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SYMPOSIUM 2022

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WORKSHOP relining job and associated hydrotest

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INTRODUCTION

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- Why is a relining needed?

Because of severe damage of the liner plates and liner welds caused by Strain Induced Intergranular Cracking (SIIC) ,severe condensation corrosion, thinning but as such that the integrity of the HP equipment is at risk.

- Where is a relining needed?

Most of the time at the top of urea Reactors in the gas phase zone but as well in less extent in other HP equipment such as Stripper, Scrubber and HPCC as well in the gas phase zone.

INTRODUCTION

- Which liner material is affected most?

Most are liner plates made of BC01 (316 UG) but in few cases observed in BC05 (25-22-2) liner plates.

Never observed in Safurex plate material because not sensible for condensation corrosion and because of the high mechanical properties.

- When do you perform a relining?

Recommended to start preparation as soon SIIC is observed but performance could be well planned in a turn around depending on crack depth.

Propagation of the crack is low but the propagation rate is not predictable.

INTRODUCTION

- Which material to be chosen for the relining?

Existing BC01 (316 UG) liners plates should be replaced by BC05 (25-22-2) new liners plates.

Existing BC05 liners plates should be replaced by BC05

Replacement by Safurex liner plates is not common and provide no benefit for old reactors.

Common thickness of BC05 plates: 6.0 mm

INTRODUCTION

Relining job is a complex activity and should be performed in 3 phases:

- 1- Preparation
- 2- Execution
- 3- Final inspection



Preparation
phase

Preparation phase

- Detailed relining procedure “tailor made” based on Stamicarbon expertise
- Purchase/ Delivery of “tailor made” BC05 liner plates, welding consumables and accessories
- Welder ‘s qualification
- Intermediate inspections

Preparation estimated lead time could be 3 to 6 months.



Execution
phase

27/11/2021

Execution phase

Mostly during a planned Turn Around but in few cases as urgent repair

- Safety check confined space
- Team building with contractor
- Removal of old/damaged liner plates
- Assessment Carbon steel for possible damages
- Repair of Carbon Steel wall if necessary (could be an issue)
- Fit up of the new liner plates followed by inspection
- Welding of the root runs

