Hyperlinks for Report Figure to Spreadsheet Plot Location

Report Figure Number

Figure 5.58

Figure 5.59

Figure 5.60

Load Data

t = 40 mm
OD = 400 mm
Ri = 160 mm

	Approximate Inertia Equation Inertia no crack	Inertia crack wedge	Inertia total	Ri+a	(Ri+a)/inertia *10^6
wedge shallow	1.0053E+09	15181261.4	990128387.8	170	0.171695
wedge deep	1.0053E+09	195283272.6	810026376.6	190	0.23456
eff length shallow	1.0053E+09	11618957.09	993690692.1	170	0.171079
eff length deep	1.0053E+09	192781878	812527771.2	190	0.233838

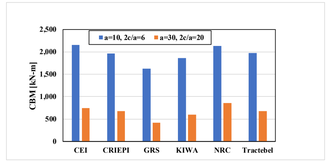
	Accurate Inertia Equation Inertia no crack	Inertia crack wedge	Inertia total	Ri+a	(Ri+a)/inertia*10^6
wedge shallow	7.4192E+08	16664733.04	725253788	170	0.234400706
wedge deep	7.4192E+08	257393937.5	484524583.6	190	0.392136966
eff length shallow	7.4192E+08	12754330.03	729164191	170	0.233143649
eff length deep	7.4192E+08	254096963.8	487821557.3	190	0.389486682

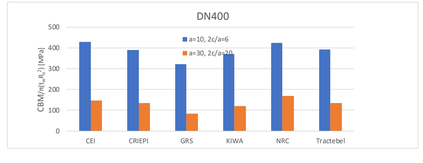
App. form. using R0, not Ri

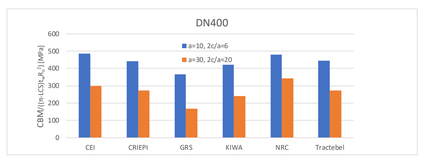
	Approximate Inertia wedge "2c"	Effective "2c"	Accurate Inertia wedge "2c"	Effective "2c"

Org	CBM, kN-m	Location	Comments	crack leng	CBM/pi()(t*R^2) [MPa]	(Wedge) CBM/(pi()-LCS)*(t*Ro^2) [MPa]	(Wedge) CBM*R0/Ieff_RO [MPa]	(Wedge) CBM*(Ri+a)/Ieff-approx [MPa]	(Eff length)CBM*(Ri+a)/Ieff-approx [MPa]	(Wedge) CBM*(Ri+a)/Ieff-acc [MPa]	(Eff length)CBM*(Ri+a)/Ieff-acc [MPa]
SCG4A; 10/60			wedge @a	0.375							
CEI	2160.	net section collapse	eff length	0.285599	429.7183463	487.1964082	442.7777652	370.8609959	369.531488	506.3055251	503.5902812
CRIEPI	1960.	Net-section collapse			389.9296106	442.0856297	401.7798239	336.5220148	335.3156094	459.4253839	456.9615514
GRS	1626.	net section (FAD, Lr>Lrmax)			323.4824218	366.7506295	333.3132621	279.1759164	278.1750923	381.1355481	379.0915728
KIWA	1866.	A-tip	Analyses were performed using J_		371.2149787	420.867775	382.4964423	320.3706751	319.222171	437.3753095	435.0297284
NRC	2130.	NSC (elliptical flaw)	xLPR NSC; CBM for constant dept		423.750036	480.4297914	436.628074	365.7101488	364.3991062	499.2735039	496.5959717
Tractebel	1970.	Net Section Collapse	See also folio 002		391.9190474	444.3411686	403.829721	338.2389639	337.0264034	461.769391	459.2929879
average	1952.						average	335.1465	average	457.5474	
st. dev.	194.4325						st. dev.	33.3831	st. dev.	45.5751	
SCG4B; 30/600			wedge @a	3.75			CV	9.960742435	CV	9.960742435	
CEI	742.	net section collapse	eff length	2.855993	147.6162097	298.7361327	237.8597721	174.0437152	173.5079157	290.9656285	288.9991184
CRIEPI	676.	Net-section collapse			134.4859269	272.163916	216.7024339	158.5627378	158.074597	265.0845888	263.2929974
GRS	418.	net section (FAD, Lr>Lrmax)			83.15845777	168.2907055	133.9964754	98.04618997	97.74435141	163.9132516	162.8054333
KIWA	601.	A-tip			119.5552038	241.9480848	192.6439758	140.9589901	140.525043	235.6547095	234.0620218
NRC	854.	NSC (elliptical flaw)	xLPR NSC; CBM for constant dept		169.8979018	343.8283791	273.7631339	200.3144647	199.6977897	334.8849687	332.6216269
Tractebel	675.	Net Section Collapse			134.2869832	271.7613067	216.3818682	158.3281776	157.8407589	264.6924518	262.9035107
average	661.						average	155.0424	average	259.1993	
st. dev.	146.2094						st. dev.	34.2949	st. dev.	57.3341	
							CV	22.11971007	CV	22.11971007	

