

2.12 APPENDIX

This appendix presents the following information:

- [Data CDs](#)
- [Structural Evaluation Results – Models AOS-025, AOS-050, and AOS-100](#)
 - [Structural Evaluation Results – Model AOS-025A](#)
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 - [Structural Evaluation Results – Models AOS-100A and AOS-100A-S](#)
 - [Structural Evaluation Results – Model AOS-100B](#)
- [LIBRA Finite Element Analysis Program and Verification Problems](#)
- [Description of LIBRA Files and Post-Processors: AOS Safety Analysis Report](#)
- [Selected Material Properties References](#)
- [Impact \(Free-Drop\) Test Report](#)
 - [Test Report: Drop Tests of the Alpha Omega Services Shipping Cask for Radioactive Material](#)
 - [Free-Drop Test Activity Record – Pre- and Post-Leak Test](#)
- [Dimensional Inspection Report](#)
- [Analysis of Content-Cask Lid Impact](#)
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- [Effect of Ribs on Stress at Foam-Cask Interface](#)
- [Analysis of 30-Ft. Drops with Shipping Cages](#)
- [Analysis of Tie-Down Devices](#)
- [Certificate of Conformance, General Plastics FR-3700 Series Foam – AOS-165A Prototype](#)
- [Analysis of Shipping Cage Lifting Bars – Models AOS-050A and AOS-100](#)
- [Shielding/Spacer Component Evaluation – Models AOS-050A, AOS-100A, and AOS-100A-S](#)

2.12.1 Data CDs

All thermal input/output files, as well as all Autodesk Inventor files, are attached on the Compact Discs (CDs), as listed below:

- **CDs 1, 2, and 3** – All analytical files, including the LIBRA FEA program
- **CD 4** – Autodesk Inventor files

2.12.2 Structural Evaluation Results – Models AOS-025, AOS-050, and AOS-100

This appendix presents Load Case, Load Combination, and Free Drop structural evaluations for each AOS Transport Packaging System model:

- [Structural Evaluation Results – Model AOS-025A](#)
- [Structural Evaluation Results – Model AOS-050A](#)
- [Structural Evaluation Results – Models AOS-100A and AOS-100A-S](#)
- [Structural Evaluation Results – Model AOS-100B](#)

2.12.2.1 Structural Evaluation Results – Model AOS-025A

This appendix presents the following information, specific to the Model AOS-025A transport package:

- [Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Model AOS-025A](#)
- [Hypothetical Accident Conditions of Transport, Summary of Damages \(Stresses\) – Model AOS-025A](#)

2.12.2.1.1 Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Model AOS-025A

[Table 2-64](#) and [Table 2-65](#) present Model AOS-025A transport package Load Cases and Load Combinations, respectively, under Normal conditions of transport:

- [Table 2-66](#) through [Table 2-83](#) present Load Case output data. Comparisons with allowable stress limits are included for Load Cases 101, 102, 103, 104, 105, and 106.
- [Table 2-84](#) through [Table 2-101](#) present Load Combination output data.

Table 2-64. Load Cases Associated with Allowable Stresses under Normal Conditions of Transport – Model AOS-025A

Load Case	Description	Data
101	100°F Ambient, Maximum Decay Heat	Table 2-66
102	100°F Ambient, Maximum Decay Heat, Maximum Insolation	Table 2-67
103	-20°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-68
104	-40°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-69
105	-40°F Ambient, Maximum Decay Heat	Table 2-70
106	-20°F Ambient, Maximum Decay Heat	Table 2-71
201	Internal Design Pressure, 207 kPa (30 psia)	Table 2-72
202	Minimum External Pressure, 24 kPa (3.5 psia)	Table 2-73
203	Maximum Increased External Pressure, 140 kPa (20 psia)	Table 2-74
204	Additional Increased External Pressure, 2 MPa (290 psia)	Table 2-75
211	Fabrication Stress	Table 2-76
215	Compression Load (5x weight)	Table 2-77
216	Rod Drop onto Cask	Table 2-78
221	Forward 10g Vibration Inertia Load	Table 2-79
222	Lateral 5g Vibration Inertia Load	Table 2-80
223	Vertical 2g Vibration Inertia Load	Table 2-81
231	4-ft. Head-On Drop	Table 2-82
232	30-ft. Head-On Drop Impact Test, Normal Conditions	Table 2-83

**Table 2-65. Load Combinations Associated with Allowable Stresses
under Normal Conditions of Transport – Model AOS-025A**

Load Combination	Load Cases	Description	Data
101	102, 201, 211	Hot Environment	Table 2-84
102	104, 201, 211	Cold Environment	Table 2-85
103	103, 202, 211	Increased External Pressure	Table 2-86
104	101, 201, 202, 211	Minimum External Pressure	Table 2-87
105	105, 201, 202, 211	Cold Environment with Maximum Decay Heat	Table 2-88
106	101, 201, 203, 211	Maximum Pressure, Hot Environment	Table 2-89
107	105, 201, 203, 211	Maximum Pressure, Cold Environment	Table 2-90
215	215, 101, 201, 211	Compression Load	Table 2-91
216	216, 101, 201, 211	Rod Drop	Table 2-92
217	216, 104, 201, 211	Rod Drop, Cold Environment	Table 2-93
221	221, 101, 201, 211	Forward Vibration	Table 2-94
222	222, 101, 201, 211	Lateral Vibration	Table 2-95
223	223, 101, 201, 211	Vertical Vibration	Table 2-96
224	221, 103, 201, 211	Forward Vibration at Cold Temperature	Table 2-97
225	222, 103, 201, 211	Lateral Vibration at Cold Temperature	Table 2-98
226	223, 103, 201, 211	Vertical Vibration at Cold Temperature	Table 2-99
231	231, 102, 201, 211	4-ft. Head-On Drop, Normal Conditions	Table 2-100
232	232, 102, 201, 211	30-ft. Head-On Drop, Normal Conditions (Impact Test)	Table 2-101
233	231, 103, 211	4-ft. Drop at Cold Temperature	Table 2-102

**Table 2-66. Load Case 101, 100°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.3327E+01 9.1885E-02	-2.7841E+01 -1.9196E-01	-1.6030E+00 -1.1052E-02	4.1168E+01 2.8384E-01	6.2735E+01 4.3254E-01
2	1.8481E+01 1.2742E-01	-3.5348E+01 -2.4371E-01	-7.3136E+00 -5.0426E-02	5.3828E+01 3.7113E-01	1.1004E+02 7.5872E-01
3	1.1888E+01 8.1963E-02	-2.5210E+01 -1.7382E-01	1.0357E+00 7.1410E-03	3.7098E+01 2.5578E-01	5.8479E+01 4.0320E-01
4	6.1221E+01 4.2210E-01	-2.5287E+02 -1.7435E+00	-3.5965E+01 -2.4797E-01	3.1409E+02 2.1656E+00	6.2290E+02 4.2948E+00
5	5.9830E+01 4.1251E-01	-2.8719E+02 -1.9801E+00	-1.3955E+02 -9.6219E-01	3.4702E+02 2.3926E+00	5.4579E+02 3.7631E+00
6	4.8628E+00 3.3528E-02	-1.4243E+02 -9.8203E-01	-1.8031E+02 -1.2432E+00	1.4729E+02 1.0156E+00	1.7075E+02 1.1773E+00
7	-1.9338E+00 -1.3333E-02	-5.4225E+01 -3.7387E-01	2.7226E+00 1.8772E-02	5.2292E+01 3.6054E-01	4.2532E+01 2.9325E-01
8	-1.9700E+00 -1.3582E-02	-5.4235E+01 -3.7394E-01	1.0402E-02 7.1718E-05	5.2265E+01 3.6035E-01	4.2866E+01 2.9555E-01
9	-1.9394E+00 -1.3372E-02	-5.4136E+01 -3.7325E-01	-1.0939E+00 -7.5424E-03	5.2196E+01 3.5988E-01	4.0292E+01 2.7780E-01
10	-8.2869E+00 -5.7136E-02	-7.4767E+01 -5.1550E-01	1.7471E+01 1.2046E-01	6.6481E+01 4.5837E-01	1.3195E+02 9.0974E-01
11	-1.8716E+01 -1.2904E-01	-1.1606E+02 -8.0020E-01	-5.8726E+01 -4.0490E-01	9.7343E+01 6.7116E-01	8.6337E+00 5.9527E-02
12	7.7527E+00 5.3453E-02	-1.3983E+02 -9.6412E-01	-1.3968E+02 -9.6303E-01	1.4759E+02 1.0176E+00	6.9585E+00 4.7977E-02
13	-1.3381E+01 -9.2257E-02	-2.0043E+02 -1.3819E+00	-3.3218E+01 -2.2903E-01	1.8705E+02 1.2897E+00	8.0556E+01 5.5541E-01
14	-1.5516E+01 -1.0698E-01	-1.7660E+02 -1.2176E+00	4.3348E+00 2.9888E-02	1.6109E+02 1.1107E+00	1.2270E+02 8.4595E-01
15	5.0409E+02 3.4756E+00	-4.6082E+02 -3.1772E+00	-3.5506E+01 -2.4481E-01	9.6491E+02 6.6528E+00	1.6214E+03 1.1179E+01

16	1.7388E+02	-3.4133E+02	-1.1891E+02	5.1521E+02	8.3771E+02
	1.1989E+00	-2.3534E+00	-8.1985E-01	3.5523E+00	5.7758E+00
17	7.6463E+01	-2.3543E+02	5.1413E+00	3.1189E+02	5.3992E+02
	5.2720E-01	-1.6232E+00	3.5448E-02	2.1504E+00	3.7226E+00
18	1.9931E+01	-1.2565E+02	1.7859E+02	1.4558E+02	2.1678E+02
	1.3742E-01	-8.6631E-01	1.2313E+00	1.0037E+00	1.4946E+00
19	5.4880E+01	-2.1571E+02	1.4014E+02	2.7059E+02	4.5442E+02
	3.7839E-01	-1.4873E+00	9.6623E-01	1.8656E+00	3.1331E+00
20	3.3759E+01	-2.7313E+02	-7.4676E-01	3.0689E+02	5.6868E+02
	2.3276E-01	-1.8831E+00	-5.1487E-03	2.1159E+00	3.9209E+00
21	1.9983E+01	4.0117E+00	1.4122E+01	1.5971E+01	8.0643E+00
	1.3778E-01	2.7660E-02	9.7370E-02	1.1012E-01	5.5601E-02
22	9.2878E+00	-1.6752E+01	5.8919E+00	2.6039E+01	5.3023E+01
	6.4037E-02	-1.1550E-01	4.0623E-02	1.7954E-01	3.6558E-01

Allowable Stress for Load Case 101

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	170.07	169.85	20.00	26.70	70.00
2	170.26	169.95	20.00	26.70	70.00
3	169.94	169.68	20.00	26.70	70.00
4	170.25	170.22	20.00	26.70	70.00
5	170.83	170.73	20.00	26.70	70.00
6	171.04	170.96	20.00	26.70	70.00
7	171.28	171.14	20.00	26.70	70.00
8	171.27	171.13	20.00	26.70	70.00
9	171.23	171.09	20.00	26.70	70.00
10	171.23	171.07	20.00	26.70	70.00
11	171.43	171.19	20.00	26.70	70.00
12	171.98	171.72	20.00	26.70	70.00
13	170.83	170.71	20.00	26.70	70.00
14	170.52	170.44	20.00	26.70	70.00
15	169.83	169.81	20.00	26.70	70.00
16	170.12	170.07	20.00	26.70	70.00
17	170.17	170.13	20.00	26.70	70.00
18	170.42	170.37	20.00	26.70	70.00
19	170.66	170.56	20.00	26.70	70.00
20	171.72	171.58	20.00	26.70	70.00
21	169.25	169.22	20.00	26.70	70.00
22	169.68	169.64	20.00	26.70	70.00

Table 2-67. Load Case 102, 100°F Ambient, Maximum Decay Heat, Maximum Insolation, Normal Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.2042E+01 8.3029E-02	-2.6465E+01 -1.8247E-01	-1.2767E+00 -8.8028E-03	3.8507E+01 2.6550E-01	5.9653E+01 4.1129E-01		
2	1.7922E+01 1.2357E-01	-3.2577E+01 -2.2461E-01	-7.4355E+00 -5.1266E-02	5.0499E+01 3.4818E-01	1.0306E+02 7.1056E-01		
3	1.2490E+01 8.6113E-02	-2.3623E+01 -1.6288E-01	-3.2368E-01 -2.2317E-03	3.6113E+01 2.4899E-01	5.4421E+01 3.7522E-01		
4	3.4914E+02 2.4072E+00	-3.2820E+02 -2.2629E+00	-2.1387E+02 -1.4745E+00	6.7734E+02 4.6701E+00	1.2718E+03 8.7691E+00		
5	3.0330E+02 2.0911E+00	-1.6590E+02 -1.1438E+00	-4.4195E+02 -3.0472E+00	4.6919E+02 3.2350E+00	4.7463E+02 3.2724E+00		
6	4.3240E+01 2.9813E-01	-3.7667E+02 -2.5971E+00	-1.1116E+03 -7.6641E+00	4.1991E+02 2.8952E+00	6.4881E+02 4.4734E+00		
7	-6.8300E+01 -4.7091E-01	-2.2748E+02 -1.5684E+00	-1.8378E+03 -1.2671E+01	1.5918E+02 1.0975E+00	5.5931E+01 3.8563E-01		
8	-7.1007E+01 -4.8958E-01	-2.2385E+02 -1.5434E+00	-1.8387E+03 -1.2677E+01	1.5285E+02 1.0538E+00	4.0158E+01 2.7688E-01		
9	-6.8874E+01 -4.7487E-01	-2.2589E+02 -1.5575E+00	-1.8513E+03 -1.2764E+01	1.5702E+02 1.0826E+00	5.2730E+01 3.6356E-01		
10	3.7940E+01 2.6159E-01	-5.7268E+02 -3.9485E+00	-9.7662E+02 -6.7336E+00	6.1062E+02 4.2101E+00	2.1127E+02 1.4567E+00		
11	-8.7258E+01 -6.0163E-01	-5.3768E+02 -3.7072E+00	-4.8550E+02 -3.3474E+00	4.5042E+02 3.1055E+00	6.3314E+02 4.3653E+00		
12	1.8612E+01 1.2832E-01	-5.4650E+02 -3.7680E+00	-5.3970E+02 -3.7211E+00	5.6511E+02 3.8963E+00	6.7494E+02 4.6535E+00		
13	7.2537E+01 5.0012E-01	-2.4837E+02 -1.7125E+00	-6.6039E+01 -4.5532E-01	3.2091E+02 2.2126E+00	3.2331E+02 2.2291E+00		
14	3.5746E+01 2.4646E-01	-2.8476E+02 -1.9634E+00	-5.3075E+01 -3.6594E-01	3.2051E+02 2.2098E+00	5.9180E+02 4.0803E+00		
15	9.2248E+02 6.3602E+00	-8.6794E+02 -5.9842E+00	-8.8106E+01 -6.0747E-01	1.7904E+03 1.2344E+01	3.0075E+03 2.0736E+01		

16	3.2164E+02	-6.4191E+02	-1.9740E+02	9.6355E+02	1.5663E+03
	2.2176E+00	-4.4258E+00	-1.3610E+00	6.6434E+00	1.0799E+01
17	1.4077E+02	-4.3793E+02	3.8502E+01	5.7869E+02	9.9987E+02
	9.7056E-01	-3.0194E+00	2.6546E-01	3.9900E+00	6.8939E+00
18	3.9472E+01	-2.2939E+02	1.9121E+02	2.6886E+02	4.3950E+02
	2.7215E-01	-1.5816E+00	1.3183E+00	1.8538E+00	3.0302E+00
19	1.1904E+02	-3.6343E+02	9.9902E+01	4.8247E+02	8.0248E+02
	8.2074E-01	-2.5058E+00	6.8880E-01	3.3265E+00	5.5329E+00
20	1.3236E+02	-4.6148E+02	-9.4106E+00	5.9384E+02	1.1111E+03
	9.1259E-01	-3.1818E+00	-6.4884E-02	4.0944E+00	7.6606E+00
21	2.4825E+01	4.5153E+00	1.5261E+01	2.0310E+01	9.4798E+00
	1.7116E-01	3.1132E-02	1.0522E-01	1.4003E-01	6.5361E-02
22	1.8018E+01	-3.0138E+01	1.3409E+01	4.8156E+01	8.9828E+01
	1.2423E-01	-2.0779E-01	9.2450E-02	3.3203E-01	6.1934E-01

Allowable Stress for Load Case 102

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	255.38	255.18	20.00	23.60	66.30
2	255.49	255.18	20.00	23.60	66.30
3	255.15	254.90	20.00	23.60	66.30
4	255.57	255.55	20.00	23.60	66.30
5	256.10	256.01	20.00	23.60	66.30
6	256.30	256.22	20.00	23.60	66.30
7	256.47	256.34	20.00	23.60	66.30
8	256.45	256.31	20.00	23.60	66.30
9	256.39	256.26	20.00	23.60	66.30
10	256.39	256.23	20.00	23.60	66.30
11	256.57	256.35	20.00	23.60	66.30
12	257.10	256.85	20.00	23.60	66.30
13	256.01	255.89	20.00	23.60	66.30
14	255.71	255.64	20.00	23.60	66.30
15	255.24	255.23	20.00	23.60	66.30
16	255.48	255.43	20.00	23.60	66.30
17	255.52	255.49	20.00	23.60	66.30
18	255.75	255.70	20.00	23.60	66.30
19	255.96	255.87	20.00	23.60	66.30
20	256.94	256.81	20.00	23.60	66.30
21	254.49	254.47	20.00	23.60	66.30
22	255.13	255.10	20.00	23.60	66.30

Table 2-68. Load Case 103, -20°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	3.6224E+01 2.4975E-01	-1.2400E+02 -8.5497E-01	-2.5915E+01 -1.7868E-01	1.6023E+02 1.1047E+00	1.5954E+02 1.1000E+00		
2	1.1401E+02 7.8607E-01	-1.5187E+00 -1.0471E-02	-3.7180E+01 -2.5635E-01	1.1553E+02 7.9655E-01	1.4883E+01 1.0262E-01		
3	1.3158E+02 9.0718E-01	-1.6611E+01 -1.1453E-01	-1.9397E+01 -1.3374E-01	1.4819E+02 1.0217E+00	1.6471E+02 1.1356E+00		
4	5.1382E+03 3.5427E+01	-3.5508E+03 -2.4482E+01	-1.0594E+03 -7.3043E+00	8.6890E+03 5.9909E+01	1.7448E+04 1.2030E+02		
5	9.0634E+03 6.2490E+01	-4.2021E+03 -2.8973E+01	-1.1953E+03 -8.2415E+00	1.3266E+04 9.1463E+01	1.5716E+04 1.0836E+02		
6	6.4410E+03 4.4409E+01	-2.3908E+02 -1.6484E+00	1.3354E+03 9.2073E+00	6.6800E+03 4.6057E+01	1.1948E+04 8.2375E+01		
7	3.5268E+03 2.4317E+01	5.1759E-01 3.5686E-03	-8.2167E+01 -5.6652E-01	3.5263E+03 2.4313E+01	9.9515E+01 6.8613E-01		
8	3.5225E+03 2.4287E+01	1.8346E-02 1.2649E-04	3.3241E+00 2.2919E-02	3.5225E+03 2.4287E+01	6.0174E-01 4.1488E-03		
9	3.5237E+03 2.4295E+01	-6.4911E-02 -4.4755E-04	-4.7631E+01 -3.2840E-01	3.5237E+03 2.4295E+01	2.6424E+01 1.8219E-01		
10	3.5411E+03 2.4415E+01	-2.7486E+02 -1.8951E+00	1.5542E+03 1.0716E+01	3.8160E+03 2.6310E+01	1.8204E+03 1.2551E+01		
11	8.5223E+02 5.8759E+00	-8.5294E+02 -5.8808E+00	1.8047E+02 1.2443E+00	1.7052E+03 1.1757E+01	1.5788E+03 1.0885E+01		
12	5.3403E+02 3.6820E+00	-3.0975E+02 -2.1356E+00	2.2055E+02 1.5206E+00	8.4378E+02 5.8177E+00	1.6088E+03 1.1092E+01		
13	4.3646E+03 3.0093E+01	-1.8592E+03 -1.2819E+01	2.8716E+02 1.9799E+00	6.2238E+03 4.2912E+01	4.0695E+03 2.8058E+01		
14	3.3108E+03 2.2827E+01	-1.5822E+03 -1.0909E+01	2.5586E+02 1.7641E+00	4.8929E+03 3.3735E+01	6.0508E+03 4.1719E+01		
15	4.5537E+02 3.1396E+00	-3.1770E+02 -2.1905E+00	3.0878E+02 2.1290E+00	7.7307E+02 5.3301E+00	1.0795E+03 7.4431E+00		

16	1.2167E+03	-5.0524E+02	4.4815E+02	1.7220E+03	1.9041E+03
	8.3891E+00	-3.4835E+00	3.0899E+00	1.1873E+01	1.3128E+01
17	1.4168E+03	-1.7911E+02	-7.3013E+01	1.5960E+03	2.7927E+03
	9.7688E+00	-1.2349E+00	-5.0341E-01	1.1004E+01	1.9255E+01
18	1.5283E+03	-2.2139E+02	-1.2031E+02	1.7497E+03	3.0619E+03
	1.0537E+01	-1.5264E+00	-8.2952E-01	1.2063E+01	2.1111E+01
19	1.4787E+03	-6.1203E+02	4.3835E+02	2.0908E+03	2.4748E+03
	1.0196E+01	-4.2198E+00	3.0223E+00	1.4415E+01	1.7063E+01
20	1.3331E+03	-6.3594E+02	2.6187E+02	1.9690E+03	3.6560E+03
	9.1914E+00	-4.3847E+00	1.8055E+00	1.3576E+01	2.5207E+01
21	4.5624E+02	-4.8712E+02	-3.3167E+01	9.4337E+02	1.8516E+03
	3.1457E+00	-3.3586E+00	-2.2868E-01	6.5043E+00	1.2766E+01
22	8.5505E+01	-1.2200E+02	8.6425E+01	2.0750E+02	1.2799E+01
	5.8953E-01	-8.4114E-01	5.9588E-01	1.4307E+00	8.8246E-02

Allowable Stress for Load Case 103

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-20.00	20.00	30.00	70.00
2	0.00	-20.00	20.00	30.00	70.00
3	0.00	-20.00	20.00	30.00	70.00
4	0.00	-20.00	20.00	30.00	70.00
5	0.00	-20.00	20.00	30.00	70.00
6	0.00	-20.00	20.00	30.00	70.00
7	0.00	-20.00	20.00	30.00	70.00
8	0.00	-20.00	20.00	30.00	70.00
9	0.00	-20.00	20.00	30.00	70.00
10	0.00	-20.00	20.00	30.00	70.00
11	0.00	-20.00	20.00	30.00	70.00
12	0.00	-20.00	20.00	30.00	70.00
13	0.00	-20.00	20.00	30.00	70.00
14	0.00	-20.00	20.00	30.00	70.00
15	0.00	-20.00	20.00	30.00	70.00
16	0.00	-20.00	20.00	30.00	70.00
17	0.00	-20.00	20.00	30.00	70.00
18	0.00	-20.00	20.00	30.00	70.00
19	0.00	-20.00	20.00	30.00	70.00
20	0.00	-20.00	20.00	30.00	70.00
21	0.00	-20.00	20.00	30.00	70.00
22	0.00	-20.00	20.00	30.00	70.00

Table 2-69. Load Case 104, -40°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	4.4273E+01 3.0525E-01	-1.5156E+02 -1.0450E+00	-3.1674E+01 -2.1838E-01	1.9583E+02 1.3502E+00	1.9499E+02 1.3444E+00
2	1.3935E+02 9.6076E-01	-1.8562E+00 -1.2798E-02	-4.5442E+01 -3.1331E-01	1.4120E+02 9.7356E-01	1.8190E+01 1.2542E-01
3	1.6081E+02 1.1088E+00	-2.0302E+01 -1.3998E-01	-2.3708E+01 -1.6346E-01	1.8112E+02 1.2488E+00	2.0131E+02 1.3880E+00
4	6.2800E+03 4.3299E+01	-4.3399E+03 -2.9923E+01	-1.2948E+03 -8.9275E+00	1.0620E+04 7.3222E+01	2.1326E+04 1.4704E+02
5	1.1078E+04 7.6377E+01	-5.1359E+03 -3.5411E+01	-1.4610E+03 -1.0073E+01	1.6213E+04 1.1179E+02	1.9209E+04 1.3244E+02
6	7.8723E+03 5.4277E+01	-2.9221E+02 -2.0147E+00	1.6322E+03 1.1253E+01	8.1645E+03 5.6292E+01	1.4603E+04 1.0068E+02
7	4.3105E+03 2.9720E+01	6.3261E-01 4.3617E-03	-1.0043E+02 -6.9242E-01	4.3099E+03 2.9716E+01	1.2163E+02 8.3860E-01
8	4.3053E+03 2.9684E+01	2.2422E-02 1.5460E-04	4.0628E+00 2.8012E-02	4.3053E+03 2.9684E+01	7.3546E-01 5.0708E-03
9	4.3067E+03 2.9694E+01	-7.9336E-02 -5.4700E-04	-5.8216E+01 -4.0138E-01	4.3068E+03 2.9694E+01	3.2296E+01 2.2268E-01
10	4.3281E+03 2.9841E+01	-3.3594E+02 -2.3162E+00	1.8996E+03 1.3097E+01	4.6640E+03 3.2157E+01	2.2249E+03 1.5340E+01
11	1.0416E+03 7.1817E+00	-1.0425E+03 -7.1877E+00	2.2057E+02 1.5208E+00	2.0841E+03 1.4369E+01	1.9296E+03 1.3304E+01
12	6.5270E+02 4.5002E+00	-3.7858E+02 -2.6102E+00	2.6956E+02 1.8586E+00	1.0313E+03 7.1105E+00	1.9663E+03 1.3557E+01
13	5.3345E+03 3.6780E+01	-2.2724E+03 -1.5668E+01	3.5097E+02 2.4198E+00	7.6069E+03 5.2447E+01	4.9738E+03 3.4293E+01
14	4.0465E+03 2.7900E+01	-1.9338E+03 -1.3333E+01	3.1272E+02 2.1561E+00	5.9802E+03 4.1232E+01	7.3954E+03 5.0989E+01
15	5.5656E+02 3.8373E+00	-3.8830E+02 -2.6772E+00	3.7740E+02 2.6021E+00	9.4486E+02 6.5146E+00	1.3194E+03 9.0971E+00

16	1.4871E+03	-6.1752E+02	5.4774E+02	2.1046E+03	2.3272E+03
	1.0253E+01	-4.2576E+00	3.7765E+00	1.4511E+01	1.6046E+01
17	1.7317E+03	-2.1891E+02	-8.9238E+01	1.9506E+03	3.4133E+03
	1.1940E+01	-1.5093E+00	-6.1527E-01	1.3449E+01	2.3534E+01
18	1.8679E+03	-2.7059E+02	-1.4705E+02	2.1385E+03	3.7423E+03
	1.2879E+01	-1.8656E+00	-1.0139E+00	1.4744E+01	2.5803E+01
19	1.8074E+03	-7.4804E+02	5.3576E+02	2.5554E+03	3.0248E+03
	1.2461E+01	-5.1576E+00	3.6940E+00	1.7619E+01	2.0855E+01
20	1.6293E+03	-7.7726E+02	3.2007E+02	2.4066E+03	4.4684E+03
	1.1234E+01	-5.3591E+00	2.2068E+00	1.6593E+01	3.0809E+01
21	5.5763E+02	-5.9537E+02	-4.0537E+01	1.1530E+03	2.2630E+03
	3.8447E+00	-4.1049E+00	-2.7949E-01	7.9497E+00	1.5603E+01
22	1.0451E+02	-1.4911E+02	1.0563E+02	2.5361E+02	1.5643E+01
	7.2054E-01	-1.0281E+00	7.2830E-01	1.7486E+00	1.0786E-01

Allowable Stress for Load Case 104

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-40.00	20.00	30.00	70.00
2	0.00	-40.00	20.00	30.00	70.00
3	0.00	-40.00	20.00	30.00	70.00
4	0.00	-40.00	20.00	30.00	70.00
5	0.00	-40.00	20.00	30.00	70.00
6	0.00	-40.00	20.00	30.00	70.00
7	0.00	-40.00	20.00	30.00	70.00
8	0.00	-40.00	20.00	30.00	70.00
9	0.00	-40.00	20.00	30.00	70.00
10	0.00	-40.00	20.00	30.00	70.00
11	0.00	-40.00	20.00	30.00	70.00
12	0.00	-40.00	20.00	30.00	70.00
13	0.00	-40.00	20.00	30.00	70.00
14	0.00	-40.00	20.00	30.00	70.00
15	0.00	-40.00	20.00	30.00	70.00
16	0.00	-40.00	20.00	30.00	70.00
17	0.00	-40.00	20.00	30.00	70.00
18	0.00	-40.00	20.00	30.00	70.00
19	0.00	-40.00	20.00	30.00	70.00
20	0.00	-40.00	20.00	30.00	70.00
21	0.00	-40.00	20.00	30.00	70.00
22	0.00	-40.00	20.00	30.00	70.00

**Table 2-70. Load Case 105, -40°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.8170E+01 1.2528E-01	-6.6102E+01 -4.5576E-01	-1.1426E+01 -7.8778E-02	8.4272E+01 5.8103E-01	1.2660E+02 8.7291E-01
2	4.4922E+01 3.0973E-01	-2.2098E+01 -1.5236E-01	-2.1504E+01 -1.4826E-01	6.7020E+01 4.6209E-01	1.1467E+02 7.9065E-01
3	5.0256E+01 3.4651E-01	-2.2140E+01 -1.5265E-01	-6.1228E+00 -4.2215E-02	7.2397E+01 4.9916E-01	2.0709E+00 1.4279E-02
4	1.6354E+03 1.1276E+01	-1.2700E+03 -8.7561E+00	-4.2512E+02 -2.9311E+00	2.9054E+03 2.0032E+01	5.7564E+03 3.9689E+01
5	3.0091E+03 2.0747E+01	-1.4824E+03 -1.0221E+01	-5.8574E+02 -4.0385E+00	4.4915E+03 3.0968E+01	5.1886E+03 3.5774E+01
6	2.1899E+03 1.5099E+01	-8.8527E+01 -6.1037E-01	2.8614E+02 1.9729E+00	2.2784E+03 1.5709E+01	4.1394E+03 2.8540E+01
7	1.2166E+03 8.3884E+00	-1.9106E+00 -1.3173E-02	-2.6714E+01 -1.8419E-01	1.2185E+03 8.4016E+00	1.0129E+01 6.9837E-02
8	1.2151E+03 8.3776E+00	-2.1309E+00 -1.4692E-02	1.1964E+00 8.2488E-03	1.2172E+03 8.3923E+00	4.6705E+01 3.2202E-01
9	1.2156E+03 8.3813E+00	-2.1383E+00 -1.4743E-02	-1.8451E+01 -1.2721E-01	1.2177E+03 8.3960E+00	3.4090E+01 2.3504E-01
10	1.2289E+03 8.4733E+00	-1.3863E+02 -9.5580E-01	5.8233E+02 4.0150E+00	1.3676E+03 9.4291E+00	8.0687E+02 5.5632E+00
11	2.3553E+02 1.6239E+00	-3.8416E+02 -2.6487E+00	5.0007E-01 3.4479E-03	6.1969E+02 4.2726E+00	5.8247E+02 4.0160E+00
12	1.1899E+02 8.2040E-01	-1.9141E+02 -1.3197E+00	-7.3078E+01 -5.0385E-01	3.1040E+02 2.1401E+00	5.9007E+02 4.0684E+00
13	1.4125E+03 9.7391E+00	-7.4122E+02 -5.1105E+00	6.6806E+01 4.6061E-01	2.1538E+03 1.4850E+01	1.3789E+03 9.5075E+00
14	1.0377E+03 7.1548E+00	-6.2489E+02 -4.3085E+00	9.7638E+01 6.7319E-01	1.6626E+03 1.1463E+01	2.0637E+03 1.4229E+01
15	1.8246E+02 1.2580E+00	-1.0634E+02 -7.3321E-01	1.3654E+02 9.4144E-01	2.8880E+02 1.9912E+00	3.8433E+02 2.6499E+00

16	4.4891E+02	-1.8048E+02	1.3548E+02	6.2939E+02	7.0517E+02
	3.0951E+00	-1.2444E+00	9.3407E-01	4.3395E+00	4.8620E+00
17	5.1359E+02	-6.3788E+01	-5.9597E+01	5.7738E+02	1.0091E+03
	3.5411E+00	-4.3980E-01	-4.1090E-01	3.9809E+00	6.9576E+00
18	5.4406E+02	-8.9168E+01	1.2934E+02	6.3323E+02	1.1123E+03
	3.7512E+00	-6.1479E-01	8.9178E-01	4.3660E+00	7.6693E+00
19	4.7174E+02	-2.4049E+02	3.4565E+02	7.1222E+02	7.6749E+02
	3.2525E+00	-1.6581E+00	2.3832E+00	4.9106E+00	5.2916E+00
20	4.0006E+02	-3.0315E+02	1.0467E+02	7.0321E+02	1.2703E+03
	2.7583E+00	-2.0902E+00	7.2169E-01	4.8485E+00	8.7587E+00
21	1.7905E+02	-1.7652E+02	1.5125E+00	3.5556E+02	6.9900E+02
	1.2345E+00	-1.2170E+00	1.0428E-02	2.4515E+00	4.8194E+00
22	3.4621E+01	-4.3313E+01	3.5022E+01	7.7934E+01	2.5093E+01
	2.3870E-01	-2.9864E-01	2.4147E-01	5.3734E-01	1.7301E-01

Allowable Stress for Load Case 105

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	36.56	36.32	20.00	30.00	70.00
2	36.80	36.47	20.00	30.00	70.00
3	36.45	36.17	20.00	30.00	70.00
4	36.76	36.73	20.00	30.00	70.00
5	37.41	37.30	20.00	30.00	70.00
6	37.63	37.55	20.00	30.00	70.00
7	37.94	37.78	20.00	30.00	70.00
8	37.94	37.79	20.00	30.00	70.00
9	37.90	37.74	20.00	30.00	70.00
10	37.89	37.71	20.00	30.00	70.00
11	38.10	37.84	20.00	30.00	70.00
12	38.69	38.41	20.00	30.00	70.00
13	37.45	37.30	20.00	30.00	70.00
14	37.09	37.01	20.00	30.00	70.00
15	36.31	36.30	20.00	30.00	70.00
16	36.67	36.60	20.00	30.00	70.00
17	36.72	36.68	20.00	30.00	70.00
18	36.98	36.94	20.00	30.00	70.00
19	37.25	37.14	20.00	30.00	70.00
20	38.45	38.28	20.00	30.00	70.00
21	35.68	35.65	20.00	30.00	70.00
22	36.10	36.05	20.00	30.00	70.00

**Table 2-71. Load Case 106, -20°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.4037E+01 9.6783E-02	-4.3087E+01 -2.9708E-01	-5.8715E+00 -4.0483E-02	5.7124E+01 3.9386E-01	9.1799E+01 6.3293E-01
2	2.9227E+01 2.0151E-01	-3.0093E+01 -2.0748E-01	-1.3528E+01 -9.3270E-02	5.9320E+01 4.0900E-01	1.1607E+02 8.0029E-01
3	2.5654E+01 1.7688E-01	-2.2139E+01 -1.5264E-01	-1.1922E+00 -8.2198E-03	4.7793E+01 3.2952E-01	3.6463E+01 2.5141E-01
4	5.5000E+02 3.7921E+00	-5.1863E+02 -3.5759E+00	-1.9923E+02 -1.3736E+00	1.0686E+03 7.3680E+00	2.0568E+03 1.4181E+01
5	1.0884E+03 7.5045E+00	-5.9124E+02 -4.0765E+00	-3.2914E+02 -2.2693E+00	1.6797E+03 1.1581E+01	1.8566E+03 1.2801E+01
6	8.2419E+02 5.6826E+00	-3.8602E+01 -2.6615E-01	5.4335E+00 3.7463E-02	8.6279E+02 5.9487E+00	1.6032E+03 1.1054E+01
7	4.6803E+02 3.2269E+00	-1.9955E+00 -1.3759E-02	-9.3068E+00 -6.4168E-02	4.7002E+02 3.2407E+00	3.0709E+01 2.1173E-01
8	4.6737E+02 3.2224E+00	-2.1091E+00 -1.4542E-02	4.9122E-01 3.3868E-03	4.6948E+02 3.2370E+00	4.6018E+01 3.1728E-01
9	4.6766E+02 3.2244E+00	-2.0995E+00 -1.4475E-02	-8.3323E+00 -5.7449E-02	4.6976E+02 3.2389E+00	3.9133E+01 2.6981E-01
10	4.7987E+02 3.3086E+00	-8.2643E+01 -5.6980E-01	2.5197E+02 1.7373E+00	5.6251E+02 3.8784E+00	4.1957E+02 2.8928E+00
11	5.8682E+01 4.0460E-01	-2.0684E+02 -1.4261E+00	-3.8372E+01 -2.6456E-01	2.6553E+02 1.8307E+00	2.4795E+02 1.7096E+00
12	1.9396E+01 1.3373E-01	-1.3892E+02 -9.5783E-01	-1.1941E+02 -8.2328E-01	1.5832E+02 1.0916E+00	2.4921E+02 1.7182E+00
13	4.9018E+02 3.3797E+00	-3.5104E+02 -2.4203E+00	3.7309E+00 2.5724E-02	8.4121E+02 5.8000E+00	5.1525E+02 3.5525E+00
14	3.3739E+02 2.3262E+00	-2.9201E+02 -2.0133E+00	4.0395E+01 2.7851E-01	6.2940E+02 4.3396E+00	7.7925E+02 5.3727E+00
15	8.3989E+01 5.7908E-01	-4.2269E+01 -2.9143E-01	6.9838E+01 4.8152E-01	1.2626E+02 8.7052E-01	1.5447E+02 1.0651E+00

16	1.8963E+02	-7.2963E+01	4.0799E+01	2.6260E+02	2.9870E+02
	1.3075E+00	-5.0306E-01	2.8130E-01	1.8105E+00	2.0595E+00
17	2.1188E+02	-2.5652E+01	-4.3233E+01	2.3753E+02	4.1432E+02
	1.4609E+00	-1.7687E-01	-2.9808E-01	1.6377E+00	2.8566E+00
18	2.2267E+02	-4.3980E+01	1.5062E+02	2.6665E+02	4.6743E+02
	1.5353E+00	-3.0323E-01	1.0385E+00	1.8385E+00	3.2228E+00
19	1.6387E+02	-1.1304E+02	2.4910E+02	2.7691E+02	2.5563E+02
	1.1299E+00	-7.7939E-01	1.7175E+00	1.9093E+00	1.7625E+00
20	1.3241E+02	-1.7580E+02	4.8167E+01	3.0821E+02	5.1758E+02
	9.1292E-01	-1.2121E+00	3.3210E-01	2.1250E+00	3.5686E+00
21	8.1670E+01	-7.3076E+01	8.0668E+00	1.5475E+02	3.0451E+02
	5.6310E-01	-5.0384E-01	5.5618E-02	1.0669E+00	2.0995E+00
22	1.7281E+01	-1.8617E+01	1.6618E+01	3.5897E+01	1.9631E+01
	1.1915E-01	-1.2836E-01	1.1458E-01	2.4750E-01	1.3535E-01

Allowable Stress for Load Case 106

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	55.71	55.47	20.00	30.00	70.00
2	55.94	55.61	20.00	30.00	70.00
3	55.60	55.32	20.00	30.00	70.00
4	55.91	55.87	20.00	30.00	70.00
5	56.55	56.44	20.00	30.00	70.00
6	56.77	56.68	20.00	30.00	70.00
7	57.06	56.91	20.00	30.00	70.00
8	57.06	56.91	20.00	30.00	70.00
9	57.02	56.87	20.00	30.00	70.00
10	57.01	56.84	20.00	30.00	70.00
11	57.22	56.96	20.00	30.00	70.00
12	57.81	57.53	20.00	30.00	70.00
13	56.58	56.44	20.00	30.00	70.00
14	56.23	56.15	20.00	30.00	70.00
15	55.46	55.44	20.00	30.00	70.00
16	55.81	55.74	20.00	30.00	70.00
17	55.86	55.82	20.00	30.00	70.00
18	56.12	56.07	20.00	30.00	70.00
19	56.38	56.27	20.00	30.00	70.00
20	57.56	57.40	20.00	30.00	70.00
21	54.84	54.80	20.00	30.00	70.00
22	55.26	55.21	20.00	30.00	70.00

**Table 2-72. Load Case 201, Internal Design Pressure, 207 kPa (30 psia),
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	3.6585E+01 2.5225E-01	-5.4281E+01 -3.7425E-01	8.7424E+00 6.0277E-02	9.0866E+01 6.2650E-01	1.3580E+02 9.3633E-01
2	9.1587E+01 6.3147E-01	-9.1726E+01 -6.3243E-01	1.3799E+00 9.5139E-03	1.8331E+02 1.2639E+00	1.1633E+02 8.0207E-01
3	5.7976E+01 3.9973E-01	-7.1305E+01 -4.9163E-01	9.5053E+01 6.5537E-01	1.2928E+02 8.9136E-01	8.6501E+01 5.9640E-01
4	3.9674E+02 2.7354E+00	-4.8939E+02 -3.3742E+00	-1.4103E+02 -9.7240E-01	8.8613E+02 6.1097E+00	1.7529E+03 1.2086E+01
5	3.4081E+02 2.3498E+00	-3.9554E+02 -2.7271E+00	-6.1119E+02 -4.2140E+00	7.3634E+02 5.0769E+00	8.7549E+02 6.0363E+00
6	7.2339E+00 4.9876E-02	-5.6062E+02 -3.8653E+00	-1.4403E+03 -9.9304E+00	5.6785E+02 3.9152E+00	9.1816E+02 6.3305E+00
7	-1.4547E+02 -1.0030E+00	-3.1548E+02 -2.1751E+00	-2.2906E+03 -1.5793E+01	1.7000E+02 1.1721E+00	5.0967E+01 3.5141E-01
8	-1.4710E+02 -1.0142E+00	-3.2278E+02 -2.2255E+00	-2.3765E+03 -1.6385E+01	1.7568E+02 1.2113E+00	4.6280E+01 3.1909E-01
9	-1.4339E+02 -9.8866E-01	-3.3248E+02 -2.2924E+00	-2.4380E+03 -1.6810E+01	1.8909E+02 1.3037E+00	7.0462E+01 4.8582E-01
10	-5.2130E+01 -3.5943E-01	-6.6136E+02 -4.5599E+00	-1.4092E+03 -9.7160E+00	6.0923E+02 4.2005E+00	5.6607E+01 3.9029E-01
11	-7.9877E+01 -5.5074E-01	-6.9324E+02 -4.7797E+00	-6.7102E+02 -4.6265E+00	6.1337E+02 4.2290E+00	7.6777E+02 5.2936E+00
12	3.7604E+01 2.5927E-01	-6.9696E+02 -4.8054E+00	-6.8111E+02 -4.6961E+00	7.3457E+02 5.0647E+00	9.7641E+02 6.7321E+00
13	6.7009E+01 4.6201E-01	-4.8695E+02 -3.3574E+00	-1.3751E+02 -9.4813E-01	5.5396E+02 3.8194E+00	1.8447E+02 1.2719E+00
14	6.3614E+01 4.3860E-01	-5.4823E+02 -3.7799E+00	-7.3920E+01 -5.0966E-01	6.1185E+02 4.2185E+00	9.8317E+02 6.7787E+00
15	6.2371E+02 4.3003E+00	-5.8489E+02 -4.0327E+00	-2.1049E+02 -1.4513E+00	1.2086E+03 8.3330E+00	1.5777E+03 1.0878E+01

16	4.3864E+02	-1.0779E+03	-4.1763E+02	1.5165E+03	2.4543E+03
	3.0243E+00	-7.4316E+00	-2.8795E+00	1.0456E+01	1.6922E+01
17	1.7526E+02	-7.9610E+02	-8.8161E+01	9.7137E+02	1.6698E+03
	1.2084E+00	-5.4889E+00	-6.0785E-01	6.6973E+00	1.1513E+01
18	8.5529E+01	-6.3566E+02	1.8824E+02	7.2119E+02	1.1780E+03
	5.8970E-01	-4.3827E+00	1.2979E+00	4.9724E+00	8.1223E+00
19	2.9758E+02	-9.5687E+02	-7.8807E+00	1.2545E+03	2.0663E+03
	2.0518E+00	-6.5974E+00	-5.4336E-02	8.6492E+00	1.4247E+01
20	3.4484E+02	-1.1050E+03	-1.3971E+02	1.4498E+03	2.7037E+03
	2.3776E+00	-7.6187E+00	-9.6327E-01	9.9963E+00	1.8641E+01
21	7.0046E+01	-3.4058E+01	-1.1059E+00	1.0410E+02	2.6339E+02
	4.8295E-01	-2.3482E-01	-7.6250E-03	7.1777E-01	1.8160E+00
22	1.4036E+02	1.1960E+01	4.0982E+01	1.2840E+02	4.1357E+01
	9.6777E-01	8.2464E-02	2.8256E-01	8.8530E-01	2.8515E-01

**Table 2-73. Load Case 202, Minimum External Pressure, 24 kPa (3.5 psia),
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	4.7455E+01 3.2719E-01	-4.8088E+01 -3.3155E-01	3.5134E+01 2.4224E-01	9.5543E+01 6.5875E-01	1.3398E+02 9.2377E-01
2	1.0023E+02 6.9106E-01	-8.0039E+01 -5.5185E-01	2.6810E+01 1.8485E-01	1.8027E+02 1.2429E+00	1.1572E+02 7.9786E-01
3	6.7627E+01 4.6627E-01	-5.9530E+01 -4.1044E-01	1.2089E+02 8.3353E-01	1.2716E+02 8.7671E-01	8.2293E+01 5.6739E-01
4	3.3559E+02 2.3138E+00	-3.8819E+02 -2.6765E+00	-1.8126E+02 -1.2497E+00	7.2378E+02 4.9903E+00	1.4175E+03 9.7733E+00
5	2.8471E+02 1.9630E+00	-2.4582E+02 -1.6948E+00	-6.6035E+02 -4.5529E+00	5.3052E+02 3.6578E+00	5.7821E+02 3.9866E+00
6	1.7823E+01 1.2289E-01	-4.6911E+02 -3.2344E+00	-1.4653E+03 -1.0103E+01	4.8693E+02 3.3573E+00	7.5436E+02 5.2011E+00
7	-1.0435E+02 -7.1947E-01	-2.9717E+02 -2.0489E+00	-2.3335E+03 -1.6089E+01	1.9282E+02 1.3294E+00	5.0263E+01 3.4655E-01
8	-1.0583E+02 -7.2965E-01	-3.0468E+02 -2.1007E+00	-2.4186E+03 -1.6676E+01	1.9886E+02 1.3711E+00	4.6250E+01 3.1888E-01
9	-1.0219E+02 -7.0460E-01	-3.1424E+02 -2.1666E+00	-2.4818E+03 -1.7111E+01	2.1205E+02 1.4620E+00	7.0044E+01 4.8294E-01
10	1.0417E+01 7.1823E-02	-6.9090E+02 -4.7636E+00	-1.3846E+03 -9.5463E+00	7.0131E+02 4.8354E+00	1.4931E+02 1.0294E+00
11	-9.4375E+01 -6.5069E-01	-6.9287E+02 -4.7772E+00	-6.7425E+02 -4.6488E+00	5.9850E+02 4.1265E+00	7.5163E+02 5.1823E+00
12	3.1391E+01 2.1643E-01	-6.8675E+02 -4.7349E+00	-6.7900E+02 -4.6815E+00	7.1814E+02 4.9514E+00	8.8422E+02 6.0965E+00
13	5.8456E+01 4.0304E-01	-3.8978E+02 -2.6874E+00	-1.2637E+02 -8.7126E-01	4.4823E+02 3.0904E+00	3.0839E+02 2.1263E+00
14	3.2885E+01 2.2674E-01	-4.3871E+02 -3.0248E+00	-6.0028E+01 -4.1388E-01	4.7160E+02 3.2516E+00	8.1555E+02 5.6230E+00
15	7.7008E+02 5.3095E+00	-6.7238E+02 -4.6359E+00	-1.4097E+02 -9.7196E-01	1.4425E+03 9.9454E+00	2.2371E+03 1.5424E+01

16	3.9147E+02	-8.7900E+02	-3.2523E+02	1.2705E+03	2.0613E+03
	2.6991E+00	-6.0605E+00	-2.2424E+00	8.7596E+00	1.4212E+01
17	1.6336E+02	-6.3436E+02	-3.4520E+01	7.9772E+02	1.3778E+03
	1.1264E+00	-4.3737E+00	-2.3801E-01	5.5001E+00	9.4998E+00
18	6.6830E+01	-4.5218E+02	2.2464E+02	5.1901E+02	8.4463E+02
	4.6077E-01	-3.1177E+00	1.5488E+00	3.5785E+00	5.8235E+00
19	2.1863E+02	-6.9687E+02	7.2926E+01	9.1550E+02	1.5151E+03
	1.5074E+00	-4.8047E+00	5.0281E-01	6.3122E+00	1.0446E+01
20	2.4582E+02	-8.2954E+02	-8.8106E+01	1.0754E+03	2.0083E+03
	1.6948E+00	-5.7195E+00	-6.0747E-01	7.4143E+00	1.3847E+01
21	4.1904E+01	-1.0111E+01	-3.0399E+00	5.2014E+01	1.1140E+02
	2.8891E-01	-6.9710E-02	-2.0959E-02	3.5863E-01	7.6804E-01
22	9.4583E+01	-3.2193E+00	2.9242E+01	9.7802E+01	4.1078E+01
	6.5213E-01	-2.2196E-02	2.0162E-01	6.7432E-01	2.8322E-01

Table 2-74. Load Case 203, Maximum Increased External Pressure, 140 kPa (20 psia), Normal Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	3.1826E+01 2.1943E-01	-5.6494E+01 -3.8951E-01	-3.3976E+00 -2.3426E-02	8.8320E+01 6.0894E-01	1.3867E+02 9.5611E-01
2	8.7012E+01 5.9993E-01	-9.8172E+01 -6.7687E-01	-1.0205E+01 -7.0359E-02	1.8518E+02 1.2768E+00	1.1681E+02 8.0535E-01
3	5.2774E+01 3.6386E-01	-7.7655E+01 -5.3541E-01	8.3021E+01 5.7241E-01	1.3043E+02 8.9927E-01	9.0403E+01 6.2331E-01
4	5.2492E+02 3.6192E+00	-7.8082E+02 -5.3836E+00	-2.3387E+02 -1.6125E+00	1.3057E+03 9.0028E+00	2.5751E+03 1.7755E+01
5	4.4608E+02 3.0756E+00	-6.5713E+02 -4.5307E+00	-6.9842E+02 -4.8155E+00	1.1032E+03 7.6064E+00	1.5392E+03 1.0613E+01
6	2.5853E+01 1.7825E-01	-6.8104E+02 -4.6956E+00	-1.5608E+03 -1.0762E+01	7.0689E+02 4.8738E+00	1.1427E+03 7.8786E+00
7	-1.6452E+02 -1.1344E+00	-3.1849E+02 -2.1959E+00	-2.3379E+03 -1.6119E+01	1.5397E+02 1.0616E+00	5.1273E+01 3.5352E-01
8	-1.6635E+02 -1.1469E+00	-3.2554E+02 -2.2445E+00	-2.4249E+03 -1.6719E+01	1.5919E+02 1.0976E+00	4.6294E+01 3.1919E-01
9	-1.6263E+02 -1.1213E+00	-3.3522E+02 -2.3113E+00	-2.4873E+03 -1.7150E+01	1.7259E+02 1.1900E+00	7.0297E+01 4.8468E-01
10	-6.4607E+01 -4.4545E-01	-6.8931E+02 -4.7526E+00	-1.4220E+03 -9.8046E+00	6.2470E+02 4.3072E+00	1.0431E+02 7.1921E-01
11	-8.8776E+01 -6.1209E-01	-6.9444E+02 -4.7880E+00	-6.7614E+02 -4.6619E+00	6.0567E+02 4.1759E+00	7.9433E+02 5.4767E+00
12	3.4433E+01 2.3741E-01	-6.9418E+02 -4.7862E+00	-6.8248E+02 -4.7056E+00	7.2861E+02 5.0236E+00	9.2658E+02 6.3885E+00
13	7.0217E+01 4.8413E-01	-4.7838E+02 -3.2983E+00	-1.3470E+02 -9.2874E-01	5.4859E+02 3.7824E+00	1.7723E+02 1.2220E+00
14	6.9538E+01 4.7945E-01	-5.4324E+02 -3.7455E+00	-6.9880E+01 -4.8180E-01	6.1278E+02 4.2250E+00	9.8177E+02 6.7691E+00
15	7.9863E+02 5.5063E+00	-7.1315E+02 -4.9170E+00	-1.4789E+02 -1.0197E+00	1.5118E+03 1.0423E+01	2.3518E+03 1.6215E+01

16	4.0879E+02	-9.1470E+02	-3.3512E+02	1.3235E+03	2.1474E+03
	2.8185E+00	-6.3066E+00	-2.3106E+00	9.1252E+00	1.4806E+01
17	1.7095E+02	-6.5933E+02	-3.0852E+01	8.3028E+02	1.4344E+03
	1.1786E+00	-4.5459E+00	-2.1272E-01	5.7246E+00	9.8899E+00
18	6.9241E+01	-4.6610E+02	2.2760E+02	5.3534E+02	8.7359E+02
	4.7740E-01	-3.2136E+00	1.5692E+00	3.6910E+00	6.0232E+00
19	2.2666E+02	-7.1653E+02	6.9118E+01	9.4319E+02	1.5602E+03
	1.5628E+00	-4.9403E+00	4.7655E-01	6.5031E+00	1.0757E+01
20	2.5792E+02	-8.5409E+02	-8.9637E+01	1.1120E+03	2.0768E+03
	1.7783E+00	-5.8888E+00	-6.1802E-01	7.6670E+00	1.4319E+01
21	7.6980E+01	-5.4733E+01	-2.0676E+00	1.3171E+02	3.2001E+02
	5.3076E-01	-3.7737E-01	-1.4256E-02	9.0813E-01	2.2064E+00
22	7.0147E+01	-1.6346E+01	2.4514E+00	8.6493E+01	1.8044E+02
	4.8364E-01	-1.1270E-01	1.6901E-02	5.9635E-01	1.2441E+00

Table 2-75. Load Case 204, Additional Increased External Pressure, 2 MPa (290 psia), Normal Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-1.2602E+02 -8.6891E-01	-2.9307E+02 -2.0206E+00	-6.3470E+02 -4.3761E+00	1.6704E+02 1.1517E+00	2.1323E+02 1.4702E+00
2	-1.1608E+02 -8.0034E-01	-4.0601E+02 -2.7994E+00	-6.1835E+02 -4.2634E+00	2.8994E+02 1.9990E+00	1.2790E+02 8.8185E-01
3	-1.6522E+02 -1.1392E+00	-3.9783E+02 -2.7429E+00	-5.1550E+02 -3.5543E+00	2.3261E+02 1.6038E+00	2.0433E+02 1.4088E+00
4	3.6672E+03 2.5285E+01	-7.1088E+03 -4.9013E+01	-1.0331E+03 -7.1229E+00	1.0776E+04 7.4298E+01	2.0933E+04 1.4433E+02
5	3.3659E+03 2.3207E+01	-7.4720E+03 -5.1518E+01	-1.2596E+03 -8.6847E+00	1.0838E+04 7.4725E+01	1.6757E+04 1.1553E+02
6	3.4034E+02 2.3465E+00	-4.2924E+03 -2.9595E+01	-3.0562E+03 -2.1072E+01	4.6327E+03 3.1942E+01	7.1770E+03 4.9483E+01
7	-2.9421E+02 -2.0285E+00	-1.5505E+03 -1.0691E+01	-2.4135E+03 -1.6641E+01	1.2563E+03 8.6621E+00	6.7087E+01 4.6255E-01
8	-3.0219E+02 -2.0836E+00	-1.5496E+03 -1.0684E+01	-2.5308E+03 -1.7449E+01	1.2474E+03 8.6006E+00	4.6994E+01 3.2401E-01
9	-3.0766E+02 -2.1212E+00	-1.5507E+03 -1.0692E+01	-2.5811E+03 -1.7796E+01	1.2431E+03 8.5706E+00	7.4008E+01 5.1027E-01
10	-4.5425E+02 -3.1320E+00	-1.5323E+03 -1.0565E+01	-2.0452E+03 -1.4101E+01	1.0780E+03 7.4328E+00	6.1550E+02 4.2437E+00
11	2.1256E+02 1.4655E+00	-9.5925E+02 -6.6138E+00	-7.3368E+02 -5.0586E+00	1.1718E+03 8.0793E+00	1.4828E+03 1.0224E+01
12	1.0685E+02 7.3667E-01	-8.8184E+02 -6.0801E+00	-7.6682E+02 -5.2870E+00	9.8869E+02 6.8167E+00	1.5857E+03 1.0933E+01
13	6.8197E+02 4.7020E+00	-2.4235E+03 -1.6709E+01	-3.1854E+02 -2.1963E+00	3.1055E+03 2.1411E+01	2.0182E+03 1.3915E+01
14	7.7645E+02 5.3534E+00	-2.4315E+03 -1.6764E+01	-2.7918E+02 -1.9249E+00	3.2079E+03 2.2118E+01	3.7414E+03 2.5796E+01
15	4.3119E+02 2.9730E+00	-1.9220E+03 -1.3252E+01	-3.4476E+02 -2.3770E+00	2.3532E+03 1.6225E+01	3.5041E+03 2.4160E+01

16	5.8662E+02	-1.2942E+03	-4.3995E+02	1.8808E+03	3.0487E+03
	4.0446E+00	-8.9234E+00	-3.0333E+00	1.2968E+01	2.1020E+01
17	2.3701E+02	-9.2544E+02	3.1708E+00	1.1625E+03	2.0151E+03
	1.6341E+00	-6.3807E+00	2.1862E-02	8.0148E+00	1.3894E+01
18	1.4002E+02	-7.4683E+02	2.6864E+02	8.8685E+02	1.4885E+03
	9.6542E-01	-5.1492E+00	1.8522E+00	6.1146E+00	1.0263E+01
19	4.0925E+02	-1.1237E+03	-3.0554E+01	1.5330E+03	2.5332E+03
	2.8217E+00	-7.7478E+00	-2.1067E-01	1.0569E+01	1.7466E+01
20	5.2124E+02	-1.3674E+03	-1.6888E+02	1.8886E+03	3.5717E+03
	3.5938E+00	-9.4276E+00	-1.1644E+00	1.3021E+01	2.4626E+01
21	7.5985E+02	-9.7395E+02	-4.8106E+01	1.7338E+03	3.6138E+03
	5.2390E+00	-6.7152E+00	-3.3168E-01	1.1954E+01	2.4916E+01
22	5.2498E+02	-1.3040E+03	-4.2627E+02	1.8290E+03	3.3465E+03
	3.6196E+00	-8.9907E+00	-2.9390E+00	1.2610E+01	2.3073E+01

**Table 2-76. Load Case 211, Fabrication Stress,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	5.0993E+02 3.5159E+00	-1.2900E+02 -8.8942E-01	4.6067E+01 3.1762E-01	6.3893E+02 4.4053E+00	8.9316E+02 6.1581E+00		
2	7.0946E+00 4.8916E-02	-4.4601E+01 -3.0751E-01	3.6652E+01 2.5270E-01	5.1695E+01 3.5643E-01	2.5230E+01 1.7395E-01		
3	4.1560E+00 2.8654E-02	-2.6427E+01 -1.8220E-01	1.1942E+01 8.2334E-02	3.0582E+01 2.1086E-01	7.2770E+00 5.0173E-02		
4	3.7259E+02 2.5689E+00	-9.3381E+01 -6.4384E-01	7.3002E+01 5.0333E-01	4.6597E+02 3.2127E+00	5.5832E+02 3.8495E+00		
5	3.7085E+02 2.5569E+00	-1.2174E+02 -8.3939E-01	4.3727E+01 3.0149E-01	4.9259E+02 3.3963E+00	7.5318E+02 5.1930E+00		
6	2.4440E+02 1.6851E+00	7.7848E+01 5.3674E-01	1.1226E+02 7.7402E-01	1.6655E+02 1.1483E+00	2.4997E+02 1.7235E+00		
7	7.4070E+01 5.1069E-01	2.1570E+00 1.4872E-02	1.3022E+01 8.9781E-02	7.1913E+01 4.9582E-01	3.4813E+00 2.4003E-02		
8	5.9997E+01 4.1366E-01	5.7216E-01 3.9449E-03	3.9280E+00 2.7083E-02	5.9425E+01 4.0972E-01	2.3979E-01 1.6533E-03		
9	8.6093E+01 5.9359E-01	3.0938E-01 2.1331E-03	1.1872E+00 8.1855E-03	8.5783E+01 5.9145E-01	3.9082E+00 2.6946E-02		
10	3.4975E+02 2.4114E+00	-3.7100E+00 -2.5579E-02	1.3939E+02 9.6107E-01	3.5346E+02 2.4370E+00	6.3643E+01 4.3880E-01		
11	1.6523E+02 1.1392E+00	-3.1028E+01 -2.1393E-01	1.0631E+02 7.3301E-01	1.9625E+02 1.3531E+00	1.9364E+02 1.3351E+00		
12	2.1035E+02 1.4503E+00	9.5687E+01 6.5974E-01	1.2097E+02 8.3406E-01	1.1466E+02 7.9058E-01	2.1929E+02 1.5120E+00		
13	5.7075E+02 3.9352E+00	-1.1986E+02 -8.2639E-01	1.6093E+02 1.1095E+00	6.9061E+02 4.7616E+00	6.9395E+02 4.7846E+00		
14	5.2477E+02 3.6181E+00	-1.1222E+02 -7.7376E-01	1.6355E+02 1.1276E+00	6.3699E+02 4.3919E+00	5.4979E+02 3.7906E+00		
15	4.8542E+02 3.3469E+00	1.3703E+02 9.4481E-01	1.3353E+02 9.2069E-01	3.4839E+02 2.4021E+00	1.1757E+02 8.1062E-01		

16	5.9771E+01	-2.3684E+01	-1.3505E+00	8.3455E+01	7.7903E+01
	4.1210E-01	-1.6330E-01	-9.3111E-03	5.7540E-01	5.3713E-01
17	9.4243E+01	-5.7775E+00	-3.0181E+01	1.0002E+02	4.3703E+01
	6.4979E-01	-3.9834E-02	-2.0809E-01	6.8962E-01	3.0132E-01
18	1.1129E+02	-1.1573E+01	-4.5575E+01	1.2286E+02	1.8277E+02
	7.6732E-01	-7.9792E-02	-3.1423E-01	8.4712E-01	1.2602E+00
19	9.1189E+01	-7.1082E+01	9.5176E+00	1.6227E+02	3.0830E+01
	6.2873E-01	-4.9009E-01	6.5621E-02	1.1188E+00	2.1257E-01
20	1.2417E+02	-1.8104E+02	2.4480E+01	3.0521E+02	6.5983E+01
	8.5612E-01	-1.2482E+00	1.6878E-01	2.1043E+00	4.5493E-01
21	1.4022E+02	-7.5207E+01	-7.1474E+01	2.1542E+02	2.5432E+02
	9.6677E-01	-5.1853E-01	-4.9280E-01	1.4853E+00	1.7535E+00
22	4.1516E+02	1.5105E+02	3.9048E+02	2.6412E+02	3.2892E+02
	2.8625E+00	1.0414E+00	2.6923E+00	1.8210E+00	2.2678E+00

**Table 2-77. Load Case 215, Compression Load (5x weight),
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-4.0707E-01 -2.8067E-03	-4.3966E+01 -3.0313E-01	-4.8806E+00 -3.3650E-02	4.3559E+01 3.0033E-01	6.7559E+01 4.6580E-01
2	7.0349E-01 4.8504E-03	-3.2850E+01 -2.2649E-01	3.5885E+00 2.4742E-02	3.3553E+01 2.3134E-01	4.0898E-02 2.8198E-04
3	-1.1958E+00 -8.2448E-03	-3.8627E+01 -2.6633E-01	6.7452E-01 4.6507E-03	3.7432E+01 2.5808E-01	1.1886E+01 8.1950E-02
4	8.2434E+01 5.6836E-01	-1.1924E+02 -8.2212E-01	7.3423E+00 5.0623E-02	2.0167E+02 1.3905E+00	2.7087E+02 1.8676E+00
5	5.9502E+01 4.1025E-01	-9.1875E+01 -6.3346E-01	8.4979E+00 5.8591E-02	1.5138E+02 1.0437E+00	2.1438E+02 1.4781E+00
6	-2.1191E+01 -1.4611E-01	-9.0401E+01 -6.2329E-01	-2.3835E+01 -1.6433E-01	6.9210E+01 4.7718E-01	3.6208E+01 2.4964E-01
7	-1.0270E-01 -7.0808E-04	-2.4311E+01 -1.6762E-01	6.3946E-01 4.4089E-03	2.4208E+01 1.6691E-01	1.7559E+00 1.2107E-02
8	1.7799E-01 1.2272E-03	-1.4624E+01 -1.0083E-01	1.7967E+00 1.2388E-02	1.4802E+01 1.0206E-01	1.0504E-01 7.2420E-04
9	1.4687E-01 1.0126E-03	-1.5811E+01 -1.0901E-01	1.8683E+00 1.2881E-02	1.5957E+01 1.1002E-01	3.7509E-01 2.5862E-03
10	-1.3586E+00 -9.3669E-03	-6.2312E+01 -4.2962E-01	-1.9160E+01 -1.3210E-01	6.0953E+01 4.2026E-01	1.5363E+01 1.0592E-01
11	5.9636E+00 4.1118E-02	-2.6511E+01 -1.8279E-01	-1.1858E+01 -8.1758E-02	3.2474E+01 2.2390E-01	3.6281E+01 2.5015E-01
12	-1.0548E+01 -7.2723E-02	-4.3654E+01 -3.0098E-01	-1.3365E+01 -9.2149E-02	3.3106E+01 2.2826E-01	5.2704E+01 3.6338E-01
13	2.5479E+01 1.7567E-01	-8.0420E+01 -5.5448E-01	-1.5349E+01 -1.0583E-01	1.0590E+02 7.3015E-01	9.8131E+01 6.7659E-01
14	2.3610E+01 1.6278E-01	-7.0825E+01 -4.8832E-01	-1.4323E+01 -9.8752E-02	9.4435E+01 6.5111E-01	8.0268E+01 5.5343E-01
15	-1.3219E+02 -9.1141E-01	-4.2422E+02 -2.9249E+00	-1.2980E+02 -8.9493E-01	2.9203E+02 2.0135E+00	1.0706E+02 7.3816E-01

16	4.2852E+00	-2.7271E+01	-8.8634E+00	3.1556E+01	2.1175E+01
	2.9545E-02	-1.8802E-01	-6.1111E-02	2.1757E-01	1.4600E-01
17	-5.8523E+00	-3.1062E+01	-6.1143E+00	2.5210E+01	3.2089E+01
	-4.0350E-02	-2.1417E-01	-4.2156E-02	1.7382E-01	2.2124E-01
18	-7.3178E+00	-3.9563E+01	5.6412E-01	3.2245E+01	5.2267E+01
	-5.0455E-02	-2.7278E-01	3.8895E-03	2.2232E-01	3.6037E-01
19	3.2495E+01	-4.3426E+01	3.1003E-01	7.5921E+01	8.7350E+01
	2.2405E-01	-2.9941E-01	2.1376E-03	5.2346E-01	6.0226E-01
20	4.8117E+01	-4.9020E+01	-7.0031E+00	9.7137E+01	1.2922E+02
	3.3175E-01	-3.3798E-01	-4.8284E-02	6.6974E-01	8.9093E-01
21	-2.6747E+00	-6.8144E+01	-3.5011E+00	6.5469E+01	2.9403E+01
	-1.8442E-02	-4.6984E-01	-2.4139E-02	4.5139E-01	2.0273E-01
22	-9.0750E+01	-1.9038E+02	-1.0670E+02	9.9630E+01	7.0107E+01
	-6.2570E-01	-1.3126E+00	-7.3565E-01	6.8692E-01	4.8337E-01

**Table 2-78. Load Case 216, Rod Drop onto Cask,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-1.2222E+01 -8.4270E-02	-1.1342E+02 -7.8204E-01	8.2376E+01 5.6796E-01	1.0120E+02 6.9777E-01	3.0094E+01 2.0749E-01		
2	4.2342E+00 2.9194E-02	-1.7886E+02 -1.2332E+00	2.3240E+01 1.6023E-01	1.8310E+02 1.2624E+00	1.8028E+01 1.2430E-01		
3	5.0955E+00 3.5132E-02	-1.9575E+02 -1.3496E+00	1.0264E+01 7.0770E-02	2.0084E+02 1.3848E+00	3.0906E+01 2.1309E-01		
4	6.0758E+02 4.1891E+00	-1.4569E+02 -1.0045E+00	4.6165E+02 3.1830E+00	7.5327E+02 5.1936E+00	9.1517E+01 6.3099E-01		
5	5.0624E+02 3.4904E+00	-3.6132E+02 -2.4912E+00	3.3898E+02 2.3372E+00	8.6756E+02 5.9816E+00	5.2569E+02 3.6245E+00		
6	-8.6692E+01 -5.9772E-01	-1.0487E+03 -7.2305E+00	-3.4299E+00 -2.3649E-02	9.6200E+02 6.6328E+00	4.0857E+02 2.8170E+00		
7	1.1395E+00 7.8562E-03	-2.2238E+02 -1.5332E+00	1.6537E+01 1.1402E-01	2.2351E+02 1.5411E+00	2.3697E+01 1.6338E-01		
8	2.0173E+00 1.3909E-02	-9.2489E+01 -6.3769E-01	1.9936E+01 1.3746E-01	9.4506E+01 6.5159E-01	1.2567E+00 8.6646E-03		
9	1.0580E+00 7.2947E-03	-9.3042E+01 -6.4150E-01	1.2869E+01 8.8726E-02	9.4100E+01 6.4880E-01	1.3847E+00 9.5474E-03		
10	-6.1571E+00 -4.2452E-02	-3.7134E+02 -2.5603E+00	-1.0758E+02 -7.4172E-01	3.6518E+02 2.5178E+00	8.6329E+01 5.9522E-01		
11	4.7129E+01 3.2494E-01	-1.5111E+02 -1.0419E+00	-5.2200E+01 -3.5991E-01	1.9824E+02 1.3668E+00	2.3162E+02 1.5970E+00		
12	-4.8566E+01 -3.3485E-01	-2.6552E+02 -1.8307E+00	-6.2850E+01 -4.3334E-01	2.1696E+02 1.4959E+00	3.1755E+02 2.1894E+00		
13	1.7672E+02 1.2184E+00	-4.5921E+02 -3.1661E+00	-5.9307E+01 -4.0891E-01	6.3593E+02 4.3846E+00	5.5973E+02 3.8592E+00		
14	1.7080E+02 1.1776E+00	-4.1020E+02 -2.8283E+00	-5.2286E+01 -3.6050E-01	5.8101E+02 4.0059E+00	5.0329E+02 3.4700E+00		
15	-5.5572E+03 -3.8316E+01	-1.9032E+04 -1.3122E+02	-5.4444E+03 -3.7538E+01	1.3475E+04 9.2904E+01	4.6668E+03 3.2177E+01		

16	4.3643E+02	-9.0325E+02	-9.2868E+01	1.3397E+03	1.4628E+03
	3.0091E+00	-6.2277E+00	-6.4030E-01	9.2368E+00	1.0086E+01
17	3.3779E+02	-8.6443E+02	1.7524E+02	1.2022E+03	1.8115E+03
	2.3290E+00	-5.9600E+00	1.2082E+00	8.2890E+00	1.2490E+01
18	1.5393E+02	-6.0276E+02	-6.2840E+01	7.5670E+02	6.6403E+02
	1.0613E+00	-4.1559E+00	-4.3327E-01	5.2173E+00	4.5783E+00
19	4.5080E+02	-2.0457E+02	2.1191E+02	6.5537E+02	2.0244E+02
	3.1081E+00	-1.4105E+00	1.4610E+00	4.5186E+00	1.3958E+00
20	7.7049E+02	-4.5219E+02	2.7273E+01	1.2227E+03	4.3619E+02
	5.3123E+00	-3.1177E+00	1.8804E-01	8.4301E+00	3.0075E+00
21	-2.9643E+01	-4.2108E+02	-3.4839E+01	3.9144E+02	1.7775E+02
	-2.0438E-01	-2.9033E+00	-2.4021E-01	2.6989E+00	1.2255E+00
22	-1.4169E+03	-7.4743E+03	-2.1260E+03	6.0574E+03	1.4578E+03
	-9.7695E+00	-5.1534E+01	-1.4658E+01	4.1764E+01	1.0051E+01

**Table 2-79. Load Case 221, Forward 10g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.9327E+01 5.4694E-01	1.0282E+01 7.0895E-02	-6.2189E+00 -4.2878E-02	8.5546E+01 5.8982E-01	3.3713E+01 2.3244E-01		
2	7.7890E+01 5.3703E-01	1.4034E+01 9.6759E-02	-9.0426E+00 -6.2346E-02	8.9834E+01 6.1939E-01	3.1460E+01 2.1691E-01		
3	7.6520E+01 5.2759E-01	9.5948E+00 6.6154E-02	-6.5601E+00 -4.5230E-02	8.3080E+01 5.7282E-01	3.6251E+01 2.4994E-01		
4	6.2521E+01 4.3107E-01	1.5869E+00 1.0941E-02	-6.5300E+00 -4.5023E-02	6.9051E+01 4.7609E-01	2.0553E+01 1.4170E-01		
5	4.3093E+01 2.9712E-01	-1.1986E+00 -8.2642E-03	-6.0654E+00 -4.1819E-02	5.7160E+01 3.9411E-01	5.3932E+00 3.7184E-02		
6	1.7063E+01 1.1764E-01	-5.9830E+00 -4.1251E-02	-1.4683E+01 -1.0124E-01	2.6576E+01 1.8324E-01	2.2684E+00 1.5640E-02		
7	2.9506E+01 2.0344E-01	-9.7233E+00 -6.7040E-02	-2.8043E+01 -1.9335E-01	2.6773E+01 1.8459E-01	2.1988E+00 1.5160E-02		
8	2.7770E+01 1.9147E-01	-1.0814E+01 -7.4563E-02	-2.6443E+01 -1.8232E-01	2.5276E+01 1.7427E-01	2.4255E+00 1.6723E-02		
9	2.6473E+01 1.8252E-01	-9.9331E+00 -6.8486E-02	-2.5080E+01 -1.7292E-01	2.4025E+01 1.6564E-01	2.2924E+00 1.5805E-02		
10	2.3249E+01 1.6029E-01	-5.2522E+00 -3.6213E-02	-1.3609E+01 -9.3833E-02	3.6858E+01 2.5413E-01	7.1230E+00 4.9111E-02		
11	2.3170E+01 1.5975E-01	1.2601E+00 8.6884E-03	-9.7610E+00 -6.7300E-02	3.2931E+01 2.2705E-01	7.0822E+00 4.8830E-02		
12	1.5520E+01 1.0701E-01	-8.1130E-01 -5.5937E-03	-9.6212E+00 -6.6336E-02	2.5141E+01 1.7334E-01	6.0924E+00 4.2006E-02		
13	3.2162E+01 2.2175E-01	-3.1985E+00 -2.2053E-02	-7.8412E+00 -5.4063E-02	4.0003E+01 2.7581E-01	1.0143E+01 6.9932E-02		
14	3.5766E+01 2.4660E-01	-7.9320E-01 -5.4689E-03	-8.0624E+00 -5.5588E-02	4.3829E+01 3.0219E-01	8.8173E+00 6.0793E-02		
15	1.2632E+01 8.7095E-02	-4.3733E+00 -3.0153E-02	-6.0133E+00 -4.1460E-02	1.6197E+01 1.1167E-01	4.7570E+00 3.2798E-02		

16	3.1463E+01	9.1659E-01	-5.8936E+00	3.7356E+01	4.1548E+00
	2.1693E-01	6.3197E-03	-4.0635E-02	2.5756E-01	2.8647E-02
17	1.2456E+01	-5.7529E+00	-1.0224E+01	2.2680E+01	6.6761E+00
	8.5882E-02	-3.9665E-02	-7.0491E-02	1.5637E-01	4.6030E-02
18	1.1893E+01	-5.8752E+00	-1.0043E+01	2.1936E+01	6.0008E+00
	8.2001E-02	-4.0508E-02	-6.9243E-02	1.5124E-01	4.1374E-02
19	3.7817E+01	-3.0640E-01	-4.2126E+00	4.2030E+01	4.0128E+00
	2.6074E-01	-2.1125E-03	-2.9045E-02	2.8978E-01	2.7667E-02
20	3.2977E+01	-4.8799E-01	-4.7144E+00	3.7691E+01	8.9088E+00
	2.2737E-01	-3.3646E-03	-3.2504E-02	2.5987E-01	6.1424E-02
21	1.7799E+01	-8.4773E-01	-9.0908E+00	2.6889E+01	4.9066E+00
	1.2272E-01	-5.8449E-03	-6.2679E-02	1.8540E-01	3.3830E-02
22	1.6382E+01	-4.9802E-01	-8.4892E+00	2.4871E+01	5.2865E+00
	1.1295E-01	-3.4337E-03	-5.8531E-02	1.7148E-01	3.6449E-02

**Table 2-80. Load Case 222, Lateral 5g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	3.9664E+01 2.7347E-01	5.1412E+00 3.5448E-02	-3.1095E+00 -2.1439E-02	4.2773E+01 2.9491E-01	1.6856E+01 1.1622E-01
2	3.8945E+01 2.6852E-01	7.0168E+00 4.8379E-02	-4.5213E+00 -3.1173E-02	4.4917E+01 3.0969E-01	1.5730E+01 1.0845E-01
3	3.8260E+01 2.6379E-01	4.7974E+00 3.3077E-02	-3.2801E+00 -2.2615E-02	4.1540E+01 2.8641E-01	1.8125E+01 1.2497E-01
4	3.1260E+01 2.1553E-01	7.9343E-01 5.4705E-03	-3.2650E+00 -2.2511E-02	3.4525E+01 2.3804E-01	1.0276E+01 7.0852E-02
5	2.1546E+01 1.4856E-01	-5.9931E-01 -4.1321E-03	-3.0327E+00 -2.0910E-02	2.8580E+01 1.9705E-01	2.6966E+00 1.8592E-02
6	8.5313E+00 5.8821E-02	-2.9915E+00 -2.0626E-02	-7.3415E+00 -5.0618E-02	1.3288E+01 9.1618E-02	1.1342E+00 7.8201E-03
7	1.4753E+01 1.0172E-01	-4.8617E+00 -3.3520E-02	-1.4021E+01 -9.6674E-02	1.3387E+01 9.2297E-02	1.0994E+00 7.5802E-03
8	1.3885E+01 9.5734E-02	-5.4072E+00 -3.7281E-02	-1.3222E+01 -9.1159E-02	1.2638E+01 8.7136E-02	1.2127E+00 8.3615E-03
9	1.3236E+01 9.1262E-02	-4.9665E+00 -3.4243E-02	-1.2540E+01 -8.6461E-02	1.2012E+01 8.2822E-02	1.1462E+00 7.9027E-03
10	1.1624E+01 8.0147E-02	-2.6261E+00 -1.8106E-02	-6.8047E+00 -4.6917E-02	1.8429E+01 1.2706E-01	3.5615E+00 2.4556E-02
11	1.1585E+01 7.9876E-02	6.3007E-01 4.3442E-03	-4.8805E+00 -3.3650E-02	1.6466E+01 1.1353E-01	3.5411E+00 2.4415E-02
12	7.7600E+00 5.3503E-02	-4.0565E-01 -2.7968E-03	-4.8106E+00 -3.3168E-02	1.2571E+01 8.6671E-02	3.0462E+00 2.1003E-02
13	1.6081E+01 1.1087E-01	-1.5993E+00 -1.1027E-02	-3.9206E+00 -2.7032E-02	2.0002E+01 1.3791E-01	5.0714E+00 3.4966E-02
14	1.7883E+01 1.2330E-01	-3.9660E-01 -2.7345E-03	-4.0312E+00 -2.7794E-02	2.1914E+01 1.5109E-01	4.4087E+00 3.0397E-02
15	6.3161E+00 4.3548E-02	-2.1866E+00 -1.5076E-02	-3.0067E+00 -2.0730E-02	8.0983E+00 5.5836E-02	2.3785E+00 1.6399E-02

16	1.5731E+01	4.5830E-01	-2.9468E+00	1.8678E+01	2.0774E+00
	1.0846E-01	3.1598E-03	-2.0317E-02	1.2878E-01	1.4323E-02
17	6.2280E+00	-2.8764E+00	-5.1119E+00	1.1340E+01	3.3381E+00
	4.2941E-02	-1.9832E-02	-3.5245E-02	7.8186E-02	2.3015E-02
18	5.9466E+00	-2.9376E+00	-5.0214E+00	1.0968E+01	3.0004E+00
	4.1001E-02	-2.0254E-02	-3.4622E-02	7.5622E-02	2.0687E-02
19	1.8909E+01	-1.5320E-01	-2.1063E+00	2.1015E+01	2.0064E+00
	1.3037E-01	-1.0563E-03	-1.4523E-02	1.4489E-01	1.3834E-02
20	1.6488E+01	-2.4400E-01	-2.3572E+00	1.8846E+01	4.4544E+00
	1.1368E-01	-1.6823E-03	-1.6252E-02	1.2994E-01	3.0712E-02
21	8.8993E+00	-4.2386E-01	-4.5454E+00	1.3445E+01	2.4533E+00
	6.1358E-02	-2.9224E-03	-3.1339E-02	9.2698E-02	1.6915E-02
22	8.1908E+00	-2.4901E-01	-4.2446E+00	1.2435E+01	2.6433E+00
	5.6474E-02	-1.7169E-03	-2.9265E-02	8.5739E-02	1.8225E-02

**Table 2-81. Load Case 223, Vertical 2g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.5824E+01 1.0910E-01	1.3769E+00 9.4932E-03	-1.1904E+01 -8.2078E-02	2.5272E+01 1.7424E-01	1.9103E+00 1.3171E-02
2	3.6583E+02 2.5223E+00	5.1326E+01 3.5388E-01	-1.9922E+01 -1.3736E-01	4.7669E+02 3.2867E+00	8.4751E+01 5.8434E-01
3	1.6234E+01 1.1193E-01	1.6494E+00 1.1373E-02	-1.3138E+01 -9.0583E-02	2.6128E+01 1.8015E-01	2.7857E+00 1.9207E-02
4	7.1429E+00 4.9249E-02	2.8061E+00 1.9348E-02	-1.1375E+00 -7.8430E-03	8.5932E+00 5.9248E-02	7.1773E+00 4.9486E-02
5	1.0441E+01 7.1991E-02	2.3594E+00 1.6267E-02	-3.4310E+00 -2.3656E-02	1.3872E+01 9.5647E-02	4.3760E-01 3.0172E-03
6	8.3799E+00 5.7777E-02	2.2804E+00 1.5723E-02	-4.3855E+00 -3.0237E-02	1.6626E+01 1.1463E-01	3.7356E+00 2.5756E-02
7	5.2336E+00 3.6084E-02	3.7936E-01 2.6156E-03	-4.2924E+00 -2.9595E-02	9.5036E+00 6.5525E-02	7.5942E-01 5.2360E-03
8	4.6921E+00 3.2351E-02	6.2000E-01 4.2747E-03	-4.6921E+00 -3.2351E-02	5.6661E+00 3.9066E-02	1.3693E+00 9.4412E-03
9	4.6234E+00 3.1877E-02	2.2395E-01 1.5441E-03	-4.6234E+00 -3.1877E-02	6.4390E+00 4.4395E-02	9.9670E-01 6.8720E-03
10	1.8357E+01 1.2657E-01	4.7530E+00 3.2771E-02	1.1155E+00 7.6912E-03	1.7242E+01 1.1888E-01	8.1740E-01 5.6358E-03
11	1.1996E+01 8.2711E-02	1.9106E-01 1.3173E-03	-1.2269E+00 -8.4593E-03	1.3299E+01 9.1692E-02	1.1556E+01 7.9676E-02
12	6.0250E+00 4.1541E-02	3.4167E-01 2.3557E-03	-2.1504E+00 -1.4827E-02	8.1755E+00 5.6368E-02	5.4546E+00 3.7608E-02
13	7.8809E+00 5.4337E-02	1.6144E+00 1.1131E-02	-2.4262E+00 -1.6728E-02	1.0307E+01 7.1065E-02	7.7148E+00 5.3192E-02
14	7.0999E+00 4.8952E-02	1.7850E+00 1.2307E-02	-2.0296E+00 -1.3994E-02	9.1295E+00 6.2946E-02	6.1607E+00 4.2476E-02
15	4.4532E+00 3.0704E-02	-4.4399E-01 -3.0612E-03	-4.4533E+00 -3.0704E-02	6.5806E+00 4.5372E-02	2.1336E+00 1.4711E-02

16	6.8752E+00 4.7403E-02	2.1663E-01 1.4936E-03	-3.1875E+00 -2.1977E-02	1.0063E+01 6.9380E-02	1.4935E+00 1.0297E-02
17	4.3508E+00 2.9997E-02	1.4174E+00 9.7727E-03	-4.3507E+00 -2.9997E-02	7.3182E+00 5.0457E-02	2.1243E+00 1.4647E-02
18	5.0002E+00 3.4475E-02	9.4257E-01 6.4988E-03	-1.9295E+00 -1.3304E-02	9.9075E+00 6.8310E-02	1.0333E+00 7.1244E-03
19	9.1207E+00 6.2885E-02	1.0719E+00 7.3907E-03	-3.1721E-01 -2.1871E-03	9.4379E+00 6.5072E-02	2.0949E+00 1.4444E-02
20	8.0415E+00 5.5444E-02	2.0293E+00 1.3992E-02	-1.8633E+00 -1.2847E-02	9.9049E+00 6.8292E-02	4.8090E+00 3.3157E-02
21	2.4280E+00 1.6740E-02	-1.4075E-01 -9.7045E-04	-1.3576E+00 -9.3604E-03	3.8128E+00 2.6288E-02	7.8305E-01 5.3989E-03
22	1.7210E+00 1.1866E-02	-1.7757E-01 -1.2243E-03	-1.0343E+00 -7.1316E-03	2.7554E+00 1.8998E-02	1.0311E+00 7.1094E-03

**Table 2-82. Load Case 231, 4-ft. Head-On Drop,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-1.1781E+01 -8.1229E-02	-1.0985E+03 -7.5742E+00	3.4727E+01 2.3944E-01	1.0868E+03 7.4929E+00	3.4599E+02 2.3855E+00		
2	1.2373E+01 8.5309E-02	-5.9157E+02 -4.0787E+00	-2.7822E+01 -1.9182E-01	6.0394E+02 4.1640E+00	5.9061E+01 4.0721E-01		
3	-6.4569E+00 -4.4519E-02	-2.1843E+02 -1.5060E+00	-5.7753E+00 -3.9820E-02	2.1197E+02 1.4615E+00	2.3115E+01 1.5937E-01		
4	6.1400E+02 4.2334E+00	-2.0260E+03 -1.3969E+01	-2.0241E+02 -1.3955E+00	2.6400E+03 1.8202E+01	9.7495E+02 6.7221E+00		
5	2.8812E+02 1.9865E+00	-8.2946E+02 -5.7189E+00	1.4579E+01 1.0052E-01	1.1176E+03 7.7054E+00	8.6904E+02 5.9918E+00		
6	-8.7409E+01 -6.0266E-01	-1.3628E+03 -9.3965E+00	-2.0239E+02 -1.3955E+00	1.2754E+03 8.7938E+00	1.5681E+02 1.0812E+00		
7	1.7158E+00 1.1830E-02	-5.2076E+02 -3.5905E+00	3.8986E+01 2.6880E-01	5.2248E+02 3.6024E+00	1.1015E+00 7.5947E-03		
8	-8.5238E-01 -5.8770E-03	-4.1060E+02 -2.8310E+00	-9.0671E+00 -6.2516E-02	4.0975E+02 2.8251E+00	3.5991E+00 2.4815E-02		
9	-3.8915E-01 -2.6831E-03	-3.1728E+02 -2.1876E+00	4.7881E-01 3.3013E-03	3.1689E+02 2.1849E+00	3.2264E-01 2.2245E-03		
10	-1.0205E+02 -7.0364E-01	-6.2168E+02 -4.2863E+00	-1.2928E+02 -8.9136E-01	5.1962E+02 3.5827E+00	2.3706E+02 1.6345E+00		
11	6.9184E+01 4.7701E-01	-3.5568E+02 -2.4523E+00	-5.7937E+01 -3.9946E-01	4.2486E+02 2.9293E+00	1.7179E+02 1.1845E+00		
12	7.4453E+01 5.1334E-01	-3.9743E+01 -2.7402E-01	6.1540E+01 4.2430E-01	1.1420E+02 7.8736E-01	2.2882E+02 1.5776E+00		
13	7.4744E+01 5.1535E-01	-2.6268E+02 -1.8111E+00	-1.0865E+01 -7.4911E-02	3.3742E+02 2.3265E+00	1.2836E+02 8.8502E-01		
14	7.0821E+01 4.8830E-01	-1.8655E+02 -1.2862E+00	1.8622E+01 1.2840E-01	2.5738E+02 1.7745E+00	8.8913E+01 6.1304E-01		
15	-8.3277E+02 -5.7418E+00	-2.5292E+03 -1.7438E+01	-8.0025E+02 -5.5175E+00	1.6964E+03 1.1696E+01	2.7886E+02 1.9227E+00		

16	1.5449E+02	-5.5559E+02	5.8282E+01	7.1008E+02	2.4754E+02
	1.0651E+00	-3.8307E+00	4.0184E-01	4.8958E+00	1.7068E+00
17	-3.4180E+01	-1.0291E+03	-1.5267E+02	9.9495E+02	1.1348E+02
	-2.3566E-01	-7.0956E+00	-1.0526E+00	6.8600E+00	7.8241E-01
18	-1.8807E+01	-1.0314E+03	-7.4420E+01	1.0126E+03	3.2987E+02
	-1.2967E-01	-7.1114E+00	-5.1311E-01	6.9818E+00	2.2744E+00
19	4.4039E+02	-7.1985E+02	1.1669E+02	1.1602E+03	4.6439E+02
	3.0364E+00	-4.9632E+00	8.0457E-01	7.9995E+00	3.2018E+00
20	4.1983E+02	-8.8913E+02	-8.9073E+01	1.3090E+03	4.0897E+02
	2.8946E+00	-6.1304E+00	-6.1413E-01	9.0250E+00	2.8197E+00
21	-5.3480E+01	-1.3001E+02	-1.2728E+02	7.6528E+01	3.8034E+01
	-3.6873E-01	-8.9637E-01	-8.7755E-01	5.2764E-01	2.6223E-01
22	-1.7542E+02	-1.5442E+03	-1.6486E+02	1.3688E+03	7.8552E+02
	-1.2095E+00	-1.0647E+01	-1.1367E+00	9.4375E+00	5.4160E+00

**Table 2-83. Load Case 232, 30-ft. Head-On Drop Impact Test, Normal Conditions,
Normal Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-3.7664E+01 -2.5969E-01	-2.0445E+03 -1.4096E+01	-3.8817E+02 -2.6763E+00	2.0068E+03 1.3836E+01	6.6642E+02 4.5948E+00		
2	1.9436E+01 1.3400E-01	-1.0696E+03 -7.3745E+00	-8.0832E+01 -5.5732E-01	1.0890E+03 7.5085E+00	6.3311E+01 4.3651E-01		
3	-2.8033E+00 -1.9328E-02	-6.2633E+02 -4.3184E+00	-2.3404E+01 -1.6136E-01	6.2352E+02 4.2990E+00	7.0647E+01 4.8710E-01		
4	3.3546E+02 2.3129E+00	-3.2914E+03 -2.2694E+01	-1.0560E+03 -7.2808E+00	3.6269E+03 2.5007E+01	1.6542E+03 1.1406E+01		
5	-4.2679E+01 -2.9426E-01	-1.0426E+03 -7.1884E+00	-4.4607E+02 -3.0755E+00	9.9991E+02 6.8942E+00	1.1870E+03 8.1838E+00		
6	-1.8983E+02 -1.3088E+00	-9.2086E+02 -6.3491E+00	-3.9715E+02 -2.7383E+00	7.3103E+02 5.0403E+00	1.9662E+02 1.3556E+00		
7	-1.0040E+01 -6.9221E-02	-7.1815E+02 -4.9515E+00	-9.7489E+01 -6.7216E-01	7.0811E+02 4.8822E+00	5.3947E+00 3.7195E-02		
8	-7.1885E+00 -4.9563E-02	-7.0102E+02 -4.8334E+00	-6.8586E+01 -4.7288E-01	6.9384E+02 4.7838E+00	9.4709E-01 6.5299E-03		
9	-2.3051E+00 -1.5893E-02	-5.7443E+02 -3.9605E+00	-1.2598E+01 -8.6858E-02	5.7212E+02 3.9447E+00	9.4499E-01 6.5155E-03		
10	-1.5349E+02 -1.0583E+00	-1.1298E+03 -7.7898E+00	-2.1535E+02 -1.4848E+00	9.7632E+02 6.7315E+00	4.4125E+02 3.0423E+00		
11	1.0340E+02 7.1291E-01	-6.1346E+02 -4.2297E+00	-1.1244E+02 -7.7521E-01	7.1686E+02 4.9426E+00	2.7277E+02 1.8807E+00		
12	1.1401E+02 7.8609E-01	-7.3421E+01 -5.0622E-01	8.3205E+01 5.7368E-01	1.8743E+02 1.2923E+00	3.9316E+02 2.7108E+00		
13	1.3008E+02 8.9686E-01	-5.7284E+02 -3.9496E+00	-5.9139E+01 -4.0775E-01	7.0292E+02 4.8465E+00	4.0703E+02 2.8064E+00		
14	1.3462E+02 9.2815E-01	-4.7673E+02 -3.2869E+00	-1.7402E+01 -1.1998E-01	6.1135E+02 4.2151E+00	2.1895E+02 1.5096E+00		
15	2.2390E+02 1.5437E+00	1.5565E+02 1.0731E+00	2.1375E+02 1.4737E+00	6.8253E+01 4.7059E-01	3.8141E+01 2.6297E-01		

16	5.1030E+01	-5.1030E+02	-1.9782E+02	5.6133E+02	2.3536E+01
	3.5184E-01	-3.5184E+00	-1.3639E+00	3.8702E+00	1.6228E-01
17	1.5478E+02	-5.9532E+02	-3.0416E+02	7.5010E+02	5.8342E+02
	1.0672E+00	-4.1046E+00	-2.0971E+00	5.1717E+00	4.0225E+00
18	1.6269E+02	-1.0551E+03	-3.1323E+02	1.2178E+03	1.0726E+03
	1.1217E+00	-7.2746E+00	-2.1596E+00	8.3963E+00	7.3952E+00
19	2.0525E+02	-9.7621E+02	-3.6657E+02	1.1815E+03	5.9874E+02
	1.4151E+00	-6.7307E+00	-2.5274E+00	8.1459E+00	4.1282E+00
20	-1.7716E+02	-6.4447E+02	-4.3104E+02	4.6731E+02	5.5081E+02
	-1.2215E+00	-4.4435E+00	-2.9719E+00	3.2220E+00	3.7977E+00
21	-1.6729E+00	-9.8990E+00	-3.8560E+00	8.2261E+00	1.8589E+01
	-1.1534E-02	-6.8251E-02	-2.6586E-02	5.6717E-02	1.2817E-01
22	3.3026E+02	8.8571E+01	3.2863E+02	2.4169E+02	1.3664E+02
	2.2771E+00	6.1067E-01	2.2658E+00	1.6664E+00	9.4208E-01

**Table 2-84. Load Combination 101, Hot Environment,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 102, 201, 211

100°F Ambient, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Stress (ksi/MPa)								

Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.73	1.03	0.04	1.76	1.80	20.00	66.30	>10
	5.03	7.09	0.27	12.13	12.39	137.90	457.12	
2	0.24	0.14	0.05	0.38	0.43	20.00	66.30	>10
	1.62	0.98	0.35	2.60	2.94	137.90	457.12	
3	0.16	0.09	0.04	0.25	0.29	20.00	66.30	>10
	1.10	0.65	0.25	1.75	2.00	137.90	457.12	
4	1.35	2.31	0.68	3.66	4.34	20.00	66.30	7.19
	9.32	15.94	4.67	25.26	29.93	137.90	457.12	
5	1.23	1.63	0.47	2.86	3.33	20.00	66.30	9.50
	8.47	11.23	3.23	19.70	22.94	137.90	457.12	
6	0.73	1.17	0.42	1.90	2.32	20.00	66.30	>10
	5.06	8.05	2.90	13.12	16.01	137.90	457.12	
7	0.24	0.05	0.16	0.30	0.46	20.00	66.30	>10
	1.67	0.38	1.10	2.04	3.14	137.90	457.12	
8	0.24	0.05	0.15	0.28	0.43	20.00	66.30	>10
	1.62	0.32	1.05	1.94	3.00	137.90	457.12	
9	0.27	0.07	0.16	0.35	0.51	20.00	66.30	>10
	1.90	0.51	1.08	2.41	3.49	137.90	457.12	
10	0.96	0.12	0.61	1.08	1.69	20.00	66.30	>10
	6.64	0.83	4.21	7.47	11.68	137.90	457.12	
11	0.81	0.96	0.45	1.77	2.22	20.00	66.30	>10
	5.58	6.63	3.11	12.21	15.32	137.90	457.12	
12	0.85	1.20	0.57	2.04	2.61	20.00	66.30	>10
	5.86	8.24	3.90	14.10	18.00	137.90	457.12	
13	1.24	0.88	0.32	2.12	2.44	20.00	66.30	>10
	8.58	6.06	2.21	14.64	16.85	137.90	457.12	

14	1.25 8.61	1.53 10.57	0.32 2.21	2.78 19.18	3.10 21.39	20.00 137.90	66.30 457.12	9.78
15	1.56 10.74	1.70 11.69	1.79 12.34	3.25 22.42	5.04 34.77	20.00 137.90	66.30 457.12	8.22
16	1.60 11.03	2.53 17.46	0.96 6.64	4.13 28.49	5.10 35.13	20.00 137.90	66.30 457.12	6.26
17	1.07 7.39	1.71 11.81	0.58 3.99	2.78 19.20	3.36 23.19	20.00 137.90	66.30 457.12	9.77
18	0.84 5.82	1.36 9.38	0.27 1.85	2.20 15.20	2.47 17.06	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	0.48 3.33	3.51 24.23	4.00 27.55	20.00 137.90	66.30 457.12	7.54
20	1.76 12.10	2.77 19.10	0.59 4.09	4.52 31.20	5.12 35.29	20.00 137.90	66.30 457.12	5.63
21	0.32 2.20	0.52 3.57	0.02 0.14	0.84 5.77	0.86 5.91	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.05 0.33	0.76 5.26	0.81 5.59	20.00 137.90	66.30 457.12	>10

Min MS: 5.630, Location: 20, Combination: Pm+Pb

**Table 2-85. Load Combination 102, Cold Environment,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 104, 201, 211
 -40°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

	Stress (ksi/MPa)							
Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.73	1.03	0.20	1.76	1.95	20.00	70.00	>10
	5.03	7.09	1.35	12.13	13.48	137.90	482.63	
2	0.24	0.14	0.14	0.38	0.52	20.00	70.00	>10
	1.62	0.98	0.97	2.60	3.57	137.90	482.63	
3	0.16	0.09	0.18	0.25	0.43	20.00	70.00	>10
	1.10	0.65	1.25	1.75	3.00	137.90	482.63	
4	1.35	2.31	10.62	3.66	14.28	20.00	70.00	3.20
	9.32	15.94	73.22	25.26	98.48	137.90	482.63	
5	1.23	1.63	16.21	2.86	19.07	20.00	70.00	2.15
	8.47	11.23	111.78	19.70	131.49	137.90	482.63	
6	0.73	1.17	8.16	1.90	10.07	20.00	70.00	4.96
	5.06	8.05	56.29	13.12	69.41	137.90	482.63	
7	0.24	0.05	4.31	0.30	4.61	20.00	70.00	>10
	1.67	0.38	29.72	2.04	31.76	137.90	482.63	
8	0.24	0.05	4.31	0.28	4.59	20.00	70.00	>10
	1.62	0.32	29.68	1.94	31.63	137.90	482.63	
9	0.27	0.07	4.31	0.35	4.66	20.00	70.00	>10
	1.90	0.51	29.69	2.41	32.10	137.90	482.63	
10	0.96	0.12	4.66	1.08	5.75	20.00	70.00	9.44
	6.64	0.83	32.16	7.47	39.62	137.90	482.63	
11	0.81	0.96	2.08	1.77	3.86	20.00	70.00	>10
	5.58	6.63	14.37	12.21	26.58	137.90	482.63	
12	0.85	1.20	1.03	2.04	3.08	20.00	70.00	>10
	5.86	8.24	7.11	14.10	21.21	137.90	482.63	
13	1.24	0.88	7.61	2.12	9.73	20.00	70.00	5.17
	8.58	6.06	52.45	14.64	67.09	137.90	482.63	

14	1.25 8.61	1.53 10.57	5.98 41.23	2.78 19.18	8.76 60.41	20.00 137.90	70.00 482.63	5.85
15	1.56 10.74	1.70 11.69	0.94 6.51	3.25 22.42	4.20 28.94	20.00 137.90	70.00 482.63	8.22
16	1.60 11.03	2.53 17.46	2.10 14.51	4.13 28.49	6.24 43.00	20.00 137.90	70.00 482.63	6.26
17	1.07 7.39	1.71 11.81	1.95 13.45	2.78 19.20	4.74 32.65	20.00 137.90	70.00 482.63	9.77
18	0.84 5.82	1.36 9.38	2.14 14.74	2.20 15.20	4.34 29.95	20.00 137.90	70.00 482.63	>10
19	1.42 9.77	2.10 14.46	2.56 17.62	3.51 24.23	6.07 41.85	20.00 137.90	70.00 482.63	7.54
20	1.76 12.10	2.77 19.10	2.41 16.59	4.52 31.20	6.93 47.79	20.00 137.90	70.00 482.63	5.63
21	0.32 2.20	0.52 3.57	1.15 7.95	0.84 5.77	1.99 13.72	20.00 137.90	70.00 482.63	>10
22	0.39 2.71	0.37 2.55	0.25 1.75	0.76 5.26	1.02 7.01	20.00 137.90	70.00 482.63	>10

Min MS: 2.146, Location: 5, Combination: Pm+Pb+Q

**Table 2-86. Load Combination 103, Increased External Pressure,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 103, 202, 211
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	
---	--	--	-	-----	-----	--	--	--
1	0.73	1.03	0.16	1.76	1.92	20.00	70.00	>10
	5.06	7.08	1.10	12.15	13.25	137.90	482.63	
2	0.23	0.14	0.12	0.37	0.49	20.00	70.00	>10
	1.60	0.97	0.80	2.57	3.37	137.90	482.63	
3	0.16	0.09	0.15	0.25	0.40	20.00	70.00	>10
	1.09	0.62	1.02	1.71	2.73	137.90	482.63	
4	1.19	1.98	8.69	3.17	11.85	20.00	70.00	4.06
	8.20	13.62	59.91	21.83	81.73	137.90	482.63	
5	1.02	1.33	13.27	2.35	15.62	20.00	70.00	2.84
	7.05	9.18	91.47	16.23	107.70	137.90	482.63	
6	0.65	1.00	6.68	1.66	8.34	20.00	70.00	6.20
	4.51	6.92	46.06	11.43	57.49	137.90	482.63	
7	0.26	0.05	3.53	0.32	3.84	20.00	70.00	>10
	1.83	0.37	24.31	2.20	26.51	137.90	482.63	
8	0.26	0.05	3.52	0.30	3.83	20.00	70.00	>10
	1.78	0.32	24.29	2.10	26.39	137.90	482.63	
9	0.30	0.07	3.52	0.37	3.90	20.00	70.00	>10
	2.05	0.51	24.30	2.56	26.86	137.90	482.63	
10	1.05	0.21	3.82	1.27	5.08	20.00	70.00	>10
	7.27	1.47	26.31	8.74	35.05	137.90	482.63	
11	0.79	0.95	1.71	1.74	3.45	20.00	70.00	>10
	5.48	6.52	11.76	12.00	23.75	137.90	482.63	
12	0.83	1.10	0.84	1.94	2.78	20.00	70.00	>10
	5.74	7.61	5.82	13.35	19.17	137.90	482.63	
13	1.14	1.00	6.22	2.14	8.36	20.00	70.00	6.17
	7.85	6.91	42.91	14.76	57.67	137.90	482.63	

14	1.11 7.64	1.37 9.41	4.89 33.74	2.47 17.06	7.37 50.79	20.00 137.90	70.00 482.63	7.14
15	1.79 12.35	2.35 16.23	0.77 5.33	4.15 28.58	4.92 33.91	20.00 137.90	70.00 482.63	6.24
16	1.35 9.34	2.14 14.75	1.72 11.87	3.49 24.08	5.22 35.96	20.00 137.90	70.00 482.63	7.59
17	0.90 6.19	1.42 9.80	1.60 11.00	2.32 15.99	3.92 26.99	20.00 137.90	70.00 482.63	>10
18	0.64 4.43	1.03 7.08	1.75 12.06	1.67 11.51	3.42 23.57	20.00 137.90	70.00 482.63	>10
19	1.08 7.43	1.55 10.66	2.09 14.42	2.62 18.09	4.71 32.51	20.00 137.90	70.00 482.63	>10
20	1.38 9.52	2.07 14.30	1.97 13.58	3.45 23.82	5.42 37.40	20.00 137.90	70.00 482.63	7.68
21	0.27 1.84	0.37 2.52	0.94 6.50	0.63 4.37	1.58 10.87	20.00 137.90	70.00 482.63	>10
22	0.36 2.50	0.37 2.55	0.21 1.43	0.73 5.05	0.94 6.48	20.00 137.90	70.00 482.63	>10

Min MS: 2.841, Location: 5, Combination: Pm+Pb+Q

**Table 2-87. Load Combination 104, Minimum External Pressure,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 101, 201, 202, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 207 kPa (30 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.83	1.16	0.04	1.99	2.03	20.00	70.00	>10	
	5.69	8.02	0.28	13.71	13.99	137.90	482.63		
2	0.42	0.26	0.05	0.67	0.73	20.00	70.00	>10	
	2.86	1.77	0.37	4.64	5.01	137.90	482.63		
3	0.29	0.18	0.04	0.46	0.50	20.00	70.00	>10	
	1.98	1.21	0.26	3.19	3.45	137.90	482.63		
4	2.08	3.73	0.31	5.80	6.12	20.00	70.00	4.17	
	14.31	25.71	2.17	40.02	42.19	137.90	482.63		
5	1.76	2.21	0.35	3.97	4.31	20.00	70.00	6.56	
	12.13	15.22	2.39	27.35	29.74	137.90	482.63		
6	1.22	1.92	0.15	3.14	3.29	20.00	70.00	8.54	
	8.42	13.26	1.02	21.68	22.69	137.90	482.63		
7	0.43	0.10	0.05	0.54	0.59	20.00	70.00	>10	
	3.00	0.72	0.36	3.72	4.08	137.90	482.63		
8	0.43	0.09	0.05	0.53	0.58	20.00	70.00	>10	
	2.99	0.64	0.36	3.63	3.99	137.90	482.63		
9	0.49	0.14	0.05	0.63	0.68	20.00	70.00	>10	
	3.36	1.00	0.36	4.35	4.71	137.90	482.63		
10	1.66	0.27	0.07	1.93	2.00	20.00	70.00	>10	
	11.47	1.86	0.46	13.33	13.79	137.90	482.63		
11	1.41	1.71	0.10	3.12	3.22	20.00	70.00	8.61	
	9.71	11.81	0.67	21.52	22.19	137.90	482.63		
12	1.57	2.08	0.15	3.65	3.79	20.00	70.00	7.23	
	10.81	14.34	1.02	25.15	26.16	137.90	482.63		

13	1.69 11.67	1.19 8.18	0.19 1.29	2.88 19.85	3.07 21.14	20.00 137.90	70.00 482.63	9.42
14	1.72 11.86	2.35 16.19	0.16 1.11	4.07 28.05	4.23 29.17	20.00 137.90	70.00 482.63	6.37
15	3.00 20.68	3.93 27.11	0.96 6.65	6.93 47.79	7.90 54.45	20.00 137.90	70.00 482.63	3.33
16	2.87 19.79	4.59 31.67	0.52 3.55	7.46 51.46	7.98 55.01	20.00 137.90	70.00 482.63	3.02
17	1.87 12.89	3.09 21.31	0.31 2.15	4.96 34.20	5.27 36.35	20.00 137.90	70.00 482.63	5.05
18	1.36 9.40	2.21 15.21	0.15 1.00	3.57 24.60	3.71 25.61	20.00 137.90	70.00 482.63	7.41
19	2.33 16.08	3.61 24.91	0.27 1.87	5.94 40.99	6.22 42.85	20.00 137.90	70.00 482.63	4.05
20	2.83 19.51	4.78 32.94	0.31 2.12	7.61 52.46	7.92 54.57	20.00 137.90	70.00 482.63	2.94
21	0.37 2.56	0.63 4.34	0.02 0.11	1.00 6.90	1.02 7.01	20.00 137.90	70.00 482.63	>10
22	0.49 3.38	0.41 2.84	0.03 0.18	0.90 6.22	0.93 6.40	20.00 137.90	70.00 482.63	>10

Min MS: 2.943, Location: 20, Combination: Pm+Pb

Table 2-88. Load Combination 105, Cold Environment with Maximum Decay Heat, Normal Conditions of Transport – Model AOS-025A

Load Cases: 105, 201, 202, 211
 -40°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 207 kPa (30 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.83	1.16	0.08	1.99	2.07	20.00	70.00	>10	
	5.69	8.02	0.58	13.71	14.29	137.90	482.63		
2	0.42	0.26	0.07	0.67	0.74	20.00	70.00	>10	
	2.86	1.77	0.46	4.64	5.10	137.90	482.63		
3	0.29	0.18	0.07	0.46	0.54	20.00	70.00	>10	
	1.98	1.21	0.50	3.19	3.69	137.90	482.63		
4	2.08	3.73	2.91	5.80	8.71	20.00	70.00	4.17	
	14.31	25.71	20.03	40.02	60.05	137.90	482.63		
5	1.76	2.21	4.49	3.97	8.46	20.00	70.00	6.09	
	12.13	15.22	30.97	27.35	58.31	137.90	482.63		
6	1.22	1.92	2.28	3.14	5.42	20.00	70.00	8.54	
	8.42	13.26	15.71	21.68	37.38	137.90	482.63		
7	0.43	0.10	1.22	0.54	1.76	20.00	70.00	>10	
	3.00	0.72	8.40	3.72	12.12	137.90	482.63		
8	0.43	0.09	1.22	0.53	1.74	20.00	70.00	>10	
	2.99	0.64	8.39	3.63	12.02	137.90	482.63		
9	0.49	0.14	1.22	0.63	1.85	20.00	70.00	>10	
	3.36	1.00	8.40	4.35	12.75	137.90	482.63		
10	1.66	0.27	1.37	1.93	3.30	20.00	70.00	>10	
	11.47	1.86	9.43	13.33	22.76	137.90	482.63		
11	1.41	1.71	0.62	3.12	3.74	20.00	70.00	8.61	
	9.71	11.81	4.27	21.52	25.79	137.90	482.63		
12	1.57	2.08	0.31	3.65	3.96	20.00	70.00	7.23	
	10.81	14.34	2.14	25.15	27.29	137.90	482.63		

13	1.69 11.67	1.19 8.18	2.15 14.85	2.88 19.85	5.03 34.70	20.00 137.90	70.00 482.63	9.42
14	1.72 11.86	2.35 16.19	1.66 11.46	4.07 28.05	5.73 39.52	20.00 137.90	70.00 482.63	6.37
15	3.00 20.68	3.93 27.11	0.29 1.99	6.93 47.79	7.22 49.78	20.00 137.90	70.00 482.63	3.33
16	2.87 19.79	4.59 31.67	0.63 4.34	7.46 51.46	8.09 55.80	20.00 137.90	70.00 482.63	3.02
17	1.87 12.89	3.09 21.31	0.58 3.98	4.96 34.20	5.54 38.18	20.00 137.90	70.00 482.63	5.05
18	1.36 9.40	2.21 15.21	0.63 4.37	3.57 24.60	4.20 28.97	20.00 137.90	70.00 482.63	7.41
19	2.33 16.08	3.61 24.91	0.71 4.91	5.94 40.99	6.66 45.90	20.00 137.90	70.00 482.63	4.05
20	2.83 19.51	4.78 32.94	0.70 4.85	7.61 52.46	8.31 57.31	20.00 137.90	70.00 482.63	2.94
21	0.37 2.56	0.63 4.34	0.36 2.45	1.00 6.90	1.36 9.35	20.00 137.90	70.00 482.63	>10
22	0.49 3.38	0.41 2.84	0.08 0.54	0.90 6.22	0.98 6.75	20.00 137.90	70.00 482.63	>10

Min MS: 2.943, Location: 20, Combination: Pm+Pb

**Table 2-89. Load Combination 106, Maximum Pressure, Hot Environment,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 101, 201, 203, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 207 kPa (30 psia)
 Maximum Increased External Pressure, 140 kPa (20 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.82	1.17	0.04	1.99	2.03	20.00	70.00	>10
	5.64	8.05	0.28	13.69	13.98	137.90	482.63	
2	0.42	0.26	0.05	0.68	0.73	20.00	70.00	>10
	2.90	1.78	0.37	4.68	5.05	137.90	482.63	
3	0.29	0.18	0.04	0.47	0.51	20.00	70.00	>10
	2.00	1.27	0.26	3.27	3.53	137.90	482.63	
4	2.66	4.89	0.31	7.54	7.86	20.00	70.00	2.98
	18.32	33.69	2.17	52.01	54.18	137.90	482.63	
5	2.33	3.17	0.35	5.50	5.85	20.00	70.00	4.45
	16.08	21.84	2.39	37.92	40.31	137.90	482.63	
6	1.44	2.31	0.15	3.75	3.90	20.00	70.00	7.00
	9.94	15.93	1.02	25.87	26.89	137.90	482.63	
7	0.40	0.11	0.05	0.50	0.55	20.00	70.00	>10
	2.73	0.73	0.36	3.46	3.82	137.90	482.63	
8	0.39	0.09	0.05	0.49	0.54	20.00	70.00	>10
	2.72	0.64	0.36	3.36	3.72	137.90	482.63	
9	0.45	0.14	0.05	0.59	0.64	20.00	70.00	>10
	3.09	1.00	0.36	4.08	4.44	137.90	482.63	
10	1.59	0.22	0.07	1.81	1.88	20.00	70.00	>10
	10.94	1.55	0.46	12.49	12.95	137.90	482.63	
11	1.42	1.76	0.10	3.17	3.27	20.00	70.00	8.46
	9.76	12.11	0.67	21.86	22.53	137.90	482.63	
12	1.58	2.12	0.15	3.70	3.85	20.00	70.00	7.11
	10.88	14.63	1.02	25.51	26.53	137.90	482.63	

13	1.79 12.36	1.06 7.28	0.19 1.29	2.85 19.64	3.04 20.93	20.00 137.90	70.00 482.63	9.53
14	1.86 12.84	2.51 17.34	0.16 1.11	4.38 30.17	4.54 31.28	20.00 137.90	70.00 482.63	5.86
15	3.07 21.16	4.05 27.90	0.96 6.65	7.12 49.06	8.08 55.71	20.00 137.90	70.00 482.63	3.22
16	2.92 20.16	4.68 32.26	0.52 3.55	7.60 52.42	8.12 55.97	20.00 137.90	70.00 482.63	2.95
17	1.90 13.11	3.15 21.70	0.31 2.15	5.05 34.82	5.36 36.97	20.00 137.90	70.00 482.63	4.94
18	1.38 9.51	2.23 15.41	0.15 1.00	3.61 24.92	3.76 25.92	20.00 137.90	70.00 482.63	7.30
19	2.36 16.27	3.66 25.22	0.27 1.87	6.02 41.49	6.29 43.35	20.00 137.90	70.00 482.63	3.99
20	2.87 19.77	4.85 33.42	0.31 2.12	7.71 53.18	8.02 55.30	20.00 137.90	70.00 482.63	2.89
21	0.45 3.11	0.84 5.78	0.02 0.11	1.29 8.89	1.30 9.00	20.00 137.90	70.00 482.63	>10
22	0.48 3.30	0.55 3.80	0.03 0.18	1.03 7.10	1.06 7.28	20.00 137.90	70.00 482.63	>10

Min MS: 2.889, Location: 20, Combination: Pm+Pb

**Table 2-90. Load Combination 107, Maximum Pressure, Cold Environment,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 105, 201, 203, 211
 -40°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 207 kPa (30 psia)
 Maximum Increased External Pressure, 140 kPa (20 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q			
---	--	--	-	-----	-----	--	--	--
1	0.82	1.17	0.08	1.99	2.07	20.00	70.00	>10
	5.64	8.05	0.58	13.69	14.27	137.90	482.63	
2	0.42	0.26	0.07	0.68	0.75	20.00	70.00	>10
	2.90	1.78	0.46	4.68	5.14	137.90	482.63	
3	0.29	0.18	0.07	0.47	0.55	20.00	70.00	>10
	2.00	1.27	0.50	3.27	3.77	137.90	482.63	
4	2.66	4.89	2.91	7.54	10.45	20.00	70.00	2.98
	18.32	33.69	20.03	52.01	72.05	137.90	482.63	
5	2.33	3.17	4.49	5.50	9.99	20.00	70.00	4.45
	16.08	21.84	30.97	37.92	68.89	137.90	482.63	
6	1.44	2.31	2.28	3.75	6.03	20.00	70.00	7.00
	9.94	15.93	15.71	25.87	41.58	137.90	482.63	
7	0.40	0.11	1.22	0.50	1.72	20.00	70.00	>10
	2.73	0.73	8.40	3.46	11.86	137.90	482.63	
8	0.39	0.09	1.22	0.49	1.70	20.00	70.00	>10
	2.72	0.64	8.39	3.36	11.75	137.90	482.63	
9	0.45	0.14	1.22	0.59	1.81	20.00	70.00	>10
	3.09	1.00	8.40	4.08	12.48	137.90	482.63	
10	1.59	0.22	1.37	1.81	3.18	20.00	70.00	>10
	10.94	1.55	9.43	12.49	21.92	137.90	482.63	
11	1.42	1.76	0.62	3.17	3.79	20.00	70.00	8.46
	9.76	12.11	4.27	21.86	26.14	137.90	482.63	
12	1.58	2.12	0.31	3.70	4.01	20.00	70.00	7.11
	10.88	14.63	2.14	25.51	27.65	137.90	482.63	

13	1.79 12.36	1.06 7.28	2.15 14.85	2.85 19.64	5.00 34.49	20.00 137.90	70.00 482.63	9.53
14	1.86 12.84	2.51 17.34	1.66 11.46	4.38 30.17	6.04 41.64	20.00 137.90	70.00 482.63	5.86
15	3.07 21.16	4.05 27.90	0.29 1.99	7.12 49.06	7.40 51.05	20.00 137.90	70.00 482.63	3.22
16	2.92 20.16	4.68 32.26	0.63 4.34	7.60 52.42	8.23 56.76	20.00 137.90	70.00 482.63	2.95
17	1.90 13.11	3.15 21.70	0.58 3.98	5.05 34.82	5.63 38.80	20.00 137.90	70.00 482.63	4.94
18	1.38 9.51	2.23 15.41	0.63 4.37	3.61 24.92	4.25 29.28	20.00 137.90	70.00 482.63	7.30
19	2.36 16.27	3.66 25.22	0.71 4.91	6.02 41.49	6.73 46.40	20.00 137.90	70.00 482.63	3.99
20	2.87 19.77	4.85 33.42	0.70 4.85	7.71 53.18	8.42 58.03	20.00 137.90	70.00 482.63	2.89
21	0.45 3.11	0.84 5.78	0.36 2.45	1.29 8.89	1.64 11.34	20.00 137.90	70.00 482.63	>10
22	0.48 3.30	0.55 3.80	0.08 0.54	1.03 7.10	1.11 7.64	20.00 137.90	70.00 482.63	>10

Min MS: 2.889, Location: 20, Combination: Pm+Pb

**Table 2-91. Load Combination 215, Compression Load,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 215, 101, 201, 211
 Compression Load (5x weight)
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.75	1.07	0.04	1.82	1.86	20.00	70.00	>10	
	5.19	7.34	0.28	12.54	12.82	137.90	482.63		
2	0.25	0.14	0.05	0.39	0.45	20.00	70.00	>10	
	1.74	0.98	0.37	2.72	3.09	137.90	482.63		
3	0.18	0.10	0.04	0.28	0.32	20.00	70.00	>10	
	1.24	0.69	0.26	1.93	2.19	137.90	482.63		
4	1.46	2.46	0.31	3.92	4.23	20.00	70.00	6.66	
	10.07	16.93	2.17	27.00	29.17	137.90	482.63		
5	1.31	1.74	0.35	3.05	3.40	20.00	70.00	8.83	
	9.03	12.02	2.39	21.05	23.44	137.90	482.63		
6	0.77	1.19	0.15	1.96	2.11	20.00	70.00	>10	
	5.32	8.19	1.02	13.51	14.52	137.90	482.63		
7	0.25	0.06	0.05	0.31	0.36	20.00	70.00	>10	
	1.76	0.38	0.36	2.14	2.50	137.90	482.63		
8	0.24	0.05	0.05	0.29	0.34	20.00	70.00	>10	
	1.68	0.32	0.36	2.00	2.36	137.90	482.63		
9	0.28	0.07	0.05	0.36	0.41	20.00	70.00	>10	
	1.95	0.51	0.36	2.47	2.83	137.90	482.63		
10	1.00	0.13	0.07	1.12	1.19	20.00	70.00	>10	
	6.86	0.89	0.46	7.75	8.21	137.90	482.63		
11	0.83	0.98	0.10	1.81	1.91	20.00	70.00	>10	
	5.70	6.76	0.67	12.46	13.14	137.90	482.63		
12	0.87	1.22	0.15	2.09	2.24	20.00	70.00	>10	
	5.98	8.44	1.02	14.42	15.43	137.90	482.63		

13	1.30 8.97	0.93 6.42	0.19 1.29	2.23 15.39	2.42 16.68	20.00 137.90	70.00 482.63	>10
14	1.30 8.96	1.58 10.87	0.16 1.11	2.88 19.82	3.04 20.93	20.00 137.90	70.00 482.63	9.43
15	1.71 11.81	1.75 12.08	0.96 6.65	3.47 23.90	4.43 30.55	20.00 137.90	70.00 482.63	7.66
16	1.62 11.15	2.54 17.54	0.52 3.55	4.16 28.68	4.68 32.24	20.00 137.90	70.00 482.63	6.21
17	1.08 7.48	1.73 11.93	0.31 2.15	2.82 19.41	3.13 21.56	20.00 137.90	70.00 482.63	9.66
18	0.86 5.94	1.39 9.57	0.15 1.00	2.25 15.51	2.40 16.52	20.00 137.90	70.00 482.63	>10
19	1.46 10.05	2.14 14.78	0.27 1.87	3.60 24.83	3.87 26.70	20.00 137.90	70.00 482.63	7.33
20	1.81 12.46	2.84 19.57	0.31 2.12	4.65 32.03	4.95 34.15	20.00 137.90	70.00 482.63	5.46
21	0.35 2.44	0.53 3.68	0.02 0.11	0.89 6.12	0.90 6.23	20.00 137.90	70.00 482.63	>10
22	0.45 3.07	0.41 2.81	0.03 0.18	0.85 5.89	0.88 6.06	20.00 137.90	70.00 482.63	>10

Min MS: 5.457, Location: 20, Combination: Pm+Pb

**Table 2-92. Load Combination 216, Rod Drop,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 216, 101, 201, 211
Rod Drop onto Cask
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 207 kPa (30 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.83	1.06	0.04	1.89	1.93	20.00	70.00	>10	
	5.73	7.30	0.28	13.03	13.31	137.90	482.63		
2	0.42	0.16	0.05	0.58	0.63	20.00	70.00	>10	
	2.88	1.10	0.37	3.98	4.35	137.90	482.63		
3	0.36	0.12	0.04	0.49	0.52	20.00	70.00	>10	
	2.49	0.86	0.26	3.35	3.60	137.90	482.63		
4	2.11	2.40	0.31	4.51	4.82	20.00	70.00	5.65	
	14.51	16.57	2.17	31.08	33.25	137.90	482.63		
5	2.10	2.15	0.35	4.25	4.60	20.00	70.00	6.06	
	14.45	14.85	2.39	29.31	31.70	137.90	482.63		
6	1.70	1.58	0.15	3.27	3.42	20.00	70.00	8.17	
	11.69	10.87	1.02	22.56	23.58	137.90	482.63		
7	0.47	0.08	0.05	0.54	0.60	20.00	70.00	>10	
	3.21	0.54	0.36	3.75	4.11	137.90	482.63		
8	0.33	0.05	0.05	0.38	0.43	20.00	70.00	>10	
	2.27	0.33	0.36	2.60	2.96	137.90	482.63		
9	0.37	0.08	0.05	0.44	0.50	20.00	70.00	>10	
	2.54	0.52	0.36	3.07	3.43	137.90	482.63		
10	1.33	0.21	0.07	1.53	1.60	20.00	70.00	>10	
	9.15	1.42	0.46	10.58	11.04	137.90	482.63		
11	1.01	1.19	0.10	2.20	2.30	20.00	70.00	>10	
	6.95	8.22	0.67	15.17	15.84	137.90	482.63		
12	1.07	1.51	0.15	2.58	2.73	20.00	70.00	>10	
	7.35	10.43	1.02	17.78	18.80	137.90	482.63		

13	1.88 12.96	1.44 9.91	0.19 1.29	3.32 22.87	3.50 24.16	20.00 137.90	70.00 482.63	8.04
14	1.83 12.61	2.04 14.04	0.16 1.11	3.87 26.65	4.03 27.76	20.00 137.90	70.00 482.63	6.76
15	15.03 103.64	6.36 43.86	0.96 6.65	21.39 147.50	22.36 154.15	20.00 137.90	70.00 482.63	0.33
16	2.94 20.27	3.99 27.54	0.52 3.55	6.93 47.81	7.45 51.36	20.00 137.90	70.00 482.63	3.33
17	2.27 15.67	3.52 24.30	0.31 2.15	5.80 39.97	6.11 42.12	20.00 137.90	70.00 482.63	4.17
18	1.60 11.03	2.02 13.96	0.15 1.00	3.62 24.99	3.77 26.00	20.00 137.90	70.00 482.63	7.28
19	2.07 14.29	2.30 15.85	0.27 1.87	4.37 30.14	4.64 32.01	20.00 137.90	70.00 482.63	5.86
20	2.98 20.53	3.21 22.10	0.31 2.12	6.18 42.63	6.49 44.75	20.00 137.90	70.00 482.63	3.85
21	0.71 4.90	0.70 4.79	0.02 0.11	1.41 9.69	1.42 9.80	20.00 137.90	70.00 482.63	>10
22	6.45 44.47	1.83 12.61	0.03 0.18	8.28 57.08	8.30 57.26	20.00 137.90	70.00 482.63	2.10

Min MS: 0.331, Location: 15, Combination: Pm

**Table 2-93. Load Combination 217, Rod Drop, Cold Environment,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 216, 104, 201, 211

Rod Drop onto Cask

-40°F Ambient, Zero Decay Heat, Zero Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	
---	--	--	-	-----	-----	--	--	--
1	0.83	1.06	0.20	1.89	2.09	20.00	70.00	>10
	5.73	7.30	1.35	13.03	14.38	137.90	482.63	
2	0.42	0.16	0.14	0.58	0.72	20.00	70.00	>10
	2.88	1.10	0.97	3.98	4.96	137.90	482.63	
3	0.36	0.12	0.18	0.49	0.67	20.00	70.00	>10
	2.49	0.86	1.25	3.35	4.59	137.90	482.63	
4	2.11	2.40	10.62	4.51	15.13	20.00	70.00	2.97
	14.51	16.57	73.22	31.08	104.30	137.90	482.63	
5	2.10	2.15	16.21	4.25	20.46	20.00	70.00	1.93
	14.45	14.85	111.78	29.31	141.09	137.90	482.63	
6	1.70	1.58	8.16	3.27	11.44	20.00	70.00	4.25
	11.69	10.87	56.29	22.56	78.86	137.90	482.63	
7	0.47	0.08	4.31	0.54	4.85	20.00	70.00	>10
	3.21	0.54	29.72	3.75	33.46	137.90	482.63	
8	0.33	0.05	4.31	0.38	4.68	20.00	70.00	>10
	2.27	0.33	29.68	2.60	32.29	137.90	482.63	
9	0.37	0.08	4.31	0.44	4.75	20.00	70.00	>10
	2.54	0.52	29.69	3.07	32.76	137.90	482.63	
10	1.33	0.21	4.66	1.53	6.20	20.00	70.00	8.68
	9.15	1.42	32.16	10.58	42.73	137.90	482.63	
11	1.01	1.19	2.08	2.20	4.28	20.00	70.00	>10
	6.95	8.22	14.37	15.17	29.54	137.90	482.63	
12	1.07	1.51	1.03	2.58	3.61	20.00	70.00	>10
	7.35	10.43	7.11	17.78	24.89	137.90	482.63	

13	1.88 12.96	1.44 9.91	7.61 52.45	3.32 22.87	10.92 75.32	20.00 137.90	70.00 482.63	4.49
14	1.83 12.61	2.04 14.04	5.98 41.23	3.87 26.65	9.85 67.88	20.00 137.90	70.00 482.63	5.09
15	15.03 103.64	6.36 43.86	0.94 6.51	21.39 147.50	22.34 154.01	20.00 137.90	70.00 482.63	0.33
16	2.94 20.27	3.99 27.54	2.10 14.51	6.93 47.81	9.04 62.32	20.00 137.90	70.00 482.63	3.33
17	2.27 15.67	3.52 24.30	1.95 13.45	5.80 39.97	7.75 53.42	20.00 137.90	70.00 482.63	4.17
18	1.60 11.03	2.02 13.96	2.14 14.74	3.62 24.99	5.76 39.74	20.00 137.90	70.00 482.63	7.28
19	2.07 14.29	2.30 15.85	2.56 17.62	4.37 30.14	6.93 47.76	20.00 137.90	70.00 482.63	5.86
20	2.98 20.53	3.21 22.10	2.41 16.59	6.18 42.63	8.59 59.22	20.00 137.90	70.00 482.63	3.85
21	0.71 4.90	0.70 4.79	1.15 7.95	1.41 9.69	2.56 17.64	20.00 137.90	70.00 482.63	>10
22	6.45 44.47	1.83 12.61	0.25 1.75	8.28 57.08	8.53 58.82	20.00 137.90	70.00 482.63	2.10

