Material Matters When Selecting POU/POE Filters

Distinguish between available cartridges to determine benefits.

By Robyn F. Gordon and Jerry M. Mark

Dealers should carefully consider the various types of filter cartridge materials available when choosing pre- and post-treatment filters to offer residential and commercial customers.

Most filters are made from selected materials to form the barrier to filter out suspended dissolved solids. Filter designs include: loose media filters with grains, resins, or other particles lying in beds or loosely packed in column-form; and cartridge-type filters that may contain membranes, fabric, fiber, bonded ceramic, pre-coat or cast solid-block media.

Three types of filter cartridges — depth, pleated and carbon — have advantages and disadvantages when used for point-of-use/point-of-entry (POU/POE) water treatment.

Depth Filters. These filters usually have a 3/4- to 7/8-inch porous wall that captures particles winding their way through it. The most common materials used are polypropylene, cotton or resin-bonded cellulose. These materials are spun, string-wound or vacuum-formed and machined.

String-wound polypropylene cartridges are manufactured from polypropylene yarn, which is wound in a specific pattern; variations in the winding pattern alter the micron ratings of the cartridge. Water flows through the yarn and the complex paths trap sediments.

Spun wound cartridges are also manufactured from polypropylene, but fine fibers are bonded and spun to form a solid structure. Water flows through the twisted paths and sediment is trapped within the filter.

These cartridges are used to filter large amounts of sediment or fine sediment. They have graded densities, with a lower density at the surface and a higher density in the center. Sediment is trapped throughout the entire cartridge as water is forced through the path between spaces in the cartridge.

- **Pleated Filters.** The pleated filter is manufactured from one of three materials. Pleated paper is the most economical material, but can't be effectively re-used. These filters have a short life in low or high pH waters and in water where bacteria tend to feed on the cellulose portion of the filter media.

The second type is a cellulose/polyester filter, which is the next most economical material and a better medium because it offers the filtering ability of cellulose and the strength of polyester. The third choice is polyester and polypropylene, which are the most expensive filter materials, yet strong enough to handle repeated washings and reuse.

Depth and pleated filter cartridges are generally used as pre-filtration in POU installations. Depth filters can be produced at lower cost and can capture particles smaller than the filter's hole size. The advantage of pleated filters is that the surface area may be 8 to 12 times greater than the surface area of depth filters. The decision to choose between these styles of filter cartridges may come down to personal preference or the application desired.

- **Carbon Filters.** Activated carbon is found in block, granulated or powdered form. It is produced by heating carbonaceous substances — bituminous coal or cellulose-based substances such as wood or coconut shell — in the absence of air, creating a highly porous absorbent material.

These cartridges are available in several forms, including granular activated carbon (GAC) or pulverized activated carbon (PAC). Carbon filters can either be used as pre- or post-treatment filters. Both of these filter media also have advantages and disadvantages.

GAC is best known for its ability to improve water aesthetics, such as reducing bad tastes and odors caused by chlorine, and is a popular choice for many different POU/POE applications. Most GAC beds start out with almost 100 percent removal rates, regardless of the water flow rate. However, the faster the flow per unit volume of GAC, the sooner the breakthrough. Most GAC cartridges are cylindrically shaped, typically 9-3/4 inches long and 2-3/4-inch outside diameter with soft rubber end-caps.

For GAC to act as an absorbent, the attraction forces between the GAC and the contaminant must be stronger than the forces of the water that hold thecontaminant in solution. Some

water conditions — such as pH or temperature — increase the solubility of a particular organic contaminant and reduce adsorption. If the attraction forces are weak, adsorption occurs too slowly and breakthrough results.

PAC is available in three configurations: paper-wound; wet-molded or extruded and dry-molded blocks.

Paper-wound cartridges are made by spiral winding paper loaded with PAC around a perforated inner core. The outer surface uses a polyolefin netting and the end-caps are the "potted on" or plastic type. This filter media is usually one of the lowest-priced units available.

Wet-molded cartridges are made from a water slurry of fibers and PAC from which the filter medium is formed on a perforated inner core. The wet tubes are formed, dried and cured to form a porous cylindrical structure consisting of PAC and fibers locked in place. This style of cartridge places them on par with the typical GAC unit.

Another type of wet-molded cartridge is a modified molded block that incorporates a similar amount of fibers and PAC as the traditional wet-molded cartridge, but has a density structure that is 25 percent greater.

Extruded blocks are designed by a continuous extrusion process using approximately 80 percent mesh and a thermoplastic binder, which under the influence of heat fuses the carbon particles into a rigid, porous structure. The tubes are cut to length and usually wrapped with a non-woven fabric and polyolefin netting before being end-capped.

Dry-molded block cartridges are produced by molding the annular cartridge from a mixture of PAC (usually 200 mesh) and a thermoplastic binder in a mold under pressure and elevated temperature. The cartridge is then wrapped with a non-woven fabric and polyolefin netting before being end-capped.

GAC cartridges, depending on their form and size, can reduce levels of volatile organic compounds (VOCs), trihalomethanes (THMs) and in certain cases, other organic chemicals. PACs have good sediment-holding capacity and are well-bonded to create a cartridge that won't channel or bypass.

Premature Clogging. Several factors can cause premature clogging in all types of filter cartridges. For instance, instant sand silica — silica is present in almost all minerals and in fresh water in a range of 1 to 100 milligrams per liter (mg/L) — can cause media filters, carbon filters and reverse osmosis (RO) membranes to plug up and their O-rings to quickly wear out.

Turbidity, which generally is in the 3- to 40-micron range, can be made up of fine silt, iron oxide, magnesium oxide or a combination of materials. While not as abrasive as silica, turbidity can cause premature clogging.

Extruded or dry-molded blocks are especially susceptible to plugging from turbidity because they are very low in permeability.

GAC can plug from particulates and debris. Over a period of time, accumulation of debris and organics also provides sufficient nutrient to support the growth of bacteria and algae.

● Robyn F. Gordon is director of operations and Jerry M. Mark is vice president of sales and marketing for O-SO PURE and Pure Water Source, Phoenix, AZ.