

PV Elite 2012 Licensee:

FileName : -----

WRC107 Analysis : Trunnion Circmf **Item: 1** **2:04p Feb 10, 2014**

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Input Echo, WRC107 Item 1, Description: Trunnion Circmf

Diameter Basis for Vessel	Vbasis	OD	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	in.
Vessel Diameter	Dv	40.000	in.
Vessel Thickness	Tv	0.500	in.

Design Temperature		100.00	F
Vessel Material		SA-516 70	
Vessel UNS Number		K02700	
Vessel Cold S.I. Allowable	Smc	20000.00	psi
Vessel Hot S.I. Allowable	Smh	20000.00	psi

Attachment Type	Type	Round
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Diameter Basis for Nozzle	Nbasis	OD	
Corrosion Allowance for Nozzle	Can	0.0000	in.
Nozzle Diameter	Dn	6.625	in.
Nozzle Thickness	Tn	0.864	in.
Nozzle Material		SA-106 B	
Nozzle UNS Number		K03006	
Nozzle Cold S.I. Allowable	SNmc	17100.00	psi
Nozzle Hot S.I. Allowable	SNmh	17100.00	psi

Design Internal Pressure	Dp	0.000	psig
Include Pressure Thrust		No	

External Forces and Moments in WRC 107 Convention:

Radial Load (SUS)	P	0.0	lb.
Longitudinal Shear (SUS)	Vl	0.0	lb.
Circumferential Shear (SUS)	Vc	30000.0	lb.
Circumferential Moment (SUS)	Mc	20000.0	ft.lb.
Longitudinal Moment (SUS)	Ml	0.0	ft.lb.
Torsional Moment (SUS)	Mt	0.0	ft.lb.

Use Interactive Control	No
WRC107 Version	Version March 1979

Include Pressure Stress Indices per Div. 2	No
Compute Pressure Stress per WRC-368	No

WRC 107 Stress Calculation for SUS tained loads:

Radial Load	P	0.0	lb.
Circumferential Shear	VC	30000.0	lb.
Longitudinal Shear	VL	0.0	lb.
Circumferential Moment	MC	20000.0	ft.lb.
Longitudinal Moment	ML	0.0	ft.lb.
Torsional Moment	MT	0.0	ft.lb.

Dimensionless Parameters used : Gamma = 39.50

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure	Value	Location
N(PHI) / (P/Rm)	0.147	4C	6.267	(A, B)
N(PHI) / (P/Rm)	0.147	3C	4.801	(C, D)
M(PHI) / (P)	0.147	2C1	0.057	(A, B)
M(PHI) / (P)	0.147	1C	0.089	(C, D)
N(PHI) / (MC/(Rm**2 * Beta))	0.147	3A	1.508	(A, B, C, D)
M(PHI) / (MC/(Rm * Beta))	0.147	1A	0.086	(A, B, C, D)
N(PHI) / (ML/(Rm**2 * Beta))	0.147	3B	4.374	(A, B, C, D)

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M(PHI) / (ML/(Rm * Beta))	0.147	1B	0.036	(A, B, C, D)
N(x) / (P/Rm)	0.147	3C	4.801	(A, B)
N(x) / (P/Rm)	0.147	4C	6.267	(C, D)
M(x) / (P)	0.147	1C1	0.093	(A, B)
M(x) / (P)	0.147	2C	0.057	(C, D)
N(x) / (MC/(Rm**2 * Beta))	0.147	4A	2.469	(A, B, C, D)
M(x) / (MC/(Rm * Beta))	0.147	2A	0.044	(A, B, C, D)
N(x) / (ML/(Rm**2 * Beta))	0.147	4B	1.464	(A, B, C, D)
M(x) / (ML/(Rm * Beta))	0.147	2B	0.053	(A, B, C, D)

Stress Concentration Factors Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Attachment Junction

