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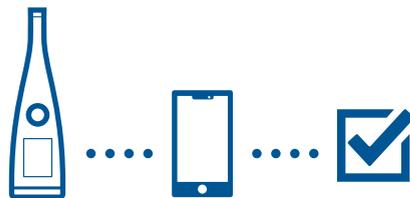
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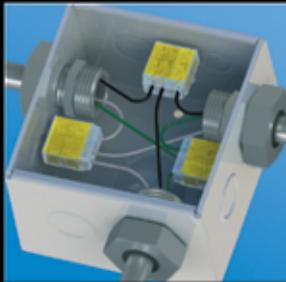
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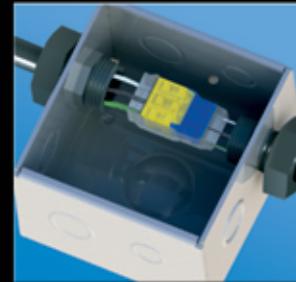
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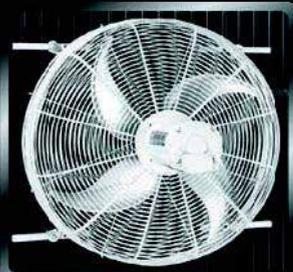
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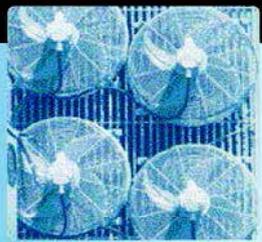
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In industrial process facilities, corrosion is the biggest single cause of plant and equipment breakdown, including machinery, vessels, structures, supports, and pipelines. While atmospheric corrosion in the form of air (oxygen), and water (moisture, humidity, vapor, etc.) is the main culprit, environmental factors including high temperatures and pressures as well as harsh substances, chemicals and gases can also accelerate the corrosion of carbon steel and other metals.

Beyond marine environments exposed to salt spray or compounds that cause corrosion, common gaseous industrial air pollutants, such as sulfur dioxide, ozone, and nitrogen dioxide, can be corrosion inducing. So can exposure to industrial chemicals such as chlorides, acetic acid, and formaldehyde.

“There is a huge need for an anti-corrosion coating that can go on in areas where conventional coatings tend to fail,” says Joey Taylor, President of IPI Inc., an Elkview W. Va.-based paint/coating contractor for commercial and industrial construction. “On certain projects, chlorides need to be removed in order to meet peak performance. But in most cases, this can be cost prohibitive.”

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Fortunately, for industrial facilities with assets prone to environmental corrosion, a new category of tough, Chemically Bonded Phosphate Ceramic (CBPC) coatings is helping to stop corrosion, ease application, and reduce production downtime.

Long-Term Environmental Corrosion Protection

When aluminum is recycled, it is melted to separate the pure metal from the impurities. The process creates a

waste product called salt cake, which contains compounds that can promote corrosion.

As a result, typical barrier-type anti-corrosion coatings, such as polymer paints, can fail prematurely. This is particularly true when the paint is scratched, chipped, or breached and corrosion promoters enter the gap between the substrate and coating. Then the coating can act like a greenhouse – trapping the corrosion promoters – that allows the corrosion to spread under the coating.

So, when an aluminum recycling plant in West Virginia required corrosion protection for its operation, it sought a long-term solution that would not require frequent recoating, according to Taylor, who was involved with the project.

“The recycling plant was not having much luck with conventional anti-corrosion coatings, which only lasted about three or four years,” says Taylor. “Really, anyone trying to protect their assets from corrosion wants their coating to last much longer than that.”

To provide long-term corrosion protection in a tough environment, the aluminum recycling plant and Taylor turned to EonCoat, a spray applied inorganic coating from the Raleigh, North Carolina based company of the same name. Eon-Coat represents a new category of rugged, Chemically Bonded Phosphate Ceramics (CBPCs) with unique properties.

