

DESIGN FACTOR OF 3.5 AND THE ASME CODE 2001 EDITION FOR USE IN THE PROVINCE OF ALBERTA

1.0 INTRODUCTION

The 2001 Edition of the ASME Code incorporates ASME Code 1998 Edition with the 1999 addenda allowing for maximum allowable stresses based on a factor of 3.5 instead of the traditional design factor of 4.0. In line with the Alberta Boiler and Pressure Vessel Technical Council's resolution and ABSA's previous Information Bulletin IB99-001, the ASME 2001 Edition may be used for pressure equipment construction for use in Alberta under the same conditions as outlined in Information Bulletin IB99-001. A summary of the issues and conditions detailed in Information Bulletin IB99-001 follows.

2.0 IMPLICATIONS

With a design factor of 3.5, versus 4.0, a 14.3% increase in the allowable design stresses, or a reduction of 12.5% in the pressure vessel minimum required wall thicknesses may be achieved. This reduction is significant, not only relative to material costs but there will be a significant corresponding reduction in all costs with respect to welding resources (consumables and manhours), transportation, handling *etc.* This may also result in possible savings in non-destructive examination, heat-treatment and other requirements.

While there may be economic benefits to a reduction of the design factor, there may be situations where designs are not governed by the membrane stresses under the general ASME Code principles. Pressure equipment may be designed for process conditions where a lower stress level has to be maintained because of stress corrosion, cyclic loading or other operational requirements. In those cases, it is the designer's responsibility to ensure that the equipment will have a sufficient safety margin for operation and the higher allowable design stresses may not be applicable. This is no different from some user requirements now, which exceed Code requirements. It is worth noting that the "Foreword" of ASME Section VIII Div. 1 states that "*The Code is not a handbook and cannot replace education, experience, and the use of engineering judgement. The phrase engineering judgement refers to technical judgements made by knowledgeable designers experienced in the application of the Code. Engineering judgements must never be used to overrule mandatory requirements or specific prohibitions of the Code.*"

It cannot be over-emphasized that codes and standards are, as a rule, written in a form so as to provide for the "minimum" requirements or provisions. Users of all the codes and standards are cautioned that for certain applications, the use of values much more conservative than these minimum requirements (whether it be the allowable design stress level, the minimum thickness, inspection opening diameters, NDT, heat treatment, *etc.*) may be needed. Some cost saving may be achieved if only the minimum provisions are being applied, but good engineering with respect to

the specific applications may not necessarily be exercised and safety may be jeopardized.

3.0 BOILER AND PRESSURE VESSEL TECHNICAL COUNCIL DECISION

In the Technical Council's meeting of June 3, 1999, the proposed ASME Code Addenda incorporating the design factor of 3.5 was reviewed in detail and the following actions were approved:

- a) For pressure equipment in toxic, lethal or flammable service, when ASME Code Section VIII Division 1 Appendix 2 is used in the design of large flanges, Appendix S-2 is to be made mandatory as a Directive from the Administrator. This will apply to all flanges 1016 mm (40 inch) internal diameter or larger used in services other than water or air (or fluid not more hazardous than water or air).
- b) The Technical Council's decision of November 1997 will be rescinded after January 1, 2000 (as the Code Cases will no longer be applicable with the publication of the Code Addenda of July 1, 1999) or upon the annulment of the Code Cases by ASME whichever comes first.

The proposed action a) above is taken because of the possibility of leakage when large diameter flanges are designed to ASME Section VIII Division 1 Appendix 2 with an increase in design stresses and the significant consequences should leakage occur. Also, the proposed action takes into consideration the cautionary statement in the Code Cases noting that "*The Maximum allowable stresses obtained from the Code Cases are not recommended for flanges or other applications where slight distortion can cause leakage or malfunction*".

In the case of vessels for export, designers/manufacturers should note that the latest Code changes might not necessarily be accepted automatically by the jurisdiction(s) of installation. It is understood that some states in the USA might not have adopted the latest codes because their legislation specifically requires a design factor of 4. However, unless otherwise advised by jurisdiction(s) of installation with special construction conditions, ABSA will apply only the requirements of the Code without the additional conditions imposed relative to large diameter flanges by the Boiler and Pressure Vessel Technical Council.

4.0 EXISTING CODE DESIGN FACTOR

It must be realized that continued application of existing published code rules without utilizing the change of design factor is a valid option and indeed, for some applications, may be a more suitable engineering option. It should not be inferred from this information bulletin that there is any promotion or discouragement of the use of the 3.5 design factor.

5.0 EXISTING EQUIPMENT

ASME Codes are applicable to the construction of new pressure equipment. There is no provision in Alberta for re-certification of existing equipment, new or in operation, which was built to code rules using a design factor of 4, by the application of the 3.5 design factor.

6.0 CODE CHANGES AND REGISTERED DESIGNS

In accordance with Section 11(1) of the Alberta Design, Construction and Installation of Boilers and Pressure Vessels Regulations, “changes to a design that has been approved and registered” shall be submitted for approval to make the change (see also Clause 4.1.4 of CSA B51).

For an existing design to be revised to utilize the design factor change, the design change submission will be reviewed as a new design submission and a new Canadian Registration Number (CRN) will be given if the design is accepted for registration. This procedure will also allow for the elimination of any confusion in the field for similar equipment built to different code/code case requirements.

7.0 REPAIRS AND ALTERATIONS

In accordance with existing ABSA policy and CSA B51-97, Clause 11.1, repairs and alterations “shall retain the factor of safety determined by the *ASME Code* Section referenced when the unit was first manufactured.” This means that replacement parts *etc.* cannot be designed using a lower design factor.

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