FILTRATION NEWS

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Perforated Metals: Clarifying Options

Function, selection and benefits of perforated metal in water filtration applications

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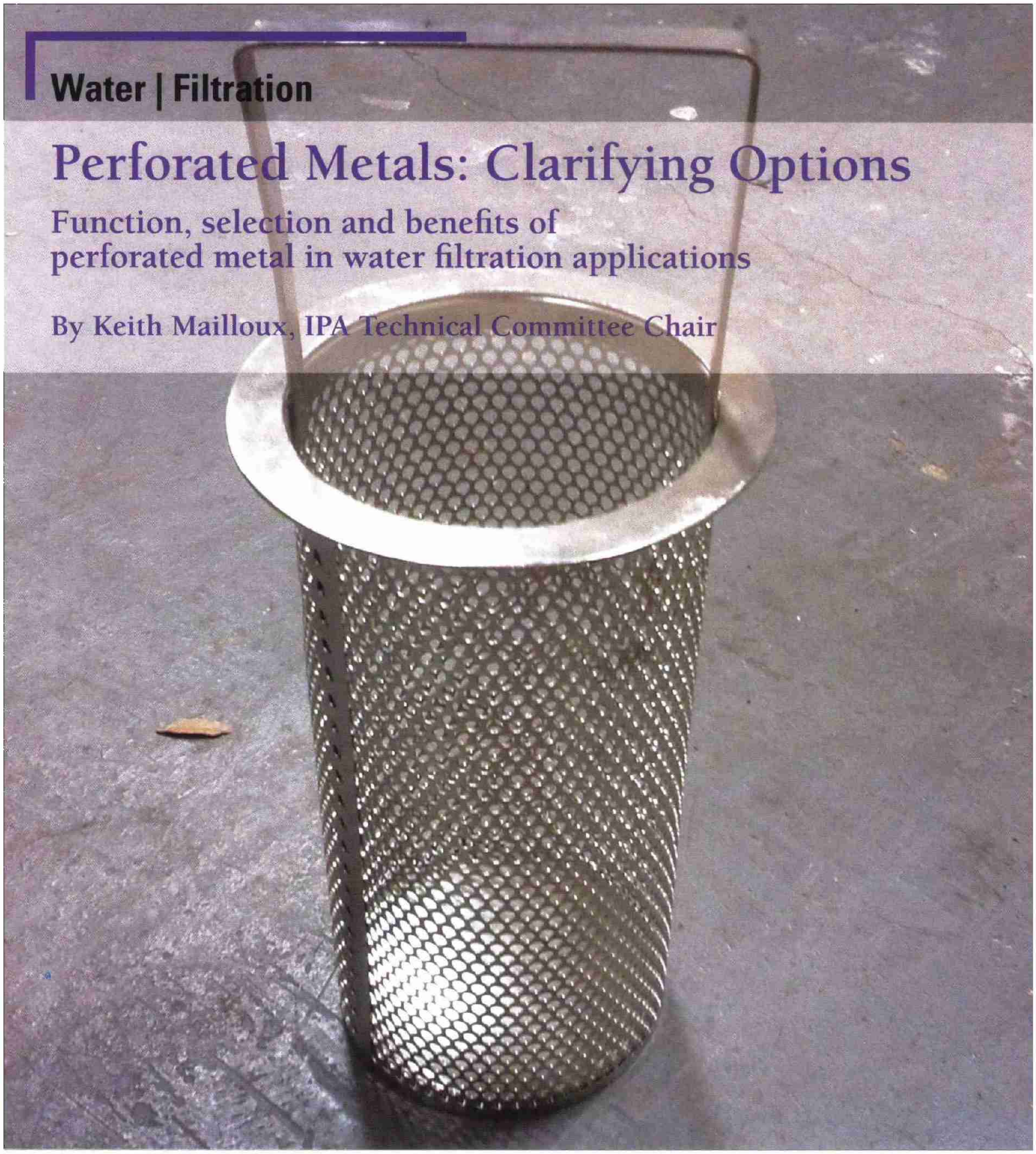


Drop in perforated stainless steel basket allows for easy removal and cleaning.

In many of the tough conditions associated with water filtration – whether dealing with coarse separation, desalination, deionization or other applications – perforated metals provide strength, structural integrity and flexibility for a long-lasting, cost efficient solution.

The water purification uses of perforated materials are growing more diverse, including a wide array of applications that sort and manage debris in liquid. To match unique needs, perforated metal can be as thin as foil or as thick as a 1½-inch steel plate, with holes punched in a wide array of shapes, patterns and sizes from microscopic up to 3 inches in diameter.

Cost-efficiency heavily influences purchase decisions. Since engineers have access to many alternative materials, including wire mesh, expanded metal, PVC or plastic screens, it's important to know when and where perforated metals are the best choice. This article will discuss the key functions and advantages of perforated metals, as well as considerations for specifying the right hole configurations, metal and options.

PRIMARY FUNCTIONS

Perforated Metals can be used in a variety of ways in water filtration applications, but they generally serve two functions better than competitive products: Primary Treatment (Coarse Separation) and Support Cores.

