

Code Case 2695 Implementation

and PV Elite 2012 Sneak Peak
by: Scott Mayeux

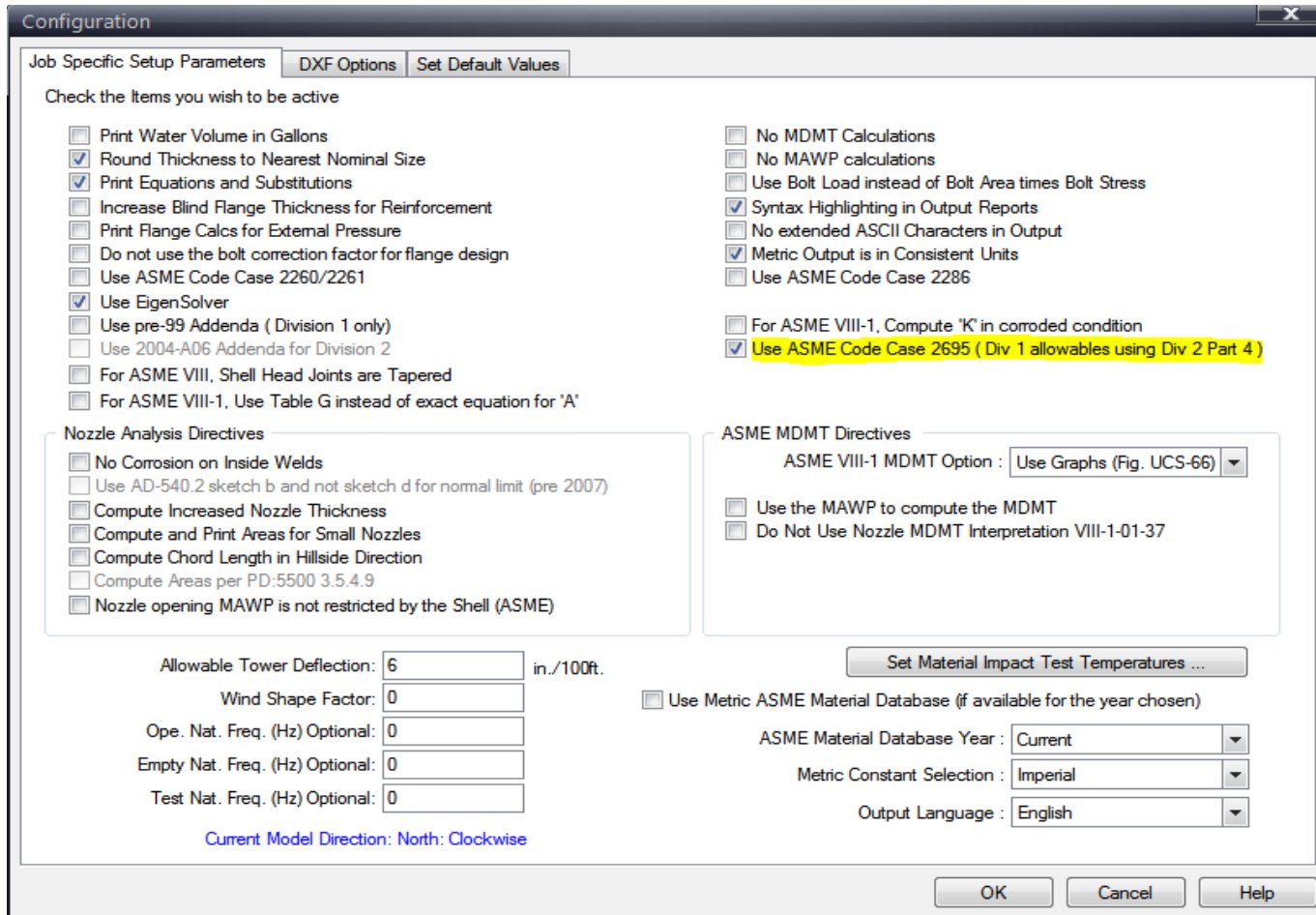


- What is ASME Code Case 2695 and why is it important?
- What are 'common rules' and how does it all tie together?
- How is this implemented in PV Elite® 2012?
- An Exchanger example with and without CC 2695
- Conclusions

