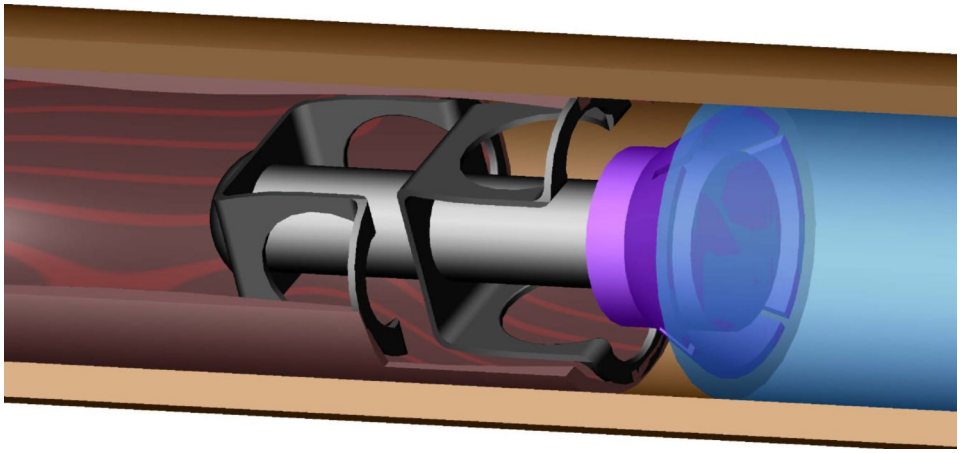
CARBON STEEL INSPECTION, INC
VERSA INTEGRITY GROUP

CSI Tech Brief

U-Tube Cleaning Service No. 007 Rev. 00 1/13/03

Why Clean?



We at Carbon Steel Inspection are often asked to provide a general description or background information on our ID u-tube cleaning service. There are various methods, technologies and manufacturers of ID tube cleaning products on the market today. This Tech Brief only addresses our implementation of the technology and equipment from our perspective and bias and does not imply the capabilities or limitations of any system, component, manufacturer or vendor's performance.

THE BASICS

Whether you call it tube fouling, deposits or scale they all have a couple of things in common. They restrict flow, increase pressure drop and decrease thermal performance. Depending on the application a poorly operating shell and tube heat exchanger may detrimentally affect the entire system. For instance, in a high pressure feedwater heater a thin film or protective scale is necessary to protect the tube from a corrosive chemical attach and its formation has been taken into consideration in the overall design of the heater, but scale or deposit build-up which is caused by a chemical imbalance within the system results in poor performance and may reduce the online reliability and life of the heater.

The reduction in performance by the formation of scale and deposits can be detected by a decrease in the total temperature rise across the heater (feedwater outlet temperature minus the feedwater inlet temperature). Heavy deposits will also be coupled with an increase in the pressure differential across the heater (feedwater inlet pressure minus feedwater outlet pressure). If the pressure differential becomes too large then it usually results in a distorted pass partition plate or manifests itself with cracks in the weld joints of the division plate.

TYPES OF CLEANING METHODS

There are several widely used methods used to clean the ID of tubes or pipes. The first is chemical cleaning which requires advanced knowledge of the type and amount of scale or deposit to be removed. Then one can estimate the dwell time the chemical s are required to stay in the tube or pipe in order to dissolve the calculated amount of scale. Usually this process is the most expensive and requires disposals of the chemicals which can be hazardous to the environment. The second is hydrolancing which utilizes high pressure water pumped through a flexible hose or rigid line sprayed through a nozzle jet in order to knock off the scale or deposit on the tube or pipe.

The harder and more tenacious the deposit the higher the applied pressure is required in order to remove it. The number of passes, insertion and retraction rates of the probe are determined by the spray pattern, pressure and type of deposit.

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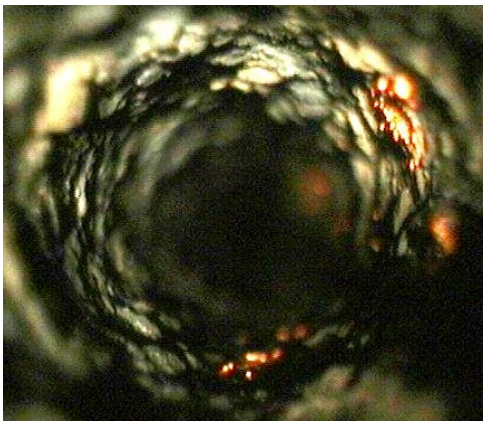

Hydrolancing can be implemented manually or automated.

However, in confined spaces especially in a hemi-head feedwater heater, there becomes a safety concern. Applying this process using pressures that can puncture the body ends up being a high safety risk. The third and last is the mechanical cleaning process which encompasses any use of a brush, drill bits or scraper style. Typically these methods use only manual push and pulling of a poly or hose shaft through the tube/pipe. They combine either air or water to flush the deposits or scale out of the tube. Most often these methods are extremely slow, limited to the straight length and not cost effective on a large production basis.

U-BEND SCRAPER

Shown in Figure 1, the u-bend scraper is sized according to traverse the smaller radius of the u-bend tubes located in the inner rows. The spring steel or plastic scrapers are loaded into the inlet side tube under tension so the edge of the scraper will knock off the scale or deposits. The scraper is forced through the tube by using a relative low pressure but high volume of water. This forces both the scraper and debris out of the opposite end of the tube. This process offers the customer a cost effective high production rate performed under safer conditions than a comparable hydro lancing service.

The longevity of the scrappers depends on the tenacity of the deposit and length of tube. We recommend using the scrapper 6 times or less in order to achieve the maximum cleanliness. On first time jobs we have to be prepared for worst case situations and may order more scrappers than average. Typically, the scrappers are sized to fit snuggly in the tube with +.030" interference but will have to downsize due to stainless steel inserts or ID restrictions from heavy deposition. The later occurrence requires that a downsized scrapper be used for the first pass then re-shoot the tube with the up-sized scrapper in order to accomplish the desired cleaning.

There exists an a small percentage of the scrappers do get stuck in tubes from heavy blockages, dents or foreign debris. Most of the time these scrappers can be flushed-out by back flushing the scrapper. Sometimes they can not and the customer has to disposition these scrappers with the required action to take. Here are the common reactions from our customers:

1. If it passes water then leave the scrapper in the tube because it won't see more pressure when operating at steady state.
2. Customer will contact their plugging vendor to plug the tube.

Overall, tube cleaning improves the performance of the heater and tube inspection results. If the tubes are dirty it decreases the sensitivity of the tube examination, increases the possibility for false calls and increases the chances for getting a probe stuck in the tube.

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