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FIELD REPAIR, -MODIFICATION AND -INSTALLATION OF

HIGH PRESSURE UREA EQUIPMENT

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1. Summary

With an increasing number of urea plants becoming older or even reaching the end of their design life , and thus the installed equipment, the need of more intensive attention directed to these equipments has become bigger. Unscheduled shutdowns as a result of failed equipment can be costly or disastrous at worst. Therefore plant operators need to establish thorough inspection and maintenance programmes in order to be able both to monitor the integrity of installed items and to take corrective actions in case of problems. These programmes must address the concept of preventive maintenance as well as quick response to emergency situations.

In those cases when equipment needs to be repaired , the decision must be made whether such repair should be carried out in a shop or could be also made in-situ. In those instances when such a repair is not technically feasible or economically justified and the equipment must be replaced , then the replacement of equipment within an acceptable time frame becomes important.

This paper describes projects of replacing old equipment with new ones on one hand and the execution of an in-situ repair of a HP heat exchanger on the other.

2. Introduction

Schoeller-Bleckmann Nooter Apparatetechnik GmbH (SBN), a company registered under the laws of Austria, along with its predecessors has been active in serving the process industry in general and the fertiliser industry in particular now for more than 30 years - uninterrupted. In this period we had the privilege to supply various types of equipments and to render different services to customers worldwide. These included high pressure heat exchangers such as strippers, carbamate condensers, scrubbers as well as urea reactors and other high pressure vessels. From the very early times we had also provided services to our clients such as field welding of piping, repairing of equipment both in the field and in the shop.

Over these many years we had always worked very closely with Stamicarbon and we were privileged to contribute to a number of developments in the area of fabrication of HP heat exchangers and reactors respectively other components as well as implementing new testing methods. These in particular included the automatisation of tube-to-tubesheet welding of HP heat exchangers in horizontal position, perfecting welding techniques for duplex stainless steels - SAFUREX being the latest achievement - , applying ultrasonic testing of tube-to-tubesheet welding. More then one hundred high pressure heat exchangers and reactors had been delivered and put in service over the years, approximately half of them within the last ten years. This demonstrates the continued confidence of our customers in our products and services.

With the ever increasing trend to larger plant capacities, equipment sizes and weights have also become larger. This requires facilities and tools which can handle such weights and geometries. In order to be able to cope better with these needs we had recently expanded our shop by increasing the shopfloor footage, coupled with new tools for machining and drilling. Amongst others, a vertical lathe for forgings with a diameter of over 4 000 mm and a horizontal 3-spindle BTA-drill allow us to in house process large diameter and heavy tubesheets as well as channels and reactor heads, ensuring an optimum production flow pattern and thus contributing to shorter fabrication time. Newly installed heavy duty overhead cranes ease the loading of finished products onto transport vehicles, either trucks or railcars. All this has been designed for faster and more economical manufacturing steps in order to be able to provide better service for our customers.

3. General

For about the same time period we were manufacturing high pressure urea equipment, we also had supported our clients by providing special field services. These included all types of field welding of HP urea grade piping, supervision of installation of various equipments - e.g. reactor trays, repairing of liners and relining of urea reactors, repairing and retubing of heat exchangers, in-situ modification of internals. Today, with the large number of equipment having a long operational life, these services have become even more important. We have established ourselves as a reliable and competent partner for the execution of such type of work, whatever the requirement is and wherever the intervention is to take place.

For a successful performance of field work, skills and expertise in a number of disciplines are demanded. All the qualifications and approvals for the fabrication of urea equipment in the shop are a prerequisite for all field welding, coupled with the ability of field personnel to adapt to the different environments and conditions during such work.

These may vary from project to project, client to client, country to country, depending upon statutory requirements as well as rules and regulations in different countries, procedures implemented by customers to be adhered to and special circumstances the actual job is subjected to. Precise and detailed planning of the works to be performed is extremely important and is a powerful tool to support a successful project completion. The proper selection, coordination and supervision of subcontractors is vital for a smooth work flow. One of the most challenging tasks, however, is the ability to manage all requirements concerning import regime of materials and tools, both temporary and permanent. The preparation of flawless documentation for customs clearance is a condition sine qua non for timely start of the works and thus for completion on time. The deep knowledge of income tax laws and insurance regulations are the guarantee for avoiding problems in the financial area.