Coarse Separation: Perforated metals are commonly used as primary treatment filters. Wastewater is passed through a perforated metal screen to remove large objects and/or a series of incrementally smaller screens to remove grit that can cause excessive wear on equipment. Typically, these filters aren't intended to be disposable; they're used in a system where they're easy to clean off with a scraper bar.

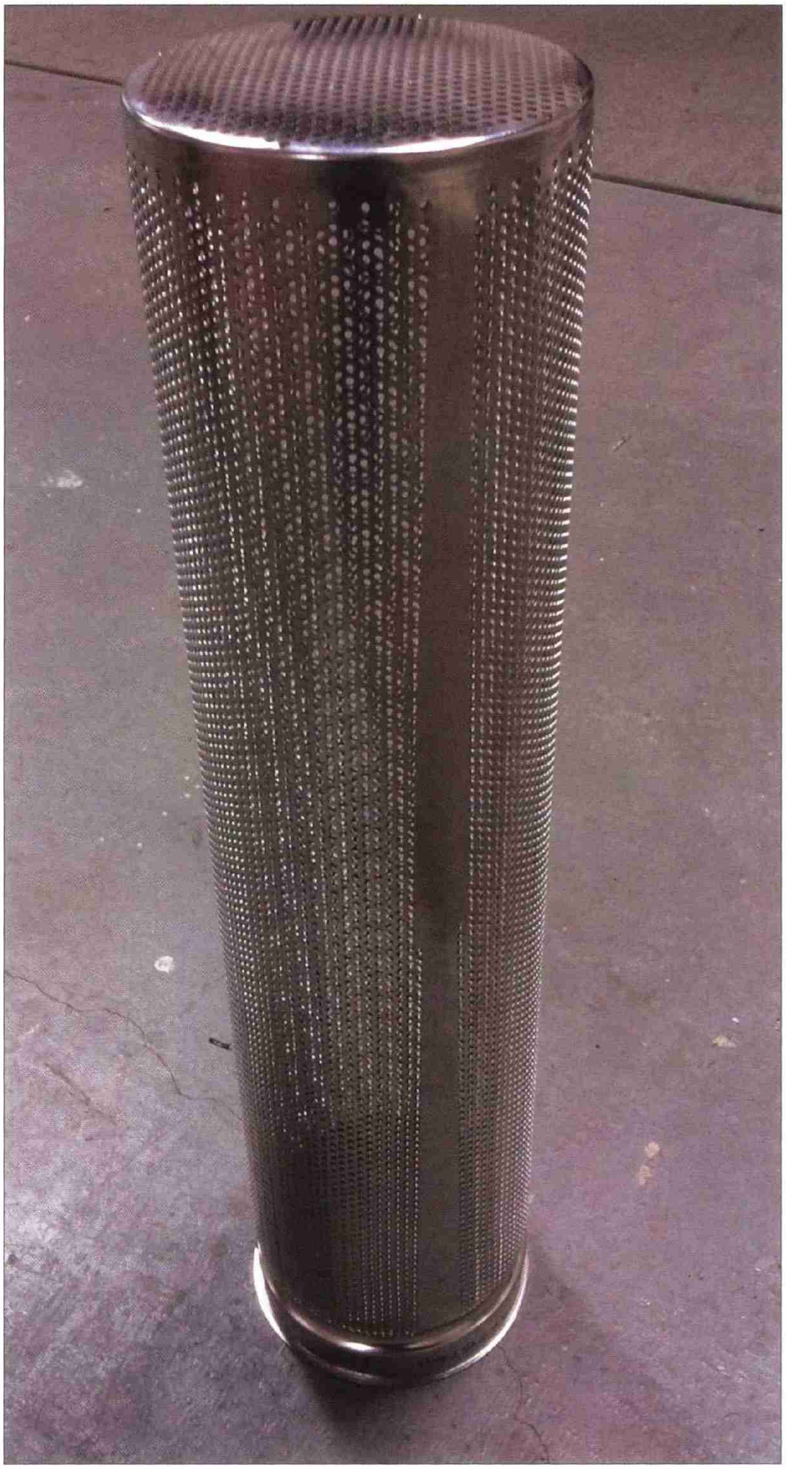
Support Mechanisms for other Filter Media: Since pass-through openings in perforated metal can't be made much smaller than about 1/100th of an inch, removing tinier particles requires other filtration media. The second common function of perforated metal is as a support mechanism for these more delicate, non-rigid filters, commonly made from paper, Styrofoam, fabric or sintered metal. While it is possible to use plastic or other materials as the support core, perforated metal is necessary when dealing with high pressures or temperatures.

Another common application is to combine the two functions. Many filters will have a perforated metal cylinder and an inner support core with an inner filter media sandwiched in between, similar to an oil filter. The outer core serves to filter out the coarse materials, and the inner core, usually permanently attached to the filter material, keeps it from collapsing on itself. This type of filter is commonly found in large commercial buildings, factories, power generation plants, hospitals or other buildings to demineralize and deionize water upstream of ion exchange units or other filtration systems.

