PRESS RELEASE

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Refurbishment by Thermaspray helps extend life span of valves for SA Coal fired power plant

Thermaspray applied the proven technologies of thermal spray coating and PTA (plasma transferred arc) welding to successfully refurbish 2-way-3way valves at one of South Africa's coal fired power generation plants.

Thermaspray is an ISO 9001:2008 Quality Management System and Eskom Level 1 certified company that delivers refurbishing, manufacturing and repair services to a number of power generation plants in South Africa. "Our thermal spray and PTA capabilities position us as the perfect refurbishment and repair solutions partner," states Thermaspray Managing Director, Dr. Jan Lourens. "Our coating and welding technologies contribute to the extension of component service life - the subsequent increased uptime and improved production translate to significant cost savings for the end-user. In addition to valves, our expertise extends to the refurbishment and repair of a wide range of components used by power stations including spindles, stator pump bearing and accumulator housings, fan blade shafts and liners, sleeves and bushes amongst other."

Depending on plant size, up to 15,000 valves can operate at a single power generation plant. In the steam cycle, components such as steam generators, pumps and turbines that handle steam and water require a variety of control, safety and shut off systems. High pressure steam, high temperatures and metal-to-metal wear at seating areas are the main contributors of wear in steam and water valves.

Thermaspray was approached by a power station to refurbish 2way-3way valves that have been in operation for many years. Philip van Wyk, Engineering Support Manager at Thermaspray, explains that over the years the valves had been repaired by different companies and, while not all the repair methods used are known, Thermaspray was able to determine that thermal spray coatings and welding processes were used on some of the valves. "Subsequent to material analysis it was found that a variety of different materials was used on the valve seats which were not necessarily the recommended Stellite 6 coating. Furthermore the split rings were manufactured from a range of materials and not the specified cast iron."

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Van Wyk adds that of major concern was the preparation method used for the spraying of the spindles and piston bores as well as the required seat face weld thickness required to refurbish the parts to original specification.

"Historically, it seems that the minimum weld thickness was applied on the seat faces and, the seat's overall width was never refurbished to the original size. This meant that in some cases welding thicknesses of more than 10mm were required." Van Wyk adds that as previous thermal spray repair preparation made use of a 'thread finish', underneath the coating which had to be completely removed resulting in coating thicknesses of more than 2,0mm.

After receipt, numbering and stripping of the valves, Thermaspray conducted a complete inspection which includes non-destructive testing on all the valve parts. This involved material analysis on the valve seat face as well as the outer diameter to establish what welding material was used for the previous repair and what the substrate material is for the Thermaspray Stellite 6 repair. Analysis was also performed on the outer body, inner body and spindle.

Van Wyk notes that they do not use old rings and bushes as part of the refurbishment process regardless of their condition. Using the correct grade cast iron, Thermaspray manufactured new spindle rings, outer body cylinder rings and bushes for each valve to the power utility's specification.

Figure 1: Outlet Sempel Valve

Explaining the refurbishment process in greater detail, Van Wyk says that to enable a thermal spray coating and PTA repair, all the old coatings, whether thermal spray, plated coatings or welding, had to be removed by machining and grinding. Non-destructive testing was repeated on the parts after coating removal to ensure substrate material integrity.

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All areas to be sprayed were then prepared using international best practice techniques. Locating diameters were sprayed using a metal alloy. Where wear resistance was required, Carbide coatings were applied which was final-ground using diamond wheels. In most cases, due to the multiple repairs and techniques used for the past repairs on the valves, both the bores and the piston spindle outer diameter required material build-up in excess of 1,0 mm. A metal alloy build-up layer was applied first, followed by the application of the wear resistant coating. Van Wyk confirms that all the coatings used for the refurbishment were finished at the Thermaspray facility.

Repair of the seat faces were done using Stellite 6 material applied with the PTA welding process. In some cases up to 10mm thick layers were applied to restore the seating area to the correct dimension. Van Wyk points out that a stainless steel butter layer can be applied when greater thickness coatings are required. “The Stellite 6 thickness after machining will typically be 3-4mm minimum.” The valve seats were stress-relieved and final machined at the Thermaspray facility.

PTA weld hardfacing is a welding process used to produce high-quality weld hardfacings of Ni, Co and Fe alloys. The PTA hardfacings are metallurgically bonded to the parent material and are able to handle impact and point loading that a thermal spray coating cannot do. The advantages of PTA welding over other weld hardfacing techniques are that PTA weld deposits are characterised by low levels of inclusions, oxides and discontinuities and the weld hardfacing closely mimics the corrosion resistance of the equivalent monolithic alloy. Most critically, the careful control of heat input makes it possible to control weld dilution to less than 5%, which is critical for many high-performance alloys.

Thermal spraying provides increased resistance to high temperatures and oxidation, traction, cavitation, chemicals and corrosion as well as wear resistance (resulting from erosion, abrasion and sliding wear). Thermal spray is the method of spraying materials onto a prepared substrate material by heating particles in the stream of a heat source to create a semi-molten state. Particles are then propelled by high velocity onto a prepared substrate where they adhere to the base surface via a mechanical bond. Particles then continue to build until a specified thickness is attained.

On completion of all repairs, NDT was done by a third party inspector to ensure that there were no coating defects. Final assembly work was done at Thermaspray. Each valve was tested and signed off by the responsible engineer from the power station.

Thermaspray also refurbished the valve spares to a standard set of dimensions to ensure interchangeability if required. These sizes were developed together with engineers from the power station and Van Wyk confirms that they have proven to be successful.

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Figure 2: Inlet Sempel Valve

All processes at Thermaspray adhere to the applicable international standards and are done according to a quality control procedure which is dated, signed and noted when any of the processes are performed. Non-destructive testing is performed by the power utility's accredited service providers. On completion of the valve refurbishments, a data pack was created consisting of all the inspections, signed QCP document, NDT testing certificates, material certificates, Weld Procedure Specifications, material analysis and relevant photos.

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