In contrast to traditional polymer coatings that sit on top of the substrate, the corrosion resistant CBPC coating bonds through a chemical reaction with the substrate. The

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coating can even be applied over flash rusted, damp steel. An alloy layer is formed. This makes it impossible for corrosion promoters like oxygen and humidity to get behind the coating the way they do with ordinary paints.

Although traditional polymer coatings mechanically bond to substrates that have been extensively prepared, if gouged, moisture and oxygen will migrate under the coating's film from all sides of the gouge.

By contrast, the same damage to the ceramic-coated substrate will not spread corrosion in industrial infrastructure because the carbon steel's surface is turned into an alloy of stable oxides. Once the steel's surface is stable (the way noble metals like gold and silver are stable) it will no longer react with the environment and cannot corrode.

Visible in scanning electron microscope photography, EonCoat does not leave a gap between the steel and the coating because the bond is chemical rather than mechanical. Since there is no gap, even if moisture was to get through to the steel due to a gouge, there is nowhere for the moisture to travel, which effectively stops corrosion in industrial applications.

The corrosion barrier is also covered by a ceramic layer that resists corrosion, water, impact, abrasion, and chemicals as well as fire and temperatures up to 450 °C.

For such durable corrosion protection, IPI Inc. successfully sprayed EonCoat on two industrial dust collectors (one 60,000 CFM and one 40,000 CFM), including four tanks as large as 40 feet tall and associated ductwork, according to Taylor.

"The CBPC anti-corrosion coating is designed to last significantly longer than traditional coatings, so frequent recoating should not be an issue," says Taylor.

Industrial operation managers or corrosion engineers looking to reduce costs are also finding additional advantages with CBPC coatings like EonCoat beyond corrosion resistance.

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Such coatings consist of two non-hazardous components that do not interact until applied with a standard industrial plural spray system like those commonly used to apply polyurethane foam or polyurea coatings. Since CBPC coatings are inorganic and non-toxic, there are no VOCs, no HAPs and no odor. This means the water soluble, non-flammable coatings can be applied safely even in confined spaces, or when adjacent parts of a plant continue to operate.

“With the CBPC coating, since there are no VOCs or odor, coating can be done around plant employees or other contractors without restrictions,” says Taylor.

One of the greatest benefits, however, is quick return to service that minimizes facility downtime. The time saved on anti-corrosion coating projects comes both from simplified surface preparation and expedited curing time. With a typical industrial coating, near white metal blast cleaning (NACE 2 / SSPC-SP 10) is required to prepare the surface. But with the ceramic coating, only a NACE 3 / SSPC-SP 6 commercial blast cleaning is typically necessary.

With traditional coatings, extensive surface preparation is required and done a little at a time to avoid surface oxidation, commonly known as ‘flash rust’, which can require re-blasting.

However, with the CBPC coating, flash rust is no issue. There is no need to ‘hold the blast’. The reason for this unique CBPC characteristic is due to the presence of iron in the rust, which helps to create the magnesium iron phosphate alloy layer. It is this alloy layer that allows CBPCs to so effectively protect carbon steel from corrosion.

“Conventional coatings require you to prime the substrate every day so you do not lose your blast,” says Taylor. “You have to stop sandblasting in the early afternoon, and then prime [the substrate] the rest of the day. This requires time-consuming daily teardown and set up of paint equipment.”

“With EonCoat, however, once you have a clean substrate surface, free of mill scale and coating, it will not

hurt it to let it flash rust,” adds Taylor. “So, you can continue coating [the next day] without having to re-blast the substrate, re-prime it, or set up and teardown paint equipment each day. You can continue to blast the entire 12-hour shift. That saved us about a 50-hour workweek on the project.”

For traditional ‘three-part system’ coatings utilizing polyurethanes or epoxies, the cure time may also be days or weeks before the next coat can be applied, depending on the product.

In contrast, a corrosion resistant coating for carbon steel, utilizing the ceramic coating in a single coat, requires almost no curing time.