- What is a Code Case?
- ASME board certified September 2011
- Allows ASME Division 1 vessels to be designed using the equations in Division 2, 2011a Addenda
- Allowable Stresses per Division 1
- MDMT per Division 1
- Use the 'Design-by-Rule' requirements of Part 4
- A number of other 'restrictions' to know about

- Division 2 represents newer technology in many areas (nozzle reinforcement) and 'copies' sections that are in Division 1 (like part UHX)
- It would be nice if there was only one set of rules for ASME to maintain
- In the future there may be only 1 set of rules
- Is CC 2695 the beginning of an important initiative?

■ Set the Code Case 2695 'parameter'



The screenshot shows the 'Configuration' dialog box with the 'Job Specific Setup Parameters' tab selected. The 'Check the Items you wish to be active' section contains two columns of checkboxes. In the right column, the option 'Use ASME Code Case 2695 (Div 1 allowables using Div 2 Part 4)' is checked and highlighted in yellow. Below this, the 'ASME VIII-1 MDMT Option' is set to 'Use Graphs (Fig. UCS-66)'. The 'Nozzle Analysis Directives' section on the left includes options for corrosion, nozzle thickness, and MDMT. The bottom section contains input fields for tower deflection, wind shape factor, and natural frequencies, along with dropdowns for material database year, metric constant selection, and output language. The 'Current Model Direction' is noted as North: Clockwise.

Configuration

Job Specific Setup Parameters | DXF Options | Set Default Values

Check the Items you wish to be active

<input type="checkbox"/> Print Water Volume in Gallons	<input type="checkbox"/> No MDMT Calculations
<input checked="" type="checkbox"/> Round Thickness to Nearest Nominal Size	<input type="checkbox"/> No MAWP calculations
<input checked="" type="checkbox"/> Print Equations and Substitutions	<input type="checkbox"/> Use Bolt Load instead of Bolt Area times Bolt Stress
<input type="checkbox"/> Increase Blind Flange Thickness for Reinforcement	<input checked="" type="checkbox"/> Syntax Highlighting in Output Reports
<input type="checkbox"/> Print Flange Calcs for External Pressure	<input type="checkbox"/> No extended ASCII Characters in Output
<input type="checkbox"/> Do not use the bolt correction factor for flange design	<input checked="" type="checkbox"/> Metric Output is in Consistent Units
<input type="checkbox"/> Use ASME Code Case 2260/2261	<input type="checkbox"/> Use ASME Code Case 2286
<input checked="" type="checkbox"/> Use EigenSolver	
<input type="checkbox"/> Use pre-99 Addenda (Division 1 only)	<input type="checkbox"/> For ASME VIII-1, Compute 'K' in corroded condition
<input type="checkbox"/> Use 2004-A06 Addenda for Division 2	<input checked="" type="checkbox"/> Use ASME Code Case 2695 (Div 1 allowables using Div 2 Part 4)
<input type="checkbox"/> For ASME VIII, Shell Head Joints are Tapered	
<input type="checkbox"/> For ASME VIII-1, Use Table G instead of exact equation for 'A'	

Nozzle Analysis Directives

<input type="checkbox"/> No Corrosion on Inside Welds
<input type="checkbox"/> Use AD-540.2 sketch b and not sketch d for normal limit (pre 2007)
<input type="checkbox"/> Compute Increased Nozzle Thickness
<input type="checkbox"/> Compute and Print Areas for Small Nozzles
<input type="checkbox"/> Compute Chord Length in Hillside Direction
<input type="checkbox"/> Compute Areas per PD:5500 3.5.4.9
<input type="checkbox"/> Nozzle opening MAWP is not restricted by the Shell (ASME)

ASME MDMT Directives

ASME VIII-1 MDMT Option : Use Graphs (Fig. UCS-66)

<input type="checkbox"/> Use the MAWP to compute the MDMT
<input type="checkbox"/> Do Not Use Nozzle MDMT Interpretation VIII-1-01-37

Allowable Tower Deflection: 6 in./100ft.

Wind Shape Factor: 0

Ope. Nat. Freq. (Hz) Optional: 0

Empty Nat. Freq. (Hz) Optional: 0

Test Nat. Freq. (Hz) Optional: 0

Current Model Direction: North: Clockwise

Set Material Impact Test Temperatures ...

