The Conard Corporation

Precision Photo Chemical Machining Since 1965

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Buyers Guide to Perforated Metals

Presented by Conard Corporation

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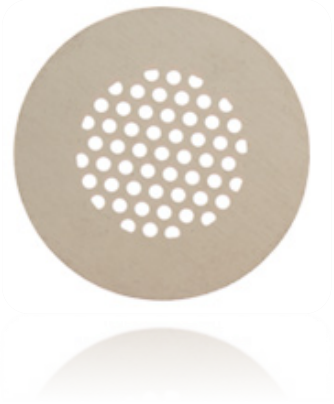
How Do You Make Holes in Metal?

Perforated products run the gamut from tiny metal filters to expanded metal gratings. There are a number of ways to make holes in metal. Stamping, punching and piercing are the most common mechanical hole-making processes. All three processes induce shearing stresses in the metal and also produce burrs on the "exit" side of the metal.

Plasma, laser and water jet cutting and electrical discharge machining (EDM) are the "directed energy" processes. Plasma and laser rely on vaporizing the metal and thus impart tremendous heat in the cutting process. EDM burns away metal using a wire electrode. With these processes, there is enough heat generated in the workpiece that slag or a "re-cast" layer can occur. The metal properties may be altered in the "heat affected zones" of the material. Water jet is a somewhat "kinder" cutting process, eroding the metal with a high pressure stream of either pure water or water with abrasive. Water jets rarely get warmer than room temperature, so there is no problem with thermal alterations of the metal.

Additive manufacturing processes, such as several technologies for laser metal sintering and electroforming, create the metal *around* the holes by either fusing metal powders or electroplating metal in solution onto a conductive pattern.



P3/4" in-line fluid filter

Detection filter

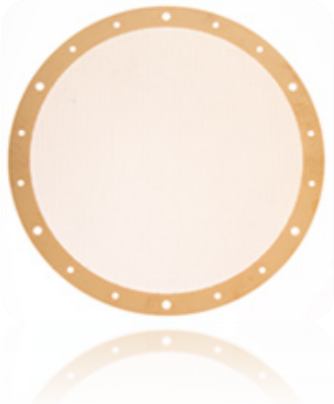
Perforated diaphragm with half etched channels

Why Choose Photo Etching as Your Solution?

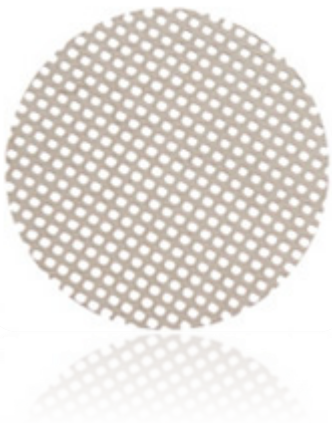
For simplicity and versatility, photo etching is an ideal solution for creating parts with lots of holes. In photo etching, the complexity of the part has no effect on tooling cost, processing or part cost. Whether the part is a solid shape or a screen, the etching process is exactly the same.

Unlike any other hole-making process, chemical etching produces holes that are completely burr-free and the metal has not been subjected to mechanical or thermal stress. Chemical etching can easily produce grids and screens that have variable patterns, with or without solid borders, and in virtually any shape at no additional cost. Acid etched screens, filters and grids find applications in so many different industries. From laser printers, to smoke detectors, to batteries, to scientific, medical and industrial instruments, and many more, photo etching is the process of choice for producing burr- and stress-free metal parts.

The photo chemical etching process produces consistent quality, screen after screen, because there is no mechanical tool wear and the metal itself is never subjected to extreme heat or shearing forces. Screens can be chemically etched in metals as thin as .001". Etched screens, filters and grids are produced in a wide variety of alloys including stainless and carbon steel, copper, brass, bronze, aluminum, nickel, and molybdenum.



Beryllium copper mesh

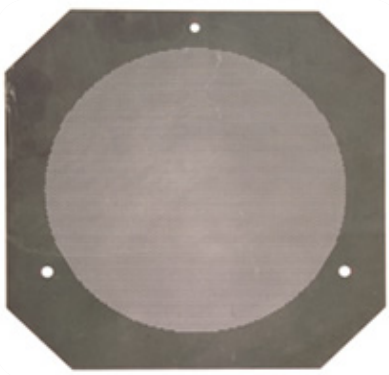


Battery grid

Space shuttle environmental system filter

Chemically Etched Screens: The Basics

- Minimum hole size is 115% of metal thickness to an absolute minimum of .005”
- Minimum land area between holes is equal to metal thickness, with an absolute minimum of.005”
- Minimum metal thicknesses is .001”
- Maximum metal thicknesses: ferrous alloys .040”, copper alloys .065”, aluminum .080”
- Maximum panel size is 24” x 60”. (Panels can be welded to make larger sizes.)
- Holes can be any shape with the caveat that the minimum radius is equal to metal thickness.
- Screens can have solid borders (or ragged edges) at no extra charge.



Photonic transmission control screen

Ventilation Screen

Applications of Perforated Metals

Battery Plates

Rechargeable nickel metal hydride (NiMH) batteries are constructed using nickel as the positive node. The nickel electrodes, or cathodes, are grids or screens of varying configurations that are readily produced by photo etching. NiMH batteries are rapidly replacing NiCad because they do not contain toxic cadmium and offer better life cycle performance.

Deposition Masks

Very fine features can be created in stainless, moly and other alloys to allow pattern deposition for a number of electronics applications.

