

Optimized Tube Plugging for Air Cooled Heat Exchangers Results: Improved performance and at significantly lower costs

Abstract

The Pop-A-Plug® system is a mechanical tube plug, as described in ASME PCC-2, and is used to seal leaking or degraded tubes in heat exchangers. This document describes the successful implementation of this process on several offshore platforms operated by a customer and covers the specific requirements for the ACHE (Air Cooled Heat Exchanger) units. The objective was to completely eliminate hammer in/welded plugs, which were inherently difficult to install and remove, and eliminate the resulting stress and damage caused to the tubesheet. This document provides an update on the technical developments and successes of the Pop-A-Plug® technology for ACHE, (or Fin-Fan®), units.

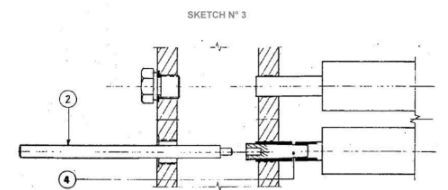
Introduction

A large multi-national oil and gas refiner operates a significant number of offshore platforms that use ACHE. Both Eddy Current and IRIS non-destructive examination revealed the ACHE have experienced tube leaks and degradation with up to 80% wall thickness loss due to age. The customer contacted the EST Group in December 2013 to review the servicing program of the ACHE because the EST Pop-A-Plug® system was used with great success on their conventional Shell and Tube heat exchangers. EST Group was asked to provide a solution eliminating their current method of hammer in and welding plugs.



Problem Description

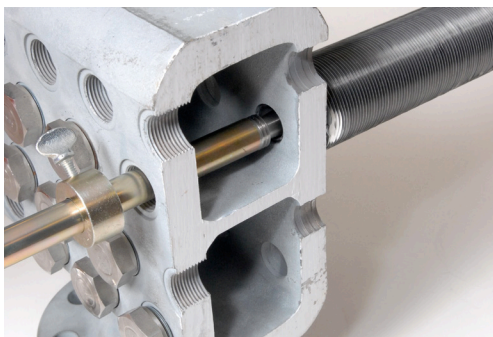
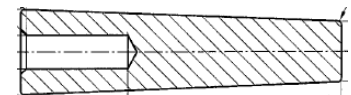
The customer's previous method of plugging the tube was to hammer-in a conical plug, using a threaded extension to reach through the plug hole of the manifold. At higher pressures, the plug was welded in place. Their procedure had the following warnings: "Do not strike too heavily to avoid damaging the tube sheet boring" and "Expert welding is needed as no NDE of weld is possible".



Application Details

The main repair challenge with ACHE units is at the tubesheet where the tube requiring plugging is recessed (4" - 24") deeper than the point where the service plugs are located (red arrow). This requires the use of modified tools to access this "remote" plugging point "at depth".

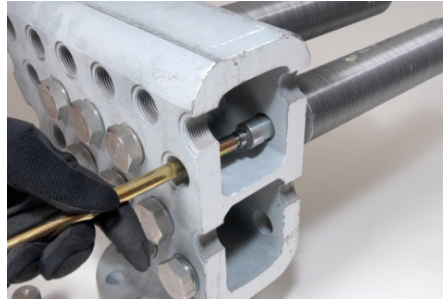
Tools were developed that solve the issue of installation of the plugs at depth, including G-150 Test Guns, Tube Preparation brush kits, Go/NoGo Gauges, Pop-A-Plug® Ram, Channel Pull Rod Assembly, and Pop-A-Plug® Heat Exchanger Tube Plugs. EST Group ensured all the steps taken during the Pop-A-Plug® installation process could be executed with simple tool extensions allowing each step to be done "at depth".



