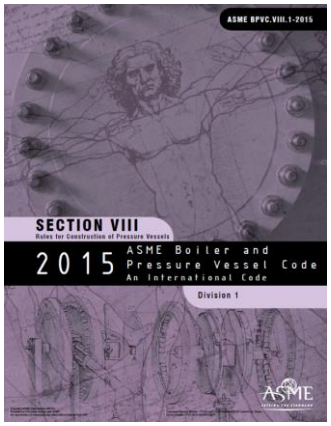
W.Maass (UK) Ltd.

Bedford Street, St. Helens, Merseyside, WA9 1PN, United Kingdom, Tel +44 (0) 1744 453393
engineering@w-maass.co.uk

Information Data Sheet – In House Design

W Maass (UK) Ltd have an in-house design department to provide support to Customers requiring design or stress analysis work ranging from formulae based flange design calculations to Finite Element Analysis. Design work can be provided as a standalone service or to support a complete project supply. Contact us for more information.

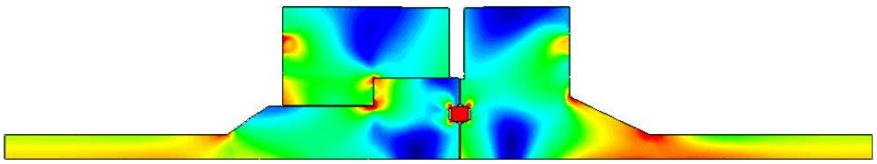
ASME VIII Division 1 / PD5500 Formulae Based Calculations



Flange design calculations to ASME VIII Div 1 Appendix 2 are the first option for design analysis and verification. They can be used for standard flange types such as Weld Necks or modified with other proprietary calculations to analyse special flanges such as Swivels and Anchors.

Formulae based calculations are the quickest and most cost effective method of flange design verification. They provide a general understanding of performance but can provide conservative results.

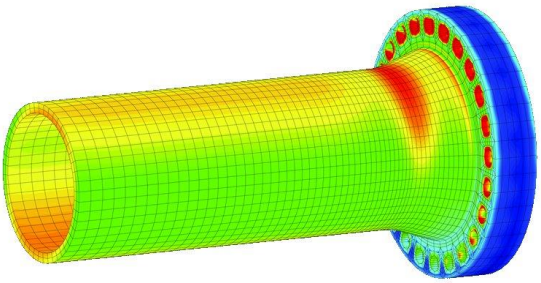
2D Axis-Symmetric Finite Element Analysis



2D Axis-Symmetric FEA is a more accurate and intricate method of design verification compared to formulae based calculations. It allows greater insight into the fine detail of flange design, in particular greater detail of seal integrity. It's also less conservative than calculation method. Analysis is performed in accordance with ASME VIII Div 2 Part 5, considering linear or non-linear stress analysis, fatigue analysis and HISC analysis.

2D Axis-Symmetric FEA is a quick and cost effective method of performing design analysis but it's slightly compromised because external bending moment has to be considered as an equivalent axial force, torque and shear forces can't be considered and bolt holes can't be accurately modelled.

3D Finite Element Analysis



3D FEA is the most accurate and informative method of design verification and provides the greatest accuracy. Analysis time can be long, especially if a complete joint is analysed using contact faces.

Analysis is performed in accordance with ASME VIII Div 2 Part 5, considering linear or non-linear stress analysis, fatigue analysis and HISC analysis. 3D FEA is most suited to non-linear analysis as the model can realistically simulate stress re-distribution at locations of yield.

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Recent Example of FEA Work

BP Shah Deniz Project, Special 32” 1500lb RTJ ASME Type Weld Neck & Swivel Flange, High External Loads

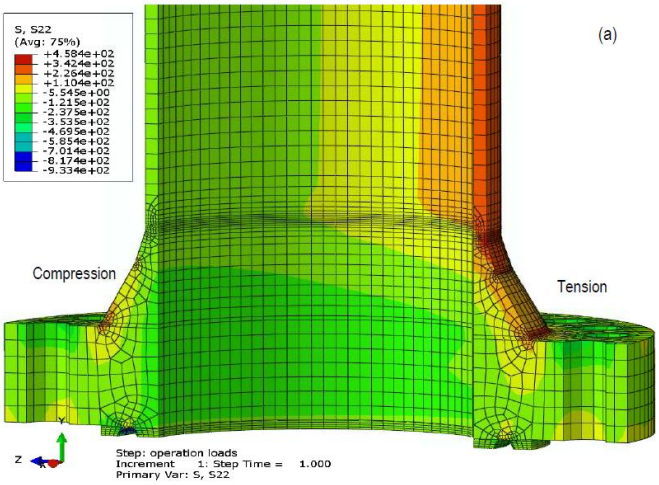
An in-depth 3D Finite Element Analysis was provide to BP in 2014 to validate bespoke 32” 1500lb type flange designs, supplied by W Maass UK Ltd to BP Shah Deniz project. The bespoke flange designs were necessary for this project due to normal ASME range for 1500lb flanges going no larger than 24” NB, ASME standard not including swivel flange type and the application of high external loads.

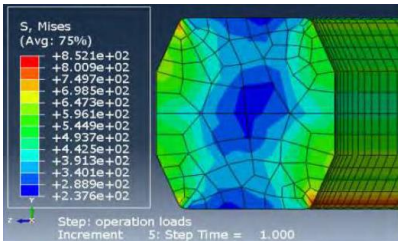
The design report validated RTJ type Weld Neck, Swivel and Blind flanges for two scenarios,

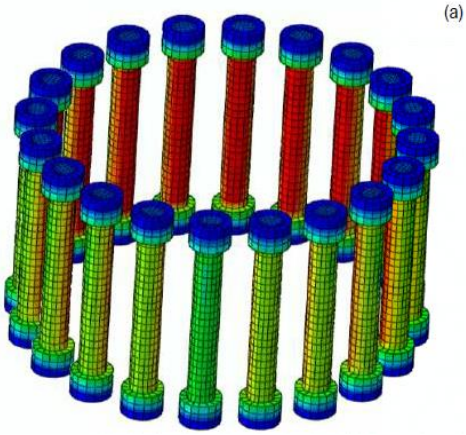
Design 1) 34.6mm wall, 4.0” Dia Bolts, 141Barg, 3000kNm
Design 2) 31.8mm wall, 3.5” Dia Bolts, 141Barg, 2,200kNm

Analysis was performed to ASME VIII Division 2 Part 5, considering stress slices for Membrane and Membrane + Linearised Bending stress through key sections. Also stress concentrations at Local Discontinuities were studied. The analysis mainly focused on Operating Conditions, considering high external loads, but additional analysis was also performed to consider the application of a short term extreme Accidental load case with regards to preserving seal integrity. Such a case could be Earth Quake scenario or trawler net snagging.

Below are some images of the FEA work. All flange stresses were determined using linear material properties but analysis of the special RTJ gasket for accidental load considered non-linear frictional contact and non-linear material properties.







Special 32” 1500lb RTJ ASME Type Flange