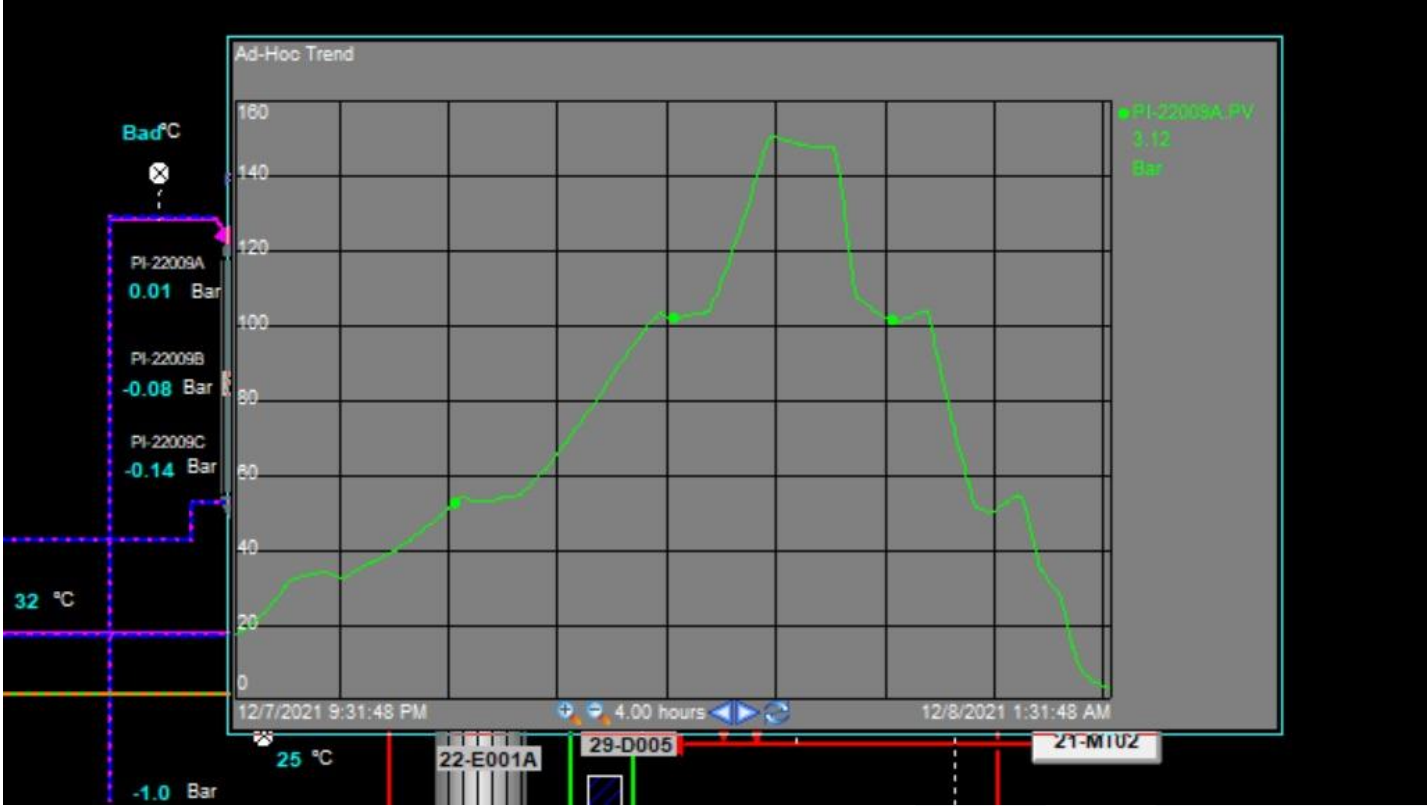
Execution phase

- Test root runs followed by inspection

One of the inspection will be the so-called air/soap test by pressurizing throughout the corresponding leak detection system. The same test system will be used during the ammonia leak test in a later stage (final)

- *Completion of liner welding following by execution closing inspection:*
 - *Visual inspection, as built drawing*
 - *Liquid dye Penetrant examination all welds*
 - *Ferrite measurement of the weld (for BC05 Fe <06%)*
 - *Gap measurement between liner and Carbon steel wall Before Hydrotest*
- Execution lead time is depending on the extent of the relining but fit mostly within a turn around schedule.

Final inspection phase



Final inspection phase

Final inspection is divided in several stages:

- Hydrostatic pressure test of well Hydrotest (Performance could be an issue)
- Visual inspection
- Liquid dye penetrant examination (DPT)
- Ammonia leak test (more reliable than Helium leak test after hydrotest)
- Gap measurement between liner and carbon steel wall after hydrotest. Gap should reduce after hydrotest

Lead time of the final inspection is mostly related to the performance of the hydrotest.

Final inspection phase

- Do we need a hydrotest?

Yes of course anyway by local regulation, plant practices, etc. in order to test the integrity of the HP equipment.

- But after a relining job the hydrotest is compulsory to :
 - Test the integrity of the liners and the liners weldsMost of the defects will show up after hydrotest
 - Allow the liner plates to yield towards the Carbon steel wall in order to get a minimum gap between liner plates and Carbon Steel wall
(Important factor to reduce the risk of SICC in the future)

Final inspection phase

- Performance of Hydrotest:

Should be established in a procedure before execution and may deviate from plant common practice.

- Important points in a procedure:

- Test pressure : Stamicarbon recommends operating pressure but not higher than design pressure.

Think of the safety valves MAWP's, internals

- Pressurization should be step wise
- Test water must be Chloride free to avoid contamination of SS parts
- Temperature of the test water should be at least 16°C
- soaking time at test pressure (not less than 30 min)

Final inspection phase

- Hydrotest performance in practice:

From experience point of view because of old design urea plant , the HP reactor is usually not isolated for the hydrotest meaning the complete HP loop will be pressurized which could generate some issues:

- In case of a TA, all equipment , lines, pumps must be boxed up and operational
- Capacity of the process water
- Filling procedure
- Delays in TA planning
- Compromise pressurization due to leak in other equipment than reactor

Final inspection phase

- But one critical point when the complete HP loop is pressurized is the cleanliness of the reactor after the relining, all debris, dirt must be removed from reactor's compartments.

Why so important?:

- Debris/dirt will end up in the top of the stripper and the chance to block liquid dividers holes is real.
- Possible consequences:
 - efficiency stripper down
 - Risk of dry HEX tube , rupture of tube BC01/05 (Safurex not sensible)

Thank you!