Min MS: 0.331, Location: 15, Combination: Pm

**Table 2-94. Load Combination 221, Forward Vibration,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 221, 101, 201, 211
Forward 10g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 207 kPa (30 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.75	1.03	0.04	1.78	1.82	20.00	70.00	>10
	5.14	7.11	0.28	12.26	12.54	137.90	482.63	
2	0.38	0.20	0.05	0.57	0.63	20.00	70.00	>10
	2.60	1.35	0.37	3.95	4.32	137.90	482.63	
3	0.18	0.10	0.04	0.28	0.31	20.00	70.00	>10
	1.23	0.68	0.26	1.91	2.16	137.90	482.63	
4	1.36	2.32	0.31	3.68	4.00	20.00	70.00	7.15
	9.40	15.98	2.17	25.38	27.55	137.90	482.63	
5	1.24	1.63	0.35	2.87	3.22	20.00	70.00	9.44
	8.55	11.27	2.39	19.82	22.21	137.90	482.63	
6	0.74	1.17	0.15	1.91	2.06	20.00	70.00	>10
	5.12	8.08	1.02	13.20	14.22	137.90	482.63	
7	0.25	0.05	0.05	0.30	0.36	20.00	70.00	>10
	1.71	0.38	0.36	2.09	2.45	137.90	482.63	
8	0.24	0.05	0.05	0.28	0.34	20.00	70.00	>10
	1.63	0.32	0.36	1.95	2.31	137.90	482.63	
9	0.28	0.07	0.05	0.35	0.41	20.00	70.00	>10
	1.93	0.52	0.36	2.45	2.81	137.90	482.63	
10	0.98	0.12	0.07	1.10	1.17	20.00	70.00	>10
	6.74	0.85	0.46	7.58	8.04	137.90	482.63	
11	0.82	0.97	0.10	1.79	1.89	20.00	70.00	>10
	5.66	6.68	0.67	12.33	13.01	137.90	482.63	

12	0.86 5.91	1.20 8.27	0.15 1.02	2.06 14.18	2.20 15.20	20.00 137.90	70.00 482.63	>10
13	1.25 8.64	0.89 6.12	0.19 1.29	2.14 14.76	2.33 16.05	20.00 137.90	70.00 482.63	>10
14	1.26 8.67	1.54 10.59	0.16 1.11	2.79 19.26	2.95 20.37	20.00 137.90	70.00 482.63	9.74
15	1.56 10.77	1.70 11.69	0.96 6.65	3.26 22.46	4.22 29.11	20.00 137.90	70.00 482.63	8.21
16	1.61 11.09	2.54 17.48	0.52 3.55	4.14 28.57	4.66 32.13	20.00 137.90	70.00 482.63	6.24
17	1.08 7.44	1.72 11.86	0.31 2.15	2.80 19.30	3.11 21.45	20.00 137.90	70.00 482.63	9.72
18	0.85 5.86	1.37 9.42	0.15 1.00	2.22 15.28	2.36 16.28	20.00 137.90	70.00 482.63	>10
19	1.42 9.82	2.10 14.47	0.27 1.87	3.52 24.29	3.79 26.16	20.00 137.90	70.00 482.63	7.52
20	1.76 12.17	2.77 19.11	0.31 2.12	4.54 31.28	4.84 33.40	20.00 137.90	70.00 482.63	5.61
21	0.33 2.28	0.52 3.60	0.02 0.11	0.85 5.89	0.87 6.00	20.00 137.90	70.00 482.63	>10
22	0.40 2.77	0.37 2.58	0.03 0.18	0.78 5.36	0.80 5.54	20.00 137.90	70.00 482.63	>10

Min MS: 5.612, Location: 20, Combination: Pm+Pb

**Table 2-95. Load Combination 222, Lateral Vibration,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 222, 101, 201, 211
Lateral 5g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 207 kPa (30 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.75	1.03	0.04	1.78	1.82	20.00	70.00	>10
	5.15	7.12	0.28	12.27	12.56	137.90	482.63	
2	0.58	0.18	0.05	0.76	0.81	20.00	70.00	>10
	4.00	1.24	0.37	5.24	5.61	137.90	482.63	
3	0.17	0.10	0.04	0.27	0.30	20.00	70.00	>10
	1.17	0.68	0.26	1.85	2.10	137.90	482.63	
4	1.40	2.35	0.31	3.75	4.06	20.00	70.00	7.00
	9.64	16.22	2.17	25.86	28.03	137.90	482.63	
5	1.27	1.66	0.35	2.93	3.28	20.00	70.00	9.22
	8.77	11.46	2.39	20.23	22.62	137.90	482.63	
6	0.78	1.18	0.15	1.96	2.11	20.00	70.00	>10
	5.39	8.15	1.02	13.54	14.56	137.90	482.63	
7	0.25	0.05	0.05	0.30	0.35	20.00	70.00	>10
	1.69	0.38	0.36	2.07	2.43	137.90	482.63	
8	0.24	0.05	0.05	0.29	0.34	20.00	70.00	>10
	1.68	0.32	0.36	2.00	2.36	137.90	482.63	
9	0.28	0.07	0.05	0.36	0.41	20.00	70.00	>10
	1.96	0.51	0.36	2.47	2.83	137.90	482.63	
10	1.02	0.14	0.07	1.17	1.23	20.00	70.00	>10
	7.06	0.97	0.46	8.03	8.49	137.90	482.63	
11	0.85	1.01	0.10	1.86	1.95	20.00	70.00	>10
	5.85	6.96	0.67	12.81	13.48	137.90	482.63	
12	0.87	1.21	0.15	2.08	2.23	20.00	70.00	>10
	6.02	8.31	1.02	14.33	15.35	137.90	482.63	

13	1.28	0.88	0.19	2.17	2.35	20.00	70.00	>10
	8.84	6.10	1.29	14.94	16.23	137.90	482.63	
14	1.28	1.55	0.16	2.82	2.98	20.00	70.00	9.63
	8.80	10.66	1.11	19.47	20.58	137.90	482.63	
15	1.58	1.70	0.96	3.28	4.24	20.00	70.00	8.15
	10.86	11.73	6.65	22.60	29.25	137.90	482.63	
16	1.62	2.56	0.52	4.18	4.69	20.00	70.00	6.18
	11.17	17.63	3.55	28.80	32.35	137.90	482.63	
17	1.09	1.73	0.31	2.81	3.12	20.00	70.00	9.67
	7.49	11.90	2.15	19.39	21.54	137.90	482.63	
18	0.85	1.36	0.15	2.21	2.36	20.00	70.00	>10
	5.88	9.39	1.00	15.27	16.27	137.90	482.63	
19	1.44	2.12	0.27	3.57	3.84	20.00	70.00	7.41
	9.94	14.65	1.87	24.59	26.45	137.90	482.63	
20	1.78	2.79	0.31	4.57	4.88	20.00	70.00	5.57
	12.25	19.24	2.12	31.50	33.61	137.90	482.63	
21	0.33	0.52	0.02	0.85	0.86	20.00	70.00	>10
	2.26	3.58	0.11	5.84	5.95	137.90	482.63	
22	0.41	0.37	0.03	0.78	0.80	20.00	70.00	>10
	2.79	2.57	0.18	5.36	5.54	137.90	482.63	

Min MS: 5.567, Location: 20, Combination: Pm+Pb

**Table 2-96. Load Combination 223, Vertical Vibration,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 223, 101, 201, 211
Vertical 2g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 207 kPa (30 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.76	1.04	0.04	1.80	1.84	20.00	70.00	>10
	5.27	7.15	0.28	12.42	12.70	137.90	482.63	
2	0.92	0.22	0.05	1.14	1.20	20.00	70.00	>10
	6.37	1.51	0.37	7.88	8.25	137.90	482.63	
3	0.18	0.10	0.04	0.28	0.32	20.00	70.00	>10
	1.24	0.70	0.26	1.94	2.20	137.90	482.63	
4	1.45	2.39	0.31	3.84	4.15	20.00	70.00	6.82
	9.97	16.50	2.17	26.46	28.63	137.90	482.63	
5	1.32	1.70	0.35	3.01	3.36	20.00	70.00	8.96
	9.07	11.69	2.39	20.76	23.15	137.90	482.63	
6	0.83	1.20	0.15	2.03	2.17	20.00	70.00	>10
	5.72	8.25	1.02	13.97	14.99	137.90	482.63	
7	0.25	0.06	0.05	0.30	0.36	20.00	70.00	>10
	1.72	0.38	0.36	2.10	2.46	137.90	482.63	
8	0.25	0.05	0.05	0.30	0.35	20.00	70.00	>10
	1.74	0.33	0.36	2.07	2.43	137.90	482.63	
9	0.29	0.07	0.05	0.37	0.42	20.00	70.00	>10
	2.02	0.51	0.36	2.53	2.89	137.90	482.63	
10	1.08	0.16	0.07	1.25	1.31	20.00	70.00	>10
	7.48	1.12	0.46	8.60	9.06	137.90	482.63	
11	0.89	1.06	0.10	1.94	2.04	20.00	70.00	>10
	6.11	7.29	0.67	13.40	14.07	137.90	482.63	

12	0.90 6.18	1.22 8.38	0.15 1.02	2.11 14.56	2.26 15.58	20.00 137.90	70.00 482.63	>10
13	1.32 9.11	0.89 6.14	0.19 1.29	2.21 15.24	2.40 16.53	20.00 137.90	70.00 482.63	>10
14	1.30 9.00	1.56 10.76	0.16 1.11	2.86 19.75	3.03 20.86	20.00 137.90	70.00 482.63	9.47
15	1.59 10.99	1.71 11.78	0.96 6.65	3.30 22.77	4.27 29.43	20.00 137.90	70.00 482.63	8.08
16	1.64 11.31	2.58 17.80	0.52 3.55	4.22 29.11	4.74 32.67	20.00 137.90	70.00 482.63	6.10
17	1.10 7.60	1.74 11.99	0.31 2.15	2.84 19.59	3.15 21.74	20.00 137.90	70.00 482.63	9.56
18	0.86 5.94	1.36 9.40	0.15 1.00	2.22 15.34	2.37 16.34	20.00 137.90	70.00 482.63	>10
19	1.47 10.11	2.15 14.84	0.27 1.87	3.62 24.95	3.89 26.82	20.00 137.90	70.00 482.63	7.29
20	1.80 12.41	2.81 19.39	0.31 2.12	4.61 31.80	4.92 33.92	20.00 137.90	70.00 482.63	5.50
21	0.34 2.32	0.52 3.59	0.02 0.11	0.86 5.91	0.87 6.02	20.00 137.90	70.00 482.63	>10
22	0.42 2.88	0.37 2.58	0.03 0.18	0.79 5.46	0.82 5.64	20.00 137.90	70.00 482.63	>10

Min MS: 5.505, Location: 20, Combination: Pm+Pb

Table 2-97. Load Combination 224, Forward Vibration at Cold Temperature, Normal Conditions of Transport – Model AOS-025A

Load Cases: 221, 103, 201, 211
 Forward 10g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.75 5.14	1.03 7.11	0.16 1.10	1.78 12.26	1.94 13.36	20.00 137.90	70.00 482.63	>10
2	0.38 2.60	0.20 1.35	0.12 0.80	0.57 3.95	0.69 4.74	20.00 137.90	70.00 482.63	>10
3	0.18 1.23	0.10 0.68	0.15 1.02	0.28 1.91	0.42 2.93	20.00 137.90	70.00 482.63	>10
4	1.36 9.40	2.32 15.98	8.69 59.91	3.68 25.38	12.37 85.29	20.00 137.90	70.00 482.63	3.85
5	1.24 8.55	1.63 11.27	13.27 91.47	2.87 19.82	16.14 111.29	20.00 137.90	70.00 482.63	2.72
6	0.74 5.12	1.17 8.08	6.68 46.06	1.91 13.20	8.59 59.26	20.00 137.90	70.00 482.63	5.98
7	0.25 1.71	0.05 0.38	3.53 24.31	0.30 2.09	3.83 26.41	20.00 137.90	70.00 482.63	>10
8	0.24 1.63	0.05 0.32	3.52 24.29	0.28 1.95	3.81 26.24	20.00 137.90	70.00 482.63	>10
9	0.28 1.93	0.07 0.52	3.52 24.30	0.35 2.45	3.88 26.74	20.00 137.90	70.00 482.63	>10
10	0.98 6.74	0.12 0.85	3.82 26.31	1.10 7.58	4.92 33.89	20.00 137.90	70.00 482.63	>10
11	0.82 5.66	0.97 6.68	1.71 11.76	1.79 12.33	3.49 24.09	20.00 137.90	70.00 482.63	>10
12	0.86 5.91	1.20 8.27	0.84 5.82	2.06 14.18	2.90 20.00	20.00 137.90	70.00 482.63	>10

13	1.25 8.64	0.89 6.12	6.22 42.91	2.14 14.76	8.36 57.67	20.00 137.90	70.00 482.63	6.17
14	1.26 8.67	1.54 10.59	4.89 33.74	2.79 19.26	7.69 53.00	20.00 137.90	70.00 482.63	6.81
15	1.56 10.77	1.70 11.69	0.77 5.33	3.26 22.46	4.03 27.79	20.00 137.90	70.00 482.63	8.21
16	1.61 11.09	2.54 17.48	1.72 11.87	4.14 28.57	5.87 40.45	20.00 137.90	70.00 482.63	6.24
17	1.08 7.44	1.72 11.86	1.60 11.00	2.80 19.30	4.40 30.30	20.00 137.90	70.00 482.63	9.72
18	0.85 5.86	1.37 9.42	1.75 12.06	2.22 15.28	3.97 27.34	20.00 137.90	70.00 482.63	>10
19	1.42 9.82	2.10 14.47	2.09 14.42	3.52 24.29	5.61 38.71	20.00 137.90	70.00 482.63	7.52
20	1.76 12.17	2.77 19.11	1.97 13.58	4.54 31.28	6.51 44.86	20.00 137.90	70.00 482.63	5.61
21	0.33 2.28	0.52 3.60	0.94 6.50	0.85 5.89	1.80 12.39	20.00 137.90	70.00 482.63	>10
22	0.40 2.77	0.37 2.58	0.21 1.43	0.78 5.36	0.98 6.79	20.00 137.90	70.00 482.63	>10

Min MS: 2.717, Location: 5, Combination: Pm+Pb+Q

Table 2-98. Load Combination 225, Lateral Vibration at Cold Temperature, Normal Conditions of Transport – Model AOS-025A

Load Cases: 222, 103, 201, 211
 Lateral 5g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.75	1.03	0.16	1.78	1.94	20.00	70.00	>10	
	5.15	7.12	1.10	12.27	13.38	137.90	482.63		
2	0.58	0.18	0.12	0.76	0.88	20.00	70.00	>10	
	4.00	1.24	0.80	5.24	6.04	137.90	482.63		
3	0.17	0.10	0.15	0.27	0.42	20.00	70.00	>10	
	1.17	0.68	1.02	1.85	2.87	137.90	482.63		
4	1.40	2.35	8.69	3.75	12.44	20.00	70.00	3.82	
	9.64	16.22	59.91	25.86	85.77	137.90	482.63		
5	1.27	1.66	13.27	2.93	16.20	20.00	70.00	2.70	
	8.77	11.46	91.47	20.23	111.70	137.90	482.63		
6	0.78	1.18	6.68	1.96	8.64	20.00	70.00	5.94	
	5.39	8.15	46.06	13.54	59.60	137.90	482.63		
7	0.25	0.05	3.53	0.30	3.83	20.00	70.00	>10	
	1.69	0.38	24.31	2.07	26.39	137.90	482.63		
8	0.24	0.05	3.52	0.29	3.81	20.00	70.00	>10	
	1.68	0.32	24.29	2.00	26.29	137.90	482.63		
9	0.28	0.07	3.52	0.36	3.88	20.00	70.00	>10	
	1.96	0.51	24.30	2.47	26.77	137.90	482.63		
10	1.02	0.14	3.82	1.17	4.98	20.00	70.00	>10	
	7.06	0.97	26.31	8.03	34.34	137.90	482.63		
11	0.85	1.01	1.71	1.86	3.56	20.00	70.00	>10	
	5.85	6.96	11.76	12.81	24.56	137.90	482.63		
12	0.87	1.21	0.84	2.08	2.92	20.00	70.00	>10	
	6.02	8.31	5.82	14.33	20.15	137.90	482.63		

13	1.28 8.84	0.88 6.10	6.22 42.91	2.17 14.94	8.39 57.85	20.00 137.90	70.00 482.63	6.15
14	1.28 8.80	1.55 10.66	4.89 33.74	2.82 19.47	7.72 53.20	20.00 137.90	70.00 482.63	6.78
15	1.58 10.86	1.70 11.73	0.77 5.33	3.28 22.60	4.05 27.93	20.00 137.90	70.00 482.63	8.15
16	1.62 11.17	2.56 17.63	1.72 11.87	4.18 28.80	5.90 40.67	20.00 137.90	70.00 482.63	6.18
17	1.09 7.49	1.73 11.90	1.60 11.00	2.81 19.39	4.41 30.40	20.00 137.90	70.00 482.63	9.67
18	0.85 5.88	1.36 9.39	1.75 12.06	2.21 15.27	3.96 27.33	20.00 137.90	70.00 482.63	>10
19	1.44 9.94	2.12 14.65	2.09 14.42	3.57 24.59	5.66 39.00	20.00 137.90	70.00 482.63	7.41
20	1.78 12.25	2.79 19.24	1.97 13.58	4.57 31.50	6.54 45.07	20.00 137.90	70.00 482.63	5.57
21	0.33 2.26	0.52 3.58	0.94 6.50	0.85 5.84	1.79 12.34	20.00 137.90	70.00 482.63	>10
22	0.41 2.79	0.37 2.57	0.21 1.43	0.78 5.36	0.99 6.79	20.00 137.90	70.00 482.63	>10

Min MS: 2.704, Location: 5, Combination: Pm+Pb+Q

Table 2-99. Load Combination 226, Vertical Vibration at Cold Temperature, Normal Conditions of Transport – Model AOS-025A

Load Cases: 223, 103, 201, 211
 Vertical 2g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.76	1.04	0.16	1.80	1.96	20.00	70.00	>10	
	5.27	7.15	1.10	12.42	13.52	137.90	482.63		
2	0.92	0.22	0.12	1.14	1.26	20.00	70.00	>10	
	6.37	1.51	0.80	7.88	8.68	137.90	482.63		
3	0.18	0.10	0.15	0.28	0.43	20.00	70.00	>10	
	1.24	0.70	1.02	1.94	2.97	137.90	482.63		
4	1.45	2.39	8.69	3.84	12.53	20.00	70.00	3.79	
	9.97	16.50	59.91	26.46	86.37	137.90	482.63		
5	1.32	1.70	13.27	3.01	16.28	20.00	70.00	2.69	
	9.07	11.69	91.47	20.76	112.23	137.90	482.63		
6	0.83	1.20	6.68	2.03	8.71	20.00	70.00	5.89	
	5.72	8.25	46.06	13.97	60.03	137.90	482.63		
7	0.25	0.06	3.53	0.30	3.83	20.00	70.00	>10	
	1.72	0.38	24.31	2.10	26.42	137.90	482.63		
8	0.25	0.05	3.52	0.30	3.82	20.00	70.00	>10	
	1.74	0.33	24.29	2.07	26.35	137.90	482.63		
9	0.29	0.07	3.52	0.37	3.89	20.00	70.00	>10	
	2.02	0.51	24.30	2.53	26.83	137.90	482.63		
10	1.08	0.16	3.82	1.25	5.06	20.00	70.00	>10	
	7.48	1.12	26.31	8.60	34.91	137.90	482.63		
11	0.89	1.06	1.71	1.94	3.65	20.00	70.00	>10	
	6.11	7.29	11.76	13.40	25.16	137.90	482.63		
12	0.90	1.22	0.84	2.11	2.96	20.00	70.00	>10	
	6.18	8.38	5.82	14.56	20.38	137.90	482.63		

13	1.32 9.11	0.89 6.14	6.22 42.91	2.21 15.24	8.43 58.16	20.00 137.90	70.00 482.63	6.11
14	1.30 9.00	1.56 10.76	4.89 33.74	2.86 19.75	7.76 53.49	20.00 137.90	70.00 482.63	6.73
15	1.59 10.99	1.71 11.78	0.77 5.33	3.30 22.77	4.08 28.10	20.00 137.90	70.00 482.63	8.08
16	1.64 11.31	2.58 17.80	1.72 11.87	4.22 29.11	5.94 40.99	20.00 137.90	70.00 482.63	6.10
17	1.10 7.60	1.74 11.99	1.60 11.00	2.84 19.59	4.44 30.59	20.00 137.90	70.00 482.63	9.56
18	0.86 5.94	1.36 9.40	1.75 12.06	2.22 15.34	3.97 27.40	20.00 137.90	70.00 482.63	>10
19	1.47 10.11	2.15 14.84	2.09 14.42	3.62 24.95	5.71 39.37	20.00 137.90	70.00 482.63	7.29
20	1.80 12.41	2.81 19.39	1.97 13.58	4.61 31.80	6.58 45.38	20.00 137.90	70.00 482.63	5.50
21	0.34 2.32	0.52 3.59	0.94 6.50	0.86 5.91	1.80 12.41	20.00 137.90	70.00 482.63	>10
22	0.42 2.88	0.37 2.58	0.21 1.43	0.79 5.46	1.00 6.89	20.00 137.90	70.00 482.63	>10

Min MS: 2.686, Location: 5, Combination: Pm+Pb+Q

Table 2-100. Load Combination 231, 4-ft. Head-On Drop, Normal Conditions, Normal Conditions of Transport – Model AOS-025A

Load Cases: 231, 102, 201, 211
 4-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	2.33	1.54	0.04	3.87	3.91	20.00	66.30	6.75
	16.05	10.65	0.27	26.70	26.96	137.90	457.12	
2	1.34	0.21	0.05	1.55	1.60	20.00	66.30	>10
	9.22	1.48	0.35	10.70	11.05	137.90	457.12	
3	1.14	0.30	0.04	1.44	1.48	20.00	66.30	>10
	7.87	2.06	0.25	9.93	10.18	137.90	457.12	
4	4.23	3.63	0.68	7.85	8.53	20.00	66.30	2.82
	29.13	25.00	4.67	54.13	58.80	137.90	457.12	
5	2.07	2.59	0.47	4.66	5.13	20.00	66.30	5.44
	14.24	17.89	3.23	32.13	35.36	137.90	457.12	
6	1.46	1.27	0.42	2.73	3.15	20.00	66.30	10.00
	10.07	8.74	2.90	18.81	21.70	137.90	457.12	
7	0.93	0.06	0.16	0.99	1.14	20.00	66.30	>10
	6.40	0.40	1.10	6.79	7.89	137.90	457.12	
8	0.96	0.05	0.15	1.01	1.16	20.00	66.30	>10
	6.64	0.34	1.05	6.98	8.03	137.90	457.12	
9	0.98	0.07	0.16	1.05	1.21	20.00	66.30	>10
	6.73	0.51	1.08	7.24	8.32	137.90	457.12	
10	2.55	0.84	0.61	3.39	4.00	20.00	66.30	6.83
	17.60	5.78	4.21	23.39	27.60	137.90	457.12	
11	1.95	1.38	0.45	3.33	3.78	20.00	66.30	8.01
	13.43	9.54	3.11	22.97	26.07	137.90	457.12	
12	1.17	1.86	0.57	3.03	3.60	20.00	66.30	8.90
	8.08	12.81	3.90	20.89	24.79	137.90	457.12	

13	2.50 17.25	1.68 11.59	0.32 2.21	4.18 28.84	4.50 31.05	20.00 137.90	66.30 457.12	6.17
14	2.43 16.74	1.94 13.35	0.32 2.21	4.36 30.09	4.68 32.30	20.00 137.90	66.30 457.12	5.87
15	1.59 10.97	1.72 11.83	1.79 12.34	3.31 22.80	5.10 35.14	20.00 137.90	66.30 457.12	8.07
16	1.97 13.58	2.54 17.51	0.96 6.64	4.51 31.09	5.47 37.73	20.00 137.90	66.30 457.12	5.65
17	1.55 10.71	2.09 14.39	0.58 3.99	3.64 25.10	4.22 29.09	20.00 137.90	66.30 457.12	7.24
18	1.73 11.91	2.13 14.70	0.27 1.85	3.86 26.61	4.13 28.46	20.00 137.90	66.30 457.12	6.77
19	2.34 16.14	2.59 17.83	0.48 3.33	4.93 33.97	5.41 37.29	20.00 137.90	66.30 457.12	5.09
20	2.26 15.56	3.22 22.20	0.59 4.09	5.48 37.76	6.07 41.86	20.00 137.90	66.30 457.12	4.48
21	1.08 7.45	0.84 5.77	0.02 0.14	1.92 13.22	1.94 13.36	20.00 137.90	66.30 457.12	>10
22	0.52 3.60	0.46 3.16	0.05 0.33	0.98 6.76	1.03 7.09	20.00 137.90	66.30 457.12	>10

Min MS: 2.821, Location: 4, Combination: Pm+Pb

Table 2-101. Load Combination 232, 30-ft. Head-On Drop, Normal Conditions (Impact Test), Normal Conditions of Transport – Model AOS-025A

Load Cases: 232, 102, 201, 211
 30-ft. Head-On Drop Impact Test, Normal Conditions
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	2.74	1.70	0.04	4.43	4.47	20.00	66.30	5.77
	18.87	11.69	0.27	30.56	30.82	137.90	457.12	
2	1.32	0.20	0.05	1.53	1.58	20.00	66.30	>10
	9.13	1.41	0.35	10.54	10.89	137.90	457.12	
3	0.78	0.16	0.04	0.95	0.98	20.00	66.30	>10
	5.40	1.13	0.25	6.53	6.78	137.90	457.12	
4	4.98	3.97	0.68	8.94	9.62	20.00	66.30	2.35
	34.33	27.34	4.67	61.67	66.34	137.90	457.12	
5	2.23	2.82	0.47	5.04	5.51	20.00	66.30	4.95
	15.37	19.41	3.23	34.78	38.02	137.90	457.12	
6	1.47	1.36	0.42	2.83	3.25	20.00	66.30	9.60
	10.10	9.41	2.90	19.51	22.41	137.90	457.12	
7	0.95	0.06	0.16	1.01	1.17	20.00	66.30	>10
	6.55	0.41	1.10	6.96	8.06	137.90	457.12	
8	0.93	0.05	0.15	0.98	1.13	20.00	66.30	>10
	6.40	0.33	1.05	6.73	7.79	137.90	457.12	
9	0.85	0.08	0.16	0.92	1.08	20.00	66.30	>10
	5.84	0.52	1.08	6.36	7.44	137.90	457.12	
10	1.94	0.56	0.61	2.50	3.11	20.00	66.30	9.31
	13.37	3.87	4.21	17.24	21.45	137.90	457.12	
11	1.53	1.23	0.45	2.76	3.21	20.00	66.30	9.87
	10.52	8.51	3.11	19.03	22.14	137.90	457.12	
12	1.04	1.59	0.57	2.63	3.19	20.00	66.30	>10
	7.15	10.95	3.90	18.10	22.00	137.90	457.12	

13	1.95 13.43	1.29 8.86	0.32 2.21	3.23 22.29	3.55 24.50	20.00 137.90	66.30 457.12	8.28
14	1.86 12.83	1.75 12.08	0.32 2.21	3.61 24.90	3.93 27.11	20.00 137.90	66.30 457.12	7.31
15	1.63 11.21	1.73 11.95	1.79 12.34	3.36 23.16	5.15 35.50	20.00 137.90	66.30 457.12	7.93
16	2.16 14.90	2.56 17.62	0.96 6.64	4.72 32.52	5.68 39.17	20.00 137.90	66.30 457.12	5.36
17	1.82 12.56	2.30 15.84	0.58 3.99	4.12 28.40	4.70 32.39	20.00 137.90	66.30 457.12	6.28
18	2.06 14.22	2.43 16.78	0.27 1.85	4.50 30.99	4.76 32.85	20.00 137.90	66.30 457.12	5.67
19	2.60 17.91	2.70 18.59	0.48 3.33	5.29 36.50	5.78 39.83	20.00 137.90	66.30 457.12	4.67
20	2.22 15.32	3.32 22.89	0.59 4.09	5.54 38.22	6.14 42.31	20.00 137.90	66.30 457.12	4.41
21	0.33 2.26	0.54 3.70	0.02 0.14	0.86 5.96	0.88 6.10	20.00 137.90	66.30 457.12	>10
22	0.63 4.37	0.51 3.50	0.05 0.33	1.14 7.87	1.19 8.20	20.00 137.90	66.30 457.12	>10

Min MS: 2.354, Location: 4, Combination: Pm+Pb

**Table 2-102. Load Combination 233, 4-ft. Drop at Cold Temperature,
Normal Conditions of Transport – Model AOS-025A**

Load Cases: 231, 103, 211

4-ft. Head-On Drop

-20°F Ambient, Zero Decay Heat, Zero Insolation

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	2.24	1.41	0.16	3.65	3.81	20.00	70.00	7.23
	15.42	9.71	1.10	25.14	26.24	137.90	482.63	
2	1.15	0.10	0.12	1.25	1.37	20.00	70.00	>10
	7.95	0.68	0.80	8.63	9.43	137.90	482.63	
3	1.01	0.21	0.15	1.22	1.37	20.00	70.00	>10
	6.98	1.47	1.02	8.45	9.47	137.90	482.63	
4	3.34	1.87	8.69	5.21	13.90	20.00	70.00	3.32
	23.02	12.91	59.91	35.94	95.85	137.90	482.63	
5	1.33	1.72	13.27	3.05	16.31	20.00	70.00	2.68
	9.16	11.85	91.47	21.01	112.48	137.90	482.63	
6	0.89	0.35	6.68	1.24	7.92	20.00	70.00	6.57
	6.15	2.41	46.06	8.56	54.62	137.90	482.63	
7	0.76	0.01	3.53	0.76	4.29	20.00	70.00	>10
	5.23	0.05	24.31	5.27	29.58	137.90	482.63	
8	0.79	0.00	3.52	0.79	4.31	20.00	70.00	>10
	5.43	0.02	24.29	5.45	29.73	137.90	482.63	
9	0.79	0.00	3.52	0.79	4.31	20.00	70.00	>10
	5.42	0.03	24.30	5.45	29.75	137.90	482.63	
10	1.94	0.78	3.82	2.73	6.54	20.00	70.00	8.17
	13.40	5.39	26.31	18.79	45.10	137.90	482.63	
11	1.33	0.62	1.71	1.95	3.66	20.00	70.00	>10
	9.20	4.25	11.76	13.44	25.20	137.90	482.63	
12	0.44	0.88	0.84	1.32	2.16	20.00	70.00	>10
	3.02	6.08	5.82	9.10	14.91	137.90	482.63	
13	1.95	1.50	6.22	3.44	9.67	20.00	70.00	5.21
	13.43	10.31	42.91	23.75	66.66	137.90	482.63	

14	1.82 12.52	0.95 6.57	4.89 33.74	2.77 19.09	7.66 52.83	20.00 137.90	70.00 482.63	6.83
15	0.38 2.64	0.14 0.95	0.77 5.33	0.52 3.59	1.29 8.92	20.00 137.90	70.00 482.63	>10
16	0.45 3.12	0.09 0.59	1.72 11.87	0.54 3.71	2.26 15.58	20.00 137.90	70.00 482.63	>10
17	0.58 4.01	0.42 2.87	1.60 11.00	1.00 6.88	2.59 17.89	20.00 137.90	70.00 482.63	>10
18	1.01 6.93	0.95 6.58	1.75 12.06	1.96 13.51	3.71 25.58	20.00 137.90	70.00 482.63	>10
19	1.09 7.49	0.52 3.58	2.09 14.42	1.61 11.07	3.70 25.49	20.00 137.90	70.00 482.63	>10
20	0.81 5.57	0.52 3.56	1.97 13.58	1.32 9.13	3.29 22.70	20.00 137.90	70.00 482.63	>10
21	0.98 6.73	0.57 3.95	0.94 6.50	1.55 10.68	2.49 17.19	20.00 137.90	70.00 482.63	>10
22	0.39 2.71	0.42 2.88	0.21 1.43	0.81 5.59	1.02 7.02	20.00 137.90	70.00 482.63	>10

Min MS: 2.678, Location: 5, Combination: Pm+Pb+Q

2.12.2.1.2 Hypothetical Accident Conditions of Transport, Summary of Damages (Stresses) – Model AOS-025A

Table 2-103 and Table 2-104 present Model AOS-025A transport package Load Cases and Load Combinations, respectively, under Hypothetical Accident conditions of transport:

- Table 2-105 through Table 2-117 present Model AOS-025A transport package output data, for the Load Cases listed in Table 2-103. Comparisons with allowable stress limits are included for Load Cases 111 and 112.
- Table 2-118 through Table 2-132 present Model AOS-025A transport package output data, for the Load Combinations listed in Table 2-103.

Table 2-103. Load Cases Associated with Allowable Stresses under Hypothetical Accident Conditions of Transport – Model AOS-025A

Load Case	Description	Data
111	Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat	Table 2-105
112	Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-106
	Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-107
	Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-108
	Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-109
	Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-110
301	30-ft. Head-On Drop	Table 2-111
302	30-ft. Side Drop + Slap-Down	Table 2-112
303	30-ft. Cg/Corner Drop	Table 2-113
304	30-ft. Head-On Drop at -40°F, Low Temperature	Table 2-114
305	30-ft. Side Drop + Slap-Down at -40°F, Low Temperature	Table 2-115
306	30-ft. Cg/Corner Drop at -40°F, Low Temperature	Table 2-116
311	4-ft. Drop onto Rod	Table 2-117

**Table 2-104. Load Combinations Associated with Allowable Stresses
under Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Combination	Load Cases ^a	Description	Data
301	301, 102, 201, 211	Head-On Drop Orientation	Table 2-118
302	302, 102, 201, 211	Side Drop Orientation	Table 2-119
303	303, 102, 201, 211	Cg/Corner Drop Orientation	Table 2-120
304	304, 105, 202, 21	Head-On Drop Orientation at -40°F, Cold Environment	Table 2-121
305	305, 105, 202, 211	Side Drop Orientation at -40°F, Cold Environment	Table 2-122
306	306, 105, 202, 211	Cg/Corner Drop Orientation at -40°F, Cold Environment	Table 2-123
310	204, 101, 211	Additional Increased External Pressure (290 psi)	Table 2-124
311	311, 101, 201, 211	4-ft. Drop onto Rod	Table 2-125
312	311, 104, 201, 211	4-ft. Drop onto Rod at -40°F, Cold Environment	Table 2-126
350	111, 201, 211	Fire at 30 Minutes	Table 2-127
351	112, 201, 211	Post Fire at 60 Minutes	Table 2-128
352		Post Fire at 90 Minutes	Table 2-129
353		Post Fire at 120 Minutes	Table 2-130
354		Post Fire at 150 Minutes	Table 2-131
355		Post Fire at 180 Minutes	Table 2-132

a. Some Normal conditions of transport Load Cases are included in Hypothetical Accident conditions of transport Load Combinations, to meet regulatory requirements.

Table 2-105. Load Case 111, Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	5.9151E+01 4.0783E-01	-5.3232E+01 -3.6702E-01	1.3313E+01 9.1791E-02	1.1238E+02 7.7485E-01	1.5376E+02 1.0602E+00		
2	1.0643E+02 7.3381E-01	-5.5001E+01 -3.7922E-01	1.2785E+02 8.8146E-01	1.6143E+02 1.1130E+00	6.9698E+01 4.8055E-01		
3	6.2110E+01 4.2823E-01	-2.6745E+01 -1.8440E-01	1.9476E+02 1.3428E+00	8.8855E+01 6.1264E-01	7.7603E+01 5.3505E-01		
4	4.3362E+02 2.9897E+00	-5.5844E+02 -3.8503E+00	-3.8678E+02 -2.6668E+00	9.9206E+02 6.8400E+00	1.9172E+03 1.3219E+01		
5	3.8148E+02 2.6302E+00	-3.7522E+02 -2.5870E+00	-6.8435E+02 -4.7184E+00	7.5670E+02 5.2173E+00	1.0010E+03 6.9018E+00		
6	4.0684E+01 2.8051E-01	-5.3326E+02 -3.6767E+00	-1.4645E+03 -1.0097E+01	5.7395E+02 3.9572E+00	9.0795E+02 6.2601E+00		
7	-9.7383E+01 -6.7143E-01	-3.1357E+02 -2.1620E+00	-2.4083E+03 -1.6605E+01	2.1619E+02 1.4906E+00	1.1302E+02 7.7921E-01		
8	-9.9918E+01 -6.8891E-01	-3.1977E+02 -2.2048E+00	-2.4959E+03 -1.7208E+01	2.1986E+02 1.5159E+00	1.0276E+02 7.0848E-01		
9	-9.5765E+01 -6.6028E-01	-3.2978E+02 -2.2737E+00	-2.5572E+03 -1.7631E+01	2.3401E+02 1.6135E+00	1.2969E+02 8.9416E-01		
10	1.2245E+01 8.4428E-02	-7.1869E+02 -4.9552E+00	-1.4017E+03 -9.6641E+00	7.3093E+02 5.0396E+00	2.2478E+02 1.5498E+00		
11	-8.2223E+01 -5.6691E-01	-6.3254E+02 -4.3612E+00	-6.1550E+02 -4.2437E+00	5.5032E+02 3.7943E+00	8.8898E+02 6.1293E+00		
12	4.9503E+01 3.4131E-01	-6.1932E+02 -4.2701E+00	-5.8968E+02 -4.0657E+00	6.6882E+02 4.6114E+00	9.5462E+02 6.5819E+00		
13	8.9949E+01 6.2018E-01	-2.4788E+02 -1.7091E+00	-8.5093E+01 -5.8670E-01	3.3783E+02 2.3292E+00	2.4896E+02 1.7165E+00		
14	8.0233E+01 5.5318E-01	-3.2160E+02 -2.2173E+00	-8.3643E+01 -5.7670E-01	4.0183E+02 2.7705E+00	6.8238E+02 4.7048E+00		
15	9.4434E+02 6.5110E+00	-8.9523E+02 -6.1724E+00	-1.2427E+02 -8.5678E-01	1.8396E+03 1.2683E+01	3.0698E+03 2.1165E+01		

16	3.3951E+02	-6.9570E+02	-1.8148E+02	1.0352E+03	1.6900E+03
	2.3408E+00	-4.7967E+00	-1.2512E+00	7.1375E+00	1.1652E+01
17	1.4898E+02	-4.7259E+02	6.9752E+01	6.2157E+02	1.0754E+03
	1.0272E+00	-3.2584E+00	4.8092E-01	4.2856E+00	7.4146E+00
18	4.4400E+01	-2.4591E+02	1.3609E+02	2.9031E+02	4.8639E+02
	3.0613E-01	-1.6955E+00	9.3831E-01	2.0016E+00	3.3535E+00
19	1.3831E+02	-3.7598E+02	1.2475E+01	5.1428E+02	8.3821E+02
	9.5360E-01	-2.5923E+00	8.6011E-02	3.5459E+00	5.7793E+00
20	2.0049E+02	-5.0043E+02	-2.9970E+01	7.0092E+02	1.3136E+03
	1.3823E+00	-3.4504E+00	-2.0663E-01	4.8327E+00	9.0567E+00
21	1.8646E+01	-4.1953E+01	-4.0036E+01	6.0598E+01	6.4045E+01
	1.2856E-01	-2.8925E-01	-2.7604E-01	4.1781E-01	4.4158E-01
22	4.6123E+00	-4.1220E+01	-2.0625E+01	4.5833E+01	1.0609E+02
	3.1801E-02	-2.8420E-01	-1.4221E-01	3.1601E-01	7.3148E-01

Allowable Stress for Load Case 111

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	254.94	254.69	20.00	23.60	66.30
2	255.08	254.68	20.00	23.60	66.30
3	254.67	254.31	20.00	23.60	66.30
4	255.26	255.23	20.00	23.60	66.30
5	255.67	255.58	20.00	23.60	66.30
6	256.08	255.90	20.00	23.60	66.30
7	257.07	256.75	20.00	23.60	66.30
8	257.05	256.72	20.00	23.60	66.30
9	256.97	256.64	20.00	23.60	66.30
10	256.45	256.10	20.00	23.60	66.30
11	256.50	255.87	20.00	23.60	66.30
12	257.17	256.36	20.00	23.60	66.30
13	255.37	255.21	20.00	23.60	66.30
14	255.12	255.04	20.00	23.60	66.30
15	255.03	254.92	20.00	23.60	66.30
16	254.90	254.85	20.00	23.60	66.30
17	254.95	254.89	20.00	23.60	66.30
18	255.22	255.19	20.00	23.60	66.30
19	255.31	255.27	20.00	23.60	66.30
20	255.97	255.79	20.00	23.60	66.30
21	254.52	254.20	20.00	23.60	66.30
22	254.77	254.65	20.00	23.60	66.30

Table 2-106. Load Case 112, Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.3943E+01 9.6135E-02	-3.0431E+01 -2.0981E-01	1.6392E+00 1.1302E-02	4.4374E+01 3.0595E-01	6.1122E+01 4.2142E-01		
2	1.6628E+01 1.1465E-01	-2.6938E+01 -1.8573E-01	-1.3796E+01 -9.5122E-02	4.3566E+01 3.0038E-01	7.1288E+01 4.9151E-01		
3	9.3689E+00 6.4596E-02	-5.0466E+00 -3.4795E-02	1.8256E+01 1.2587E-01	1.4415E+01 9.9391E-02	2.2622E+01 1.5597E-01		
4	4.4069E+02 3.0384E+00	-3.6547E+02 -2.5198E+00	-2.5565E+02 -1.7626E+00	8.0616E+02 5.5583E+00	1.4932E+03 1.0295E+01		
5	4.0664E+02 2.8037E+00	-1.6404E+02 -1.1310E+00	-6.0379E+02 -4.1630E+00	5.7068E+02 3.9347E+00	4.5801E+02 3.1578E+00		
6	6.5258E+01 4.4993E-01	-4.7711E+02 -3.2896E+00	-1.5139E+03 -1.0438E+01	5.4237E+02 3.7395E+00	8.1254E+02 5.6023E+00		
7	-8.0879E+01 -5.5764E-01	-3.0737E+02 -2.1193E+00	-2.5665E+03 -1.7696E+01	2.2649E+02 1.5616E+00	6.0090E+01 4.1431E-01		
8	-8.4611E+01 -5.8337E-01	-3.0428E+02 -2.0979E+00	-2.5840E+03 -1.7816E+01	2.1967E+02 1.5146E+00	3.9199E+01 2.7026E-01		
9	-8.1452E+01 -5.6159E-01	-3.0926E+02 -2.1323E+00	-2.6190E+03 -1.8058E+01	2.2781E+02 1.5707E+00	5.8675E+01 4.0455E-01		
10	7.0839E+01 4.8842E-01	-7.9974E+02 -5.5140E+00	-1.3864E+03 -9.5589E+00	8.7058E+02 6.0024E+00	2.2569E+02 1.5561E+00		
11	-9.7611E+01 -6.7301E-01	-7.0238E+02 -4.8427E+00	-6.3264E+02 -4.3619E+00	6.0477E+02 4.1697E+00	9.7648E+02 6.7326E+00		
12	4.4142E+01 3.0435E-01	-7.1010E+02 -4.8960E+00	-6.7833E+02 -4.6769E+00	7.5424E+02 5.2003E+00	1.0324E+03 7.1180E+00		
13	1.6690E+02 1.1507E+00	-2.3658E+02 -1.6312E+00	-5.7161E+01 -3.9411E-01	4.0348E+02 2.7819E+00	5.1233E+02 3.5324E+00		
14	1.1456E+02 7.8989E-01	-3.1120E+02 -2.1456E+00	-9.9917E+01 -6.8890E-01	4.2576E+02 2.9355E+00	7.9285E+02 5.4665E+00		
15	1.0131E+03 6.9848E+00	-9.4631E+02 -6.5246E+00	-8.9292E+01 -6.1565E-01	1.9594E+03 1.3509E+01	3.2916E+03 2.2695E+01		

16	3.5309E+02	-7.0175E+02	-2.2426E+02	1.0548E+03	1.7142E+03
	2.4344E+00	-4.8384E+00	-1.5462E+00	7.2728E+00	1.1819E+01
17	1.5453E+02	-4.7982E+02	3.4095E+01	6.3436E+02	1.0959E+03
	1.0655E+00	-3.3083E+00	2.3508E-01	4.3737E+00	7.5557E+00
18	4.2638E+01	-2.5221E+02	2.3599E+02	2.9485E+02	4.7392E+02
	2.9398E-01	-1.7390E+00	1.6271E+00	2.0329E+00	3.2676E+00
19	1.2757E+02	-4.0644E+02	1.3858E+02	5.3402E+02	8.8967E+02
	8.7957E-01	-2.8023E+00	9.5545E-01	3.6819E+00	6.1341E+00
20	1.3177E+02	-5.1216E+02	-2.1697E+01	6.4393E+02	1.2061E+03
	9.0855E-01	-3.5312E+00	-1.4960E-01	4.4398E+00	8.3160E+00
21	1.3371E+01	-8.5806E+01	-8.5802E+01	9.9177E+01	3.0133E+01
	9.2187E-02	-5.9161E-01	-5.9159E-01	6.8380E-01	2.0776E-01
22	4.6085E+01	-2.7761E+01	4.5958E+01	7.3847E+01	5.0029E+01
	3.1775E-01	-1.9141E-01	3.1687E-01	5.0915E-01	3.4494E-01

Allowable Stress for Load Case 112 (Post Fire at 60 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	272.45	272.11	20.00	23.60	66.30
2	273.64	273.33	20.00	23.60	66.30
3	274.61	274.55	20.00	23.60	66.30
4	272.15	272.10	20.00	23.60	66.30
5	273.06	272.89	20.00	23.60	66.30
6	273.33	273.24	20.00	23.60	66.30
7	274.22	274.08	20.00	23.60	66.30
8	274.58	274.43	20.00	23.60	66.30
9	274.90	274.76	20.00	23.60	66.30
10	275.60	275.33	20.00	23.60	66.30
11	275.89	275.72	20.00	23.60	66.30
12	276.48	276.24	20.00	23.60	66.30
13	275.60	275.59	20.00	23.60	66.30
14	275.59	275.59	20.00	23.60	66.30
15	270.99	270.97	20.00	23.60	66.30
16	271.35	271.29	20.00	23.60	66.30
17	271.39	271.36	20.00	23.60	66.30
18	271.73	271.68	20.00	23.60	66.30
19	272.02	271.91	20.00	23.60	66.30
20	273.35	273.16	20.00	23.60	66.30
21	277.94	277.73	20.00	23.60	66.30
22	270.88	270.86	20.00	23.60	66.30

Table 2-107. Load Case 112, Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.2198E+01 8.4102E-02	-2.7116E+01 -1.8696E-01	-2.3369E-01 -1.6113E-03	3.9314E+01 2.7106E-01	5.9159E+01 4.0789E-01		
2	1.6890E+01 1.1645E-01	-2.9454E+01 -2.0308E-01	-1.1593E+01 -7.9928E-02	4.6344E+01 3.1953E-01	9.0990E+01 6.2735E-01		
3	7.7301E+00 5.3297E-02	-1.3987E+01 -9.6434E-02	6.2882E+00 4.3356E-02	2.1717E+01 1.4973E-01	2.7365E+01 1.8867E-01		
4	4.7105E+02 3.2478E+00	-3.7259E+02 -2.5689E+00	-2.8236E+02 -1.9468E+00	8.4364E+02 5.8167E+00	1.5516E+03 1.0698E+01		
5	4.4243E+02 3.0505E+00	-1.6646E+02 -1.1477E+00	-5.8252E+02 -4.0163E+00	6.0890E+02 4.1982E+00	4.6484E+02 3.2050E+00		
6	7.3487E+01 5.0668E-01	-4.9179E+02 -3.3908E+00	-1.5134E+03 -1.0434E+01	5.6527E+02 3.8974E+00	8.4899E+02 5.8536E+00		
7	-8.2883E+01 -5.7146E-01	-3.1146E+02 -2.1475E+00	-2.5960E+03 -1.7899E+01	2.2858E+02 1.5760E+00	6.1708E+01 4.2546E-01		
8	-8.6761E+01 -5.9820E-01	-3.0681E+02 -2.1154E+00	-2.6015E+03 -1.7937E+01	2.2005E+02 1.5172E+00	3.9334E+01 2.7120E-01		
9	-8.3640E+01 -5.7668E-01	-3.1044E+02 -2.1404E+00	-2.6247E+03 -1.8097E+01	2.2680E+02 1.5638E+00	5.8013E+01 3.9999E-01		
10	6.7941E+01 4.6844E-01	-7.9554E+02 -5.4851E+00	-1.3894E+03 -9.5799E+00	8.6348E+02 5.9535E+00	2.3917E+02 1.6490E+00		
11	-1.0733E+02 -7.4002E-01	-7.1296E+02 -4.9157E+00	-6.5239E+02 -4.4981E+00	6.0563E+02 4.1757E+00	9.3260E+02 6.4301E+00		
12	3.5338E+01 2.4365E-01	-7.2035E+02 -4.9666E+00	-6.9753E+02 -4.8093E+00	7.5569E+02 5.2103E+00	9.8598E+02 6.7981E+00		
13	1.4662E+02 1.0109E+00	-2.7085E+02 -1.8674E+00	-7.1948E+01 -4.9606E-01	4.1747E+02 2.8784E+00	5.0655E+02 3.4926E+00		
14	9.0882E+01 6.2661E-01	-3.3493E+02 -2.3093E+00	-8.8638E+01 -6.1114E-01	4.2581E+02 2.9359E+00	7.9819E+02 5.5033E+00		
15	1.0168E+03 7.0105E+00	-9.5738E+02 -6.6009E+00	-9.7935E+01 -6.7524E-01	1.9742E+03 1.3611E+01	3.3158E+03 2.2862E+01		

16	3.5539E+02	-7.0980E+02	-2.1768E+02	1.0652E+03	1.7314E+03
	2.4504E+00	-4.8939E+00	-1.5009E+00	7.3443E+00	1.1938E+01
17	1.5546E+02	-4.8407E+02	4.3547E+01	6.3954E+02	1.1048E+03
	1.0719E+00	-3.3376E+00	3.0024E-01	4.4095E+00	7.6171E+00
18	4.3914E+01	-2.5385E+02	2.0498E+02	2.9776E+02	4.8800E+02
	3.0278E-01	-1.7502E+00	1.4133E+00	2.0530E+00	3.3647E+00
19	1.3271E+02	-4.0084E+02	1.0272E+02	5.3355E+02	8.8687E+02
	9.1500E-01	-2.7637E+00	7.0826E-01	3.6787E+00	6.1148E+00
20	1.5015E+02	-5.0844E+02	-1.4117E+01	6.5859E+02	1.2321E+03
	1.0352E+00	-3.5056E+00	-9.7333E-02	4.5408E+00	8.4949E+00
21	1.4182E+01	-1.5368E+01	-1.5540E+01	2.9550E+01	4.4945E+00
	9.7782E-02	-1.0596E-01	-1.0715E-01	2.0374E-01	3.0988E-02
22	2.6332E+01	-3.0226E+01	2.3925E+01	5.6557E+01	8.2641E+01
	1.8155E-01	-2.0840E-01	1.6495E-01	3.8995E-01	5.6979E-01

Allowable Stress for Load Case 112 (Post Fire at 90 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	273.67	273.44	20.00	23.60	66.30
2	274.04	273.74	20.00	23.60	66.30
3	274.06	273.89	20.00	23.60	66.30
4	273.73	273.70	20.00	23.60	66.30
5	274.35	274.24	20.00	23.60	66.30
6	274.56	274.48	20.00	23.60	66.30
7	274.92	274.78	20.00	23.60	66.30
8	274.99	274.85	20.00	23.60	66.30
9	275.04	274.90	20.00	23.60	66.30
10	275.32	275.11	20.00	23.60	66.30
11	275.55	275.35	20.00	23.60	66.30
12	276.10	275.86	20.00	23.60	66.30
13	275.08	275.03	20.00	23.60	66.30
14	274.92	274.89	20.00	23.60	66.30
15	273.21	273.20	20.00	23.60	66.30
16	273.46	273.41	20.00	23.60	66.30
17	273.50	273.47	20.00	23.60	66.30
18	273.75	273.71	20.00	23.60	66.30
19	273.99	273.89	20.00	23.60	66.30
20	275.04	274.90	20.00	23.60	66.30
21	274.79	274.76	20.00	23.60	66.30
22	273.11	273.08	20.00	23.60	66.30

Table 2-108. Load Case 112, Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.1927E+01 8.2233E-02	-2.6408E+01 -1.8208E-01	-6.2339E-01 -4.2981E-03	3.8335E+01 2.6431E-01	5.9171E+01 4.0797E-01		
2	1.7787E+01 1.2264E-01	-3.1310E+01 -2.1587E-01	-1.1170E+01 -7.7014E-02	4.9097E+01 3.3851E-01	9.9401E+01 6.8535E-01		
3	1.0448E+01 7.2040E-02	-1.9702E+01 -1.3584E-01	1.7856E+00 1.2312E-02	3.0150E+01 2.0788E-01	4.3323E+01 2.9870E-01		
4	4.7894E+02 3.3021E+00	-3.7162E+02 -2.5623E+00	-2.8894E+02 -1.9921E+00	8.5056E+02 5.8644E+00	1.5602E+03 1.0757E+01		
5	4.5334E+02 3.1257E+00	-1.6530E+02 -1.1397E+00	-5.7514E+02 -3.9655E+00	6.1863E+02 4.2653E+00	4.5943E+02 3.1677E+00		
6	7.6121E+01 5.2484E-01	-4.9469E+02 -3.4108E+00	-1.5117E+03 -1.0423E+01	5.7081E+02 3.9356E+00	8.5689E+02 5.9080E+00		
7	-8.3001E+01 -5.7227E-01	-3.1251E+02 -2.1547E+00	-2.6045E+03 -1.7958E+01	2.2951E+02 1.5824E+00	6.2268E+01 4.2932E-01		
8	-8.6920E+01 -5.9929E-01	-3.0736E+02 -2.1192E+00	-2.6061E+03 -1.7968E+01	2.2044E+02 1.5199E+00	3.9453E+01 2.7202E-01		
9	-8.3802E+01 -5.7779E-01	-3.1054E+02 -2.1411E+00	-2.6251E+03 -1.8099E+01	2.2674E+02 1.5633E+00	5.7918E+01 3.9933E-01		
10	6.7054E+01 4.6232E-01	-7.9189E+02 -5.4599E+00	-1.3904E+03 -9.5864E+00	8.5895E+02 5.9222E+00	2.4438E+02 1.6850E+00		
11	-1.1061E+02 -7.6262E-01	-7.1745E+02 -4.9467E+00	-6.6091E+02 -4.5568E+00	6.0684E+02 4.1840E+00	9.1042E+02 6.2771E+00		
12	3.1641E+01 2.1816E-01	-7.2397E+02 -4.9916E+00	-7.0523E+02 -4.8624E+00	7.5561E+02 5.2097E+00	9.6294E+02 6.6393E+00		
13	1.3584E+02 9.3658E-01	-2.8562E+02 -1.9693E+00	-7.7972E+01 -5.3759E-01	4.2146E+02 2.9059E+00	4.9783E+02 3.4324E+00		
14	7.8310E+01 5.3993E-01	-3.4319E+02 -2.3662E+00	-8.1209E+01 -5.5992E-01	4.2150E+02 2.9061E+00	7.9167E+02 5.4584E+00		
15	1.0179E+03 7.0185E+00	-9.6042E+02 -6.6219E+00	-1.0024E+02 -6.9114E-01	1.9784E+03 1.3640E+01	3.3227E+03 2.2909E+01		

16	3.5603E+02	-7.1199E+02	-2.1592E+02	1.0680E+03	1.7361E+03
	2.4547E+00	-4.9090E+00	-1.4887E+00	7.3637E+00	1.1970E+01
17	1.5572E+02	-4.8522E+02	4.6108E+01	6.4093E+02	1.1071E+03
	1.0736E+00	-3.3454E+00	3.1791E-01	4.4191E+00	7.6335E+00
18	4.4292E+01	-2.5429E+02	1.9642E+02	2.9858E+02	4.9178E+02
	3.0538E-01	-1.7533E+00	1.3543E+00	2.0587E+00	3.3907E+00
19	1.3411E+02	-3.9925E+02	9.2861E+01	5.3337E+02	8.8598E+02
	9.2468E-01	-2.7528E+00	6.4025E-01	3.6774E+00	6.1086E+00
20	1.5523E+02	-5.0742E+02	-1.2026E+01	6.6265E+02	1.2390E+03
	1.0703E+00	-3.4985E+00	-8.2917E-02	4.5688E+00	8.5429E+00
21	1.9407E+01	1.3705E+00	5.7524E+00	1.8037E+01	5.2293E+00
	1.3381E-01	9.4492E-03	3.9662E-02	1.2436E-01	3.6055E-02
22	2.2085E+01	-3.1537E+01	1.8417E+01	5.3622E+01	9.0956E+01
	1.5227E-01	-2.1744E-01	1.2698E-01	3.6971E-01	6.2712E-01

Allowable Stress for Load Case 112 (Post Fire at 120 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	274.02	273.84	20.00	23.60	66.30
2	274.16	273.86	20.00	23.60	66.30
3	273.87	273.63	20.00	23.60	66.30
4	274.19	274.16	20.00	23.60	66.30
5	274.72	274.63	20.00	23.60	66.30
6	274.92	274.84	20.00	23.60	66.30
7	275.12	274.98	20.00	23.60	66.30
8	275.10	274.96	20.00	23.60	66.30
9	275.05	274.92	20.00	23.60	66.30
10	275.13	274.96	20.00	23.60	66.30
11	275.33	275.11	20.00	23.60	66.30
12	275.86	275.62	20.00	23.60	66.30
13	274.80	274.70	20.00	23.60	66.30
14	274.55	274.49	20.00	23.60	66.30
15	273.83	273.82	20.00	23.60	66.30
16	274.06	274.02	20.00	23.60	66.30
17	274.10	274.07	20.00	23.60	66.30
18	274.33	274.29	20.00	23.60	66.30
19	274.54	274.46	20.00	23.60	66.30
20	275.52	275.39	20.00	23.60	66.30
21	273.68	273.67	20.00	23.60	66.30
22	273.74	273.71	20.00	23.60	66.30

Table 2-109. Load Case 112, Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.1841E+01	-2.6178E+01	-7.5417E-01	3.8020E+01	5.9152E+01		
	8.1642E-02	-1.8049E-01	-5.1998E-03	2.6214E-01	4.0784E-01		
2	1.8110E+01	-3.1921E+01	-1.1059E+01	5.0032E+01	1.0191E+02		
	1.2487E-01	-2.2009E-01	-7.6252E-02	3.4496E-01	7.0265E-01		
3	1.1325E+01	-2.1444E+01	4.7776E-01	3.2769E+01	4.7938E+01		
	7.8083E-02	-1.4785E-01	3.2940E-03	2.2593E-01	3.3052E-01		
4	4.8105E+02	-3.7091E+02	-2.9082E+02	8.5196E+02	1.5614E+03		
	3.3167E+00	-2.5573E+00	-2.0051E+00	5.8741E+00	1.0765E+01		
5	4.5653E+02	-1.6472E+02	-5.7252E+02	6.2125E+02	4.5693E+02		
	3.1477E+00	-1.1357E+00	-3.9474E+00	4.2834E+00	3.1504E+00		
6	7.6912E+01	-4.9525E+02	-1.5104E+03	5.7216E+02	8.5869E+02		
	5.3029E-01	-3.4146E+00	-1.0414E+01	3.9449E+00	5.9205E+00		
7	-8.2962E+01	-3.1267E+02	-2.6059E+03	2.2971E+02	6.2431E+01		
	-5.7200E-01	-2.1558E+00	-1.7967E+01	1.5838E+00	4.3045E-01		
8	-8.6892E+01	-3.0737E+02	-2.6061E+03	2.2048E+02	3.9490E+01		
	-5.9910E-01	-2.1193E+00	-1.7969E+01	1.5202E+00	2.7227E-01		
9	-8.3776E+01	-3.1041E+02	-2.6238E+03	2.2664E+02	5.7879E+01		
	-5.7762E-01	-2.1402E+00	-1.8091E+01	1.5626E+00	3.9906E-01		
10	6.6781E+01	-7.9034E+02	-1.3899E+03	8.5712E+02	2.4602E+02		
	4.6044E-01	-5.4492E+00	-9.5834E+00	5.9097E+00	1.6963E+00		
11	-1.1149E+02	-7.1868E+02	-6.6331E+02	6.0719E+02	9.0284E+02		
	-7.6868E-01	-4.9551E+00	-4.5734E+00	4.1864E+00	6.2248E+00		
12	3.0420E+01	-7.2483E+02	-7.0737E+02	7.5525E+02	9.5497E+02		
	2.0974E-01	-4.9975E+00	-4.8771E+00	5.2072E+00	6.5843E+00		
13	1.3235E+02	-2.9025E+02	-7.9868E+01	4.2260E+02	4.9465E+02		
	9.1250E-01	-2.0012E+00	-5.5067E-01	2.9137E+00	3.4105E+00		
14	7.4194E+01	-3.4558E+02	-7.8777E+01	4.1978E+02	7.8883E+02		
	5.1155E-01	-2.3827E+00	-5.4315E-01	2.8943E+00	5.4388E+00		
15	1.0181E+03	-9.6122E+02	-1.0095E+02	1.9793E+03	3.3243E+03		
	7.0197E+00	-6.6274E+00	-6.9604E-01	1.3647E+01	2.2920E+01		

16	3.5616E+02	-7.1254E+02	-2.1532E+02	1.0687E+03	1.7372E+03
	2.4556E+00	-4.9128E+00	-1.4846E+00	7.3684E+00	1.1978E+01
17	1.5577E+02	-4.8548E+02	4.6908E+01	6.4125E+02	1.1077E+03
	1.0740E+00	-3.3473E+00	3.2342E-01	4.4213E+00	7.6372E+00
18	4.4405E+01	-2.5439E+02	1.9371E+02	2.9879E+02	4.9287E+02
	3.0616E-01	-1.7539E+00	1.3356E+00	2.0601E+00	3.3982E+00
19	1.3453E+02	-3.9868E+02	8.9757E+01	5.3321E+02	8.8553E+02
	9.2754E-01	-2.7488E+00	6.1886E-01	3.6764E+00	6.1055E+00
20	1.5680E+02	-5.0700E+02	-1.1362E+01	6.6380E+02	1.2410E+03
	1.0811E+00	-3.4957E+00	-7.8341E-02	4.5768E+00	8.5562E+00
21	2.3394E+01	3.2432E+00	1.1491E+01	2.0151E+01	8.8805E+00
	1.6129E-01	2.2361E-02	7.9225E-02	1.3893E-01	6.1229E-02
22	2.0843E+01	-3.2064E+01	1.6666E+01	5.2906E+01	9.3599E+01
	1.4371E-01	-2.2107E-01	1.1491E-01	3.6478E-01	6.4534E-01

Allowable Stress for Load Case 112 (Post Fire at 150 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	274.10	273.93	20.00	23.60	66.30
2	274.16	273.86	20.00	23.60	66.30
3	273.78	273.52	20.00	23.60	66.30
4	274.30	274.28	20.00	23.60	66.30
5	274.81	274.72	20.00	23.60	66.30
6	275.00	274.92	20.00	23.60	66.30
7	275.15	275.01	20.00	23.60	66.30
8	275.10	274.96	20.00	23.60	66.30
9	275.03	274.89	20.00	23.60	66.30
10	275.04	274.87	20.00	23.60	66.30
11	275.23	275.00	20.00	23.60	66.30
12	275.75	275.51	20.00	23.60	66.30
13	274.68	274.57	20.00	23.60	66.30
14	274.39	274.33	20.00	23.60	66.30
15	274.00	273.99	20.00	23.60	66.30
16	274.22	274.18	20.00	23.60	66.30
17	274.26	274.23	20.00	23.60	66.30
18	274.48	274.44	20.00	23.60	66.30
19	274.69	274.60	20.00	23.60	66.30
20	275.64	275.52	20.00	23.60	66.30
21	273.32	273.30	20.00	23.60	66.30
22	273.90	273.88	20.00	23.60	66.30

Table 2-110. Load Case 112, Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.1813E+01 8.1450E-02	-2.6103E+01 -1.7998E-01	-7.9298E-01 -5.4674E-03	3.7917E+01 2.6143E-01	5.9137E+01 4.0773E-01		
2	1.8216E+01 1.2560E-01	-3.2117E+01 -2.2144E-01	-1.1023E+01 -7.6000E-02	5.0333E+01 3.4704E-01	1.0269E+02 7.0801E-01		
3	1.1601E+01 7.9986E-02	-2.1991E+01 -1.5162E-01	6.7917E-02 4.6827E-04	3.3592E+01 2.3161E-01	4.9384E+01 3.4049E-01		
4	4.8149E+02 3.3198E+00	-3.7061E+02 -2.5552E+00	-2.9128E+02 -2.0083E+00	8.5209E+02 5.8750E+00	1.5613E+03 1.0765E+01		
5	4.5727E+02 3.1527E+00	-1.6452E+02 -1.1344E+00	-5.7148E+02 -3.9402E+00	6.2179E+02 4.2871E+00	4.5616E+02 3.1451E+00		
6	7.7103E+01 5.3160E-01	-4.9522E+02 -3.4144E+00	-1.5093E+03 -1.0407E+01	5.7232E+02 3.9460E+00	8.5890E+02 5.9219E+00		
7	-8.2924E+01 -5.7174E-01	-3.1258E+02 -2.1552E+00	-2.6050E+03 -1.7961E+01	2.2966E+02 1.5834E+00	6.2472E+01 4.3073E-01		
8	-8.6856E+01 -5.9885E-01	-3.0724E+02 -2.1183E+00	-2.6049E+03 -1.7960E+01	2.2038E+02 1.5195E+00	3.9503E+01 2.7236E-01		
9	-8.3742E+01 -5.7738E-01	-3.1023E+02 -2.1389E+00	-2.6222E+03 -1.8079E+01	2.2649E+02 1.5616E+00	5.7858E+01 3.9892E-01		
10	6.6650E+01 4.5953E-01	-7.8949E+02 -5.4434E+00	-1.3891E+03 -9.5777E+00	8.5614E+02 5.9029E+00	2.4648E+02 1.6994E+00		
11	-1.1171E+02 -7.7021E-01	-7.1877E+02 -4.9557E+00	-6.6376E+02 -4.5765E+00	6.0706E+02 4.1855E+00	9.0002E+02 6.2054E+00		
12	3.0018E+01 2.0697E-01	-7.2480E+02 -4.9973E+00	-7.0776E+02 -4.8798E+00	7.5482E+02 5.2043E+00	9.5201E+02 6.5639E+00		
13	1.3117E+02 9.0435E-01	-2.9163E+02 -2.0107E+00	-8.0436E+01 -5.5459E-01	4.2280E+02 2.9151E+00	4.9337E+02 3.4017E+00		
14	7.2847E+01 5.0226E-01	-3.4623E+02 -2.3872E+00	-7.7975E+01 -5.3762E-01	4.1908E+02 2.8894E+00	7.8761E+02 5.4304E+00		
15	1.0180E+03 7.0190E+00	-9.6132E+02 -6.6281E+00	-1.0116E+02 -6.9745E-01	1.9793E+03 1.3647E+01	3.3242E+03 2.2920E+01		

16	3.5614E+02	-7.1260E+02	-2.1510E+02	1.0687E+03	1.7373E+03
	2.4555E+00	-4.9132E+00	-1.4830E+00	7.3687E+00	1.1978E+01
17	1.5576E+02	-4.8549E+02	4.7148E+01	6.4124E+02	1.1077E+03
	1.0739E+00	-3.3473E+00	3.2508E-01	4.4212E+00	7.6371E+00
18	4.4432E+01	-2.5437E+02	1.9286E+02	2.9881E+02	4.9312E+02
	3.0635E-01	-1.7539E+00	1.3297E+00	2.0602E+00	3.3999E+00
19	1.3463E+02	-3.9845E+02	8.8803E+01	5.3308E+02	8.8525E+02
	9.2826E-01	-2.7472E+00	6.1227E-01	3.6754E+00	6.1036E+00
20	1.5725E+02	-5.0680E+02	-1.1152E+01	6.6405E+02	1.2414E+03
	1.0842E+00	-3.4943E+00	-7.6891E-02	4.5784E+00	8.5589E+00
21	2.4750E+01	3.7115E+00	1.3283E+01	2.1038E+01	1.0026E+01
	1.7064E-01	2.5590E-02	9.1583E-02	1.4505E-01	6.9130E-02
22	2.0461E+01	-3.2237E+01	1.6112E+01	5.2698E+01	9.4422E+01
	1.4107E-01	-2.2227E-01	1.1109E-01	3.6334E-01	6.5102E-01

Allowable Stress for Load Case 112 (Post Fire at 180 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
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1	274.10	273.92	20.00	23.60	66.30
2	274.13	273.83	20.00	23.60	66.30
3	273.72	273.46	20.00	23.60	66.30
4	274.31	274.28	20.00	23.60	66.30
5	274.80	274.72	20.00	23.60	66.30
6	275.00	274.92	20.00	23.60	66.30
7	275.13	274.99	20.00	23.60	66.30
8	275.07	274.93	20.00	23.60	66.30
9	274.99	274.85	20.00	23.60	66.30
10	274.98	274.82	20.00	23.60	66.30
11	275.16	274.94	20.00	23.60	66.30
12	275.69	275.44	20.00	23.60	66.30
13	274.61	274.49	20.00	23.60	66.30
14	274.32	274.25	20.00	23.60	66.30
15	274.02	274.01	20.00	23.60	66.30
16	274.24	274.19	20.00	23.60	66.30
17	274.28	274.25	20.00	23.60	66.30
18	274.49	274.45	20.00	23.60	66.30
19	274.70	274.62	20.00	23.60	66.30
20	275.65	275.52	20.00	23.60	66.30
21	273.18	273.15	20.00	23.60	66.30
22	273.93	273.90	20.00	23.60	66.30

**Table 2-111. Load Case 301, 30-ft. Head-On Drop,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-9.6405E+01 -6.6469E-01	-5.9822E+03 -4.1246E+01	-1.1502E+03 -7.9301E+00	5.8858E+03 4.0581E+01	1.9762E+03 1.3625E+01
2	5.7295E+01 3.9503E-01	-2.7939E+03 -1.9263E+01	-2.2671E+02 -1.5631E+00	2.8512E+03 1.9658E+01	1.5399E+02 1.0617E+00
3	-8.0867E+00 -5.5756E-02	-1.1189E+03 -7.7143E+00	-9.8104E+01 -6.7641E-01	1.1108E+03 7.6586E+00	1.4264E+01 9.8344E-02
4	9.7431E+02 6.7176E+00	-9.6940E+03 -6.6838E+01	-3.1632E+03 -2.1809E+01	1.0668E+04 7.3556E+01	4.8467E+03 3.3417E+01
5	-1.2894E+02 -8.8902E-01	-3.0192E+03 -2.0816E+01	-1.3322E+03 -9.1853E+00	2.8902E+03 1.9927E+01	3.4497E+03 2.3785E+01
6	-5.1628E+02 -3.5597E+00	-2.4719E+03 -1.7043E+01	-1.1297E+03 -7.7888E+00	1.9557E+03 1.3484E+01	6.5895E+02 4.5433E+00
7	-2.8366E+01 -1.9557E-01	-1.9230E+03 -1.3259E+01	-2.8820E+02 -1.9871E+00	1.8946E+03 1.3063E+01	1.7742E+01 1.2233E-01
8	-2.1253E+01 -1.4654E-01	-1.7954E+03 -1.2379E+01	-2.0339E+02 -1.4023E+00	1.7742E+03 1.2233E+01	1.8592E-03 1.2818E-05
9	-1.0051E+01 -6.9300E-02	-1.3237E+03 -9.1264E+00	-7.7217E+01 -5.3239E-01	1.3136E+03 9.0571E+00	3.8105E+00 2.6272E-02
10	-3.1964E+02 -2.2039E+00	-1.9806E+03 -1.3656E+01	-4.2686E+02 -2.9431E+00	1.6610E+03 1.1452E+01	7.5008E+02 5.1716E+00
11	1.8930E+02 1.3052E+00	-1.0747E+03 -7.4099E+00	-2.1514E+02 -1.4834E+00	1.2640E+03 8.7151E+00	4.9607E+02 3.4203E+00
12	2.4729E+02 1.7050E+00	-8.0666E+01 -5.5617E-01	1.4462E+02 9.9712E-01	3.2795E+02 2.2611E+00	6.3549E+02 4.3815E+00
13	1.9171E+02 1.3218E+00	-8.4764E+02 -5.8443E+00	-9.5911E+01 -6.6129E-01	1.0394E+03 7.1661E+00	4.8531E+02 3.3461E+00
14	1.7143E+02 1.1819E+00	-6.1792E+02 -4.2604E+00	-1.0243E+01 -7.0624E-02	7.8934E+02 5.4423E+00	3.0263E+02 2.0866E+00
15	7.7714E+02 5.3582E+00	5.3688E+02 3.7017E+00	7.4522E+02 5.1381E+00	2.4025E+02 1.6565E+00	1.2853E+02 8.8615E-01

16	2.2056E+02	-1.5357E+03	-5.3391E+02	1.7563E+03	1.0856E+02
	1.5207E+00	-1.0588E+01	-3.6812E+00	1.2109E+01	7.4851E-01
17	5.4448E+02	-1.8335E+03	-8.7802E+02	2.3779E+03	1.8534E+03
	3.7541E+00	-1.2641E+01	-6.0537E+00	1.6395E+01	1.2779E+01
18	6.0950E+02	-3.1099E+03	-9.1866E+02	3.7194E+03	3.2647E+03
	4.2023E+00	-2.1442E+01	-6.3339E+00	2.5644E+01	2.2509E+01
19	6.2776E+02	-2.8842E+03	-1.1225E+03	3.5120E+03	1.7382E+03
	4.3282E+00	-1.9886E+01	-7.7396E+00	2.4214E+01	1.1985E+01
20	-5.7449E+02	-1.8134E+03	-1.2748E+03	1.2389E+03	1.5966E+03
	-3.9610E+00	-1.2503E+01	-8.7895E+00	8.5419E+00	1.1008E+01
21	1.2323E+03	1.2135E+02	1.2415E+02	1.1110E+03	3.9580E+02
	8.4964E+00	8.3667E-01	8.5595E-01	7.6598E+00	2.7290E+00
22	1.1247E+03	2.9782E+02	1.1193E+03	8.2689E+02	4.3606E+02
	7.7546E+00	2.0534E+00	7.7171E+00	5.7012E+00	3.0065E+00

**Table 2-112. Load Case 302, 30-ft. Side Drop + Slap-Down,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.1488E+02 1.4816E+00	-1.3866E+02 -9.5603E-01	-4.8941E+02 -3.3743E+00	3.8901E+03 2.6821E+01	8.8439E+02 6.0976E+00		
2	3.3241E+02 2.2919E+00	-3.7804E+01 -2.6065E-01	-2.4987E+02 -1.7228E+00	3.2923E+03 2.2700E+01	3.5751E+02 2.4650E+00		
3	2.1237E+02 1.4642E+00	-1.3471E+02 -9.2876E-01	-4.8535E+02 -3.3464E+00	3.8890E+03 2.6814E+01	8.8998E+02 6.1362E+00		
4	7.7792E+02 5.3635E+00	-7.5764E+01 -5.2238E-01	-9.9177E+02 -6.8380E+00	3.8507E+03 2.6549E+01	4.5050E+02 3.1061E+00		
5	7.6262E+02 5.2581E+00	-2.9462E+01 -2.0313E-01	-1.3799E+03 -9.5138E+00	4.0958E+03 2.8240E+01	8.5987E+01 5.9286E-01		
6	3.7337E+02 2.5743E+00	-1.2243E+02 -8.4415E-01	-1.7502E+03 -1.2068E+01	3.9673E+03 2.7354E+01	2.1820E+02 1.5044E+00		
7	1.1060E+03 7.6254E+00	6.0569E+02 4.1761E+00	1.5356E+01 1.0587E-01	4.0773E+03 2.8112E+01	2.2160E+02 1.5278E+00		
8	1.0822E+03 7.4617E+00	6.1450E+02 4.2368E+00	2.3652E+01 1.6307E-01	4.2542E+03 2.9332E+01	2.1149E+02 1.4581E+00		
9	1.1145E+03 7.6839E+00	5.9637E+02 4.1118E+00	1.8014E+01 1.2421E-01	4.0693E+03 2.8057E+01	2.2416E+02 1.5455E+00		
10	7.1892E+02 4.9568E+00	1.7082E+02 1.1778E+00	-1.0134E+03 -6.9874E+00	3.6008E+03 2.4827E+01	3.5973E+02 2.4802E+00		
11	1.5029E+02 1.0362E+00	-2.3134E+02 -1.5951E+00	-1.9054E+03 -1.3138E+01	3.6146E+03 2.4922E+01	1.5697E+03 1.0823E+01		
12	-4.5517E+01 -3.1383E-01	-5.4311E+02 -3.7446E+00	-2.4221E+03 -1.6700E+01	2.5238E+03 1.7401E+01	2.9713E+02 2.0487E+00		
13	7.5383E+02 5.1975E+00	-2.9452E+01 -2.0306E-01	-1.3033E+03 -8.9858E+00	3.9188E+03 2.7019E+01	1.8193E+02 1.2544E+00		
14	8.5625E+02 5.9036E+00	-5.3955E+01 -3.7201E-01	-1.1513E+03 -7.9380E+00	4.0280E+03 2.7772E+01	2.8821E+02 1.9871E+00		
15	-8.7534E+01 -6.0352E-01	-1.4126E+02 -9.7399E-01	-1.5001E+03 -1.0343E+01	1.4369E+03 9.9074E+00	1.0772E+01 7.4273E-02		

16	2.4763E+02	-6.0236E+01	-1.3561E+03	2.6353E+03	1.1601E+02
	1.7073E+00	-4.1531E-01	-9.3499E+00	1.8170E+01	7.9987E-01
17	1.6620E+02	-1.0344E+02	-1.4741E+03	2.9163E+03	1.5442E+02
	1.1459E+00	-7.1319E-01	-1.0163E+01	2.0107E+01	1.0647E+00
18	5.5446E+02	-1.5327E+02	-1.3155E+03	4.2621E+03	1.9885E+02
	3.8229E+00	-1.0568E+00	-9.0701E+00	2.9386E+01	1.3710E+00
19	7.9446E+02	-1.0196E+02	-1.2545E+03	4.2566E+03	5.5802E+01
	5.4776E+00	-7.0302E-01	-8.6495E+00	2.9348E+01	3.8474E-01
20	2.4970E+02	-1.0523E+02	-1.4931E+03	3.1055E+03	2.0937E+02
	1.7216E+00	-7.2556E-01	-1.0294E+01	2.1411E+01	1.4435E+00
21	-3.6704E+01	-1.3100E+02	-1.5290E+03	1.5247E+03	4.4725E+01
	-2.5307E-01	-9.0319E-01	-1.0542E+01	1.0512E+01	3.0837E-01
22	-2.7237E+01	-1.3435E+02	-1.5570E+03	1.5613E+03	3.6198E+01
	-1.8779E-01	-9.2631E-01	-1.0735E+01	1.0765E+01	2.4958E-01

**Table 2-113. Load Case 303, 30-ft. Cg/Corner Drop,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	6.7746E+02 4.6709E+00	-6.4396E+02 -4.4399E+00	-5.4027E+03 -3.7251E+01	5.2487E+03 3.6189E+01	2.4259E+03 1.6726E+01		
2	4.1698E+02 2.8750E+00	-2.3686E+02 -1.6331E+00	-5.7179E+02 -3.9424E+00	2.7955E+03 1.9274E+01	3.0737E+02 2.1193E+00		
3	5.0172E+03 3.4592E+01	5.4102E+02 3.7302E+00	-1.5654E+01 -1.0793E-01	5.0329E+03 3.4700E+01	1.3794E+03 9.5105E+00		
4	6.0552E+02 4.1749E+00	4.0116E+01 2.7659E-01	-3.7707E+03 -2.5998E+01	7.1885E+03 4.9563E+01	4.7488E+02 3.2742E+00		
5	8.8096E+02 6.0740E+00	-5.9719E+02 -4.1175E+00	-4.7519E+03 -3.2763E+01	5.9828E+03 4.1250E+01	2.0231E+02 1.3949E+00		
6	6.4811E+02 4.4686E+00	-1.3896E+03 -9.5811E+00	-5.7909E+03 -3.9927E+01	5.8310E+03 4.0203E+01	6.8104E+02 4.6956E+00		
7	9.4084E+02 6.4869E+00	9.1055E+01 6.2780E-01	-2.9517E+02 -2.0351E+00	5.4967E+03 3.7898E+01	1.4431E+02 9.9501E-01		
8	6.9203E+02 4.7713E+00	1.3181E+01 9.0879E-02	-6.2912E+02 -4.3376E+00	4.0290E+03 2.7779E+01	6.9759E+01 4.8097E-01		
9	1.0250E+03 7.0670E+00	-5.3490E+02 -3.6880E+00	-8.9652E+02 -6.1813E+00	2.7753E+03 1.9135E+01	9.0507E+01 6.2402E-01		
10	1.0765E+03 7.4220E+00	-6.3822E+02 -4.4004E+00	-9.5761E+02 -6.6025E+00	2.4280E+03 1.6740E+01	1.0258E+03 7.0726E+00		
11	1.7046E+03 1.1753E+01	-1.1270E+02 -7.7703E-01	-2.9242E+02 -2.0161E+00	2.0632E+03 1.4225E+01	6.1682E+02 4.2528E+00		
12	1.1946E+03 8.2367E+00	1.6630E+02 1.1466E+00	3.1222E+01 2.1527E-01	1.1774E+03 8.1178E+00	2.5886E+02 1.7848E+00		
13	1.4537E+03 1.0023E+01	-4.4662E+02 -3.0793E+00	-9.2468E+02 -6.3755E+00	2.3784E+03 1.6398E+01	5.2548E+01 3.6231E-01		
14	1.5032E+03 1.0364E+01	-4.4892E+02 -3.0952E+00	-9.5053E+02 -6.5537E+00	2.4537E+03 1.6918E+01	1.7604E+02 1.2138E+00		
15	8.8620E+02 6.1101E+00	1.7615E+02 1.2145E+00	-2.6862E+03 -1.8521E+01	3.6222E+03 2.4974E+01	9.2058E+01 6.3472E-01		

16	1.1559E+03 7.9694E+00	1.3316E+02 9.1810E-01	-2.7112E+03 -1.8693E+01	6.0915E+03 4.1999E+01	3.5016E+02 2.4143E+00
17	1.1780E+03 8.1221E+00	8.2224E+01 5.6692E-01	-3.2360E+03 -2.2311E+01	6.9719E+03 4.8070E+01	4.5864E+02 3.1622E+00
18	8.5040E+02 5.8633E+00	-2.1577E+02 -1.4877E+00	-4.4449E+03 -3.0646E+01	5.3898E+03 3.7162E+01	2.7889E+02 1.9229E+00
19	9.8981E+02 6.8245E+00	-2.7379E+02 -1.8877E+00	-4.4781E+03 -3.0876E+01	5.6257E+03 3.8788E+01	6.2430E+02 4.3044E+00
20	6.5259E+02 4.4994E+00	-9.3060E+02 -6.4163E+00	-4.7890E+03 -3.3019E+01	5.3639E+03 3.6983E+01	2.5294E+02 1.7440E+00
21	7.6449E+02 5.2709E+00	-4.8707E+01 -3.3583E-01	-5.2781E+02 -3.6391E+00	1.2843E+03 8.8550E+00	7.5736E+01 5.2218E-01
22	1.3972E+03 9.6337E+00	7.8175E+01 5.3900E-01	-2.5048E+03 -1.7270E+01	3.9572E+03 2.7284E+01	3.8968E+02 2.6868E+00

Table 2-114. Load Case 304, 30-ft. Head-On Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-1.3768E+02 -9.4925E-01	-8.3090E+03 -5.7289E+01	-1.6110E+03 -1.1107E+01	8.1713E+03 5.6339E+01	2.7445E+03 1.8923E+01
2	7.9467E+01 5.4790E-01	-3.8778E+03 -2.6736E+01	-3.1445E+02 -2.1681E+00	3.9573E+03 2.7284E+01	2.1145E+02 1.4579E+00
3	-1.1225E+01 -7.7393E-02	-1.5523E+03 -1.0702E+01	-1.3606E+02 -9.3807E-01	1.5410E+03 1.0625E+01	1.9879E+01 1.3706E-01
4	1.3398E+03 9.2378E+00	-1.3469E+04 -9.2865E+01	-4.4079E+03 -3.0391E+01	1.4809E+04 1.0210E+02	6.7381E+03 4.6457E+01
5	-1.8720E+02 -1.2907E+00	-4.1982E+03 -2.8946E+01	-1.8617E+03 -1.2836E+01	4.0110E+03 2.7655E+01	4.7904E+03 3.3029E+01
6	-7.2035E+02 -4.9666E+00	-3.4293E+03 -2.3645E+01	-1.5759E+03 -1.0865E+01	2.7090E+03 1.8678E+01	9.1709E+02 6.3231E+00
7	-3.9716E+01 -2.7383E-01	-2.6713E+03 -1.8418E+01	-4.0349E+02 -2.7820E+00	2.6316E+03 1.8144E+01	2.4479E+01 1.6878E-01
8	-2.9569E+01 -2.0387E-01	-2.4939E+03 -1.7195E+01	-2.8290E+02 -1.9506E+00	2.4643E+03 1.6991E+01	1.2881E-01 8.8813E-04
9	-1.3944E+01 -9.6140E-02	-1.8380E+03 -1.2672E+01	-1.0709E+02 -7.3835E-01	1.8240E+03 1.2576E+01	5.3223E+00 3.6696E-02
10	-4.4354E+02 -3.0581E+00	-2.7487E+03 -1.8952E+01	-5.9222E+02 -4.0832E+00	2.3052E+03 1.5894E+01	1.0410E+03 7.1774E+00
11	2.6283E+02 1.8122E+00	-1.4914E+03 -1.0283E+01	-2.9843E+02 -2.0576E+00	1.7542E+03 1.2095E+01	6.8834E+02 4.7460E+00
12	3.4338E+02 2.3675E+00	-1.1181E+02 -7.7091E-01	2.0085E+02 1.3848E+00	4.5519E+02 3.1384E+00	8.8186E+02 6.0802E+00
13	2.6614E+02 1.8350E+00	-1.1762E+03 -8.1095E+00	-1.3299E+02 -9.1691E-01	1.4423E+03 9.9445E+00	6.7328E+02 4.6421E+00
14	2.3793E+02 1.6405E+00	-8.5728E+02 -5.9107E+00	-1.4086E+01 -9.7120E-02	1.0952E+03 7.5512E+00	4.1982E+02 2.8946E+00
15	1.0628E+03 7.3275E+00	7.3926E+02 5.0970E+00	1.0175E+03 7.0155E+00	3.2350E+02 2.2305E+00	1.7623E+02 1.2151E+00

16	2.9841E+02	-2.1504E+03	-7.6315E+02	2.4488E+03	1.4964E+02
	2.0574E+00	-1.4827E+01	-5.2618E+00	1.6884E+01	1.0317E+00
17	7.5004E+02	-2.5439E+03	-1.2334E+03	3.2940E+03	2.5661E+03
	5.1713E+00	-1.7540E+01	-8.5042E+00	2.2711E+01	1.7692E+01
18	8.4600E+02	-4.3187E+03	-1.2831E+03	5.1647E+03	4.5363E+03
	5.8329E+00	-2.9776E+01	-8.8465E+00	3.5609E+01	3.1276E+01
19	8.6122E+02	-4.0089E+03	-1.5698E+03	4.8702E+03	2.4137E+03
	5.9379E+00	-2.7641E+01	-1.0823E+01	3.3579E+01	1.6642E+01
20	-8.0680E+02	-2.5182E+03	-1.7777E+03	1.7114E+03	2.2179E+03
	-5.5627E+00	-1.7362E+01	-1.2257E+01	1.1799E+01	1.5292E+01
21	1.7121E+03	1.6870E+02	1.7259E+02	1.5434E+03	5.4993E+02
	1.1805E+01	1.1632E+00	1.1900E+00	1.0641E+01	3.7917E+00
22	1.5338E+03	4.1191E+02	1.5262E+03	1.1219E+03	5.9937E+02
	1.0575E+01	2.8400E+00	1.0523E+01	7.7349E+00	4.1325E+00

Table 2-115. Load Case 305, 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	3.0233E+02 2.0845E+00	-1.9436E+02 -1.3400E+00	-6.8353E+02 -4.7128E+00	5.4356E+03 3.7477E+01	1.2239E+03 8.4384E+00		
2	4.6520E+02 3.2075E+00	-5.3259E+01 -3.6721E-01	-3.5000E+02 -2.4132E+00	4.6104E+03 3.1788E+01	4.9893E+02 3.4400E+00		
3	2.9823E+02 2.0562E+00	-1.8907E+02 -1.3036E+00	-6.7782E+02 -4.6734E+00	5.4300E+03 3.7439E+01	1.2269E+03 8.4594E+00		
4	1.0858E+03 7.4864E+00	-1.0592E+02 -7.3029E-01	-1.3878E+03 -9.5683E+00	5.3860E+03 3.7135E+01	6.2929E+02 4.3388E+00		
5	1.0651E+03 7.3434E+00	-4.1088E+01 -2.8330E-01	-1.9314E+03 -1.3317E+01	5.7325E+03 3.9524E+01	1.2006E+02 8.2779E-01		
6	5.2285E+02 3.6049E+00	-1.7121E+02 -1.1804E+00	-2.4502E+03 -1.6893E+01	5.5538E+03 3.8292E+01	3.0544E+02 2.1060E+00		
7	1.5472E+03 1.0668E+01	8.4836E+02 5.8492E+00	2.1518E+01 1.4836E-01	5.7090E+03 3.9362E+01	3.1031E+02 2.1395E+00		
8	1.5135E+03 1.0435E+01	8.6072E+02 5.9344E+00	3.3161E+01 2.2864E-01	5.9561E+03 4.1066E+01	2.9599E+02 2.0408E+00		
9	1.5593E+03 1.0751E+01	8.4728E+02 5.8418E+00	2.1955E+01 1.5137E-01	5.6982E+03 3.9288E+01	3.1398E+02 2.1648E+00		
10	1.0067E+03 6.9407E+00	2.3958E+02 1.6518E+00	-1.4184E+03 -9.7795E+00	5.0451E+03 3.4785E+01	5.0495E+02 3.4815E+00		
11	2.1068E+02 1.4526E+00	-3.2349E+02 -2.2304E+00	-2.6671E+03 -1.8389E+01	5.0617E+03 3.4899E+01	2.1998E+03 1.5167E+01		
12	-6.3705E+01 -4.3923E-01	-7.5973E+02 -5.2382E+00	-3.3909E+03 -2.3379E+01	3.5335E+03 2.4362E+01	4.1649E+02 2.8716E+00		
13	1.0530E+03 7.2600E+00	-4.1015E+01 -2.8279E-01	-1.8241E+03 -1.2576E+01	5.4849E+03 3.7817E+01	2.5527E+02 1.7600E+00		
14	1.1962E+03 8.2472E+00	-7.5405E+01 -5.1990E-01	-1.6113E+03 -1.1109E+01	5.6365E+03 3.8862E+01	4.0244E+02 2.7748E+00		
15	-1.2240E+02 -8.4391E-01	-1.9639E+02 -1.3541E+00	-2.0968E+03 -1.4457E+01	2.0085E+03 1.3848E+01	1.4951E+01 1.0309E-01		

16	3.3961E+02	-8.4204E+01	-1.8946E+03	3.6754E+03	1.6212E+02
	2.3415E+00	-5.8057E-01	-1.3063E+01	2.5341E+01	1.1178E+00
17	2.2396E+02	-1.4431E+02	-2.0585E+03	4.0654E+03	2.1350E+02
	1.5442E+00	-9.9496E-01	-1.4193E+01	2.8030E+01	1.4720E+00
18	7.7278E+02	-2.1439E+02	-1.8408E+03	5.9595E+03	2.7817E+02
	5.3281E+00	-1.4781E+00	-1.2692E+01	4.1089E+01	1.9179E+00
19	1.1089E+03	-1.4256E+02	-1.7556E+03	5.9546E+03	7.7638E+01
	7.6459E+00	-9.8292E-01	-1.2104E+01	4.1055E+01	5.3530E-01
20	3.4899E+02	-1.4717E+02	-2.0900E+03	4.3467E+03	2.9324E+02
	2.4062E+00	-1.0147E+00	-1.4410E+01	2.9969E+01	2.0218E+00
21	-5.1512E+01	-1.8147E+02	-2.1362E+03	2.1300E+03	6.1849E+01
	-3.5517E-01	-1.2512E+00	-1.4729E+01	1.4686E+01	4.2643E-01
22	-3.8079E+01	-1.8628E+02	-2.1754E+03	2.1816E+03	4.9863E+01
	-2.6255E-01	-1.2844E+00	-1.4999E+01	1.5041E+01	3.4379E-01

Table 2-116. Load Case 306, 30-ft. Cg/Corner Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-025A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	9.4841E+02 6.5390E+00	-9.0159E+02 -6.2162E+00	-7.5640E+03 -5.2152E+01	7.3484E+03 5.0666E+01	3.4263E+03 2.3623E+01		
2	5.8372E+02 4.0246E+00	-3.3146E+02 -2.2853E+00	-8.0023E+02 -5.5174E+00	3.9136E+03 2.6984E+01	4.3031E+02 2.9669E+00		
3	7.0251E+03 4.8436E+01	7.5759E+02 5.2234E+00	-2.1857E+01 -1.5070E-01	7.0470E+03 4.8587E+01	1.9314E+03 1.3316E+01		
4	8.4768E+02 5.8445E+00	5.6125E+01 3.8697E-01	-5.2790E+03 -3.6397E+01	1.0064E+04 6.9386E+01	6.6484E+02 4.5839E+00		
5	1.2333E+03 8.5034E+00	-8.3604E+02 -5.7643E+00	-6.6527E+03 -4.5869E+01	8.3758E+03 5.7749E+01	2.8323E+02 1.9528E+00		
6	9.0796E+02 6.2601E+00	-1.9454E+03 -1.3413E+01	-8.1072E+03 -5.5897E+01	8.1632E+03 5.6284E+01	9.5335E+02 6.5731E+00		
7	1.3171E+03 9.0808E+00	1.2744E+02 8.7869E-01	-4.1321E+02 -2.8490E+00	7.6951E+03 5.3056E+01	2.0204E+02 1.3930E+00		
8	9.6881E+02 6.6797E+00	1.8433E+01 1.2709E-01	-8.8080E+02 -6.0729E+00	5.6405E+03 3.8890E+01	9.7666E+01 6.7338E-01		
9	1.4351E+03 9.8946E+00	-7.4903E+02 -5.1644E+00	-1.2552E+03 -8.6544E+00	3.8854E+03 2.6789E+01	1.2671E+02 8.7362E-01		
10	1.5072E+03 1.0392E+01	-8.9364E+02 -6.1614E+00	-1.3408E+03 -9.2444E+00	3.3993E+03 2.3437E+01	1.4361E+03 9.9015E+00		
11	2.3867E+03 1.6456E+01	-1.5783E+02 -1.0882E+00	-4.0944E+02 -2.8230E+00	2.8887E+03 1.9917E+01	8.6358E+02 5.9542E+00		
12	1.6727E+03 1.1533E+01	2.3279E+02 1.6051E+00	4.3710E+01 3.0137E-01	1.6485E+03 1.1366E+01	3.6241E+02 2.4987E+00		
13	2.0354E+03 1.4033E+01	-6.2532E+02 -4.3114E+00	-1.2947E+03 -8.9263E+00	3.3300E+03 2.2960E+01	7.3568E+01 5.0724E-01		
14	2.1047E+03 1.4511E+01	-6.2853E+02 -4.3335E+00	-1.3308E+03 -9.1758E+00	3.4355E+03 2.3687E+01	2.4649E+02 1.6995E+00		
15	1.2408E+03 8.5552E+00	2.4666E+02 1.7006E+00	-3.7614E+03 -2.5934E+01	5.0720E+03 3.4970E+01	1.2888E+02 8.8857E-01		

16	1.6182E+03	1.8644E+02	-3.7959E+03	8.5346E+03	4.9048E+02
	1.1157E+01	1.2854E+00	-2.6172E+01	5.8844E+01	3.3817E+00
17	1.6492E+03	1.1511E+02	-4.5306E+03	9.7710E+03	6.4207E+02
	1.1371E+01	7.9368E-01	-3.1237E+01	6.7369E+01	4.4269E+00
18	1.1905E+03	-3.0208E+02	-6.2229E+03	7.5455E+03	3.9045E+02
	8.2081E+00	-2.0827E+00	-4.2905E+01	5.2025E+01	2.6921E+00
19	1.3857E+03	-3.8331E+02	-6.2694E+03	7.8759E+03	8.7408E+02
	9.5539E+00	-2.6428E+00	-4.3226E+01	5.4302E+01	6.0266E+00
20	9.1433E+02	-1.3028E+03	-6.7047E+03	7.5094E+03	3.5410E+02
	6.3041E+00	-8.9824E+00	-4.6227E+01	5.1776E+01	2.4415E+00
21	1.0704E+03	-6.8196E+01	-7.3896E+02	1.7982E+03	1.0603E+02
	7.3801E+00	-4.7019E-01	-5.0950E+00	1.2398E+01	7.3104E-01
22	1.9563E+03	1.0948E+02	-3.5076E+03	5.5412E+03	5.4557E+02
	1.3488E+01	7.5482E-01	-2.4184E+01	3.8205E+01	3.7616E+00

**Table 2-117. Load Case 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.9603E+01 3.4200E-01	-5.8890E+02 -4.0603E+00	4.1131E+02 2.8359E+00	6.3850E+02 4.4023E+00	4.0271E+02 2.7766E+00		
2	1.5154E+01 1.0448E-01	-4.6590E+02 -3.2123E+00	1.0076E+02 6.9475E-01	4.8106E+02 3.3168E+00	7.5039E+01 5.1737E-01		
3	7.7368E+00 5.3343E-02	-1.8009E+02 -1.2417E+00	1.0470E+01 7.2191E-02	1.8783E+02 1.2950E+00	1.8392E+01 1.2681E-01		
4	1.8903E+03 1.3033E+01	-1.7594E+03 -1.2130E+01	8.2625E+02 5.6968E+00	3.6497E+03 2.5164E+01	4.6125E+03 3.1802E+01		
5	1.4623E+03 1.0082E+01	-1.5658E+03 -1.0796E+01	7.3875E+02 5.0935E+00	3.0281E+03 2.0878E+01	3.7700E+03 2.5993E+01		
6	-3.8121E+02 -2.6283E+00	-2.1378E+03 -1.4740E+01	-1.3872E+02 -9.5642E-01	1.7566E+03 1.2111E+01	3.4307E+02 2.3654E+00		
7	1.5451E+00 1.0653E-02	-4.4774E+02 -3.0871E+00	5.6310E+01 3.8824E-01	4.4929E+02 3.0977E+00	3.8120E+01 2.6283E-01		
8	3.5520E+00 2.4490E-02	-1.9422E+02 -1.3391E+00	3.4566E+01 2.3832E-01	1.9777E+02 1.3636E+00	2.5107E+00 1.7311E-02		
9	1.4893E+00 1.0269E-02	-1.2321E+02 -8.4953E-01	1.3706E+01 9.4501E-02	1.2470E+02 8.5980E-01	2.1363E-01 1.4729E-03		
10	-6.9995E+01 -4.8260E-01	-2.8738E+02 -1.9814E+00	-6.6348E+01 -4.5745E-01	2.1738E+02 1.4988E+00	9.1327E+01 6.2967E-01		
11	9.3899E+01 6.4741E-01	-1.8536E+02 -1.2780E+00	8.0859E+00 5.5750E-02	2.7926E+02 1.9255E+00	1.9239E+02 1.3265E+00		
12	3.4636E+01 2.3881E-01	-2.3498E+02 -1.6201E+00	1.9409E+01 1.3382E-01	2.6961E+02 1.8589E+00	4.2594E+02 2.9367E+00		
13	2.3969E+02 1.6526E+00	-1.3150E+01 -9.0663E-02	1.1817E+02 8.1475E-01	2.5284E+02 1.7433E+00	2.0153E+02 1.3895E+00		
14	2.6022E+02 1.7941E+00	-6.4443E+00 -4.4432E-02	1.4315E+02 9.8699E-01	2.6666E+02 1.8386E+00	8.7788E+01 6.0527E-01		
15	-6.1353E+03 -4.2302E+01	-2.0916E+04 -1.4421E+02	-5.9990E+03 -4.1361E+01	1.4780E+04 1.0191E+02	5.1674E+03 3.5628E+01		

16	6.3812E+02	-1.2334E+03	4.4903E+01	1.8715E+03	1.4585E+03
	4.3997E+00	-8.5037E+00	3.0959E-01	1.2903E+01	1.0056E+01
17	-8.7001E+01	-1.3209E+03	1.1327E+02	1.2339E+03	1.8614E+03
	-5.9985E-01	-9.1070E+00	7.8099E-01	8.5071E+00	1.2834E+01
18	-1.5821E+02	-1.0915E+03	1.3328E+01	9.3334E+02	5.1622E+02
	-1.0908E+00	-7.5260E+00	9.1890E-02	6.4351E+00	3.5592E+00
19	8.5154E+02	-8.3158E+02	2.3348E+02	1.6831E+03	1.7892E+03
	5.8711E+00	-5.7335E+00	1.6098E+00	1.1605E+01	1.2336E+01
20	1.3709E+03	-1.0751E+03	1.8285E+01	2.4460E+03	2.5928E+03
	9.4519E+00	-7.4128E+00	1.2607E-01	1.6865E+01	1.7877E+01
21	1.0044E+02	-1.8842E+02	-1.8477E+02	2.8886E+02	4.0398E+02
	6.9250E-01	-1.2991E+00	-1.2740E+00	1.9916E+00	2.7853E+00
22	-2.2459E+03	-8.9651E+03	-2.4120E+03	6.7192E+03	2.9155E+03
	-1.5485E+01	-6.1812E+01	-1.6630E+01	4.6327E+01	2.0102E+01

**Table 2-118. Load Combination 301, Head-On Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 301, 102, 201, 211
 30-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	6.62	3.01	9.62	20.00	66.30	5.89
	45.61	20.72	66.33	137.90	457.12	
2	3.09	0.30	3.38	20.00	66.30	>10
	21.28	2.04	23.32	137.90	457.12	
3	1.27	0.11	1.38	20.00	66.30	>10
	8.76	0.74	9.51	137.90	457.12	
4	12.02	7.16	19.18	20.00	66.30	2.46
	82.88	49.35	132.23	137.90	457.12	
5	4.12	5.08	9.20	20.00	66.30	6.21
	28.40	35.01	63.41	137.90	457.12	
6	2.69	1.83	4.52	20.00	66.30	>10
	18.55	12.60	31.14	137.90	457.12	
7	2.14	0.07	2.21	20.00	66.30	>10
	14.73	0.50	15.23	137.90	457.12	
8	2.01	0.05	2.06	20.00	66.30	>10
	13.85	0.32	14.17	137.90	457.12	
9	1.59	0.08	1.67	20.00	66.30	>10
	10.95	0.54	11.49	137.90	457.12	
10	2.62	0.87	3.49	20.00	66.30	>10
	18.09	6.00	24.09	137.90	457.12	
11	2.07	1.46	3.53	20.00	66.30	>10
	14.30	10.05	24.35	137.90	457.12	
12	1.18	1.83	3.01	20.00	66.30	>10
	8.12	12.63	20.74	137.90	457.12	

13	2.28 15.75	1.36 9.40	3.65 25.15	20.00 137.90	66.30 457.12	>10
14	2.04 14.05	1.84 12.66	3.87 26.71	20.00 137.90	66.30 457.12	>10
15	1.80 12.39	1.82 12.57	3.62 24.97	20.00 137.90	66.30 457.12	>10
16	3.36 23.14	2.64 18.21	6.00 41.35	20.00 137.90	66.30 457.12	>10
17	3.45 23.78	3.57 24.59	7.02 48.37	20.00 137.90	66.30 457.12	8.45
18	4.56 31.46	4.63 31.89	9.19 63.36	20.00 137.90	66.30 457.12	6.22
19	4.93 33.98	3.84 26.44	8.76 60.43	20.00 137.90	66.30 457.12	6.56
20	2.99 20.64	4.37 30.10	7.36 50.75	20.00 137.90	66.30 457.12	8.01
21	1.43 9.86	0.91 6.30	2.34 16.16	20.00 137.90	66.30 457.12	>10
22	1.22 8.41	0.81 5.56	2.03 13.97	20.00 137.90	66.30 457.12	>10

Min MS: 2.457, Location: 4, Combination: Pm+Pb

**Table 2-119. Load Combination 302, Side Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 302, 102, 201, 211
 30-ft. Side Drop + Slap-Down
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.61 31.82	1.91 13.14	6.52 44.96	20.00 137.90	66.30 457.12	9.06
2	3.53 24.33	0.50 3.43	4.03 27.76	20.00 137.90	66.30 457.12	>10
3	4.04 27.87	0.97 6.71	5.02 34.58	20.00 137.90	66.30 457.12	>10
4	5.20 35.85	2.76 19.03	7.96 54.89	20.00 137.90	66.30 457.12	7.33
5	5.32 36.71	1.71 11.82	7.04 48.53	20.00 137.90	66.30 457.12	7.72
6	4.70 32.42	1.39 9.56	6.09 41.97	20.00 137.90	66.30 457.12	8.87
7	4.32 29.78	0.28 1.90	4.60 31.69	20.00 137.90	66.30 457.12	9.74
8	4.49 30.95	0.26 1.78	4.75 32.73	20.00 137.90	66.30 457.12	9.34
9	4.34 29.96	0.30 2.06	4.64 32.02	20.00 137.90	66.30 457.12	9.68
10	4.57 31.48	0.48 3.31	5.05 34.80	20.00 137.90	66.30 457.12	9.16
11	4.43 30.51	2.53 17.46	6.96 47.97	20.00 137.90	66.30 457.12	8.53
12	3.37 23.26	1.49 10.29	4.87 33.55	20.00 137.90	66.30 457.12	>10

13	5.16 35.60	1.06 7.31	6.22 42.91	20.00 137.90	66.30 457.12	7.99
14	5.28 36.37	1.82 12.55	7.10 48.92	20.00 137.90	66.30 457.12	7.80
15	2.99 20.62	1.71 11.76	4.70 32.38	20.00 137.90	66.30 457.12	>10
16	4.23 29.15	2.65 18.26	6.88 47.41	20.00 137.90	66.30 457.12	8.64
17	3.98 27.44	1.87 12.87	5.85 40.30	20.00 137.90	66.30 457.12	>10
18	5.10 35.18	1.56 10.75	6.66 45.93	20.00 137.90	66.30 457.12	8.10
19	5.67 39.10	2.15 14.84	7.82 53.94	20.00 137.90	66.30 457.12	7.18
20	4.86 33.51	2.98 20.54	7.84 54.05	20.00 137.90	66.30 457.12	7.46
21	1.84 12.70	0.56 3.87	2.40 16.57	20.00 137.90	66.30 457.12	>10
22	1.95 13.45	0.41 2.80	2.36 16.26	20.00 137.90	66.30 457.12	>10

Min MS: 7.184, Location: 19, Combination: Pm

**Table 2-120. Load Combination 303, Cg/Corner Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 303, 102, 201, 211
 30-ft. Cg/Corner Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	5.98 41.22	3.48 23.97	9.45 65.19	20.00 137.90	66.30 457.12	6.01
2	3.03 20.89	0.45 3.10	3.48 23.99	20.00 137.90	66.30 457.12	>10
3	5.19 35.80	1.47 10.16	6.67 45.96	20.00 137.90	66.30 457.12	7.94
4	8.54 58.88	2.79 19.21	11.33 78.09	20.00 137.90	66.30 457.12	4.43
5	7.21 49.72	1.83 12.62	9.04 62.35	20.00 137.90	66.30 457.12	5.44
6	6.57 45.27	1.85 12.75	8.41 58.02	20.00 137.90	66.30 457.12	6.07
7	5.74 39.57	0.20 1.37	5.94 40.94	20.00 137.90	66.30 457.12	7.09
8	4.26 29.40	0.12 0.80	4.38 30.20	20.00 137.90	66.30 457.12	9.88
9	3.05 21.03	0.16 1.14	3.22 22.17	20.00 137.90	66.30 457.12	>10
10	3.39 23.38	1.15 7.90	4.54 31.28	20.00 137.90	66.30 457.12	>10
11	2.87 19.81	1.58 10.88	4.45 30.69	20.00 137.90	66.30 457.12	>10
12	2.03 13.97	1.45 10.03	3.48 24.00	20.00 137.90	66.30 457.12	>10

13	3.62	0.93	4.55	20.00	66.30	>10
	24.98	6.42	31.40	137.90	457.12	
14	3.70	1.71	5.41	20.00	66.30	>10
	25.53	11.78	37.31	137.90	457.12	
15	5.18	1.79	6.97	20.00	66.30	7.96
	35.71	12.32	48.04	137.90	457.12	
16	7.70	2.88	10.58	20.00	66.30	5.03
	53.06	19.87	72.94	137.90	457.12	
17	8.05	2.17	10.22	20.00	66.30	4.76
	55.51	14.98	70.48	137.90	457.12	
18	6.23	1.64	7.87	20.00	66.30	6.44
	42.98	11.31	54.29	137.90	457.12	
19	7.04	2.72	9.76	20.00	66.30	5.59
	48.56	18.76	67.32	137.90	457.12	
20	7.12	3.02	10.14	20.00	66.30	5.52
	49.08	20.84	69.92	137.90	457.12	
21	1.60	0.59	2.20	20.00	66.30	>10
	11.06	4.09	15.15	137.90	457.12	
22	4.35	0.76	5.11	20.00	66.30	9.67
	30.00	5.24	35.24	137.90	457.12	

Min MS: 4.434, Location: 4, Combination: Pm

Table 2-121. Load Combination 304, Head-On Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-025A

Load Cases: 304, 105, 202, 21
 30-ft. Head-On Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	8.91 61.40	3.77 26.00	12.68 87.41	20.00 137.90	70.00 482.63	4.39
2	4.19 28.88	0.35 2.43	4.54 31.31	20.00 137.90	70.00 482.63	>10
3	1.70 11.71	0.11 0.75	1.81 12.47	20.00 137.90	70.00 482.63	>10
4	16.00 110.31	8.71 60.08	24.71 170.39	20.00 137.90	70.00 482.63	1.83
5	5.03 34.71	6.12 42.21	11.16 76.92	20.00 137.90	70.00 482.63	5.27
6	3.36 23.18	1.92 13.25	5.28 36.43	20.00 137.90	70.00 482.63	>10
7	2.90 19.97	0.08 0.54	2.97 20.51	20.00 137.90	70.00 482.63	>10
8	2.72 18.77	0.05 0.32	2.77 19.09	20.00 137.90	70.00 482.63	>10
9	2.12 14.63	0.08 0.55	2.20 15.18	20.00 137.90	70.00 482.63	>10
10	3.36 23.17	1.25 8.65	4.61 31.81	20.00 137.90	70.00 482.63	>10
11	2.55 17.57	1.63 11.26	4.18 28.84	20.00 137.90	70.00 482.63	>10
12	1.29 8.88	1.99 13.69	3.27 22.57	20.00 137.90	70.00 482.63	>10

13	2.58	1.68	4.26	20.00	70.00	>10
	17.80	11.55	29.35	137.90	482.63	
14	2.20	1.79	3.99	20.00	70.00	>10
	15.19	12.31	27.50	137.90	482.63	
15	2.11	2.53	4.65	20.00	70.00	>10
	14.58	17.45	32.03	137.90	482.63	
16	3.80	2.29	6.09	20.00	70.00	>10
	26.22	15.78	42.00	137.90	482.63	
17	4.19	3.99	8.18	20.00	70.00	7.56
	28.90	27.49	56.39	137.90	482.63	
18	5.81	5.56	11.37	20.00	70.00	5.16
	40.03	38.36	78.40	137.90	482.63	
19	5.95	3.96	9.91	20.00	70.00	6.07
	41.01	27.30	68.31	137.90	482.63	
20	3.09	4.29	7.38	20.00	70.00	8.48
	21.32	29.59	50.91	137.90	482.63	
21	1.81	0.92	2.73	20.00	70.00	>10
	12.49	6.31	18.80	137.90	482.63	
22	1.48	0.97	2.45	20.00	70.00	>10
	10.23	6.68	16.91	137.90	482.63	

Min MS: 1.833, Location: 4, Combination: Pm+Pb

Table 2-122. Load Combination 305, Side Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-025A

Load Cases: 305, 105, 202, 211
 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	6.17	2.26	8.43	20.00	70.00	6.78
	42.57	15.55	58.11	137.90	482.63	
2	4.84	0.64	5.48	20.00	70.00	8.91
	33.39	4.41	37.80	137.90	482.63	
3	5.59	1.32	6.91	20.00	70.00	7.58
	38.56	9.11	47.67	137.90	482.63	
4	6.58	2.61	9.18	20.00	70.00	6.30
	45.35	17.96	63.31	137.90	482.63	
5	6.76	1.45	8.21	20.00	70.00	6.10
	46.58	10.01	56.59	137.90	482.63	
6	6.21	1.31	7.52	20.00	70.00	6.73
	42.80	9.03	51.83	137.90	482.63	
7	5.97	0.36	6.34	20.00	70.00	7.04
	41.19	2.51	43.70	137.90	482.63	
8	6.21	0.34	6.56	20.00	70.00	6.72
	42.85	2.36	45.21	137.90	482.63	
9	6.00	0.39	6.38	20.00	70.00	7.01
	41.34	2.67	44.01	137.90	482.63	
10	6.10	0.72	6.82	20.00	70.00	6.87
	42.05	4.95	47.00	137.90	482.63	
11	5.86	3.14	9.00	20.00	70.00	6.78
	40.38	21.68	62.06	137.90	482.63	
12	4.37	1.52	5.89	20.00	70.00	9.99
	30.10	10.48	40.58	137.90	482.63	

13	6.62 45.67	1.26 8.67	7.88 54.34	20.00 137.90	70.00 482.63	6.25
14	6.75 46.51	1.77 12.19	8.51 58.70	20.00 137.90	70.00 482.63	6.12
15	3.80 26.19	2.37 16.33	6.17 42.53	20.00 137.90	70.00 482.63	>10
16	5.03 34.71	2.30 15.87	7.33 50.57	20.00 137.90	70.00 482.63	8.54
17	4.97 34.26	1.64 11.27	6.60 45.53	20.00 137.90	70.00 482.63	8.66
18	6.60 45.53	1.31 9.00	7.91 54.53	20.00 137.90	70.00 482.63	6.27
19	7.03 48.49	1.62 11.19	8.66 59.69	20.00 137.90	70.00 482.63	5.82
20	5.73 39.49	2.37 16.32	8.09 55.81	20.00 137.90	70.00 482.63	7.38
21	2.40 16.53	0.43 2.95	2.83 19.48	20.00 137.90	70.00 482.63	>10
22	2.54 17.54	0.42 2.90	2.96 20.44	20.00 137.90	70.00 482.63	>10

Min MS: 5.825, Location: 19, Combination: Pm

Table 2-123. Load Combination 306, Cg/Corner Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-025A

Load Cases: 306, 105, 202, 211
 30-ft. Cg/Corner Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc ---	Stress (ksi/MPa) -----					
	Pm --	Pb --	Pm+Pb -----	Sm --	Su --	MS --
1	8.08 55.73	4.45 30.71	12.54 86.43	20.00 137.90	70.00 482.63	4.58
2	4.15 28.58	0.57 3.94	4.72 32.52	20.00 137.90	70.00 482.63	>10
3	7.20 49.67	2.02 13.93	9.23 63.61	20.00 137.90	70.00 482.63	5.66
4	11.25 77.59	2.64 18.21	13.89 95.80	20.00 137.90	70.00 482.63	3.27
5	9.40 64.80	1.61 11.13	11.01 75.94	20.00 137.90	70.00 482.63	4.11
6	8.82 60.79	1.96 13.50	10.77 74.29	20.00 137.90	70.00 482.63	4.44
7	7.96 54.88	0.26 1.76	8.22 56.64	20.00 137.90	70.00 482.63	5.03
8	5.90 40.67	0.14 0.99	6.04 41.66	20.00 137.90	70.00 482.63	7.14
9	4.18 28.84	0.20 1.38	4.38 30.23	20.00 137.90	70.00 482.63	>10
10	4.45 30.71	1.65 11.37	6.10 42.08	20.00 137.90	70.00 482.63	9.78
11	3.68 25.40	1.81 12.47	5.49 37.87	20.00 137.90	70.00 482.63	>10
12	2.48 17.11	1.47 10.11	3.95 27.22	20.00 137.90	70.00 482.63	>10

13	4.47 30.81	1.08 7.42	5.54 38.23	20.00 137.90	70.00 482.63	9.74
14	4.54 31.33	1.61 11.11	6.16 42.44	20.00 137.90	70.00 482.63	9.56
15	6.86 47.32	2.48 17.12	9.35 64.44	20.00 137.90	70.00 482.63	5.99
16	9.89 68.18	2.63 18.13	12.52 86.31	20.00 137.90	70.00 482.63	3.85
17	10.67 73.56	2.06 14.23	12.73 87.79	20.00 137.90	70.00 482.63	3.50
18	8.19 56.45	1.42 9.78	9.61 66.23	20.00 137.90	70.00 482.63	4.86
19	8.95 61.73	2.42 16.69	11.37 78.42	20.00 137.90	70.00 482.63	4.36
20	8.89 61.29	2.43 16.74	11.32 78.04	20.00 137.90	70.00 482.63	4.40
21	2.07 14.24	0.47 3.25	2.54 17.49	20.00 137.90	70.00 482.63	>10
22	5.90 40.70	0.92 6.31	6.82 47.01	20.00 137.90	70.00 482.63	7.13

Min MS: 3.265, Location: 4, Combination: Pm

Table 2-124. Load Combination 310, Additional Increased External Pressure (290 psi), Hypothetical Accident Conditions of Transport – Model AOS-025A

Load Cases: 204, 101, 211

Additional Increased External Pressure, 2 MPa (290 psia)

100°F Ambient, Maximum Decay Heat

Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.81	1.11	1.91	20.00	70.00	>10
	5.56	7.63	13.19	137.90	482.63	
2	0.34	0.15	0.49	20.00	70.00	>10
	2.36	1.06	3.41	137.90	482.63	
3	0.26	0.21	0.47	20.00	70.00	>10
	1.81	1.46	3.27	137.90	482.63	
4	11.24	21.49	32.73	20.00	70.00	1.14
	77.51	148.18	225.69	137.90	482.63	
5	11.33	17.51	28.84	20.00	70.00	1.43
	78.12	120.73	198.85	137.90	482.63	
6	4.80	7.43	12.23	20.00	70.00	4.73
	33.09	51.21	84.30	137.90	482.63	
7	1.33	0.07	1.40	20.00	70.00	>10
	9.16	0.49	9.64	137.90	482.63	
8	1.31	0.05	1.35	20.00	70.00	>10
	9.01	0.33	9.34	137.90	482.63	
9	1.33	0.08	1.41	20.00	70.00	>10
	9.16	0.54	9.70	137.90	482.63	
10	1.43	0.68	2.11	20.00	70.00	>10
	9.87	4.68	14.55	137.90	482.63	
11	1.37	1.68	3.04	20.00	70.00	>10
	9.43	11.56	20.99	137.90	482.63	
12	1.10	1.80	2.91	20.00	70.00	>10
	7.61	12.44	20.05	137.90	482.63	
13	3.80	2.71	6.51	20.00	70.00	9.76
	26.17	18.70	44.87	137.90	482.63	

14	3.84 26.51	4.29 29.59	8.14 56.10	20.00 137.90	70.00 482.63	7.60
15	2.70 18.63	3.62 24.97	6.32 43.60	20.00 137.90	70.00 482.63	>10
16	1.96 13.54	3.13 21.56	5.09 35.10	20.00 137.90	70.00 482.63	>10
17	1.26 8.70	2.06 14.19	3.32 22.90	20.00 137.90	70.00 482.63	>10
18	1.01 6.96	1.67 11.52	2.68 18.48	20.00 137.90	70.00 482.63	>10
19	1.70 11.69	2.56 17.68	4.26 29.37	20.00 137.90	70.00 482.63	>10
20	2.19 15.13	3.64 25.08	5.83 40.21	20.00 137.90	70.00 482.63	>10
21	1.95 13.44	3.87 26.67	5.82 40.11	20.00 137.90	70.00 482.63	>10
22	2.09 14.43	3.68 25.34	5.77 39.77	20.00 137.90	70.00 482.63	>10

Min MS: 1.138, Location: 4, Combination: Pm+Pb

**Table 2-125. Load Combination 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 311, 101, 201, 211
 4-ft. Drop onto Rod
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 207 kPa (30 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.21	1.33	2.54	20.00	70.00	>10
	8.35	9.19	17.54	137.90	482.63	
2	0.60	0.20	0.80	20.00	70.00	>10
	4.12	1.37	5.48	137.90	482.63	
3	0.30	0.11	0.41	20.00	70.00	>10
	2.08	0.74	2.82	137.90	482.63	
4	4.10	5.79	9.89	20.00	70.00	6.08
	28.28	39.89	68.17	137.90	482.63	
5	3.51	4.47	7.98	20.00	70.00	7.77
	24.20	30.81	55.01	137.90	482.63	
6	2.06	1.43	3.48	20.00	70.00	>10
	14.19	9.84	24.02	137.90	482.63	
7	0.58	0.08	0.66	20.00	70.00	>10
	4.00	0.57	4.57	137.90	482.63	
8	0.38	0.05	0.43	20.00	70.00	>10
	2.65	0.33	2.98	137.90	482.63	
9	0.37	0.07	0.44	20.00	70.00	>10
	2.54	0.51	3.06	137.90	482.63	
10	1.13	0.19	1.32	20.00	70.00	>10
	7.77	1.30	9.07	137.90	482.63	
11	1.02	1.11	2.13	20.00	70.00	>10
	7.03	7.63	14.66	137.90	482.63	
12	1.05	1.52	2.57	20.00	70.00	>10
	7.26	10.46	17.71	137.90	482.63	

13	1.43 9.89	1.03 7.10	2.46 16.99	20.00 137.90	70.00 482.63	>10
14	1.45 9.99	1.60 11.02	3.05 21.02	20.00 137.90	70.00 482.63	>10
15	12.69 87.50	5.59 38.53	18.28 126.03	20.00 137.90	70.00 482.63	2.78
16	3.01 20.75	3.63 25.03	6.64 45.79	20.00 137.90	70.00 482.63	9.54
17	2.00 13.80	3.12 21.48	5.12 35.28	20.00 137.90	70.00 482.63	>10
18	1.55 10.67	1.75 12.06	3.30 22.73	20.00 137.90	70.00 482.63	>10
19	2.68 18.51	3.44 23.75	6.13 42.26	20.00 137.90	70.00 482.63	>10
20	3.60 24.80	4.72 32.56	8.32 57.37	20.00 137.90	70.00 482.63	7.41
21	0.54 3.70	0.82 5.67	1.36 9.37	20.00 137.90	70.00 482.63	>10
22	5.46 37.62	2.57 17.69	8.02 55.31	20.00 137.90	70.00 482.63	7.73

Min MS: 2.782, Location: 15, Combination: Pm

Table 2-126. Load Combination 312, 4-ft. Drop onto Rod at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-025A

Load Cases: 311, 104, 201, 211

4-ft. Drop onto Rod

-40°F Ambient, Zero Decay Heat, Zero Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.21	1.33	2.54	20.00	70.00	>10
	8.35	9.19	17.54	137.90	482.63	
2	0.60	0.20	0.80	20.00	70.00	>10
	4.12	1.37	5.48	137.90	482.63	
3	0.30	0.11	0.41	20.00	70.00	>10
	2.08	0.74	2.82	137.90	482.63	
4	4.10	5.79	9.89	20.00	70.00	6.08
	28.28	39.89	68.17	137.90	482.63	
5	3.51	4.47	7.98	20.00	70.00	7.77
	24.20	30.81	55.01	137.90	482.63	
6	2.06	1.43	3.48	20.00	70.00	>10
	14.19	9.84	24.02	137.90	482.63	
7	0.58	0.08	0.66	20.00	70.00	>10
	4.00	0.57	4.57	137.90	482.63	
8	0.38	0.05	0.43	20.00	70.00	>10
	2.65	0.33	2.98	137.90	482.63	
9	0.37	0.07	0.44	20.00	70.00	>10
	2.54	0.51	3.06	137.90	482.63	
10	1.13	0.19	1.32	20.00	70.00	>10
	7.77	1.30	9.07	137.90	482.63	
11	1.02	1.11	2.13	20.00	70.00	>10
	7.03	7.63	14.66	137.90	482.63	
12	1.05	1.52	2.57	20.00	70.00	>10
	7.26	10.46	17.71	137.90	482.63	

13	1.43 9.89	1.03 7.10	2.46 16.99	20.00 137.90	70.00 482.63	>10
14	1.45 9.99	1.60 11.02	3.05 21.02	20.00 137.90	70.00 482.63	>10
15	12.69 87.50	5.59 38.53	18.28 126.03	20.00 137.90	70.00 482.63	2.78
16	3.01 20.75	3.63 25.03	6.64 45.79	20.00 137.90	70.00 482.63	9.54
17	2.00 13.80	3.12 21.48	5.12 35.28	20.00 137.90	70.00 482.63	>10
18	1.55 10.67	1.75 12.06	3.30 22.73	20.00 137.90	70.00 482.63	>10
19	2.68 18.51	3.44 23.75	6.13 42.26	20.00 137.90	70.00 482.63	>10
20	3.60 24.80	4.72 32.56	8.32 57.37	20.00 137.90	70.00 482.63	7.41
21	0.54 3.70	0.82 5.67	1.36 9.37	20.00 137.90	70.00 482.63	>10
22	5.46 37.62	2.57 17.69	8.02 55.31	20.00 137.90	70.00 482.63	7.73

Min MS: 2.782, Location: 15, Combination: Pm

**Table 2-127. Load Combination 350, Fire at 30 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 111, 201, 211

Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.73 5.03	1.03 7.09	1.76 12.13	20.00 137.90	66.30 457.12	>10
2	0.24 1.62	0.14 0.98	0.38 2.60	20.00 137.90	66.30 457.12	>10
3	0.16 1.10	0.09 0.65	0.25 1.75	20.00 137.90	66.30 457.12	>10
4	1.35 9.32	2.31 15.94	3.66 25.26	20.00 137.90	66.30 457.12	>10
5	1.23 8.47	1.63 11.23	2.86 19.70	20.00 137.90	66.30 457.12	>10
6	0.73 5.06	1.17 8.05	1.90 13.12	20.00 137.90	66.30 457.12	>10
7	0.24 1.67	0.05 0.38	0.30 2.04	20.00 137.90	66.30 457.12	>10
8	0.24 1.62	0.05 0.32	0.28 1.94	20.00 137.90	66.30 457.12	>10
9	0.27 1.90	0.07 0.51	0.35 2.41	20.00 137.90	66.30 457.12	>10
10	0.96 6.64	0.12 0.83	1.08 7.47	20.00 137.90	66.30 457.12	>10
11	0.81 5.58	0.96 6.63	1.77 12.21	20.00 137.90	66.30 457.12	>10
12	0.85 5.86	1.20 8.24	2.04 14.10	20.00 137.90	66.30 457.12	>10
13	1.24 8.58	0.88 6.06	2.12 14.64	20.00 137.90	66.30 457.12	>10

14	1.25 8.61	1.53 10.57	2.78 19.18	20.00 137.90	66.30 457.12	>10
15	1.56 10.74	1.70 11.69	3.25 22.42	20.00 137.90	66.30 457.12	>10
16	1.60 11.03	2.53 17.46	4.13 28.49	20.00 137.90	66.30 457.12	>10
17	1.07 7.39	1.71 11.81	2.78 19.20	20.00 137.90	66.30 457.12	>10
18	0.84 5.82	1.36 9.38	2.20 15.20	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	3.51 24.23	20.00 137.90	66.30 457.12	>10
20	1.76 12.10	2.77 19.10	4.52 31.20	20.00 137.90	66.30 457.12	>10
21	0.32 2.20	0.52 3.57	0.84 5.77	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.76 5.26	20.00 137.90	66.30 457.12	>10

Min MS: 13.653, Location: 20, Combination: Pm+Pb

**Table 2-128. Load Combination 351, Post Fire at 60 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 112, 201, 211

Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.73 5.03	1.03 7.09	1.76 12.13	20.00 137.90	66.30 457.12	>10
2	0.24 1.62	0.14 0.98	0.38 2.60	20.00 137.90	66.30 457.12	>10
3	0.16 1.10	0.09 0.65	0.25 1.75	20.00 137.90	66.30 457.12	>10
4	1.35 9.32	2.31 15.94	3.66 25.26	20.00 137.90	66.30 457.12	>10
5	1.23 8.47	1.63 11.23	2.86 19.70	20.00 137.90	66.30 457.12	>10
6	0.73 5.06	1.17 8.05	1.90 13.12	20.00 137.90	66.30 457.12	>10
7	0.24 1.67	0.05 0.38	0.30 2.04	20.00 137.90	66.30 457.12	>10
8	0.24 1.62	0.05 0.32	0.28 1.94	20.00 137.90	66.30 457.12	>10
9	0.27 1.90	0.07 0.51	0.35 2.41	20.00 137.90	66.30 457.12	>10
10	0.96 6.64	0.12 0.83	1.08 7.47	20.00 137.90	66.30 457.12	>10
11	0.81 5.58	0.96 6.63	1.77 12.21	20.00 137.90	66.30 457.12	>10
12	0.85 5.86	1.20 8.24	2.04 14.10	20.00 137.90	66.30 457.12	>10
13	1.24 8.58	0.88 6.06	2.12 14.64	20.00 137.90	66.30 457.12	>10

14	1.25 8.61	1.53 10.57	2.78 19.18	20.00 137.90	66.30 457.12	>10
15	1.56 10.74	1.70 11.69	3.25 22.42	20.00 137.90	66.30 457.12	>10
16	1.60 11.03	2.53 17.46	4.13 28.49	20.00 137.90	66.30 457.12	>10
17	1.07 7.39	1.71 11.81	2.78 19.20	20.00 137.90	66.30 457.12	>10
18	0.84 5.82	1.36 9.38	2.20 15.20	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	3.51 24.23	20.00 137.90	66.30 457.12	>10
20	1.76 12.10	2.77 19.10	4.52 31.20	20.00 137.90	66.30 457.12	>10
21	0.32 2.20	0.52 3.57	0.84 5.77	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.76 5.26	20.00 137.90	66.30 457.12	>10

Min MS: 13.653, Location: 20, Combination: Pm+Pb

**Table 2-129. Load Combination 352, Post Fire at 90 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 112, 201, 211

Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.73 5.03	1.03 7.09	1.76 12.13	20.00 137.90	66.30 457.12	>10
2	0.24 1.62	0.14 0.98	0.38 2.60	20.00 137.90	66.30 457.12	>10
3	0.16 1.10	0.09 0.65	0.25 1.75	20.00 137.90	66.30 457.12	>10
4	1.35 9.32	2.31 15.94	3.66 25.26	20.00 137.90	66.30 457.12	>10
5	1.23 8.47	1.63 11.23	2.86 19.70	20.00 137.90	66.30 457.12	>10
6	0.73 5.06	1.17 8.05	1.90 13.12	20.00 137.90	66.30 457.12	>10
7	0.24 1.67	0.05 0.38	0.30 2.04	20.00 137.90	66.30 457.12	>10
8	0.24 1.62	0.05 0.32	0.28 1.94	20.00 137.90	66.30 457.12	>10
9	0.27 1.90	0.07 0.51	0.35 2.41	20.00 137.90	66.30 457.12	>10
10	0.96 6.64	0.12 0.83	1.08 7.47	20.00 137.90	66.30 457.12	>10
11	0.81 5.58	0.96 6.63	1.77 12.21	20.00 137.90	66.30 457.12	>10
12	0.85 5.86	1.20 8.24	2.04 14.10	20.00 137.90	66.30 457.12	>10
13	1.24 8.58	0.88 6.06	2.12 14.64	20.00 137.90	66.30 457.12	>10

14	1.25 8.61	1.53 10.57	2.78 19.18	20.00 137.90	66.30 457.12	>10
15	1.56 10.74	1.70 11.69	3.25 22.42	20.00 137.90	66.30 457.12	>10
16	1.60 11.03	2.53 17.46	4.13 28.49	20.00 137.90	66.30 457.12	>10
17	1.07 7.39	1.71 11.81	2.78 19.20	20.00 137.90	66.30 457.12	>10
18	0.84 5.82	1.36 9.38	2.20 15.20	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	3.51 24.23	20.00 137.90	66.30 457.12	>10
20	1.76 12.10	2.77 19.10	4.52 31.20	20.00 137.90	66.30 457.12	>10
21	0.32 2.20	0.52 3.57	0.84 5.77	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.76 5.26	20.00 137.90	66.30 457.12	>10

Min MS: 13.653, Location: 20, Combination: Pm+Pb

**Table 2-130. Load Combination 353, Post Fire at 120 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 112, 201, 211

Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.73 5.03	1.03 7.09	1.76 12.13	20.00 137.90	66.30 457.12	>10
2	0.24 1.62	0.14 0.98	0.38 2.60	20.00 137.90	66.30 457.12	>10
3	0.16 1.10	0.09 0.65	0.25 1.75	20.00 137.90	66.30 457.12	>10
4	1.35 9.32	2.31 15.94	3.66 25.26	20.00 137.90	66.30 457.12	>10
5	1.23 8.47	1.63 11.23	2.86 19.70	20.00 137.90	66.30 457.12	>10
6	0.73 5.06	1.17 8.05	1.90 13.12	20.00 137.90	66.30 457.12	>10
7	0.24 1.67	0.05 0.38	0.30 2.04	20.00 137.90	66.30 457.12	>10
8	0.24 1.62	0.05 0.32	0.28 1.94	20.00 137.90	66.30 457.12	>10
9	0.27 1.90	0.07 0.51	0.35 2.41	20.00 137.90	66.30 457.12	>10
10	0.96 6.64	0.12 0.83	1.08 7.47	20.00 137.90	66.30 457.12	>10
11	0.81 5.58	0.96 6.63	1.77 12.21	20.00 137.90	66.30 457.12	>10
12	0.85 5.86	1.20 8.24	2.04 14.10	20.00 137.90	66.30 457.12	>10
13	1.24 8.58	0.88 6.06	2.12 14.64	20.00 137.90	66.30 457.12	>10

14	1.25 8.61	1.53 10.57	2.78 19.18	20.00 137.90	66.30 457.12	>10
15	1.56 10.74	1.70 11.69	3.25 22.42	20.00 137.90	66.30 457.12	>10
16	1.60 11.03	2.53 17.46	4.13 28.49	20.00 137.90	66.30 457.12	>10
17	1.07 7.39	1.71 11.81	2.78 19.20	20.00 137.90	66.30 457.12	>10
18	0.84 5.82	1.36 9.38	2.20 15.20	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	3.51 24.23	20.00 137.90	66.30 457.12	>10
20	1.76 12.10	2.77 19.10	4.52 31.20	20.00 137.90	66.30 457.12	>10
21	0.32 2.20	0.52 3.57	0.84 5.77	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.76 5.26	20.00 137.90	66.30 457.12	>10

Min MS: 13.653, Location: 20, Combination: Pm+Pb

**Table 2-131. Load Combination 354, Post Fire at 150 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 112, 201, 211

Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.73 5.03	1.03 7.09	1.76 12.13	20.00 137.90	66.30 457.12	>10
2	0.24 1.62	0.14 0.98	0.38 2.60	20.00 137.90	66.30 457.12	>10
3	0.16 1.10	0.09 0.65	0.25 1.75	20.00 137.90	66.30 457.12	>10
4	1.35 9.32	2.31 15.94	3.66 25.26	20.00 137.90	66.30 457.12	>10
5	1.23 8.47	1.63 11.23	2.86 19.70	20.00 137.90	66.30 457.12	>10
6	0.73 5.06	1.17 8.05	1.90 13.12	20.00 137.90	66.30 457.12	>10
7	0.24 1.67	0.05 0.38	0.30 2.04	20.00 137.90	66.30 457.12	>10
8	0.24 1.62	0.05 0.32	0.28 1.94	20.00 137.90	66.30 457.12	>10
9	0.27 1.90	0.07 0.51	0.35 2.41	20.00 137.90	66.30 457.12	>10
10	0.96 6.64	0.12 0.83	1.08 7.47	20.00 137.90	66.30 457.12	>10
11	0.81 5.58	0.96 6.63	1.77 12.21	20.00 137.90	66.30 457.12	>10
12	0.85 5.86	1.20 8.24	2.04 14.10	20.00 137.90	66.30 457.12	>10
13	1.24 8.58	0.88 6.06	2.12 14.64	20.00 137.90	66.30 457.12	>10

14	1.25 8.61	1.53 10.57	2.78 19.18	20.00 137.90	66.30 457.12	>10
15	1.56 10.74	1.70 11.69	3.25 22.42	20.00 137.90	66.30 457.12	>10
16	1.60 11.03	2.53 17.46	4.13 28.49	20.00 137.90	66.30 457.12	>10
17	1.07 7.39	1.71 11.81	2.78 19.20	20.00 137.90	66.30 457.12	>10
18	0.84 5.82	1.36 9.38	2.20 15.20	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	3.51 24.23	20.00 137.90	66.30 457.12	>10
20	1.76 12.10	2.77 19.10	4.52 31.20	20.00 137.90	66.30 457.12	>10
21	0.32 2.20	0.52 3.57	0.84 5.77	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.76 5.26	20.00 137.90	66.30 457.12	>10

Min MS: 13.653, Location: 20, Combination: Pm+Pb

**Table 2-132. Load Combination 355, Post Fire at 180 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-025A**

Load Cases: 112, 201, 211

Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 207 kPa (30 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.73 5.03	1.03 7.09	1.76 12.13	20.00 137.90	66.30 457.12	>10
2	0.24 1.62	0.14 0.98	0.38 2.60	20.00 137.90	66.30 457.12	>10
3	0.16 1.10	0.09 0.65	0.25 1.75	20.00 137.90	66.30 457.12	>10
4	1.35 9.32	2.31 15.94	3.66 25.26	20.00 137.90	66.30 457.12	>10
5	1.23 8.47	1.63 11.23	2.86 19.70	20.00 137.90	66.30 457.12	>10
6	0.73 5.06	1.17 8.05	1.90 13.12	20.00 137.90	66.30 457.12	>10
7	0.24 1.67	0.05 0.38	0.30 2.04	20.00 137.90	66.30 457.12	>10
8	0.24 1.62	0.05 0.32	0.28 1.94	20.00 137.90	66.30 457.12	>10
9	0.27 1.90	0.07 0.51	0.35 2.41	20.00 137.90	66.30 457.12	>10
10	0.96 6.64	0.12 0.83	1.08 7.47	20.00 137.90	66.30 457.12	>10
11	0.81 5.58	0.96 6.63	1.77 12.21	20.00 137.90	66.30 457.12	>10
12	0.85 5.86	1.20 8.24	2.04 14.10	20.00 137.90	66.30 457.12	>10
13	1.24 8.58	0.88 6.06	2.12 14.64	20.00 137.90	66.30 457.12	>10

14	1.25 8.61	1.53 10.57	2.78 19.18	20.00 137.90	66.30 457.12	>10
15	1.56 10.74	1.70 11.69	3.25 22.42	20.00 137.90	66.30 457.12	>10
16	1.60 11.03	2.53 17.46	4.13 28.49	20.00 137.90	66.30 457.12	>10
17	1.07 7.39	1.71 11.81	2.78 19.20	20.00 137.90	66.30 457.12	>10
18	0.84 5.82	1.36 9.38	2.20 15.20	20.00 137.90	66.30 457.12	>10
19	1.42 9.77	2.10 14.46	3.51 24.23	20.00 137.90	66.30 457.12	>10
20	1.76 12.10	2.77 19.10	4.52 31.20	20.00 137.90	66.30 457.12	>10
21	0.32 2.20	0.52 3.57	0.84 5.77	20.00 137.90	66.30 457.12	>10
22	0.39 2.71	0.37 2.55	0.76 5.26	20.00 137.90	66.30 457.12	>10

Min MS: 13.653, Location: 20, Combination: Pm+Pb

2.12.2.2 Structural Evaluation Results – Model AOS-050A

This appendix presents the following information, specific to the Model AOS-050A transport package:

- [Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Model AOS-050A](#)
- [Hypothetical Accident Conditions of Transport Summary of Damages \(Stresses\) – Model AOS-050A](#)

2.12.2.2.1 Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Model AOS-050A

[Table 2-133](#) and [Table 2-134](#) present Model AOS-050A transport package Load Cases and Load Combinations, respectively, under Normal conditions of transport:

- [Table 2-135](#) through [Table 2-152](#) present Load Case output data. Comparisons with allowable stress limits are included for Load Cases 101, 102, 103, 104, 105, and 106.
- [Table 2-153](#) through [Table 2-170](#) present Load Combination output data.

