Sample No. 5

Sample FEA Analysis for Reinforced Branch Connection

DN2000 WT=10mm Header with DN300 WT=10mm Branch
Pipe Material A106-B

Geometry:

Header Pipe OD =	2000	mm	D/t=	200
Header Pipe WT=	10	mm		
Branch Pipe OD =	300	mm	D/t=	30
Branch Pipe WT=	10	mm		
Re-pad Width=	150	mm	Note: D/t is greater than 20 therefore can be considered as thin shell.	
Re-pad WT=	20	mm		

With 2 m of Length for Header and 1 m for Branch
Note: Length of Header is the total length. Branch is modelled at the center of header.
The given length of Branch is from face of header to end of branch.

Loads Applied at Branch End:

In-plane Bending Moment=	30000	N-m
Out-Plane Bending Moment=	10000	N-m
Axial Force=	100000	N
Torsional Moment=	50000	N-m
Internal Pressure, P=	1	Mpa

Boundary Condition:
Fixed at the One End of the Header Pipe

Inplane Von-Mises Equivalent Stress Output:

One FEA Sotware	283	Mpa	(Inplane)	
Another FEA Software (Brick Element)	258	Mpa	(Inplane)	(Mid Nodes Not Included)
Another FEA Software (Brick Element)	306	Mpa	(Inplane)	(Mid Nodes Included)
Another FEA Software (Plate Element)=	526	Mpa	(Inplane)	(Linear Plate Element Formulation)
Another FEA Software (Shell Element)=	632	Mpa	(Inplane)	(General Shell Element with Mid Node)
Another FEA Software (Shell Element)=	578	Mpa	(Inplane)	(Thin Shell Element)

Outplane Von-Mises Equivalent Stress Output:

One FEA Sotware	151	Mpa	(Outplane)	
Another FEA Software (Brick Element)	144	Mpa	(Outplane)	(Mid Nodes Not Included)
Another FEA Software (Brick Element)	163	Mpa	(Outplane)	(Mid Nodes Included)
Another FEA Software (Plate Element)=	306	Mpa	(Outplane)	(Linear Plate Element Formulation)
Another FEA Software (Shell Element)=	360	Mpa	(Outplane)	(General Shell Element with Mid Node)
Another FEA Software (Shell Element)=	324	Mpa	(Outplane)	(Thin Shell Element)

Axial Von-Mises Equivalent Stress Output:

One FEA Sotware	192	Mpa	(Axial)	
Another FEA Software (Brick Element)	174	Mpa	(Axial)	(Mid Nodes Not Included)
Another FEA Software (Brick Element)	218	Mpa	(Axial)	(Mid Nodes Included)
Another FEA Software (Plate Element)=	428	Mpa	(Axial)	(Linear Plate Element Formulation)
Another FEA Software (Shell Element)=	435	Mpa	(Axial)	(Thin Shell Element)
Another FEA Software (Shell Element)=	485	Mpa	(Axial)	(General Shell Element with Mid Node)

Torsion Von-Mises Equivalent Stress Output:

One FEA Sotware	76	Mpa	(Torsion)	
Another FEA Software (Brick Element)	91	Mpa	(Torsion)	(Mid Nodes Not Included)
Another FEA Software (Brick Element)	116	Mpa	(Torsion)	(Mid Nodes Included)
Another FEA Software (Plate Element)=	81	Mpa	(Torsion)	(Linear Plate Element Formulation)
Another FEA Software (Shell Element)=	88	Mpa	(Torsion)	(Thin Shell Element)
Another FEA Software (Shell Element)=	87	Mpa	(Torsion)	(General Shell Element with Mid Node)

Pressure Von-Mises Equivalent Stress Output:

One FEA Sotware	204	Mpa	(Pressure)	
Another FEA Software (Brick Element)	278	Mpa	(Pressure)	(Mid Nodes Not Included)
Another FEA Software (Brick Element)	351	Mpa	(Pressure)	(Mid Nodes Included)
Another FEA Software (Plate Element)=	319	Mpa	(Pressure)	(Linear Plate Element Formulation)
Another FEA Software (Shell Element)=	253	Mpa	(Pressure)	(Thin Shell Element)
Another FEA Software (Shell Element)=	361	Mpa	(Pressure)	(General Shell Element with Mid Node)

Combined Loading Von-Mises Equivalent Stress Output:

One FEA Sotware	442	Mpa	(Combined)	
Another FEA Software (Brick Element)	407	Mpa	(Combined)	(Mid Nodes Not Included)
Another FEA Software (Brick Element)	483	Mpa	(Combined)	(Mid Nodes Included)
Another FEA Software (Plate Element)=	1238	Mpa	(Combined)	(Linear Plate Element Formulation)
Another FEA Software (Shell Element)=	1239	Mpa	(Combined)	(Thin Shell Element)
Another FEA Software (Shell Element)=	1424	Mpa	(Combined)	(General Shell Element with Mid Node)