Type of		Stress Values at (psi)							
Stress	Load	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P		0	0	0	0	0	0	0	0
Circ. Bend. P		0	0	0	0	0	0	0	0
Circ. Memb. MC		0	0	0	0	-12643	-12643	12643	12643
Circ. Bend. MC		0	0	0	0	-171138	171138	171138	-171138
Circ. Memb. ML		0	0	0	0	0	0	0	0
Circ. Bend. ML		0	0	0	0	0	0	0	0
Tot. Circ. Str.		0	0	0	0	-183782	158495	183782	-158495
Long. Memb. P		0	0	0	0	0	0	0	0
Long. Bend. P		0	0	0	0	0	0	0	0
Long. Memb. MC		0	0	0	0	-20699	-20699	20699	20699
Long. Bend. MC		0	0	0	0	-87952	87952	87952	-87952
Long. Memb. ML		0	0	0	0	0	0	0	0
Long. Bend. ML		0	0	0	0	0	0	0	0
Tot. Long. Str.		0	0	0	0	-108652	67253	108652	-67253
Shear VC		5765	5765	-5765	-5765	0	0	0	0
Shear VL		0	0	0	0	0	0	0	0
Shear MT		0	0	0	0	0	0	0	0
Tot. Shear		5765	5765	-5765	-5765	0	0	0	0
Str. Int.		11531	11531	11531	11531	183782	158495	183782	158495

WRC 107 Stress Summations:

Vessel Stress Summation at Attachment Junction

Type of Stress Int.		Stress Values at (psi)							
Location		Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)		0	0	0	0	0	0	0	0
Circ. Pl (SUS)		0	0	0	0	-12643	-12643	12643	12643
Circ. Q (SUS)		0	0	0	0	-171138	171138	171138	-171138
Long. Pm (SUS)		0	0	0	0	0	0	0	0
Long. Pl (SUS)		0	0	0	0	-20699	-20699	20699	20699
Long. Q (SUS)		0	0	0	0	-87952	87952	87952	-87952

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Shear Pm (SUS)		0	0	0	0	0	0	0	0
Shear Pl (SUS)		5765	5765	-5765	-5765	0	0	0	0
Shear Q (SUS)		0	0	0	0	0	0	0	0

Pm (SUS)		0	0	0	0	0	0	0	0

Pm+Pl (SUS)		11531	11531	11531	11531	20699	20699	20699	20699

Pm+Pl+Q (Total)		11531	11531	11531	11531	183782	158495	183782	158495

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
	psi		
Pm (SUS)	0	20000	Passed
Pm+Pl (SUS)	20699	30000	Passed
<i>Pm+Pl+Q (TOTAL)</i>	<i>183782</i>	<i>60000</i>	<i>Failed</i>

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Diameter Basis for Vessel	Vbasis	OD	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	in.
Vessel Diameter	Dv	40.000	in.
Vessel Thickness	Tv	0.500	in.

Design Temperature		100.00	F
Vessel Material		SA-516 70	
Vessel UNS Number		K02700	
Vessel Cold S.I. Allowable	Smc	20000.00	psi
Vessel Hot S.I. Allowable	Smh	20000.00	psi

Attachment Type	Type	Round
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Diameter Basis for Nozzle	Nbasis	OD	
Corrosion Allowance for Nozzle	Can	0.0000	in.
Nozzle Diameter	Dn	6.625	in.
Nozzle Thickness	Tn	0.864	in.
Nozzle Material		SA-106 B	
Nozzle UNS Number		K03006	
Nozzle Cold S.I. Allowable	SNmc	17100.00	psi
Nozzle Hot S.I. Allowable	SNmh	17100.00	psi

Thickness of Reinforcing Pad	Tpad	0.500	in.
Diameter of Reinforcing Pad	Dpad	18.000	in.

Design Internal Pressure	Dp	0.000	psig
Include Pressure Thrust		No	

External Forces and Moments in WRC 107 Convention:

Radial Load (SUS)	P	0.0	lb.
Longitudinal Shear (SUS)	Vl	0.0	lb.
Circumferential Shear (SUS)	Vc	30000.0	lb.
Circumferential Moment (SUS)	Mc	20000.0	ft.lb.
Longitudinal Moment (SUS)	Ml	0.0	ft.lb.
Torsional Moment (SUS)	Mt	0.0	ft.lb.

Use Interactive Control	No
WRC107 Version	Version March 1979

Include Pressure Stress Indices per Div. 2	No
Compute Pressure Stress per WRC-368	No

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	0.0	lb.
Circumferential Shear	VC	30000.0	lb.
Longitudinal Shear	VL	0.0	lb.
Circumferential Moment	MC	20000.0	ft.lb.
Longitudinal Moment	ML	0.0	ft.lb.
Torsional Moment	MT	0.0	ft.lb.