Table 2-133. Load Cases Associated with Allowable Stresses under Normal Conditions of Transport – Model AOS-050A

Load Case	Description	Data
101	100°F Ambient, Maximum Decay Heat	Table 2-135
102	100°F Ambient, Maximum Decay Heat, Maximum Insolation	Table 2-136
103	-20°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-137
104	-40°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-138
105	-40°F Ambient, Maximum Decay Heat	Table 2-139
106	-20°F Ambient, Maximum Decay Heat	Table 2-140
201	Internal Design Pressure, 414 kPa (60 psia)	Table 2-141
202	Minimum External Pressure, 24 kPa (3.5 psia)	Table 2-142
203	Maximum Increased External Pressure, 140 kPa (20 psia)	Table 2-143
204	Additional Increased External Pressure, 2 MPa (290 psia)	Table 2-144
211	Fabrication Stress	Table 2-145
215	Compression Load (5x weight)	Table 2-146
216	Rod Drop onto Cask	Table 2-147
221	Forward 10g Vibration Inertia Load	Table 2-148
222	Lateral 5g Vibration Inertia Load	Table 2-149
223	Vertical 2g Vibration Inertia Load	Table 2-150
231	4-ft. Head-On Drop	Table 2-151
232	30-ft. Head-On Drop Impact Test, Normal Conditions	Table 2-152

**Table 2-134. Load Combinations Associated with Allowable Stresses
under Normal Conditions of Transport – Model AOS-050A**

Load Combination	Load Cases	Description	Data
101	102, 201, 211	Hot Environment	Table 2-153
102	104, 201, 211	Cold Environment	Table 2-154
103	103, 202, 211	Increased External Pressure	Table 2-155
104	101, 201, 202, 211	Minimum External Pressure	Table 2-156
105	105, 201, 202, 211	Cold Environment with Maximum Decay Heat	Table 2-157
106	101, 201, 203, 211	Maximum Pressure, Hot Environment	Table 2-158
107	105, 201, 203, 211	Maximum Pressure, Cold Environment	Table 2-159
215	215, 101, 201, 211	Compression Load	Table 2-160
216	216, 101, 201, 211	Rod Drop	Table 2-161
217	216, 104, 201, 211	Rod Drop, Cold Environment	Table 2-162
221	221, 101, 201, 211	Forward Vibration	Table 2-163
222	222, 101, 201, 211	Lateral Vibration	Table 2-164
223	223, 101, 201, 211	Vertical Vibration	Table 2-165
224	221, 103, 201, 211	Forward Vibration at Cold Temperature	Table 2-166
225	222, 103, 201, 211	Lateral Vibration at Cold Temperature	Table 2-167
226	223, 103, 201, 211	Vertical Vibration at Cold Temperature	Table 2-168
231	231, 102, 201, 211	4-ft. Head-On Drop, Normal Conditions	Table 2-169
232	232, 102, 201, 211	30-ft. Head-On Drop, Normal Conditions (Impact Test)	Table 2-170
233	231, 103, 211	4-ft. Drop at Cold Temperature	Table 2-171

**Table 2-135. Load Case 101, 100°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	5.0983E+01 3.5151E-01	-1.0957E+02 -7.5544E-01	-2.1641E+01 -1.4921E-01	1.6055E+02 1.1070E+00	2.5535E+02 1.7606E+00
2	6.1579E+01 4.2457E-01	-1.4600E+02 -1.0066E+00	-1.8781E+01 -1.2949E-01	2.0758E+02 1.4312E+00	4.2119E+02 2.9040E+00
3	5.2022E+01 3.5868E-01	-1.0195E+02 -7.0290E-01	-7.1029E+00 -4.8973E-02	1.5397E+02 1.0616E+00	2.3914E+02 1.6488E+00
4	2.1572E+02 1.4874E+00	-9.1625E+02 -6.3173E+00	-1.9724E+02 -1.3599E+00	1.1320E+03 7.8047E+00	2.2401E+03 1.5445E+01
5	1.9711E+02 1.3590E+00	-9.8229E+02 -6.7727E+00	-6.4541E+02 -4.4500E+00	1.1794E+03 8.1317E+00	1.8500E+03 1.2755E+01
6	2.5459E+01 1.7553E-01	-5.1469E+02 -3.5486E+00	-9.1093E+02 -6.2807E+00	5.4015E+02 3.7242E+00	6.2083E+02 4.2804E+00
7	-3.9486E+01 -2.7225E-01	-1.8746E+02 -1.2925E+00	-4.3852E+02 -3.0235E+00	1.4798E+02 1.0203E+00	2.0576E+02 1.4186E+00
8	-3.9611E+01 -2.7311E-01	-1.8733E+02 -1.2916E+00	-4.4531E+02 -3.0703E+00	1.4772E+02 1.0185E+00	2.0547E+02 1.4167E+00
9	-4.0479E+01 -2.7909E-01	-1.8627E+02 -1.2843E+00	-4.5882E+02 -3.1634E+00	1.4579E+02 1.0052E+00	2.0040E+02 1.3817E+00
10	1.5765E+01 1.0870E-01	-4.3796E+02 -3.0196E+00	-9.4487E+01 -6.5146E-01	4.5372E+02 3.1283E+00	6.9574E+02 4.7970E+00
11	-1.1675E+02 -8.0496E-01	-5.8621E+02 -4.0418E+00	-3.1189E+02 -2.1504E+00	4.6946E+02 3.2368E+00	1.5875E+02 1.0945E+00
12	1.4648E+00 1.0100E-02	-6.9981E+02 -4.8250E+00	-6.9521E+02 -4.7933E+00	7.0128E+02 4.8351E+00	1.8196E+02 1.2546E+00
13	-3.0732E+01 -2.1189E-01	-7.2585E+02 -5.0046E+00	-6.8918E+01 -4.7517E-01	6.9512E+02 4.7927E+00	8.3651E+01 5.7676E-01
14	-6.5893E+01 -4.5432E-01	-6.3576E+02 -4.3834E+00	6.8736E+01 4.7391E-01	5.6987E+02 3.9291E+00	4.8608E+02 3.3514E+00
15	7.0612E+02 4.8685E+00	-7.0239E+02 -4.8428E+00	-2.9121E+00 -2.0078E-02	1.4085E+03 9.7114E+00	2.3761E+03 1.6383E+01

16	1.7608E+02	-3.1436E+02	-1.5377E+02	4.9044E+02	7.9644E+02
	1.2140E+00	-2.1674E+00	-1.0602E+00	3.3814E+00	5.4913E+00
17	7.8085E+01	-2.1398E+02	-5.6290E+01	2.9207E+02	5.0506E+02
	5.3837E-01	-1.4754E+00	-3.8811E-01	2.0137E+00	3.4822E+00
18	5.2701E+01	-1.3938E+02	6.5634E+02	1.9208E+02	3.8182E+01
	3.6336E-01	-9.6101E-01	4.5253E+00	1.3244E+00	2.6326E-01
19	-1.4122E+01	-2.9148E+02	7.2132E+02	2.7736E+02	3.9503E+02
	-9.7365E-02	-2.0097E+00	4.9733E+00	1.9123E+00	2.7237E+00
20	-2.0709E+01	-5.7822E+02	5.2506E+01	5.5751E+02	6.9097E+01
	-1.4279E-01	-3.9867E+00	3.6202E-01	3.8439E+00	4.7641E-01
21	1.6800E+01	-1.0547E+01	6.2925E+00	2.7347E+01	5.3309E+01
	1.1583E-01	-7.2718E-02	4.3385E-02	1.8855E-01	3.6755E-01
22	-2.0512E+01	-9.3130E+01	-3.6011E+01	7.2618E+01	1.5539E+02
	-1.4143E-01	-6.4211E-01	-2.4829E-01	5.0069E-01	1.0714E+00

Allowable Stress for Load Case 101

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	215.29	214.44	20.00	25.00	66.30
2	215.51	213.44	20.00	25.00	66.30
3	215.35	214.53	20.00	25.00	66.30
4	216.67	216.56	20.00	25.00	66.30
5	219.04	218.65	20.00	25.00	66.30
6	220.00	219.58	20.00	25.00	66.30
7	220.62	219.93	20.00	25.00	66.30
8	220.65	219.96	20.00	25.00	66.30
9	220.71	220.01	20.00	25.00	66.30
10	221.28	220.39	20.00	25.00	66.30
11	222.29	221.17	20.00	25.00	66.30
12	224.99	223.71	20.00	25.00	66.30
13	219.61	219.12	20.00	25.00	66.30
14	218.36	218.07	20.00	25.00	66.30
15	215.93	215.90	20.00	25.00	66.30
16	216.78	216.59	20.00	25.00	66.30
17	216.94	216.80	20.00	25.00	66.30
18	217.90	217.69	20.00	25.00	66.30
19	218.86	218.46	20.00	25.00	66.30
20	223.43	222.81	20.00	25.00	66.30
21	214.87	214.80	20.00	25.00	66.30
22	215.46	215.39	20.00	25.00	66.30

Table 2-136. Load Case 102, 100°F Ambient, Maximum Decay Heat, Maximum Insolation, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	4.6230E+01 3.1875E-01	-1.0386E+02 -7.1607E-01	-2.5844E+01 -1.7819E-01	1.5009E+02 1.0348E+00	2.4183E+02 1.6674E+00
2	5.6787E+01 3.9153E-01	-1.3727E+02 -9.4643E-01	-7.9275E+00 -5.4659E-02	1.9405E+02 1.3380E+00	3.8942E+02 2.6849E+00
3	5.3378E+01 3.6803E-01	-9.8542E+01 -6.7943E-01	-7.6213E+00 -5.2547E-02	1.5192E+02 1.0475E+00	2.3448E+02 1.6167E+00
4	4.3735E+02 3.0155E+00	-9.1795E+02 -6.3290E+00	-3.4836E+02 -2.4019E+00	1.3553E+03 9.3445E+00	2.6809E+03 1.8484E+01
5	3.4319E+02 2.3662E+00	-7.6386E+02 -5.2666E+00	-9.0477E+02 -6.2382E+00	1.1070E+03 7.6328E+00	1.6564E+03 1.1421E+01
6	1.7645E+01 1.2166E-01	-6.4881E+02 -4.4734E+00	-1.7320E+03 -1.1941E+01	6.6646E+02 4.5950E+00	1.0025E+03 6.9121E+00
7	-1.0537E+02 -7.2653E-01	-3.2530E+02 -2.2429E+00	-2.1215E+03 -1.4627E+01	2.1993E+02 1.5163E+00	2.1383E+02 1.4743E+00
8	-1.0983E+02 -7.5728E-01	-3.2034E+02 -2.2086E+00	-2.1299E+03 -1.4685E+01	2.1050E+02 1.4514E+00	1.9672E+02 1.3563E+00
9	-1.0774E+02 -7.4284E-01	-3.2317E+02 -2.2282E+00	-2.1648E+03 -1.4926E+01	2.1543E+02 1.4853E+00	2.0456E+02 1.4104E+00
10	6.0058E+01 4.1409E-01	-8.6588E+02 -5.9700E+00	-9.6955E+02 -6.6848E+00	9.2593E+02 6.3841E+00	7.8500E+02 5.4124E+00
11	-1.8286E+02 -1.2608E+00	-9.2728E+02 -6.3933E+00	-6.6824E+02 -4.6073E+00	7.4442E+02 5.1326E+00	7.3835E+02 5.0907E+00
12	2.3527E+00 1.6221E-02	-1.0214E+03 -7.0423E+00	-1.0163E+03 -7.0072E+00	1.0237E+03 7.0585E+00	7.8038E+02 5.3806E+00
13	2.2747E+01 1.5683E-01	-6.9578E+02 -4.7972E+00	-8.4108E+01 -5.7990E-01	7.1853E+02 4.9541E+00	2.9726E+02 2.0495E+00
14	-6.2364E+01 -4.2998E-01	-6.4557E+02 -4.4510E+00	1.7843E+01 1.2302E-01	5.8320E+02 4.0211E+00	8.6998E+02 5.9983E+00
15	1.0380E+03 7.1570E+00	-1.0666E+03 -7.3542E+00	-3.8747E+01 -2.6715E-01	2.1047E+03 1.4511E+01	3.5508E+03 2.4482E+01

16	2.6063E+02	-4.8203E+02	-1.8953E+02	7.4266E+02	1.2050E+03
	1.7970E+00	-3.3235E+00	-1.3068E+00	5.1205E+00	8.3082E+00
17	1.1458E+02	-3.2024E+02	-3.1572E+01	4.3483E+02	7.4874E+02
	7.9002E-01	-2.2080E+00	-2.1768E-01	2.9980E+00	5.1624E+00
18	4.0402E+01	-1.5380E+02	6.3354E+02	1.9420E+02	3.4897E+01
	2.7856E-01	-1.0604E+00	4.3681E+00	1.3390E+00	2.4061E-01
19	-2.9257E+00	-3.1945E+02	6.7747E+02	3.1652E+02	4.9011E+02
	-2.0172E-02	-2.2025E+00	4.6710E+00	2.1823E+00	3.3792E+00
20	-3.6221E+01	-5.6814E+02	4.6641E+01	5.3192E+02	2.3743E+02
	-2.4974E-01	-3.9172E+00	3.2158E-01	3.6675E+00	1.6370E+00
21	1.8711E+01	-1.1642E+01	7.0702E+00	3.0353E+01	5.8956E+01
	1.2901E-01	-8.0267E-02	4.8747E-02	2.0928E-01	4.0648E-01
22	-1.7445E+01	-1.3227E+02	-3.4003E+01	1.1483E+02	2.0598E+02
	-1.2028E-01	-9.1199E-01	-2.3445E-01	7.9171E-01	1.4202E+00

Allowable Stress for Load Case 102

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	285.77	284.89	20.00	23.60	66.30
2	286.21	284.12	20.00	23.60	66.30
3	286.55	285.90	20.00	23.60	66.30
4	287.11	287.00	20.00	23.60	66.30
5	289.41	289.03	20.00	23.60	66.30
6	290.34	289.93	20.00	23.60	66.30
7	290.97	290.30	20.00	23.60	66.30
8	291.14	290.47	20.00	23.60	66.30
9	291.36	290.68	20.00	23.60	66.30
10	292.10	291.22	20.00	23.60	66.30
11	293.09	292.03	20.00	23.60	66.30
12	295.71	294.48	20.00	23.60	66.30
13	290.56	290.12	20.00	23.60	66.30
14	289.43	289.16	20.00	23.60	66.30
15	286.42	286.39	20.00	23.60	66.30
16	287.16	286.99	20.00	23.60	66.30
17	287.30	287.18	20.00	23.60	66.30
18	288.23	288.03	20.00	23.60	66.30
19	289.15	288.77	20.00	23.60	66.30
20	293.49	292.91	20.00	23.60	66.30
21	286.27	286.21	20.00	23.60	66.30
22	286.03	285.98	20.00	23.60	66.30

Table 2-137. Load Case 103, -20°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.6850E+01 1.1617E-01	-5.7642E+01 -3.9743E-01	-1.2011E+01 -8.2811E-02	7.4491E+01 5.1360E-01	7.4156E+01 5.1129E-01
2	5.2966E+01 3.6518E-01	-7.2093E-01 -4.9706E-03	-1.7049E+01 -1.1755E-01	5.3686E+01 3.7016E-01	6.2906E+00 4.3372E-02
3	6.3488E+01 4.3774E-01	-7.0567E+00 -4.8654E-02	-1.0242E+01 -7.0617E-02	7.0545E+01 4.8639E-01	8.0488E+01 5.5494E-01
4	5.5406E+03 3.8201E+01	-3.3127E+03 -2.2840E+01	-2.5172E+02 -1.7355E+00	8.8533E+03 6.1041E+01	1.8218E+04 1.2561E+02
5	8.3774E+03 5.7760E+01	-3.7199E+03 -2.5648E+01	-3.7144E+02 -2.5610E+00	1.2097E+04 8.3408E+01	1.6026E+04 1.1049E+02
6	5.4241E+03 3.7398E+01	-3.1938E+02 -2.2020E+00	1.5464E+03 1.0662E+01	5.7435E+03 3.9600E+01	9.8360E+03 6.7817E+01
7	2.6398E+03 1.8201E+01	2.9829E-01 2.0566E-03	-7.0236E+01 -4.8426E-01	2.6395E+03 1.8199E+01	7.6393E+01 5.2671E-01
8	2.6366E+03 1.8178E+01	1.8166E-02 1.2525E-04	2.7199E+00 1.8753E-02	2.6365E+03 1.8178E+01	6.2703E-01 4.3232E-03
9	2.6375E+03 1.8185E+01	-5.2561E-02 -3.6239E-04	-3.8085E+01 -2.6259E-01	2.6375E+03 1.8185E+01	2.2161E+01 1.5279E-01
10	2.6582E+03 1.8328E+01	-2.3659E+02 -1.6312E+00	1.2395E+03 8.5458E+00	2.8948E+03 1.9959E+01	1.4578E+03 1.0051E+01
11	7.2041E+02 4.9671E+00	-6.9588E+02 -4.7979E+00	2.1569E+02 1.4871E+00	1.4163E+03 9.7650E+00	1.1990E+03 8.2670E+00
12	4.7851E+02 3.2992E+00	-2.1300E+02 -1.4685E+00	2.6203E+02 1.8066E+00	6.9150E+02 4.7678E+00	1.2938E+03 8.9205E+00
13	3.6711E+03 2.5312E+01	-1.3545E+03 -9.3392E+00	4.0530E+02 2.7945E+00	5.0257E+03 3.4651E+01	3.5441E+03 2.4436E+01
14	2.9070E+03 2.0043E+01	-1.1628E+03 -8.0170E+00	3.9355E+02 2.7134E+00	4.0697E+03 2.8060E+01	4.8272E+03 3.3283E+01
15	2.8905E+02 1.9929E+00	-7.8743E+01 -5.4291E-01	2.6000E+02 1.7927E+00	3.6779E+02 2.5358E+00	3.2041E+01 2.2091E-01

16	1.0613E+03	-4.3425E+02	3.7751E+02	1.4955E+03	1.9830E+03
	7.3171E+00	-2.9940E+00	2.6028E+00	1.0311E+01	1.3672E+01
17	1.1013E+03	-1.7666E+02	-7.6683E+01	1.2779E+03	2.2490E+03
	7.5931E+00	-1.2181E+00	-5.2871E-01	8.8111E+00	1.5506E+01
18	1.1521E+03	-1.8406E+02	-1.3282E+02	1.3361E+03	2.3457E+03
	7.9433E+00	-1.2690E+00	-9.1573E-01	9.2123E+00	1.6173E+01
19	1.2608E+03	-5.1856E+02	3.2010E+02	1.7794E+03	2.4779E+03
	8.6929E+00	-3.5754E+00	2.2070E+00	1.2268E+01	1.7084E+01
20	1.3175E+03	-6.5056E+02	1.6353E+02	1.9680E+03	3.6550E+03
	9.0836E+00	-4.4854E+00	1.1275E+00	1.3569E+01	2.5200E+01
21	2.2245E+02	-4.9835E+02	-4.6625E+01	7.2080E+02	1.7043E+03
	1.5338E+00	-3.4360E+00	-3.2147E-01	4.9698E+00	1.1751E+01
22	3.2992E+01	-5.9942E+01	3.3119E+01	9.2934E+01	3.3780E+00
	2.2747E-01	-4.1329E-01	2.2835E-01	6.4076E-01	2.3290E-02

Allowable Stress for Load Case 103

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-20.00	20.00	30.00	70.00
2	0.00	-20.00	20.00	30.00	70.00
3	0.00	-20.00	20.00	30.00	70.00
4	0.00	-20.00	20.00	30.00	70.00
5	0.00	-20.00	20.00	30.00	70.00
6	0.00	-20.00	20.00	30.00	70.00
7	0.00	-20.00	20.00	30.00	70.00
8	0.00	-20.00	20.00	30.00	70.00
9	0.00	-20.00	20.00	30.00	70.00
10	0.00	-20.00	20.00	30.00	70.00
11	0.00	-20.00	20.00	30.00	70.00
12	0.00	-20.00	20.00	30.00	70.00
13	0.00	-20.00	20.00	30.00	70.00
14	0.00	-20.00	20.00	30.00	70.00
15	0.00	-20.00	20.00	30.00	70.00
16	0.00	-20.00	20.00	30.00	70.00
17	0.00	-20.00	20.00	30.00	70.00
18	0.00	-20.00	20.00	30.00	70.00
19	0.00	-20.00	20.00	30.00	70.00
20	0.00	-20.00	20.00	30.00	70.00
21	0.00	-20.00	20.00	30.00	70.00
22	0.00	-20.00	20.00	30.00	70.00

Table 2-138. Load Case 104, -40°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.0594E+01 1.4199E-01	-7.0451E+01 -4.8574E-01	-1.4680E+01 -1.0121E-01	9.1045E+01 6.2773E-01	9.0635E+01 6.2491E-01		
2	6.4736E+01 4.4634E-01	-8.8114E-01 -6.0752E-03	-2.0838E+01 -1.4367E-01	6.5617E+01 4.5241E-01	7.6885E+00 5.3010E-02		
3	7.7597E+01 5.3501E-01	-8.6248E+00 -5.9466E-02	-1.2518E+01 -8.6310E-02	8.6222E+01 5.9448E-01	9.8374E+01 6.7826E-01		
4	6.7716E+03 4.6689E+01	-4.0488E+03 -2.7915E+01	-3.0745E+02 -2.1198E+00	1.0820E+04 7.4604E+01	2.2265E+04 1.5351E+02		
5	1.0239E+04 7.0595E+01	-4.5464E+03 -3.1346E+01	-4.5364E+02 -3.1278E+00	1.4785E+04 1.0194E+02	1.9587E+04 1.3505E+02		
6	6.6294E+03 4.5708E+01	-3.9027E+02 -2.6909E+00	1.8903E+03 1.3033E+01	7.0197E+03 4.8399E+01	1.2021E+04 8.2885E+01		
7	3.2265E+03 2.2246E+01	3.6449E-01 2.5130E-03	-8.5844E+01 -5.9188E-01	3.2261E+03 2.2243E+01	9.3362E+01 6.4371E-01		
8	3.2225E+03 2.2218E+01	2.2195E-02 1.5303E-04	3.3242E+00 2.2920E-02	3.2225E+03 2.2218E+01	7.6651E-01 5.2849E-03		
9	3.2236E+03 2.2226E+01	-6.4251E-02 -4.4300E-04	-4.6549E+01 -3.2094E-01	3.2237E+03 2.2226E+01	2.7085E+01 1.8675E-01		
10	3.2489E+03 2.2401E+01	-2.8916E+02 -1.9937E+00	1.5149E+03 1.0445E+01	3.5381E+03 2.4394E+01	1.7818E+03 1.2285E+01		
11	8.8051E+02 6.0709E+00	-8.5052E+02 -5.8641E+00	2.6362E+02 1.8176E+00	1.7310E+03 1.1935E+01	1.4655E+03 1.0104E+01		
12	5.8485E+02 4.0324E+00	-2.6033E+02 -1.7949E+00	3.2026E+02 2.2081E+00	8.4517E+02 5.8273E+00	1.5813E+03 1.0903E+01		
13	4.4870E+03 3.0937E+01	-1.6556E+03 -1.1415E+01	4.9537E+02 3.4155E+00	6.1425E+03 4.2351E+01	4.3317E+03 2.9866E+01		
14	3.5530E+03 2.4497E+01	-1.4212E+03 -9.7987E+00	4.8101E+02 3.3164E+00	4.9742E+03 3.4296E+01	5.9000E+03 4.0679E+01		
15	3.5383E+02 2.4396E+00	-9.9180E+01 -6.8382E-01	3.1738E+02 2.1882E+00	4.5301E+02 3.1234E+00	1.0049E+01 6.9287E-02		

16	1.2958E+03	-5.3016E+02	4.6107E+02	1.8260E+03	2.4200E+03
	8.9345E+00	-3.6553E+00	3.1790E+00	1.2590E+01	1.6685E+01
17	1.3450E+03	-2.1565E+02	-9.3592E+01	1.5606E+03	2.7464E+03
	9.2732E+00	-1.4868E+00	-6.4530E-01	1.0760E+01	1.8936E+01
18	1.4090E+03	-2.2572E+02	-1.6263E+02	1.6347E+03	2.8697E+03
	9.7147E+00	-1.5563E+00	-1.1213E+00	1.1271E+01	1.9786E+01
19	1.5420E+03	-6.3407E+02	3.9162E+02	2.1761E+03	3.0303E+03
	1.0632E+01	-4.3718E+00	2.7001E+00	1.5004E+01	2.0893E+01
20	1.6114E+03	-7.9560E+02	2.0012E+02	2.4070E+03	4.4702E+03
	1.1110E+01	-5.4855E+00	1.3797E+00	1.6595E+01	3.0821E+01
21	2.7189E+02	-6.0909E+02	-5.6986E+01	8.8098E+02	2.0830E+03
	1.8746E+00	-4.1996E+00	-3.9290E-01	6.0741E+00	1.4362E+01
22	4.0429E+01	-7.4955E+01	4.0488E+01	1.1538E+02	5.8085E-01
	2.7875E-01	-5.1680E-01	2.7915E-01	7.9555E-01	4.0048E-03

Allowable Stress for Load Case 104

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-40.00	20.00	30.00	70.00
2	0.00	-40.00	20.00	30.00	70.00
3	0.00	-40.00	20.00	30.00	70.00
4	0.00	-40.00	20.00	30.00	70.00
5	0.00	-40.00	20.00	30.00	70.00
6	0.00	-40.00	20.00	30.00	70.00
7	0.00	-40.00	20.00	30.00	70.00
8	0.00	-40.00	20.00	30.00	70.00
9	0.00	-40.00	20.00	30.00	70.00
10	0.00	-40.00	20.00	30.00	70.00
11	0.00	-40.00	20.00	30.00	70.00
12	0.00	-40.00	20.00	30.00	70.00
13	0.00	-40.00	20.00	30.00	70.00
14	0.00	-40.00	20.00	30.00	70.00
15	0.00	-40.00	20.00	30.00	70.00
16	0.00	-40.00	20.00	30.00	70.00
17	0.00	-40.00	20.00	30.00	70.00
18	0.00	-40.00	20.00	30.00	70.00
19	0.00	-40.00	20.00	30.00	70.00
20	0.00	-40.00	20.00	30.00	70.00
21	0.00	-40.00	20.00	30.00	70.00
22	0.00	-40.00	20.00	30.00	70.00

Table 2-139. Load Case 105, -40°F Ambient, Maximum Decay Heat, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	5.5839E+01 3.8500E-01	-1.1883E+02 -8.1929E-01	-2.2736E+01 -1.5676E-01	1.7467E+02 1.2043E+00	2.7716E+02 1.9109E+00
2	6.5948E+01 4.5469E-01	-1.5751E+02 -1.0860E+00	-1.5452E+01 -1.0654E-01	2.2346E+02 1.5407E+00	4.5242E+02 3.1193E+00
3	5.5860E+01 3.8514E-01	-1.1037E+02 -7.6101E-01	-6.8416E+00 -4.7171E-02	1.6623E+02 1.1461E+00	2.5835E+02 1.7813E+00
4	1.9042E+02 1.3129E+00	-1.0004E+03 -6.8978E+00	-1.8727E+02 -1.2912E+00	1.1909E+03 8.2107E+00	2.3369E+03 1.6113E+01
5	1.9786E+02 1.3642E+00	-1.1294E+03 -7.7872E+00	-6.4891E+02 -4.4741E+00	1.3273E+03 9.1513E+00	2.0827E+03 1.4359E+01
6	4.1004E+01 2.8271E-01	-5.4237E+02 -3.7395E+00	-7.9853E+02 -5.5057E+00	5.8337E+02 4.0222E+00	5.9323E+02 4.0902E+00
7	-9.5409E+00 -6.5782E-02	-1.7703E+02 -1.2205E+00	1.0790E+01 7.4396E-02	1.6748E+02 1.1548E+00	2.1977E+02 1.5152E+00
8	-9.4034E+00 -6.4834E-02	-1.7740E+02 -1.2231E+00	1.6039E-01 1.1059E-03	1.6799E+02 1.1583E+00	2.2197E+02 1.5304E+00
9	-1.0023E+01 -6.9104E-02	-1.7620E+02 -1.2148E+00	-8.2646E+00 -5.6983E-02	1.6617E+02 1.1457E+00	2.1010E+02 1.4486E+00
10	1.8427E+01 1.2705E-01	-3.5550E+02 -2.4511E+00	1.5696E+02 1.0822E+00	3.7393E+02 2.5782E+00	7.2509E+02 4.9993E+00
11	-1.0196E+02 -7.0296E-01	-5.3089E+02 -3.6604E+00	-2.3148E+02 -1.5960E+00	4.2894E+02 2.9574E+00	9.7031E+00 6.6901E-02
12	1.6215E+00 1.1180E-02	-6.5490E+02 -4.5154E+00	-6.4984E+02 -4.4805E+00	6.5652E+02 4.5265E+00	9.1107E+00 6.2816E-02
13	-4.8748E+01 -3.3611E-01	-7.9395E+02 -5.4741E+00	-7.2535E+01 -5.0011E-01	7.4520E+02 5.1380E+00	2.0897E+02 1.4408E+00
14	-6.3816E+01 -4.4000E-01	-6.9168E+02 -4.7690E+00	8.9448E+01 6.1672E-01	6.2787E+02 4.3290E+00	4.0639E+02 2.8020E+00
15	9.5656E+01 6.5953E-01	-4.4706E+01 -3.0823E-01	5.7432E+01 3.9598E-01	1.4036E+02 9.6776E-01	2.1843E+02 1.5060E+00

16	2.5575E+01	-1.6982E+01	-8.7265E+01	4.2556E+01	6.4542E+01
	1.7633E-01	-1.1709E-01	-6.0167E-01	2.9342E-01	4.4500E-01
17	1.3134E+01	-2.5814E+01	-9.7813E+01	3.8948E+01	6.8735E+01
	9.0556E-02	-1.7798E-01	-6.7440E-01	2.6854E-01	4.7391E-01
18	8.2458E+01	-1.2727E+02	7.0961E+02	2.0973E+02	1.5466E+02
	5.6853E-01	-8.7749E-01	4.8926E+00	1.4460E+00	1.0663E+00
19	-1.7161E+01	-2.6883E+02	8.1056E+02	2.5167E+02	2.5669E+02
	-1.1832E-01	-1.8535E+00	5.5886E+00	1.7352E+00	1.7698E+00
20	4.7242E+00	-6.1232E+02	6.1728E+01	6.1704E+02	1.8718E+02
	3.2573E-02	-4.2218E+00	4.2560E-01	4.2543E+00	1.2906E+00
21	1.6107E+01	-1.1244E+01	4.9746E+00	2.7351E+01	5.3830E+01
	1.1105E-01	-7.7522E-02	3.4298E-02	1.8858E-01	3.7115E-01
22	-7.0050E+00	-4.0466E+01	-3.9284E+01	3.3461E+01	4.0684E+01
	-4.8298E-02	-2.7900E-01	-2.7085E-01	2.3071E-01	2.8051E-01

Allowable Stress for Load Case 105

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	85.20	84.29	20.00	30.00	70.00
2	85.37	83.11	20.00	30.00	70.00
3	85.14	84.25	20.00	30.00	70.00
4	86.74	86.62	20.00	30.00	70.00
5	89.32	88.89	20.00	30.00	70.00
6	90.33	89.90	20.00	30.00	70.00
7	91.10	90.35	20.00	30.00	70.00
8	91.11	90.36	20.00	30.00	70.00
9	91.15	90.39	20.00	30.00	70.00
10	91.69	90.75	20.00	30.00	70.00
11	92.75	91.53	20.00	30.00	70.00
12	95.64	94.26	20.00	30.00	70.00
13	89.82	89.27	20.00	30.00	70.00
14	88.42	88.10	20.00	30.00	70.00
15	86.11	86.07	20.00	30.00	70.00
16	87.10	86.89	20.00	30.00	70.00
17	87.28	87.12	20.00	30.00	70.00
18	88.28	88.07	20.00	30.00	70.00
19	89.34	88.91	20.00	30.00	70.00
20	94.39	93.69	20.00	30.00	70.00
21	84.61	84.53	20.00	30.00	70.00
22	85.45	85.36	20.00	30.00	70.00

Table 2-140. Load Case 106, -20°F Ambient, Maximum Decay Heat, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	5.5124E+01 3.8006E-01	-1.1744E+02 -8.0973E-01	-2.2543E+01 -1.5543E-01	1.7256E+02 1.1898E+00	2.7388E+02 1.8883E+00
2	6.5288E+01 4.5014E-01	-1.5579E+02 -1.0741E+00	-1.5919E+01 -1.0975E-01	2.2107E+02 1.5242E+00	4.4774E+02 3.0870E+00
3	5.5268E+01 3.8106E-01	-1.0911E+02 -7.5229E-01	-6.8729E+00 -4.7387E-02	1.6438E+02 1.1334E+00	2.5546E+02 1.7614E+00
4	1.8296E+02 1.2615E+00	-9.7592E+02 -6.7287E+00	-1.8240E+02 -1.2576E+00	1.1589E+03 7.9902E+00	2.2727E+03 1.5670E+01
5	1.9071E+02 1.3149E+00	-1.1021E+03 -7.5990E+00	-6.3851E+02 -4.4024E+00	1.2928E+03 8.9139E+00	2.0277E+03 1.3980E+01
6	3.6860E+01 2.5414E-01	-5.2883E+02 -3.6462E+00	-7.8545E+02 -5.4155E+00	5.6569E+02 3.9003E+00	5.6960E+02 3.9272E+00
7	-9.4953E+00 -6.5468E-02	-1.7511E+02 -1.2073E+00	1.0512E+01 7.2474E-02	1.6562E+02 1.1419E+00	2.1714E+02 1.4971E+00
8	-9.3313E+00 -6.4337E-02	-1.7552E+02 -1.2101E+00	1.6311E-01 1.1246E-03	1.6618E+02 1.1458E+00	2.1949E+02 1.5133E+00
9	-9.9130E+00 -6.8348E-02	-1.7436E+02 -1.2022E+00	-8.2176E+00 -5.6658E-02	1.6445E+02 1.1338E+00	2.0776E+02 1.4324E+00
10	1.8043E+01 1.2440E-01	-3.5160E+02 -2.4242E+00	1.5578E+02 1.0740E+00	3.6964E+02 2.5486E+00	7.1652E+02 4.9402E+00
11	-1.0083E+02 -6.9519E-01	-5.2419E+02 -3.6142E+00	-2.2793E+02 -1.5716E+00	4.2336E+02 2.9190E+00	7.7954E+00 5.3747E-02
12	1.6112E+00 1.1109E-02	-6.4693E+02 -4.4604E+00	-6.4192E+02 -4.4259E+00	6.4854E+02 4.4715E+00	1.0921E+01 7.5299E-02
13	-4.8038E+01 -3.3121E-01	-7.8334E+02 -5.4010E+00	-7.1148E+01 -4.9055E-01	7.3530E+02 5.0697E+00	2.0637E+02 1.4228E+00
14	-6.3042E+01 -4.3466E-01	-6.8245E+02 -4.7053E+00	8.7911E+01 6.0613E-01	6.1940E+02 4.2706E+00	4.0256E+02 2.7756E+00
15	1.6311E+02 1.1246E+00	-1.3068E+02 -9.0099E-01	4.7634E+01 3.2842E-01	2.9378E+02 2.0256E+00	4.8759E+02 3.3618E+00

16	4.5134E+01	-5.7895E+01	-9.6748E+01	1.0303E+02	1.6613E+02
	3.1119E-01	-3.9917E-01	-6.6705E-01	7.1036E-01	1.1454E+00
17	2.1050E+01	-5.2514E+01	-9.1912E+01	7.3563E+01	1.3076E+02
	1.4513E-01	-3.6207E-01	-6.3371E-01	5.0720E-01	9.0154E-01
18	7.4037E+01	-1.3023E+02	7.0274E+02	2.0427E+02	1.2020E+02
	5.1047E-01	-8.9794E-01	4.8452E+00	1.4084E+00	8.2877E-01
19	-1.8398E+01	-2.7632E+02	7.9460E+02	2.5792E+02	3.0566E+02
	-1.2685E-01	-1.9052E+00	5.4786E+00	1.7783E+00	2.1075E+00
20	-6.3668E+00	-6.0830E+02	5.8336E+01	6.0193E+02	1.0142E+02
	-4.3897E-02	-4.1941E+00	4.0222E-01	4.1502E+00	6.9930E-01
21	1.6196E+01	-1.1100E+01	5.1929E+00	2.7296E+01	5.3636E+01
	1.1167E-01	-7.6532E-02	3.5804E-02	1.8820E-01	3.6981E-01
22	-1.3398E+01	-4.3555E+01	-3.8401E+01	3.0156E+01	6.2234E+01
	-9.2377E-02	-3.0030E-01	-2.6476E-01	2.0792E-01	4.2909E-01

Allowable Stress for Load Case 106

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
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1	104.04	103.14	20.00	30.00	70.00
2	104.22	101.99	20.00	30.00	70.00
3	104.01	103.12	20.00	30.00	70.00
4	105.56	105.44	20.00	30.00	70.00
5	108.10	107.68	20.00	30.00	70.00
6	109.11	108.68	20.00	30.00	70.00
7	109.86	109.11	20.00	30.00	70.00
8	109.87	109.12	20.00	30.00	70.00
9	109.91	109.16	20.00	30.00	70.00
10	110.45	109.52	20.00	30.00	70.00
11	111.51	110.31	20.00	30.00	70.00
12	114.37	113.01	20.00	30.00	70.00
13	108.62	108.08	20.00	30.00	70.00
14	107.24	106.92	20.00	30.00	70.00
15	104.91	104.87	20.00	30.00	70.00
16	105.88	105.67	20.00	30.00	70.00
17	106.05	105.90	20.00	30.00	70.00
18	107.05	106.84	20.00	30.00	70.00
19	108.09	107.67	20.00	30.00	70.00
20	113.06	112.39	20.00	30.00	70.00
21	103.48	103.40	20.00	30.00	70.00
22	104.28	104.20	20.00	30.00	70.00

**Table 2-141. Load Case 201, Internal Design Pressure, 414 kPa (60 psia),
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-9.9637E+00 -6.8698E-02	-1.4964E+01 -1.0317E-01	-3.4826E+01 -2.4012E-01	5.0003E+00 3.4476E-02	1.7422E+00 1.2012E-02
2	-9.3770E+00 -6.4652E-02	-1.4507E+01 -1.0002E-01	-3.4263E+01 -2.3623E-01	5.1301E+00 3.5371E-02	2.0523E-02 1.4150E-04
3	-1.0205E+01 -7.0362E-02	-1.5403E+01 -1.0620E-01	-3.3406E+01 -2.3033E-01	5.1980E+00 3.5839E-02	1.0146E+00 6.9954E-03
4	2.1308E+02 1.4691E+00	-8.4345E+01 -5.8154E-01	2.0480E+02 1.4121E+00	2.9742E+02 2.0507E+00	4.5758E+02 3.1549E+00
5	1.0676E+02 7.3612E-01	-8.0446E+01 -5.5466E-01	2.2057E+02 1.5208E+00	1.8721E+02 1.2908E+00	3.0364E+02 2.0935E+00
6	1.1886E+01 8.1950E-02	-3.5988E+01 -2.4813E-01	2.5276E+02 1.7427E+00	4.7874E+01 3.3008E-01	2.5236E+01 1.7399E-01
7	-2.0116E+01 -1.3870E-01	-3.4486E+01 -2.3777E-01	2.2998E+02 1.5857E+00	1.4370E+01 9.9075E-02	2.4817E-01 1.7111E-03
8	-2.0060E+01 -1.3831E-01	-3.4547E+01 -2.3819E-01	2.2980E+02 1.5844E+00	1.4487E+01 9.9882E-02	1.4077E-02 9.7059E-05
9	-2.0262E+01 -1.3970E-01	-3.4384E+01 -2.3707E-01	2.3562E+02 1.6245E+00	1.4122E+01 9.7370E-02	1.2728E+00 8.7756E-03
10	8.0771E+01 5.5690E-01	-7.8965E+01 -5.4444E-01	3.7800E+01 2.6062E-01	1.5974E+02 1.1013E+00	1.6498E+02 1.1375E+00
11	5.4384E+01 3.7496E-01	-3.4294E+01 -2.3645E-01	1.9712E+01 1.3591E-01	8.8678E+01 6.1141E-01	3.7104E+01 2.5582E-01
12	-1.1232E+01 -7.7443E-02	-1.5844E+02 -1.0924E+00	-7.9868E+00 -5.5067E-02	1.4721E+02 1.0150E+00	1.8325E+01 1.2635E-01
13	2.0214E+01 1.3937E-01	-1.2905E+02 -8.8979E-01	-1.9451E+01 -1.3411E-01	1.4927E+02 1.0292E+00	1.2676E+02 8.7397E-01
14	2.0505E+01 1.4138E-01	-1.0978E+02 -7.5688E-01	-2.0240E+01 -1.3955E-01	1.3028E+02 8.9826E-01	1.3482E+02 9.2955E-01
15	3.4270E+02 2.3628E+00	-1.6295E+02 -1.1235E+00	-1.4325E+02 -9.8765E-01	5.0564E+02 3.4863E+00	5.7893E+02 3.9916E+00

16	8.4824E+00	-3.2435E+02	-2.0810E+02	3.3283E+02	4.6608E+02
	5.8484E-02	-2.2363E+00	-1.4348E+00	2.2948E+00	3.2135E+00
17	-2.3511E+01	-2.6230E+02	-2.3195E+02	2.3879E+02	3.1791E+02
	-1.6211E-01	-1.8085E+00	-1.5993E+00	1.6464E+00	2.1919E+00
18	-7.4818E+00	-3.0591E+02	-2.0375E+02	2.9842E+02	4.3205E+02
	-5.1585E-02	-2.1092E+00	-1.4048E+00	2.0576E+00	2.9789E+00
19	6.0670E+01	-4.1318E+02	-2.0065E+02	4.7385E+02	7.3127E+02
	4.1830E-01	-2.8488E+00	-1.3835E+00	3.2671E+00	5.0419E+00
20	2.0599E+01	-3.2032E+02	-1.5665E+02	3.4092E+02	6.1980E+02
	1.4203E-01	-2.2085E+00	-1.0801E+00	2.3506E+00	4.2734E+00
21	-1.0848E+01	-1.0589E+02	-1.3598E+01	9.5043E+01	1.0176E+02
	-7.4791E-02	-7.3009E-01	-9.3757E-02	6.5530E-01	7.0159E-01
22	1.7178E+02	-7.3973E+00	7.2357E+01	1.7918E+02	1.2413E+02
	1.1844E+00	-5.1002E-02	4.9889E-01	1.2354E+00	8.5586E-01

Table 2-142. Load Case 202, Minimum External Pressure, 24 kPa (3.5 psia), Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-2.3776E+00 -1.6393E-02	-3.5614E+00 -2.4555E-02	-8.2912E+00 -5.7166E-02	1.1839E+00 8.1624E-03	4.2463E-01 2.9278E-03
2	-2.2321E+00 -1.5390E-02	-3.4436E+00 -2.3743E-02	-8.1611E+00 -5.6269E-02	1.2115E+00 8.3529E-03	1.9912E-03 1.3729E-05
3	-2.4296E+00 -1.6751E-02	-3.6560E+00 -2.5207E-02	-7.9521E+00 -5.4828E-02	1.2264E+00 8.4556E-03	2.2792E-01 1.5714E-03
4	5.3650E+01 3.6990E-01	-2.1226E+01 -1.4635E-01	5.0491E+01 3.4812E-01	7.4876E+01 5.1625E-01	1.1577E+02 7.9822E-01
5	2.7425E+01 1.8909E-01	-2.0098E+01 -1.3857E-01	5.4283E+01 3.7427E-01	4.7524E+01 3.2766E-01	7.7386E+01 5.3356E-01
6	3.5221E+00 2.4284E-02	-8.6393E+00 -5.9566E-02	6.2349E+01 4.2988E-01	1.2161E+01 8.3850E-02	7.3443E+00 5.0637E-02
7	-4.7350E+00 -3.2647E-02	-8.2580E+00 -5.6937E-02	5.6335E+01 3.8842E-01	3.5229E+00 2.4290E-02	5.6483E-02 3.8944E-04
8	-4.7226E+00 -3.2561E-02	-8.2719E+00 -5.7033E-02	5.6301E+01 3.8818E-01	3.5493E+00 2.4472E-02	3.0827E-03 2.1254E-05
9	-4.7763E+00 -3.2932E-02	-8.2282E+00 -5.6731E-02	5.7728E+01 3.9802E-01	3.4519E+00 2.3800E-02	3.1828E-01 2.1944E-03
10	2.0028E+01 1.3809E-01	-1.9130E+01 -1.3190E-01	9.2455E+00 6.3746E-02	3.9157E+01 2.6998E-01	4.0700E+01 2.8062E-01
11	1.3447E+01 9.2715E-02	-8.3763E+00 -5.7753E-02	4.8736E+00 3.3602E-02	2.1824E+01 1.5047E-01	9.2090E+00 6.3494E-02
12	-2.6943E+00 -1.8577E-02	-3.8340E+01 -2.6434E-01	-1.8871E+00 -1.3011E-02	3.5645E+01 2.4577E-01	3.6784E+00 2.5361E-02
13	4.9184E+00 3.3911E-02	-3.1373E+01 -2.1631E-01	-4.6707E+00 -3.2204E-02	3.6291E+01 2.5022E-01	3.0661E+01 2.1140E-01
14	5.0053E+00 3.4511E-02	-2.6701E+01 -1.8410E-01	-4.8796E+00 -3.3644E-02	3.1706E+01 2.1861E-01	3.2957E+01 2.2723E-01
15	8.5421E+01 5.8896E-01	-3.9614E+01 -2.7313E-01	-3.4938E+01 -2.4089E-01	1.2503E+02 8.6208E-01	1.4257E+02 9.8298E-01

16	2.0120E+00	-7.9314E+01	-5.0964E+01	8.1326E+01	1.1389E+02
	1.3872E-02	-5.4685E-01	-3.5138E-01	5.6072E-01	7.8523E-01
17	-5.7662E+00	-6.4115E+01	-5.6869E+01	5.8349E+01	7.7560E+01
	-3.9756E-02	-4.4206E-01	-3.9210E-01	4.0230E-01	5.3476E-01
18	-1.8090E+00	-7.4860E+01	-4.9901E+01	7.3051E+01	1.0570E+02
	-1.2473E-02	-5.1614E-01	-3.4405E-01	5.0367E-01	7.2876E-01
19	1.4857E+01	-1.0116E+02	-4.9100E+01	1.1601E+02	1.7915E+02
	1.0244E-01	-6.9746E-01	-3.3853E-01	7.9989E-01	1.2352E+00
20	5.0682E+00	-7.8519E+01	-3.8307E+01	8.3588E+01	1.5189E+02
	3.4944E-02	-5.4137E-01	-2.6412E-01	5.7632E-01	1.0473E+00
21	-2.5780E+00	-2.5274E+01	-3.2441E+00	2.2696E+01	2.4499E+01
	-1.7775E-02	-1.7426E-01	-2.2367E-02	1.5649E-01	1.6891E-01
22	4.2655E+01	-1.7449E+00	1.7863E+01	4.4400E+01	3.0631E+01
	2.9409E-01	-1.2031E-02	1.2316E-01	3.0612E-01	2.1120E-01

Table 2-143. Load Case 203, Maximum Increased External Pressure, 140 kPa (20 psia), Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-1.2540E+01 -8.6459E-02	-2.0150E+01 -1.3893E-01	-4.7181E+01 -3.2530E-01	7.6097E+00 5.2467E-02	4.5725E-01 3.1526E-03
2	-1.2778E+01 -8.8101E-02	-2.0895E+01 -1.4406E-01	-4.6164E+01 -3.1829E-01	8.1166E+00 5.5962E-02	2.9930E-01 2.0636E-03
3	-1.3847E+01 -9.5470E-02	-2.2191E+01 -1.5300E-01	-4.5381E+01 -3.1289E-01	8.3448E+00 5.7535E-02	3.1926E+00 2.2012E-02
4	6.8813E+01 4.7445E-01	-1.6936E+02 -1.1677E+00	4.5984E+00 3.1705E-02	2.3817E+02 1.6422E+00	4.3118E+02 2.9729E+00
5	6.3656E+01 4.3889E-01	-1.9258E+02 -1.3278E+00	1.8359E+01 1.2658E-01	2.5623E+02 1.7667E+00	3.6937E+02 2.5467E+00
6	-1.5294E+01 -1.0545E-01	-1.1635E+02 -8.0222E-01	-1.9555E+00 -1.3483E-02	1.0106E+02 6.9678E-01	1.6920E+02 1.1666E+00
7	-6.6334E+00 -4.5736E-02	-7.1881E+01 -4.9560E-01	5.7740E+01 3.9810E-01	6.5247E+01 4.4986E-01	7.3452E-01 5.0643E-03
8	-6.6350E+00 -4.5747E-02	-7.1852E+01 -4.9540E-01	5.6277E+01 3.8802E-01	6.5217E+01 4.4965E-01	6.2788E-02 4.3291E-04
9	-6.6170E+00 -4.5622E-02	-7.1819E+01 -4.9518E-01	5.7419E+01 3.9589E-01	6.5203E+01 4.4956E-01	7.2927E-01 5.0282E-03
10	-2.9634E+00 -2.0432E-02	-7.3126E+01 -5.0418E-01	1.0679E+01 7.3629E-02	7.0162E+01 4.8375E-01	4.2061E+00 2.9000E-02
11	4.6213E+00 3.1863E-02	-2.4193E+01 -1.6681E-01	-2.6994E+00 -1.8612E-02	2.8815E+01 1.9867E-01	1.1263E+01 7.7656E-02
12	-9.5967E+00 -6.6167E-02	-1.1993E+02 -8.2690E-01	-1.3685E+01 -9.4354E-02	1.1033E+02 7.6073E-01	1.3594E+02 9.3725E-01
13	1.3364E+01 9.2145E-02	-7.6836E+01 -5.2976E-01	-2.0824E+01 -1.4358E-01	9.0200E+01 6.2191E-01	9.8887E+01 6.8180E-01
14	9.9218E+00 6.8408E-02	-6.2354E+01 -4.2991E-01	-1.8430E+01 -1.2707E-01	7.2276E+01 4.9832E-01	4.9187E+01 3.3913E-01
15	-9.2832E+01 -6.4006E-01	-2.7126E+02 -1.8703E+00	-7.2167E+01 -4.9757E-01	1.7843E+02 1.2302E+00	1.1370E+02 7.8393E-01

16	1.1254E+01	-1.0328E+02	-5.4667E+01	1.1454E+02	1.5876E+02
	7.7592E-02	-7.1210E-01	-3.7691E-01	7.8969E-01	1.0946E+00
17	-6.0309E+00	-8.7812E+01	-5.1732E+01	8.1781E+01	1.2528E+02
	-4.1581E-02	-6.0544E-01	-3.5668E-01	5.6386E-01	8.6376E-01
18	-1.8069E+00	-9.8323E+01	-5.2057E+01	9.6516E+01	1.5327E+02
	-1.2458E-02	-6.7791E-01	-3.5892E-01	6.6545E-01	1.0568E+00
19	2.0858E+01	-1.2553E+02	-6.3299E+01	1.4639E+02	2.0466E+02
	1.4381E-01	-8.6549E-01	-4.3643E-01	1.0093E+00	1.4111E+00
20	1.1169E+01	-8.5757E+01	-5.3655E+01	9.6926E+01	1.7056E+02
	7.7007E-02	-5.9127E-01	-3.6994E-01	6.6828E-01	1.1760E+00
21	-1.5260E+01	-1.3431E+02	-1.7384E+01	1.1905E+02	9.5926E+01
	-1.0522E-01	-9.2603E-01	-1.1986E-01	8.2081E-01	6.6139E-01
22	-2.5216E+00	-7.5985E+01	-3.5531E+00	7.3463E+01	2.8480E+01
	-1.7386E-02	-5.2389E-01	-2.4498E-02	5.0651E-01	1.9636E-01

Table 2-144. Load Case 204, Additional Increased External Pressure, 2 MPa (290 psia), Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-1.7897E+02 -1.2340E+00	-2.9203E+02 -2.0135E+00	-6.8423E+02 -4.7176E+00	1.1305E+02 7.7948E-01	2.0488E+00 1.4126E-02
2	-1.8533E+02 -1.2778E+00	-3.0584E+02 -2.1087E+00	-6.6821E+02 -4.6071E+00	1.2050E+02 8.3085E-01	5.1960E+00 3.5825E-02
3	-2.0060E+02 -1.3831E+00	-3.2485E+02 -2.2398E+00	-6.5786E+02 -4.5358E+00	1.2425E+02 8.5670E-01	5.0674E+01 3.4938E-01
4	1.4297E+03 9.8572E+00	-3.5578E+03 -2.4530E+01	-6.7935E+02 -4.6840E+00	4.9875E+03 3.4388E+01	8.7446E+03 6.0292E+01
5	1.2332E+03 8.5023E+00	-3.4653E+03 -2.3892E+01	-5.2014E+02 -3.5862E+00	4.6984E+03 3.2395E+01	7.1641E+03 4.9395E+01
6	-2.4249E+02 -1.6719E+00	-1.9408E+03 -1.3381E+01	-9.9559E+02 -6.8644E+00	1.6983E+03 1.1710E+01	2.8135E+03 1.9398E+01
7	-6.8967E+00 -4.7551E-02	-1.1877E+03 -8.1889E+00	7.7235E+01 5.3251E-01	1.1808E+03 8.1413E+00	1.1018E+01 7.5968E-02
8	-6.8962E+00 -4.7548E-02	-1.1873E+03 -8.1859E+00	5.3832E+01 3.7116E-01	1.1804E+03 8.1384E+00	1.0414E+00 7.1800E-03
9	-6.6293E+00 -4.5707E-02	-1.1865E+03 -8.1807E+00	5.0562E+01 3.4862E-01	1.1799E+03 8.1350E+00	1.7881E+01 1.2328E-01
10	-1.4409E+02 -9.9348E-01	-1.2350E+03 -8.5148E+00	1.8382E+01 1.2674E-01	1.0909E+03 7.5213E+00	7.2991E+02 5.0325E+00
11	1.2791E+02 8.8194E-01	-5.5687E+02 -3.8395E+00	-1.3223E+02 -9.1167E-01	6.8478E+02 4.7214E+00	3.6345E+02 2.5059E+00
12	-1.0473E+02 -7.2209E-01	-1.4921E+03 -1.0287E+01	-2.1354E+02 -1.4723E+00	1.3873E+03 9.5654E+00	2.3063E+03 1.5901E+01
13	1.7994E+02 1.2406E+00	-8.8841E+02 -6.1254E+00	-2.9578E+02 -2.0393E+00	1.0683E+03 7.3660E+00	1.2740E+03 8.7837E+00
14	1.1494E+02 7.9249E-01	-7.0107E+02 -4.8337E+00	-2.5025E+02 -1.7254E+00	8.1601E+02 5.6262E+00	3.7610E+02 2.5931E+00
15	-1.3860E+03 -9.5564E+00	-6.0918E+03 -4.2001E+01	-7.2401E+02 -4.9919E+00	4.7057E+03 3.2445E+01	2.2382E+02 1.5432E+00

16	1.4912E+02	-5.0348E+02	-1.2405E+02	6.5260E+02	8.4995E+02
	1.0281E+00	-3.4714E+00	-8.5532E-01	4.4995E+00	5.8602E+00
17	-1.4252E+01	-5.0311E+02	1.0876E+01	4.8886E+02	8.4925E+02
	-9.8267E-02	-3.4688E+00	7.4990E-02	3.3706E+00	5.8553E+00
18	5.4514E+01	-6.3618E+02	-8.8589E+01	6.9070E+02	1.2132E+03
	3.7586E-01	-4.3863E+00	-6.1080E-01	4.7622E+00	8.3646E+00
19	2.1856E+02	-7.3199E+02	-3.5686E+02	9.5055E+02	1.0213E+03
	1.5069E+00	-5.0469E+00	-2.4605E+00	6.5538E+00	7.0418E+00
20	4.6757E+02	-6.3862E+02	-3.6205E+02	1.1062E+03	9.5716E+02
	3.2238E+00	-4.4031E+00	-2.4962E+00	7.6269E+00	6.5994E+00
21	-2.2209E+02	-1.9226E+03	-2.4916E+02	1.7005E+03	1.2828E+03
	-1.5312E+00	-1.3256E+01	-1.7179E+00	1.1724E+01	8.8449E+00
22	-2.7064E+02	-1.8039E+03	-3.2746E+02	1.5333E+03	3.0855E+02
	-1.8660E+00	-1.2438E+01	-2.2578E+00	1.0572E+01	2.1274E+00

**Table 2-145. Load Case 211, Fabrication Stress,
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	9.7351E+02 6.7121E+00	-2.1563E+02 -1.4867E+00	8.5266E+01 5.8789E-01	1.1891E+03 8.1988E+00	1.7001E+03 1.1722E+01		
2	1.3459E+01 9.2798E-02	-5.8805E+01 -4.0544E-01	6.7805E+01 4.6750E-01	7.2264E+01 4.9824E-01	5.2992E+01 3.6536E-01		
3	1.4657E+00 1.0106E-02	-2.8786E+01 -1.9847E-01	9.1236E+00 6.2905E-02	3.0252E+01 2.0858E-01	1.2115E+01 8.3530E-02		
4	9.5184E+02 6.5627E+00	-4.5862E+02 -3.1621E+00	2.1372E+01 1.4736E-01	1.4105E+03 9.7248E+00	2.2342E+03 1.5405E+01		
5	9.9352E+02 6.8501E+00	-4.6663E+02 -3.2173E+00	-5.1619E+01 -3.5590E-01	1.4601E+03 1.0067E+01	2.2298E+03 1.5374E+01		
6	6.1320E+02 4.2278E+00	5.0514E+01 3.4828E-01	1.8716E+02 1.2904E+00	5.6268E+02 3.8795E+00	9.9432E+02 6.8556E+00		
7	3.2774E+02 2.2597E+00	1.7666E+00 1.2180E-02	7.7846E+00 5.3673E-02	3.2597E+02 2.2475E+00	1.0225E+00 7.0498E-03		
8	3.2770E+02 2.2594E+00	1.6260E+00 1.1211E-02	1.4504E+01 1.0000E-01	3.2608E+02 2.2482E+00	3.1287E-01 2.1572E-03		
9	3.2766E+02 2.2592E+00	1.5739E+00 1.0852E-02	1.1271E+01 7.7709E-02	3.2609E+02 2.2483E+00	6.1901E-01 4.2679E-03		
10	3.2876E+02 2.2667E+00	-4.3942E+00 -3.0297E-02	1.2904E+02 8.8969E-01	3.3315E+02 2.2970E+00	4.9381E+01 3.4047E-01		
11	1.3106E+02 9.0360E-01	-4.8099E+01 -3.3163E-01	8.5113E+01 5.8683E-01	1.7916E+02 1.2352E+00	1.2564E+02 8.6628E-01		
12	1.4923E+02 1.0289E+00	6.3354E+01 4.3681E-01	9.8866E+01 6.8166E-01	8.5875E+01 5.9209E-01	9.1623E+01 6.3172E-01		
13	5.8070E+02 4.0038E+00	-8.9612E+01 -6.1785E-01	1.7635E+02 1.2159E+00	6.7031E+02 4.6216E+00	7.6593E+02 5.2809E+00		
14	5.8048E+02 4.0023E+00	-9.9058E+01 -6.8298E-01	1.8936E+02 1.3056E+00	6.7954E+02 4.6852E+00	5.0988E+02 3.5155E+00		
15	1.0967E+03 7.5616E+00	2.4792E+02 1.7094E+00	1.3063E+02 9.0068E-01	8.4879E+02 5.8522E+00	6.8606E+01 4.7302E-01		

16	3.7161E+01	6.6692E+00	1.4060E+01	3.0492E+01	3.1036E+00
	2.5621E-01	4.5982E-02	9.6941E-02	2.1023E-01	2.1398E-02
17	4.8153E+01	3.7694E+00	-3.7879E+01	4.4383E+01	3.0663E+01
	3.3200E-01	2.5989E-02	-2.6116E-01	3.0601E-01	2.1142E-01
18	1.5031E+02	-6.3520E+01	-9.5799E+01	2.1383E+02	3.8267E+02
	1.0363E+00	-4.3795E-01	-6.6051E-01	1.4743E+00	2.6384E+00
19	1.5796E+02	-1.1219E+02	1.9872E+01	2.7015E+02	2.3392E+02
	1.0891E+00	-7.7349E-01	1.3701E-01	1.8626E+00	1.6128E+00
20	1.7985E+02	-2.1071E+02	2.8922E+01	3.9057E+02	3.9100E+02
	1.2401E+00	-1.4528E+00	1.9941E-01	2.6929E+00	2.6958E+00
21	5.3589E+01	-2.4012E+01	-3.4314E+00	7.7601E+01	1.8597E+02
	3.6948E-01	-1.6556E-01	-2.3659E-02	5.3504E-01	1.2822E+00
22	7.6580E+02	2.2399E+02	7.1270E+02	5.4181E+02	2.3627E+02
	5.2800E+00	1.5444E+00	4.9139E+00	3.7357E+00	1.6291E+00

**Table 2-146. Load Case 215, Compression Load (5x weight),
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	7.2799E-01 5.0193E-03	-6.2272E+01 -4.2935E-01	-7.5879E+00 -5.2317E-02	6.3000E+01 4.3437E-01	9.4946E+01 6.5463E-01
2	8.9059E-01 6.1404E-03	-4.7835E+01 -3.2981E-01	5.8525E+00 4.0352E-02	4.8725E+01 3.3595E-01	5.7911E-01 3.9928E-03
3	-1.4882E+00 -1.0261E-02	-5.6659E+01 -3.9065E-01	2.3238E+00 1.6022E-02	5.5171E+01 3.8039E-01	1.7928E+01 1.2361E-01
4	1.0378E+02 7.1555E-01	-1.2713E+02 -8.7655E-01	3.2866E+01 2.2661E-01	2.3091E+02 1.5921E+00	3.7745E+02 2.6024E+00
5	9.6289E+01 6.6389E-01	-1.3834E+02 -9.5383E-01	2.9853E+01 2.0583E-01	2.3463E+02 1.6177E+00	3.1335E+02 2.1604E+00
6	-3.1494E+01 -2.1715E-01	-1.3958E+02 -9.6235E-01	-2.5039E+01 -1.7264E-01	1.0808E+02 7.4521E-01	7.0674E+01 4.8728E-01
7	-2.0563E-01 -1.4178E-03	-8.2596E+01 -5.6948E-01	-1.2495E+00 -8.6151E-03	8.2390E+01 5.6806E-01	8.9403E-01 6.1641E-03
8	-1.9330E-01 -1.3328E-03	-6.1219E+01 -4.2209E-01	-1.3690E+00 -9.4392E-03	6.1026E+01 4.2076E-01	2.3658E-02 1.6312E-04
9	-2.0146E-01 -1.3890E-03	-5.5872E+01 -3.8522E-01	-1.1292E+00 -7.7858E-03	5.5670E+01 3.8383E-01	4.1784E-01 2.8809E-03
10	-3.5180E+00 -2.4256E-02	-6.4776E+01 -4.4662E-01	-1.4338E+01 -9.8857E-02	6.1258E+01 4.2236E-01	9.3357E+00 6.4367E-02
11	4.9695E+00 3.4263E-02	-2.0625E+01 -1.4220E-01	-8.5401E+00 -5.8882E-02	2.5595E+01 1.7647E-01	2.5705E+01 1.7723E-01
12	-8.0941E+00 -5.5807E-02	-4.6860E+01 -3.2309E-01	-1.1010E+01 -7.5912E-02	3.8766E+01 2.6728E-01	5.8231E+01 4.0149E-01
13	1.9496E+01 1.3442E-01	-7.4830E+01 -5.1594E-01	-1.7225E+01 -1.1876E-01	9.4326E+01 6.5036E-01	9.3052E+01 6.4157E-01
14	1.6234E+01 1.1193E-01	-6.2968E+01 -4.3415E-01	-1.6182E+01 -1.1157E-01	7.9202E+01 5.4608E-01	6.6222E+01 4.5659E-01
15	-2.9345E+02 -2.0233E+00	-1.2709E+03 -8.7625E+00	-1.5635E+02 -1.0780E+00	9.7745E+02 6.7393E+00	6.3209E+01 4.3581E-01

16	6.5558E+01	-1.5926E+02	-2.1510E+01	2.2482E+02	2.7652E+02
	4.5201E-01	-1.0980E+00	-1.4831E-01	1.5501E+00	1.9065E+00
17	-4.4574E+01	-1.9762E+02	-3.1382E+01	1.5305E+02	1.6259E+02
	-3.0733E-01	-1.3626E+00	-2.1637E-01	1.0552E+00	1.1210E+00
18	-2.1987E+01	-1.1124E+02	-1.6639E+01	8.9248E+01	8.1231E+01
	-1.5160E-01	-7.6694E-01	-1.1472E-01	6.1534E-01	5.6007E-01
19	6.0220E+01	-9.0619E+01	-8.8800E+00	1.5084E+02	1.8711E+02
	4.1520E-01	-6.2479E-01	-6.1225E-02	1.0400E+00	1.2901E+00
20	8.4368E+01	-9.4085E+01	-1.9170E+01	1.7845E+02	2.7240E+02
	5.8170E-01	-6.4870E-01	-1.3217E-01	1.2304E+00	1.8782E+00
21	-7.0632E+00	-7.5153E+01	-7.3015E+00	6.8090E+01	3.3872E+01
	-4.8699E-02	-5.1816E-01	-5.0342E-02	4.6946E-01	2.3354E-01
22	-1.2477E+02	-3.7019E+02	-1.4589E+02	2.4541E+02	1.4858E+02
	-8.6027E-01	-2.5523E+00	-1.0059E+00	1.6921E+00	1.0244E+00

**Table 2-147. Load Case 216, Rod Drop onto Cask,
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	6.0149E+00 4.1471E-02	-3.5028E+01 -2.4151E-01	3.4399E+01 2.3717E-01	4.1043E+01 2.8298E-01	7.4091E+00 5.1084E-02		
2	6.6401E-01 4.5782E-03	-4.7941E+01 -3.3054E-01	2.3717E+00 1.6353E-02	4.8605E+01 3.3512E-01	8.2904E+00 5.7160E-02		
3	4.0693E+00 2.8057E-02	-5.5503E+01 -3.8268E-01	2.1065E+00 1.4524E-02	5.9572E+01 4.1074E-01	9.1304E+00 6.2952E-02		
4	2.4233E+02 1.6708E+00	-5.9070E+01 -4.0727E-01	1.4809E+02 1.0210E+00	3.0140E+02 2.0781E+00	3.1217E+02 2.1524E+00		
5	1.4727E+02 1.0154E+00	-5.6513E+01 -3.8964E-01	1.1170E+02 7.7012E-01	2.0378E+02 1.4050E+00	8.6796E+01 5.9844E-01		
6	8.3725E+00 5.7726E-02	-2.5080E+02 -1.7292E+00	4.0039E+01 2.7606E-01	2.5917E+02 1.7869E+00	1.7897E+02 1.2340E+00		
7	-3.7564E-01 -2.5899E-03	-1.5776E+02 -1.0877E+00	-4.4347E+00 -3.0576E-02	1.5738E+02 1.0851E+00	2.7150E+00 1.8719E-02		
8	-3.4907E-01 -2.4068E-03	-1.0885E+02 -7.5050E-01	-2.6551E+00 -1.8306E-02	1.0850E+02 7.4809E-01	7.3890E-03 5.0945E-05		
9	-3.5832E-01 -2.4705E-03	-9.1583E+01 -6.3145E-01	-1.8729E+00 -1.2913E-02	9.1225E+01 6.2898E-01	3.7882E-01 2.6119E-03		
10	-2.7700E+00 -1.9098E-02	-9.8007E+01 -6.7573E-01	-2.6502E+01 -1.8272E-01	9.5237E+01 6.5663E-01	1.1577E+00 7.9821E-03		
11	1.1201E+01 7.7229E-02	-2.7402E+01 -1.8893E-01	-9.4454E+00 -6.5124E-02	3.8603E+01 2.6616E-01	4.3591E+01 3.0055E-01		
12	-1.0519E+01 -7.2527E-02	-5.7455E+01 -3.9614E-01	-1.3360E+01 -9.2112E-02	4.6936E+01 3.2361E-01	6.0875E+01 4.1972E-01		
13	3.7904E+01 2.6134E-01	-1.1975E+02 -8.2561E-01	-2.0129E+01 -1.3878E-01	1.5765E+02 1.0870E+00	1.4607E+02 1.0071E+00		
14	3.5501E+01 2.4477E-01	-1.0597E+02 -7.3063E-01	-1.9398E+01 -1.3374E-01	1.4147E+02 9.7540E-01	1.2560E+02 8.6598E-01		
15	-1.5498E+03 -1.0686E+01	-8.9488E+03 -6.1700E+01	-5.5380E+02 -3.8183E+00	7.3990E+03 5.1014E+01	5.1906E+02 3.5788E+00		

16	2.6423E+02	-5.7804E+02	1.9906E+01	8.4226E+02	1.1825E+03
	1.8218E+00	-3.9854E+00	1.3724E-01	5.8072E+00	8.1531E+00
17	-8.0922E+00	-5.2509E+02	8.4148E+01	5.1700E+02	8.6095E+02
	-5.5794E-02	-3.6204E+00	5.8018E-01	3.5646E+00	5.9361E+00
18	2.0418E+01	-2.3526E+02	-6.0660E+01	2.5568E+02	2.0053E+02
	1.4078E-01	-1.6221E+00	-4.1823E-01	1.7628E+00	1.3826E+00
19	1.1115E+02	-5.8673E+01	3.1446E+01	1.6982E+02	6.5049E+01
	7.6634E-01	-4.0454E-01	2.1681E-01	1.1709E+00	4.4850E-01
20	1.8887E+02	-1.0380E+02	-2.0982E+01	2.9267E+02	1.1612E+02
	1.3022E+00	-7.1565E-01	-1.4467E-01	2.0179E+00	8.0061E-01
21	-4.7524E+00	-6.3298E+01	-4.9087E+00	5.8546E+01	2.8537E+01
	-3.2766E-02	-4.3643E-01	-3.3844E-02	4.0366E-01	1.9675E-01
22	3.0372E+02	-3.5147E+03	-8.4847E+02	3.8184E+03	3.1093E+03
	2.0941E+00	-2.4233E+01	-5.8500E+00	2.6327E+01	2.1438E+01

**Table 2-148. Load Case 221, Forward 10g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.3509E+00 2.9999E-02	1.4348E+00 9.8925E-03	-2.9530E+00 -2.0360E-02	7.3072E+00 5.0382E-02	2.3874E+00 1.6461E-02		
2	9.7532E+01 6.7246E-01	1.6723E+00 1.1530E-02	-3.3953E+00 -2.3410E-02	1.3601E+02 9.3778E-01	1.5213E+01 1.0489E-01		
3	2.1800E+00 1.5030E-02	8.5932E-01 5.9248E-03	-1.5968E+00 -1.1009E-02	3.7305E+00 2.5721E-02	2.3712E+00 1.6349E-02		
4	2.9082E+01 2.0051E-01	-9.7039E+00 -6.6906E-02	-2.9082E+01 -2.0051E-01	3.6638E+01 2.5261E-01	1.9915E+01 1.3731E-01		
5	1.7028E+01 1.1741E-01	-9.8758E+00 -6.8091E-02	-1.7028E+01 -1.1741E-01	1.2422E+01 8.5646E-02	8.2783E+00 5.7077E-02		
6	2.2740E+01 1.5679E-01	-8.1148E+00 -5.5950E-02	-2.2740E+01 -1.5679E-01	2.9001E+01 1.9995E-01	2.9977E+00 2.0669E-02		
7	1.0452E+00 7.2062E-03	-5.5670E-01 -3.8383E-03	-1.0453E+00 -7.2072E-03	1.6790E+00 1.1576E-02	5.2159E-01 3.5963E-03		
8	2.0517E+00 1.4146E-02	4.1873E-01 2.8870E-03	-1.9301E+00 -1.3307E-02	3.9490E+00 2.7228E-02	2.9575E-01 2.0392E-03		
9	2.8162E+00 1.9417E-02	-3.0414E-01 -2.0970E-03	-1.6945E+00 -1.1683E-02	4.3532E+00 3.0014E-02	1.0684E-01 7.3667E-04		
10	1.9379E+01 1.3361E-01	9.2204E+00 6.3573E-02	5.2539E+00 3.6224E-02	2.1348E+01 1.4719E-01	6.7182E+00 4.6320E-02		
11	1.8921E+01 1.3046E-01	4.2413E+00 2.9243E-02	-2.6684E+00 -1.8398E-02	2.1590E+01 1.4886E-01	1.8327E+01 1.2636E-01		
12	3.7749E+00 2.6027E-02	1.6394E-01 1.1303E-03	-3.0092E+00 -2.0748E-02	6.7841E+00 4.6775E-02	3.2100E-01 2.2132E-03		
13	1.0751E+01 7.4122E-02	3.3716E+00 2.3246E-02	-1.0751E+01 -7.4123E-02	1.2840E+01 8.8529E-02	5.1452E+00 3.5475E-02		
14	1.7924E+01 1.2358E-01	4.7885E+00 3.3016E-02	-2.2859E+00 -1.5761E-02	2.0210E+01 1.3934E-01	6.8329E+00 4.7112E-02		
15	4.1164E+00 2.8382E-02	-9.3427E-02 -6.4415E-04	-3.9639E+00 -2.7330E-02	8.0818E+00 5.5722E-02	3.2024E-02 2.2079E-04		

16	8.0606E+00	1.1142E+00	-2.9266E+00	1.0987E+01	1.1137E+01
	5.5576E-02	7.6821E-03	-2.0178E-02	7.5754E-02	7.6788E-02
17	8.3142E+00	-1.7259E+00	-3.7140E+00	1.2028E+01	4.5579E+00
	5.7325E-02	-1.1900E-02	-2.5607E-02	8.2932E-02	3.1425E-02
18	1.0749E+01	4.8734E+00	-1.0749E+01	8.3549E+00	4.8390E+00
	7.4115E-02	3.3601E-02	-7.4114E-02	5.7605E-02	3.3364E-02
19	2.0545E+01	-4.3129E+00	-2.0545E+01	3.0599E+01	1.3239E+01
	1.4165E-01	-2.9736E-02	-1.4165E-01	2.1097E-01	9.1278E-02
20	1.8364E+01	-4.6632E+00	-1.8364E+01	2.2267E+01	1.6083E+00
	1.2662E-01	-3.2152E-02	-1.2662E-01	1.5353E-01	1.1089E-02
21	2.7873E+00	4.4081E-03	-2.7874E+00	5.4935E+00	6.0605E-01
	1.9218E-02	3.0393E-05	-1.9218E-02	3.7876E-02	4.1785E-03
22	2.7803E+00	4.4518E-02	-2.3648E+00	5.1451E+00	2.8651E-01
	1.9169E-02	3.0694E-04	-1.6305E-02	3.5474E-02	1.9754E-03

**Table 2-149. Load Case 222, Lateral 5g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.1755E+00 1.4999E-02	7.1739E-01 4.9462E-03	-1.4765E+00 -1.0180E-02	3.6536E+00 2.5191E-02	1.1937E+00 8.2304E-03		
2	4.8766E+01 3.3623E-01	8.3613E-01 5.7649E-03	-1.6977E+00 -1.1705E-02	6.8006E+01 4.6889E-01	7.6067E+00 5.2446E-02		
3	1.0900E+00 7.5152E-03	4.2966E-01 2.9624E-03	-7.9839E-01 -5.5047E-03	1.8652E+00 1.2860E-02	1.1856E+00 8.1744E-03		
4	1.4541E+01 1.0026E-01	-4.8519E+00 -3.3453E-02	-1.4541E+01 -1.0026E-01	1.8319E+01 1.2631E-01	9.9574E+00 6.8654E-02		
5	8.5141E+00 5.8703E-02	-4.9379E+00 -3.4046E-02	-8.5141E+00 -5.8703E-02	6.2110E+00 4.2823E-02	4.1391E+00 2.8538E-02		
6	1.1370E+01 7.8395E-02	-4.0574E+00 -2.7975E-02	-1.1370E+01 -7.8395E-02	1.4500E+01 9.9976E-02	1.4989E+00 1.0334E-02		
7	5.2259E-01 3.6031E-03	-2.7835E-01 -1.9192E-03	-5.2265E-01 -3.6036E-03	8.3949E-01 5.7881E-03	2.6080E-01 1.7981E-03		
8	1.0259E+00 7.0730E-03	2.0936E-01 1.4435E-03	-9.6503E-01 -6.6536E-03	1.9745E+00 1.3614E-02	1.4788E-01 1.0196E-03		
9	1.4081E+00 9.7085E-03	-1.5207E-01 -1.0485E-03	-8.4723E-01 -5.8415E-03	2.1766E+00 1.5007E-02	5.3422E-02 3.6833E-04		
10	9.6896E+00 6.6807E-02	4.6102E+00 3.1786E-02	2.6270E+00 1.8112E-02	1.0674E+01 7.3594E-02	3.3591E+00 2.3160E-02		
11	9.4606E+00 6.5229E-02	2.1207E+00 1.4621E-02	-1.3342E+00 -9.1991E-03	1.0795E+01 7.4428E-02	9.1635E+00 6.3180E-02		
12	1.8875E+00 1.3014E-02	8.1970E-02 5.6516E-04	-1.5046E+00 -1.0374E-02	3.3921E+00 2.3387E-02	1.6050E-01 1.1066E-03		
13	5.3753E+00 3.7061E-02	1.6858E+00 1.1623E-02	-5.3753E+00 -3.7061E-02	6.4201E+00 4.4265E-02	2.5726E+00 1.7737E-02		
14	8.9618E+00 6.1789E-02	2.3943E+00 1.6508E-02	-1.1430E+00 -7.8805E-03	1.0105E+01 6.9670E-02	3.4165E+00 2.3556E-02		
15	2.0582E+00 1.4191E-02	-4.6713E-02 -3.2208E-04	-1.9819E+00 -1.3665E-02	4.0409E+00 2.7861E-02	1.6012E-02 1.1040E-04		

16	4.0303E+00	5.5710E-01	-1.4633E+00	5.4936E+00	5.5686E+00
	2.7788E-02	3.8410E-03	-1.0089E-02	3.7877E-02	3.8394E-02
17	4.1571E+00	-8.6294E-01	-1.8570E+00	6.0141E+00	2.2789E+00
	2.8662E-02	-5.9498E-03	-1.2804E-02	4.1466E-02	1.5713E-02
18	5.3747E+00	2.4367E+00	-5.3746E+00	4.1775E+00	2.4195E+00
	3.7057E-02	1.6801E-02	-3.7057E-02	2.8803E-02	1.6682E-02
19	1.0273E+01	-2.1564E+00	-1.0273E+01	1.5300E+01	6.6194E+00
	7.0827E-02	-1.4868E-02	-7.0827E-02	1.0549E-01	4.5639E-02
20	9.1820E+00	-2.3316E+00	-9.1820E+00	1.1134E+01	8.0416E-01
	6.3308E-02	-1.6076E-02	-6.3308E-02	7.6763E-02	5.5445E-03
21	1.3937E+00	2.2040E-03	-1.3937E+00	2.7467E+00	3.0302E-01
	9.6090E-03	1.5196E-05	-9.6092E-03	1.8938E-02	2.0893E-03
22	1.3901E+00	2.2259E-02	-1.1824E+00	2.5725E+00	1.4326E-01
	9.5846E-03	1.5347E-04	-8.1524E-03	1.7737E-02	9.8772E-04

**Table 2-150. Load Case 223, Vertical 2g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.0195E+00 7.0292E-03	2.6090E-02 1.7988E-04	-9.9812E-02 -6.8818E-04	1.1477E+00 7.9133E-03	8.5736E-02 5.9113E-04
2	6.8545E+00 4.7260E-02	3.3509E-01 2.3104E-03	-5.7483E-02 -3.9633E-04	1.1281E+01 7.7776E-02	4.2216E+00 2.9107E-02
3	2.4187E-01 1.6676E-03	6.1706E-03 4.2545E-05	-2.2134E-01 -1.5261E-03	1.3723E+00 9.4614E-03	1.6300E-01 1.1239E-03
4	8.6053E-01 5.9331E-03	9.1570E-02 6.3136E-04	-4.1071E-01 -2.8318E-03	1.2109E+00 8.3486E-03	3.8899E-01 2.6820E-03
5	5.9144E-01 4.0778E-03	1.4320E-01 9.8732E-04	-3.8119E-01 -2.6282E-03	7.7930E-01 5.3731E-03	1.3081E-01 9.0188E-04
6	5.4478E-01 3.7561E-03	2.0284E-01 1.3985E-03	-2.9430E-01 -2.0292E-03	7.2300E-01 4.9849E-03	1.2664E-01 8.7316E-04
7	7.2082E-01 4.9699E-03	1.9114E-01 1.3179E-03	6.4772E-02 4.4659E-04	6.5605E-01 4.5233E-03	6.8904E-02 4.7508E-04
8	8.9867E-02 6.1961E-04	4.3753E-02 3.0166E-04	-2.7483E-02 -1.8949E-04	1.1836E-01 8.1607E-04	7.7670E-03 5.3552E-05
9	4.3280E-01 2.9840E-03	2.2470E-01 1.5493E-03	-5.7104E-01 -3.9372E-03	5.2221E-01 3.6005E-03	6.9084E-02 4.7632E-04
10	1.7035E-01 1.1745E-03	-1.9751E-01 -1.3618E-03	-6.4368E-01 -4.4380E-03	1.1804E+00 8.1383E-03	1.3445E-01 9.2697E-04
11	2.5184E-01 1.7364E-03	-6.9699E-02 -4.8056E-04	-4.0688E-01 -2.8054E-03	9.9174E-01 6.8378E-03	4.9297E-01 3.3989E-03
12	2.0547E-01 1.4167E-03	-1.2037E-02 -8.2991E-05	-3.1461E-01 -2.1692E-03	5.2048E-01 3.5886E-03	5.6022E-02 3.8626E-04
13	2.0800E-01 1.4341E-03	-1.8625E-01 -1.2841E-03	-3.3192E-01 -2.2885E-03	7.4802E-01 5.1574E-03	3.6848E-01 2.5406E-03
14	2.6140E-01 1.8023E-03	1.2441E-01 8.5781E-04	-2.6289E-01 -1.8125E-03	9.4280E-01 6.5004E-03	3.5615E-01 2.4556E-03
15	4.2596E-01 2.9369E-03	6.0972E-02 4.2039E-04	-1.1413E-01 -7.8687E-04	5.3992E-01 3.7226E-03	2.0856E-02 1.4380E-04

16	6.5471E-01 4.5141E-03	2.9926E-02 2.0633E-04	-3.3671E-01 -2.3215E-03	8.2950E-01 5.7192E-03	1.1848E-01 8.1693E-04
17	4.0222E-01 2.7732E-03	8.9842E-02 6.1944E-04	-1.6897E-01 -1.1650E-03	6.9567E-01 4.7965E-03	3.0951E-01 2.1340E-03
18	3.3807E-01 2.3309E-03	1.0834E-01 7.4696E-04	-1.6130E-01 -1.1121E-03	5.3704E-01 3.7027E-03	2.1514E-01 1.4833E-03
19	1.0127E+00 6.9826E-03	2.7975E-02 1.9288E-04	-4.6173E-01 -3.1835E-03	1.1071E+00 7.6331E-03	7.7497E-02 5.3432E-04
20	5.8408E-01 4.0271E-03	1.3782E-01 9.5023E-04	-2.4431E-01 -1.6844E-03	6.9754E-01 4.8094E-03	2.7622E-02 1.9045E-04
21	-3.5197E-02 -2.4267E-04	-1.8696E-01 -1.2890E-03	-6.5293E-01 -4.5018E-03	6.1796E-01 4.2607E-03	1.6975E-01 1.1704E-03
22	5.6683E-01 3.9081E-03	2.7404E-02 1.8894E-04	-1.0338E-01 -7.1278E-04	6.7024E-01 4.6211E-03	9.9472E-02 6.8583E-04

Table 2-151. Load Case 231, 4-ft. Head-On Drop, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.5081E+01 1.7293E-01	-8.0590E+02 -5.5565E+00	2.9077E+01 2.0048E-01	8.3098E+02 5.7294E+00	2.5110E+02 1.7313E+00		
2	1.1076E+01 7.6369E-02	-4.2209E+02 -2.9102E+00	-2.2676E+01 -1.5635E-01	4.3317E+02 2.9866E+00	4.7028E+01 3.2425E-01		
3	-3.5670E+00 -2.4594E-02	-1.5070E+02 -1.0391E+00	-5.5195E+00 -3.8055E-02	1.4714E+02 1.0145E+00	9.8840E+00 6.8148E-02		
4	4.4411E+02 3.0620E+00	-1.1686E+03 -8.0571E+00	-1.0719E+02 -7.3902E-01	1.6127E+03 1.1119E+01	1.0200E+03 7.0326E+00		
5	2.3446E+02 1.6165E+00	-5.0894E+02 -3.5090E+00	6.3021E+00 4.3451E-02	7.4340E+02 5.1256E+00	8.3938E+02 5.7873E+00		
6	-9.3121E+01 -6.4205E-01	-7.4048E+02 -5.1054E+00	-1.2968E+02 -8.9412E-01	6.4736E+02 4.4634E+00	8.2209E+01 5.6681E-01		
7	-3.0654E-01 -2.1135E-03	-3.2215E+02 -2.2211E+00	4.0210E+00 2.7724E-02	3.2184E+02 2.2190E+00	6.1986E+00 4.2738E-02		
8	-6.8691E-01 -4.7361E-03	-2.3375E+02 -1.6117E+00	-5.2667E+00 -3.6313E-02	2.3307E+02 1.6069E+00	6.2432E-01 4.3046E-03		
9	-6.5915E-01 -4.5447E-03	-2.0957E+02 -1.4449E+00	-6.5272E+00 -4.5003E-02	2.0891E+02 1.4404E+00	3.8681E-01 2.6670E-03		
10	-4.7699E+01 -3.2888E-01	-3.4766E+02 -2.3970E+00	-1.7391E+01 -1.1991E-01	2.9996E+02 2.0682E+00	2.0507E+02 1.4139E+00		
11	6.7773E+01 4.6728E-01	-1.9481E+02 -1.3432E+00	-2.2237E+00 -1.5332E-02	2.6258E+02 1.8104E+00	8.9717E+01 6.1858E-01		
12	6.7768E+01 4.6724E-01	-5.3668E+01 -3.7003E-01	5.8299E+01 4.0196E-01	1.2144E+02 8.3727E-01	2.3071E+02 1.5907E+00		
13	7.9508E+01 5.4819E-01	-1.4393E+02 -9.9238E-01	1.3652E+01 9.4126E-02	2.2344E+02 1.5406E+00	7.6129E+01 5.2489E-01		
14	7.6913E+01 5.3030E-01	-9.0796E+01 -6.2601E-01	3.6403E+01 2.5099E-01	1.6771E+02 1.1563E+00	5.0712E+01 3.4965E-01		
15	-7.9538E+02 -5.4839E+00	-3.0569E+03 -2.1077E+01	-5.9343E+02 -4.0915E+00	2.2616E+03 1.5593E+01	1.3954E+02 9.6208E-01		

16	1.3964E+02	-4.5686E+02	3.4294E+01	5.9650E+02	3.6570E+02
	9.6278E-01	-3.1499E+00	2.3645E-01	4.1127E+00	2.5214E+00
17	-8.4400E+01	-1.0522E+03	-2.1359E+02	9.6782E+02	1.9075E+02
	-5.8192E-01	-7.2548E+00	-1.4726E+00	6.6729E+00	1.3152E+00
18	-4.0819E+01	-5.4141E+02	-3.8096E+01	5.0060E+02	2.8556E+02
	-2.8144E-01	-3.7329E+00	-2.6266E-01	3.4515E+00	1.9689E+00
19	2.8037E+02	-3.9524E+02	5.6069E+01	6.7562E+02	4.2483E+02
	1.9331E+00	-2.7251E+00	3.8658E-01	4.6582E+00	2.9291E+00
20	2.9901E+02	-4.5679E+02	-4.7247E+01	7.5580E+02	4.6828E+02
	2.0616E+00	-3.1495E+00	-3.2576E-01	5.2111E+00	3.2287E+00
21	-4.0078E+01	-9.8076E+01	-8.7314E+01	5.7998E+01	2.2693E+01
	-2.7633E-01	-6.7621E-01	-6.0201E-01	3.9988E-01	1.5646E-01
22	-1.2036E+02	-1.5632E+03	-1.0933E+02	1.4428E+03	3.9576E+02
	-8.2985E-01	-1.0778E+01	-7.5381E-01	9.9477E+00	2.7287E+00

Table 2-152. Load Case 232, 30-ft. Head-On Drop Impact Test, Normal Conditions, Normal Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-4.3851E+01 -3.0234E-01	-3.2062E+03 -2.2106E+01	-5.9694E+02 -4.1157E+00	3.1624E+03 2.1804E+01	1.2779E+03 8.8110E+00		
2	3.6608E+01 2.5240E-01	-1.7299E+03 -1.1927E+01	-1.0905E+02 -7.5189E-01	1.7665E+03 1.2180E+01	8.2715E+01 5.7030E-01		
3	1.4808E+01 1.0210E-01	-1.0201E+03 -7.0335E+00	-3.7223E+01 -2.5664E-01	1.0349E+03 7.1356E+00	8.9395E+01 6.1636E-01		
4	8.7090E+02 6.0047E+00	-5.1268E+03 -3.5348E+01	-1.6448E+03 -1.1341E+01	5.9977E+03 4.1353E+01	4.3668E+03 3.0108E+01		
5	1.4694E+02 1.0131E+00	-1.9133E+03 -1.3192E+01	-8.0020E+02 -5.5172E+00	2.0603E+03 1.4205E+01	2.9578E+03 2.0393E+01		
6	-3.3587E+02 -2.3157E+00	-1.3042E+03 -8.9919E+00	-6.9110E+02 -4.7650E+00	9.6830E+02 6.6762E+00	5.0009E+02 3.4480E+00		
7	-6.4298E+00 -4.4332E-02	-8.8189E+02 -6.0804E+00	-5.5845E+01 -3.8504E-01	8.7546E+02 6.0361E+00	1.6685E+01 1.1504E-01		
8	-3.9646E+00 -2.7335E-02	-8.4322E+02 -5.8138E+00	-3.9722E+01 -2.7387E-01	8.3925E+02 5.7864E+00	8.5101E-01 5.8675E-03		
9	-3.2081E+00 -2.2119E-02	-8.1085E+02 -5.5906E+00	-2.7565E+01 -1.9006E-01	8.0765E+02 5.5685E+00	5.7717E-01 3.9795E-03		
10	-1.5792E+02 -1.0888E+00	-1.3134E+03 -9.0557E+00	-9.6320E+01 -6.6410E-01	1.1555E+03 7.9668E+00	6.8283E+02 4.7080E+00		
11	2.0361E+02 1.4038E+00	-6.7121E+02 -4.6278E+00	-4.4778E+01 -3.0873E-01	8.7482E+02 6.0316E+00	3.1955E+02 2.2032E+00		
12	1.9175E+02 1.3221E+00	-1.8880E+02 -1.3018E+00	1.4942E+02 1.0302E+00	3.8055E+02 2.6238E+00	7.7647E+02 5.3536E+00		
13	2.5373E+02 1.7494E+00	-7.1035E+02 -4.8977E+00	-3.8245E+01 -2.6369E-01	9.6407E+02 6.6471E+00	6.7407E+02 4.6476E+00		
14	2.4952E+02 1.7204E+00	-5.6415E+02 -3.8897E+00	2.2970E+01 1.5837E-01	8.1367E+02 5.6101E+00	3.5190E+02 2.4263E+00		
15	8.3614E+02 5.7650E+00	1.8534E+02 1.2778E+00	1.3136E+02 9.0573E-01	6.5081E+02 4.4872E+00	2.3281E+01 1.6052E-01		

16	2.8958E+02	-9.1798E+02	-4.4126E+02	1.2076E+03	5.6522E+02
	1.9966E+00	-6.3292E+00	-3.0424E+00	8.3258E+00	3.8970E+00
17	4.9047E+02	-8.8069E+02	-4.9980E+02	1.3712E+03	1.1635E+03
	3.3817E+00	-6.0722E+00	-3.4460E+00	9.4538E+00	8.0221E+00
18	4.6270E+02	-1.4211E+03	-2.9977E+02	1.8838E+03	2.1661E+03
	3.1902E+00	-9.7984E+00	-2.0668E+00	1.2989E+01	1.4935E+01
19	4.0197E+02	-1.4487E+03	-5.6530E+02	1.8507E+03	1.2611E+03
	2.7715E+00	-9.9885E+00	-3.8976E+00	1.2760E+01	8.6948E+00
20	-9.7709E+01	-9.6214E+02	-6.2784E+02	8.6443E+02	1.4123E+03
	-6.7368E-01	-6.6337E+00	-4.3288E+00	5.9600E+00	9.7373E+00
21	1.6604E+02	1.2645E+00	-3.2787E-01	1.6478E+02	9.0540E+00
	1.1448E+00	8.7186E-03	-2.2606E-03	1.1361E+00	6.2425E-02
22	5.3497E+02	1.2521E+02	3.5320E+02	4.0975E+02	3.3572E+02
	3.6885E+00	8.6331E-01	2.4353E+00	2.8252E+00	2.3147E+00

**Table 2-153. Load Combination 101, Hot Environment,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 102, 201, 211

100°F Ambient, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.19	1.70	0.15	2.90	3.05	20.00	66.30	9.36
	8.23	11.73	1.03	19.97	21.00	137.90	457.12	
2	0.08	0.05	0.19	0.13	0.32	20.00	66.30	>10
	0.53	0.37	1.34	0.90	2.24	137.90	457.12	
3	0.04	0.01	0.15	0.05	0.20	20.00	66.30	>10
	0.24	0.09	1.05	0.33	1.38	137.90	457.12	
4	1.71	2.69	1.36	4.40	5.76	20.00	66.30	5.82
	11.78	18.56	9.34	30.33	39.68	137.90	457.12	
5	1.65	2.53	1.11	4.18	5.29	20.00	66.30	6.18
	11.36	17.47	7.63	28.83	36.46	137.90	457.12	
6	0.61	1.02	0.67	1.63	2.30	20.00	66.30	>10
	4.21	7.03	4.60	11.24	15.83	137.90	457.12	
7	0.34	0.00	0.22	0.34	0.56	20.00	66.30	>10
	2.35	0.01	1.52	2.36	3.87	137.90	457.12	
8	0.34	0.00	0.21	0.34	0.55	20.00	66.30	>10
	2.35	0.00	1.45	2.35	3.80	137.90	457.12	
9	0.34	0.00	0.22	0.34	0.56	20.00	66.30	>10
	2.35	0.01	1.49	2.36	3.84	137.90	457.12	
10	0.49	0.21	0.93	0.71	1.63	20.00	66.30	>10
	3.40	1.48	6.38	4.88	11.26	137.90	457.12	
11	0.27	0.16	0.74	0.43	1.18	20.00	66.30	>10
	1.85	1.12	5.13	2.97	8.10	137.90	457.12	
12	0.23	0.11	1.02	0.34	1.37	20.00	66.30	>10
	1.61	0.76	7.06	2.37	9.42	137.90	457.12	
13	0.82	0.89	0.72	1.71	2.43	20.00	66.30	>10
	5.65	6.15	4.95	11.81	16.76	137.90	457.12	

14	0.81 5.58	0.64 4.45	0.58 4.02	1.45 10.03	2.04 14.05	20.00 137.90	66.30 457.12	>10
15	1.35 9.34	0.65 4.46	2.10 14.51	2.00 13.80	4.11 28.31	20.00 137.90	66.30 457.12	>10
16	0.36 2.51	0.47 3.23	0.74 5.12	0.83 5.74	1.58 10.86	20.00 137.90	66.30 457.12	>10
17	0.28 1.95	0.35 2.40	0.43 3.00	0.63 4.36	1.07 7.35	20.00 137.90	66.30 457.12	>10
18	0.51 3.53	0.81 5.62	0.19 1.34	1.33 9.15	1.52 10.49	20.00 137.90	66.30 457.12	>10
19	0.74 5.13	0.97 6.65	0.32 2.18	1.71 11.78	2.03 13.97	20.00 137.90	66.30 457.12	>10
20	0.73 5.04	1.01 6.97	0.53 3.67	1.74 12.01	2.27 15.68	20.00 137.90	66.30 457.12	>10
21	0.17 1.19	0.29 1.98	0.03 0.21	0.46 3.17	0.49 3.38	20.00 137.90	66.30 457.12	>10
22	0.72 4.97	0.36 2.48	0.11 0.79	1.08 7.46	1.20 8.25	20.00 137.90	66.30 457.12	>10

Min MS: 5.819, Location: 4, Combination: Pm+Pb

**Table 2-154. Load Combination 102, Cold Environment,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 104, 201, 211
 -40°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.19	1.70	0.09	2.90	2.99	20.00	70.00	9.36
	8.23	11.73	0.63	19.97	20.59	137.90	482.63	
2	0.08	0.05	0.07	0.13	0.20	20.00	70.00	>10
	0.53	0.37	0.45	0.90	1.35	137.90	482.63	
3	0.04	0.01	0.09	0.05	0.13	20.00	70.00	>10
	0.24	0.09	0.59	0.33	0.93	137.90	482.63	
4	1.71	2.69	10.82	4.40	15.22	20.00	70.00	2.94
	11.78	18.56	74.60	30.33	104.94	137.90	482.63	
5	1.65	2.53	14.79	4.18	18.97	20.00	70.00	2.16
	11.36	17.47	101.94	28.83	130.76	137.90	482.63	
6	0.61	1.02	7.02	1.63	8.65	20.00	70.00	5.94
	4.21	7.03	48.40	11.24	59.64	137.90	482.63	
7	0.34	0.00	3.23	0.34	3.57	20.00	70.00	>10
	2.35	0.01	22.24	2.36	24.60	137.90	482.63	
8	0.34	0.00	3.22	0.34	3.56	20.00	70.00	>10
	2.35	0.00	22.22	2.35	24.57	137.90	482.63	
9	0.34	0.00	3.22	0.34	3.57	20.00	70.00	>10
	2.35	0.01	22.23	2.36	24.59	137.90	482.63	
10	0.49	0.21	3.54	0.71	4.25	20.00	70.00	>10
	3.40	1.48	24.39	4.88	29.27	137.90	482.63	
11	0.27	0.16	1.73	0.43	2.16	20.00	70.00	>10
	1.85	1.12	11.93	2.97	14.90	137.90	482.63	
12	0.23	0.11	0.85	0.34	1.19	20.00	70.00	>10
	1.61	0.76	5.83	2.37	8.19	137.90	482.63	
13	0.82	0.89	6.14	1.71	7.85	20.00	70.00	6.64
	5.65	6.15	42.35	11.81	54.16	137.90	482.63	

14	0.81 5.58	0.64 4.45	4.97 34.30	1.45 10.03	6.43 44.32	20.00 137.90	70.00 482.63	8.33
15	1.35 9.34	0.65 4.46	0.45 3.12	2.00 13.80	2.45 16.93	20.00 137.90	70.00 482.63	>10
16	0.36 2.51	0.47 3.23	1.83 12.59	0.83 5.74	2.66 18.33	20.00 137.90	70.00 482.63	>10
17	0.28 1.95	0.35 2.40	1.56 10.76	0.63 4.36	2.19 15.12	20.00 137.90	70.00 482.63	>10
18	0.51 3.53	0.81 5.62	1.63 11.27	1.33 9.15	2.96 20.42	20.00 137.90	70.00 482.63	>10
19	0.74 5.13	0.97 6.65	2.18 15.00	1.71 11.78	3.89 26.79	20.00 137.90	70.00 482.63	>10
20	0.73 5.04	1.01 6.97	2.41 16.60	1.74 12.01	4.15 28.61	20.00 137.90	70.00 482.63	>10
21	0.17 1.19	0.29 1.98	0.88 6.07	0.46 3.17	1.34 9.25	20.00 137.90	70.00 482.63	>10
22	0.72 4.97	0.36 2.48	0.12 0.80	1.08 7.46	1.20 8.25	20.00 137.90	70.00 482.63	>10

Min MS: 2.164, Location: 5, Combination: Pm+Pb+Q

**Table 2-155. Load Combination 103, Increased External Pressure,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 103, 202, 211

-20°F Ambient, Zero Decay Heat, Zero Insolation

Minimum External Pressure, 24 kPa (3.5 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.19	1.70	0.07	2.89	2.97	20.00	70.00	9.38
	8.21	11.72	0.51	19.93	20.45	137.90	482.63	
2	0.07	0.05	0.05	0.13	0.18	20.00	70.00	>10
	0.51	0.37	0.37	0.87	1.24	137.90	482.63	
3	0.03	0.01	0.07	0.04	0.11	20.00	70.00	>10
	0.22	0.09	0.49	0.30	0.79	137.90	482.63	
4	1.49	2.35	8.85	3.84	12.69	20.00	70.00	3.73
	10.24	16.20	61.04	26.44	87.49	137.90	482.63	
5	1.51	2.31	12.10	3.81	15.91	20.00	70.00	2.77
	10.39	15.91	83.41	26.30	109.71	137.90	482.63	
6	0.57	1.00	5.74	1.58	7.32	20.00	70.00	7.20
	3.96	6.91	39.60	10.87	50.47	137.90	482.63	
7	0.33	0.00	2.64	0.33	2.97	20.00	70.00	>10
	2.27	0.01	18.20	2.28	20.48	137.90	482.63	
8	0.33	0.00	2.64	0.33	2.97	20.00	70.00	>10
	2.27	0.00	18.18	2.27	20.45	137.90	482.63	
9	0.33	0.00	2.64	0.33	2.97	20.00	70.00	>10
	2.27	0.01	18.18	2.28	20.46	137.90	482.63	
10	0.37	0.09	2.89	0.46	3.36	20.00	70.00	>10
	2.57	0.62	19.96	3.19	23.15	137.90	482.63	
11	0.20	0.13	1.42	0.34	1.75	20.00	70.00	>10
	1.39	0.93	9.77	2.32	12.08	137.90	482.63	
12	0.12	0.10	0.69	0.22	0.91	20.00	70.00	>10
	0.84	0.66	4.77	1.49	6.26	137.90	482.63	
13	0.71	0.80	5.03	1.50	6.53	20.00	70.00	8.19
	4.87	5.49	34.65	10.36	45.02	137.90	482.63	

14	0.71 4.90	0.54 3.74	4.07 28.06	1.25 8.65	5.32 36.71	20.00 137.90	70.00 482.63	>10
15	0.97 6.71	0.21 1.46	0.37 2.54	1.18 8.17	1.55 10.71	20.00 137.90	70.00 482.63	>10
16	0.11 0.77	0.12 0.81	1.50 10.31	0.23 1.58	1.72 11.89	20.00 137.90	70.00 482.63	>10
17	0.10 0.71	0.11 0.75	1.28 8.81	0.21 1.45	1.49 10.27	20.00 137.90	70.00 482.63	>10
18	0.29 1.98	0.49 3.37	1.34 9.21	0.78 5.35	2.11 14.56	20.00 137.90	70.00 482.63	>10
19	0.39 2.66	0.41 2.85	1.78 12.27	0.80 5.51	2.58 17.78	20.00 137.90	70.00 482.63	>10
20	0.47 3.27	0.54 3.74	1.97 13.57	1.02 7.01	2.99 20.58	20.00 137.90	70.00 482.63	>10
21	0.10 0.69	0.21 1.45	0.72 4.97	0.31 2.14	1.03 7.11	20.00 137.90	70.00 482.63	>10
22	0.59 4.04	0.27 1.84	0.09 0.64	0.85 5.88	0.95 6.52	20.00 137.90	70.00 482.63	>10

Min MS: 2.771, Location: 5, Combination: Pm+Pb+Q

**Table 2-156. Load Combination 104, Minimum External Pressure,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 101, 201, 202, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 414 kPa (60 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.16	2.90	3.06	20.00	66.30	9.35
	8.24	11.74	1.11	19.98	21.08	137.90	457.12	
2	0.08	0.05	0.21	0.13	0.34	20.00	66.30	>10
	0.54	0.37	1.43	0.91	2.34	137.90	457.12	
3	0.04	0.01	0.15	0.05	0.20	20.00	66.30	>10
	0.25	0.09	1.06	0.34	1.41	137.90	457.12	
4	1.78	2.81	1.13	4.59	5.72	20.00	66.30	5.54
	12.29	19.36	7.80	31.65	39.45	137.90	457.12	
5	1.69	2.61	1.18	4.31	5.49	20.00	66.30	5.97
	11.69	18.00	8.13	29.69	37.82	137.90	457.12	
6	0.62	1.03	0.54	1.65	2.19	20.00	66.30	>10
	4.29	7.08	3.72	11.37	15.10	137.90	457.12	
7	0.34	0.00	0.15	0.35	0.49	20.00	66.30	>10
	2.37	0.01	1.02	2.38	3.40	137.90	457.12	
8	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.37	0.00	1.02	2.37	3.39	137.90	457.12	
9	0.34	0.00	0.15	0.35	0.49	20.00	66.30	>10
	2.37	0.02	1.01	2.38	3.39	137.90	457.12	
10	0.53	0.26	0.45	0.79	1.24	20.00	66.30	>10
	3.67	1.76	3.13	5.43	8.56	137.90	457.12	
11	0.29	0.17	0.47	0.46	0.93	20.00	66.30	>10
	2.00	1.19	3.24	3.18	6.42	137.90	457.12	
12	0.27	0.11	0.70	0.38	1.08	20.00	66.30	>10
	1.85	0.78	4.84	2.64	7.47	137.90	457.12	

13	0.86 5.90	0.92 6.37	0.70 4.79	1.78 12.27	2.47 17.06	20.00 137.90	66.30 457.12	>10
14	0.84 5.80	0.68 4.67	0.57 3.93	1.52 10.47	2.09 14.40	20.00 137.90	66.30 457.12	>10
15	1.48 10.20	0.79 5.45	1.41 9.71	2.27 15.65	3.68 25.36	20.00 137.90	66.30 457.12	>10
16	0.44 3.07	0.58 4.02	0.49 3.38	1.03 7.09	1.52 10.47	20.00 137.90	66.30 457.12	>10
17	0.34 2.35	0.43 2.94	0.29 2.01	0.77 5.29	1.06 7.31	20.00 137.90	66.30 457.12	>10
18	0.59 4.04	0.92 6.35	0.19 1.32	1.51 10.38	1.70 11.71	20.00 137.90	66.30 457.12	>10
19	0.86 5.93	1.14 7.89	0.28 1.91	2.00 13.82	2.28 15.73	20.00 137.90	66.30 457.12	>10
20	0.82 5.62	1.16 8.02	0.56 3.84	1.98 13.64	2.54 17.48	20.00 137.90	66.30 457.12	>10
21	0.20 1.35	0.31 2.15	0.03 0.19	0.51 3.50	0.53 3.69	20.00 137.90	66.30 457.12	>10
22	0.77 5.28	0.39 2.70	0.07 0.50	1.16 7.97	1.23 8.47	20.00 137.90	66.30 457.12	>10

Min MS: 5.535, Location: 4, Combination: Pm+Pb

Table 2-157. Load Combination 105, Cold Environment with Maximum Decay Heat, Normal Conditions of Transport – Model AOS-050A

Load Cases: 105, 201, 202, 211
 -40°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 414 kPa (60 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.17	2.90	3.07	20.00	70.00	9.35
	8.24	11.74	1.20	19.98	21.18	137.90	482.63	
2	0.08	0.05	0.22	0.13	0.36	20.00	70.00	>10
	0.54	0.37	1.54	0.91	2.45	137.90	482.63	
3	0.04	0.01	0.17	0.05	0.22	20.00	70.00	>10
	0.25	0.09	1.15	0.34	1.49	137.90	482.63	
4	1.78	2.81	1.19	4.59	5.78	20.00	70.00	5.54
	12.29	19.36	8.21	31.65	39.86	137.90	482.63	
5	1.69	2.61	1.33	4.31	5.63	20.00	70.00	5.97
	11.69	18.00	9.15	29.69	38.84	137.90	482.63	
6	0.62	1.03	0.58	1.65	2.23	20.00	70.00	>10
	4.29	7.08	4.02	11.37	15.40	137.90	482.63	
7	0.34	0.00	0.17	0.35	0.51	20.00	70.00	>10
	2.37	0.01	1.15	2.38	3.53	137.90	482.63	
8	0.34	0.00	0.17	0.34	0.51	20.00	70.00	>10
	2.37	0.00	1.16	2.37	3.53	137.90	482.63	
9	0.34	0.00	0.17	0.35	0.51	20.00	70.00	>10
	2.37	0.02	1.15	2.38	3.53	137.90	482.63	
10	0.53	0.26	0.37	0.79	1.16	20.00	70.00	>10
	3.67	1.76	2.58	5.43	8.01	137.90	482.63	
11	0.29	0.17	0.43	0.46	0.89	20.00	70.00	>10
	2.00	1.19	2.96	3.18	6.14	137.90	482.63	
12	0.27	0.11	0.66	0.38	1.04	20.00	70.00	>10
	1.85	0.78	4.53	2.64	7.16	137.90	482.63	

13	0.86 5.90	0.92 6.37	0.75 5.14	1.78 12.27	2.52 17.41	20.00 137.90	70.00 482.63	>10
14	0.84 5.80	0.68 4.67	0.63 4.33	1.52 10.47	2.15 14.80	20.00 137.90	70.00 482.63	>10
15	1.48 10.20	0.79 5.45	0.14 0.97	2.27 15.65	2.41 16.62	20.00 137.90	70.00 482.63	>10
16	0.44 3.07	0.58 4.02	0.04 0.29	1.03 7.09	1.07 7.38	20.00 137.90	70.00 482.63	>10
17	0.34 2.35	0.43 2.94	0.04 0.27	0.77 5.29	0.81 5.56	20.00 137.90	70.00 482.63	>10
18	0.59 4.04	0.92 6.35	0.21 1.45	1.51 10.38	1.72 11.83	20.00 137.90	70.00 482.63	>10
19	0.86 5.93	1.14 7.89	0.25 1.74	2.00 13.82	2.26 15.55	20.00 137.90	70.00 482.63	>10
20	0.82 5.62	1.16 8.02	0.62 4.25	1.98 13.64	2.59 17.89	20.00 137.90	70.00 482.63	>10
21	0.20 1.35	0.31 2.15	0.03 0.19	0.51 3.50	0.53 3.69	20.00 137.90	70.00 482.63	>10
22	0.77 5.28	0.39 2.70	0.03 0.23	1.16 7.97	1.19 8.20	20.00 137.90	70.00 482.63	>10

Min MS: 5.535, Location: 4, Combination: Pm+Pb

**Table 2-158. Load Combination 106, Maximum Pressure, Hot Environment,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 101, 201, 203, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 414 kPa (60 psia)
 Maximum Increased External Pressure, 140 kPa (20 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.16	2.90	3.06	20.00	66.30	9.33
	8.29	11.74	1.11	20.02	21.13	137.90	457.12	
2	0.09	0.05	0.21	0.14	0.35	20.00	66.30	>10
	0.59	0.37	1.43	0.96	2.39	137.90	457.12	
3	0.04	0.02	0.15	0.06	0.21	20.00	66.30	>10
	0.30	0.11	1.06	0.41	1.48	137.90	457.12	
4	1.95	3.12	1.13	5.07	6.20	20.00	66.30	4.92
	13.42	21.53	7.80	34.95	42.75	137.90	457.12	
5	1.90	2.90	1.18	4.81	5.99	20.00	66.30	5.24
	13.12	20.01	8.13	33.14	41.27	137.90	457.12	
6	0.71	1.19	0.54	1.90	2.44	20.00	66.30	>10
	4.91	8.20	3.72	13.10	16.83	137.90	457.12	
7	0.41	0.00	0.15	0.41	0.56	20.00	66.30	>10
	2.80	0.01	1.02	2.81	3.83	137.90	457.12	
8	0.41	0.00	0.15	0.41	0.55	20.00	66.30	>10
	2.80	0.00	1.02	2.80	3.82	137.90	457.12	
9	0.41	0.00	0.15	0.41	0.55	20.00	66.30	>10
	2.80	0.02	1.01	2.81	3.82	137.90	457.12	
10	0.56	0.22	0.45	0.78	1.24	20.00	66.30	>10
	3.88	1.51	3.13	5.39	8.52	137.90	457.12	
11	0.30	0.17	0.47	0.47	0.94	20.00	66.30	>10
	2.05	1.20	3.24	3.25	6.48	137.90	457.12	
12	0.34	0.25	0.70	0.59	1.29	20.00	66.30	>10
	2.37	1.70	4.84	4.06	8.90	137.90	457.12	

13	0.91 6.27	0.99 6.84	0.70 4.79	1.90 13.11	2.60 17.90	20.00 137.90	66.30 457.12	>10
14	0.88 6.08	0.69 4.78	0.57 3.93	1.58 10.87	2.15 14.80	20.00 137.90	66.30 457.12	>10
15	1.53 10.57	0.76 5.25	1.41 9.71	2.29 15.82	3.70 25.53	20.00 137.90	66.30 457.12	>10
16	0.48 3.29	0.63 4.33	0.49 3.38	1.11 7.62	1.60 11.01	20.00 137.90	66.30 457.12	>10
17	0.36 2.52	0.47 3.27	0.29 2.01	0.84 5.78	1.13 7.80	20.00 137.90	66.30 457.12	>10
18	0.61 4.20	0.97 6.67	0.19 1.32	1.58 10.87	1.77 12.20	20.00 137.90	66.30 457.12	>10
19	0.89 6.14	1.17 8.07	0.28 1.91	2.06 14.20	2.34 16.12	20.00 137.90	66.30 457.12	>10
20	0.83 5.71	1.18 8.15	0.56 3.84	2.01 13.86	2.57 17.70	20.00 137.90	66.30 457.12	>10
21	0.29 2.01	0.38 2.65	0.03 0.19	0.68 4.66	0.70 4.84	20.00 137.90	66.30 457.12	>10
22	0.79 5.48	0.39 2.68	0.07 0.50	1.18 8.16	1.26 8.66	20.00 137.90	66.30 457.12	>10

Min MS: 4.918, Location: 4, Combination: Pm+Pb

**Table 2-159. Load Combination 107, Maximum Pressure, Cold Environment,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 105, 201, 203, 211

-40°F Ambient, Maximum Decay Heat

Internal Design Pressure, 414 kPa (60 psia)

Maximum Increased External Pressure, 140 kPa (20 psia)

Fabrication Stress

Stress (ksi/MPa)								

Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.17	2.90	3.08	20.00	70.00	9.33
	8.29	11.74	1.20	20.02	21.23	137.90	482.63	
2	0.09	0.05	0.22	0.14	0.36	20.00	70.00	>10
	0.59	0.37	1.54	0.96	2.50	137.90	482.63	
3	0.04	0.02	0.17	0.06	0.23	20.00	70.00	>10
	0.30	0.11	1.15	0.41	1.56	137.90	482.63	
4	1.95	3.12	1.19	5.07	6.26	20.00	70.00	4.92
	13.42	21.53	8.21	34.95	43.16	137.90	482.63	
5	1.90	2.90	1.33	4.81	6.13	20.00	70.00	5.24
	13.12	20.01	9.15	33.14	42.29	137.90	482.63	
6	0.71	1.19	0.58	1.90	2.48	20.00	70.00	>10
	4.91	8.20	4.02	13.10	17.12	137.90	482.63	
7	0.41	0.00	0.17	0.41	0.58	20.00	70.00	>10
	2.80	0.01	1.15	2.81	3.96	137.90	482.63	
8	0.41	0.00	0.17	0.41	0.57	20.00	70.00	>10
	2.80	0.00	1.16	2.80	3.96	137.90	482.63	
9	0.41	0.00	0.17	0.41	0.57	20.00	70.00	>10
	2.80	0.02	1.15	2.81	3.96	137.90	482.63	
10	0.56	0.22	0.37	0.78	1.16	20.00	70.00	>10
	3.88	1.51	2.58	5.39	7.97	137.90	482.63	
11	0.30	0.17	0.43	0.47	0.90	20.00	70.00	>10
	2.05	1.20	2.96	3.25	6.20	137.90	482.63	
12	0.34	0.25	0.66	0.59	1.25	20.00	70.00	>10
	2.37	1.70	4.53	4.06	8.59	137.90	482.63	

13	0.91 6.27	0.99 6.84	0.75 5.14	1.90 13.11	2.65 18.25	20.00 137.90	70.00 482.63	>10
14	0.88 6.08	0.69 4.78	0.63 4.33	1.58 10.87	2.20 15.20	20.00 137.90	70.00 482.63	>10
15	1.53 10.57	0.76 5.25	0.14 0.97	2.29 15.82	2.43 16.78	20.00 137.90	70.00 482.63	>10
16	0.48 3.29	0.63 4.33	0.04 0.29	1.11 7.62	1.15 7.92	20.00 137.90	70.00 482.63	>10
17	0.36 2.52	0.47 3.27	0.04 0.27	0.84 5.78	0.88 6.05	20.00 137.90	70.00 482.63	>10
18	0.61 4.20	0.97 6.67	0.21 1.45	1.58 10.87	1.79 12.32	20.00 137.90	70.00 482.63	>10
19	0.89 6.14	1.17 8.07	0.25 1.74	2.06 14.20	2.31 15.94	20.00 137.90	70.00 482.63	>10
20	0.83 5.71	1.18 8.15	0.62 4.25	2.01 13.86	2.63 18.11	20.00 137.90	70.00 482.63	>10
21	0.29 2.01	0.38 2.65	0.03 0.19	0.68 4.66	0.70 4.84	20.00 137.90	70.00 482.63	>10
22	0.79 5.48	0.39 2.68	0.03 0.23	1.18 8.16	1.22 8.39	20.00 137.90	70.00 482.63	>10

Min MS: 4.918, Location: 4, Combination: Pm+Pb

**Table 2-160. Load Combination 215, Compression Load,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 215, 101, 201, 211
 Compression Load (5x weight)
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.26	1.80	0.16	3.05	3.21	20.00	66.30	8.82
	8.67	12.39	1.11	21.06	22.16	137.90	457.12	
2	0.13	0.05	0.21	0.18	0.39	20.00	66.30	>10
	0.87	0.37	1.43	1.24	2.67	137.90	457.12	
3	0.09	0.03	0.15	0.12	0.28	20.00	66.30	>10
	0.62	0.21	1.06	0.84	1.90	137.90	457.12	
4	1.94	3.07	1.13	5.01	6.14	20.00	66.30	4.99
	13.37	21.16	7.80	34.53	42.33	137.90	457.12	
5	1.88	2.85	1.18	4.73	5.91	20.00	66.30	5.34
	12.98	19.63	8.13	32.60	40.74	137.90	457.12	
6	0.72	1.09	0.54	1.81	2.35	20.00	66.30	>10
	4.95	7.52	3.72	12.47	16.20	137.90	457.12	
7	0.42	0.00	0.15	0.42	0.57	20.00	66.30	>10
	2.91	0.01	1.02	2.93	3.95	137.90	457.12	
8	0.40	0.00	0.15	0.40	0.55	20.00	66.30	>10
	2.77	0.00	1.02	2.77	3.79	137.90	457.12	
9	0.40	0.00	0.15	0.40	0.54	20.00	66.30	>10
	2.73	0.02	1.01	2.75	3.75	137.90	457.12	
10	0.55	0.22	0.45	0.78	1.23	20.00	66.30	>10
	3.82	1.54	3.13	5.36	8.49	137.90	457.12	
11	0.29	0.19	0.47	0.48	0.95	20.00	66.30	>10
	2.02	1.30	3.24	3.32	6.56	137.90	457.12	
12	0.27	0.17	0.70	0.44	1.14	20.00	66.30	>10
	1.87	1.16	4.84	3.03	7.87	137.90	457.12	

13	0.91 6.30	0.99 6.80	0.70 4.79	1.90 13.10	2.59 17.89	20.00 137.90	66.30 457.12	>10
14	0.89 6.13	0.71 4.90	0.57 3.93	1.60 11.03	2.17 14.96	20.00 137.90	66.30 457.12	>10
15	2.33 16.08	0.71 4.90	1.41 9.71	3.04 20.98	4.45 30.69	20.00 137.90	66.30 457.12	7.58
16	0.59 4.06	0.75 5.14	0.49 3.38	1.33 9.20	1.82 12.58	20.00 137.90	66.30 457.12	>10
17	0.44 3.01	0.51 3.52	0.29 2.01	0.95 6.53	1.24 8.55	20.00 137.90	66.30 457.12	>10
18	0.60 4.15	0.90 6.18	0.19 1.32	1.50 10.32	1.69 11.65	20.00 137.90	66.30 457.12	>10
19	0.89 6.17	1.15 7.94	0.28 1.91	2.05 14.11	2.32 16.03	20.00 137.90	66.30 457.12	>10
20	0.91 6.27	1.28 8.85	0.56 3.84	2.19 15.12	2.75 18.97	20.00 137.90	66.30 457.12	>10
21	0.24 1.66	0.32 2.22	0.03 0.19	0.56 3.88	0.59 4.07	20.00 137.90	66.30 457.12	>10
22	0.97 6.66	0.51 3.51	0.07 0.50	1.48 10.17	1.55 10.67	20.00 137.90	66.30 457.12	>10