☐ Use Metric ASME Material Database (if available for the year chosen)

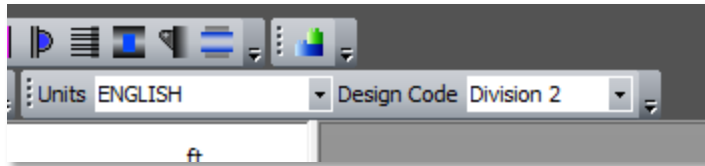
ASME Material Database Year : Current

Metric Constant Selection : Imperial

Output Language : English

OK Cancel Help

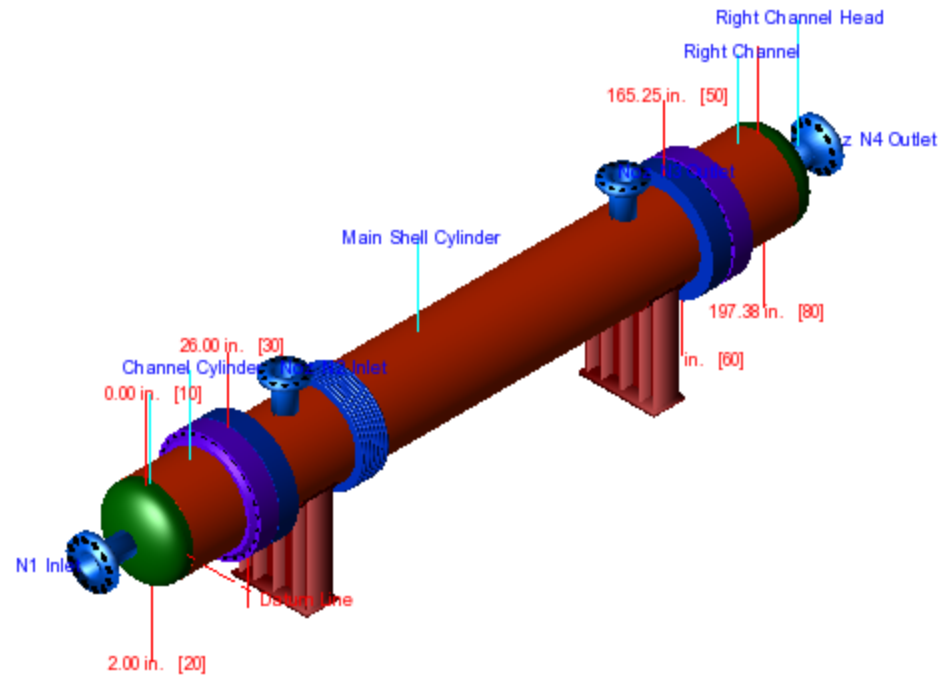
- Notice the design Code is set to Division 2



- Model as usual
- Numerous notes in the output to make this clear to inspectors and checkers

This analysis was performed per ASME VIII-1 and Code Case 2695 which allows the use of ASME VIII-2 Part 4 formulas using VIII-1 allowable stresses. The MDMT calculations are per UCS-66 where applicable.

- Evaluate a Heat Exchanger



- Review CC 2695 results :
 - Internal Pressure
 - External Pressure
 - Nozzles
 - Tubes

- Re-run without using the Code Case
 - Review

Internal Pressure Comparison



■ With 2695

Element Required Thickness and MAWP :

From	To	Design Pressure psig	M.A.W.P. Corroded psig	M.A.P. New & Cold psig	Minimum Thickness in.	Required Thickness in.
Left Chann		1425.00	1489.89	1809.95	1.00000	0.95971
Channel Cy		1425.00	1579.20	1887.26	1.18750	1.07978
30	40	1425.00	1782.95	1782.95	6.00000	5.25100
Main Shell		375.000	376.544	615.433	0.37500	0.37397
50	60	1425.00	1782.95	1782.95	6.00000	5.25100
Right Chan		1425.00	1579.20	1887.26	1.18750	1.07978
Right Chan		1425.00	1489.89	1809.95	1.00000	0.95971

■ Without 2695

Element Required Thickness and MAWP :