STRENGTH AND DURABILITY

In general, perforated metal is stronger and more durable than other alternatives, such as wire cloth or expanded metal. The perforation process, usually accomplished through punching holes out of a sheet of metal, maintains much of the structural integrity of the original metal sheet – enabling the design to withstand high amounts of stress.

Because of its strength, perforated metal handles high-temperature and high-pressure applications much better than its alternatives. For example, demineralization takes place in a high-pressure tank. If that pressure builds up too high or suddenly drops, wire cloth is susceptible to bending or breaking.



Perforated filter core provides stable support and initial filter stages for outer micro-filtration media.

Perforated metals provide the structural integrity to withstand the stress without adding much weight.

Perforated metals are most often used in commercial settings, where pressure and temperature are a factor, rather than in residential applications, where lower-cost material functions just as well.

DESIGN CRITERIA

Most filters are design-engineered products, meaning their design must meet certain known specifications. The type of metal used, the hole design and size, all impact the strength, flexibility and capabilities. However, the science behind filtration and water flow is advanced enough that engineers can calculate pressure drop across a perforated surface, pressure drop against fluid flow, flow dynamics, cavitation and other factors that influence design. From there, they can specify what they need in a design and know with a high degree of confidence how the part will function.

While hole patterns are fairly consistent for water filtration applications, most perforators have the flexibility to customize tooling to meet customized design requirements. They can also provide recommendations for more standard options that have similar properties to help manage cost.

SPECIFYING MATERIALS

In the same way that the desired flow rate and pressure gradient will dictate the hole size, the environment will dictate the type of metal needed. For low-cost applications, it makes sense to use as thin and inexpensive of a material as possible. However, corrosive or high-pressures environments require more robust metals. Four of the most common metals are Stainless Steel, ETP, Brass and Titanium.

Stainless Steel: Perforated stainless steel sheet is essentially a low carbon steel that contains chromium at 10% or more by weight. The chromium content of the steel allows the formation of a rough, adherent, invisible, corrosionresisting chromium oxide film on the steel surface. If damaged mechanically or chemically, this film is self-healing in most environments.

Austenitic: Austenitic stainless steels are non-magnetic, non-heat-treatable steels that have excellent corrosion and heat resistance with good formability over a wide range of temperatures. Additions of molybdenum can increase the corrosion resistance.

Ferritic: Ferritic stainless steels are magnetic non heat-treatable steels that contain chromium but not nickel. They have good heat and corrosion resistance, in particular to seawater, and good resistance to stress-corrosion cracking.

Martensitic: Martensitic grades are magnetic and can be hardened by heat treatment. They are not as corrosion resistant as austenitic or ferritic grades, but their hardness levels are among the highest of all the stainless steels.

ETP: Commonly called tinplate, ETP is a coated steel product composed of a thin sheet of steel, providing strength and structural integrity, electrolytically coated with a layer of tin for corrosion resistance and other protective characteristics.

Titanium: While it's one of the most expensive options available, Titanium provides the best strength-to-weight ratio among metals – 40 percent lighter than steel and 60% heavier than aluminum.

Inconel Alloys: Inconel refers to a family of high strength nickel-chromium-iron alloys known for their resistance to oxidation and their ability to maintain their structural integrity in high-temperature environments. While each variation of Inconel has unique traits that make it effective in a different circumstance, they all stand up very well to caustic corrosion, corrosion caused by high purity water, and stress-corrosion cracking.

Brass: When zinc is added to copper, it forms brass, which is stronger and harder than either of the pure metals and extremely useful for many perforated metal applications. As a general rule, corrosion resistance decreases as zinc content increases, so brass used for water filtration applications usually requires a copper content as high as 80 percent and 90 percent.

CHOOSING THE RIGHT OPTION

As mentioned earlier, there are many different filtration options available to engineers. Perforated metal, expanded metal, wire cloth or plastic polymers all present different advantages. It's important to consider more than just price when evaluating these options. It's also crucial to understand the functional demands of the application and find the material that strikes the best balance between long-term cost efficiency and utility.

For perforated metals, the main factors influencing the cost are material cost, the perforated pattern's level of difficulty (hole size versus material thickness, margins), tolerances and the quantity ordered. Working with a member company of the Industrial Perforators Association assures a reputable perforator and a known standard of quality. This can open up new avenues of cost savings through alternative options, standardized hole arrangements or new technologies.

Today, the water purification uses of perforated materials are growing more diverse, and perforators are helping push the boundaries through research, knowledge sharing and innovation. They can be an excellent resource to help overcome many of the tough challenges. So when considering water filtration choices, reach out to experts in the perforation industry. They'll help identify specific needs, consider options and embrace the proven benefits and boundless potential of perforated materials.

This article was written by a joint collaboration of the members of the Industrial Perforators Association (IPA).

About the Industrial Perforators Association: As the only North American organization devoted to the advancement of perforated materials, the Industrial Perforators Association continues to push the boundaries of what these materials can do. Through extensive research, knowledge sharing, standards setting and more, the IPA provides members with the tools to drive innovation and increase utilization in perforation. In the process, they act as an essential resource to anyone who may benefit from incorporating perforated materials into their design.

For more information on perforated metals, their applications and their benefits, visit www.iperf.org