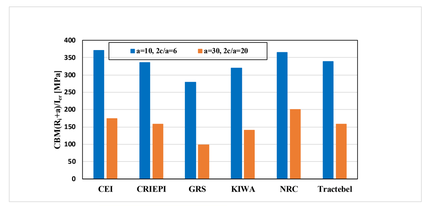
effective length = length of crack at same "a" value having equivalent area to semi-elliptical crack



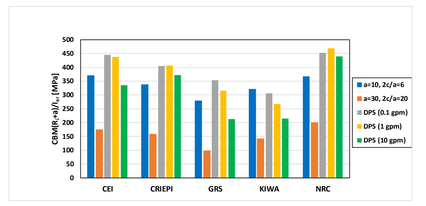




Wedge - Approximate Inertia



Wedge - Approximate Inertia



Wedge - Accurate Inertia

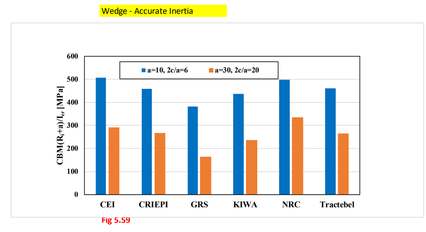


Fig 5.59

Wedge - Accurate Inertia

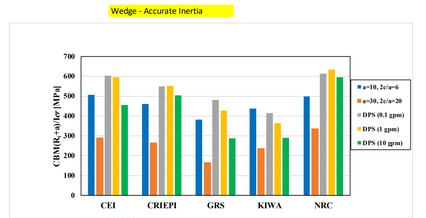


Fig 5.60

DPS Results

thick. (mm	OD (mm)	uncracked moments of Inertia actual	approximate
40	400	7.4192E+08	1.0053E+09

DPS1, DN400, 1 gpm

	LCS (deg)	LCS (rad)	CBM [kN-m]	accurate CBM*(R0)/I [MPa]	approximate CBM*(R0)/I [MPa]
CEI	53.4	0.93264938	1595.8	594.3883	438.6586
CRIEPI	41.8	0.72954763	1590.0	551.0603	406.6825
GRS	50.4	0.87964594	1171.0	428.1006	315.9382
KIWA	45.5	0.79412481	1023.8	363.1131	267.9775
NRC	43.1	0.75223691	1815.0	634.1570	468.0079
			average	514.1638	379.4529
			st. dev.	114.4759	84.4832
			CV	22.2644716	22.26447

DPS2, DN400, 0.1 gpm

	LCS (deg)	LCS (rad)	CBM [kN-m]	accurate CBM*(R0)/I [MPa]	approximate CBM*(R0)/I [MPa]
CEI	22.9	0.39964725	1958.5	603.7524	445.5693
CRIEPI	17.7	0.30892328	1840.0	549.6306	405.6274
GRS	24.5	0.42760567	1542.0	480.0300	354.2621
KIWA	19.4	0.33859387	1372.5	414.2196	305.6941
NRC	17.0	0.29670597	2065.0	614.2541	453.3195
			average	532.3773	392.8945
			st. dev.	84.8489	62.6185
			CV	15.9377441	15.93774

DPS3, DN400, 10 gpm

	LCS (deg)	LCS (rad)	CBM [kN-m]	accurate CBM*(R0)/I [MPa]	approximate CBM*(R0)/I [MPa]
CEI	110.9	1.93505533	916.9	454.9168	335.7286
CRIEPI	83.5	1.45734993	1140.0	503.8522	371.8429
GRS	109.5	1.91078647	583.0	287.9211	212.4858
KIWA	83.7	1.45996792	655.9	290.0927	214.0884
NRC	85.4	1.49051118	1335.0	595.6905	439.6196
			average	426.4947	314.7531
			st. dev.	135.3028	99.8534
			CV	31.7243772	31.72438

