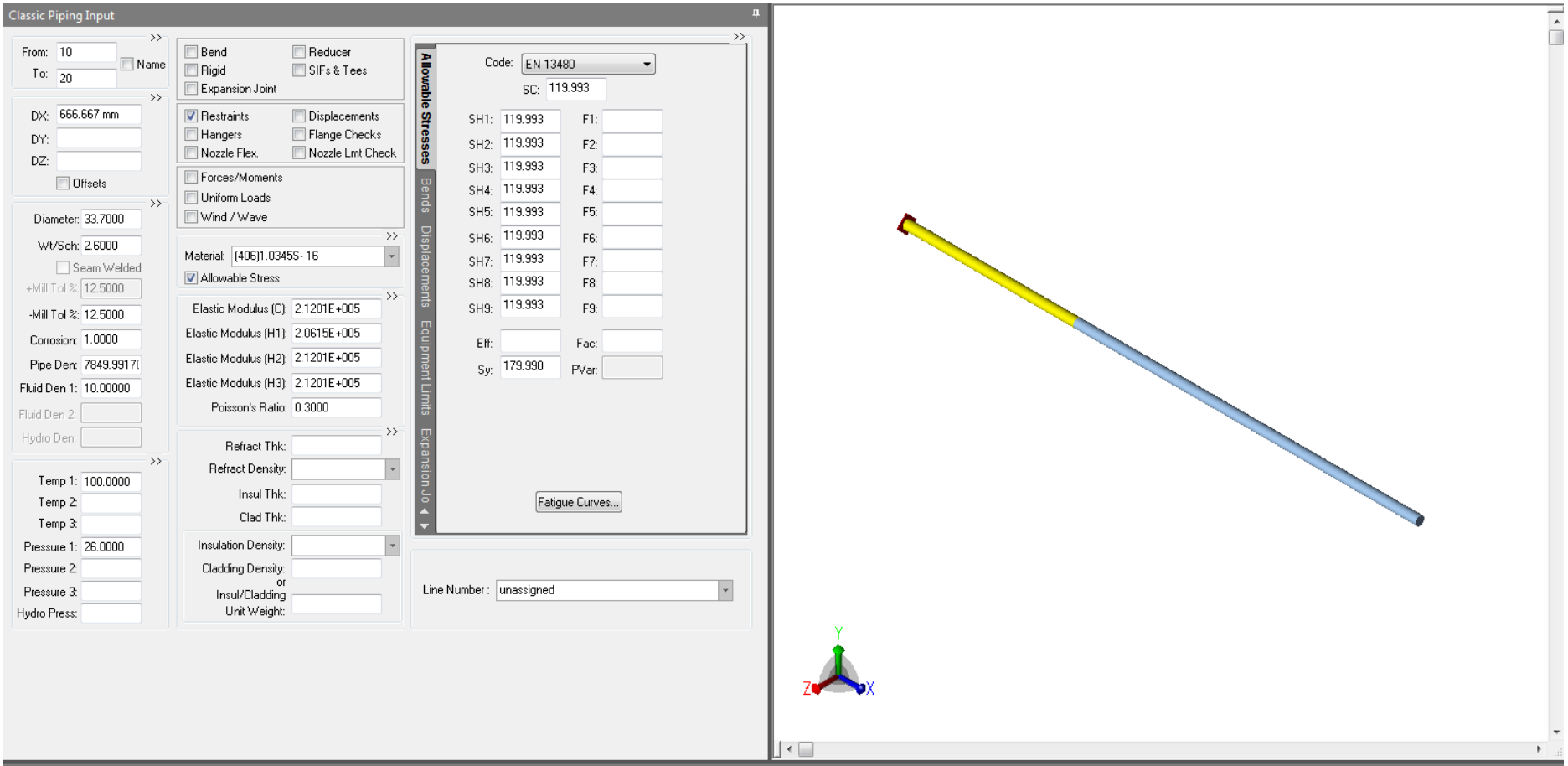
