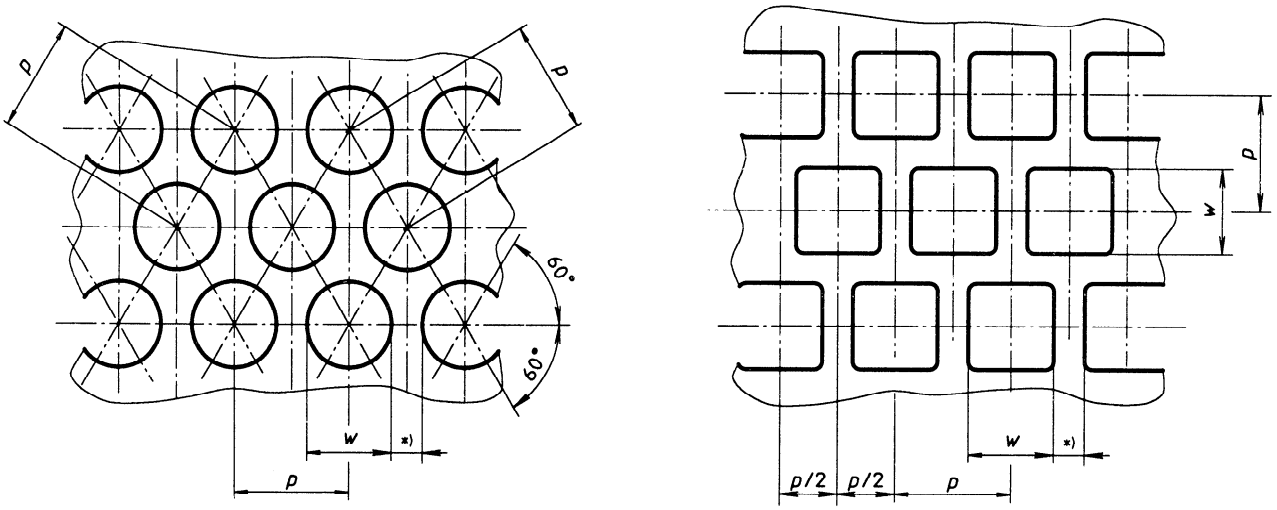
For perforated metal plate in coils without subsequent edge preparation, the tolerances on plate width a_1 shall be the rolling mill tolerances appropriate to the unperforated material supplied.

For perforated metal plate in coils, recut along the two longitudinal edges and with a width of less than 600 mm, the tolerance on plate width a_1 shall not exceed $\pm$ 0,5 mm. The tolerance on plate widths a_1 of 600 mm and above shall be agreed before ordering.

9.3 Flatness

Coils of perforated metal plate cannot be roller-levelled before delivery.

Tolerances on the flatness of uncoiled perforated metal plate shall be agreed before ordering.



Round holes, 60° staggered arrangement;
open area = $0{,}907\ (w/p)^2$

Square holes, half-pitch staggered arrangement;
open area = $(w/p)^2$

*) Bridge width (bar)

