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TITLE CR-3, PRESSURIZER SURGE NOZZLE STRESSES

PREPARED BY:		REVIEWED BY:	
NAME	D.E. COSTA	NAME	J. F. SHEPARD
SIGNATURE	D E Cost	SIGNATURE	JF Shepard
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PURPOSE AND SUMMARY OF RESULTS:

PURPOSE: The purpose of this analysis is to determine and document the stresses at the juncture of the pressurizer surge nozzle-to-pressurizer lower head. Stresses due to pressure, temperature, and external loads associated with surge line stratification are included.

The stresses will be used as input to the fatigue crack growth analysis of Reference [1].

RESULTS: The pertinent results for input to the fatigue crack growth analysis are contained in microfiche CR3SCL2.OUT and summarized in Table 7-1.

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THIS DOCUMENT CONTAINS ASSUMPTIONS THAT MUST BE VERIFIED PRIOR TO USE ON SAFETY-RELATED WORK

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1.0 INTRODUCTION:
During 9R Section XI examinations of the pressurizer, a flaw indication was found in the weld connecting the pressurizer surge nozzle to the pressurizer lower head. The flaw was determined to exceed the flaw acceptance standards of ASME Section XI, IWB-3500.

A fatigue crack growth analysis, Reference [4], as prepared to justify continued operation of the plant. Due to time constraints and lack of detailed stresses at the location of the flaw, the analysis was performed assuming the maximum stress ranges from any transient were applicable for all transient cycles. This very conservative approach resulted in a flaw acceptability of only one fuel cycle.

In order to perform a less conservative more realistic flaw evaluation, the membrane and bending stresses through the thickness of the pressurizer lower head at the location of the flaw (surge nozzle-to-head weld) are required.

The purpose of this analysis is to determine and document the stresses at the juncture (weld) of the pressurizer surge nozzle-to-pressurizer lower head. Stresses due to pressure, temperature, and external loads associated with surge line stratification are included.

The stresses will be used as input to the fatigue crack growth analysis of Reference [1].

2.0 RESULTS/CONCLUSIONS: The pertinent results for input to the fatigue crack growth analysis are contained in microfiche CR3SCL2.OUT and summarized in Table 7-1.

3.0 LIST OF ASSUMPTIONS:

1) Although the stresses due to the external loads (moments) are tensile on one side of the nozzle and compressive on the other, only the tensile stresses are added to the thermal and pressure transient stresses. By adding the external load tensile stress to the thermal and pressure transient stresses, the membrane and membrane plus bending tensile stresses are maximized. The maximum external load stress at the nozz' to-head juncture is 8.6 ksi, Reference [2] page 54.

4.0 REFERENCES:

1) BWNT Document # 32-1235116-00, "FM Assessment of CR-3 Pzr WP-15 Flaw Until End-of-Life", by L.T. Hill (this document is proprietary to BWNT, a non-proprietary version is contained in BWNT document 32-1236235-00)

2) BWNT Document # 32-1179379-00, "LL Pressurizer Surge Nozzle Evaluation, Thermal Stratification", by D.E. Costa

3) BWNT Document # 32-1202340-01, "TE Pressurizer Surge Nozzle Thermal Stratification Analysis", by D.E. Costa

4) BWNT Document # 32-1233483-00, "CR-3 Pressurizer Surge Nozzle Flaw Evaluation", by L.T. Hill

5) BWNT Document # 32-1235087-00, "CR-3, Pressurizer Surge Nozzle Stresses", by D.E. Costa

NOTE: Reference [5] is the proprietary version of this document.

5.0 DISCUSSION OF ANALYSIS:

Stresses in the surge nozzle-to-pressurizer weld (the flaw location) are caused by the pressure, thermal, and external loadings associated with thermal stratification of the surge line. Reference [2] contains the detailed stress and fatigue analysis of the pressurizer surge nozzle for the B&W lower loop plants (including CR-3) for surge line stratification. Although Reference [2] provides the complete stress and fatigue analysis of the surge nozzle, it does not include a listing of the detailed transient stresses at the location of the flaw.

In addition to the lower loop surge nozzle analysis, Reference [3] contains the detailed stress and fatigue analysis of the pressurizer surge nozzle for the B&W raised loop plant (Davis Besse) for surge line stratification. The lower and raised loop nozzle analyses used the same methodology for determining stresses at various locations in the nozzles. The raised loop analysis actually uses (references) many of the stresses from the lower loop analysis. The one difference in the two analyses is that the raised loop analysis uses a FORTRAN program to manipulate all the data associated with the surge line stratification transients.

The stresses at the flaw location will be determined using a combination of information from References [2] and [3]. The methodology used in both Reference [2] and [3] for determining stresses at other locations in the nozzle will be used for determining the stresses at the nozzle-to-head weld.

The following summary describes the method of analysis used in the surge nozzle evaluations of References [2] and [3];

> Due to the number of transient data points (PVs, peaks and valleys) associated with surge line stratification it was not practical to evaluate each one individually. Therefore, the transient PVs (572 for lower loop) were reviewed and a series of thermal "base cases" (94) were created using various ramp rates, starting temperatures and delta temperatures. A pressure base case using 2200 psi was also made. The base cases were designed to cover the broad spectrum of actual transient conditions.
> The thermal stresses for each PV were determined by comparing the PV thermal parameters to the base case thermal parameters and using the base case stresses from the most representative base case. The pressure stresses for each PV were determined by multiplying the base case pressure stresses by the ratio of the PV pressure to the base case pressure (2200 psi). Stresses due to the PV external loads were determined and added to

the thermal and pressure stresses for each PV for use in ASME code analysis.

The same method described above for the surge nozzle analyses will be used for the nozzle-to-head weld. The procedure outline for determining the nozzle-to-head stresses is given below.

1) <u>SUMMARIZE TRANSIENT CONDITIONS FOR CR-3</u>: The transient data for the lowered loop plants (including CR-3) is taken from Table A-1 of Reference [2]. The transient information includes starting temperature, ending temperature, ramp rate, pressure, and external load (moment) associated with the thermal stratification of the surge line. A summary of the thermal stratification transient parameters in contained in the FORTRAN output of microfiche CR3SCL2.OUT. The transient cycles for CR-3 are taken from Table C-0 (page C-3) of Reference [2] and are also summarized in the FORTRAN output of microfiche CR3SCL2.OUT and in Table 7-1.

2) <u>TABULATE BASE CASE CONDITIONS AND RESULTING STRESSES</u>: The base case transient parameters are taken from Table 10-3 of Reference [3]. Per Reference [4] and Figure 10-2 of Reference [2], stress classification line number 2 is appropriate for the nozzle-to-head weld. The linearized component stresses for the nozzle-to-head weld, SCL 2, are taken from the microfiche of References [2] and [3]. A summary of the base case parameters and resulting stresses is contained in Table 6-1.

3) <u>CHOOSE BASE CASE FOR EACH TRANSIENT PV</u>: The FORTRAN program listed in Appendix A is used to determine the appropriate base case for each PV. The program compares ramp rate, starting temperature, and delta temperature of the PVs to those of the base cases and selects the base case that best represents the PV thermal parameters. The selected base case for each transient PV is summarized in the FORTRAN output of microfiche CR3SCL2.OUT. Verification of the selection process is contained in Appendix B.

4) <u>DETERMINE PV THERMAL STRESSES</u>: The thermal stresses from the appropriate base case determined in step 3 above are multiplied by the ratio of the transient PV ΔT to base case ΔT to arrive at the transient PV thermal stresses. The resulting thermal stresses for each PV are tabulated in the FORTRAN output of microfiche CR3SCL2.OUT. Verification of the procedure is contained in Appendix B.

5) DEFINE PV METAL TEMPERATURES: In addition to stresses, the fracture mechanics evaluation of Reference [1] requires the metal temperatures for the PVs. The metal temperatures from the selected base case are used to approximate the actual PV metal temperatures. The base case metal temperatures at the wall ID, OD, and flaw location (nodes 88, 96, and 93 respectively) are taken from the microfiche of References [2] and [3] and listed in CR3SCL2.OUT. The selected PV metal temperatures are contained in the stress intensity summary table of CR3SCL2.OUT.

From Reference [4], the flaw is located approximately 1.5" radially from the outer surface of the pressurizer wall. Node 93 of the finite element model of References [2] and [3] corresponds to this location. Node 88 represents the base metal ID and node 96 represents the base metal OD.

6) DETERMINE PV PRESSURE STRESSES: The pressure stresses from the base case pressure case are multiplied by the ratio of the transient PV pressure to base case pressure (2200 psi) to arrive at the transient PV pressure stresses. The resulting pressure stresses for each PV are tabulated in the FORTRAN output of microfiche CR3SCL2.OUT. Verification of the procedure is contained in Appendix B.

7) DETERMINE PV EXTERNAL LOAD STRESSES: The resultant external moments used the surge nozzle analysis are also used for the nozzle-to-head weld stresses. The stresses for the nozzle-to-head weld are determined using the Bijlaard method for determination of stresses for cylinder-to-sphere connections. From pages 54 and 55 of Reference [2], the stresses associated with a moment of 2508422 in-lbs are:

stress component	outside surface		inside surface	
	stress (psi)	stress-to-moment ratio	stress (ksi)	stress-to-moment ratio
radial	0.0	0.0	0.0	0.0
longitudinal	6400	0.0026	3800	0.0015
hoop	8600	0.0034	6200	0.0025
Note: moment = 2508422 in-lbs				

The moments for each transient PV are multiplied by the stress-to-moment ratio to arrive at the PV external load stresses. The PV moment and resulting external load hoop stress for each PV are tabulated in the output of microfiche CR3SCL2.OUT. The resulting external load radial and longitudinal stresses are calculated and used in the FORTRAN evaluation but are not printed out in the microfiche. Verification of this procedure is contained in Appendix B.

As stated in Assumption 1), only the tensile stress associated with the moments are considered. This is conservative because it maximizes the tensile membrane and bending stresses used in the fracture mechanics evaluation.

8) DETERMINE PV TOTAL STRESSES: The PV thermal stresses, pressure stresses and external stresses determined in step 4,5 and 6 above are added to achieve the PV total stresses. The PV total stresses are summarized in the FORTRAN output of microfiche CR3SCL2.OUT and summarized in Table 7-1. These results are used as input to the fracture mechanics evaluations of Reference [1].

6.0 BASE CASE STRESSES:

This section contains the base case stresses used in the determination of transient stresses. The base case temperatures and pressures are summarized in Table 10-3 of Reference [3] and the stresses are taken from the microfiche of References [2] and [3].