Min MS: 4.990, Location: 4, Combination: Pm+Pb

**Table 2-161. Load Combination 216, Rod Drop,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 216, 101, 201, 211
Rod Drop onto Cask
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 414 kPa (60 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.24	1.71	0.16	2.94	3.10	20.00	66.30	9.19
	8.52	11.78	1.11	20.30	21.41	137.90	457.12	
2	0.13	0.06	0.21	0.19	0.39	20.00	66.30	>10
	0.87	0.42	1.43	1.29	2.72	137.90	457.12	
3	0.10	0.02	0.15	0.12	0.27	20.00	66.30	>10
	0.66	0.15	1.06	0.81	1.87	137.90	457.12	
4	2.01	3.00	1.13	5.01	6.15	20.00	66.30	4.98
	13.85	20.71	7.80	34.57	42.37	137.90	457.12	
5	1.85	2.62	1.18	4.47	5.65	20.00	66.30	5.71
	12.76	18.07	8.13	30.83	38.96	137.90	457.12	
6	0.87	1.20	0.54	2.07	2.61	20.00	66.30	>10
	6.00	8.26	3.72	14.26	17.98	137.90	457.12	
7	0.50	0.00	0.15	0.50	0.65	20.00	66.30	>10
	3.43	0.03	1.02	3.46	4.48	137.90	457.12	
8	0.45	0.00	0.15	0.45	0.60	20.00	66.30	>10
	3.10	0.00	1.02	3.10	4.12	137.90	457.12	
9	0.43	0.00	0.15	0.43	0.58	20.00	66.30	>10
	2.97	0.02	1.01	2.99	4.00	137.90	457.12	
10	0.59	0.22	0.45	0.80	1.26	20.00	66.30	>10
	4.05	1.49	3.13	5.54	8.67	137.90	457.12	
11	0.31	0.21	0.47	0.51	0.98	20.00	66.30	>10
	2.11	1.42	3.24	3.54	6.77	137.90	457.12	
12	0.28	0.17	0.70	0.45	1.15	20.00	66.30	>10
	1.93	1.18	4.84	3.11	7.94	137.90	457.12	

13	0.98 6.74	1.04 7.16	0.70 4.79	2.02 13.90	2.71 18.69	20.00 137.90	66.30 457.12	>10
14	0.95 6.56	0.77 5.31	0.57 3.93	1.72 11.87	2.29 15.80	20.00 137.90	66.30 457.12	>10
15	8.75 60.35	1.17 8.04	1.41 9.71	9.92 68.40	11.33 78.11	20.00 137.90	66.30 457.12	1.28
16	1.21 8.31	1.65 11.39	0.49 3.38	2.86 19.70	3.35 23.08	20.00 137.90	66.30 457.12	9.50
17	0.80 5.52	1.21 8.34	0.29 2.01	2.01 13.86	2.30 15.87	20.00 137.90	66.30 457.12	>10
18	0.77 5.29	1.02 7.00	0.19 1.32	1.78 12.29	1.98 13.62	20.00 137.90	66.30 457.12	>10
19	0.91 6.30	1.03 7.10	0.28 1.91	1.94 13.40	2.22 15.32	20.00 137.90	66.30 457.12	>10
20	1.02 7.06	1.13 7.77	0.56 3.84	2.15 14.83	2.71 18.68	20.00 137.90	66.30 457.12	>10
21	0.23 1.59	0.32 2.18	0.03 0.19	0.55 3.77	0.57 3.96	20.00 137.90	66.30 457.12	>10
22	4.54 31.30	3.47 23.92	0.07 0.50	8.01 55.22	8.08 55.72	20.00 137.90	66.30 457.12	2.75

Min MS: 1.285, Location: 15, Combination: Pm

**Table 2-162. Load Combination 217, Rod Drop, Cold Environment,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 216, 104, 201, 211

Rod Drop onto Cask

-40°F Ambient, Zero Decay Heat, Zero Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.24	1.71	0.09	2.94	3.04	20.00	70.00	9.19
	8.52	11.78	0.63	20.30	20.93	137.90	482.63	
2	0.13	0.06	0.07	0.19	0.25	20.00	70.00	>10
	0.87	0.42	0.45	1.29	1.74	137.90	482.63	
3	0.10	0.02	0.09	0.12	0.20	20.00	70.00	>10
	0.66	0.15	0.59	0.81	1.40	137.90	482.63	
4	2.01	3.00	10.82	5.01	15.83	20.00	70.00	2.79
	13.85	20.71	74.60	34.57	109.17	137.90	482.63	
5	1.85	2.62	14.79	4.47	19.26	20.00	70.00	2.12
	12.76	18.07	101.94	30.83	132.77	137.90	482.63	
6	0.87	1.20	7.02	2.07	9.09	20.00	70.00	5.60
	6.00	8.26	48.40	14.26	62.66	137.90	482.63	
7	0.50	0.00	3.23	0.50	3.73	20.00	70.00	>10
	3.43	0.03	22.24	3.46	25.70	137.90	482.63	
8	0.45	0.00	3.22	0.45	3.67	20.00	70.00	>10
	3.10	0.00	22.22	3.10	25.32	137.90	482.63	
9	0.43	0.00	3.22	0.43	3.66	20.00	70.00	>10
	2.97	0.02	22.23	2.99	25.22	137.90	482.63	
10	0.59	0.22	3.54	0.80	4.34	20.00	70.00	>10
	4.05	1.49	24.39	5.54	29.94	137.90	482.63	
11	0.31	0.21	1.73	0.51	2.24	20.00	70.00	>10
	2.11	1.42	11.93	3.54	15.47	137.90	482.63	
12	0.28	0.17	0.85	0.45	1.30	20.00	70.00	>10
	1.93	1.18	5.83	3.11	8.94	137.90	482.63	

13	0.98 6.74	1.04 7.16	6.14 42.35	2.02 13.90	8.16 56.25	20.00 137.90	70.00 482.63	6.35
14	0.95 6.56	0.77 5.31	4.97 34.30	1.72 11.87	6.70 46.17	20.00 137.90	70.00 482.63	7.96
15	8.75 60.35	1.17 8.04	0.45 3.12	9.92 68.40	10.37 71.52	20.00 137.90	70.00 482.63	1.28
16	1.21 8.31	1.65 11.39	1.83 12.59	2.86 19.70	4.68 32.29	20.00 137.90	70.00 482.63	9.50
17	0.80 5.52	1.21 8.34	1.56 10.76	2.01 13.86	3.57 24.62	20.00 137.90	70.00 482.63	>10
18	0.77 5.29	1.02 7.00	1.63 11.27	1.78 12.29	3.42 23.57	20.00 137.90	70.00 482.63	>10
19	0.91 6.30	1.03 7.10	2.18 15.00	1.94 13.40	4.12 28.41	20.00 137.90	70.00 482.63	>10
20	1.02 7.06	1.13 7.77	2.41 16.60	2.15 14.83	4.56 31.43	20.00 137.90	70.00 482.63	>10
21	0.23 1.59	0.32 2.18	0.88 6.07	0.55 3.77	1.43 9.85	20.00 137.90	70.00 482.63	>10
22	4.54 31.30	3.47 23.92	0.12 0.80	8.01 55.22	8.12 56.02	20.00 137.90	70.00 482.63	2.75

Min MS: 1.285, Location: 15, Combination: Pm

**Table 2-163. Load Combination 221, Forward Vibration,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 221, 101, 201, 211
 Forward 10g Vibration Inertia Load
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.16	2.91	3.07	20.00	66.30	9.32
	8.28	11.75	1.11	20.03	21.14	137.90	457.12	
2	0.21	0.07	0.21	0.28	0.49	20.00	66.30	>10
	1.47	0.47	1.43	1.94	3.37	137.90	457.12	
3	0.04	0.02	0.15	0.05	0.21	20.00	66.30	>10
	0.27	0.11	1.06	0.38	1.44	137.90	457.12	
4	1.74	2.71	1.13	4.46	5.59	20.00	66.30	5.73
	12.03	18.70	7.80	30.72	38.53	137.90	457.12	
5	1.66	2.54	1.18	4.20	5.38	20.00	66.30	6.14
	11.44	17.52	8.13	28.97	37.10	137.90	457.12	
6	0.64	1.02	0.54	1.66	2.20	20.00	66.30	>10
	4.41	7.05	3.72	11.46	15.18	137.90	457.12	
7	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.36	0.01	1.02	2.37	3.39	137.90	457.12	
8	0.34	0.00	0.15	0.35	0.49	20.00	66.30	>10
	2.38	0.00	1.02	2.38	3.40	137.90	457.12	
9	0.34	0.00	0.15	0.35	0.49	20.00	66.30	>10
	2.38	0.01	1.01	2.39	3.39	137.90	457.12	
10	0.51	0.22	0.45	0.74	1.19	20.00	66.30	>10
	3.55	1.52	3.13	5.07	8.20	137.90	457.12	
11	0.29	0.18	0.47	0.47	0.94	20.00	66.30	>10
	2.00	1.25	3.24	3.24	6.48	137.90	457.12	
12	0.24	0.11	0.70	0.35	1.05	20.00	66.30	>10
	1.65	0.76	4.84	2.41	7.25	137.90	457.12	

13	0.83 5.74	0.90 6.19	0.70 4.79	1.73 11.93	2.43 16.72	20.00 137.90	66.30 457.12	>10
14	0.83 5.72	0.65 4.49	0.57 3.93	1.48 10.22	2.05 14.14	20.00 137.90	66.30 457.12	>10
15	1.36 9.39	0.65 4.46	1.41 9.71	2.01 13.86	3.42 23.57	20.00 137.90	66.30 457.12	>10
16	0.37 2.58	0.48 3.31	0.49 3.38	0.85 5.89	1.35 9.27	20.00 137.90	66.30 457.12	>10
17	0.30 2.04	0.35 2.43	0.29 2.01	0.65 4.47	0.94 6.48	20.00 137.90	66.30 457.12	>10
18	0.52 3.59	0.82 5.65	0.19 1.32	1.34 9.24	1.53 10.56	20.00 137.90	66.30 457.12	>10
19	0.77 5.34	0.98 6.75	0.28 1.91	1.75 12.09	2.03 14.00	20.00 137.90	66.30 457.12	>10
20	0.75 5.20	1.01 6.98	0.56 3.84	1.77 12.18	2.32 16.02	20.00 137.90	66.30 457.12	>10
21	0.18 1.23	0.29 1.99	0.03 0.19	0.47 3.22	0.49 3.40	20.00 137.90	66.30 457.12	>10
22	0.73 5.01	0.36 2.49	0.07 0.50	1.09 7.49	1.16 7.99	20.00 137.90	66.30 457.12	>10

Min MS: 5.732, Location: 4, Combination: Pm+Pb

**Table 2-164. Load Combination 222, Lateral Vibration,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 222, 101, 201, 211
Lateral 5g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 414 kPa (60 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.16	2.90	3.06	20.00	66.30	9.34
	8.26	11.74	1.11	20.00	21.11	137.90	457.12	
2	0.15	0.06	0.21	0.21	0.41	20.00	66.30	>10
	1.00	0.42	1.43	1.42	2.85	137.90	457.12	
3	0.04	0.01	0.15	0.05	0.21	20.00	66.30	>10
	0.26	0.10	1.06	0.36	1.42	137.90	457.12	
4	1.73	2.70	1.13	4.43	5.56	20.00	66.30	5.78
	11.90	18.63	7.80	30.53	38.33	137.90	457.12	
5	1.65	2.54	1.18	4.19	5.37	20.00	66.30	6.16
	11.40	17.50	8.13	28.90	37.03	137.90	457.12	
6	0.63	1.02	0.54	1.65	2.19	20.00	66.30	>10
	4.31	7.04	3.72	11.35	15.07	137.90	457.12	
7	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.35	0.01	1.02	2.36	3.38	137.90	457.12	
8	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.36	0.00	1.02	2.37	3.38	137.90	457.12	
9	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.36	0.01	1.01	2.37	3.38	137.90	457.12	
10	0.50	0.22	0.45	0.72	1.18	20.00	66.30	>10
	3.47	1.50	3.13	4.97	8.10	137.90	457.12	
11	0.28	0.17	0.47	0.45	0.92	20.00	66.30	>10
	1.92	1.19	3.24	3.11	6.34	137.90	457.12	
12	0.24	0.11	0.70	0.35	1.05	20.00	66.30	>10
	1.63	0.76	4.84	2.39	7.22	137.90	457.12	

13	0.83 5.70	0.90 6.17	0.70 4.79	1.72 11.87	2.42 16.66	20.00 137.90	66.30 457.12	>10
14	0.82 5.65	0.65 4.47	0.57 3.93	1.47 10.12	2.04 14.05	20.00 137.90	66.30 457.12	>10
15	1.36 9.37	0.65 4.46	1.41 9.71	2.01 13.83	3.41 23.54	20.00 137.90	66.30 457.12	>10
16	0.37 2.54	0.47 3.27	0.49 3.38	0.84 5.82	1.33 9.20	20.00 137.90	66.30 457.12	>10
17	0.29 1.99	0.35 2.42	0.29 2.01	0.64 4.41	0.93 6.43	20.00 137.90	66.30 457.12	>10
18	0.52 3.56	0.82 5.63	0.19 1.32	1.33 9.19	1.53 10.52	20.00 137.90	66.30 457.12	>10
19	0.76 5.24	0.97 6.70	0.28 1.91	1.73 11.94	2.01 13.85	20.00 137.90	66.30 457.12	>10
20	0.74 5.12	1.01 6.97	0.56 3.84	1.75 12.09	2.31 15.94	20.00 137.90	66.30 457.12	>10
21	0.18 1.21	0.29 1.99	0.03 0.19	0.46 3.20	0.49 3.38	20.00 137.90	66.30 457.12	>10
22	0.72 4.99	0.36 2.49	0.07 0.50	1.08 7.47	1.16 7.98	20.00 137.90	66.30 457.12	>10

Min MS: 5.775, Location: 4, Combination: Pm+Pb

**Table 2-165. Load Combination 223, Vertical Vibration,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 223, 101, 201, 211
Vertical 2g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 414 kPa (60 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.16	2.90	3.06	20.00	66.30	9.35
	8.24	11.73	1.11	19.98	21.08	137.90	457.12	
2	0.09	0.06	0.21	0.15	0.35	20.00	66.30	>10
	0.61	0.39	1.43	1.01	2.44	137.90	457.12	
3	0.04	0.01	0.15	0.05	0.20	20.00	66.30	>10
	0.25	0.09	1.06	0.35	1.41	137.90	457.12	
4	1.71	2.69	1.13	4.40	5.53	20.00	66.30	5.82
	11.78	18.56	7.80	30.35	38.15	137.90	457.12	
5	1.65	2.53	1.18	4.18	5.36	20.00	66.30	6.17
	11.36	17.47	8.13	28.83	36.96	137.90	457.12	
6	0.61	1.02	0.54	1.63	2.17	20.00	66.30	>10
	4.21	7.03	3.72	11.25	14.97	137.90	457.12	
7	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.35	0.01	1.02	2.36	3.38	137.90	457.12	
8	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.35	0.00	1.02	2.35	3.37	137.90	457.12	
9	0.34	0.00	0.15	0.34	0.49	20.00	66.30	>10
	2.35	0.01	1.01	2.36	3.37	137.90	457.12	
10	0.49	0.21	0.45	0.71	1.16	20.00	66.30	>10
	3.41	1.48	3.13	4.89	8.01	137.90	457.12	
11	0.27	0.16	0.47	0.43	0.90	20.00	66.30	>10
	1.85	1.13	3.24	2.98	6.22	137.90	457.12	
12	0.23	0.11	0.70	0.34	1.04	20.00	66.30	>10
	1.61	0.76	4.84	2.37	7.20	137.90	457.12	

13	0.82 5.66	0.89 6.16	0.70 4.79	1.71 11.81	2.41 16.61	20.00 137.90	66.30 457.12	>10
14	0.81 5.59	0.65 4.45	0.57 3.93	1.46 10.04	2.03 13.97	20.00 137.90	66.30 457.12	>10
15	1.35 9.34	0.65 4.46	1.41 9.71	2.00 13.81	3.41 23.52	20.00 137.90	66.30 457.12	>10
16	0.36 2.51	0.47 3.24	0.49 3.38	0.83 5.75	1.32 9.13	20.00 137.90	66.30 457.12	>10
17	0.28 1.96	0.35 2.41	0.29 2.01	0.63 4.36	0.92 6.38	20.00 137.90	66.30 457.12	>10
18	0.51 3.54	0.81 5.62	0.19 1.32	1.33 9.15	1.52 10.48	20.00 137.90	66.30 457.12	>10
19	0.75 5.14	0.97 6.66	0.28 1.91	1.71 11.79	1.99 13.70	20.00 137.90	66.30 457.12	>10
20	0.73 5.05	1.01 6.97	0.56 3.84	1.74 12.02	2.30 15.86	20.00 137.90	66.30 457.12	>10
21	0.17 1.19	0.29 1.98	0.03 0.19	0.46 3.18	0.49 3.37	20.00 137.90	66.30 457.12	>10
22	0.72 4.98	0.36 2.49	0.07 0.50	1.08 7.46	1.15 7.96	20.00 137.90	66.30 457.12	>10

Min MS: 5.816, Location: 4, Combination: Pm+Pb

Table 2-166. Load Combination 224, Forward Vibration at Cold Temperature, Normal Conditions of Transport – Model AOS-050A

Load Cases: 221, 103, 201, 211
 Forward 10g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.07	2.91	2.98	20.00	70.00	9.32
	8.28	11.75	0.51	20.03	20.55	137.90	482.63	
2	0.21	0.07	0.05	0.28	0.34	20.00	70.00	>10
	1.47	0.47	0.37	1.94	2.31	137.90	482.63	
3	0.04	0.02	0.07	0.05	0.13	20.00	70.00	>10
	0.27	0.11	0.49	0.38	0.86	137.90	482.63	
4	1.74	2.71	8.85	4.46	13.31	20.00	70.00	3.51
	12.03	18.70	61.04	30.72	91.77	137.90	482.63	
5	1.66	2.54	12.10	4.20	16.30	20.00	70.00	2.68
	11.44	17.52	83.41	28.97	112.37	137.90	482.63	
6	0.64	1.02	5.74	1.66	7.41	20.00	70.00	7.10
	4.41	7.05	39.60	11.46	51.06	137.90	482.63	
7	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.36	0.01	18.20	2.37	20.57	137.90	482.63	
8	0.34	0.00	2.64	0.35	2.98	20.00	70.00	>10
	2.38	0.00	18.18	2.38	20.56	137.90	482.63	
9	0.34	0.00	2.64	0.35	2.98	20.00	70.00	>10
	2.38	0.01	18.18	2.39	20.57	137.90	482.63	
10	0.51	0.22	2.89	0.74	3.63	20.00	70.00	>10
	3.55	1.52	19.96	5.07	25.03	137.90	482.63	
11	0.29	0.18	1.42	0.47	1.89	20.00	70.00	>10
	2.00	1.25	9.77	3.24	13.01	137.90	482.63	
12	0.24	0.11	0.69	0.35	1.04	20.00	70.00	>10
	1.65	0.76	4.77	2.41	7.18	137.90	482.63	

13	0.83 5.74	0.90 6.19	5.03 34.65	1.73 11.93	6.76 46.58	20.00 137.90	70.00 482.63	7.88
14	0.83 5.72	0.65 4.49	4.07 28.06	1.48 10.22	5.55 38.27	20.00 137.90	70.00 482.63	9.81
15	1.36 9.39	0.65 4.46	0.37 2.54	2.01 13.86	2.38 16.39	20.00 137.90	70.00 482.63	>10
16	0.37 2.58	0.48 3.31	1.50 10.31	0.85 5.89	2.35 16.20	20.00 137.90	70.00 482.63	>10
17	0.30 2.04	0.35 2.43	1.28 8.81	0.65 4.47	1.93 13.28	20.00 137.90	70.00 482.63	>10
18	0.52 3.59	0.82 5.65	1.34 9.21	1.34 9.24	2.68 18.45	20.00 137.90	70.00 482.63	>10
19	0.77 5.34	0.98 6.75	1.78 12.27	1.75 12.09	3.53 24.36	20.00 137.90	70.00 482.63	>10
20	0.75 5.20	1.01 6.98	1.97 13.57	1.77 12.18	3.73 25.75	20.00 137.90	70.00 482.63	>10
21	0.18 1.23	0.29 1.99	0.72 4.97	0.47 3.22	1.19 8.19	20.00 137.90	70.00 482.63	>10
22	0.73 5.01	0.36 2.49	0.09 0.64	1.09 7.49	1.18 8.13	20.00 137.90	70.00 482.63	>10

Min MS: 2.681, Location: 5, Combination: Pm+Pb+Q

Table 2-167. Load Combination 225, Lateral Vibration at Cold Temperature, Normal Conditions of Transport – Model AOS-050A

Load Cases: 222, 103, 201, 211
 Lateral 5g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.07	2.90	2.98	20.00	70.00	9.34
	8.26	11.74	0.51	20.00	20.51	137.90	482.63	
2	0.15	0.06	0.05	0.21	0.26	20.00	70.00	>10
	1.00	0.42	0.37	1.42	1.79	137.90	482.63	
3	0.04	0.01	0.07	0.05	0.12	20.00	70.00	>10
	0.26	0.10	0.49	0.36	0.84	137.90	482.63	
4	1.73	2.70	8.85	4.43	13.28	20.00	70.00	3.52
	11.90	18.63	61.04	30.53	91.57	137.90	482.63	
5	1.65	2.54	12.10	4.19	16.29	20.00	70.00	2.68
	11.40	17.50	83.41	28.90	112.30	137.90	482.63	
6	0.63	1.02	5.74	1.65	7.39	20.00	70.00	7.12
	4.31	7.04	39.60	11.35	50.95	137.90	482.63	
7	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.35	0.01	18.20	2.36	20.56	137.90	482.63	
8	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.36	0.00	18.18	2.37	20.54	137.90	482.63	
9	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.36	0.01	18.18	2.37	20.56	137.90	482.63	
10	0.50	0.22	2.89	0.72	3.62	20.00	70.00	>10
	3.47	1.50	19.96	4.97	24.93	137.90	482.63	
11	0.28	0.17	1.42	0.45	1.87	20.00	70.00	>10
	1.92	1.19	9.77	3.11	12.87	137.90	482.63	
12	0.24	0.11	0.69	0.35	1.04	20.00	70.00	>10
	1.63	0.76	4.77	2.39	7.16	137.90	482.63	

13	0.83 5.70	0.90 6.17	5.03 34.65	1.72 11.87	6.75 46.52	20.00 137.90	70.00 482.63	7.89
14	0.82 5.65	0.65 4.47	4.07 28.06	1.47 10.12	5.54 38.18	20.00 137.90	70.00 482.63	9.83
15	1.36 9.37	0.65 4.46	0.37 2.54	2.01 13.83	2.37 16.37	20.00 137.90	70.00 482.63	>10
16	0.37 2.54	0.47 3.27	1.50 10.31	0.84 5.82	2.34 16.13	20.00 137.90	70.00 482.63	>10
17	0.29 1.99	0.35 2.42	1.28 8.81	0.64 4.41	1.92 13.22	20.00 137.90	70.00 482.63	>10
18	0.52 3.56	0.82 5.63	1.34 9.21	1.33 9.19	2.67 18.41	20.00 137.90	70.00 482.63	>10
19	0.76 5.24	0.97 6.70	1.78 12.27	1.73 11.94	3.51 24.20	20.00 137.90	70.00 482.63	>10
20	0.74 5.12	1.01 6.97	1.97 13.57	1.75 12.09	3.72 25.66	20.00 137.90	70.00 482.63	>10
21	0.18 1.21	0.29 1.99	0.72 4.97	0.46 3.20	1.18 8.16	20.00 137.90	70.00 482.63	>10
22	0.72 4.99	0.36 2.49	0.09 0.64	1.08 7.47	1.18 8.12	20.00 137.90	70.00 482.63	>10

Min MS: 2.684, Location: 5, Combination: Pm+Pb+Q

Table 2-168. Load Combination 226, Vertical Vibration at Cold Temperature, Normal Conditions of Transport – Model AOS-050A

Load Cases: 223, 103, 201, 211
 Vertical 2g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	1.20	1.70	0.07	2.90	2.97	20.00	70.00	9.35
	8.24	11.73	0.51	19.98	20.49	137.90	482.63	
2	0.09	0.06	0.05	0.15	0.20	20.00	70.00	>10
	0.61	0.39	0.37	1.01	1.38	137.90	482.63	
3	0.04	0.01	0.07	0.05	0.12	20.00	70.00	>10
	0.25	0.09	0.49	0.35	0.83	137.90	482.63	
4	1.71	2.69	8.85	4.40	13.25	20.00	70.00	3.53
	11.78	18.56	61.04	30.35	91.39	137.90	482.63	
5	1.65	2.53	12.10	4.18	16.28	20.00	70.00	2.69
	11.36	17.47	83.41	28.83	112.24	137.90	482.63	
6	0.61	1.02	5.74	1.63	7.37	20.00	70.00	7.14
	4.21	7.03	39.60	11.25	50.85	137.90	482.63	
7	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.35	0.01	18.20	2.36	20.56	137.90	482.63	
8	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.35	0.00	18.18	2.35	20.53	137.90	482.63	
9	0.34	0.00	2.64	0.34	2.98	20.00	70.00	>10
	2.35	0.01	18.18	2.36	20.55	137.90	482.63	
10	0.49	0.21	2.89	0.71	3.60	20.00	70.00	>10
	3.41	1.48	19.96	4.89	24.84	137.90	482.63	
11	0.27	0.16	1.42	0.43	1.85	20.00	70.00	>10
	1.85	1.13	9.77	2.98	12.74	137.90	482.63	
12	0.23	0.11	0.69	0.34	1.04	20.00	70.00	>10
	1.61	0.76	4.77	2.37	7.14	137.90	482.63	

13	0.82 5.66	0.89 6.16	5.03 34.65	1.71 11.81	6.74 46.46	20.00 137.90	70.00 482.63	7.90
14	0.81 5.59	0.65 4.45	4.07 28.06	1.46 10.04	5.53 38.10	20.00 137.90	70.00 482.63	9.86
15	1.35 9.34	0.65 4.46	0.37 2.54	2.00 13.81	2.37 16.34	20.00 137.90	70.00 482.63	>10
16	0.36 2.51	0.47 3.24	1.50 10.31	0.83 5.75	2.33 16.06	20.00 137.90	70.00 482.63	>10
17	0.28 1.96	0.35 2.41	1.28 8.81	0.63 4.36	1.91 13.17	20.00 137.90	70.00 482.63	>10
18	0.51 3.54	0.81 5.62	1.34 9.21	1.33 9.15	2.66 18.37	20.00 137.90	70.00 482.63	>10
19	0.75 5.14	0.97 6.66	1.78 12.27	1.71 11.79	3.49 24.06	20.00 137.90	70.00 482.63	>10
20	0.73 5.05	1.01 6.97	1.97 13.57	1.74 12.02	3.71 25.59	20.00 137.90	70.00 482.63	>10
21	0.17 1.19	0.29 1.98	0.72 4.97	0.46 3.18	1.18 8.15	20.00 137.90	70.00 482.63	>10
22	0.72 4.98	0.36 2.49	0.09 0.64	1.08 7.46	1.18 8.10	20.00 137.90	70.00 482.63	>10

Min MS: 2.686, Location: 5, Combination: Pm+Pb+Q

Table 2-169. Load Combination 231, 4-ft. Head-On Drop, Normal Conditions, Normal Conditions of Transport – Model AOS-050A

Load Cases: 231, 102, 201, 211
 4-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	2.03	1.95	0.15	3.98	4.13	20.00	66.30	6.54
	13.96	13.47	1.03	27.43	28.46	137.90	457.12	
2	0.51	0.10	0.19	0.61	0.80	20.00	66.30	>10
	3.52	0.69	1.34	4.21	5.55	137.90	457.12	
3	0.18	0.02	0.15	0.21	0.36	20.00	66.30	>10
	1.26	0.16	1.05	1.42	2.47	137.90	457.12	
4	3.32	3.71	1.36	7.03	8.39	20.00	66.30	3.27
	22.89	25.59	9.34	48.49	57.83	137.90	457.12	
5	2.39	3.37	1.11	5.76	6.87	20.00	66.30	4.21
	16.48	23.25	7.63	39.74	47.37	137.90	457.12	
6	1.26	1.10	0.67	2.36	3.03	20.00	66.30	>10
	8.67	7.60	4.60	16.27	20.86	137.90	457.12	
7	0.66	0.01	0.22	0.67	0.89	20.00	66.30	>10
	4.57	0.05	1.52	4.62	6.13	137.90	457.12	
8	0.57	0.00	0.21	0.57	0.79	20.00	66.30	>10
	3.96	0.01	1.45	3.96	5.41	137.90	457.12	
9	0.55	0.00	0.22	0.55	0.77	20.00	66.30	>10
	3.79	0.02	1.49	3.80	5.29	137.90	457.12	
10	0.79	0.42	0.93	1.21	2.14	20.00	66.30	>10
	5.47	2.89	6.38	8.36	14.74	137.90	457.12	
11	0.53	0.25	0.74	0.78	1.53	20.00	66.30	>10
	3.66	1.74	5.13	5.40	10.53	137.90	457.12	
12	0.35	0.34	1.02	0.70	1.72	20.00	66.30	>10
	2.44	2.35	7.06	4.79	11.85	137.90	457.12	

13	1.04 7.19	0.97 6.68	0.72 4.95	2.01 13.87	2.73 18.83	20.00 137.90	66.30 457.12	>10
14	0.98 6.74	0.70 4.79	0.58 4.02	1.67 11.53	2.26 15.56	20.00 137.90	66.30 457.12	>10
15	3.62 24.93	0.79 5.43	2.10 14.51	4.40 30.36	6.51 44.87	20.00 137.90	66.30 457.12	4.53
16	0.96 6.62	0.83 5.76	0.74 5.12	1.79 12.37	2.54 17.49	20.00 137.90	66.30 457.12	>10
17	1.25 8.63	0.54 3.72	0.43 3.00	1.79 12.34	2.23 15.34	20.00 137.90	66.30 457.12	>10
18	1.01 6.98	1.10 7.59	0.19 1.34	2.11 14.57	2.31 15.91	20.00 137.90	66.30 457.12	>10
19	1.42 9.79	1.39 9.58	0.32 2.18	2.81 19.37	3.13 21.55	20.00 137.90	66.30 457.12	9.68
20	1.49 10.25	1.48 10.20	0.53 3.67	2.97 20.45	3.50 24.12	20.00 137.90	66.30 457.12	9.11
21	0.23 1.59	0.31 2.14	0.03 0.21	0.54 3.73	0.57 3.94	20.00 137.90	66.30 457.12	>10
22	2.16 14.92	0.76 5.21	0.11 0.79	2.92 20.13	3.03 20.92	20.00 137.90	66.30 457.12	8.24

Min MS: 3.266, Location: 4, Combination: Pm+Pb

Table 2-170. Load Combination 232, 30-ft. Head-On Drop, Normal Conditions (Impact Test), Normal Conditions of Transport – Model AOS-050A

Load Cases: 232, 102, 201, 211
 30-ft. Head-On Drop Impact Test, Normal Conditions
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	4.36	2.98	0.15	7.34	7.49	20.00	66.30	3.09
	30.04	20.54	1.03	50.58	51.62	137.90	457.12	
2	1.84	0.14	0.19	1.98	2.17	20.00	66.30	9.85
	12.71	0.94	1.34	13.65	14.99	137.90	457.12	
3	1.07	0.10	0.15	1.17	1.32	20.00	66.30	>10
	7.38	0.71	1.05	8.09	9.13	137.90	457.12	
4	7.71	7.06	1.36	14.76	16.12	20.00	66.30	1.03
	53.13	48.67	9.34	101.80	111.14	137.90	457.12	
5	3.71	5.49	1.11	9.20	10.31	20.00	66.30	2.26
	25.56	37.86	7.63	63.42	71.06	137.90	457.12	
6	1.58	1.52	0.67	3.10	3.76	20.00	66.30	8.68
	10.89	10.48	4.60	21.36	25.96	137.90	457.12	
7	1.22	0.02	0.22	1.23	1.45	20.00	66.30	>10
	8.38	0.12	1.52	8.51	10.02	137.90	457.12	
8	1.18	0.00	0.21	1.18	1.39	20.00	66.30	>10
	8.13	0.01	1.45	8.14	9.59	137.90	457.12	
9	1.15	0.00	0.22	1.15	1.37	20.00	66.30	>10
	7.91	0.02	1.49	7.93	9.42	137.90	457.12	
10	1.65	0.90	0.93	2.55	3.47	20.00	66.30	>10
	11.37	6.19	6.38	17.55	23.94	137.90	457.12	
11	1.14	0.48	0.74	1.62	2.37	20.00	66.30	>10
	7.88	3.33	5.13	11.20	16.34	137.90	457.12	
12	0.61	0.89	1.02	1.50	2.52	20.00	66.30	>10
	4.23	6.11	7.06	10.34	17.40	137.90	457.12	

13	1.78 12.30	1.57 10.80	0.72 4.95	3.35 23.10	4.07 28.05	20.00 137.90	66.30 457.12	7.95
14	1.62 11.19	1.00 6.87	0.58 4.02	2.62 18.06	3.20 22.09	20.00 137.90	66.30 457.12	>10
15	2.01 13.83	0.67 4.63	2.10 14.51	2.68 18.45	4.78 32.96	20.00 137.90	66.30 457.12	8.97
16	1.57 10.83	1.03 7.13	0.74 5.12	2.61 17.96	3.35 23.08	20.00 137.90	66.30 457.12	>10
17	1.65 11.41	1.51 10.43	0.43 3.00	3.17 21.83	3.60 24.83	20.00 137.90	66.30 457.12	8.47
18	2.40 16.52	2.98 20.55	0.19 1.34	5.38 37.07	5.57 38.41	20.00 137.90	66.30 457.12	4.58
19	2.59 17.89	2.23 15.35	0.32 2.18	4.82 33.24	5.14 35.42	20.00 137.90	66.30 457.12	5.22
20	1.60 11.00	2.42 16.71	0.53 3.67	4.02 27.71	4.55 31.38	20.00 137.90	66.30 457.12	6.46
21	0.34 2.33	0.30 2.05	0.03 0.21	0.63 4.37	0.66 4.58	20.00 137.90	66.30 457.12	>10
22	1.13 7.80	0.70 4.80	0.11 0.79	1.83 12.60	1.94 13.39	20.00 137.90	66.30 457.12	>10

Min MS: 1.032, Location: 4, Combination: Pm+Pb

**Table 2-171. Load Combination 233, 4-ft. Drop at Cold Temperature,
Normal Conditions of Transport – Model AOS-050A**

Load Cases: 231, 103, 211

4-ft. Head-On Drop

-20°F Ambient, Zero Decay Heat, Zero Insolation

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	2.02	1.95	0.07	3.97	4.05	20.00	70.00	6.55
	13.93	13.45	0.51	27.38	27.89	137.90	482.63	
2	0.51	0.10	0.05	0.61	0.66	20.00	70.00	>10
	3.48	0.69	0.37	4.17	4.54	137.90	482.63	
3	0.18	0.02	0.07	0.20	0.27	20.00	70.00	>10
	1.22	0.15	0.49	1.37	1.86	137.90	482.63	
4	3.02	3.25	8.85	6.28	15.13	20.00	70.00	2.97
	20.84	22.44	61.04	43.28	104.32	137.90	482.63	
5	2.20	3.07	12.10	5.27	17.37	20.00	70.00	2.45
	15.19	21.16	83.41	36.35	119.76	137.90	482.63	
6	1.21	1.08	5.74	2.29	8.03	20.00	70.00	6.47
	8.34	7.42	39.60	15.77	55.37	137.90	482.63	
7	0.65	0.01	2.64	0.66	3.29	20.00	70.00	>10
	4.47	0.05	18.20	4.52	22.71	137.90	482.63	
8	0.56	0.00	2.64	0.56	3.20	20.00	70.00	>10
	3.86	0.01	18.18	3.86	22.04	137.90	482.63	
9	0.54	0.00	2.64	0.54	3.17	20.00	70.00	>10
	3.69	0.01	18.18	3.70	21.88	137.90	482.63	
10	0.63	0.25	2.89	0.89	3.78	20.00	70.00	>10
	4.37	1.75	19.96	6.12	26.08	137.90	482.63	
11	0.44	0.22	1.42	0.66	2.07	20.00	70.00	>10
	3.05	1.48	9.77	4.53	14.30	137.90	482.63	
12	0.21	0.32	0.69	0.53	1.22	20.00	70.00	>10
	1.43	2.22	4.77	3.65	8.42	137.90	482.63	
13	0.89	0.84	5.03	1.74	6.76	20.00	70.00	7.87
	6.16	5.81	34.65	11.97	46.62	137.90	482.63	

14	0.85	0.56	4.07	1.41	5.48	20.00	70.00	9.95
	5.84	3.87	28.06	9.71	37.77	137.90	482.63	
15	3.11	0.21	0.37	3.32	3.69	20.00	70.00	5.43
	21.45	1.44	2.54	22.88	25.42	137.90	482.63	
16	0.63	0.37	1.50	1.00	2.49	20.00	70.00	>10
	4.32	2.54	10.31	6.87	17.18	137.90	482.63	
17	1.01	0.22	1.28	1.23	2.51	20.00	70.00	>10
	6.98	1.53	8.81	8.51	17.32	137.90	482.63	
18	0.71	0.67	1.34	1.38	2.72	20.00	70.00	>10
	4.93	4.61	9.21	9.53	18.75	137.90	482.63	
19	0.95	0.66	1.78	1.60	3.38	20.00	70.00	>10
	6.52	4.54	12.27	11.06	23.33	137.90	482.63	
20	1.15	0.86	1.97	2.01	3.97	20.00	70.00	>10
	7.90	5.92	13.57	13.83	27.40	137.90	482.63	
21	0.14	0.21	0.72	0.34	1.07	20.00	70.00	>10
	0.93	1.44	4.97	2.37	7.34	137.90	482.63	
22	1.98	0.63	0.09	2.62	2.71	20.00	70.00	9.08
	13.68	4.36	0.64	18.04	18.68	137.90	482.63	

Min MS: 2.454, Location: 5, Combination: Pm+Pb+Q

2.12.2.2.2 Hypothetical Accident Conditions of Transport Summary of Damages (Stresses) – Model AOS-050A

Table 2-172 and Table 2-173 present Model AOS-050A transport package Load Cases and Load Combinations, respectively, under Hypothetical Accident conditions of transport:

- Table 2-174 through Table 2-186 present Model AOS-050A transport package output data, for the Load Cases listed in Table 2-172. Comparisons with allowable stress limits are included for Load Cases 111 and 112.
- Table 2-187 through Table 2-201 present Model AOS-050A transport package output data, for the Load Combinations listed in Table 2-173.

Table 2-172. Load Cases Associated with Allowable Stresses under Hypothetical Accident Conditions of Transport – Model AOS-050A

Load Case	Description	Data
111	Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat	Table 2-174
112	Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-175
	Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-176
	Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-177
	Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-178
	Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-179
301	30-ft. Head-On Drop	Table 2-180
302	30-ft. Side Drop + Slap-Down	Table 2-181
303	30-ft. Cg/Corner Drop	Table 2-182
304	30-ft. Head-On Drop at -40°F, Low Temperature	Table 2-183
305	30-ft. Side Drop + Slap-Down at -40°F, Low Temperature	Table 2-184
306	30-ft. Cg/Corner Drop at -40°F, Low Temperature	Table 2-185
311	4-ft. Drop onto Rod	Table 2-186

**Table 2-173. Load Combinations Associated with Allowable Stresses
under Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Combination	Load Cases ^a	Description	Data
301	301, 102, 201, 211	Head-On Drop Orientation	Table 2-187
302	302, 102, 201, 211	Side Drop Orientation	Table 2-188
303	303, 102, 201, 211	Cg/Corner Drop Orientation	Table 2-189
304	304, 105, 202, 211	Head-On Drop Orientation at -40°F, Cold Environment	Table 2-190
305	305, 105, 202, 211	Side Drop Orientation at -40°F, Cold Environment	Table 2-191
306	306, 105, 202, 211	Cg/Corner Drop Orientation at -40°F, Cold Environment	Table 2-192
310	204, 101, 211	Additional Increased External Pressure (290 psi)	Table 2-193
311	311, 101, 201, 211	4-ft. Drop onto Rod	Table 2-194
312	311, 104, 201, 211	4-ft. Drop onto Rod at -40°F, Cold Environment	Table 2-195
350	111, 201, 211	Fire at 30 Minutes	Table 2-196
351	112, 201, 211	Post Fire at 60 Minutes	Table 2-197
352		Post Fire at 90 Minutes	Table 2-198
353		Post Fire at 120 Minutes	Table 2-199
354		Post Fire at 150 Minutes	Table 2-200
355		Post Fire at 180 Minutes	Table 2-201

a. Some Normal conditions of transport Load Cases are included in Hypothetical Accident conditions of transport Load Combinations, to meet regulatory requirements.

Table 2-174. Load Case 111, Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.5796E+03 3.1575E+01	-1.2819E+03 -8.8387E+00	4.4694E+03 3.0815E+01	5.8615E+03 4.0414E+01	1.2021E+04 8.2879E+01		
2	2.6180E+03 1.8051E+01	-2.5618E+03 -1.7663E+01	-2.8452E+03 -1.9617E+01	5.1798E+03 3.5714E+01	3.4052E+02 2.3478E+00		
3	1.7950E+04 1.2376E+02	1.4247E+03 9.8227E+00	4.7503E+03 3.2752E+01	1.6525E+04 1.1394E+02	3.7483E+04 2.5843E+02		
4	2.7618E+05 1.9042E+03	-1.2650E+05 -8.7220E+02	5.1951E+04 3.5819E+02	4.0268E+05 2.7764E+03	7.8198E+05 5.3916E+03		
5	3.0065E+05 2.0729E+03	-1.2122E+05 -8.3580E+02	4.3394E+04 2.9919E+02	4.2188E+05 2.9087E+03	6.5632E+05 4.5251E+03		
6	1.5728E+05 1.0844E+03	-1.8310E+04 -1.2624E+02	7.8580E+04 5.4179E+02	1.7559E+05 1.2107E+03	2.6006E+05 1.7931E+03		
7	5.3806E+04 3.7098E+02	-3.5585E+02 -2.4535E+00	-4.9957E+03 -3.4444E+01	5.4162E+04 3.7344E+02	5.6408E+02 3.8892E+00		
8	5.3765E+04 3.7070E+02	-4.2570E+02 -2.9351E+00	-3.6996E+03 -2.5508E+01	5.4191E+04 3.7363E+02	3.5821E+02 2.4698E+00		
9	5.3768E+04 3.7072E+02	-3.7319E+02 -2.5731E+00	-3.8451E+03 -2.6511E+01	5.4141E+04 3.7329E+02	2.9466E+02 2.0316E+00		
10	5.4166E+04 3.7346E+02	-3.4384E+03 -2.3707E+01	2.2364E+04 1.5420E+02	5.7604E+04 3.9717E+02	1.4717E+04 1.0147E+02		
11	2.6135E+04 1.8020E+02	-7.9723E+03 -5.4967E+01	1.9351E+04 1.3342E+02	3.4108E+04 2.3516E+02	1.2764E+04 8.8006E+01		
12	2.2493E+04 1.5508E+02	4.3957E+01 3.0307E-01	2.2447E+04 1.5477E+02	2.2449E+04 1.5478E+02	1.3230E+04 9.1218E+01		
13	1.0535E+05 7.2639E+02	-1.0239E+04 -7.0596E+01	3.7221E+04 2.5663E+02	1.1559E+05 7.9699E+02	1.1863E+05 8.1793E+02		
14	9.1204E+04 6.2883E+02	-7.7992E+03 -5.3773E+01	3.7840E+04 2.6090E+02	9.9003E+04 6.8260E+02	8.3276E+04 5.7417E+02		
15	1.0334E+03 7.1252E+00	-1.3703E+03 -9.4478E+00	-1.1719E+02 -8.0802E-01	2.4037E+03 1.6573E+01	4.1770E+03 2.8799E+01		

16	4.2120E+02	-2.9970E+02	2.6328E+02	7.2090E+02	1.0227E+03
	2.9040E+00	-2.0664E+00	1.8152E+00	4.9704E+00	7.0514E+00
17	2.8206E+02	-1.4335E+02	7.1079E+01	4.2541E+02	6.4594E+02
	1.9447E+00	-9.8835E-01	4.9007E-01	2.9331E+00	4.4536E+00
18	3.8532E+02	-1.7315E+02	-6.6447E+02	5.5847E+02	7.7538E+02
	2.6567E+00	-1.1938E+00	-4.5814E+00	3.8505E+00	5.3461E+00
19	4.7407E+02	-5.2052E+01	-9.9344E+02	5.2612E+02	1.0959E+03
	3.2686E+00	-3.5888E-01	-6.8495E+00	3.6275E+00	7.5558E+00
20	8.1099E+02	3.9024E+01	-5.7322E+02	7.7197E+02	3.9559E+02
	5.5916E+00	2.6906E-01	-3.9522E+00	5.3225E+00	2.7275E+00
21	1.1293E+04	-1.2886E+04	-1.5824E+03	2.4179E+04	4.7502E+04
	7.7862E+01	-8.8843E+01	-1.0910E+01	1.6671E+02	3.2751E+02
22	1.4512E+03	-3.6346E+03	-2.2596E+03	5.0858E+03	9.1212E+03
	1.0006E+01	-2.5060E+01	-1.5580E+01	3.5065E+01	6.2889E+01

Allowable Stress for Load Case 111

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	285.29	284.34	20.00	23.60	66.30
2	375.45	298.79	20.00	23.60	66.30
3	286.05	285.07	20.00	23.60	66.30
4	286.71	286.65	20.00	23.60	66.30
5	288.11	287.85	20.00	23.60	66.30
6	289.77	288.99	20.00	23.60	66.30
7	289.77	289.05	20.00	23.60	66.30
8	289.88	289.16	20.00	23.60	66.30
9	290.06	289.34	20.00	23.60	66.30
10	290.46	289.60	20.00	23.60	66.30
11	291.45	289.96	20.00	23.60	66.30
12	294.02	292.02	20.00	23.60	66.30
13	288.33	288.10	20.00	23.60	66.30
14	287.79	287.70	20.00	23.60	66.30
15	286.74	286.40	20.00	23.60	66.30
16	286.19	286.04	20.00	23.60	66.30
17	286.29	286.07	20.00	23.60	66.30
18	287.11	286.89	20.00	23.60	66.30
19	287.35	287.21	20.00	23.60	66.30
20	289.77	289.13	20.00	23.60	66.30
21	286.68	285.78	20.00	23.60	66.30
22	285.98	285.56	20.00	23.60	66.30

Table 2-175. Load Case 112, Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.0929E+02 4.8904E+00	-7.3560E+02 -5.0718E+00	3.6014E+02 2.4831E+00	1.4449E+03 9.9621E+00	1.2677E+03 8.7402E+00		
2	6.3836E+02 4.4013E+00	-1.5380E+03 -1.0604E+01	-2.7042E+02 -1.8645E+00	2.1764E+03 1.5006E+01	4.2658E+03 2.9411E+01		
3	4.1814E+02 2.8829E+00	-1.0720E+03 -7.3913E+00	7.1345E+01 4.9191E-01	1.4902E+03 1.0274E+01	2.4856E+03 1.7138E+01		
4	3.2879E+04 2.2670E+02	-1.5295E+04 -1.0546E+02	7.1709E+03 4.9441E+01	4.8175E+04 3.3215E+02	9.3393E+04 6.4392E+02		
5	3.6141E+04 2.4919E+02	-1.4881E+04 -1.0260E+02	2.8287E+03 1.9503E+01	5.1023E+04 3.5179E+02	7.9321E+04 5.4690E+02		
6	1.8440E+04 1.2714E+02	-2.3419E+03 -1.6147E+01	5.1506E+03 3.5512E+01	2.0782E+04 1.4329E+02	3.0984E+04 2.1363E+02		
7	6.4546E+03 4.4503E+01	-6.9622E+02 -4.8003E+00	-6.2455E+03 -4.3061E+01	7.1508E+03 4.9303E+01	1.9337E+02 1.3332E+00		
8	6.4512E+03 4.4480E+01	-7.0700E+02 -4.8746E+00	-6.1298E+03 -4.2264E+01	7.1582E+03 4.9354E+01	2.6885E+02 1.8536E+00		
9	6.4504E+03 4.4474E+01	-6.9892E+02 -4.8189E+00	-6.1680E+03 -4.2527E+01	7.1493E+03 4.9293E+01	2.9066E+02 2.0040E+00		
10	6.6925E+03 4.6143E+01	-1.9986E+03 -1.3780E+01	-3.8192E+02 -2.6332E+00	8.6910E+03 5.9922E+01	4.7106E+03 3.2478E+01		
11	7.6085E+02 5.2459E+00	-3.3081E+03 -2.2808E+01	-1.6278E+03 -1.1223E+01	4.0689E+03 2.8054E+01	3.3079E+03 2.2807E+01		
12	2.8410E+02 1.9588E+00	-1.9155E+03 -1.3207E+01	-1.6648E+03 -1.1478E+01	2.1996E+03 1.5166E+01	3.4228E+03 2.3600E+01		
13	9.6008E+03 6.6195E+01	-4.7170E+03 -3.2522E+01	1.6518E+03 1.1389E+01	1.4318E+04 9.8718E+01	1.2645E+04 8.7181E+01		
14	8.2849E+03 5.7123E+01	-4.0899E+03 -2.8199E+01	3.6470E+03 2.5145E+01	1.2375E+04 8.5322E+01	1.1345E+04 7.8223E+01		
15	7.7385E+02 5.3355E+00	-2.7673E+02 -1.9080E+00	6.2302E+02 4.2955E+00	1.0506E+03 7.2435E+00	1.4804E+03 1.0207E+01		

16	2.1092E+02	-7.9022E+01	-7.8407E+02	2.8994E+02	3.2378E+02
	1.4542E+00	-5.4484E-01	-5.4060E+00	1.9991E+00	2.2324E+00
17	1.0275E+02	-1.7187E+02	-7.6653E+02	2.7463E+02	4.4204E+02
	7.0845E-01	-1.1850E+00	-5.2851E+00	1.8935E+00	3.0477E+00
18	3.4845E+02	-4.8784E+02	2.4617E+03	8.3629E+02	8.1017E+02
	2.4025E+00	-3.3635E+00	1.6973E+01	5.7660E+00	5.5860E+00
19	-3.5492E+01	-9.2616E+02	2.7862E+03	8.9067E+02	7.8904E+02
	-2.4471E-01	-6.3856E+00	1.9210E+01	6.1409E+00	5.4402E+00
20	9.5752E+01	-2.0131E+03	-3.7772E+02	2.1088E+03	1.1919E+03
	6.6019E-01	-1.3879E+01	-2.6043E+00	1.4540E+01	8.2178E+00
21	1.1655E+03	2.0969E+01	1.1637E+03	1.1446E+03	9.1766E+02
	8.0360E+00	1.4457E-01	8.0236E+00	7.8914E+00	6.3270E+00
22	1.3167E+03	-6.0887E+01	1.3189E+03	1.3776E+03	1.0254E+03
	9.0784E+00	-4.1980E-01	9.0937E+00	9.4982E+00	7.0702E+00

Allowable Stress for Load Case 112 (Post Fire at 60 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	443.49	438.67	18.70	20.70	59.70
2	467.28	465.01	18.70	20.70	59.70
3	448.40	442.79	18.70	20.70	59.70
4	425.18	424.14	18.70	20.70	59.70
5	441.89	438.61	18.70	20.70	59.70
6	446.64	444.69	18.70	20.70	59.70
7	468.28	467.45	18.70	20.70	59.70
8	470.98	470.30	18.70	20.70	59.70
9	468.68	467.86	18.70	20.70	59.70
10	452.91	449.74	18.70	20.70	59.70
11	445.89	439.23	18.70	20.70	59.70
12	441.98	440.63	18.70	20.70	59.70
13	431.37	424.91	18.70	20.70	59.70
14	417.35	414.03	18.70	20.70	59.70
15	383.58	383.40	20.00	22.40	61.80
16	392.70	391.63	20.00	22.40	61.80
17	393.81	393.29	20.00	22.40	61.80
18	401.55	400.06	18.70	20.70	59.70
19	405.42	403.67	18.70	20.70	59.70
20	425.55	422.26	18.70	20.70	59.70
21	375.35	374.88	20.00	22.40	61.80
22	382.00	381.78	20.00	22.40	61.80

Table 2-176. Load Case 112, Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.8584E+02 3.3498E+00	-3.1556E+02 -2.1757E+00	6.4749E+01 4.4643E-01	8.0140E+02 5.5255E+00	2.3623E+02 1.6287E+00		
2	6.9159E+01 4.7683E-01	-6.9507E+02 -4.7923E+00	9.0200E+01 6.2191E-01	7.6423E+02 5.2692E+00	1.4424E+03 9.9451E+00		
3	1.1609E+02 8.0042E-01	-6.1606E+02 -4.2476E+00	-5.3632E+01 -3.6978E-01	7.3215E+02 5.0480E+00	1.3665E+03 9.4217E+00		
4	4.0413E+04 2.7864E+02	-1.8074E+04 -1.2462E+02	7.7971E+03 5.3759E+01	5.8487E+04 4.0325E+02	1.1354E+05 7.8286E+02		
5	4.4661E+04 3.0793E+02	-1.7632E+04 -1.2157E+02	5.2931E+03 3.6494E+01	6.2293E+04 4.2949E+02	9.7109E+04 6.6955E+02		
6	2.2722E+04 1.5666E+02	-2.7706E+03 -1.9103E+01	8.5261E+03 5.8785E+01	2.5492E+04 1.7576E+02	3.7379E+04 2.5772E+02		
7	7.8776E+03 5.4314E+01	-6.3221E+02 -4.3589E+00	-5.7598E+03 -3.9712E+01	8.5098E+03 5.8673E+01	1.3341E+02 9.1982E-01		
8	7.8746E+03 5.4294E+01	-6.3738E+02 -4.3946E+00	-5.5257E+03 -3.8098E+01	8.5120E+03 5.8688E+01	1.9615E+02 1.3524E+00		
9	7.8736E+03 5.4286E+01	-6.3552E+02 -4.3817E+00	-5.6682E+03 -3.9081E+01	8.5091E+03 5.8668E+01	2.2456E+02 1.5483E+00		
10	8.1527E+03 5.6211E+01	-2.2092E+03 -1.5232E+01	8.5173E+02 5.8725E+00	1.0362E+04 7.1443E+01	4.6429E+03 3.2012E+01		
11	1.7578E+03 1.2120E+01	-2.8963E+03 -1.9970E+01	-8.1345E+01 -5.6086E-01	4.6541E+03 3.2089E+01	1.7949E+03 1.2376E+01		
12	3.9001E+02 2.6890E+00	-5.6919E+02 -3.9244E+00	-1.9537E+02 -1.3470E+00	9.5920E+02 6.6134E+00	1.8120E+03 1.2493E+01		
13	1.3292E+04 9.1643E+01	-3.5876E+03 -2.4736E+01	3.2089E+03 2.2125E+01	1.6879E+04 1.1638E+02	1.6293E+04 1.1234E+02		
14	1.1340E+04 7.8188E+01	-3.0368E+03 -2.0938E+01	3.8959E+03 2.6862E+01	1.4377E+04 9.9125E+01	1.3108E+04 9.0373E+01		
15	3.4476E+02 2.3770E+00	-3.3150E+02 -2.2856E+00	1.8745E+02 1.2924E+00	6.7626E+02 4.6626E+00	1.0419E+03 7.1838E+00		

16	1.2660E+02	-1.4731E+02	-3.1231E+02	2.7392E+02	4.1758E+02
	8.7289E-01	-1.0157E+00	-2.1533E+00	1.8886E+00	2.8791E+00
17	5.7671E+01	-1.5080E+02	-2.6642E+02	2.0847E+02	3.6118E+02
	3.9762E-01	-1.0397E+00	-1.8369E+00	1.4373E+00	2.4903E+00
18	1.6867E+02	-2.3117E+02	1.0525E+03	3.9984E+02	4.9722E+02
	1.1630E+00	-1.5938E+00	7.2568E+00	2.7568E+00	3.4282E+00
19	8.5039E+00	-3.8015E+02	1.2473E+03	3.8866E+02	2.2473E+02
	5.8633E-02	-2.6211E+00	8.6001E+00	2.6797E+00	1.5495E+00
20	6.4266E+01	-8.8456E+02	-5.0844E+01	9.4882E+02	6.9044E+02
	4.4310E-01	-6.0988E+00	-3.5056E-01	6.5419E+00	4.7604E+00
21	4.7576E+02	6.3512E+00	4.7560E+02	4.6941E+02	3.3736E+02
	3.2803E+00	4.3790E-02	3.2792E+00	3.2365E+00	2.3260E+00
22	3.0383E+02	-1.0215E+02	2.6332E+02	4.0598E+02	6.7062E+02
	2.0948E+00	-7.0432E-01	1.8155E+00	2.7991E+00	4.6238E+00

Allowable Stress for Load Case 112 (Post Fire at 90 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	438.87	437.16	18.70	20.70	59.70
2	443.48	439.44	18.70	20.70	59.70
3	441.27	439.79	18.70	20.70	59.70
4	435.23	434.91	18.70	20.70	59.70
5	440.59	439.57	18.70	20.70	59.70
6	442.04	441.58	18.70	20.70	59.70
7	447.99	447.32	18.70	20.70	59.70
8	448.70	448.04	18.70	20.70	59.70
9	448.53	447.86	18.70	20.70	59.70
10	444.18	443.35	18.70	20.70	59.70
11	442.82	440.85	18.70	20.70	59.70
12	444.09	442.89	18.70	20.70	59.70
13	437.61	435.46	18.70	20.70	59.70
14	432.83	431.70	18.70	20.70	59.70
15	421.93	421.87	18.70	20.70	59.70
16	425.18	424.79	18.70	20.70	59.70
17	425.55	425.38	18.70	20.70	59.70
18	428.34	427.85	18.70	20.70	59.70
19	430.05	429.32	18.70	20.70	59.70
20	438.41	437.13	18.70	20.70	59.70
21	417.33	417.13	18.70	20.70	59.70
22	421.36	421.26	18.70	20.70	59.70

Table 2-177. Load Case 112, Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.9874E+02 2.0597E+00	-1.9490E+02 -1.3438E+00	-3.5440E+01 -2.4435E-01	4.9364E+02 3.4036E+00	1.7513E+02 1.2075E+00		
2	-2.2246E+01 -1.5338E-01	-3.8579E+02 -2.6599E+00	1.1290E+02 7.7839E-01	3.6355E+02 2.5066E+00	7.0767E+02 4.8792E+00		
3	5.7393E+01 3.9571E-01	-3.7110E+02 -2.5586E+00	-5.6239E+01 -3.8776E-01	4.2849E+02 2.9544E+00	8.0780E+02 5.5696E+00		
4	2.5728E+04 1.7739E+02	-1.1252E+04 -7.7577E+01	4.6014E+03 3.1725E+01	3.6979E+04 2.5496E+02	7.1790E+04 4.9498E+02		
5	2.8742E+04 1.9817E+02	-1.1073E+04 -7.6344E+01	3.0491E+03 2.1023E+01	3.9814E+04 2.7451E+02	6.2177E+04 4.2870E+02		
6	1.4342E+04 9.8883E+01	-1.7959E+03 -1.2382E+01	4.4316E+03 3.0554E+01	1.6138E+04 1.1127E+02	2.3376E+04 1.6117E+02		
7	4.9997E+03 3.4471E+01	-6.2494E+02 -4.3088E+00	-5.6025E+03 -3.8628E+01	5.6246E+03 3.8780E+01	1.6323E+02 1.1254E+00		
8	4.9987E+03 3.4465E+01	-6.2700E+02 -4.3230E+00	-5.4389E+03 -3.7500E+01	5.6257E+03 3.8788E+01	1.8013E+02 1.2420E+00		
9	4.9976E+03 3.4457E+01	-6.2706E+02 -4.3234E+00	-5.5732E+03 -3.8426E+01	5.6247E+03 3.8781E+01	2.0961E+02 1.4452E+00		
10	5.2883E+03 3.6461E+01	-2.0479E+03 -1.4120E+01	-3.1479E+02 -2.1704E+00	7.3361E+03 5.0581E+01	3.2121E+03 2.2147E+01		
11	9.3734E+02 6.4627E+00	-2.1417E+03 -1.4767E+01	-3.0698E+02 -2.1166E+00	3.0790E+03 2.1229E+01	5.2413E+01 3.6137E-01		
12	2.9010E+01 2.0001E-01	-5.1422E+02 -3.5454E+00	-5.1196E+02 -3.5298E+00	5.4323E+02 3.7454E+00	2.1921E+01 1.5114E-01		
13	8.7383E+03 6.0248E+01	-2.1121E+03 -1.4563E+01	2.2068E+03 1.5215E+01	1.0850E+04 7.4811E+01	1.1083E+04 7.6415E+01		
14	7.2448E+03 4.9951E+01	-1.6996E+03 -1.1718E+01	2.3868E+03 1.6457E+01	8.9444E+03 6.1670E+01	7.6440E+03 5.2703E+01		
15	6.7176E+02 4.6316E+00	-7.3529E+02 -5.0697E+00	1.7788E+01 1.2264E-01	1.4071E+03 9.7013E+00	2.3707E+03 1.6345E+01		

16	1.8515E+02	-3.2376E+02	-1.8830E+02	5.0891E+02	8.2230E+02
	1.2766E+00	-2.2322E+00	-1.2983E+00	3.5088E+00	5.6696E+00
17	8.1133E+01	-2.3143E+02	-8.4627E+01	3.1256E+02	5.4349E+02
	5.5939E-01	-1.5957E+00	-5.8348E-01	2.1550E+00	3.7472E+00
18	6.5241E+01	-1.4160E+02	6.3520E+02	2.0684E+02	1.7101E+02
	4.4982E-01	-9.7627E-01	4.3795E+00	1.4261E+00	1.1791E+00
19	-1.1909E+01	-2.5073E+02	7.2978E+02	2.3882E+02	2.8255E+02
	-8.2110E-02	-1.7287E+00	5.0317E+00	1.6466E+00	1.9481E+00
20	2.3506E+00	-5.5184E+02	4.3315E+01	5.5419E+02	1.4211E+02
	1.6207E-02	-3.8048E+00	2.9865E-01	3.8210E+00	9.7978E-01
21	1.0093E+02	2.0068E+01	9.5572E+01	8.0864E+01	5.2142E+00
	6.9590E-01	1.3837E-01	6.5895E-01	5.5754E-01	3.5951E-02
22	9.8070E+01	-2.7328E+02	-8.0117E+01	3.7135E+02	8.1464E+02
	6.7617E-01	-1.8842E+00	-5.5239E-01	2.5604E+00	5.6168E+00

Allowable Stress for Load Case 112 (Post Fire at 120 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	434.50	433.48	18.70	20.70	59.70
2	433.99	429.55	18.70	20.70	59.70
3	435.69	435.02	18.70	20.70	59.70
4	435.54	435.43	18.70	20.70	59.70
5	437.84	437.45	18.70	20.70	59.70
6	438.68	438.34	18.70	20.70	59.70
7	439.45	438.81	18.70	20.70	59.70
8	439.55	438.90	18.70	20.70	59.70
9	439.91	439.27	18.70	20.70	59.70
10	440.18	439.47	18.70	20.70	59.70
11	441.01	439.94	18.70	20.70	59.70
12	443.43	442.29	18.70	20.70	59.70
13	438.31	437.70	18.70	20.70	59.70
14	436.81	436.45	18.70	20.70	59.70
15	432.59	432.55	18.70	20.70	59.70
16	433.82	433.61	18.70	20.70	59.70
17	434.00	433.88	18.70	20.70	59.70
18	435.18	434.99	18.70	20.70	59.70
19	436.19	435.79	18.70	20.70	59.70
20	440.78	440.15	18.70	20.70	59.70
21	432.40	432.28	18.70	20.70	59.70
22	432.18	432.10	18.70	20.70	59.70

Table 2-178. Load Case 112, Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.6427E+02 1.1326E+00	-1.4887E+02 -1.0264E+00	-8.3512E+01 -5.7579E-01	3.1315E+02 2.1591E+00	2.8102E+02 1.9375E+00
2	-9.7236E+00 -6.7042E-02	-2.4509E+02 -1.6899E+00	8.7475E+01 6.0312E-01	2.3537E+02 1.6228E+00	4.8005E+02 3.3099E+00
3	4.3712E+01 3.0138E-01	-2.2367E+02 -1.5421E+00	-5.5058E+01 -3.7961E-01	2.6738E+02 1.8435E+00	5.2638E+02 3.6293E+00
4	1.1558E+04 7.9691E+01	-4.7612E+03 -3.2827E+01	1.7291E+03 1.1922E+01	1.6319E+04 1.1252E+02	3.1663E+04 2.1831E+02
5	1.3321E+04 9.1843E+01	-4.8267E+03 -3.3279E+01	7.3113E+02 5.0410E+00	1.8147E+04 1.2512E+02	2.8457E+04 1.9621E+02
6	6.2624E+03 4.3177E+01	-8.7330E+02 -6.0212E+00	3.3519E+02 2.3111E+00	7.1357E+03 4.9199E+01	9.9667E+03 6.8718E+01
7	2.2265E+03 1.5351E+01	-6.2619E+02 -4.3174E+00	-5.5180E+03 -3.8045E+01	2.8527E+03 1.9669E+01	2.0037E+02 1.3815E+00
8	2.2274E+03 1.5357E+01	-6.2644E+02 -4.3192E+00	-5.4367E+03 -3.7485E+01	2.8538E+03 1.9676E+01	1.7741E+02 1.2232E+00
9	2.2262E+03 1.5349E+01	-6.2733E+02 -4.3253E+00	-5.5463E+03 -3.8240E+01	2.8536E+03 1.9675E+01	2.0807E+02 1.4346E+00
10	2.5414E+03 1.7522E+01	-1.8837E+03 -1.2988E+01	-1.5439E+03 -1.0644E+01	4.4251E+03 3.0510E+01	1.9984E+03 1.3779E+01
11	7.0462E+01 4.8582E-01	-1.6045E+03 -1.1063E+01	-8.0316E+02 -5.5376E+00	1.6750E+03 1.1549E+01	1.1497E+03 7.9269E+00
12	2.8207E+01 1.9448E-01	-1.0800E+03 -7.4465E+00	-1.0702E+03 -7.3790E+00	1.1082E+03 7.6410E+00	1.2509E+03 8.6243E+00
13	4.0564E+03 2.7968E+01	-1.0489E+03 -7.2320E+00	1.0109E+03 6.9701E+00	5.1053E+03 3.5200E+01	5.8248E+03 4.0161E+01
14	3.0978E+03 2.1359E+01	-7.4968E+02 -5.1689E+00	9.9739E+02 6.8768E+00	3.8475E+03 2.6527E+01	2.6175E+03 1.8047E+01
15	1.2460E+03 8.5907E+00	-1.3009E+03 -8.9691E+00	-6.2961E+01 -4.3410E-01	2.5468E+03 1.7560E+01	4.2964E+03 2.9622E+01

16	3.1219E+02	-5.8405E+02	-2.0676E+02	8.9624E+02	1.4540E+03
	2.1525E+00	-4.0269E+00	-1.4256E+00	6.1793E+00	1.0025E+01
17	1.3734E+02	-3.8545E+02	-1.1003E+01	5.2279E+02	8.9981E+02
	9.4696E-01	-2.6576E+00	-7.5866E-02	3.6045E+00	6.2040E+00
18	2.7248E+01	-1.5219E+02	5.3208E+02	1.7944E+02	1.0355E+02
	1.8787E-01	-1.0493E+00	3.6686E+00	1.2372E+00	7.1393E-01
19	1.1110E+01	-3.0792E+02	5.5162E+02	3.1903E+02	5.1693E+02
	7.6599E-02	-2.1230E+00	3.8033E+00	2.1996E+00	3.5641E+00
20	-4.4081E+01	-4.9303E+02	6.0572E+01	4.4895E+02	3.6950E+02
	-3.0392E-01	-3.3993E+00	4.1763E-01	3.0954E+00	2.5476E+00
21	2.1029E+01	-3.8417E+01	-3.7864E+01	5.9446E+01	5.5341E+01
	1.4499E-01	-2.6488E-01	-2.6106E-01	4.0986E-01	3.8157E-01
22	-1.0427E+01	-2.5726E+02	-1.2604E+02	2.4683E+02	6.0835E+02
	-7.1889E-02	-1.7737E+00	-8.6902E-01	1.7018E+00	4.1945E+00

Allowable Stress for Load Case 112 (Post Fire at 150 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	430.53	429.62	18.70	20.70	59.70
2	428.45	423.93	18.70	20.70	59.70
3	431.30	430.74	18.70	20.70	59.70
4	432.91	432.85	18.70	20.70	59.70
5	434.32	434.12	18.70	20.70	59.70
6	435.18	434.68	18.70	20.70	59.70
7	434.21	433.56	18.70	20.70	59.70
8	434.10	433.46	18.70	20.70	59.70
9	434.64	433.98	18.70	20.70	59.70
10	436.92	435.78	18.70	20.70	59.70
11	438.13	437.27	18.70	20.70	59.70
12	440.87	439.74	18.70	20.70	59.70
13	436.23	436.11	18.70	20.70	59.70
14	435.80	435.70	18.70	20.70	59.70
15	433.14	433.11	18.70	20.70	59.70
16	433.78	433.62	18.70	20.70	59.70
17	433.93	433.79	18.70	20.70	59.70
18	434.68	434.51	18.70	20.70	59.70
19	435.41	435.10	18.70	20.70	59.70
20	438.87	438.44	18.70	20.70	59.70
21	434.84	434.79	18.70	20.70	59.70
22	432.76	432.67	18.70	20.70	59.70

Table 2-179. Load Case 112, Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	8.1736E+01 5.6355E-01	-1.5244E+02 -1.0510E+00	-1.1229E+02 -7.7422E-01	2.3417E+02 1.6146E+00	3.9852E+02 2.7477E+00		
2	3.4940E+01 2.4091E-01	-1.8029E+02 -1.2430E+00	5.7543E+01 3.9675E-01	2.1523E+02 1.4839E+00	4.0211E+02 2.7724E+00		
3	5.9785E+01 4.1220E-01	-1.4019E+02 -9.6661E-01	-5.7046E+01 -3.9332E-01	1.9998E+02 1.3788E+00	3.6104E+02 2.4893E+00		
4	6.7053E+02 4.6231E+00	3.2549E+01 2.2441E-01	-4.7267E+02 -3.2589E+00	6.3798E+02 4.3987E+00	1.3841E+02 9.5433E-01		
5	1.2572E+03 8.6684E+00	-5.0233E+01 -3.4634E-01	-1.1051E+03 -7.6191E+00	1.3075E+03 9.0148E+00	1.7297E+03 1.1926E+01		
6	3.3741E+02 2.3263E+00	-6.1390E+02 -4.2327E+00	-2.9095E+03 -2.0060E+01	9.5130E+02 6.5590E+00	6.4181E+02 4.4251E+00		
7	3.4539E+01 2.3814E-01	-6.2731E+02 -4.3251E+00	-5.4488E+03 -3.7568E+01	6.6184E+02 4.5633E+00	2.3201E+02 1.5996E+00		
8	3.6574E+01 2.5217E-01	-6.2618E+02 -4.3174E+00	-5.4362E+03 -3.7481E+01	6.6276E+02 4.5695E+00	1.7811E+02 1.2281E+00		
9	3.5708E+01 2.4620E-01	-6.2785E+02 -4.3289E+00	-5.5220E+03 -3.8073E+01	6.6356E+02 4.5751E+00	2.1018E+02 1.4492E+00		
10	4.3003E+02 2.9649E+00	-1.8033E+03 -1.2433E+01	-2.5304E+03 -1.7447E+01	2.2333E+03 1.5398E+01	1.0730E+03 7.3979E+00		
11	-2.8429E+02 -1.9601E+00	-1.5590E+03 -1.0749E+01	-1.2485E+03 -8.6081E+00	1.2747E+03 8.7888E+00	1.9819E+03 1.3665E+01		
12	4.3691E+01 3.0124E-01	-1.6037E+03 -1.1057E+01	-1.5580E+03 -1.0742E+01	1.6474E+03 1.1358E+01	2.0740E+03 1.4300E+01		
13	5.0467E+02 3.4796E+00	-4.9086E+02 -3.3844E+00	3.1225E+01 2.1529E-01	9.9554E+02 6.8640E+00	1.6252E+03 1.1205E+01		
14	2.0860E+02 1.4383E+00	-4.9426E+02 -3.4078E+00	-5.9350E+01 -4.0921E-01	7.0286E+02 4.8461E+00	1.2996E+03 8.9601E+00		
15	1.6631E+03 1.1466E+01	-1.7573E+03 -1.2116E+01	-1.1208E+02 -7.7279E-01	3.4204E+03 2.3583E+01	5.7693E+03 3.9778E+01		

16	4.2031E+02	-7.9958E+02	-2.4917E+02	1.2199E+03	1.9788E+03
	2.8979E+00	-5.5129E+00	-1.7179E+00	8.4108E+00	1.3643E+01
17	1.8438E+02	-5.2246E+02	2.3224E+01	7.0685E+02	1.2147E+03
	1.2713E+00	-3.6023E+00	1.6013E-01	4.8736E+00	8.3751E+00
18	2.4126E+01	-1.8400E+02	5.0427E+02	2.0813E+02	2.0070E+02
	1.6634E-01	-1.2686E+00	3.4768E+00	1.4350E+00	1.3838E+00
19	3.3252E+01	-3.5178E+02	4.9819E+02	3.8503E+02	6.4014E+02
	2.2926E-01	-2.4255E+00	3.4349E+00	2.6547E+00	4.4136E+00
20	-4.8086E+01	-5.0044E+02	6.5246E+01	4.5235E+02	5.9658E+02
	-3.3154E-01	-3.4504E+00	4.4985E-01	3.1188E+00	4.1133E+00
21	3.0044E-01	-7.2825E+01	-7.2621E+01	7.3126E+01	1.0566E+01
	2.0715E-03	-5.0211E-01	-5.0070E-01	5.0418E-01	7.2848E-02
22	-5.0145E+01	-2.2962E+02	-9.2711E+01	1.7948E+02	3.9815E+02
	-3.4574E-01	-1.5832E+00	-6.3922E-01	1.2374E+00	2.7452E+00

Allowable Stress for Load Case 112 (Post Fire at 180 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	426.72	425.79	18.70	20.70	59.70
2	424.18	419.68	18.70	20.70	59.70
3	427.33	426.76	18.70	20.70	59.70
4	429.45	429.39	18.70	20.70	59.70
5	430.60	430.44	18.70	20.70	59.70
6	431.46	430.92	18.70	20.70	59.70
7	430.00	429.35	18.70	20.70	59.70
8	429.84	429.20	18.70	20.70	59.70
9	430.42	429.76	18.70	20.70	59.70
10	433.34	432.06	18.70	20.70	59.70
11	434.69	433.88	18.70	20.70	59.70
12	437.53	436.40	18.70	20.70	59.70
13	433.15	433.06	18.70	20.70	59.70
14	432.97	432.92	18.70	20.70	59.70
15	430.59	430.57	18.70	20.70	59.70
16	431.06	430.91	18.70	20.70	59.70
17	431.20	431.07	18.70	20.70	59.70
18	431.84	431.66	18.70	20.70	59.70
19	432.48	432.20	18.70	20.70	59.70
20	435.62	435.25	18.70	20.70	59.70
21	432.79	432.77	18.70	20.70	59.70
22	430.22	430.14	18.70	20.70	59.70

**Table 2-180. Load Case 301, 30-ft. Head-On Drop,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-3.5116E+01 -2.4211E-01	-2.9001E+03 -1.9996E+01	-5.5330E+02 -3.8148E+00	2.8650E+03 1.9754E+01	1.1789E+03 8.1279E+00
2	3.3916E+01 2.3384E-01	-1.3934E+03 -9.6069E+00	-9.0219E+01 -6.2203E-01	1.4273E+03 9.8407E+00	5.3870E+01 3.7142E-01
3	1.4267E+00 9.8365E-03	-5.4534E+02 -3.7600E+00	-4.7895E+01 -3.3023E-01	5.4677E+02 3.7698E+00	3.3162E+01 2.2865E-01
4	7.7808E+02 5.3646E+00	-4.7237E+03 -3.2569E+01	-1.5509E+03 -1.0693E+01	5.5018E+03 3.7933E+01	3.9945E+03 2.7541E+01
5	1.1872E+02 8.1855E-01	-1.7425E+03 -1.2014E+01	-7.5377E+02 -5.1971E+00	1.8612E+03 1.2832E+01	2.6817E+03 1.8489E+01
6	-2.7831E+02 -1.9189E+00	-1.0850E+03 -7.4810E+00	-6.1748E+02 -4.2574E+00	8.0671E+02 5.5621E+00	5.1541E+02 3.5536E+00
7	-5.2503E+00 -3.6199E-02	-7.1220E+02 -4.9105E+00	-4.9558E+01 -3.4169E-01	7.0695E+02 4.8743E+00	1.5190E+01 1.0473E-01
8	-3.1436E+00 -2.1675E-02	-6.4805E+02 -4.4682E+00	-3.4302E+01 -2.3650E-01	6.4491E+02 4.4465E+00	1.1054E+00 7.6218E-03
9	-2.4186E+00 -1.6676E-02	-5.4079E+02 -3.7286E+00	-2.3776E+01 -1.6393E-01	5.3837E+02 3.7119E+00	1.3545E+00 9.3389E-03
10	-8.9156E+01 -6.1471E-01	-6.7229E+02 -4.6353E+00	-4.7569E+01 -3.2798E-01	5.8314E+02 4.0206E+00	3.7204E+02 2.5651E+00
11	1.1772E+02 8.1162E-01	-3.4634E+02 -2.3879E+00	-1.9542E+01 -1.3473E-01	4.6405E+02 3.1995E+00	1.5388E+02 1.0609E+00
12	1.3958E+02 9.6238E-01	-4.7826E+01 -3.2975E-01	9.0518E+01 6.2410E-01	1.8741E+02 1.2921E+00	3.6107E+02 2.4895E+00
13	1.3854E+02 9.5520E-01	-2.7560E+02 -1.9002E+00	3.7434E+00 2.5810E-02	4.1414E+02 2.8554E+00	1.8586E+02 1.2815E+00
14	1.3380E+02 9.2253E-01	-1.7833E+02 -1.2295E+00	4.6187E+01 3.1845E-01	3.1213E+02 2.1520E+00	1.1527E+02 7.9474E-01
15	8.6155E+02 5.9402E+00	2.2188E+02 1.5298E+00	1.6629E+02 1.1465E+00	6.3967E+02 4.4104E+00	2.4334E+01 1.6778E-01

16	3.2008E+02	-8.6857E+02	-3.8581E+02	1.1887E+03	5.7904E+02
	2.2069E+00	-5.9886E+00	-2.6600E+00	8.1955E+00	3.9923E+00
17	5.2320E+02	-8.2819E+02	-4.4192E+02	1.3514E+03	1.1426E+03
	3.6074E+00	-5.7102E+00	-3.0470E+00	9.3175E+00	7.8778E+00
18	5.0319E+02	-1.3152E+03	-2.6974E+02	1.8183E+03	2.0601E+03
	3.4693E+00	-9.0677E+00	-1.8598E+00	1.2537E+01	1.4204E+01
19	3.6845E+02	-1.3417E+03	-5.4649E+02	1.7101E+03	1.1334E+03
	2.5404E+00	-9.2506E+00	-3.7679E+00	1.1791E+01	7.8143E+00
20	-1.2184E+02	-8.5843E+02	-5.8185E+02	7.3659E+02	1.2655E+03
	-8.4007E-01	-5.9187E+00	-4.0117E+00	5.0786E+00	8.7250E+00
21	1.0029E+03	9.6474E+01	8.7138E+01	9.0639E+02	2.5673E+02
	6.9145E+00	6.6516E-01	6.0079E-01	6.2493E+00	1.7701E+00
22	5.5755E+02	1.4411E+02	3.8842E+02	4.1344E+02	3.2933E+02
	3.8442E+00	9.9363E-01	2.6781E+00	2.8505E+00	2.2707E+00

**Table 2-181. Load Case 302, 30-ft. Side Drop + Slap-Down,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.6541E+02 1.1405E+00	-4.5912E+01 -3.1655E-01	-6.0601E+02 -4.1783E+00	4.0576E+03 2.7976E+01	1.2379E+03 8.5349E+00		
2	1.1180E+03 7.7081E+00	1.2822E+02 8.8405E-01	-3.0835E+02 -2.1260E+00	1.0751E+03 7.4126E+00	1.0217E+03 7.0446E+00		
3	1.6154E+02 1.1138E+00	-4.1720E+01 -2.8765E-01	-6.0587E+02 -4.1774E+00	4.0573E+03 2.7974E+01	1.2418E+03 8.5621E+00		
4	7.7054E+02 5.3127E+00	-4.0454E+01 -2.7892E-01	-1.0613E+03 -7.3171E+00	2.7347E+03 1.8855E+01	3.9787E+02 2.7432E+00		
5	1.2475E+03 8.6015E+00	-1.9604E+02 -1.3516E+00	-1.4070E+03 -9.7006E+00	2.7876E+03 1.9220E+01	9.4642E+01 6.5253E-01		
6	1.2282E+03 8.4681E+00	-3.3666E+02 -2.3212E+00	-1.5636E+03 -1.0780E+01	2.6357E+03 1.8173E+01	1.1918E+02 8.2172E-01		
7	1.9713E+02 1.3591E+00	9.2049E+01 6.3466E-01	-1.8501E+01 -1.2756E-01	1.4709E+03 1.0142E+01	7.4553E+01 5.1402E-01		
8	9.8975E+01 6.8241E-01	7.5648E+01 5.2158E-01	1.7793E+01 1.2268E-01	7.0487E+02 4.8599E+00	1.2318E+02 8.4928E-01		
9	1.9594E+02 1.3510E+00	9.1246E+01 6.2912E-01	-1.8590E+01 -1.2817E-01	1.4535E+03 1.0022E+01	7.5795E+01 5.2258E-01		
10	1.4394E+03 9.9246E+00	-1.4019E+02 -9.6658E-01	-1.5843E+03 -1.0923E+01	2.1244E+03 1.4647E+01	8.0793E+02 5.5705E+00		
11	7.4679E+02 5.1490E+00	-3.5841E+02 -2.4712E+00	-1.7708E+03 -1.2209E+01	2.0617E+03 1.4215E+01	7.0617E+02 4.8689E+00		
12	-2.9026E+01 -2.0012E-01	-3.3606E+02 -2.3170E+00	-1.3343E+03 -9.1999E+00	1.3053E+03 8.9998E+00	1.0596E+02 7.3054E-01		
13	1.2678E+03 8.7414E+00	-2.0114E+02 -1.3868E+00	-1.3391E+03 -9.2329E+00	2.7529E+03 1.8980E+01	7.9651E+01 5.4917E-01		
14	1.0115E+03 6.9742E+00	-1.2945E+02 -8.9253E-01	-1.2263E+03 -8.4548E+00	2.6979E+03 1.8601E+01	4.2554E+02 2.9340E+00		
15	-4.0810E+01 -2.8138E-01	-3.0469E+02 -2.1008E+00	-1.4456E+03 -9.9670E+00	1.4716E+03 1.0146E+01	3.0999E+01 2.1373E-01		

16	1.7310E+02	-5.3771E+01	-1.1908E+03	2.7937E+03	1.7134E+02
	1.1935E+00	-3.7074E-01	-8.2104E+00	1.9262E+01	1.1814E+00
17	2.9150E+02	-4.1475E+01	-1.1724E+03	2.8857E+03	1.9079E+02
	2.0098E+00	-2.8596E-01	-8.0837E+00	1.9896E+01	1.3154E+00
18	8.5918E+02	-1.3055E+02	-1.1857E+03	2.9929E+03	1.4956E+02
	5.9239E+00	-9.0014E-01	-8.1752E+00	2.0635E+01	1.0312E+00
19	1.0019E+03	-1.9561E+02	-1.3569E+03	2.9706E+03	2.3880E+02
	6.9078E+00	-1.3487E+00	-9.3552E+00	2.0481E+01	1.6464E+00
20	9.0894E+02	-2.6122E+02	-1.3854E+03	2.3040E+03	1.0307E+02
	6.2669E+00	-1.8011E+00	-9.5521E+00	1.5886E+01	7.1063E-01
21	-1.6703E+01	-3.5213E+02	-1.5582E+03	1.6117E+03	1.7836E+02
	-1.1516E-01	-2.4278E+00	-1.0743E+01	1.1112E+01	1.2298E+00
22	-1.5636E+01	-3.7289E+02	-1.6116E+03	1.6630E+03	1.3679E+02
	-1.0780E-01	-2.5710E+00	-1.1111E+01	1.1466E+01	9.4315E-01

**Table 2-182. Load Case 303, 30-ft. Cg/Corner Drop,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.5701E+02 1.7720E+00	-2.6745E+02 -1.8440E+00	-2.1557E+03 -1.4863E+01	2.1163E+03 1.4591E+01	9.2973E+02 6.4103E+00		
2	1.6433E+02 1.1330E+00	-9.2145E+01 -6.3532E-01	-2.3264E+02 -1.6040E+00	1.0880E+03 7.5013E+00	1.3700E+02 9.4460E-01		
3	1.9994E+03 1.3785E+01	2.1350E+02 1.4720E+00	-1.1081E+01 -7.6402E-02	2.0105E+03 1.3862E+01	5.6937E+02 3.9257E+00		
4	2.2346E+02 1.5407E+00	8.1579E+00 5.6247E-02	-1.5277E+03 -1.0533E+01	3.1410E+03 2.1656E+01	2.9858E+02 2.0586E+00		
5	3.3744E+02 2.3265E+00	-2.3627E+02 -1.6290E+00	-1.9440E+03 -1.3404E+01	2.2466E+03 1.5489E+01	1.2180E+02 8.3977E-01		
6	2.4504E+02 1.6895E+00	-5.1990E+02 -3.5846E+00	-2.2210E+03 -1.5313E+01	2.2996E+03 1.5855E+01	3.2604E+02 2.2480E+00		
7	3.6734E+02 2.5327E+00	3.7477E+01 2.5839E-01	-1.1148E+02 -7.6865E-01	2.1271E+03 1.4666E+01	6.0993E+01 4.2053E-01		
8	2.1693E+02 1.4957E+00	4.6502E+00 3.2062E-02	-2.4376E+02 -1.6806E+00	1.5598E+03 1.0755E+01	2.7507E+01 1.8965E-01		
9	3.9893E+02 2.7506E+00	-2.1034E+02 -1.4502E+00	-3.5078E+02 -2.4185E+00	1.0727E+03 7.3960E+00	3.6927E+01 2.5460E-01		
10	4.1028E+02 2.8288E+00	-2.5828E+02 -1.7808E+00	-3.9179E+02 -2.7013E+00	9.6869E+02 6.6789E+00	4.1412E+02 2.8553E+00		
11	6.6814E+02 4.6067E+00	-5.6125E+01 -3.8697E-01	-1.3145E+02 -9.0634E-01	8.2192E+02 5.6669E+00	2.3771E+02 1.6390E+00		
12	4.6909E+02 3.2343E+00	6.1672E+01 4.2521E-01	9.3444E+00 6.4427E-02	4.6651E+02 3.2165E+00	1.0903E+02 7.5174E-01		
13	6.1537E+02 4.2428E+00	-1.6862E+02 -1.1626E+00	-3.5689E+02 -2.4607E+00	9.7226E+02 6.7035E+00	2.3268E+01 1.6043E-01		
14	6.4493E+02 4.4466E+00	-1.6404E+02 -1.1310E+00	-3.5092E+02 -2.4195E+00	9.9585E+02 6.8661E+00	1.0501E+02 7.2404E-01		
15	3.4366E+02 2.3695E+00	6.7605E+01 4.6612E-01	-1.0765E+03 -7.4225E+00	1.4438E+03 9.9545E+00	3.0378E+01 2.0945E-01		

16	4.5978E+02	3.3047E+01	-1.2048E+03	2.6438E+03	2.1964E+02
	3.1701E+00	2.2785E-01	-8.3067E+00	1.8228E+01	1.5144E+00
17	4.5231E+02	6.8367E+01	-1.2967E+03	2.7945E+03	2.9933E+02
	3.1185E+00	4.7137E-01	-8.9401E+00	1.9268E+01	2.0638E+00
18	3.4295E+02	-6.6787E+01	-1.7027E+03	2.1467E+03	1.5108E+02
	2.3646E+00	-4.6048E-01	-1.1740E+01	1.4801E+01	1.0417E+00
19	3.8126E+02	-1.4676E+02	-1.9014E+03	2.1102E+03	3.8729E+02
	2.6287E+00	-1.0118E+00	-1.3110E+01	1.4549E+01	2.6703E+00
20	1.9062E+02	-3.5358E+02	-1.8875E+03	2.0605E+03	1.1304E+02
	1.3143E+00	-2.4378E+00	-1.3014E+01	1.4207E+01	7.7940E-01
21	3.1154E+02	-1.9187E+01	-2.1272E+02	5.2125E+02	2.9505E+01
	2.1480E+00	-1.3229E-01	-1.4666E+00	3.5939E+00	2.0343E-01
22	5.2669E+02	3.0133E+01	-1.0409E+03	1.5918E+03	1.3825E+02
	3.6314E+00	2.0776E-01	-7.1766E+00	1.0975E+01	9.5323E-01

Table 2-183. Load Case 304, 30-ft. Head-On Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-5.0687E+01 -3.4947E-01	-3.9919E+03 -2.7523E+01	-7.5881E+02 -5.2318E+00	3.9412E+03 2.7173E+01	1.6842E+03 1.1612E+01
2	4.6885E+01 3.2326E-01	-1.9176E+03 -1.3222E+01	-1.2056E+02 -8.3124E-01	1.9645E+03 1.3545E+01	7.3792E+01 5.0878E-01
3	1.8846E+00 1.2994E-02	-7.5175E+02 -5.1831E+00	-6.5726E+01 -4.5316E-01	7.5363E+02 5.1961E+00	4.5429E+01 3.1322E-01
4	1.0866E+03 7.4920E+00	-6.5700E+03 -4.5299E+01	-2.1553E+03 -1.4860E+01	7.6567E+03 5.2791E+01	5.5695E+03 3.8400E+01
5	1.6469E+02 1.1355E+00	-2.4236E+03 -1.6710E+01	-1.0495E+03 -7.2359E+00	2.5883E+03 1.7845E+01	3.7299E+03 2.5717E+01
6	-3.8984E+02 -2.6879E+00	-1.5144E+03 -1.0442E+01	-8.6182E+02 -5.9420E+00	1.1246E+03 7.7537E+00	7.1310E+02 4.9167E+00
7	-7.1583E+00 -4.9355E-02	-9.9119E+02 -6.8340E+00	-6.7122E+01 -4.6279E-01	9.8403E+02 6.7847E+00	2.0818E+01 1.4353E-01
8	-4.2370E+00 -2.9213E-02	-8.9825E+02 -6.1932E+00	-4.6180E+01 -3.1840E-01	8.9401E+02 6.1640E+00	1.5353E+00 1.0585E-02
9	-3.3001E+00 -2.2753E-02	-7.4826E+02 -5.1591E+00	-3.2299E+01 -2.2269E-01	7.4496E+02 5.1363E+00	1.8184E+00 1.2538E-02
10	-1.2319E+02 -8.4939E-01	-9.3015E+02 -6.4131E+00	-6.5732E+01 -4.5320E-01	8.0695E+02 5.5638E+00	5.1422E+02 3.5454E+00
11	1.6270E+02 1.1218E+00	-4.7892E+02 -3.3021E+00	-2.7013E+01 -1.8625E-01	6.4162E+02 4.4238E+00	2.1281E+02 1.4673E+00
12	1.9261E+02 1.3280E+00	-6.6476E+01 -4.5833E-01	1.2508E+02 8.6243E-01	2.5909E+02 1.7864E+00	4.9969E+02 3.4452E+00
13	1.9135E+02 1.3193E+00	-3.8226E+02 -2.6356E+00	4.8390E+00 3.3364E-02	5.7361E+02 3.9549E+00	2.5929E+02 1.7878E+00
14	1.8463E+02 1.2730E+00	-2.4779E+02 -1.7085E+00	6.3387E+01 4.3704E-01	4.3242E+02 2.9814E+00	1.6017E+02 1.1043E+00
15	1.1874E+03 8.1869E+00	2.8310E+02 1.9519E+00	2.0638E+02 1.4229E+00	9.0431E+02 6.2350E+00	3.5890E+01 2.4745E-01

16	4.3424E+02	-1.2296E+03	-5.6563E+02	1.6638E+03	7.9864E+02
	2.9940E+00	-8.4775E+00	-3.8999E+00	1.1471E+01	5.5064E+00
17	7.1724E+02	-1.1463E+03	-6.3420E+02	1.8635E+03	1.5770E+03
	4.9452E+00	-7.9034E+00	-4.3727E+00	1.2849E+01	1.0873E+01
18	6.9599E+02	-1.8304E+03	-3.7892E+02	2.5264E+03	2.8644E+03
	4.7986E+00	-1.2620E+01	-2.6126E+00	1.7419E+01	1.9749E+01
19	5.1032E+02	-1.8680E+03	-7.6163E+02	2.3783E+03	1.5816E+03
	3.5186E+00	-1.2879E+01	-5.2513E+00	1.6398E+01	1.0905E+01
20	-1.6961E+02	-1.1956E+03	-8.1091E+02	1.0260E+03	1.7615E+03
	-1.1694E+00	-8.2436E+00	-5.5910E+00	7.0742E+00	1.2145E+01
21	1.3789E+03	1.3274E+02	1.1990E+02	1.2461E+03	3.5286E+02
	9.5070E+00	9.1518E-01	8.2668E-01	8.5919E+00	2.4329E+00
22	7.4664E+02	1.8287E+02	4.9662E+02	5.6377E+02	4.4612E+02
	5.1479E+00	1.2608E+00	3.4240E+00	3.8871E+00	3.0759E+00

Table 2-184. Load Case 305, 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.3156E+02 1.5965E+00	-6.4154E+01 -4.4232E-01	-8.4731E+02 -5.8420E+00	5.6803E+03 3.9164E+01	1.7329E+03 1.1948E+01		
2	1.5651E+03 1.0791E+01	1.7952E+02 1.2377E+00	-4.3127E+02 -2.9735E+00	1.5051E+03 1.0377E+01	1.4304E+03 9.8621E+00		
3	2.2614E+02 1.5592E+00	-5.8279E+01 -4.0182E-01	-8.4711E+02 -5.8406E+00	5.6799E+03 3.9161E+01	1.7384E+03 1.1986E+01		
4	1.0787E+03 7.4372E+00	-5.6726E+01 -3.9111E-01	-1.4852E+03 -1.0240E+01	3.8282E+03 2.6395E+01	5.5696E+02 3.8401E+00		
5	1.7464E+03 1.2041E+01	-2.7452E+02 -1.8927E+00	-1.9691E+03 -1.3577E+01	3.9023E+03 2.6905E+01	1.3248E+02 9.1343E-01		
6	1.7194E+03 1.1855E+01	-4.7133E+02 -3.2497E+00	-2.1884E+03 -1.5088E+01	3.6895E+03 2.5439E+01	1.6681E+02 1.1501E+00		
7	2.7577E+02 1.9014E+00	1.2851E+02 8.8608E-01	-2.5959E+01 -1.7898E-01	2.0590E+03 1.4196E+01	1.0431E+02 7.1916E-01		
8	1.3828E+02 9.5342E-01	1.0549E+02 7.2736E-01	2.4849E+01 1.7133E-01	9.8660E+02 6.8024E+00	1.7246E+02 1.1891E+00		
9	2.7411E+02 1.8900E+00	1.2739E+02 8.7832E-01	-2.6084E+01 -1.7984E-01	2.0346E+03 1.4028E+01	1.0604E+02 7.3115E-01		
10	2.0151E+03 1.3893E+01	-1.9647E+02 -1.3546E+00	-2.2175E+03 -1.5289E+01	2.9738E+03 2.0504E+01	1.1310E+03 7.7983E+00		
11	1.0455E+03 7.2083E+00	-5.0175E+02 -3.4594E+00	-2.4785E+03 -1.7088E+01	2.8860E+03 1.9898E+01	9.8837E+02 6.8146E+00		
12	-4.0632E+01 -2.8015E-01	-4.7056E+02 -3.2444E+00	-1.8677E+03 -1.2877E+01	1.8270E+03 1.2597E+01	1.4830E+02 1.0225E+00		
13	1.7748E+03 1.2237E+01	-2.8165E+02 -1.9419E+00	-1.8742E+03 -1.2922E+01	3.8536E+03 2.6570E+01	1.1148E+02 7.6863E-01		
14	1.4160E+03 9.7631E+00	-1.8130E+02 -1.2500E+00	-1.7162E+03 -1.1833E+01	3.7766E+03 2.6039E+01	5.9570E+02 4.1072E+00		
15	-5.7119E+01 -3.9382E-01	-4.2663E+02 -2.9415E+00	-2.0235E+03 -1.3952E+01	2.0599E+03 1.4203E+01	4.3397E+01 2.9921E-01		

16	2.4232E+02	-7.5334E+01	-1.6666E+03	3.9109E+03	2.3986E+02
	1.6707E+00	-5.1941E-01	-1.1491E+01	2.6964E+01	1.6538E+00
17	4.0807E+02	-5.8127E+01	-1.6408E+03	4.0396E+03	2.6708E+02
	2.8135E+00	-4.0077E-01	-1.1313E+01	2.7852E+01	1.8415E+00
18	1.2028E+03	-1.8282E+02	-1.6593E+03	4.1896E+03	2.0937E+02
	8.2928E+00	-1.2605E+00	-1.1441E+01	2.8887E+01	1.4435E+00
19	1.4025E+03	-2.7389E+02	-1.8989E+03	4.1584E+03	3.3429E+02
	9.6702E+00	-1.8884E+00	-1.3093E+01	2.8671E+01	2.3048E+00
20	1.2724E+03	-3.6571E+02	-1.9390E+03	3.2252E+03	1.4427E+02
	8.7732E+00	-2.5214E+00	-1.3369E+01	2.2237E+01	9.9472E-01
21	-2.3378E+01	-4.9304E+02	-2.1812E+03	2.2561E+03	2.4968E+02
	-1.6119E-01	-3.3994E+00	-1.5039E+01	1.5555E+01	1.7215E+00
22	-2.1886E+01	-5.2210E+02	-2.2559E+03	2.3279E+03	1.9149E+02
	-1.5090E-01	-3.5998E+00	-1.5554E+01	1.6050E+01	1.3203E+00

Table 2-185. Load Case 306, 30-ft. Cg/Corner Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-050A

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	3.6241E+02 2.4987E+00	-3.7796E+02 -2.6060E+00	-3.0391E+03 -2.0954E+01	2.9609E+03 2.0415E+01	1.3012E+03 8.9712E+00		
2	2.2850E+02 1.5754E+00	-1.2931E+02 -8.9153E-01	-3.1748E+02 -2.1889E+00	1.5271E+03 1.0529E+01	1.9067E+02 1.3146E+00		
3	2.8247E+03 1.9476E+01	3.0180E+02 2.0808E+00	-1.3501E+01 -9.3084E-02	2.8382E+03 1.9569E+01	8.0357E+02 5.5404E+00		
4	3.1109E+02 2.1449E+00	9.7584E+00 6.7282E-02	-2.1404E+03 -1.4758E+01	4.4027E+03 3.0355E+01	4.1819E+02 2.8833E+00		
5	4.7118E+02 3.2487E+00	-3.2844E+02 -2.2645E+00	-2.7219E+03 -1.8767E+01	3.1441E+03 2.1678E+01	1.7093E+02 1.1785E+00		
6	3.4172E+02 2.3560E+00	-7.2535E+02 -5.0011E+00	-3.1089E+03 -2.1435E+01	3.2182E+03 2.2189E+01	4.5712E+02 3.1517E+00		
7	5.1542E+02 3.5537E+00	5.1444E+01 3.5470E-01	-1.5408E+02 -1.0624E+00	2.9736E+03 2.0502E+01	8.5737E+01 5.9113E-01		
8	3.0008E+02 2.0690E+00	5.9366E+00 4.0931E-02	-3.4162E+02 -2.3554E+00	2.1812E+03 1.5039E+01	3.8402E+01 2.6477E-01		
9	5.5770E+02 3.8452E+00	-2.9654E+02 -2.0446E+00	-4.9361E+02 -3.4033E+00	1.5012E+03 1.0350E+01	5.1661E+01 3.5619E-01		
10	5.7426E+02 3.9594E+00	-3.6453E+02 -2.5134E+00	-5.5427E+02 -3.8215E+00	1.3589E+03 9.3690E+00	5.8017E+02 4.0001E+00		
11	9.3689E+02 6.4596E+00	-8.0768E+01 -5.5687E-01	-1.8664E+02 -1.2869E+00	1.1546E+03 7.9606E+00	3.3133E+02 2.2844E+00		
12	6.5987E+02 4.5496E+00	8.6933E+01 5.9938E-01	1.3263E+01 9.1445E-02	6.5611E+02 4.5237E+00	1.5374E+02 1.0600E+00		
13	8.6383E+02 5.9559E+00	-2.3720E+02 -1.6354E+00	-5.0409E+02 -3.4756E+00	1.3679E+03 9.4315E+00	3.2579E+01 2.2462E-01		
14	9.0588E+02 6.2458E+00	-2.3021E+02 -1.5872E+00	-4.9478E+02 -3.4114E+00	1.4007E+03 9.6572E+00	1.4811E+02 1.0212E+00		
15	4.8358E+02 3.3342E+00	9.5041E+01 6.5529E-01	-1.5041E+03 -1.0370E+01	2.0207E+03 1.3932E+01	4.2676E+01 2.9424E-01		

16	6.4475E+02	4.6722E+01	-1.6870E+03	3.6998E+03	3.0764E+02
	4.4454E+00	3.2214E-01	-1.1631E+01	2.5510E+01	2.1211E+00
17	6.3405E+02	9.6125E+01	-1.8168E+03	3.9130E+03	4.2075E+02
	4.3716E+00	6.6276E-01	-1.2526E+01	2.6979E+01	2.9010E+00
18	4.7992E+02	-9.2365E+01	-2.3860E+03	3.0079E+03	2.1165E+02
	3.3090E+00	-6.3684E-01	-1.6451E+01	2.0739E+01	1.4593E+00
19	5.3286E+02	-2.0447E+02	-2.6632E+03	2.9540E+03	5.4281E+02
	3.6739E+00	-1.4098E+00	-1.8362E+01	2.0367E+01	3.7426E+00
20	2.6583E+02	-4.9436E+02	-2.6420E+03	2.8836E+03	1.5858E+02
	1.8329E+00	-3.4085E+00	-1.8216E+01	1.9881E+01	1.0934E+00
21	4.3560E+02	-2.7056E+01	-2.9845E+02	7.2983E+02	4.1409E+01
	3.0033E+00	-1.8654E-01	-2.0578E+00	5.0320E+00	2.8551E-01
22	7.4081E+02	4.2418E+01	-1.4528E+03	2.2275E+03	1.9433E+02
	5.1077E+00	2.9246E-01	-1.0017E+01	1.5358E+01	1.3399E+00

**Table 2-186. Load Case 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.6974E+02 1.1703E+00	-6.4945E+02 -4.4778E+00	5.1804E+02 3.5717E+00	8.1919E+02 5.6481E+00	3.0668E+02 2.1145E+00		
2	1.1445E+01 7.8908E-02	-4.3328E+02 -2.9874E+00	5.5915E+01 3.8552E-01	4.4472E+02 3.0663E+00	1.0559E+02 7.2800E-01		
3	-9.5691E-01 -6.5977E-03	-1.6421E+02 -1.1322E+00	-4.6289E-01 -3.1915E-03	1.6326E+02 1.1256E+00	6.0573E+00 4.1764E-02		
4	1.1516E+03 7.9399E+00	-5.1307E+02 -3.5375E+00	9.6764E+02 6.6716E+00	1.6647E+03 1.1477E+01	1.6562E+03 1.1419E+01		
5	1.2021E+03 8.2884E+00	-1.1314E+03 -7.8007E+00	7.9134E+02 5.4561E+00	2.3335E+03 1.6089E+01	2.2243E+03 1.5336E+01		
6	-2.7456E+02 -1.8930E+00	-2.0689E+03 -1.4265E+01	2.5927E+01 1.7876E-01	1.7944E+03 1.2372E+01	7.1126E+01 4.9040E-01		
7	-2.1855E+00 -1.5069E-02	-1.1668E+03 -8.0448E+00	-2.3357E+01 -1.6104E-01	1.1646E+03 8.0297E+00	1.7503E+01 1.2068E-01		
8	-1.3331E+00 -9.1911E-03	-6.5760E+02 -4.5340E+00	-1.5021E+01 -1.0357E-01	6.5627E+02 4.5248E+00	7.0483E-02 4.8597E-04		
9	-3.5221E-01 -2.4284E-03	-3.4780E+02 -2.3980E+00	-1.2974E+01 -8.9453E-02	3.4745E+02 2.3956E+00	4.1675E+00 2.8734E-02		
10	-4.4026E+00 -3.0355E-02	-2.0145E+02 -1.3889E+00	1.3960E+02 9.6252E-01	1.9705E+02 1.3586E+00	3.1541E+02 2.1747E+00		
11	1.5797E+02 1.0891E+00	-1.7579E+02 -1.2120E+00	9.4606E+01 6.5228E-01	3.3375E+02 2.3012E+00	3.5381E+01 2.4395E-01		
12	1.2004E+02 8.2763E-01	-3.0655E+02 -2.1136E+00	1.0044E+02 6.9252E-01	4.2659E+02 2.9412E+00	6.4229E+02 4.4284E+00		
13	4.4846E+02 3.0920E+00	-2.4516E+01 -1.6903E-01	1.7786E+02 1.2263E+00	4.7298E+02 3.2611E+00	5.0223E+02 3.4627E+00		
14	4.8460E+02 3.3412E+00	-4.1545E+01 -2.8644E-01	2.0762E+02 1.4315E+00	5.2614E+02 3.6276E+00	3.8715E+02 2.6693E+00		
15	-8.3867E+03 -5.7825E+01	-4.0915E+04 -2.8210E+02	-3.9021E+03 -2.6904E+01	3.2528E+04 2.2427E+02	1.0345E+03 7.1324E+00		

16	2.0267E+03	-4.0934E+03	6.5762E+00	6.1201E+03	7.7446E+03
	1.3974E+01	-2.8223E+01	4.5342E-02	4.2197E+01	5.3397E+01
17	-8.5409E+02	-4.3894E+03	2.2172E+01	3.5353E+03	5.2415E+03
	-5.8887E+00	-3.0264E+01	1.5287E-01	2.4375E+01	3.6139E+01
18	-2.6582E+02	-2.1098E+03	-3.9135E+02	1.8440E+03	2.2186E+02
	-1.8327E+00	-1.4547E+01	-2.6983E+00	1.2714E+01	1.5297E+00
19	9.3488E+02	-1.1226E+03	1.7267E+01	2.0575E+03	2.3177E+03
	6.4458E+00	-7.7401E+00	1.1905E-01	1.4186E+01	1.5980E+01
20	1.3799E+03	-1.2267E+03	-2.3507E+02	2.6066E+03	3.3942E+03
	9.5140E+00	-8.4577E+00	-1.6207E+00	1.7972E+01	2.3402E+01
21	4.5185E+01	-1.8479E+02	-5.9691E+01	2.2997E+02	3.2562E+02
	3.1154E-01	-1.2741E+00	-4.1155E-01	1.5856E+00	2.2450E+00
22	-2.8736E+03	-1.2749E+04	-3.9544E+03	9.8759E+03	6.9379E+01
	-1.9812E+01	-8.7905E+01	-2.7264E+01	6.8092E+01	4.7835E-01

**Table 2-187. Load Combination 301, Head-On Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 301, 102, 201, 211
 30-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.06	2.88	6.94	20.00	66.30	8.55
	27.99	19.86	47.85	137.90	457.12	
2	1.50	0.11	1.61	20.00	66.30	>10
	10.37	0.74	11.11	137.90	457.12	
3	0.58	0.05	0.63	20.00	66.30	>10
	4.01	0.32	4.33	137.90	457.12	
4	7.21	6.69	13.90	20.00	66.30	3.77
	49.71	46.10	95.81	137.90	457.12	
5	3.51	5.22	8.72	20.00	66.30	6.60
	24.19	35.96	60.15	137.90	457.12	
6	1.42	1.53	2.95	20.00	66.30	>10
	9.77	10.58	20.35	137.90	457.12	
7	1.05	0.02	1.06	20.00	66.30	>10
	7.22	0.11	7.33	137.90	457.12	
8	0.99	0.00	0.99	20.00	66.30	>10
	6.79	0.01	6.80	137.90	457.12	
9	0.88	0.00	0.88	20.00	66.30	>10
	6.06	0.02	6.08	137.90	457.12	
10	1.08	0.59	1.66	20.00	66.30	>10
	7.42	4.04	11.46	137.90	457.12	
11	0.73	0.32	1.05	20.00	66.30	>10
	5.05	2.18	7.23	137.90	457.12	
12	0.42	0.47	0.89	20.00	66.30	>10
	2.90	3.25	6.15	137.90	457.12	

13	1.23 8.51	1.08 7.44	2.31 15.94	20.00 137.90	66.30 457.12	>10
14	1.12 7.74	0.76 5.24	1.88 12.98	20.00 137.90	66.30 457.12	>10
15	1.99 13.75	0.67 4.63	2.67 18.38	20.00 137.90	66.30 457.12	>10
16	1.55 10.70	1.05 7.23	2.60 17.93	20.00 137.90	66.30 457.12	>10
17	1.63 11.27	1.49 10.28	3.13 21.55	20.00 137.90	66.30 457.12	>10
18	2.33 16.07	2.87 19.82	5.21 35.89	20.00 137.90	66.30 457.12	>10
19	2.45 16.92	2.10 14.47	4.55 31.39	20.00 137.90	66.30 457.12	>10
20	1.47 10.12	2.28 15.69	3.74 25.82	20.00 137.90	66.30 457.12	>10
21	1.08 7.44	0.54 3.75	1.62 11.19	20.00 137.90	66.30 457.12	>10
22	1.13 7.82	0.69 4.76	1.82 12.58	20.00 137.90	66.30 457.12	>10

Min MS: 3.771, Location: 4, Combination: Pm+Pb

**Table 2-188. Load Combination 302, Side Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 302, 102, 201, 211
 30-ft. Side Drop + Slap-Down
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	5.25	2.94	8.19	20.00	66.30	7.09
	36.21	20.27	56.48	137.90	457.12	
2	1.15	1.07	2.23	20.00	66.30	>10
	7.95	7.41	15.36	137.90	457.12	
3	4.09	1.25	5.35	20.00	66.30	>10
	28.22	8.65	36.87	137.90	457.12	
4	4.44	3.09	7.53	20.00	66.30	7.80
	30.63	21.30	51.93	137.90	457.12	
5	4.43	2.63	7.06	20.00	66.30	8.39
	30.58	18.12	48.70	137.90	457.12	
6	3.25	1.14	4.38	20.00	66.30	>10
	22.38	7.85	30.23	137.90	457.12	
7	1.81	0.08	1.89	20.00	66.30	>10
	12.49	0.52	13.01	137.90	457.12	
8	1.05	0.12	1.17	20.00	66.30	>10
	7.21	0.85	8.06	137.90	457.12	
9	1.79	0.08	1.87	20.00	66.30	>10
	12.37	0.54	12.90	137.90	457.12	
10	2.62	1.02	3.64	20.00	66.30	>10
	18.05	7.05	25.09	137.90	457.12	
11	2.33	0.87	3.20	20.00	66.30	>10
	16.06	5.99	22.05	137.90	457.12	
12	1.54	0.22	1.75	20.00	66.30	>10
	10.61	1.49	12.10	137.90	457.12	

13	3.57 24.63	0.97 6.70	4.54 31.34	20.00 137.90	66.30 457.12	>10
14	3.51 24.18	1.07 7.38	4.58 31.56	20.00 137.90	66.30 457.12	>10
15	2.83 19.48	0.68 4.68	3.50 24.16	20.00 137.90	66.30 457.12	>10
16	3.16 21.77	0.64 4.42	3.80 26.18	20.00 137.90	66.30 457.12	>10
17	3.17 21.85	0.54 3.72	3.71 25.57	20.00 137.90	66.30 457.12	>10
18	3.51 24.17	0.96 6.65	4.47 30.82	20.00 137.90	66.30 457.12	>10
19	3.71 25.61	1.20 8.30	4.92 33.91	20.00 137.90	66.30 457.12	>10
20	3.04 20.93	1.11 7.68	4.15 28.61	20.00 137.90	66.30 457.12	>10
21	1.78 12.30	0.47 3.21	2.25 15.52	20.00 137.90	66.30 457.12	>10
22	2.38 16.44	0.50 3.43	2.88 19.87	20.00 137.90	66.30 457.12	>10

Min MS: 7.094, Location: 1, Combination: Pm+Pb

**Table 2-189. Load Combination 303, Cg/Corner Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 303, 102, 201, 211
 30-ft. Cg/Corner Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	3.31	2.63	5.94	20.00	66.30	>10
	22.82	18.14	40.97	137.90	457.12	
2	1.17	0.19	1.36	20.00	66.30	>10
	8.04	1.31	9.35	137.90	457.12	
3	2.05	0.58	2.63	20.00	66.30	>10
	14.11	4.02	18.12	137.90	457.12	
4	4.85	2.99	7.84	20.00	66.30	7.46
	33.43	20.62	54.05	137.90	457.12	
5	3.89	2.66	6.55	20.00	66.30	9.12
	26.85	18.31	45.15	137.90	457.12	
6	2.91	1.35	4.26	20.00	66.30	>10
	20.06	9.28	29.34	137.90	457.12	
7	2.47	0.06	2.53	20.00	66.30	>10
	17.01	0.43	17.44	137.90	457.12	
8	1.90	0.03	1.93	20.00	66.30	>10
	13.10	0.19	13.29	137.90	457.12	
9	1.41	0.04	1.45	20.00	66.30	>10
	9.74	0.27	10.01	137.90	457.12	
10	1.46	0.63	2.09	20.00	66.30	>10
	10.08	4.33	14.41	137.90	457.12	
11	1.09	0.40	1.49	20.00	66.30	>10
	7.51	2.76	10.27	137.90	457.12	
12	0.70	0.22	0.92	20.00	66.30	>10
	4.82	1.51	6.33	137.90	457.12	

13	1.79 12.35	0.92 6.32	2.71 18.67	20.00 137.90	66.30 457.12	>10
14	1.81 12.45	0.75 5.17	2.56 17.62	20.00 137.90	66.30 457.12	>10
15	2.80 19.29	0.68 4.67	3.48 23.97	20.00 137.90	66.30 457.12	>10
16	3.01 20.73	0.69 4.75	3.70 25.48	20.00 137.90	66.30 457.12	>10
17	3.08 21.22	0.65 4.47	3.73 25.69	20.00 137.90	66.30 457.12	>10
18	2.66 18.33	0.97 6.66	3.62 24.99	20.00 137.90	66.30 457.12	>10
19	2.85 19.68	1.35 9.33	4.21 29.00	20.00 137.90	66.30 457.12	>10
20	2.79 19.25	1.12 7.75	3.92 27.00	20.00 137.90	66.30 457.12	>10
21	0.69 4.78	0.32 2.19	1.01 6.97	20.00 137.90	66.30 457.12	>10
22	2.31 15.95	0.50 3.44	2.81 19.38	20.00 137.90	66.30 457.12	>10

Min MS: 7.457, Location: 4, Combination: Pm+Pb

Table 2-190. Load Combination 304, Head-On Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-050A

Load Cases: 304, 105, 202, 211
 30-ft. Head-On Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	5.13	3.38	8.52	20.00	70.00	7.22
	35.38	23.34	58.72	137.90	482.63	
2	2.04	0.13	2.16	20.00	70.00	>10
	14.05	0.87	14.93	137.90	482.63	
3	0.79	0.06	0.84	20.00	70.00	>10
	5.41	0.40	5.81	137.90	482.63	
4	9.14	7.92	17.06	20.00	70.00	3.10
	63.03	54.60	117.64	137.90	482.63	
5	4.10	6.04	10.13	20.00	70.00	5.91
	28.24	41.62	69.86	137.90	482.63	
6	1.70	1.71	3.41	20.00	70.00	>10
	11.72	11.82	23.54	137.90	482.63	
7	1.31	0.02	1.34	20.00	70.00	>10
	9.06	0.15	9.21	137.90	482.63	
8	1.22	0.00	1.23	20.00	70.00	>10
	8.44	0.01	8.45	137.90	482.63	
9	1.07	0.00	1.08	20.00	70.00	>10
	7.41	0.02	7.43	137.90	482.63	
10	1.18	0.60	1.78	20.00	70.00	>10
	8.13	4.17	12.30	137.90	482.63	
11	0.84	0.35	1.19	20.00	70.00	>10
	5.81	2.40	8.21	137.90	482.63	
12	0.38	0.59	0.98	20.00	70.00	>10
	2.62	4.10	6.73	137.90	482.63	

13	1.28 8.83	1.06 7.28	2.34 16.11	20.00 137.90	70.00 482.63	>10
14	1.14 7.89	0.70 4.85	1.85 12.73	20.00 137.90	70.00 482.63	>10
15	1.88 12.95	0.25 1.70	2.13 14.65	20.00 137.90	70.00 482.63	>10
16	1.78 12.24	0.92 6.31	2.69 18.56	20.00 137.90	70.00 482.63	>10
17	1.97 13.56	1.69 11.62	3.65 25.18	20.00 137.90	70.00 482.63	>10
18	2.81 19.40	3.35 23.12	6.17 42.51	20.00 137.90	70.00 482.63	>10
19	2.76 19.06	1.99 13.75	4.76 32.81	20.00 137.90	70.00 482.63	>10
20	1.50 10.34	2.30 15.89	3.80 26.23	20.00 137.90	70.00 482.63	>10
21	1.35 9.28	0.56 3.88	1.91 13.17	20.00 137.90	70.00 482.63	>10
22	1.15 7.93	0.71 4.92	1.86 12.84	20.00 137.90	70.00 482.63	>10

Min MS: 3.103, Location: 4, Combination: Pm+Pb

Table 2-191. Load Combination 305, Side Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-050A

Load Cases: 305, 105, 202, 211
 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	6.87	3.43	10.30	20.00	70.00	5.79
	47.37	23.67	71.04	137.90	482.63	
2	1.58	1.48	3.06	20.00	70.00	>10
	10.88	10.23	21.11	137.90	482.63	
3	5.71	1.75	7.46	20.00	70.00	7.40
	39.38	12.07	51.45	137.90	482.63	
4	5.31	2.91	8.22	20.00	70.00	7.52
	36.64	20.04	56.68	137.90	482.63	
5	5.41	2.44	7.85	20.00	70.00	7.87
	37.30	16.82	54.12	137.90	482.63	
6	4.26	1.17	5.43	20.00	70.00	>10
	29.40	8.06	37.46	137.90	482.63	
7	2.39	0.11	2.49	20.00	70.00	>10
	16.47	0.73	17.19	137.90	482.63	
8	1.32	0.17	1.49	20.00	70.00	>10
	9.08	1.19	10.27	137.90	482.63	
9	2.36	0.11	2.47	20.00	70.00	>10
	16.30	0.74	17.04	137.90	482.63	
10	3.35	1.22	4.57	20.00	70.00	>10
	23.07	8.42	31.49	137.90	482.63	
11	3.09	1.12	4.21	20.00	70.00	>10
	21.28	7.74	29.03	137.90	482.63	
12	1.95	0.24	2.19	20.00	70.00	>10
	13.43	1.68	15.11	137.90	482.63	

13	4.56	0.91	5.47	20.00	70.00	9.53
	31.44	6.26	37.70	137.90	482.63	
14	4.49	1.14	5.63	20.00	70.00	9.70
	30.94	7.85	38.79	137.90	482.63	
15	3.03	0.25	3.29	20.00	70.00	>10
	20.92	1.76	22.67	137.90	482.63	
16	4.02	0.36	4.38	20.00	70.00	>10
	27.74	2.46	30.20	137.90	482.63	
17	4.14	0.38	4.52	20.00	70.00	>10
	28.56	2.59	31.15	137.90	482.63	
18	4.48	0.70	5.17	20.00	70.00	9.72
	30.86	4.81	35.67	137.90	482.63	
19	4.54	0.75	5.29	20.00	70.00	9.56
	31.33	5.15	36.49	137.90	482.63	
20	3.70	0.69	4.39	20.00	70.00	>10
	25.51	4.74	30.24	137.90	482.63	
21	2.36	0.46	2.82	20.00	70.00	>10
	16.25	3.17	19.42	137.90	482.63	
22	2.91	0.46	3.37	20.00	70.00	>10
	20.09	3.16	23.25	137.90	482.63	

Min MS: 5.793, Location: 1, Combination: Pm+Pb

Table 2-192. Load Combination 306, Cg/Corner Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-050A

Load Cases: 306, 105, 202, 211
 30-ft. Cg/Corner Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.15	3.00	7.15	20.00	70.00	8.79
	28.62	20.70	49.32	137.90	482.63	
2	1.60	0.24	1.84	20.00	70.00	>10
	11.04	1.68	12.72	137.90	482.63	
3	2.87	0.82	3.69	20.00	70.00	>10
	19.79	5.63	25.41	137.90	482.63	
4	5.89	2.77	8.66	20.00	70.00	7.09
	40.60	19.09	59.68	137.90	482.63	
5	4.65	2.48	7.13	20.00	70.00	8.82
	32.07	17.09	49.16	137.90	482.63	
6	3.79	1.46	5.25	20.00	70.00	>10
	26.15	10.06	36.21	137.90	482.63	
7	3.30	0.09	3.39	20.00	70.00	>10
	22.77	0.60	23.37	137.90	482.63	
8	2.51	0.04	2.55	20.00	70.00	>10
	17.31	0.27	17.58	137.90	482.63	
9	1.83	0.05	1.88	20.00	70.00	>10
	12.62	0.36	12.99	137.90	482.63	
10	1.73	0.67	2.40	20.00	70.00	>10
	11.94	4.62	16.56	137.90	482.63	
11	1.36	0.47	1.82	20.00	70.00	>10
	9.35	3.21	12.56	137.90	482.63	
12	0.78	0.25	1.03	20.00	70.00	>10
	5.36	1.72	7.08	137.90	482.63	

13	2.07	0.83	2.90	20.00	70.00	>10
	14.30	5.72	20.02	137.90	482.63	
14	2.11	0.69	2.80	20.00	70.00	>10
	14.56	4.76	19.33	137.90	482.63	
15	2.99	0.25	3.25	20.00	70.00	>10
	20.65	1.75	22.40	137.90	482.63	
16	3.81	0.42	4.24	20.00	70.00	>10
	26.28	2.93	29.21	137.90	482.63	
17	4.02	0.53	4.54	20.00	70.00	>10
	27.69	3.65	31.33	137.90	482.63	
18	3.29	0.70	3.99	20.00	70.00	>10
	22.72	4.83	27.54	137.90	482.63	
19	3.34	0.96	4.30	20.00	70.00	>10
	23.03	6.59	29.62	137.90	482.63	
20	3.36	0.70	4.06	20.00	70.00	>10
	23.15	4.84	27.99	137.90	482.63	
21	0.83	0.25	1.08	20.00	70.00	>10
	5.72	1.74	7.46	137.90	482.63	
22	2.81	0.46	3.27	20.00	70.00	>10
	19.40	3.18	22.58	137.90	482.63	

Min MS: 7.087, Location: 4, Combination: Pm+Pb

Table 2-193. Load Combination 310, Additional Increased External Pressure (290 psi), Hypothetical Accident Conditions of Transport – Model AOS-050A

Load Cases: 204, 101, 211

Additional Increased External Pressure, 2 MPa (290 psia)

100°F Ambient, Maximum Decay Heat

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.30	1.70	3.00	20.00	66.30	>10
	8.98	11.74	20.71	137.90	457.12	
2	0.19	0.06	0.25	20.00	66.30	>10
	1.33	0.40	1.73	137.90	457.12	
3	0.15	0.06	0.22	20.00	66.30	>10
	1.07	0.43	1.50	137.90	457.12	
4	6.40	10.98	17.38	20.00	66.30	2.82
	44.11	75.70	119.81	137.90	457.12	
5	6.16	9.39	15.55	20.00	66.30	3.26
	42.46	64.77	107.23	137.90	457.12	
6	2.26	3.81	6.07	20.00	66.30	9.92
	15.59	26.25	41.84	137.90	457.12	
7	1.51	0.01	1.52	20.00	66.30	>10
	10.39	0.08	10.47	137.90	457.12	
8	1.51	0.00	1.51	20.00	66.30	>10
	10.39	0.01	10.40	137.90	457.12	
9	1.51	0.02	1.52	20.00	66.30	>10
	10.38	0.13	10.51	137.90	457.12	
10	1.42	0.78	2.20	20.00	66.30	>10
	9.82	5.37	15.19	137.90	457.12	
11	0.86	0.49	1.35	20.00	66.30	>10
	5.96	3.37	9.33	137.90	457.12	
12	1.47	2.40	3.87	20.00	66.30	>10
	10.16	16.53	26.69	137.90	457.12	
13	1.74	2.04	3.78	20.00	66.30	>10
	11.99	14.06	26.05	137.90	457.12	

14	1.50	0.89	2.38	20.00	66.30	>10
	10.31	6.11	16.42	137.90	457.12	
15	5.55	0.29	5.85	20.00	66.30	7.36
	38.30	2.02	40.31	137.90	457.12	
16	0.68	0.85	1.54	20.00	66.30	>10
	4.71	5.88	10.59	137.90	457.12	
17	0.53	0.88	1.41	20.00	66.30	>10
	3.68	6.07	9.74	137.90	457.12	
18	0.90	1.60	2.50	20.00	66.30	>10
	6.24	11.00	17.24	137.90	457.12	
19	1.22	1.26	2.48	20.00	66.30	>10
	8.42	8.65	17.07	137.90	457.12	
20	1.50	1.35	2.84	20.00	66.30	>10
	10.32	9.30	19.62	137.90	457.12	
21	1.78	1.47	3.25	20.00	66.30	>10
	12.26	10.13	22.39	137.90	457.12	
22	2.08	0.54	2.62	20.00	66.30	>10
	14.31	3.76	18.06	137.90	457.12	

Min MS: 2.815, Location: 4, Combination: Pm+Pb

**Table 2-194. Load Combination 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 311, 101, 201, 211
 4-ft. Drop onto Rod
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	2.01 13.88	2.01 13.85	4.02 27.73	20.00 137.90	66.30 457.12	>10
2	0.52 3.60	0.16 1.09	0.68 4.69	20.00 137.90	66.30 457.12	>10
3	0.20 1.37	0.02 0.13	0.22 1.50	20.00 137.90	66.30 457.12	>10
4	3.37 23.25	4.35 29.98	7.72 53.23	20.00 137.90	66.30 457.12	7.59
5	3.98 27.45	4.76 32.80	8.74 60.25	20.00 137.90	66.30 457.12	6.59
6	2.40 16.58	1.09 7.52	3.50 24.10	20.00 137.90	66.30 457.12	>10
7	1.50 10.38	0.02 0.13	1.52 10.51	20.00 137.90	66.30 457.12	>10
8	1.00 6.87	0.00 0.00	1.00 6.88	20.00 137.90	66.30 457.12	>10
9	0.69 4.74	0.01 0.04	0.69 4.78	20.00 137.90	66.30 457.12	>10
10	0.69 4.76	0.53 3.65	1.22 8.41	20.00 137.90	66.30 457.12	>10
11	0.60 4.15	0.20 1.37	0.80 5.51	20.00 137.90	66.30 457.12	>10
12	0.66 4.55	0.75 5.19	1.41 9.73	20.00 137.90	66.30 457.12	>10

13	1.29 8.91	1.39 9.62	2.69 18.53	20.00 137.90	66.30 457.12	>10
14	1.34 9.21	1.03 7.11	2.37 16.33	20.00 137.90	66.30 457.12	>10
15	33.88 233.61	1.68 11.60	35.56 245.21	20.00 137.90	66.30 457.12	0.37
16	6.48 44.70	8.21 56.63	14.70 101.33	20.00 137.90	66.30 457.12	3.51
17	3.82 26.33	5.59 38.54	9.41 64.87	20.00 137.90	66.30 457.12	6.05
18	2.36 16.25	1.04 7.15	3.39 23.39	20.00 137.90	66.30 457.12	>10
19	2.80 19.32	3.28 22.63	6.08 41.95	20.00 137.90	66.30 457.12	9.90
20	3.34 23.02	4.41 30.37	7.74 53.39	20.00 137.90	66.30 457.12	7.56
21	0.40 2.78	0.61 4.23	1.02 7.00	20.00 137.90	66.30 457.12	>10
22	10.60 73.06	0.43 2.96	11.03 76.03	20.00 137.90	66.30 457.12	3.38

Min MS: 0.370, Location: 15, Combination: Pm

Table 2-195. Load Combination 312, 4-ft. Drop onto Rod at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-050A

Load Cases: 311, 104, 201, 211
 4-ft. Drop onto Rod
 -40°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 414 kPa (60 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	2.01 13.88	2.01 13.85	4.02 27.73	20.00 137.90	70.00 482.63	>10
2	0.52 3.60	0.16 1.09	0.68 4.69	20.00 137.90	70.00 482.63	>10
3	0.20 1.37	0.02 0.13	0.22 1.50	20.00 137.90	70.00 482.63	>10
4	3.37 23.25	4.35 29.98	7.72 53.23	20.00 137.90	70.00 482.63	8.07
5	3.98 27.45	4.76 32.80	8.74 60.25	20.00 137.90	70.00 482.63	7.01
6	2.40 16.58	1.09 7.52	3.50 24.10	20.00 137.90	70.00 482.63	>10
7	1.50 10.38	0.02 0.13	1.52 10.51	20.00 137.90	70.00 482.63	>10
8	1.00 6.87	0.00 0.00	1.00 6.88	20.00 137.90	70.00 482.63	>10
9	0.69 4.74	0.01 0.04	0.69 4.78	20.00 137.90	70.00 482.63	>10
10	0.69 4.76	0.53 3.65	1.22 8.41	20.00 137.90	70.00 482.63	>10
11	0.60 4.15	0.20 1.37	0.80 5.51	20.00 137.90	70.00 482.63	>10
12	0.66 4.55	0.75 5.19	1.41 9.73	20.00 137.90	70.00 482.63	>10

13	1.29 8.91	1.39 9.62	2.69 18.53	20.00 137.90	70.00 482.63	>10
14	1.34 9.21	1.03 7.11	2.37 16.33	20.00 137.90	70.00 482.63	>10
15	33.88 233.61	1.68 11.60	35.56 245.21	20.00 137.90	70.00 482.63	0.42
16	6.48 44.70	8.21 56.63	14.70 101.33	20.00 137.90	70.00 482.63	3.76
17	3.82 26.33	5.59 38.54	9.41 64.87	20.00 137.90	70.00 482.63	6.44
18	2.36 16.25	1.04 7.15	3.39 23.39	20.00 137.90	70.00 482.63	>10
19	2.80 19.32	3.28 22.63	6.08 41.95	20.00 137.90	70.00 482.63	>10
20	3.34 23.02	4.41 30.37	7.74 53.39	20.00 137.90	70.00 482.63	8.04
21	0.40 2.78	0.61 4.23	1.02 7.00	20.00 137.90	70.00 482.63	>10
22	10.60 73.06	0.43 2.96	11.03 76.03	20.00 137.90	70.00 482.63	3.53

Min MS: 0.417, Location: 15, Combination: Pm

**Table 2-196. Load Combination 350, Fire at 30 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 111, 201, 211

Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	1.19	1.70	2.90	20.00	66.30	>10
	8.23	11.73	19.97	137.90	457.12	
2	0.08	0.05	0.13	20.00	66.30	>10
	0.53	0.37	0.90	137.90	457.12	
3	0.04	0.01	0.05	20.00	66.30	>10
	0.24	0.09	0.33	137.90	457.12	
4	1.71	2.69	4.40	20.00	66.30	>10
	11.78	18.56	30.33	137.90	457.12	
5	1.65	2.53	4.18	20.00	66.30	>10
	11.36	17.47	28.83	137.90	457.12	
6	0.61	1.02	1.63	20.00	66.30	>10
	4.21	7.03	11.24	137.90	457.12	
7	0.34	0.00	0.34	20.00	66.30	>10
	2.35	0.01	2.36	137.90	457.12	
8	0.34	0.00	0.34	20.00	66.30	>10
	2.35	0.00	2.35	137.90	457.12	
9	0.34	0.00	0.34	20.00	66.30	>10
	2.35	0.01	2.36	137.90	457.12	
10	0.49	0.21	0.71	20.00	66.30	>10
	3.40	1.48	4.88	137.90	457.12	
11	0.27	0.16	0.43	20.00	66.30	>10
	1.85	1.12	2.97	137.90	457.12	
12	0.23	0.11	0.34	20.00	66.30	>10
	1.61	0.76	2.37	137.90	457.12	
13	0.82	0.89	1.71	20.00	66.30	>10
	5.65	6.15	11.81	137.90	457.12	

14	0.81 5.58	0.64 4.45	1.45 10.03	20.00 137.90	66.30 457.12	>10
15	1.35 9.34	0.65 4.46	2.00 13.80	20.00 137.90	66.30 457.12	>10
16	0.36 2.51	0.47 3.23	0.83 5.74	20.00 137.90	66.30 457.12	>10
17	0.28 1.95	0.35 2.40	0.63 4.36	20.00 137.90	66.30 457.12	>10
18	0.51 3.53	0.81 5.62	1.33 9.15	20.00 137.90	66.30 457.12	>10
19	0.74 5.13	0.97 6.65	1.71 11.78	20.00 137.90	66.30 457.12	>10
20	0.73 5.04	1.01 6.97	1.74 12.01	20.00 137.90	66.30 457.12	>10
21	0.17 1.19	0.29 1.98	0.46 3.17	20.00 137.90	66.30 457.12	>10
22	0.72 4.97	0.36 2.48	1.08 7.46	20.00 137.90	66.30 457.12	>10

Min MS: 14.069, Location: 4, Combination: Pm+Pb

**Table 2-197. Load Combination 351, Post Fire at 60 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 112, 201, 211

Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	1.19	1.70	2.90	18.70	59.70	>10
	8.23	11.73	19.97	128.93	411.62	
2	0.08	0.05	0.13	18.70	59.70	>10
	0.53	0.37	0.90	128.93	411.62	
3	0.04	0.01	0.05	18.70	59.70	>10
	0.24	0.09	0.33	128.93	411.62	
4	1.71	2.69	4.40	18.70	59.70	>10
	11.78	18.56	30.33	128.93	411.62	
5	1.65	2.53	4.18	18.70	59.70	>10
	11.36	17.47	28.83	128.93	411.62	
6	0.61	1.02	1.63	18.70	59.70	>10
	4.21	7.03	11.24	128.93	411.62	
7	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
8	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.00	2.35	128.93	411.62	
9	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
10	0.49	0.21	0.71	18.70	59.70	>10
	3.40	1.48	4.88	128.93	411.62	
11	0.27	0.16	0.43	18.70	59.70	>10
	1.85	1.12	2.97	128.93	411.62	
12	0.23	0.11	0.34	18.70	59.70	>10
	1.61	0.76	2.37	128.93	411.62	
13	0.82	0.89	1.71	18.70	59.70	>10
	5.65	6.15	11.81	128.93	411.62	

14	0.81 5.58	0.64 4.45	1.45 10.03	18.70 128.93	59.70 411.62	>10
15	1.35 9.34	0.65 4.46	2.00 13.80	20.00 137.90	61.80 426.10	>10
16	0.36 2.51	0.47 3.23	0.83 5.74	20.00 137.90	61.80 426.10	>10
17	0.28 1.95	0.35 2.40	0.63 4.36	20.00 137.90	61.80 426.10	>10
18	0.51 3.53	0.81 5.62	1.33 9.15	18.70 128.93	59.70 411.62	>10
19	0.74 5.13	0.97 6.65	1.71 11.78	18.70 128.93	59.70 411.62	>10
20	0.73 5.04	1.01 6.97	1.74 12.01	18.70 128.93	59.70 411.62	>10
21	0.17 1.19	0.29 1.98	0.46 3.17	20.00 137.90	61.80 426.10	>10
22	0.72 4.97	0.36 2.48	1.08 7.46	20.00 137.90	61.80 426.10	>10

Min MS: 12.569, Location: 4, Combination: Pm+Pb

**Table 2-198. Load Combination 352, Post Fire at 90 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 112, 201, 211

Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	1.19	1.70	2.90	18.70	59.70	>10
	8.23	11.73	19.97	128.93	411.62	
2	0.08	0.05	0.13	18.70	59.70	>10
	0.53	0.37	0.90	128.93	411.62	
3	0.04	0.01	0.05	18.70	59.70	>10
	0.24	0.09	0.33	128.93	411.62	
4	1.71	2.69	4.40	18.70	59.70	>10
	11.78	18.56	30.33	128.93	411.62	
5	1.65	2.53	4.18	18.70	59.70	>10
	11.36	17.47	28.83	128.93	411.62	
6	0.61	1.02	1.63	18.70	59.70	>10
	4.21	7.03	11.24	128.93	411.62	
7	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
8	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.00	2.35	128.93	411.62	
9	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
10	0.49	0.21	0.71	18.70	59.70	>10
	3.40	1.48	4.88	128.93	411.62	
11	0.27	0.16	0.43	18.70	59.70	>10
	1.85	1.12	2.97	128.93	411.62	
12	0.23	0.11	0.34	18.70	59.70	>10
	1.61	0.76	2.37	128.93	411.62	
13	0.82	0.89	1.71	18.70	59.70	>10
	5.65	6.15	11.81	128.93	411.62	

14	0.81 5.58	0.64 4.45	1.45 10.03	18.70 128.93	59.70 411.62	>10
15	1.35 9.34	0.65 4.46	2.00 13.80	18.70 128.93	59.70 411.62	>10
16	0.36 2.51	0.47 3.23	0.83 5.74	18.70 128.93	59.70 411.62	>10
17	0.28 1.95	0.35 2.40	0.63 4.36	18.70 128.93	59.70 411.62	>10
18	0.51 3.53	0.81 5.62	1.33 9.15	18.70 128.93	59.70 411.62	>10
19	0.74 5.13	0.97 6.65	1.71 11.78	18.70 128.93	59.70 411.62	>10
20	0.73 5.04	1.01 6.97	1.74 12.01	18.70 128.93	59.70 411.62	>10
21	0.17 1.19	0.29 1.98	0.46 3.17	18.70 128.93	59.70 411.62	>10
22	0.72 4.97	0.36 2.48	1.08 7.46	18.70 128.93	59.70 411.62	>10

Min MS: 12.569, Location: 4, Combination: Pm+Pb

**Table 2-199. Load Combination 353, Post Fire at 120 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 112, 201, 211

Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	1.19	1.70	2.90	18.70	59.70	>10
	8.23	11.73	19.97	128.93	411.62	
2	0.08	0.05	0.13	18.70	59.70	>10
	0.53	0.37	0.90	128.93	411.62	
3	0.04	0.01	0.05	18.70	59.70	>10
	0.24	0.09	0.33	128.93	411.62	
4	1.71	2.69	4.40	18.70	59.70	>10
	11.78	18.56	30.33	128.93	411.62	
5	1.65	2.53	4.18	18.70	59.70	>10
	11.36	17.47	28.83	128.93	411.62	
6	0.61	1.02	1.63	18.70	59.70	>10
	4.21	7.03	11.24	128.93	411.62	
7	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
8	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.00	2.35	128.93	411.62	
9	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
10	0.49	0.21	0.71	18.70	59.70	>10
	3.40	1.48	4.88	128.93	411.62	
11	0.27	0.16	0.43	18.70	59.70	>10
	1.85	1.12	2.97	128.93	411.62	
12	0.23	0.11	0.34	18.70	59.70	>10
	1.61	0.76	2.37	128.93	411.62	
13	0.82	0.89	1.71	18.70	59.70	>10
	5.65	6.15	11.81	128.93	411.62	

14	0.81 5.58	0.64 4.45	1.45 10.03	18.70 128.93	59.70 411.62	>10
15	1.35 9.34	0.65 4.46	2.00 13.80	18.70 128.93	59.70 411.62	>10
16	0.36 2.51	0.47 3.23	0.83 5.74	18.70 128.93	59.70 411.62	>10
17	0.28 1.95	0.35 2.40	0.63 4.36	18.70 128.93	59.70 411.62	>10
18	0.51 3.53	0.81 5.62	1.33 9.15	18.70 128.93	59.70 411.62	>10
19	0.74 5.13	0.97 6.65	1.71 11.78	18.70 128.93	59.70 411.62	>10
20	0.73 5.04	1.01 6.97	1.74 12.01	18.70 128.93	59.70 411.62	>10
21	0.17 1.19	0.29 1.98	0.46 3.17	18.70 128.93	59.70 411.62	>10
22	0.72 4.97	0.36 2.48	1.08 7.46	18.70 128.93	59.70 411.62	>10

Min MS: 12.569, Location: 4, Combination: Pm+Pb

**Table 2-200. Load Combination 354, Post Fire at 150 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 112, 201, 211

Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.19	1.70	2.90	18.70	59.70	>10
	8.23	11.73	19.97	128.93	411.62	
2	0.08	0.05	0.13	18.70	59.70	>10
	0.53	0.37	0.90	128.93	411.62	
3	0.04	0.01	0.05	18.70	59.70	>10
	0.24	0.09	0.33	128.93	411.62	
4	1.71	2.69	4.40	18.70	59.70	>10
	11.78	18.56	30.33	128.93	411.62	
5	1.65	2.53	4.18	18.70	59.70	>10
	11.36	17.47	28.83	128.93	411.62	
6	0.61	1.02	1.63	18.70	59.70	>10
	4.21	7.03	11.24	128.93	411.62	
7	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
8	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.00	2.35	128.93	411.62	
9	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
10	0.49	0.21	0.71	18.70	59.70	>10
	3.40	1.48	4.88	128.93	411.62	
11	0.27	0.16	0.43	18.70	59.70	>10
	1.85	1.12	2.97	128.93	411.62	
12	0.23	0.11	0.34	18.70	59.70	>10
	1.61	0.76	2.37	128.93	411.62	
13	0.82	0.89	1.71	18.70	59.70	>10
	5.65	6.15	11.81	128.93	411.62	

14	0.81 5.58	0.64 4.45	1.45 10.03	18.70 128.93	59.70 411.62	>10
15	1.35 9.34	0.65 4.46	2.00 13.80	18.70 128.93	59.70 411.62	>10
16	0.36 2.51	0.47 3.23	0.83 5.74	18.70 128.93	59.70 411.62	>10
17	0.28 1.95	0.35 2.40	0.63 4.36	18.70 128.93	59.70 411.62	>10
18	0.51 3.53	0.81 5.62	1.33 9.15	18.70 128.93	59.70 411.62	>10
19	0.74 5.13	0.97 6.65	1.71 11.78	18.70 128.93	59.70 411.62	>10
20	0.73 5.04	1.01 6.97	1.74 12.01	18.70 128.93	59.70 411.62	>10
21	0.17 1.19	0.29 1.98	0.46 3.17	18.70 128.93	59.70 411.62	>10
22	0.72 4.97	0.36 2.48	1.08 7.46	18.70 128.93	59.70 411.62	>10

Min MS: 12.569, Location: 4, Combination: Pm+Pb

**Table 2-201. Load Combination 355, Post Fire at 180 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-050A**

Load Cases: 112, 201, 211

Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 414 kPa (60 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.19	1.70	2.90	18.70	59.70	>10
	8.23	11.73	19.97	128.93	411.62	
2	0.08	0.05	0.13	18.70	59.70	>10
	0.53	0.37	0.90	128.93	411.62	
3	0.04	0.01	0.05	18.70	59.70	>10
	0.24	0.09	0.33	128.93	411.62	
4	1.71	2.69	4.40	18.70	59.70	>10
	11.78	18.56	30.33	128.93	411.62	
5	1.65	2.53	4.18	18.70	59.70	>10
	11.36	17.47	28.83	128.93	411.62	
6	0.61	1.02	1.63	18.70	59.70	>10
	4.21	7.03	11.24	128.93	411.62	
7	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
8	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.00	2.35	128.93	411.62	
9	0.34	0.00	0.34	18.70	59.70	>10
	2.35	0.01	2.36	128.93	411.62	
10	0.49	0.21	0.71	18.70	59.70	>10
	3.40	1.48	4.88	128.93	411.62	
11	0.27	0.16	0.43	18.70	59.70	>10
	1.85	1.12	2.97	128.93	411.62	
12	0.23	0.11	0.34	18.70	59.70	>10
	1.61	0.76	2.37	128.93	411.62	
13	0.82	0.89	1.71	18.70	59.70	>10
	5.65	6.15	11.81	128.93	411.62	

14	0.81 5.58	0.64 4.45	1.45 10.03	18.70 128.93	59.70 411.62	>10
15	1.35 9.34	0.65 4.46	2.00 13.80	18.70 128.93	59.70 411.62	>10
16	0.36 2.51	0.47 3.23	0.83 5.74	18.70 128.93	59.70 411.62	>10
17	0.28 1.95	0.35 2.40	0.63 4.36	18.70 128.93	59.70 411.62	>10
18	0.51 3.53	0.81 5.62	1.33 9.15	18.70 128.93	59.70 411.62	>10
19	0.74 5.13	0.97 6.65	1.71 11.78	18.70 128.93	59.70 411.62	>10
20	0.73 5.04	1.01 6.97	1.74 12.01	18.70 128.93	59.70 411.62	>10
21	0.17 1.19	0.29 1.98	0.46 3.17	18.70 128.93	59.70 411.62	>10
22	0.72 4.97	0.36 2.48	1.08 7.46	18.70 128.93	59.70 411.62	>10

Min MS: 12.569, Location: 4, Combination: Pm+Pb

2.12.2.3 Structural Evaluation Results – Models AOS-100A and AOS-100A-S

This appendix presents the following information, specific to the Model AOS-100A and AOS-100A-S transport packages:

- [Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Models AOS-100A and AOS-100A-S](#)
- [Hypothetical Accident Conditions of Transport Summary of Damages \(Stresses\) – Models AOS-100A and AOS-100A-S](#)

Note: *The drop analyses results for the Model AOS-100A and AOS-100A-S are covered by the drop analysis for the Model AOS-100A, because both models have the same dimensions and weight. Refer to [Subsection 2.7.1](#) for information on the Free Drop for the Model AOS-100. Impact Free Drop analysis on the Model AOS-100B conservatively used the impact forces identified for the Model AOS-100A.*

2.12.2.3.1 Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Models AOS-100A and AOS-100A-S

Table 2-202 and Table 2-203 present Model AOS-100A and AOS-100A-S transport package Load Cases and Load Combinations, respectively, under Normal conditions of transport:

- Table 2-204 through Table 2-221 present Load Case output data. Comparisons with allowable stress limits are included for Load Cases 101, 102, 103, 104, 105, and 106.
- Table 2-222 through Table 2-238 present Load Combination output data.

