Perforated metal sheets

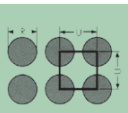
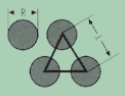
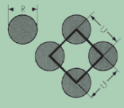
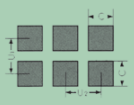
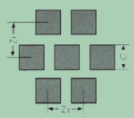
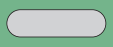
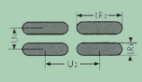
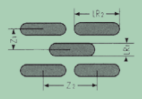
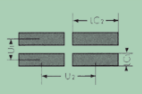
PERFORATION FORMS AND PERFORATION POSITIONS

HOLE SHAPES

We differentiate between 5 hole shapes:

HOLE POSITIONS

The various hole positions are marked as follows:

SYMBOL	CODE	EXPLANATION	SYMBOL	CODE	EXPLANATION
	**R**	Round perforation		**Ru**	Round hole in **straight** rows
				**Rt**	Round hole in **staggered** rows
				**Rm**	Round hole in **diagonal staggered** rows
	**C**	Square perforation hole side **parallel** to the metal sheet		**Cu**	Square perforation in **straight** rows
				**Cz**	Square perforation in **staggered** rows
	**Cd**	Square perforation hole side **diagonal** to the metal sheet		**Cd**	Square perforation in **diagonal staggered** rows
	**L**	Slotted perforation with **round** corners		**Lru**	Slotted perforation in **straight** rows
				**Lrz**	Slotted perforation in **staggered** rows
	**Lc**	Slotted perforation with **sharp** corners		**Lcu**	Slotted perforation, angular in **straight** rows

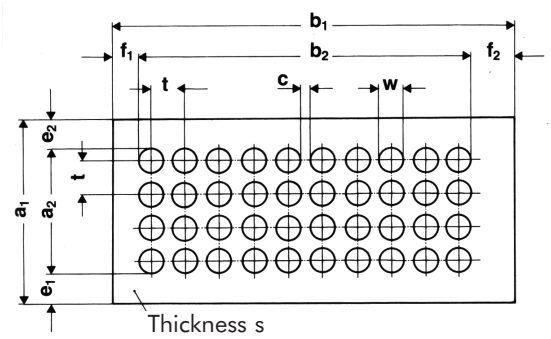
Perforated metal sheets

ROUND PERFORATION

Round perforation in straight rows

Relative free perforation area:

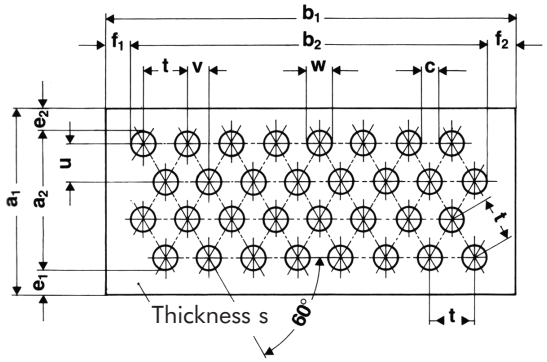
$$a_o = \frac{78.5 \cdot w^2}{t^2} \text{ in \%}$$



Round perforation in staggered rows

Relative free perforation area:

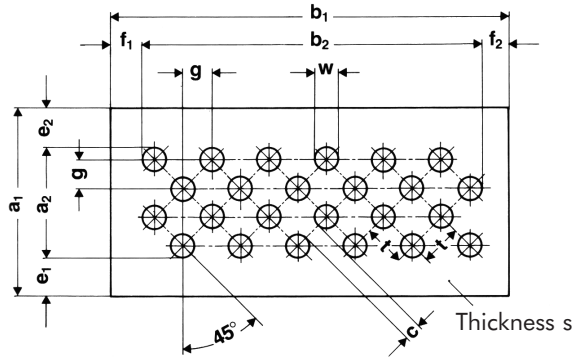
$$a_o = \frac{90.7 \cdot w^2}{t^2} \text{ in \%}$$



Round perforation in diagonally staggered rows

Relative free perforation area:

$$a_o = \frac{78.5 \cdot w^2}{t^2} \text{ in \%}$$



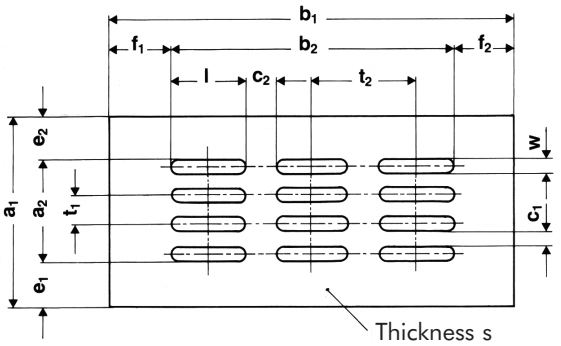
Perforated metal sheets

SLOTTED PERFORATION

Slotted perforation in straight rows

Relative free perforation area:

