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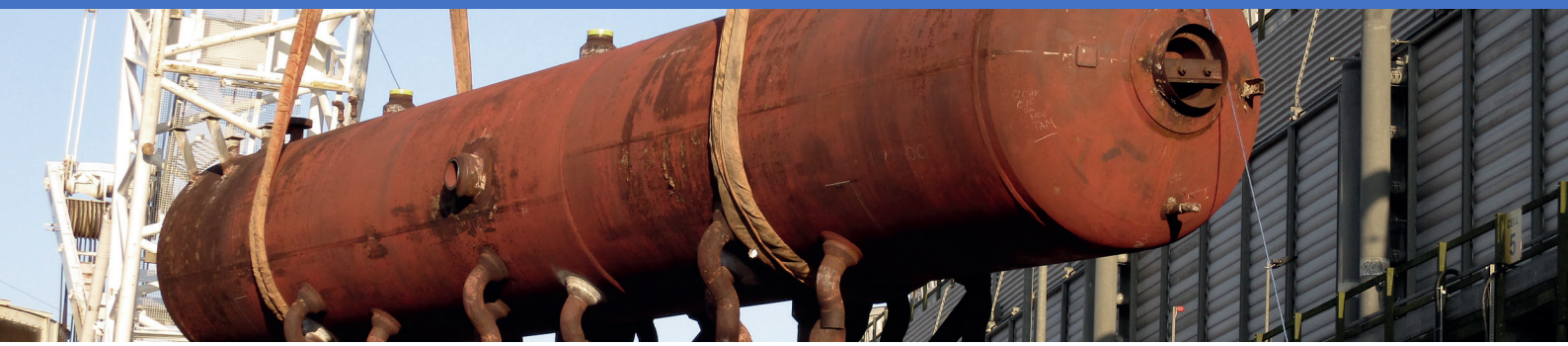
POWER CASE STUDY



Unit Superheater Engineering (USE) undertook an extremely challenging repair and upgrade of two high pressure steam drums for the HRSG's at a CCGT plant in Runcorn, Cheshire.

The adopted approach was to remove both drums from site utilising a Liebherr 1750 ton crane with superlift, and transport each 120 ton drum back to USE's engineering facility. From initial access to reinstallation, all mechanical work was completed safely and on time despite an extremely challenging schedule.

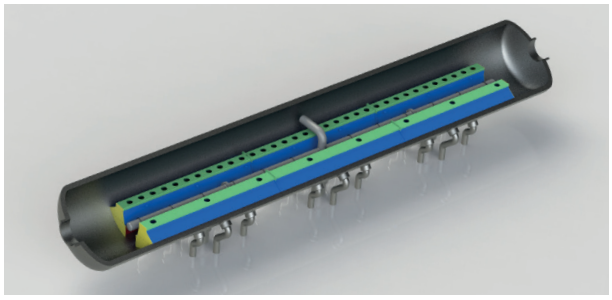
The Client opted for an off-site approach, as previous comparable repair works undertaken by others in situ had taken almost twice as long, and at a substantially higher cost and greater risk to personnel carrying out the works.

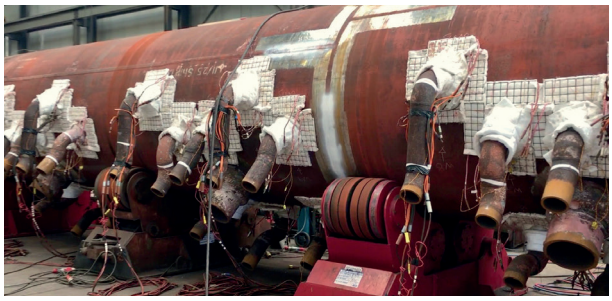
Benefits of USE off-site solution

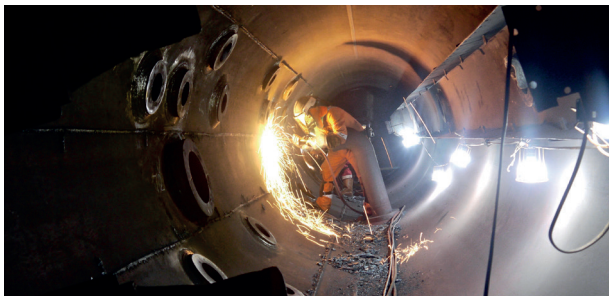
- Substantial reduction in plant downtime
- Significant savings in direct cost
- Drum-rotation assisting oxy-fuel excavation
- Flux-cored Arc Welding (FCAW)
- Replacement internal furniture fabricated concurrently alongside drum repairs in workshop avoiding schedule delays
- Post Weld Heat Treatment (PWHT) reduced from 230 to 90 hours per drum by utilising LPG fired burners rather than electrical resistance elements previously used in situ
- Safer and more controlled working environment

Whilst USE's site construction team carried out all Risk Assessments and Method Statements, including detailed crane studies, prior to removal of the drums, USE's off-site project team in South Wales carried out preparation work required to receive them. This included the design and manufacture of bespoke support saddles, necessary to ensure a safe and controlled working environment.

