

To: *Whom it may concern*

From: *Stefan Foot*

Tel: *071 865 2518*

Date: *20-Aug-18*

File: *ME.18.0483*

Memo revision number: *Rev. 01*

Memorandum:

Sealing of heat exchanger tubes by means of expanding plugs

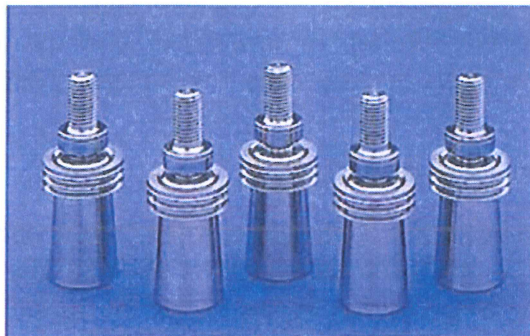
1. Introduction

During the September 2017 shutdown the tubes of a heat exchanger were damaged during maintenance work. This required a repair to be performed in order to plug the affected tubes. However, due to the configuration of the heat exchanger, it was very difficult to get a proper seal weld on the plug. This prompted an investigation into alternative methods of plugging.

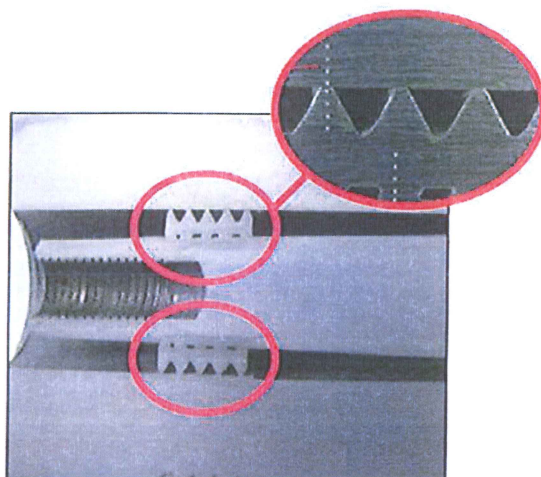
One of the most viable options was the use of expanding metal plugs (Pop-a-plugs). These plugs could be installed into a tube or tubesheet without the need for welding and can be done on site with the equipment in-situ. This memorandum addresses the requirements for the use of such a plugging method.

2. Pop-a-plug technology

Pop-a-plugs utilise a tapered plug which expands a serrated ring which bites into the tubes or tubesheet of the affected heat exchanger. These plugs can be installed by a hand held tool on site by an artisan using plant air and does not require welding. These plugs can be left in-situ for the entirety of the equipment's remaining life, but can be removed without the need for drilling.



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The use of these mechanical plugs are supported by ASME PCC-2 Article 3.12 paragraph 4.2 (c) and is currently considered best practice for heat exchanger plugging by ExxonMobil and Shell. Standard sizes and materials plugs are kept in stock by the supplier and can be provided to the plant with a very short lead time. Training for the installation of the plugs is also provided by the supplier. Extension pieces are also available that will allow for the plugging of plug-type air cooled heat exchanger headerboxes. The current supplier, Valcon, is on SSO's approved Vendors list.

3. PER and Code Compliance

As the plug technology is a listed option in PCC-2, which is a listed health and safety standard according to the PER, the use of these plugs is deemed an acceptable repair according to the PER. The only issue that needs to be addressed with each order is to ensure the material selected is fit for the process stream and is listed in the correct Sections and Tables of the relevant health and safety standard. For example, stainless steel may be acceptable from a metallurgical perspective but for an acceptable repair on an ASME BPVC Section VIII Division 1 exchanger, it needs to be made from a material such as SA-479.

4. Mechanical Engineering Involvement

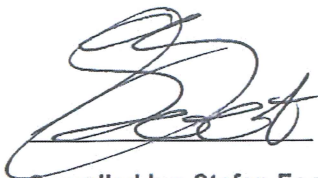
As the plug selection depends on the tube and tubesheet material, tube diameters, product, pressure and temperature, each exchanger (or similar exchangers) will have unique plugs. These plugs are specified by the supplier after the document in Appendix A has been completed by the plant mechanical engineer. Once the plugs have been specified by the supplier it is the responsibility of the plant support mechanical engineer to review the quote supplied in terms of the material of the plug to ensure that the material is a listed material

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acceptable to the code of construction and that material certificates are supplied with the plugs.

