Proceedings of the ASME PVP 2012 Pressure Vessels and Piping Division Conference
PVP2012
July 15-19, 2012, Toronto, Ontario, Canada

Paper presented at ASME PVP 2012 Pressure Vessels and Piping Division Conference

Toronto, Ontario, Canada
15 – 19 July 2012

Contact ASME for a copy of this paper

PVP2012 - 78130

A REVIEW AND REMEDIATION OF A CODE NON-COMPLIANCE INCIDENT – LESSONS LEARNED

John J. Aumuller
University of Alberta
Edmonton, Alberta, Canada

Zihui Xia
University of Alberta
Edmonton, Alberta, Canada

Vincent A. Carucci
Carmagen Engineering Inc.
Rockaway, N.J., USA

ABSTRACT

The ASME Codes address the needs of industry and the public for the construction of safe equipment for pressure containment. The two basic philosophies underlying the requirements of the ASME VIII sections are "rules based" design versus "design by analysis".

Code contributors have written extensively on the need for Code users to apply common sense when using the Code. This message is often lost in the confusion when atypical mechanical design details have been intentionally or inadvertently used. Those atypical design details that can be identified during the review process can be easily resolved; details that are discovered after construction completion and, worse yet, just prior to operation can be devastating to a project. The Code places emphasis on education, experience and the use of engineering judgment but, these can never be used to overrule mandatory requirements or specific prohibitions of the Code.

A specific incident is reviewed wherein the regulatory authority of the jurisdiction intervened and de-registered a vessel design due to Code non-compliance. Although the deficient detail was thought to be better, based on consideration of engineering principles, than the detail strictly meeting Code requirements, the as-constructed detail was rejected by the regulatory authority. Extensive field rework ensued to modify the detail to conform to Code, and of course the costs were very high. This paper reviews the engineering issues, illustrates the motivation for the Code requirements, and serves as a reminder to Code users to be vigilant in the details of Code construction.

INTRODUCTION

Thousands of pressure vessels are routinely constructed for a multitude of applications every year globally. Many of the receiving locations are in jurisdictions which are authorized by national or local law to register these vessels. The registration process requires review and design acceptance by the regulatory authority of the jurisdiction. The regulations enabling the construction of pressure vessels in the jurisdiction references national pressure vessel construction codes and /or international codes. The ASME codes are internationally recognized and are accepted by the Canadian CSA Standard B51 Boiler, pressure vessel and piping code, as well as explicitly in pressure equipment regulations of the Canadian provincial jurisdictions.

The specific vessels under consideration were designed for saturated steam service at 2,048 psig [14.114 MPa] and 662 °F [350 °C] and, non-cyclic operation. Both ASME Section VIII Division 1 (the "Code") and CSA B51 were specified as the codes of construction for this particular vessel design [1, 2].

The vessel design is configured with a vertical orientation of a single thickness cylindrical portion, two end closures being hemispherical heads and supported by a skirted section. Nozzle connections consisting of inlet, outlet, drain, instrumentation and inspection connections are present but inconsequential to the issue of this narrative. The necessary calculations to perform the pressure thickness calculations for the vessel are presented in the Code and are well known. For convenience, the equations are repeated:

For the cylinder, equation UG-27(c)(1) is used:

$$t = P \bullet R / (S \bullet E - 0.6 \bullet P) + CA, \text{ where} \quad (1)$$

t ≡ calculated pressure thickness
P ≡ design pressure
R ≡ corroded radius of shell
S ≡ allowable stress for material of fabrication
E ≡ joint efficiency
CA ≡ corrosion allowance