Dimensionless Parameters used : Gamma = 20.00

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure	Value	Location
N(PHI) / (P/Rm)	0.145	4C	3.426	(A,B)
N(PHI) / (P/Rm)	0.145	3C	2.955	(C,D)
M(PHI) / (P)	0.145	2C1	0.084	(A,B)
M(PHI) / (P)	0.145	1C	0.117	(C,D)

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N(PHI) / (MC/(Rm**2 * Beta))	0.145	3A	0.621	(A, B, C, D)
M(PHI) / (MC/(Rm * Beta))	0.145	1A	0.096	(A, B, C, D)
N(PHI) / (ML/(Rm**2 * Beta))	0.145	3B	2.058	(A, B, C, D)
M(PHI) / (ML/(Rm * Beta))	0.145	1B	0.045	(A, B, C, D)
N(x) / (P/Rm)	0.145	3C	2.955	(A, B)
N(x) / (P/Rm)	0.145	4C	3.426	(C, D)
M(x) / (P)	0.145	1C1	0.121	(A, B)
M(x) / (P)	0.145	2C	0.084	(C, D)
N(x) / (MC/(Rm**2 * Beta))	0.145	4A	0.932	(A, B, C, D)
M(x) / (MC/(Rm * Beta))	0.145	2A	0.053	(A, B, C, D)
N(x) / (ML/(Rm**2 * Beta))	0.145	4B	0.599	(A, B, C, D)
M(x) / (ML/(Rm * Beta))	0.145	2B	0.073	(A, B, C, D)

Stress Concentration Factors Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Attachment Junction

Type of		Stress Values at (psi)							
Stress	Load	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P		0	0	0	0	0	0	0	0
Circ. Bend. P		0	0	0	0	0	0	0	0
Circ. Memb. MC		0	0	0	0	-2572	-2572	2572	2572
Circ. Bend. MC		0	0	0	0	-47549	47549	47549	-47549
Circ. Memb. ML		0	0	0	0	0	0	0	0
Circ. Bend. ML		0	0	0	0	0	0	0	0
Tot. Circ. Str.		0	0	0	0	-50122	44977	50122	-44977
Long. Memb. P		0	0	0	0	0	0	0	0
Long. Bend. P		0	0	0	0	0	0	0	0
Long. Memb. MC		0	0	0	0	-3858	-3858	3858	3858
Long. Bend. MC		0	0	0	0	-26196	26196	26196	-26196
Long. Memb. ML		0	0	0	0	0	0	0	0
Long. Bend. ML		0	0	0	0	0	0	0	0
Tot. Long. Str.		0	0	0	0	-30055	22338	30055	-22338
Shear VC		2882	2882	-2882	-2882	0	0	0	0
Shear VL		0	0	0	0	0	0	0	0
Shear MT		0	0	0	0	0	0	0	0
Tot. Shear		2882	2882	-2882	-2882	0	0	0	0
Str. Int.		5765	5765	5765	5765	50122	44977	50122	44977

Dimensionless Parameters used : Gamma = 39.50

Dimensionless Loads for Cylindrical Shells at Pad edge:

Curves read for 1979	Beta	Figure	Value	Location
N(PHI) / (P/Rm)	0.399	4C	3.468	(A, B)
N(PHI) / (P/Rm)	0.399	3C	1.415	(C, D)
M(PHI) / (P)	0.399	2C1	0.009	(A, B)
M(PHI) / (P)	0.399	1C !	0.062	(C, D)
N(PHI) / (MC/(Rm**2 * Beta))	0.399	3A	1.118	(A, B, C, D)
M(PHI) / (MC/(Rm * Beta))	0.399	1A	0.063	(A, B, C, D)
N(PHI) / (ML/(Rm**2 * Beta))	0.399	3B	2.003	(A, B, C, D)
M(PHI) / (ML/(Rm * Beta))	0.399	1B	0.008	(A, B, C, D)

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N(x)	/ (P/Rm)	0.399	3C	1.415	(A,B)
N(x)	/ (P/Rm)	0.399	4C	3.468	(C,D)
M(x)	/ (P)	0.399	1C1	0.023	(A,B)
M(x)	/ (P)	0.399	2C !	0.032	(C,D)
N(x)	/ (MC/(Rm**2 * Beta))	0.399	4A	3.815	(A,B,C,D)
M(x)	/ (MC/(Rm * Beta))	0.399	2A	0.025	(A,B,C,D)
N(x)	/ (ML/(Rm**2 * Beta))	0.399	4B	1.171	(A,B,C,D)
M(x)	/ (ML/(Rm * Beta))	0.399	2B	0.013	(A,B,C,D)

Note - The ! mark next to the figure name denotes curve value exceeded.

