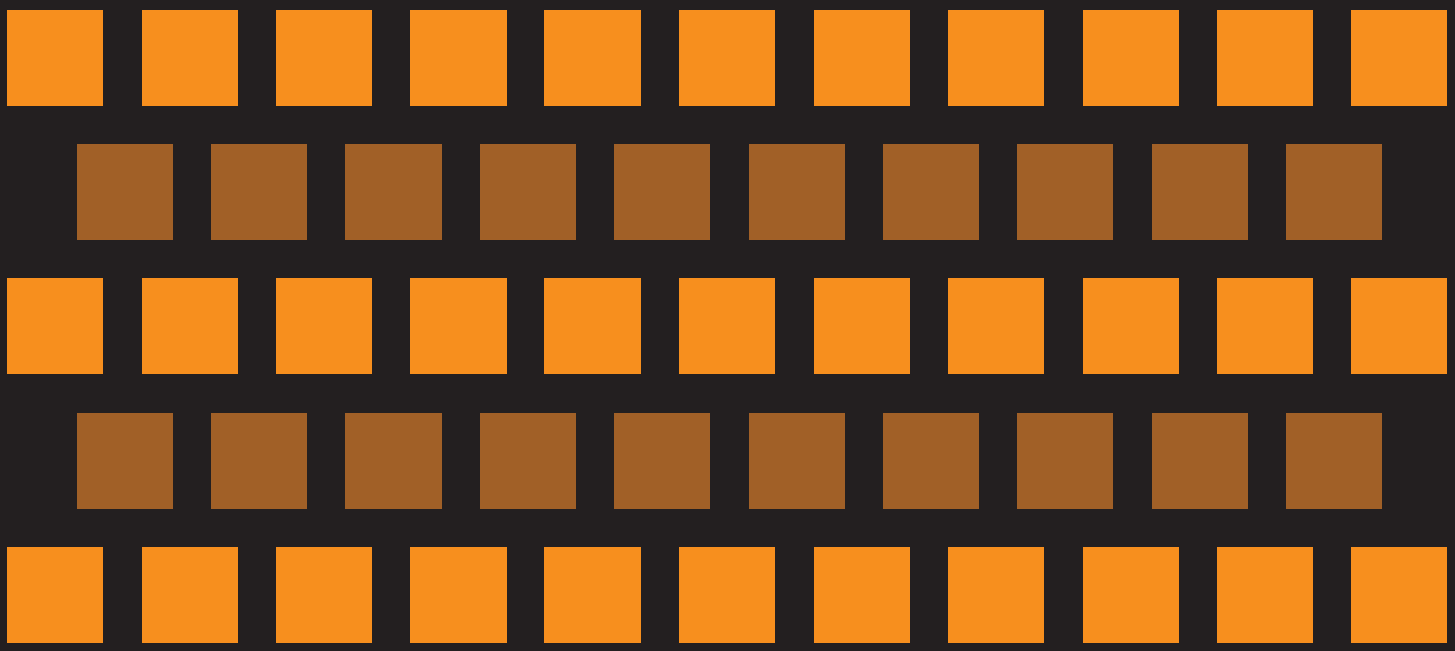
STP-NU-035

EXTEND ALLOWABLE STRESS VALUES FOR ALLOY 800H



ASME STANDARDS TECHNOLOGY, LLC

STP-NU-035

EXTEND ALLOWABLE STRESS VALUES FOR ALLOY 800H

Prepared by:

Robert W. Swindeman
Cromtech Inc

Douglas L. Marriott
Stress Engineering Services Inc

Jude R. Foulds
Clarus Consulting, LLC

ASME STANDARDS TECHNOLOGY, LLC

Date of Issuance: November 20, 2012

This report was prepared as an account of work sponsored by the U.S. Department of Energy (DOE) and the ASME Standards Technology, LLC (ASME ST-LLC).

ASME Standards Technology, LLC
Three Park Avenue, New York, NY 10016-5990
ISBN No. 978-0-7918-6859-1

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FOREWORD

This document is the result of work resulting from Cooperative Agreement DE-NE0000288 between the U.S. Department of Energy (DOE) and ASME Standards Technology, LLC (ASME ST-LLC) for the Generation IV (Gen IV) Reactor Materials Project. The objective of the project is to provide technical information necessary to update and expand appropriate ASME materials, construction and design codes for application in future Gen IV nuclear reactor systems that operate at elevated temperatures. The scope of work is divided into specific areas that are tied to the Generation IV Reactors Integrated Materials Technology Program Plan. This report is the result of work performed under Task 13 titled "Extend Allowable Stress Values for Alloy 800H."

ASME ST-LLC has introduced the results of the project into the ASME volunteer standards committees developing new code rules for Generation IV nuclear reactors. The project deliverables are expected to become vital references for the committees and serve as important technical bases for new rules. These new rules will be developed under ASME's voluntary consensus process, which requires balance of interest, openness, consensus and due process. Through the course of the project, ASME ST-LLC has involved key stakeholders from industry and government to help ensure that the technical direction of the research supports the anticipated codes and standards needs. This directed approach and early stakeholder involvement is expected to result in consensus building that will ultimately expedite the standards development process as well as commercialization of the technology.

ASME has been involved in nuclear codes and standards since 1956. The Society created Section III of the Boiler and Pressure Vessel Code, which addresses nuclear reactor technology, in 1963. ASME Standards promote safety, reliability and component interchangeability in mechanical systems.

Established in 1880, the American Society of Mechanical Engineers (ASME) is a professional not-for-profit organization with more than 127,000 members promoting the art, science and practice of mechanical and multidisciplinary engineering and allied sciences. ASME develops codes and standards that enhance public safety, and provides lifelong learning and technical exchange opportunities benefiting the engineering and technology community. Visit www.asme.org for more information.

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ABSTRACT

The tensile, creep and stress-rupture databases for alloy 800H (UNS N08810) were assembled and analyzed with the intent of extending the allowable stresses in ASME Section III, Subsection NH for service to 500,000 h at 1400°F (760°C) and below and recommending new allowable stresses for limited service times to temperatures as high as 1650°F (900°C). Values for S_{Y1} and S_U were produced for the temperature range of 800 to 1650°F (425 to 900°C). These include a revision of existing values to 1500°F (800°C). Values for S_m were produced for the same temperature range. Values for the minimum stress-to-rupture, S_r, were produced for the temperature range of 800 to 1650°F (425 to 900°C), including a revision of existing values to 1400°F (750°C).

Development of values for S_t and S_{mt} required the construction of tensile curves to 1% strain, the estimation of the stresses to produce 1% creep strains to 500,000 h and the estimation of the minimum stress to initiate tertiary creep for times to 500,000 h. Because of the shortage of very long-time data for all categories, extensive use was made of time-temperature parametric models based on Larson-Miller. The observation of "non-classical" creep behavior in many of the creep curves for alloy 800H greatly reduced the confidence in the extrapolations needed to estimate stresses corresponding to the criteria on which the S_t and S_{mt} values were based. As a result, restrictions on the scope of the S_t values were recommended. These restrictions limited values to less than 500,000 h for temperatures of 1550°F (or 850°C) and above.