TABLE 6-1

BASE CASE STRESSES, SCL 2, NOZZLE-TO-HEAD WELD

Base Run, BR #	TRANSIENT INFORMATION Temperatures (F) Strt	End	Delta	Ramp Rate F/Hr	Press (psi)	LINEARIZED STRESSES Inside Surface RAD (ksi)	LONG (ksi)	HOOP (ksi)	Outside Surface RAD (ksi)	LONG (ksi)	HOOP (ksi)	METAL TEMPERATURES (BASE METAL, NODE #) ID 88	FLAW 93	OD 96	MICROFICHE NAME THRM	STRS,it
1.1	80	462	402	900		0	-15.9	-16.3	0	19.5	19.6	362	249	230	GDHR	GEKJ,7
1.2	80	446	366	900		0	-14.7	-15.1	0	18	18.1	331	223	206		6
1.3	80	373	293	900		0	-11.9	-12.4	0	14.6	14.8	269	177	162		5
1.4	80	309	229	900		0	-9.3	-9.8	0	11.4	11.7	216	141	129		4
1.5	80	253	173	900		0	-6.9	-7.3	0	8.4	8.9	174	114	106		3
1.6	80	209	129	900		0	-4.8	-5.1	0	6	6.4	142	98	92		2
1.7	80	172	92	900		0	-3.1	-3.3	0	3.9	4.2	119	88	85		1
2.1	250	550	300	1000		0	-15.3	-15.7	0	19.1	20	449	342	325	GMCO	GEKK,7
2.2	250	484	234	1000		0	-11.9	-12.2	0	15	16.3	394	307	294		6
2.3	250	430	180	1000		0	-8.9	-9	0	11.5	12.9	352	283	273		5
2.4	250	382	132	1000		0	-6	-5.8	0	8.1	9.6	317	267	260		4
2.5	250	346	96	1000		0	-3.8	-3.4	0	5.5	6.9	293	258	254		3
2.6	250	316	66	1000		0	-2	-1.4	0	3.4	4.7	275	253	251		2
2.7	250	292	42	1000		0	-0.7	0	0	1.9	3	262	251	250		1
3.1	150	500	350	1500		0	-17.6	-18.8	0	21.6	22.5	373	241	221	GQPX	GEJH,7
3.2	150	443	293	1500		0	-14.8	-15.7	0	18.2	19.3	331	216	199		6
3.3	150	383	233	1500		0	-11	-11.7	0	13.7	14.9	281	189	177		5
3.4	150	327	177	1500		0	-7.7	-8.1	0	9.9	11	240	171	163		4
3.5	150	285	135	1500		0	-5.3	-5.4	0	6.9	8	212	161	156		3
3.6	150	248	98	1500		0	-3.2	-3.1	0	4.4	5.3	189	155	152		2
3.7	150	220	70	1500		0	-1.7	-1.5	0	2.7	3.4	174	152	151		1
4.1	250	482	232	2000		0	-11.4	-12	0	14.7	16.6	371	276	265	GJTX	GEKL,5
4.2	250	431	181	2000		0	-8	-8.2	0	10.7	12.5	336	264	257		4
4.3	250	389	139	2000		0	-5.3	-5.1	0	7.5	9.1	309	257	253		3
4.4	250	352	102	2000		0	-3	-2.6	0	4.8	6.2	287	253	251		2
4.5	250	320	70	2000		0	-1.4	-0.7	0	2.7	4	271	251	250		1
5.1	200	450	250	5000		0	-13.7	-14.8	0	17.1	19.1	336	225	211	ECOL	EDKG,7
5.2	200	420	220	5000		0	-12.1	-13	0	15	16.8	321	222	210	see notes	
5.3	200	370	170	5000		0	-9.3	-10.1	0	11.6	13	294	217	207	see notes	
5.4	200	330	130	5000		0	-7.1	-7.7	0	8.9	9.9	272	213	206	see notes	
5.5	200	290	90	5000		0	-4.9	-5.3	0	6.2	6.9	250	209	204	see notes	
5.6	200	260	60	5000		0	-3.3	-3.6	0	4.1	4.6	233	206	203	see notes	
6.1	80	400	320	99999		0	-14.9	-16.6	0	18.3	19.9	242	102	87	ECOY	EDJZ,2
7.1	500	650	150	1000		0	-8.6	-8.2	0	12.1	14.5	588	521	513	GBPP	GRKT,4
7.2	500	611	111	1000		0	-5.7	-4.9	0	8.7	11.1	559	511	506		3
7.3	500	579	79	1000		0	-3.2	-2	0	5.8	8.1	537	504	502		2
7.4	500	555	55	1000		0	-1.4	0	0	3.7	5.9	521	502	500		1
8.1	500	650	150	1500		0	-7.9	-7.5	0	11.4	14.1	580	513	506	GNLU	GEKZ,3
8.2	500	624	124	1500		0	-5.5	-5.1	0	9	11.6	561	508	503		2
8.3	500	590	90	1500		0	-3.3	-2.2	0	6	8.4	539	503	501		1
9.1	400	650	250	2000		0	-14.9	-15.5	0	19.3	21.6	546	432	418	GNNE	GEKN,5
9.2	400	635	235	2000		0	-13.8	-14.2	0	18	20.3	534	427	415		4
9.3	400	580	180	2000		0	-9.4	-9.4	0	13	15.2	494	414	407		3
9.4	400	535	135	2000		0	-5.9	-5.5	0	8.9	10.9	463	407	402		2
9.5	400	500	100	2000		0	-3.4	-2.7	0	5.9	7.8	441	403	401		1
10.1	500	650	150	21000		0	-10	-9.9	0	13.6	16.4	590	515	506	EDKZ	EDTZ,6
10.2	500	604	104	21000		0	-6.9	-6.9	0	9.4	11.4	562	510	504	see notes	
10.3	500	569	69	21000		0	-4.6	-4.6	0	6.3	7.5	541	507	503	see notes	
10.4	500	546	46	21000		0	-3.1	-3	0	4.2	5	528	505	502	see notes	
11.1	500	600	100	99999		0	-6.4	-5.6	0	9.2	11.7	559	511	505	EDLE	EDUE,2
12.1	550	550	0	0		0	0.8	2.6	0	1.1	3	550	550	550	GJGJ	GMVW,1
12.2	450	450	0	0		0	0.7	2.2	0	0.9	2.6	450	450	450	GAPZ	GCTT,1
12.3	300	300	0	0		0	0.4	1.5	0	0.6	1.8	300	300	300	GPGK	GAIN,1
12.4	70	70	0	0		0	0	0	0	0	0	70	70	70	none	none
13.1	550	300	-250	-800		0	16.3	19.3	0	-17.4	-14.6	364	465	481	GJGJ	GMVW,8
13.2	550	332	-218	-800		0	15	18.1	0	-15.7	-13.3	392	484	499		7
13.3	550	386	-164	-800		0	12	15.2	0	-12.2	-10.3	437	513	524		6
13.4	550	432	-118	-800		0	8.8	11.6	0	-8.4	-6.8	475	532	539		5
13.5	550	468	-82	-800		0	6	8.7	0	-5.2	-3.6	502	542	546		4
13.6	550	493	-57	-800		0	3.9	6.3	0	-2.8	-1.1	520	547	549		3
13.7	550	514	-36	-800		0	2.3	4.4	0	-0.8	0.9	535	549	550		2
14.1	450	100	-350	-1700		0	22.1	25.9	0	-24.8	-23.2	210	364	388	GJDK	GMVG,8
14.2	450	145	-305	-1700		0	19.9	23.8	0	-22.1	-20.9	247	386	406		7
14.3	450	215	-235	-1700		0	15.7	19.3	0	-17.2	-16.2	302	413	428		6
14.4	450	270	-180	-1700		0	11.8	14.9	0	-12.6	-11.7	344	430	440		5
14.5	450	315	-135	-1700		0	8.3	11	0	-8.5	-7.5	377	441	446		4
14.6	450	350	-100	-1700		0	5.6	7.9	0	-5.3	-4.1	401	446	449		3
14.7	450	380	-70	-1700		0	3.4	5.5	0	-2.7	-1.4	421	449	450		2
14.8	450	405	-45	-17[illegible]		0	1.9	3.7	0	-0.8	0.7	435	450	450		1
15.1	450	100	-350	-3[illegible]00		0	22.7	27.4	0	-25.8	-25.5	234	404	425	GAPZ	GCTT,8
15.2	450	135	-315	[illegible]000		0	20.3	24.8	0	-23	-22.7	260	414	432		7
15.3	450	198	-252	3000		0	15.7	19.6	0	-17.5	-17.2	307	429	441		6
15.4	450	254	-196	-3000		0	11.3	14.6	0	-12.4	-11.8	347	440	446		5
15.5	450	296	-154	-3000		0	8.1	10.9	0	-8.5	-7.7	375	445	449		4
15.6	450	338	-112	-3000		0	5.1	7.4	0	-4.9	-3.8	402	448	450		3
15.7	450	373	-77	-3000		0	2.9	4.9	0	-2.2	-0.9	422	449	450		2
16.1	482	160	-37[illegible]	-4000		0	24.4	28.8	0	-26.8	-25.5	253	410	437	GEBV	GFHP,5
16.2	482	218	-2[illegible]4	-4000		0	20	23.6	0	-22	-20.9	294	423	445	see notes	
16.3	482	276	-[illegible]06	-4000		0	15.6	18.4	0	-17.1	-16.3	335	436	453	see notes	
16.4	482	321	161	-4000		0	12.2	14.4	0	-13.4	-12.8	368	446	460	see notes	
17.1	450	200	-250	-20000		0	18.6	22.9	0	-20.6	-20.5	293	429	443	EDMD	EDUJ,5
17.2	450	240	-210	-20000		0	15.6	18.2	0	-17.3	-17.2	318	432	444	see notes	
17.3	450	300	-150	-20000		0	11.2	13.7	0	-12.4	-12.3	356	437	446	see notes	
17.4	450	350	-100	-20000		0	7.4	9.2	0	-8.2	-8.2	387	442	447	see notes	
18.5	600	520	-80	-99999		0	7.2	10.1	0	-6.2	-4.9	548	592	597	EDMW	EDUQ,2

PREPARED BY: D. E. COSTA DATE: ____________

REVIEWED BY: J. F. SHEPARD DATE: ____________

TABLE 6-1

BASE CASE STRESSES, SCL 2, NOZZLE-TO-HEAD WELD

Base Run, BR #	TRANSIENT INFORMATION Temperatures (F) Strt	End	Delta	Ramp Rate F/Hr	Press (psi)	LINEARIZED STRESSES Inside Surface RAD (ksi)	Inside Surface LONG (ksi)	Inside Surface HOOP (ksi)	Outside Surface RAD (ksi)	Outside Surface LONG (ksi)	Outside Surface HOOP (ksi)	METAL TEMPERATURES (BASE METAL, NODE #) ID 68	FLAW 93	OD 96	MICROFICHE NAME THRM	STRS,it
19.1	300	100	-200	-700		0	9.9	11.7	0	-11	-9.6	165	237	249	GPGK	GAIN,6
19.2	300	137	-163	-700		0	8.7	10.5	0	-9.4	[illegible].2	196	258	268		5
19.3	300	183	-117	-700		0	6.5	8.3	0	-6.8	[illegible].8	231	279	286		4
19.4	300	217	-83	-700		0	4.5	6.2	0	-4.4	[illegible].5	257	290	394		3
19.5	300	243	-57	-700		0	2.9	4.4	0	-2.5	-1.5	274	296	298		2
20.1	250	100	-150	-1500		0	7.3	9.1	0	-8.1	-7.6	174	235	242	EDNS	EDUS,4
20.2	250	148	-102	-1500		0	4.4	5.9	0	-4.7	-4.1	205	244	248		3
20.3	250	180	-70	-1500		0	2.5	3.8	0	-2.4	-1.7	224	248	249		2
20.4	250	209	-41	-1500		0	1.2	2.3	0	-0.7	0.2	239	250	250		1
30.1					2200	-2.2	3.6	12.8	0	10.3	11.5				none	GEMC,1

NOTES:

1) The stresses for these cases are calculated by multiplying the maximum stresses for the ramp rate by the ratio of desired delta T to maximum stress delta T.

2) The temperatures for these cases are determined by the following equation:

$$T @ \max \Delta T = \text{values from microfiche for iteration in question}$$

$$T @ \text{other } \Delta Ts = T_{strt} + (T @ \max\Delta T - T_{strt})(\Delta T_{other}/\Delta T_{max})$$

PREPARED BY: D. E. COSTA DATE: ____________

REVIEWED BY: J. F. SHEPARD DATE: ____________

7.0 NOZZLE-TO-HEAD WELD STRESS SUMMARY: Reference microfiche CR3SCL2.OUT

This section contains a summary of the transient stresses at the surge nozzle-to-pressurizer head weld. As previously mentioned, these stresses include the effects of thermal, pressure, and external loads associated with surge line stratification transients. The table is taken from the microfiche output of CR3SCL2.OUT