Table 2-202. Load Cases Associated with Allowable Stresses under Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Case	Description	Data
101	100°F Ambient, Maximum Decay Heat	Table 2-204
102	100°F Ambient, Maximum Decay Heat, Maximum Insolation	Table 2-205
103	-20°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-206
104	-40°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-207
105	-40°F Ambient, Maximum Decay Heat	Table 2-208
106	-20°F Ambient, Maximum Decay Heat	Table 2-209
201	Internal Design Pressure, 1,930 kPa (280 psia)	Table 2-210
202	Minimum External Pressure, 24 kPa (3.5 psia)	Table 2-211
203	Maximum Increased External Pressure, 140 kPa (20 psia)	Table 2-212
204	Additional Increased External Pressure, 2 MPa (290 psia)	Table 2-213
211	Fabrication Stress	Table 2-214
215	Compression Load (5x weight)	Table 2-215
216	Rod Drop onto Cask	Table 2-216
221	Forward 10g Vibration Inertia Load	Table 2-217
222	Lateral 5g Vibration Inertia Load	Table 2-218
223	Vertical 2g Vibration Inertia Load	Table 2-219
231	3-ft. Head-On Drop	Table 2-220
232	30-ft. Head-On Drop Impact Test, Normal Conditions	Table 2-221

**Table 2-203. Load Combinations Associated with Allowable Stresses
under Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Combination	Load Cases	Description	Data
101	102, 201, 211	Hot Environment	Table 2-222
102	104, 201, 211	Cold Environment	Table 2-223
103	103, 202, 211	Increased External Pressure	Table 2-224
104	101, 201, 202, 211	Minimum External Pressure	Table 2-225
105	105, 201, 202, 211	Cold Environment with Maximum Decay Heat	Table 2-226
106	101, 201, 203, 211	Maximum Pressure, Hot Environment	Table 2-227
107	105, 201, 203, 211	Maximum Pressure, Cold Environment	Table 2-228
215	215, 101, 201, 211	Compression Load	Table 2-229
216	216, 101, 201, 211	Rod Drop	Table 2-230
217	216, 104, 201, 211	Rod Drop, Cold Environment	Table 2-231
221	221, 101, 201, 211	Forward Vibration	Table 2-232
222	222, 101, 201, 211	Lateral Vibration	Table 2-233
223	223, 101, 201, 211	Vertical Vibration	Table 2-234
224	221, 103, 201, 211	Forward Vibration at Cold Temperature	Table 2-235
225	222, 103, 201, 211	Lateral Vibration at Cold Temperature	Table 2-236
226	223, 103, 201, 211	Vertical Vibration at Cold Temperature	Table 2-237
231	231, 102, 201, 211	3-ft. Head-On Drop, Normal Conditions	Table 2-238
232 ^a	232, 102, 201, 211	30-ft. Head-On Drop, Normal Conditions (Impact Test)	—
233	231, 103, 211	3-ft. Drop at Cold Temperature	Table 2-239

a. Load Combination 232 is documented only for the Model AOS-025A and AOS-050A transport packages, and demonstrates compliance with the requirements of IAEA TS-R-1, Paragraph 737 (Reference [\[2.2\]](#)).

**Table 2-204. Load Case 101, 100°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.0801E+02 7.4467E-01	-1.9311E+02 -1.3314E+00	-1.4653E+01 -1.0103E-01	3.0111E+02 2.0761E+00	4.2883E+02 2.9567E+00
2	1.4322E+02 9.8744E-01	-3.0638E+02 -2.1124E+00	-9.4421E+01 -6.5101E-01	4.4959E+02 3.0998E+00	9.2433E+02 6.3731E+00
3	1.0532E+02 7.2617E-01	-1.9335E+02 -1.3331E+00	7.5520E+00 5.2070E-02	2.9868E+02 2.0593E+00	4.2414E+02 2.9243E+00
4	6.6414E+02 4.5791E+00	-2.4376E+03 -1.6807E+01	-4.6417E+02 -3.2004E+00	3.1017E+03 2.1386E+01	6.1156E+03 4.2166E+01
5	6.3776E+02 4.3972E+00	-2.6798E+03 -1.8477E+01	-1.2856E+03 -8.8641E+00	3.3176E+03 2.2874E+01	5.2411E+03 3.6136E+01
6	9.3000E+01 6.4121E-01	-1.3406E+03 -9.2431E+00	-1.7179E+03 -1.1845E+01	1.4336E+03 9.8843E+00	1.7073E+03 1.1771E+01
7	-5.3968E+01 -3.7210E-01	-4.5240E+02 -3.1192E+00	-2.8746E+02 -1.9820E+00	3.9843E+02 2.7471E+00	4.1031E+02 2.8290E+00
8	-5.4135E+01 -3.7325E-01	-4.5242E+02 -3.1193E+00	-3.0834E+02 -2.1259E+00	3.9829E+02 2.7461E+00	4.1217E+02 2.8418E+00
9	-5.3811E+01 -3.7101E-01	-4.5187E+02 -3.1155E+00	-3.2323E+02 -2.2286E+00	3.9806E+02 2.7445E+00	3.9634E+02 2.7327E+00
10	-6.6535E+01 -4.5874E-01	-7.3165E+02 -5.0446E+00	4.6671E+01 3.2179E-01	6.6512E+02 4.5858E+00	1.2510E+03 8.6251E+00
11	-1.9259E+02 -1.3279E+00	-1.0216E+03 -7.0433E+00	-4.9584E+02 -3.4187E+00	8.2896E+02 5.7155E+00	1.5013E+02 1.0351E+00
12	2.5098E+00 1.7305E-02	-1.2511E+03 -8.6259E+00	-1.2417E+03 -8.5616E+00	1.2536E+03 8.6432E+00	1.8636E+02 1.2849E+00
13	-9.4089E+01 -6.4872E-01	-1.5636E+03 -1.0781E+01	-1.5283E+02 -1.0537E+00	1.4695E+03 1.0132E+01	5.7985E+02 3.9979E+00
14	-1.2335E+02 -8.5049E-01	-1.3668E+03 -9.4237E+00	1.3841E+02 9.5432E-01	1.2434E+03 8.5732E+00	1.0214E+03 7.0423E+00
15	3.4153E+02 2.3548E+00	-3.3102E+02 -2.2823E+00	4.8566E+01 3.3485E-01	6.7255E+02 4.6371E+00	1.1360E+03 7.8321E+00

16	9.7236E+01	-1.4949E+02	-1.5531E+02	2.4673E+02	4.0501E+02
	6.7042E-01	-1.0307E+00	-1.0708E+00	1.7011E+00	2.7925E+00
17	4.3967E+01	-1.1986E+02	-1.3120E+02	1.6383E+02	2.8967E+02
	3.0314E-01	-8.2644E-01	-9.0462E-01	1.1296E+00	1.9972E+00
18	1.1604E+02	-2.2296E+02	1.1801E+03	3.3900E+02	1.6664E+02
	8.0007E-01	-1.5372E+00	8.1367E+00	2.3373E+00	1.1490E+00
19	-3.1194E+01	-4.7500E+02	1.3395E+03	4.4380E+02	5.5159E+02
	-2.1508E-01	-3.2750E+00	9.2356E+00	3.0599E+00	3.8031E+00
20	-2.3344E+01	-1.0379E+03	1.2496E+02	1.0145E+03	3.9610E+01
	-1.6095E-01	-7.1558E+00	8.6159E-01	6.9948E+00	2.7310E-01
21	2.0234E+01	-4.3635E+01	-2.3233E+01	6.3869E+01	1.2139E+02
	1.3951E-01	-3.0085E-01	-1.6018E-01	4.4036E-01	8.3695E-01
22	-3.2360E+01	-8.8807E+01	-7.7649E+01	5.6447E+01	1.1651E+02
	-2.2311E-01	-6.1231E-01	-5.3537E-01	3.8919E-01	8.0329E-01

Allowable Stress for Load Case 101

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	213.44	211.51	20.00	25.00	66.30
2	214.29	210.71	20.00	25.00	66.30
3	213.18	211.18	20.00	25.00	66.30
4	216.26	216.04	20.00	25.00	66.30
5	220.88	220.11	20.00	25.00	66.30
6	222.72	221.94	20.00	25.00	66.30
7	224.30	222.91	20.00	25.00	66.30
8	224.36	222.98	20.00	25.00	66.30
9	224.32	222.93	20.00	25.00	66.30
10	224.82	223.17	20.00	25.00	66.30
11	226.69	224.40	20.00	25.00	66.30
12	231.86	229.28	20.00	25.00	66.30
13	221.25	220.22	20.00	25.00	66.30
14	218.67	218.09	20.00	25.00	66.30
15	215.29	215.24	20.00	25.00	66.30
16	216.66	216.32	20.00	25.00	66.30
17	216.95	216.69	20.00	25.00	66.30
18	218.63	218.28	20.00	25.00	66.30
19	220.29	219.60	20.00	25.00	66.30
20	228.70	227.49	20.00	25.00	66.30
21	212.92	212.81	20.00	25.00	66.30
22	214.17	214.07	20.00	25.00	66.30

Table 2-205. Load Case 102, 100°F Ambient, Maximum Decay Heat, Maximum Insolation, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.0156E+02 7.0026E-01	-1.8526E+02 -1.2773E+00	-6.4586E+00 -4.4530E-02	2.8683E+02 1.9776E+00	4.0295E+02 2.7782E+00		
2	1.3702E+02 9.4474E-01	-2.9263E+02 -2.0176E+00	-9.1538E+01 -6.3114E-01	4.2965E+02 2.9623E+00	8.8296E+02 6.0878E+00		
3	1.0211E+02 7.0401E-01	-1.8188E+02 -1.2540E+00	1.1508E-01 7.9345E-04	2.8399E+02 1.9580E+00	4.0662E+02 2.8035E+00		
4	7.6625E+02 5.2831E+00	-2.3620E+03 -1.6286E+01	-5.4082E+02 -3.7288E+00	3.1283E+03 2.1569E+01	6.1726E+03 4.2558E+01		
5	6.9043E+02 4.7604E+00	-2.4580E+03 -1.6947E+01	-1.4206E+03 -9.7945E+00	3.1484E+03 2.1708E+01	4.9462E+03 3.4103E+01		
6	6.3606E+01 4.3855E-01	-1.3610E+03 -9.3839E+00	-2.1811E+03 -1.5038E+01	1.4246E+03 9.8224E+00	1.8617E+03 1.2836E+01		
7	-1.3917E+02 -9.5955E-01	-4.8098E+02 -3.3162E+00	-1.3219E+03 -9.1141E+00	3.4181E+02 2.3567E+00	4.0291E+02 2.7780E+00		
8	-1.4105E+02 -9.7253E-01	-4.7903E+02 -3.3028E+00	-1.3429E+03 -9.2588E+00	3.3797E+02 2.3303E+00	3.9474E+02 2.7216E+00		
9	-1.4261E+02 -9.8324E-01	-4.7729E+02 -3.2908E+00	-1.3729E+03 -9.4659E+00	3.3468E+02 2.3076E+00	3.8647E+02 2.6646E+00		
10	-7.0349E+01 -4.8504E-01	-9.4132E+02 -6.4902E+00	-4.8087E+02 -3.3155E+00	8.7097E+02 6.0051E+00	1.2791E+03 8.8191E+00		
11	-2.3265E+02 -1.6041E+00	-1.1882E+03 -8.1924E+00	-6.8888E+02 -4.7497E+00	9.5555E+02 6.5883E+00	5.1200E+02 3.5301E+00		
12	2.4600E+00 1.6961E-02	-1.4031E+03 -9.6738E+00	-1.3942E+03 -9.6126E+00	1.4055E+03 9.6908E+00	5.5965E+02 3.8587E+00		
13	-5.7860E+01 -3.9893E-01	-1.4909E+03 -1.0279E+01	-1.5354E+02 -1.0586E+00	1.4330E+03 9.8804E+00	3.3276E+02 2.2943E+00		
14	-1.2709E+02 -8.7627E-01	-1.3157E+03 -9.0714E+00	9.8367E+01 6.7822E-01	1.1886E+03 8.1952E+00	1.2324E+03 8.4970E+00		
15	5.1572E+02 3.5558E+00	-5.5280E+02 -3.8114E+00	2.0118E+01 1.3871E-01	1.0685E+03 7.3672E+00	1.8123E+03 1.2495E+01		

16	1.4683E+02	-2.5269E+02	-1.7282E+02	3.9951E+02	6.5500E+02
	1.0123E+00	-1.7422E+00	-1.1915E+00	2.7545E+00	4.5161E+00
17	6.4372E+01	-1.8556E+02	-1.1059E+02	2.4993E+02	4.3800E+02
	4.4383E-01	-1.2794E+00	-7.6247E-01	1.7232E+00	3.0199E+00
18	9.7642E+01	-2.2924E+02	1.1406E+03	3.2688E+02	8.3608E+01
	6.7322E-01	-1.5806E+00	7.8638E+00	2.2538E+00	5.7646E-01
19	-2.3922E+01	-4.9290E+02	1.2737E+03	4.6897E+02	6.5450E+02
	-1.6494E-01	-3.3984E+00	8.7816E+00	3.2335E+00	4.5126E+00
20	-4.3546E+01	-1.0085E+03	1.1160E+02	9.6491E+02	1.4640E+02
	-3.0024E-01	-6.9530E+00	7.6944E-01	6.6528E+00	1.0094E+00
21	2.2876E+01	-4.1989E+01	-1.8990E+01	6.4865E+01	1.2455E+02
	1.5772E-01	-2.8951E-01	-1.3093E-01	4.4723E-01	8.5877E-01
22	-3.9623E+01	-1.0300E+02	-7.3378E+01	6.3374E+01	1.5788E+02
	-2.7319E-01	-7.1013E-01	-5.0592E-01	4.3695E-01	1.0885E+00

Allowable Stress for Load Case 102

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	293.06	291.02	20.00	23.60	66.30
2	294.42	290.97	20.00	23.60	66.30
3	293.94	292.24	20.00	23.60	66.30
4	295.74	295.51	20.00	23.60	66.30
5	300.26	299.51	20.00	23.60	66.30
6	302.05	301.29	20.00	22.40	61.80
7	303.70	302.36	20.00	22.40	61.80
8	303.96	302.63	20.00	22.40	61.80
9	304.12	302.78	20.00	22.40	61.80
10	304.88	303.26	20.00	22.40	61.80
11	306.72	304.54	20.00	22.40	61.80
12	311.71	309.25	20.00	22.40	61.80
13	301.58	300.64	20.00	22.40	61.80
14	299.21	298.67	20.00	23.60	66.30
15	294.60	294.55	20.00	23.60	66.30
16	295.84	295.53	20.00	23.60	66.30
17	296.12	295.87	20.00	23.60	66.30
18	297.79	297.43	20.00	23.60	66.30
19	299.39	298.72	20.00	23.60	66.30
20	307.44	306.29	20.00	22.40	61.80
21	293.90	293.81	20.00	23.60	66.30
22	293.68	293.59	20.00	23.60	66.30

Table 2-206. Load Case 103, -20°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	6.3482E+01 4.3769E-01	-8.5843E+00 -5.9187E-02	-1.0329E+01 -7.1218E-02	7.2066E+01 4.9688E-01	7.2902E+01 5.0264E-01		
2	5.7962E+01 3.9963E-01	-7.3768E-01 -5.0861E-03	-1.5287E+01 -1.0540E-01	5.8700E+01 4.0472E-01	1.6743E-01 1.1544E-03		
3	6.9792E+01 4.8120E-01	-7.0002E+00 -4.8265E-02	-1.0848E+01 -7.4791E-02	7.6792E+01 5.2946E-01	8.6945E+01 5.9946E-01		
4	2.9374E+03 2.0252E+01	-2.0246E+03 -1.3959E+01	-3.8426E+02 -2.6494E+00	4.9620E+03 3.4212E+01	1.0177E+04 7.0166E+01		
5	4.7887E+03 3.3017E+01	-2.1862E+03 -1.5073E+01	-3.9240E+02 -2.7055E+00	6.9748E+03 4.8090E+01	9.1372E+03 6.2999E+01		
6	3.1014E+03 2.1383E+01	-1.9487E+02 -1.3436E+00	7.4379E+02 5.1283E+00	3.2963E+03 2.2727E+01	5.6790E+03 3.9155E+01		
7	1.5067E+03 1.0388E+01	2.1325E-01 1.4703E-03	-3.9524E+01 -2.7251E-01	1.5064E+03 1.0387E+01	4.5757E+01 3.1548E-01		
8	1.5046E+03 1.0374E+01	9.1324E-03 6.2966E-05	1.7180E+00 1.1845E-02	1.5046E+03 1.0374E+01	6.4715E-01 4.4620E-03		
9	1.5055E+03 1.0380E+01	1.4930E-02 1.0294E-04	-2.6797E+01 -1.8476E-01	1.5055E+03 1.0380E+01	1.9005E+01 1.3103E-01		
10	1.5419E+03 1.0631E+01	-2.3326E+02 -1.6083E+00	8.3267E+02 5.7410E+00	1.7752E+03 1.2239E+01	1.1832E+03 8.1576E+00		
11	4.2181E+02 2.9082E+00	-5.3081E+02 -3.6598E+00	8.1941E+01 5.6497E-01	9.5262E+02 6.5681E+00	7.2075E+02 4.9694E+00		
12	1.8920E+02 1.3045E+00	-5.3550E+02 -3.6922E+00	8.0639E+01 5.5598E-01	7.2470E+02 4.9966E+00	1.5479E+03 1.0672E+01		
13	2.2557E+03 1.5553E+01	-8.8888E+02 -6.1286E+00	1.5802E+02 1.0895E+00	3.1446E+03 2.1681E+01	2.0034E+03 1.3813E+01		
14	1.7857E+03 1.2312E+01	-7.7851E+02 -5.3676E+00	1.5649E+02 1.0789E+00	2.5642E+03 1.7680E+01	3.2124E+03 2.2149E+01		
15	4.1133E+02 2.8360E+00	-2.1278E+02 -1.4671E+00	2.1340E+02 1.4714E+00	6.2411E+02 4.3031E+00	9.3193E+02 6.4254E+00		

16	9.1644E+02	-3.8128E+02	3.1305E+02	1.2977E+03	1.9190E+03
	6.3187E+00	-2.6288E+00	2.1584E+00	8.9475E+00	1.3231E+01
17	8.6118E+02	-1.6625E+02	-7.3086E+01	1.0274E+03	1.8083E+03
	5.9377E+00	-1.1462E+00	-5.0391E-01	7.0839E+00	1.2468E+01
18	8.5625E+02	-1.4779E+02	-1.2726E+02	1.0040E+03	1.7602E+03
	5.9036E+00	-1.0190E+00	-8.7739E-01	6.9226E+00	1.2136E+01
19	1.0302E+03	-4.2825E+02	2.2546E+02	1.4585E+03	2.2011E+03
	7.1030E+00	-2.9527E+00	1.5545E+00	1.0056E+01	1.5176E+01
20	1.1809E+03	-5.8680E+02	9.5877E+01	1.7677E+03	3.2791E+03
	8.1418E+00	-4.0459E+00	6.6105E-01	1.2188E+01	2.2609E+01
21	1.3795E+02	-6.9196E+02	-6.6008E+01	8.2990E+02	2.0682E+03
	9.5112E-01	-4.7709E+00	-4.5511E-01	5.7220E+00	1.4260E+01
22	6.3805E+01	-3.6307E+01	4.3021E+01	1.0011E+02	1.5270E+02
	4.3992E-01	-2.5033E-01	2.9662E-01	6.9025E-01	1.0528E+00

Allowable Stress for Load Case 103

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-20.00	20.00	30.00	70.00
2	0.00	-20.00	20.00	30.00	70.00
3	0.00	-20.00	20.00	30.00	70.00
4	0.00	-20.00	20.00	30.00	70.00
5	0.00	-20.00	20.00	30.00	70.00
6	0.00	-20.00	20.00	30.00	70.00
7	0.00	-20.00	20.00	30.00	70.00
8	0.00	-20.00	20.00	30.00	70.00
9	0.00	-20.00	20.00	30.00	70.00
10	0.00	-20.00	20.00	30.00	70.00
11	0.00	-20.00	20.00	30.00	70.00
12	0.00	-20.00	20.00	30.00	70.00
13	0.00	-20.00	20.00	30.00	70.00
14	0.00	-20.00	20.00	30.00	70.00
15	0.00	-20.00	20.00	30.00	70.00
16	0.00	-20.00	20.00	30.00	70.00
17	0.00	-20.00	20.00	30.00	70.00
18	0.00	-20.00	20.00	30.00	70.00
19	0.00	-20.00	20.00	30.00	70.00
20	0.00	-20.00	20.00	30.00	70.00
21	0.00	-20.00	20.00	30.00	70.00
22	0.00	-20.00	20.00	30.00	70.00

Table 2-207. Load Case 104, -40°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.7589E+01 5.3496E-01	-1.0492E+01 -7.2340E-02	-1.2625E+01 -8.7044E-02	8.8081E+01 6.0730E-01	8.9103E+01 6.1434E-01		
2	7.0843E+01 4.8844E-01	-9.0161E-01 -6.2164E-03	-1.8685E+01 -1.2883E-01	7.1744E+01 4.9466E-01	2.0464E-01 1.4109E-03		
3	8.5301E+01 5.8813E-01	-8.5558E+00 -5.8990E-02	-1.3258E+01 -9.1411E-02	9.3857E+01 6.4712E-01	1.0627E+02 7.3267E-01		
4	3.5901E+03 2.4753E+01	-2.4745E+03 -1.7061E+01	-4.6965E+02 -3.2381E+00	6.0647E+03 4.1814E+01	1.2438E+04 8.5758E+01		
5	5.8528E+03 4.0354E+01	-2.6720E+03 -1.8423E+01	-4.7960E+02 -3.3067E+00	8.5248E+03 5.8776E+01	1.1168E+04 7.6999E+01		
6	3.7906E+03 2.6135E+01	-2.3817E+02 -1.6421E+00	9.0908E+02 6.2679E+00	4.0288E+03 2.7777E+01	6.9410E+03 4.7857E+01		
7	1.8415E+03 1.2696E+01	2.6064E-01 1.7970E-03	-4.8307E+01 -3.3307E-01	1.8412E+03 1.2695E+01	5.5925E+01 3.8559E-01		
8	1.8390E+03 1.2680E+01	1.1162E-02 7.6958E-05	2.0998E+00 1.4478E-02	1.8390E+03 1.2679E+01	7.9096E-01 5.4535E-03		
9	1.8400E+03 1.2687E+01	1.8247E-02 1.2581E-04	-3.2752E+01 -2.2582E-01	1.8400E+03 1.2686E+01	2.3228E+01 1.6015E-01		
10	1.8845E+03 1.2993E+01	-2.8510E+02 -1.9657E+00	1.0177E+03 7.0168E+00	2.1696E+03 1.4959E+01	1.4461E+03 9.9704E+00		
11	5.1554E+02 3.5545E+00	-6.4877E+02 -4.4731E+00	1.0015E+02 6.9051E-01	1.1643E+03 8.0276E+00	8.8092E+02 6.0737E+00		
12	2.3124E+02 1.5944E+00	-6.5451E+02 -4.5127E+00	9.8558E+01 6.7954E-01	8.8575E+02 6.1070E+00	1.8919E+03 1.3044E+01		
13	2.7570E+03 1.9009E+01	-1.0864E+03 -7.4905E+00	1.9314E+02 1.3316E+00	3.8434E+03 2.6499E+01	2.4487E+03 1.6883E+01		
14	2.1825E+03 1.5048E+01	-9.5151E+02 -6.5604E+00	1.9126E+02 1.3187E+00	3.1340E+03 2.1608E+01	3.9263E+03 2.7071E+01		
15	5.0273E+02 3.4662E+00	-2.6007E+02 -1.7931E+00	2.6083E+02 1.7983E+00	7.6280E+02 5.2593E+00	1.1390E+03 7.8533E+00		

16	1.1201E+03	-4.6601E+02	3.8262E+02	1.5861E+03	2.3454E+03
	7.7228E+00	-3.2130E+00	2.6381E+00	1.0936E+01	1.6171E+01
17	1.0526E+03	-2.0319E+02	-8.9328E+01	1.2557E+03	2.2102E+03
	7.2571E+00	-1.4010E+00	-6.1589E-01	8.6581E+00	1.5239E+01
18	1.0465E+03	-1.8063E+02	-1.5553E+02	1.2272E+03	2.1513E+03
	7.2155E+00	-1.2454E+00	-1.0724E+00	8.4609E+00	1.4833E+01
19	1.2591E+03	-5.2342E+02	2.7557E+02	1.7826E+03	2.6902E+03
	8.6815E+00	-3.6088E+00	1.9000E+00	1.2290E+01	1.8548E+01
20	1.4433E+03	-7.1721E+02	1.1718E+02	2.1605E+03	4.0078E+03
	9.9511E+00	-4.9450E+00	8.0795E-01	1.4896E+01	2.7633E+01
21	1.6860E+02	-8.4572E+02	-8.0676E+01	1.0143E+03	2.5278E+03
	1.1625E+00	-5.8311E+00	-5.5624E-01	6.9935E+00	1.7429E+01
22	7.7984E+01	-4.4375E+01	5.2581E+01	1.2236E+02	1.8663E+02
	5.3768E-01	-3.0596E-01	3.6254E-01	8.4364E-01	1.2868E+00

Allowable Stress for Load Case 104

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-40.00	20.00	30.00	70.00
2	0.00	-40.00	20.00	30.00	70.00
3	0.00	-40.00	20.00	30.00	70.00
4	0.00	-40.00	20.00	30.00	70.00
5	0.00	-40.00	20.00	30.00	70.00
6	0.00	-40.00	20.00	30.00	70.00
7	0.00	-40.00	20.00	30.00	70.00
8	0.00	-40.00	20.00	30.00	70.00
9	0.00	-40.00	20.00	30.00	70.00
10	0.00	-40.00	20.00	30.00	70.00
11	0.00	-40.00	20.00	30.00	70.00
12	0.00	-40.00	20.00	30.00	70.00
13	0.00	-40.00	20.00	30.00	70.00
14	0.00	-40.00	20.00	30.00	70.00
15	0.00	-40.00	20.00	30.00	70.00
16	0.00	-40.00	20.00	30.00	70.00
17	0.00	-40.00	20.00	30.00	70.00
18	0.00	-40.00	20.00	30.00	70.00
19	0.00	-40.00	20.00	30.00	70.00
20	0.00	-40.00	20.00	30.00	70.00
21	0.00	-40.00	20.00	30.00	70.00
22	0.00	-40.00	20.00	30.00	70.00

**Table 2-208. Load Case 105, -40°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.1725E+02 8.0839E-01	-2.0832E+02 -1.4363E+00	-2.0644E+01 -1.4233E-01	3.2557E+02 2.2447E+00	4.6549E+02 3.2094E+00		
2	1.5258E+02 1.0520E+00	-3.2830E+02 -2.2635E+00	-9.7429E+01 -6.7175E-01	4.8088E+02 3.3156E+00	9.8797E+02 6.8118E+00		
3	1.1415E+02 7.8701E-01	-2.0952E+02 -1.4446E+00	3.5970E+00 2.4801E-02	3.2366E+02 2.2316E+00	4.6182E+02 3.1841E+00		
4	7.1645E+02 4.9397E+00	-2.6859E+03 -1.8519E+01	-4.9551E+02 -3.4164E+00	3.4024E+03 2.3458E+01	6.7051E+03 4.6230E+01		
5	7.0404E+02 4.8542E+00	-2.9893E+03 -2.0611E+01	-1.3714E+03 -9.4552E+00	3.6934E+03 2.5465E+01	5.8400E+03 4.0265E+01		
6	1.2252E+02 8.4471E-01	-1.4727E+03 -1.0154E+01	-1.7629E+03 -1.2155E+01	1.5952E+03 1.0999E+01	1.8810E+03 1.2969E+01		
7	-2.0240E+01 -1.3955E-01	-4.8730E+02 -3.3598E+00	2.7253E+01 1.8790E-01	4.6706E+02 3.2203E+00	4.4322E+02 3.0559E+00		
8	-2.0585E+01 -1.4193E-01	-4.8728E+02 -3.3597E+00	4.9196E-03 3.3920E-05	4.6669E+02 3.2177E+00	4.4410E+02 3.0620E+00		
9	-2.0324E+01 -1.4013E-01	-4.8649E+02 -3.3542E+00	-1.2080E+01 -8.3291E-02	4.6616E+02 3.2141E+00	4.2312E+02 2.9173E+00		
10	-6.1562E+01 -4.2445E-01	-7.1883E+02 -4.9561E+00	2.1574E+02 1.4875E+00	6.5727E+02 4.5317E+00	1.3218E+03 9.1132E+00		
11	-1.8904E+02 -1.3034E+00	-1.0359E+03 -7.1424E+00	-4.7031E+02 -3.2427E+00	8.4688E+02 5.8390E+00	3.2035E+01 2.2087E-01		
12	2.7180E+00 1.8740E-02	-1.2826E+03 -8.8434E+00	-1.2726E+03 -8.7739E+00	1.2854E+03 8.8622E+00	6.6040E+01 4.5533E-01		
13	-1.1401E+02 -7.8605E-01	-1.6998E+03 -1.1720E+01	-1.6732E+02 -1.1536E+00	1.5858E+03 1.0934E+01	7.1645E+02 4.9398E+00		
14	-1.2896E+02 -8.8918E-01	-1.4827E+03 -1.0223E+01	1.6140E+02 1.1128E+00	1.3538E+03 9.3339E+00	1.0182E+03 7.0201E+00		
15	9.8788E+01 6.8112E-01	-7.4359E+00 -5.1269E-02	9.4685E+01 6.5283E-01	1.0622E+02 7.3239E-01	1.0410E+02 7.1778E-01		

16	3.6503E+01	-3.6924E+00	-1.2904E+02	4.0195E+01	1.2999E+01
	2.5168E-01	-2.5458E-02	-8.8969E-01	2.7713E-01	8.9623E-02
17	1.7798E+01	-2.1503E+01	-1.6586E+02	3.9301E+01	5.6240E+01
	1.2271E-01	-1.4826E-01	-1.1436E+00	2.7097E-01	3.8776E-01
18	1.5634E+02	-2.2199E+02	1.2690E+03	3.7834E+02	3.1651E+02
	1.0779E+00	-1.5306E+00	8.7492E+00	2.6085E+00	2.1822E+00
19	-2.4435E+01	-4.7145E+02	1.4772E+03	4.4701E+02	3.7620E+02
	-1.6847E-01	-3.2505E+00	1.0185E+01	3.0820E+00	2.5938E+00
20	1.7609E+01	-1.1093E+03	1.4684E+02	1.1269E+03	3.7894E+02
	1.2141E-01	-7.6480E+00	1.0125E+00	7.7694E+00	2.6127E+00
21	2.0249E+01	-4.8181E+01	-2.7656E+01	6.8430E+01	1.2936E+02
	1.3961E-01	-3.3220E-01	-1.9068E-01	4.7181E-01	8.9189E-01
22	-3.1724E+00	-9.1665E+01	-9.1005E+01	8.8493E+01	4.2109E+01
	-2.1873E-02	-6.3201E-01	-6.2746E-01	6.1014E-01	2.9033E-01

Allowable Stress for Load Case 105

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
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1	85.45	83.42	20.00	30.00	70.00
2	86.26	82.35	20.00	30.00	70.00
3	85.09	82.95	20.00	30.00	70.00
4	88.60	88.37	20.00	30.00	70.00
5	93.61	92.78	20.00	30.00	70.00
6	95.56	94.74	20.00	30.00	70.00
7	97.44	95.94	20.00	30.00	70.00
8	97.49	95.99	20.00	30.00	70.00
9	97.43	95.94	20.00	30.00	70.00
10	97.81	96.09	20.00	30.00	70.00
11	99.79	97.30	20.00	30.00	70.00
12	105.30	102.51	20.00	30.00	70.00
13	93.87	92.72	20.00	30.00	70.00
14	91.01	90.36	20.00	30.00	70.00
15	87.98	87.91	20.00	30.00	70.00
16	89.56	89.17	20.00	30.00	70.00
17	89.88	89.59	20.00	30.00	70.00
18	91.61	91.24	20.00	30.00	70.00
19	93.39	92.65	20.00	30.00	70.00
20	102.58	101.24	20.00	30.00	70.00
21	84.82	84.70	20.00	30.00	70.00
22	86.44	86.31	20.00	30.00	70.00

**Table 2-209. Load Case 106, -20°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	9.7556E+01 6.7262E-01	-1.9794E+02 -1.3648E+00	-6.1081E+01 -4.2114E-01	2.9550E+02 2.0374E+00	4.7452E+02 3.2717E+00		
2	1.5491E+02 1.0681E+00	-3.2014E+02 -2.2073E+00	-1.9874E+02 -1.3703E+00	4.7504E+02 3.2753E+00	9.5108E+02 6.5574E+00		
3	9.8478E+01 6.7898E-01	-1.9987E+02 -1.3780E+00	-4.4432E+01 -3.0635E-01	2.9835E+02 2.0570E+00	4.7055E+02 3.2443E+00		
4	1.2514E+03 8.6284E+00	-3.3705E+03 -2.3239E+01	-2.0910E+02 -1.4417E+00	4.6219E+03 3.1867E+01	9.4586E+03 6.5215E+01		
5	1.2872E+03 8.8751E+00	-4.5339E+03 -3.1260E+01	-1.0849E+03 -7.4803E+00	5.8211E+03 4.0135E+01	8.2608E+03 5.6956E+01		
6	-4.1496E+01 -2.8611E-01	-2.6987E+03 -1.8607E+01	-2.0571E+03 -1.4183E+01	2.6572E+03 1.8321E+01	4.0158E+03 2.7688E+01		
7	-9.4494E+01 -6.5151E-01	-1.3095E+03 -9.0286E+00	-6.1911E+02 -4.2686E+00	1.2150E+03 8.3771E+00	4.5696E+02 3.1506E+00		
8	-9.4310E+01 -6.5024E-01	-1.3087E+03 -9.0231E+00	-6.5157E+02 -4.4924E+00	1.2144E+03 8.3729E+00	4.3887E+02 3.0259E+00		
9	-9.4098E+01 -6.4878E-01	-1.3083E+03 -9.0204E+00	-6.5860E+02 -4.5409E+00	1.2142E+03 8.3716E+00	4.2896E+02 2.9576E+00		
10	-3.1983E+02 -2.2051E+00	-1.3476E+03 -9.2914E+00	-5.0910E+02 -3.5101E+00	1.0278E+03 7.0863E+00	9.0286E+02 6.2250E+00		
11	-1.6034E+02 -1.1055E+00	-1.2504E+03 -8.6211E+00	-7.0087E+02 -4.8323E+00	1.0900E+03 7.5156E+00	5.6749E+02 3.9127E+00		
12	8.2274E+01 5.6726E-01	-1.4940E+03 -1.0301E+01	-1.4910E+03 -1.0280E+01	1.5762E+03 1.0868E+01	7.8695E+02 5.4258E+00		
13	1.2327E+02 8.4993E-01	-2.7190E+03 -1.8747E+01	-3.5996E+02 -2.4818E+00	2.8423E+03 1.9597E+01	1.6033E+03 1.1054E+01		
14	7.1513E+01 4.9307E-01	-2.3218E+03 -1.6009E+01	-4.4020E+01 -3.0351E-01	2.3934E+03 1.6502E+01	2.7873E+03 1.9218E+01		
15	3.5330E+02 2.4359E+00	-1.3230E+02 -9.1220E-01	-1.7285E+02 -1.1917E+00	4.8561E+02 3.3481E+00	1.9621E+02 1.3528E+00		

16	1.5239E+02	-6.7002E+02	-5.0310E+02	8.2241E+02	1.2228E+03
	1.0507E+00	-4.6196E+00	-3.4688E+00	5.6703E+00	8.4307E+00
17	1.0702E+01	-5.4696E+02	-5.1372E+02	5.5766E+02	8.5280E+02
	7.3787E-02	-3.7712E+00	-3.5420E+00	3.8449E+00	5.8798E+00
18	2.4075E+02	-1.1814E+03	9.5576E+02	1.4222E+03	1.9206E+03
	1.6599E+00	-8.1458E+00	6.5897E+00	9.8057E+00	1.3242E+01
19	3.4232E+02	-2.0640E+03	7.8431E+02	2.4063E+03	3.9791E+03
	2.3602E+00	-1.4230E+01	5.4076E+00	1.6591E+01	2.7435E+01
20	-2.0446E+01	-2.2197E+03	-3.6441E+02	2.1992E+03	3.8546E+03
	-1.4097E-01	-1.5304E+01	-2.5125E+00	1.5163E+01	2.6577E+01
21	2.0863E+02	-3.9992E+01	-2.9707E+00	2.4862E+02	5.6510E+02
	1.4384E+00	-2.7573E-01	-2.0483E-02	1.7142E+00	3.8962E+00
22	1.0940E+02	-6.6564E+01	-6.1527E+01	1.7596E+02	8.8025E+01
	7.5427E-01	-4.5894E-01	-4.2421E-01	1.2132E+00	6.0691E-01

Allowable Stress for Load Case 106

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
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1	104.28	102.26	20.00	30.00	70.00
2	105.11	101.26	20.00	30.00	70.00
3	103.92	101.80	20.00	30.00	70.00
4	107.38	107.15	20.00	30.00	70.00
5	112.33	111.51	20.00	30.00	70.00
6	114.26	113.45	20.00	30.00	70.00
7	116.10	114.62	20.00	30.00	70.00
8	116.15	114.67	20.00	30.00	70.00
9	116.09	114.61	20.00	30.00	70.00
10	116.48	114.77	20.00	30.00	70.00
11	118.44	115.98	20.00	30.00	70.00
12	123.90	121.14	20.00	30.00	70.00
13	112.59	111.46	20.00	30.00	70.00
14	109.77	109.14	20.00	30.00	70.00
15	106.69	106.63	20.00	30.00	70.00
16	108.24	107.86	20.00	30.00	70.00
17	108.56	108.27	20.00	30.00	70.00
18	110.28	109.91	20.00	30.00	70.00
19	112.05	111.31	20.00	30.00	70.00
20	121.12	119.80	20.00	30.00	70.00
21	103.65	103.52	20.00	30.00	70.00
22	105.22	105.10	20.00	30.00	70.00

**Table 2-210. Load Case 201, Internal Design Pressure, 1,930 kPa (280 psia),
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.0745E+00 7.4086E-03	-1.2812E+01 -8.8336E-02	-3.9938E+01 -2.7536E-01	1.3887E+01 9.5745E-02	1.3041E+01 8.9916E-02		
2	1.9621E-02 1.3528E-04	-9.5804E+00 -6.6055E-02	-3.7802E+01 -2.6063E-01	9.6001E+00 6.6190E-02	8.0928E-01 5.5798E-03		
3	2.2656E+00 1.5621E-02	-1.2326E+01 -8.4982E-02	-3.6331E+01 -2.5049E-01	1.4591E+01 1.0060E-01	1.9476E+01 1.3428E-01		
4	2.8893E+03 1.9921E+01	-1.2658E+03 -8.7275E+00	1.4435E+03 9.9527E+00	4.1551E+03 2.8648E+01	7.3286E+03 5.0529E+01		
5	2.2675E+03 1.5634E+01	-1.1443E+03 -7.8896E+00	1.4644E+03 1.0097E+01	3.4118E+03 2.3523E+01	5.6450E+03 3.8921E+01		
6	9.1841E+02 6.3322E+00	-3.7997E+02 -2.6198E+00	1.8086E+03 1.2470E+01	1.2984E+03 8.9520E+00	1.6505E+03 1.1380E+01		
7	1.2576E+01 8.6711E-02	-1.2354E+02 -8.5176E-01	1.0847E+03 7.4789E+00	1.3611E+02 9.3847E-01	5.8551E+00 4.0369E-02		
8	1.2232E+01 8.4340E-02	-1.2340E+02 -8.5080E-01	1.0985E+03 7.5741E+00	1.3563E+02 9.3514E-01	2.1526E-01 1.4841E-03		
9	1.2216E+01 8.4227E-02	-1.2376E+02 -8.5332E-01	1.1291E+03 7.7847E+00	1.3598E+02 9.3754E-01	1.1458E+01 7.8999E-02		
10	5.1145E+02 3.5263E+00	-3.1410E+02 -2.1656E+00	1.2988E+02 8.9550E-01	8.2555E+02 5.6920E+00	9.6671E+02 6.6652E+00		
11	3.4114E+02 2.3521E+00	-1.8717E+02 -1.2905E+00	8.6447E+01 5.9603E-01	5.2831E+02 3.6426E+00	2.2475E+02 1.5496E+00		
12	-2.4114E+01 -1.6626E-01	-4.9997E+02 -3.4472E+00	-2.9756E+01 -2.0516E-01	4.7586E+02 3.2809E+00	4.0233E+02 2.7740E+00		
13	8.6447E+01 5.9603E-01	-6.4651E+02 -4.4575E+00	-1.0260E+02 -7.0743E-01	7.3296E+02 5.0536E+00	5.9602E+02 4.1094E+00		
14	1.0103E+02 6.9660E-01	-5.8087E+02 -4.0049E+00	-1.1764E+02 -8.1109E-01	6.8190E+02 4.7015E+00	7.3101E+02 5.0402E+00		
15	1.6259E+03 1.1210E+01	-1.8949E+03 -1.3065E+01	-8.8200E+02 -6.0812E+00	3.5208E+03 2.4275E+01	5.4379E+03 3.7493E+01		

16	2.4297E+02	-2.0535E+03	-1.1489E+03	2.2964E+03	3.3625E+03
	1.6752E+00	-1.4158E+01	-7.9213E+00	1.5833E+01	2.3184E+01
17	-4.2901E+01	-1.6649E+03	-1.1215E+03	1.6220E+03	2.4245E+03
	-2.9580E-01	-1.1479E+01	-7.7323E+00	1.1184E+01	1.6716E+01
18	1.0350E+01	-1.8462E+03	-1.0252E+03	1.8565E+03	2.8425E+03
	7.1360E-02	-1.2729E+01	-7.0686E+00	1.2800E+01	1.9598E+01
19	4.7835E+02	-2.5206E+03	-1.1455E+03	2.9990E+03	4.6702E+03
	3.2981E+00	-1.7379E+01	-7.8981E+00	2.0677E+01	3.2200E+01
20	3.3629E+02	-2.0600E+03	-8.9475E+02	2.3963E+03	4.4985E+03
	2.3186E+00	-1.4203E+01	-6.1691E+00	1.6522E+01	3.1016E+01
21	7.0008E-01	-1.9681E+02	-2.0429E+01	1.9751E+02	4.0159E+02
	4.8269E-03	-1.3570E+00	-1.4086E-01	1.3618E+00	2.7689E+00
22	1.3120E+03	-3.7885E+02	5.0285E+02	1.6909E+03	2.3361E+03
	9.0461E+00	-2.6121E+00	3.4670E+00	1.1658E+01	1.6107E+01

**Table 2-211. Load Case 202, Minimum External Pressure, 24 kPa (3.5 psia),
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-2.3360E+00 -1.6106E-02	-3.6389E+00 -2.5090E-02	-8.4101E+00 -5.7985E-02	1.3030E+00 8.9835E-03	5.6886E-01 3.9222E-03		
2	-2.2251E+00 -1.5341E-02	-3.4540E+00 -2.3814E-02	-8.1673E+00 -5.6311E-02	1.2289E+00 8.4728E-03	7.6515E-02 5.2755E-04		
3	-2.3988E+00 -1.6539E-02	-3.6788E+00 -2.5364E-02	-8.1338E+00 -5.6081E-02	1.2800E+00 8.8250E-03	4.2054E-01 2.8995E-03		
4	8.6873E+01 5.9897E-01	-3.5775E+01 -2.4666E-01	6.4095E+01 4.4192E-01	1.2265E+02 8.4563E-01	1.9979E+02 1.3775E+00		
5	5.3597E+01 3.6954E-01	-3.3184E+01 -2.2879E-01	6.7388E+01 4.6462E-01	8.6781E+01 5.9833E-01	1.4493E+02 9.9928E-01		
6	1.3890E+01 9.5765E-02	-1.5930E+01 -1.0984E-01	7.6765E+01 5.2927E-01	2.9820E+01 2.0560E-01	2.7270E+01 1.8802E-01		
7	-6.0285E+00 -4.1565E-02	-1.0849E+01 -7.4801E-02	5.7369E+01 3.9554E-01	4.8204E+00 3.3236E-02	1.7231E-02 1.1880E-04		
8	-6.0237E+00 -4.1532E-02	-1.0851E+01 -7.4817E-02	5.7603E+01 3.9716E-01	4.8276E+00 3.3285E-02	8.0194E-03 5.5292E-05		
9	-6.0832E+00 -4.1942E-02	-1.0804E+01 -7.4490E-02	5.9176E+01 4.0801E-01	4.7206E+00 3.2548E-02	4.5006E-01 3.1030E-03		
10	2.0667E+01 1.4249E-01	-2.3017E+01 -1.5870E-01	6.8270E+00 4.7071E-02	4.3684E+01 3.0119E-01	4.4835E+01 3.0913E-01		
11	1.5080E+01 1.0397E-01	-9.7133E+00 -6.6971E-02	4.3805E+00 3.0203E-02	2.4793E+01 1.7094E-01	7.4089E+00 5.1083E-02		
12	-3.4729E+00 -2.3945E-02	-3.9384E+01 -2.7154E-01	-2.6388E+00 -1.8194E-02	3.5911E+01 2.4760E-01	3.4359E-01 2.3689E-03		
13	7.1314E+00 4.9169E-02	-3.9296E+01 -2.7094E-01	-5.8886E+00 -4.0601E-02	4.6428E+01 3.2011E-01	3.8704E+01 2.6686E-01		
14	7.0102E+00 4.8333E-02	-3.3351E+01 -2.2995E-01	-6.1013E+00 -4.2067E-02	4.0361E+01 2.7828E-01	4.2551E+01 2.9338E-01		
15	7.8611E+01 5.4200E-01	-9.6274E+01 -6.6379E-01	-4.6246E+01 -3.1886E-01	1.7488E+02 1.2058E+00	2.7093E+02 1.8680E+00		

16	1.1883E+01	-1.0573E+02	-5.9774E+01	1.1761E+02	1.7180E+02
	8.1929E-02	-7.2897E-01	-4.1213E-01	8.1090E-01	1.1845E+00
17	-2.5828E+00	-8.5700E+01	-5.8959E+01	8.3117E+01	1.2343E+02
	-1.7808E-02	-5.9088E-01	-4.0651E-01	5.7307E-01	8.5100E-01
18	7.1470E-01	-9.6276E+01	-5.3349E+01	9.6991E+01	1.4832E+02
	4.9277E-03	-6.6380E-01	-3.6783E-01	6.6873E-01	1.0226E+00
19	2.5084E+01	-1.3163E+02	-5.9543E+01	1.5671E+02	2.4441E+02
	1.7295E-01	-9.0754E-01	-4.1053E-01	1.0805E+00	1.6852E+00
20	1.7760E+01	-1.0809E+02	-4.6333E+01	1.2585E+02	2.3602E+02
	1.2245E-01	-7.4528E-01	-3.1946E-01	8.6773E-01	1.6273E+00
21	-2.5723E+00	-2.9338E+01	-3.3283E+00	2.6766E+01	2.6295E+01
	-1.7736E-02	-2.0228E-01	-2.2948E-02	1.8454E-01	1.8130E-01
22	5.2520E+01	-1.2599E+01	2.0775E+01	6.5119E+01	7.8345E+01
	3.6211E-01	-8.6864E-02	1.4324E-01	4.4898E-01	5.4017E-01

Table 2-212. Load Case 203, Maximum Increased External Pressure, 140 kPa (20 psia), Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-1.3126E+01 -9.0499E-02	-2.4084E+01 -1.6605E-01	-4.6805E+01 -3.2271E-01	1.0958E+01 7.5555E-02	6.6823E+00 4.6073E-02		
2	-1.2719E+01 -8.7697E-02	-2.3018E+01 -1.5870E-01	-4.5823E+01 -3.1594E-01	1.0298E+01 7.1003E-02	3.0728E-01 2.1186E-03		
3	-1.3537E+01 -9.3331E-02	-2.4745E+01 -1.7061E-01	-4.6003E+01 -3.1718E-01	1.1209E+01 7.7281E-02	7.2915E+00 5.0273E-02		
4	7.7949E+01 5.3744E-01	-1.6574E+02 -1.1428E+00	1.9547E+01 1.3477E-01	2.4369E+02 1.6802E+00	4.7358E+02 3.2652E+00		
5	7.7028E+01 5.3109E-01	-2.0985E+02 -1.4469E+00	3.2638E+01 2.2503E-01	2.8688E+02 1.9780E+00	4.1046E+02 2.8300E+00		
6	-7.6705E+00 -5.2886E-02	-1.2702E+02 -8.7576E-01	6.5105E+00 4.4888E-02	1.1935E+02 8.2287E-01	1.9826E+02 1.3670E+00		
7	-6.5226E+00 -4.4972E-02	-6.9798E+01 -4.8124E-01	5.8866E+01 4.0587E-01	6.3276E+01 4.3627E-01	1.1730E+00 8.0873E-03		
8	-6.5220E+00 -4.4967E-02	-6.9748E+01 -4.8090E-01	5.7262E+01 3.9481E-01	6.3226E+01 4.3593E-01	1.2151E-02 8.3778E-05		
9	-6.5034E+00 -4.4839E-02	-6.9724E+01 -4.8073E-01	5.8513E+01 4.0343E-01	6.3221E+01 4.3589E-01	5.7573E-01 3.9695E-03		
10	-1.7827E+00 -1.2291E-02	-7.1026E+01 -4.8971E-01	1.0023E+01 6.9108E-02	6.9243E+01 4.7741E-01	2.6848E+00 1.8511E-02		
11	7.0682E+00 4.8733E-02	-2.0909E+01 -1.4416E-01	1.1492E+00 7.9238E-03	2.7977E+01 1.9289E-01	1.4931E+01 1.0295E-01		
12	-7.6942E+00 -5.3049E-02	-1.3260E+02 -9.1423E-01	-1.1590E+01 -7.9911E-02	1.2490E+02 8.6118E-01	1.3869E+02 9.5623E-01		
13	1.8797E+01 1.2960E-01	-7.1605E+01 -4.9370E-01	-1.3701E+01 -9.4466E-02	9.0402E+01 6.2330E-01	8.8937E+01 6.1320E-01		
14	1.4042E+01 9.6818E-02	-5.4197E+01 -3.7368E-01	-1.0913E+01 -7.5244E-02	6.8240E+01 4.7050E-01	5.4589E+01 3.7638E-01		
15	-6.5318E+01 -4.5035E-01	-2.4885E+02 -1.7157E+00	-7.3545E+01 -5.0708E-01	1.8353E+02 1.2654E+00	2.2005E+02 1.5172E+00		

16	1.9412E+01	-1.2380E+02	-6.3409E+01	1.4322E+02	2.0975E+02
	1.3384E-01	-8.5360E-01	-4.3719E-01	9.8744E-01	1.4462E+00
17	-1.1423E+00	-1.0229E+02	-5.4177E+01	1.0115E+02	1.5936E+02
	-7.8758E-03	-7.0526E-01	-3.7354E-01	6.9738E-01	1.0987E+00
18	2.2928E-01	-1.0755E+02	-5.2818E+01	1.0778E+02	1.7108E+02
	1.5808E-03	-7.4152E-01	-3.6417E-01	7.4310E-01	1.1796E+00
19	2.7292E+01	-1.4174E+02	-6.5878E+01	1.6904E+02	2.5177E+02
	1.8817E-01	-9.7729E-01	-4.5421E-01	1.1655E+00	1.7359E+00
20	2.0009E+01	-1.0845E+02	-5.3036E+01	1.2846E+02	2.4152E+02
	1.3796E-01	-7.4777E-01	-3.6567E-01	8.8573E-01	1.6652E+00
21	-1.5622E+01	-1.4864E+02	-1.7156E+01	1.3302E+02	7.2967E+01
	-1.0771E-01	-1.0249E+00	-1.1829E-01	9.1715E-01	5.0309E-01
22	-5.1788E+00	-5.4847E+01	-7.3022E+00	4.9668E+01	2.2968E+01
	-3.5707E-02	-3.7816E-01	-5.0347E-02	3.4245E-01	1.5836E-01

Table 2-213. Load Case 204, Additional Increased External Pressure, 2 MPa (290 psia), Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-1.8938E+02 -1.3057E+00	-3.5619E+02 -2.4558E+00	-6.7702E+02 -4.6679E+00	1.6681E+02 1.1501E+00	1.0421E+02 7.1852E-01		
2	-1.8438E+02 -1.2712E+00	-3.4056E+02 -2.3481E+00	-6.6267E+02 -4.5690E+00	1.5618E+02 1.0769E+00	4.4556E+00 3.0720E-02		
3	-1.9571E+02 -1.3493E+00	-3.6662E+02 -2.5278E+00	-6.6608E+02 -4.5925E+00	1.7092E+02 1.1784E+00	1.1573E+02 7.9794E-01		
4	1.6926E+03 1.1670E+01	-3.7634E+03 -2.5947E+01	-5.4869E+02 -3.7831E+00	5.4560E+03 3.7618E+01	1.0170E+04 7.0117E+01		
5	1.5542E+03 1.0716E+01	-3.9613E+03 -2.7312E+01	-4.0001E+02 -2.7580E+00	5.5155E+03 3.8028E+01	8.4232E+03 5.8076E+01		
6	-6.1023E+01 -4.2074E-01	-2.1961E+03 -1.5141E+01	-9.8109E+02 -6.7644E+00	2.1351E+03 1.4721E+01	3.4499E+03 2.3786E+01		
7	-6.5404E+00 -4.5094E-02	-1.1180E+03 -7.7082E+00	8.4648E+01 5.8363E-01	1.1114E+03 7.6631E+00	1.8282E+01 1.2605E-01		
8	-6.5434E+00 -4.5115E-02	-1.1172E+03 -7.7028E+00	5.6792E+01 3.9156E-01	1.1107E+03 7.6577E+00	2.8813E-01 1.9866E-03		
9	-6.3082E+00 -4.3493E-02	-1.1165E+03 -7.6981E+00	5.3730E+01 3.7046E-01	1.1102E+03 7.6546E+00	1.6962E+01 1.1695E-01		
10	-1.3828E+02 -9.5338E-01	-1.1616E+03 -8.0093E+00	3.4250E+01 2.3614E-01	1.0234E+03 7.0559E+00	6.6777E+02 4.6041E+00		
11	1.6835E+02 1.1608E+00	-5.0911E+02 -3.5102E+00	-6.4845E+01 -4.4709E-01	6.7746E+02 4.6709E+00	4.0912E+02 2.8208E+00		
12	-7.0673E+01 -4.8728E-01	-1.7027E+03 -1.1740E+01	-1.7382E+02 -1.1984E+00	1.6320E+03 1.1252E+01	2.4142E+03 1.6645E+01		
13	2.5169E+02 1.7354E+00	-7.2728E+02 -5.0144E+00	-1.6806E+02 -1.1587E+00	9.7897E+02 6.7498E+00	1.0358E+03 7.1418E+00		
14	1.6580E+02 1.1431E+00	-5.0221E+02 -3.4626E+00	-1.1545E+02 -7.9597E-01	6.6801E+02 4.6057E+00	3.6496E+02 2.5163E+00		
15	-1.1726E+03 -8.0845E+00	-4.8875E+03 -3.3698E+01	-6.3248E+02 -4.3608E+00	3.7150E+03 2.5614E+01	7.0757E+01 4.8785E-01		

16	1.8950E+02	-5.8363E+02	-1.7592E+02	7.7313E+02	1.1317E+03
	1.3066E+00	-4.0240E+00	-1.2129E+00	5.3306E+00	7.8029E+00
17	2.7957E+01	-5.2449E+02	2.5910E+00	5.5244E+02	9.7715E+02
	1.9275E-01	-3.6162E+00	1.7864E-02	3.8090E+00	6.7372E+00
18	4.2621E+01	-5.3946E+02	-7.2332E+01	5.8208E+02	1.0222E+03
	2.9386E-01	-3.7195E+00	-4.9871E-01	4.0133E+00	7.0475E+00
19	1.9275E+02	-6.3767E+02	-2.9370E+02	8.3042E+02	1.0015E+03
	1.3290E+00	-4.3966E+00	-2.0250E+00	5.7256E+00	6.9048E+00
20	3.4137E+02	-5.2526E+02	-2.7881E+02	8.6663E+02	1.0628E+03
	2.3536E+00	-3.6216E+00	-1.9224E+00	5.9752E+00	7.3278E+00
21	-2.2739E+02	-2.1138E+03	-2.4453E+02	1.8864E+03	8.9000E+02
	-1.5678E+00	-1.4574E+01	-1.6860E+00	1.3007E+01	6.1363E+00
22	-1.1200E+02	-1.6656E+03	-4.1001E+02	1.5536E+03	8.9413E+02
	-7.7225E-01	-1.1484E+01	-2.8269E+00	1.0712E+01	6.1648E+00

**Table 2-214. Load Case 211, Fabrication Stress,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.8501E+02 3.3440E+00	-1.0148E+02 -6.9966E-01	4.1733E+01 2.8774E-01	5.8649E+02 4.0437E+00	8.4660E+02 5.8371E+00		
2	7.9194E+00 5.4603E-02	-2.3676E+01 -1.6324E-01	3.1818E+01 2.1938E-01	3.1596E+01 2.1784E-01	2.6392E+01 1.8196E-01		
3	6.5146E-01 4.4916E-03	-9.7676E+00 -6.7345E-02	3.1614E+00 2.1797E-02	1.0419E+01 7.1837E-02	3.7264E+00 2.5693E-02		
4	5.1276E+02 3.5354E+00	-2.7696E+02 -1.9096E+00	-1.7763E+01 -1.2247E-01	7.8972E+02 5.4449E+00	1.3865E+03 9.5595E+00		
5	5.7698E+02 3.9781E+00	-2.8656E+02 -1.9758E+00	-5.4983E+01 -3.7910E-01	8.6354E+02 5.9539E+00	1.3236E+03 9.1258E+00		
6	3.5146E+02 2.4232E+00	-1.0345E+01 -7.1328E-02	8.6866E+01 5.9892E-01	3.6181E+02 2.4946E+00	6.1937E+02 4.2704E+00		
7	1.4944E+02 1.0303E+00	4.3845E-01 3.0230E-03	-8.9387E-01 -6.1630E-03	1.4900E+02 1.0273E+00	1.9476E+00 1.3428E-02		
8	1.4935E+02 1.0297E+00	4.0939E-01 2.8226E-03	3.7247E+00 2.5681E-02	1.4894E+02 1.0269E+00	4.4174E-02 3.0457E-04		
9	1.4935E+02 1.0297E+00	3.9967E-01 2.7556E-03	1.9826E+00 1.3670E-02	1.4895E+02 1.0270E+00	6.1644E-02 4.2502E-04		
10	1.4984E+02 1.0331E+00	-5.6285E+00 -3.8807E-02	6.3516E+01 4.3792E-01	1.5547E+02 1.0719E+00	4.1670E+01 2.8730E-01		
11	5.6314E+01 3.8827E-01	-2.7677E+01 -1.9083E-01	3.3436E+01 2.3053E-01	8.3991E+01 5.7910E-01	5.9976E+01 4.1352E-01		
12	5.9136E+01 4.0773E-01	1.9400E+01 1.3376E-01	3.9125E+01 2.6975E-01	3.9736E+01 2.7397E-01	8.5089E+00 5.8667E-02		
13	2.5872E+02 1.7838E+00	-4.8757E+01 -3.3617E-01	6.9335E+01 4.7805E-01	3.0748E+02 2.1200E+00	3.2102E+02 2.2133E+00		
14	2.4820E+02 1.7113E+00	-4.9865E+01 -3.4381E-01	7.3710E+01 5.0822E-01	2.9807E+02 2.0551E+00	2.5178E+02 1.7360E+00		
15	4.0912E+02 2.8208E+00	9.4841E+01 6.5391E-01	4.9988E+01 3.4466E-01	3.1428E+02 2.1669E+00	1.2156E+01 8.3816E-02		

16	2.2502E+01	-2.6229E+00	8.3354E+00	2.5125E+01	3.2013E+01
	1.5515E-01	-1.8084E-02	5.7470E-02	1.7323E-01	2.2073E-01
17	2.0822E+01	1.5247E+00	-1.3011E+01	1.9297E+01	3.2841E+01
	1.4356E-01	1.0512E-02	-8.9705E-02	1.3305E-01	2.2643E-01
18	6.2622E+01	-2.5562E+01	-3.2996E+01	8.8184E+01	1.5707E+02
	4.3176E-01	-1.7625E-01	-2.2750E-01	6.0801E-01	1.0830E+00
19	7.2071E+01	-4.2653E+01	1.2702E+01	1.1472E+02	1.3128E+02
	4.9691E-01	-2.9408E-01	8.7580E-02	7.9099E-01	9.0518E-01
20	7.6190E+01	-7.0101E+01	1.2497E+01	1.4629E+02	2.1132E+02
	5.2531E-01	-4.8333E-01	8.6166E-02	1.0086E+00	1.4570E+00
21	2.2184E+01	-4.5781E+00	4.4874E-01	2.6762E+01	6.4225E+01
	1.5295E-01	-3.1565E-02	3.0939E-03	1.8452E-01	4.4281E-01
22	3.6010E+02	7.9852E+01	3.4061E+02	2.8025E+02	3.5378E+00
	2.4828E+00	5.5056E-01	2.3484E+00	1.9323E+00	2.4392E-02

**Table 2-215. Load Case 215, Compression Load (5x weight),
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.3658E+00 1.6311E-02	-1.2765E+02 -8.8011E-01	-1.6318E+01 -1.1251E-01	1.3002E+02 8.9642E-01	1.9505E+02 1.3448E+00		
2	1.5175E+00 1.0463E-02	-9.8912E+01 -6.8197E-01	1.3542E+01 9.3367E-02	1.0043E+02 6.9244E-01	2.9327E+00 2.0220E-02		
3	-2.9633E+00 -2.0431E-02	-1.1494E+02 -7.9251E-01	5.2656E+00 3.6305E-02	1.1198E+02 7.7208E-01	3.5007E+01 2.4136E-01		
4	2.7031E+02 1.8637E+00	-3.7393E+02 -2.5782E+00	7.0544E+01 4.8638E-01	6.4424E+02 4.4419E+00	1.1801E+03 8.1367E+00		
5	2.5740E+02 1.7747E+00	-4.2556E+02 -2.9341E+00	7.5476E+01 5.2039E-01	6.8296E+02 4.7088E+00	9.5558E+02 6.5885E+00		
6	-7.5599E+01 -5.2124E-01	-3.4300E+02 -2.3649E+00	-6.7963E+01 -4.6859E-01	2.6740E+02 1.8437E+00	3.2496E+02 2.2405E+00		
7	-3.0777E-01 -2.1220E-03	-2.0730E+02 -1.4293E+00	-1.5253E-01 -1.0517E-03	2.0699E+02 1.4271E+00	1.2480E+00 8.6045E-03		
8	-3.1884E-01 -2.1983E-03	-1.6477E+02 -1.1360E+00	-2.4264E+00 -1.6729E-02	1.6445E+02 1.1338E+00	8.2386E-03 5.6803E-05		
9	-3.1779E-01 -2.1911E-03	-1.4688E+02 -1.0127E+00	-1.3157E+00 -9.0716E-03	1.4656E+02 1.0105E+00	6.2749E-01 4.3264E-03		
10	-3.5740E+00 -2.4642E-02	-1.4903E+02 -1.0275E+00	-4.2076E+01 -2.9010E-01	1.4546E+02 1.0029E+00	2.1058E+00 1.4519E-02		
11	1.3678E+01 9.4310E-02	-4.4026E+01 -3.0355E-01	-2.1512E+01 -1.4832E-01	5.7704E+01 3.9786E-01	5.8859E+01 4.0582E-01		
12	-2.2699E+01 -1.5650E-01	-9.3622E+01 -6.4550E-01	-2.8402E+01 -1.9583E-01	7.0923E+01 4.8900E-01	9.6809E+01 6.6748E-01		
13	4.7426E+01 3.2699E-01	-1.8876E+02 -1.3015E+00	-4.3744E+01 -3.0161E-01	2.3619E+02 1.6285E+00	2.2598E+02 1.5581E+00		
14	3.9828E+01 2.7461E-01	-1.5964E+02 -1.1007E+00	-4.2252E+01 -2.9132E-01	1.9947E+02 1.3753E+00	1.8017E+02 1.2422E+00		
15	-6.2896E+02 -4.3365E+00	-2.8004E+03 -1.9308E+01	-3.1978E+02 -2.2048E+00	2.1715E+03 1.4972E+01	1.3835E+02 9.5386E-01		

16	1.7437E+02	-4.1480E+02	-6.8711E+01	5.8916E+02	8.0097E+02
	1.2022E+00	-2.8599E+00	-4.7375E-01	4.0621E+00	5.5225E+00
17	-9.9755E+01	-4.3683E+02	-4.1559E+01	3.3707E+02	5.1338E+02
	-6.8779E-01	-3.0118E+00	-2.8654E-01	2.3240E+00	3.5396E+00
18	-5.8351E+01	-2.5561E+02	-2.7289E+01	1.9726E+02	2.9246E+02
	-4.0231E-01	-1.7624E+00	-1.8815E-01	1.3601E+00	2.0165E+00
19	1.4604E+02	-2.6296E+02	-4.7481E+01	4.0899E+02	5.5603E+02
	1.0069E+00	-1.8130E+00	-3.2737E-01	2.8199E+00	3.8337E+00
20	2.0817E+02	-2.8803E+02	-5.9896E+01	4.9620E+02	8.5022E+02
	1.4353E+00	-1.9859E+00	-4.1297E-01	3.4212E+00	5.8621E+00
21	-1.3365E+01	-1.4375E+02	-1.4241E+01	1.3039E+02	6.6990E+01
	-9.2146E-02	-9.9112E-01	-9.8191E-02	8.9897E-01	4.6188E-01
22	-2.2108E+02	-8.1762E+02	-3.0105E+02	5.9653E+02	1.3959E+02
	-1.5243E+00	-5.6373E+00	-2.0757E+00	4.1130E+00	9.6245E-01

**Table 2-216. Load Case 216, Rod Drop onto Cask,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	8.4333E+00 5.8146E-02	-1.6671E+01 -1.1494E-01	2.2942E+01 1.5818E-01	2.5104E+01 1.7309E-01	1.3012E+01 8.9715E-02		
2	2.1340E-01 1.4713E-03	-1.5475E+01 -1.0669E-01	-8.4199E-01 -5.8053E-03	1.5688E+01 1.0817E-01	5.5909E+00 3.8548E-02		
3	7.7830E-01 5.3662E-03	-1.4149E+01 -9.7551E-02	-1.4557E-01 -1.0037E-03	1.4927E+01 1.0292E-01	1.5585E+00 1.0746E-02		
4	9.4239E+01 6.4975E-01	-2.4038E+01 -1.6573E-01	6.1295E+01 4.2262E-01	1.1828E+02 8.1549E-01	1.4099E+02 9.7209E-01		
5	5.3039E+01 3.6569E-01	-1.6018E+01 -1.1044E-01	5.1447E+01 3.5472E-01	6.9057E+01 4.7613E-01	5.1055E+01 3.5201E-01		
6	6.2745E+00 4.3261E-02	-7.4543E+01 -5.1396E-01	2.7290E+01 1.8815E-01	8.0817E+01 5.5722E-01	5.1907E+01 3.5789E-01		
7	-7.0090E-02 -4.8325E-04	-5.0886E+01 -3.5084E-01	-1.0434E+00 -7.1940E-03	5.0816E+01 3.5036E-01	7.5721E-01 5.2208E-03		
8	-5.8683E-02 -4.0461E-04	-3.5112E+01 -2.4209E-01	-6.0866E-01 -4.1966E-03	3.5053E+01 2.4168E-01	1.7600E-02 1.2135E-04		
9	-5.0346E-02 -3.4713E-04	-2.5741E+01 -1.7748E-01	-3.4281E-01 -2.3636E-03	2.5691E+01 1.7713E-01	5.1197E-02 3.5299E-04		
10	-1.6312E-01 -1.1247E-03	-2.0350E+01 -1.4031E-01	-5.6738E+00 -3.9120E-02	2.0187E+01 1.3919E-01	2.0498E+00 1.4133E-02		
11	2.5516E+00 1.7593E-02	-4.7386E+00 -3.2672E-02	-1.3303E+00 -9.1721E-03	7.2903E+00 5.0265E-02	8.4236E+00 5.8079E-02		
12	-1.6017E+00 -1.1043E-02	-9.0831E+00 -6.2626E-02	-2.0052E+00 -1.3825E-02	7.4814E+00 5.1582E-02	8.4322E+00 5.8138E-02		
13	7.7893E+00 5.3705E-02	-2.2673E+01 -1.5633E-01	-3.1391E+00 -2.1643E-02	3.0463E+01 2.1003E-01	2.5994E+01 1.7922E-01		
14	7.1270E+00 4.9139E-02	-1.9484E+01 -1.3434E-01	-2.9825E+00 -2.0563E-02	2.6611E+01 1.8348E-01	2.6235E+01 1.8088E-01		
15	-8.3941E+02 -5.7875E+00	-4.9038E+03 -3.3810E+01	-2.8876E+02 -1.9910E+00	4.0644E+03 2.8023E+01	7.4901E+02 5.1642E+00		

16	1.6205E+02	-3.4125E+02	-1.9840E+00	5.0330E+02	7.6073E+02
	1.1173E+00	-2.3529E+00	-1.3679E-02	3.4701E+00	5.2451E+00
17	-1.4398E+00	-2.9131E+02	5.3461E+01	2.8987E+02	5.1015E+02
	-9.9271E-03	-2.0085E+00	3.6860E-01	1.9986E+00	3.5174E+00
18	-1.1799E+01	-9.5708E+01	-2.0161E+01	8.3909E+01	4.2785E+00
	-8.1352E-02	-6.5988E-01	-1.3900E-01	5.7853E-01	2.9499E-02
19	3.6876E+01	-4.7346E+01	-3.7438E+00	8.4222E+01	9.7521E+01
	2.5425E-01	-3.2644E-01	-2.5813E-02	5.8069E-01	6.7238E-01
20	5.6102E+01	-5.3666E+01	-1.5243E+01	1.0977E+02	1.5310E+02
	3.8681E-01	-3.7002E-01	-1.0510E-01	7.5683E-01	1.0556E+00
21	-3.1829E-01	-4.5769E+00	-3.4193E-01	4.2586E+00	2.1352E+00
	-2.1946E-03	-3.1556E-02	-2.3575E-03	2.9362E-02	1.4722E-02
22	2.4910E+02	-3.7685E+03	-7.6798E+02	4.0176E+03	4.7597E+03
	1.7175E+00	-2.5983E+01	-5.2950E+00	2.7700E+01	3.2817E+01

**Table 2-217. Load Case 221, Forward 10g Vibration Inertia Load,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.6659E+02 1.8381E+00	3.2882E+01 2.2671E-01	-6.0940E+01 -4.2017E-01	3.2753E+02 2.2582E+00	6.9083E+01 4.7631E-01		
2	5.8894E+02 4.0606E+00	1.0064E+02 6.9389E-01	-3.3935E+01 -2.3397E-01	8.3430E+02 5.7523E+00	2.0773E+02 1.4322E+00		
3	2.3444E+02 1.6164E+00	3.5685E+01 2.4604E-01	-6.3090E+01 -4.3499E-01	2.9753E+02 2.0514E+00	1.0043E+02 6.9241E-01		
4	5.5996E+02 3.8608E+00	6.8523E+01 4.7245E-01	1.5955E+01 1.1001E-01	5.4401E+02 3.7508E+00	3.0152E+02 2.0789E+00		
5	3.8235E+02 2.6362E+00	3.8745E+01 2.6714E-01	9.6501E+00 6.6535E-02	3.9057E+02 2.6929E+00	1.3598E+02 9.3757E-01		
6	1.9008E+02 1.3106E+00	2.4897E+01 1.7166E-01	-3.6801E+01 -2.5373E-01	2.1418E+02 1.4767E+00	5.5415E+01 3.8207E-01		
7	5.1640E+01 3.5605E-01	5.4004E+00 3.7235E-02	-2.5234E+01 -1.7398E-01	6.3285E+01 4.3633E-01	2.0464E+01 1.4109E-01		
8	4.9557E+01 3.4168E-01	-8.8915E-01 -6.1304E-03	-2.0868E+01 -1.4388E-01	6.0547E+01 4.1746E-01	2.1599E+01 1.4892E-01		
9	4.5591E+01 3.1434E-01	3.5317E+00 2.4350E-02	-1.6958E+01 -1.1692E-01	5.5773E+01 3.8454E-01	2.3666E+01 1.6317E-01		
10	8.6499E+01 5.9639E-01	9.3231E+00 6.4280E-02	-3.2061E+01 -2.2105E-01	1.1856E+02 8.1744E-01	1.3932E+02 9.6061E-01		
11	1.7364E+02 1.1972E+00	2.2242E+01 1.5336E-01	-3.1329E-01 -2.1600E-03	1.7395E+02 1.1993E+00	5.4633E+01 3.7668E-01		
12	1.5659E+02 1.0797E+00	2.7380E+00 1.8878E-02	-5.2831E+00 -3.6426E-02	1.6188E+02 1.1161E+00	3.4699E+01 2.3924E-01		
13	3.2123E+02 2.2148E+00	2.1928E+01 1.5119E-01	1.0767E+01 7.4233E-02	3.1046E+02 2.1405E+00	1.9980E+01 1.3776E-01		
14	3.2645E+02 2.2508E+00	2.7620E+01 1.9043E-01	1.0973E+01 7.5655E-02	3.1548E+02 2.1751E+00	9.8320E+01 6.7790E-01		
15	1.3543E+02 9.3377E-01	-1.2885E+00 -8.8841E-03	-5.7906E+01 -3.9925E-01	1.9334E+02 1.3330E+00	1.6230E+02 1.1190E+00		

16	1.5178E+02	2.0870E+01	-1.1094E+00	1.5289E+02	1.3273E+02
	1.0465E+00	1.4390E-01	-7.6489E-03	1.0541E+00	9.1517E-01
17	9.0911E+01	-2.3428E+00	-4.5487E+01	1.3640E+02	6.0305E+01
	6.2681E-01	-1.6153E-02	-3.1362E-01	9.4043E-01	4.1579E-01
18	7.5746E+01	-8.6920E+00	-4.1804E+01	1.1755E+02	9.0382E+01
	5.2225E-01	-5.9929E-02	-2.8823E-01	8.1048E-01	6.2316E-01
19	2.4103E+02	2.6225E+01	-5.6238E-01	2.4159E+02	6.4073E+01
	1.6618E+00	1.8082E-01	-3.8775E-03	1.6657E+00	4.4177E-01
20	2.8897E+02	2.5819E+01	8.3274E+00	2.8310E+02	1.3391E+02
	1.9924E+00	1.7802E-01	5.7415E-02	1.9519E+00	9.2328E-01
21	2.3965E+02	2.6277E+01	-8.6023E-01	2.4051E+02	6.0551E+01
	1.6523E+00	1.8117E-01	-5.9311E-03	1.6583E+00	4.1749E-01
22	1.4738E+02	2.0357E+00	-4.5493E+00	1.5193E+02	4.8760E+01
	1.0162E+00	1.4036E-02	-3.1366E-02	1.0475E+00	3.3619E-01

**Table 2-218. Load Case 222, Lateral 5g Vibration Inertia Load,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.1239E+01 4.9118E-01	1.2971E+00 8.9432E-03	-3.0493E+01 -2.1024E-01	8.2259E+01 5.6716E-01	2.8856E+01 1.9896E-01		
2	6.2725E+01 4.3248E-01	1.3868E+01 9.5616E-02	-3.0221E+01 -2.0836E-01	7.2006E+01 4.9646E-01	2.8141E+01 1.9402E-01		
3	7.1426E+01 4.9246E-01	-1.4235E+00 -9.8146E-03	-3.0953E+01 -2.1341E-01	8.2167E+01 5.6652E-01	2.8125E+01 1.9391E-01		
4	6.7314E+01 4.6412E-01	8.0847E+00 5.5742E-02	-1.9069E+00 -1.3147E-02	7.3809E+01 5.0890E-01	5.3920E+01 3.7176E-01		
5	4.9245E+01 3.3953E-01	8.0405E+00 5.5437E-02	2.4483E+00 1.6880E-02	7.1867E+01 4.9550E-01	3.4528E+01 2.3806E-01		
6	2.0484E+01 1.4123E-01	4.1956E+00 2.8928E-02	-2.0053E+00 -1.3826E-02	3.4237E+01 2.3605E-01	1.3443E+01 9.2684E-02		
7	4.1020E+00 2.8282E-02	-2.0515E+00 -1.4145E-02	-3.9641E+00 -2.7331E-02	5.2096E+00 3.5919E-02	9.6729E-01 6.6692E-03		
8	4.4289E+00 3.0536E-02	-1.5313E+00 -1.0558E-02	-4.4386E+00 -3.0603E-02	5.1857E+00 3.5754E-02	7.2379E-01 4.9904E-03		
9	4.5556E+00 3.1410E-02	-2.3430E+00 -1.6154E-02	-4.4312E+00 -3.0552E-02	5.4521E+00 3.7591E-02	1.1779E+00 8.1211E-03		
10	1.2079E+01 8.3281E-02	-2.2138E+00 -1.5263E-02	-4.4477E+00 -3.0666E-02	2.4128E+01 1.6636E-01	4.2216E+00 2.9107E-02		
11	9.2518E+00 6.3789E-02	-1.3517E+00 -9.3194E-03	-3.2488E+00 -2.2399E-02	1.3205E+01 9.1048E-02	1.0481E+01 7.2262E-02		
12	9.6060E+00 6.6231E-02	5.5064E-01 3.7966E-03	-2.4198E+00 -1.6684E-02	1.2028E+01 8.2929E-02	1.3276E+01 9.1536E-02		
13	3.2252E+01 2.2237E-01	2.4542E+00 1.6921E-02	-2.9228E-01 -2.0152E-03	4.1455E+01 2.8582E-01	8.1674E+00 5.6312E-02		
14	3.4637E+01 2.3881E-01	2.8226E+00 1.9461E-02	-3.2608E+00 -2.2483E-02	3.7932E+01 2.6153E-01	1.9408E+01 1.3381E-01		
15	5.2127E+01 3.5941E-01	-4.1156E-01 -2.8376E-03	-4.0878E+01 -2.8184E-01	9.3012E+01 6.4130E-01	8.7407E+01 6.0265E-01		

16	1.8391E+01	-2.0416E-01	-4.7055E+00	2.3097E+01	8.9950E-01
	1.2680E-01	-1.4076E-03	-3.2444E-02	1.5925E-01	6.2018E-03
17	7.8495E+00	-3.7211E+00	-6.4705E+00	1.4321E+01	9.2355E-01
	5.4120E-02	-2.5656E-02	-4.4613E-02	9.8743E-02	6.3677E-03
18	1.0768E+01	-3.7937E+00	-1.0766E+01	1.8931E+01	1.1043E+01
	7.4243E-02	-2.6157E-02	-7.4227E-02	1.3052E-01	7.6136E-02
19	2.4583E+01	1.7372E+00	-5.7274E+00	3.0315E+01	4.1146E+00
	1.6950E-01	1.1977E-02	-3.9489E-02	2.0901E-01	2.8369E-02
20	2.3101E+01	6.1340E-01	-3.2872E+00	2.6388E+01	8.9684E+00
	1.5928E-01	4.2293E-03	-2.2664E-02	1.8194E-01	6.1835E-02
21	2.1783E+01	1.2681E+00	-5.7775E+00	2.7560E+01	2.9002E+01
	1.5019E-01	8.7429E-03	-3.9835E-02	1.9002E-01	1.9996E-01
22	1.2324E+01	7.9082E-01	-3.2059E+00	1.5530E+01	1.6337E+01
	8.4972E-02	5.4525E-03	-2.2104E-02	1.0708E-01	1.1264E-01

**Table 2-219. Load Case 223, Vertical 2g Vibration Inertia Load,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.3521E+00 5.0691E-02	1.5632E+00 1.0778E-02	-5.6581E-01 -3.9012E-03	7.9584E+00 5.4871E-02	2.2911E+00 1.5796E-02		
2	2.5154E+01 1.7343E-01	4.7512E+00 3.2759E-02	-4.1851E-01 -2.8856E-03	2.9376E+01 2.0254E-01	9.9860E+00 6.8851E-02		
3	2.8984E+01 1.9984E-01	2.8168E+00 1.9421E-02	-1.8686E+00 -1.2883E-02	3.0852E+01 2.1272E-01	1.1972E+01 8.2547E-02		
4	8.6560E-01 5.9681E-03	-9.9521E+00 -6.8617E-02	-1.7798E+01 -1.2271E-01	1.8623E+01 1.2840E-01	1.4036E+01 9.6774E-02		
5	1.8196E+00 1.2546E-02	-7.5895E+00 -5.2328E-02	-1.1464E+01 -7.9039E-02	1.3208E+01 9.1063E-02	1.0154E+01 7.0009E-02		
6	1.0679E+01 7.3627E-02	-2.0076E+00 -1.3842E-02	-4.3830E+00 -3.0220E-02	1.5017E+01 1.0354E-01	8.9184E+00 6.1490E-02		
7	8.3457E+00 5.7542E-02	2.9847E-01 2.0579E-03	4.1650E-02 2.8716E-04	8.3198E+00 5.7363E-02	3.1798E-02 2.1924E-04		
8	1.0970E+01 7.5633E-02	3.5986E-01 2.4811E-03	6.4421E-02 4.4417E-04	1.0927E+01 7.5342E-02	2.1606E-02 1.4897E-04		
9	1.6722E+01 1.1529E-01	4.3994E-01 3.0333E-03	6.8710E-02 4.7374E-04	1.6663E+01 1.1489E-01	2.5112E-01 1.7314E-03		
10	2.9156E+01 2.0102E-01	7.0123E+00 4.8348E-02	1.5161E+00 1.0453E-02	2.7776E+01 1.9151E-01	4.8589E+00 3.3501E-02		
11	1.0894E+01 7.5108E-02	5.4145E+00 3.7332E-02	-1.3395E+00 -9.2358E-03	1.2233E+01 8.4344E-02	1.1250E+01 7.7568E-02		
12	1.9692E+01 1.3577E-01	6.6013E+00 4.5514E-02	3.2294E+00 2.2266E-02	1.7030E+01 1.1742E-01	2.2876E+01 1.5773E-01		
13	3.9612E+01 2.7312E-01	1.0038E+01 6.9211E-02	-7.1041E+00 -4.8981E-02	4.6716E+01 3.2210E-01	4.7430E+01 3.2702E-01		
14	3.5543E+01 2.4506E-01	9.4214E+00 6.4958E-02	-6.3537E+00 -4.3807E-02	4.1896E+01 2.8886E-01	3.0958E+01 2.1345E-01		
15	4.5735E+00 3.1533E-02	-6.1560E-01 -4.2444E-03	-8.9241E-01 -6.1530E-03	5.4639E+00 3.7672E-02	6.0187E-01 4.1498E-03		

16	8.1183E+00 5.5974E-02	1.0540E+00 7.2674E-03	-4.7885E+00 -3.3015E-02	1.2907E+01 8.8989E-02	1.3600E+01 9.3767E-02
17	8.3584E+00 5.7629E-02	-1.6610E-01 -1.1452E-03	-3.1385E+00 -2.1639E-02	1.1497E+01 7.9268E-02	1.4024E+01 9.6695E-02
18	8.4619E+00 5.8343E-02	1.4811E+00 1.0212E-02	-3.4233E+00 -2.3603E-02	1.1885E+01 8.1946E-02	1.1634E+01 8.0213E-02
19	2.1298E+00 1.4684E-02	-2.0574E+00 -1.4185E-02	-7.2346E+00 -4.9881E-02	9.3519E+00 6.4479E-02	2.2602E+00 1.5583E-02
20	4.0044E+00 2.7610E-02	-8.9306E-01 -6.1575E-03	-9.3791E+00 -6.4666E-02	1.3364E+01 9.2140E-02	3.5009E+00 2.4138E-02
21	6.7440E+01 4.6498E-01	8.4553E+00 5.8297E-02	2.6382E+00 1.8190E-02	6.5109E+01 4.4891E-01	2.4042E+01 1.6577E-01
22	7.6497E+00 5.2743E-02	4.5009E+00 3.1033E-02	-1.6657E+00 -1.1485E-02	9.3089E+00 6.4183E-02	1.5188E+01 1.0471E-01

**Table 2-220. Load Case 231, 3-ft. Head-On Drop,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	5.2893E+00 3.6468E-02	-1.1045E+02 -7.6150E-01	4.8701E+00 3.3578E-02	1.1574E+02 7.9797E-01	3.3927E+01 2.3392E-01		
2	1.5814E+00 1.0903E-02	-5.9614E+01 -4.1103E-01	-1.9467E+00 -1.3422E-02	6.1196E+01 4.2193E-01	5.5359E+00 3.8169E-02		
3	-4.2678E-02 -2.9426E-04	-2.0986E+01 -1.4470E-01	-4.7846E-01 -3.2989E-03	2.0944E+01 1.4440E-01	5.1599E-01 3.5576E-03		
4	7.0873E+01 4.8865E-01	-1.5825E+02 -1.0911E+00	-1.6707E+01 -1.1519E-01	2.2912E+02 1.5798E+00	2.1843E+02 1.5061E+00		
5	4.0897E+01 2.8197E-01	-8.0737E+01 -5.5666E-01	-3.9752E+00 -2.7408E-02	1.2163E+02 8.3864E-01	1.6924E+02 1.1669E+00		
6	-1.7824E+01 -1.2289E-01	-8.3645E+01 -5.7671E-01	-2.2269E+01 -1.5354E-01	6.5821E+01 4.5382E-01	1.0287E+01 7.0924E-02		
7	-1.1135E-01 -7.6776E-04	-3.8311E+01 -2.6414E-01	-2.5945E-01 -1.7889E-03	3.8200E+01 2.6338E-01	9.9396E-01 6.8531E-03		
8	-7.9429E-02 -5.4764E-04	-2.6506E+01 -1.8276E-01	-5.3638E-01 -3.6982E-03	2.6427E+01 1.8221E-01	3.2321E-02 2.2285E-04		
9	-4.9581E-02 -3.4185E-04	-2.3987E+01 -1.6538E-01	-8.2209E-01 -5.6681E-03	2.3937E+01 1.6504E-01	3.9130E-02 2.6979E-04		
10	-5.5323E+00 -3.8144E-02	-3.7309E+01 -2.5724E-01	1.9997E+00 1.3787E-02	3.1777E+01 2.1910E-01	2.7439E+01 1.8919E-01		
11	1.1373E+01 7.8415E-02	-2.2173E+01 -1.5288E-01	3.0644E+00 2.1128E-02	3.3547E+01 2.3130E-01	1.2374E+01 8.5318E-02		
12	9.5675E+00 6.5965E-02	-1.4001E+01 -9.6536E-02	8.1720E+00 5.6344E-02	2.3569E+01 1.6250E-01	4.1608E+01 2.8688E-01		
13	1.8196E+01 1.2546E-01	-9.9047E+00 -6.8291E-02	7.7296E+00 5.3294E-02	2.8101E+01 1.9375E-01	5.6810E+00 3.9169E-02		
14	1.9332E+01 1.3329E-01	-5.0481E+00 -3.4806E-02	1.1035E+01 7.6086E-02	2.4380E+01 1.6809E-01	4.8746E-01 3.3609E-03		
15	-1.1745E+02 -8.0977E-01	-4.9548E+02 -3.4162E+00	-7.4386E+01 -5.1287E-01	3.7804E+02 2.6065E+00	2.0875E+01 1.4393E-01		

16	1.8936E+01	-4.6506E+01	7.2581E+00	6.5442E+01	4.8381E+01
	1.3056E-01	-3.2065E-01	5.0043E-02	4.5121E-01	3.3357E-01
17	-9.2174E+00	-1.1104E+02	-2.0015E+01	1.0182E+02	1.6928E+01
	-6.3552E-02	-7.6556E-01	-1.3800E-01	7.0201E-01	1.1671E-01
18	-7.3170E+00	-5.8801E+01	-3.3685E+00	5.1484E+01	6.4371E+01
	-5.0449E-02	-4.0542E-01	-2.3225E-02	3.5497E-01	4.4382E-01
19	3.5483E+01	-5.3888E+01	-3.9258E-01	8.9371E+01	7.9479E+01
	2.4465E-01	-3.7155E-01	-2.7067E-03	6.1619E-01	5.4799E-01
20	3.7086E+01	-5.0814E+01	-8.6148E+00	8.7900E+01	9.9294E+01
	2.5570E-01	-3.5035E-01	-5.9397E-02	6.0605E-01	6.8461E-01
21	-5.0943E+00	-1.7411E+01	-1.2532E+01	1.2317E+01	7.6682E+00
	-3.5124E-02	-1.2005E-01	-8.6403E-02	8.4921E-02	5.2870E-02
22	-1.4452E+01	-2.1083E+02	-1.3852E+01	1.9638E+02	6.6197E+01
	-9.9642E-02	-1.4536E+00	-9.5507E-02	1.3540E+00	4.5641E-01

Table 2-221. Load Case 232, 30-ft. Head-On Drop Impact Test, Normal Conditions, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-3.5624E+01 -2.4562E-01	-3.0377E+03 -2.0944E+01	-5.7141E+02 -3.9398E+00	3.0021E+03 2.0699E+01	1.3153E+03 9.0686E+00		
2	3.3840E+01 2.3332E-01	-1.6948E+03 -1.1685E+01	-5.7305E+01 -3.9511E-01	1.7286E+03 1.1919E+01	2.1319E+01 1.4699E-01		
3	2.3417E+01 1.6145E-01	-9.1756E+02 -6.3263E+00	-3.3970E+01 -2.3421E-01	9.4097E+02 6.4878E+00	1.3890E+01 9.5771E-02		
4	1.3051E+03 8.9985E+00	-5.1575E+03 -3.5560E+01	-1.6233E+03 -1.1192E+01	6.4626E+03 4.4558E+01	6.6418E+03 4.5794E+01		
5	5.1571E+02 3.5557E+00	-2.4203E+03 -1.6687E+01	-9.5034E+02 -6.5523E+00	2.9360E+03 2.0243E+01	4.4849E+03 3.0922E+01		
6	-3.5056E+02 -2.4170E+00	-1.2789E+03 -8.8175E+00	-8.9242E+02 -6.1530E+00	9.2831E+02 6.4005E+00	9.7681E+02 6.7348E+00		
7	-3.0675E+00 -2.1150E-02	-6.6503E+02 -4.5852E+00	-2.0442E+01 -1.4094E-01	6.6196E+02 4.5641E+00	1.9669E+01 1.3561E-01		
8	-1.2572E+00 -8.6684E-03	-5.8923E+02 -4.0626E+00	-1.4967E+01 -1.0319E-01	5.8797E+02 4.0539E+00	6.8131E-01 4.6975E-03		
9	-1.0983E+00 -7.5728E-03	-5.6084E+02 -3.8669E+00	-1.6324E+01 -1.1255E-01	5.5975E+02 3.8593E+00	1.6999E+00 1.1720E-02		
10	-1.0327E+02 -7.1206E-01	-7.9022E+02 -5.4484E+00	-1.7452E+01 -1.2033E-01	6.8695E+02 4.7363E+00	4.5667E+02 3.1486E+00		
11	1.8320E+02 1.2631E+00	-3.9676E+02 -2.7355E+00	1.9767E+01 1.3629E-01	5.7996E+02 3.9987E+00	2.6192E+02 1.8059E+00		
12	1.3812E+02 9.5228E-01	-2.1573E+02 -1.4874E+00	1.0509E+02 7.2455E-01	3.5384E+02 2.4397E+00	6.9455E+02 4.7887E+00		
13	2.6981E+02 1.8603E+00	-3.1839E+02 -2.1952E+00	6.9013E+01 4.7583E-01	5.8820E+02 4.0555E+00	2.7305E+02 1.8826E+00		
14	2.5627E+02 1.7669E+00	-2.0323E+02 -1.4012E+00	1.2073E+02 8.3243E-01	4.5950E+02 3.1681E+00	2.1369E+02 1.4733E+00		
15	1.1604E+03 8.0003E+00	6.6171E+01 4.5624E-01	-3.8550E+01 -2.6579E-01	1.0942E+03 7.5441E+00	6.1555E+00 4.2441E-02		

16	4.1228E+02	-7.2998E+02	-3.3516E+02	1.1423E+03	8.1758E+02
	2.8425E+00	-5.0331E+00	-2.3108E+00	7.8756E+00	5.6370E+00
17	5.8537E+02	-6.2846E+02	-4.2834E+02	1.2138E+03	1.3129E+03
	4.0360E+00	-4.3331E+00	-2.9533E+00	8.3691E+00	9.0519E+00
18	6.6580E+02	-1.3209E+03	-1.4426E+02	1.9867E+03	2.6286E+03
	4.5905E+00	-9.1071E+00	-9.9464E-01	1.3698E+01	1.8123E+01
19	4.3034E+02	-1.4481E+03	-6.0022E+02	1.8784E+03	1.7026E+03
	2.9671E+00	-9.9843E+00	-4.1383E+00	1.2951E+01	1.1739E+01
20	1.3614E+02	-1.0829E+03	-6.0449E+02	1.2190E+03	2.2178E+03
	9.3864E-01	-7.4661E+00	-4.1678E+00	8.4048E+00	1.5291E+01
21	8.6909E+02	7.8247E+01	7.1473E+01	7.9084E+02	2.7440E+02
	5.9921E+00	5.3950E-01	4.9279E-01	5.4526E+00	1.8920E+00
22	6.8767E+02	3.9006E+01	3.4223E+02	6.4867E+02	6.5267E+02
	4.7413E+00	2.6894E-01	2.3596E+00	4.4724E+00	4.5000E+00

**Table 2-222. Load Combination 101, Hot Environment,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 102, 201, 211

100°F Ambient, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)						Sm	Su	MS
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q				
---	--	--	-	-----	-----		--	--	--
1	0.60	0.86	0.29	1.46	1.75	20.00	66.30	>10	
	4.14	5.93	1.98	10.07	12.04	137.90	457.12		
2	0.04	0.03	0.43	0.07	0.50	20.00	66.30	>10	
	0.28	0.19	2.96	0.47	3.43	137.90	457.12		
3	0.03	0.02	0.28	0.05	0.33	20.00	66.30	>10	
	0.17	0.16	1.96	0.33	2.29	137.90	457.12		
4	4.94	8.72	3.13	13.66	16.79	20.00	66.30	1.20	
	34.09	60.09	21.57	94.18	115.75	137.90	457.12		
5	4.28	6.97	3.15	11.24	14.39	20.00	66.30	1.67	
	29.48	48.05	21.71	77.52	99.23	137.90	457.12		
6	1.66	2.27	1.42	3.93	5.35	20.00	61.80	6.63	
	11.45	15.65	9.82	27.10	36.92	137.90	426.10		
7	0.29	0.01	0.34	0.29	0.63	20.00	61.80	>10	
	1.97	0.05	2.36	2.02	4.38	137.90	426.10		
8	0.28	0.00	0.34	0.28	0.62	20.00	61.80	>10	
	1.96	0.00	2.33	1.96	4.29	137.90	426.10		
9	0.28	0.01	0.33	0.30	0.63	20.00	61.80	>10	
	1.96	0.08	2.31	2.04	4.35	137.90	426.10		
10	0.98	1.01	0.87	1.99	2.86	20.00	61.80	>10	
	6.76	6.95	6.01	13.72	19.72	137.90	426.10		
11	0.61	0.28	0.96	0.90	1.85	20.00	61.80	>10	
	4.22	1.96	6.59	6.18	12.77	137.90	426.10		
12	0.52	0.41	1.41	0.93	2.33	20.00	61.80	>10	
	3.55	2.83	9.69	6.39	16.08	137.90	426.10		
13	1.04	0.92	1.43	1.96	3.39	20.00	61.80	>10	
	7.17	6.32	9.88	13.50	23.38	137.90	426.10		

14	0.98 6.76	0.98 6.78	1.19 8.20	1.96 13.53	3.15 21.73	20.00 137.90	66.30 457.12	>10
15	3.84 26.44	5.45 37.58	1.07 7.37	9.29 64.02	10.35 71.39	20.00 137.90	66.30 457.12	2.23
16	2.32 16.01	3.39 23.40	0.40 2.75	5.72 39.41	6.12 42.17	20.00 137.90	66.30 457.12	4.25
17	1.64 11.32	2.46 16.94	0.25 1.72	4.10 28.26	4.35 29.98	20.00 137.90	66.30 457.12	6.32
18	1.94 13.41	3.00 20.68	0.33 2.25	4.94 34.09	5.27 36.34	20.00 137.90	66.30 457.12	5.07
19	3.11 21.47	4.80 33.11	0.47 3.23	7.92 54.57	8.38 57.81	20.00 137.90	66.30 457.12	2.79
20	2.54 17.53	4.71 32.47	0.96 6.65	7.25 50.00	8.22 56.66	20.00 137.90	61.80 426.10	3.14
21	0.22 1.55	0.47 3.21	0.06 0.45	0.69 4.76	0.75 5.21	20.00 137.90	66.30 457.12	>10
22	1.97 13.59	2.34 16.13	0.06 0.44	4.31 29.72	4.37 30.16	20.00 137.90	66.30 457.12	5.96

Min MS: 1.196, Location: 4, Combination: Pm+Pb

**Table 2-223. Load Combination 102, Cold Environment,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 104, 201, 211

-40°F Ambient, Zero Decay Heat, Zero Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.09	1.46	1.55	20.00	70.00	>10
	4.14	5.93	0.61	10.07	10.67	137.90	482.63	
2	0.04	0.03	0.07	0.07	0.14	20.00	70.00	>10
	0.28	0.19	0.49	0.47	0.97	137.90	482.63	
3	0.03	0.02	0.09	0.05	0.14	20.00	70.00	>10
	0.17	0.16	0.65	0.33	0.98	137.90	482.63	
4	4.94	8.72	6.06	13.66	19.72	20.00	70.00	1.20
	34.09	60.09	41.81	94.18	136.00	137.90	482.63	
5	4.28	6.97	8.52	11.24	19.77	20.00	70.00	1.67
	29.48	48.05	58.78	77.52	136.30	137.90	482.63	
6	1.66	2.27	4.03	3.93	7.96	20.00	70.00	6.54
	11.45	15.65	27.78	27.10	54.87	137.90	482.63	
7	0.29	0.01	1.84	0.29	2.13	20.00	70.00	>10
	1.97	0.05	12.69	2.02	14.71	137.90	482.63	
8	0.28	0.00	1.84	0.28	2.12	20.00	70.00	>10
	1.96	0.00	12.68	1.96	14.64	137.90	482.63	
9	0.28	0.01	1.84	0.30	2.14	20.00	70.00	>10
	1.96	0.08	12.69	2.04	14.73	137.90	482.63	
10	0.98	1.01	2.17	1.99	4.16	20.00	70.00	>10
	6.76	6.95	14.96	13.72	28.68	137.90	482.63	
11	0.61	0.28	1.16	0.90	2.06	20.00	70.00	>10
	4.22	1.96	8.03	6.18	14.21	137.90	482.63	
12	0.52	0.41	0.89	0.93	1.81	20.00	70.00	>10
	3.55	2.83	6.11	6.39	12.49	137.90	482.63	
13	1.04	0.92	3.84	1.96	5.80	20.00	70.00	9.34
	7.17	6.32	26.50	13.50	40.00	137.90	482.63	

14	0.98 6.76	0.98 6.78	3.13 21.61	1.96 13.53	5.10 35.14	20.00 137.90	70.00 482.63	>10
15	3.84 26.44	5.45 37.58	0.76 5.26	9.29 64.02	10.05 69.28	20.00 137.90	70.00 482.63	2.23
16	2.32 16.01	3.39 23.40	1.59 10.94	5.72 39.41	7.30 50.35	20.00 137.90	70.00 482.63	4.25
17	1.64 11.32	2.46 16.94	1.26 8.66	4.10 28.26	5.35 36.92	20.00 137.90	70.00 482.63	6.32
18	1.94 13.41	3.00 20.68	1.23 8.46	4.94 34.09	6.17 42.55	20.00 137.90	70.00 482.63	5.07
19	3.11 21.47	4.80 33.11	1.78 12.29	7.92 54.57	9.70 66.86	20.00 137.90	70.00 482.63	2.79
20	2.54 17.53	4.71 32.47	2.16 14.90	7.25 50.00	9.41 64.90	20.00 137.90	70.00 482.63	3.14
21	0.22 1.55	0.47 3.21	1.01 6.99	0.69 4.76	1.70 11.75	20.00 137.90	70.00 482.63	>10
22	1.97 13.59	2.34 16.13	0.12 0.84	4.31 29.72	4.43 30.57	20.00 137.90	70.00 482.63	5.96

Min MS: 1.196, Location: 4, Combination: Pm+Pb

**Table 2-224. Load Combination 103, Increased External Pressure,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 103, 202, 211

-20°F Ambient, Zero Decay Heat, Zero Insolation

Minimum External Pressure, 24 kPa (3.5 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.59	0.85	0.07	1.43	1.51	20.00	70.00	>10
	4.05	5.84	0.50	9.89	10.39	137.90	482.63	
2	0.03	0.03	0.06	0.06	0.12	20.00	70.00	>10
	0.23	0.18	0.40	0.41	0.81	137.90	482.63	
3	0.01	0.00	0.08	0.02	0.09	20.00	70.00	>10
	0.08	0.03	0.53	0.11	0.64	137.90	482.63	
4	0.91	1.59	4.96	2.50	7.46	20.00	70.00	7.04
	6.29	10.94	34.21	17.23	51.44	137.90	482.63	
5	0.95	1.47	6.97	2.42	9.39	20.00	70.00	5.39
	6.55	10.13	48.09	16.68	64.77	137.90	482.63	
6	0.39	0.65	3.30	1.04	4.33	20.00	70.00	>10
	2.70	4.46	22.73	7.16	29.89	137.90	482.63	
7	0.15	0.00	1.51	0.16	1.66	20.00	70.00	>10
	1.06	0.01	10.39	1.07	11.46	137.90	482.63	
8	0.15	0.00	1.50	0.15	1.66	20.00	70.00	>10
	1.06	0.00	10.37	1.06	11.43	137.90	482.63	
9	0.15	0.00	1.51	0.15	1.66	20.00	70.00	>10
	1.06	0.00	10.38	1.06	11.44	137.90	482.63	
10	0.20	0.09	1.78	0.29	2.06	20.00	70.00	>10
	1.37	0.60	12.24	1.97	14.21	137.90	482.63	
11	0.11	0.07	0.95	0.18	1.13	20.00	70.00	>10
	0.75	0.46	6.57	1.21	7.78	137.90	482.63	
12	0.08	0.01	0.72	0.08	0.81	20.00	70.00	>10
	0.52	0.06	5.00	0.58	5.58	137.90	482.63	
13	0.35	0.36	3.14	0.71	3.86	20.00	70.00	>10
	2.44	2.48	21.68	4.92	26.60	137.90	482.63	

14	0.34 2.33	0.29 2.03	2.56 17.68	0.63 4.36	3.20 22.04	20.00 137.90	70.00 482.63	>10
15	0.49 3.37	0.28 1.95	0.62 4.30	0.77 5.32	1.40 9.63	20.00 137.90	70.00 482.63	>10
16	0.14 0.98	0.20 1.41	1.30 8.95	0.35 2.39	1.64 11.34	20.00 137.90	70.00 482.63	>10
17	0.10 0.71	0.16 1.08	1.03 7.08	0.26 1.78	1.29 8.87	20.00 137.90	70.00 482.63	>10
18	0.19 1.28	0.31 2.11	1.00 6.92	0.49 3.38	1.49 10.30	20.00 137.90	70.00 482.63	>10
19	0.27 1.87	0.38 2.59	1.46 10.06	0.65 4.46	2.11 14.52	20.00 137.90	70.00 482.63	>10
20	0.27 1.88	0.45 3.08	1.77 12.19	0.72 4.96	2.49 17.15	20.00 137.90	70.00 482.63	>10
21	0.05 0.37	0.09 0.62	0.83 5.72	0.14 0.99	0.97 6.72	20.00 137.90	70.00 482.63	>10
22	0.35 2.38	0.08 0.56	0.10 0.69	0.43 2.95	0.53 3.64	20.00 137.90	70.00 482.63	>10

Min MS: 5.387, Location: 5, Combination: Pm+Pb+Q

**Table 2-225. Load Combination 104, Minimum External Pressure,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 101, 201, 202, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.30	1.46	1.76	20.00	66.30	>10
	4.15	5.93	2.08	10.08	12.16	137.90	457.12	
2	0.04	0.03	0.45	0.07	0.52	20.00	66.30	>10
	0.29	0.19	3.10	0.48	3.58	137.90	457.12	
3	0.03	0.02	0.30	0.05	0.35	20.00	66.30	>10
	0.18	0.16	2.06	0.34	2.40	137.90	457.12	
4	5.07	8.91	3.10	13.98	17.08	20.00	66.30	1.15
	34.94	61.47	21.39	96.40	117.79	137.90	457.12	
5	4.36	7.11	3.32	11.48	14.79	20.00	66.30	1.61
	30.08	49.05	22.87	79.12	102.00	137.90	457.12	
6	1.69	2.30	1.43	3.99	5.42	20.00	66.30	6.52
	11.65	15.84	9.88	27.49	37.37	137.90	457.12	
7	0.29	0.01	0.40	0.30	0.70	20.00	66.30	>10
	2.00	0.05	2.75	2.05	4.80	137.90	457.12	
8	0.29	0.00	0.40	0.29	0.69	20.00	66.30	>10
	2.00	0.00	2.75	2.00	4.74	137.90	457.12	
9	0.29	0.01	0.40	0.30	0.70	20.00	66.30	>10
	2.00	0.08	2.74	2.08	4.82	137.90	457.12	
10	1.02	1.05	0.67	2.08	2.74	20.00	66.30	>10
	7.07	7.26	4.59	14.33	18.91	137.90	457.12	
11	0.64	0.29	0.83	0.93	1.76	20.00	66.30	>10
	4.39	2.01	5.72	6.41	12.12	137.90	457.12	
12	0.55	0.41	1.25	0.96	2.22	20.00	66.30	>10
	3.80	2.84	8.64	6.64	15.28	137.90	457.12	
13	1.09	0.96	1.47	2.04	3.51	20.00	66.30	>10
	7.49	6.59	10.13	14.08	24.22	137.90	457.12	

14	1.02 7.03	1.03 7.07	1.24 8.57	2.05 14.10	3.29 22.68	20.00 137.90	66.30 457.12	>10
15	4.01 27.65	5.72 39.44	0.67 4.64	9.73 67.09	10.40 71.73	20.00 137.90	66.30 457.12	2.08
16	2.44 16.82	3.57 24.59	0.25 1.70	6.01 41.41	6.25 43.11	20.00 137.90	66.30 457.12	4.00
17	1.72 11.89	2.58 17.79	0.16 1.13	4.31 29.68	4.47 30.81	20.00 137.90	66.30 457.12	5.97
18	2.04 14.08	3.15 21.70	0.34 2.34	5.19 35.78	5.53 38.12	20.00 137.90	66.30 457.12	4.78
19	3.27 22.55	5.05 34.79	0.44 3.06	8.32 57.34	8.76 60.40	20.00 137.90	66.30 457.12	2.61
20	2.67 18.40	4.95 34.10	1.01 6.99	7.61 52.50	8.63 59.49	20.00 137.90	66.30 457.12	2.94
21	0.25 1.73	0.49 3.39	0.06 0.44	0.74 5.12	0.81 5.56	20.00 137.90	66.30 457.12	>10
22	2.04 14.04	2.42 16.67	0.06 0.39	4.45 30.71	4.51 31.10	20.00 137.90	66.30 457.12	5.74

Min MS: 1.146, Location: 4, Combination: Pm+Pb

Table 2-226. Load Combination 105, Cold Environment with Maximum Decay Heat, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 105, 201, 202, 211
 -40°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.33	1.46	1.79	20.00	70.00	>10
	4.15	5.93	2.24	10.08	12.32	137.90	482.63	
2	0.04	0.03	0.48	0.07	0.55	20.00	70.00	>10
	0.29	0.19	3.32	0.48	3.80	137.90	482.63	
3	0.03	0.02	0.32	0.05	0.37	20.00	70.00	>10
	0.18	0.16	2.23	0.34	2.58	137.90	482.63	
4	5.07	8.91	3.40	13.98	17.38	20.00	70.00	1.15
	34.94	61.47	23.46	96.40	119.86	137.90	482.63	
5	4.36	7.11	3.69	11.48	15.17	20.00	70.00	1.61
	30.08	49.05	25.47	79.12	104.59	137.90	482.63	
6	1.69	2.30	1.60	3.99	5.58	20.00	70.00	6.52
	11.65	15.84	11.00	27.49	38.49	137.90	482.63	
7	0.29	0.01	0.47	0.30	0.76	20.00	70.00	>10
	2.00	0.05	3.22	2.05	5.27	137.90	482.63	
8	0.29	0.00	0.47	0.29	0.76	20.00	70.00	>10
	2.00	0.00	3.22	2.00	5.21	137.90	482.63	
9	0.29	0.01	0.47	0.30	0.77	20.00	70.00	>10
	2.00	0.08	3.21	2.08	5.29	137.90	482.63	
10	1.02	1.05	0.66	2.08	2.74	20.00	70.00	>10
	7.07	7.26	4.53	14.33	18.86	137.90	482.63	
11	0.64	0.29	0.85	0.93	1.78	20.00	70.00	>10
	4.39	2.01	5.84	6.41	12.25	137.90	482.63	
12	0.55	0.41	1.29	0.96	2.25	20.00	70.00	>10
	3.80	2.84	8.86	6.64	15.50	137.90	482.63	
13	1.09	0.96	1.59	2.04	3.63	20.00	70.00	>10
	7.49	6.59	10.93	14.08	25.02	137.90	482.63	

14	1.02 7.03	1.03 7.07	1.35 9.33	2.05 14.10	3.40 23.44	20.00 137.90	70.00 482.63	>10
15	4.01 27.65	5.72 39.44	0.11 0.73	9.73 67.09	9.84 67.82	20.00 137.90	70.00 482.63	2.08
16	2.44 16.82	3.57 24.59	0.04 0.28	6.01 41.41	6.05 41.68	20.00 137.90	70.00 482.63	4.00
17	1.72 11.89	2.58 17.79	0.04 0.27	4.31 29.68	4.34 29.95	20.00 137.90	70.00 482.63	5.97
18	2.04 14.08	3.15 21.70	0.38 2.61	5.19 35.78	5.57 38.39	20.00 137.90	70.00 482.63	4.78
19	3.27 22.55	5.05 34.79	0.45 3.08	8.32 57.34	8.76 60.42	20.00 137.90	70.00 482.63	2.61
20	2.67 18.40	4.95 34.10	1.13 7.77	7.61 52.50	8.74 60.27	20.00 137.90	70.00 482.63	2.94
21	0.25 1.73	0.49 3.39	0.07 0.47	0.74 5.12	0.81 5.60	20.00 137.90	70.00 482.63	>10
22	2.04 14.04	2.42 16.67	0.09 0.61	4.45 30.71	4.54 31.32	20.00 137.90	70.00 482.63	5.74

Min MS: 1.146, Location: 4, Combination: Pm+Pb

**Table 2-227. Load Combination 106, Maximum Pressure, Hot Environment,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 101, 201, 203, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Maximum Increased External Pressure, 140 kPa (20 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.87	0.30	1.48	1.78	20.00	66.30	>10
	4.22	5.97	2.08	10.19	12.26	137.90	457.12	
2	0.05	0.03	0.45	0.08	0.53	20.00	66.30	>10
	0.36	0.19	3.10	0.54	3.64	137.90	457.12	
3	0.04	0.03	0.30	0.07	0.37	20.00	66.30	>10
	0.25	0.21	2.06	0.46	2.52	137.90	457.12	
4	5.19	9.19	3.10	14.38	17.48	20.00	66.30	1.09
	35.77	63.35	21.39	99.13	120.51	137.90	457.12	
5	4.56	7.38	3.32	11.94	15.26	20.00	66.30	1.51
	31.46	50.88	22.87	82.33	105.21	137.90	457.12	
6	1.78	2.47	1.43	4.25	5.68	20.00	66.30	6.06
	12.27	17.02	9.88	29.29	39.17	137.90	457.12	
7	0.35	0.01	0.40	0.36	0.76	20.00	66.30	>10
	2.40	0.06	2.75	2.46	5.21	137.90	457.12	
8	0.35	0.00	0.40	0.35	0.75	20.00	66.30	>10
	2.40	0.00	2.75	2.40	5.15	137.90	457.12	
9	0.35	0.01	0.40	0.36	0.76	20.00	66.30	>10
	2.40	0.08	2.74	2.48	5.23	137.90	457.12	
10	1.05	1.01	0.67	2.06	2.73	20.00	66.30	>10
	7.24	6.97	4.59	14.21	18.80	137.90	457.12	
11	0.64	0.30	0.83	0.94	1.77	20.00	66.30	>10
	4.41	2.07	5.72	6.48	12.20	137.90	457.12	
12	0.64	0.55	1.25	1.19	2.44	20.00	66.30	>10
	4.42	3.79	8.64	8.20	16.85	137.90	457.12	
13	1.13	1.01	1.47	2.14	3.61	20.00	66.30	>10
	7.80	6.94	10.13	14.73	24.86	137.90	457.12	

14	1.05 7.23	1.04 7.15	1.24 8.57	2.09 14.38	3.33 22.95	20.00 137.90	66.30 457.12	>10
15	4.02 27.71	5.67 39.09	0.67 4.64	9.69 66.80	10.36 71.44	20.00 137.90	66.30 457.12	2.10
16	2.46 16.99	3.60 24.85	0.25 1.70	6.07 41.84	6.32 43.55	20.00 137.90	66.30 457.12	3.94
17	1.74 12.01	2.62 18.04	0.16 1.13	4.36 30.06	4.52 31.18	20.00 137.90	66.30 457.12	5.88
18	2.05 14.15	3.17 21.86	0.34 2.34	5.22 36.01	5.56 38.35	20.00 137.90	66.30 457.12	4.74
19	3.28 22.63	5.05 34.84	0.44 3.06	8.34 57.47	8.78 60.53	20.00 137.90	66.30 457.12	2.60
20	2.67 18.42	4.95 34.14	1.01 6.99	7.62 52.55	8.64 59.55	20.00 137.90	66.30 457.12	2.94
21	0.36 2.46	0.54 3.71	0.06 0.44	0.90 6.18	0.96 6.62	20.00 137.90	66.30 457.12	>10
22	2.02 13.93	2.36 16.29	0.06 0.39	4.38 30.22	4.44 30.61	20.00 137.90	66.30 457.12	5.84

