TOTAL NO. OF PAGES 8
(EXCLUDING THIS PAGE)

KHTC REFERENCE : T10176 – NOZZ

DOCUMENT TITLE : NOZZLE LOAD CALCULATION

EQUIPMENT NAME : SRU FEED STEAM HEATER

CUSTOMER: SHELL ALBIAN SANDS

ITEM NUMBER: 260-SX-101/201 A/B/C/D

P.O. NUMBER: 50274775 002 OP

Rev	Description	By / Date	Chk'd By /Date	App'd By / Date
0	First Issue	HUI R. /2009/4/30	KL 2009/5/4	4 MAY 2009
1	Nozzle load changed	HUI R./2009/5/28	KL 2009/5/28	28 MAY 2009

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FILE NO. T10176S1 09/05/14
JOB NO. T10176
CLIENT: SHELL ALBIAN SANDS PAGE 1
SHELL 14"-300#

CALCULATION OF LOCAL STRESSES DUE TO EXTERNAL LOAD ON NOZZLES ACC. TO W.R.C. BULLETIN NR. 107 (REV MARCH 1979)

TYPE OF CALCULATION: MAX STRESS			NOZZLE DIMENSIONS			APPLIED LOADS			CALCULATIONS - NOZZLE & PAD		
INTERNAL PRESSURE	= 221.00	PSI	OD-NOZZLE	= 14.0000	IN	P = 1125	LB		SHELL CORR. THK.	= 0.5000	IN
DESIGN TEMPERATURE	= 385	F	THK-NOZZLE	= 0.5190	IN *	Vc = 900	LB		SHELL MEAN RADIUS	= 32.6875	IN
ID-SHELL	= 64.0000	IN	PAD WIDTH	= 3.0000	IN	Vl = 2250	LB		NOZZLE OUTER RADIUS	= 7.0000	IN
THK-SHELL	= 0.6250	IN	THK-PAD	= 0.6250	IN	Mc = 53079	INLB	⚠	GAMMA	= 29.0556	
STR. ALLOW. (shell)	= 20000.00	PSI				Ml = 115004	INLB	⚠	BETA (nozzle)	= 0.1874	
STR. ALLOW. (nozzle)	= 17100.00	PSI				Mt = 61925	INLB	⚠	Nozzle Corr. Thk	= 0.3940	IN
Kn	= 1.0000										
Kb	= 1.0000										
CORROSION ALLOWANCE	= 0.1250	IN									

AT NOZZLE-OUTER DIAMETER		CURVE	AU	AL	BU	BL	CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	4.475	137	137	137	137	.3C	3.534	108	108	108	108	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.048	505	-505	505	-505	.1C	0.085	891	-891	891	-891	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	1.207	-284	-284	284	284	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.083	-6737	6737	6737	-6737	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	3.305	-1687	-1687	1687	1687	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.032	-5710	5710	5710	-5710	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-6755	3655	8040	-4392			-6022	5669	8021	-7236	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14310	14310	14310	14310			14310	14310	14310	14310	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			7554	17964	22350	9918			8288	19979	22331	7074	
Kn.(Fig) . P / (Rm.T)	.3C	3.534	108	108	108	108	.4C	4.475	137	137	137	137	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.081	849	-849	849	-849	.2C	0.046	485	-485	485	-485	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	1.977	-466	-466	466	466	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.043	-3491	3491	3491	-3491	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	1.172	-599	-599	599	599	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.052	-9170	9170	9170	-9170	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-8812	7831	10726	-9313			-3335	2678	4579	-3374	
LONGITUDINAL STRESS DUE TO PRESSURE			7155	7155	7155	7155			7155	7155	7155	7155	2)
TOTAL LONGITUDINAL X-STRESS			-1657	14986	17881	-2158			3820	9832	11734	3781	
Mt / (2.pi.Ro^2.T)	.		179	179	179	179			179	179	179	179	
Vc / (pi.Ro.T)	.		36	36	-36	-36			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-91	-91	91	91	
TOTAL SHEAR STRESS			215	215	142	142			88	88	270	270	
TOTAL COMBINED STRESS INTENSITY			9221	17980	22354	12080			8290	19980	22338	7095	
ALLOWABLE COMBINED STRESS	= 3.00 Ss =		60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			12759	12759	16134	16134			14134	14134	14702	14702	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			6664	6664	7862	7862			6826	6826	7758	7758	
ALLOWABLE PRIMARY MEMBRANE STRESS	= 1.50 Ss =		30000										