TABLE 7-1

*************************** LINEARIZED STRESS SUMMARY, SCL 2 ***************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
HU1A1	1.	10.	0.0	0.0	0.1	0.0	0.1	0.1	70.	70.	70.
HU1A1	2.	10.	-0.6	-11.7	-7.2	0.0	29.1	31.5	362.	249.	230.
HU1A1	3.	10.	-0.6	26.0	33.3	0.0	-22.5	-20.5	253.	410.	437.
HU1A1	4.	10.	-0.6	-8.1	-3.6	0.0	25.0	27.4	331.	223.	206.
HU1A1	5.	10.	-0.6	30.5	38.5	0.0	-28.6	-26.5	253.	410.	437.
HU1A1	6.	10.	-0.6	-1.0	3.6	0.0	16.1	11.9	174.	114.	106.
HU1A1	7.	10.	-0.6	11.9	18.4	0.0	1.3	4.6	196.	258.	268.
HU1A1	8.	10.	-0.6	-7.1	-3.0	0.0	23.7	26.9	331.	216.	199.
HU1A1	9.	10.	-0.6	16.3	22.8	0.0	-12.7	-11.7	307.	429.	441.
HU1A1	10.	10.	-0.6	-3.6	0.2	0.0	16.9	19.7	240.	171.	163.
HU1A1	11.	10.	-0.6	8.9	13.2	0.0	-3.8	-2.1	196.	258.	268.
HU1A1	12.	10.	-0.6	0.6	3.6	0.0	5.6	6.8	174.	152.	151.
HU1A1	13.	10.	-0.6	5.1	9.2	0.0	-0.2	1.1	257.	290.	294.
HU1A1	14.	10.	-0.6	-1.8	2.5	0.0	16.2	19.1	240.	171.	163.
HU1A1	15.	10.	-0.6	8.7	13.1	0.0	-3.9	-2.2	196.	258.	268.
HU1A1	16.	10.	-0.6	-3.7	-0.1	0.0	15.3	18.2	336.	264.	257.
HU1A1	17.	10.	-0.6	9.4	13.9	0.0	-4.9	-3.2	196.	258.	268.
HU1A1	18.	10.	-0.6	-2.1	1.7	0.0	13.7	15.7	174.	114.	106.
HU1A1	19.	10.	-0.6	8.3	12.6	0.0	-3.4	-1.8	196.	258.	268.
HU1A1	20.	10.	-0.6	-5.5	-2.0	0.0	18.3	21.0	281.	189.	177.
HU1A1	21.	10.	-0.6	14.0	19.4	0.0	-9.3	-6.7	392.	484.	499.
HU1A1	22.	10.	-0.6	-15.8	-14.4	0.0	23.9	25.2	373.	241.	221.
HU1A1	23.	10.	-0.6	[illegible]	21.6	0.0	-5.8	-2.3	392.	484.	499.
HU1A1	24.	10.	-0.6	0.7	5.2	0.0	11.1	14.1	441.	403.	401.
HU1A1	25.	10.	-0.6	12.5	19.0	0.0	-2.7	0.3	437.	513.	524.
HU1A1	26.	10.	-0.6	2.1	6.2	0.0	8.5	10.5	174.	152.	151.
HU1A1	27.	10.	-0.6	5.1	9.3	0.0	-0.2	1.2	257.	290.	294.
HU1A1	28.	10.	-0.6	-6.9	-3.7	0.0	18.8	21.8	371.	276.	265.
HU1A1	29.	10.	-0.6	14.5	20.0	0.0	-9.8	-7.1	392.	484.	499.
HU1A1	30.	10.	-0.6	-0.4	3.0	0.0	9.0	10.8	189.	155.	152.
HU1A1	31.	10.	-0.6	8.2	13.2	0.0	-3.7	-2.0	475.	532.	539.
HU1A1	32.	10.	-0.6	-8.3	-5.8	0.0	15.9	16.8	269.	177.	162.
HU1A1	33.	10.	-0.6	19.3	26.4	0.0	-9.8	-5.4	364.	465.	481.
HU1A1	34.	10.	-0.6	-5.7	-2.5	0.0	17.1	19.4	281.	189.	177.
HU1A1	35.	10.	-0.6	6.5	11.5	0.0	1.2	3.1	401.	446.	449.
HU1A1	36.	10.	-0.6	-0.3	4.4	0.0	11.6	15.2	539.	503.	501.
HU1A1	37.	10.	-0.7	11.8	17.6	0.0	-6.4	-4.9	344.	430.	440.
HU1A1	38.	10.	-0.7	-1.6	3.2	0.0	14.7	17.9	309.	257.	253.
HU1A1	39.	10.	-0.9	11.3	17.9	0.0	-4.7	-2.5	437.	513.	524.
HU1A1	40.	10.	-1.5	-10.1	-2.0	0.0	32.3	35.8	449.	342.	325.
HU1A1	41.	10.	-1.6	7.1	16.6	0.0	8.8	11.9	422.	449.	450.
HU1A1	42.	10.	-1.6	2.9	12.2	0.0	16.5	20.5	537.	504.	502.
HU1A1	43.	10.	-1.7	13.4	24.7	0.0	3.3	7.0	475.	532.	539.
HU1A1	44.	10.	-1.7	2.7	12.6	0.0	17.8	22.3	539.	503.	501.
HU1A1	45.	10.	-1.8	15.0	26.0	0.0	-1.8	0.5	344.	430.	440.
HU1A1	46.	10.	-1.8	-0.8	8.2	0.0	20.7	24.7	562.	510.	504.
HU1A1	47.	10.	-2.0	12.8	23.8	0.0	0.9	3.7	437.	513.	524.
HU1A1	48.	10.	-2.0	-1.2	9.1	0.0	24.1	28.3	494.	414.	407.
HU1A1	49.	10.	-2.1	9.2	20.7	0.0	8.4	11.3	401.	446.	449.
HU1A1	50.	10.	-2.1	1.5	13.0	0.0	22.4	27.2	561.	508.	503.

TABLE 7-1 cont.

************************** LINEARIZED STRESS SUMMARY, SCL 2 *************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
HU1A1	51.	10.	-2.2	10.8	22.5	0.0	3.9	6.1	377.	441.	446.
HU1A1	52.	10.	-2.2	-7.8	4.1	0.0	35.7	42.4	588.	521.	513.
HU1A1	53.	10.	-2.2	18.2	30.9	0.0	-2.0	1.9	392.	484.	499.
HU1A1	54.	10.	-2.2	1.0	12.1	0.0	21.8	25.9	463.	407.	402.
HU1A1	55.	10.	-2.2	13.1	25.9	0.0	4.0	7.3	475.	532.	539.
HU1A1	56.	10.	-2.2	-2.8	8.7	0.0	27.9	33.6	580.	513.	506.
HU1A1	57.	10.	-2.2	15.4	28.2	0.0	1.0	4.4	437.	513.	524.
HU1A1	58.	10.	-2.2	1.6	12.9	0.0	21.0	25.3	561.	508.	503.
HU1A1	59.	10.	-2.2	7.8	19.6	0.0	8.5	11.6	520.	547.	549.
HU1A1	60.	10.	-2.2	-2.4	8.5	0.0	24.7	29.1	588.	521.	513.
HU1A1	61.	10.	-2.2	12.6	25.2	0.0	4.6	7.8	475.	532.	539.
HU1A1	62.	10.	-2.2	2.8	14.1	0.0	17.8	21.8	537.	504.	502.
HU1A1	63.	10.	-2.2	10.7	22.7	0.0	5.9	8.7	475.	532.	539.
HU1A1	64.	10.	-2.2	-2.8	7.2	0.0	21.4	25.3	580.	513.	506.
HU1A1	65.	10.	-2.2	13.7	25.9	0.0	2.3	5.4	437.	513.	524.
HU1A1	66.	10.	-2.2	4.0	15.6	0.0	16.7	20.8	521.	502.	500.
HU1A1	67.	10.	-2.2	8.1	20.1	0.0	8.8	12.1	520.	547.	549.
HU1A1	68.	10.	-2.2	-1.6	9.1	0.0	22.9	26.9	588.	521.	513.
HU1A1	69.	10.	-2.2	9.8	22.0	0.0	7.3	10.3	502.	542.	546.
HU1A1	70.	10.	-2.2	3.4	14.3	0.0	14.6	17.9	521.	502.	500.
HU1A2	1.	8.	0.0	0.0	0.0	0.0	0.0	0.0	70.	70.	70.
HU1A2	2.	8.	-0.2	-9.8	-7.2	0.0	22.6	24.4	331.	223.	206.
HU1A2	3.	8.	-0.2	18.3	23.5	0.0	-17.2	-16.5	260.	414.	432.
HU1A2	4.	8.	-0.2	-7.3	-4.7	0.0	19.8	21.8	269.	177.	162.
HU1A2	5.	8.	-0.2	21.9	27.6	0.0	-22.3	-21.7	234.	404.	425.
HU1A2	6.	8.	-0.2	-3.1	-2.0	0.0	6.6	7.2	142.	98.	92.
HU1A2	7.	8.	-0.2	9.1	13.7	0.0	0.7	3.3	231.	279.	286.
HU1A2	8.	8.	-0.2	-6.6	-3.7	0.0	19.2	22.1	394.	307.	294.
HU1A2	9.	8.	-0.4	11.0	15.3	0.0	-8.3	-7.1	174.	235.	242.
HU1A2	10.	8.	-0.4	-4.4	-1.2	0.0	16.1	18.9	352.	283.	273.
HU1A2	11.	8.	-0.4	9.2	12.7	0.0	-6.4	-4.9	196.	258.	268.
HU1A2	12.	8.	-0.4	-5.4	-2.2	0.0	19.2	22.2	281.	189.	177.
HU1A2	13.	8.	-0.4	11.0	14.8	0.0	-8.0	-6.1	165.	237.	249.
HU1A2	14.	8.	-0.4	-4.3	-1.6	0.0	14.5	17.3	336.	264.	257.
HU1A2	15.	8.	-0.4	9.4	13.0	0.0	-6.3	-4.7	196.	258.	268.
HU1A2	16.	8.	-0.4	-2.8	0.1	0.0	12.9	14.8	174.	114.	106.
HU1A2	17.	8.	-0.4	8.2	11.7	0.0	-4.8	-3.3	196.	258.	268.
HU1A2	18.	8.	-0.4	-5.8	-3.2	0.0	17.2	19.7	281.	189.	177.
HU1A2	19.	8.	-0.4	9.6	12.9	0.0	-7.2	-5.6	165.	237.	249.
HU1A2	20.	8.	-0.4	-3.2	-0.9	0.0	10.6	12.6	212.	161.	156.
HU1A2	21.	8.	-0.4	3.2	6.2	0.0	-0.1	1.1	274.	296.	298.
HU1A2	22.	8.	-0.4	-9.3	-8.0	0.0	14.3	14.8	269.	177.	162.
HU1A2	23.	8.	-0.4	14.7	20.2	0.0	-6.9	-3.6	392.	484.	499.
HU1A2	24.	8.	-0.4	0.7	4.0	0.0	8.9	11.2	287.	253.	251.
HU1A2	25.	8.	-0.4	11.7	17.1	0.0	-3.5	-0.8	437.	513.	524.
HU1A2	26.	8.	-0.4	1.6	4.7	0.0	7.4	9.3	174.	152.	151.
HU1A2	27.	8.	-0.4	5.1	8.5	0.0	-1.6	-0.4	257.	290.	294.
HU1A2	28.	8.	-0.4	-7.5	-5.3	0.0	17.7	20.5	371.	276.	265.
HU1A2	29.	8.	-0.4	14.2	18.8	0.0	-11.1	-8.5	392.	484.	499.
HU1A2	30.	8.	-0.4	-1.0	1.5	0.0	7.9	9.6	189.	155.	152.
HU1A2	31.	8.	-0.4	6.2	9.3	0.0	-3.6	-2.5	231.	279.	286.
HU1A2	32.	8.	-0.4	-9.3	-8.1	0.0	14.4	14.8	269.	177.	162.
HU1A2	33.	8.	-0.4	18.5	24.5	0.0	-10.7	-6.6	364.	465.	481.
HU1A2	34.	8.	-0.4	-7.4	-5.1	0.0	17.9	20.3	281.	189.	177.
HU1A2	35.	8.	-0.4	6.0	10.3	0.0	0.6	2.4	402.	448.	450.
HU1A2	36.	8.	-0.4	-1.7	1.8	0.0	11.8	14.8	559.	511.	506.
HU1A2	37.	8.	-0.4	13.6	18.5	0.0	-11.5	-10.4	302.	413.	428.
HU1A2	38.	8.	-0.6	-7.7	-4.1	0.0	19.9	21.5	269.	177.	162.
HU1A2	39.	8.	-0.6	4.8	9.8	0.0	3.3	5.3	421.	449.	450.
HU1A2	40.	8.	-0.6	1.8	7.0	0.0	9.6	12.9	521.	502.	500.
HU1A2	41.	8.	-0.7	9.8	16.0	0.0	-1.9	0.5	475.	532.	539.
HU1A2	42.	8.	-0.7	0.9	5.8	0.0	10.6	13.7	539.	503.	501.
HU1A2	43.	8.	-0.7	10.8	16.7	0.0	-4.4	-2.3	437.	513.	524.
HU1A2	44.	8.	-0.8	-2.3	3.2	0.0	16.4	20.6	561.	508.	503.
HU1A2	45.	8.	-1.0	11.6	18.7	0.0	-3.5	-1.1	437.	513.	524.

TABLE 7-1 cont.