The three case studies which we are discussing today incorporate all of the above to a different degree, depending upon the type of project and location. Also do we see differences in our client's approach towards the commercial agreements made. The spectrum varies from turnkey lump sum agreements to a mix of fixed and variable parts and also solely variable cost components. We are experienced in all of these variations, depending upon the nature of the work, the work conditions, the time frame available for executing the work and the possible tie-in of other jobs carried out in parallel.

4. Case studies

CASE A: Removal of an existing carbamate condenser from the structure and the installation of a new one - turnkey lump sum

Due to the bad condition of the originally installed heat exchanger - quite a number of tubes were plugged and limited the performance of the condenser - the client decided to replace the existing condenser with one featuring the same type of materials of construction and number of tubes. The internationally announced tender attracted a number of bidders, all of them Stamicarbon approved suppliers. Besides the supply of a new condenser based on the latest Stamicarbon specifications and also subjected to comprehensive inspection and testing carried out by Stamicarbon, the tender specification also asked for the installation of the same after removing the existing one. All this for a lump sum fixed price, valid throughout the entire period of executing the project. Against stiff international competition, SBN emerged as the successful bidder.

The fabrication of the new condenser went smoothly including the transportation to site, in fact the actual delivery time was significantly less than the contractual one. Based on the anticipated arrival time of the new condenser, the client could start making preparations for the shutdown of the plant which was eventually fixed for mid September of last year. In parallel all necessary preparations were made by SBN for the actual installation work. Due to the extreme position of the old condenser relative to the possible crane location - steel structure on top of a concrete structure, pipelines on the ground near the foundations - a 600 ton crawler crane was selected with a radius of 30,5 m and a length of the main boom of 73 m. With this the condenser weighing 85 tons could be lifted.

Since this crane had to be brought into the country, the coordination between the client for shut down date and the crane company for bringing in the crane on time was vital. A 30 days window was allowed for the entire operation, from arrival of the crane on site, cutting the existing pipe connections, removing some cross steel beams, lifting the old condenser from the supports, installing the new condenser, welding of the pipe connections, testing and commissioning the new installation. The total time needed was less than the 30 days, only working during the day!

No problems were reported during start up and the condenser is in operation since performing as per design.

CASE B: Removal of an existing carbamate condenser and installing a new one - mix of fixed and variable cost components

Similar as for case A, this client also was forced to replace the installed condenser due to the bad condition with a number of tubes plugged. But unlike in case A in this project the client had tendered the supply of a new condenser including transportation to CIF port of entry for a lump sum fixed price while for the installation works a separate proposal was asked for. Since this urea plant has only a concrete structure, a lifting of the installed and also the new condenser by one large crane was not possible. The client evaluated the different proposals for both the new condenser and the installation and - again - SBN was selected for the fabrication of the new condenser and also the installation.

SBN proposed a combination of hydraulic lifters and cranes, allowing to put the old condenser from vertical to horizontal position, moving it horizontally to the end of the concrete structure and subsequently to be taken up by 2 cranes. The new condenser was installed in reverse order. SBN was responsible for the installation concept, providing all necessary tools and manpower for the hydraulic lifting part, supervision of all other lifting operations. The client was responsible for the 2 main cranes and all the welding and miscellaneous work. The project was executed without any problems and the newly installed condenser is working as expected.

CASE C: Repairing tube-to-tubesheet welds of a carbamate condenser - variable cost component

A client operating a urea plant with a carbamate condenser working for more than 15 years repeatedly experienced leaks in his condenser resulting from corrosion of tube-to-tubesheet welds of the top tube sheet. The corroded areas were concentrated at the outermost tube rows and at the area around the tie rods. Since the tubes themselves were still in good condition it was decided to look for repair options to stop the corrosion. SBN was selected for this project having done similar repairs in the past on HP urea heat exchangers.

The repair had to be made on some 250 tubes during a planned turnaround and SBN specialists performed all the work. The challenge was to leave the tubes intact while removing the old welds. This was achieved by a specially designed automatic grinder. After removing the old welds and checking with dye penetrant, the tubes were welded in automatically with 2 layers. After completing all the repair welds and checking of the same with dye penetrant, an ammonia leak test was performed to ensure that no further leaks were present. All the tests showed good results and the condenser was put back in service. It is now working without problems.

The duration of this repair job was 10 days. No special circumstances were reported.

5. Conclusions

The 3 case studies presented constitute only a few examples of the wide spectrum of possible field related projects and demonstrate the ability and competence of SBN to perform field interventions for HP urea equipment. These services will be available also in the future.