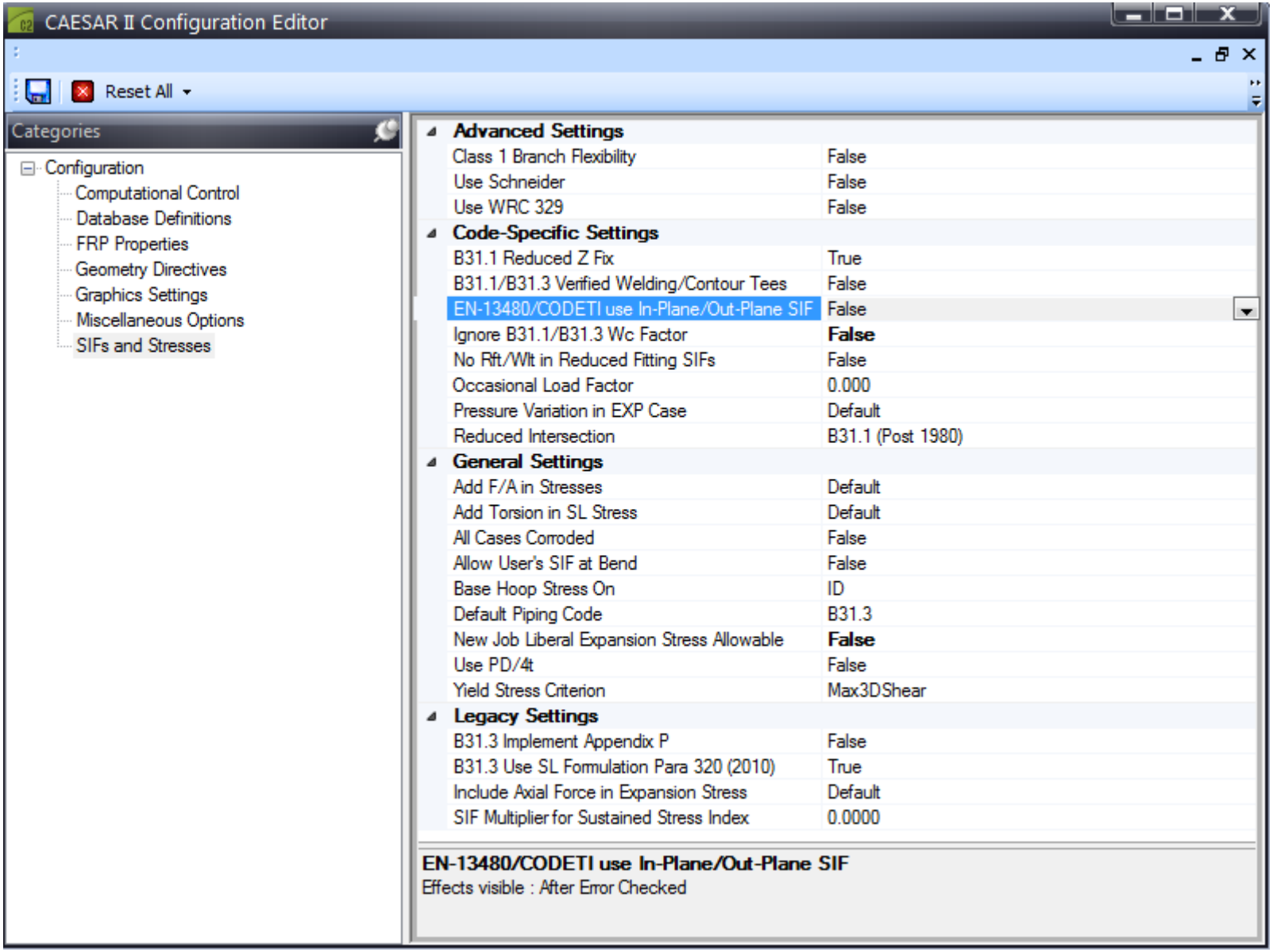