*************************** LINEARIZED STRESS SUMMARY, SCL 2 **************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
HU1A2	46.	8.	-1.0	-6.7	-0.1	0.0	25.2	30.3	588.	521.	513.
HU1A2	47.	8.	-1.2	13.9	21.5	0.0	-6.1	-3.4	392.	484.	499.
HU1A2	48.	8.	-1.4	-9.0	-0.7	0.0	30.8	36.9	588.	521.	513.
HU1A2	49.	8.	-1.7	16.5	27.3	0.0	-1.2	2.6	392.	484.	499.
HU1A2	50.	8.	-1.7	0.8	9.8	0.0	18.9	22.6	463.	407.	402.
HU1A2	51.	8.	-1.9	12.7	24.4	0.0	2.4	5.5	475.	532.	539.
HU1A2	52.	8.	-2.2	-5.8	4.8	0.0	31.2	36.0	534.	427.	415.
HU1A2	53.	8.	-2.2	16.6	28.9	0.0	-0.6	3.1	392.	484.	499.
HU1A2	54.	8.	-2.2	1.2	12.5	0.0	22.6	26.9	463.	407.	402.
HU1A2	55.	8.	-2.2	9.4	21.4	0.0	6.5	9.4	502.	542.	546.
HU1A2	56.	8.	-2.2	-5.2	5.2	0.0	26.0	30.5	588.	521.	513.
HU1A2	57.	8.	-2.2	14.9	27.9	0.0	4.0	7.7	437.	513.	524.
HU1A2	58.	8.	-2.2	-2.8	7.1	0.0	21.5	25.4	580.	513.	506.
HU1A2	59.	8.	-2.2	14.7	27.6	0.0	3.7	7.3	437.	513.	524.
HU1A2	60.	8.	-2.2	2.8	14.1	0.0	17.8	21.8	537.	504.	502.
HU1A2	61.	8.	-2.2	9.1	20.9	0.0	7.5	10.3	502.	542.	546.
HU1A2	62.	8.	-2.2	-0.5	10.7	0.0	22.0	26.6	561.	508.	503.
HU1A2	63.	8.	-2.2	9.8	22.0	0.0	7.3	10.3	502.	542.	546.
HU1A2	64.	8.	-2.2	3.9	15.1	0.0	15.4	19.0	521.	502.	500.
HU1A3	1.	45.	0.0	0.0	0.1	0.0	0.1	0.1	70.	70.	70.
HU1A3	2.	45.	-0.2	-10.0	-7.4	0.0	22.4	24.2	331.	223.	206.
HU1A3	3.	45.	-0.2	17.3	22.4	0.0	-16.3	-15.6	260.	414.	432.
HU1A3	4.	45.	-0.2	-6.9	-4.4	0.0	18.9	20.7	269.	177.	162.
HU1A3	5.	45.	-0.2	20.3	25.9	0.0	-20.5	-19.9	260.	414.	432.
HU1A3	6.	45.	-0.2	-2.8	-1.8	0.0	6.2	6.8	142.	98.	92.
HU1A3	7.	45.	-0.2	8.3	12.7	0.0	0.9	3.3	231.	279.	286.
HU1A3	8.	45.	-0.2	-6.0	-3.3	0.0	17.9	20.5	394.	307.	294.
HU1A3	9.	45.	-0.4	10.0	14.1	0.0	-7.3	-6.2	174.	235.	242.
HU1A3	10.	45.	-0.4	-3.8	-0.8	0.0	14.7	17.3	352.	283.	273.
HU1A3	11.	45.	-0.4	7.9	11.2	0.0	-5.2	-3.8	196.	258.	268.
HU1A3	12.	45.	-0.4	-5.1	-1.6	0.0	18.4	21.7	352.	283.	273.
HU1A3	13.	45.	-0.4	10.0	13.5	0.0	-7.0	-5.2	165.	237.	249.
HU1A3	14.	45.	-0.4	-3.7	-1.3	0.0	12.9	14.9	240.	171.	163.
HU1A3	15.	45.	-0.4	8.3	11.7	0.0	-5.2	-3.7	196.	258.	268.
HU1A3	16.	45.	-0.4	-2.0	0.7	0.0	11.5	13.2	142.	98.	92.
HU1A3	17.	45.	-0.4	7.6	11.3	0.0	-4.0	-2.5	231.	279.	286.
HU1A3	18.	45.	-0.4	-5.7	-2.8	0.0	16.6	19.4	352.	283.	273.
HU1A3	19.	45.	-0.4	13.0	18.1	0.0	-9.4	-7.1	437.	513.	524.
HU1A3	20.	45.	-0.4	-14.0	-13.4	0.0	20.3	21.3	373.	241.	221.
HU1A3	21.	45.	-0.4	12.9	18.5	0.0	-5.5	-2.7	437.	513.	524.
HU1A3	22.	45.	-0.4	1.0	4.0	0.0	7.4	9.2	174.	152.	151.
HU1A3	23.	45.	-0.4	10.5	16.0	0.0	-2.6	0.1	475.	532.	539.
HU1A3	24.	45.	-0.4	1.5	4.5	0.0	6.6	8.2	174.	152.	151.
HU1A3	25.	45.	-0.4	3.8	7.1	0.0	0.0	1.3	274.	296.	298.
HU1A3	26.	45.	-0.4	-5.0	-2.6	0.0	14.3	17.0	336.	264.	257.
HU1A3	27.	45.	-0.4	12.4	17.3	0.0	-8.8	-6.5	437.	513.	524.
HU1A3	28.	45.	-0.4	-0.5	1.9	0.0	7.0	8.4	189.	155.	152.
HU1A3	29.	45.	-0.4	6.5	10.8	0.0	-2.9	-1.1	502.	542.	546.
HU1A3	30.	45.	-0.4	-7.3	-6.1	0.0	12.0	12.6	216.	141.	129.
HU1A3	31.	45.	-0.4	16.5	22.3	0.0	-9.(	-5.5	392.	484.	499.
HU1A3	32.	45.	-0.4	-6.2	-4.7	0.0	11.7	12.5	216.	141.	129.
HU1A3	33.	45.	-0.4	6.5	10.9	0.0	1.1	3.1	401.	446.	449.
HU1A3	34.	45.	-0.4	-0.3	3.5	0.0	9.8	12.9	537.	504.	502.
HU1A3	35.	45.	-0.4	11.7	16.6	0.0	-7.8	-5.6	437.	513.	524.
HU1A3	36.	45.	-0.4	0.4	3.0	0.0	6.9	8.1	119.	88.	85.
HU1A3	37.	45.	-0.4	3.9	7.8	0.0	0.4	2.1	520.	547.	549.
HU1A3	38.	45.	-0.6	-5.6	-2.3	0.0	16.2	17.7	216.	141.	129.
HU1A3	39.	45.	-0.6	3.9	8.8	0.0	4.1	6.4	435.	450.	450.
HU1A3	40.	45.	-0.6	1.2	5.6	0.0	7.7	10.3	521.	502.	500.
HU1A3	41.	45.	-0.7	8.3	14.8	0.0	1.2	4.0	502.	542.	546.
HU1A3	42.	45.	-0.7	1.6	6.8	0.0	9.2	12.4	521.	502.	500.
HU1A3	43.	45.	-0.7	9.1	15.1	0.0	-2.3	-0.2	475.	532.	539.
HU1A3	44.	45.	-0.8	-1.6	3.6	0.0	14.0	17.5	559.	511.	506.
HU1A3	45.	45.	-1.0	9.3	16.3	0.0	-0.8	1.4	475.	532.	539.
HU1A3	46.	45.	-1.0	-5.3	1.0	0.0	22.3	26.7	588.	521.	513.

TABLE 7-1 cont.

************************** LINEARIZED STRESS SUMMARY, SCL 2 ************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
HU1A3	47.	45.	-1.2	11.9	19.6	0.0	-3.7	-1.3	437.	513.	524.
HU1A3	48.	45.	-1.4	-8.5	-1.9	0.0	23.0	27.1	588.	521.	513.
HU1A3	49.	45.	-1.7	14.7	25.9	0.0	1.9	5.6	437.	513.	524.
HU1A3	50.	45.	-1.7	2.0	11.7	0.0	17.5	21.8	539.	503.	501.
HU1A3	51.	45.	-1.9	10.9	22.0	0.0	4.3	7.1	475.	532.	539.
HU1A3	52.	45.	-2.1	-0.8	10.0	0.0	23.9	28.7	580.	513.	506.
HU1A3	53.	45.	-2.2	11.5	23.9	0.0	6.1	9.2	475.	532.	539.
HU1A3	54.	45.	-2.2	3.0	14.7	0.0	19.8	24.4	539.	503.	501.
HU1A3	55.	45.	-2.2	8.3	19.8	0.0	7.5	10.1	502.	542.	546.
HU1A3	56.	45.	-2.2	-2.6	8.3	0.0	25.1	29.6	588.	521.	513.
HU1A3	57.	45.	-2.2	12.9	25.6	0.0	4.2	7.5	475.	532.	539.
HU1A3	58.	45.	-2.2	2.9	14.1	0.0	17.6	21.5	539.	503.	501.
HU1A3	59.	45.	-2.2	10.6	22.5	0.0	6.0	8.7	475.	532.	539.
HU1A3	60.	45.	-2.2	-1.6	9.2	0.0	23.5	28.0	580.	513.	506.
HU1A3	61.	45.	-2.2	13.6	25.7	0.0	1.9	4.9	437.	513.	524.
HU1A3	62.	45.	-2.2	3.2	14.2	0.0	17.0	20.7	539.	503.	501.
HU1A3	63.	45.	-2.2	8.8	20.5	0.0	7.7	10.5	502.	542.	546.
HU1A3	64.	45.	-2.2	-0.5	10.6	0.0	22.0	26.6	561.	508.	503.
HU1A3	65.	45.	-2.2	9.8	22.0	0.0	7.3	10.3	502.	542.	546.
HU1A3	66.	45.	-2.2	3.9	15.1	0.0	15.4	19.0	521.	502.	500.
HU1A4	1.	29.	0.0	0.0	0.0	0.0	0.0	0.0	70.	70.	70.
HU1A4	2.	29.	-0.4	-10.6	-7.1	0.0	25.4	27.5	362.	249.	230.
HU1A4	3.	29.	-0.4	23.8	29.9	0.0	-21.7	-19.9	253.	410.	437.
HU1A4	4.	29.	-0.4	-7.9	-4.3	0.0	22.3	24.5	331.	223.	206.
HU1A4	5.	29.	-0.4	28.5	35.3	0.0	-27.8	-25.9	253.	410.	437.
HU1A4	6.	29.	-0.4	-3.3	-1.8	0.0	7.8	8.6	142.	98.	92.
HU1A4	7.	29.	-0.4	10.4	16.0	0.0	1.2	4.2	231.	279.	286.
HU1A4	8.	29.	-0.4	-6.2	-3.0	0.0	20.5	23.7	281.	189.	177.
HU1A4	9.	29.	-0.4	12.0	16.6	0.0	-9.3	-8.1	174.	235.	242.
HU1A4	10.	29.	-0.4	-4.3	-1.1	0.0	16.0	16.8	352.	283.	273.
HU1A4	11.	29.	-0.4	9.1	12.6	0.0	-6.4	-4.8	196.	258.	268.
HU1A4	12.	29.	-0.4	-5.4	-2.2	0.0	19.2	22.2	281.	189.	177.
HU1A4	13.	29.	-0.4	11.0	14.8	0.0	-8.0	-6.1	165.	237.	249.
HU1A4	14.	29.	-0.4	-4.3	-1.6	0.0	14.5	17.3	336.	264.	257.
HU1A4	15.	29.	-0.4	9.0	12.5	0.0	-6.0	-4.5	196.	258.	268.
HU1A4	16.	29.	-0.4	-2.2	0.5	0.0	11.0	13.[illegible]	212.	161.	156.
HU1A4	17.	29.	-0.4	4.8	8.1	0.0	-0.1	1.1	205.	244.	248.
HU1A4	18.	29.	-0.4	-0.1	2.6	0.0	8.3	9.8	119.	88.	85.
HU1A4	19.	29.	-0.4	5.8	8.9	0.0	-2.9	-1.7	231.	279.	286.
HU1A4	20.	29.	-0.6	-5.2	-2.2	0.0	15.0	17.1	240.	171.	163.
HU1A4	21.	29.	-0.6	3.8	7.8	0.0	1.0	2.3	274.	296.	298.
HU1A4	22.	29.	-0.6	-8.7	-6.5	0.0	15.4	16.0	269.	177.	162.
HU1A4	23.	29.	-0.6	13.4	18.5	0.0	-9.5	-7.1	392.	484.	499.
HU1A4	24.	29.	-0.6	0.9	5.5	0.0	11.1	14.0	441.	403.	401.
HU1A4	25.	29.	-0.6	12.6	19.2	0.0	-2.6	0.5	437.	513.	524.
HU1A4	26.	29.	-0.6	2.1	6.4	0.0	8.8	10.9	174.	152.	151.
HU1A4	27.	29.	-0.6	5.1	9.3	0.0	0.1	1.4	257.	290.	294.
HU1A4	28.	29.	-0.6	-7.0	-3.7	0.0	19.2	22.3	371.	276.	265.
HU1A4	29.	29.	-0.6	14.9	20.5	0.0	-10.0	-7.2	392.	484.	499.
HU1A4	30.	29.	-0.6	-0.4	3.1	0.0	9.2	11.1	189.	155.	152.
HU1A4	31.	29.	-0.6	8.4	13.5	0.0	-3.7	-2.0	475.	532.	539.
HU1A4	32.	29.	-0.6	-8.9	-6.7	0.0	15.6	16.2	269.	177.	162.
HU1A4	33.	29.	-0.6	19.6	26.8	0.0	-9.9	-5.4	364.	465.	481.
HU1A4	34.	29.	-0.6	-5.8	-2.5	0.0	17.3	19.7	281.	189.	177.
HU1A4	35.	29.	-0.6	6.8	12.0	0.0	1.1	3.1	401.	446.	449.
HU1A4	36.	29.	-0.6	-0.3	4.5	0.0	11.9	15.6	539.	503.	501.
HU1A4	37.	29.	-0.6	11.8	17.4	0.0	-6.8	-5.3	344.	430.	440.
HU1A4	38.	29.	-0.6	-1.6	2.6	0.0	13.5	16.5	309.	257.	253.
HU1A4	39.	29.	-0.6	10.1	15.2	0.0	-5.7	-3.8	437.	513.	524.
HU1A4	40.	29.	-0.6	-5.4	-2.1	0.0	16.1	17.6	216.	141.	129.
HU1A4	41.	29.	-0.6	6.9	12.3	0.0	2.1	4.3	401.	446.	449.
HU1A4	42.	29.	-0.6	0.6	4.7	0.0	6.9	9.2	521.	502.	500.
HU1A4	43.	29.	-0.6	8.9	14.4	0.0	-2.9	-0.8	475.	532.	539.
HU1A4	44.	29.	-0.6	0.6	4.7	0.0	8.8	11.2	539.	503.	501.
HU1A4	45.	29.	-0.8	6.7	12.6	0.0	0.4	2.4	502.	542.	546.