NOZZLE STRESS:

RESULTANT MOMENT	=	140989	INLB
MEMBRANE STRESS	=	1975	PSI
MEMBRANE & BENDING STRESS	=	4505	PSI
ALLOWABLE MEMBRANE STRESS	=	17100	PSI
ALLOWABLE MEMBRANE & BENDING STRESS	=	25650	PSI

* MIN. THK USED IN CALC.

MEAN SHELL RADIUS = 32.3750 IN GAMMA = 64.7500 BETA (pad)= 0.2703 PAD OUTER RADIUS = 10.0000

AT PAD OUTSIDE DIAMETER		CURVE	AU	AL	BU	BL		CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	6.673	464	464	464	464	.3C	2.980	207	207	207	207	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.013	361	-361	361	-361	.1C	0.075	2022	-2022	2022	-2022	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	2.126	-797	-797	797	797	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.060	-8664	8664	8664	-8664	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	4.417	-3586	-3586	3586	3586	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.010	-3185	3185	3185	-3185	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-5947	-298	7596	504			-7232	6053	11690	-9682	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14310	14310	14310	14310			14310	14310	14310	14310	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			8363	14012	21905	14814			7077	20363	26000	4628	
Kn.(Fig) . P / (Rm.T)	.3C	2.980	207	207	207	207	.4C	6.673	464	464	464	464	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.034	907	-907	907	-907	.2C	0.041	1107	-1107	1107	-1107	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	6.227	-2334	-2334	2334	2334	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.024	-3499	3499	3499	-3499	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	2.322	-1885	-1885	1885	1885	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.014	-4342	4342	4342	-4342	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-5113	1757	7341	-3156			-4262	523	7404	-1809	
LONGITUDINAL STRESS DUE TO PRESSURE			7155	7155	7155	7155			7155	7155	7155	7155	2)
TOTAL LONGITUDINAL X-STRESS			2042	8912	14496	3999			2893	7678	14558	5346	
Mt / (2.pi.Ro^2.T)	.		197	197	197	197			197	197	197	197	
Vc / (pi.Ro.T)	.		57	57	-57	-57			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-143	-143	143	143	
TOTAL SHEAR STRESS			254	254	140	140			54	54	340	340	
TOTAL COMBINED STRESS INTENSITY			8373	14025	21908	14816			7078	20363	26010	5481	
ALLOWABLE COMBINED STRESS		= 3.00 Ss =	60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			11187	11187	18360	18360			13720	13720	15314	15314	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			5477	5477	9247	9247			5285	5285	9952	9952	
ALLOWABLE PRIMARY MEMBRANE STRESS		= 1.50 Ss =	30000										

CALCULATION OF LOCAL STRESSES DUE TO EXTERNAL LOAD ON NOZZLES ACC. TO W.R.C. BULLETIN NR. 107 (REV MARCH 1979)