Elements

From Node	To Node	DX mm.	DY mm.	DZ mm.	Pipe OD mm.	Pipe Wall mm.	+Mill Tolerance %	-Mill Tolerance %	Insulation Thickness mm.	Corrosion mm.	Pipe Density kg./cu.m	Fluid Density kg./cu.m	Insulation Density kg./cu.m	Cladding Thickness mm.	Cladding Density kg./cu.m	Insul/Clad Unit Weight N./mm.	Refractory Thickness mm.	Refractory Density kg./cu.m	T1 Deg C	T2 Deg C	T3 Deg C
10	20	666.667 mm			33.7000	2.6000	12.5000	12.5000	0.0000	1.0000	7849.99170	10.00000	0.00000	0.0000	0.00000	0.0000	0.0000	0.00000	100.0000	0.0000	0.0000
20	30	666.667 mm			33.7000	2.6000	12.5000	12.5000	0.0000	1.0000	7849.99170	10.00000	0.00000	0.0000	0.00000	0.0000	0.0000	0.00000	100.0000	0.0000	0.0000
30	40	666.667 mm			33.7000	2.6000	12.5000	12.5000	0.0000	1.0000	7849.99170	10.00000	0.00000	0.0000	0.00000	0.0000	0.0000	0.00000	100.0000	0.0000	0.0000


CAESAR II Configuration Editor
Reset All
Categories
Configuration
Computational Control
Database Definitions
FRP Properties
Geometry Directives
Graphics Settings
Miscellaneous Options
SIFs and Stresses
Advanced Settings
Class 1 Branch Flexibility False
Use Schneider False
Use WRC 329 False
Code-Specific Settings
B31.1 Reduced Z Fix True
B31.1/B31.3 Verified Welding/Contour Tees False
EN-13480/CODETI use In-Plane/Out-Plane SIF False
Ignore B31.1/B31.3 Wc Factor False
No Rft/Wlt in Reduced Fitting SIFs False
Occasional Load Factor 0.000
Pressure Variation in EXP Case Default
Reduced Intersection B31.1 (Post 1980)
General Settings
Add F/A in Stresses Default
Add Torsion in SL Stress Default
All Cases Corroded False
Allow User's SIF at Bend False
Base Hoop Stress On ID
Default Piping Code B31.3
New Job Liberal Expansion Stress Allowable False
Use PD/4t False
Yield Stress Criterion Max3DShear
Legacy Settings
B31.3 Implement Appendix P False
B31.3 Use SL Formulation Para 320 (2010) True
Include Axial Force in Expansion Stress Default
SIF Multiplier for Sustained Stress Index 0.0000
EN-13480/CODETI use In-Plane/Out-Plane SIF
Effects visible : After Error Checked

STRESSES EXTENDED REPORT: Stresses on Elements
CASE 2 (SUS) W+P1

Node	Axial Stress N./sq.mm.	Bending Stress N./sq.mm.	Torsion Stress N./sq.mm.	Hoop Stress N./sq.mm.	Max Stress Intensity N./sq.mm.	SIF/Index In Plane	SIF/Index Out Plane	Code Stress N./sq.mm.	Allowable Stress N./sq.mm.	Ratio %	Piping Code

Piping Code: EN-13480 = EN-13480, June 2012

CODE STRESS CHECK PASSED : LOADCASE 2 (SUS) W+P1

Highest Stresses: (N./sq.mm.)