TABLE 7-1 cont.

*************************** LINEARIZED STRESS SUMMARY, SCL 2 **************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
HU1A4	46.	29.	-0.9	-1.2	4.3	0.0	14.0	17.2	559.	511.	506.
HU1A4	47.	29.	-0.9	5.8	12.3	0.0	4.0	6.4	520.	547.	549.
HU1A4	48.	29.	-1.0	0.6	7.2	0.0	13.3	16.9	537.	504.	502.
HU1A4	49.	29.	-1.2	6.6	13.6	0.0	2.2	4.2	502.	542.	546.
HU1A4	50.	29.	-1.4	-6.3	1.3	0.0	25.1	30.0	588.	521.	513.
HU1A4	51.	29.	-1.6	13.7	23.7	0.0	-1.4	1.5	437.	513.	524.
HU1A4	52.	29.	-1.6	0.1	8.8	0.0	17.7	21.6	561.	508.	503.
HU1A4	53.	29.	-1.8	10.5	20.8	0.0	3.6	6.3	475.	532.	539.
HU1A4	54.	29.	-1.9	-2.7	7.5	0.0	25.4	30.6	580.	513.	506.
HU1A4	55.	29.	-2.2	14.2	26.6	0.0	2.0	5.3	437.	513.	524.
HU1A4	56.	29.	-2.2	1.5	12.9	0.0	21.0	25.4	561.	508.	503.
HU1A4	57.	29.	-2.2	7.8	19.6	0.0	8.5	11.6	520.	547.	549.
HU1A4	58.	29.	-2.2	-2.4	8.5	0.0	24.7	29.2	588.	521.	513.
HU1A4	59.	29.	-2.2	12.6	25.2	0.0	4.6	7.8	475.	532.	539.
HU1A4	60.	29.	-2.2	2.8	14.1	0.0	17.8	21.8	537.	504.	502.
HU1A4	61.	29.	-2.2	10.7	22.7	0.0	5.9	8.7	475.	532.	539.
HU1A4	62.	29.	-2.2	-2.8	7.2	0.0	21.4	25.3	580.	513.	506.
HU1A4	63.	29.	-2.2	13.7	25.9	0.0	2.3	5.4	437.	513.	524.
HU1A4	64.	29.	-2.2	4.0	15.6	0.0	16.7	20.8	521.	502.	500.
HU1A4	65.	29.	-2.2	8.1	20.2	0.0	8.8	12.1	520.	547.	549.
HU1A4	66.	29.	-2.2	-1.6	9.1	0.0	22.9	26.9	588.	521.	513.
HU1A4	67.	29.	-2.2	9.8	22.0	0.0	7.2	10.3	502.	542.	546.
HU1A4	68.	29.	-2.2	3.4	14.3	0.0	14.6	17.9	521.	502.	500.
HU1A5	1.	148.	0.0	0.1	0.1	0.0	0.1	0.2	70.	70.	70.
HU1A5	2.	148.	-0.2	-9.5	-7.3	0.0	20.7	22.3	331.	223.	206.
HU1A5	3.	148.	-0.2	15.1	19.8	0.0	-13.9	-13.2	307.	429.	441.
HU1A5	4.	148.	-0.2	-6.3	-4.2	0.0	16.8	18.6	216.	141.	129.
HU1A5	5.	148.	-0.2	18.0	22.9	0.0	-18.2	-17.6	260.	414.	432.
HU1A5	6.	148.	-0.2	-2.2	-1.4	0.0	5.1	5.7	119.	88.	85.
HU1A5	7.	148.	-0.2	7.6	11.5	0.0	0.5	2.7	231.	279.	286.
HU1A5	8.	148.	-0.2	-3.7	-1.5	0.0	13.4	15.4	174.	114.	106.
HU1A5	9.	148.	-0.2	8.7	11.8	0.0	-7.1	-6.2	174.	235.	242.
HU1A5	10.	148.	-0.3	-2.1	0.2	0.0	10.7	12.4	142.	98.	92.
HU1A5	11.	148.	-0.4	7.3	10.4	0.0	-4.4	-3.2	196.	258.	268.
HU1A5	12.	148.	-0.4	-3.2	-0.1	0.0	15.2	17.5	174.	114.	106.
HU1A5	13.	148.	-0.4	9.9	13.4	0.0	-6.8	-5.1	165.	237.	249.
HU1A5	14.	148.	-0.4	-3.6	-1.1	0.0	12.6	14.6	240.	171.	163.
HU1A5	15.	148.	-0.4	8.3	11.6	0.0	-5.1	-3.7	196.	258.	268.
HU1A5	16.	148.	-0.4	-1.9	0.8	0.0	11.3	13.1	142.	98.	92.
HU1A5	17.	148.	-0.4	7.7	11.4	0.0	-4.0	-2.5	231.	279.	286.
HU1A5	18.	148.	-0.4	-5.6	-2.7	0.0	16.5	19.2	352.	283.	273.
HU1A5	19.	148.	-0.4	13.0	18.0	0.0	-9.4	-7.0	437.	513.	524.
HU1A5	20.	148.	-0.6	-16.1	-14.6	0.0	24.4	25.7	373.	241.	221.
HU1A5	21.	148.	-0.6	15.5	22.0	0.0	-5.8	-2.3	392.	484.	499.
HU1A5	22.	148.	-0.6	0.7	5.3	0.0	11.4	14.4	441.	403.	401.
HU1A5	23.	148.	-0.6	12.8	19.4	0.0	-2.8	0.3	437.	513.	524.
HU1A5	24.	148.	-0.6	2.2	6.4	0.0	8.7	10.8	174.	152.	151.
HU1A5	25.	148.	-0.6	6.5	11.7	0.0	-0.8	1.1	502.	542.	546.
HU1A5	26.	148.	-0.6	-7.0	-3.7	0.0	19.2	22.3	371.	276.	265.
HU1A5	27.	148.	-0.6	14.8	20.5	0.0	-10.0	-7.2	392.	484.	499.
HU1A5	28.	148.	-0.6	-0.4	3.1	0.0	9.2	11.1	189.	155.	152.
HU1A5	29.	148.	-0.6	8.4	13.5	0.0	-3.7	-2.0	475.	532.	539.
HU1A5	30.	148.	-0.6	-8.5	-5.9	0.0	16.3	17.2	269.	177.	162.
HU1A5	31.	148.	-0.6	19.7	26.9	0.0	-10.0	-5.5	364.	465.	481.
HU1A5	32.	148.	-0.6	-5.8	-2.5	0.0	17.5	19.9	281.	189.	177.
HU1A5	33.	148.	-0.6	6.6	11.8	0.0	1.3	3.3	401.	446.	449.
HU1A5	34.	148.	-0.6	-0.3	4.6	0.0	11.9	15.5	539.	503.	501.
HU1A5	35.	148.	-0.6	11.9	17.5	0.0	-6.8	-5.4	344.	430.	440.
HU1A5	36.	148.	-0.6	-1.6	2.6	0.0	13.5	16.5	309.	257.	253.
HU1A5	37.	148.	-0.6	10.2	15.2	0.0	-5.8	-3.9	437.	513.	524.
HU1A5	38.	148.	-0.6	-5.4	-2.1	0.0	16.1	17.7	216.	141.	129.
HU1A5	39.	148.	-0.6	6.9	12.3	0.0	2.2	4.3	401.	446.	449.
HU1A5	40.	148.	-0.6	0.6	4.7	0.0	6.9	9.2	521.	502.	500.
HU1A5	41.	148.	-0.6	8.9	14.4	0.0	-2.9	-0.8	475.	532.	539.
HU1A5	42.	148.	-0.6	0.6	4.7	0.0	8.8	11.2	539.	503.	501.

TABLE 7-1 cont.

