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General processing

Process cooling fluid options

Selecting a filtration strategy for process cooling fluids can be as challenging as developing a filtration solution for the process products themselves. This article looks at some of the options available and how mechanically cleaned filters can provide a solution.

Keeping process cooling fluids clean is not as easy and choosing the best filtration solution for a process cooling application must consider a number of factors including:

- The fluid source
- The source, volume and nature of contaminants present in the fluids
- The heat exchanger materials and technology being used
- Pressures and temperatures within the process environment
- The amount, if any, of acceptable downtime for filter maintenance
- The initial capital and long-term operating cost of the filtration solution

Even the most cursory examination of that list should make it clear that no pre-packaged, one-size-fits-all solution is likely to be successful. In reality, selecting a filtration strategy for process cooling fluids can be every bit as challenging as developing a filtration solution for the process products themselves.

The water source will also influence the type of media used in the strainer or filter. (Image: Getty Images)

Complementary technologies

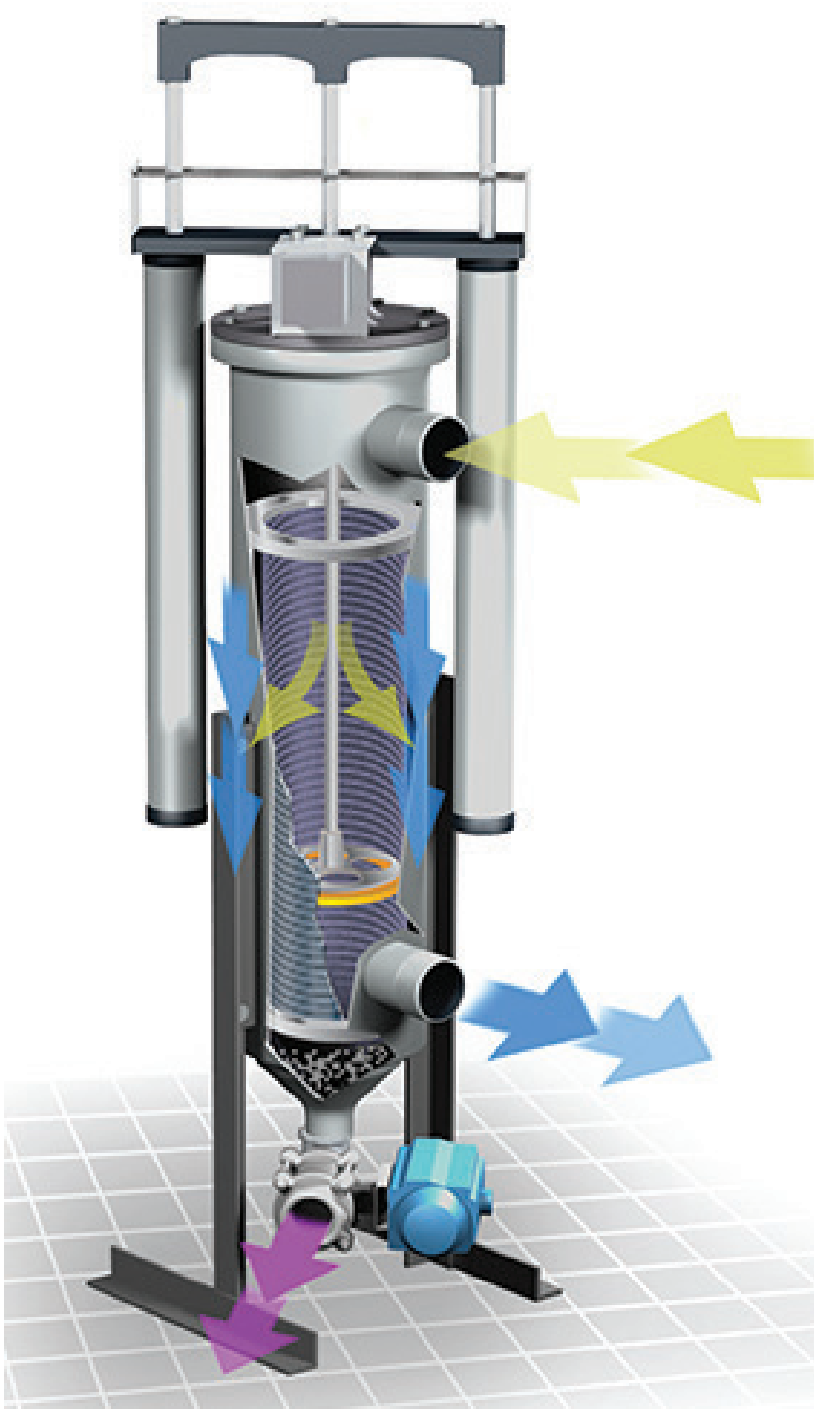
A successful solution is likely to include a variety of complementary technologies. For example, a system using raw river or ocean water as a source might very well

include intake bars to keep out large floating debris; a screen with 3/8 in openings; a strainer to trap anything larger than 1/32 in diameter; and, finally, a filter to remove any particles larger than 25 microns.

The water source will also influence the type of media used in the strainer or filter. Sand, for example, does not change size or shape so it is easily trapped in a porous filter medium. Pond scum, on the other hand, presents an entirely different challenge that is best handled with mechanically cleanable media. Other organic contaminants, which are typically present in quantity in surface water after rainstorms, present their own challenges that have to be quantified and accommodated based on specific local conditions.