TYPE OF CALCULATION: MAX STRESS			NOZZLE DIMENSIONS			APPLIED LOADS			CALCULATIONS - NOZZLE & PAD		
INTERNAL PRESSURE	= 221.00	PSI	OD-NOZZLE	= 6.6250	IN	P = 675	LB		SHELL CORR. THK.	= 0.5000	IN
DESIGN TEMPERATURE	= 385	F	THK-NOZZLE	= 0.3780	IN *	Vc = 450	LB		SHELL MEAN RADIUS	= 32.6875	IN
ID-SHELL	= 64.0000	IN	PAD WIDTH	= 2.0000	IN	Vl = 900	LB		NOZZLE OUTER RADIUS	= 3.3125	IN
THK-SHELL	= 0.6250	IN	THK-PAD	= 0.6250	IN	Mc = 26540	INLB	1	GAMMA	= 29.0556	
STR. ALLOW. (shell)	= 20000.00	PSI				Ml = 8846	INLB	1	BETA (nozzle)	= 0.0887	
STR. ALLOW. (nozzle)	= 17100.00	PSI				Mt = 44233	INLB	1	Nozzle Corr. Thk	= 0.2530	IN
Kn	= 1.0000										
Kb	= 1.0000										
CORROSION ALLOWANCE	= 0.1250	IN									

AT NOZZLE-OUTER DIAMETER		CURVE	AU	AL	BU	BL		CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	5.366	98	98	98	98	.3C	5.525	101	101	101	101	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.116	732	-732	732	-732	.1C	0.155	980	-980	980	-980	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	0.696	-173	-173	173	173	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.100	-8584	8584	8584	-8584	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	2.436	-202	-202	202	202	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.050	-1420	1420	1420	-1420	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-791	583	2453	-1851			-7676	7532	9840	-9290	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14310	14310	14310	14310			14310	14310	14310	14310	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			13519	14893	16762	12458			6634	21842	24149	5020	
Kn.(Fig) . P / (Rm.T)	.3C	5.525	101	101	101	101	.4C	5.366	98	98	98	98	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.154	973	-973	973	-973	.2C	0.115	730	-730	730	-730	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	0.924	-230	-230	230	230	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.046	-3951	3951	3951	-3951	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	0.679	-56	-56	56	56	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.081	-2303	2303	2303	-2303	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-1285	1375	3433	-3118			-3353	3090	5009	-4352	
LONGITUDINAL STRESS DUE TO PRESSURE			7155	7155	7155	7155			7155	7155	7155	7155	2)
TOTAL LONGITUDINAL X-STRESS			5870	8530	10588	4037			3802	10245	12164	2803	
Mt / (2.pi.Ro^2.T)	.		570	570	570	570			570	570	570	570	
Vc / (pi.Ro.T)	.		38	38	-38	-38			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-77	-77	77	77	
TOTAL SHEAR STRESS			609	609	532	532			493	493	647	647	
TOTAL COMBINED STRESS INTENSITY			13567	14951	16808	12492			6717	21863	24184	5195	
ALLOWABLE COMBINED STRESS	= 3.00 Ss =		60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			14206	14206	14610	14610			14238	14238	14584	14584	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			7200	7200	7313	7313			7023	7023	7483	7483	
ALLOWABLE PRIMARY MEMBRANE STRESS	= 1.50 Ss =		30000										

NOZZLE STRESS:

RESULTANT MOMENT	=	52337	INLB
MEMBRANE STRESS	=	1525	PSI
MEMBRANE & BENDING STRESS	=	8259	PSI
ALLOWABLE MEMBRANE STRESS	=	17100	PSI
ALLOWABLE MEMBRANE & BENDING STRESS	=	25650	PSI

* MIN. THK USED IN CALC.