*************************** LINEARIZED STRESS SUMMARY, SCL 2 **************************

TRANS	PV	TRANSIENT	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE			TOTAL LINEARIZED STRESS (ksi) OUTSIDE SURFACE			BASE METAL TEMPERATURES (F)		
NAME	#	CYCLES	RAD	LONG	HOOP	RAD	LONG	HOOP	ID	FLAW	OD
HU1A5	43.	148.	-0.8	6.7	12.6	0.0	0.4	2.4	502.	542.	546.
HU1A5	44.	148.	-0.9	-1.2	4.3	0.0	14.0	17.3	559.	511.	506.
HU1A5	45.	148.	-0.9	5.8	12.4	0.0	4.0	6.4	520.	547.	549.
HU1A5	46.	148.	-1.0	0.5	7.1	0.0	13.3	17.0	537.	504.	502.
HU1A5	47.	148.	-1.2	6.6	13.7	0.0	2.2	4.2	502.	542.	546.
HU1A5	48.	148.	-1.4	-6.3	1.3	0.0	25.1	29.9	588.	521.	513.
HU1A5	49.	148.	-1.6	13.7	23.7	0.0	-1.4	1.5	437.	513.	524.
HU1A5	50.	148.	-1.6	0.1	8.8	0.0	17.7	21.6	561.	508.	503.
HU1A5	51.	148.	-1.8	10.5	20.8	0.0	3.6	6.3	475.	532.	539.
HU1A5	52.	148.	-1.9	-2.7	7.5	0.0	25.4	30.6	580.	513.	506.
HU1A5	53.	148.	-2.2	14.2	26.6	0.0	2.0	5.3	437.	513.	524.
HU1A5	54.	148.	-2.2	1.5	12.9	0.0	21.0	25.4	561.	508.	503.
HU1A5	55.	148.	-2.2	7.8	19.6	0.0	8.5	11.6	520.	547.	549.
HU1A5	56.	148.	-2.2	-2.4	8.5	0.0	24.7	29.2	588.	521.	513.
HU1A5	57.	148.	-2.2	12.6	25.2	0.0	4.6	7.8	475.	532.	539.
HU1A5	58.	148.	-2.2	2.8	14.1	0.0	17.8	21.8	537.	504.	502.
HU1A5	59.	148.	-2.2	10.7	22.7	0.0	5.9	8.7	475.	532.	539.
HU1A5	60.	148.	-2.2	-2.8	7.2	0.0	21.4	25.3	580.	513.	506.
HU1A5	61.	148.	-2.2	13.7	25.9	0.0	2.3	5.4	437.	513.	524.
HU1A5	62.	148.	-2.2	4.0	15.6	0.0	16.7	20.8	521.	502.	500.
HU1A5	63.	148.	-2.2	8.1	20.1	0.0	8.8	12.1	520.	547.	549.
HU1A5	64.	148.	-2.2	-1.6	9.1	0.0	22.9	26.9	588.	521.	513.
HU1A5	65.	148.	-2.2	9.8	22.0	0.0	7.3	10.3	502.	542.	546.
HU1A5	66.	148.	-2.2	3.4	14.3	0.0	14.6	17.9	521.	502.	500.
CD1B1	1.	40.	-2.2	5.1	15.7	0.0	13.8	16.3	521.	502.	500.
CD1B1	2.	40.	-2.2	8.2	20.3	0.0	10.1	13.4	520.	547.	549.
CD1B1	3.	40.	-2.2	4.7	16.4	0.0	17.0	21.1	521.	502.	500.
CD1B1	4.	40.	-2.2	12.7	24.5	0.0	1.9	4.6	437.	513.	524.
CD1B1	5.	40.	-2.2	-6.6	4.8	0.0	32.4	38.4	588.	521.	513.
CD1B1	6.	40.	-2.2	7.8	19.9	0.0	11.7	15.0	422.	449.	450.
CD1B1	7.	40.	-2.2	3.8	15.6	0.0	19.4	23.9	537.	504.	502.
CD1B1	8.	40.	-2.0	13.6	26.4	0.0	5.4	8.5	375.	445.	449.
CD1B1	9.	40.	-1.0	0.9	6.9	0.0	9.3	12.2	521.	502.	500.
CD1B1	10.	40.	-1.0	22.0	30.3	0.0	-16.5	-14.4	247.	386.	406.
CD1B1	11.	40.	-0.7	-4.2	-1.0	0.0	13.8	15.8	272.	213.	206.
CD1B1	12.	40.	-0.7	10.5	16.7	0.0	-4.1	-1.9	475.	532.	539.
CD1B1	13.	40.	-0.7	-1.4	2.4	0.0	11.1	13.1	212.	161.	156.
CD1B1	14.	40.	-0.7	8.8	14.5	0.0	-2.9	-1.0	475.	532.	539.
CD1B1	15.	40.	-0.7	-3.7	0.4	0.0	16.7	19.4	240.	171.	163.
CD1B1	16.	40.	-0.7	14.2	20.0	0.0	-9.1	-6.5	392.	484.	499.
CD1B1	17.	40.	-0.7	-5.4	-2.3	0.0	15.7	18.1	294.	217.	207.
CD1B1	18.	40.	-0.7	11.6	17.5	0.0	-6.1	-3.8	437.	513.	524.
CD1B1	19.	40.	-0.7	-4.1	-0.2	0.0	16.0	18.5	240.	171.	163.
CD1B1	20.	40.	-0.7	12.9	19.4	0.0	-6.0	-3.4	437.	513.	524.
CD1B1	21.	40.	-0.7	-0.1	4.2	0.0	10.7	13.2	287.	253.	251.
CD1B1	22.	40.	-0.7	10.0	16.0	0.0	-4.8	-2.7	475.	532.	539.
CD1B1	23.	40.	-0.7	-9.5	-5.5	0.0	23.5	25.9	449.	342.	325.
CD1B1	24.	40.	-0.7	18.6	25.0	0.0	-13.9	-10.3	364.	465.	481.
CD1B1	25.	40.	-0.7	-6.5	-2.9	0.0	18.9	21.4	281.	189.	177.
CD1B1	26.	40.	-0.7	16.1	22.2	0.0	-11.3	-8.3	392.	484.	499.
CD1B1	27.	40.	-0.7	-4.4	-1.2	0.0	13.9	16.0	272.	213.	206.
CD1B1	28.	40.	-0.7	10.0	16.1	0.0	-3.8	-1.6	475.	532.	539.
CD1B1	29.	40.	-0.7	-2.3	1.7	0.0	13.0	15.3	212.	161.	156.
CD1B1	30.	40.	-0.7	10.6	16.1	0.0	-5.0	-3.0	437.	513.	524.
CD1B1	31.	40.	-0.7	-3.8	0.1	0.0	16.1	18.6	240.	171.	163.
CD1B1	32.	40.	-0.7	12.0	17.8	0.0	-7.9	-6.7	344.	430.	440.
CD1B1	33.	40.	-0.7	-6.6	-2.6	0.0	19.6	21.3	269.	177.	162.
CD1B1	34.	40.	-0.7	12.3	18.7	0.0	-4.6	-2.7	344.	430.	440.
CD1B1	35.	40.	-0.6	-3.6	0.9	0.0	16.5	19.9	588.	521.	513.
CD1B1	36.	40.	-0.6	13.0	19.0	0.0	-8.4	-7.0	344.	430.	440.
CD1B1	37.	40.	-0.6	-5.3	-1.5	0.0	18.8	21.5	281.	189.	177.
CD1B1	38.	40.	-0.6	10.3	16.5	0.0	-1.9	0.2	377.	441.	446.
CD1B1	39.	40.	-0.6	-3.0	1.5	0.0	16.5	20.1	588.	521.	513.
CD1B1	40.	40.	-0.6	14.1	21.0	0.0	-4.0	-1.5	344.	430.	440.
CD1B1	41.	40.	-0.6	-7.5	-4.4	0.0	16.2	19.2	588.	521.	513.

TABLE 7-1 cont.

**************************** LINEARIZED STRESS SUMMARY, SCL 2 ***************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
CD1B1	42.	40.	-0.5	7.6	13.3	0.0	2.9	5.5	401.	446.	449.
CD1B1	43.	40.	-0.5	-0.6	3.4	0.0	9.5	12.4	537.	504.	502.
CD1B1	44.	40.	-0.5	11.2	16.5	0.0	-4.8	-3.1	344.	430.	440.
CD1B1	45.	40.	-0.5	-3.6	0.3	0.0	16.2	19.7	588.	521.	513.
CD1B1	46.	40.	-0.4	5.7	10.7	0.0	4.5	7.0	421.	449.	450.
CD1B1	47.	40.	-0.4	-0.2	2.8	0.0	5.3	7.4	521.	502.	500.
CD1B1	48.	40.	-0.4	16.0	21.6	0.0	-14.6	-14.0	307.	429.	441.
CD1B1	49.	40.	-0.4	-7.0	-4.2	0.0	18.1	19.7	269.	177.	162.
CD1B1	50.	40.	-0.4	16.8	21.8	0.0	-14.9	-13.5	247.	386.	406.
CD1B1	51.	40.	-0.4	-6.5	-3.8	0.0	17.9	20.5	281.	189.	177.
CD1B1	52.	40.	-0.4	16.3	21.6	0.0	-12.3	-9.4	392.	484.	499.
CD1B1	53.	40.	-0.4	-5.5	-3.4	0.0	14.3	16.5	294.	217.	207.
CD1B1	54.	40.	-0.4	12.4	17.4	0.0	-8.9	-6.7	437.	513.	524.
CD1B1	55.	40.	-0.4	-6.6	-5.0	0.0	12.4	13.9	240.	171.	163.
CD1B1	56.	40.	-0.4	6.1	10.4	0.0	-1.9	-0.1	502.	542.	546.
CD1B1	57.	40.	-0.4	-1.6	0.5	0.0	6.1	7.3	189.	155.	152.
CD1B1	58.	40.	-0.4	8.6	14.5	0.0	2.2	5.2	502.	542.	546.
CD1B1	59.	40.	-0.4	2.0	5.7	0.0	9.0	11.2	174.	152.	151.
CD1B1	60.	40.	-0.4	8.5	14.3	0.0	2.3	5.3	502.	542.	546.
CD1B1	61.	40.	-0.4	0.2	3.9	0.0	11.1	13.6	189.	155.	152.
CD1B1	62.	40.	-0.4	15.1	20.2	0.0	-13.4	-12.1	302.	413.	428.
CD1B1	63.	40.	-0.4	-11.4	-9.0	0.0	23.4	25.9	331.	216.	199.
CD1B1	64.	40.	-0.4	19.4	25.5	0.0	-18.3	-17.6	260.	414.	432.
CD1B1	65.	40.	-0.4	-5.4	-3.7	0.0	10.7	12.0	240.	171.	163.
CD1B1	66.	40.	-0.4	14.1	20.7	0.0	-3.5	0.0	437.	513.	524.
CD1B1	67.	40.	-0.4	-9.3	-6.2	0.0	23.8	27.7	371.	276.	265.
CD1B1	68.	40.	-0.4	19.8	25.5	0.0	-18.6	-17.1	247.	386.	406.
CD1B1	69.	40.	-0.4	-11.7	-9.6	0.0	23.1	25.4	331.	216.	199.
CD1B1	70.	40.	-0.3	11.4	16.1	0.0	-6.5	-4.9	344.	430.	440.
CD1B1	71.	40.	-0.3	-2.6	0.0	0.0	11.8	14.2	212.	161.	156.
CD1B1	72.	40.	-0.3	14.2	18.8	0.0	-11.9	-10.6	302.	413.	428.
CD1B1	73.	40.	-0.2	-3.6	-2.1	0.0	10.7	12.1	174.	114.	106.
CD1B1	74.	40.	-0.2	14.2	17.7	0.0	-13.6	-11.2	392.	484.	499.
CD1B1	75.	40.	0.0	-1.3	-1.2	0.0	2.0	2.2	119.	88.	85.
CD1B1	76.	40.	0.0	3.4	4.8	0.0	-3.0	-2.3	257.	290.	294.
CD1B2	1.	200.	-2.2	5.1	15.7	0.0	13.8	16.3	521.	502.	500.
CD1B2	2.	200.	-2.2	8.2	20.3	0.0	10.1	13.4	520.	547.	549.
CD1B2	3.	200.	-2.2	4.7	18.4	0.0	17.0	21.1	521.	502.	500.
CD1B2	4.	200.	-2.2	12.7	24.3	0.0	1.8	4.5	437.	513.	524.
CD1B2	5.	200.	-1.5	-5.0	2.8	0.0	22.7	27.0	588.	521.	513.
CD1B2	6.	200.	-1.3	7.1	14.9	0.0	3.7	5.7	401.	446.	449.
CD1B2	7.	200.	-1.3	0.2	7.2	0.0	12.3	15.3	537.	504.	502.
CD1B2	8.	200.	-1.2	23.7	32.8	0.0	-17.3	-14.8	210.	364.	388.
CD1B2	9.	200.	-0.4	-1.1	1.4	0.0	7.8	9.8	287.	253.	251.
CD1B2	10.	200.	-0.4	7.6	11.6	0.0	-3.7	-2.1	475.	532.	539.
CD1B2	11.	200.	-0.4	-0.8	1.6	0.0	7.2	8.8	189.	155.	152.
CD1B2	12.	200.	-0.4	6.3	10.4	0.0	-2.3	-0.5	502.	542.	546.
CD1B2	13.	200.	-0.4	-4.1	-1.7	0.0	13.3	15.0	174.	114.	106.
CD1B2	14.	200.	-0.4	13.5	17.9	0.0	-10.7	-8.3	392.	484.	499.
CD1B2	15.	200.	-0.4	-2.5	-0.1	0.0	9.6	11.7	309.	257.	253.
CD1B2	16.	200.	-0.4	8.7	13.0	0.0	-4.8	-3.0	475.	532.	539.
CD1B2	17.	200.	-0.4	-2.5	-0.2	0.0	10.3	11.7	142.	98.	92.
CD1B2	18.	200.	-0.4	9.7	14.5	0.0	-4.9	-2.8	475.	532.	539.
CD1B2	19.	200.	-0.4	-0.5	1.9	0.0	7.2	8.7	189.	155.	152.
CD1B2	20.	200.	-0.4	7.3	11.2	0.0	-4.3	-2.8	475.	532.	539.
CD1B2	21.	200.	-0.4	-5.5	-3.2	0.0	14.2	15.6	216.	141.	129.
CD1B2	22.	200.	-0.4	14.6	19.2	0.0	-11.6	-9.0	392.	484.	499.
CD1B2	23.	200.	-0.4	-4.6	-2.4	0.0	13.2	15.2	240.	171.	163.
CD1B2	24.	200.	-0.4	12.5	17.3	0.0	-9.[illegible]	-7.3	437.	513.	524.
CD1B2	25.	200.	-0.4	-1.2	1.3	0.0	7.8	9.8	287.	253.	251.
CD1B2	26.	200.	-0.4	7.3	11.2	0.0	-3.4	-1.8	475.	532.	539.
CD1B2	27.	200.	-0.4	-1.9	0.4	0.0	9.1	10.8	212.	161.	156.
CD1B2	28.	200.	-0.4	7.7	11.7	0.0	-4.0	-2.4	475.	532.	539.
CD1B2	29.	200.	-0.4	-3.8	-1.5	0.0	12.2	13.8	174.	114.	106.
CD1B2	30.	200.	-0.4	10.8	15.0	0.0	-8.8	-7.7	344.	430.	440.