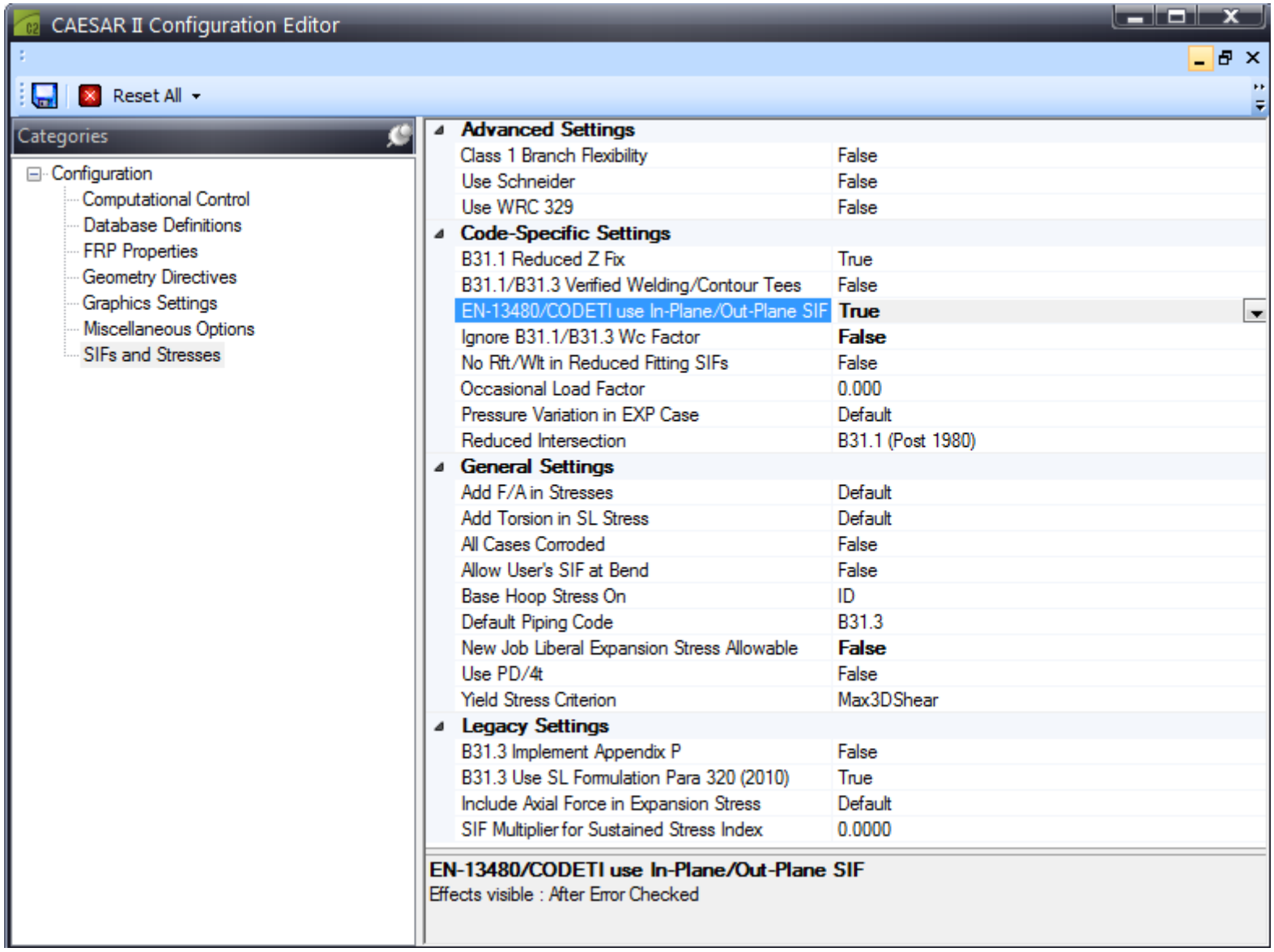
Ratio (%):	24.3	@Node	10
Code Stress:	29.2	Allowable Stress:	120.0
Axial Stress:	6.5	@Node	20
Bending Stress:	21.4	@Node	10
Torsion Stress:	0.0	@Node	20
Hoop Stress:	14.3	@Node	20
Max Stress Intensity:	45.0	@Node	10