Figure 1 — Examples of hole arrangements

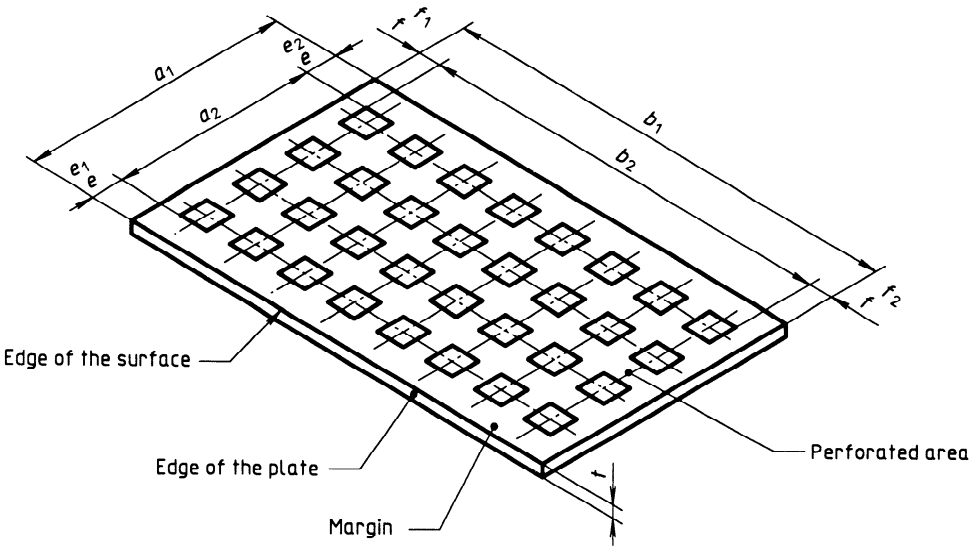


Figure 2 — Characteristics of a perforated plate

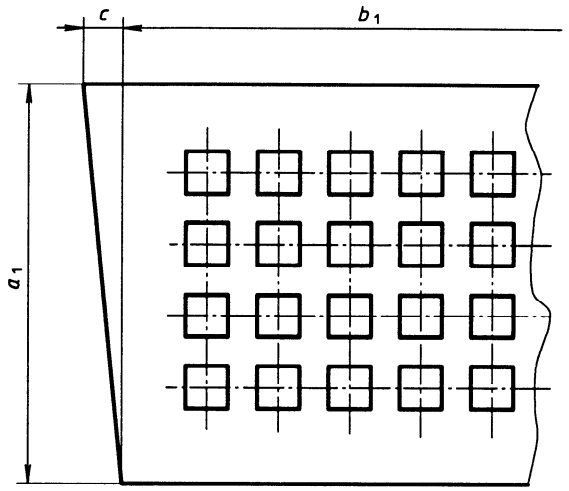


Figure 3 — Measurement of amount out-of-square

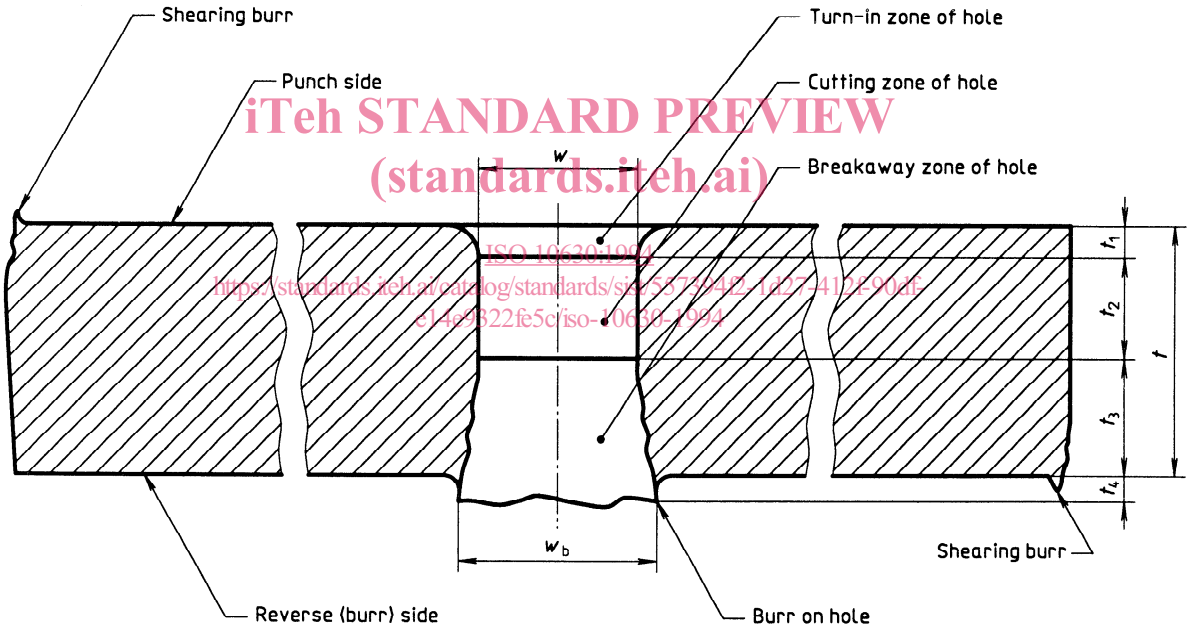


Figure 4 — Cross-section of perforated metal plate