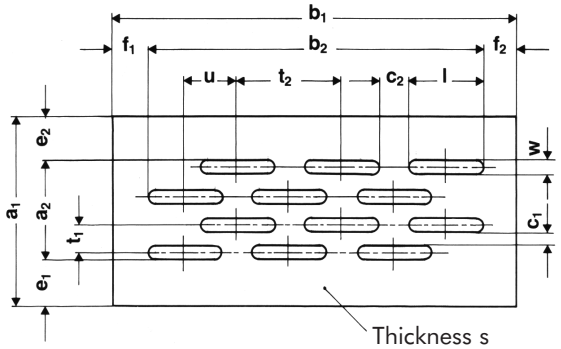
$$a_o = \frac{w \cdot l - 0.215w^2}{t^2 \cdot t^2} \cdot 100 \text{ in } \%$$



Slotted perforation in staggered rows

Relative free perforation area:

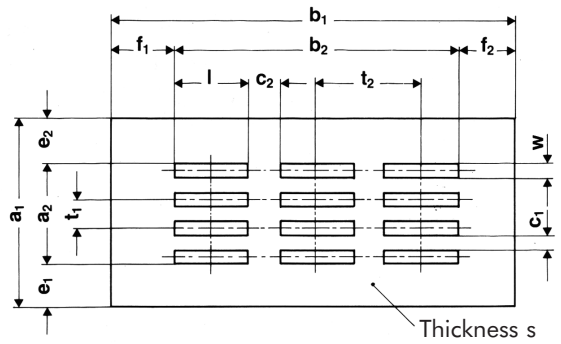
$$a_o = \frac{w \cdot l - 0.215w^2}{t_1 \cdot t_2} \cdot 100 \text{ in } \%$$



Slotted perforation in straight rows, angular

Relative free perforation area:

$$a_o = \frac{w \cdot l}{t_1 \cdot t_2} \cdot 100 \text{ in } \%$$



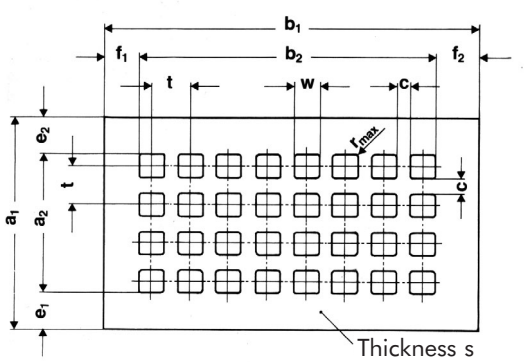
Perforated metal sheets

SQUARE PERFORATION

Square perforation in straight rows

Relative free perforation area:

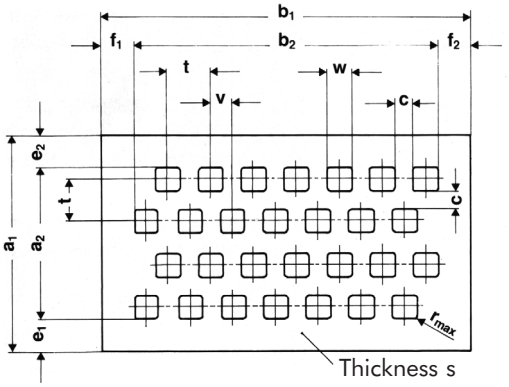
$$a_o = \frac{100 \cdot w^2}{t^2} \text{ in } \%$$



Square perforation in staggered rows

Relative free perforation area:

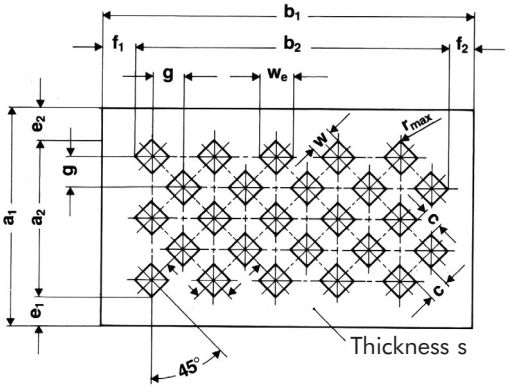
$$a_o = \frac{100 \cdot w^2}{t_2} \text{ in } \%$$



Square perforation in diagonally staggered rows

Relative free perforation area:

$$a_o = \frac{100 \cdot w^2}{t_2} \text{ in } \%$$



Perforated metal sheets

STANDARDS / TOLERANCES

General

The term "perforated plate" (perforated metal sheet) is defined in the DIN-standard 24041:2002-12 and in DIN 4185 part 2. We use the DIN-tolerances to take into consideration the different factors that impact the accuracy of the perforated sheets. Dimensional deviations for perforated metal sheets are evident in DIN 24041. Deviations from the nominal dimension may occur due to raw material tolerances, perforation and subsequent machine straightening.