TABLE 7-1 cont.

************************** LINEARIZED STRESS SUMMARY, SCL 2 **************************

TRANS NAME	PV #	TRANSIENT CYCLES	TOTAL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
CD1B2	31.	200.	-0.4	-4.8	-2.5	0.0	13.6	15.0	216.	141.	129.
CD1B2	32.	200.	-0.4	13.9	18.9	0.0	-7.2	-4.2	392.	484.	499.
CD1B2	33.	200.	-0.4	-1.8	0.3	0.0	6.7	8.4	287.	253.	251.
CD1B2	34.	200.	-0.4	9.7	13.7	0.0	-6.6	-4.8	437.	513.	524.
CD1B2	35.	200.	-0.4	-3.7	-1.0	0.0	12.4	14.9	317.	267.	260.
CD1B2	36.	200.	-0.4	11.1	15.7	0.0	-6.8	-4.7	437.	513.	524.
CD1B2	37.	200.	-0.4	-0.5	2.2	0.0	7.5	9.5	287.	253.	251.
CD1B2	38.	200.	-0.4	9.2	13.8	0.0	-5.6	-3.7	475.	532.	539.
CD1B2	39.	200.	-0.4	-0.2	1.6	0.0	4.2	5.0	174.	152.	151.
CD1B2	40.	200.	-0.4	5.1	9.2	0.0	2.5	4.6	274.	296.	298.
CD1B2	41.	200.	-0.4	-5.2	-2.9	0.0	14.6	16.8	240.	171.	163.
CD1B2	42.	200.	-0.4	13.0	17.1	0.0	-11.0	-8.7	392.	484.	499.
CD1B2	43.	200.	-0.4	-6.9	-4.4	0.0	17.1	18.6	269.	177.	162.
CD1B2	44.	200.	-0.4	15.6	20.0	0.0	-13.4	-10.5	364.	465.	481.
CD1B2	45.	200.	-0.4	-7.1	-4.7	0.0	17.9	20.4	281.	189.	177.
CD1B2	46.	200.	-0.4	15.9	20.5	0.0	-12.7	-9.6	364.	465.	481.
CD1B2	47.	200.	-0.4	-5.2	-3.4	0.0	13.2	15.3	294.	217.	207.
CD1B2	48.	200.	-0.4	11.6	16.1	0.0	-8.6	-6.5	437.	513.	524.
CD1B2	49.	200.	-0.4	-6.2	-4.9	0.0	11.4	12.8	240.	171.	163.
CD1B2	50.	200.	-0.4	5.7	9.6	0.0	-1.9	-0.3	502.	542.	546.
CD1B2	51.	200.	-0.4	0.6	3.7	0.0	9.2	11.4	189.	155.	152.
CD1B2	52.	200.	-0.4	7.9	13.2	0.0	1.6	4.4	502.	542.	546.
CD1B2	53.	200.	-0.4	1.6	4.9	0.0	8.0	10.0	174.	152.	151.
CD1B2	54.	200.	-0.4	7.8	13.0	0.0	1.7	4.5	502.	542.	546.
CD1B2	55.	200.	-0.4	0.0	3.2	0.0	9.9	12.2	189.	155.	152.
CD1B2	56.	200.	-0.3	14.4	18.7	0.0	-12.5	-10.0	392.	484.	499.
CD1B2	57.	200.	-0.2	-6.9	-5.2	0.0	15.1	16.5	216.	141.	129.
CD1B2	58.	200.	-0.2	15.8	20.4	0.0	-15.4	-14.2	302.	413.	428.
CD1B2	59.	200.	-0.1	-1.2	0.1	0.0	6.9	8.1	119.	88.	85.
CD1B2	60.	200.	-0.1	6.8	9.7	0.0	-2.1	-0.4	231.	279.	286.
CD1B2	61.	200.	-0.1	-5.3	-4.7	0.0	7.9	9.4	317.	267.	260.
CD1B2	62.	200.	-0.1	7.5	9.3	0.0	-7.3	-6.2	196.	258.	268.
CD1B2	63.	200.	0.0	-2.9	-2.5	0.0	5.9	6.6	142.	98.	92.
CD1B2	64.	200.	0.0	6.0	7.8	0.0	-5.7	-4.8	231.	279.	286.
CD1B2	65.	200.	0.0	-0.9	-0.5	0.0	3.1	3.6	119.	88.	85.
CD1B2	66.	200.	0.0	2.5	3.8	0.0	-1.8	-0.9	274.	296.	298.
CD1B2	67.	200.	0.0	-1.3	-1.0	0.0	3.7	4.2	119.	88.	85.
CD1B2	68.	200.	0.0	3.4	4.8	0.0	-3.0	-2.3	257.	290.	294.
TRAN2A	1.	1440.	-2.2	5.2	16.8	0.0	12.8	16.3	550.	550.	550.
TRAN2A	2.	1440.	-2.2	2.0	13.5	0.0	18.7	22.9	537.	504.	502.
TRAN2B	1.	1440.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN2B	2.	1440.	-2.2	1.0	11.9	0.0	19.5	23.3	559.	511.	506.
TRAN2B	3.	1440.	-2.2	9.1	20.6	0.0	6.3	8.8	401.	446.	449.
TRAN2B	4.	1440.	-2.2	0.6	11.5	0.0	20.1	24.0	559.	511.	506.
TRAN3	1.	48000.	-2.2	5.3	16.8	0.0	12.9	16.5	550.	550.	550.
TRAN3	2.	48000.	-2.3	-0.3	10.9	0.0	21.3	25.5	559.	511.	506.
TRAN4	1.	48000.	-2.2	3.7	15.1	0.0	15.9	19.8	521.	502.	500.
TRAN4	2.	48000.	-2.2	8.9	20.7	0.0	7.4	10.1	502.	542.	546.
TRAN5	0.	8000.	-2.2	3.4	13.6	0.0	12.8	15.3	521.	502.	500.
TRAN5	0.	8000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN6	0.	8000.	-2.2	3.7	13.6	0.0	12.1	14.2	521.	502.	500.
TRAN6	0.	8000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN7	1.	310.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN7	2.	310.	-2.1	2.5	12.9	0.0	16.2	19.7	537.	504.	502.
TRAN7	3.	310.	-2.2	9.1	20.9	0.0	6.9	9.7	502.	542.	546.
TRAN7	4.	310.	-2.2	2.1	13.4	0.0	18.1	22.2	537.	504.	502.
TRAN8A	1.	80.	-2.5	2.0	13.8	0.0	17.2	20.7	537.	504.	502.
TRAN8A	2.	80.	-2.2	12.6	25.3	0.0	5.6	8.9	475.	532.	539.
TRAN8B	1.	162.	-2.4	6.3	18.6	0.0	11.8	14.7	535.	549.	550.
TRAN8B	2.	162.	-2.2	2.2	13.7	0.0	18.7	23.0	537.	504.	502.
TRAN8C	1.	88.	-2.6	5.0	17.7	0.0	16.7	20.0	521.	502.	500.
TRAN8C	2.	88.	-2.2	8.4	20.6	0.0	10.4	13.8	520.	547.	549.
TRAN8D	1.	70.	-2.4	5.3	17.1	0.0	15.6	18.5	521.	502.	500.
TRAN8D	2.	70.	-2.2	8.4	20.7	0.0	11.1	14.6	520.	547.	549.
TRAN9	0.	40.	-2.2	4.0	14.8	0.0	14.4	17.4	521.	502.	500.
TRAN9	0.	40.	-2.2	11.4	23.4	0.0	3.8	6.6	475.	532.	539.

TABLE 7-1 cont.

*************************** LI D STRESS SUMMARY, SCL 2 **************************

TRANS NAME	PV #	TRANSIENT CYCLES	AL LINEARIZED STRESS (ksi) INSIDE SURFACE RAD	LONG	HOOP	OUTSIDE SURFACE RAD	LONG	HOOP	BASE METAL TEMPERATURES (F) ID	FLAW	OD
TRAN10	0.	20.	-2.2	4.2	15.1	0.0	14.7	17.8	521.	502.	500.
TRAN10	0.	20.	-2.2	5.2	16.7	0.0	12.8	16.3	550.	550.	550.
TRAN13	0.	140000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN13	0.	140000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN14	1.	40.	-2.2	4.8	16.0	0.0	12.1	15.4	550.	550.	550.
TRAN14	2.	40.	-2.3	1.8	12.8	0.0	16.3	19.7	537.	504.	502.
TRAN19	0.	4000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRAN19	0.	4000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRN20A	0.	30000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRN20A	0.	30000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRN20B	1.	20000.	-2.2	4.8	16.0	0.0	12.1	15.4	550.	550.	550.
TRN20B	2.	20000.	-2.2	2.8	13.4	0.0	14.4	17.8	521.	502.	500.
TRN20C	0.	4000000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TRN20C	0.	4000000.	-2.2	4.9	16.2	0.0	12.2	15.6	550.	550.	550.
TR20D1	1.	0.	-2.2	4.8	16.0	0.0	12.1	15.4	550.	550.	550.
TR20D1	2.	0.	-2.2	2.9	13.4	0.0	13.9	17.0	521.	502.	500.
TR20D2	1.	34000.	-2.2	5.7	17.4	0.0	13.6	17.4	550.	550.	550.
TR20D2	2.	34000.	-2.2	1.7	12.2	0.0	16.2	19.6	537.	504.	502.
TR22A1	1.	5.	-0.6	1.3	3.9	0.0	3.2	3.7	70.	70.	70.
TR22A1	2.	5.	-0.6	-6.6	-2.3	0.0	22.6	25.0	269.	177.	162.
TR22B1	1.	15.	-0.2	0.7	1.9	0.0	1.7	1.9	70.	70.	70.
TR22B1	2.	15.	-0.2	-6.5	-3.9	0.0	18.5	20.4	269.	177.	162.
TR22C1	1.	10.	-0.9	2.5	7.7	0.0	5.8	7.8	300.	300.	300.
TR22C1	2.	10.	-0.9	-3.0	2.2	0.0	18.0	20.3	216.	141.	129.
TR22D1	1.	10.	-0.7	2.1	6.4	0.0	4.8	6.7	300.	300.	300.
TR22D1	2.	10.	-0.7	-2.9	1.3	0.0	15.6	17.8	174.	114.	106.
TR22A2	1.	7.	-0.6	1.2	3.8	0.0	3.2	3.7	70.	70.	70.
TR22A2	2.	7.	-0.6	-6.7	-2.4	0.0	22.4	24.8	269.	177.	162.
TR22A2	3.	7.	-0.6	9.7	15.7	0.0	-1.5	0.5	375.	445.	449.
TR22A2	4.	7.	-0.6	-3.5	0.8	0.0	18.5	21.0	216.	141.	129.
TR22A2	5.	7.	-0.6	15.7	21.6	0.0	-8.5	-6.6	335.	436.	453.
TR22A2	6.	7.	-0.6	-3.1	1.2	0.0	18.0	20.5	216.	141.	129.
TR22A2	7.	7.	-0.6	16.3	22.2	0.0	-9.1	-7.2	335.	436.	453.
TR22A2	8.	7.	-0.6	-1.9	2.4	0.0	16.2	18.8	174.	114.	106.
TR22A2	9.	7.	-0.6	18.0	25.3	0.0	-11.3	-9.8	307.	429.	441.
TR22A2	10.	7.	-0.6	1.2	3.8	0.0	3.2	3.7	70.	70.	70.
TR22B2	1.	42.	-0.2	0.7	1.9	0.0	1.6	1.9	70.	70.	70.
TR22B2	2.	42.	-0.2	-6.6	-4.0	0.0	18.4	20.3	269.	177.	162.
TR22B2	3.	42.	-0.2	8.1	12.3	0.0	-2.7	-1.2	375.	445.	449.
TR22B2	4.	42.	-0.2	-3.3	-0.7	0.0	14.4	16.6	174.	114.	106.
TR22B2	5.	42.	-0.2	9.7	14.5	0.0	-4.5	-2.8	375.	445.	.49.
TR22B2	6.	42.	-0.2	-3.0	-0.3	0.0	14.0	16.2	174.	114.	106.
TR22B2	7.	42.	-0.2	10.0	14.8	0.0	-4.8	-3.1	375.	445.	449.
TR22B2	8.	42.	-0.2	-2.2	0.5	0.0	12.7	14.8	174.	114.	106.
TR22B2	9.	42.	-0.2	14.7	19.9	0.0	-10.6	-9.4	307.	429.	441.
TR22B2	10.	42.	-0.2	0.7	1.9	0.0	1.6	1.9	70.	70.	70.
TR22C2	1.	7.	-0.9	2.4	7.6	0.0	5.7	7.7	300.	300.	300.
TR22C2	2.	7.	-0.9	-3.2	2.0	0.0	18.0	20.2	216.	141.	129.
TR22C2	3.	7.	-0.9	7.6	14.3	0.0	2.6	4.9	401.	446.	449.
TR22C2	4.	7.	-0.9	-3.1	2.7	0.0	19.1	23.1	588.	521.	513.
TR22C2	5.	7.	-0.9	7.9	14.9	0.0	2.0	4.4	402.	448.	450.
TR22C2	6.	7.	-0.9	-2.7	3.1	0.0	18.4	22.2	588.	521.	513.
TR22C2	7.	7.	-0.9	8.9	15.7	0.0	0.4	2.3	375.	445.	449.
TR22C2	8.	7.	-0.9	-1.1	5.1	0.0	16.5	20.5	559.	511.	506.
TR22C2	9.	7.	-0.9	13.7	21.6	0.0	-5.1	-3.3	347.	440.	446.
TR22C2	10.	7.	-0.9	2.4	7.6	0.0	5.7	7.7	300.	300.	300.
TR22D2	1.	100.	-0.7	2.0	6.3	0.0	4.7	6.6	300.	300.	300.
TR22D2	2.	100.	-0.7	-3.0	1.1	0.0	15.5	17.7	174.	114.	106.
TR22D2	3.	100.	-0.7	6.6	12.1	0.0	1.8	3.8	401.	446	449.
TR22D2	4.	100.	-0.7	-2.9	1.9	0.0	16.5	19.9	588.	521.	513.
TR22D2	5.	100.	-0.7	6.9	12.7	0.0	1.3	3.4	402.	448.	450.
TR22D2	6.	100.	-0.7	-1.9	3.3	0.0	15.7	19.6	559.	511.	506.
TR22D2	7.	100.	-0.7	7.1	12.9	0.0	1.1	3.2	402.	448.	450.
TR22D2	8.	100.	-0.7	-1.1	3.9	0.0	14.2	17.8	559.	511.	506.
TR22D2	9.	100.	-0.7	14.8	21.3	0.0	-7.9	-6.1	302.	413.	428.
TR22D2	10.	100.	-0.7	2.0	6.3	0.0	4.7	6.6	300.	300.	300.

