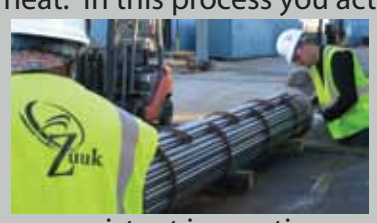
Heat Exchangers and Coolers

Heat exchangers are essential production equipment found in most manufacturing and processing industries. Failure of these mission-critical components can cause lost revenue and unplanned downtime ranging into millions of dollars. Heat exchangers and their components are subject to potential failure with even the most moderate use. Erosion, corrosion and other damage-inflicting elements can cause the need for intensive maintenance.

The principle function of a heat exchanger (or cooler) is to transfer heat from one media to another. Typically, a fluid (or air) runs through [around] a tube system that encapsulates another fluid. The fluid in the encapsulated tube essentially surrounds all of the surface area of each tube in the tube system. By design, the more surface area exposed to the fluid equates to more transfer [exchange] of heat. In this process you actually have three actions of heat transfer:

1. Convective heat transfer from fluid to the inner wall of the tube;
2. Conductive heat transfer through the tube wall; and
3. Convective heat transfer from the outer tube wall to the outside encapsulating fluid.



Most systems are resilient to degradation; however, it is imperative that they be monitored and undergo consistent inspection, maintenance, and repair if necessary. Detecting erosion, steam impingement, and tube failures is key to reducing the impact of a potential critical failure.
During normal operation, materials (dissolved minerals, coke, organisms, etc.) adhere to the heat transfer surfaces. This act of deposition, commonly referred to as scale, is called "Fouling" when referencing a heat exchanger. Basically, this is an inevitable and accelerating process that leads to compounding increases in operating costs and lower product yields. Fortunately, periodic and planned cleanings and inspections can prevent or deter lost efficiencies and profits.

As a unit works its way through its lifecycle, the walls of the tube system will thin and the tube sheet will corrode. This will eventually cause leaking at the joint. In the early stages of failure, a re-rolling of the tube may temporarily deter the leak. As the leak returns, it will become necessary to plug the tube opening(s), blocking any fluid from entering and nullifying the leaking tube. Tube plugs are relatively quick and inexpensive; but the tube is no longer contributing to heat transfer and the pressure on the remaining tubes will increase. Increased pressure (velocity) in the remaining tubes will accelerate tube wall erosion.

It is industry practice to plug leaking tubes as a temporary solution;
however, such a required action should signal to the owner/operator that:

1. There is oncoming loss of efficiency in the unit (tube side pressure will drop).
2. Tube side velocity will increase causing acceleration and promote tube wall erosion.
3. The unit needs to be cleaned and evaluated.

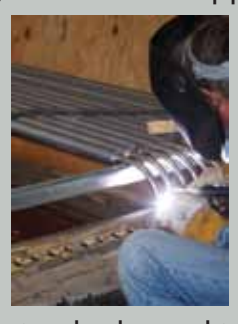
The general rule of thumb is that up to 10% of the tubes in an exchanger can be plugged. After this point, the following repair methods should be considered:

- Partial Re-tube
- Complete Re-tube
- Replacement

ZuukCM provides cleaning, inspection and Repair of Industrial and Commercial Heat Exchangers and Coolers

- "R" stamp repair
- "U" stamp fabrication
- Chemical cleaning
- Custom manufacturing
- Header repair/replacement
- Individual tube isolation
- In-house NDT
- Machining
- Mechanical cleaning
- Modification and pressure calculations
- Pressure Testing (hydro)
- Re-rating
- Re-tubing
- Reverse engineering
- Tube bundle repair
- Tube plugging
- Tube sheet repair
- Vacuum testing

A partial re-tube is basically another version of a Band-Aid and is usually very temporary. If a unit is slotted to be taken off line permanently at some point, this may be the appropriate choice. If a unit needs to be replaced, it can either be refurbished or supplemented with a new unit. Oftentimes, it is less expensive to purchase a new unit from the original manufacturer, but this is only viable if the unit is common and in stock. Most heat exchangers are custom built for mission-critical systems in unique operating systems. Unless there is significant planning, it is rare that such a unit is readily available. Thus, refurbishing an existing unit (complete re-tube) would be the appropriate call to action.



The purpose of refurbishing a heat exchanger is to return it to a standard, equal to, or better than the original specification. This can be performed in a dedicated facility or in the field. Many units have to be re-tubed onsite. It is not unheard of to replace thousands of tubes in excess of thirty feet in length without removing the unit from its place of original field construction. Examples include: turbine condensers, tubular air heaters, and high-pressure water heaters.

At times, it may be necessary to rerate a unit. This occurs when production processes and techniques require alterations and/or upgrades. Existing exchangers can be re-rated based upon current operating conditions to the current version of the ASME code. With the correct information, we can perform all of the calculations necessary to ensure compliance. In conjunction with an updated hydrotest and an ASME inspection, the exchanger will receive a new nameplate.

Some of the more challenging projects arise when the original manufacturer is no longer in business and/or the drawings are unobtainable. If a unit is recognizable and measurements and templates are possible, a replica can be created.

New Vs. Refurbished

If an owner/operator needs to replace a standard unit that can be bought "off the shelf", it is probably the best practice to buy from a large wholesaler. If this is not the case, refurbishing may be the optimal path.

It is a common misconception that a "retube" should cost less than a new unit. In fact, it is more often that a refurbished unit cost 10% to 40% more than a new unit. So, why would you pay such a premium?

Sometimes, the manufacturer is no longer in business, but the empirical reason is time. Most OEM's will only begin production of new units after receipt of an order. Thus, the lead time on some units can be up to several months. Alternatively, a custom fabrication facility, such as Zuuk CM does not have process constraints such as that of a large manufacturer.

So why does it cost more? With a refurbishment, there is the additional cost of deconstructing the unit prior to reconstructing it. More simply, you have to take apart the old one to get the re-usable components which are key to the reconstruction, i.e. the tubesheets, baffles, tie-rods, etc.

Why such a range in projected cost? It all depends on how quickly a unit needs to be back in service. Zuuk has facilities that are designed to run around the clock to meet the most aggressive deadlines. The more aggressive the schedule, the more expensive it is to meet it.

About Zuuk

Zuuk International has three divisions: Industrial, Inspection and Commercial/Mechanical. **Zuuk Industrial** focuses on high-quality, high-profile time-critical [capital repair/construction] projects, governed by the most stringent mechanical and nuclear codes. **Zuuk Inspection** offers a full spectrum of non-destructive testing and examination services under codes including NQA-1, ASME, API, AWS, AWWA, ANSI, ABS, MIL-STD, ASTM and others. **Zuuk Commercial/Mechanical (ZuukCM)** provides maintenance, routine repair, mechanical modification and service.