10	6.53	21.38	0.00	14.25	45.00	1.000	1.000	29.21	119.99	24.34	EN-13480
20	6.53	9.50	0.00	14.25	28.75	1.000	1.000	17.33	119.99	14.44	EN-13480
20	6.53	9.50	0.00	14.25	28.75	1.000	1.000	17.33	119.99	14.44	EN-13480
30	6.53	2.38	0.00	14.25	28.75	1.000	1.000	10.20	119.99	8.50	EN-13480
30	6.53	2.38	0.00	14.25	28.75	1.000	1.000	10.20	119.99	8.50	EN-13480
40	6.53	0.00	0.00	14.25	28.75	1.000	1.000	7.83	119.99	6.52	EN-13480

LOCAL ELEMENT FORCES AND MOMENTS REPORT: Forces on Elements
CASE 2 (SUS) W+P1

Node	Load Case	fx N.	fy N.	fz N.	mx N.m.	my N.m.	mz N.m.
LOAD CASE DEFINITION KEY							
CASE 2 (SUS) W+P1							
10							
	2 (SUS)	0	0	-39	0.0	39.2	0.0
20							
	2 (SUS)	-0	0	26	0.0	-17.4	0.0
20							
	2 (SUS)	0	0	-26	0.0	17.4	0.0
30							
	2 (SUS)	-0	0	13	0.0	-4.4	0.0
30							
	2 (SUS)	0	0	-13	0.0	4.4	0.0
40							
	2 (SUS)	-0	0	0	0.0	0.0	0.0

Update Config Setting for In-plane/out-plane improve sifs



CASE 2 (SUS) W+P1

Node	Axial Stress N./sq.mm.	Bending Stress N./sq.mm.	Torsion Stress N./sq.mm.	Hoop Stress N./sq.mm.	Max Stress Intensity N./sq.mm.	SIF/Index In Plane	SIF/Index Out Plane	Code Stress N./sq.mm.	Allowable Stress N./sq.mm.	Ratio %	Piping Code

Piping Code: EN-13480 = EN-13480, June 2012

CODE STRESS CHECK PASSED : LOADCASE 2 (SUS) W+P1

Highest Stresses: (N./sq.mm.)

Ratio (%):	37.3	@Node	10
Code Stress:	44.8	Allowable Stress:	120.0
Axial Stress:	11.8	@Node	20
Bending Stress:	31.7	@Node	10
Torsion Stress:	0.0	@Node	20
Hoop Stress:	24.8	@Node	20
Max Stress Intensity:	43.5	@Node	10

10	11.77	31.73	0.00	24.78	43.51	1.000	1.000	44.81	119.99	37.34	EN-13480
20	11.77	14.10	0.00	24.78	28.75	1.000	1.000	27.18	119.99	22.65	EN-13480
20	11.77	14.10	0.00	24.78	28.75	1.000	1.000	27.18	119.99	22.65	EN-13480
30	11.77	3.53	0.00	24.78	28.75	1.000	1.000	16.60	119.99	13.83	EN-13480
30	11.77	3.53	0.00	24.78	28.75	1.000	1.000	16.60	119.99	13.83	EN-13480
40	11.77	0.00	0.00	24.78	28.75	1.000	1.000	13.07	119.99	10.89	EN-13480

LOCAL ELEMENT FORCES AND MOMENTS REPORT: Forces on Elements
CASE 2 (SUS) W+P1

Node	Load Case	fx N.	fy N.	fz N.	mx N.m.	my N.m.	mz N.m.
LOAD CASE DEFINITION KEY							
CASE 2 (SUS) W+P1							
10							
	2(SUS)	0	0	-39	0.0	39.2	0.0
20							
	2(SUS)	-0	0	26	0.0	-17.4	0.0
20							
	2(SUS)	0	0	-26	0.0	17.4	0.0
30							
	2(SUS)	-0	0	13	0.0	-4.4	0.0
30							
	2(SUS)	0	0	-13	0.0	4.4	0.0
40							
	2(SUS)	-0	0	0	0.0	0.0	0.0

Hand Calc Stresses – match original analysis run but not revised run even though sifs are unity and all raw forces and moments are identical