PREPARED BY: D. E. COSTA DATE: ____________

REVIEWED BY: J. F. SHEPARD DATE: ____________

APPENDIX A: FORTRAN PROGRAM LISTING

THIS APPENDIX CONTAINS INFORMATION PROPRIETARY TO BWNT AND IS THEREFORE REMOVED FROM THIS NON-PROPRIETARY DOCUMENT. THE CONTENTS OF THIS APPENDIX ARE CONTAINED IN THE PROPRIETARY VERSION OF THIS DOCUMENT, REFERENCE [5].

APPENDIX B: FORTRAN PROGRAM VERIFICATION

This appendix contains a set of calculations used to verify the FORTRAN program listed in Appendix A. It should be noted that the program is a modification of the FORTRAN programs used previously in the fatigue analysis of the TE pressurizer surge nozzle for thermal stratification, Reference [3].

Test cases were run at several stages to verify the various routines as they were added to (or modified) the program. For example, after the routine to pick the base case for each pv was added, a sample of 200+ pv's was run and the actual pv data (starting temperature, ΔT, and ramp rate) was compared to the equivalent base case parameters chosen by the program. In addition to intermediate verifications and verification contained herein, both the preparer and reviewer have reviewed the programs logic and structure.

It should be noted that the program listing contained in Appendix A also contains numerous comment cards explaining the various program commands and routines. By reviewing the comment cards and the FORTRAN statements following, it is possible to verify if the intended procedure has been satisfied.

To verify that the program performs as intended, hand calculations will be performed to show that the results given in the output of the FORTRAN program are correct. HU1A1 pv 5 and HU1A1 pv 40 have been arbitrarily chosen for review.

VERIFICATION CASE, SCL 2 (nozzle-to-head juncture), FICHE CR3SCL2.OUT

Data for HU1A1 pv 5:

Input Data:

Starting Temperature = 482F		Ref [2], Table A-1
Ending Temperature = 97F		Ref [2], Table A-1
Delta Temperature (ΔT) = -385F		Ref [2], Table A-1
Ramp Rate = -3849 F/Hr		Ref [2], Table A-1
Internal Pressure = 578 psi		Ref [2], Table A-1
Resultant Moment (Mr) =	280908 in-lbs	Ref [2], Table A-1
	280.908 in-kips	
Stress-to-Moment Ratio:	ID radial = 0.0	Section 5.0
	ID long = 0.0015	
	ID hoop = 0.0025	
	OD radial = 0.0	
	OD long = 0.0026	
	OD hoop = 0.0034	
Number of Cycles = 10 for CR-3		Ref [2], Table C-0

Choose Base Case:

1) ramp rate is negative, therefore base cases 13.1 to 20.4
2) start temp = 482, therefore base cases 13.1 to 18.5 (tstrt > 300)

3) ramp rate = -3849, therefore base cases 16.1 to 16.4 (rate = -4000)
4) ΔT = -385, therefore base case 16.1 (ΔT = -322)

Base Case Metal Temperatures:

inside surface temperature = 253°F
flaw temperature = 410°F
outside surface temperature = 437°F

Base Case Stresses (linearized): Table 6-1

thermal stresses (base case 16.1)

inside surface: radial = 0.0 ksi
longitudinal = 24.4 ksi
hoop = 28.8 ksi

outside surface: radial = 0.0 ksi
longitudinal = -26.8 ksi
hoop = -25.5 ksi

pressure stresses (base case 30.1)

inside surface: radial = -2.2 ksi
longitudinal = 3.6 ksi
hoop = 12.8 ksi

outside surface: radial = 0.0 ksi
longitudinal = 10.3 ksi
hoop = 11.5 ksi

Resulting PV stresses:

thermal stress: ΔT ratio = -385/-322 = 1.196

inside surface: radial = 0.0(1.196) = 0.0 ksi
longitudinal = 24.4(1.196) = 29.18 ksi
hoop = 28.8(1.196) = 34.44 ksi

outside surface: radial = 0.0(1.196) = 0.0 ksi
longitudinal = -26.8(1.196) = -32.05 ksi
hoop = -25.5(1.196) = -30.49 ksi

pressure stresses: pressure ratio = 578/2200 = 0.263

inside surface: radial = -2.2(0.263) = -0.58 ksi
longitudinal = 3.6(0.263) = 0.95 ksi
hoop = 12.8(0.263) = 3.36 ksi

outside surface: radial = 0.0(0.263) = 0.0 ksi
longitudinal = 10.3(0.263) = 2.71 ksi
hoop = 11.5(0.263) = 3.02 ksi

moment stress:

inside surface: radial = 280.908(0.0) = 0.0 ksi
longitudinal = 280.908(0.0015) = 0.42 ksi
hoop = 280.908(0.0025) = 0.70 ksi

outside surface: radial = 280.908(0.0) = 0.0 ksi
longitudinal = 280.908(0.0026) = 0.73 ksi
hoop = 280.908(0.0034) = 0.96 ksi

Combined PV stresses:

inside surface: radial = 0.0 + (-0.58) + 0.0 = -0.58 ksi
longitudinal = 29.18 + 0.95 + 0.42 = 30.55 ksi
hoop = 34.44 + 3.36 + 0.70 = 38.50 ksi

outside surface: radial = 0.0 + 0.0 + 0.0 = 0.0 ksi
longitudinal = -32.05 + 2.71 + 0.73 = -28.61 ksi
hoop = -30.49 + 3.02 + 0.96 = -26.51 ksi

<u>Data for HU1A1 pv 40:</u>

Input Data:

Starting Temperature = 282F		Ref [2], Table A-1
Ending Temperature = 591F		Ref [2], Table A-1
Delta Temperature (ΔT) = 309F		Ref [2], Table A-1
Ramp Rate = 1058 F/Hr		Ref [2], Table A-1
Internal Pressure = 1543 psi		Ref [2], Table A-1
Resultant Moment (Mr) =	2092208 in-lbs	Ref [2], Table A-1
	2092.208 in-kips	
Stress-to-Moment Ratio:	ID radial = 0.0	Section 5.0
	ID long = 0.0015	
	ID hoop = 0.0025	
	OD radial = 0.0	
	OD long = 0.0026	
	OD hoop = 0.0034	
Number of Cycles = 10 for CR-3		Ref [2], Table C-0

Choose Base Case:

1) ramp rate is positive, therefore base cases 1.1 to 11.1
2) start temp = 282, therefore base cases 1.1 to 6.1 (tstrt < 300)
3) ramp rate = 1058, therefore base cases 2.1 to 2.7 (1.1 rate = 1100)
4) ΔT = 309, therefore base case 2.1 (ΔT = 300)

Base Case Metal Temperatures:

inside surface temperature = 449°F
flaw temperature = 342°F
outside surface temperature = 325°F

Base Case Stresses (linearized): Table 6-1

thermal stresses (base case 2.1)

inside surface: radial = 0.0 ksi
longitudinal = -15.3 ksi
hoop = -15.7 ksi

outside surface: radial = 0.0 ksi
longitudinal = 19.1 ksi
hoop = 20.0 ksi

pressure stresses (base case 30.1)

inside surface: radial = -2.2 ksi
longitudinal = 3.6 ksi
hoop = 12.8 ksi

outside surface: radial = 0.0 ksi
longitudinal = 10.3 ksi
hoop = 11.5 ksi

Resulting PV stresses:

thermal stress: ΔT ratio = 309/300 = 1.03

inside surface: radial = 0.0(1.03) = 0.0 ksi
longitudinal = -15.3(1.03) = -15.76 ksi
hoop = -15.7(1.03) = -16.17 ksi

outside surface: radial = 0.0(1.03) = 0.0 ksi
longitudinal = 19.1(1.03) = 19.67 ksi
hoop = 20.0(1.03) = 20.60 ksi

pressure stresses: pressure ratio = 1543/2200 = 0.70

inside surface: radial = -2.2(0.70) = -1.54 ksi
longitudinal = 3.6(0.70) = 2.52 ksi
hoop = 12.8(0.70) = 8.96 ksi

outside surface: radial = 0.0(0.70) = 0.0 ksi
longitudinal = 10.3(0.70) = 7.21 ksi
hoop = 11.5(0.70) = 8.05 ksi

moment stress:

inside surface: radial = 2092.208(0.0) = 0.0 ksi
longitudinal = 2092.208(0.0015) = 3.14 ksi
hoop = 2092.208(0.0025) = 5.23 ksi

outside surface: radial = 2092.208(0.0) = 0.0 ksi
longitudinal = 2092.208(0.0026) = 5.44 ksi
hoop = 2092.208(0.0034) = 7.11 ksi

Combined PV stresses:

inside surface: radial = 0.0 - 1.54 + 0.0 = -1.54 ksi
longitudinal = -15.76 + 2.52 + 3.14 = -10.10 ksi
hoop = -16.17 + 8.96 + 5.23 = -1.98 ksi

outside surface: radial = 0.0 + 0.0 + 0.0 = 0.0 ksi
longitudinal = 19.67 + 7.21 + 5.44 = 32.32 ksi
hoop = 20.60 + 8.05 + 7.11 = 35.76 ksi

CONCLUSION:

The values determined above are comparable to the values resulting from the FORTRAN calculations of CR3SCL2.OUT. It is therefore concluded that the FORTRAN program is correct.

APPENDIX C: MICROFICHE

CR3SCL2.IN - Echo of FORTRAN input file

dated 11-06-94 @ 11:31 am

CR3SCL2.OUT - Stress results for the nozzle-to-head weld region (stress classification line 2). The stresses are a result of surge line stratification.

dated 11-06-94 @ 1:22 pm

COPIES OF MICROFICHE ARE NOT CONTAINED IN THIS DOCUMENT. THE MICROFICHE ARE CONTAINED IN REFERENCE [5].