Min MS: 1.087, Location: 4, Combination: Pm+Pb

**Table 2-228. Load Combination 107, Maximum Pressure, Cold Environment,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 105, 201, 203, 211
 -40°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Maximum Increased External Pressure, 140 kPa (20 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.87	0.33	1.48	1.80	20.00	70.00	>10
	4.22	5.97	2.24	10.19	12.43	137.90	482.63	
2	0.05	0.03	0.48	0.08	0.56	20.00	70.00	>10
	0.36	0.19	3.32	0.54	3.86	137.90	482.63	
3	0.04	0.03	0.32	0.07	0.39	20.00	70.00	>10
	0.25	0.21	2.23	0.46	2.69	137.90	482.63	
4	5.19	9.19	3.40	14.38	17.78	20.00	70.00	1.09
	35.77	63.35	23.46	99.13	122.59	137.90	482.63	
5	4.56	7.38	3.69	11.94	15.63	20.00	70.00	1.51
	31.46	50.88	25.47	82.33	107.80	137.90	482.63	
6	1.78	2.47	1.60	4.25	5.84	20.00	70.00	6.06
	12.27	17.02	11.00	29.29	40.29	137.90	482.63	
7	0.35	0.01	0.47	0.36	0.82	20.00	70.00	>10
	2.40	0.06	3.22	2.46	5.68	137.90	482.63	
8	0.35	0.00	0.47	0.35	0.81	20.00	70.00	>10
	2.40	0.00	3.22	2.40	5.62	137.90	482.63	
9	0.35	0.01	0.47	0.36	0.83	20.00	70.00	>10
	2.40	0.08	3.21	2.48	5.70	137.90	482.63	
10	1.05	1.01	0.66	2.06	2.72	20.00	70.00	>10
	7.24	6.97	4.53	14.21	18.74	137.90	482.63	
11	0.64	0.30	0.85	0.94	1.79	20.00	70.00	>10
	4.41	2.07	5.84	6.48	12.32	137.90	482.63	
12	0.64	0.55	1.29	1.19	2.48	20.00	70.00	>10
	4.42	3.79	8.86	8.20	17.07	137.90	482.63	
13	1.13	1.01	1.59	2.14	3.72	20.00	70.00	>10
	7.80	6.94	10.93	14.73	25.67	137.90	482.63	

14	1.05 7.23	1.04 7.15	1.35 9.33	2.09 14.38	3.44 23.71	20.00 137.90	70.00 482.63	>10
15	4.02 27.71	5.67 39.09	0.11 0.73	9.69 66.80	9.79 67.53	20.00 137.90	70.00 482.63	2.10
16	2.46 16.99	3.60 24.85	0.04 0.28	6.07 41.84	6.11 42.12	20.00 137.90	70.00 482.63	3.94
17	1.74 12.01	2.62 18.04	0.04 0.27	4.36 30.06	4.40 30.33	20.00 137.90	70.00 482.63	5.88
18	2.05 14.15	3.17 21.86	0.38 2.61	5.22 36.01	5.60 38.62	20.00 137.90	70.00 482.63	4.74
19	3.28 22.63	5.05 34.84	0.45 3.08	8.34 57.47	8.78 60.56	20.00 137.90	70.00 482.63	2.60
20	2.67 18.42	4.95 34.14	1.13 7.77	7.62 52.55	8.75 60.32	20.00 137.90	70.00 482.63	2.94
21	0.36 2.46	0.54 3.71	0.07 0.47	0.90 6.18	0.96 6.65	20.00 137.90	70.00 482.63	>10
22	2.02 13.93	2.36 16.29	0.09 0.61	4.38 30.22	4.47 30.83	20.00 137.90	70.00 482.63	5.84

Min MS: 1.087, Location: 4, Combination: Pm+Pb

**Table 2-229. Load Combination 215, Compression Load,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 215, 101, 201, 211
 Compression Load (5x weight)
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.73	1.05	0.30	1.79	2.09	20.00	66.30	>10
	5.04	7.27	2.08	12.31	14.38	137.90	457.12	
2	0.14	0.03	0.45	0.17	0.62	20.00	66.30	>10
	0.98	0.21	3.10	1.18	4.28	137.90	457.12	
3	0.14	0.06	0.30	0.20	0.49	20.00	66.30	>10
	0.94	0.40	2.06	1.35	3.41	137.90	457.12	
4	5.59	9.90	3.10	15.48	18.59	20.00	66.30	0.94
	38.54	68.23	21.39	106.76	128.15	137.90	457.12	
5	4.96	7.92	3.32	12.88	16.20	20.00	66.30	1.33
	34.19	54.64	22.87	88.82	111.70	137.90	457.12	
6	1.93	2.59	1.43	4.52	5.96	20.00	66.30	5.63
	13.29	17.89	9.88	31.18	41.07	137.90	457.12	
7	0.49	0.01	0.40	0.50	0.90	20.00	66.30	>10
	3.39	0.06	2.75	3.46	6.20	137.90	457.12	
8	0.45	0.00	0.40	0.45	0.85	20.00	66.30	>10
	3.10	0.00	2.75	3.10	5.84	137.90	457.12	
9	0.43	0.01	0.40	0.44	0.84	20.00	66.30	>10
	2.98	0.08	2.74	3.06	5.80	137.90	457.12	
10	1.13	1.01	0.67	2.14	2.80	20.00	66.30	>10
	7.77	6.97	4.59	14.73	19.32	137.90	457.12	
11	0.67	0.34	0.83	1.01	1.84	20.00	66.30	>10
	4.62	2.37	5.72	6.99	12.70	137.90	457.12	
12	0.59	0.51	1.25	1.09	2.35	20.00	66.30	>10
	4.04	3.50	8.64	7.54	16.19	137.90	457.12	
13	1.28	1.14	1.47	2.42	3.89	20.00	66.30	>10
	8.80	7.88	10.13	16.68	26.81	137.90	457.12	

14	1.18 8.13	1.16 8.02	1.24 8.57	2.34 16.15	3.59 24.72	20.00 137.90	66.30 457.12	>10
15	6.01 41.41	5.59 38.53	0.67 4.64	11.59 79.94	12.27 84.58	20.00 137.90	66.30 457.12	1.59
16	2.91 20.07	4.20 28.93	0.25 1.70	7.11 49.00	7.35 50.70	20.00 137.90	66.30 457.12	3.22
17	1.98 13.64	2.97 20.48	0.16 1.13	4.95 34.12	5.11 35.25	20.00 137.90	66.30 457.12	5.06
18	2.14 14.77	3.29 22.70	0.34 2.34	5.43 37.47	5.77 39.80	20.00 137.90	66.30 457.12	4.52
19	3.52 24.29	5.36 36.94	0.44 3.06	8.88 61.23	9.32 64.29	20.00 137.90	66.30 457.12	2.38
20	3.04 20.95	5.56 38.34	1.01 6.99	8.60 59.29	9.61 66.28	20.00 137.90	66.30 457.12	2.49
21	0.35 2.45	0.53 3.67	0.06 0.44	0.89 6.12	0.95 6.56	20.00 137.90	66.30 457.12	>10
22	2.57 17.70	2.48 17.09	0.06 0.39	5.05 34.80	5.10 35.19	20.00 137.90	66.30 457.12	4.94

Min MS: 0.937, Location: 4, Combination: Pm+Pb

**Table 2-230. Load Combination 216, Rod Drop,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 216, 101, 201, 211
Rod Drop onto Cask
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.63	0.87	0.30	1.50	1.80	20.00	66.30	>10
	4.31	6.02	2.08	10.33	12.41	137.90	457.12	
2	0.06	0.03	0.45	0.09	0.54	20.00	66.30	>10
	0.39	0.23	3.10	0.62	3.72	137.90	457.12	
3	0.04	0.02	0.30	0.06	0.36	20.00	66.30	>10
	0.28	0.17	2.06	0.45	2.51	137.90	457.12	
4	5.06	8.86	3.10	13.92	17.02	20.00	66.30	1.16
	34.91	61.06	21.39	95.97	117.35	137.90	457.12	
5	4.34	7.02	3.32	11.36	14.68	20.00	66.30	1.64
	29.95	48.40	22.87	78.35	101.23	137.90	457.12	
6	1.74	2.32	1.43	4.06	5.50	20.00	66.30	6.38
	12.00	16.01	9.88	28.01	37.90	137.90	457.12	
7	0.34	0.01	0.40	0.34	0.74	20.00	66.30	>10
	2.32	0.06	2.75	2.38	5.12	137.90	457.12	
8	0.32	0.00	0.40	0.32	0.72	20.00	66.30	>10
	2.20	0.00	2.75	2.21	4.95	137.90	457.12	
9	0.31	0.01	0.40	0.32	0.72	20.00	66.30	>10
	2.14	0.08	2.74	2.22	4.97	137.90	457.12	
10	1.00	1.01	0.67	2.01	2.68	20.00	66.30	>10
	6.90	6.97	4.59	13.87	18.46	137.90	457.12	
11	0.62	0.29	0.83	0.91	1.74	20.00	66.30	>10
	4.27	2.02	5.72	6.29	12.01	137.90	457.12	
12	0.52	0.42	1.25	0.94	2.20	20.00	66.30	>10
	3.61	2.89	8.64	6.50	15.14	137.90	457.12	
13	1.07	0.94	1.47	2.01	3.48	20.00	66.30	>10
	7.38	6.50	10.13	13.89	24.02	137.90	457.12	

14	1.01 6.94	1.01 6.96	1.24 8.57	2.02 13.90	3.26 22.47	20.00 137.90	66.30 457.12	>10
15	7.90 54.46	6.20 42.74	0.67 4.64	14.10 97.21	14.77 101.84	20.00 137.90	66.30 457.12	1.13
16	2.82 19.48	4.16 28.65	0.25 1.70	6.98 48.13	7.23 49.83	20.00 137.90	66.30 457.12	3.30
17	1.93 13.31	2.97 20.46	0.16 1.13	4.90 33.78	5.06 34.90	20.00 137.90	66.30 457.12	5.12
18	2.03 13.99	3.00 20.71	0.34 2.34	5.03 34.70	5.37 37.03	20.00 137.90	66.30 457.12	4.96
19	3.20 22.05	4.90 33.78	0.44 3.06	8.10 55.83	8.54 58.89	20.00 137.90	66.30 457.12	2.71
20	2.65 18.29	4.86 33.53	1.01 6.99	7.52 51.82	8.53 58.81	20.00 137.90	66.30 457.12	2.99
21	0.23 1.58	0.47 3.23	0.06 0.44	0.70 4.80	0.76 5.24	20.00 137.90	66.30 457.12	>10
22	5.99 41.29	7.10 48.95	0.06 0.39	13.09 90.24	13.14 90.63	20.00 137.90	66.30 457.12	1.29

Min MS: 1.128, Location: 15, Combination: Pm+Pb

**Table 2-231. Load Combination 217, Rod Drop, Cold Environment,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 216, 104, 201, 211

Rod Drop onto Cask

-40°F Ambient, Zero Decay Heat, Zero Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Stress (ksi/MPa)								

Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.63	0.87	0.09	1.50	1.59	20.00	70.00	>10
	4.31	6.02	0.61	10.33	10.94	137.90	482.63	
2	0.06	0.03	0.07	0.09	0.16	20.00	70.00	>10
	0.39	0.23	0.49	0.62	1.11	137.90	482.63	
3	0.04	0.02	0.09	0.06	0.16	20.00	70.00	>10
	0.28	0.17	0.65	0.45	1.09	137.90	482.63	
4	5.06	8.86	6.06	13.92	19.98	20.00	70.00	1.16
	34.91	61.06	41.81	95.97	137.78	137.90	482.63	
5	4.34	7.02	8.52	11.36	19.89	20.00	70.00	1.64
	29.95	48.40	58.78	78.35	137.13	137.90	482.63	
6	1.74	2.32	4.03	4.06	8.09	20.00	70.00	6.38
	12.00	16.01	27.78	28.01	55.79	137.90	482.63	
7	0.34	0.01	1.84	0.34	2.19	20.00	70.00	>10
	2.32	0.06	12.69	2.38	15.07	137.90	482.63	
8	0.32	0.00	1.84	0.32	2.16	20.00	70.00	>10
	2.20	0.00	12.68	2.21	14.89	137.90	482.63	
9	0.31	0.01	1.84	0.32	2.16	20.00	70.00	>10
	2.14	0.08	12.69	2.22	14.91	137.90	482.63	
10	1.00	1.01	2.17	2.01	4.18	20.00	70.00	>10
	6.90	6.97	14.96	13.87	28.83	137.90	482.63	
11	0.62	0.29	1.16	0.91	2.08	20.00	70.00	>10
	4.27	2.02	8.03	6.29	14.32	137.90	482.63	
12	0.52	0.42	0.89	0.94	1.83	20.00	70.00	>10
	3.61	2.89	6.11	6.50	12.60	137.90	482.63	
13	1.07	0.94	3.84	2.01	5.86	20.00	70.00	9.24
	7.38	6.50	26.50	13.89	40.38	137.90	482.63	

14	1.01 6.94	1.01 6.96	3.13 21.61	2.02 13.90	5.15 35.51	20.00 137.90	70.00 482.63	>10
15	7.90 54.46	6.20 42.74	0.76 5.26	14.10 97.21	14.86 102.47	20.00 137.90	70.00 482.63	1.13
16	2.82 19.48	4.16 28.65	1.59 10.94	6.98 48.13	8.57 59.06	20.00 137.90	70.00 482.63	3.30
17	1.93 13.31	2.97 20.46	1.26 8.66	4.90 33.78	6.15 42.43	20.00 137.90	70.00 482.63	5.12
18	2.03 13.99	3.00 20.71	1.23 8.46	5.03 34.70	6.26 43.16	20.00 137.90	70.00 482.63	4.96
19	3.20 22.05	4.90 33.78	1.78 12.29	8.10 55.83	9.88 68.12	20.00 137.90	70.00 482.63	2.71
20	2.65 18.29	4.86 33.53	2.16 14.90	7.52 51.82	9.68 66.71	20.00 137.90	70.00 482.63	2.99
21	0.23 1.58	0.47 3.23	1.01 6.99	0.70 4.80	1.71 11.80	20.00 137.90	70.00 482.63	>10
22	5.99 41.29	7.10 48.95	0.12 0.84	13.09 90.24	13.21 91.08	20.00 137.90	70.00 482.63	1.29

Min MS: 1.128, Location: 15, Combination: Pm+Pb

**Table 2-232. Load Combination 221, Forward Vibration,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 221, 101, 201, 211
Forward 10g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Stress (ksi/MPa)								

Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.93	0.93	0.30	1.86	2.16	20.00	66.30	>10
	6.40	6.40	2.08	12.80	14.88	137.90	457.12	
2	0.88	0.23	0.45	1.11	1.56	20.00	66.30	>10
	6.04	1.62	3.10	7.66	10.76	137.90	457.12	
3	0.32	0.12	0.30	0.45	0.74	20.00	66.30	>10
	2.22	0.85	2.06	3.08	5.14	137.90	457.12	
4	5.49	9.02	3.10	14.51	17.61	20.00	66.30	1.07
	37.84	62.17	21.39	100.01	121.40	137.90	457.12	
5	4.67	7.10	3.32	11.77	15.09	20.00	66.30	1.55
	32.17	48.98	22.87	81.15	104.03	137.90	457.12	
6	1.87	2.33	1.43	4.20	5.63	20.00	66.30	6.14
	12.92	16.03	9.88	28.96	38.84	137.90	457.12	
7	0.35	0.03	0.40	0.38	0.78	20.00	66.30	>10
	2.40	0.19	2.75	2.60	5.34	137.90	457.12	
8	0.35	0.02	0.40	0.37	0.77	20.00	66.30	>10
	2.38	0.15	2.75	2.53	5.28	137.90	457.12	
9	0.34	0.04	0.40	0.38	0.77	20.00	66.30	>10
	2.35	0.24	2.74	2.59	5.34	137.90	457.12	
10	1.10	1.15	0.67	2.25	2.91	20.00	66.30	>10
	7.58	7.91	4.59	15.49	20.08	137.90	457.12	
11	0.79	0.34	0.83	1.13	1.95	20.00	66.30	>10
	5.42	2.34	5.72	7.76	13.48	137.90	457.12	
12	0.68	0.45	1.25	1.12	2.38	20.00	66.30	>10
	4.67	3.07	8.64	7.74	16.39	137.90	457.12	
13	1.35	0.94	1.47	2.29	3.76	20.00	66.30	>10
	9.31	6.46	10.13	15.77	25.91	137.90	457.12	

14	1.30 8.93	1.08 7.45	1.24 8.57	2.38 16.39	3.62 24.96	20.00 137.90	66.30 457.12	>10
15	4.03 27.77	5.61 38.70	0.67 4.64	9.64 66.47	10.31 71.11	20.00 137.90	66.30 457.12	2.11
16	2.47 17.06	3.53 24.32	0.25 1.70	6.00 41.38	6.25 43.08	20.00 137.90	66.30 457.12	4.00
17	1.78 12.26	2.52 17.36	0.16 1.13	4.30 29.62	4.46 30.74	20.00 137.90	66.30 457.12	5.98
18	2.06 14.22	3.09 21.30	0.34 2.34	5.15 35.52	5.49 37.86	20.00 137.90	66.30 457.12	4.82
19	3.36 23.13	4.87 33.55	0.44 3.06	8.22 56.68	8.66 59.74	20.00 137.90	66.30 457.12	2.65
20	2.83 19.48	4.84 33.40	1.01 6.99	7.67 52.88	8.68 59.87	20.00 137.90	66.30 457.12	2.91
21	0.46 3.20	0.53 3.63	0.06 0.44	0.99 6.83	1.06 7.27	20.00 137.90	66.30 457.12	>10
22	2.12 14.64	2.39 16.47	0.06 0.39	4.51 31.11	4.57 31.49	20.00 137.90	66.30 457.12	5.65

Min MS: 1.068, Location: 4, Combination: Pm+Pb

**Table 2-233. Load Combination 222, Lateral Vibration,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 222, 101, 201, 211
Lateral 5g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.68	0.89	0.30	1.57	1.87	20.00	66.30	>10
	4.71	6.13	2.08	10.83	12.91	137.90	457.12	
2	0.11	0.06	0.45	0.17	0.62	20.00	66.30	>10
	0.78	0.38	3.10	1.16	4.26	137.90	457.12	
3	0.11	0.05	0.30	0.16	0.46	20.00	66.30	>10
	0.74	0.35	2.06	1.09	3.15	137.90	457.12	
4	5.02	8.77	3.10	13.79	16.89	20.00	66.30	1.18
	34.60	60.46	21.39	95.06	116.45	137.90	457.12	
5	4.35	7.00	3.32	11.35	14.67	20.00	66.30	1.64
	29.97	48.28	22.87	78.26	101.13	137.90	457.12	
6	1.69	2.28	1.43	3.98	5.41	20.00	66.30	6.54
	11.68	15.74	9.88	27.43	37.31	137.90	457.12	
7	0.29	0.01	0.40	0.30	0.70	20.00	66.30	>10
	2.00	0.06	2.75	2.06	4.81	137.90	457.12	
8	0.29	0.00	0.40	0.29	0.69	20.00	66.30	>10
	2.00	0.01	2.75	2.00	4.75	137.90	457.12	
9	0.29	0.01	0.40	0.30	0.70	20.00	66.30	>10
	2.00	0.09	2.74	2.09	4.83	137.90	457.12	
10	1.01	1.01	0.67	2.02	2.68	20.00	66.30	>10
	6.93	6.98	4.59	13.91	18.50	137.90	457.12	
11	0.63	0.30	0.83	0.92	1.75	20.00	66.30	>10
	4.31	2.04	5.72	6.35	12.06	137.90	457.12	
12	0.53	0.42	1.25	0.95	2.21	20.00	66.30	>10
	3.64	2.92	8.64	6.56	15.21	137.90	457.12	
13	1.08	0.93	1.47	2.01	3.48	20.00	66.30	>10
	7.46	6.38	10.13	13.84	23.97	137.90	457.12	

14	1.02 7.02	1.00 6.91	1.24 8.57	2.02 13.93	3.26 22.50	20.00 137.90	66.30 457.12	>10
15	3.93 27.08	5.54 38.18	0.67 4.64	9.47 65.26	10.14 69.90	20.00 137.90	66.30 457.12	2.17
16	2.34 16.17	3.40 23.41	0.25 1.70	5.74 39.58	5.99 41.28	20.00 137.90	66.30 457.12	4.23
17	1.66 11.42	2.46 16.95	0.16 1.13	4.11 28.36	4.28 29.49	20.00 137.90	66.30 457.12	6.29
18	1.96 13.54	3.01 20.76	0.34 2.34	4.97 34.30	5.31 36.63	20.00 137.90	66.30 457.12	5.03
19	3.14 21.68	4.81 33.13	0.44 3.06	7.95 54.81	8.39 57.87	20.00 137.90	66.30 457.12	2.77
20	2.57 17.71	4.72 32.53	1.01 6.99	7.29 50.25	8.30 57.24	20.00 137.90	66.30 457.12	3.12
21	0.25 1.74	0.49 3.41	0.06 0.44	0.75 5.15	0.81 5.59	20.00 137.90	66.30 457.12	>10
22	1.99 13.70	2.36 16.24	0.06 0.39	4.34 29.94	4.40 30.33	20.00 137.90	66.30 457.12	5.91

Min MS: 1.176, Location: 4, Combination: Pm+Pb

**Table 2-234. Load Combination 223, Vertical Vibration,
Normal Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 223, 101, 201, 211
Vertical 2g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.86	0.30	1.47	1.77	20.00	66.30	>10
	4.19	5.94	2.08	10.14	12.21	137.90	457.12	
2	0.07	0.04	0.45	0.11	0.56	20.00	66.30	>10
	0.49	0.26	3.10	0.74	3.84	137.90	457.12	
3	0.06	0.04	0.30	0.09	0.39	20.00	66.30	>10
	0.39	0.24	2.06	0.63	2.69	137.90	457.12	
4	4.96	8.73	3.10	13.69	16.79	20.00	66.30	1.19
	34.22	60.19	21.39	94.41	115.79	137.90	457.12	
5	4.29	6.98	3.32	11.27	14.58	20.00	66.30	1.66
	29.57	48.12	22.87	77.69	100.56	137.90	457.12	
6	1.68	2.28	1.43	3.95	5.39	20.00	66.30	6.59
	11.55	15.71	9.88	27.26	37.15	137.90	457.12	
7	0.29	0.01	0.40	0.30	0.70	20.00	66.30	>10
	2.02	0.05	2.75	2.08	4.82	137.90	457.12	
8	0.30	0.00	0.40	0.30	0.69	20.00	66.30	>10
	2.04	0.00	2.75	2.04	4.79	137.90	457.12	
9	0.30	0.01	0.40	0.31	0.71	20.00	66.30	>10
	2.08	0.08	2.74	2.16	4.91	137.90	457.12	
10	1.01	1.01	0.67	2.02	2.69	20.00	66.30	>10
	6.96	6.99	4.59	13.94	18.53	137.90	457.12	
11	0.62	0.30	0.83	0.92	1.75	20.00	66.30	>10
	4.31	2.04	5.72	6.35	12.06	137.90	457.12	
12	0.53	0.43	1.25	0.97	2.22	20.00	66.30	>10
	3.67	2.99	8.64	6.66	15.31	137.90	457.12	
13	1.09	0.96	1.47	2.05	3.52	20.00	66.30	>10
	7.50	6.65	10.13	14.15	24.28	137.90	457.12	

14	1.02 7.05	1.01 6.99	1.24 8.57	2.04 14.04	3.28 22.61	20.00 137.90	66.30 457.12	>10
15	3.84 26.48	5.45 37.58	0.67 4.64	9.29 64.06	9.96 68.70	20.00 137.90	66.30 457.12	2.23
16	2.33 16.10	3.41 23.50	0.25 1.70	5.74 39.59	5.99 41.29	20.00 137.90	66.30 457.12	4.22
17	1.65 11.40	2.47 17.04	0.16 1.13	4.12 28.44	4.29 29.56	20.00 137.90	66.30 457.12	6.27
18	1.96 13.49	3.01 20.76	0.34 2.34	4.97 34.25	5.31 36.59	20.00 137.90	66.30 457.12	5.04
19	3.12 21.53	4.80 33.12	0.44 3.06	7.93 54.65	8.37 57.71	20.00 137.90	66.30 457.12	2.78
20	2.56 17.62	4.71 32.50	1.01 6.99	7.27 50.12	8.28 57.11	20.00 137.90	66.30 457.12	3.13
21	0.29 2.00	0.49 3.38	0.06 0.44	0.78 5.37	0.84 5.81	20.00 137.90	66.30 457.12	>10
22	1.98 13.65	2.35 16.24	0.06 0.39	4.34 29.89	4.39 30.28	20.00 137.90	66.30 457.12	5.92

Min MS: 1.191, Location: 4, Combination: Pm+Pb

Table 2-235. Load Combination 224, Forward Vibration at Cold Temperature, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 221, 103, 201, 211
 Forward 10g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Stress (ksi/MPa)								

Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.93	0.93	0.07	1.86	1.93	20.00	70.00	>10
	6.40	6.40	0.50	12.80	13.30	137.90	482.63	
2	0.88	0.23	0.06	1.11	1.17	20.00	70.00	>10
	6.04	1.62	0.40	7.66	8.06	137.90	482.63	
3	0.32	0.12	0.08	0.45	0.52	20.00	70.00	>10
	2.22	0.85	0.53	3.08	3.61	137.90	482.63	
4	5.49	9.02	4.96	14.51	19.47	20.00	70.00	1.07
	37.84	62.17	34.21	100.01	134.22	137.90	482.63	
5	4.67	7.10	6.97	11.77	18.75	20.00	70.00	1.55
	32.17	48.98	48.09	81.15	129.24	137.90	482.63	
6	1.87	2.33	3.30	4.20	7.50	20.00	70.00	6.14
	12.92	16.03	22.73	28.96	51.68	137.90	482.63	
7	0.35	0.03	1.51	0.38	1.88	20.00	70.00	>10
	2.40	0.19	10.39	2.60	12.98	137.90	482.63	
8	0.35	0.02	1.50	0.37	1.87	20.00	70.00	>10
	2.38	0.15	10.37	2.53	12.90	137.90	482.63	
9	0.34	0.04	1.51	0.38	1.88	20.00	70.00	>10
	2.35	0.24	10.38	2.59	12.97	137.90	482.63	
10	1.10	1.15	1.78	2.25	4.02	20.00	70.00	>10
	7.58	7.91	12.24	15.49	27.73	137.90	482.63	
11	0.79	0.34	0.95	1.13	2.08	20.00	70.00	>10
	5.42	2.34	6.57	7.76	14.33	137.90	482.63	
12	0.68	0.45	0.72	1.12	1.85	20.00	70.00	>10
	4.67	3.07	5.00	7.74	12.74	137.90	482.63	

13	1.35 9.31	0.94 6.46	3.14 21.68	2.29 15.77	5.43 37.46	20.00 137.90	70.00 482.63	>10
14	1.30 8.93	1.08 7.45	2.56 17.68	2.38 16.39	4.94 34.07	20.00 137.90	70.00 482.63	>10
15	4.03 27.77	5.61 38.70	0.62 4.30	9.64 66.47	10.26 70.77	20.00 137.90	70.00 482.63	2.11
16	2.47 17.06	3.53 24.32	1.30 8.95	6.00 41.38	7.30 50.33	20.00 137.90	70.00 482.63	4.00
17	1.78 12.26	2.52 17.36	1.03 7.08	4.30 29.62	5.32 36.70	20.00 137.90	70.00 482.63	5.98
18	2.06 14.22	3.09 21.30	1.00 6.92	5.15 35.52	6.16 42.45	20.00 137.90	70.00 482.63	4.82
19	3.36 23.13	4.87 33.55	1.46 10.06	8.22 56.68	9.68 66.74	20.00 137.90	70.00 482.63	2.65
20	2.83 19.48	4.84 33.40	1.77 12.19	7.67 52.88	9.44 65.07	20.00 137.90	70.00 482.63	2.91
21	0.46 3.20	0.53 3.63	0.83 5.72	0.99 6.83	1.82 12.56	20.00 137.90	70.00 482.63	>10
22	2.12 14.64	2.39 16.47	0.10 0.69	4.51 31.11	4.61 31.80	20.00 137.90	70.00 482.63	5.65

Min MS: 1.068, Location: 4, Combination: Pm+Pb

Table 2-236. Load Combination 225, Lateral Vibration at Cold Temperature, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 222, 103, 201, 211
 Lateral 5g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.68	0.89	0.07	1.57	1.64	20.00	70.00	>10
	4.71	6.13	0.50	10.83	11.33	137.90	482.63	
2	0.11	0.06	0.06	0.17	0.23	20.00	70.00	>10
	0.78	0.38	0.40	1.16	1.57	137.90	482.63	
3	0.11	0.05	0.08	0.16	0.24	20.00	70.00	>10
	0.74	0.35	0.53	1.09	1.62	137.90	482.63	
4	5.02	8.77	4.96	13.79	18.75	20.00	70.00	1.18
	34.60	60.46	34.21	95.06	129.27	137.90	482.63	
5	4.35	7.00	6.97	11.35	18.33	20.00	70.00	1.64
	29.97	48.28	48.09	78.26	126.35	137.90	482.63	
6	1.69	2.28	3.30	3.98	7.27	20.00	70.00	6.54
	11.68	15.74	22.73	27.43	50.15	137.90	482.63	
7	0.29	0.01	1.51	0.30	1.81	20.00	70.00	>10
	2.00	0.06	10.39	2.06	12.45	137.90	482.63	
8	0.29	0.00	1.50	0.29	1.80	20.00	70.00	>10
	2.00	0.01	10.37	2.00	12.38	137.90	482.63	
9	0.29	0.01	1.51	0.30	1.81	20.00	70.00	>10
	2.00	0.09	10.38	2.09	12.47	137.90	482.63	
10	1.01	1.01	1.78	2.02	3.79	20.00	70.00	>10
	6.93	6.98	12.24	13.91	26.15	137.90	482.63	
11	0.63	0.30	0.95	0.92	1.87	20.00	70.00	>10
	4.31	2.04	6.57	6.35	12.92	137.90	482.63	
12	0.53	0.42	0.72	0.95	1.68	20.00	70.00	>10
	3.64	2.92	5.00	6.56	11.56	137.90	482.63	

13	1.08 7.46	0.93 6.38	3.14 21.68	2.01 13.84	5.15 35.52	20.00 137.90	70.00 482.63	>10
14	1.02 7.02	1.00 6.91	2.56 17.68	2.02 13.93	4.58 31.61	20.00 137.90	70.00 482.63	>10
15	3.93 27.08	5.54 38.18	0.62 4.30	9.47 65.26	10.09 69.57	20.00 137.90	70.00 482.63	2.17
16	2.34 16.17	3.40 23.41	1.30 8.95	5.74 39.58	7.04 48.52	20.00 137.90	70.00 482.63	4.23
17	1.66 11.42	2.46 16.95	1.03 7.08	4.11 28.36	5.14 35.45	20.00 137.90	70.00 482.63	6.29
18	1.96 13.54	3.01 20.76	1.00 6.92	4.97 34.30	5.98 41.22	20.00 137.90	70.00 482.63	5.03
19	3.14 21.68	4.81 33.13	1.46 10.06	7.95 54.81	9.41 64.87	20.00 137.90	70.00 482.63	2.77
20	2.57 17.71	4.72 32.53	1.77 12.19	7.29 50.25	9.06 62.44	20.00 137.90	70.00 482.63	3.12
21	0.25 1.74	0.49 3.41	0.83 5.72	0.75 5.15	1.58 10.87	20.00 137.90	70.00 482.63	>10
22	1.99 13.70	2.36 16.24	0.10 0.69	4.34 29.94	4.44 30.63	20.00 137.90	70.00 482.63	5.91

Min MS: 1.176, Location: 4, Combination: Pm+Pb

Table 2-237. Load Combination 226, Vertical Vibration at Cold Temperature, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 223, 103, 201, 211
 Vertical 2g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.86	0.07	1.47	1.54	20.00	70.00	>10
	4.19	5.94	0.50	10.14	10.63	137.90	482.63	
2	0.07	0.04	0.06	0.11	0.17	20.00	70.00	>10
	0.49	0.26	0.40	0.74	1.15	137.90	482.63	
3	0.06	0.04	0.08	0.09	0.17	20.00	70.00	>10
	0.39	0.24	0.53	0.63	1.16	137.90	482.63	
4	4.96	8.73	4.96	13.69	18.65	20.00	70.00	1.19
	34.22	60.19	34.21	94.41	128.62	137.90	482.63	
5	4.29	6.98	6.97	11.27	18.24	20.00	70.00	1.66
	29.57	48.12	48.09	77.69	125.77	137.90	482.63	
6	1.68	2.28	3.30	3.95	7.25	20.00	70.00	6.59
	11.55	15.71	22.73	27.26	49.99	137.90	482.63	
7	0.29	0.01	1.51	0.30	1.81	20.00	70.00	>10
	2.02	0.05	10.39	2.08	12.46	137.90	482.63	
8	0.30	0.00	1.50	0.30	1.80	20.00	70.00	>10
	2.04	0.00	10.37	2.04	12.41	137.90	482.63	
9	0.30	0.01	1.51	0.31	1.82	20.00	70.00	>10
	2.08	0.08	10.38	2.16	12.54	137.90	482.63	
10	1.01	1.01	1.78	2.02	3.80	20.00	70.00	>10
	6.96	6.99	12.24	13.94	26.18	137.90	482.63	
11	0.62	0.30	0.95	0.92	1.87	20.00	70.00	>10
	4.31	2.04	6.57	6.35	12.91	137.90	482.63	
12	0.53	0.43	0.72	0.97	1.69	20.00	70.00	>10
	3.67	2.99	5.00	6.66	11.66	137.90	482.63	

13	1.09 7.50	0.96 6.65	3.14 21.68	2.05 14.15	5.20 35.83	20.00 137.90	70.00 482.63	>10
14	1.02 7.05	1.01 6.99	2.56 17.68	2.04 14.04	4.60 31.71	20.00 137.90	70.00 482.63	>10
15	3.84 26.48	5.45 37.58	0.62 4.30	9.29 64.06	9.92 68.36	20.00 137.90	70.00 482.63	2.23
16	2.33 16.10	3.41 23.50	1.30 8.95	5.74 39.59	7.04 48.54	20.00 137.90	70.00 482.63	4.22
17	1.65 11.40	2.47 17.04	1.03 7.08	4.12 28.44	5.15 35.52	20.00 137.90	70.00 482.63	6.27
18	1.96 13.49	3.01 20.76	1.00 6.92	4.97 34.25	5.97 41.17	20.00 137.90	70.00 482.63	5.04
19	3.12 21.53	4.80 33.12	1.46 10.06	7.93 54.65	9.39 64.71	20.00 137.90	70.00 482.63	2.78
20	2.56 17.62	4.71 32.50	1.77 12.19	7.27 50.12	9.04 62.31	20.00 137.90	70.00 482.63	3.13
21	0.29 2.00	0.49 3.38	0.83 5.72	0.78 5.37	1.61 11.09	20.00 137.90	70.00 482.63	>10
22	1.98 13.65	2.35 16.24	0.10 0.69	4.34 29.89	4.44 30.58	20.00 137.90	70.00 482.63	5.92

Min MS: 1.191, Location: 4, Combination: Pm+Pb

Table 2-238. Load Combination 231, 3-ft. Head-On Drop, Normal Conditions, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 231, 102, 201, 211
 3-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.72	0.89	0.29	1.61	1.90	20.00	66.30	>10
	4.94	6.16	1.98	11.10	13.08	137.90	457.12	
2	0.10	0.03	0.43	0.14	0.56	20.00	66.30	>10
	0.71	0.23	2.96	0.93	3.89	137.90	457.12	
3	0.05	0.02	0.28	0.07	0.35	20.00	66.30	>10
	0.32	0.16	1.96	0.48	2.44	137.90	457.12	
4	5.17	8.93	3.13	14.11	17.24	20.00	66.30	1.13
	35.67	61.59	21.57	97.27	118.84	137.90	457.12	
5	4.40	7.14	3.15	11.53	14.68	20.00	66.30	1.60
	30.32	49.21	21.71	79.53	101.24	137.90	457.12	
6	1.73	2.28	1.42	4.01	5.43	20.00	61.80	6.49
	11.90	15.72	9.82	27.62	37.44	137.90	426.10	
7	0.32	0.01	0.34	0.33	0.67	20.00	61.80	>10
	2.23	0.06	2.36	2.29	4.65	137.90	426.10	
8	0.31	0.00	0.34	0.31	0.65	20.00	61.80	>10
	2.14	0.00	2.33	2.15	4.48	137.90	426.10	
9	0.31	0.01	0.33	0.32	0.66	20.00	61.80	>10
	2.13	0.08	2.31	2.21	4.52	137.90	426.10	
10	1.01	1.04	0.87	2.05	2.92	20.00	61.80	>10
	6.98	7.14	6.01	14.12	20.13	137.90	426.10	
11	0.65	0.30	0.96	0.94	1.90	20.00	61.80	>10
	4.45	2.05	6.59	6.50	13.09	137.90	426.10	
12	0.54	0.45	1.41	0.99	2.40	20.00	61.80	>10
	3.72	3.12	9.69	6.84	16.53	137.90	426.10	
13	1.07	0.92	1.43	1.99	3.42	20.00	61.80	>10
	7.37	6.36	9.88	13.73	23.61	137.90	426.10	

14	1.00 6.92	0.98 6.78	1.19 8.20	1.99 13.70	3.18 21.90	20.00 137.90	66.30 457.12	>10
15	4.21 29.05	5.47 37.72	1.07 7.37	9.68 66.77	10.75 74.14	20.00 137.90	66.30 457.12	2.10
16	2.39 16.46	3.44 23.74	0.40 2.75	5.83 40.20	6.23 42.95	20.00 137.90	66.30 457.12	4.15
17	1.74 12.02	2.47 17.06	0.25 1.72	4.22 29.08	4.47 30.80	20.00 137.90	66.30 457.12	6.11
18	2.00 13.76	3.06 21.13	0.33 2.25	5.06 34.89	5.39 37.14	20.00 137.90	66.30 457.12	4.93
19	3.20 22.08	4.88 33.65	0.47 3.23	8.08 55.74	8.55 58.97	20.00 137.90	66.30 457.12	2.71
20	2.63 18.14	4.81 33.16	0.96 6.65	7.44 51.29	8.40 57.95	20.00 137.90	61.80 426.10	3.03
21	0.24 1.63	0.47 3.26	0.06 0.45	0.71 4.90	0.77 5.34	20.00 137.90	66.30 457.12	>10
22	2.17 14.94	2.41 16.59	0.06 0.44	4.57 31.53	4.64 31.97	20.00 137.90	66.30 457.12	5.56

Min MS: 1.127, Location: 4, Combination: Pm+Pb

Table 2-239. Load Combination 233, 3-ft. Drop at Cold Temperature, Normal Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 231, 103, 211

3-ft. Head-On Drop

-20°F Ambient, Zero Decay Heat, Zero Insolation

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.70	0.88	0.07	1.58	1.65	20.00	70.00	>10
	4.84	6.07	0.50	10.91	11.41	137.90	482.63	
2	0.09	0.03	0.06	0.12	0.18	20.00	70.00	>10
	0.64	0.22	0.40	0.86	1.26	137.90	482.63	
3	0.03	0.00	0.08	0.04	0.11	20.00	70.00	>10
	0.22	0.03	0.53	0.25	0.77	137.90	482.63	
4	1.02	1.60	4.96	2.62	7.59	20.00	70.00	6.91
	7.02	11.07	34.21	18.09	52.30	137.90	482.63	
5	0.99	1.49	6.97	2.48	9.45	20.00	70.00	5.35
	6.79	10.29	48.09	17.09	65.17	137.90	482.63	
6	0.43	0.63	3.30	1.06	4.35	20.00	70.00	>10
	2.95	4.34	22.73	7.29	30.02	137.90	482.63	
7	0.19	0.00	1.51	0.19	1.70	20.00	70.00	>10
	1.29	0.02	10.39	1.31	11.70	137.90	482.63	
8	0.18	0.00	1.50	0.18	1.68	20.00	70.00	>10
	1.21	0.00	10.37	1.21	11.58	137.90	482.63	
9	0.17	0.00	1.51	0.17	1.68	20.00	70.00	>10
	1.19	0.00	10.38	1.19	11.57	137.90	482.63	
10	0.19	0.07	1.78	0.26	2.03	20.00	70.00	>10
	1.29	0.48	12.24	1.77	14.01	137.90	482.63	
11	0.12	0.07	0.95	0.19	1.14	20.00	70.00	>10
	0.81	0.50	6.57	1.31	7.88	137.90	482.63	
12	0.06	0.05	0.72	0.11	0.84	20.00	70.00	>10
	0.44	0.35	5.00	0.78	5.78	137.90	482.63	
13	0.34	0.33	3.14	0.66	3.81	20.00	70.00	>10
	2.31	2.25	21.68	4.57	26.25	137.90	482.63	

14	0.32 2.22	0.25 1.74	2.56 17.68	0.57 3.96	3.14 21.64	20.00 137.90	70.00 482.63	>10
15	0.69 4.77	0.03 0.23	0.62 4.30	0.73 5.00	1.35 9.30	20.00 137.90	70.00 482.63	>10
16	0.09 0.62	0.08 0.55	1.30 8.95	0.17 1.18	1.47 10.13	20.00 137.90	70.00 482.63	>10
17	0.12 0.84	0.05 0.34	1.03 7.08	0.17 1.18	1.20 8.26	20.00 137.90	70.00 482.63	>10
18	0.14 0.96	0.22 1.53	1.00 6.92	0.36 2.49	1.37 9.41	20.00 137.90	70.00 482.63	>10
19	0.20 1.41	0.21 1.45	1.46 10.06	0.41 2.86	1.87 12.92	20.00 137.90	70.00 482.63	>10
20	0.23 1.61	0.31 2.14	1.77 12.19	0.54 3.76	2.31 15.94	20.00 137.90	70.00 482.63	>10
21	0.04 0.27	0.07 0.50	0.83 5.72	0.11 0.77	0.94 6.49	20.00 137.90	70.00 482.63	>10
22	0.48 3.29	0.07 0.48	0.10 0.69	0.55 3.77	0.65 4.46	20.00 137.90	70.00 482.63	>10

Min MS: 5.347, Location: 5, Combination: Pm+Pb+Q

2.12.2.3.2 Hypothetical Accident Conditions of Transport Summary of Damages (Stresses) – Models AOS-100A and AOS-100A-S

Table 2-240 and Table 2-241 present Model AOS-100A and AOS-100A-S transport package Load Cases and Load Combinations, respectively, under Hypothetical Accident conditions of transport:

- Table 2-242 through Table 2-254 present Model AOS-100A and AOS-100A-S transport package output data, for the Load Cases listed in Table 2-202. Comparisons with allowable stress limits are included for Load Cases 111 and 112.
- Table 2-255 through Table 2-269 present Model AOS-100A and AOS-100A-S transport package output data, for the Load Combinations listed in Table 2-241.

Table 2-240. Load Cases Associated with Allowable Stresses under Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Case	Description	Data
111	Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat	Table 2-242
112	Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-243
	Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-244
	Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-245
	Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-246
	Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-247
301	30-ft. Head-On Drop	Table 2-248
302	30-ft. Side Drop + Slap-Down	Table 2-249
303	30-ft. Cg/Corner Drop	Table 2-250
304	30-ft. Head-On Drop at -40°F, Low Temperature	Table 2-251
305	30-ft. Side Drop + Slap-Down at -40°F, Low Temperature	Table 2-252
306	30-ft. Cg/Corner Drop at -40°F, Low Temperature	Table 2-253
311	4-ft. Drop onto Rod	Table 2-254

Table 2-241. Load Combinations Associated with Allowable Stresses under Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Combination	Load Cases ^a	Description	Data
301	301, 102, 201, 211	Head-On Drop Orientation	Table 2-255
302	302, 102, 201, 211	Side Drop Orientation	Table 2-256
303	303, 102, 201, 211	Cg/Corner Drop Orientation	Table 2-257
304	304, 105, 202, 211	Head-On Drop Orientation at -40°F, Cold Environment	Table 2-258
305	305, 105, 202, 211	Side Drop Orientation at -40°F, Cold Environment	Table 2-259
306	306, 105, 202, 211	Cg/Corner Drop Orientation at -40°F, Cold Environment	Table 2-260
310	204, 101, 211	Additional Increased External Pressure (290 psi)	Table 2-261
311	311, 101, 201, 211	4-ft. Drop onto Rod	Table 2-262
312	311, 104, 201, 211	4-ft. Drop onto Rod at -40°F, Cold Environment	Table 2-263
350	111, 201, 211	Fire at 30 Minutes	Table 2-264
351	112, 201, 211	Post Fire at 60 Minutes	Table 2-265
352		Post Fire at 90 Minutes	Table 2-266
353		Post Fire at 120 Minutes	Table 2-267
354		Post Fire at 150 Minutes	Table 2-268
355		Post Fire at 180 Minutes	Table 2-269

a. Some Normal conditions of transport Load Cases are included in Hypothetical Accident conditions of transport Load Combinations, to meet regulatory requirements.

Table 2-242. Load Case 111, Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	9.6773E+03 6.6722E+01	-4.3445E+03 -2.9954E+01	5.6027E+03 3.8629E+01	1.4022E+04 9.6677E+01	2.4655E+04 1.6999E+02
2	1.4318E+04 9.8716E+01	-4.9512E+03 -3.4137E+01	5.9560E+03 4.1065E+01	1.9269E+04 1.3285E+02	3.9589E+04 2.7296E+02
3	9.7054E+03 6.6916E+01	-4.4688E+03 -3.0811E+01	5.7146E+03 3.9401E+01	1.4174E+04 9.7727E+01	2.4865E+04 1.7144E+02
4	5.5311E+04 3.8136E+02	-2.4666E+04 -1.7007E+02	1.0993E+04 7.5794E+01	7.9977E+04 5.5142E+02	1.5578E+05 1.0741E+03
5	6.0198E+04 4.1505E+02	-2.3684E+04 -1.6330E+02	9.9075E+03 6.8310E+01	8.3883E+04 5.7835E+02	1.3075E+05 9.0149E+02
6	3.1356E+04 2.1619E+02	-3.5781E+03 -2.4670E+01	1.7001E+04 1.1722E+02	3.4934E+04 2.4086E+02	5.1348E+04 3.5403E+02
7	1.0700E+04 7.3775E+01	-1.6684E+02 -1.1503E+00	-1.8895E+03 -1.3028E+01	1.0867E+04 7.4925E+01	1.4215E+02 9.8012E-01
8	1.0693E+04 7.3728E+01	-1.7574E+02 -1.2117E+00	-1.5929E+03 -1.0982E+01	1.0869E+04 7.4940E+01	9.1606E+00 6.3160E-02
9	1.0692E+04 7.3718E+01	-1.6920E+02 -1.1666E+00	-1.6240E+03 -1.1197E+01	1.0861E+04 7.4885E+01	4.1295E+01 2.8472E-01
10	1.0739E+04 7.4041E+01	-6.0191E+02 -4.1500E+00	3.4312E+03 2.3657E+01	1.1341E+04 7.8191E+01	2.8146E+03 1.9406E+01
11	4.9067E+03 3.3830E+01	-1.4237E+03 -9.8159E+00	3.1690E+03 2.1849E+01	6.3303E+03 4.3646E+01	2.9640E+03 2.0436E+01
12	4.2978E+03 2.9632E+01	-4.5997E-01 -3.1714E-03	4.2854E+03 2.9547E+01	4.2982E+03 2.9635E+01	3.1368E+03 2.1628E+01
13	1.9841E+04 1.3680E+02	-2.4304E+03 -1.6757E+01	5.6943E+03 3.9261E+01	2.2272E+04 1.5356E+02	2.0398E+04 1.4064E+02
14	1.7637E+04 1.2161E+02	-2.1707E+03 -1.4966E+01	5.7203E+03 3.9440E+01	1.9808E+04 1.3657E+02	1.9411E+04 1.3383E+02
15	-1.7493E+01 -1.2061E-01	-1.2277E+02 -8.4649E-01	-9.5375E+01 -6.5759E-01	1.0528E+02 7.2588E-01	1.1034E+02 7.6077E-01

16	4.9214E+00	-8.3534E+01	4.7984E+01	8.8456E+01	1.6757E+02
	3.3932E-02	-5.7595E-01	3.3084E-01	6.0988E-01	1.1554E+00
17	2.0840E+01	-5.8439E+01	8.7507E+01	7.9279E+01	3.7431E+01
	1.4368E-01	-4.0293E-01	6.0334E-01	5.4661E-01	2.5807E-01
18	1.6297E+02	-8.4317E+01	-4.9845E+02	2.4729E+02	2.4196E+02
	1.1236E+00	-5.8135E-01	-3.4367E+00	1.7050E+00	1.6683E+00
19	2.5345E+02	-2.5049E+01	-7.0846E+02	2.7850E+02	5.2191E+02
	1.7475E+00	-1.7271E-01	-4.8847E+00	1.9202E+00	3.5984E+00
20	4.7037E+02	-3.1389E+01	-1.4196E+02	5.0176E+02	4.2466E+02
	3.2431E+00	-2.1642E-01	-9.7880E-01	3.4595E+00	2.9279E+00
21	3.6101E-01	-1.3064E+03	-1.3036E+03	1.3067E+03	8.0836E+02
	2.4891E-03	-9.0072E+00	-8.9882E+00	9.0097E+00	5.5734E+00
22	2.5657E+02	-9.3864E+02	-6.6478E+02	1.1952E+03	2.1380E+03
	1.7690E+00	-6.4717E+00	-4.5835E+00	8.2406E+00	1.4741E+01

Allowable Stress for Load Case 111

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	292.89	290.51	20.00	23.60	66.30
2	379.41	299.30	20.00	23.60	66.30
3	294.26	291.96	20.00	23.60	66.30
4	295.95	295.77	20.00	23.60	66.30
5	299.16	298.52	20.00	23.60	66.30
6	303.64	301.30	20.00	22.40	61.80
7	302.89	301.16	20.00	22.40	61.80
8	303.16	301.43	20.00	22.40	61.80
9	303.32	301.60	20.00	22.40	61.80
10	304.15	301.99	20.00	22.40	61.80
11	306.29	303.07	20.00	22.40	61.80
12	311.39	307.27	20.00	22.40	61.80
13	299.41	298.74	20.00	23.60	66.30
14	298.04	297.74	20.00	23.60	66.30
15	295.47	294.87	20.00	23.60	66.30
16	294.97	294.57	20.00	23.60	66.30
17	295.05	294.57	20.00	23.60	66.30
18	296.81	296.17	20.00	23.60	66.30
19	297.47	297.10	20.00	23.60	66.30
20	303.13	301.44	20.00	22.40	61.80
21	295.28	293.92	20.00	23.60	66.30
22	294.12	293.39	20.00	23.60	66.30

Table 2-243. Load Case 112, Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	9.3309E+02 6.4334E+00	-8.2077E+02 -5.6590E+00	1.8993E+03 1.3095E+01	1.7539E+03 1.2092E+01	7.4243E+02 5.1189E+00
2	2.0783E+03 1.4329E+01	-2.6109E+03 -1.8002E+01	-1.9481E+03 -1.3431E+01	4.6892E+03 3.2331E+01	7.7797E+03 5.3639E+01
3	8.6204E+02 5.9435E+00	-8.6796E+02 -5.9843E+00	1.5610E+03 1.0762E+01	1.7300E+03 1.1928E+01	1.1176E+03 7.7055E+00
4	-2.7978E+02 -1.9290E+00	-3.4168E+03 -2.3558E+01	6.1332E+02 4.2287E+00	3.1370E+03 2.1629E+01	3.5487E+03 2.4467E+01
5	4.0656E+01 2.8032E-01	-4.4066E+03 -3.0383E+01	-5.4655E+03 -3.7683E+01	4.4473E+03 3.0663E+01	6.3532E+03 4.3803E+01
6	2.6733E+02 1.8431E+00	-2.0649E+03 -1.4237E+01	-6.0614E+03 -4.1792E+01	2.3322E+03 1.6080E+01	7.6190E+02 5.2531E+00
7	-2.1839E+02 -1.5057E+00	-5.3165E+02 -3.6656E+00	-3.1190E+03 -2.1504E+01	3.1326E+02 2.1598E+00	2.7492E+02 1.8955E+00
8	-1.9054E+02 -1.3137E+00	-5.8259E+02 -4.0168E+00	-3.3577E+03 -2.3151E+01	3.9205E+02 2.7031E+00	4.1996E+02 2.8955E+00
9	-1.8380E+02 -1.2673E+00	-5.7244E+02 -3.9468E+00	-3.0912E+03 -2.1313E+01	3.8864E+02 2.6796E+00	4.0098E+02 2.7646E+00
10	5.0673E+02 3.4938E+00	-7.4191E+02 -5.1153E+00	-3.4403E+03 -2.3720E+01	1.2486E+03 8.6091E+00	7.2830E+01 5.0214E-01
11	5.4513E+02 3.7585E+00	-2.6247E+03 -1.8096E+01	-3.1697E+03 -2.1855E+01	3.1698E+03 2.1855E+01	4.1611E+03 2.8690E+01
12	4.0206E+02 2.7721E+00	-2.2796E+03 -1.5717E+01	-1.8841E+03 -1.2991E+01	2.6817E+03 1.8490E+01	4.5197E+03 3.1162E+01
13	-5.2877E+02 -3.6458E+00	-5.6083E+03 -3.8668E+01	-2.3038E+03 -1.5884E+01	5.0795E+03 3.5022E+01	3.1096E+03 2.1440E+01
14	-6.8989E+01 -4.7566E-01	-4.9562E+03 -3.4172E+01	8.0858E+02 5.5750E+00	4.8872E+03 3.3696E+01	1.4593E+03 1.0061E+01
15	5.8916E+02 4.0621E+00	-2.1120E+02 -1.4562E+00	3.7534E+02 2.5879E+00	8.0037E+02 5.5183E+00	1.2511E+03 8.6260E+00

16	1.4047E+02	-5.8429E+01	-5.3867E+02	1.9889E+02	2.5352E+02
	9.6848E-01	-4.0285E-01	-3.7140E+00	1.3713E+00	1.7479E+00
17	6.5510E+01	-1.0836E+02	-5.7104E+02	1.7387E+02	2.7921E+02
	4.5168E-01	-7.4712E-01	-3.9371E+00	1.1988E+00	1.9251E+00
18	3.6978E+02	-5.1577E+02	2.6415E+03	8.8554E+02	7.3844E+02
	2.5495E+00	-3.5561E+00	1.8213E+01	6.1056E+00	5.0913E+00
19	-5.8471E+01	-1.0204E+03	2.8975E+03	9.6196E+02	9.0326E+02
	-4.0315E-01	-7.0356E+00	1.9977E+01	6.6325E+00	6.2277E+00
20	5.3282E+01	-2.0803E+03	-8.2882E+02	2.1336E+03	8.4242E+02
	3.6737E-01	-1.4343E+01	-5.7145E+00	1.4710E+01	5.8083E+00
21	4.4239E+02	-1.2573E+00	4.4353E+02	4.4365E+02	1.4300E+02
	3.0502E+00	-8.6686E-03	3.0580E+00	3.0588E+00	9.8593E-01
22	1.1198E+03	-1.2799E+02	1.0261E+03	1.2478E+03	1.7296E+03
	7.7205E+00	-8.8244E-01	7.0750E+00	8.6029E+00	1.1925E+01

Allowable Stress for Load Case 112 (Post Fire at 60 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	411.04	405.03	18.70	20.70	59.70
2	540.65	524.50	17.40	19.40	59.20
3	413.61	408.25	18.70	20.70	59.70
4	352.14	349.64	20.00	22.40	61.80
5	384.36	377.52	20.00	22.40	61.80
6	394.99	389.93	20.00	22.40	61.80
7	452.31	451.10	18.70	20.70	59.70
8	461.82	461.16	18.70	20.70	59.70
9	452.08	450.85	18.70	20.70	59.70
10	410.99	401.81	18.70	20.70	59.70
11	390.65	373.79	20.00	22.40	61.80
12	368.19	365.49	20.00	22.40	61.80
13	364.40	353.35	20.00	22.40	61.80
14	342.71	337.27	20.00	22.40	61.80
15	300.93	300.79	20.00	22.40	61.80
16	306.87	305.95	20.00	22.40	61.80
17	307.78	307.33	20.00	22.40	61.80
18	317.29	315.37	20.00	22.40	61.80
19	321.65	319.62	20.00	22.40	61.80
20	345.14	340.67	20.00	22.40	61.80
21	300.75	300.44	20.00	22.40	61.80
22	299.11	298.96	20.00	23.60	66.30

Table 2-244. Load Case 112, Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	1.0363E+03 7.1447E+00	-1.4324E+03 -9.8760E+00	9.3041E+02 6.4150E+00	2.4687E+03 1.7021E+01	2.6978E+03 1.8601E+01
2	1.6927E+03 1.1671E+01	-2.7471E+03 -1.8941E+01	-1.3277E+03 -9.1541E+00	4.4398E+03 3.0611E+01	8.7117E+03 6.0065E+01
3	9.9257E+02 6.8436E+00	-1.4690E+03 -1.0129E+01	6.3418E+02 4.3725E+00	2.4616E+03 1.6972E+01	3.0231E+03 2.0844E+01
4	1.1922E+03 8.2197E+00	-6.7985E+03 -4.6874E+01	5.0820E+01 3.5039E-01	7.9906E+03 5.5093E+01	1.5524E+04 1.0703E+02
5	1.5052E+03 1.0378E+01	-8.1260E+03 -5.6027E+01	-5.8201E+03 -4.0128E+01	9.6312E+03 6.6405E+01	1.5338E+04 1.0575E+02
6	2.7014E+02 1.8625E+00	-4.0853E+03 -2.8167E+01	-7.2256E+03 -4.9819E+01	4.3555E+03 3.0030E+01	4.6139E+03 3.1812E+01
7	-4.1272E+02 -2.8456E+00	-1.1981E+03 -8.2606E+00	-3.3793E+03 -2.3299E+01	7.8539E+02 5.4151E+00	4.9382E+02 3.4048E+00
8	-4.2460E+02 -2.9275E+00	-1.2000E+03 -8.2739E+00	-3.5856E+03 -2.4722E+01	7.7542E+02 5.3463E+00	5.5423E+02 3.8213E+00
9	-4.1161E+02 -2.8379E+00	-1.2021E+03 -8.2885E+00	-3.4034E+03 -2.3466E+01	7.9053E+02 5.4505E+00	5.6205E+02 3.8752E+00
10	-5.5547E+01 -3.8298E-01	-1.4640E+03 -1.0094E+01	-3.2955E+03 -2.2721E+01	1.4084E+03 9.7109E+00	1.5001E+03 1.0343E+01
11	1.3288E+01 9.1614E-02	-3.8214E+03 -2.6348E+01	-3.8779E+03 -2.6737E+01	3.8347E+03 2.6439E+01	3.7631E+03 2.5946E+01
12	2.7833E+01 1.9190E-01	-3.6795E+03 -2.5369E+01	-3.6545E+03 -2.5197E+01	3.7073E+03 2.5561E+01	4.0654E+03 2.8030E+01
13	-7.7377E+02 -5.3349E+00	-7.7941E+03 -5.3738E+01	-2.6601E+03 -1.8340E+01	7.0203E+03 4.8403E+01	4.0178E+03 2.7702E+01
14	-3.7774E+02 -2.6044E+00	-6.9031E+03 -4.7595E+01	7.3586E+02 5.0736E+00	6.5254E+03 4.4991E+01	5.7647E+02 3.9746E+00
15	1.2747E+03 8.7885E+00	-7.1219E+02 -4.9104E+00	6.5600E+02 4.5230E+00	1.9869E+03 1.3699E+01	3.2080E+03 2.2118E+01

16	3.2216E+02	-2.7958E+02	-9.8291E+02	6.0174E+02	9.0471E+02
	2.2212E+00	-1.9276E+00	-6.7769E+00	4.1489E+00	6.2378E+00
17	1.4955E+02	-3.1722E+02	-9.1427E+02	4.6677E+02	7.8531E+02
	1.0311E+00	-2.1871E+00	-6.3037E+00	3.2182E+00	5.4145E+00
18	4.5184E+02	-7.5360E+02	3.7306E+03	1.2054E+03	7.5059E+02
	3.1153E+00	-5.1959E+00	2.5721E+01	8.3112E+00	5.1751E+00
19	-8.9218E+01	-1.5254E+03	4.0468E+03	1.4362E+03	1.7220E+03
	-6.1514E-01	-1.0517E+01	2.7901E+01	9.9021E+00	1.1873E+01
20	1.7019E+01	-3.0101E+03	-8.3665E+02	3.0271E+03	7.2518E+02
	1.1734E-01	-2.0754E+01	-5.7685E+00	2.0871E+01	4.9999E+00
21	1.1388E+03	-2.1294E+00	1.1388E+03	1.1409E+03	7.4636E+02
	7.8514E+00	-1.4682E-02	7.8514E+00	7.8661E+00	5.1460E+00
22	2.1007E+03	-1.8912E+02	2.0194E+03	2.2898E+03	2.8609E+03
	1.4484E+01	-1.3039E+00	1.3923E+01	1.5788E+01	1.9725E+01

Allowable Stress for Load Case 112 (Post Fire at 90 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	418.42	409.60	18.70	20.70	59.70
2	481.93	479.49	18.70	20.70	59.70
3	424.71	413.94	18.70	20.70	59.70
4	379.92	377.54	20.00	22.40	61.80
5	411.41	405.03	18.70	20.70	59.70
6	420.90	416.67	18.70	20.70	59.70
7	468.17	466.57	18.70	20.70	59.70
8	474.53	473.30	18.70	20.70	59.70
9	467.93	466.32	18.70	20.70	59.70
10	433.62	426.87	18.70	20.70	59.70
11	418.52	404.46	18.70	20.70	59.70
12	405.92	403.09	18.70	20.70	59.70
13	392.01	380.39	20.00	22.40	61.80
14	368.02	361.92	20.00	22.40	61.80
15	314.55	314.34	20.00	22.40	61.80
16	325.01	323.69	20.00	22.40	61.80
17	326.42	325.75	20.00	22.40	61.80
18	338.99	336.46	20.00	22.40	61.80
19	345.02	342.25	20.00	22.40	61.80
20	376.06	370.61	20.00	22.40	61.80
21	312.86	312.29	20.00	22.40	61.80
22	311.96	311.74	20.00	22.40	61.80

Table 2-245. Load Case 112, Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	8.3871E+02 5.7827E+00	-1.2454E+03 -8.5864E+00	5.0382E+02 3.4737E+00	2.0841E+03 1.4369E+01	2.5016E+03 1.7248E+01
2	1.2641E+03 8.7153E+00	-2.1801E+03 -1.5031E+01	-8.7745E+02 -6.0498E+00	3.4441E+03 2.3746E+01	6.8987E+03 4.7565E+01
3	8.1229E+02 5.6005E+00	-1.2703E+03 -8.7585E+00	2.7621E+02 1.9044E+00	2.0826E+03 1.4359E+01	2.7615E+03 1.9040E+01
4	1.5008E+03 1.0348E+01	-6.1400E+03 -4.2334E+01	6.3729E+00 4.3939E-02	7.6408E+03 5.2681E+01	1.5013E+04 1.0351E+02
5	1.5989E+03 1.1024E+01	-7.0615E+03 -4.8688E+01	-4.5491E+03 -3.1365E+01	8.6604E+03 5.9711E+01	1.3808E+04 9.5200E+01
6	2.2446E+02 1.5476E+00	-3.6852E+03 -2.5408E+01	-6.0895E+03 -4.1985E+01	3.9096E+03 2.6956E+01	4.5723E+03 3.1525E+01
7	-4.0158E+02 -2.7688E+00	-1.1242E+03 -7.7513E+00	-3.2906E+03 -2.2688E+01	7.2265E+02 4.9825E+00	5.0364E+02 3.4725E+00
8	-4.0985E+02 -2.8258E+00	-1.1240E+03 -7.7500E+00	-3.4424E+03 -2.3735E+01	7.1419E+02 4.9242E+00	5.2179E+02 3.5976E+00
9	-4.0136E+02 -2.7673E+00	-1.1259E+03 -7.7630E+00	-3.3327E+03 -2.2978E+01	7.2456E+02 4.9957E+00	5.3707E+02 3.7030E+00
10	-2.1944E+02 -1.5130E+00	-1.4521E+03 -1.0012E+01	-2.7536E+03 -1.8985E+01	1.2327E+03 8.4989E+00	1.7983E+03 1.2399E+01
11	-1.7893E+02 -1.2337E+00	-3.5254E+03 -2.4307E+01	-3.3505E+03 -2.3101E+01	3.3465E+03 2.3073E+01	2.6423E+03 1.8218E+01
12	8.4485E+00 5.8250E-02	-3.5859E+03 -2.4724E+01	-3.5772E+03 -2.4664E+01	3.5944E+03 2.4782E+01	2.8512E+03 1.9658E+01
13	-6.3190E+02 -4.3568E+00	-6.7553E+03 -4.6576E+01	-2.1264E+03 -1.4661E+01	6.1234E+03 4.2219E+01	3.1898E+03 2.1993E+01
14	-3.7195E+02 -2.5645E+00	-5.9782E+03 -4.1219E+01	6.1857E+02 4.2649E+00	5.6063E+03 3.8654E+01	1.0487E+03 7.2303E+00
15	1.3046E+03 8.9951E+00	-6.8144E+02 -4.6984E+00	7.1810E+02 4.9511E+00	1.9861E+03 1.3693E+01	3.1761E+03 2.1899E+01

16	3.2778E+02	-2.6486E+02	-1.0247E+03	5.9265E+02	8.7845E+02
	2.2600E+00	-1.8262E+00	-7.0649E+00	4.0861E+00	6.0567E+00
17	1.5539E+02	-3.1879E+02	-9.4460E+02	4.7417E+02	7.9726E+02
	1.0713E+00	-2.1980E+00	-6.5128E+00	3.2693E+00	5.4969E+00
18	4.1292E+02	-7.0862E+02	3.5117E+03	1.1215E+03	6.5962E+02
	2.8470E+00	-4.8858E+00	2.4212E+01	7.7327E+00	4.5479E+00
19	-8.0854E+01	-1.4469E+03	3.8198E+03	1.3661E+03	1.6853E+03
	-5.5747E-01	-9.9763E+00	2.6336E+01	9.4189E+00	1.1620E+01
20	-3.1280E+00	-2.8685E+03	-6.1639E+02	2.8654E+03	5.7248E+02
	-2.1567E-02	-1.9778E+01	-4.2499E+00	1.9756E+01	3.9471E+00
21	1.2646E+03	-2.1560E+00	1.2642E+03	1.2667E+03	8.1701E+02
	8.7190E+00	-1.4865E-02	8.7166E+00	8.7339E+00	5.6331E+00
22	2.1569E+03	-1.6868E+02	2.0942E+03	2.3256E+03	2.8197E+03
	1.4872E+01	-1.1630E+00	1.4439E+01	1.6035E+01	1.9441E+01

Allowable Stress for Load Case 112 (Post Fire at 120 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	419.14	410.98	18.70	20.70	59.70
2	457.41	454.88	18.70	20.70	59.70
3	424.31	415.40	18.70	20.70	59.70
4	392.93	391.10	20.00	22.40	61.80
5	417.37	412.48	18.70	20.70	59.70
6	424.49	421.51	18.70	20.70	59.70
7	459.07	457.50	18.70	20.70	59.70
8	463.34	462.03	18.70	20.70	59.70
9	459.08	457.51	18.70	20.70	59.70
10	433.68	429.20	18.70	20.70	59.70
11	423.65	413.29	18.70	20.70	59.70
12	417.63	414.88	18.70	20.70	59.70
13	402.30	392.95	20.00	22.40	61.80
14	382.68	377.69	20.00	22.40	61.80
15	334.28	334.06	20.00	22.40	61.80
16	345.42	344.07	20.00	22.40	61.80
17	346.83	346.16	20.00	22.40	61.80
18	358.32	356.05	20.00	22.40	61.80
19	363.89	361.35	20.00	22.40	61.80
20	392.32	387.49	20.00	22.40	61.80
21	330.57	329.92	20.00	22.40	61.80
22	331.53	331.29	20.00	22.40	61.80

Table 2-246. Load Case 112, Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	6.4073E+02 4.4177E+00	-9.8501E+02 -6.7914E+00	2.8175E+02 1.9426E+00	1.6257E+03 1.1209E+01	2.0395E+03 1.4062E+01		
2	9.2908E+02 6.4058E+00	-1.6651E+03 -1.1480E+01	-6.1390E+02 -4.2327E+00	2.5942E+03 1.7886E+01	5.2380E+03 3.6115E+01		
3	6.2659E+02 4.3202E+00	-1.0049E+03 -6.9284E+00	1.0955E+02 7.5529E-01	1.6315E+03 1.1249E+01	2.2471E+03 1.5493E+01		
4	1.4538E+03 1.0023E+01	-5.0638E+03 -3.4914E+01	-7.6009E+01 -5.2406E-01	6.5176E+03 4.4937E+01	1.2813E+04 8.8343E+01		
5	1.4358E+03 9.8993E+00	-5.6523E+03 -3.8971E+01	-3.5232E+03 -2.4292E+01	7.0881E+03 4.8871E+01	1.1267E+04 7.7684E+01		
6	1.6993E+02 1.1716E+00	-3.0527E+03 -2.1047E+01	-5.0284E+03 -3.4670E+01	3.2226E+03 2.2219E+01	3.9825E+03 2.7458E+01		
7	-3.7298E+02 -2.5716E+00	-9.5920E+02 -6.6135E+00	-3.1700E+03 -2.1856E+01	5.8622E+02 4.0418E+00	4.8253E+02 3.3269E+00		
8	-3.7763E+02 -2.6037E+00	-9.5936E+02 -6.6146E+00	-3.2806E+03 -2.2619E+01	5.8173E+02 4.0109E+00	4.8020E+02 3.3109E+00		
9	-3.7128E+02 -2.5599E+00	-9.6176E+02 -6.6311E+00	-3.2200E+03 -2.2201E+01	5.9048E+02 4.0712E+00	4.9713E+02 3.4276E+00		
10	-2.5759E+02 -1.7760E+00	-1.3453E+03 -9.2758E+00	-2.3223E+03 -1.6012E+01	1.0878E+03 7.4998E+00	1.7407E+03 1.2002E+01		
11	-2.3094E+02 -1.5923E+00	-3.0063E+03 -2.0728E+01	-2.7256E+03 -1.8792E+01	2.7754E+03 1.9136E+01	1.6403E+03 1.1310E+01		
12	5.0257E+00 3.4651E-02	-3.1279E+03 -2.1566E+01	-3.1208E+03 -2.1517E+01	3.1329E+03 2.1600E+01	1.7731E+03 1.2225E+01		
13	-4.7472E+02 -3.2731E+00	-5.3604E+03 -3.6959E+01	-1.5874E+03 -1.0945E+01	4.8857E+03 3.3686E+01	2.3367E+03 1.6111E+01		
14	-3.2271E+02 -2.2250E+00	-4.7415E+03 -3.2691E+01	4.8151E+02 3.3199E+00	4.4187E+03 3.0466E+01	1.1842E+03 8.1648E+00		
15	1.2058E+03 8.3139E+00	-6.7985E+02 -4.6874E+00	6.1825E+02 4.2627E+00	1.8857E+03 1.3001E+01	3.0452E+03 2.0996E+01		

16	3.0580E+02	-2.7284E+02	-8.9712E+02	5.7864E+02	8.7177E+02
	2.1084E+00	-1.8812E+00	-6.1854E+00	3.9896E+00	6.0106E+00
17	1.4490E+02	-3.0697E+02	-8.0763E+02	4.5187E+02	7.6543E+02
	9.9903E-01	-2.1165E+00	-5.5684E+00	3.1155E+00	5.2774E+00
18	3.3380E+02	-5.9923E+02	2.9572E+03	9.3304E+02	5.0176E+02
	2.3015E+00	-4.1316E+00	2.0389E+01	6.4331E+00	3.4595E+00
19	-6.5914E+01	-1.2333E+03	3.2207E+03	1.1674E+03	1.4846E+03
	-4.5446E-01	-8.5034E+00	2.2206E+01	8.0489E+00	1.0236E+01
20	-2.1394E+01	-2.4398E+03	-4.2073E+02	2.4184E+03	3.4695E+02
	-1.4751E-01	-1.6822E+01	-2.9008E+00	1.6674E+01	2.3921E+00
21	1.1311E+03	-1.8885E+00	1.1308E+03	1.1330E+03	7.2974E+02
	7.7988E+00	-1.3021E-02	7.7963E+00	7.8118E+00	5.0314E+00
22	1.8073E+03	-1.4528E+02	1.7653E+03	1.9526E+03	2.2977E+03
	1.2461E+01	-1.0017E+00	1.2171E+01	1.3463E+01	1.5842E+01

Allowable Stress for Load Case 112 (Post Fire at 150 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	417.38	410.78	18.70	20.70	59.70
2	443.06	438.92	18.70	20.70	59.70
3	421.65	414.90	18.70	20.70	59.70
4	399.76	398.41	20.00	22.40	61.80
5	418.13	414.49	18.70	20.70	59.70
6	423.34	421.31	18.70	20.70	59.70
7	448.38	446.89	18.70	20.70	59.70
8	451.36	450.04	18.70	20.70	59.70
9	448.62	447.13	18.70	20.70	59.70
10	430.02	427.21	18.70	20.70	59.70
11	423.70	416.20	18.70	20.70	59.70
12	421.56	418.91	18.70	20.70	59.70
13	407.29	400.21	18.70	20.70	59.70
14	392.30	388.51	20.00	22.40	61.80
15	353.27	353.08	20.00	22.40	61.80
16	362.95	361.79	20.00	22.40	61.80
17	364.14	363.58	20.00	22.40	61.80
18	373.45	371.67	20.00	22.40	61.80
19	378.11	376.01	20.00	22.40	61.80
20	401.63	397.71	20.00	22.40	61.80
21	348.49	347.90	20.00	22.40	61.80
22	350.84	350.62	20.00	22.40	61.80

Table 2-247. Load Case 112, Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.9116E+02 3.3864E+00	-7.7742E+02 -5.3602E+00	1.5306E+02 1.0553E+00	1.2686E+03 8.7466E+00	1.6463E+03 1.1351E+01		
2	6.9145E+02 4.7674E+00	-1.2884E+03 -8.8835E+00	-4.5271E+02 -3.1213E+00	1.9799E+03 1.3651E+01	4.0250E+03 2.7752E+01		
3	4.8486E+02 3.3430E+00	-7.9238E+02 -5.4633E+00	2.6076E+01 1.7979E-01	1.2772E+03 8.8062E+00	1.8051E+03 1.2446E+01		
4	1.3516E+03 9.3187E+00	-4.2251E+03 -2.9131E+01	-1.9802E+02 -1.3653E+00	5.5766E+03 3.8449E+01	1.0966E+04 7.5609E+01		
5	1.2750E+03 8.7908E+00	-4.5859E+03 -3.1619E+01	-2.8435E+03 -1.9605E+01	5.8609E+03 4.0409E+01	9.2820E+03 6.3997E+01		
6	1.3022E+02 8.9784E-01	-2.5624E+03 -1.7667E+01	-4.2891E+03 -2.9572E+01	2.6926E+03 1.8565E+01	3.4703E+03 2.3927E+01		
7	-3.3399E+02 -2.3028E+00	-8.4051E+02 -5.7951E+00	-3.0679E+03 -2.1153E+01	5.0652E+02 3.4923E+00	4.6137E+02 3.1810E+00		
8	-3.3921E+02 -2.3388E+00	-8.3807E+02 -5.7783E+00	-3.1496E+03 -2.1716E+01	4.9886E+02 3.4395E+00	4.4833E+02 3.0911E+00		
9	-3.3450E+02 -2.3063E+00	-8.4051E+02 -5.7951E+00	-3.1233E+03 -2.1535E+01	5.0601E+02 3.4888E+00	4.6402E+02 3.1993E+00		
10	-2.4396E+02 -1.6821E+00	-1.2823E+03 -8.8409E+00	-2.0024E+03 -1.3806E+01	1.0383E+03 7.1588E+00	1.6371E+03 1.1287E+01		
11	-2.5536E+02 -1.7606E+00	-2.5590E+03 -1.7644E+01	-2.2197E+03 -1.5304E+01	2.3037E+03 1.5883E+01	8.6317E+02 5.9514E+00		
12	3.4546E+00 2.3818E-02	-2.7103E+03 -1.8687E+01	-2.7037E+03 -1.8641E+01	2.7138E+03 1.8711E+01	9.3842E+02 6.4702E+00		
13	-3.4905E+02 -2.4066E+00	-4.2173E+03 -2.9077E+01	-1.1665E+03 -8.0430E+00	3.8683E+03 2.6671E+01	1.6700E+03 1.1514E+01		
14	-2.7933E+02 -1.9259E+00	-3.7289E+03 -2.5710E+01	3.6471E+02 2.5146E+00	3.4496E+03 2.3784E+01	1.2723E+03 8.7725E+00		
15	1.0879E+03 7.5008E+00	-7.0015E+02 -4.8273E+00	4.7673E+02 3.2870E+00	1.7880E+03 1.2328E+01	2.9342E+03 2.0231E+01		

16	2.8051E+02	-2.9282E+02	-7.3391E+02	5.7334E+02	8.8505E+02
	1.9341E+00	-2.0190E+00	-5.0601E+00	3.9530E+00	6.1022E+00
17	1.3112E+02	-2.9515E+02	-6.3712E+02	4.2627E+02	7.2894E+02
	9.0406E-01	-2.0350E+00	-4.3928E+00	2.9390E+00	5.0259E+00
18	2.6138E+02	-4.9790E+02	2.4390E+03	7.5928E+02	3.5837E+02
	1.8021E+00	-3.4329E+00	1.6816E+01	5.2350E+00	2.4709E+00
19	-5.1698E+01	-1.0339E+03	2.6582E+03	9.8221E+02	1.2909E+03
	-3.5644E-01	-7.1285E+00	1.8328E+01	6.7721E+00	8.9002E+00
20	-3.6189E+01	-2.0333E+03	-2.7062E+02	1.9971E+03	1.4351E+02
	-2.4951E-01	-1.4019E+01	-1.8658E+00	1.3769E+01	9.8948E-01
21	9.1643E+02	-1.5374E+00	9.1617E+02	9.1796E+02	6.0471E+02
	6.3185E+00	-1.0600E-02	6.3167E+00	6.3291E+00	4.1693E+00
22	1.3788E+03	-1.2660E+02	1.3541E+03	1.5054E+03	1.7090E+03
	9.5067E+00	-8.7291E-01	9.3361E+00	1.0380E+01	1.1783E+01

Allowable Stress for Load Case 112 (Post Fire at 180 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	415.13	409.80	18.70	20.70	59.70
2	432.64	427.61	18.70	20.70	59.70
3	418.66	413.48	18.70	20.70	59.70
4	403.70	402.71	18.70	20.70	59.70
5	417.63	414.90	18.70	20.70	59.70
6	421.42	420.11	18.70	20.70	59.70
7	439.59	438.17	18.70	20.70	59.70
8	441.71	440.40	18.70	20.70	59.70
9	439.98	438.56	18.70	20.70	59.70
10	426.66	424.80	18.70	20.70	59.70
11	422.79	417.42	18.70	20.70	59.70
12	423.30	420.74	18.70	20.70	59.70
13	410.26	404.98	18.70	20.70	59.70
14	398.97	396.13	20.00	22.40	61.80
15	368.87	368.71	20.00	22.40	61.80
16	376.58	375.63	20.00	22.40	61.80
17	377.51	377.07	20.00	22.40	61.80
18	384.75	383.41	20.00	22.40	61.80
19	388.58	386.90	20.00	22.40	61.80
20	407.66	404.54	18.70	20.70	59.70
21	364.10	363.61	20.00	22.40	61.80
22	366.86	366.67	20.00	22.40	61.80

**Table 2-248. Load Case 301, 30-ft. Head-On Drop,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-2.9940E+01 -2.0643E-01	-2.8525E+03 -1.9668E+01	-5.4790E+02 -3.7776E+00	2.8226E+03 1.9461E+01	1.2605E+03 8.6905E+00		
2	3.2567E+01 2.2454E-01	-1.4483E+03 -9.9854E+00	-4.8487E+01 -3.3430E-01	1.4808E+03 1.0210E+01	4.1952E+00 2.8925E-02		
3	1.0120E+01 6.9778E-02	-5.5631E+02 -3.8356E+00	-4.5881E+01 -3.1634E-01	5.6643E+02 3.9054E+00	7.6903E+01 5.3023E-01		
4	1.2360E+03 8.5217E+00	-4.9852E+03 -3.4371E+01	-1.5991E+03 -1.1025E+01	6.2211E+03 4.2893E+01	6.3790E+03 4.3982E+01		
5	4.7810E+02 3.2964E+00	-2.3239E+03 -1.6023E+01	-9.3470E+02 -6.4445E+00	2.8020E+03 1.9319E+01	4.2844E+03 2.9540E+01		
6	-2.9367E+02 -2.0248E+00	-1.1656E+03 -8.0365E+00	-8.4873E+02 -5.8518E+00	8.7192E+02 6.0117E+00	9.8877E+02 6.8173E+00		
7	-2.4064E+00 -1.6592E-02	-5.5893E+02 -3.8537E+00	-1.7514E+01 -1.2076E-01	5.5653E+02 3.8371E+00	1.8545E+01 1.2786E-01		
8	-6.7155E-01 -4.6302E-03	-4.6163E+02 -3.1828E+00	-1.1862E+01 -8.1784E-02	4.6096E+02 3.1782E+00	7.4107E-01 5.1095E-03		
9	-2.7392E-01 -1.8886E-03	-3.6212E+02 -2.4967E+00	-1.0248E+01 -7.0661E-02	3.6184E+02 2.4948E+00	9.5463E-01 6.5819E-03		
10	-5.4016E+01 -3.7243E-01	-3.6226E+02 -2.4977E+00	3.0567E+01 2.1075E-01	3.0824E+02 2.1252E+00	2.8123E+02 1.9390E+00		
11	1.3456E+02 9.2773E-01	-2.1107E+02 -1.4553E+00	4.5531E+01 3.1392E-01	3.4563E+02 2.3830E+00	1.0485E+02 7.2295E-01		
12	1.4592E+02 1.0061E+00	-3.0974E+01 -2.1355E-01	1.0529E+02 7.2595E-01	1.7689E+02 1.2196E+00	3.1841E+02 2.1953E+00		
13	2.7004E+02 1.8618E+00	-6.2309E+01 -4.2961E-01	1.1836E+02 8.1604E-01	3.3235E+02 2.2914E+00	2.0905E+02 1.4413E+00		
14	3.1019E+02 2.1387E+00	-3.5638E+01 -2.4572E-01	1.6007E+02 1.1036E+00	3.4583E+02 2.3844E+00	7.0666E+01 4.8722E-01		
15	1.2085E+03 8.3320E+00	1.0180E+02 7.0190E-01	-6.9485E+00 -4.7908E-02	1.1067E+03 7.6301E+00	5.4635E+00 3.7670E-02		

16	4.4746E+02	-7.1865E+02	-2.9993E+02	1.1661E+03	8.5265E+02
	3.0851E+00	-4.9549E+00	-2.0679E+00	8.0400E+00	5.8788E+00
17	6.2459E+02	-6.2086E+02	-3.9725E+02	1.2454E+03	1.3436E+03
	4.3064E+00	-4.2807E+00	-2.7390E+00	8.5871E+00	9.2636E+00
18	7.0210E+02	-1.2822E+03	-1.2982E+02	1.9843E+03	2.5937E+03
	4.8408E+00	-8.8403E+00	-8.9510E-01	1.3681E+01	1.7883E+01
19	4.0754E+02	-1.4038E+03	-5.9775E+02	1.8113E+03	1.6132E+03
	2.8099E+00	-9.6786E+00	-4.1213E+00	1.2489E+01	1.1123E+01
20	1.0619E+02	-1.0356E+03	-5.8430E+02	1.1418E+03	2.1014E+03
	7.3216E-01	-7.1404E+00	-4.0286E+00	7.8726E+00	1.4488E+01
21	1.5583E+03	1.4514E+02	1.3330E+02	1.4132E+03	5.2131E+02
	1.0744E+01	1.0007E+00	9.1904E-01	9.7436E+00	3.5943E+00
22	7.3129E+02	6.1186E+01	3.9463E+02	6.7010E+02	6.7024E+02
	5.0421E+00	4.2186E-01	2.7209E+00	4.6202E+00	4.6211E+00

**Table 2-249. Load Case 302, 30-ft. Side Drop + Slap-Down,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	1.3968E+02 9.6309E-01	-6.8637E+01 -4.7324E-01	-5.3256E+02 -3.6719E+00	3.6131E+03 2.4911E+01	1.2213E+03 8.4208E+00
2	9.1222E+02 6.2895E+00	-1.3328E+02 -9.1893E-01	-2.5653E+02 -1.7687E+00	9.3053E+02 6.4158E+00	1.1567E+03 7.9750E+00
3	1.3409E+02 9.2449E-01	-6.2195E+01 -4.2882E-01	-5.2913E+02 -3.6482E+00	3.6142E+03 2.4919E+01	1.2153E+03 8.3795E+00
4	7.1756E+02 4.9474E+00	-3.9376E+01 -2.7149E-01	-9.5615E+02 -6.5924E+00	2.9538E+03 2.0366E+01	6.3647E+02 4.3883E+00
5	1.0110E+03 6.9708E+00	-1.5693E+02 -1.0820E+00	-1.3386E+03 -9.2293E+00	2.9148E+03 2.0097E+01	7.6459E+01 5.2717E-01
6	1.1511E+03 7.9368E+00	-2.3027E+02 -1.5877E+00	-1.3557E+03 -9.3473E+00	2.6470E+03 1.8250E+01	1.4563E+02 1.0041E+00
7	2.0904E+02 1.4412E+00	1.2182E+02 8.3991E-01	-1.1830E+01 -8.1566E-02	1.5169E+03 1.0459E+01	8.0662E+01 5.5614E-01
8	1.3473E+02 9.2895E-01	1.1408E+02 7.8656E-01	1.7296E+01 1.1925E-01	7.2069E+02 4.9690E+00	1.0594E+02 7.3045E-01
9	2.1845E+02 1.5062E+00	1.1923E+02 8.2203E-01	-1.2258E+01 -8.4518E-02	1.4963E+03 1.0317E+01	8.1904E+01 5.6471E-01
10	1.2717E+03 8.7678E+00	-6.8768E+01 -4.7414E-01	-1.3667E+03 -9.4232E+00	1.9866E+03 1.3697E+01	6.7179E+02 4.6318E+00
11	6.0792E+02 4.1915E+00	-3.3477E+02 -2.3082E+00	-1.5654E+03 -1.0793E+01	2.0550E+03 1.4168E+01	6.2723E+02 4.3246E+00
12	-4.2067E+01 -2.9004E-01	-2.9458E+02 -2.0310E+00	-1.2994E+03 -8.9587E+00	1.2681E+03 8.7433E+00	1.4601E+02 1.0067E+00
13	1.0517E+03 7.2513E+00	-1.6792E+02 -1.1577E+00	-1.2557E+03 -8.6579E+00	2.8279E+03 1.9497E+01	8.2296E+01 5.6741E-01
14	8.0120E+02 5.5241E+00	-1.2512E+02 -8.6270E-01	-1.1483E+03 -7.9169E+00	2.7763E+03 1.9142E+01	5.5651E+02 3.8370E+00
15	-6.5674E+01 -4.5281E-01	-2.3256E+02 -1.6035E+00	-1.2914E+03 -8.9037E+00	1.2881E+03 8.8812E+00	5.3015E+01 3.6552E-01

16	1.2799E+02	-8.8239E+01	-1.1994E+03	2.6960E+03	2.5158E+02
	8.8247E-01	-6.0838E-01	-8.2695E+00	1.8589E+01	1.7346E+00
17	4.0181E+02	-2.6336E+01	-1.0550E+03	2.6877E+03	2.6710E+02
	2.7704E+00	-1.8158E-01	-7.2740E+00	1.8531E+01	1.8416E+00
18	8.6913E+02	-1.0430E+02	-1.0064E+03	2.9196E+03	2.0213E+02
	5.9924E+00	-7.1913E-01	-6.9386E+00	2.0130E+01	1.3936E+00
19	7.5856E+02	-2.0786E+02	-1.3113E+03	3.1150E+03	2.3580E+02
	5.2301E+00	-1.4331E+00	-9.0411E+00	2.1477E+01	1.6258E+00
20	7.9190E+02	-2.1748E+02	-1.2537E+03	2.3570E+03	1.8706E+02
	5.4600E+00	-1.4995E+00	-8.6437E+00	1.6251E+01	1.2898E+00
21	-2.4145E+01	-2.8385E+02	-1.4077E+03	1.4476E+03	1.7288E+02
	-1.6647E-01	-1.9571E+00	-9.7054E+00	9.9809E+00	1.1920E+00
22	-2.1531E+01	-3.0654E+02	-1.4702E+03	1.5102E+03	1.4132E+02
	-1.4845E-01	-2.1135E+00	-1.0136E+01	1.0412E+01	9.7438E-01

**Table 2-250. Load Case 303, 30-ft. Cg/Corner Drop,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	3.0882E+02 2.1292E+00	9.9384E+01 6.8523E-01	-1.3350E+03 -9.2043E+00	2.3145E+03 1.5958E+01	8.3219E+02 5.7377E+00		
2	3.2694E+02 2.2541E+00	-9.7695E+01 -6.7358E-01	-5.7799E+02 -3.9851E+00	1.2703E+03 8.7586E+00	2.0891E+02 1.4404E+00		
3	1.0783E+03 7.4345E+00	-3.4774E+01 -2.3976E-01	-1.3952E+02 -9.6193E-01	1.2178E+03 8.3964E+00	3.2285E+02 2.2260E+00		
4	3.1767E+02 2.1903E+00	3.0107E+01 2.0758E-01	-1.4176E+03 -9.7741E+00	3.9975E+03 2.7562E+01	4.3202E+02 2.9787E+00		
5	3.9524E+02 2.7251E+00	-3.3432E+02 -2.3051E+00	-1.9562E+03 -1.3487E+01	2.3042E+03 1.5887E+01	2.6207E+02 1.8069E+00		
6	3.8951E+02 2.6856E+00	-6.0195E+02 -4.1503E+00	-2.1436E+03 -1.4780E+01	2.4948E+03 1.7201E+01	4.8545E+02 3.3470E+00		
7	3.3983E+02 2.3430E+00	5.9379E+01 4.0941E-01	-2.2951E+02 -1.5824E+00	2.5180E+03 1.7361E+01	5.0709E+01 3.4963E-01		
8	4.5534E+02 3.1395E+00	1.0147E+01 6.9965E-02	-2.9234E+02 -2.0156E+00	1.9301E+03 1.3308E+01	3.3335E+01 2.2984E-01		
9	5.0291E+02 3.4674E+00	-1.4606E+02 -1.0070E+00	-3.0233E+02 -2.0845E+00	1.3196E+03 9.0983E+00	4.5411E+01 3.1310E-01		
10	5.3146E+02 3.6643E+00	-1.3192E+02 -9.0956E-01	-2.0961E+02 -1.4452E+00	9.6928E+02 6.6829E+00	4.4100E+02 3.0406E+00		
11	6.2706E+02 4.3235E+00	5.8407E+01 4.0270E-01	-7.3861E+01 -5.0926E-01	7.1636E+02 4.9391E+00	3.3225E+02 2.2908E+00		
12	3.3457E+02 2.3068E+00	1.2032E+01 8.2959E-02	-1.4275E+01 -9.8420E-02	3.4885E+02 2.4052E+00	7.1196E+01 4.9088E-01		
13	5.3330E+02 3.6770E+00	-1.0521E+02 -7.2538E-01	-1.8677E+02 -1.2877E+00	7.2444E+02 4.9948E+00	3.1629E+01 2.1807E-01		
14	5.3246E+02 3.6712E+00	-1.3802E+02 -9.5164E-01	-2.0479E+02 -1.4120E+00	7.3725E+02 5.0832E+00	8.2920E+01 5.7171E-01		
15	3.3884E+02 2.3362E+00	1.0369E+02 7.1493E-01	-1.0038E+03 -6.9213E+00	1.3811E+03 9.5227E+00	3.2166E+01 2.2178E-01		

16	4.4454E+02	3.1933E+01	-1.0252E+03	3.0364E+03	2.5476E+02
	3.0650E+00	2.2017E-01	-7.0682E+00	2.0935E+01	1.7565E+00
17	4.1155E+02	9.8915E+01	-9.5956E+02	2.9072E+03	5.0705E+02
	2.8375E+00	6.8199E-01	-6.6159E+00	2.0044E+01	3.4960E+00
18	3.9052E+02	-9.1967E+01	-1.4386E+03	2.3354E+03	4.5800E+02
	2.6925E+00	-6.3409E-01	-9.9186E+00	1.6102E+01	3.1578E+00
19	4.2118E+02	-2.2376E+02	-1.9041E+03	2.1644E+03	5.2637E+02
	2.9039E+00	-1.5428E+00	-1.3128E+01	1.4923E+01	3.6292E+00
20	2.7251E+02	-3.8419E+02	-1.8683E+03	2.1308E+03	1.9785E+02
	1.8789E+00	-2.6489E+00	-1.2881E+01	1.4691E+01	1.3641E+00
21	2.9946E+02	2.2593E+02	-3.6470E+01	3.2279E+02	8.0494E+00
	2.0647E+00	1.5577E+00	-2.5145E-01	2.2256E+00	5.5499E-02
22	5.0760E+02	4.1393E+01	-9.8404E+02	1.5315E+03	1.2996E+02
	3.4998E+00	2.8539E-01	-6.7847E+00	1.0560E+01	8.9601E-01

**Table 2-251. Load Case 304, 30-ft. Head-On Drop at -40°F, Low Temperature,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	-4.2094E+01 -2.9023E-01	-4.0127E+03 -2.7667E+01	-7.6985E+02 -5.3079E+00	3.9707E+03 2.7377E+01	1.7722E+03 1.2219E+01
2	4.5773E+01 3.1559E-01	-2.0425E+03 -1.4082E+01	-6.8408E+01 -4.7165E-01	2.0882E+03 1.4398E+01	6.5677E+00 4.5283E-02
3	1.4450E+01 9.9628E-02	-7.9327E+02 -5.4694E+00	-6.4051E+01 -4.4161E-01	8.0772E+02 5.5691E+00	1.0498E+02 7.2380E-01
4	1.7387E+03 1.1988E+01	-7.0074E+03 -4.8314E+01	-2.2463E+03 -1.5488E+01	8.7461E+03 6.0302E+01	8.9683E+03 6.1834E+01
5	6.7297E+02 4.6400E+00	-3.2671E+03 -2.2526E+01	-1.3129E+03 -9.0524E+00	3.9400E+03 2.7166E+01	6.0243E+03 4.1536E+01
6	-4.1478E+02 -2.8598E+00	-1.6406E+03 -1.1311E+01	-1.1933E+03 -8.2276E+00	1.2258E+03 8.4515E+00	1.3883E+03 9.5719E+00
7	-3.4014E+00 -2.3452E-02	-7.8863E+02 -5.4374E+00	-2.4678E+01 -1.7015E-01	7.8522E+02 5.4139E+00	2.6087E+01 1.7987E-01
8	-9.6327E-01 -6.6415E-03	-6.5266E+02 -4.4999E+00	-1.6763E+01 -1.1557E-01	6.5170E+02 4.4933E+00	1.0380E+00 7.1571E-03
9	-4.1248E-01 -2.8439E-03	-5.1526E+02 -3.5526E+00	-1.4599E+01 -1.0066E-01	5.1485E+02 3.5498E+00	1.2519E+00 8.6317E-03
10	-7.7868E+01 -5.3688E-01	-5.2278E+02 -3.6045E+00	4.1327E+01 2.8494E-01	4.4491E+02 3.0676E+00	4.0089E+02 2.7640E+00
11	1.9052E+02 1.3136E+00	-3.0257E+02 -2.0862E+00	6.3088E+01 4.3498E-01	4.9309E+02 3.3998E+00	1.5253E+02 1.0517E+00
12	2.0361E+02 1.4038E+00	-4.8603E+01 -3.3511E-01	1.4788E+02 1.0196E+00	2.5221E+02 1.7389E+00	4.5981E+02 3.1703E+00
13	3.7569E+02 2.5903E+00	-9.2489E+01 -6.3769E-01	1.6459E+02 1.1348E+00	4.6817E+02 3.2279E+00	2.7750E+02 1.9133E+00
14	4.2923E+02 2.9594E+00	-5.1008E+01 -3.5169E-01	2.2351E+02 1.5411E+00	4.8024E+02 3.3111E+00	8.9745E+01 6.1877E-01
15	1.6958E+03 1.1692E+01	1.4207E+02 9.7953E-01	-1.0543E+01 -7.2693E-02	1.5537E+03 1.0712E+01	7.7502E+00 5.3436E-02

16	6.2734E+02	-1.0095E+03	-4.2212E+02	1.6368E+03	1.1965E+03
	4.3254E+00	-6.9603E+00	-2.9104E+00	1.1286E+01	8.2493E+00
17	8.7592E+02	-8.7259E+02	-5.5885E+02	1.7485E+03	1.8863E+03
	6.0393E+00	-6.0163E+00	-3.8531E+00	1.2056E+01	1.3006E+01
18	9.8482E+02	-1.8022E+03	-1.8269E+02	2.7870E+03	3.6441E+03
	6.7901E+00	-1.2426E+01	-1.2596E+00	1.9216E+01	2.5125E+01
19	5.7335E+02	-1.9731E+03	-8.3942E+02	2.5464E+03	2.2689E+03
	3.9531E+00	-1.3604E+01	-5.7876E+00	1.7557E+01	1.5644E+01
20	1.5027E+02	-1.4560E+03	-8.2116E+02	1.6063E+03	2.9554E+03
	1.0361E+00	-1.0039E+01	-5.6617E+00	1.1075E+01	2.0377E+01
21	2.1657E+03	2.0163E+02	1.8515E+02	1.9641E+03	7.2396E+02
	1.4932E+01	1.3902E+00	1.2766E+00	1.3542E+01	4.9915E+00
22	1.0261E+03	8.5458E+01	5.5324E+02	9.4068E+02	9.4114E+02
	7.0750E+00	5.8921E-01	3.8145E+00	6.4858E+00	6.4889E+00

Table 2-252. Load Case 305, 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	1.9412E+02 1.3384E+00	-9.2510E+01 -6.3783E-01	-7.1002E+02 -4.8954E+00	5.0282E+03 3.4668E+01	1.6993E+03 1.1716E+01
2	1.2705E+03 8.7597E+00	-1.8353E+02 -1.2654E+00	-3.4588E+02 -2.3847E+00	1.2956E+03 8.9328E+00	1.6107E+03 1.1105E+01
3	1.8634E+02 1.2848E+00	-8.3546E+01 -5.7603E-01	-7.0533E+02 -4.8631E+00	5.0297E+03 3.4678E+01	1.6910E+03 1.1659E+01
4	9.9781E+02 6.8796E+00	-5.7415E+01 -3.9586E-01	-1.3161E+03 -9.0741E+00	4.1071E+03 2.8317E+01	8.8459E+02 6.0990E+00
5	1.4064E+03 9.6965E+00	-2.2092E+02 -1.5232E+00	-1.8471E+03 -1.2735E+01	4.0504E+03 2.7927E+01	1.0609E+02 7.3148E-01
6	1.6015E+03 1.1042E+01	-3.2210E+02 -2.2208E+00	-1.8724E+03 -1.2910E+01	3.6777E+03 2.5357E+01	2.0161E+02 1.3901E+00
7	2.8822E+02 1.9872E+00	1.5972E+02 1.1012E+00	-1.7752E+01 -1.2240E-01	2.1032E+03 1.4501E+01	1.1034E+02 7.6075E-01
8	1.7966E+02 1.2387E+00	1.4991E+02 1.0336E+00	2.3124E+01 1.5943E-01	9.8986E+02 6.8248E+00	1.4815E+02 1.0215E+00
9	3.0138E+02 2.0779E+00	1.5610E+02 1.0763E+00	-1.8358E+01 -1.2657E-01	2.0745E+03 1.4303E+01	1.1206E+02 7.7260E-01
10	1.7692E+03 1.2198E+01	-1.0179E+02 -7.0182E-01	-1.8912E+03 -1.3039E+01	2.7594E+03 1.9026E+01	9.3568E+02 6.4513E+00
11	8.4687E+02 5.8390E+00	-4.4524E+02 -3.0698E+00	-2.1696E+03 -1.4959E+01	2.8542E+03 1.9679E+01	8.6720E+02 5.9791E+00
12	-5.8495E+01 -4.0331E-01	-4.1322E+02 -2.8490E+00	-1.7998E+03 -1.2409E+01	1.7568E+03 1.2113E+01	2.0230E+02 1.3948E+00
13	1.4630E+03 1.0087E+01	-2.3587E+02 -1.6263E+00	-1.7329E+03 -1.1948E+01	3.9300E+03 2.7096E+01	1.1378E+02 7.8452E-01
14	1.1144E+03 7.6836E+00	-1.7639E+02 -1.2162E+00	-1.5827E+03 -1.0913E+01	3.8590E+03 2.6607E+01	7.7373E+02 5.3347E+00
15	-9.0950E+01 -6.2708E-01	-3.2607E+02 -2.2482E+00	-1.7920E+03 -1.2355E+01	1.7880E+03 1.2328E+01	7.3707E+01 5.0819E-01

16	1.7775E+02	-1.2436E+02	-1.6547E+03	3.7477E+03	3.4974E+02
	1.2255E+00	-8.5741E-01	-1.1408E+01	2.5839E+01	2.4114E+00
17	5.5885E+02	-3.9168E+01	-1.4542E+03	3.7364E+03	3.7155E+02
	3.8532E+00	-2.7006E-01	-1.0026E+01	2.5761E+01	2.5617E+00
18	1.2090E+03	-1.4722E+02	-1.3855E+03	4.0588E+03	2.8121E+02
	8.3354E+00	-1.0151E+00	-9.5528E+00	2.7984E+01	1.9388E+00
19	1.0553E+03	-2.9021E+02	-1.8070E+03	4.3297E+03	3.2814E+02
	7.2759E+00	-2.0010E+00	-1.2459E+01	2.9852E+01	2.2624E+00
20	1.1022E+03	-3.0343E+02	-1.7320E+03	3.2749E+03	2.5961E+02
	7.5991E+00	-2.0921E+00	-1.1942E+01	2.2580E+01	1.7899E+00
21	-3.3469E+01	-3.9757E+02	-1.9533E+03	2.0093E+03	2.4029E+02
	-2.3076E-01	-2.7412E+00	-1.3468E+01	1.3854E+01	1.6567E+00
22	-2.9865E+01	-4.2919E+02	-2.0401E+03	2.0961E+03	1.9640E+02
	-2.0591E-01	-2.9592E+00	-1.4066E+01	1.4452E+01	1.3541E+00

Table 2-253. Load Case 306, 30-ft. Cg/Corner Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	3.6031E+02 2.4843E+00	1.1604E+02 8.0008E-01	-1.5585E+03 -1.0746E+01	2.7004E+03 1.8619E+01	9.7099E+02 6.6947E+00
2	3.8085E+02 2.6259E+00	-1.1403E+02 -7.8621E-01	-6.7492E+02 -4.6534E+00	1.4821E+03 1.0219E+01	2.4375E+02 1.6806E+00
3	1.2572E+03 8.6681E+00	-4.0757E+01 -2.8101E-01	-1.6291E+02 -1.1232E+00	1.4201E+03 9.7914E+00	3.7648E+02 2.5957E+00
4	3.7062E+02 2.5553E+00	3.5184E+01 2.4259E-01	-1.6544E+03 -1.1406E+01	4.6640E+03 3.2157E+01	5.0417E+02 3.4761E+00
5	4.6116E+02 3.1796E+00	-3.9003E+02 -2.6892E+00	-2.2827E+03 -1.5739E+01	2.6886E+03 1.8537E+01	3.0576E+02 2.1082E+00
6	4.5447E+02 3.1334E+00	-7.0231E+02 -4.8423E+00	-2.5014E+03 -1.7247E+01	2.9109E+03 2.0070E+01	5.6637E+02 3.9050E+00
7	3.9637E+02 2.7329E+00	6.9316E+01 4.7792E-01	-2.6767E+02 -1.8455E+00	2.9378E+03 2.0256E+01	5.9191E+01 4.0811E-01
8	5.3104E+02 3.6614E+00	1.1888E+01 8.1965E-02	-3.4097E+02 -2.3509E+00	2.2519E+03 1.5526E+01	3.8881E+01 2.6807E-01
9	5.8648E+02 4.0436E+00	-1.7018E+02 -1.1734E+00	-3.5260E+02 -2.4311E+00	1.5395E+03 1.0615E+01	5.2968E+01 3.6520E-01
10	6.1982E+02 4.2735E+00	-1.5383E+02 -1.0606E+00	-2.4448E+02 -1.6856E+00	1.1308E+03 7.7963E+00	5.1456E+02 3.5478E+00
11	7.3131E+02 5.0422E+00	6.8124E+01 4.6970E-01	-8.6113E+01 -5.9373E-01	8.3556E+02 5.7610E+00	3.8754E+02 2.6720E+00
12	3.9020E+02 2.6904E+00	1.4076E+01 9.7054E-02	-1.6619E+01 -1.1458E-01	4.0682E+02 2.8049E+00	8.3056E+01 5.7265E-01
13	6.2191E+02 4.2880E+00	-1.2274E+02 -8.4627E-01	-2.1791E+02 -1.5024E+00	8.4494E+02 5.8257E+00	3.6907E+01 2.5446E-01
14	6.2092E+02 4.2811E+00	-1.6100E+02 -1.1101E+00	-2.3898E+02 -1.6477E+00	8.5990E+02 5.9288E+00	9.6686E+01 6.6663E-01
15	3.9537E+02 2.7259E+00	1.2096E+02 8.3399E-01	-1.1714E+03 -8.0766E+00	1.6116E+03 1.1112E+01	3.7528E+01 2.5875E-01

16	5.1874E+02	3.7258E+01	-1.1965E+03	3.5428E+03	2.9725E+02
	3.5766E+00	2.5689E-01	-8.2496E+00	2.4427E+01	2.0494E+00
17	4.8025E+02	1.1544E+02	-1.1199E+03	3.3920E+03	5.9156E+02
	3.3112E+00	7.9591E-01	-7.7218E+00	2.3387E+01	4.0787E+00
18	4.5567E+02	-1.0726E+02	-1.6788E+03	2.7248E+03	5.3436E+02
	3.1417E+00	-7.3955E-01	-1.1575E+01	1.8787E+01	3.6843E+00
19	4.9145E+02	-2.6105E+02	-2.2220E+03	2.5253E+03	6.1414E+02
	3.3884E+00	-1.7999E+00	-1.5320E+01	1.7412E+01	4.2343E+00
20	3.1796E+02	-4.4826E+02	-2.1801E+03	2.4862E+03	2.3085E+02
	2.1923E+00	-3.0907E+00	-1.5031E+01	1.7142E+01	1.5916E+00
21	3.4932E+02	2.6348E+02	-4.2515E+01	3.7650E+02	9.3910E+00
	2.4085E+00	1.8166E+00	-2.9313E-01	2.5959E+00	6.4749E-02
22	5.9226E+02	4.8287E+01	-1.1483E+03	1.7871E+03	1.5162E+02
	4.0835E+00	3.3293E-01	-7.9176E+00	1.2322E+01	1.0454E+00

**Table 2-254. Load Case 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.0628E+02 1.4222E+00	-4.9951E+02 -3.4440E+00	5.2133E+02 3.5944E+00	7.0578E+02 4.8662E+00	3.6794E+00 2.5369E-02		
2	9.7119E+00 6.6961E-02	-3.3206E+02 -2.2895E+00	2.2342E+01 1.5404E-01	3.4177E+02 2.3564E+00	1.1125E+02 7.6705E-01		
3	-1.6402E+00 -1.1309E-02	-1.2721E+02 -8.7706E-01	-1.3949E+00 -9.6178E-03	1.2557E+02 8.6575E-01	1.4617E+01 1.0078E-01		
4	9.9753E+02 6.8777E+00	-2.9860E+02 -2.0588E+00	9.2603E+02 6.3848E+00	1.2961E+03 8.9365E+00	3.8144E+02 2.6299E+00		
5	8.9652E+02 6.1813E+00	-7.3102E+02 -5.0402E+00	8.0956E+02 5.5817E+00	1.6275E+03 1.1221E+01	1.2367E+03 8.5265E+00		
6	-1.6175E+02 -1.1152E+00	-1.5458E+03 -1.0658E+01	2.2211E+02 1.5314E+00	1.3841E+03 9.5430E+00	1.0179E+02 7.0184E-01		
7	-7.5795E-01 -5.2259E-03	-9.6629E+02 -6.6623E+00	-1.1520E+01 -7.9425E-02	9.6553E+02 6.6571E+00	1.2715E+01 8.7666E-02		
8	-1.0510E-01 -7.2461E-04	-5.5458E+02 -3.8237E+00	-8.0492E+00 -5.5498E-02	5.5448E+02 3.8230E+00	1.1177E-01 7.7061E-04		
9	1.4254E+00 9.8277E-03	-2.4540E+02 -1.6920E+00	-9.5904E+00 -6.6124E-02	2.4683E+02 1.7018E+00	4.6153E+00 3.1821E-02		
10	9.6863E+01 6.6785E-01	-1.3712E+02 -9.4540E-01	1.8414E+02 1.2696E+00	2.3398E+02 1.6132E+00	3.1484E+02 2.1707E+00		
11	1.6178E+02 1.1154E+00	-1.5472E+02 -1.0667E+00	1.0365E+02 7.1461E-01	3.1650E+02 2.1822E+00	3.7600E+01 2.5925E-01		
12	1.2243E+02 8.4414E-01	-2.8632E+02 -1.9741E+00	1.0373E+02 7.1518E-01	4.0875E+02 2.8182E+00	6.0876E+02 4.1972E+00		
13	5.9946E+02 4.1331E+00	-6.6468E+01 -4.5828E-01	1.9441E+02 1.3404E+00	6.6593E+02 4.5914E+00	6.8838E+02 4.7462E+00		
14	6.1276E+02 4.2248E+00	-8.5532E+01 -5.8972E-01	2.1954E+02 1.5137E+00	6.9829E+02 4.8145E+00	5.9216E+02 4.0828E+00		
15	-7.8465E+03 -5.4100E+01	-4.0547E+04 -2.7956E+02	-3.2688E+03 -2.2538E+01	3.2700E+04 2.2546E+02	8.6713E+02 5.9787E+00		

16	2.2425E+03	-4.5369E+03	-1.8808E+02	6.7794E+03	9.6881E+03
	1.5462E+01	-3.1281E+01	-1.2968E+00	4.6742E+01	6.6797E+01
17	-3.0895E+02	-4.2002E+03	4.6060E+02	3.8912E+03	6.8057E+03
	-2.1301E+00	-2.8959E+01	3.1757E+00	2.6829E+01	4.6924E+01
18	-2.7004E+02	-1.6941E+03	-3.1620E+02	1.4241E+03	4.3105E+02
	-1.8619E+00	-1.1681E+01	-2.1801E+00	9.8189E+00	2.9720E+00
19	7.4373E+02	-1.0598E+03	-1.3258E+02	1.8035E+03	2.2113E+03
	5.1279E+00	-7.3070E+00	-9.1408E-01	1.2435E+01	1.5246E+01
20	1.1079E+03	-1.1824E+03	-3.2353E+02	2.2903E+03	3.4755E+03
	7.6386E+00	-8.1524E+00	-2.2307E+00	1.5791E+01	2.3963E+01
21	8.6882E+01	-1.2537E+02	-2.6223E+01	2.1225E+02	4.0111E+02
	5.9903E-01	-8.6440E-01	-1.8080E-01	1.4634E+00	2.7655E+00
22	-1.1520E+03	-1.4960E+04	-4.2375E+03	1.3808E+04	1.0341E+04
	-7.9425E+00	-1.0314E+02	-2.9216E+01	9.5200E+01	7.1298E+01

**Table 2-255. Load Combination 301, Head-On Drop Orientation,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 301, 102, 201, 211
 30-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	3.42	2.12	5.54	20.00	66.30	>10
	23.60	14.62	38.22	137.90	457.12	
2	1.52	0.03	1.55	20.00	66.30	>10
	10.49	0.22	10.71	137.90	457.12	
3	0.59	0.10	0.69	20.00	66.30	>10
	4.08	0.69	4.77	137.90	457.12	
4	11.17	15.09	26.26	20.00	66.30	1.52
	76.99	104.07	181.06	137.90	457.12	
5	7.08	11.25	18.33	20.00	66.30	2.62
	48.80	77.59	126.38	137.90	457.12	
6	2.53	3.26	5.79	20.00	61.80	9.67
	17.46	22.47	39.93	137.90	426.10	
7	0.84	0.03	0.87	20.00	61.80	>10
	5.80	0.18	5.98	137.90	426.10	
8	0.75	0.00	0.75	20.00	61.80	>10
	5.14	0.01	5.15	137.90	426.10	
9	0.65	0.01	0.66	20.00	61.80	>10
	4.46	0.09	4.55	137.90	426.10	
10	1.29	1.29	2.58	20.00	61.80	>10
	8.89	8.89	17.78	137.90	426.10	
11	0.96	0.39	1.35	20.00	61.80	>10
	6.60	2.69	9.29	137.90	426.10	
12	0.69	0.73	1.42	20.00	61.80	>10
	4.77	5.03	9.80	137.90	426.10	
13	1.37	1.13	2.50	20.00	61.80	>10
	9.47	7.76	17.23	137.90	426.10	

14	1.33 9.14	1.05 7.26	2.38 16.40	20.00 137.90	66.30 457.12	>10
15	4.94 34.07	5.46 37.61	10.40 71.69	20.00 137.90	66.30 457.12	5.38
16	3.49 24.05	4.25 29.28	7.73 53.33	20.00 137.90	66.30 457.12	7.57
17	2.89 19.90	3.80 26.21	6.69 46.11	20.00 137.90	66.30 457.12	8.91
18	3.93 27.09	5.59 38.56	9.52 65.65	20.00 137.90	66.30 457.12	5.96
19	4.93 33.96	6.41 44.23	11.34 78.18	20.00 137.90	66.30 457.12	4.85
20	3.68 25.40	6.81 46.96	10.50 72.36	20.00 137.90	61.80 426.10	4.89
21	1.64 11.29	0.99 6.81	2.62 18.10	20.00 137.90	66.30 457.12	>10
22	2.64 18.21	3.01 20.75	5.65 38.96	20.00 137.90	66.30 457.12	>10

Min MS: 1.525, Location: 4, Combination: Pm+Pb

**Table 2-256. Load Combination 302, Side Drop Orientation,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 302, 102, 201, 211
 30-ft. Side Drop + Slap-Down
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.21	2.08	6.29	20.00	66.30	9.53
	29.05	14.35	43.40	137.90	457.12	
2	0.97	1.18	2.16	20.00	66.30	>10
	6.70	8.16	14.86	137.90	457.12	
3	3.64	1.24	4.88	20.00	66.30	>10
	25.09	8.54	33.63	137.90	457.12	
4	7.90	9.35	17.25	20.00	66.30	2.84
	54.46	64.48	118.94	137.90	457.12	
5	7.19	7.05	14.24	20.00	66.30	3.66
	49.57	48.57	98.15	137.90	457.12	
6	4.31	2.42	6.72	20.00	61.80	8.19
	29.70	16.65	46.35	137.90	426.10	
7	1.80	0.09	1.89	20.00	61.80	>10
	12.42	0.61	13.03	137.90	426.10	
8	1.01	0.11	1.11	20.00	61.80	>10
	6.93	0.73	7.66	137.90	426.10	
9	1.78	0.09	1.87	20.00	61.80	>10
	12.28	0.64	12.93	137.90	426.10	
10	2.97	1.68	4.65	20.00	61.80	>10
	20.46	11.58	32.05	137.90	426.10	
11	2.67	0.91	3.58	20.00	61.80	>10
	18.39	6.29	24.68	137.90	426.10	
12	1.78	0.56	2.34	20.00	61.80	>10
	12.30	3.84	16.14	137.90	426.10	
13	3.87	1.00	4.87	20.00	61.80	>10
	26.67	6.89	33.56	137.90	426.10	

14	3.76 25.90	1.54 10.61	5.30 36.51	20.00 137.90	66.30 457.12	>10
15	5.12 35.32	5.50 37.94	10.63 73.27	20.00 137.90	66.30 457.12	5.24
16	5.02 34.59	3.65 25.14	8.66 59.73	20.00 137.90	66.30 457.12	6.65
17	4.33 29.85	2.72 18.78	7.05 48.63	20.00 137.90	66.30 457.12	8.40
18	4.86 33.54	3.20 22.07	8.07 55.61	20.00 137.90	66.30 457.12	7.22
19	6.23 42.95	5.04 34.73	11.27 77.68	20.00 137.90	66.30 457.12	4.88
20	4.90 33.78	4.90 33.76	9.80 67.54	20.00 137.90	61.80 426.10	5.31
21	1.67 11.53	0.64 4.40	2.31 15.93	20.00 137.90	66.30 457.12	>10
22	3.48 24.00	2.48 17.11	5.96 41.11	20.00 137.90	66.30 457.12	>10

Min MS: 2.843, Location: 4, Combination: Pm+Pb

**Table 2-257. Load Combination 303, Cg/Corner Drop Orientation,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 303, 102, 201, 211
 30-ft. Cg/Corner Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	2.91	1.69	4.61	20.00	66.30	>10
	20.10	11.66	31.76	137.90	457.12	
2	1.31	0.24	1.55	20.00	66.30	>10
	9.04	1.63	10.67	137.90	457.12	
3	1.24	0.35	1.59	20.00	66.30	>10
	8.57	2.39	10.95	137.90	457.12	
4	8.94	9.15	18.09	20.00	66.30	2.67
	61.66	63.07	124.72	137.90	457.12	
5	6.58	7.23	13.81	20.00	66.30	3.80
	45.36	49.85	95.22	137.90	457.12	
6	4.16	2.76	6.91	20.00	61.80	7.94
	28.65	19.00	47.65	137.90	426.10	
7	2.80	0.06	2.86	20.00	61.80	>10
	19.33	0.40	19.73	137.90	426.10	
8	2.21	0.03	2.25	20.00	61.80	>10
	15.27	0.23	15.50	137.90	426.10	
9	1.60	0.06	1.66	20.00	61.80	>10
	11.06	0.39	11.46	137.90	426.10	
10	1.95	1.45	3.40	20.00	61.80	>10
	13.45	9.99	23.44	137.90	426.10	
11	1.33	0.62	1.95	20.00	61.80	>10
	9.16	4.25	13.41	137.90	426.10	
12	0.86	0.48	1.35	20.00	61.80	>10
	5.96	3.32	9.28	137.90	426.10	
13	1.76	0.95	2.71	20.00	61.80	>10
	12.17	6.54	18.71	137.90	426.10	

14	1.72 11.84	1.07 7.35	2.78 19.19	20.00 137.90	66.30 457.12	>10
15	5.22 35.96	5.48 37.80	10.70 73.76	20.00 137.90	66.30 457.12	5.20
16	5.36 36.94	3.65 25.16	9.01 62.10	20.00 137.90	66.30 457.12	6.36
17	4.55 31.36	2.96 20.44	7.51 51.80	20.00 137.90	66.30 457.12	7.82
18	4.28 29.51	3.46 23.84	7.74 53.35	20.00 137.90	66.30 457.12	7.57
19	5.28 36.39	5.33 36.73	10.61 73.13	20.00 137.90	66.30 457.12	5.25
20	4.67 32.22	4.91 33.84	9.58 66.06	20.00 137.90	61.80 426.10	5.45
21	0.55 3.77	0.47 3.27	1.02 7.04	20.00 137.90	66.30 457.12	>10
22	3.50 24.15	2.47 17.03	5.97 41.18	20.00 137.90	66.30 457.12	>10

Min MS: 2.665, Location: 4, Combination: Pm+Pb

Table 2-258. Load Combination 304, Head-On Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 304, 105, 202, 211
 30-ft. Head-On Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.56	2.62	7.18	20.00	70.00	8.75
	31.43	18.06	49.49	137.90	482.63	
2	2.12	0.03	2.15	20.00	70.00	>10
	14.62	0.23	14.85	137.90	482.63	
3	0.82	0.11	0.93	20.00	70.00	>10
	5.65	0.75	6.40	137.90	482.63	
4	9.66	10.55	20.21	20.00	70.00	2.46
	66.59	72.77	139.36	137.90	482.63	
5	4.89	7.49	12.38	20.00	70.00	4.65
	33.72	51.66	85.38	137.90	482.63	
6	1.62	2.03	3.65	20.00	70.00	>10
	11.15	14.03	25.18	137.90	482.63	
7	0.94	0.03	0.97	20.00	70.00	>10
	6.47	0.19	6.67	137.90	482.63	
8	0.81	0.00	0.81	20.00	70.00	>10
	5.55	0.01	5.56	137.90	482.63	
9	0.67	0.00	0.67	20.00	70.00	>10
	4.61	0.01	4.62	137.90	482.63	
10	0.64	0.49	1.13	20.00	70.00	>10
	4.44	3.36	7.80	137.90	482.63	
11	0.60	0.22	0.82	20.00	70.00	>10
	4.15	1.52	5.67	137.90	482.63	
12	0.33	0.47	0.80	20.00	70.00	>10
	2.26	3.23	5.49	137.90	482.63	
13	0.82	0.64	1.46	20.00	70.00	>10
	5.67	4.39	10.06	137.90	482.63	

14	0.82	0.38	1.20	20.00	70.00	>10
	5.64	2.65	8.29	137.90	482.63	
15	2.04	0.29	2.33	20.00	70.00	>10
	14.09	2.01	16.09	137.90	482.63	
16	1.78	1.40	3.18	20.00	70.00	>10
	12.27	9.65	21.92	137.90	482.63	
17	1.85	2.04	3.89	20.00	70.00	>10
	12.76	14.08	26.84	137.90	482.63	
18	2.97	3.95	6.92	20.00	70.00	9.11
	20.49	27.23	47.72	137.90	482.63	
19	2.82	2.64	5.46	20.00	70.00	>10
	19.43	18.23	37.66	137.90	482.63	
20	1.88	3.40	5.28	20.00	70.00	>10
	12.95	23.46	36.41	137.90	482.63	
21	2.02	0.81	2.83	20.00	70.00	>10
	13.91	5.62	19.53	137.90	482.63	
22	1.29	1.02	2.31	20.00	70.00	>10
	8.87	7.05	15.92	137.90	482.63	

Min MS: 2.463, Location: 4, Combination: Pm+Pb

Table 2-259. Load Combination 305, Side Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 305, 105, 202, 211
 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	5.62	2.55	8.16	20.00	70.00	7.55
	38.72	17.56	56.28	137.90	482.63	
2	1.33	1.64	2.97	20.00	70.00	>10
	9.16	11.29	20.45	137.90	482.63	
3	5.04	1.70	6.74	20.00	70.00	8.52
	34.76	11.69	46.45	137.90	482.63	
4	5.02	2.47	7.49	20.00	70.00	8.35
	34.61	17.04	51.64	137.90	482.63	
5	5.00	1.57	6.58	20.00	70.00	8.60
	34.48	10.86	45.34	137.90	482.63	
6	4.07	0.85	4.92	20.00	70.00	>10
	28.06	5.85	33.91	137.90	482.63	
7	2.26	0.11	2.37	20.00	70.00	>10
	15.56	0.77	16.34	137.90	482.63	
8	1.14	0.15	1.29	20.00	70.00	>10
	7.89	1.02	8.91	137.90	482.63	
9	2.23	0.11	2.34	20.00	70.00	>10
	15.36	0.78	16.14	137.90	482.63	
10	2.96	1.02	3.98	20.00	70.00	>10
	20.40	7.05	27.45	137.90	482.63	
11	2.96	0.93	3.90	20.00	70.00	>10
	20.43	6.44	26.87	137.90	482.63	
12	1.83	0.21	2.04	20.00	70.00	>10
	12.63	1.46	14.09	137.90	482.63	
13	4.28	0.47	4.76	20.00	70.00	>10
	29.54	3.26	32.80	137.90	482.63	

14	4.20	1.07	5.27	20.00	70.00	>10
	28.94	7.36	36.30	137.90	482.63	
15	2.28	0.36	2.63	20.00	70.00	>10
	15.70	2.46	18.16	137.90	482.63	
16	3.89	0.55	4.44	20.00	70.00	>10
	26.82	3.82	30.64	137.90	482.63	
17	3.84	0.53	4.37	20.00	70.00	>10
	26.47	3.64	30.11	137.90	482.63	
18	4.24	0.59	4.83	20.00	70.00	>10
	29.26	4.04	33.31	137.90	482.63	
19	4.60	0.70	5.30	20.00	70.00	9.43
	31.72	4.85	36.58	137.90	482.63	
20	3.55	0.71	4.25	20.00	70.00	>10
	24.46	4.87	29.33	137.90	482.63	
21	2.06	0.33	2.39	20.00	70.00	>10
	14.22	2.28	16.50	137.90	482.63	
22	2.44	0.28	2.72	20.00	70.00	>10
	16.83	1.92	18.75	137.90	482.63	

Min MS: 7.547, Location: 1, Combination: Pm

Table 2-260. Load Combination 306, Cg/Corner Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 306, 105, 202, 211
 30-ft. Cg/Corner Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	3.29	1.82	5.11	20.00	70.00	>10
	22.67	12.54	35.21	137.90	482.63	
2	1.51	0.27	1.79	20.00	70.00	>10
	10.45	1.86	12.31	137.90	482.63	
3	1.43	0.38	1.81	20.00	70.00	>10
	9.87	2.62	12.50	137.90	482.63	
4	5.58	2.09	7.67	20.00	70.00	7.61
	38.45	14.41	52.86	137.90	482.63	
5	3.64	1.77	5.41	20.00	70.00	>10
	25.09	12.23	37.32	137.90	482.63	
6	3.30	1.21	4.52	20.00	70.00	>10
	22.77	8.36	31.13	137.90	482.63	
7	3.09	0.06	3.15	20.00	70.00	>10
	21.32	0.42	21.74	137.90	482.63	
8	2.41	0.04	2.44	20.00	70.00	>10
	16.59	0.27	16.85	137.90	482.63	
9	1.69	0.05	1.75	20.00	70.00	>10
	11.67	0.37	12.04	137.90	482.63	
10	1.33	0.60	1.93	20.00	70.00	>10
	9.17	4.14	13.31	137.90	482.63	
11	0.94	0.45	1.40	20.00	70.00	>10
	6.51	3.14	9.65	137.90	482.63	
12	0.48	0.09	0.57	20.00	70.00	>10
	3.33	0.63	3.96	137.90	482.63	
13	1.20	0.40	1.60	20.00	70.00	>10
	8.27	2.73	11.00	137.90	482.63	

14	1.20	0.39	1.59	20.00	70.00	>10
	8.26	2.70	10.96	137.90	482.63	
15	2.10	0.32	2.42	20.00	70.00	>10
	14.48	2.21	16.69	137.90	482.63	
16	3.69	0.50	4.19	20.00	70.00	>10
	25.41	3.45	28.87	137.90	482.63	
17	3.49	0.75	4.24	20.00	70.00	>10
	24.09	5.16	29.25	137.90	482.63	
18	2.91	0.84	3.75	20.00	70.00	>10
	20.06	5.79	25.85	137.90	482.63	
19	2.80	0.99	3.79	20.00	70.00	>10
	19.28	6.82	26.11	137.90	482.63	
20	2.76	0.68	3.44	20.00	70.00	>10
	19.02	4.68	23.69	137.90	482.63	
21	0.43	0.10	0.53	20.00	70.00	>10
	2.96	0.69	3.65	137.90	482.63	
22	2.13	0.23	2.37	20.00	70.00	>10
	14.70	1.61	16.31	137.90	482.63	

Min MS: 7.608, Location: 4, Combination: Pm

Table 2-261. Load Combination 310, Additional Increased External Pressure (290 psi), Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 204, 101, 211

Additional Increased External Pressure, 2 MPa (290 psia)

100°F Ambient, Maximum Decay Heat

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.75	0.95	1.70	20.00	66.30	>10
	5.19	6.56	11.75	137.90	457.12	
2	0.19	0.03	0.22	20.00	66.30	>10
	1.29	0.21	1.51	137.90	457.12	
3	0.18	0.12	0.30	20.00	66.30	>10
	1.25	0.82	2.07	137.90	457.12	
4	6.25	11.56	17.80	20.00	66.30	2.72
	43.06	79.68	122.74	137.90	457.12	
5	6.38	9.75	16.13	20.00	66.30	3.11
	43.98	67.20	111.18	137.90	457.12	
6	2.50	4.07	6.57	20.00	66.30	9.10
	17.22	28.06	45.27	137.90	457.12	
7	1.26	0.02	1.28	20.00	66.30	>10
	8.69	0.14	8.83	137.90	457.12	
8	1.26	0.00	1.26	20.00	66.30	>10
	8.68	0.00	8.69	137.90	457.12	
9	1.26	0.02	1.28	20.00	66.30	>10
	8.68	0.12	8.80	137.90	457.12	
10	1.18	0.71	1.89	20.00	66.30	>10
	8.13	4.89	13.02	137.90	457.12	
11	0.76	0.47	1.23	20.00	66.30	>10
	5.25	3.23	8.48	137.90	457.12	
12	1.67	2.42	4.09	20.00	66.30	>10
	11.53	16.70	28.23	137.90	457.12	
13	1.29	1.36	2.64	20.00	66.30	>10
	8.87	9.35	18.22	137.90	457.12	

14	0.97 6.66	0.62 4.25	1.58 10.91	20.00 137.90	66.30 457.12	>10
15	4.03 27.78	0.08 0.57	4.11 28.35	20.00 137.90	66.30 457.12	>10
16	0.80 5.50	1.16 8.02	1.96 13.53	20.00 137.90	66.30 457.12	>10
17	0.57 3.94	1.01 6.96	1.58 10.91	20.00 137.90	66.30 457.12	>10
18	0.67 4.62	1.18 8.13	1.85 12.75	20.00 137.90	66.30 457.12	>10
19	0.95 6.52	1.13 7.81	2.08 14.33	20.00 137.90	66.30 457.12	>10
20	1.01 6.98	1.27 8.78	2.29 15.77	20.00 137.90	66.30 457.12	>10
21	1.91 13.19	0.95 6.58	2.87 19.77	20.00 137.90	66.30 457.12	>10
22	1.83 12.64	0.90 6.19	2.73 18.83	20.00 137.90	66.30 457.12	>10

Min MS: 2.724, Location: 4, Combination: Pm+Pb

**Table 2-262. Load Combination 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 311, 101, 201, 211
4-ft. Drop onto Rod
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	1.31	0.86	2.17	20.00	66.30	>10
	9.01	5.95	14.96	137.90	457.12	
2	0.38	0.14	0.52	20.00	66.30	>10
	2.64	0.95	3.60	137.90	457.12	
3	0.15	0.04	0.19	20.00	66.30	>10
	1.04	0.26	1.30	137.90	457.12	
4	6.24	9.10	15.34	20.00	66.30	3.32
	43.03	62.72	105.75	137.90	457.12	
5	5.90	8.21	14.11	20.00	66.30	3.70
	40.70	56.57	97.27	137.90	457.12	
6	3.04	2.37	5.42	20.00	66.30	>10
	20.99	16.35	37.34	137.90	457.12	
7	1.25	0.02	1.27	20.00	66.30	>10
	8.62	0.14	8.76	137.90	457.12	
8	0.84	0.00	0.84	20.00	66.30	>10
	5.79	0.00	5.79	137.90	457.12	
9	0.53	0.02	0.55	20.00	66.30	>10
	3.67	0.11	3.78	137.90	457.12	
10	1.22	1.32	2.54	20.00	66.30	>10
	8.38	9.12	17.50	137.90	457.12	
11	0.93	0.32	1.25	20.00	66.30	>10
	6.40	2.22	8.63	137.90	457.12	
12	0.92	1.02	1.94	20.00	66.30	>10
	6.37	7.03	13.40	137.90	457.12	
13	1.71	1.61	3.31	20.00	66.30	>10
	11.77	11.07	22.83	137.90	457.12	

14	1.68 11.57	1.57 10.86	3.25 22.43	20.00 137.90	66.30 457.12	>10
15	36.54 251.90	6.32 43.56	42.85 295.46	20.00 137.90	66.30 457.12	0.27
16	9.10 62.75	13.08 90.20	22.18 152.95	20.00 137.90	66.30 457.12	1.99
17	5.53 38.15	9.26 63.87	14.80 102.01	20.00 137.90	66.30 457.12	3.48
18	3.37 23.23	3.43 23.65	6.80 46.88	20.00 137.90	66.30 457.12	8.75
19	4.92 33.90	7.01 48.35	11.93 82.25	20.00 137.90	66.30 457.12	4.56
20	4.83 33.32	8.19 56.44	13.02 89.76	20.00 137.90	66.30 457.12	4.09
21	0.44 3.01	0.87 5.98	1.30 8.99	20.00 137.90	66.30 457.12	>10
22	15.78 108.79	12.68 87.43	28.46 196.22	20.00 137.90	66.30 457.12	1.33

Min MS: 0.270, Location: 15, Combination: Pm

Table 2-263. Load Combination 312, 4-ft. Drop onto Rod at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Load Cases: 311, 104, 201, 211
 4-ft. Drop onto Rod
 -40°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Stress (ksi/MPa)						

Loc	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.31	0.86	2.17	20.00	70.00	>10
	9.01	5.95	14.96	137.90	482.63	
2	0.38	0.14	0.52	20.00	70.00	>10
	2.64	0.95	3.60	137.90	482.63	
3	0.15	0.04	0.19	20.00	70.00	>10
	1.04	0.26	1.30	137.90	482.63	
4	6.24	9.10	15.34	20.00	70.00	3.56
	43.03	62.72	105.75	137.90	482.63	
5	5.90	8.21	14.11	20.00	70.00	3.96
	40.70	56.57	97.27	137.90	482.63	
6	3.04	2.37	5.42	20.00	70.00	>10
	20.99	16.35	37.34	137.90	482.63	
7	1.25	0.02	1.27	20.00	70.00	>10
	8.62	0.14	8.76	137.90	482.63	
8	0.84	0.00	0.84	20.00	70.00	>10
	5.79	0.00	5.79	137.90	482.63	
9	0.53	0.02	0.55	20.00	70.00	>10
	3.67	0.11	3.78	137.90	482.63	
10	1.22	1.32	2.54	20.00	70.00	>10
	8.38	9.12	17.50	137.90	482.63	
11	0.93	0.32	1.25	20.00	70.00	>10
	6.40	2.22	8.63	137.90	482.63	
12	0.92	1.02	1.94	20.00	70.00	>10
	6.37	7.03	13.40	137.90	482.63	
13	1.71	1.61	3.31	20.00	70.00	>10
	11.77	11.07	22.83	137.90	482.63	

14	1.68	1.57	3.25	20.00	70.00	>10
	11.57	10.86	22.43	137.90	482.63	
15	36.54	6.32	42.85	20.00	70.00	0.31
	251.90	43.56	295.46	137.90	482.63	
16	9.10	13.08	22.18	20.00	70.00	2.16
	62.75	90.20	152.95	137.90	482.63	
17	5.53	9.26	14.80	20.00	70.00	3.73
	38.15	63.87	102.01	137.90	482.63	
18	3.37	3.43	6.80	20.00	70.00	9.30
	23.23	23.65	46.88	137.90	482.63	
19	4.92	7.01	11.93	20.00	70.00	4.87
	33.90	48.35	82.25	137.90	482.63	
20	4.83	8.19	13.02	20.00	70.00	4.38
	33.32	56.44	89.76	137.90	482.63	
21	0.44	0.87	1.30	20.00	70.00	>10
	3.01	5.98	8.99	137.90	482.63	
22	15.78	12.68	28.46	20.00	70.00	1.46
	108.79	87.43	196.22	137.90	482.63	

Min MS: 0.314, Location: 15, Combination: Pm

**Table 2-264. Load Combination 350, Fire at 30 Minutes,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 111, 201, 211

Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	20.00	66.30	>10
	4.14	5.93	10.07	137.90	457.12	
2	0.04	0.03	0.07	20.00	66.30	>10
	0.28	0.19	0.47	137.90	457.12	
3	0.03	0.02	0.05	20.00	66.30	>10
	0.17	0.16	0.33	137.90	457.12	
4	4.94	8.72	13.66	20.00	66.30	3.85
	34.09	60.09	94.18	137.90	457.12	
5	4.28	6.97	11.24	20.00	66.30	4.90
	29.48	48.05	77.52	137.90	457.12	
6	1.66	2.27	3.93	20.00	61.80	>10
	11.45	15.65	27.10	137.90	426.10	
7	0.29	0.01	0.29	20.00	61.80	>10
	1.97	0.05	2.02	137.90	426.10	
8	0.28	0.00	0.28	20.00	61.80	>10
	1.96	0.00	1.96	137.90	426.10	
9	0.28	0.01	0.30	20.00	61.80	>10
	1.96	0.08	2.04	137.90	426.10	
10	0.98	1.01	1.99	20.00	61.80	>10
	6.76	6.95	13.72	137.90	426.10	
11	0.61	0.28	0.90	20.00	61.80	>10
	4.22	1.96	6.18	137.90	426.10	
12	0.52	0.41	0.93	20.00	61.80	>10
	3.55	2.83	6.39	137.90	426.10	
13	1.04	0.92	1.96	20.00	66.30	>10
	7.17	6.32	13.50	137.90	457.12	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	66.30 457.12	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	66.30 457.12	6.14
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	66.30 457.12	>10
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	66.30 457.12	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	66.30 457.12	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	66.30 457.12	7.38
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	66.30 457.12	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	66.30 457.12	>10

Min MS: 3.854, Location: 4, Combination: Pm+Pb

**Table 2-265. Load Combination 351, Post Fire at 60 Minutes,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 112, 201, 211

Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	17.40	59.20	>10
	0.28	0.19	0.47	119.97	408.17	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	20.00	61.80	4.50
	29.48	48.05	77.52	137.90	426.10	
6	1.66	2.27	3.93	20.00	61.80	>10
	11.45	15.65	27.10	137.90	426.10	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	20.00	61.80	>10
	4.22	1.96	6.18	137.90	426.10	
12	0.52	0.41	0.93	20.00	61.80	>10
	3.55	2.83	6.39	137.90	426.10	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	66.30 457.12	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-266. Load Combination 352, Post Fire at 90 Minutes,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 112, 201, 211

Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-267. Load Combination 353, Post Fire at 120 Minutes,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 112, 201, 211

Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-268. Load Combination 354, Post Fire at 150 Minutes,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 112, 201, 211

Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	18.70	59.70	>10
	7.17	6.32	13.50	128.93	411.62	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-269. Load Combination 355, Post Fire at 180 Minutes,
Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S**

Load Cases: 112, 201, 211

Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	18.70	59.70	3.37
	34.09	60.09	94.18	128.93	411.62	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	18.70	59.70	>10
	7.17	6.32	13.50	128.93	411.62	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	18.70 128.93	59.70 411.62	7.23
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.370, Location: 4, Combination: Pm+Pb

2.12.2.4 Structural Evaluation Results – Model AOS-100B

This appendix presents the following information, specific to the Model AOS-100B transport package:

- [Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Model AOS-100B](#)
- [Hypothetical Accident Conditions of Transport Summary of Damages \(Stresses\) – Model AOS-100B](#)

Note: *The drop analyses results for the Model AOS-100B are based by the impact loading identified for the Model AOS-100A; a conservative approach because the Model AOS-100B has less weight than the Model AOS-100A.*

2.12.2.4.1 Normal Conditions of Transport Stress Summary and Comparisons with Allowable – Model AOS-100B

Table 2-270 and Table 2-271 present Model AOS-100B transport package Load Cases and Load Combinations, respectively, under Normal conditions of transport:

- Table 2-272 through Table 2-289 present Load Case output data. Comparisons with allowable stress limits are included for Load Cases 101, 102, 103, 104, 105, and 106.
- Table 2-290 through Table 2-306 present Load Combination output data.