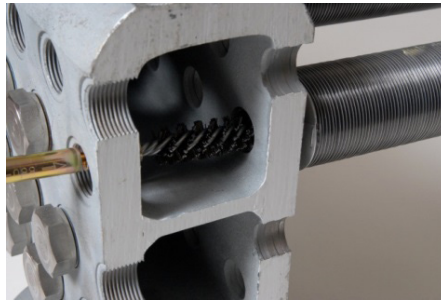
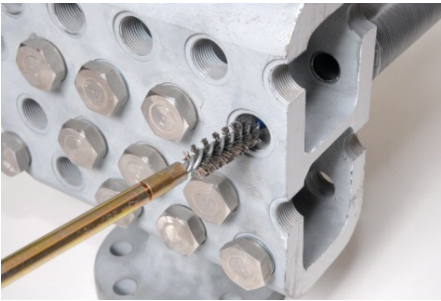
Solution

The customer determined anticipated wall thickness losses from data obtained during testing and selected a range of Pop-A-Plug's in both Medium pressure CPI/PERMA and High Pressure P2 series to bracket the anticipated inside diameters.

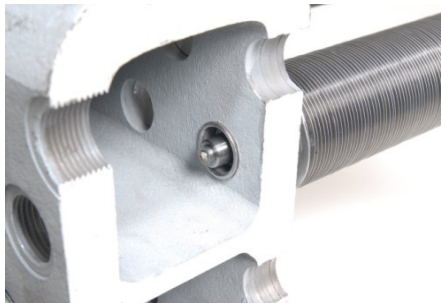
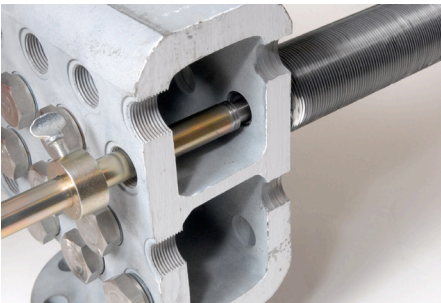
Tube Gauging (Determining actual tube inside diameter for correct size Pop-A-Plug®)



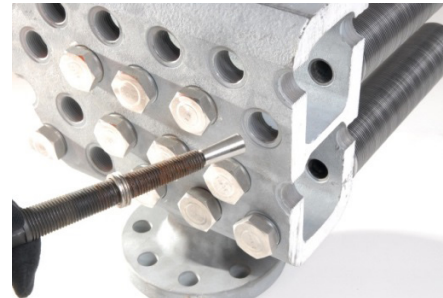
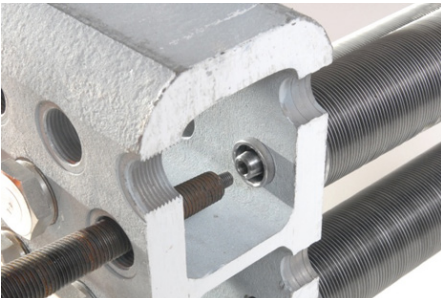
Tube Brushing (Cleaning inside of tube of scale, rust, debris etc. for a clean surface)



Plug Installation (Installing Pop-A-Plug® inside the tube sheet at depth)



Removal (Easy removal of the installed Pop-A-Plug® in preparation for re-tubing)



Conclusion

The customer reported the test plugging of ACHE units with EST Pop-A-Plugs was completed successfully and resulted in “very significant savings”. Subsequent to approval in December 2013, the customer has placed eight additional orders for product in excess of 3000 Pop-A-Plugs.

Reduced Downtime

Average Installation time 2 Minutes per plug.
No weld permits required.
No expert welders required.
No damage to shoulder / service plug threads.

Note

The customer reported an ACHE Unit requiring 20 tubes to be plugged was back in operation in ONE hour after the unit was handed over to maintenance (work release) using the EST Group Pop-A-Plug® system. Using the previous method of hammer in and weld plugs, an average downtime of 18 to 26 hours was recorded.

Re-tubing

The customer reported in the past that several ACHE units had to be scrapped halfway through the re-tubing process due to severe damage as a result of stress cracks and weld effects at the tubesheet. Using the EST Group Pop-A-Plugs, the cost for retubing of units was significantly reduced since no hammer-in welded plugs had to be drilled/removed. In addition, the tubesheet suffered no damage from the plug installation procedure.