From	To	Design Pressure psig	M.A.W.P. Corroded psig	M.A.P. New & Cold psig	Minimum Thickness in.	Required Thickness in.
Left Chann		1425.00 >>>	1346.98	1652.89	1.00000 <<<	1.05107
Channel Cy		1425.00	1565.13	1868.24	1.18750	1.08784
30	40	1425.00	1782.95	1782.95	6.00000	5.23400
Main Shell		375.000	375.764	613.497	0.37500	0.37449
50	60	1425.00	1782.95	1782.95	6.00000	5.23400
Right Chan		1425.00	1565.13	1868.24	1.18750	1.08784
Right Chan		1425.00 >>>	1346.98	1652.89	1.00000 <<<	1.05107

Note the difference in the MAWP and required thickness of the heads.

Nozzle Results Comparison



- With 2695

Nozzle Calculation Summary:

Description	MAWP	Ext	MAPNC	Table 4.5.2	Weld	
N1 Inlet	1489.56	OK	...	OK	OK	Passed
Noz N2 Inlet	376.54	OK	...	OK	OK	Passed
Noz N3 Outlet	376.54	OK	...	OK	OK	Passed
Noz N4 Outlet	1489.56	OK	...	OK	OK	Passed

- Without 2695

Nozzle Calculation Summary:

Description	MAWP psig	Ext	MAPNC psig	UG45 [tr]	Weld Path	Areas or Stresses
N1 Inlet		...	...Failed	0.000	Failed	NoCalc[*]
Noz N2 Inlet	375.76	OK	0.00	OK 0.370	OK	Passed
Noz N3 Outlet	375.76	OK	0.00	OK 0.370	OK	Passed
Noz N4 Outlet		...	...Failed	0.000	Failed	NoCalc[*]

- w/o 2695
UG-37

Nozzle Calculation Summary:

Description	MAWP psig	Ext	MAPNC psig	UG45 [tr]	Weld Path	Areas or Stresses
N1 Inlet		...	...Failed	0.000	Failed	NoCalc[*]
Noz N2 Inlet	284.73	OK	...	OK 0.370	OK	Failed
Noz N3 Outlet	284.73	OK	...	OK 0.370	OK	Failed
Noz N4 Outlet		...	...Failed	0.000	Failed	NoCalc[*]

The design works using CC 2695 and does not work otherwise.

Tube Results Comparison



■ With 2695

Summary of Tube Required Thickness Results:

Total Required Thickness including Corrosion all.	0.0347	in.
Allowable Internal Pressure at Corroded thickness	1048.39	psig
Required Internal Design Pressure	1040.00	psig
Allowable External Pressure at Corroded thickness	1060.99	psig
Required External Design Pressure	335.00	psig
Required Thickness due to Shell Side pressure	0.0197	in.

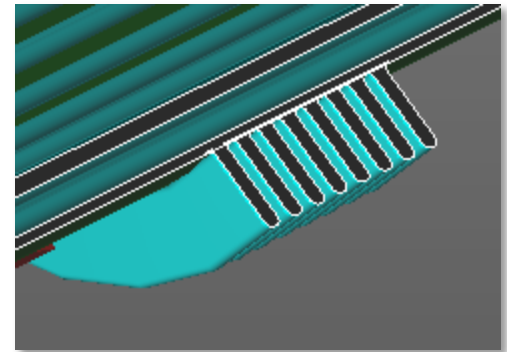
■ Without 2695

Summary of Tube Required Thickness Results:

Total Required Thickness including Corrosion all.	0.0351	in.
Allowable Internal Pressure at Corroded thickness	1037.40	psig
Required Internal Design Pressure	1040.00	psig
Allowable External Pressure at Corroded thickness	519.01	psig
Required External Design Pressure	335.00	psig
Required Thickness due to Shell Side pressure	0.0257	in.

Note the difference in the results for the tubes, especially the MAEP.

- Thinner heads and tubes
- More efficient nozzle reinforcement
- Higher component MAWP's & MAEP's
- CC 2695 can produce more economical designs
- Read and understand the Code Case and abide by any 'local' requirements
- PV Elite® 2012 makes this easy



The End

Thanks for viewing this presentation!