“We were able to complete the project from start to finish in nine weeks, including substrate preparation, spraying, and adding a high-performance topcoat with minimal disruption to the plant’s operations,” says Taylor.

Industrial facility managers looking for more reliable, long-term corrosion protection in harsh environments will find that CBPC coatings add significantly to safety, production, and the bottom line.

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Complex Processing Vessel Fabrication Calls for Grace Under Pressure

Chemical, oil & gas refinery and petrochemical facilities use complex processing vessels such as heat exchangers, chemical reactors, distillation columns, and pressure equipment that operate under extremely intense environments.

These vessels must endure high temperatures and high pressure over decades of grueling use. They are critical pieces of operating equipment that often function as the central processing units of an entire manufacturing facility. As a result, any equipment downtime can be extremely costly to the operator.

Supporting the many industries that depend on these high-performance vessels is a marketplace of equipment designers and engineers, specialized in metallurgy, vessel fabricators, maintenance and repair services, advanced product testing technologies and certification and accreditation organizations. Given the performance and safety requirements for a complex processing vessel, leading fabricators certify their vessels with the American Society of Mechanical Engineers (ASME) to indicate that their products fulfill the requirements of relevant ASME codes and standards.

Eighty years ago, the roots of the complex processing vessel sector started with boiler manufacture and repair shops and has now grown to include off-the-

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shelf heat exchanger and pressure vessel fabricators and highly sophisticated and credentialed design and manufacturing specialists. These specialist fabricators work with customers to design, engineer, manufacture, and test ASME Division I and II code vessels of every size, material, and finish including rare and challenging alloys selected for their superior performance and durability.

One of the challenges facing industries that require specialized complex processing vessels is the relatively small number of these specialist fabricators. There are still relatively few worldwide who provide the in-house design and engineering expertise to craft vessels that can withstand high intensity environments.

Manufacturing processes that involve high temperatures and high pressures require equipment that is constructed from specialized alloys and that are custom-designed to the operator's unique needs. Far from off-the-shelf, clients often turn to a specialist fabricator to design custom equipment based on a profile of their operating criteria. The fabricator then needs to create a design, engineer, manufacture and test to ASME codes.

Tate & Lyle is a global supplier of ingredients to food and beverage markets. When constructing their plant in McIntosh, Alabama they required custom-designed

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distillation columns, pressure vessels and heat exchangers. Because of high operating temperatures and pressure, specialized solutions were required for performance and durability. Moreover, the company needed equipment that could run 24/7 with only two shutdowns a year.

“At the time, the engineering team only provided a fabricator with a data sheet of the requirements - things like how many gallons for the vessels, operating temperatures, pressure levels, and how many nozzles were needed. From there, we needed the vendor to come up with the equipment design and be able to build it to ASME Section VIII Div. 1 code,” says Linda Rutherford, a member of the Quality Control department at Tate & Lyle. “Because of the criticality of the equipment to our manufacturing process, we needed equipment that would not break down and stand the test of time. And at this plant, we measure durability in decades.”

Based on a combination of capability, quality, service and price criteria, the company partnered with Alabama-based Mitternacht, a fabricator specialist that holds certifications in ASME Div. I and II stamps as well as a Chinese License for Pressure Vessels A2. Mitternacht designed and engineered the plant’s original separators, heat exchangers, storage tanks, and pressure vessels. Given the operating parameters, the company built the equipment, which included fabricating pressure vessels more than 100 feet tall, using stainless, specialized alloys.

Complexity Starts with Design & Engineering

The work of fabricating a specialized processing vessel first begins with design and engineering. While an industrial customer will have a finished and approved drawing package for a standard heat exchanger, customers will also seek specialized expertise in designing and engineering vessels for custom processes with unique code parameters. This requires the fabricator to create a piece of equipment that meets their unique and challenging specifications.

