Filter Fundamentals

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Water treatment dealers of today face some of the most challenging situations and conditions ever regarding the quality of our water. Over the years, water quality has noticeably deteriorated worldwide. This decline in water quality stems from the extreme demand on very limited natural resources. Various principles of filtration are used in many applications to improve the general quality of the water that is being treated. For example, one method of pretreatment that may be used for large particulate matter and sand is called screen filtration. Along with screen filters, coagulation/filtration, neutralizing filters, oxidizing filters, clarifying filters and carbon filters are other treatment methods that may be used.

Screen Filters

Screen filters are available in plastic, bronze, stainless steel and cast iron. Along with the variety of appearances, there also are "T," "Y" and spin-down cyclone styles. These filters have many different mesh screen sizes. (For example, 60, 100, 250 and 1,000.) Each mesh size relates to the weave tightness of the screen and the size of particulate it can remove. Most units have a drain or blow-off capability to empty the solids from the chamber, by using a simple quarter-turn ball valve or by using an electronic cycling timer and a solenoid valve. Screen filters are used on central water supply systems as well as private wells and surface water systems to remove matter. Some of the particulate being removed includes iron and iron pipe fragments, dirt or debris, shells and sand. This technique of treatment is an extremely effective method for large, highly visible material.

Coagulation Filtration

Coagulation is a two-step process widely used for colloidal and suspended matter within the water stream, which can be visible in most cases. Colloidal matter will not settle out when left standing and will not pass through most filters. The process takes two steps because a coagulant or pH-adjusting chemical first must be injected before matter can be filtered out of the water stream. The injection of a chemical coagulant assists the suspended matter in flowing or bonding together, making the particulate larger in molecular weight and size, which in turn allows it to be filtered out of the water stream. Once the matter has bonded, various methods of filtration can be applied such as cartridge, sand, multimedia or depth filtration. The size of the system and flow rate required for the demand will determine which process to use. Each process responds well to its own specifications and capabilities.

Neutralizing Filters

Neutralizing filters are used in water systems to correct what may not appear visible to the individual eye but are detrimental to any form of metal within the pipe stream. The purpose of the filter is to adjust the pH and correct acid water conditions. Acid water can cause internal degradation and corrosion of all metal piping including copper, lead and other harmful elements, which get into the water stream.

Neutralizing filters are used in a downward flow path using an automatic backwashing control head to backwash the material on a regular basis, preventing solidification of the material. They also can be used in a reverse upward flow path with no control valve required or as a simple in/out closure. The two most common materials used for the process are calcium carbonate (calcite) and magnesium oxide (Corrosex). Optimal pH ranges between 7.5 to 8.0.

Oxidizing Filters

Oxidation may occur in numerous ways including through chemical injection, chemical draw and the presence of natural catalysts in the water supply. All three oxidation methods are dependent on the type of media used. The use of oxidizing filters is common for eliminating the most typical problems seen in private well applications. Iron, manganese and hydrogen sulfide are known as the three most common problems involved in private well applications.

One form of chemical injection is chlorine injection. This can be accomplished in three ways: by using

liquid chlorine and a chemical feed pump; by using a dry pellet inline feeder; or by using a down well pellet dropper. It always is best to introduce the chemical before the pressure tank on a well application to ensure contact of all water used with the chlorine. The water then will enter a contact cylinder called a retention tank, allowing time to filter out the oxidized particulate for the chlorine to oxidize (precipitate) the matter within the well such as iron, manganese and hydrogen sulfide. Another form of filtration is used after the retention tank to filter out the oxidized particulate and reduce the chlorine levels where desired. Sand filters and multimedia filters are used to filter the particulate from the water stream. Carbon filters and/or carbon and sand combination filters are used to filter the particulate and reduce the chlorine concentration prior to the water use.

Another form of oxidation injection ion is ozone. When oxygen is passed through a chamber and charged with electrical current it becomes ozone (O3). It can become a highly effective method of oxidation when properly sized and applied. However, much like chlorination, ozone also should have a contact cylinder or retention tank with venting capability, followed by the proper steps of filtration. Most all filter applications for ozone do not have a need for carbon. Unlike chlorine, ozone does not have a noticeable offensive residual.

Manganese greensand filters also are commonly used. This medium requires a regeneration cycle using a chemical potassium permanganate. For most small to large residential systems they are designed to work with an automatic control valve with a regenerant draw capability. The potassium permanganate used typically is put into a feeder in dry form. These feeders have a level control float and use an automatic control valve to acquire the water needed to dissolve the chemical. This system has normal intervals of regeneration, which include a preliminary backwash. This will assist in cleaning out any foreign matter or debris. Then the system will go into a chemical draw and rinse cycle where the potassium dissolved in the feeder is drawn in to regenerate the manganese greensand. Typically, after this cycle the system will go into a down flow rinse, which is at the same rate as backwash to insure all regenerant is purged from the tank. Finally, it will go into the refill cycle to replenish water back into the feeder to dissolve potassium for the next regeneration.

On large-scale commercial and industrial greensand systems you will, more often than not, notice a continuous feed being used. This is accomplished by premixing the potassium permanganate and water in a large solution tank. By using a chemical feed pump, a balanced level of chemical in the water stream in front of the filter unit is attained. These systems are known as continuous regeneration systems.

Other specialty media widely used today are intended for backwash configuration only. They primarily reduce iron and hydrogen sulfide. By trade name, these media include Birm, Pyrolox, Centaur (catalytic carbon), KDF55 and KDF85. All of these media have very specific operating parameters that are not universal. It is extremely important to understand and follow the guidelines on the media set forth by the manufacturer to ensure the effectiveness of the system. With some of the heavier material, it is important to pay close attention to its backwash requirement. In some cases, more may be needed than the source supply can deliver, which will result in a fouled media bed and failure. Be sure to consult the supplier to confirm the applications' capability for success first.

Clarifying Filters

Clarifying filters commonly are used for turbidity, or a cloudy appearance in the water stream. The types of filters that are used are spun cartridge, pleated cartridge, depth cartridge, sand filters, staged media filters and multimedia filters. The proper selection of filter type is dependent solely on the gallon per minute, flow and total volume requirement of the application. Each type requires proper sizing to its own specification for service flow rates to prevent leakage or blow-through from over-running the system. Just as important as the service is its backwash or maintenance requirement. Be sure to understand the maintenance requirements of each cartridge type and that the proper water flow is available to accommodate the required backwash. Unnecessary failures often stem from system neglect or improper flow-rate availability.

Carbon Filters

Carbon filters are known as the polishing filters. They are best recognized for final treatment. Carbon is known to have the best result in aesthetic quality correction when treating water. Activated carbon absorbs low molecular weight organics and is highly effective in reducing levels of chlorine or other halogens from the water stream. Most carbon filters are set up with automatic backwash controls intended to lift and clean the bed and discourage organic growth. Due to carbon's specific "life," it should be changed periodically to ensure proper system performance. In most cases, this will prevent any bacterial growth problems. When using an automatic control valve, carbon filters are used to backwash out accumulated solids and particulate debris--the cleaner the bed of carbon the better the system performance. As with all other systems used today, carbon media have specific guidelines for service flow capability and backwash requirement.

Paying close attention to these various filtration techniques will ensure a high success rate in solving customers' water problems. All media sold in today's market come with detailed data sheets that offer overall operating parameters. Do not hesitate to ask for them or assistance from your supplier in proper application sizing.