Od =	33.7	mm					
t =	2.6	mm		2.275	mm	1.275	mm
mill tol =	-12.5	% =		-0.325	mm		
corro =	-1	mm					
id =	28.5	mm		29.15	mm	31.15	mm
	no red			-mill		-mill-corr	
CSA =	254.03	mm2		224.60	mm2	129.88	mm2
Z =	1835.44	mm3		1654.01		1014.57	
hoop stress =	14.25	N/mm2		16.66	N/mm2	31.76	N/mm2
Axial stress 1 =	0.00	N/mm2		0.00	N/mm2	0.00	N/mm2
Axial stress 2 =	6.53	N/mm2		0.00	N/mm2	15.26	N/mm2
	6.53	N/mm2		0.00	N/mm2	15.26	N/mm2
bending stress =	21.36	N/mm2		23.70	N/mm2	38.64	N/mm2
Torsional stress =	0.00	N/mm2		0.00	N/mm2	0.00	N/mm2
sif =	1			1		1	
code stress =	29.78	N/mm2		33.33	N/mm2	55.82	N/mm2
C2 =	29.2	N/mm2					
diff =	0.58	N/mm2	- difference because C2 uses the alternative pressure term.				

8.43	= pcdo/4en	
7.83	= ((pcdi2)/(do2-di2))+(Pc/2)	
0.60	N/mm2	
29.2	N/mm2 - using 7.83 N/mm2	- matches C2 exactly now!

	axial			torsion		
P (N/mm2)	fx (N)	fy (N)	fz (N)	mx (Nm)	my (Nm)	mz (Nm)
2.6	0	0	-39	0	39.2	0

The stress intensification factors, i, are given in Tables H-1 and H-2.

As an alternative route to equations given in 12.3.2 to 12.3.6, a more detailed determination of the stresses by separating in-plane and out-of-plane moments can be performed, using the corresponding stress intensity factors in Table H-3.

In this case the factor 0,75 i for moment M_A, M_B and M_C in equations (12.3.2-1), (12.3.3-1), (12.3.4-2) and (12.3.5-1) shall be replaced by i_o and i_i respectively, in accordance with Table H-3. In the same way, the factor i for moments M_C and M_D in equations (12.3.4-1), (12.3.4-2), (12.3.5-1) and (12.3.6-1) shall be replaced by i_o and i_i.

NOTE The pressure term $\frac{p_c d_o}{4e_n}$ in the equations (12.3.2-1), (12.3.3-1), (12.3.4-1), (12.3.4-2) and (12.3.5-1) may be replaced by the alternative term $\frac{p_c d_i^2}{d_o^2 - d_i^2} + \frac{p_c}{2}$.

For the general and the alternative route, the stress intensity factors, i, including the reduction factor 0,75, if defined, shall be greater than or equal to 1,0 (0,75 $i \geq$ 1,0). If a value less than 1 is obtained then the value 1,0 shall be used.

12.3.2 Stress due to sustained loads

The sum of primary stresses σ_1, due to calculation pressure, p_c, and the resultant moment, M_A, from weight and other sustained mechanical loads shall satisfy the following equation:

$$\sigma_1 = \frac{p_c d_o}{4e_n} + \frac{0{,}75\, i\, M_A}{Z} \leq f_f \qquad (12.3.2\text{-}1)$$

where

M_A is the resultant moment from the sustained mechanical loads which shall be determined by using the most unfavourable combination of the following loads:

— piping dead weight including insulation, internals and attachments;

— weight of fluid;

— internal pressure forces due to unrelieved axial expansion joints etc.

f_f is the design stress for flexibility analysis in N/mm2 (MPa) with $f_f = \min(f; f_{cr})$.

12.3.3 Stress due to sustained and occasional or exceptional loads

The sum of primary stresses, σ_2, due to internal pressure, p_c, resultant moment, M_A, from weight and other sustained mechanical loads and resultant moment, M_B, from occasional or exceptional loads shall satisfy the