Stress Concentration Factors $K_n = 1.00$, $K_b = 1.00$

Stresses in the Vessel at the Edge of Reinforcing Pad

Type of		Stress Values at (psi)							
Stress	Load	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P		0	0	0	0	0	0	0	0
Circ. Bend. P		0	0	0	0	0	0	0	0
Circ. Memb. MC		0	0	0	0	-3451	-3451	3451	3451
Circ. Bend. MC		0	0	0	0	-45720	45720	45720	-45720
Circ. Memb. ML		0	0	0	0	0	0	0	0
Circ. Bend. ML		0	0	0	0	0	0	0	0
Tot. Circ. Str.		0	0	0	0	-49171	42268	49171	-42268
Long. Memb. P		0	0	0	0	0	0	0	0
Long. Bend. P		0	0	0	0	0	0	0	0
Long. Memb. MC		0	0	0	0	-11772	-11772	11772	11772
Long. Bend. MC		0	0	0	0	-18327	18327	18327	-18327
Long. Memb. ML		0	0	0	0	0	0	0	0
Long. Bend. ML		0	0	0	0	0	0	0	0
Tot. Long. Str.		0	0	0	0	-30099	6555	30099	-6555
Shear VC		2122	2122	-2122	-2122	0	0	0	0
Shear VL		0	0	0	0	0	0	0	0
Shear MT		0	0	0	0	0	0	0	0
Tot. Shear		2122	2122	-2122	-2122	0	0	0	0
Str. Int.		4244	4244	4244	4244	49171	42268	49171	42268

WRC 107 Stress Summations:**Vessel Stress Summation at Attachment Junction**

Type of Stress Int.		Stress Values at (psi)							
Location		Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)		0	0	0	0	0	0	0	0
Circ. Pl (SUS)		0	0	0	0	-2572	-2572	2572	2572
Circ. Q (SUS)		0	0	0	0	-47549	47549	47549	-47549
Long. Pm (SUS)		0	0	0	0	0	0	0	0
Long. Pl (SUS)		0	0	0	0	-3858	-3858	3858	3858
Long. Q (SUS)		0	0	0	0	-26196	26196	26196	-26196

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Shear Pm (SUS)	0	0	0	0	0	0	0	0
Shear Pl (SUS)	2882	2882	-2882	-2882	0	0	0	0
Shear Q (SUS)	0	0	0	0	0	0	0	0
Pm (SUS)	0	0	0	0	0	0	0	0
Pm+Pl (SUS)	5765	5765	5765	5765	3858	3858	3858	3858
Pm+Pl+Q (Total)	5765	5765	5765	5765	50122	44977	50122	44977

Type of Stress Int.	Max. S.I. psi	S.I. Allowable	Result
Pm (SUS)	0	20000	Passed
Pm+Pl (SUS)	5765	30000	Passed
Pm+Pl+Q (TOTAL)	50122	60000	Passed

WRC 107 Stress Summations:

Vessel Stress Summation at Reinforcing Pad Edge

Type of Stress Int.	Stress Values at (psi)							
Location	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	0	0	0	0	0	0	0	0
Circ. Pl (SUS)	0	0	0	0	-3451	-3451	3451	3451
Circ. Q (SUS)	0	0	0	0	-45720	45720	45720	-45720
Long. Pm (SUS)	0	0	0	0	0	0	0	0
Long. Pl (SUS)	0	0	0	0	-11772	-11772	11772	11772
Long. Q (SUS)	0	0	0	0	-18327	18327	18327	-18327
Shear Pm (SUS)	0	0	0	0	0	0	0	0
Shear Pl (SUS)	2122	2122	-2122	-2122	0	0	0	0
Shear Q (SUS)	0	0	0	0	0	0	0	0
Pm (SUS)	0	0	0	0	0	0	0	0
Pm+Pl (SUS)	4244	4244	4244	4244	11772	11772	11772	11772
Pm+Pl+Q (Total)	4244	4244	4244	4244	49171	42268	49171	42268

Type of Stress Int.	Max. S.I. psi	S.I. Allowable	Result
Pm (SUS)	0	20000	Passed
Pm+Pl (SUS)	11772	30000	Passed
Pm+Pl+Q (TOTAL)	49171	60000	Passed