Participating Organization:	Candu Energy	Analyst Identification:	Deepak Somasundaram	Reporting Date:	30-Nov-23

Codes and Procedures Used in Analysis (add space as needed)

	Name and Version #	List any code or analysis limitiations for these problems (e.g., utilizes flat-plate K-solutions)	List any analysis assumptions	Briefly describe the approach that your code or analysis uses to determine output variables (e.g., CBM, stability determination)	Provide any other comments related to your code capabilities or evaluation approach that affects your results
Task 4: Surface Crack Stability Code(s)	Praise-Candu 2.1.1				

Quantitative Outputs (add space as needed)

Task 4: Crack Stability

Analysis Characteristics							Results		
Analysis Number	Pipe Diameter (OD, mm)	Wall Thickness (mm)	a (mm)	2c (mm)	NO + SSE Axial Stress (MPa)	Axial Stress from Pressure (MPa)	CBM @ constant NO+SSE axial force (kN-m)	Location of Stability (a-tip, c-tip, or net section collapse)	Comments or Notes Pertaining to Analysis
SCG4A	400	40	10	60	1.06	27.6	2.16E+03	net section collapse	
SCG4B	400	40	30	600	1.06	27.6	742	net section collapse	

Participating Organization:	CRIEPI	Analyst Identification:		Reporting Date:	Oct. 21st

Codes and Procedures Used in Analysis (add space as needed)

	Name and Version #	List any code or analysis limitiations for these problems (e.g., utilizes flat-plate K-solutions)	List any analysis assumptions	Briefly describe the approach that your code or analysis uses to determine output variables (e.g., CBM, stability determination)	Provide any other comments related to your code capabilities or evaluation approach that affects your results
Task 4: Surface Crack Stability Code(s)	Calculations were made using Microsfot Excel				

Quantitative Outputs (add space as needed)

Task 4: Crack Stability

Analysis Characteristics							Results		
Analysis Number	Pipe Diameter (OD, mm)	Wall Thickness (mm)	a (mm)	2c (mm)	NO + SSE Axial Stress (MPa)	Axial Stress from Pressure (MPa)	CBM @ constant NO+SSE axial force (kN-m)	Location of Stability (a-tip, c-tip, or net section collapse)	Comments or Notes Pertaining to Analysis
SCG4A	400	40	10	60	1.06	27.6	1.96E+03	Net-section collapse	
SCG4B	400	40	30	600	1.06	27.6	6.76E+02	Net-section collapse	

Participating Organization:		Analyst Identification:		Reporting Date:	

Codes and Procedures Used in Analysis (add space as needed)

	Name and Version #	List any code or analysis limitiations for these problems (e.g., utilizes flat-plate K-solutions)	List any analysis assumptions	Briefly describe the approach that your code or analysis uses to determine output variables (e.g., CBM, stability determination)	Provide any other comments related to your code capabilities or evaluation approach that affects your results
Task 4: Surface Crack Stability Code(s)	PROST v4.8.3		The ductile crack growth initiation value is chosen as a fracture criterion	ASME BPVC 2017 stress intensity factor solution, SSM Lr method, FAD diagram SINTAP Level 3	

Quantitative Outputs (add space as needed)

Task 4: Crack Stability

Analysis Characteristics							Results		
Analysis Number	Pipe Diameter (OD, mm)	Wall Thickness (mm)	a (mm)	2c (mm)	NO + SSE Axial Stress (MPa)	Axial Stress from Pressure (MPa)	CBM @ constant NO+SSE axial force (kN-m)	Location of Stability (a-tip, c-tip, or net section collapse)	Comments or Notes Pertaining to Analysis
SCG4A	400	40	10	60	1.06	27.6	1626	net section (FAD, Lr>Lrmax)	
SCG4B	400	40	30	600	1.06	27.6	418	net section (FAD, Lr>Lrmax)	

Participating Organization:	Kiwa	Analyst Identification:	Andrey Shipsha	Reporting Date:	10/26/2022