Length and width

Metal sheets and plates with fixed dimensions do not undergo additional cutting after perforation and straightening. The deviations may be bigger than the steelwork tolerances

Measurement plate length or plate width	Permissible tolerance at material thickness up to 5 mm	Permissible tolerance at material thickness up to 5 mm
up to 100 mm	+/_ 0.8 mm	+/_ 1.5 mm
above 100 to 300 mm	+/_ 1.2 mm	+/_ 2.0 mm
above 300 to 1000 mm	+/_ 2.0 mm	+/_ 3.0 mm
above 300 to 2000 mm	+/_ 3.0 mm	+/_ 5.0 mm
above 1000 to 4000 mm	+/_ 4.0 mm	+/_ 8.0 mm
above 2000 to 4000 mm	+/_ 5.0 mm	+/_ 10.0 mm

Perpendicularity of cut plates

In the course of the perforation process, the perforated field is expanded, i.e. the metal sheet's length and width change. The finishing treatment, in particular, straightening, results in expansions in the perforated field. The degree of change depends on factors such as e.g. hole size, hole arrangement, thickness and type of material, and it is therefore difficult to determine the change in advance.

Material thickness	Permissible perpendicularity tolerance
up to 5 mm	+/– 0.5 degrees (= 0.9 mm for every 100 mm length)
above 5 mm to 15 mm	+/– 0.5 degrees (= 0.9 mm for every 100 mm length)
above 15 mm to 25 mm	+/– 0.5 degrees (= 0.9 mm for every 100 mm length)

Permissible deviations regarding the width of the unperforated edges for fixed dimensions

Division – t	Permissible deviations for e1, e2, f1, f2
up to 5 mm	+/_ 5 mm
above 5 to 20 mm	+/_ 10 mm
above 20 mm	+/_ t/2

Edge bows

Edge bows may occur on perforated sheets. This results in a deviation between the metal sheet's edges and the middle of its end. Permissible deviations: up to a metal thickness of 3 mm – max. 1.5% of the total length; above a metal sheet thickness of 3 mm – max. deviation 2% of the total length.

Perforated metal sheets

STANDARDS / TOLERANCES

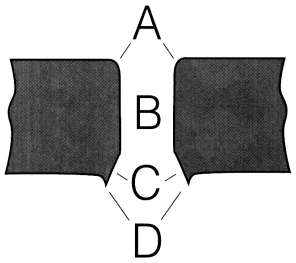
CUTTING BURR AND SHEARING BURR

The page usually shown in the drawing of a perforated sheet (top view) is the side of the stamp entry. The cutting burr is on the bottom side. The burr side must be expressly listed for assymetric metal sheets and parts with respective further processing. The burr is generally on the same side as the burr side. In the course of certain activities with scissors, the cutting burr may be on the opposite side. If the shearing burr and the cutting burr must be on the same side, this must be explicitly agreed in advance.

Permitted burr height under regular hole conditions

Sheet thickness	Burr height
up to 0.6 mm	0.15 mm*
above 0.6 mm to 1.5 mm	0.17 mm*
above 1.5 mm to 3.0 mm	0.20 mm*
above 3.0 mm to 6.0 mm	0.25 mm*
above 6.0 mm	0.50 mm*

*Non-corrosive steel +50%



Up to 10% of the perforated surface or 10% of the number of holes may be outside these tolerances. The burr can be pushed back into the hole in the course of the straightening process.

Evenness

Perforated metal sheets can be machine-straightened. There are 3 supply conditions:

a) not straightened
b) straightened by means of machines
c) precision-straightened

Perforated sheets are generally straightened 1x by means of machines in order to ensure the evenness tolerances required in accordance with DIN. As a result of margins of different sizes, unperforated areas, high passage, certain materials, residual stress in the metal sheet cannot be excluded. Special requirements with regards to evenness are subject to individual agreements.

Beginning and end of perforation field

During the perforation process the stamp may break partially or fully. In order to prevent tool breakage, the stamps are generally arranged in a staggered way. This results in the first and last perforation row in advance direction being incomplete.