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Aus-Bay Quenching of 300M Steel

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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This document has been declared "Stabilized" by the SAE Aerospace Metals Engineering (AMEC) Committee, and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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FOREWORD

The Aerospace Metals Engineering Committee (AMEC) consists of specialists in metallic materials and processes from major aerospace and government organizations. AMEC is dedicated to the objectives of solving common problems related to metallic materials and processes.

This program was initiated by AMEC and monitored by General Dynamics, Convair Division and conducted by AMEC representatives and their support personnel. Technical evaluation and review was performed by other active AMEC members.

Aus-bay quenching is a process in which the alloy is given an intermediate quench from the 1600 °F (871 °C) austenitizing temperature to an intermediate temperature, 1000 °F (538 °C), where the transformation to ferrite and carbides is sluggish and does not start for several hours, see Figure 1. The upper nose of the transformation curve is displaced to the right far enough so the quench rate is not critical and slower quench mediums, such as inert gases or vacuum, can be used without transformation occurring. The alloy is held at this temperature for a time to allow stress relief to occur and the temperature gradients to disappear and is then quenched in oil. Minimizing residual stresses in this manner results in significantly less heat treat distortion in the part. Insufficient information existed, however, to justify using the procedure, so this program was initiated to develop additional data.

The program was divided into two phases:

a. Phase 1 to determine the feasibility of the process
b. Phase 2 to fully characterize the heat treated properties

FOREWORD (Continued)

A cooperative program was initiated by the Aerospace Metals Engineering Committee to study the effect of aus-bay quenching on the mechanical properties of 300M steel heat treated to a nominal strength level of 280 ksi (1931 MPa). Aus-bay quenching may have significant economic benefits by minimizing heat treat distortion with the subsequent straightening problems and by reducing stock removal required after heat treating. Insufficient information existed, however, to justify using the procedure without additional evaluation.

Two round bars of 300M steel, 3-1/8 in (79.4 mm) and 3-1/2 in (88.9 mm) diameter were heat treated to a strength level of 280 ksi (1931 MPa) and tested in the transverse direction. The results of the tests indicated the tensile, fracture toughness, fatigue, and stress corrosion properties of the aus-bay quenched steel are equivalent to the properties obtained using the conventional oil quenching process.