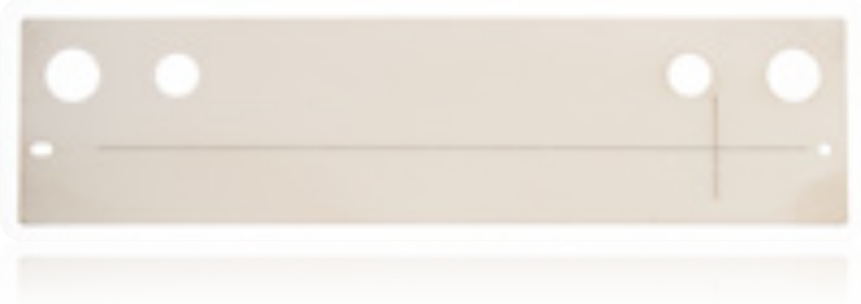
Filtration

Applications range from heavy gauge metal effluent filtration to extremely fine thin-gauge filters and diaphragms for liquids and gasses in a variety of alloys including steel, copper, aluminum, nickel and molybdenum.

Industrial, Architectural, Decorative

Metal meshes can be photo etched in a wide variety of alloys including steel, nickel, copper, brass, aluminum and more. Holes can be made in a variety of shapes and sizes at no additional cost in tooling.

Photo etched meshes, grids, filters and screens are used in many types of industrial, decorative and architectural applications. In many cases, chemical etching of metal meshes, grids, screens and filters provide better value and performance than woven or punched products.



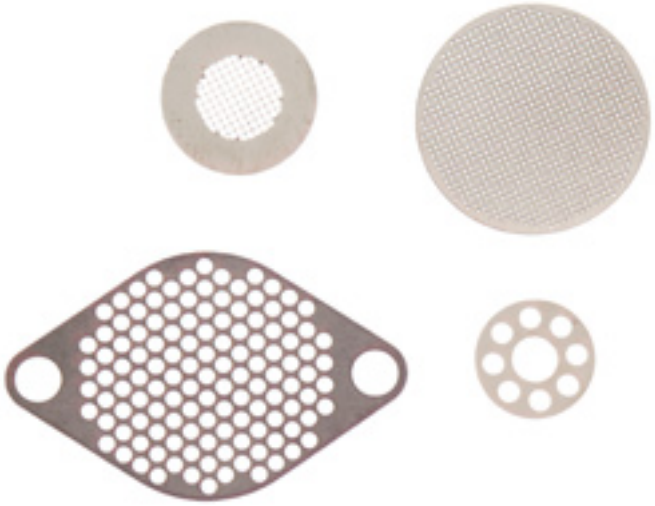
Commonly Used Terms

Bar

The bar refers to the solid area between the holes that is not perforated.

Camber

Camber means there is a minor curve of the material, or the sides of the perforated metal sheet are not completely straight.



End Pattern

The end pattern refers to how the pattern of the perforations at the beginning or end of the sheet appears. The end pattern can either be finished or unfinished.

Gauge

The gauge refers to the thickness from the top to bottom of the sheet. The gauge can range from 30 gauge to 8 gauge. The higher the gauge number is, the thinner the metal sheet will be.

Hole Center

The hole center refers to the distance from the center of one hole to the center of the nearest hole in the adjoining row.

Hole Shape

Holes can be made in virtually any shape, and they don't have to be the same shape. Any collection of shapes can be made. The caveat is that the minimum radius is equal to the material thickness and the 120% rule applies to the narrowest area of an opening.

Hole Size

Hole size means the diameter of each perforation.

Hole Pattern

Hole pattern refers to how the holes on a sheet are arranged, which can be in either straight or staggered rows.

Margins

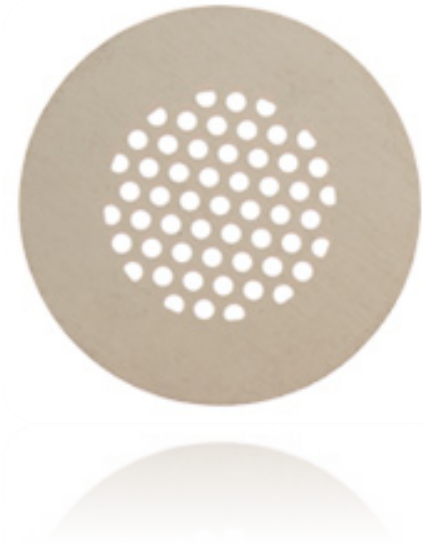
Margins are the blank area, or area on the sides, ends or inside of the sheet, that does not have perforations.

No Margins

No margins means that holes are perforated to the edge of the sheet.

Open Area

Open area is calculated by dividing the total area of the holes by the total area of the sheet. The final number is expressed as a percent.



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About Conard Corporation

Conard was founded in 1965 in Glastonbury, CT and has continuously specialized in Photo Chemical Machining (PCM) or chemical etching. The founder, Richard C. Huttinger, was a metallurgist and engineer who had previously worked for both Boeing and Pratt & Whitney. Huttinger developed a process to chemically mill the surface of forged aluminum propeller hubs for Pratt & Whitney. This process was more efficient and cost effective than conventional milling in the days before CNC machining was widely available.

Conard's early expertise in etching aluminum came to the attention of a major aerospace avionics company. Military and commercial avionics systems needed flat aluminum heatsinks to cool printed circuit boards. The heatsinks required detailed cutouts around each component. Photo etching was a cost-saving ideal solution, and flat heatsinks remain a significant part of our business today.

Conard is a Green Circle Award recipient from the Connecticut Department of Environmental Protection for consistently meeting and exceeding our environmental requirements. Conard has achieved registration under the AS9100/ISO9001 standards, in order to assure both existing and new customers that we are qualified to meet your requirements.

Conard has assisted hundreds of companies in developing applications for photo etching. We provide engineering and design support; rapid turn around of prototypes; and engage in special development projects to help customers solve complex problem.