Once in the process system, the water may be further treated to inhibit corrosion in carbon steel piping and heat exchangers or filtered again to remove even smaller particulate as necessary. At that point, the process cooling water represents a significant investment and will likely be recycled through a secondary heat exchanger and recirculated. That, of course, means it must also be re-filtered to remove any scale or corrosion particles picked up from pipes and heat exchangers.

Strainers and filters perform essentially the same function, but filters can remove particles of much smaller size. The general rule of thumb is "If you can see it, you can strain it." In practical terms that means that particles down to range of 0.003 in – 0.004 in (0.07 - 0.1 mm, 75 – 100 microns, 200 – 150 mesh) can be removed effectively with a simple strainer. For anything smaller, a filter, which can remove particles as small as a few microns, will be necessary.



The Eaton DCF-Series of mechanically cleaned filters have been designed to handle highly viscous, abrasive, or sticky liquids.

Periodic removal

Regardless of whether a strainer or a filter is in place, the build-up of particles trapped in the media must be removed periodically. For a basic basket-type strainer this can be as simple as shutting off the flow, manually removing the basket and dumping the trapped debris. Simple filters may also use a filter bag constructed of woven polyester material that is maintained in essentially the same way.

Obviously, stopping the flow and manually cleaning the filter element means that the process is either shut down during the maintenance period or it is unprotected while the filter or strainer is by-passed. Neither situation is optimal. The solution is a self-cleaning filter that comes in two basic designs.

An automatic self-cleaning filter uses a rotating hollow internal arm to collect debris deposited on the filter media. As more and more particles are trapped on the media the pressure drop through the filter increases until it reaches a predetermined value. At that point a valve is opened which allows fluid to exit the filter through the rotating arm, carrying the accumulated debris with it.

This type of filter typically removes particles larger than 50 microns and can handle debris loads up to about 200 parts per million. Automatic filters are

Choosing a process cooling filtration solution

It should be clear that choosing a process cooling filtration solution is a complex process. Perhaps a worked example of a successful application will help demonstrate why the effort involved is well worthwhile.

Background

Process chilling is a critical element in the production of biological buffers, which are a key element used by chemical companies in the production of common household drugs such as aspirin and a variety of prescription medications. One of the country's largest producers of biological buffers determined it was time to replace the old inefficient chillers they had been using for decades as they were becoming too difficult to repair and susceptible to frequent breakdowns.

Challenges

To improve efficiency and mitigate potential maintenance costs, the company decided to install new process critical chillers with plate and frame heat exchangers.
The new chillers were more efficient, but their design led to contamination and clogging in hard-to-clean areas of the plates.

This clogging caused the equipment to shut down and required weekly cleaning by an outside contractor in an inefficient and messy process. The entire system was shut down during each cleaning, resulting in four to five hours of unplanned downtime each week. Even worse, during high production cycles additional contaminants were introduced into the process cooling water resulting in emergency calls for additional unscheduled cleanings.

Solution

Plant officials approached an Eaton distributor about a self-cleaning filtration solution that would effectively filter contaminants out and prevent their new chillers from clogging and interrupting the process.z

A customer engineer explained that they had expected the switch to the new chillers to generate some contaminants, but not at the level they were experiencing. Moreover, the clogging was in areas that were difficult to clean and the unexpected downtime required for manual cleaning was costly. What they wanted was a solution that continuously cleaned itself so they didn't have to 'babysit' the operation.

After reviewing the customer's operation, needs and goals, Eaton regional sales manager Jim Lago recommended the MCS-500 duplex strainer. This filter offered a higher level of filtration (30 micron) than the previous solution (60 micron), and the efficient design and small footprint allowed for installation in a tight space on the second floor of the production facility.

Designed to handle fresh water from treated sources, the High Flow MCS-500 strainer addresses the challenges water filtration can bring to industrial manufacturing. The MCS-500's magnetically coupled actuation eliminates the need for dynamic seals.

This technology provides quick and easy access for maintenance, reduces potential leaks, and requires few moving parts while providing a long service life. The filters were installed upstream of the new chillers to filter 100% of the condenser water supplied to the new process chillers. That means contaminants are filtered out of the water source before it comes into the process.

Results

The new filtration system was installed and the customer reports excellent results so far. The system has eliminated both the need for regular weekly cleaning and the associated cost and downtime, and the unscheduled downtime for emergency cleaning that had adversely impacted productivity. Now the heat exchanger stays clean and runs efficiently without any 'babysitting'.

With the new filtration system now in place, the biological buffer production process is flowing without interruption, and that's eliminated a lot of headaches for plant operators. Investing the time and effort to choose the right technology solution pays big dividends in the long run.

"Investing the time and effort to choose the right technology solution pays big dividends in the long run."

best used in high-volume situations where fluid losses up to 5% of total flow during cleaning is acceptable.

Mechanical disc

A mechanical self-cleaning filter uses a mechanical disc to scrape accumulated debris off the filter media. Again, as trapped debris increases the pressure drop across the filter the scraper is actuated at a predetermined value.
The debris is deposited at the bottom of the filter housing where it can be removed without interrupting the flow through the filter. The cleaning action of the mechanical filter makes it suitable for removing particles less than 10 microns in diameter.

These filters are also able to handle higher debris loads and more frequent purge cycles than automatic filters. They also consume a much smaller volume of fluid during cleaning than an automatic filter.

Note that either a strainer or a filter creates a pressure drop and also a flow restriction. Both factors must be accounted for in designing the system. Adding either as an afterthought may require up-sizing pumps to maintain adequate flow volume and pressure. ●

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