5. Recommendation

It is recommended that mechanical plugs (Pop-a-plugs) are considered as a viable alternative to welding and hammered tapered plugs as a means of sealing damaged mechanical tubes on heat exchangers (including fin fans). The quality and quantity of the plugs to be used are to be verified by the plant mechanical engineer. This includes sizes, materials and code compliance. It will be the responsibility of the GMR 2.1 to train relevant personnel in the installation and maintenance of the plugs as well as to institute a system of record keeping.



Compiled by: Stefan Foot
Designation: Mechanical Engineer




Approved by: Hugh-Jean Nel Pr. Eng.
Designation: Senior Mechanical Engineer

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Appendix A: Tube Plugging System Application Sheet

SSO Mechanical Engineering: Memo

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Pop-A-Plug® Tube Plugging System Application Sheet

Date	
Company	
Contact	
Phone	
E-mail	

Device Type	Heat Exchanger	
	ACHE	
	Condenser	
	Other	

Installation Type	Near End Tube	
	Near End U-Tube	
	Through-The-Tube	
	Tube Sheet Plugging	
	Tube Stabilizers	

Please provide as much information as possible

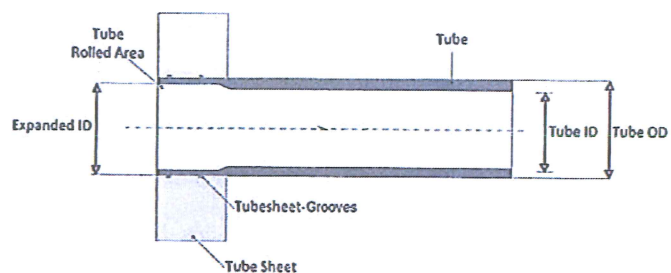
Heat Exchanger / Condenser Info	
Tag Number	
Shell Side Pressure (units)	
Tube Side Pressure (units)	
Max Temperature (units)	
Hydrotest Pressure (units)	
Tube Side Media	
Shell Side Media	

Tube / Pipe & Tube Sheet Info	
Material (Tube)	
Material (Tube Sheet)	
Tube OD (units)	
Tube ID (units)	
Wall Thick/BWG (units)	
Tube to Tube Sheet Joint	<input type="checkbox"/> Expanded <input type="checkbox"/> Welded <input type="checkbox"/> Exp. & Welded <input type="checkbox"/> Other

Order Info	
PAP Part Number	
Number of Kits	
Date Required	
Expedite Required	
QA Docs Required	<input type="checkbox"/> QADOC-COC <input type="checkbox"/> QADOC-1 <input type="checkbox"/> QADOC-2 <input type="checkbox"/> QADOC-4 <input checked="" type="checkbox"/> QADOC-5

Additional Information**Additional Equipment**

- | | |
|---|--|
| <input type="checkbox"/> Installation Ram Kit | <input type="checkbox"/> Brushes |
| <input type="checkbox"/> Manual Installation Tool | <input type="checkbox"/> Go/No-Go Gage |
| <input type="checkbox"/> Pull Rod | <input type="checkbox"/> Extension |
| <input type="checkbox"/> Channel Head Pull Rod | <input type="checkbox"/> Taper Reamer |



North, Central & South America
EST Group Corporate Office
2701 Township Line Road
Hatfield, PA 19440-1770 USA
P: +1.215.721.1103
+1.800.353.7044
F: +1.215.721.1101
est-info@curtisswright.com

Europe / Middle East / Africa
EST Group B.V.
Hoon 312a
2404 HL Alphen aan den Rijn
The Netherlands
P: +31.172.418341
F: +31.172.418649
est-emea@curtisswright.com

Asia Pacific
EST Group Asia
35 Tannery Road, #11-10 Tannery Block
Ruby Industrial Complex
Singapore 347740
P: +65.6745.8560
F: +65.6742.8700
est-asia@curtisswright.com

China
EST Group China
Rm 3709, China World Office 1
No. 1 Jan Guo Men Wai Avenue
Beijing, 100004
P: +86.10.65055956
F: +86.10.65050066
est-china@curtisswright.com