

STP-PT-026

GUARANTEED HIGHER STRENGTH PROPERTIES



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Prepared by:

Elmar Uppis
Becht Engineering Company

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FOREWORD

This document was developed under a research and development project which resulted from ASME Pressure Technology Codes & Standards (PTCS) committee requests to identify, prioritize and address technology gaps in current or new PTCS Codes, Standards and Guidelines. This project is one of several included for ASME fiscal year 2008 sponsorship which are intended to establish and maintain the technical relevance of ASME codes & standards products. The specific project related to this document is project 07-07 (BPVC#4), entitled, "Guaranteed Strength Properties."

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ABSTRACT

This report discusses the various aspects related to the tensile properties in plates and forgings, including the feasibility of using guaranteed tensile values that exceed the specified minimum tensile strength in the material specifications, and provides recommendations for design stresses and Code construction based on the higher guaranteed tensile and yield strength values.

The issues discussed in this report apply mainly to tensile strength values higher than the minimum specification values since the tensile strength generally governs the Code allowable stresses for carbon and low alloy steels for Section VIII, Division 1 construction. However, with the increase in tensile strength there is also an increase in the yield strength. The yield strength may govern the Code allowable stresses for Section VIII, Division 2 and 3 construction

1 INTRODUCTION

Material specifications list the specified minimum yield strength, minimum and, in most cases, maximum tensile strength and values for materials and grades covered by the specification. The tensile properties for a particular material and grade are based on chemical composition, heat treatment, thickness and production data. The tensile properties can also be influenced by the amount of work (reduction) during the rolling process, resulting in higher values for thin plates than for thick plates. The mill production data must show that all tensile strength values are within the specified tensile strength ranges and that the yield strength values exceed the specified minimum values to make it commercially acceptable for the producer of that material. Increasing the specified minimum tensile strength or yield strength would involve a commercial decision by the material producer, based on his production data and the expected rejection rate, as to what minimum specified tensile properties above the specification values are acceptable to that producer.

Improved melting practices, chemistry controls and rolling practices can result in improved notch toughness and tensile properties. Typical production data indicate that often the actual tensile properties (tensile strength and yield strength) significantly exceed the specified minimum properties, particularly in thinner plates. Some industry standards (e.g., API 650, Welded Steel Tanks for Oil Storage, CODAP) recognize this and include provisions for use of higher tensile properties. API 650 permits an increase up to 5 ksi above the specified minimum values for certain carbon steels. These higher tensile strength values are subject to agreement between the purchaser and the material producer. The use of higher guaranteed tensile properties (where this is feasible) reduces the weight of the vessel component, resulting in savings to the vessel manufacturer and the owner.