

Safe repair of wind turbine nacelle cracks

Snapshot

Client

International energy company

Challenge

A technique was needed to repair cracking that was occurring at welded joints of turbine nacelle frames at onshore and offshore wind farms.

Solution

We carried out systematic analysis of the cracks and worked with the Original Equipment Manufacturer (OEM) to develop a weld procedure to safely repair cracked parts in-situ and install reinforcement plates. We put in place qualification and testing requirements for the welding contractor.

Benefits

The cracking in the nacelle frame welds were successfully and safely repaired, avoiding potentially long periods out of service.

When structural problems are discovered, wind farm operators need the input of independent expertise to assess risk to their assets. In this case, our engineers not only determined the extent of the problem, but also provided a safe repair technique.

Risk to nacelle structure

Fatigue cracking was discovered in welded bedplate joints of four nacelles from the same manufacturer at two of our client's wind farms, one onshore and one offshore. The cracking posed a significant risk to the integrity of the nacelle structure. Any repair of the cracking in the nacelle needed to ensure that the integrity of the structure, including bolted joints, was maintained during the repair process.

Successful repair achieved

We carried out comprehensive NDT inspections to measure crack lengths and depths, and to monitor their growth rates. Weld procedures were developed to repair cracking and install reinforcement plates designed by the OEM. The OEM's stress analysis was assessed ensuring that the reinforcement plates were fit-for-purpose. Our qualification of the welding contractor was essential to achieving required weld quality.

Our finite element stress analysis and fracture mechanics calculations demonstrated the stability of the cracks, the structure's resistance to collapse and calculated bolt loads for a safe sequence of bolt removal for repairs of the nacelle frame. Cracking subsequently discovered in other nacelles operated by the same client are now undergoing similar repairs.

Wind farm operators should be aware of the potential for cracking to develop at welds in wind turbine nacelles. We can support operators with inspection, integrity assessment and repair strategies to minimize impact on their business.

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