As in the case of Tate & Lyle’s plant, complexity can start with the original design request. A process engineer will draw up a concept and then turn to a

company like Mitternacht to determine how to create it. According to Lance Covan, owner of Mitternacht, “Our clients will look to us for the code specifications, identify what’s allowable, define what will meet the certifications of the given parameters they have in their plan and also what will not.”

The design of a new complex processing vessel is a product of material selection which itself is based on temperature and pressure considerations. A fabricating specialist will identify all the parameters based on ASME, metallurgical and temperature requirements to meet a client’s process needs.

Once a vessel is designed and engineered, fabricating to meet the performance specifications requires expertise and craftsmanship in metallurgy. And specialized alloys selected for their performance attributes can themselves be inherently challenging. Welding specialized high-grade nickel alloys of up to 99% nickel, such as Nickel 200 for example, is a demanding process.

There may not even be a weld procedure in existence for the client’s specifications. It then is up to the fabricator to define and achieve the weld parameters that have never before been made. Says Covan, “we’ve had to literally write the manual through the process of fabricating the vessel. We will work with metallurgists on the client side who require certain things without the benefit of any real precedent in the market because the weld has never been made before.”

Staying in Code

Metallurgical craftsmanship is also called upon in the repair of corroded vessels. According to Covan, “a lot of highly corrosive chemical catalysts move in and out of exchangers. We can apply overlays of weld metal with a process that build up the thickness lost to corrosion given the caustic environment. It’s one thing to do this with carbon steel, but when you deal with specialty noble metals, this kind of work is highly specialized.”

Industrial quality control specialists like Tate & Lyle’s Linda Rutherford regularly monitor the thickness of vessels to ensure they remain in specification. “A key to durability is selecting the right metals in the first place”,

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says Rutherford. "Then when repairs and maintenance are needed, the code work needs to be completed and recertified. We've asked Mitternacht to repair and complete replacements of pressure vessels and heat exchangers."

Vertical Integration Supports Long-Term Success

With so much invested in the performance, safety and durability of complex process vessels, operators can find a lot of value in working with a fabricator who not

only has expertise in specialized metal alloys but who can partner with them through the entire design-engineer-fabricate-test-support continuum. Not only do fewer handoffs protect the intellectual property of a client's process design and custom vessel needs, but there is less risk of fabricating delays.

According to Covan, "Vertical integration means more control and control means making deadlines. Delivery is critical because we can be talking about millions of

dollars a day at risk for a client. When you can control the entire process, you have a much better chance of meeting delivery deadlines."

Tate & Lyle has had a 20-year relationship with Mitternacht at their plant which is now the only one of its kind in the U.S. Ongoing support includes the fabrication of new vessels, repairs (including rerolling exchanger tubes), replacements of pressure vessels and heat exchangers and fabricating alterations such as cutting in extra nozzles on 2:1 elliptical heads.

Having a trusted relationship with a specialist fabricator who can support an industrial client from design to service is key to long-term success. In the case of the 12-foot diameter specialized alloy column, Mitternacht worked with Tate & Lyle's senior plant personnel including their QA & Engineering teams to plan, design and schedule in-house fabrication, field work, installation, final welding and testing – all within a scheduled plant shutdown of 8 days.