Codes and Procedures Used in Analysis (add space as needed)

	Name and Version #	List any code or analysis limitiations for these problems (e.g., utilizes flat-plate K-solutions)	List any analysis assumptions	Briefly describe the approach that your code or analysis uses to determine output variables (e.g., CBM, stability determination)	Provide any other comments related to your code capabilities or evaluation approach that affects your results
Task 4: Surface Crack Stability Code(s)					

Quantitative Outputs (add space as needed)

Task 4: Crack Stability

Analysis Characteristics							Results		
Analysis Number	Pipe Diameter (OD, mm)	Wall Thickness (mm)	a (mm)	2c (mm)	NO + SSE Axial Stress (MPa)	Axial Stress from Pressure (MPa)	CBM @ constant NO+SSE axial force (kN-m)	Location of Stability (a-tip, c-tip, or net section collapse)	Comments or Notes Pertaining to Analysis
SCG4A	400	40	10	60	1.06	27.6	1865.93	A-tip	Analyses were performed using J_Ic-value, without consideration of J-R curve. Failure was predicted by reaching elastic-plastic fracture instability for initial cracks using R6 FAD assessment.
SCG4B	400	40	30	600	1.06	27.6	600.95	A-tip	

Participating Organization:	NRC	Reporting Date:	10/25/2022

Codes and Procedures Used in Analysis (add space as needed)

	Name and Version #	List any code or analysis limitiations for these problems (e.g., utilizes flat-plate K-solutions)	List any analysis assumptions	Briefly describe the approach that your code or analysis uses to determine output variables (e.g., CBM, stability determination)	Provide any other comments related to your code capabilities or evaluation approach that affects your results
Task 4: Surface Crack Stability Code(s)	SC-CrFail-Multi_V3.3_R20200311 from xLPR	None known	Z-factor not used with xLPR NSC	Main results not decreased by Z-factor. ASME results with Z-factor decreased Sf by 1/Z (Z=1.195)	

Quantitative Outputs (add space as needed)

Task 4: Crack Stability

Analysis Characteristics							Results		
Analysis Number	Pipe Diameter (OD, mm)	Wall Thickness (mm)	a (mm)	2c (mm)	NO + SSE Axial Stress (MPa)	Axial Stress from Pressure (MPa)	CBM @ constant NO+SSE axial force (kN-m)	Location of Stability (a-tip, c-tip, or net section collapse)	Comments or Notes Pertaining to Analysis
SCG4A	400	40	10	60	1.06	27.6	2130	NSC (elliptical flaw)	xLPR NSC; CBM for constant depth: 2116 kN-m; ASME XI C6321 with 1.20 Z-factor: 1657 kN-m
SCG4B	400	40	30	600	1.06	27.6	854	NSC (elliptical flaw)	xLPR NSC; CBM for constant depth: 572 kN-m; ASME XI C6321 with 1.20 Z-factor: 687 kN-m

Participating Organization:		Reporting Date:	

Codes and Procedures Used in Analysis (add space as needed)

	Name and Version #	in the present case, limit load calculation does no need calculation of KI	List any analysis assumptions	Briefly describe the approach that your code or analysis uses to determine output variables (e.g., CBM, stability determination)	Provide any other comments related to your code capabilities or evaluation approach that affects your results
Task 4: Surface Crack Stability Code(s)	Excel	We have used an Excel worksheet to implement ASME XI Appendix C.	In ASME XI App.C, we have assumed a limit load behaviour of the Inconel weld	Excel worksheet yields σb/Sc of ASME XI App.C. When equal to 1, the critical bending moment CBM is found	See our folio 002 to compare the results with ASME XI Appendix H (FAD)

Quantitative Outputs (add space as needed)

Task 4: Crack Stability

Analysis Characteristics							Results		
Analysis Number	Pipe Diameter (OD, mm)	Wall Thickness (mm)	a (mm)	2c (mm)	NO + SSE Axial Stress (MPa)	Axial Stress from Pressure (MPa)	CBM @ constant NO+SSE axial force (kN-m)	Location of Stability (a-tip, c-tip, or net section collapse)	Comments or Notes Pertaining to Analysis
SCG4A	400	40	10	60	1.06	27.6	1970	Net Section Collapse	See also folio 002
SCG4B	400	40	30	600	1.06	27.6	675	Net Section Collapse	