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UTILIZATION OF ADDITIVE MANUFACTURING FOR PUMP IMPELLERS IN LNG APPLICATIONS

Pump impellers which are used for handling fluids at temperatures as low as -320°F (-196°C) have traditionally been cast from Aluminum alloys. Through the utilization of Direct Metal Laser Sintering (DMLS), these impellers can be additively manufactured at a reduced leadtime which is critical for replacement impellers and service operations along with providing an opportunity for a digital inventory of replacement components. Pump impellers present unique challenges for powder bed additive manufacturing due the complicated geometry which is fully shrouded. The additive manufacturing process was qualified utilizing AISi10Mg per ASTM F3318. The qualification of the impeller for this critical service was based upon DNV-ST-B203 and required an in-depth review of the mechanical properties obtained from the additive manufacturing and heat treatment process, microstructural review, physical properties, non-destructive analysis of the impeller along with the geometry of the as-printed surfaces. Special attention was provided to the high cycle fatigue properties of the additively manufactured material in comparison with the traditional casting alloy, and specific steps were taken to account for the as-printed surface condition of the impeller flowpath. This paper reviews qualification of the impeller manufacturing procedures through the approach to the DMLS process to obtain the correct impeller geometry, the testing of the mechanical and physical properties of the ASTM F3318 material

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