Table 2-270. Load Cases Associated with Allowable Stresses under Normal Conditions of Transport – Model AOS-100B

Load Case	Description	Data
101	100°F Ambient, Maximum Decay Heat	Table 2-272
102	100°F Ambient, Maximum Decay Heat, Maximum Insolation	Table 2-273
103	-20°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-274
104	-40°F Ambient, Zero Decay Heat, Zero Insolation	Table 2-275
105	-40°F Ambient, Maximum Decay Heat	Table 2-276
106	-20°F Ambient, Maximum Decay Heat	Table 2-277
201	Internal Design Pressure, 1,930 kPa (280 psia)	Table 2-278
202	Minimum External Pressure, 24 kPa (3.5 psia)	Table 2-279
203	Maximum Increased External Pressure, 140 kPa (20 psia)	Table 2-280
204	Additional Increased External Pressure, 2 MPa (290 psia)	Table 2-281
211	Fabrication Stress	Table 2-282
215	Compression Load (5x weight)	Table 2-283
216	Rod Drop onto Cask	Table 2-284
221	Forward 10g Vibration Inertia Load	Table 2-285
222	Lateral 5g Vibration Inertia Load	Table 2-286
223	Vertical 2g Vibration Inertia Load	Table 2-287
231	3-ft. Head-On Drop	Table 2-288
232	30-ft. Head-On Drop Impact Test, Normal Conditions	Table 2-289

Table 2-271. Load Combinations Associated with Allowable Stresses under Normal Conditions of Transport – Model AOS-100B

Load Combination	Load Cases	Description	Data
101	102, 201, 211	Hot Environment	Table 2-290
102	104, 201, 211	Cold Environment	Table 2-291
103	103, 202, 211	Increased External Pressure	Table 2-292
104	101, 201, 202, 211	Minimum External Pressure	Table 2-293
105	105, 201, 202, 211	Cold Environment with Maximum Decay Heat	Table 2-294
106	101, 201, 203, 211	Maximum Pressure, Hot Environment	Table 2-295
107	105, 201, 203, 211	Maximum Pressure, Cold Environment	Table 2-296
215	215, 101, 201, 211	Compression Load	Table 2-297
216	216, 101, 201, 211	Rod Drop	Table 2-298
217	216, 104, 201, 211	Rod Drop, Cold Environment	Table 2-299
221	221, 101, 201, 211	Forward Vibration	Table 2-300
222	222, 101, 201, 211	Lateral Vibration	Table 2-301
223	223, 101, 201, 211	Vertical Vibration	Table 2-302
224	221, 103, 201, 211	Forward Vibration at Cold Temperature	Table 2-303
225	222, 103, 201, 211	Lateral Vibration at Cold Temperature	Table 2-304
226	223, 103, 201, 211	Vertical Vibration at Cold Temperature	Table 2-305
231	231, 102, 201, 211	3-ft. Head-On Drop, Normal Conditions	Table 2-306
232 ^a	232, 102, 201, 211	30-ft. Head-On Drop, Normal Conditions (Impact Test)	—
233	231, 103, 211	3-ft. Drop at Cold Temperature	Table 2-307

a. Load Combination 232 is documented only for the Model AOS-025A and AOS-050A transport packages, and demonstrates compliance with the requirements of IAEA TS-R-1, Paragraph 737 (Reference [\[2.2\]](#)).

**Table 2-272. Load Case 101, 100°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.0803E+02 7.4484E-01	-1.9243E+02 -1.3267E+00	-1.3924E+01 -9.6003E-02	3.0046E+02 2.0716E+00	4.2719E+02 2.9454E+00
2	1.4341E+02 9.8880E-01	-3.0628E+02 -2.1117E+00	-9.5476E+01 -6.5829E-01	4.4969E+02 3.1005E+00	9.2455E+02 6.3745E+00
3	1.0509E+02 7.2459E-01	-1.9235E+02 -1.3262E+00	9.0296E+00 6.2257E-02	2.9744E+02 2.0508E+00	4.2157E+02 2.9066E+00
4	6.5633E+02 4.5252E+00	-2.5001E+03 -1.7238E+01	-4.6248E+02 -3.1887E+00	3.1565E+03 2.1763E+01	6.2199E+03 4.2885E+01
5	6.4750E+02 4.4644E+00	-2.7847E+03 -1.9200E+01	-1.2983E+03 -8.9514E+00	3.4322E+03 2.3664E+01	5.4286E+03 3.7429E+01
6	1.0357E+02 7.1408E-01	-1.3704E+03 -9.4487E+00	-1.6650E+03 -1.1480E+01	1.4740E+03 1.0163E+01	1.7244E+03 1.1889E+01
7	-1.8779E+01 -1.2948E-01	-4.6146E+02 -3.1817E+00	2.5234E+01 1.7399E-01	4.4268E+02 3.0522E+00	4.1120E+02 2.8351E+00
8	-1.9103E+01 -1.3171E-01	-4.6147E+02 -3.1817E+00	3.2601E-02 2.2478E-04	4.4236E+02 3.0500E+00	4.1263E+02 2.8450E+00
9	-1.8867E+01 -1.3008E-01	-4.6074E+02 -3.1767E+00	-1.1404E+01 -7.8626E-02	4.4188E+02 3.0466E+00	3.9342E+02 2.7125E+00
10	-6.1752E+01 -4.2576E-01	-6.7272E+02 -4.6383E+00	2.0181E+02 1.3914E+00	6.1097E+02 4.2125E+00	1.2261E+03 8.4539E+00
11	-1.7635E+02 -1.2159E+00	-9.6788E+02 -6.6733E+00	-4.4001E+02 -3.0338E+00	7.9153E+02 5.4574E+00	3.1832E+01 2.1948E-01
12	2.6034E+00 1.7950E-02	-1.1988E+03 -8.2656E+00	-1.1894E+03 -8.2004E+00	1.2014E+03 8.2835E+00	6.3656E+01 4.3889E-01
13	-1.0573E+02 -7.2900E-01	-1.5943E+03 -1.0992E+01	-1.6417E+02 -1.1319E+00	1.4886E+03 1.0263E+01	6.6986E+02 4.6186E+00
14	-1.2121E+02 -8.3573E-01	-1.3921E+03 -9.5979E+00	1.3879E+02 9.5694E-01	1.2708E+03 8.7621E+00	9.7342E+02 6.7115E+00
15	2.6477E+02 1.8255E+00	-2.4404E+02 -1.6826E+00	5.3926E+01 3.7181E-01	5.0880E+02 3.5081E+00	8.5555E+02 5.8988E+00

16	7.6582E+01	-1.1001E+02	-1.4296E+02	1.8659E+02	3.0600E+02
	5.2801E-01	-7.5850E-01	-9.8567E-01	1.2865E+00	2.1098E+00
17	3.5023E+01	-9.3734E+01	-1.3238E+02	1.2876E+02	2.2804E+02
	2.4147E-01	-6.4627E-01	-9.1275E-01	8.8774E-01	1.5723E+00
18	1.2087E+02	-2.1982E+02	1.1819E+03	3.4069E+02	1.8750E+02
	8.3337E-01	-1.5156E+00	8.1492E+00	2.3489E+00	1.2927E+00
19	-3.1520E+01	-4.6824E+02	1.3478E+03	4.3672E+02	5.2246E+02
	-2.1732E-01	-3.2284E+00	9.2927E+00	3.0111E+00	3.6022E+00
20	-1.6296E+01	-1.0384E+03	1.2550E+02	1.0221E+03	1.0222E+02
	-1.1236E-01	-7.1595E+00	8.6530E-01	7.0471E+00	7.0475E-01
21	2.0355E+01	-4.4272E+01	-2.3759E+01	6.4626E+01	1.2272E+02
	1.4034E-01	-3.0524E-01	-1.6381E-01	4.4558E-01	8.4616E-01
22	-2.6655E+01	-8.3776E+01	-7.7286E+01	5.7121E+01	9.6540E+01
	-1.8378E-01	-5.7762E-01	-5.3287E-01	3.9384E-01	6.6562E-01

Allowable Stress for Load Case 101

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	213.42	211.51	20.00	25.00	66.30
2	214.30	210.71	20.00	25.00	66.30
3	213.16	211.18	20.00	25.00	66.30
4	216.38	216.15	20.00	25.00	66.30
5	221.14	220.35	20.00	25.00	66.30
6	223.00	222.22	20.00	25.00	66.30
7	224.79	223.40	20.00	25.00	66.30
8	224.87	223.49	20.00	25.00	66.30
9	224.81	223.42	20.00	25.00	66.30
10	225.15	223.53	20.00	25.00	66.30
11	227.00	224.70	20.00	25.00	66.30
12	232.15	229.57	20.00	25.00	66.30
13	221.52	220.46	20.00	25.00	66.30
14	218.88	218.28	20.00	25.00	66.30
15	215.30	215.25	20.00	25.00	66.30
16	216.64	216.30	20.00	25.00	66.30
17	216.94	216.68	20.00	25.00	66.30
18	218.82	218.44	20.00	25.00	66.30
19	220.48	219.78	20.00	25.00	66.30
20	228.92	227.71	20.00	25.00	66.30
21	212.96	212.85	20.00	25.00	66.30
22	214.18	214.07	20.00	25.00	66.30

Table 2-273. Load Case 102, 100°F Ambient, Maximum Decay Heat, Maximum Insolation, Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.0040E+02 6.9221E-01	-1.8330E+02 -1.2638E+00	-4.6024E+00 -3.1732E-02	2.8369E+02 1.9560E+00	3.9834E+02 2.7465E+00
2	1.3676E+02 9.4291E-01	-2.9275E+02 -2.0184E+00	-9.2405E+01 -6.3711E-01	4.2951E+02 2.9614E+00	8.8299E+02 6.0880E+00
3	1.0213E+02 7.0417E-01	-1.8271E+02 -1.2597E+00	6.6129E-01 4.5595E-03	2.8484E+02 1.9639E+00	4.0891E+02 2.8193E+00
4	6.0545E+02 4.1744E+00	-2.3746E+03 -1.6372E+01	-4.4128E+02 -3.0425E+00	2.9800E+03 2.0547E+01	5.8721E+03 4.0487E+01
5	6.0039E+02 4.1395E+00	-2.6486E+03 -1.8262E+01	-1.2672E+03 -8.7368E+00	3.2490E+03 2.2401E+01	5.1413E+03 3.5448E+01
6	9.2129E+01 6.3520E-01	-1.3010E+03 -8.9702E+00	-1.6153E+03 -1.1137E+01	1.3931E+03 9.6054E+00	1.6132E+03 1.1122E+01
7	-1.7993E+01 -1.2406E-01	-4.4241E+02 -3.0503E+00	2.4113E+01 1.6625E-01	4.2442E+02 2.9263E+00	3.9246E+02 2.7059E+00
8	-1.8316E+01 -1.2628E-01	-4.4249E+02 -3.0509E+00	5.4994E-02 3.7917E-04	4.2418E+02 2.9246E+00	3.9562E+02 2.7277E+00
9	-1.8096E+01 -1.2476E-01	-4.4183E+02 -3.0463E+00	-1.1449E+01 -7.8937E-02	4.2374E+02 2.9216E+00	3.7799E+02 2.6061E+00
10	-6.0018E+01 -4.1381E-01	-6.4621E+02 -4.4555E+00	2.0023E+02 1.3805E+00	5.8619E+02 4.0417E+00	1.1747E+03 8.0996E+00
11	-1.6963E+02 -1.1695E+00	-9.1986E+02 -6.3422E+00	-4.1129E+02 -2.8357E+00	7.5023E+02 5.1727E+00	5.0599E+01 3.4886E-01
12	2.5549E+00 1.7616E-02	-1.1425E+03 -7.8770E+00	-1.1333E+03 -7.8142E+00	1.1450E+03 7.8946E+00	8.2599E+01 5.6950E-01
13	-9.8408E+01 -6.7850E-01	-1.5093E+03 -1.0406E+01	-1.5068E+02 -1.0389E+00	1.4108E+03 9.7274E+00	6.3655E+02 4.3888E+00
14	-1.1449E+02 -7.8937E-01	-1.3180E+03 -9.0873E+00	1.2706E+02 8.7606E-01	1.2035E+03 8.2979E+00	9.3838E+02 6.4699E+00
15	3.4634E+02 2.3879E+00	-3.6591E+02 -2.5229E+00	3.2450E+01 2.2374E-01	7.1225E+02 4.9108E+00	1.2043E+03 8.3036E+00

16	1.0438E+02	-1.7161E+02	-1.4949E+02	2.7599E+02	4.5282E+02
	7.1969E-01	-1.1832E+00	-1.0307E+00	1.9029E+00	3.1221E+00
17	4.5971E+01	-1.3310E+02	-1.1543E+02	1.7907E+02	3.1517E+02
	3.1696E-01	-9.1767E-01	-7.9584E-01	1.2346E+00	2.1730E+00
18	1.0443E+02	-2.2197E+02	1.1415E+03	3.2641E+02	1.1859E+02
	7.2005E-01	-1.5305E+00	7.8701E+00	2.2505E+00	8.1766E-01
19	-2.7153E+01	-4.7734E+02	1.2848E+03	4.5019E+02	6.0204E+02
	-1.8721E-01	-3.2912E+00	8.8585E+00	3.1040E+00	4.1509E+00
20	-3.0984E+01	-1.0060E+03	1.1333E+02	9.7504E+02	3.9217E+01
	-2.1363E-01	-6.9363E+00	7.8139E-01	6.7227E+00	2.7039E-01
21	2.1789E+01	-4.1427E+01	-1.9586E+01	6.3216E+01	1.2096E+02
	1.5023E-01	-2.8563E-01	-1.3504E-01	4.3586E-01	8.3398E-01
22	-3.1747E+01	-9.1194E+01	-7.5625E+01	5.9446E+01	1.3364E+02
	-2.1889E-01	-6.2876E-01	-5.2141E-01	4.0987E-01	9.2138E-01

Allowable Stress for Load Case 102

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	292.98	290.96	20.00	23.60	66.30
2	294.43	290.97	20.00	23.60	66.30
3	293.99	292.29	20.00	23.60	66.30
4	295.81	295.57	20.00	23.60	66.30
5	300.49	299.71	20.00	23.60	66.30
6	302.30	301.55	20.00	22.40	61.80
7	304.21	302.87	20.00	22.40	61.80
8	304.54	303.20	20.00	22.40	61.80
9	304.71	303.38	20.00	22.40	61.80
10	305.32	303.73	20.00	22.40	61.80
11	307.13	304.95	20.00	22.40	61.80
12	312.11	309.64	20.00	22.40	61.80
13	301.95	300.98	20.00	22.40	61.80
14	299.51	298.96	20.00	23.60	66.30
15	294.55	294.50	20.00	23.60	66.30
16	295.76	295.45	20.00	23.60	66.30
17	296.05	295.80	20.00	23.60	66.30
18	297.93	297.55	20.00	23.60	66.30
19	299.53	298.86	20.00	23.60	66.30
20	307.63	306.47	20.00	22.40	61.80
21	294.01	293.91	20.00	23.60	66.30
22	293.63	293.54	20.00	23.60	66.30

Table 2-274. Load Case 103, -20°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.0915E+01 7.5255E-02	-1.4534E+00 -1.0021E-02	-1.7126E+00 -1.1808E-02	1.2368E+01 8.5276E-02	1.2644E+01 8.7178E-02		
2	9.9257E+00 6.8436E-02	-1.2611E-01 -8.6947E-04	-2.6507E+00 -1.8276E-02	1.0052E+01 6.9305E-02	3.6428E-02 2.5116E-04		
3	1.2043E+01 8.3035E-02	-1.2367E+00 -8.5264E-03	-1.6857E+00 -1.1623E-02	1.3280E+01 9.1561E-02	1.5254E+01 1.0517E-01		
4	4.9965E+02 3.4449E+00	-3.4390E+02 -2.3711E+00	-6.3809E+01 -4.3995E-01	8.4355E+02 5.8161E+00	1.7300E+03 1.1928E+01		
5	8.1557E+02 5.6231E+00	-3.7152E+02 -2.5615E+00	-6.4751E+01 -4.4644E-01	1.1871E+03 8.1846E+00	1.5556E+03 1.0725E+01		
6	5.2793E+02 3.6400E+00	-3.2826E+01 -2.2632E-01	1.2815E+02 8.8359E-01	5.6076E+02 3.8663E+00	9.6583E+02 6.6592E+00		
7	2.5667E+02 1.7697E+00	3.5817E-02 2.4695E-04	-6.7333E+00 -4.6424E-02	2.5663E+02 1.7694E+00	7.7543E+00 5.3464E-02		
8	2.5633E+02 1.7673E+00	1.5445E-03 1.0649E-05	2.9216E-01 2.0144E-03	2.5633E+02 1.7673E+00	1.0943E-01 7.5449E-04		
9	2.5647E+02 1.7683E+00	2.5104E-03 1.7308E-05	-4.5623E+00 -3.1456E-02	2.5647E+02 1.7683E+00	3.2343E+00 2.2300E-02		
10	2.6266E+02 1.8110E+00	-3.9675E+01 -2.7355E-01	1.4177E+02 9.7749E-01	3.0233E+02 2.0845E+00	2.0139E+02 1.3885E+00		
11	7.1834E+01 4.9528E-01	-9.0416E+01 -6.2340E-01	1.3921E+01 9.5984E-02	1.6225E+02 1.1187E+00	1.2292E+02 8.4753E-01		
12	3.2620E+01 2.2491E-01	-8.9081E+01 -6.1419E-01	1.3923E+01 9.5994E-02	1.2170E+02 8.3910E-01	2.6164E+02 1.8040E+00		
13	3.8418E+02 2.6488E+00	-1.5146E+02 -1.0443E+00	2.6869E+01 1.8526E-01	5.3564E+02 3.6931E+00	3.4150E+02 2.3545E+00		
14	3.0391E+02 2.0954E+00	-1.3259E+02 -9.1418E-01	2.6558E+01 1.8311E-01	4.3650E+02 3.0096E+00	5.4677E+02 3.7698E+00		
15	3.8920E+01 2.6835E-01	-1.8710E+01 -1.2900E-01	3.3995E+01 2.3438E-01	5.7630E+01 3.9734E-01	1.7875E+01 1.2324E-01		

16	1.4842E+02	-6.1294E+01	5.1323E+01	2.0971E+02	3.0649E+02
	1.0233E+00	-4.2261E-01	3.5386E-01	1.4459E+00	2.1132E+00
17	1.4060E+02	-2.6710E+01	-1.1697E+01	1.6731E+02	2.9436E+02
	9.6944E-01	-1.8416E-01	-8.0649E-02	1.1536E+00	2.0295E+00
18	1.5040E+02	-2.8890E+01	-2.3215E+01	1.7929E+02	3.1352E+02
	1.0370E+00	-1.9919E-01	-1.6006E-01	1.2362E+00	2.1616E+00
19	1.8164E+02	-7.5003E+01	4.0247E+01	2.5664E+02	3.8699E+02
	1.2524E+00	-5.1712E-01	2.7749E-01	1.7695E+00	2.6682E+00
20	2.0803E+02	-1.0318E+02	1.7412E+01	3.1121E+02	5.7753E+02
	1.4343E+00	-7.1139E-01	1.2005E-01	2.1457E+00	3.9819E+00
21	2.4020E+01	-1.1538E+02	-1.1357E+01	1.3940E+02	3.4829E+02
	1.6561E-01	-7.9555E-01	-7.8302E-02	9.6116E-01	2.4013E+00
22	7.3339E+00	-1.1052E+01	7.2823E+00	1.8386E+01	6.8998E+00
	5.0565E-02	-7.6200E-02	5.0210E-02	1.2677E-01	4.7572E-02

Allowable Stress for Load Case 103

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-20.00	20.00	30.00	70.00
2	0.00	-20.00	20.00	30.00	70.00
3	0.00	-20.00	20.00	30.00	70.00
4	0.00	-20.00	20.00	30.00	70.00
5	0.00	-20.00	20.00	30.00	70.00
6	0.00	-20.00	20.00	30.00	70.00
7	0.00	-20.00	20.00	30.00	70.00
8	0.00	-20.00	20.00	30.00	70.00
9	0.00	-20.00	20.00	30.00	70.00
10	0.00	-20.00	20.00	30.00	70.00
11	0.00	-20.00	20.00	30.00	70.00
12	0.00	-20.00	20.00	30.00	70.00
13	0.00	-20.00	20.00	30.00	70.00
14	0.00	-20.00	20.00	30.00	70.00
15	0.00	-20.00	20.00	30.00	70.00
16	0.00	-20.00	20.00	30.00	70.00
17	0.00	-20.00	20.00	30.00	70.00
18	0.00	-20.00	20.00	30.00	70.00
19	0.00	-20.00	20.00	30.00	70.00
20	0.00	-20.00	20.00	30.00	70.00
21	0.00	-20.00	20.00	30.00	70.00
22	0.00	-20.00	20.00	30.00	70.00

Table 2-275. Load Case 104, -40°F Ambient, Zero Decay Heat, Zero Insolation, Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.3340E+01 9.1978E-02	-1.7764E+00 -1.2248E-02	-2.0932E+00 -1.4432E-02	1.5117E+01 1.0423E-01	1.5454E+01 1.0655E-01
2	1.2131E+01 8.3643E-02	-1.5413E-01 -1.0627E-03	-3.2397E+00 -2.2337E-02	1.2286E+01 8.4706E-02	4.4523E-02 3.0697E-04
3	1.4719E+01 1.0149E-01	-1.5115E+00 -1.0421E-02	-2.0603E+00 -1.4206E-02	1.6231E+01 1.1191E-01	1.8644E+01 1.2855E-01
4	6.1068E+02 4.2105E+00	-4.2032E+02 -2.8980E+00	-7.7988E+01 -5.3771E-01	1.0310E+03 7.1085E+00	2.1144E+03 1.4578E+01
5	9.9680E+02 6.8727E+00	-4.5408E+02 -3.1307E+00	-7.9140E+01 -5.4565E-01	1.4509E+03 1.0003E+01	1.9013E+03 1.3109E+01
6	6.4525E+02 4.4488E+00	-4.0120E+01 -2.7662E-01	1.5663E+02 1.0799E+00	6.8537E+02 4.7255E+00	1.1805E+03 8.1390E+00
7	3.1371E+02 2.1629E+00	4.3777E-02 3.0183E-04	-8.2296E+00 -5.6741E-02	3.1366E+02 2.1626E+00	9.4775E+00 6.5345E-02
8	3.1329E+02 2.1601E+00	1.8877E-03 1.3015E-05	3.5709E-01 2.4620E-03	3.1329E+02 2.1601E+00	1.3375E-01 9.2215E-04
9	3.1346E+02 2.1613E+00	3.0682E-03 2.1155E-05	-5.5761E+00 -3.8446E-02	3.1346E+02 2.1612E+00	3.9531E+00 2.7255E-02
10	3.2103E+02 2.2134E+00	-4.8492E+01 -3.3434E-01	1.7328E+02 1.1947E+00	3.6952E+02 2.5477E+00	2.4614E+02 1.6971E+00
11	8.7797E+01 6.0534E-01	-1.1051E+02 -7.6193E-01	1.7015E+01 1.1731E-01	1.9831E+02 1.3673E+00	1.5024E+02 1.0359E+00
12	3.9869E+01 2.7489E-01	-1.0888E+02 -7.5068E-01	1.7017E+01 1.1733E-01	1.4875E+02 1.0256E+00	3.1979E+02 2.2048E+00
13	4.6956E+02 3.2375E+00	-1.8511E+02 -1.2763E+00	3.2840E+01 2.2642E-01	6.5467E+02 4.5138E+00	4.1739E+02 2.8778E+00
14	3.7145E+02 2.5610E+00	-1.6206E+02 -1.1173E+00	3.2459E+01 2.2380E-01	5.3350E+02 3.6784E+00	6.6827E+02 4.6076E+00
15	4.7569E+01 3.2798E-01	-2.2867E+01 -1.5766E-01	4.1549E+01 2.8647E-01	7.0437E+01 4.8564E-01	2.1847E+01 1.5063E-01

16	1.8140E+02	-7.4915E+01	6.2728E+01	2.5632E+02	3.7460E+02
	1.2507E+00	-5.1652E-01	4.3249E-01	1.7672E+00	2.5828E+00
17	1.7185E+02	-3.2645E+01	-1.4297E+01	2.0450E+02	3.5977E+02
	1.1849E+00	-2.2508E-01	-9.8571E-02	1.4099E+00	2.4805E+00
18	1.8382E+02	-3.5309E+01	-2.8374E+01	2.1913E+02	3.8319E+02
	1.2674E+00	-2.4345E-01	-1.9563E-01	1.5109E+00	2.6420E+00
19	2.2201E+02	-9.1670E+01	4.9191E+01	3.1367E+02	4.7298E+02
	1.5307E+00	-6.3204E-01	3.3916E-01	2.1627E+00	3.2611E+00
20	2.5426E+02	-1.2611E+02	2.1282E+01	3.8036E+02	7.0587E+02
	1.7530E+00	-8.6947E-01	1.4673E-01	2.6225E+00	4.8668E+00
21	2.9357E+01	-1.4103E+02	-1.3880E+01	1.7038E+02	4.2568E+02
	2.0241E-01	-9.7234E-01	-9.5702E-02	1.1747E+00	2.9350E+00
22	8.9636E+00	-1.3508E+01	8.9006E+00	2.2472E+01	8.4331E+00
	6.1802E-02	-9.3134E-02	6.1367E-02	1.5494E-01	5.8144E-02

Allowable Stress for Load Case 104

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	0.00	-40.00	20.00	30.00	70.00
2	0.00	-40.00	20.00	30.00	70.00
3	0.00	-40.00	20.00	30.00	70.00
4	0.00	-40.00	20.00	30.00	70.00
5	0.00	-40.00	20.00	30.00	70.00
6	0.00	-40.00	20.00	30.00	70.00
7	0.00	-40.00	20.00	30.00	70.00
8	0.00	-40.00	20.00	30.00	70.00
9	0.00	-40.00	20.00	30.00	70.00
10	0.00	-40.00	20.00	30.00	70.00
11	0.00	-40.00	20.00	30.00	70.00
12	0.00	-40.00	20.00	30.00	70.00
13	0.00	-40.00	20.00	30.00	70.00
14	0.00	-40.00	20.00	30.00	70.00
15	0.00	-40.00	20.00	30.00	70.00
16	0.00	-40.00	20.00	30.00	70.00
17	0.00	-40.00	20.00	30.00	70.00
18	0.00	-40.00	20.00	30.00	70.00
19	0.00	-40.00	20.00	30.00	70.00
20	0.00	-40.00	20.00	30.00	70.00
21	0.00	-40.00	20.00	30.00	70.00
22	0.00	-40.00	20.00	30.00	70.00

**Table 2-276. Load Case 105, -40°F Ambient, Maximum Decay Heat,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.1750E+02 8.1012E-01	-2.0776E+02 -1.4325E+00	-2.0206E+01 -1.3932E-01	3.2526E+02 2.2426E+00	4.6405E+02 3.1995E+00
2	1.5290E+02 1.0542E+00	-3.2804E+02 -2.2618E+00	-9.8242E+01 -6.7735E-01	4.8094E+02 3.3160E+00	9.8802E+02 6.8121E+00
3	1.1415E+02 7.8703E-01	-2.0846E+02 -1.4373E+00	4.7286E+00 3.2603E-02	3.2261E+02 2.2243E+00	4.5896E+02 3.1644E+00
4	7.4211E+02 5.1167E+00	-2.7654E+03 -1.9067E+01	-5.1124E+02 -3.5249E+00	3.5075E+03 2.4184E+01	6.9116E+03 4.7654E+01
5	7.3069E+02 5.0379E+00	-3.0790E+03 -2.1229E+01	-1.4066E+03 -9.6983E+00	3.8097E+03 2.6267E+01	6.0241E+03 4.1535E+01
6	1.2712E+02 8.7646E-01	-1.5175E+03 -1.0463E+01	-1.8066E+03 -1.2456E+01	1.6446E+03 1.1339E+01	1.9470E+03 1.3424E+01
7	-2.0233E+01 -1.3950E-01	-5.0153E+02 -3.4580E+00	2.8070E+01 1.9354E-01	4.8130E+02 3.3184E+00	4.4413E+02 3.0622E+00
8	-2.0582E+01 -1.4190E-01	-5.0147E+02 -3.4575E+00	1.1619E-02 8.0109E-05	4.8089E+02 3.3156E+00	4.4427E+02 3.0632E+00
9	-2.0325E+01 -1.4014E-01	-5.0069E+02 -3.4522E+00	-1.1926E+01 -8.2229E-02	4.8037E+02 3.3120E+00	4.2365E+02 2.9210E+00
10	-6.5775E+01 -4.5351E-01	-7.3038E+02 -5.0358E+00	2.1451E+02 1.4790E+00	6.6461E+02 4.5823E+00	1.3335E+03 9.1944E+00
11	-1.9448E+02 -1.3409E+00	-1.0439E+03 -7.1976E+00	-4.7934E+02 -3.3050E+00	8.4943E+02 5.8566E+00	1.8789E+01 1.2954E-01
12	4.5171E-01 3.1144E-03	-1.2899E+03 -8.8933E+00	-1.2796E+03 -8.8224E+00	1.2903E+03 8.8964E+00	3.8929E+01 2.6840E-01
13	-1.1861E+02 -8.1778E-01	-1.7152E+03 -1.1826E+01	-1.7722E+02 -1.2219E+00	1.5966E+03 1.1008E+01	7.1757E+02 4.9475E+00
14	-1.3069E+02 -9.0110E-01	-1.4957E+03 -1.0313E+01	1.5869E+02 1.0941E+00	1.3650E+03 9.4116E+00	1.0157E+03 7.0028E+00
15	9.6058E+01 6.6229E-01	-4.3290E+00 -2.9847E-02	9.3851E+01 6.4708E-01	1.0039E+02 6.9214E-01	7.4427E+01 5.1316E-01

16	3.7086E+01	-2.3955E+00	-1.2607E+02	3.9482E+01	1.2364E-01
	2.5570E-01	-1.6516E-02	-8.6925E-01	2.7222E-01	8.5245E-04
17	1.7330E+01	-1.8766E+01	-1.6406E+02	3.6096E+01	4.6803E+01
	1.1948E-01	-1.2939E-01	-1.1312E+00	2.4887E-01	3.2270E-01
18	1.5737E+02	-2.2205E+02	1.2711E+03	3.7942E+02	3.1945E+02
	1.0850E+00	-1.5310E+00	8.7637E+00	2.6160E+00	2.2025E+00
19	-2.4027E+01	-4.7203E+02	1.4811E+03	4.4801E+02	3.7427E+02
	-1.6566E-01	-3.2545E+00	1.0212E+01	3.0889E+00	2.5805E+00
20	1.9758E+01	-1.1116E+03	1.4626E+02	1.1314E+03	3.9629E+02
	1.3623E-01	-7.6645E+00	1.0084E+00	7.8008E+00	2.7323E+00
21	2.8118E+01	-5.8405E+01	-2.8554E+01	8.6524E+01	1.6778E+02
	1.9387E-01	-4.0269E-01	-1.9687E-01	5.9656E-01	1.1568E+00
22	-2.0658E+00	-9.0795E+01	-9.0258E+01	8.8729E+01	3.6539E+01
	-1.4243E-02	-6.2601E-01	-6.2230E-01	6.1176E-01	2.5193E-01

Allowable Stress for Load Case 105

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	85.44	83.42	20.00	30.00	70.00
2	86.26	82.35	20.00	30.00	70.00
3	85.07	82.95	20.00	30.00	70.00
4	88.70	88.46	20.00	30.00	70.00
5	93.82	92.97	20.00	30.00	70.00
6	95.78	94.97	20.00	30.00	70.00
7	97.83	96.33	20.00	30.00	70.00
8	97.89	96.39	20.00	30.00	70.00
9	97.82	96.32	20.00	30.00	70.00
10	98.07	96.36	20.00	30.00	70.00
11	100.02	97.52	20.00	30.00	70.00
12	105.52	102.73	20.00	30.00	70.00
13	94.07	92.90	20.00	30.00	70.00
14	91.17	90.52	20.00	30.00	70.00
15	87.99	87.92	20.00	30.00	70.00
16	89.54	89.16	20.00	30.00	70.00
17	89.87	89.58	20.00	30.00	70.00
18	91.76	91.38	20.00	30.00	70.00
19	93.55	92.80	20.00	30.00	70.00
20	102.76	101.42	20.00	30.00	70.00
21	84.85	84.72	20.00	30.00	70.00
22	86.45	86.32	20.00	30.00	70.00

Table 2-277. Load Case 106, -20°F Ambient, Maximum Decay Heat, Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.0940E+02 7.5430E-01	-2.0896E+02 -1.4407E+00	-6.5116E+00 -4.4896E-02	3.1836E+02 2.1950E+00	4.6897E+02 3.2334E+00
2	1.4827E+02 1.0223E+00	-3.2783E+02 -2.2603E+00	-8.5420E+01 -5.8895E-01	4.7611E+02 3.2826E+00	9.8264E+02 6.7751E+00
3	1.1160E+02 7.6942E-01	-2.0873E+02 -1.4392E+00	1.1378E+01 7.8450E-02	3.2033E+02 2.2086E+00	4.5814E+02 3.1588E+00
4	6.0884E+02 4.1978E+00	-2.5351E+03 -1.7479E+01	-2.9596E+02 -2.0406E+00	3.1440E+03 2.1677E+01	6.2724E+03 4.3247E+01
5	5.9007E+02 4.0684E+00	-3.0914E+03 -2.1314E+01	-1.1527E+03 -7.9473E+00	3.6814E+03 2.5383E+01	5.4891E+03 3.7846E+01
6	-4.4345E+01 -3.0575E-01	-1.6830E+03 -1.1604E+01	-1.6253E+03 -1.1206E+01	1.6387E+03 1.1298E+01	2.1154E+03 1.4585E+01
7	-4.8761E+01 -3.3620E-01	-7.7063E+02 -5.3133E+00	-2.2889E+02 -1.5782E+00	7.2187E+02 4.9771E+00	4.4126E+02 3.0424E+00
8	-4.8649E+01 -3.3543E-01	-7.7053E+02 -5.3127E+00	-2.4908E+02 -1.7174E+00	7.2189E+02 4.9772E+00	4.3956E+02 3.0307E+00
9	-4.8517E+01 -3.3451E-01	-7.6987E+02 -5.3081E+00	-2.6161E+02 -1.8037E+00	7.2135E+02 4.9735E+00	4.2248E+02 2.9129E+00
10	-2.0221E+02 -1.3942E+00	-9.0345E+02 -6.2290E+00	-2.5829E+01 -1.7809E-01	7.0124E+02 4.8348E+00	1.2456E+03 8.5879E+00
11	-2.0441E+02 -1.4094E+00	-1.1150E+03 -7.6874E+00	-5.6512E+02 -3.8963E+00	9.1056E+02 6.2781E+00	2.0623E+02 1.4219E+00
12	-3.8297E+01 -2.6405E-01	-1.3745E+03 -9.4772E+00	-1.3602E+03 -9.3783E+00	1.3362E+03 9.2131E+00	1.5887E+02 1.0954E+00
13	-8.3045E+01 -5.7258E-01	-2.0008E+03 -1.3795E+01	-2.5393E+02 -1.7508E+00	1.9178E+03 1.3223E+01	1.0270E+03 7.0811E+00
14	-1.0150E+02 -6.9981E-01	-1.7350E+03 -1.1963E+01	7.5473E+01 5.2037E-01	1.6335E+03 1.1263E+01	1.5202E+03 1.0482E+01
15	-5.1137E+01 -3.5258E-01	-2.1964E+02 -1.5144E+00	-3.6493E+01 -2.5161E-01	1.6850E+02 1.1618E+00	1.3190E+02 9.0944E-01

16	4.2815E+01	-2.1335E+02	-2.5605E+02	2.5617E+02	3.4214E+02
	2.9520E-01	-1.4710E+00	-1.7654E+00	1.7662E+00	2.3590E+00
17	-2.1640E+01	-2.2019E+02	-2.7328E+02	1.9854E+02	3.2333E+02
	-1.4921E-01	-1.5181E+00	-1.8842E+00	1.3689E+00	2.2293E+00
18	1.3046E+02	-6.6090E+02	1.1163E+03	7.9136E+02	8.8703E+02
	8.9950E-01	-4.5568E+00	7.6969E+00	5.4563E+00	6.1159E+00
19	8.2187E+01	-1.2729E+03	1.0531E+03	1.3550E+03	2.2264E+03
	5.6666E-01	-8.7760E+00	7.2609E+00	9.3427E+00	1.5351E+01
20	-1.6824E+02	-1.5715E+03	-1.9003E+02	1.4032E+03	1.9396E+03
	-1.1600E+00	-1.0835E+01	-1.3102E+00	9.6751E+00	1.3373E+01
21	2.4016E+01	-5.1131E+01	-2.5561E+01	7.5147E+01	1.4563E+02
	1.6558E-01	-3.5254E-01	-1.7624E-01	5.1812E-01	1.0041E+00
22	2.6272E+01	-1.2895E+02	-5.5174E+01	1.5522E+02	3.4963E+02
	1.8114E-01	-8.8905E-01	-3.8041E-01	1.0702E+00	2.4106E+00

Allowable Stress for Load Case 106

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	104.27	102.27	20.00	30.00	70.00
2	105.11	101.26	20.00	30.00	70.00
3	103.90	101.79	20.00	30.00	70.00
4	107.48	107.24	20.00	30.00	70.00
5	112.55	111.70	20.00	30.00	70.00
6	114.50	113.69	20.00	30.00	70.00
7	116.50	115.02	20.00	30.00	70.00
8	116.56	115.08	20.00	30.00	70.00
9	116.49	115.01	20.00	30.00	70.00
10	116.74	115.05	20.00	30.00	70.00
11	118.68	116.22	20.00	30.00	70.00
12	124.13	121.37	20.00	30.00	70.00
13	112.81	111.65	20.00	30.00	70.00
14	109.94	109.30	20.00	30.00	70.00
15	106.70	106.64	20.00	30.00	70.00
16	108.23	107.85	20.00	30.00	70.00
17	108.55	108.27	20.00	30.00	70.00
18	110.44	110.06	20.00	30.00	70.00
19	112.21	111.47	20.00	30.00	70.00
20	121.31	119.98	20.00	30.00	70.00
21	103.67	103.54	20.00	30.00	70.00
22	105.23	105.10	20.00	30.00	70.00

Table 2-278. Load Case 201, Internal Design Pressure, 1,930 kPa (280 psia), Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	1.0745E+00 7.4086E-03	-1.2812E+01 -8.8336E-02	-3.9938E+01 -2.7536E-01	1.3887E+01 9.5745E-02	1.3041E+01 8.9916E-02
2	1.9621E-02 1.3528E-04	-9.5804E+00 -6.6055E-02	-3.7802E+01 -2.6063E-01	9.6001E+00 6.6190E-02	8.0928E-01 5.5798E-03
3	2.2656E+00 1.5621E-02	-1.2326E+01 -8.4982E-02	-3.6331E+01 -2.5049E-01	1.4591E+01 1.0060E-01	1.9476E+01 1.3428E-01
4	2.8893E+03 1.9921E+01	-1.2658E+03 -8.7275E+00	1.4435E+03 9.9527E+00	4.1551E+03 2.8648E+01	7.3286E+03 5.0529E+01
5	2.2675E+03 1.5634E+01	-1.1443E+03 -7.8896E+00	1.4644E+03 1.0097E+01	3.4118E+03 2.3523E+01	5.6450E+03 3.8921E+01
6	9.1841E+02 6.3322E+00	-3.7997E+02 -2.6198E+00	1.8086E+03 1.2470E+01	1.2984E+03 8.9520E+00	1.6505E+03 1.1380E+01
7	1.2576E+01 8.6711E-02	-1.2354E+02 -8.5176E-01	1.0847E+03 7.4789E+00	1.3611E+02 9.3847E-01	5.8551E+00 4.0369E-02
8	1.2232E+01 8.4340E-02	-1.2340E+02 -8.5080E-01	1.0985E+03 7.5741E+00	1.3563E+02 9.3514E-01	2.1526E-01 1.4841E-03
9	1.2216E+01 8.4227E-02	-1.2376E+02 -8.5332E-01	1.1291E+03 7.7847E+00	1.3598E+02 9.3754E-01	1.1458E+01 7.8999E-02
10	5.1145E+02 3.5263E+00	-3.1410E+02 -2.1656E+00	1.2988E+02 8.9550E-01	8.2555E+02 5.6920E+00	9.6671E+02 6.6652E+00
11	3.4114E+02 2.3521E+00	-1.8717E+02 -1.2905E+00	8.6447E+01 5.9603E-01	5.2831E+02 3.6426E+00	2.2475E+02 1.5496E+00
12	-2.4114E+01 -1.6626E-01	-4.9997E+02 -3.4472E+00	-2.9756E+01 -2.0516E-01	4.7586E+02 3.2809E+00	4.0233E+02 2.7740E+00
13	8.6447E+01 5.9603E-01	-6.4651E+02 -4.4575E+00	-1.0260E+02 -7.0743E-01	7.3296E+02 5.0536E+00	5.9602E+02 4.1094E+00
14	1.0103E+02 6.9660E-01	-5.8087E+02 -4.0049E+00	-1.1764E+02 -8.1109E-01	6.8190E+02 4.7015E+00	7.3101E+02 5.0402E+00
15	1.6259E+03 1.1210E+01	-1.8949E+03 -1.3065E+01	-8.8200E+02 -6.0812E+00	3.5208E+03 2.4275E+01	5.4379E+03 3.7493E+01

16	2.4297E+02	-2.0535E+03	-1.1489E+03	2.2964E+03	3.3625E+03
	1.6752E+00	-1.4158E+01	-7.9213E+00	1.5833E+01	2.3184E+01
17	-4.2901E+01	-1.6649E+03	-1.1215E+03	1.6220E+03	2.4245E+03
	-2.9580E-01	-1.1479E+01	-7.7323E+00	1.1184E+01	1.6716E+01
18	1.0350E+01	-1.8462E+03	-1.0252E+03	1.8565E+03	2.8425E+03
	7.1360E-02	-1.2729E+01	-7.0686E+00	1.2800E+01	1.9598E+01
19	4.7835E+02	-2.5206E+03	-1.1455E+03	2.9990E+03	4.6702E+03
	3.2981E+00	-1.7379E+01	-7.8981E+00	2.0677E+01	3.2200E+01
20	3.3629E+02	-2.0600E+03	-8.9475E+02	2.3963E+03	4.4985E+03
	2.3186E+00	-1.4203E+01	-6.1691E+00	1.6522E+01	3.1016E+01
21	7.0008E-01	-1.9681E+02	-2.0429E+01	1.9751E+02	4.0159E+02
	4.8269E-03	-1.3570E+00	-1.4086E-01	1.3618E+00	2.7689E+00
22	1.3120E+03	-3.7885E+02	5.0285E+02	1.6909E+03	2.3361E+03
	9.0461E+00	-2.6121E+00	3.4670E+00	1.1658E+01	1.6107E+01

**Table 2-279. Load Case 202, Minimum External Pressure, 24 kPa (3.5 psia),
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-2.3360E+00 -1.6106E-02	-3.6389E+00 -2.5090E-02	-8.4101E+00 -5.7985E-02	1.3030E+00 8.9835E-03	5.6886E-01 3.9222E-03
2	-2.2251E+00 -1.5341E-02	-3.4540E+00 -2.3814E-02	-8.1673E+00 -5.6311E-02	1.2289E+00 8.4728E-03	7.6515E-02 5.2755E-04
3	-2.3988E+00 -1.6539E-02	-3.6788E+00 -2.5364E-02	-8.1338E+00 -5.6081E-02	1.2800E+00 8.8250E-03	4.2054E-01 2.8995E-03
4	8.6873E+01 5.9897E-01	-3.5775E+01 -2.4666E-01	6.4095E+01 4.4192E-01	1.2265E+02 8.4563E-01	1.9979E+02 1.3775E+00
5	5.3597E+01 3.6954E-01	-3.3184E+01 -2.2879E-01	6.7388E+01 4.6462E-01	8.6781E+01 5.9833E-01	1.4493E+02 9.9928E-01
6	1.3890E+01 9.5765E-02	-1.5930E+01 -1.0984E-01	7.6765E+01 5.2927E-01	2.9820E+01 2.0560E-01	2.7270E+01 1.8802E-01
7	-6.0285E+00 -4.1565E-02	-1.0849E+01 -7.4801E-02	5.7369E+01 3.9554E-01	4.8204E+00 3.3236E-02	1.7231E-02 1.1880E-04
8	-6.0237E+00 -4.1532E-02	-1.0851E+01 -7.4817E-02	5.7603E+01 3.9716E-01	4.8276E+00 3.3285E-02	8.0194E-03 5.5292E-05
9	-6.0832E+00 -4.1942E-02	-1.0804E+01 -7.4490E-02	5.9176E+01 4.0801E-01	4.7206E+00 3.2548E-02	4.5006E-01 3.1030E-03
10	2.0667E+01 1.4249E-01	-2.3017E+01 -1.5870E-01	6.8270E+00 4.7071E-02	4.3684E+01 3.0119E-01	4.4835E+01 3.0913E-01
11	1.5080E+01 1.0397E-01	-9.7133E+00 -6.6971E-02	4.3805E+00 3.0203E-02	2.4793E+01 1.7094E-01	7.4089E+00 5.1083E-02
12	-3.4729E+00 -2.3945E-02	-3.9384E+01 -2.7154E-01	-2.6388E+00 -1.8194E-02	3.5911E+01 2.4760E-01	3.4359E-01 2.3689E-03
13	7.1314E+00 4.9169E-02	-3.9296E+01 -2.7094E-01	-5.8886E+00 -4.0601E-02	4.6428E+01 3.2011E-01	3.8704E+01 2.6686E-01
14	7.0102E+00 4.8333E-02	-3.3351E+01 -2.2995E-01	-6.1013E+00 -4.2067E-02	4.0361E+01 2.7828E-01	4.2551E+01 2.9338E-01
15	7.8611E+01 5.4200E-01	-9.6274E+01 -6.6379E-01	-4.6246E+01 -3.1886E-01	1.7488E+02 1.2058E+00	2.7093E+02 1.8680E+00

16	1.1883E+01	-1.0573E+02	-5.9774E+01	1.1761E+02	1.7180E+02
	8.1929E-02	-7.2897E-01	-4.1213E-01	8.1090E-01	1.1845E+00
17	-2.5828E+00	-8.5700E+01	-5.8959E+01	8.3117E+01	1.2343E+02
	-1.7808E-02	-5.9088E-01	-4.0651E-01	5.7307E-01	8.5100E-01
18	7.1470E-01	-9.6276E+01	-5.3349E+01	9.6991E+01	1.4832E+02
	4.9277E-03	-6.6380E-01	-3.6783E-01	6.6873E-01	1.0226E+00
19	2.5084E+01	-1.3163E+02	-5.9543E+01	1.5671E+02	2.4441E+02
	1.7295E-01	-9.0754E-01	-4.1053E-01	1.0805E+00	1.6852E+00
20	1.7760E+01	-1.0809E+02	-4.6333E+01	1.2585E+02	2.3602E+02
	1.2245E-01	-7.4528E-01	-3.1946E-01	8.6773E-01	1.6273E+00
21	-2.5723E+00	-2.9338E+01	-3.3283E+00	2.6766E+01	2.6295E+01
	-1.7736E-02	-2.0228E-01	-2.2948E-02	1.8454E-01	1.8130E-01
22	5.2520E+01	-1.2599E+01	2.0775E+01	6.5119E+01	7.8345E+01
	3.6211E-01	-8.6864E-02	1.4324E-01	4.4898E-01	5.4017E-01

Table 2-280. Load Case 203, Maximum Increased External Pressure, 140 kPa (20 psia), Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-1.3126E+01 -9.0499E-02	-2.4084E+01 -1.6605E-01	-4.6805E+01 -3.2271E-01	1.0958E+01 7.5555E-02	6.6823E+00 4.6073E-02
2	-1.2719E+01 -8.7697E-02	-2.3018E+01 -1.5870E-01	-4.5823E+01 -3.1594E-01	1.0298E+01 7.1003E-02	3.0728E-01 2.1186E-03
3	-1.3537E+01 -9.3331E-02	-2.4745E+01 -1.7061E-01	-4.6003E+01 -3.1718E-01	1.1209E+01 7.7281E-02	7.2915E+00 5.0273E-02
4	7.7949E+01 5.3744E-01	-1.6574E+02 -1.1428E+00	1.9547E+01 1.3477E-01	2.4369E+02 1.6802E+00	4.7358E+02 3.2652E+00
5	7.7028E+01 5.3109E-01	-2.0985E+02 -1.4469E+00	3.2638E+01 2.2503E-01	2.8688E+02 1.9780E+00	4.1046E+02 2.8300E+00
6	-7.6705E+00 -5.2886E-02	-1.2702E+02 -8.7576E-01	6.5105E+00 4.4888E-02	1.1935E+02 8.2287E-01	1.9826E+02 1.3670E+00
7	-6.5226E+00 -4.4972E-02	-6.9798E+01 -4.8124E-01	5.8866E+01 4.0587E-01	6.3276E+01 4.3627E-01	1.1730E+00 8.0873E-03
8	-6.5220E+00 -4.4967E-02	-6.9748E+01 -4.8090E-01	5.7262E+01 3.9481E-01	6.3226E+01 4.3593E-01	1.2151E-02 8.3778E-05
9	-6.5034E+00 -4.4839E-02	-6.9724E+01 -4.8073E-01	5.8513E+01 4.0343E-01	6.3221E+01 4.3589E-01	5.7573E-01 3.9695E-03
10	-1.7827E+00 -1.2291E-02	-7.1026E+01 -4.8971E-01	1.0023E+01 6.9108E-02	6.9243E+01 4.7741E-01	2.6848E+00 1.8511E-02
11	7.0682E+00 4.8733E-02	-2.0909E+01 -1.4416E-01	1.1492E+00 7.9238E-03	2.7977E+01 1.9289E-01	1.4931E+01 1.0295E-01
12	-7.6942E+00 -5.3049E-02	-1.3260E+02 -9.1423E-01	-1.1590E+01 -7.9911E-02	1.2490E+02 8.6118E-01	1.3869E+02 9.5623E-01
13	1.8797E+01 1.2960E-01	-7.1605E+01 -4.9370E-01	-1.3701E+01 -9.4466E-02	9.0402E+01 6.2330E-01	8.8937E+01 6.1320E-01
14	1.4042E+01 9.6818E-02	-5.4197E+01 -3.7368E-01	-1.0913E+01 -7.5244E-02	6.8240E+01 4.7050E-01	5.4589E+01 3.7638E-01
15	-6.5318E+01 -4.5035E-01	-2.4885E+02 -1.7157E+00	-7.3545E+01 -5.0708E-01	1.8353E+02 1.2654E+00	2.2005E+02 1.5172E+00

16	1.9412E+01	-1.2380E+02	-6.3409E+01	1.4322E+02	2.0975E+02
	1.3384E-01	-8.5360E-01	-4.3719E-01	9.8744E-01	1.4462E+00
17	-1.1423E+00	-1.0229E+02	-5.4177E+01	1.0115E+02	1.5936E+02
	-7.8758E-03	-7.0526E-01	-3.7354E-01	6.9738E-01	1.0987E+00
18	2.2928E-01	-1.0755E+02	-5.2818E+01	1.0778E+02	1.7108E+02
	1.5808E-03	-7.4152E-01	-3.6417E-01	7.4310E-01	1.1796E+00
19	2.7292E+01	-1.4174E+02	-6.5878E+01	1.6904E+02	2.5177E+02
	1.8817E-01	-9.7729E-01	-4.5421E-01	1.1655E+00	1.7359E+00
20	2.0009E+01	-1.0845E+02	-5.3036E+01	1.2846E+02	2.4152E+02
	1.3796E-01	-7.4777E-01	-3.6567E-01	8.8573E-01	1.6652E+00
21	-1.5622E+01	-1.4864E+02	-1.7156E+01	1.3302E+02	7.2967E+01
	-1.0771E-01	-1.0249E+00	-1.1829E-01	9.1715E-01	5.0309E-01
22	-5.1788E+00	-5.4847E+01	-7.3022E+00	4.9668E+01	2.2968E+01
	-3.5707E-02	-3.7816E-01	-5.0347E-02	3.4245E-01	1.5836E-01

Table 2-281. Load Case 204, Additional Increased External Pressure, 2 MPa (290 psia), Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-1.8938E+02 -1.3057E+00	-3.5619E+02 -2.4558E+00	-6.7702E+02 -4.6679E+00	1.6681E+02 1.1501E+00	1.0421E+02 7.1852E-01
2	-1.8438E+02 -1.2712E+00	-3.4056E+02 -2.3481E+00	-6.6267E+02 -4.5690E+00	1.5618E+02 1.0769E+00	4.4556E+00 3.0720E-02
3	-1.9571E+02 -1.3493E+00	-3.6662E+02 -2.5278E+00	-6.6608E+02 -4.5925E+00	1.7092E+02 1.1784E+00	1.1573E+02 7.9794E-01
4	1.6926E+03 1.1670E+01	-3.7634E+03 -2.5947E+01	-5.4869E+02 -3.7831E+00	5.4560E+03 3.7618E+01	1.0170E+04 7.0117E+01
5	1.5542E+03 1.0716E+01	-3.9613E+03 -2.7312E+01	-4.0001E+02 -2.7580E+00	5.5155E+03 3.8028E+01	8.4232E+03 5.8076E+01
6	-6.1023E+01 -4.2074E-01	-2.1961E+03 -1.5141E+01	-9.8109E+02 -6.7644E+00	2.1351E+03 1.4721E+01	3.4499E+03 2.3786E+01
7	-6.5404E+00 -4.5094E-02	-1.1180E+03 -7.7082E+00	8.4648E+01 5.8363E-01	1.1114E+03 7.6631E+00	1.8282E+01 1.2605E-01
8	-6.5434E+00 -4.5115E-02	-1.1172E+03 -7.7028E+00	5.6792E+01 3.9156E-01	1.1107E+03 7.6577E+00	2.8813E-01 1.9866E-03
9	-6.3082E+00 -4.3493E-02	-1.1165E+03 -7.6981E+00	5.3730E+01 3.7046E-01	1.1102E+03 7.6546E+00	1.6962E+01 1.1695E-01
10	-1.3828E+02 -9.5338E-01	-1.1616E+03 -8.0093E+00	3.4250E+01 2.3614E-01	1.0234E+03 7.0559E+00	6.6777E+02 4.6041E+00
11	1.6835E+02 1.1608E+00	-5.0911E+02 -3.5102E+00	-6.4845E+01 -4.4709E-01	6.7746E+02 4.6709E+00	4.0912E+02 2.8208E+00
12	-7.0673E+01 -4.8728E-01	-1.7027E+03 -1.1740E+01	-1.7382E+02 -1.1984E+00	1.6320E+03 1.1252E+01	2.4142E+03 1.6645E+01
13	2.5169E+02 1.7354E+00	-7.2728E+02 -5.0144E+00	-1.6806E+02 -1.1587E+00	9.7897E+02 6.7498E+00	1.0358E+03 7.1418E+00
14	1.6580E+02 1.1431E+00	-5.0221E+02 -3.4626E+00	-1.1545E+02 -7.9597E-01	6.6801E+02 4.6057E+00	3.6496E+02 2.5163E+00
15	-1.1726E+03 -8.0845E+00	-4.8875E+03 -3.3698E+01	-6.3248E+02 -4.3608E+00	3.7150E+03 2.5614E+01	7.0757E+01 4.8785E-01

16	1.8950E+02	-5.8363E+02	-1.7592E+02	7.7313E+02	1.1317E+03
	1.3066E+00	-4.0240E+00	-1.2129E+00	5.3306E+00	7.8029E+00
17	2.7957E+01	-5.2449E+02	2.5910E+00	5.5244E+02	9.7715E+02
	1.9275E-01	-3.6162E+00	1.7864E-02	3.8090E+00	6.7372E+00
18	4.2621E+01	-5.3946E+02	-7.2332E+01	5.8208E+02	1.0222E+03
	2.9386E-01	-3.7195E+00	-4.9871E-01	4.0133E+00	7.0475E+00
19	1.9275E+02	-6.3767E+02	-2.9370E+02	8.3042E+02	1.0015E+03
	1.3290E+00	-4.3966E+00	-2.0250E+00	5.7256E+00	6.9048E+00
20	3.4137E+02	-5.2526E+02	-2.7881E+02	8.6663E+02	1.0628E+03
	2.3536E+00	-3.6216E+00	-1.9224E+00	5.9752E+00	7.3278E+00
21	-2.2739E+02	-2.1138E+03	-2.4453E+02	1.8864E+03	8.9000E+02
	-1.5678E+00	-1.4574E+01	-1.6860E+00	1.3007E+01	6.1363E+00
22	-1.1200E+02	-1.6656E+03	-4.1001E+02	1.5536E+03	8.9413E+02
	-7.7225E-01	-1.1484E+01	-2.8269E+00	1.0712E+01	6.1648E+00

**Table 2-282. Load Case 211, Fabrication Stress,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	4.8501E+02 3.3440E+00	-1.0148E+02 -6.9966E-01	4.1733E+01 2.8774E-01	5.8649E+02 4.0437E+00	8.4660E+02 5.8371E+00		
2	7.9194E+00 5.4603E-02	-2.3676E+01 -1.6324E-01	3.1818E+01 2.1938E-01	3.1596E+01 2.1784E-01	2.6392E+01 1.8196E-01		
3	6.5146E-01 4.4916E-03	-9.7676E+00 -6.7345E-02	3.1614E+00 2.1797E-02	1.0419E+01 7.1837E-02	3.7264E+00 2.5693E-02		
4	5.1276E+02 3.5354E+00	-2.7696E+02 -1.9096E+00	-1.7763E+01 -1.2247E-01	7.8972E+02 5.4449E+00	1.3865E+03 9.5595E+00		
5	5.7698E+02 3.9781E+00	-2.8656E+02 -1.9758E+00	-5.4983E+01 -3.7910E-01	8.6354E+02 5.9539E+00	1.3236E+03 9.1258E+00		
6	3.5146E+02 2.4232E+00	-1.0345E+01 -7.1328E-02	8.6866E+01 5.9892E-01	3.6181E+02 2.4946E+00	6.1937E+02 4.2704E+00		
7	1.4944E+02 1.0303E+00	4.3845E-01 3.0230E-03	-8.9387E-01 -6.1630E-03	1.4900E+02 1.0273E+00	1.9476E+00 1.3428E-02		
8	1.4935E+02 1.0297E+00	4.0939E-01 2.8226E-03	3.7247E+00 2.5681E-02	1.4894E+02 1.0269E+00	4.4174E-02 3.0457E-04		
9	1.4935E+02 1.0297E+00	3.9967E-01 2.7556E-03	1.9826E+00 1.3670E-02	1.4895E+02 1.0270E+00	6.1644E-02 4.2502E-04		
10	1.4984E+02 1.0331E+00	-5.6285E+00 -3.8807E-02	6.3516E+01 4.3792E-01	1.5547E+02 1.0719E+00	4.1670E+01 2.8730E-01		
11	5.6314E+01 3.8827E-01	-2.7677E+01 -1.9083E-01	3.3436E+01 2.3053E-01	8.3991E+01 5.7910E-01	5.9976E+01 4.1352E-01		
12	5.9136E+01 4.0773E-01	1.9400E+01 1.3376E-01	3.9125E+01 2.6975E-01	3.9736E+01 2.7397E-01	8.5089E+00 5.8667E-02		
13	2.5872E+02 1.7838E+00	-4.8757E+01 -3.3617E-01	6.9335E+01 4.7805E-01	3.0748E+02 2.1200E+00	3.2102E+02 2.2133E+00		
14	2.4820E+02 1.7113E+00	-4.9865E+01 -3.4381E-01	7.3710E+01 5.0822E-01	2.9807E+02 2.0551E+00	2.5178E+02 1.7360E+00		
15	4.0912E+02 2.8208E+00	9.4841E+01 6.5391E-01	4.9988E+01 3.4466E-01	3.1428E+02 2.1669E+00	1.2156E+01 8.3816E-02		

16	2.2502E+01	-2.6229E+00	8.3354E+00	2.5125E+01	3.2013E+01
	1.5515E-01	-1.8084E-02	5.7470E-02	1.7323E-01	2.2073E-01
17	2.0822E+01	1.5247E+00	-1.3011E+01	1.9297E+01	3.2841E+01
	1.4356E-01	1.0512E-02	-8.9705E-02	1.3305E-01	2.2643E-01
18	6.2622E+01	-2.5562E+01	-3.2996E+01	8.8184E+01	1.5707E+02
	4.3176E-01	-1.7625E-01	-2.2750E-01	6.0801E-01	1.0830E+00
19	7.2071E+01	-4.2653E+01	1.2702E+01	1.1472E+02	1.3128E+02
	4.9691E-01	-2.9408E-01	8.7580E-02	7.9099E-01	9.0518E-01
20	7.6190E+01	-7.0101E+01	1.2497E+01	1.4629E+02	2.1132E+02
	5.2531E-01	-4.8333E-01	8.6166E-02	1.0086E+00	1.4570E+00
21	2.2184E+01	-4.5781E+00	4.4874E-01	2.6762E+01	6.4225E+01
	1.5295E-01	-3.1565E-02	3.0939E-03	1.8452E-01	4.4281E-01
22	3.6010E+02	7.9852E+01	3.4061E+02	2.8025E+02	3.5378E+00
	2.4828E+00	5.5056E-01	2.3484E+00	1.9323E+00	2.4392E-02

**Table 2-283. Load Case 215, Compression Load (5x weight),
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	2.3658E+00 1.6311E-02	-1.2765E+02 -8.8011E-01	-1.6318E+01 -1.1251E-01	1.3002E+02 8.9642E-01	1.9505E+02 1.3448E+00
2	1.5175E+00 1.0463E-02	-9.8912E+01 -6.8197E-01	1.3542E+01 9.3367E-02	1.0043E+02 6.9244E-01	2.9327E+00 2.0220E-02
3	-2.9633E+00 -2.0431E-02	-1.1494E+02 -7.9251E-01	5.2656E+00 3.6305E-02	1.1198E+02 7.7208E-01	3.5007E+01 2.4136E-01
4	2.7031E+02 1.8637E+00	-3.7393E+02 -2.5782E+00	7.0544E+01 4.8638E-01	6.4424E+02 4.4419E+00	1.1801E+03 8.1367E+00
5	2.5740E+02 1.7747E+00	-4.2556E+02 -2.9341E+00	7.5476E+01 5.2039E-01	6.8296E+02 4.7088E+00	9.5558E+02 6.5885E+00
6	-7.5599E+01 -5.2124E-01	-3.4300E+02 -2.3649E+00	-6.7963E+01 -4.6859E-01	2.6740E+02 1.8437E+00	3.2496E+02 2.2405E+00
7	-3.0777E-01 -2.1220E-03	-2.0730E+02 -1.4293E+00	-1.5253E-01 -1.0517E-03	2.0699E+02 1.4271E+00	1.2480E+00 8.6045E-03
8	-3.1884E-01 -2.1983E-03	-1.6477E+02 -1.1360E+00	-2.4264E+00 -1.6729E-02	1.6445E+02 1.1338E+00	8.2386E-03 5.6803E-05
9	-3.1779E-01 -2.1911E-03	-1.4688E+02 -1.0127E+00	-1.3157E+00 -9.0716E-03	1.4656E+02 1.0105E+00	6.2749E-01 4.3264E-03
10	-3.5740E+00 -2.4642E-02	-1.4903E+02 -1.0275E+00	-4.2076E+01 -2.9010E-01	1.4546E+02 1.0029E+00	2.1058E+00 1.4519E-02
11	1.3678E+01 9.4310E-02	-4.4026E+01 -3.0355E-01	-2.1512E+01 -1.4832E-01	5.7704E+01 3.9786E-01	5.8859E+01 4.0582E-01
12	-2.2699E+01 -1.5650E-01	-9.3622E+01 -6.4550E-01	-2.8402E+01 -1.9583E-01	7.0923E+01 4.8900E-01	9.6809E+01 6.6748E-01
13	4.7426E+01 3.2699E-01	-1.8876E+02 -1.3015E+00	-4.3744E+01 -3.0161E-01	2.3619E+02 1.6285E+00	2.2598E+02 1.5581E+00
14	3.9828E+01 2.7461E-01	-1.5964E+02 -1.1007E+00	-4.2252E+01 -2.9132E-01	1.9947E+02 1.3753E+00	1.8017E+02 1.2422E+00
15	-6.2896E+02 -4.3365E+00	-2.8004E+03 -1.9308E+01	-3.1978E+02 -2.2048E+00	2.1715E+03 1.4972E+01	1.3835E+02 9.5386E-01

16	1.7437E+02	-4.1480E+02	-6.8711E+01	5.8916E+02	8.0097E+02
	1.2022E+00	-2.8599E+00	-4.7375E-01	4.0621E+00	5.5225E+00
17	-9.9755E+01	-4.3683E+02	-4.1559E+01	3.3707E+02	5.1338E+02
	-6.8779E-01	-3.0118E+00	-2.8654E-01	2.3240E+00	3.5396E+00
18	-5.8351E+01	-2.5561E+02	-2.7289E+01	1.9726E+02	2.9246E+02
	-4.0231E-01	-1.7624E+00	-1.8815E-01	1.3601E+00	2.0165E+00
19	1.4604E+02	-2.6296E+02	-4.7481E+01	4.0899E+02	5.5603E+02
	1.0069E+00	-1.8130E+00	-3.2737E-01	2.8199E+00	3.8337E+00
20	2.0817E+02	-2.8803E+02	-5.9896E+01	4.9620E+02	8.5022E+02
	1.4353E+00	-1.9859E+00	-4.1297E-01	3.4212E+00	5.8621E+00
21	-1.3365E+01	-1.4375E+02	-1.4241E+01	1.3039E+02	6.6990E+01
	-9.2146E-02	-9.9112E-01	-9.8191E-02	8.9897E-01	4.6188E-01
22	-2.2108E+02	-8.1762E+02	-3.0105E+02	5.9653E+02	1.3959E+02
	-1.5243E+00	-5.6373E+00	-2.0757E+00	4.1130E+00	9.6245E-01

**Table 2-284. Load Case 216, Rod Drop onto Cask,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	8.4333E+00 5.8146E-02	-1.6671E+01 -1.1494E-01	2.2942E+01 1.5818E-01	2.5104E+01 1.7309E-01	1.3012E+01 8.9715E-02		
2	2.1340E-01 1.4713E-03	-1.5475E+01 -1.0669E-01	-8.4199E-01 -5.8053E-03	1.5688E+01 1.0817E-01	5.5909E+00 3.8548E-02		
3	7.7830E-01 5.3662E-03	-1.4149E+01 -9.7551E-02	-1.4557E-01 -1.0037E-03	1.4927E+01 1.0292E-01	1.5585E+00 1.0746E-02		
4	9.4239E+01 6.4975E-01	-2.4038E+01 -1.6573E-01	6.1295E+01 4.2262E-01	1.1828E+02 8.1549E-01	1.4099E+02 9.7209E-01		
5	5.3039E+01 3.6569E-01	-1.6018E+01 -1.1044E-01	5.1447E+01 3.5472E-01	6.9057E+01 4.7613E-01	5.1055E+01 3.5201E-01		
6	6.2745E+00 4.3261E-02	-7.4543E+01 -5.1396E-01	2.7290E+01 1.8815E-01	8.0817E+01 5.5722E-01	5.1907E+01 3.5789E-01		
7	-7.0090E-02 -4.8325E-04	-5.0886E+01 -3.5084E-01	-1.0434E+00 -7.1940E-03	5.0816E+01 3.5036E-01	7.5721E-01 5.2208E-03		
8	-5.8683E-02 -4.0461E-04	-3.5112E+01 -2.4209E-01	-6.0866E-01 -4.1966E-03	3.5053E+01 2.4168E-01	1.7600E-02 1.2135E-04		
9	-5.0346E-02 -3.4713E-04	-2.5741E+01 -1.7748E-01	-3.4281E-01 -2.3636E-03	2.5691E+01 1.7713E-01	5.1197E-02 3.5299E-04		
10	-1.6312E-01 -1.1247E-03	-2.0350E+01 -1.4031E-01	-5.6738E+00 -3.9120E-02	2.0187E+01 1.3919E-01	2.0498E+00 1.4133E-02		
11	2.5516E+00 1.7593E-02	-4.7386E+00 -3.2672E-02	-1.3303E+00 -9.1721E-03	7.2903E+00 5.0265E-02	8.4236E+00 5.8079E-02		
12	-1.6017E+00 -1.1043E-02	-9.0831E+00 -6.2626E-02	-2.0052E+00 -1.3825E-02	7.4814E+00 5.1582E-02	8.4322E+00 5.8138E-02		
13	7.7893E+00 5.3705E-02	-2.2673E+01 -1.5633E-01	-3.1391E+00 -2.1643E-02	3.0463E+01 2.1003E-01	2.5994E+01 1.7922E-01		
14	7.1270E+00 4.9139E-02	-1.9484E+01 -1.3434E-01	-2.9825E+00 -2.0563E-02	2.6611E+01 1.8348E-01	2.6235E+01 1.8088E-01		
15	-8.3941E+02 -5.7875E+00	-4.9038E+03 -3.3810E+01	-2.8876E+02 -1.9910E+00	4.0644E+03 2.8023E+01	7.4901E+02 5.1642E+00		

16	1.6205E+02	-3.4125E+02	-1.9840E+00	5.0330E+02	7.6073E+02
	1.1173E+00	-2.3529E+00	-1.3679E-02	3.4701E+00	5.2451E+00
17	-1.4398E+00	-2.9131E+02	5.3461E+01	2.8987E+02	5.1015E+02
	-9.9271E-03	-2.0085E+00	3.6860E-01	1.9986E+00	3.5174E+00
18	-1.1799E+01	-9.5708E+01	-2.0161E+01	8.3909E+01	4.2785E+00
	-8.1352E-02	-6.5988E-01	-1.3900E-01	5.7853E-01	2.9499E-02
19	3.6876E+01	-4.7346E+01	-3.7438E+00	8.4222E+01	9.7521E+01
	2.5425E-01	-3.2644E-01	-2.5813E-02	5.8069E-01	6.7238E-01
20	5.6102E+01	-5.3666E+01	-1.5243E+01	1.0977E+02	1.5310E+02
	3.8681E-01	-3.7002E-01	-1.0510E-01	7.5683E-01	1.0556E+00
21	-3.1829E-01	-4.5769E+00	-3.4193E-01	4.2586E+00	2.1352E+00
	-2.1946E-03	-3.1556E-02	-2.3575E-03	2.9362E-02	1.4722E-02
22	2.4910E+02	-3.7685E+03	-7.6798E+02	4.0176E+03	4.7597E+03
	1.7175E+00	-2.5983E+01	-5.2950E+00	2.7700E+01	3.2817E+01

**Table 2-285. Load Case 221, Forward 10g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	2.6659E+02 1.8381E+00	3.2882E+01 2.2671E-01	-6.0940E+01 -4.2017E-01	3.2753E+02 2.2582E+00	6.9083E+01 4.7631E-01
2	5.8894E+02 4.0606E+00	1.0064E+02 6.9389E-01	-3.3935E+01 -2.3397E-01	8.3430E+02 5.7523E+00	2.0773E+02 1.4322E+00
3	2.3444E+02 1.6164E+00	3.5685E+01 2.4604E-01	-6.3090E+01 -4.3499E-01	2.9753E+02 2.0514E+00	1.0043E+02 6.9241E-01
4	5.5996E+02 3.8608E+00	6.8523E+01 4.7245E-01	1.5955E+01 1.1001E-01	5.4401E+02 3.7508E+00	3.0152E+02 2.0789E+00
5	3.8235E+02 2.6362E+00	3.8745E+01 2.6714E-01	9.6501E+00 6.6535E-02	3.9057E+02 2.6929E+00	1.3598E+02 9.3757E-01
6	1.9008E+02 1.3106E+00	2.4897E+01 1.7166E-01	-3.6801E+01 -2.5373E-01	2.1418E+02 1.4767E+00	5.5415E+01 3.8207E-01
7	5.1640E+01 3.5605E-01	5.4004E+00 3.7235E-02	-2.5234E+01 -1.7398E-01	6.3285E+01 4.3633E-01	2.0464E+01 1.4109E-01
8	4.9557E+01 3.4168E-01	-8.8915E-01 -6.1304E-03	-2.0868E+01 -1.4388E-01	6.0547E+01 4.1746E-01	2.1599E+01 1.4892E-01
9	4.5591E+01 3.1434E-01	3.5317E+00 2.4350E-02	-1.6958E+01 -1.1692E-01	5.5773E+01 3.8454E-01	2.3666E+01 1.6317E-01
10	8.6499E+01 5.9639E-01	9.3231E+00 6.4280E-02	-3.2061E+01 -2.2105E-01	1.1856E+02 8.1744E-01	1.3932E+02 9.6061E-01
11	1.7364E+02 1.1972E+00	2.2242E+01 1.5336E-01	-3.1329E-01 -2.1600E-03	1.7395E+02 1.1993E+00	5.4633E+01 3.7668E-01
12	1.5659E+02 1.0797E+00	2.7380E+00 1.8878E-02	-5.2831E+00 -3.6426E-02	1.6188E+02 1.1161E+00	3.4699E+01 2.3924E-01
13	3.2123E+02 2.2148E+00	2.1928E+01 1.5119E-01	1.0767E+01 7.4233E-02	3.1046E+02 2.1405E+00	1.9980E+01 1.3776E-01
14	3.2645E+02 2.2508E+00	2.7620E+01 1.9043E-01	1.0973E+01 7.5655E-02	3.1548E+02 2.1751E+00	9.8320E+01 6.7790E-01
15	1.3543E+02 9.3377E-01	-1.2885E+00 -8.8841E-03	-5.7906E+01 -3.9925E-01	1.9334E+02 1.3330E+00	1.6230E+02 1.1190E+00

16	1.5178E+02	2.0870E+01	-1.1094E+00	1.5289E+02	1.3273E+02
	1.0465E+00	1.4390E-01	-7.6489E-03	1.0541E+00	9.1517E-01
17	9.0911E+01	-2.3428E+00	-4.5487E+01	1.3640E+02	6.0305E+01
	6.2681E-01	-1.6153E-02	-3.1362E-01	9.4043E-01	4.1579E-01
18	7.5746E+01	-8.6920E+00	-4.1804E+01	1.1755E+02	9.0382E+01
	5.2225E-01	-5.9929E-02	-2.8823E-01	8.1048E-01	6.2316E-01
19	2.4103E+02	2.6225E+01	-5.6238E-01	2.4159E+02	6.4073E+01
	1.6618E+00	1.8082E-01	-3.8775E-03	1.6657E+00	4.4177E-01
20	2.8897E+02	2.5819E+01	8.3274E+00	2.8310E+02	1.3391E+02
	1.9924E+00	1.7802E-01	5.7415E-02	1.9519E+00	9.2328E-01
21	2.3965E+02	2.6277E+01	-8.6023E-01	2.4051E+02	6.0551E+01
	1.6523E+00	1.8117E-01	-5.9311E-03	1.6583E+00	4.1749E-01
22	1.4738E+02	2.0357E+00	-4.5493E+00	1.5193E+02	4.8760E+01
	1.0162E+00	1.4036E-02	-3.1366E-02	1.0475E+00	3.3619E-01

**Table 2-286. Load Case 222, Lateral 5g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.1239E+01 4.9118E-01	1.2971E+00 8.9432E-03	-3.0493E+01 -2.1024E-01	8.2259E+01 5.6716E-01	2.8856E+01 1.9896E-01		
2	6.2725E+01 4.3248E-01	1.3868E+01 9.5616E-02	-3.0221E+01 -2.0836E-01	7.2006E+01 4.9646E-01	2.8141E+01 1.9402E-01		
3	7.1426E+01 4.9246E-01	-1.4235E+00 -9.8146E-03	-3.0953E+01 -2.1341E-01	8.2167E+01 5.6652E-01	2.8125E+01 1.9391E-01		
4	6.7314E+01 4.6412E-01	8.0847E+00 5.5742E-02	-1.9069E+00 -1.3147E-02	7.3809E+01 5.0890E-01	5.3920E+01 3.7176E-01		
5	4.9245E+01 3.3953E-01	8.0405E+00 5.5437E-02	2.4483E+00 1.6880E-02	7.1867E+01 4.9550E-01	3.4528E+01 2.3806E-01		
6	2.0484E+01 1.4123E-01	4.1956E+00 2.8928E-02	-2.0053E+00 -1.3826E-02	3.4237E+01 2.3605E-01	1.3443E+01 9.2684E-02		
7	4.1020E+00 2.8282E-02	-2.0515E+00 -1.4145E-02	-3.9641E+00 -2.7331E-02	5.2096E+00 3.5919E-02	9.6729E-01 6.6692E-03		
8	4.4289E+00 3.0536E-02	-1.5313E+00 -1.0558E-02	-4.4386E+00 -3.0603E-02	5.1857E+00 3.5754E-02	7.2379E-01 4.9904E-03		
9	4.5556E+00 3.1410E-02	-2.3430E+00 -1.6154E-02	-4.4312E+00 -3.0552E-02	5.4521E+00 3.7591E-02	1.1779E+00 8.1211E-03		
10	1.2079E+01 8.3281E-02	-2.2138E+00 -1.5263E-02	-4.4477E+00 -3.0666E-02	2.4128E+01 1.6636E-01	4.2216E+00 2.9107E-02		
11	9.2518E+00 6.3789E-02	-1.3517E+00 -9.3194E-03	-3.2488E+00 -2.2399E-02	1.3205E+01 9.1048E-02	1.0481E+01 7.2262E-02		
12	9.6060E+00 6.6231E-02	5.5064E-01 3.7966E-03	-2.4198E+00 -1.6684E-02	1.2028E+01 8.2929E-02	1.3276E+01 9.1536E-02		
13	3.2252E+01 2.2237E-01	2.4542E+00 1.6921E-02	-2.9228E-01 -2.0152E-03	4.1455E+01 2.8582E-01	8.1674E+00 5.6312E-02		
14	3.4637E+01 2.3881E-01	2.8226E+00 1.9461E-02	-3.2608E+00 -2.2483E-02	3.7932E+01 2.6153E-01	1.9408E+01 1.3381E-01		
15	5.2127E+01 3.5941E-01	-4.1156E-01 -2.8376E-03	-4.0878E+01 -2.8184E-01	9.3012E+01 6.4130E-01	8.7407E+01 6.0265E-01		

16	1.8391E+01	-2.0416E-01	-4.7055E+00	2.3097E+01	8.9950E-01
	1.2680E-01	-1.4076E-03	-3.2444E-02	1.5925E-01	6.2018E-03
17	7.8495E+00	-3.7211E+00	-6.4705E+00	1.4321E+01	9.2355E-01
	5.4120E-02	-2.5656E-02	-4.4613E-02	9.8743E-02	6.3677E-03
18	1.0768E+01	-3.7937E+00	-1.0766E+01	1.8931E+01	1.1043E+01
	7.4243E-02	-2.6157E-02	-7.4227E-02	1.3052E-01	7.6136E-02
19	2.4583E+01	1.7372E+00	-5.7274E+00	3.0315E+01	4.1146E+00
	1.6950E-01	1.1977E-02	-3.9489E-02	2.0901E-01	2.8369E-02
20	2.3101E+01	6.1340E-01	-3.2872E+00	2.6388E+01	8.9684E+00
	1.5928E-01	4.2293E-03	-2.2664E-02	1.8194E-01	6.1835E-02
21	2.1783E+01	1.2681E+00	-5.7775E+00	2.7560E+01	2.9002E+01
	1.5019E-01	8.7429E-03	-3.9835E-02	1.9002E-01	1.9996E-01
22	1.2324E+01	7.9082E-01	-3.2059E+00	1.5530E+01	1.6337E+01
	8.4972E-02	5.4525E-03	-2.2104E-02	1.0708E-01	1.1264E-01

**Table 2-287. Load Case 223, Vertical 2g Vibration Inertia Load,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.3521E+00 5.0691E-02	1.5632E+00 1.0778E-02	-5.6581E-01 -3.9012E-03	7.9584E+00 5.4871E-02	2.2911E+00 1.5796E-02		
2	2.5154E+01 1.7343E-01	4.7512E+00 3.2759E-02	-4.1851E-01 -2.8856E-03	2.9376E+01 2.0254E-01	9.9860E+00 6.8851E-02		
3	2.8984E+01 1.9984E-01	2.8168E+00 1.9421E-02	-1.8686E+00 -1.2883E-02	3.0852E+01 2.1272E-01	1.1972E+01 8.2547E-02		
4	8.6560E-01 5.9681E-03	-9.9521E+00 -6.8617E-02	-1.7798E+01 -1.2271E-01	1.8623E+01 1.2840E-01	1.4036E+01 9.6774E-02		
5	1.8196E+00 1.2546E-02	-7.5895E+00 -5.2328E-02	-1.1464E+01 -7.9039E-02	1.3208E+01 9.1063E-02	1.0154E+01 7.0009E-02		
6	1.0679E+01 7.3627E-02	-2.0076E+00 -1.3842E-02	-4.3830E+00 -3.0220E-02	1.5017E+01 1.0354E-01	8.9184E+00 6.1490E-02		
7	8.3457E+00 5.7542E-02	2.9847E-01 2.0579E-03	4.1650E-02 2.8716E-04	8.3198E+00 5.7363E-02	3.1798E-02 2.1924E-04		
8	1.0970E+01 7.5633E-02	3.5986E-01 2.4811E-03	6.4421E-02 4.4417E-04	1.0927E+01 7.5342E-02	2.1606E-02 1.4897E-04		
9	1.6722E+01 1.1529E-01	4.3994E-01 3.0333E-03	6.8710E-02 4.7374E-04	1.6663E+01 1.1489E-01	2.5112E-01 1.7314E-03		
10	2.9156E+01 2.0102E-01	7.0123E+00 4.8348E-02	1.5161E+00 1.0453E-02	2.7776E+01 1.9151E-01	4.8589E+00 3.3501E-02		
11	1.0894E+01 7.5108E-02	5.4145E+00 3.7332E-02	-1.3395E+00 -9.2358E-03	1.2233E+01 8.4344E-02	1.1250E+01 7.7568E-02		
12	1.9692E+01 1.3577E-01	6.6013E+00 4.5514E-02	3.2294E+00 2.2266E-02	1.7030E+01 1.1742E-01	2.2876E+01 1.5773E-01		
13	3.9612E+01 2.7312E-01	1.0038E+01 6.9211E-02	-7.1041E+00 -4.8981E-02	4.6716E+01 3.2210E-01	4.7430E+01 3.2702E-01		
14	3.5543E+01 2.4506E-01	9.4214E+00 6.4958E-02	-6.3537E+00 -4.3807E-02	4.1896E+01 2.8886E-01	3.0958E+01 2.1345E-01		
15	4.5735E+00 3.1533E-02	-6.1560E-01 -4.2444E-03	-8.9241E-01 -6.1530E-03	5.4639E+00 3.7672E-02	6.0187E-01 4.1498E-03		

16	8.1183E+00	1.0540E+00	-4.7885E+00	1.2907E+01	1.3600E+01
	5.5974E-02	7.2674E-03	-3.3015E-02	8.8989E-02	9.3767E-02
17	8.3584E+00	-1.6610E-01	-3.1385E+00	1.1497E+01	1.4024E+01
	5.7629E-02	-1.1452E-03	-2.1639E-02	7.9268E-02	9.6695E-02
18	8.4619E+00	1.4811E+00	-3.4233E+00	1.1885E+01	1.1634E+01
	5.8343E-02	1.0212E-02	-2.3603E-02	8.1946E-02	8.0213E-02
19	2.1298E+00	-2.0574E+00	-7.2346E+00	9.3519E+00	2.2602E+00
	1.4684E-02	-1.4185E-02	-4.9881E-02	6.4479E-02	1.5583E-02
20	4.0044E+00	-8.9306E-01	-9.3791E+00	1.3364E+01	3.5009E+00
	2.7610E-02	-6.1575E-03	-6.4666E-02	9.2140E-02	2.4138E-02
21	6.7440E+01	8.4553E+00	2.6382E+00	6.5109E+01	2.4042E+01
	4.6498E-01	5.8297E-02	1.8190E-02	4.4891E-01	1.6577E-01
22	7.6497E+00	4.5009E+00	-1.6657E+00	9.3089E+00	1.5188E+01
	5.2743E-02	3.1033E-02	-1.1485E-02	6.4183E-02	1.0471E-01

**Table 2-288. Load Case 231, 3-ft. Head-On Drop,
Normal Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	5.2893E+00 3.6468E-02	-1.1045E+02 -7.6150E-01	4.8701E+00 3.3578E-02	1.1574E+02 7.9797E-01	3.3927E+01 2.3392E-01		
2	1.5814E+00 1.0903E-02	-5.9614E+01 -4.1103E-01	-1.9467E+00 -1.3422E-02	6.1196E+01 4.2193E-01	5.5359E+00 3.8169E-02		
3	-4.2678E-02 -2.9426E-04	-2.0986E+01 -1.4470E-01	-4.7846E-01 -3.2989E-03	2.0944E+01 1.4440E-01	5.1599E-01 3.5576E-03		
4	7.0873E+01 4.8865E-01	-1.5825E+02 -1.0911E+00	-1.6707E+01 -1.1519E-01	2.2912E+02 1.5798E+00	2.1843E+02 1.5061E+00		
5	4.0897E+01 2.8197E-01	-8.0737E+01 -5.5666E-01	-3.9752E+00 -2.7408E-02	1.2163E+02 8.3864E-01	1.6924E+02 1.1669E+00		
6	-1.7824E+01 -1.2289E-01	-8.3645E+01 -5.7671E-01	-2.2269E+01 -1.5354E-01	6.5821E+01 4.5382E-01	1.0287E+01 7.0924E-02		
7	-1.1135E-01 -7.6776E-04	-3.8311E+01 -2.6414E-01	-2.5945E-01 -1.7889E-03	3.8200E+01 2.6338E-01	9.9396E-01 6.8531E-03		
8	-7.9429E-02 -5.4764E-04	-2.6506E+01 -1.8276E-01	-5.3638E-01 -3.6982E-03	2.6427E+01 1.8221E-01	3.2321E-02 2.2285E-04		
9	-4.9581E-02 -3.4185E-04	-2.3987E+01 -1.6538E-01	-8.2209E-01 -5.6681E-03	2.3937E+01 1.6504E-01	3.9130E-02 2.6979E-04		
10	-5.5323E+00 -3.8144E-02	-3.7309E+01 -2.5724E-01	1.9997E+00 1.3787E-02	3.1777E+01 2.1910E-01	2.7439E+01 1.8919E-01		
11	1.1373E+01 7.8415E-02	-2.2173E+01 -1.5288E-01	3.0644E+00 2.1128E-02	3.3547E+01 2.3130E-01	1.2374E+01 8.5318E-02		
12	9.5675E+00 6.5965E-02	-1.4001E+01 -9.6536E-02	8.1720E+00 5.6344E-02	2.3569E+01 1.6250E-01	4.1608E+01 2.8688E-01		
13	1.8196E+01 1.2546E-01	-9.9047E+00 -6.8291E-02	7.7296E+00 5.3294E-02	2.8101E+01 1.9375E-01	5.6810E+00 3.9169E-02		
14	1.9332E+01 1.3329E-01	-5.0481E+00 -3.4806E-02	1.1035E+01 7.6086E-02	2.4380E+01 1.6809E-01	4.8746E-01 3.3609E-03		
15	-1.1745E+02 -8.0977E-01	-4.9548E+02 -3.4162E+00	-7.4386E+01 -5.1287E-01	3.7804E+02 2.6065E+00	2.0875E+01 1.4393E-01		

16	1.8936E+01	-4.6506E+01	7.2581E+00	6.5442E+01	4.8381E+01
	1.3056E-01	-3.2065E-01	5.0043E-02	4.5121E-01	3.3357E-01
17	-9.2174E+00	-1.1104E+02	-2.0015E+01	1.0182E+02	1.6928E+01
	-6.3552E-02	-7.6556E-01	-1.3800E-01	7.0201E-01	1.1671E-01
18	-7.3170E+00	-5.8801E+01	-3.3685E+00	5.1484E+01	6.4371E+01
	-5.0449E-02	-4.0542E-01	-2.3225E-02	3.5497E-01	4.4382E-01
19	3.5483E+01	-5.3888E+01	-3.9258E-01	8.9371E+01	7.9479E+01
	2.4465E-01	-3.7155E-01	-2.7067E-03	6.1619E-01	5.4799E-01
20	3.7086E+01	-5.0814E+01	-8.6148E+00	8.7900E+01	9.9294E+01
	2.5570E-01	-3.5035E-01	-5.9397E-02	6.0605E-01	6.8461E-01
21	-5.0943E+00	-1.7411E+01	-1.2532E+01	1.2317E+01	7.6682E+00
	-3.5124E-02	-1.2005E-01	-8.6403E-02	8.4921E-02	5.2870E-02
22	-1.4452E+01	-2.1083E+02	-1.3852E+01	1.9638E+02	6.6197E+01
	-9.9642E-02	-1.4536E+00	-9.5507E-02	1.3540E+00	4.5641E-01

Table 2-289. Load Case 232, 30-ft. Head-On Drop Impact Test, Normal Conditions, Normal Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-3.5624E+01 -2.4562E-01	-3.0377E+03 -2.0944E+01	-5.7141E+02 -3.9398E+00	3.0021E+03 2.0699E+01	1.3153E+03 9.0686E+00		
2	3.3840E+01 2.3332E-01	-1.6948E+03 -1.1685E+01	-5.7305E+01 -3.9511E-01	1.7286E+03 1.1919E+01	2.1319E+01 1.4699E-01		
3	2.3417E+01 1.6145E-01	-9.1756E+02 -6.3263E+00	-3.3970E+01 -2.3421E-01	9.4097E+02 6.4878E+00	1.3890E+01 9.5771E-02		
4	1.3051E+03 8.9985E+00	-5.1575E+03 -3.5560E+01	-1.6233E+03 -1.1192E+01	6.4626E+03 4.4558E+01	6.6418E+03 4.5794E+01		
5	5.1571E+02 3.5557E+00	-2.4203E+03 -1.6687E+01	-9.5034E+02 -6.5523E+00	2.9360E+03 2.0243E+01	4.4849E+03 3.0922E+01		
6	-3.5056E+02 -2.4170E+00	-1.2789E+03 -8.8175E+00	-8.9242E+02 -6.1530E+00	9.2831E+02 6.4005E+00	9.7681E+02 6.7348E+00		
7	-3.0675E+00 -2.1150E-02	-6.6503E+02 -4.5852E+00	-2.0442E+01 -1.4094E-01	6.6196E+02 4.5641E+00	1.9669E+01 1.3561E-01		
8	-1.2572E+00 -8.6684E-03	-5.8923E+02 -4.0626E+00	-1.4967E+01 -1.0319E-01	5.8797E+02 4.0539E+00	6.8131E-01 4.6975E-03		
9	-1.0983E+00 -7.5728E-03	-5.6084E+02 -3.8669E+00	-1.6324E+01 -1.1255E-01	5.5975E+02 3.8593E+00	1.6999E+00 1.1720E-02		
10	-1.0327E+02 -7.1206E-01	-7.9022E+02 -5.4484E+00	-1.7452E+01 -1.2033E-01	6.8695E+02 4.7363E+00	4.5667E+02 3.1486E+00		
11	1.8320E+02 1.2631E+00	-3.9676E+02 -2.7355E+00	1.9767E+01 1.3629E-01	5.7996E+02 3.9987E+00	2.6192E+02 1.8059E+00		
12	1.3812E+02 9.5228E-01	-2.1573E+02 -1.4874E+00	1.0509E+02 7.2455E-01	3.5384E+02 2.4397E+00	6.9455E+02 4.7887E+00		
13	2.6981E+02 1.8603E+00	-3.1839E+02 -2.1952E+00	6.9013E+01 4.7583E-01	5.8820E+02 4.0555E+00	2.7305E+02 1.8826E+00		
14	2.5627E+02 1.7669E+00	-2.0323E+02 -1.4012E+00	1.2073E+02 8.3243E-01	4.5950E+02 3.1681E+00	2.1369E+02 1.4733E+00		
15	1.1604E+03 8.0003E+00	6.6171E+01 4.5624E-01	-3.8550E+01 -2.6579E-01	1.0942E+03 7.5441E+00	6.1555E+00 4.2441E-02		

16	4.1228E+02	-7.2998E+02	-3.3516E+02	1.1423E+03	8.1758E+02
	2.8425E+00	-5.0331E+00	-2.3108E+00	7.8756E+00	5.6370E+00
17	5.8537E+02	-6.2846E+02	-4.2834E+02	1.2138E+03	1.3129E+03
	4.0360E+00	-4.3331E+00	-2.9533E+00	8.3691E+00	9.0519E+00
18	6.6580E+02	-1.3209E+03	-1.4426E+02	1.9867E+03	2.6286E+03
	4.5905E+00	-9.1071E+00	-9.9464E-01	1.3698E+01	1.8123E+01
19	4.3034E+02	-1.4481E+03	-6.0022E+02	1.8784E+03	1.7026E+03
	2.9671E+00	-9.9843E+00	-4.1383E+00	1.2951E+01	1.1739E+01
20	1.3614E+02	-1.0829E+03	-6.0449E+02	1.2190E+03	2.2178E+03
	9.3864E-01	-7.4661E+00	-4.1678E+00	8.4048E+00	1.5291E+01
21	8.6909E+02	7.8247E+01	7.1473E+01	7.9084E+02	2.7440E+02
	5.9921E+00	5.3950E-01	4.9279E-01	5.4526E+00	1.8920E+00
22	6.8767E+02	3.9006E+01	3.4223E+02	6.4867E+02	6.5267E+02
	4.7413E+00	2.6894E-01	2.3596E+00	4.4724E+00	4.5000E+00

**Table 2-290. Load Combination 101, Hot Environment,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 102, 201, 211

100°F Ambient, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.28	1.46	1.74	20.00	66.30	>10
	4.14	5.93	1.96	10.07	12.02	137.90	457.12	
2	0.04	0.03	0.43	0.07	0.50	20.00	66.30	>10
	0.28	0.19	2.96	0.47	3.43	137.90	457.12	
3	0.03	0.02	0.28	0.05	0.33	20.00	66.30	>10
	0.17	0.16	1.96	0.33	2.30	137.90	457.12	
4	4.94	8.72	2.98	13.66	16.64	20.00	66.30	1.20
	34.09	60.09	20.55	94.18	114.73	137.90	457.12	
5	4.28	6.97	3.25	11.24	14.49	20.00	66.30	1.67
	29.48	48.05	22.40	77.52	99.93	137.90	457.12	
6	1.66	2.27	1.39	3.93	5.32	20.00	61.80	6.63
	11.45	15.65	9.61	27.10	36.70	137.90	426.10	
7	0.29	0.01	0.42	0.29	0.72	20.00	61.80	>10
	1.97	0.05	2.93	2.02	4.95	137.90	426.10	
8	0.28	0.00	0.42	0.28	0.71	20.00	61.80	>10
	1.96	0.00	2.92	1.96	4.89	137.90	426.10	
9	0.28	0.01	0.42	0.30	0.72	20.00	61.80	>10
	1.96	0.08	2.92	2.04	4.97	137.90	426.10	
10	0.98	1.01	0.59	1.99	2.58	20.00	61.80	>10
	6.76	6.95	4.04	13.72	17.76	137.90	426.10	
11	0.61	0.28	0.75	0.90	1.65	20.00	61.80	>10
	4.22	1.96	5.17	6.18	11.36	137.90	426.10	
12	0.52	0.41	1.15	0.93	2.07	20.00	61.80	>10
	3.55	2.83	7.89	6.39	14.28	137.90	426.10	
13	1.04	0.92	1.41	1.96	3.37	20.00	61.80	>10
	7.17	6.32	9.73	13.50	23.22	137.90	426.10	

14	0.98	0.98	1.20	1.96	3.17	20.00	66.30	>10
	6.76	6.78	8.30	13.53	21.83	137.90	457.12	
15	3.84	5.45	0.71	9.29	10.00	20.00	66.30	2.23
	26.44	37.58	4.91	64.02	68.93	137.90	457.12	
16	2.32	3.39	0.28	5.72	5.99	20.00	66.30	4.25
	16.01	23.40	1.90	39.41	41.31	137.90	457.12	
17	1.64	2.46	0.18	4.10	4.28	20.00	66.30	6.32
	11.32	16.94	1.23	28.26	29.49	137.90	457.12	
18	1.94	3.00	0.33	4.94	5.27	20.00	66.30	5.07
	13.41	20.68	2.25	34.09	36.34	137.90	457.12	
19	3.11	4.80	0.45	7.92	8.37	20.00	66.30	2.79
	21.47	33.11	3.10	54.57	57.68	137.90	457.12	
20	2.54	4.71	0.98	7.25	8.23	20.00	61.80	3.14
	17.53	32.47	6.72	50.00	56.73	137.90	426.10	
21	0.22	0.47	0.06	0.69	0.75	20.00	66.30	>10
	1.55	3.21	0.44	4.76	5.19	137.90	457.12	
22	1.97	2.34	0.06	4.31	4.37	20.00	66.30	5.96
	13.59	16.13	0.41	29.72	30.13	137.90	457.12	

Min MS: 1.196, Location: 4, Combination: Pm+Pb

**Table 2-291. Load Combination 102, Cold Environment,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 104, 201, 211
 -40°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.02	1.46	1.48	20.00	70.00	>10
	4.14	5.93	0.10	10.07	10.17	137.90	482.63	
2	0.04	0.03	0.01	0.07	0.08	20.00	70.00	>10
	0.28	0.19	0.08	0.47	0.56	137.90	482.63	
3	0.03	0.02	0.02	0.05	0.06	20.00	70.00	>10
	0.17	0.16	0.11	0.33	0.44	137.90	482.63	
4	4.94	8.72	1.03	13.66	14.69	20.00	70.00	1.20
	34.09	60.09	7.11	94.18	101.29	137.90	482.63	
5	4.28	6.97	1.45	11.24	12.69	20.00	70.00	1.67
	29.48	48.05	10.00	77.52	87.53	137.90	482.63	
6	1.66	2.27	0.69	3.93	4.62	20.00	70.00	6.63
	11.45	15.65	4.73	27.10	31.82	137.90	482.63	
7	0.29	0.01	0.31	0.29	0.61	20.00	70.00	>10
	1.97	0.05	2.16	2.02	4.18	137.90	482.63	
8	0.28	0.00	0.31	0.28	0.60	20.00	70.00	>10
	1.96	0.00	2.16	1.96	4.12	137.90	482.63	
9	0.28	0.01	0.31	0.30	0.61	20.00	70.00	>10
	1.96	0.08	2.16	2.04	4.21	137.90	482.63	
10	0.98	1.01	0.37	1.99	2.36	20.00	70.00	>10
	6.76	6.95	2.55	13.72	16.26	137.90	482.63	
11	0.61	0.28	0.20	0.90	1.10	20.00	70.00	>10
	4.22	1.96	1.37	6.18	7.55	137.90	482.63	
12	0.52	0.41	0.15	0.93	1.08	20.00	70.00	>10
	3.55	2.83	1.03	6.39	7.41	137.90	482.63	
13	1.04	0.92	0.65	1.96	2.61	20.00	70.00	>10
	7.17	6.32	4.51	13.50	18.01	137.90	482.63	

14	0.98	0.98	0.53	1.96	2.50	20.00	70.00	>10
	6.76	6.78	3.68	13.53	17.21	137.90	482.63	
15	3.84	5.45	0.07	9.29	9.36	20.00	70.00	2.23
	26.44	37.58	0.49	64.02	64.50	137.90	482.63	
16	2.32	3.39	0.26	5.72	5.97	20.00	70.00	4.25
	16.01	23.40	1.77	39.41	41.18	137.90	482.63	
17	1.64	2.46	0.20	4.10	4.30	20.00	70.00	6.32
	11.32	16.94	1.41	28.26	29.67	137.90	482.63	
18	1.94	3.00	0.22	4.94	5.16	20.00	70.00	5.07
	13.41	20.68	1.51	34.09	35.60	137.90	482.63	
19	3.11	4.80	0.31	7.92	8.23	20.00	70.00	2.79
	21.47	33.11	2.16	54.57	56.74	137.90	482.63	
20	2.54	4.71	0.38	7.25	7.63	20.00	70.00	3.14
	17.53	32.47	2.62	50.00	52.63	137.90	482.63	
21	0.22	0.47	0.17	0.69	0.86	20.00	70.00	>10
	1.55	3.21	1.17	4.76	5.93	137.90	482.63	
22	1.97	2.34	0.02	4.31	4.33	20.00	70.00	5.96
	13.59	16.13	0.15	29.72	29.88	137.90	482.63	

Min MS: 1.196, Location: 4, Combination: Pm+Pb

**Table 2-292. Load Combination 103, Increased External Pressure,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 103, 202, 211
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.59	0.85	0.01	1.43	1.45	20.00	70.00	>10
	4.05	5.84	0.09	9.89	9.98	137.90	482.63	
2	0.03	0.03	0.01	0.06	0.07	20.00	70.00	>10
	0.23	0.18	0.07	0.41	0.48	137.90	482.63	
3	0.01	0.00	0.01	0.02	0.03	20.00	70.00	>10
	0.08	0.03	0.09	0.11	0.20	137.90	482.63	
4	0.91	1.59	0.84	2.50	3.34	20.00	70.00	>10
	6.29	10.94	5.82	17.23	23.04	137.90	482.63	
5	0.95	1.47	1.19	2.42	3.61	20.00	70.00	>10
	6.55	10.13	8.18	16.68	24.86	137.90	482.63	
6	0.39	0.65	0.56	1.04	1.60	20.00	70.00	>10
	2.70	4.46	3.87	7.16	11.02	137.90	482.63	
7	0.15	0.00	0.26	0.16	0.41	20.00	70.00	>10
	1.06	0.01	1.77	1.07	2.84	137.90	482.63	
8	0.15	0.00	0.26	0.15	0.41	20.00	70.00	>10
	1.06	0.00	1.77	1.06	2.83	137.90	482.63	
9	0.15	0.00	0.26	0.15	0.41	20.00	70.00	>10
	1.06	0.00	1.77	1.06	2.83	137.90	482.63	
10	0.20	0.09	0.30	0.29	0.59	20.00	70.00	>10
	1.37	0.60	2.08	1.97	4.05	137.90	482.63	
11	0.11	0.07	0.16	0.18	0.34	20.00	70.00	>10
	0.75	0.46	1.12	1.21	2.33	137.90	482.63	
12	0.08	0.01	0.12	0.08	0.21	20.00	70.00	>10
	0.52	0.06	0.84	0.58	1.42	137.90	482.63	
13	0.35	0.36	0.54	0.71	1.25	20.00	70.00	>10
	2.44	2.48	3.69	4.92	8.61	137.90	482.63	

14	0.34 2.33	0.29 2.03	0.44 3.01	0.63 4.36	1.07 7.37	20.00 137.90	70.00 482.63	>10
15	0.49 3.37	0.28 1.95	0.06 0.40	0.77 5.32	0.83 5.72	20.00 137.90	70.00 482.63	>10
16	0.14 0.98	0.20 1.41	0.21 1.45	0.35 2.39	0.56 3.84	20.00 137.90	70.00 482.63	>10
17	0.10 0.71	0.16 1.08	0.17 1.15	0.26 1.78	0.43 2.94	20.00 137.90	70.00 482.63	>10
18	0.19 1.28	0.31 2.11	0.18 1.24	0.49 3.38	0.67 4.62	20.00 137.90	70.00 482.63	>10
19	0.27 1.87	0.38 2.59	0.26 1.77	0.65 4.46	0.90 6.23	20.00 137.90	70.00 482.63	>10
20	0.27 1.88	0.45 3.08	0.31 2.15	0.72 4.96	1.03 7.11	20.00 137.90	70.00 482.63	>10
21	0.05 0.37	0.09 0.62	0.14 0.96	0.14 0.99	0.28 1.95	20.00 137.90	70.00 482.63	>10
22	0.35 2.38	0.08 0.56	0.02 0.13	0.43 2.95	0.45 3.07	20.00 137.90	70.00 482.63	>10

Min MS: 11.006, Location: 4, Combination: Pm+Pb

**Table 2-293. Load Combination 104, Minimum External Pressure,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 101, 201, 202, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.30	1.46	1.76	20.00	66.30	>10
	4.15	5.93	2.07	10.08	12.15	137.90	457.12	
2	0.04	0.03	0.45	0.07	0.52	20.00	66.30	>10
	0.29	0.19	3.10	0.48	3.58	137.90	457.12	
3	0.03	0.02	0.30	0.05	0.35	20.00	66.30	>10
	0.18	0.16	2.05	0.34	2.39	137.90	457.12	
4	5.07	8.91	3.16	13.98	17.14	20.00	66.30	1.15
	34.94	61.47	21.76	96.40	118.17	137.90	457.12	
5	4.36	7.11	3.43	11.48	14.91	20.00	66.30	1.61
	30.08	49.05	23.66	79.12	102.79	137.90	457.12	
6	1.69	2.30	1.47	3.99	5.46	20.00	66.30	6.52
	11.65	15.84	10.16	27.49	37.65	137.90	457.12	
7	0.29	0.01	0.44	0.30	0.74	20.00	66.30	>10
	2.00	0.05	3.05	2.05	5.11	137.90	457.12	
8	0.29	0.00	0.44	0.29	0.73	20.00	66.30	>10
	2.00	0.00	3.05	2.00	5.05	137.90	457.12	
9	0.29	0.01	0.44	0.30	0.74	20.00	66.30	>10
	2.00	0.08	3.05	2.08	5.13	137.90	457.12	
10	1.02	1.05	0.61	2.08	2.69	20.00	66.30	>10
	7.07	7.26	4.21	14.33	18.54	137.90	457.12	
11	0.64	0.29	0.79	0.93	1.72	20.00	66.30	>10
	4.39	2.01	5.46	6.41	11.86	137.90	457.12	
12	0.55	0.41	1.20	0.96	2.16	20.00	66.30	>10
	3.80	2.84	8.28	6.64	14.92	137.90	457.12	

13	1.09 7.49	0.96 6.59	1.49 10.26	2.04 14.08	3.53 24.35	20.00 137.90	66.30 457.12	>10
14	1.02 7.03	1.03 7.07	1.27 8.76	2.05 14.10	3.32 22.87	20.00 137.90	66.30 457.12	>10
15	4.01 27.65	5.72 39.44	0.51 3.51	9.73 67.09	10.24 70.60	20.00 137.90	66.30 457.12	2.08
16	2.44 16.82	3.57 24.59	0.19 1.29	6.01 41.41	6.19 42.69	20.00 137.90	66.30 457.12	4.00
17	1.72 11.89	2.58 17.79	0.13 0.89	4.31 29.68	4.43 30.57	20.00 137.90	66.30 457.12	5.97
18	2.04 14.08	3.15 21.70	0.34 2.35	5.19 35.78	5.53 38.13	20.00 137.90	66.30 457.12	4.78
19	3.27 22.55	5.05 34.79	0.44 3.01	8.32 57.34	8.75 60.35	20.00 137.90	66.30 457.12	2.61
20	2.67 18.40	4.95 34.10	1.02 7.05	7.61 52.50	8.64 59.55	20.00 137.90	66.30 457.12	2.94
21	0.25 1.73	0.49 3.39	0.06 0.45	0.74 5.12	0.81 5.57	20.00 137.90	66.30 457.12	>10
22	2.04 14.04	2.42 16.67	0.06 0.39	4.45 30.71	4.51 31.10	20.00 137.90	66.30 457.12	5.74

Min MS: 1.146, Location: 4, Combination: Pm+Pb

Table 2-294. Load Combination 105, Cold Environment with Maximum Decay Heat, Normal Conditions of Transport – Model AOS-100B

Load Cases: 105, 201, 202, 211
 -40°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.60	0.86	0.33	1.46	1.79	20.00	70.00	>10
	4.15	5.93	2.24	10.08	12.32	137.90	482.63	
2	0.04	0.03	0.48	0.07	0.55	20.00	70.00	>10
	0.29	0.19	3.32	0.48	3.80	137.90	482.63	
3	0.03	0.02	0.32	0.05	0.37	20.00	70.00	>10
	0.18	0.16	2.22	0.34	2.57	137.90	482.63	
4	5.07	8.91	3.51	13.98	17.49	20.00	70.00	1.15
	34.94	61.47	24.18	96.40	120.59	137.90	482.63	
5	4.36	7.11	3.81	11.48	15.29	20.00	70.00	1.61
	30.08	49.05	26.27	79.12	105.39	137.90	482.63	
6	1.69	2.30	1.64	3.99	5.63	20.00	70.00	6.52
	11.65	15.84	11.34	27.49	38.83	137.90	482.63	
7	0.29	0.01	0.48	0.30	0.78	20.00	70.00	>10
	2.00	0.05	3.32	2.05	5.37	137.90	482.63	
8	0.29	0.00	0.48	0.29	0.77	20.00	70.00	>10
	2.00	0.00	3.32	2.00	5.31	137.90	482.63	
9	0.29	0.01	0.48	0.30	0.78	20.00	70.00	>10
	2.00	0.08	3.31	2.08	5.39	137.90	482.63	
10	1.02	1.05	0.66	2.08	2.74	20.00	70.00	>10
	7.07	7.26	4.58	14.33	18.91	137.90	482.63	
11	0.64	0.29	0.85	0.93	1.78	20.00	70.00	>10
	4.39	2.01	5.86	6.41	12.26	137.90	482.63	
12	0.55	0.41	1.29	0.96	2.25	20.00	70.00	>10
	3.80	2.84	8.90	6.64	15.53	137.90	482.63	

13	1.09 7.49	0.96 6.59	1.60 11.01	2.04 14.08	3.64 25.09	20.00 137.90	70.00 482.63	>10
14	1.02 7.03	1.03 7.07	1.37 9.41	2.05 14.10	3.41 23.52	20.00 137.90	70.00 482.63	>10
15	4.01 27.65	5.72 39.44	0.10 0.69	9.73 67.09	9.83 67.78	20.00 137.90	70.00 482.63	2.08
16	2.44 16.82	3.57 24.59	0.04 0.27	6.01 41.41	6.04 41.68	20.00 137.90	70.00 482.63	4.00
17	1.72 11.89	2.58 17.79	0.04 0.25	4.31 29.68	4.34 29.93	20.00 137.90	70.00 482.63	5.97
18	2.04 14.08	3.15 21.70	0.38 2.62	5.19 35.78	5.57 38.40	20.00 137.90	70.00 482.63	4.78
19	3.27 22.55	5.05 34.79	0.45 3.09	8.32 57.34	8.76 60.43	20.00 137.90	70.00 482.63	2.61
20	2.67 18.40	4.95 34.10	1.13 7.80	7.61 52.50	8.75 60.30	20.00 137.90	70.00 482.63	2.94
21	0.25 1.73	0.49 3.39	0.09 0.60	0.74 5.12	0.83 5.72	20.00 137.90	70.00 482.63	>10
22	2.04 14.04	2.42 16.67	0.09 0.61	4.45 30.71	4.54 31.32	20.00 137.90	70.00 482.63	5.74

Min MS: 1.146, Location: 4, Combination: Pm+Pb

**Table 2-295. Load Combination 106, Maximum Pressure, Hot Environment,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 101, 201, 203, 211
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Maximum Increased External Pressure, 140 kPa (20 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.87	0.30	1.48	1.78	20.00	66.30	>10
	4.22	5.97	2.07	10.19	12.26	137.90	457.12	
2	0.05	0.03	0.45	0.08	0.53	20.00	66.30	>10
	0.36	0.19	3.10	0.54	3.65	137.90	457.12	
3	0.04	0.03	0.30	0.07	0.36	20.00	66.30	>10
	0.25	0.21	2.05	0.46	2.51	137.90	457.12	
4	5.19	9.19	3.16	14.38	17.53	20.00	66.30	1.09
	35.77	63.35	21.76	99.13	120.89	137.90	457.12	
5	4.56	7.38	3.43	11.94	15.37	20.00	66.30	1.51
	31.46	50.88	23.66	82.33	106.00	137.90	457.12	
6	1.78	2.47	1.47	4.25	5.72	20.00	66.30	6.06
	12.27	17.02	10.16	29.29	39.45	137.90	457.12	
7	0.35	0.01	0.44	0.36	0.80	20.00	66.30	>10
	2.40	0.06	3.05	2.46	5.52	137.90	457.12	
8	0.35	0.00	0.44	0.35	0.79	20.00	66.30	>10
	2.40	0.00	3.05	2.40	5.45	137.90	457.12	
9	0.35	0.01	0.44	0.36	0.80	20.00	66.30	>10
	2.40	0.08	3.05	2.48	5.53	137.90	457.12	
10	1.05	1.01	0.61	2.06	2.67	20.00	66.30	>10
	7.24	6.97	4.21	14.21	18.42	137.90	457.12	
11	0.64	0.30	0.79	0.94	1.73	20.00	66.30	>10
	4.41	2.07	5.46	6.48	11.94	137.90	457.12	
12	0.64	0.55	1.20	1.19	2.39	20.00	66.30	>10
	4.42	3.79	8.28	8.20	16.49	137.90	457.12	

13	1.13 7.80	1.01 6.94	1.49 10.26	2.14 14.73	3.63 25.00	20.00 137.90	66.30 457.12	>10
14	1.05 7.23	1.04 7.15	1.27 8.76	2.09 14.38	3.36 23.14	20.00 137.90	66.30 457.12	>10
15	4.02 27.71	5.67 39.09	0.51 3.51	9.69 66.80	10.20 70.31	20.00 137.90	66.30 457.12	2.10
16	2.46 16.99	3.60 24.85	0.19 1.29	6.07 41.84	6.26 43.13	20.00 137.90	66.30 457.12	3.94
17	1.74 12.01	2.62 18.04	0.13 0.89	4.36 30.06	4.49 30.94	20.00 137.90	66.30 457.12	5.88
18	2.05 14.15	3.17 21.86	0.34 2.35	5.22 36.01	5.56 38.36	20.00 137.90	66.30 457.12	4.74
19	3.28 22.63	5.05 34.84	0.44 3.01	8.34 57.47	8.77 60.49	20.00 137.90	66.30 457.12	2.60
20	2.67 18.42	4.95 34.14	1.02 7.05	7.62 52.55	8.64 59.60	20.00 137.90	66.30 457.12	2.94
21	0.36 2.46	0.54 3.71	0.06 0.45	0.90 6.18	0.96 6.62	20.00 137.90	66.30 457.12	>10
22	2.02 13.93	2.36 16.29	0.06 0.39	4.38 30.22	4.44 30.62	20.00 137.90	66.30 457.12	5.84

Min MS: 1.087, Location: 4, Combination: Pm+Pb

**Table 2-296. Load Combination 107, Maximum Pressure, Cold Environment,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 105, 201, 203, 211
-40°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Maximum Increased External Pressure, 140 kPa (20 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.87	0.33	1.48	1.80	20.00	70.00	>10
	4.22	5.97	2.24	10.19	12.43	137.90	482.63	
2	0.05	0.03	0.48	0.08	0.56	20.00	70.00	>10
	0.36	0.19	3.32	0.54	3.86	137.90	482.63	
3	0.04	0.03	0.32	0.07	0.39	20.00	70.00	>10
	0.25	0.21	2.22	0.46	2.68	137.90	482.63	
4	5.19	9.19	3.51	14.38	17.88	20.00	70.00	1.09
	35.77	63.35	24.18	99.13	123.31	137.90	482.63	
5	4.56	7.38	3.81	11.94	15.75	20.00	70.00	1.51
	31.46	50.88	26.27	82.33	108.60	137.90	482.63	
6	1.78	2.47	1.64	4.25	5.89	20.00	70.00	6.06
	12.27	17.02	11.34	29.29	40.63	137.90	482.63	
7	0.35	0.01	0.48	0.36	0.84	20.00	70.00	>10
	2.40	0.06	3.32	2.46	5.78	137.90	482.63	
8	0.35	0.00	0.48	0.35	0.83	20.00	70.00	>10
	2.40	0.00	3.32	2.40	5.72	137.90	482.63	
9	0.35	0.01	0.48	0.36	0.84	20.00	70.00	>10
	2.40	0.08	3.31	2.48	5.80	137.90	482.63	
10	1.05	1.01	0.66	2.06	2.73	20.00	70.00	>10
	7.24	6.97	4.58	14.21	18.79	137.90	482.63	
11	0.64	0.30	0.85	0.94	1.79	20.00	70.00	>10
	4.41	2.07	5.86	6.48	12.34	137.90	482.63	
12	0.64	0.55	1.29	1.19	2.48	20.00	70.00	>10
	4.42	3.79	8.90	8.20	17.10	137.90	482.63	

13	1.13 7.80	1.01 6.94	1.60 11.01	2.14 14.73	3.73 25.74	20.00 137.90	70.00 482.63	>10
14	1.05 7.23	1.04 7.15	1.37 9.41	2.09 14.38	3.45 23.79	20.00 137.90	70.00 482.63	>10
15	4.02 27.71	5.67 39.09	0.10 0.69	9.69 66.80	9.79 67.49	20.00 137.90	70.00 482.63	2.10
16	2.46 16.99	3.60 24.85	0.04 0.27	6.07 41.84	6.11 42.12	20.00 137.90	70.00 482.63	3.94
17	1.74 12.01	2.62 18.04	0.04 0.25	4.36 30.06	4.40 30.30	20.00 137.90	70.00 482.63	5.88
18	2.05 14.15	3.17 21.86	0.38 2.62	5.22 36.01	5.60 38.63	20.00 137.90	70.00 482.63	4.74
19	3.28 22.63	5.05 34.84	0.45 3.09	8.34 57.47	8.78 60.56	20.00 137.90	70.00 482.63	2.60
20	2.67 18.42	4.95 34.14	1.13 7.80	7.62 52.55	8.75 60.36	20.00 137.90	70.00 482.63	2.94
21	0.36 2.46	0.54 3.71	0.09 0.60	0.90 6.18	0.98 6.77	20.00 137.90	70.00 482.63	>10
22	2.02 13.93	2.36 16.29	0.09 0.61	4.38 30.22	4.47 30.83	20.00 137.90	70.00 482.63	5.84

Min MS: 1.087, Location: 4, Combination: Pm+Pb

**Table 2-297. Load Combination 215, Compression Load,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 215, 101, 201, 211
 Compression Load (5x weight)
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.73	1.05	0.30	1.79	2.09	20.00	66.30	>10
	5.04	7.27	2.07	12.31	14.38	137.90	457.12	
2	0.14	0.03	0.45	0.17	0.62	20.00	66.30	>10
	0.98	0.21	3.10	1.18	4.28	137.90	457.12	
3	0.14	0.06	0.30	0.20	0.49	20.00	66.30	>10
	0.94	0.40	2.05	1.35	3.40	137.90	457.12	
4	5.59	9.90	3.16	15.48	18.64	20.00	66.30	0.94
	38.54	68.23	21.76	106.76	128.52	137.90	457.12	
5	4.96	7.92	3.43	12.88	16.31	20.00	66.30	1.33
	34.19	54.64	23.66	88.82	112.49	137.90	457.12	
6	1.93	2.59	1.47	4.52	6.00	20.00	66.30	5.63
	13.29	17.89	10.16	31.18	41.34	137.90	457.12	
7	0.49	0.01	0.44	0.50	0.94	20.00	66.30	>10
	3.39	0.06	3.05	3.46	6.51	137.90	457.12	
8	0.45	0.00	0.44	0.45	0.89	20.00	66.30	>10
	3.10	0.00	3.05	3.10	6.15	137.90	457.12	
9	0.43	0.01	0.44	0.44	0.89	20.00	66.30	>10
	2.98	0.08	3.05	3.06	6.11	137.90	457.12	
10	1.13	1.01	0.61	2.14	2.75	20.00	66.30	>10
	7.77	6.97	4.21	14.73	18.95	137.90	457.12	
11	0.67	0.34	0.79	1.01	1.81	20.00	66.30	>10
	4.62	2.37	5.46	6.99	12.45	137.90	457.12	
12	0.59	0.51	1.20	1.09	2.30	20.00	66.30	>10
	4.04	3.50	8.28	7.54	15.83	137.90	457.12	

13	1.28 8.80	1.14 7.88	1.49 10.26	2.42 16.68	3.91 26.95	20.00 137.90	66.30 457.12	>10
14	1.18 8.13	1.16 8.02	1.27 8.76	2.34 16.15	3.61 24.91	20.00 137.90	66.30 457.12	>10
15	6.01 41.41	5.59 38.53	0.51 3.51	11.59 79.94	12.10 83.45	20.00 137.90	66.30 457.12	1.59
16	2.91 20.07	4.20 28.93	0.19 1.29	7.11 49.00	7.29 50.28	20.00 137.90	66.30 457.12	3.22
17	1.98 13.64	2.97 20.48	0.13 0.89	4.95 34.12	5.08 35.01	20.00 137.90	66.30 457.12	5.06
18	2.14 14.77	3.29 22.70	0.34 2.35	5.43 37.47	5.77 39.81	20.00 137.90	66.30 457.12	4.52
19	3.52 24.29	5.36 36.94	0.44 3.01	8.88 61.23	9.32 64.24	20.00 137.90	66.30 457.12	2.38
20	3.04 20.95	5.56 38.34	1.02 7.05	8.60 59.29	9.62 66.33	20.00 137.90	66.30 457.12	2.49
21	0.35 2.45	0.53 3.67	0.06 0.45	0.89 6.12	0.95 6.56	20.00 137.90	66.30 457.12	>10
22	2.57 17.70	2.48 17.09	0.06 0.39	5.05 34.80	5.10 35.19	20.00 137.90	66.30 457.12	4.94

Min MS: 0.937, Location: 4, Combination: Pm+Pb

**Table 2-298. Load Combination 216, Rod Drop,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 216, 101, 201, 211
Rod Drop onto Cask
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.63 4.31	0.87 6.02	0.30 2.07	1.50 10.33	1.80 12.40	20.00 137.90	66.30 457.12	>10
2	0.06 0.39	0.03 0.23	0.45 3.10	0.09 0.62	0.54 3.72	20.00 137.90	66.30 457.12	>10
3	0.04 0.28	0.02 0.17	0.30 2.05	0.06 0.45	0.36 2.50	20.00 137.90	66.30 457.12	>10
4	5.06 34.91	8.86 61.06	3.16 21.76	13.92 95.97	17.08 117.73	20.00 137.90	66.30 457.12	1.16
5	4.34 29.95	7.02 48.40	3.43 23.66	11.36 78.35	14.80 102.02	20.00 137.90	66.30 457.12	1.64
6	1.74 12.00	2.32 16.01	1.47 10.16	4.06 28.01	5.54 38.17	20.00 137.90	66.30 457.12	6.38
7	0.34 2.32	0.01 0.06	0.44 3.05	0.34 2.38	0.79 5.43	20.00 137.90	66.30 457.12	>10
8	0.32 2.20	0.00 0.00	0.44 3.05	0.32 2.21	0.76 5.26	20.00 137.90	66.30 457.12	>10
9	0.31 2.14	0.01 0.08	0.44 3.05	0.32 2.22	0.76 5.27	20.00 137.90	66.30 457.12	>10
10	1.00 6.90	1.01 6.97	0.61 4.21	2.01 13.87	2.62 18.08	20.00 137.90	66.30 457.12	>10
11	0.62 4.27	0.29 2.02	0.79 5.46	0.91 6.29	1.70 11.75	20.00 137.90	66.30 457.12	>10
12	0.52 3.61	0.42 2.89	1.20 8.28	0.94 6.50	2.14 14.78	20.00 137.90	66.30 457.12	>10

