

How to increase the performance of VOP Heat Exchangers ?

Introduction

Vertical One Pass (VOP) heat exchangers are many times applied in urea plants. As the residence time in these heat exchangers is small, unwanted side reactions like biuret formation and hydrolysis of urea are limited. Liquid enters the tubes of the heat exchanger at the bottom side via a control valve. Due to the pressure drop over this control valve some flashing will occur. Further more the heat input from the shell side also will result in gas formation. The gas causes a turbulent environment at the tube side increasing the heat exchange co-efficient.

Problem description

Some phenomena however can limit or reduce the performance of these heat exchangers. One is a bad distribution of the inlet liquid / gas mixture over all the tubes. Some tubes can more feed, others less and maybe even recirculation from the outlet to the inlet occurs all limiting the performance. Another problem can be fouling on the tubes side, which causes limitations of the heat exchanger.

Solution

The more turbulence on the tube side of VOP heat exchangers, the higher the heat transfer co-efficient, the better the performance of the heat exchanger and the lower the risk that fouling can settle on the tube side.

It is common knowledge that orifices at the inlet of the tubes improve the distribution over all the tubes, increase the turbulence on the tube side, reduce the fouling on the tube side and thus increase the performance.

UreaKnowHow.com is able to offer restriction orifices, which are a combination of PTFE and stainless steel. The large expansion coefficient of PTFE and conical shape assure a reliable fit.

The restriction orifices are easy and quick to install and remove without any welding so that cleaning of the tubes can be done without any problems. The installation procedure is simple: Lightly hammer a cold restriction orifice in each tube end. Removing can be done very easy by hand with a simple small hook.

These restriction orifices have been very successfully in operation since 2004 in LP and MP recirculation heaters and have proven to be very reliable and effective.

Bank address:

RABOBANK Maastricht e.o.

P.O. Box 200
6200 AE Maastricht
The Netherlands

BIC: RABONL2U

Account number: 1402.09.840

IBAN: NL07 RABO 0140 2098 40

UreaKnowHow.com B.V.

Chamber of Commerce: 52907090

VAT number: NL 850659024.B.01

The picture below shows all restriction orifices are neatly in place after opening the heat exchanger during a turnaround after two years of operation.



Another advantage of installing a restriction orifice in each tube over an orifice plate is that there is no risk of bypassing and mal distribution. Finally, the costs of these restriction orifices are significant lower.

References

Already since 2004 SKW in Germany has installed successfully these specially designed orifices in their three E302 (low pressure recirculation heaters) and the E312 (medium pressure recirculation heater). Due to the special design, the orifices can be installed very easily into the bottom tube sheet of heat exchanger tube ends.

A slight press fit holds the orifices in position. During the operation the orifices were never pushed out.

The orifices can be easily disassembled with a simple manual tool. There fore the cleaning of the HEX-tubes can be done very quickly. The orifices can be reused at least two times again.

Conclusions

UreaKnowHow.com is able to offer reliable solution to improve the performance of VOP Heat Exchangers. Since 2011 this solution has been proven and increases the performance and reduces the fouling tendency in a medium and low pressure recirculation heater. The restriction orifices are very easy and quick to install and remove during a shut down when one wants to clean the tubes.

Offer

UreaKnowHow.com can offer you the detailed design and/or supply the restriction orifices. After removal of the existing welded plugs, one can immediately install these removable orifice plugs.

For more information please contact:

Mark Brouwer, UreaKnowHow.com via mark.brouwer@ureaknowhow.com