MEAN SHELL RADIUS = 32.3750 IN GAMMA = 64.7500 BETA (pad)= 0.1436 PAD OUTER RADIUS = 5.3125

AT PAD OUTSIDE DIAMETER		CURVE	AU	AL	BU	BL		CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	9.735	406	406	406	406	.3C	6.778	283	283	283	283	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.043	703	-703	703	-703	.1C	0.074	1196	-1196	1196	-1196	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	2.589	-913	-913	913	913	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.078	-10734	10734	10734	-10734	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	7.033	-827	-827	827	827	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.029	-1309	1309	1309	-1309	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-1028	186	3245	-779			-10168	8907	13125	-10734	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14310	14310	14310	14310			14310	14310	14310	14310	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			13282	14496	17554	13531			4142	23217	27435	3576	
Kn.(Fig) . P / (Rm.T)	.3C	6.778	283	283	283	283	.4C	9.735	406	406	406	406	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.076	1231	-1231	1231	-1231	.2C	0.040	644	-644	644	-644	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	4.804	-1694	-1694	1694	1694	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.039	-5393	5393	5393	-5393	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	2.701	-318	-318	318	318	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.040	-1813	1813	1813	-1813	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-617	547	3644	-2444			-6037	3460	8137	-3936	
LONGITUDINAL STRESS DUE TO PRESSURE			7155	7155	7155	7155			7155	7155	7155	7155	2)
TOTAL LONGITUDINAL X-STRESS			6538	7702	10799	4711			1118	10615	15292	3219	
Mt / (2.pi.Ro^2.T)	.		499	499	499	499			499	499	499	499	
Vc / (pi.Ro.T)	.		54	54	-54	-54			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-108	-108	108	108	
TOTAL SHEAR STRESS			553	553	445	445			391	391	607	607	
TOTAL COMBINED STRESS INTENSITY			13327	14540	17584	13553			4192	23229	27465	4030	
ALLOWABLE COMBINED STRESS		= 3.00 Ss =	60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			13889	13889	15542	15542			13679	13679	15505	15505	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			7120	7120	7755	7755			5867	5867	9255	9255	
ALLOWABLE PRIMARY MEMBRANE STRESS		= 1.50 Ss =	30000										

CALCULATION OF LOCAL STRESSES DUE TO EXTERNAL LOAD ON NOZZLES ACC. TO W.R.C. BULLETIN NR. 107 (REV MARCH 1979)

TYPE OF CALCULATION: MAX STRESS			NOZZLE DIMENSIONS			APPLIED LOADS			CALCULATIONS - NOZZLE & PAD		
INTERNAL PRESSURE	= 331.00	PSI	OD-NOZZLE	= 12.7500	IN	P =	2250	LB	SHELL CORR. THK.	= 0.7500	IN
DESIGN TEMPERATURE	= 326	F	THK-NOZZLE	= 0.4910	IN *	Vc =	1125	LB	SHELL MEAN RADIUS	= 32.8125	IN
ID-SHELL	= 64.0000	IN	PAD WIDTH	= 3.0000	IN	Vl =	2250	LB	NOZZLE OUTER RADIUS	= 6.3750	IN
THK-SHELL	= 0.8750	IN	THK-PAD	= 0.6250	IN	Mc =	61925	INLB	GAMMA	= 23.8636	
STR. ALLOW. (shell)	= 20000.00	PSI				Ml =	61925	INLB	BETA (nozzle)	= 0.1700	
STR. ALLOW. (nozzle)	= 17100.00	PSI				Mt =	61925	INLB	Nozzle Corr. Thk	= 0.3660	IN
Kn	= 1.0000										
Kb	= 1.0000										
CORROSION ALLOWANCE	= 0.1250	IN									