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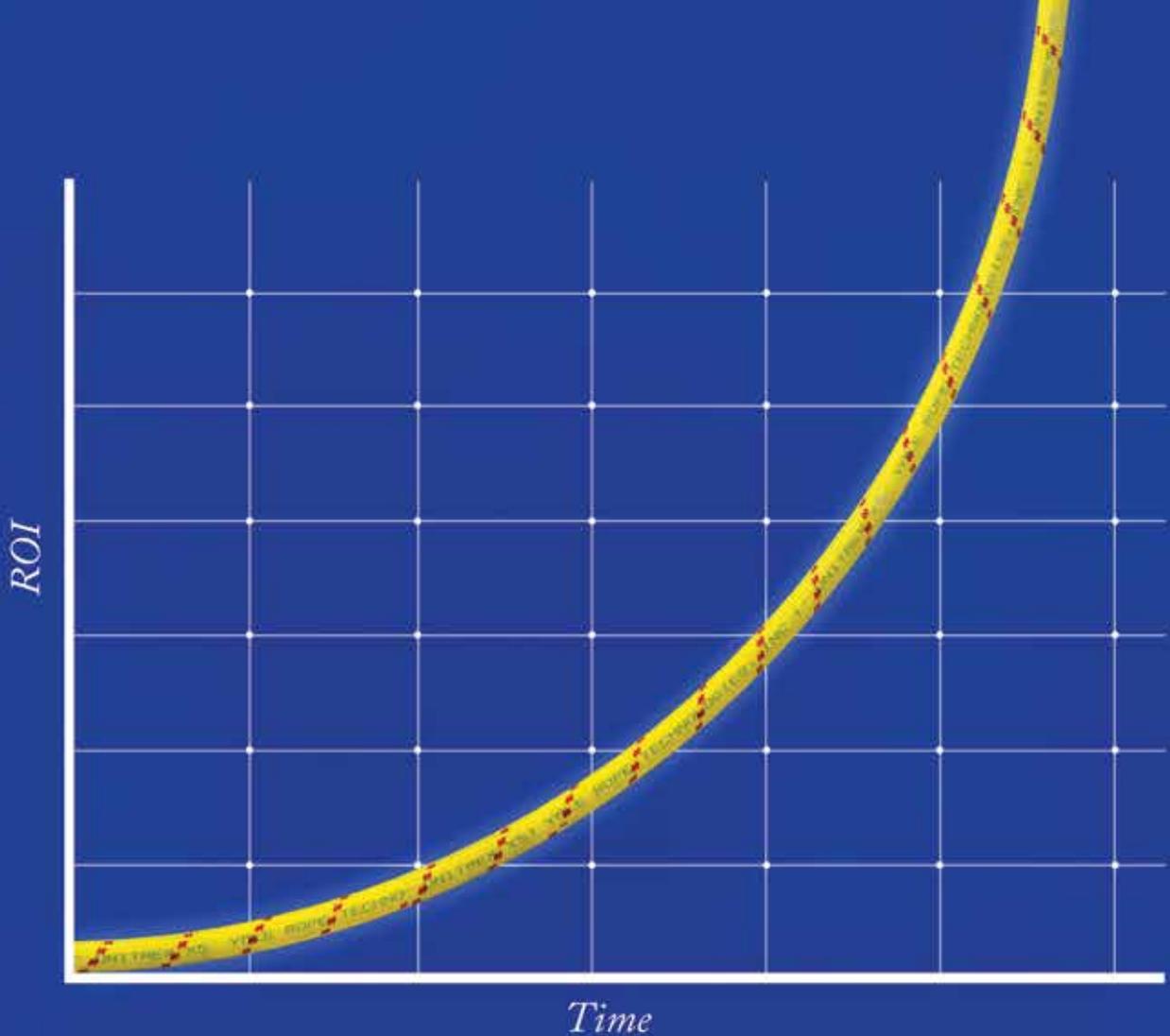