Non-destructive testing of the existing welds confirmed the need for repair work to both drums; each 15m long, 2m diameter with 121mm wall thickness. Having completed an extremely challenging lift to remove the drums from the 22m level of the HRSG, they were transported to Swansea and offloaded using a hydraulic four-point lift system.







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After internal inspection it became apparent that the steam separators fitted to the lower half of the drums required replacing. Two new sets of internal baffles were manufactured and installed with zero impact on the schedule. Furniture design improvements were identified and implemented, which will allow for easy access to the nozzles during future inspections and facilitate easier handling at the 22m level of the HRSG.

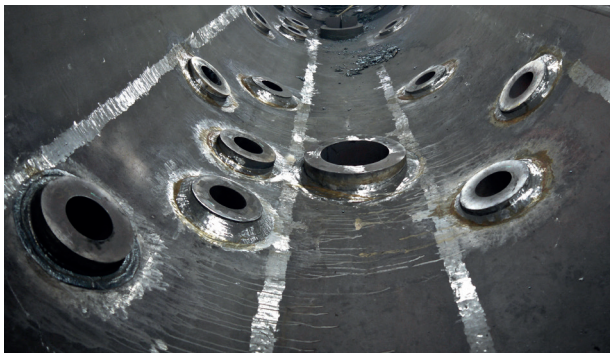
A major advantage of performing this type of repair and upgrade work at ground level is the ability to rotate the drums. This allows the nozzle positions to be manipulated, enabling the use of optimum excavation and welding techniques, as well as providing a more efficient and far safer working environment.

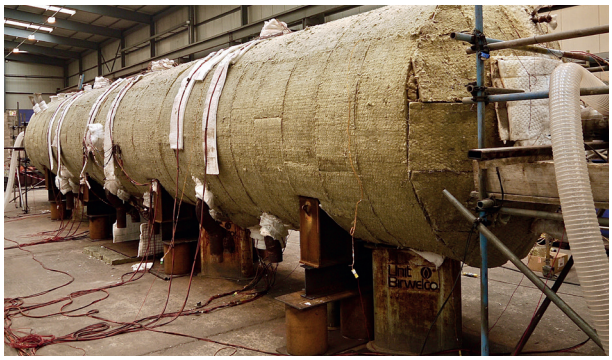
The existing internal welds to forty eight 6", six 8", two 10" and six 14" nozzles were excavated to a depth of between 50mm and 70mm by oxy-fuel gouging - preferred over air arc gouging or machining and made possible by drum rotation - and then ground to a smooth profile before being subjected to Magnetic Particle Inspection.

Re-welding of the nozzles under electric braid pre-heat was undertaken using the FCAW process. The weld profile was also re-designed by USE to avoid the same failures occurring again. The design of the new weld was in accordance with ASME Div. VIII Section 1, with the final profile reducing the compressive and tensile stress at the toe of the weld that had resulted in previous fatigue cracking. The completed welds were then dressed and subjected to Ultrasonic and Magnetic Particle Inspection.

PWHT of the drums was performed using LPG fired burners, with electric braids placed around the nozzles to further control the heat distribution. The heat treatment cycle on each drum took ≈ 90 hours; far quicker than the estimated 240 hours taken by electric elements, which have been used in similar repairs.

After final NDT and fitting of the numerous steam separators, filtration units and internal pipework, the drums were loaded onto transport and returned to USE's site installation team. The drums were then re-positioned to a tolerance of +/- 3mm before being re-welded to the existing 62 large bore piping connections. Whilst this critical work was being undertaken the rest of the USE site team carried out the installation and connection of new small bore pipework, steel platforms and equipment. All this activity was carried out in a high risk area with no lost time injuries or harm to the environment.





The sequencing of these activities was critical to achieving the aggressive schedule required by the Client whilst still maintaining a safe work environment.

Full work scope

- Engineering design, risk assessment and lift planning
- Initial on-site NDT
- Drum removal, lifting and transport to workshop
- Complete NDT of original welds (including Phased Array)
- Internal furniture removal
- Oxy-fuel gouging, grinding and FCAW welding of 62 nozzles
- NDT of all welds
- Re-engineering, manufacture and installation of new steam separator baffles
- Post Weld Heat Treatment
- Transport, lifting and re-installation
- Manufacture and installation of connecting pipework.
- Final NDT

Despite a number of additional in-progress requirements, the project was completed in 76 days, as originally scheduled, with zero weld repair failures and with an outstanding safety record.

CONTACT

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