AT NOZZLE-OUTER DIAMETER		CURVE	AU	AL	BU	BL		CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	3.909	195	195	195	195	.3C	3.389	169	169	169	169	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.062	882	-882	882	-882	.1C	0.092	1310	-1310	1310	-1310	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	0.900	-222	-222	222	222	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.089	-6188	6188	6188	-6188	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	2.790	-687	-687	687	687	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.039	-2722	2722	2722	-2722	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-2331	1348	4485	-2722			-4931	4826	7889	-7108	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14343	14343	14343	14343			14343	14343	14343	14343	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			12012	15692	18829	11621			9412	19169	22232	7236	
Kn.(Fig) . P / (Rm.T)	.3C	3.389	169	169	169	169	.4C	3.909	195	195	195	195	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.098	1383	-1383	1383	-1383	.2C	0.062	872	-872	872	-872	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	1.343	-330	-330	330	330	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.047	-3308	3308	3308	-3308	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	0.866	-213	-213	213	213	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.063	-4388	4388	4388	-4388	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-3049	2961	6154	-5389			-2572	2301	4706	-3655	
LONGITUDINAL STRESS DUE TO PRESSURE			7172	7172	7172	7172			7172	7172	7172	7172	2)
TOTAL LONGITUDINAL X-STRESS			4122	10133	13325	1782			4600	9472	11877	3517	
Mt / (2.pi.Ro^2.T)	.		176	176	176	176			176	176	176	176	
Vc / (pi.Ro.T)	.		41	41	-41	-41			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-82	-82	82	82	
TOTAL SHEAR STRESS			217	217	136	136			95	95	258	258	
TOTAL COMBINED STRESS INTENSITY			12018	15700	18832	11623			9414	19170	22238	7254	
ALLOWABLE COMBINED STRESS	= 3.00 Ss =		60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			13852	13852	15225	15225			14291	14291	14734	14734	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			7127	7127	7554	7554			7036	7036	7697	7697	
ALLOWABLE PRIMARY MEMBRANE STRESS	= 1.50 Ss =		30000										

NOZZLE STRESS:

RESULTANT MOMENT	=	107257	INLB
MEMBRANE STRESS	=	2958	PSI
MEMBRANE & BENDING STRESS	=	5461	PSI
ALLOWABLE MEMBRANE STRESS	=	17100	PSI
ALLOWABLE MEMBRANE & BENDING STRESS	=	25650	PSI

* MIN. THK. USED IN CALC.

MEAN SHELL RADIUS = 32.5000 IN GAMMA = 43.3333 BETA (pad)= 0.2524 PAD OUTER RADIUS = 9.3750

AT PAD OUTSIDE DIAMETER		CURVE	AU	AL	BU	BL		CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	5.378	496	496	496	496	.3C	3.014	278	278	278	278	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.021	500	-500	500	-500	.1C	0.065	1561	-1561	1561	-1561	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	1.729	-535	-535	535	535	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.067	-5432	5432	5432	-5432	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	3.844	-1190	-1190	1190	1190	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.016	-1286	1286	1286	-1286	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-1479	91	3473	-99			-4128	3614	7806	-6179	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14343	14343	14343	14343			14343	14343	14343	14343	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			12864	14435	17816	14244			10215	17957	22149	8164	
Kn.(Fig) . P / (Rm.T)	.3C	3.014	278	278	278	278	.4C	5.378	496	496	496	496	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.046	1115	-1115	1115	-1115	.2C	0.032	775	-775	775	-775	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	4.041	-1251	-1251	1251	1251	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.030	-2400	2400	2400	-2400	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	1.797	-557	-557	557	557	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.025	-1975	1975	1975	-1975	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-1138	581	3925	-2255			-2379	870	4923	-1427	
LONGITUDINAL STRESS DUE TO PRESSURE			7172	7172	7172	7172			7172	7172	7172	7172	2)
TOTAL LONGITUDINAL X-STRESS			6034	7753	11097	4916			4792	8041	12094	5745	
Mt / (2.pi.Ro^2.T)	.		150	150	150	150			150	150	150	150	
Vc / (pi.Ro.T)	.		51	51	-51	-51			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-102	-102	102	102	
TOTAL SHEAR STRESS			200	200	99	99			48	48	251	251	
TOTAL COMBINED STRESS INTENSITY			12870	14441	17817	14245			10216	17957	22156	8190	
ALLOWABLE COMBINED STRESS		= 3.00 Ss =	60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			13649	13649	16030	16030			14086	14086	15157	15157	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			6893	6893	8006	8006			6417	6417	8920	8920	
ALLOWABLE PRIMARY MEMBRANE STRESS		= 1.50 Ss =	30000										