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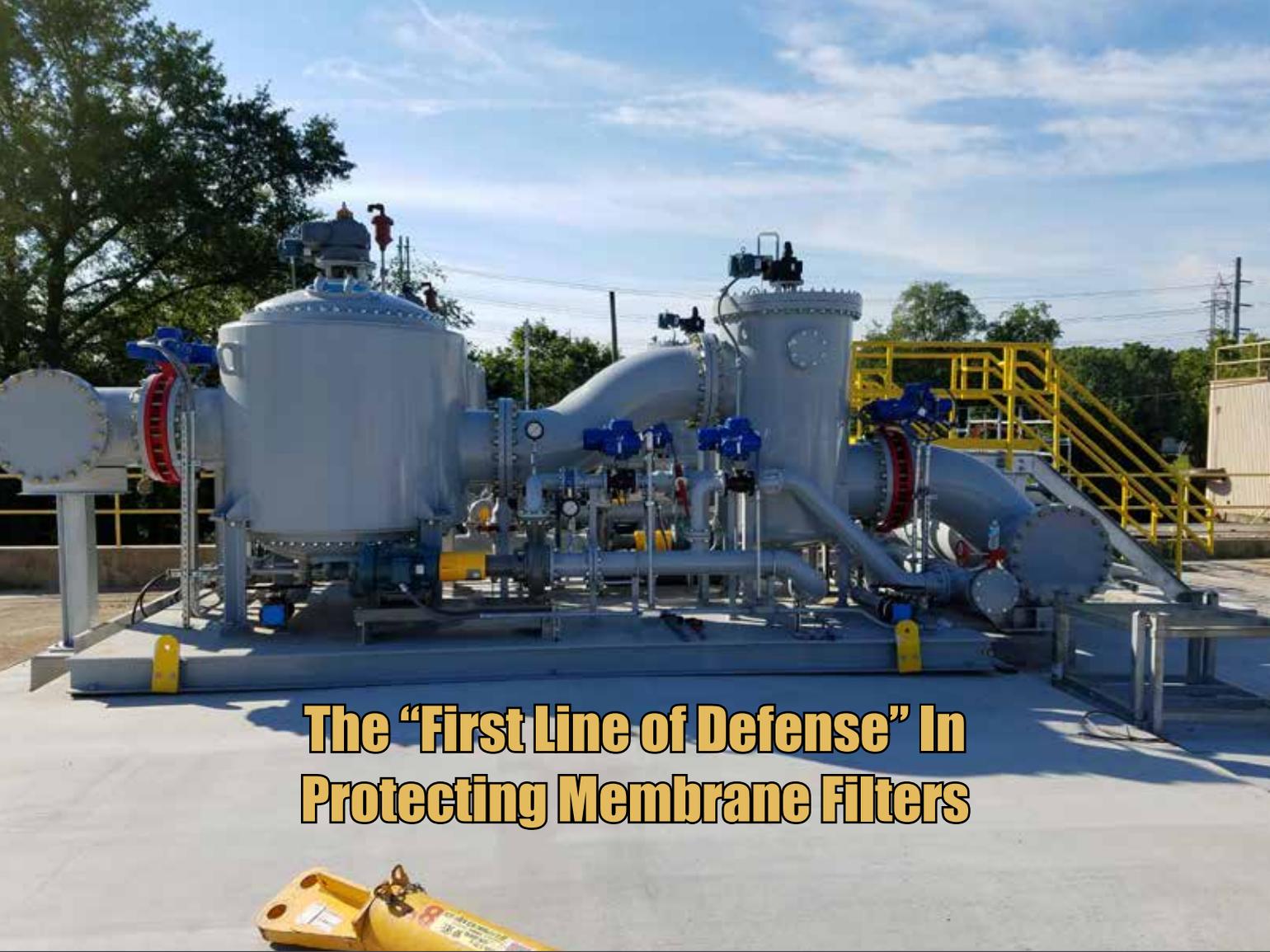


