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Development of Composite patch for Offshore Steel Repair

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The number of floating production, storage and offloading units (FPSO) around the globe is in continuous increase and a relatively high number of them are now almost 20 years aged. The general geographical layout, being in tropical area makes the corrosion a fundamental ageing problem of the steel structures in structural area, like decks or side shell but also inner structure. Therefore, there is a strong need for proposing repair solutions having low impact on their exploitation. Such repair solutions (“cold repair” in contrast with “hot works”), like adhesively bonded FRP (Fiber Reinforced Polymer) requires additional development, in particular in the preliminary characterization and design step, and regarding the durability issues. Use of composite to build onsite repair seems adequate to solve this issue as they require limited heat (80°C) and can easily be installed on various shape, position and surfaces. However, the lack of application cases and design method lead to limited references on the best way to install composite patch repair. By design, the stress concentration at the border of the patch tends to decrease the overall strength and failure load that adhesives can sustain. Therefore, patch geometry must be addressed with care to obtain high performance patches. The overall capacity of the patch is highly related to the energy that can withstand the bonded interface with the steel adherent, and so, a particular attention to the surface preparation must be taken. Finally, the patch layup controls the overall stiffness and strains in the patch, which must lead to a particular design to obtain the required properties.

This paper presents the design methodology, the surface preparation protocol study and the manufacturing protocol of a composite patch developed during the Joint Industrial Project Strength Bond Offshore. The results of the static and fatigue test campaign in tension and bending are also presented. The assessment of the overall capacities of the composite patch repair are compared to a simpler bonded steel repair. The use of distributed strain measurement optical fiber as the new patch monitoring technique following [1] applied to composite patch are developed and highlighted.

[1] Q. Sourisseau, E. Lepretre, S. Chataigner, X. Chapeleau, L. Mouton and S. Paboeuf, *Int J of Adh and Adh*, Elsevier, 2022, 115, pp.1-20.