You Don't Need A New Heat Exchanger

Process industry professionals know all to well that damaged or failed heat exchangers can lead to unexpected downtime and corresponding consequences. While a replacement heat exchanger may seem like the only choice, properly diagnosing and evaluating the root problem should be the first course of action.

When a heat exchanger begins to fail or becomes problematic, it may be indicative of various problems ranging from inappropriate mechanical design to unforeseen chemical reactions.

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A abundance of heat exchangers are used in process lines and power systems for the chemical process industry, for proper temperature control of heat in fluids and gasses.

“There are multiple factors that you need to measure and evaluate, “ says Daniel Bina, President/CEO of American Power Services (APS), a nationwide provider of heat transfer equipment services that include troubleshooting and repairing, to complete rebuilding projects. “Essentially, it is usually best to keep an open mind about whether you can restore the efficiency of heat transfer equipment and thereby extend its life – or whether you must spend the capital and downtime to replace an existing unit with a new one.”

Bina says from his experience, it’s usually more cost-effective and process-efficient to repair or upgrade heat exchangers thus eliminating the root cause of failure

rather than to replace a unit, particularly for the smaller heaters found throughout the chemical process industry. According to Bina, there are several criteria that plant managers and engineers should consider to determine the best course of action.

Performance Analysis

The immediate question to ask is: If your problem heat exchanger is less than 30 years old, then the problem could be due to such factors as water chemistry, cycling, operating controls and a variety of things that could affect dynamics such as velocity and vibration, all of which can be diagnosed.

“If performance appears to be off, or if you have a tube failure, a performance analysis can tell you a lot,” Bina says. “You can verify the flow through the heat exchanger; and also the temperatures in and out. You verify those and the pressure drop across the heat exchanger’s tubes. All of those tests will give you an indication of what is off of normal performance parameters. If it is a tube failure, which does occur, where is the tube failure located? Is it near an inlet, or near an outlet or a baffle? Where is it in relation to other parts of the heat exchanger?”

Troubleshooting Assistance

If a performance problem is evident, users may be able to solve the problem themselves. Bina suggests that users first phone their service professionals and describe the situation.

“Their service provider should be willing to advise the user about troubleshooting the problem: what specific things they can do to diagnose and pinpoint the damage, and possibly how to repair it themselves,” he says. “For instance, our organization has half a dozen people always available to provide that type of service, which can save users considerable time and costs.”

New heat exchanger shell that was fabricated by APS for a process line at a leading national brewery. The white coating is an epoxy that helps to reduce corrosion.

Professional Testing Methods

If the problem is difficult to diagnose, or the severity requires comprehensive

analysis, the user will normally call in the service provider to perform sophisticated testing so that appropriate repair recommendations can be provided.

“There are several types of testing methods available to pinpoint the problem,” Bina adds, “such as eddy current, ultrasonic, hydrostatic and magnetic particle testing, depending on what the situation requires.”

Among the many types of testing, eddy current testing can tell you the most regarding the overall condition of a heat exchanger. This nondestructive test involves sending a test probe down a heat exchanger tube. The probe determines where the defect is located along the length of the tube. It also determines the type of defect, measures the severity of the defect and its probable cause.

Pulling a Tube Sample

In many instances it is necessary to cut and pull a tube sample out and diagnose the exact failure area to determine the root cause of failure, whether it’s chemistry, a failed weld, pitting or stress cracking of tubes, as well as the percentage of tube wall loss. Thorough analysis will also indicate whether impending tube failures are imminent, and over what period of time that will likely happen.

In high-pressure heat exchanger applications, pulling a tube sample by cutting inside the tube can be very difficult. For that reason APS developed its own tool, a unique plasma ID tube cutter that can penetrate heavy-duty material such as .120-wall stainless steel, making it possible to cut anywhere along the length of the tube.

“Extracting a tube sample can go a long way toward indicating whether a heat exchanger can be repaired rather than replaced, and what repair procedures are required as well as the time that is likely to be involved.

Simultaneous Test & Repair

Process Heat Exchanger Tube Bundle Rebuilt by American Power Services

The criteria for choosing heat exchanger repair versus replacement varies from heat exchanger to heat exchanger based upon a multitude of criteria. Downtime can certainly be a deciding factor. However, in many instances downtime can be

virtually eliminated through the service provider's abilities to test and repair simultaneously.

"In many instances the same people doing the testing can do the repair work," says Bina. "By doing both at the same time we often limit downtime to just a few hours. Of course, the user could call a testing laboratory that will do the testing and give you a report with a recommendation as to what repairs might be required. But then the user will have to call in someone else to service or replace the damaged or failed heat exchangers. So, you've kept your downtime to an absolute minimum by using a service that has the capability of testing and repairing the problems right away."

Bina points out that some repairs require slightly more time. For example, if testing indicates stress cracking in some heat exchanger tubing, the quickest solution – or at least a temporary one – may be to sleeve the ID tube in order to eliminate the leakage as well as containing the cracking problem. Sleeving can typically be done within a day or two, thereby diminishing downtime and consequential problems.

Rebuild vs. Replace

In cases of more extensive damage to heat exchangers or other tubular heat transfer equipment, the service provider's recommendation to rebuild or replace the unit may hinge on their capabilities or inclination to sell new equipment. Yet, the choice to replace can have a huge impact on both replacement and downtime costs.

Bina cites a recent instance at a nuclear power plant where a low-pressure feedwater heater had stress cracking at various locations along the tube length within more than 700 tubes. APS was able to sleeve the entire array of tubes in just a few days, enabling the unit to stay online and thereby optimize performance while eliminating months of heater related downtime.

In other cases replacement is unavoidable, yet the months of waiting for a new unit can be tremendously expensive, particularly in process operations. In one such instance a process plant lost both redundant heat exchangers.

"The whole process was shut down. So, the plant went to several manufacturers to see what the lead-time would be to get a replacement heat exchanger. They would have ended up waiting several months for the different components of a replacement heat exchanger to be fabricated and assembled. Fortunately, by using materials that were already in stock, we were able to design a heat exchanger that was delivered within six weeks of receiving the purchase order. The customer saved a significant amount of money by getting their processing line back online months ahead of the time that would have been otherwise required."

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