Structural Weld Overlays

Unique capabilities, proven processes

A design repair solution

Just prior to a planned shutdown, this Northeastern Utility identified one thru-wall crack and various indications in the dissimilar metal weld joints of their Cold Reheat Piping. There was not enough lead-time to consider any kind of section replacement and conventional repairs were not considered reliable for these 400psi / 800°F, 32-inch diameter lines. Whether applied in response to or in anticipation of cracking, there were 3-inch pad welds centered on the P-1 side of the heat affected zone which were also failing.

Because of a history of similar applications in the Nuclear Industry, WSI suggested a structural weld overlay to replace/reposition the pressure boundary and to pull the tensile-stressed DMW Joint back into compression. This is a highly engineered yet Code-approved method for permanent repair. It depends on precise engineering design and analysis of the overlay, taking into account the strength of various materials, geometries and the width and thicknesses of applied overlay layers. The analysis depends on predictable and machine consistency in the deposition of the weld-applied alloy. WSI equipment technology delivers that necessary consistency.

Using a high-tensile strength alloy, the new overlay pressure boundary was applied in either a 6 or 12-inch band and specific design thicknesses (all less than a half-inch) depending on the variations of each joint. Regardless of the defective condition of the substrate and joint the repair design overlay creates a new pressure boundary while placing the localized substrate in compression to eliminate the stress drivers that would contribute to cracking.

Structural weld overlay as a design repair solution may have many applications for high energy components in aging power generation stations.

Beneficial Stresses of Weld Overlay

Welding imparts stresses that can lead to distortion. The consistency of a machine-applied, weld metal deposit can result in a more uniform and manageable stress. The capability to analyze and predict these stresses makes possible the use of welding stresses in beneficial ways. Such is the case for Structural Weld Overlay.

Make no mistake about it – the required engineering analysis is complex. There are many variables that must be considered:

- Different materials have many different physical properties in melting, cooling, and solid state.
- The dimensions and geometry of an application area must be included in exacting detail. For each bead of material that is placed, the geometry and behavior of the component changes.
- Residual stresses of the component in all stages and transitions between cold and steady-state operating condition must be analyzed for any repair design.
- All weld-application process details that pertain to bead size and placement, the sequence of area applications as well as many other weld parameters relevant to heat input must be included.

WSI's ability to analyze and predict residual and distortion stresses related to weld applications is based on extensive modeling and sophisticated programming for very high predictive reliability.

wsisolutions.com

WSI
560 Horizon Drive
Suite 100
Suwanee, GA 30024
T: 678.728.9100