

Assessment of Structural Integrity of Titanium Weldments for US Navy Applications

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Abstract

The US Navy has several uses for structural welded titanium, taking advantage of its good strength to weight ratio and corrosion resistance. Examples both current and emerging include M777 howitzer support components and aircraft elevator doors for aircraft carriers. As welding procedures are defined for these applications, weld strength and fatigue performance are structural properties crucial to the service capability. Acceptance criteria for weld imperfections can also be crucial to productivity and serviceability.

Data from these development programs will be shown and the larger context of knowledge on structural titanium weldments discussed, including effects of alloy content and welding process effects. Some of this context has been embodied in the first welding design code for titanium alloy welded structures D1.9:2007 from the American Welding Society, through its consensus standards process and the work of many volunteers.

Defining the provisions of this new code required collecting and summarizing both strength and fatigue data for titanium structural welds, including data from the howitzer welding development program. The design provisions were based on these data, but only in context of the other provisions of the code in areas of welding procedure qualification, fabrication, ballistic testing and inspection. For instance, the allowable imperfection sizes found on inspection had to be correlated with the expected fatigue performance of imperfect welds.

Some of the tension between individual application development and code provisions will be discussed, as well as their means of resolution. The accommodation for engineering computation and experience in this process will be described.

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References

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