CALCULATION OF LOCAL STRESSES DUE TO EXTERNAL LOAD ON NOZZLES ACC. TO W.R.C. BULLETIN NR. 107 (REV MARCH 1979)

TYPE OF CALCULATION: MAX STRESS			NOZZLE DIMENSIONS			APPLIED LOADS			CALCULATIONS - NOZZLE & PAD		
INTERNAL PRESSURE	= 331.00	PSI	OD-NOZZLE	= 30.0000	IN	P = 10125	LB	⚠	SHELL CORR. THK.	= 0.7500	IN
DESIGN TEMPERATURE	= 326	F	THK-NOZZLE	= 0.5000	IN	Vc = 2025	LB	⚠	SHELL MEAN RADIUS	= 32.9375	IN
ID-SHELL	= 64.0000	IN	PAD WIDTH	= 6.3750	IN	Vl = 7200	LB	⚠	NOZZLE OUTER RADIUS	= 15.0000	IN
THK-SHELL	= 0.8750	IN	THK-PAD	= 0.8750	IN	Mc = 309625	INLB	⚠	GAMMA	= 20.2692	
STR. ALLOW. (shell)	= 20000.00	PSI				Ml = 212314	INLB	⚠	BETA (nozzle)	= 0.3985	
STR. ALLOW. (nozzle)	= 20000.00	PSI				Mt = 194621	INLB	⚠	Nozzle Corr. Thk	= 0.3750	IN
Kn	= 1.0000										
Kb	= 1.0000										
CORROSION ALLOWANCE	= 0.1250	IN									

AT NOZZLE-OUTER DIAMETER		CURVE	AU	AL	BU	BL	CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	2.331	441	441	441	441	.3C 1.287	243	243	243	243	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.018	808	-808	808	-808	.1C 0.061	2808	-2808	2808	-2808	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A 0.833	-367	-367	367	367	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A 0.071	-7520	7520	7520	-7520	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	1.578	-477	-477	477	477	. 0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.015	-1123	1123	1123	-1123	. 0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			-350	278	2849	-1013		-4836	4588	10938	-9717	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14343	14343	14343	14343		14343	14343	14343	14343	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			13993	14622	17193	13330		9508	18932	25281	4627	
Kn.(Fig) . P / (Rm.T)	.3C	1.287	243	243	243	243	.4C 2.331	441	441	441	441	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.036	1644	-1644	1644	-1644	.2C 0.044	1995	-1995	1995	-1995	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A 2.098	-925	-925	925	925	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A 0.032	-3369	3369	3369	-3369	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	0.793	-240	-240	240	240	. 0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.027	-1943	1943	1943	-1943	. 0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			-295	303	4070	-3104		-1858	890	6730	-3999	
LONGITUDINAL STRESS DUE TO PRESSURE			7172	7172	7172	7172		7172	7172	7172	7172	2)
TOTAL LONGITUDINAL X-STRESS			6876	7474	11242	4068		5314	8062	13902	3173	
Mt / (2.pi.Ro^2.T)	.		85	85	85	85		85	85	85	85	
Vc / (pi.Ro.T)	.		26	26	-26	-26		0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0		-94	-94	94	94	
TOTAL SHEAR STRESS			111	111	58	58		-9	-9	179	179	
TOTAL COMBINED STRESS INTENSITY			13995	14623	17193	13331		9508	18932	25284	4648	
ALLOWABLE COMBINED STRESS	= 3.00 Ss =		60000									
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			14307	14307	15261	15261		14220	14220	14954	14954	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			7175	7175	7655	7655		6688	6688	8537	8537	
ALLOWABLE PRIMARY MEMBRANE STRESS	= 1.50 Ss =		30000									

NOZZLE STRESS:

RESULTANT MOMENT	=	422874	INLB
MEMBRANE STRESS	=	6827	PSI
MEMBRANE & BENDING STRESS	=	8484	PSI
ALLOWABLE MEMBRANE STRESS	=	20000	PSI
ALLOWABLE MEMBRANE & BENDING STRESS	=	30000	PSI

MEAN SHELL RADIUS = 32.5000 IN GAMMA = 43.3333 BETA (pad)= 0.5000 PAD OUTER RADIUS = 21.3750

AT PAD OUTSIDE DIAMETER		CURVE	AU	AL	BU	BL		CURVE	CU	CL	DU	DL	
Kn.(Fig) . P / (Rm.T)	.4C	2.853	1185	1185	1185	1185	.3C	1.027	427	427	427	427	1)
Kb.(Fig).6.P / (T^2)	.2C1	0.005	568	-568	568	-568	.1C	0.058	6232	-6232	6232	-6232	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.3A	0.924	-722	-722	722	722	1)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.1A	0.061	-12327	12327	12327	-12327	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.3B	1.552	-832	-832	832	832	.	0.000	0	0	0	0	1)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.1B1	0.004	-594	594	594	-594	.	0.000	0	0	0	0	
SUBTOTAL CIRCUMFERENTIAL PHI-STRESS			327	379	3178	856			-6391	5800	19708	-17411	
CIRCUMFERENTIAL STRESS DUE TO PRESSURE			14343	14343	14343	14343			14343	14343	14343	14343	1)
TOTAL CIRCUMFERENTIAL PHI-STRESS			14670	14722	17522	15199			7952	20143	34051	-3067	
Kn.(Fig) . P / (Rm.T)	.3C	1.027	427	427	427	427	.4C	2.853	1185	1185	1185	1185	2)
Kb.(Fig).6.P / (T^2)	.1C1	0.012	1335	-1335	1335	-1335	.2C	0.040	4350	-4350	4350	-4350	
Kn.(Fig) . Mc / (Rm^2.Beta.T)	.	0.000	0	0	0	0	.4A	4.131	-3229	-3229	3229	3229	2)
Kb.(Fig).6.Mc / (Rm.Beta.T^2)	.	0.000	0	0	0	0	.2A	0.024	-4836	4836	4836	-4836	
Kn.(Fig) . Ml / (Rm^2.Beta.T)	.4B	0.943	-505	-505	505	505	.	0.000	0	0	0	0	2)
Kb.(Fig).6.Ml / (Rm.Beta.T^2)	.2B1	0.007	-1031	1031	1031	-1031	.	0.000	0	0	0	0	
SUBTOTAL LONGITUDINAL X-STRESS			225	-383	3299	-1435			-2530	-1558	13600	-4772	
LONGITUDINAL STRESS DUE TO PRESSURE			7172	7172	7172	7172			7172	7172	7172	7172	2)
TOTAL LONGITUDINAL X-STRESS			7397	6789	10470	5737			4642	5613	20772	2400	
Mt / (2.pi.Ro^2.T)	.		90	90	90	90			90	90	90	90	
Vc / (pi.Ro.T)	.		40	40	-40	-40			0	0	0	0	
Vl / (pi.Ro.T)	.		0	0	0	0			-143	-143	143	143	
TOTAL SHEAR STRESS			131	131	50	50			-53	-53	233	233	
TOTAL COMBINED STRESS INTENSITY			14673	14724	17522	15200			7953	20143	34055	5487	
ALLOWABLE COMBINED STRESS		= 3.00 Ss =	60000										
SUM OF PRIMARY CIRC. MEMBR. STRESS, SEE 1)			14696	14696	16361	16361			14048	14048	15492	15492	
SUM OF PRIMARY LONG. MEMBR. STRESS, SEE 2)			7093	7093	8103	8103			5128	5128	11586	11586	
ALLOWABLE PRIMARY MEMBRANE STRESS		= 1.50 Ss =	30000										