

A BRIEF DISCUSSION ON ASME SECTION VIII DIVISIONS 1 AND 2 AND THE NEW DIVISION 3

K.T.Lau, Ph.D., P.Eng., 3rd Annual Pressure Industry Conference, Banff, Alberta, Canada, February 1999.

Last Update - October, 2000

	Section VIII Division 1	Section VIII Division 2	Section VIII Division 3
	"Unfired" Pressure Vessel Rules	Alternative Rules	Alternative Rules for High Pressure
Published	< 1940	1968	1997
Pressure Limits	Normally up to 3000 psig	No limits either way, usually 600+ psig	No limit; Normally from 10,000 psig
Organization	General, Construction Type & Material U, UG, UW, UF, UB, UCS, UNF, UCI, UCL, UCD, UHT, ULT	General, Material, Design, Fabrication and others AG, AM, AD, AF, AR, AI, AT, AS	Similar to Division 2 KG, KM, KD, KF, KR, KE, KT, KS
Design Factor	Design Factor 3.5 on tensile (4* used previously) and other yield and temperature considerations	Design Factor of 3 on tensile (lower factor under reviewed) and other yield and temperature considerations	Yield based with reduction factor for yield to tensile ratio less than 0.7
Design Rules	Membrane - Maximum stress Generally Elastic analysis Very detailed design rules with Quality (joint efficiency) Factors. Little stress analysis required; pure membrane without consideration of discontinuities controlling stress concentration to a safety factor of 3.5 or higher	Shell of Revolution - Max. shear stress Generally Elastic analysis Membrane + Bending. Fairly detailed design rules. In addition to the design rules, discontinuities, fatigue and other stress analysis considerations may be required unless exempted and guidance provided for in Appendix 4, 5 and 6	Maximum shear stress Elastic/Plastic Analyses and more. Some design rules provided; Fatigue analysis required; Fracture mechanics evaluation required unless proven leak- before-burst, Residual stresses become significant and maybe positive factors (e.g. autofrettage)
Experimental Stress Analysis	Normally not required	Introduced and may be required	Experimental design verification but may be exempted
Material and Impact Testing	Few restrictions on materials; Impact required unless exempted; extensive exemptions under UG-20, UCS 66/67	More restrictions on materials; impact required in general with similar rules as Division 1	Even more restrictive than Division 2 with different requirements. Fracture toughness testing requirement for fracture mechanics evaluation Crack tip opening displacement (CTOD) testing and establishment of K _{Ic} and/or J _{Ic} values
NDE Requirements	NDE requirements may be exempted through increased design factor	More stringent NDE requirements; extensive use of RT as well as UT, MT and PT.	Even more restrictive than Division 2; UT used for all butt welds, RT otherwise, extensive use of PT and MT
Welding and fabrication	Different types with butt welds and others	Extensive use/requirement of butt welds and full penetration welds including non- pressure attachment welds	Butt Welds and extensive use of other construction methods such as threaded, layered, wire-wound, interlocking strip- wound and others

User	User or designated agent to provide specifications (see U-2(a))	User's Design Specification with detailed design requirements (see AG-301.1) include AD 160 for fatigue evaluation	User's Design Specification with more specific details (see KG-310) including contained fluid data, etc with useful operation life expected and others. Designer defined
Manufacturer	Manufacturer to declare compliance in data report	Manufacturer's Design Report certifying design specification and code compliance in addition to data report	Same as Division 2
Professional Engineer Certification	Normally not required	Professional Engineers' Certification of User's Design Specification as well as Manufacturer's Design Report Professional Engineer shall be experienced in pressure vessel design	Same as Division 2 but the Professional Engineer shall be experienced in <u>high</u> pressure vessel design and shall not sign for both User and Manufacturer
Safety Relief Valve	UV Stamp	UV Stamp	UV3 Stamp
Code Stamp and Marking	U Stamp with Addition markings including W, P, B, RES; L, UB, DF; RT, HT	U2 Stamp with Additional marking including HT	U3 Stamp with additional marking denoting construction type; HT, PS, WL, M, F, W, UQT, WW, SW
Hydrostatic Test	1.3 (Was 1.5 before the use of the 3.5 Design Factor in the 1999 Addenda)	1.25	1.25 (may be exempted for autofrettaged vessels)

* In 1998, Code Cases 2278 and 2290 for ASME Section VIII Division 1 allowed for alternative maximum allowable design stresses based on a factor of 3.5 under certain provisions instead of a factor of 4 used by the Code. These code cases were incorporated into the Code in 1999.

Common Features

Jurisdiction may have requirements in addition to Code

Mandatory Manufacturer's Quality Control System Implementation and Audit Requirements

Code Stamp Authorization through ASME Accreditation and Authorization

Authorized Inspection Agency in accordance with QAI

Authorized Inspector with Jurisdictional approval and certification

Manufacturer being held accountable for Code Stamp Application and full Code Compliance

NDE Personnel to SNT-TC-1A

Note: This brief comparative table is presented for discussion and does not represent the opinion of the ABSA, the ASME or the ASME Boiler and Pressure Vessel Code Committees. Readers are advised to consult with the ASME Code Section VIII Divisions 1, 2 & 3 for details