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The “First Line of Defense” In Protecting Membrane Filters

Multi-element, self-cleaning pre-treatment filters optimize membrane filter life and production, while minimizing maintenance and downtime

For municipal water authorities, pre-filtration of water is critical to protect and extend the life of membrane systems, as well as increase intervals between backwashing or necessary maintenance.

Pressure-driven membrane systems utilize thin, porous sheets of material to separate contaminants from water. The technology, in the form of microfiltration, ultrafiltration, reverse osmosis filtration, and nanofiltration membranes, provides superior water quality with less waste than technologies like sand filtration. Because of this, it is commonly used for potable water production and advanced wastewater treatment, including “purple pipe” reclaimed and recycled wastewater applications.

However, without adequate pre-filtering of the water entering the membranes, such systems can be susceptible to irreparable damage from large particles. In addition, water that is not adequately pre-filtered can cause excessive membrane fouling, leading to sub-par water production as well as costly, premature replacement and unscheduled production downtime.



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Fortunately, a growing number of municipalities are ensuring superior water quality, as well as membrane longevity and reliable production, utilizing low maintenance, multi-element, self-cleaning, pre-treatment filters.

Optimizing Membrane Longevity and Production

When a municipal water utilities plant in the Southeast United States needed to protect its membranes filters, a superior pre-filtering system was required.

According to an instrumentation technician who installs, programs, configures, and troubleshoots monitoring devices in the drinking water facility, as soon as the water is pulled from the wells, it goes through a strainer. From there, it goes to other parts of the plant for further treatment and cleaning, with membrane filtration utilized at the end of the process.

“The well water has to be strained,” says the technician. “If the sand got through, it would destroy the membrane. The membrane is sensitive to large particles and expensive [to replace].”

While the facility has utilized a sand strainer, instrumentation technician felt this was too small for the plant’s volume, which produces millions of gallons of drinking water per day.

In response, the plant turned to a multi-element, self-cleaning pre-treatment filter from R. P. Adams, which first introduced and patented the technology in the 1960s and has over 10,000 installations worldwide today.

This design provides an alternative to sand filters, centrifugal separators, and basket type strainers. Unlike those designs, which have limitations in particle size filtration and also require frequent maintenance, the multi-element, self-cleaning pre-treatment filter can provide continuous removal of suspended solids. When utilized as the “first line of defense” for pre-membrane water filtration, it typically filters out sand, silt, and other suspended solids from 500 to 75 microns.

Another significant feature of the multi-element design is in the engineering of the backwash mechanism. With traditional strainers, the backwash mechanism comes into direct contact with the straining media. This can be problematic, as large, suspended solids often encountered with raw water can become lodged between the straining media and the backwash arm. The result is straining media damage and/or rupture that can compromise membranes and other downstream equipment, hindering plant operation.

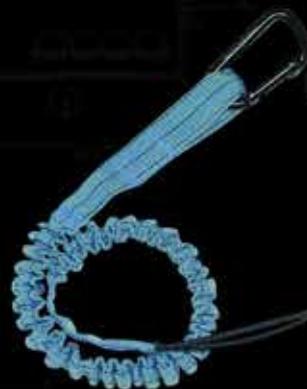
Instead, the multi-element design utilizes a tube sheet to separate the straining media from the backwash mechanism. This prevents the backwash mechanism from coming into contact with the media and damaging the elements, caused by large solids becoming lodged between the media and the backwash arm.

According to the instrumentation technician, the pre-filter has helped to prolong the usable life of the drinking water facility’s main membrane.

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“With pre-filtering, our main membrane functions well for about seven years before it needs to be replaced,” he says. “Without pre-filtering, it would need to be replaced much sooner.”

Municipal water plants also need to consider how to best reduce membrane fouling and required maintenance. Traditional strainers, however, due to limitations in straining area can become clogged quickly. When that occurs, cleaning, media replacement or backwashing is necessary, which adversely affects productivity as well as maintenance costs.

In this regard, the multi-element design provides three to four times the surface area of traditional strainers and pre-filters. This translates directly into less frequent backwashing so less water goes to waste, less power is consumed, and less maintenance is required.

“We have had no real issues since we bought the pre-filter,” says the technician.

When considering pre-filter technology for municipal potable water or wastewater systems, automatic multi-element, self-cleaning, pre-treatment filters are an increasingly popular choice and a reliable, cost effective solution.

For more information contact R.P. Adams, Inc., P.O. Box 963, Buffalo, NY 14240-0963; Phone: (716) 877-2608, toll-free: (800) 896-8869; Fax: (716) 877-9385; E-mail: info@rpadams.com; Visit the web site: www.rpadams.com

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