13	1.07 7.38	0.94 6.50	1.49 10.26	2.01 13.89	3.50 24.15	20.00 137.90	66.30 457.12	>10
14	1.01 6.94	1.01 6.96	1.27 8.76	2.02 13.90	3.29 22.66	20.00 137.90	66.30 457.12	>10
15	7.90 54.46	6.20 42.74	0.51 3.51	14.10 97.21	14.61 100.71	20.00 137.90	66.30 457.12	1.13
16	2.82 19.48	4.16 28.65	0.19 1.29	6.98 48.13	7.17 49.41	20.00 137.90	66.30 457.12	3.30
17	1.93 13.31	2.97 20.46	0.13 0.89	4.90 33.78	5.03 34.66	20.00 137.90	66.30 457.12	5.12
18	2.03 13.99	3.00 20.71	0.34 2.35	5.03 34.70	5.37 37.05	20.00 137.90	66.30 457.12	4.96
19	3.20 22.05	4.90 33.78	0.44 3.01	8.10 55.83	8.53 58.84	20.00 137.90	66.30 457.12	2.71
20	2.65 18.29	4.86 33.53	1.02 7.05	7.52 51.82	8.54 58.86	20.00 137.90	66.30 457.12	2.99
21	0.23 1.58	0.47 3.23	0.06 0.45	0.70 4.80	0.76 5.25	20.00 137.90	66.30 457.12	>10
22	5.99 41.29	7.10 48.95	0.06 0.39	13.09 90.24	13.15 90.63	20.00 137.90	66.30 457.12	1.29

Min MS: 1.128, Location: 15, Combination: Pm+Pb

**Table 2-299. Load Combination 217, Rod Drop, Cold Environment,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 216, 104, 201, 211

Rod Drop onto Cask

-40°F Ambient, Zero Decay Heat, Zero Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.63	0.87	0.02	1.50	1.51	20.00	70.00	>10
	4.31	6.02	0.10	10.33	10.43	137.90	482.63	
2	0.06	0.03	0.01	0.09	0.10	20.00	70.00	>10
	0.39	0.23	0.08	0.62	0.70	137.90	482.63	
3	0.04	0.02	0.02	0.06	0.08	20.00	70.00	>10
	0.28	0.17	0.11	0.45	0.56	137.90	482.63	
4	5.06	8.86	1.03	13.92	14.95	20.00	70.00	1.16
	34.91	61.06	7.11	95.97	103.08	137.90	482.63	
5	4.34	7.02	1.45	11.36	12.81	20.00	70.00	1.64
	29.95	48.40	10.00	78.35	88.36	137.90	482.63	
6	1.74	2.32	0.69	4.06	4.75	20.00	70.00	6.38
	12.00	16.01	4.73	28.01	32.74	137.90	482.63	
7	0.34	0.01	0.31	0.34	0.66	20.00	70.00	>10
	2.32	0.06	2.16	2.38	4.54	137.90	482.63	
8	0.32	0.00	0.31	0.32	0.63	20.00	70.00	>10
	2.20	0.00	2.16	2.21	4.37	137.90	482.63	
9	0.31	0.01	0.31	0.32	0.64	20.00	70.00	>10
	2.14	0.08	2.16	2.22	4.38	137.90	482.63	
10	1.00	1.01	0.37	2.01	2.38	20.00	70.00	>10
	6.90	6.97	2.55	13.87	16.42	137.90	482.63	
11	0.62	0.29	0.20	0.91	1.11	20.00	70.00	>10
	4.27	2.02	1.37	6.29	7.66	137.90	482.63	
12	0.52	0.42	0.15	0.94	1.09	20.00	70.00	>10
	3.61	2.89	1.03	6.50	7.52	137.90	482.63	

13	1.07 7.38	0.94 6.50	0.65 4.51	2.01 13.89	2.67 18.40	20.00 137.90	70.00 482.63	>10
14	1.01 6.94	1.01 6.96	0.53 3.68	2.02 13.90	2.55 17.58	20.00 137.90	70.00 482.63	>10
15	7.90 54.46	6.20 42.74	0.07 0.49	14.10 97.21	14.17 97.69	20.00 137.90	70.00 482.63	1.13
16	2.82 19.48	4.16 28.65	0.26 1.77	6.98 48.13	7.24 49.89	20.00 137.90	70.00 482.63	3.30
17	1.93 13.31	2.97 20.46	0.20 1.41	4.90 33.78	5.10 35.19	20.00 137.90	70.00 482.63	5.12
18	2.03 13.99	3.00 20.71	0.22 1.51	5.03 34.70	5.25 36.21	20.00 137.90	70.00 482.63	4.96
19	3.20 22.05	4.90 33.78	0.31 2.16	8.10 55.83	8.41 57.99	20.00 137.90	70.00 482.63	2.71
20	2.65 18.29	4.86 33.53	0.38 2.62	7.52 51.82	7.90 54.44	20.00 137.90	70.00 482.63	2.99
21	0.23 1.58	0.47 3.23	0.17 1.17	0.70 4.80	0.87 5.98	20.00 137.90	70.00 482.63	>10
22	5.99 41.29	7.10 48.95	0.02 0.15	13.09 90.24	13.11 90.39	20.00 137.90	70.00 482.63	1.29

Min MS: 1.128, Location: 15, Combination: Pm+Pb

**Table 2-300. Load Combination 221, Forward Vibration,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 221, 101, 201, 211
Forward 10g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.93	0.93	0.30	1.86	2.16	20.00	66.30	>10
	6.40	6.40	2.07	12.80	14.87	137.90	457.12	
2	0.88	0.23	0.45	1.11	1.56	20.00	66.30	>10
	6.04	1.62	3.10	7.66	10.76	137.90	457.12	
3	0.32	0.12	0.30	0.45	0.74	20.00	66.30	>10
	2.22	0.85	2.05	3.08	5.13	137.90	457.12	
4	5.49	9.02	3.16	14.51	17.66	20.00	66.30	1.07
	37.84	62.17	21.76	100.01	121.77	137.90	457.12	
5	4.67	7.10	3.43	11.77	15.20	20.00	66.30	1.55
	32.17	48.98	23.66	81.15	104.82	137.90	457.12	
6	1.87	2.33	1.47	4.20	5.67	20.00	66.30	6.14
	12.92	16.03	10.16	28.96	39.12	137.90	457.12	
7	0.35	0.03	0.44	0.38	0.82	20.00	66.30	>10
	2.40	0.19	3.05	2.60	5.65	137.90	457.12	
8	0.35	0.02	0.44	0.37	0.81	20.00	66.30	>10
	2.38	0.15	3.05	2.53	5.58	137.90	457.12	
9	0.34	0.04	0.44	0.38	0.82	20.00	66.30	>10
	2.35	0.24	3.05	2.59	5.64	137.90	457.12	
10	1.10	1.15	0.61	2.25	2.86	20.00	66.30	>10
	7.58	7.91	4.21	15.49	19.71	137.90	457.12	
11	0.79	0.34	0.79	1.13	1.92	20.00	66.30	>10
	5.42	2.34	5.46	7.76	13.22	137.90	457.12	
12	0.68	0.45	1.20	1.12	2.32	20.00	66.30	>10
	4.67	3.07	8.28	7.74	16.03	137.90	457.12	

13	1.35 9.31	0.94 6.46	1.49 10.26	2.29 15.77	3.78 26.04	20.00 137.90	66.30 457.12	>10
14	1.30 8.93	1.08 7.45	1.27 8.76	2.38 16.39	3.65 25.15	20.00 137.90	66.30 457.12	>10
15	4.03 27.77	5.61 38.70	0.51 3.51	9.64 66.47	10.15 69.98	20.00 137.90	66.30 457.12	2.11
16	2.47 17.06	3.53 24.32	0.19 1.29	6.00 41.38	6.19 42.67	20.00 137.90	66.30 457.12	4.00
17	1.78 12.26	2.52 17.36	0.13 0.89	4.30 29.62	4.42 30.50	20.00 137.90	66.30 457.12	5.98
18	2.06 14.22	3.09 21.30	0.34 2.35	5.15 35.52	5.49 37.87	20.00 137.90	66.30 457.12	4.82
19	3.36 23.13	4.87 33.55	0.44 3.01	8.22 56.68	8.66 59.69	20.00 137.90	66.30 457.12	2.65
20	2.83 19.48	4.84 33.40	1.02 7.05	7.67 52.88	8.69 59.93	20.00 137.90	66.30 457.12	2.91
21	0.46 3.20	0.53 3.63	0.06 0.45	0.99 6.83	1.06 7.28	20.00 137.90	66.30 457.12	>10
22	2.12 14.64	2.39 16.47	0.06 0.39	4.51 31.11	4.57 31.50	20.00 137.90	66.30 457.12	5.65

Min MS: 1.068, Location: 4, Combination: Pm+Pb

**Table 2-301. Load Combination 222, Lateral Vibration,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 222, 101, 201, 211
Lateral 5g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.68	0.89	0.30	1.57	1.87	20.00	66.30	>10
	4.71	6.13	2.07	10.83	12.90	137.90	457.12	
2	0.11	0.06	0.45	0.17	0.62	20.00	66.30	>10
	0.78	0.38	3.10	1.16	4.26	137.90	457.12	
3	0.11	0.05	0.30	0.16	0.46	20.00	66.30	>10
	0.74	0.35	2.05	1.09	3.14	137.90	457.12	
4	5.02	8.77	3.16	13.79	16.94	20.00	66.30	1.18
	34.60	60.46	21.76	95.06	116.83	137.90	457.12	
5	4.35	7.00	3.43	11.35	14.78	20.00	66.30	1.64
	29.97	48.28	23.66	78.26	101.92	137.90	457.12	
6	1.69	2.28	1.47	3.98	5.45	20.00	66.30	6.54
	11.68	15.74	10.16	27.43	37.59	137.90	457.12	
7	0.29	0.01	0.44	0.30	0.74	20.00	66.30	>10
	2.00	0.06	3.05	2.06	5.11	137.90	457.12	
8	0.29	0.00	0.44	0.29	0.73	20.00	66.30	>10
	2.00	0.01	3.05	2.00	5.05	137.90	457.12	
9	0.29	0.01	0.44	0.30	0.74	20.00	66.30	>10
	2.00	0.09	3.05	2.09	5.14	137.90	457.12	
10	1.01	1.01	0.61	2.02	2.63	20.00	66.30	>10
	6.93	6.98	4.21	13.91	18.12	137.90	457.12	
11	0.63	0.30	0.79	0.92	1.71	20.00	66.30	>10
	4.31	2.04	5.46	6.35	11.81	137.90	457.12	
12	0.53	0.42	1.20	0.95	2.15	20.00	66.30	>10
	3.64	2.92	8.28	6.56	14.85	137.90	457.12	

13	1.08 7.46	0.93 6.38	1.49 10.26	2.01 13.84	3.50 24.10	20.00 137.90	66.30 457.12	>10
14	1.02 7.02	1.00 6.91	1.27 8.76	2.02 13.93	3.29 22.69	20.00 137.90	66.30 457.12	>10
15	3.93 27.08	5.54 38.18	0.51 3.51	9.47 65.26	9.97 68.77	20.00 137.90	66.30 457.12	2.17
16	2.34 16.17	3.40 23.41	0.19 1.29	5.74 39.58	5.93 40.86	20.00 137.90	66.30 457.12	4.23
17	1.66 11.42	2.46 16.95	0.13 0.89	4.11 28.36	4.24 29.25	20.00 137.90	66.30 457.12	6.29
18	1.96 13.54	3.01 20.76	0.34 2.35	4.97 34.30	5.31 36.65	20.00 137.90	66.30 457.12	5.03
19	3.14 21.68	4.81 33.13	0.44 3.01	7.95 54.81	8.39 57.82	20.00 137.90	66.30 457.12	2.77
20	2.57 17.71	4.72 32.53	1.02 7.05	7.29 50.25	8.31 57.29	20.00 137.90	66.30 457.12	3.12
21	0.25 1.74	0.49 3.41	0.06 0.45	0.75 5.15	0.81 5.59	20.00 137.90	66.30 457.12	>10
22	1.99 13.70	2.36 16.24	0.06 0.39	4.34 29.94	4.40 30.34	20.00 137.90	66.30 457.12	5.91

Min MS: 1.176, Location: 4, Combination: Pm+Pb

**Table 2-302. Load Combination 223, Vertical Vibration,
Normal Conditions of Transport – Model AOS-100B**

Load Cases: 223, 101, 201, 211
Vertical 2g Vibration Inertia Load
100°F Ambient, Maximum Decay Heat
Internal Design Pressure, 1,930 kPa (280 psia)
Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.86	0.30	1.47	1.77	20.00	66.30	>10
	4.19	5.94	2.07	10.14	12.21	137.90	457.12	
2	0.07	0.04	0.45	0.11	0.56	20.00	66.30	>10
	0.49	0.26	3.10	0.74	3.84	137.90	457.12	
3	0.06	0.04	0.30	0.09	0.39	20.00	66.30	>10
	0.39	0.24	2.05	0.63	2.68	137.90	457.12	
4	4.96	8.73	3.16	13.69	16.85	20.00	66.30	1.19
	34.22	60.19	21.76	94.41	116.17	137.90	457.12	
5	4.29	6.98	3.43	11.27	14.70	20.00	66.30	1.66
	29.57	48.12	23.66	77.69	101.35	137.90	457.12	
6	1.68	2.28	1.47	3.95	5.43	20.00	66.30	6.59
	11.55	15.71	10.16	27.26	37.42	137.90	457.12	
7	0.29	0.01	0.44	0.30	0.74	20.00	66.30	>10
	2.02	0.05	3.05	2.08	5.13	137.90	457.12	
8	0.30	0.00	0.44	0.30	0.74	20.00	66.30	>10
	2.04	0.00	3.05	2.04	5.09	137.90	457.12	
9	0.30	0.01	0.44	0.31	0.76	20.00	66.30	>10
	2.08	0.08	3.05	2.16	5.21	137.90	457.12	
10	1.01	1.01	0.61	2.02	2.63	20.00	66.30	>10
	6.96	6.99	4.21	13.94	18.15	137.90	457.12	
11	0.62	0.30	0.79	0.92	1.71	20.00	66.30	>10
	4.31	2.04	5.46	6.35	11.80	137.90	457.12	
12	0.53	0.43	1.20	0.97	2.17	20.00	66.30	>10
	3.67	2.99	8.28	6.66	14.95	137.90	457.12	

13	1.09 7.50	0.96 6.65	1.49 10.26	2.05 14.15	3.54 24.41	20.00 137.90	66.30 457.12	>10
14	1.02 7.05	1.01 6.99	1.27 8.76	2.04 14.04	3.31 22.80	20.00 137.90	66.30 457.12	>10
15	3.84 26.48	5.45 37.58	0.51 3.51	9.29 64.06	9.80 67.57	20.00 137.90	66.30 457.12	2.23
16	2.33 16.10	3.41 23.50	0.19 1.29	5.74 39.59	5.93 40.88	20.00 137.90	66.30 457.12	4.22
17	1.65 11.40	2.47 17.04	0.13 0.89	4.12 28.44	4.25 29.32	20.00 137.90	66.30 457.12	6.27
18	1.96 13.49	3.01 20.76	0.34 2.35	4.97 34.25	5.31 36.60	20.00 137.90	66.30 457.12	5.04
19	3.12 21.53	4.80 33.12	0.44 3.01	7.93 54.65	8.36 57.66	20.00 137.90	66.30 457.12	2.78
20	2.56 17.62	4.71 32.50	1.02 7.05	7.27 50.12	8.29 57.17	20.00 137.90	66.30 457.12	3.13
21	0.29 2.00	0.49 3.38	0.06 0.45	0.78 5.37	0.84 5.82	20.00 137.90	66.30 457.12	>10
22	1.98 13.65	2.35 16.24	0.06 0.39	4.34 29.89	4.39 30.28	20.00 137.90	66.30 457.12	5.92

Min MS: 1.191, Location: 4, Combination: Pm+Pb

Table 2-303. Load Combination 224, Forward Vibration at Cold Temperature, Normal Conditions of Transport – Models AOS-100B

Load Cases: 221, 103, 201, 211
 Forward 10g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.93	0.93	0.01	1.86	1.87	20.00	70.00	>10
	6.40	6.40	0.09	12.80	12.89	137.90	482.63	
2	0.88	0.23	0.01	1.11	1.12	20.00	70.00	>10
	6.04	1.62	0.07	7.66	7.73	137.90	482.63	
3	0.32	0.12	0.01	0.45	0.46	20.00	70.00	>10
	2.22	0.85	0.09	3.08	3.17	137.90	482.63	
4	5.49	9.02	0.84	14.51	15.35	20.00	70.00	1.07
	37.84	62.17	5.82	100.01	105.83	137.90	482.63	
5	4.67	7.10	1.19	11.77	12.96	20.00	70.00	1.55
	32.17	48.98	8.18	81.15	89.34	137.90	482.63	
6	1.87	2.33	0.56	4.20	4.76	20.00	70.00	6.14
	12.92	16.03	3.87	28.96	32.82	137.90	482.63	
7	0.35	0.03	0.26	0.38	0.63	20.00	70.00	>10
	2.40	0.19	1.77	2.60	4.37	137.90	482.63	
8	0.35	0.02	0.26	0.37	0.62	20.00	70.00	>10
	2.38	0.15	1.77	2.53	4.30	137.90	482.63	
9	0.34	0.04	0.26	0.38	0.63	20.00	70.00	>10
	2.35	0.24	1.77	2.59	4.36	137.90	482.63	
10	1.10	1.15	0.30	2.25	2.55	20.00	70.00	>10
	7.58	7.91	2.08	15.49	17.58	137.90	482.63	
11	0.79	0.34	0.16	1.13	1.29	20.00	70.00	>10
	5.42	2.34	1.12	7.76	8.88	137.90	482.63	
12	0.68	0.45	0.12	1.12	1.24	20.00	70.00	>10
	4.67	3.07	0.84	7.74	8.58	137.90	482.63	

13	1.35 9.31	0.94 6.46	0.54 3.69	2.29 15.77	2.82 19.47	20.00 137.90	70.00 482.63	>10
14	1.30 8.93	1.08 7.45	0.44 3.01	2.38 16.39	2.81 19.40	20.00 137.90	70.00 482.63	>10
15	4.03 27.77	5.61 38.70	0.06 0.40	9.64 66.47	9.70 66.87	20.00 137.90	70.00 482.63	2.11
16	2.47 17.06	3.53 24.32	0.21 1.45	6.00 41.38	6.21 42.83	20.00 137.90	70.00 482.63	4.00
17	1.78 12.26	2.52 17.36	0.17 1.15	4.30 29.62	4.46 30.77	20.00 137.90	70.00 482.63	5.98
18	2.06 14.22	3.09 21.30	0.18 1.24	5.15 35.52	5.33 36.76	20.00 137.90	70.00 482.63	4.82
19	3.36 23.13	4.87 33.55	0.26 1.77	8.22 56.68	8.48 58.45	20.00 137.90	70.00 482.63	2.65
20	2.83 19.48	4.84 33.40	0.31 2.15	7.67 52.88	7.98 55.02	20.00 137.90	70.00 482.63	2.91
21	0.46 3.20	0.53 3.63	0.14 0.96	0.99 6.83	1.13 7.79	20.00 137.90	70.00 482.63	>10
22	2.12 14.64	2.39 16.47	0.02 0.13	4.51 31.11	4.53 31.23	20.00 137.90	70.00 482.63	5.65

Min MS: 1.068, Location: 4, Combination: Pm+Pb

Table 2-304. Load Combination 225, Lateral Vibration at Cold Temperature, Normal Conditions of Transport – Models AOS-100B

Load Cases: 222, 103, 201, 211
 Lateral 5g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.68	0.89	0.01	1.57	1.58	20.00	70.00	>10
	4.71	6.13	0.09	10.83	10.92	137.90	482.63	
2	0.11	0.06	0.01	0.17	0.18	20.00	70.00	>10
	0.78	0.38	0.07	1.16	1.23	137.90	482.63	
3	0.11	0.05	0.01	0.16	0.17	20.00	70.00	>10
	0.74	0.35	0.09	1.09	1.18	137.90	482.63	
4	5.02	8.77	0.84	13.79	14.63	20.00	70.00	1.18
	34.60	60.46	5.82	95.06	100.88	137.90	482.63	
5	4.35	7.00	1.19	11.35	12.54	20.00	70.00	1.64
	29.97	48.28	8.18	78.26	86.44	137.90	482.63	
6	1.69	2.28	0.56	3.98	4.54	20.00	70.00	6.54
	11.68	15.74	3.87	27.43	31.29	137.90	482.63	
7	0.29	0.01	0.26	0.30	0.56	20.00	70.00	>10
	2.00	0.06	1.77	2.06	3.83	137.90	482.63	
8	0.29	0.00	0.26	0.29	0.55	20.00	70.00	>10
	2.00	0.01	1.77	2.00	3.77	137.90	482.63	
9	0.29	0.01	0.26	0.30	0.56	20.00	70.00	>10
	2.00	0.09	1.77	2.09	3.86	137.90	482.63	
10	1.01	1.01	0.30	2.02	2.32	20.00	70.00	>10
	6.93	6.98	2.08	13.91	16.00	137.90	482.63	
11	0.63	0.30	0.16	0.92	1.08	20.00	70.00	>10
	4.31	2.04	1.12	6.35	7.47	137.90	482.63	
12	0.53	0.42	0.12	0.95	1.07	20.00	70.00	>10
	3.64	2.92	0.84	6.56	7.40	137.90	482.63	

13	1.08	0.93	0.54	2.01	2.54	20.00	70.00	>10
	7.46	6.38	3.69	13.84	17.53	137.90	482.63	
14	1.02	1.00	0.44	2.02	2.46	20.00	70.00	>10
	7.02	6.91	3.01	13.93	16.94	137.90	482.63	
15	3.93	5.54	0.06	9.47	9.52	20.00	70.00	2.17
	27.08	38.18	0.40	65.26	65.66	137.90	482.63	
16	2.34	3.40	0.21	5.74	5.95	20.00	70.00	4.23
	16.17	23.41	1.45	39.58	41.02	137.90	482.63	
17	1.66	2.46	0.17	4.11	4.28	20.00	70.00	6.29
	11.42	16.95	1.15	28.36	29.52	137.90	482.63	
18	1.96	3.01	0.18	4.97	5.15	20.00	70.00	5.03
	13.54	20.76	1.24	34.30	35.53	137.90	482.63	
19	3.14	4.81	0.26	7.95	8.21	20.00	70.00	2.77
	21.68	33.13	1.77	54.81	56.58	137.90	482.63	
20	2.57	4.72	0.31	7.29	7.60	20.00	70.00	3.12
	17.71	32.53	2.15	50.25	52.39	137.90	482.63	
21	0.25	0.49	0.14	0.75	0.89	20.00	70.00	>10
	1.74	3.41	0.96	5.15	6.11	137.90	482.63	
22	1.99	2.36	0.02	4.34	4.36	20.00	70.00	5.91
	13.70	16.24	0.13	29.94	30.07	137.90	482.63	

Min MS: 1.176, Location: 4, Combination: Pm+Pb

Table 2-305. Load Combination 226, Vertical Vibration at Cold Temperature, Normal Conditions of Transport – Models AOS-100B

Load Cases: 223, 103, 201, 211
 Vertical 2g Vibration Inertia Load
 -20°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.61	0.86	0.01	1.47	1.48	20.00	70.00	>10
	4.19	5.94	0.09	10.14	10.22	137.90	482.63	
2	0.07	0.04	0.01	0.11	0.12	20.00	70.00	>10
	0.49	0.26	0.07	0.74	0.81	137.90	482.63	
3	0.06	0.04	0.01	0.09	0.10	20.00	70.00	>10
	0.39	0.24	0.09	0.63	0.72	137.90	482.63	
4	4.96	8.73	0.84	13.69	14.54	20.00	70.00	1.19
	34.22	60.19	5.82	94.41	100.22	137.90	482.63	
5	4.29	6.98	1.19	11.27	12.45	20.00	70.00	1.66
	29.57	48.12	8.18	77.69	85.87	137.90	482.63	
6	1.68	2.28	0.56	3.95	4.51	20.00	70.00	6.59
	11.55	15.71	3.87	27.26	31.13	137.90	482.63	
7	0.29	0.01	0.26	0.30	0.56	20.00	70.00	>10
	2.02	0.05	1.77	2.08	3.85	137.90	482.63	
8	0.30	0.00	0.26	0.30	0.55	20.00	70.00	>10
	2.04	0.00	1.77	2.04	3.81	137.90	482.63	
9	0.30	0.01	0.26	0.31	0.57	20.00	70.00	>10
	2.08	0.08	1.77	2.16	3.93	137.90	482.63	
10	1.01	1.01	0.30	2.02	2.32	20.00	70.00	>10
	6.96	6.99	2.08	13.94	16.03	137.90	482.63	
11	0.62	0.30	0.16	0.92	1.08	20.00	70.00	>10
	4.31	2.04	1.12	6.35	7.47	137.90	482.63	
12	0.53	0.43	0.12	0.97	1.09	20.00	70.00	>10
	3.67	2.99	0.84	6.66	7.50	137.90	482.63	

13	1.09 7.50	0.96 6.65	0.54 3.69	2.05 14.15	2.59 17.84	20.00 137.90	70.00 482.63	>10
14	1.02 7.05	1.01 6.99	0.44 3.01	2.04 14.04	2.47 17.04	20.00 137.90	70.00 482.63	>10
15	3.84 26.48	5.45 37.58	0.06 0.40	9.29 64.06	9.35 64.46	20.00 137.90	70.00 482.63	2.23
16	2.33 16.10	3.41 23.50	0.21 1.45	5.74 39.59	5.95 41.04	20.00 137.90	70.00 482.63	4.22
17	1.65 11.40	2.47 17.04	0.17 1.15	4.12 28.44	4.29 29.59	20.00 137.90	70.00 482.63	6.27
18	1.96 13.49	3.01 20.76	0.18 1.24	4.97 34.25	5.15 35.49	20.00 137.90	70.00 482.63	5.04
19	3.12 21.53	4.80 33.12	0.26 1.77	7.93 54.65	8.18 56.42	20.00 137.90	70.00 482.63	2.78
20	2.56 17.62	4.71 32.50	0.31 2.15	7.27 50.12	7.58 52.27	20.00 137.90	70.00 482.63	3.13
21	0.29 2.00	0.49 3.38	0.14 0.96	0.78 5.37	0.92 6.33	20.00 137.90	70.00 482.63	>10
22	1.98 13.65	2.35 16.24	0.02 0.13	4.34 29.89	4.35 30.02	20.00 137.90	70.00 482.63	5.92

Min MS: 1.191, Location: 4, Combination: Pm+Pb

Table 2-306. Load Combination 231, 3-ft. Head-On Drop, Normal Conditions, Normal Conditions of Transport – Model AOS-100B

Load Cases: 231, 102, 201, 211
 3-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.72	0.89	0.28	1.61	1.89	20.00	66.30	>10
	4.94	6.16	1.96	11.10	13.05	137.90	457.12	
2	0.10	0.03	0.43	0.14	0.56	20.00	66.30	>10
	0.71	0.23	2.96	0.93	3.89	137.90	457.12	
3	0.05	0.02	0.28	0.07	0.35	20.00	66.30	>10
	0.32	0.16	1.96	0.48	2.44	137.90	457.12	
4	5.17	8.93	2.98	14.11	17.09	20.00	66.30	1.13
	35.67	61.59	20.55	97.27	117.81	137.90	457.12	
5	4.40	7.14	3.25	11.53	14.78	20.00	66.30	1.60
	30.32	49.21	22.40	79.53	101.93	137.90	457.12	
6	1.73	2.28	1.39	4.01	5.40	20.00	61.80	6.49
	11.90	15.72	9.61	27.62	37.23	137.90	426.10	
7	0.32	0.01	0.42	0.33	0.76	20.00	61.80	>10
	2.23	0.06	2.93	2.29	5.22	137.90	426.10	
8	0.31	0.00	0.42	0.31	0.74	20.00	61.80	>10
	2.14	0.00	2.92	2.15	5.07	137.90	426.10	
9	0.31	0.01	0.42	0.32	0.74	20.00	61.80	>10
	2.13	0.08	2.92	2.21	5.13	137.90	426.10	
10	1.01	1.04	0.59	2.05	2.63	20.00	61.80	>10
	6.98	7.14	4.04	14.12	18.17	137.90	426.10	
11	0.65	0.30	0.75	0.94	1.69	20.00	61.80	>10
	4.45	2.05	5.17	6.50	11.67	137.90	426.10	
12	0.54	0.45	1.15	0.99	2.14	20.00	61.80	>10
	3.72	3.12	7.89	6.84	14.73	137.90	426.10	

13	1.07 7.37	0.92 6.36	1.41 9.73	1.99 13.73	3.40 23.46	20.00 137.90	61.80 426.10	>10
14	1.00 6.92	0.98 6.78	1.20 8.30	1.99 13.70	3.19 22.00	20.00 137.90	66.30 457.12	>10
15	4.21 29.05	5.47 37.72	0.71 4.91	9.68 66.77	10.40 71.68	20.00 137.90	66.30 457.12	2.10
16	2.39 16.46	3.44 23.74	0.28 1.90	5.83 40.20	6.11 42.10	20.00 137.90	66.30 457.12	4.15
17	1.74 12.02	2.47 17.06	0.18 1.23	4.22 29.08	4.40 30.31	20.00 137.90	66.30 457.12	6.11
18	2.00 13.76	3.06 21.13	0.33 2.25	5.06 34.89	5.39 37.14	20.00 137.90	66.30 457.12	4.93
19	3.20 22.08	4.88 33.65	0.45 3.10	8.08 55.74	8.53 58.84	20.00 137.90	66.30 457.12	2.71
20	2.63 18.14	4.81 33.16	0.98 6.72	7.44 51.29	8.41 58.02	20.00 137.90	61.80 426.10	3.03
21	0.24 1.63	0.47 3.26	0.06 0.44	0.71 4.90	0.77 5.33	20.00 137.90	66.30 457.12	>10
22	2.17 14.94	2.41 16.59	0.06 0.41	4.57 31.53	4.63 31.94	20.00 137.90	66.30 457.12	5.56

Min MS: 1.127, Location: 4, Combination: Pm+Pb

**Table 2-307. Load Combination 233, 3-ft. Drop at Cold Temperature,
Normal Conditions of Transport – Models AOS-100B**

Load Cases: 231, 103, 211

3-ft. Head-On Drop

-20°F Ambient, Zero Decay Heat, Zero Insolation

Fabrication Stress

Loc	Stress (ksi/MPa)							
	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.70	0.88	0.01	1.58	1.60	20.00	70.00	>10
	4.84	6.07	0.09	10.91	11.00	137.90	482.63	
2	0.09	0.03	0.01	0.12	0.13	20.00	70.00	>10
	0.64	0.22	0.07	0.86	0.93	137.90	482.63	
3	0.03	0.00	0.01	0.04	0.05	20.00	70.00	>10
	0.22	0.03	0.09	0.25	0.34	137.90	482.63	
4	1.02	1.60	0.84	2.62	3.47	20.00	70.00	>10
	7.02	11.07	5.82	18.09	23.91	137.90	482.63	
5	0.99	1.49	1.19	2.48	3.67	20.00	70.00	>10
	6.79	10.29	8.18	17.09	25.27	137.90	482.63	
6	0.43	0.63	0.56	1.06	1.62	20.00	70.00	>10
	2.95	4.34	3.87	7.29	11.16	137.90	482.63	
7	0.19	0.00	0.26	0.19	0.45	20.00	70.00	>10
	1.29	0.02	1.77	1.31	3.08	137.90	482.63	
8	0.18	0.00	0.26	0.18	0.43	20.00	70.00	>10
	1.21	0.00	1.77	1.21	2.98	137.90	482.63	
9	0.17	0.00	0.26	0.17	0.43	20.00	70.00	>10
	1.19	0.00	1.77	1.19	2.96	137.90	482.63	
10	0.19	0.07	0.30	0.26	0.56	20.00	70.00	>10
	1.29	0.48	2.08	1.77	3.85	137.90	482.63	
11	0.12	0.07	0.16	0.19	0.35	20.00	70.00	>10
	0.81	0.50	1.12	1.31	2.43	137.90	482.63	
12	0.06	0.05	0.12	0.11	0.24	20.00	70.00	>10
	0.44	0.35	0.84	0.78	1.62	137.90	482.63	
13	0.34	0.33	0.54	0.66	1.20	20.00	70.00	>10
	2.31	2.25	3.69	4.57	8.26	137.90	482.63	

14	0.32 2.22	0.25 1.74	0.44 3.01	0.57 3.96	1.01 6.97	20.00 137.90	70.00 482.63	>10
15	0.69 4.77	0.03 0.23	0.06 0.40	0.73 5.00	0.78 5.40	20.00 137.90	70.00 482.63	>10
16	0.09 0.62	0.08 0.55	0.21 1.45	0.17 1.18	0.38 2.62	20.00 137.90	70.00 482.63	>10
17	0.12 0.84	0.05 0.34	0.17 1.15	0.17 1.18	0.34 2.33	20.00 137.90	70.00 482.63	>10
18	0.14 0.96	0.22 1.53	0.18 1.24	0.36 2.49	0.54 3.73	20.00 137.90	70.00 482.63	>10
19	0.20 1.41	0.21 1.45	0.26 1.77	0.41 2.86	0.67 4.63	20.00 137.90	70.00 482.63	>10
20	0.23 1.61	0.31 2.14	0.31 2.15	0.54 3.76	0.86 5.90	20.00 137.90	70.00 482.63	>10
21	0.04 0.27	0.07 0.50	0.14 0.96	0.11 0.77	0.25 1.73	20.00 137.90	70.00 482.63	>10
22	0.48 3.29	0.07 0.48	0.02 0.13	0.55 3.77	0.56 3.89	20.00 137.90	70.00 482.63	>10

Min MS: 10.434, Location: 4, Combination: Pm+Pb

2.12.2.4.2 Hypothetical Accident Conditions of Transport Summary of Damages (Stresses) – Model AOS-100B

Table 2-308 and Table 2-309 present Model AOS-100B transport package Load Cases and Load Combinations, respectively, under Hypothetical Accident conditions of transport:

- Table 2-310 through Table 2-322 present Model AOS-050A transport package output data, for the Load Cases listed in Table 2-308. Comparisons with allowable stress limits are included for Load Cases 111 and 112.
- Table 2-323 through Table 2-337 present Model AOS-050A transport package output data, for the Load Combinations listed in Table 2-309.

Table 2-308. Load Cases Associated with Allowable Stresses under Hypothetical Accident Conditions of Transport – Model AOS-100B

Load Case	Description	Data
111	Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat	Table 2-310
112	Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-311
	Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-312
	Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-313
	Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-314
	Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation	Table 2-315
301	30-ft. Head-On Drop	Table 2-316
302	30-ft. Side Drop + Slap-Down	Table 2-317
303	30-ft. Cg/Corner Drop	Table 2-318
304	30-ft. Head-On Drop at -40°F, Low Temperature	Table 2-319
305	30-ft. Side Drop + Slap-Down at -40°F, Low Temperature	Table 2-320
306	30-ft. Cg/Corner Drop at -40°F, Low Temperature	Table 2-321
311	4-ft. Drop onto Rod	Table 2-322

**Table 2-309. Load Combinations Associated with Allowable Stresses
under Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Combination	Load Cases ^a	Description	Data
301	301, 102, 201, 211	Head-On Drop Orientation	Table 2-323
302	302, 102, 201, 211	Side Drop Orientation	Table 2-324
303	303, 102, 201, 211	Cg/Corner Drop Orientation	Table 2-325
304	304, 105, 202, 211	Head-On Drop Orientation at -40°F, Cold Environment	Table 2-326
305	305, 105, 202, 211	Side Drop Orientation at -40°F, Cold Environment	Table 2-327
306	306, 105, 202, 211	Cg/Corner Drop Orientation at -40°F, Cold Environment	Table 2-328
310	204, 101, 211	Additional Increased External Pressure (290 psi)	Table 2-329
311	311, 101, 201, 211	4-ft. Drop onto Rod	Table 2-330
312	311, 104, 201, 211	4-ft. Drop onto Rod at -40°F, Cold Environment	Table 2-331
350	111, 201, 211	Fire at 30 Minutes	Table 2-332
351	112, 201, 211	Post Fire at 60 Minutes	Table 2-333
352		Post Fire at 90 Minutes	Table 2-334
353		Post Fire at 120 Minutes	Table 2-335
354		Post Fire at 150 Minutes	Table 2-336
355		Post Fire at 180 Minutes	Table 2-337

a. Some Normal conditions of transport Load Cases are included in Hypothetical Accident conditions of transport Load Combinations, to meet regulatory requirements.

Table 2-310. Load Case 111, Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	9.0726E+03 6.2553E+01	-4.7465E+03 -3.2726E+01	5.5696E+03 3.8401E+01	1.3819E+04 9.5280E+01	2.3055E+04 1.5896E+02		
2	1.4658E+04 1.0107E+02	-4.8666E+03 -3.3554E+01	5.7606E+03 3.9718E+01	1.9525E+04 1.3462E+02	4.0121E+04 2.7663E+02		
3	9.1776E+03 6.3277E+01	-4.8127E+03 -3.3182E+01	5.6969E+03 3.9279E+01	1.3990E+04 9.6460E+01	2.3464E+04 1.6178E+02		
4	1.5615E+04 1.0766E+02	-6.9478E+03 -4.7903E+01	3.0024E+03 2.0701E+01	2.2563E+04 1.5556E+02	4.4039E+04 3.0364E+02		
5	1.6693E+04 1.1509E+02	-6.4612E+03 -4.4548E+01	3.0841E+03 2.1264E+01	2.3154E+04 1.5964E+02	3.5963E+04 2.4795E+02		
6	8.7624E+03 6.0414E+01	-9.5512E+02 -6.5853E+00	5.4606E+03 3.7650E+01	9.7175E+03 6.7000E+01	1.4278E+04 9.8445E+01		
7	2.9866E+03 2.0592E+01	-4.5990E-01 -3.1709E-03	-1.1098E+02 -7.6517E-01	2.9871E+03 2.0595E+01	4.7387E+01 3.2672E-01		
8	2.9853E+03 2.0583E+01	2.6582E+00 1.8328E-02	5.4217E+00 3.7381E-02	2.9826E+03 2.0564E+01	7.6729E+01 5.2903E-01		
9	2.9832E+03 2.0568E+01	-5.3737E-01 -3.7050E-03	-5.0554E+00 -3.4856E-02	2.9837E+03 2.0572E+01	1.2700E+02 8.7567E-01		
10	2.9932E+03 2.0638E+01	1.2102E+02 8.3438E-01	7.7498E+02 5.3433E+00	2.8722E+03 1.9803E+01	3.5798E+01 2.4682E-01		
11	1.8702E+03 1.2895E+01	-2.8561E+01 -1.9692E-01	1.3186E+03 9.0916E+00	1.8988E+03 1.3092E+01	7.9925E+02 5.5107E+00		
12	1.9630E+03 1.3535E+01	-2.8210E+00 -1.9450E-02	1.9575E+03 1.3497E+01	1.9658E+03 1.3554E+01	8.8416E+02 6.0961E+00		
13	5.8891E+03 4.0604E+01	-3.5033E+02 -2.4154E+00	1.7894E+03 1.2337E+01	6.2394E+03 4.3019E+01	4.8346E+03 3.3333E+01		
14	5.4160E+03 3.7342E+01	-3.6513E+02 -2.5175E+00	1.7124E+03 1.1806E+01	5.7812E+03 3.9860E+01	6.2386E+03 4.3014E+01		
15	2.0220E+02 1.3941E+00	-2.5866E+02 -1.7834E+00	-3.9595E+01 -2.7300E-01	4.6086E+02 3.1775E+00	8.0014E+02 5.5167E+00		

16	8.9323E+01	-7.4065E+01	5.8036E+01	1.6339E+02	2.3393E+02
	6.1586E-01	-5.1066E-01	4.0014E-01	1.1265E+00	1.6129E+00
17	7.6795E+01	-4.2262E+01	3.9729E+01	1.1906E+02	1.9686E+02
	5.2949E-01	-2.9138E-01	2.7392E-01	8.2087E-01	1.3573E+00
18	1.3471E+02	-5.5665E+01	-4.0694E+02	1.9038E+02	1.8932E+02
	9.2881E-01	-3.8380E-01	-2.8057E+00	1.3126E+00	1.3053E+00
19	2.0797E+02	-1.8062E+01	-5.1441E+02	2.2604E+02	4.4022E+02
	1.4339E+00	-1.2453E-01	-3.5467E+00	1.5585E+00	3.0352E+00
20	3.4856E+02	-1.6868E+01	-6.7462E+01	3.6543E+02	2.5720E+02
	2.4032E+00	-1.1630E-01	-4.6513E-01	2.5196E+00	1.7733E+00
21	1.1848E+02	-1.3672E+03	-1.2481E+03	1.4857E+03	2.2650E+03
	8.1690E-01	-9.4268E+00	-8.6051E+00	1.0244E+01	1.5617E+01
22	1.5491E+02	-5.9977E+02	-4.6587E+02	7.5468E+02	1.2493E+03
	1.0681E+00	-4.1352E+00	-3.2121E+00	5.2033E+00	8.6133E+00

Allowable Stress for Load Case 111

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	292.80	290.44	20.00	23.60	66.30
2	379.41	299.30	20.00	23.60	66.30
3	294.33	292.02	20.00	23.60	66.30
4	296.03	295.84	20.00	23.60	66.30
5	299.42	298.79	20.00	23.60	66.30
6	303.90	301.60	20.00	22.40	61.80
7	303.41	301.70	20.00	22.40	61.80
8	303.76	302.05	20.00	22.40	61.80
9	303.94	302.24	20.00	22.40	61.80
10	304.61	302.51	20.00	22.40	61.80
11	306.71	303.48	20.00	22.40	61.80
12	311.79	307.68	20.00	22.40	61.80
13	299.84	299.12	20.00	23.60	66.30
14	298.38	298.04	20.00	23.60	66.30
15	295.39	294.81	20.00	23.60	66.30
16	294.89	294.49	20.00	23.60	66.30
17	294.98	294.50	20.00	23.60	66.30
18	296.84	296.21	20.00	23.60	66.30
19	297.59	297.19	20.00	23.60	66.30
20	303.35	301.66	20.00	22.40	61.80
21	295.38	294.02	20.00	23.60	66.30
22	294.07	293.33	20.00	23.60	66.30

Table 2-311. Load Case 112, Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	8.1904E+02 5.6471E+00	-5.0496E+02 -3.4816E+00	2.0463E+03 1.4109E+01	1.3240E+03 9.1286E+00	1.4838E+02 1.0230E+00		
2	1.9537E+03 1.3470E+01	-2.3244E+03 -1.6026E+01	-2.1032E+03 -1.4501E+01	4.2781E+03 2.9497E+01	6.6275E+03 4.5695E+01		
3	7.1891E+02 4.9567E+00	-5.2914E+02 -3.6483E+00	1.7040E+03 1.1749E+01	1.2481E+03 8.6050E+00	2.4226E+02 1.6703E+00		
4	6.9183E+02 4.7700E+00	-2.3292E+03 -1.6059E+01	1.3287E+03 9.1613E+00	3.0210E+03 2.0829E+01	4.4243E+03 3.0505E+01		
5	2.4760E+02 1.7071E+00	-2.3540E+03 -1.6230E+01	-3.3957E+03 -2.3412E+01	2.6016E+03 1.7937E+01	1.9783E+02 1.3640E+00		
6	7.5839E+02 5.2289E+00	-8.6566E+02 -5.9685E+00	-3.0087E+03 -2.0744E+01	1.6240E+03 1.1197E+01	1.8142E+03 1.2509E+01		
7	1.8983E+02 1.3088E+00	-3.0234E+01 -2.0846E-01	7.5502E+01 5.2057E-01	2.2006E+02 1.5173E+00	2.5919E+02 1.7871E+00		
8	2.2274E+02 1.5357E+00	-7.4501E+01 -5.1366E-01	-1.1948E+01 -8.2382E-02	2.9724E+02 2.0494E+00	4.6859E+02 3.2308E+00		
9	2.1764E+02 1.5006E+00	-6.5180E+01 -4.4940E-01	1.3540E+02 9.3355E-01	2.8282E+02 1.9500E+00	4.0239E+02 2.7744E+00		
10	1.0260E+03 7.0737E+00	-2.8693E+02 -1.9783E+00	-1.6501E+03 -1.1377E+01	1.3129E+03 9.0520E+00	3.3008E+02 2.2758E+00		
11	8.0709E+02 5.5647E+00	-1.9014E+03 -1.3110E+01	-2.1192E+03 -1.4611E+01	2.7085E+03 1.8675E+01	4.3287E+03 2.9845E+01		
12	7.2554E+02 5.0024E+00	-1.7810E+03 -1.2280E+01	-1.0730E+03 -7.3983E+00	2.5065E+03 1.7282E+01	4.6347E+03 3.1955E+01		
13	-2.3426E+02 -1.6152E+00	-4.2584E+03 -2.9361E+01	-1.7055E+03 -1.1759E+01	4.0242E+03 2.7746E+01	2.3255E+03 1.6033E+01		
14	2.2164E+02 1.5281E+00	-3.7350E+03 -2.5752E+01	9.2367E+02 6.3685E+00	3.9567E+03 2.7280E+01	2.6513E+03 1.8280E+01		
15	3.9050E+02 2.6924E+00	-9.1140E+01 -6.2839E-01	3.0037E+02 2.0710E+00	4.8164E+02 3.3208E+00	7.0530E+02 4.8629E+00		

16	9.8130E+01	-2.3807E+01	-4.2038E+02	1.2194E+02	1.1281E+02
	6.7658E-01	-1.6415E-01	-2.8984E+00	8.4073E-01	7.7781E-01
17	3.8125E+01	-5.7613E+01	-4.5176E+02	9.5738E+01	1.4063E+02
	2.6287E-01	-3.9723E-01	-3.1148E+00	6.6009E-01	9.6961E-01
18	3.2244E+02	-4.4205E+02	2.2419E+03	7.6450E+02	6.4598E+02
	2.2232E+00	-3.0479E+00	1.5457E+01	5.2710E+00	4.4539E+00
19	-4.8324E+01	-8.7042E+02	2.4751E+03	8.2210E+02	7.6676E+02
	-3.3318E-01	-6.0014E+00	1.7066E+01	5.6682E+00	5.2866E+00
20	4.9801E+01	-1.7867E+03	-6.7880E+02	1.8365E+03	7.6410E+02
	3.4337E-01	-1.2319E+01	-4.6802E+00	1.2662E+01	5.2683E+00
21	4.4635E+02	1.2284E+01	4.4569E+02	4.3407E+02	4.5492E+01
	3.0775E+00	8.4692E-02	3.0729E+00	2.9928E+00	3.1366E-01
22	1.0865E+03	-9.5839E+01	1.0078E+03	1.1823E+03	1.6293E+03
	7.4910E+00	-6.6078E-01	6.9488E+00	8.1518E+00	1.1234E+01

Allowable Stress for Load Case 112 (Post Fire at 60 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	409.02	401.04	18.70	20.70	59.70
2	538.47	520.65	17.40	19.40	59.20
3	411.08	404.42	18.70	20.70	59.70
4	344.69	342.72	20.00	22.40	61.80
5	370.24	364.68	20.00	22.40	61.80
6	379.06	374.81	20.00	22.40	61.80
7	433.75	432.49	18.70	20.70	59.70
8	445.45	444.89	18.70	20.70	59.70
9	433.71	432.43	18.70	20.70	59.70
10	392.59	384.81	20.00	22.40	61.80
11	375.32	360.74	20.00	22.40	61.80
12	356.41	353.76	20.00	22.40	61.80
13	352.83	343.55	20.00	22.40	61.80
14	334.72	330.21	20.00	22.40	61.80
15	299.24	299.15	20.00	23.60	66.30
16	303.87	303.26	20.00	22.40	61.80
17	304.70	304.31	20.00	22.40	61.80
18	313.45	311.70	20.00	22.40	61.80
19	317.08	315.36	20.00	22.40	61.80
20	337.08	333.26	20.00	22.40	61.80
21	299.74	299.55	20.00	23.60	66.30
22	298.05	297.96	20.00	23.60	66.30

Table 2-312. Load Case 112, Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	9.1996E+02 6.3429E+00	-1.1920E+03 -8.2184E+00	1.0819E+03 7.4591E+00	2.1119E+03 1.4561E+01	2.1362E+03 1.4728E+01		
2	1.5952E+03 1.0998E+01	-2.5937E+03 -1.7883E+01	-1.5067E+03 -1.0388E+01	4.1888E+03 2.8881E+01	8.1944E+03 5.6499E+01		
3	8.7561E+02 6.0371E+00	-1.2316E+03 -8.4918E+00	7.8355E+02 5.4024E+00	2.1072E+03 1.4529E+01	2.4717E+03 1.7042E+01		
4	5.4994E+02 3.7917E+00	-5.2729E+03 -3.6356E+01	4.8558E+02 3.3480E+00	5.8229E+03 4.0147E+01	1.1027E+04 7.6030E+01		
5	1.0166E+03 7.0094E+00	-6.7828E+03 -4.6766E+01	-4.5986E+03 -3.1706E+01	7.7995E+03 5.3775E+01	1.2347E+04 8.5127E+01		
6	2.9524E+02 2.0356E+00	-3.1621E+03 -2.1802E+01	-5.0028E+03 -3.4493E+01	3.4573E+03 2.3837E+01	3.1078E+03 2.1427E+01		
7	-1.5028E+01 -1.0362E-01	-9.1190E+02 -6.2873E+00	1.1537E+02 7.9543E-01	8.9687E+02 6.1837E+00	4.8540E+02 3.3467E+00		
8	-1.7922E+01 -1.2357E-01	-9.1637E+02 -6.3182E+00	-8.9565E+00 -6.1753E-02	8.9845E+02 6.1946E+00	6.0103E+02 4.1439E+00		
9	-1.4998E+01 -1.0341E-01	-9.1683E+02 -6.3213E+00	1.2347E+02 8.5128E-01	9.0183E+02 6.2179E+00	5.8142E+02 4.0088E+00		
10	5.3375E+02 3.6801E+00	-1.1233E+03 -7.7450E+00	-1.6998E+03 -1.1720E+01	1.6571E+03 1.1425E+01	7.9107E+02 5.4543E+00		
11	4.2021E+02 2.8972E+00	-3.1466E+03 -2.1695E+01	-3.0062E+03 -2.0727E+01	3.5668E+03 2.4592E+01	4.4323E+03 3.0560E+01		
12	2.3407E+02 1.6139E+00	-2.9932E+03 -2.0637E+01	-2.7618E+03 -1.9042E+01	3.2272E+03 2.2251E+01	4.7461E+03 3.2723E+01		
13	-7.4559E+02 -5.1406E+00	-6.9239E+03 -4.7738E+01	-2.4026E+03 -1.6565E+01	6.1783E+03 4.2598E+01	4.1388E+03 2.8536E+01		
14	-2.4216E+02 -1.6697E+00	-6.1142E+03 -4.2156E+01	7.6363E+02 5.2651E+00	5.8720E+03 4.0486E+01	5.3631E+02 3.6977E+00		
15	8.4357E+02 5.8162E+00	-4.1818E+02 -2.8833E+00	5.1871E+02 3.5764E+00	1.2618E+03 8.6995E+00	1.9722E+03 1.3598E+01		

16	2.1236E+02	-1.6503E+02	-7.5972E+02	3.7740E+02	5.4760E+02
	1.4642E+00	-1.1379E+00	-5.2381E+00	2.6021E+00	3.7756E+00
17	8.8614E+01	-1.9263E+02	-7.1865E+02	2.8124E+02	4.5516E+02
	6.1097E-01	-1.3281E+00	-4.9549E+00	1.9391E+00	3.1382E+00
18	4.3361E+02	-6.9333E+02	3.4114E+03	1.1269E+03	7.3959E+02
	2.9896E+00	-4.7803E+00	2.3521E+01	7.7700E+00	5.0993E+00
19	-8.2705E+01	-1.3960E+03	3.7174E+03	1.3133E+03	1.5525E+03
	-5.7023E-01	-9.6249E+00	2.5631E+01	9.0546E+00	1.0704E+01
20	4.1213E+01	-2.7701E+03	-7.8058E+02	2.8113E+03	8.4754E+02
	2.8415E-01	-1.9099E+01	-5.3819E+00	1.9383E+01	5.8436E+00
21	1.1238E+03	-1.5185E+00	1.1234E+03	1.1254E+03	6.6815E+02
	7.7486E+00	-1.0469E-02	7.7455E+00	7.7590E+00	4.6067E+00
22	2.0486E+03	-1.4355E+02	1.9738E+03	2.1921E+03	2.7619E+03
	1.4124E+01	-9.8972E-01	1.3609E+01	1.5114E+01	1.9043E+01

Allowable Stress for Load Case 112 (Post Fire at 90 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	409.78	404.01	18.70	20.70	59.70
2	476.62	474.03	18.70	20.70	59.70
3	416.06	408.48	18.70	20.70	59.70
4	372.58	370.46	20.00	22.40	61.80
5	400.61	394.84	20.00	22.40	61.80
6	409.33	405.38	18.70	20.70	59.70
7	458.11	456.46	18.70	20.70	59.70
8	466.58	465.42	18.70	20.70	59.70
9	457.89	456.23	18.70	20.70	59.70
10	420.76	414.35	18.70	20.70	59.70
11	406.37	392.90	20.00	22.40	61.80
12	393.89	391.08	20.00	22.40	61.80
13	381.54	370.78	20.00	22.40	61.80
14	359.47	353.89	20.00	22.40	61.80
15	311.15	311.02	20.00	22.40	61.80
16	319.21	318.42	20.00	22.40	61.80
17	320.47	319.89	20.00	22.40	61.80
18	332.73	330.25	20.00	22.40	61.80
19	338.25	335.69	20.00	22.40	61.80
20	366.88	361.81	20.00	22.40	61.80
21	311.06	310.70	20.00	22.40	61.80
22	309.81	309.71	20.00	22.40	61.80

Table 2-313. Load Case 112, Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	7.9718E+02 5.4964E+00	-1.1509E+03 -7.9353E+00	6.2377E+02 4.3008E+00	1.9481E+03 1.3432E+01	2.2671E+03 1.5631E+01		
2	1.2434E+03 8.5727E+00	-2.1786E+03 -1.5021E+01	-1.0259E+03 -7.0736E+00	3.4220E+03 2.3594E+01	6.8902E+03 4.7506E+01		
3	7.7107E+02 5.3164E+00	-1.1776E+03 -8.1192E+00	3.9363E+02 2.7140E+00	1.9487E+03 1.3436E+01	2.5312E+03 1.7452E+01		
4	1.0479E+03 7.2247E+00	-5.5897E+03 -3.8540E+01	2.9087E+02 2.0055E+00	6.6376E+03 4.5764E+01	1.2902E+04 8.8953E+01		
5	1.3419E+03 9.2522E+00	-6.8739E+03 -4.7394E+01	-3.9018E+03 -2.6902E+01	8.2158E+03 5.6646E+01	1.3087E+04 9.0230E+01		
6	2.8313E+02 1.9521E+00	-3.2893E+03 -2.2679E+01	-4.4858E+03 -3.0929E+01	3.5724E+03 2.4631E+01	3.7312E+03 2.5726E+01		
7	-1.7488E+01 -1.2058E-01	-1.0111E+03 -6.9711E+00	1.0241E+02 7.0607E-01	9.9359E+02 6.8506E+00	5.0401E+02 3.4750E+00		
8	-1.9663E+01 -1.3557E-01	-1.0132E+03 -6.9854E+00	-5.7619E+00 -3.9727E-02	9.9349E+02 6.8499E+00	5.6277E+02 3.8801E+00		
9	-1.7836E+01 -1.2297E-01	-1.0138E+03 -6.9898E+00	9.1542E+01 6.3116E-01	9.9595E+02 6.8669E+00	5.6309E+02 3.8824E+00		
10	2.8914E+02 1.9936E+00	-1.1754E+03 -8.1038E+00	-1.2748E+03 -8.7893E+00	1.4645E+03 1.0097E+01	1.2227E+03 8.4299E+00		
11	1.7047E+02 1.1753E+00	-3.0112E+03 -2.0761E+01	-2.6950E+03 -1.8581E+01	3.1817E+03 2.1937E+01	3.5917E+03 2.4764E+01		
12	8.2081E+01 5.6593E-01	-2.9798E+03 -2.0545E+01	-2.8975E+03 -1.9978E+01	3.0619E+03 2.1111E+01	3.8328E+03 2.6426E+01		
13	-6.8845E+02 -4.7467E+00	-6.5012E+03 -4.4824E+01	-2.0772E+03 -1.4322E+01	5.8127E+03 4.0077E+01	3.7495E+03 2.5852E+01		
14	-2.8715E+02 -1.9798E+00	-5.7389E+03 -3.9569E+01	6.5731E+02 4.5320E+00	5.4518E+03 3.7589E+01	1.5430E+02 1.0638E+00		
15	8.8810E+02 6.1232E+00	-4.1819E+02 -2.8833E+00	5.6129E+02 3.8700E+00	1.3063E+03 9.0065E+00	2.0309E+03 1.4002E+01		

16	2.2096E+02	-1.6808E+02	-7.9452E+02	3.8904E+02	5.6039E+02
	1.5235E+00	-1.1589E+00	-5.4780E+00	2.6823E+00	3.8638E+00
17	9.2597E+01	-1.9833E+02	-7.4127E+02	2.9093E+02	4.7125E+02
	6.3844E-01	-1.3675E+00	-5.1109E+00	2.0059E+00	3.2491E+00
18	4.2790E+02	-6.9453E+02	3.4260E+03	1.1224E+03	7.1586E+02
	2.9503E+00	-4.7886E+00	2.3621E+01	7.7389E+00	4.9357E+00
19	-8.0489E+01	-1.4079E+03	3.7465E+03	1.3274E+03	1.6002E+03
	-5.5495E-01	-9.7072E+00	2.5831E+01	9.1522E+00	1.1033E+01
20	2.7482E+01	-2.8148E+03	-6.2236E+02	2.8423E+03	7.9073E+02
	1.8948E-01	-1.9407E+01	-4.2910E+00	1.9597E+01	5.4519E+00
21	1.2395E+03	-1.7681E+00	1.2387E+03	1.2413E+03	7.6140E+02
	8.5462E+00	-1.2191E-02	8.5407E+00	8.5583E+00	5.2496E+00
22	2.1259E+03	-1.3052E+02	2.0649E+03	2.2564E+03	2.7666E+03
	1.4657E+01	-8.9992E-01	1.4237E+01	1.5557E+01	1.9075E+01

Allowable Stress for Load Case 112 (Post Fire at 120 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	412.09	405.21	18.70	20.70	59.70
2	452.57	449.69	18.70	20.70	59.70
3	417.23	409.71	18.70	20.70	59.70
4	386.29	384.54	20.00	22.40	61.80
5	409.66	404.93	18.70	20.70	59.70
6	416.63	413.65	18.70	20.70	59.70
7	453.96	452.34	18.70	20.70	59.70
8	459.73	458.45	18.70	20.70	59.70
9	453.89	452.27	18.70	20.70	59.70
10	425.30	420.78	18.70	20.70	59.70
11	415.13	404.65	18.70	20.70	59.70
12	408.53	405.77	18.70	20.70	59.70
13	393.97	384.77	20.00	22.40	61.80
14	374.74	369.88	20.00	22.40	61.80
15	328.92	328.79	20.00	22.40	61.80
16	337.45	336.69	20.00	22.40	61.80
17	338.71	338.14	20.00	22.40	61.80
18	350.47	348.11	20.00	22.40	61.80
19	355.96	353.45	20.00	22.40	61.80
20	383.93	379.15	20.00	22.40	61.80
21	327.68	327.24	20.00	22.40	61.80
22	327.67	327.58	20.00	22.40	61.80

Table 2-314. Load Case 112, Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)				
	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
1	6.3675E+02 4.3902E+00	-9.6211E+02 -6.6335E+00	3.7347E+02 2.5750E+00	1.5989E+03 1.1024E+01	1.9658E+03 1.3554E+01
2	9.4728E+02 6.5312E+00	-1.7268E+03 -1.1906E+01	-7.2874E+02 -5.0245E+00	2.6741E+03 1.8437E+01	5.4333E+03 3.7462E+01
3	6.2296E+02 4.2951E+00	-9.8362E+02 -6.7818E+00	1.9770E+02 1.3631E+00	1.6066E+03 1.1077E+01	2.1776E+03 1.5014E+01
4	1.0640E+03 7.3359E+00	-4.9036E+03 -3.3809E+01	1.7328E+02 1.1947E+00	5.9675E+03 4.1145E+01	1.1678E+04 8.0516E+01
5	1.2534E+03 8.6416E+00	-5.9237E+03 -4.0843E+01	-3.1087E+03 -2.1433E+01	7.1771E+03 4.9484E+01	1.1438E+04 7.8863E+01
6	2.3811E+02 1.6417E+00	-2.8639E+03 -1.9746E+01	-3.6842E+03 -2.5402E+01	3.1020E+03 2.1387E+01	3.3867E+03 2.3351E+01
7	-1.7910E+01 -1.2349E-01	-9.0442E+02 -6.2358E+00	8.3161E+01 5.7338E-01	8.8651E+02 6.1123E+00	4.8201E+02 3.3233E+00
8	-1.9502E+01 -1.3446E-01	-9.0543E+02 -6.2427E+00	-3.8064E+00 -2.6244E-02	8.8592E+02 6.1082E+00	5.1361E+02 3.5412E+00
9	-1.8287E+01 -1.2609E-01	-9.0600E+02 -6.2467E+00	6.4994E+01 4.4812E-01	8.8771E+02 6.1206E+00	5.1903E+02 3.5786E+00
10	1.5249E+02 1.0514E+00	-1.0465E+03 -7.2153E+00	-8.9555E+02 -6.1746E+00	1.1990E+03 8.2667E+00	1.2936E+03 8.9190E+00
11	3.3820E+01 2.3318E-01	-2.5407E+03 -1.7518E+01	-2.1741E+03 -1.4990E+01	2.5745E+03 1.7751E+01	2.7066E+03 1.8661E+01
12	2.5527E+01 1.7600E-01	-2.5939E+03 -1.7885E+01	-2.5665E+03 -1.7695E+01	2.6195E+03 1.8061E+01	2.8793E+03 1.9852E+01
13	-5.6266E+02 -3.8794E+00	-5.4033E+03 -3.7254E+01	-1.6212E+03 -1.1178E+01	4.8406E+03 3.3375E+01	3.0511E+03 2.1036E+01
14	-2.6143E+02 -1.8025E+00	-4.7652E+03 -3.2855E+01	5.4038E+02 3.7258E+00	4.5038E+03 3.1053E+01	4.0243E+02 2.7747E+00
15	8.4784E+02 5.8456E+00	-4.5237E+02 -3.1190E+00	4.8357E+02 3.3341E+00	1.3002E+03 8.9646E+00	2.0635E+03 1.4227E+01

16	2.1573E+02	-1.9509E+02	-7.0577E+02	4.1082E+02	6.1080E+02
	1.4874E+00	-1.3451E+00	-4.8661E+00	2.8325E+00	4.2113E+00
17	9.0595E+01	-2.0613E+02	-6.3938E+02	2.9672E+02	4.8826E+02
	6.2463E-01	-1.4212E+00	-4.4084E+00	2.0458E+00	3.3664E+00
18	3.6385E+02	-6.1269E+02	3.0130E+03	9.7655E+02	5.8420E+02
	2.5087E+00	-4.2244E+00	2.0774E+01	6.7331E+00	4.0279E+00
19	-6.9331E+01	-1.2497E+03	3.3005E+03	1.1804E+03	1.4599E+03
	-4.7802E-01	-8.6164E+00	2.2756E+01	8.1384E+00	1.0066E+01
20	8.3768E+00	-2.4986E+03	-4.5214E+02	2.5069E+03	5.8772E+02
	5.7756E-02	-1.7227E+01	-3.1174E+00	1.7285E+01	4.0522E+00
21	1.1078E+03	-1.4889E+00	1.1071E+03	1.1093E+03	6.9085E+02
	7.6383E+00	-1.0266E-02	7.6333E+00	7.6486E+00	4.7633E+00
22	1.8163E+03	-1.1410E+02	1.7733E+03	1.9304E+03	2.3069E+03
	1.2523E+01	-7.8667E-01	1.2227E+01	1.3310E+01	1.5905E+01

Allowable Stress for Load Case 112 (Post Fire at 150 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	411.36	405.27	18.70	20.70	59.70
2	439.60	434.45	18.70	20.70	59.70
3	415.63	409.42	18.70	20.70	59.70
4	393.51	392.16	20.00	22.40	61.80
5	411.93	408.24	18.70	20.70	59.70
6	417.26	415.13	18.70	20.70	59.70
7	445.24	443.70	18.70	20.70	59.70
8	449.30	448.00	18.70	20.70	59.70
9	445.39	443.85	18.70	20.70	59.70
10	423.89	420.89	18.70	20.70	59.70
11	417.12	409.24	18.70	20.70	59.70
12	414.31	411.64	18.70	20.70	59.70
13	400.23	392.96	20.00	22.40	61.80
14	384.90	381.03	20.00	22.40	61.80
15	346.46	346.35	20.00	22.40	61.80
16	353.93	353.27	20.00	22.40	61.80
17	355.00	354.52	20.00	22.40	61.80
18	364.90	362.95	20.00	22.40	61.80
19	369.70	367.53	20.00	22.40	61.80
20	393.89	389.84	20.00	22.40	61.80
21	344.50	344.09	20.00	22.40	61.80
22	345.39	345.31	20.00	22.40	61.80

Table 2-315. Load Case 112, Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	5.0278E+02 3.4666E+00	-7.8453E+02 -5.4092E+00	2.2398E+02 1.5443E+00	1.2873E+03 8.8757E+00	1.6419E+03 1.1320E+01		
2	7.2491E+02 4.9981E+00	-1.3676E+03 -9.4295E+00	-5.4044E+02 -3.7262E+00	2.0925E+03 1.4428E+01	4.2757E+03 2.9480E+01		
3	4.9680E+02 3.4253E+00	-8.0185E+02 -5.5286E+00	9.2114E+01 6.3511E-01	1.2987E+03 8.9539E+00	1.8075E+03 1.2462E+01		
4	9.8667E+02 6.8028E+00	-4.2149E+03 -2.9061E+01	5.2223E+01 3.6007E-01	5.2016E+03 3.5864E+01	1.0194E+04 7.0285E+01		
5	1.1078E+03 7.6378E+00	-5.0208E+03 -3.4617E+01	-2.5127E+03 -1.7324E+01	6.1286E+03 4.2255E+01	9.7624E+03 6.7309E+01		
6	1.9685E+02 1.3573E+00	-2.4419E+03 -1.6836E+01	-3.0415E+03 -2.0970E+01	2.6387E+03 1.8193E+01	2.9506E+03 2.0344E+01		
7	-1.7888E+01 -1.2334E-01	-7.8620E+02 -5.4207E+00	6.6947E+01 4.6158E-01	7.6831E+02 5.2973E+00	4.5682E+02 3.1496E+00		
8	-1.9078E+01 -1.3154E-01	-7.8670E+02 -5.4241E+00	-2.5591E+00 -1.7644E-02	7.6762E+02 5.2925E+00	4.7460E+02 3.2722E+00		
9	-1.8261E+01 -1.2590E-01	-7.8707E+02 -5.4266E+00	4.4485E+01 3.0671E-01	7.6881E+02 5.3007E+00	4.7908E+02 3.3032E+00		
10	6.4044E+01 4.4157E-01	-9.1522E+02 -6.3102E+00	-6.0079E+02 -4.1423E+00	9.7926E+02 6.7518E+00	1.2712E+03 8.7645E+00		
11	-4.9479E+01 -3.4115E-01	-2.0930E+03 -1.4430E+01	-1.7085E+03 -1.1780E+01	2.0435E+03 1.4089E+01	1.9706E+03 1.3587E+01		
12	1.0540E+01 7.2669E-02	-2.2139E+03 -1.5264E+01	-2.2003E+03 -1.5171E+01	2.2245E+03 1.5337E+01	2.0885E+03 1.4400E+01		
13	-4.4834E+02 -3.0912E+00	-4.3780E+03 -3.0185E+01	-1.2278E+03 -8.4652E+00	3.9296E+03 2.7094E+01	2.4313E+03 1.6764E+01		
14	-2.2864E+02 -1.5764E+00	-3.8566E+03 -2.6590E+01	4.3693E+02 3.0125E+00	3.6280E+03 2.5014E+01	5.4080E+02 3.7287E+00		
15	7.7806E+02 5.3645E+00	-4.8292E+02 -3.3296E+00	3.7810E+02 2.6069E+00	1.2610E+03 8.6942E+00	2.0459E+03 1.4106E+01		

16	2.0478E+02	-2.2111E+02	-5.8825E+02	4.2589E+02	6.5215E+02
	1.4119E+00	-1.5245E+00	-4.0558E+00	2.9364E+00	4.4964E+00
17	8.5915E+01	-2.0967E+02	-5.1376E+02	2.9558E+02	4.9395E+02
	5.9236E-01	-1.4456E+00	-3.5422E+00	2.0380E+00	3.4056E+00
18	2.9602E+02	-5.2119E+02	2.5536E+03	8.1721E+02	4.5133E+02
	2.0410E+00	-3.5934E+00	1.7607E+01	5.6345E+00	3.1118E+00
19	-5.7649E+01	-1.0695E+03	2.8016E+03	1.0118E+03	1.2813E+03
	-3.9747E-01	-7.3737E+00	1.9317E+01	6.9762E+00	8.8341E+00
20	-7.0184E+00	-2.1362E+03	-3.1043E+02	2.1292E+03	3.9341E+02
	-4.8390E-02	-1.4729E+01	-2.1404E+00	1.4680E+01	2.7125E+00
21	9.0350E+02	-1.1749E+00	9.0295E+02	9.0467E+02	5.7998E+02
	6.2294E+00	-8.1007E-03	6.2256E+00	6.2375E+00	3.9988E+00
22	1.4237E+03	-9.8708E+01	1.3961E+03	1.5224E+03	1.7706E+03
	9.8158E+00	-6.8057E-01	9.6254E+00	1.0496E+01	1.2208E+01

Allowable Stress for Load Case 112 (Post Fire at 180 Minutes)

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
---	-----	-----	-----	-----	-----
1	409.75	404.59	18.70	20.70	59.70
2	429.61	423.74	18.70	20.70	59.70
3	413.34	408.31	18.70	20.70	59.70
4	397.69	396.66	20.00	22.40	61.80
5	412.16	409.29	18.70	20.70	59.70
6	416.20	414.73	18.70	20.70	59.70
7	437.15	435.69	18.70	20.70	59.70
8	440.07	438.77	18.70	20.70	59.70
9	437.48	436.02	18.70	20.70	59.70
10	421.51	419.56	18.70	20.70	59.70
11	417.23	411.39	18.70	20.70	59.70
12	417.06	414.47	18.70	20.70	59.70
13	403.95	398.35	20.00	22.40	61.80
14	392.02	389.02	20.00	22.40	61.80
15	361.25	361.16	20.00	22.40	61.80
16	367.29	366.75	20.00	22.40	61.80
17	368.15	367.77	20.00	22.40	61.80
18	376.10	374.57	20.00	22.40	61.80
19	380.16	378.36	20.00	22.40	61.80
20	400.37	397.04	20.00	22.40	61.80
21	359.23	358.88	20.00	22.40	61.80
22	360.34	360.27	20.00	22.40	61.80

**Table 2-316. Load Case 301, 30-ft. Head-On Drop,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	-2.9940E+01 -2.0643E-01	-2.8525E+03 -1.9668E+01	-5.4790E+02 -3.7776E+00	2.8226E+03 1.9461E+01	1.2605E+03 8.6905E+00
2	3.2567E+01 2.2454E-01	-1.4483E+03 -9.9854E+00	-4.8487E+01 -3.3430E-01	1.4808E+03 1.0210E+01	4.1952E+00 2.8925E-02
3	1.0120E+01 6.9778E-02	-5.5631E+02 -3.8356E+00	-4.5881E+01 -3.1634E-01	5.6643E+02 3.9054E+00	7.6903E+01 5.3023E-01
4	1.2360E+03 8.5217E+00	-4.9852E+03 -3.4371E+01	-1.5991E+03 -1.1025E+01	6.2211E+03 4.2893E+01	6.3790E+03 4.3982E+01
5	4.7810E+02 3.2964E+00	-2.3239E+03 -1.6023E+01	-9.3470E+02 -6.4445E+00	2.8020E+03 1.9319E+01	4.2844E+03 2.9540E+01
6	-2.9367E+02 -2.0248E+00	-1.1656E+03 -8.0365E+00	-8.4873E+02 -5.8518E+00	8.7192E+02 6.0117E+00	9.8877E+02 6.8173E+00
7	-2.4064E+00 -1.6592E-02	-5.5893E+02 -3.8537E+00	-1.7514E+01 -1.2076E-01	5.5653E+02 3.8371E+00	1.8545E+01 1.2786E-01
8	-6.7155E-01 -4.6302E-03	-4.6163E+02 -3.1828E+00	-1.1862E+01 -8.1784E-02	4.6096E+02 3.1782E+00	7.4107E-01 5.1095E-03
9	-2.7392E-01 -1.8886E-03	-3.6212E+02 -2.4967E+00	-1.0248E+01 -7.0661E-02	3.6184E+02 2.4948E+00	9.5463E-01 6.5819E-03
10	-5.4016E+01 -3.7243E-01	-3.6226E+02 -2.4977E+00	3.0567E+01 2.1075E-01	3.0824E+02 2.1252E+00	2.8123E+02 1.9390E+00
11	1.3456E+02 9.2773E-01	-2.1107E+02 -1.4553E+00	4.5531E+01 3.1392E-01	3.4563E+02 2.3830E+00	1.0485E+02 7.2295E-01
12	1.4592E+02 1.0061E+00	-3.0974E+01 -2.1355E-01	1.0529E+02 7.2595E-01	1.7689E+02 1.2196E+00	3.1841E+02 2.1953E+00
13	2.7004E+02 1.8618E+00	-6.2309E+01 -4.2961E-01	1.1836E+02 8.1604E-01	3.3235E+02 2.2914E+00	2.0905E+02 1.4413E+00
14	3.1019E+02 2.1387E+00	-3.5638E+01 -2.4572E-01	1.6007E+02 1.1036E+00	3.4583E+02 2.3844E+00	7.0666E+01 4.8722E-01
15	1.2085E+03 8.3320E+00	1.0180E+02 7.0190E-01	-6.9485E+00 -4.7908E-02	1.1067E+03 7.6301E+00	5.4635E+00 3.7670E-02

16	4.4746E+02	-7.1865E+02	-2.9993E+02	1.1661E+03	8.5265E+02
	3.0851E+00	-4.9549E+00	-2.0679E+00	8.0400E+00	5.8788E+00
17	6.2459E+02	-6.2086E+02	-3.9725E+02	1.2454E+03	1.3436E+03
	4.3064E+00	-4.2807E+00	-2.7390E+00	8.5871E+00	9.2636E+00
18	7.0210E+02	-1.2822E+03	-1.2982E+02	1.9843E+03	2.5937E+03
	4.8408E+00	-8.8403E+00	-8.9510E-01	1.3681E+01	1.7883E+01
19	4.0754E+02	-1.4038E+03	-5.9775E+02	1.8113E+03	1.6132E+03
	2.8099E+00	-9.6786E+00	-4.1213E+00	1.2489E+01	1.1123E+01
20	1.0619E+02	-1.0356E+03	-5.8430E+02	1.1418E+03	2.1014E+03
	7.3216E-01	-7.1404E+00	-4.0286E+00	7.8726E+00	1.4488E+01
21	1.5583E+03	1.4514E+02	1.3330E+02	1.4132E+03	5.2131E+02
	1.0744E+01	1.0007E+00	9.1904E-01	9.7436E+00	3.5943E+00
22	7.3129E+02	6.1186E+01	3.9463E+02	6.7010E+02	6.7024E+02
	5.0421E+00	4.2186E-01	2.7209E+00	4.6202E+00	4.6211E+00

**Table 2-317. Load Case 302, 30-ft. Side Drop + Slap-Down,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.3968E+02 9.6309E-01	-6.8637E+01 -4.7324E-01	-5.3256E+02 -3.6719E+00	3.6131E+03 2.4911E+01	1.2213E+03 8.4208E+00		
2	9.1222E+02 6.2895E+00	-1.3328E+02 -9.1893E-01	-2.5653E+02 -1.7687E+00	9.3053E+02 6.4158E+00	1.1567E+03 7.9750E+00		
3	1.3409E+02 9.2449E-01	-6.2195E+01 -4.2882E-01	-5.2913E+02 -3.6482E+00	3.6142E+03 2.4919E+01	1.2153E+03 8.3795E+00		
4	7.1756E+02 4.9474E+00	-3.9376E+01 -2.7149E-01	-9.5615E+02 -6.5924E+00	2.9538E+03 2.0366E+01	6.3647E+02 4.3883E+00		
5	1.0110E+03 6.9708E+00	-1.5693E+02 -1.0820E+00	-1.3386E+03 -9.2293E+00	2.9148E+03 2.0097E+01	7.6459E+01 5.2717E-01		
6	1.1511E+03 7.9368E+00	-2.3027E+02 -1.5877E+00	-1.3557E+03 -9.3473E+00	2.6470E+03 1.8250E+01	1.4563E+02 1.0041E+00		
7	2.0904E+02 1.4412E+00	1.2182E+02 8.3991E-01	-1.1830E+01 -8.1566E-02	1.5169E+03 1.0459E+01	8.0662E+01 5.5614E-01		
8	1.3473E+02 9.2895E-01	1.1408E+02 7.8656E-01	1.7296E+01 1.1925E-01	7.2069E+02 4.9690E+00	1.0594E+02 7.3045E-01		
9	2.1845E+02 1.5062E+00	1.1923E+02 8.2203E-01	-1.2258E+01 -8.4518E-02	1.4963E+03 1.0317E+01	8.1904E+01 5.6471E-01		
10	1.2717E+03 8.7678E+00	-6.8768E+01 -4.7414E-01	-1.3667E+03 -9.4232E+00	1.9866E+03 1.3697E+01	6.7179E+02 4.6318E+00		
11	6.0792E+02 4.1915E+00	-3.3477E+02 -2.3082E+00	-1.5654E+03 -1.0793E+01	2.0550E+03 1.4168E+01	6.2723E+02 4.3246E+00		
12	-4.2067E+01 -2.9004E-01	-2.9458E+02 -2.0310E+00	-1.2994E+03 -8.9587E+00	1.2681E+03 8.7433E+00	1.4601E+02 1.0067E+00		
13	1.0517E+03 7.2513E+00	-1.6792E+02 -1.1577E+00	-1.2557E+03 -8.6579E+00	2.8279E+03 1.9497E+01	8.2296E+01 5.6741E-01		
14	8.0120E+02 5.5241E+00	-1.2512E+02 -8.6270E-01	-1.1483E+03 -7.9169E+00	2.7763E+03 1.9142E+01	5.5651E+02 3.8370E+00		
15	-6.5674E+01 -4.5281E-01	-2.3256E+02 -1.6035E+00	-1.2914E+03 -8.9037E+00	1.2881E+03 8.8812E+00	5.3015E+01 3.6552E-01		

16	1.2799E+02	-8.8239E+01	-1.1994E+03	2.6960E+03	2.5158E+02
	8.8247E-01	-6.0838E-01	-8.2695E+00	1.8589E+01	1.7346E+00
17	4.0181E+02	-2.6336E+01	-1.0550E+03	2.6877E+03	2.6710E+02
	2.7704E+00	-1.8158E-01	-7.2740E+00	1.8531E+01	1.8416E+00
18	8.6913E+02	-1.0430E+02	-1.0064E+03	2.9196E+03	2.0213E+02
	5.9924E+00	-7.1913E-01	-6.9386E+00	2.0130E+01	1.3936E+00
19	7.5856E+02	-2.0786E+02	-1.3113E+03	3.1150E+03	2.3580E+02
	5.2301E+00	-1.4331E+00	-9.0411E+00	2.1477E+01	1.6258E+00
20	7.9190E+02	-2.1748E+02	-1.2537E+03	2.3570E+03	1.8706E+02
	5.4600E+00	-1.4995E+00	-8.6437E+00	1.6251E+01	1.2898E+00
21	-2.4145E+01	-2.8385E+02	-1.4077E+03	1.4476E+03	1.7288E+02
	-1.6647E-01	-1.9571E+00	-9.7054E+00	9.9809E+00	1.1920E+00
22	-2.1531E+01	-3.0654E+02	-1.4702E+03	1.5102E+03	1.4132E+02
	-1.4845E-01	-2.1135E+00	-1.0136E+01	1.0412E+01	9.7438E-01

**Table 2-318. Load Case 303, 30-ft. Cg/Corner Drop,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	3.0882E+02 2.1292E+00	9.9384E+01 6.8523E-01	-1.3350E+03 -9.2043E+00	2.3145E+03 1.5958E+01	8.3219E+02 5.7377E+00
2	3.2694E+02 2.2541E+00	-9.7695E+01 -6.7358E-01	-5.7799E+02 -3.9851E+00	1.2703E+03 8.7586E+00	2.0891E+02 1.4404E+00
3	1.0783E+03 7.4345E+00	-3.4774E+01 -2.3976E-01	-1.3952E+02 -9.6193E-01	1.2178E+03 8.3964E+00	3.2285E+02 2.2260E+00
4	3.1767E+02 2.1903E+00	3.0107E+01 2.0758E-01	-1.4176E+03 -9.7741E+00	3.9975E+03 2.7562E+01	4.3202E+02 2.9787E+00
5	3.9524E+02 2.7251E+00	-3.3432E+02 -2.3051E+00	-1.9562E+03 -1.3487E+01	2.3042E+03 1.5887E+01	2.6207E+02 1.8069E+00
6	3.8951E+02 2.6856E+00	-6.0195E+02 -4.1503E+00	-2.1436E+03 -1.4780E+01	2.4948E+03 1.7201E+01	4.8545E+02 3.3470E+00
7	3.3983E+02 2.3430E+00	5.9379E+01 4.0941E-01	-2.2951E+02 -1.5824E+00	2.5180E+03 1.7361E+01	5.0709E+01 3.4963E-01
8	4.5534E+02 3.1395E+00	1.0147E+01 6.9965E-02	-2.9234E+02 -2.0156E+00	1.9301E+03 1.3308E+01	3.3335E+01 2.2984E-01
9	5.0291E+02 3.4674E+00	-1.4606E+02 -1.0070E+00	-3.0233E+02 -2.0845E+00	1.3196E+03 9.0983E+00	4.5411E+01 3.1310E-01
10	5.3146E+02 3.6643E+00	-1.3192E+02 -9.0956E-01	-2.0961E+02 -1.4452E+00	9.6928E+02 6.6829E+00	4.4100E+02 3.0406E+00
11	6.2706E+02 4.3235E+00	5.8407E+01 4.0270E-01	-7.3861E+01 -5.0926E-01	7.1636E+02 4.9391E+00	3.3225E+02 2.2908E+00
12	3.3457E+02 2.3068E+00	1.2032E+01 8.2959E-02	-1.4275E+01 -9.8420E-02	3.4885E+02 2.4052E+00	7.1196E+01 4.9088E-01
13	5.3330E+02 3.6770E+00	-1.0521E+02 -7.2538E-01	-1.8677E+02 -1.2877E+00	7.2444E+02 4.9948E+00	3.1629E+01 2.1807E-01
14	5.3246E+02 3.6712E+00	-1.3802E+02 -9.5164E-01	-2.0479E+02 -1.4120E+00	7.3725E+02 5.0832E+00	8.2920E+01 5.7171E-01
15	3.3884E+02 2.3362E+00	1.0369E+02 7.1493E-01	-1.0038E+03 -6.9213E+00	1.3811E+03 9.5227E+00	3.2166E+01 2.2178E-01

16	4.4454E+02	3.1933E+01	-1.0252E+03	3.0364E+03	2.5476E+02
	3.0650E+00	2.2017E-01	-7.0682E+00	2.0935E+01	1.7565E+00
17	4.1155E+02	9.8915E+01	-9.5956E+02	2.9072E+03	5.0705E+02
	2.8375E+00	6.8199E-01	-6.6159E+00	2.0044E+01	3.4960E+00
18	3.9052E+02	-9.1967E+01	-1.4386E+03	2.3354E+03	4.5800E+02
	2.6925E+00	-6.3409E-01	-9.9186E+00	1.6102E+01	3.1578E+00
19	4.2118E+02	-2.2376E+02	-1.9041E+03	2.1644E+03	5.2637E+02
	2.9039E+00	-1.5428E+00	-1.3128E+01	1.4923E+01	3.6292E+00
20	2.7251E+02	-3.8419E+02	-1.8683E+03	2.1308E+03	1.9785E+02
	1.8789E+00	-2.6489E+00	-1.2881E+01	1.4691E+01	1.3641E+00
21	2.9946E+02	2.2593E+02	-3.6470E+01	3.2279E+02	8.0494E+00
	2.0647E+00	1.5577E+00	-2.5145E-01	2.2256E+00	5.5499E-02
22	5.0760E+02	4.1393E+01	-9.8404E+02	1.5315E+03	1.2996E+02
	3.4998E+00	2.8539E-01	-6.7847E+00	1.0560E+01	8.9601E-01

Table 2-319. Load Case 304, 30-ft. Head-On Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	-4.2094E+01 -2.9023E-01	-4.0127E+03 -2.7667E+01	-7.6985E+02 -5.3079E+00	3.9707E+03 2.7377E+01	1.7722E+03 1.2219E+01		
2	4.5773E+01 3.1559E-01	-2.0425E+03 -1.4082E+01	-6.8408E+01 -4.7165E-01	2.0882E+03 1.4398E+01	6.5677E+00 4.5283E-02		
3	1.4450E+01 9.9628E-02	-7.9327E+02 -5.4694E+00	-6.4051E+01 -4.4161E-01	8.0772E+02 5.5691E+00	1.0498E+02 7.2380E-01		
4	1.7387E+03 1.1988E+01	-7.0074E+03 -4.8314E+01	-2.2463E+03 -1.5488E+01	8.7461E+03 6.0302E+01	8.9683E+03 6.1834E+01		
5	6.7297E+02 4.6400E+00	-3.2671E+03 -2.2526E+01	-1.3129E+03 -9.0524E+00	3.9400E+03 2.7166E+01	6.0243E+03 4.1536E+01		
6	-4.1478E+02 -2.8598E+00	-1.6406E+03 -1.1311E+01	-1.1933E+03 -8.2276E+00	1.2258E+03 8.4515E+00	1.3883E+03 9.5719E+00		
7	-3.4014E+00 -2.3452E-02	-7.8863E+02 -5.4374E+00	-2.4678E+01 -1.7015E-01	7.8522E+02 5.4139E+00	2.6087E+01 1.7987E-01		
8	-9.6327E-01 -6.6415E-03	-6.5266E+02 -4.4999E+00	-1.6763E+01 -1.1557E-01	6.5170E+02 4.4933E+00	1.0380E+00 7.1571E-03		
9	-4.1248E-01 -2.8439E-03	-5.1526E+02 -3.5526E+00	-1.4599E+01 -1.0066E-01	5.1485E+02 3.5498E+00	1.2519E+00 8.6317E-03		
10	-7.7868E+01 -5.3688E-01	-5.2278E+02 -3.6045E+00	4.1327E+01 2.8494E-01	4.4491E+02 3.0676E+00	4.0089E+02 2.7640E+00		
11	1.9052E+02 1.3136E+00	-3.0257E+02 -2.0862E+00	6.3088E+01 4.3498E-01	4.9309E+02 3.3998E+00	1.5253E+02 1.0517E+00		
12	2.0361E+02 1.4038E+00	-4.8603E+01 -3.3511E-01	1.4788E+02 1.0196E+00	2.5221E+02 1.7389E+00	4.5981E+02 3.1703E+00		
13	3.7569E+02 2.5903E+00	-9.2489E+01 -6.3769E-01	1.6459E+02 1.1348E+00	4.6817E+02 3.2279E+00	2.7750E+02 1.9133E+00		
14	4.2923E+02 2.9594E+00	-5.1008E+01 -3.5169E-01	2.2351E+02 1.5411E+00	4.8024E+02 3.3111E+00	8.9745E+01 6.1877E-01		
15	1.6958E+03 1.1692E+01	1.4207E+02 9.7953E-01	-1.0543E+01 -7.2693E-02	1.5537E+03 1.0712E+01	7.7502E+00 5.3436E-02		

16	6.2734E+02	-1.0095E+03	-4.2212E+02	1.6368E+03	1.1965E+03
	4.3254E+00	-6.9603E+00	-2.9104E+00	1.1286E+01	8.2493E+00
17	8.7592E+02	-8.7259E+02	-5.5885E+02	1.7485E+03	1.8863E+03
	6.0393E+00	-6.0163E+00	-3.8531E+00	1.2056E+01	1.3006E+01
18	9.8482E+02	-1.8022E+03	-1.8269E+02	2.7870E+03	3.6441E+03
	6.7901E+00	-1.2426E+01	-1.2596E+00	1.9216E+01	2.5125E+01
19	5.7335E+02	-1.9731E+03	-8.3942E+02	2.5464E+03	2.2689E+03
	3.9531E+00	-1.3604E+01	-5.7876E+00	1.7557E+01	1.5644E+01
20	1.5027E+02	-1.4560E+03	-8.2116E+02	1.6063E+03	2.9554E+03
	1.0361E+00	-1.0039E+01	-5.6617E+00	1.1075E+01	2.0377E+01
21	2.1657E+03	2.0163E+02	1.8515E+02	1.9641E+03	7.2396E+02
	1.4932E+01	1.3902E+00	1.2766E+00	1.3542E+01	4.9915E+00
22	1.0261E+03	8.5458E+01	5.5324E+02	9.4068E+02	9.4114E+02
	7.0750E+00	5.8921E-01	3.8145E+00	6.4858E+00	6.4889E+00

Table 2-320. Load Case 305, 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	1.9412E+02 1.3384E+00	-9.2510E+01 -6.3783E-01	-7.1002E+02 -4.8954E+00	5.0282E+03 3.4668E+01	1.6993E+03 1.1716E+01		
2	1.2705E+03 8.7597E+00	-1.8353E+02 -1.2654E+00	-3.4588E+02 -2.3847E+00	1.2956E+03 8.9328E+00	1.6107E+03 1.1105E+01		
3	1.8634E+02 1.2848E+00	-8.3546E+01 -5.7603E-01	-7.0533E+02 -4.8631E+00	5.0297E+03 3.4678E+01	1.6910E+03 1.1659E+01		
4	9.9781E+02 6.8796E+00	-5.7415E+01 -3.9586E-01	-1.3161E+03 -9.0741E+00	4.1071E+03 2.8317E+01	8.8459E+02 6.0990E+00		
5	1.4064E+03 9.6965E+00	-2.2092E+02 -1.5232E+00	-1.8471E+03 -1.2735E+01	4.0504E+03 2.7927E+01	1.0609E+02 7.3148E-01		
6	1.6015E+03 1.1042E+01	-3.2210E+02 -2.2208E+00	-1.8724E+03 -1.2910E+01	3.6777E+03 2.5357E+01	2.0161E+02 1.3901E+00		
7	2.8822E+02 1.9872E+00	1.5972E+02 1.1012E+00	-1.7752E+01 -1.2240E-01	2.1032E+03 1.4501E+01	1.1034E+02 7.6075E-01		
8	1.7966E+02 1.2387E+00	1.4991E+02 1.0336E+00	2.3124E+01 1.5943E-01	9.8986E+02 6.8248E+00	1.4815E+02 1.0215E+00		
9	3.0138E+02 2.0779E+00	1.5610E+02 1.0763E+00	-1.8358E+01 -1.2657E-01	2.0745E+03 1.4303E+01	1.1206E+02 7.7260E-01		
10	1.7692E+03 1.2198E+01	-1.0179E+02 -7.0182E-01	-1.8912E+03 -1.3039E+01	2.7594E+03 1.9026E+01	9.3568E+02 6.4513E+00		
11	8.4687E+02 5.8390E+00	-4.4524E+02 -3.0698E+00	-2.1696E+03 -1.4959E+01	2.8542E+03 1.9679E+01	8.6720E+02 5.9791E+00		
12	-5.8495E+01 -4.0331E-01	-4.1322E+02 -2.8490E+00	-1.7998E+03 -1.2409E+01	1.7568E+03 1.2113E+01	2.0230E+02 1.3948E+00		
13	1.4630E+03 1.0087E+01	-2.3587E+02 -1.6263E+00	-1.7329E+03 -1.1948E+01	3.9300E+03 2.7096E+01	1.1378E+02 7.8452E-01		
14	1.1144E+03 7.6836E+00	-1.7639E+02 -1.2162E+00	-1.5827E+03 -1.0913E+01	3.8590E+03 2.6607E+01	7.7373E+02 5.3347E+00		
15	-9.0950E+01 -6.2708E-01	-3.2607E+02 -2.2482E+00	-1.7920E+03 -1.2355E+01	1.7880E+03 1.2328E+01	7.3707E+01 5.0819E-01		

16	1.7775E+02	-1.2436E+02	-1.6547E+03	3.7477E+03	3.4974E+02
	1.2255E+00	-8.5741E-01	-1.1408E+01	2.5839E+01	2.4114E+00
17	5.5885E+02	-3.9168E+01	-1.4542E+03	3.7364E+03	3.7155E+02
	3.8532E+00	-2.7006E-01	-1.0026E+01	2.5761E+01	2.5617E+00
18	1.2090E+03	-1.4722E+02	-1.3855E+03	4.0588E+03	2.8121E+02
	8.3354E+00	-1.0151E+00	-9.5528E+00	2.7984E+01	1.9388E+00
19	1.0553E+03	-2.9021E+02	-1.8070E+03	4.3297E+03	3.2814E+02
	7.2759E+00	-2.0010E+00	-1.2459E+01	2.9852E+01	2.2624E+00
20	1.1022E+03	-3.0343E+02	-1.7320E+03	3.2749E+03	2.5961E+02
	7.5991E+00	-2.0921E+00	-1.1942E+01	2.2580E+01	1.7899E+00
21	-3.3469E+01	-3.9757E+02	-1.9533E+03	2.0093E+03	2.4029E+02
	-2.3076E-01	-2.7412E+00	-1.3468E+01	1.3854E+01	1.6567E+00
22	-2.9865E+01	-4.2919E+02	-2.0401E+03	2.0961E+03	1.9640E+02
	-2.0591E-01	-2.9592E+00	-1.4066E+01	1.4452E+01	1.3541E+00

Table 2-321. Load Case 306, 30-ft. Cg/Corner Drop at -40°F, Low Temperature, Hypothetical Accident Conditions of Transport – Model AOS-100B

Location	Stress (psi/MPa)			Pm	Pb
	Sigma_1	Sigma_2	Sigma_3		
1	3.6031E+02 2.4843E+00	1.1604E+02 8.0008E-01	-1.5585E+03 -1.0746E+01	2.7004E+03 1.8619E+01	9.7099E+02 6.6947E+00
2	3.8085E+02 2.6259E+00	-1.1403E+02 -7.8621E-01	-6.7492E+02 -4.6534E+00	1.4821E+03 1.0219E+01	2.4375E+02 1.6806E+00
3	1.2572E+03 8.6681E+00	-4.0757E+01 -2.8101E-01	-1.6291E+02 -1.1232E+00	1.4201E+03 9.7914E+00	3.7648E+02 2.5957E+00
4	3.7062E+02 2.5553E+00	3.5184E+01 2.4259E-01	-1.6544E+03 -1.1406E+01	4.6640E+03 3.2157E+01	5.0417E+02 3.4761E+00
5	4.6116E+02 3.1796E+00	-3.9003E+02 -2.6892E+00	-2.2827E+03 -1.5739E+01	2.6886E+03 1.8537E+01	3.0576E+02 2.1082E+00
6	4.5447E+02 3.1334E+00	-7.0231E+02 -4.8423E+00	-2.5014E+03 -1.7247E+01	2.9109E+03 2.0070E+01	5.6637E+02 3.9050E+00
7	3.9637E+02 2.7329E+00	6.9316E+01 4.7792E-01	-2.6767E+02 -1.8455E+00	2.9378E+03 2.0256E+01	5.9191E+01 4.0811E-01
8	5.3104E+02 3.6614E+00	1.1888E+01 8.1965E-02	-3.4097E+02 -2.3509E+00	2.2519E+03 1.5526E+01	3.8881E+01 2.6807E-01
9	5.8648E+02 4.0436E+00	-1.7018E+02 -1.1734E+00	-3.5260E+02 -2.4311E+00	1.5395E+03 1.0615E+01	5.2968E+01 3.6520E-01
10	6.1982E+02 4.2735E+00	-1.5383E+02 -1.0606E+00	-2.4448E+02 -1.6856E+00	1.1308E+03 7.7963E+00	5.1456E+02 3.5478E+00
11	7.3131E+02 5.0422E+00	6.8124E+01 4.6970E-01	-8.6113E+01 -5.9373E-01	8.3556E+02 5.7610E+00	3.8754E+02 2.6720E+00
12	3.9020E+02 2.6904E+00	1.4076E+01 9.7054E-02	-1.6619E+01 -1.1458E-01	4.0682E+02 2.8049E+00	8.3056E+01 5.7265E-01
13	6.2191E+02 4.2880E+00	-1.2274E+02 -8.4627E-01	-2.1791E+02 -1.5024E+00	8.4494E+02 5.8257E+00	3.6907E+01 2.5446E-01
14	6.2092E+02 4.2811E+00	-1.6100E+02 -1.1101E+00	-2.3898E+02 -1.6477E+00	8.5990E+02 5.9288E+00	9.6686E+01 6.6663E-01
15	3.9537E+02 2.7259E+00	1.2096E+02 8.3399E-01	-1.1714E+03 -8.0766E+00	1.6116E+03 1.1112E+01	3.7528E+01 2.5875E-01

16	5.1874E+02	3.7258E+01	-1.1965E+03	3.5428E+03	2.9725E+02
	3.5766E+00	2.5689E-01	-8.2496E+00	2.4427E+01	2.0494E+00
17	4.8025E+02	1.1544E+02	-1.1199E+03	3.3920E+03	5.9156E+02
	3.3112E+00	7.9591E-01	-7.7218E+00	2.3387E+01	4.0787E+00
18	4.5567E+02	-1.0726E+02	-1.6788E+03	2.7248E+03	5.3436E+02
	3.1417E+00	-7.3955E-01	-1.1575E+01	1.8787E+01	3.6843E+00
19	4.9145E+02	-2.6105E+02	-2.2220E+03	2.5253E+03	6.1414E+02
	3.3884E+00	-1.7999E+00	-1.5320E+01	1.7412E+01	4.2343E+00
20	3.1796E+02	-4.4826E+02	-2.1801E+03	2.4862E+03	2.3085E+02
	2.1923E+00	-3.0907E+00	-1.5031E+01	1.7142E+01	1.5916E+00
21	3.4932E+02	2.6348E+02	-4.2515E+01	3.7650E+02	9.3910E+00
	2.4085E+00	1.8166E+00	-2.9313E-01	2.5959E+00	6.4749E-02
22	5.9226E+02	4.8287E+01	-1.1483E+03	1.7871E+03	1.5162E+02
	4.0835E+00	3.3293E-01	-7.9176E+00	1.2322E+01	1.0454E+00

**Table 2-322. Load Case 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Location	Stress (psi/MPa)					Pm	Pb
	Sigma_1	Sigma_2	Sigma_3				
1	2.0628E+02 1.4222E+00	-4.9951E+02 -3.4440E+00	5.2133E+02 3.5944E+00	7.0578E+02 4.8662E+00	3.6794E+00 2.5369E-02		
2	9.7119E+00 6.6961E-02	-3.3206E+02 -2.2895E+00	2.2342E+01 1.5404E-01	3.4177E+02 2.3564E+00	1.1125E+02 7.6705E-01		
3	-1.6402E+00 -1.1309E-02	-1.2721E+02 -8.7706E-01	-1.3949E+00 -9.6178E-03	1.2557E+02 8.6575E-01	1.4617E+01 1.0078E-01		
4	9.9753E+02 6.8777E+00	-2.9860E+02 -2.0588E+00	9.2603E+02 6.3848E+00	1.2961E+03 8.9365E+00	3.8144E+02 2.6299E+00		
5	8.9652E+02 6.1813E+00	-7.3102E+02 -5.0402E+00	8.0956E+02 5.5817E+00	1.6275E+03 1.1221E+01	1.2367E+03 8.5265E+00		
6	-1.6175E+02 -1.1152E+00	-1.5458E+03 -1.0658E+01	2.2211E+02 1.5314E+00	1.3841E+03 9.5430E+00	1.0179E+02 7.0184E-01		
7	-7.5795E-01 -5.2259E-03	-9.6629E+02 -6.6623E+00	-1.1520E+01 -7.9425E-02	9.6553E+02 6.6571E+00	1.2715E+01 8.7666E-02		
8	-1.0510E-01 -7.2461E-04	-5.5458E+02 -3.8237E+00	-8.0492E+00 -5.5498E-02	5.5448E+02 3.8230E+00	1.1177E-01 7.7061E-04		
9	1.4254E+00 9.8277E-03	-2.4540E+02 -1.6920E+00	-9.5904E+00 -6.6124E-02	2.4683E+02 1.7018E+00	4.6153E+00 3.1821E-02		
10	9.6863E+01 6.6785E-01	-1.3712E+02 -9.4540E-01	1.8414E+02 1.2696E+00	2.3398E+02 1.6132E+00	3.1484E+02 2.1707E+00		
11	1.6178E+02 1.1154E+00	-1.5472E+02 -1.0667E+00	1.0365E+02 7.1461E-01	3.1650E+02 2.1822E+00	3.7600E+01 2.5925E-01		
12	1.2243E+02 8.4414E-01	-2.8632E+02 -1.9741E+00	1.0373E+02 7.1518E-01	4.0875E+02 2.8182E+00	6.0876E+02 4.1972E+00		
13	5.9946E+02 4.1331E+00	-6.6468E+01 -4.5828E-01	1.9441E+02 1.3404E+00	6.6593E+02 4.5914E+00	6.8838E+02 4.7462E+00		
14	6.1276E+02 4.2248E+00	-8.5532E+01 -5.8972E-01	2.1954E+02 1.5137E+00	6.9829E+02 4.8145E+00	5.9216E+02 4.0828E+00		
15	-7.8465E+03 -5.4100E+01	-4.0547E+04 -2.7956E+02	-3.2688E+03 -2.2538E+01	3.2700E+04 2.2546E+02	8.6713E+02 5.9787E+00		

16	2.2425E+03	-4.5369E+03	-1.8808E+02	6.7794E+03	9.6881E+03
	1.5462E+01	-3.1281E+01	-1.2968E+00	4.6742E+01	6.6797E+01
17	-3.0895E+02	-4.2002E+03	4.6060E+02	3.8912E+03	6.8057E+03
	-2.1301E+00	-2.8959E+01	3.1757E+00	2.6829E+01	4.6924E+01
18	-2.7004E+02	-1.6941E+03	-3.1620E+02	1.4241E+03	4.3105E+02
	-1.8619E+00	-1.1681E+01	-2.1801E+00	9.8189E+00	2.9720E+00
19	7.4373E+02	-1.0598E+03	-1.3258E+02	1.8035E+03	2.2113E+03
	5.1279E+00	-7.3070E+00	-9.1408E-01	1.2435E+01	1.5246E+01
20	1.1079E+03	-1.1824E+03	-3.2353E+02	2.2903E+03	3.4755E+03
	7.6386E+00	-8.1524E+00	-2.2307E+00	1.5791E+01	2.3963E+01
21	8.6882E+01	-1.2537E+02	-2.6223E+01	2.1225E+02	4.0111E+02
	5.9903E-01	-8.6440E-01	-1.8080E-01	1.4634E+00	2.7655E+00
22	-1.1520E+03	-1.4960E+04	-4.2375E+03	1.3808E+04	1.0341E+04
	-7.9425E+00	-1.0314E+02	-2.9216E+01	9.5200E+01	7.1298E+01

**Table 2-323. Load Combination 301, Head-On Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 301, 102, 201, 211
 30-ft. Head-On Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	3.42	2.12	5.54	20.00	66.30	>10
	23.60	14.62	38.22	137.90	457.12	
2	1.52	0.03	1.55	20.00	66.30	>10
	10.49	0.22	10.71	137.90	457.12	
3	0.59	0.10	0.69	20.00	66.30	>10
	4.08	0.69	4.77	137.90	457.12	
4	11.17	15.09	26.26	20.00	66.30	1.52
	76.99	104.07	181.06	137.90	457.12	
5	7.08	11.25	18.33	20.00	66.30	2.62
	48.80	77.59	126.38	137.90	457.12	
6	2.53	3.26	5.79	20.00	61.80	9.67
	17.46	22.47	39.93	137.90	426.10	
7	0.84	0.03	0.87	20.00	61.80	>10
	5.80	0.18	5.98	137.90	426.10	
8	0.75	0.00	0.75	20.00	61.80	>10
	5.14	0.01	5.15	137.90	426.10	
9	0.65	0.01	0.66	20.00	61.80	>10
	4.46	0.09	4.55	137.90	426.10	
10	1.29	1.29	2.58	20.00	61.80	>10
	8.89	8.89	17.78	137.90	426.10	
11	0.96	0.39	1.35	20.00	61.80	>10
	6.60	2.69	9.29	137.90	426.10	
12	0.69	0.73	1.42	20.00	61.80	>10
	4.77	5.03	9.80	137.90	426.10	

13	1.37 9.47	1.13 7.76	2.50 17.23	20.00 137.90	61.80 426.10	>10
14	1.33 9.14	1.05 7.26	2.38 16.40	20.00 137.90	66.30 457.12	>10
15	4.94 34.07	5.46 37.61	10.40 71.69	20.00 137.90	66.30 457.12	5.38
16	3.49 24.05	4.25 29.28	7.73 53.33	20.00 137.90	66.30 457.12	7.57
17	2.89 19.90	3.80 26.21	6.69 46.11	20.00 137.90	66.30 457.12	8.91
18	3.93 27.09	5.59 38.56	9.52 65.65	20.00 137.90	66.30 457.12	5.96
19	4.93 33.96	6.41 44.23	11.34 78.18	20.00 137.90	66.30 457.12	4.85
20	3.68 25.40	6.81 46.96	10.50 72.36	20.00 137.90	61.80 426.10	4.89
21	1.64 11.29	0.99 6.81	2.62 18.10	20.00 137.90	66.30 457.12	>10
22	2.64 18.21	3.01 20.75	5.65 38.96	20.00 137.90	66.30 457.12	>10

Min MS: 1.525, Location: 4, Combination: Pm+Pb

**Table 2-324. Load Combination 302, Side Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 302, 102, 201, 211
 30-ft. Side Drop + Slap-Down
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.21	2.08	6.29	20.00	66.30	9.53
	29.05	14.35	43.40	137.90	457.12	
2	0.97	1.18	2.16	20.00	66.30	>10
	6.70	8.16	14.86	137.90	457.12	
3	3.64	1.24	4.88	20.00	66.30	>10
	25.09	8.54	33.63	137.90	457.12	
4	7.90	9.35	17.25	20.00	66.30	2.84
	54.46	64.48	118.94	137.90	457.12	
5	7.19	7.05	14.24	20.00	66.30	3.66
	49.57	48.57	98.15	137.90	457.12	
6	4.31	2.42	6.72	20.00	61.80	8.19
	29.70	16.65	46.35	137.90	426.10	
7	1.80	0.09	1.89	20.00	61.80	>10
	12.42	0.61	13.03	137.90	426.10	
8	1.01	0.11	1.11	20.00	61.80	>10
	6.93	0.73	7.66	137.90	426.10	
9	1.78	0.09	1.87	20.00	61.80	>10
	12.28	0.64	12.93	137.90	426.10	
10	2.97	1.68	4.65	20.00	61.80	>10
	20.46	11.58	32.05	137.90	426.10	
11	2.67	0.91	3.58	20.00	61.80	>10
	18.39	6.29	24.68	137.90	426.10	
12	1.78	0.56	2.34	20.00	61.80	>10
	12.30	3.84	16.14	137.90	426.10	

13	3.87 26.67	1.00 6.89	4.87 33.56	20.00 137.90	61.80 426.10	>10
14	3.76 25.90	1.54 10.61	5.30 36.51	20.00 137.90	66.30 457.12	>10
15	5.12 35.32	5.50 37.94	10.63 73.27	20.00 137.90	66.30 457.12	5.24
16	5.02 34.59	3.65 25.14	8.66 59.73	20.00 137.90	66.30 457.12	6.65
17	4.33 29.85	2.72 18.78	7.05 48.63	20.00 137.90	66.30 457.12	8.40
18	4.86 33.54	3.20 22.07	8.07 55.61	20.00 137.90	66.30 457.12	7.22
19	6.23 42.95	5.04 34.73	11.27 77.68	20.00 137.90	66.30 457.12	4.88
20	4.90 33.78	4.90 33.76	9.80 67.54	20.00 137.90	61.80 426.10	5.31
21	1.67 11.53	0.64 4.40	2.31 15.93	20.00 137.90	66.30 457.12	>10
22	3.48 24.00	2.48 17.11	5.96 41.11	20.00 137.90	66.30 457.12	>10

Min MS: 2.843, Location: 4, Combination: Pm+Pb

**Table 2-325. Load Combination 303, Cg/Corner Drop Orientation,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 303, 102, 201, 211
 30-ft. Cg/Corner Drop
 100°F Ambient, Maximum Decay Heat, Maximum Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	2.91 20.10	1.69 11.66	4.61 31.76	20.00 137.90	66.30 457.12	>10
2	1.31 9.04	0.24 1.63	1.55 10.67	20.00 137.90	66.30 457.12	>10
3	1.24 8.57	0.35 2.39	1.59 10.95	20.00 137.90	66.30 457.12	>10
4	8.94 61.66	9.15 63.07	18.09 124.72	20.00 137.90	66.30 457.12	2.67
5	6.58 45.36	7.23 49.85	13.81 95.22	20.00 137.90	66.30 457.12	3.80
6	4.16 28.65	2.76 19.00	6.91 47.65	20.00 137.90	61.80 426.10	7.94
7	2.80 19.33	0.06 0.40	2.86 19.73	20.00 137.90	61.80 426.10	>10
8	2.21 15.27	0.03 0.23	2.25 15.50	20.00 137.90	61.80 426.10	>10
9	1.60 11.06	0.06 0.39	1.66 11.46	20.00 137.90	61.80 426.10	>10
10	1.95 13.45	1.45 9.99	3.40 23.44	20.00 137.90	61.80 426.10	>10
11	1.33 9.16	0.62 4.25	1.95 13.41	20.00 137.90	61.80 426.10	>10
12	0.86 5.96	0.48 3.32	1.35 9.28	20.00 137.90	61.80 426.10	>10

13	1.76 12.17	0.95 6.54	2.71 18.71	20.00 137.90	61.80 426.10	>10
14	1.72 11.84	1.07 7.35	2.78 19.19	20.00 137.90	66.30 457.12	>10
15	5.22 35.96	5.48 37.80	10.70 73.76	20.00 137.90	66.30 457.12	5.20
16	5.36 36.94	3.65 25.16	9.01 62.10	20.00 137.90	66.30 457.12	6.36
17	4.55 31.36	2.96 20.44	7.51 51.80	20.00 137.90	66.30 457.12	7.82
18	4.28 29.51	3.46 23.84	7.74 53.35	20.00 137.90	66.30 457.12	7.57
19	5.28 36.39	5.33 36.73	10.61 73.13	20.00 137.90	66.30 457.12	5.25
20	4.67 32.22	4.91 33.84	9.58 66.06	20.00 137.90	61.80 426.10	5.45
21	0.55 3.77	0.47 3.27	1.02 7.04	20.00 137.90	66.30 457.12	>10
22	3.50 24.15	2.47 17.03	5.97 41.18	20.00 137.90	66.30 457.12	>10

Min MS: 2.665, Location: 4, Combination: Pm+Pb

Table 2-326. Load Combination 304, Head-On Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-100B

Load Cases: 304, 105, 202, 211
 30-ft. Head-On Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	4.56 31.43	2.62 18.06	7.18 49.49	20.00 137.90	70.00 482.63	8.75
2	2.12 14.62	0.03 0.23	2.15 14.85	20.00 137.90	70.00 482.63	>10
3	0.82 5.65	0.11 0.75	0.93 6.40	20.00 137.90	70.00 482.63	>10
4	9.66 66.59	10.55 72.77	20.21 139.36	20.00 137.90	70.00 482.63	2.46
5	4.89 33.72	7.49 51.66	12.38 85.38	20.00 137.90	70.00 482.63	4.65
6	1.62 11.15	2.03 14.03	3.65 25.18	20.00 137.90	70.00 482.63	>10
7	0.94 6.47	0.03 0.19	0.97 6.67	20.00 137.90	70.00 482.63	>10
8	0.81 5.55	0.00 0.01	0.81 5.56	20.00 137.90	70.00 482.63	>10
9	0.67 4.61	0.00 0.01	0.67 4.62	20.00 137.90	70.00 482.63	>10
10	0.64 4.44	0.49 3.36	1.13 7.80	20.00 137.90	70.00 482.63	>10
11	0.60 4.15	0.22 1.52	0.82 5.67	20.00 137.90	70.00 482.63	>10
12	0.33 2.26	0.47 3.23	0.80 5.49	20.00 137.90	70.00 482.63	>10

13	0.82 5.67	0.64 4.39	1.46 10.06	20.00 137.90	70.00 482.63	>10
14	0.82 5.64	0.38 2.65	1.20 8.29	20.00 137.90	70.00 482.63	>10
15	2.04 14.09	0.29 2.01	2.33 16.09	20.00 137.90	70.00 482.63	>10
16	1.78 12.27	1.40 9.65	3.18 21.92	20.00 137.90	70.00 482.63	>10
17	1.85 12.76	2.04 14.08	3.89 26.84	20.00 137.90	70.00 482.63	>10
18	2.97 20.49	3.95 27.23	6.92 47.72	20.00 137.90	70.00 482.63	9.11
19	2.82 19.43	2.64 18.23	5.46 37.66	20.00 137.90	70.00 482.63	>10
20	1.88 12.95	3.40 23.46	5.28 36.41	20.00 137.90	70.00 482.63	>10
21	2.02 13.91	0.81 5.62	2.83 19.53	20.00 137.90	70.00 482.63	>10
22	1.29 8.87	1.02 7.05	2.31 15.92	20.00 137.90	70.00 482.63	>10

Min MS: 2.463, Location: 4, Combination: Pm+Pb

Table 2-327. Load Combination 305, Side Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-100B

Load Cases: 305, 105, 202, 211
 30-ft. Side Drop + Slap-Down at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	5.62	2.55	8.16	20.00	70.00	7.55
	38.72	17.56	56.28	137.90	482.63	
2	1.33	1.64	2.97	20.00	70.00	>10
	9.16	11.29	20.45	137.90	482.63	
3	5.04	1.70	6.74	20.00	70.00	8.52
	34.76	11.69	46.45	137.90	482.63	
4	5.02	2.47	7.49	20.00	70.00	8.35
	34.61	17.04	51.64	137.90	482.63	
5	5.00	1.57	6.58	20.00	70.00	8.60
	34.48	10.86	45.34	137.90	482.63	
6	4.07	0.85	4.92	20.00	70.00	>10
	28.06	5.85	33.91	137.90	482.63	
7	2.26	0.11	2.37	20.00	70.00	>10
	15.56	0.77	16.34	137.90	482.63	
8	1.14	0.15	1.29	20.00	70.00	>10
	7.89	1.02	8.91	137.90	482.63	
9	2.23	0.11	2.34	20.00	70.00	>10
	15.36	0.78	16.14	137.90	482.63	
10	2.96	1.02	3.98	20.00	70.00	>10
	20.40	7.05	27.45	137.90	482.63	
11	2.96	0.93	3.90	20.00	70.00	>10
	20.43	6.44	26.87	137.90	482.63	
12	1.83	0.21	2.04	20.00	70.00	>10
	12.63	1.46	14.09	137.90	482.63	

13	4.28	0.47	4.76	20.00	70.00	>10
	29.54	3.26	32.80	137.90	482.63	
14	4.20	1.07	5.27	20.00	70.00	>10
	28.94	7.36	36.30	137.90	482.63	
15	2.28	0.36	2.63	20.00	70.00	>10
	15.70	2.46	18.16	137.90	482.63	
16	3.89	0.55	4.44	20.00	70.00	>10
	26.82	3.82	30.64	137.90	482.63	
17	3.84	0.53	4.37	20.00	70.00	>10
	26.47	3.64	30.11	137.90	482.63	
18	4.24	0.59	4.83	20.00	70.00	>10
	29.26	4.04	33.31	137.90	482.63	
19	4.60	0.70	5.30	20.00	70.00	9.43
	31.72	4.85	36.58	137.90	482.63	
20	3.55	0.71	4.25	20.00	70.00	>10
	24.46	4.87	29.33	137.90	482.63	
21	2.06	0.33	2.39	20.00	70.00	>10
	14.22	2.28	16.50	137.90	482.63	
22	2.44	0.28	2.72	20.00	70.00	>10
	16.83	1.92	18.75	137.90	482.63	

Min MS: 7.547, Location: 1, Combination: Pm

Table 2-328. Load Combination 306, Cg/Corner Drop Orientation at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-100B

Load Cases: 306, 105, 202, 211
 30-ft. Cg/Corner Drop at -40°F, Low Temperature
 -40°F Ambient, Maximum Decay Heat
 Minimum External Pressure, 24 kPa (3.5 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					MS
	Pm	Pb	Pm+Pb	Sm	Su	
---	--	--	-----	--	--	--
1	3.29	1.82	5.11	20.00	70.00	>10
	22.67	12.54	35.21	137.90	482.63	
2	1.51	0.27	1.79	20.00	70.00	>10
	10.45	1.86	12.31	137.90	482.63	
3	1.43	0.38	1.81	20.00	70.00	>10
	9.87	2.62	12.50	137.90	482.63	
4	5.58	2.09	7.67	20.00	70.00	7.61
	38.45	14.41	52.86	137.90	482.63	
5	3.64	1.77	5.41	20.00	70.00	>10
	25.09	12.23	37.32	137.90	482.63	
6	3.30	1.21	4.52	20.00	70.00	>10
	22.77	8.36	31.13	137.90	482.63	
7	3.09	0.06	3.15	20.00	70.00	>10
	21.32	0.42	21.74	137.90	482.63	
8	2.41	0.04	2.44	20.00	70.00	>10
	16.59	0.27	16.85	137.90	482.63	
9	1.69	0.05	1.75	20.00	70.00	>10
	11.67	0.37	12.04	137.90	482.63	
10	1.33	0.60	1.93	20.00	70.00	>10
	9.17	4.14	13.31	137.90	482.63	
11	0.94	0.45	1.40	20.00	70.00	>10
	6.51	3.14	9.65	137.90	482.63	
12	0.48	0.09	0.57	20.00	70.00	>10
	3.33	0.63	3.96	137.90	482.63	

13	1.20 8.27	0.40 2.73	1.60 11.00	20.00 137.90	70.00 482.63	>10
14	1.20 8.26	0.39 2.70	1.59 10.96	20.00 137.90	70.00 482.63	>10
15	2.10 14.48	0.32 2.21	2.42 16.69	20.00 137.90	70.00 482.63	>10
16	3.69 25.41	0.50 3.45	4.19 28.87	20.00 137.90	70.00 482.63	>10
17	3.49 24.09	0.75 5.16	4.24 29.25	20.00 137.90	70.00 482.63	>10
18	2.91 20.06	0.84 5.79	3.75 25.85	20.00 137.90	70.00 482.63	>10
19	2.80 19.28	0.99 6.82	3.79 26.11	20.00 137.90	70.00 482.63	>10
20	2.76 19.02	0.68 4.68	3.44 23.69	20.00 137.90	70.00 482.63	>10
21	0.43 2.96	0.10 0.69	0.53 3.65	20.00 137.90	70.00 482.63	>10
22	2.13 14.70	0.23 1.61	2.37 16.31	20.00 137.90	70.00 482.63	>10

Min MS: 7.608, Location: 4, Combination: Pm

Table 2-329. Load Combination 310, Additional Increased External Pressure (290 psi), Hypothetical Accident Conditions of Transport – Model AOS-100B

Load Cases: 204, 101, 211

Additional Increased External Pressure, 2 MPa (290 psia)

100°F Ambient, Maximum Decay Heat

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.75	0.95	1.70	20.00	66.30	>10
	5.19	6.56	11.75	137.90	457.12	
2	0.19	0.03	0.22	20.00	66.30	>10
	1.29	0.21	1.51	137.90	457.12	
3	0.18	0.12	0.30	20.00	66.30	>10
	1.25	0.82	2.07	137.90	457.12	
4	6.25	11.56	17.80	20.00	66.30	2.72
	43.06	79.68	122.74	137.90	457.12	
5	6.38	9.75	16.13	20.00	66.30	3.11
	43.98	67.20	111.18	137.90	457.12	
6	2.50	4.07	6.57	20.00	66.30	9.10
	17.22	28.06	45.27	137.90	457.12	
7	1.26	0.02	1.28	20.00	66.30	>10
	8.69	0.14	8.83	137.90	457.12	
8	1.26	0.00	1.26	20.00	66.30	>10
	8.68	0.00	8.69	137.90	457.12	
9	1.26	0.02	1.28	20.00	66.30	>10
	8.68	0.12	8.80	137.90	457.12	
10	1.18	0.71	1.89	20.00	66.30	>10
	8.13	4.89	13.02	137.90	457.12	
11	0.76	0.47	1.23	20.00	66.30	>10
	5.25	3.23	8.48	137.90	457.12	
12	1.67	2.42	4.09	20.00	66.30	>10
	11.53	16.70	28.23	137.90	457.12	
13	1.29	1.36	2.64	20.00	66.30	>10
	8.87	9.35	18.22	137.90	457.12	

14	0.97 6.66	0.62 4.25	1.58 10.91	20.00 137.90	66.30 457.12	>10
15	4.03 27.78	0.08 0.57	4.11 28.35	20.00 137.90	66.30 457.12	>10
16	0.80 5.50	1.16 8.02	1.96 13.53	20.00 137.90	66.30 457.12	>10
17	0.57 3.94	1.01 6.96	1.58 10.91	20.00 137.90	66.30 457.12	>10
18	0.67 4.62	1.18 8.13	1.85 12.75	20.00 137.90	66.30 457.12	>10
19	0.95 6.52	1.13 7.81	2.08 14.33	20.00 137.90	66.30 457.12	>10
20	1.01 6.98	1.27 8.78	2.29 15.77	20.00 137.90	66.30 457.12	>10
21	1.91 13.19	0.95 6.58	2.87 19.77	20.00 137.90	66.30 457.12	>10
22	1.83 12.64	0.90 6.19	2.73 18.83	20.00 137.90	66.30 457.12	>10

Min MS: 2.724, Location: 4, Combination: Pm+Pb

**Table 2-330. Load Combination 311, 4-ft. Drop onto Rod,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 311, 101, 201, 211
 4-ft. Drop onto Rod
 100°F Ambient, Maximum Decay Heat
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.31	0.86	2.17	20.00	66.30	>10
	9.01	5.95	14.96	137.90	457.12	
2	0.38	0.14	0.52	20.00	66.30	>10
	2.64	0.95	3.60	137.90	457.12	
3	0.15	0.04	0.19	20.00	66.30	>10
	1.04	0.26	1.30	137.90	457.12	
4	6.24	9.10	15.34	20.00	66.30	3.32
	43.03	62.72	105.75	137.90	457.12	
5	5.90	8.21	14.11	20.00	66.30	3.70
	40.70	56.57	97.27	137.90	457.12	
6	3.04	2.37	5.42	20.00	66.30	>10
	20.99	16.35	37.34	137.90	457.12	
7	1.25	0.02	1.27	20.00	66.30	>10
	8.62	0.14	8.76	137.90	457.12	
8	0.84	0.00	0.84	20.00	66.30	>10
	5.79	0.00	5.79	137.90	457.12	
9	0.53	0.02	0.55	20.00	66.30	>10
	3.67	0.11	3.78	137.90	457.12	
10	1.22	1.32	2.54	20.00	66.30	>10
	8.38	9.12	17.50	137.90	457.12	
11	0.93	0.32	1.25	20.00	66.30	>10
	6.40	2.22	8.63	137.90	457.12	
12	0.92	1.02	1.94	20.00	66.30	>10
	6.37	7.03	13.40	137.90	457.12	

13	1.71	1.61	3.31	20.00	66.30	>10
	11.77	11.07	22.83	137.90	457.12	
14	1.68	1.57	3.25	20.00	66.30	>10
	11.57	10.86	22.43	137.90	457.12	
15	36.54	6.32	42.85	20.00	66.30	0.27
	251.90	43.56	295.46	137.90	457.12	
16	9.10	13.08	22.18	20.00	66.30	1.99
	62.75	90.20	152.95	137.90	457.12	
17	5.53	9.26	14.80	20.00	66.30	3.48
	38.15	63.87	102.01	137.90	457.12	
18	3.37	3.43	6.80	20.00	66.30	8.75
	23.23	23.65	46.88	137.90	457.12	
19	4.92	7.01	11.93	20.00	66.30	4.56
	33.90	48.35	82.25	137.90	457.12	
20	4.83	8.19	13.02	20.00	66.30	4.09
	33.32	56.44	89.76	137.90	457.12	
21	0.44	0.87	1.30	20.00	66.30	>10
	3.01	5.98	8.99	137.90	457.12	
22	15.78	12.68	28.46	20.00	66.30	1.33
	108.79	87.43	196.22	137.90	457.12	

Min MS: 0.270, Location: 15, Combination: Pm

Table 2-331. Load Combination 312, 4-ft. Drop onto Rod at -40°F, Cold Environment, Hypothetical Accident Conditions of Transport – Model AOS-100B

Load Cases: 311, 104, 201, 211
 4-ft. Drop onto Rod
 -40°F Ambient, Zero Decay Heat, Zero Insolation
 Internal Design Pressure, 1,930 kPa (280 psia)
 Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	1.31	0.86	2.17	20.00	70.00	>10
	9.01	5.95	14.96	137.90	482.63	
2	0.38	0.14	0.52	20.00	70.00	>10
	2.64	0.95	3.60	137.90	482.63	
3	0.15	0.04	0.19	20.00	70.00	>10
	1.04	0.26	1.30	137.90	482.63	
4	6.24	9.10	15.34	20.00	70.00	3.56
	43.03	62.72	105.75	137.90	482.63	
5	5.90	8.21	14.11	20.00	70.00	3.96
	40.70	56.57	97.27	137.90	482.63	
6	3.04	2.37	5.42	20.00	70.00	>10
	20.99	16.35	37.34	137.90	482.63	
7	1.25	0.02	1.27	20.00	70.00	>10
	8.62	0.14	8.76	137.90	482.63	
8	0.84	0.00	0.84	20.00	70.00	>10
	5.79	0.00	5.79	137.90	482.63	
9	0.53	0.02	0.55	20.00	70.00	>10
	3.67	0.11	3.78	137.90	482.63	
10	1.22	1.32	2.54	20.00	70.00	>10
	8.38	9.12	17.50	137.90	482.63	
11	0.93	0.32	1.25	20.00	70.00	>10
	6.40	2.22	8.63	137.90	482.63	
12	0.92	1.02	1.94	20.00	70.00	>10
	6.37	7.03	13.40	137.90	482.63	

13	1.71	1.61	3.31	20.00	70.00	>10
	11.77	11.07	22.83	137.90	482.63	
14	1.68	1.57	3.25	20.00	70.00	>10
	11.57	10.86	22.43	137.90	482.63	
15	36.54	6.32	42.85	20.00	70.00	0.31
	251.90	43.56	295.46	137.90	482.63	
16	9.10	13.08	22.18	20.00	70.00	2.16
	62.75	90.20	152.95	137.90	482.63	
17	5.53	9.26	14.80	20.00	70.00	3.73
	38.15	63.87	102.01	137.90	482.63	
18	3.37	3.43	6.80	20.00	70.00	9.30
	23.23	23.65	46.88	137.90	482.63	
19	4.92	7.01	11.93	20.00	70.00	4.87
	33.90	48.35	82.25	137.90	482.63	
20	4.83	8.19	13.02	20.00	70.00	4.38
	33.32	56.44	89.76	137.90	482.63	
21	0.44	0.87	1.30	20.00	70.00	>10
	3.01	5.98	8.99	137.90	482.63	
22	15.78	12.68	28.46	20.00	70.00	1.46
	108.79	87.43	196.22	137.90	482.63	

Min MS: 0.314, Location: 15, Combination: Pm

**Table 2-332. Load Combination 350, Fire at 30 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 111, 201, 211

Fire at 30 Minutes, 1,475°F Ambient, Maximum Decay Heat

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	20.00	66.30	>10
	4.14	5.93	10.07	137.90	457.12	
2	0.04	0.03	0.07	20.00	66.30	>10
	0.28	0.19	0.47	137.90	457.12	
3	0.03	0.02	0.05	20.00	66.30	>10
	0.17	0.16	0.33	137.90	457.12	
4	4.94	8.72	13.66	20.00	66.30	3.85
	34.09	60.09	94.18	137.90	457.12	
5	4.28	6.97	11.24	20.00	66.30	4.90
	29.48	48.05	77.52	137.90	457.12	
6	1.66	2.27	3.93	20.00	61.80	>10
	11.45	15.65	27.10	137.90	426.10	
7	0.29	0.01	0.29	20.00	61.80	>10
	1.97	0.05	2.02	137.90	426.10	
8	0.28	0.00	0.28	20.00	61.80	>10
	1.96	0.00	1.96	137.90	426.10	
9	0.28	0.01	0.30	20.00	61.80	>10
	1.96	0.08	2.04	137.90	426.10	
10	0.98	1.01	1.99	20.00	61.80	>10
	6.76	6.95	13.72	137.90	426.10	
11	0.61	0.28	0.90	20.00	61.80	>10
	4.22	1.96	6.18	137.90	426.10	
12	0.52	0.41	0.93	20.00	61.80	>10
	3.55	2.83	6.39	137.90	426.10	
13	1.04	0.92	1.96	20.00	66.30	>10
	7.17	6.32	13.50	137.90	457.12	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	66.30 457.12	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	66.30 457.12	6.14
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	66.30 457.12	>10
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	66.30 457.12	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	66.30 457.12	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	66.30 457.12	7.38
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	66.30 457.12	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	66.30 457.12	>10

Min MS: 3.854, Location: 4, Combination: Pm+Pb

**Table 2-333. Load Combination 351, Post Fire at 60 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 112, 201, 211

Post Fire at 60 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	17.40	59.20	>10
	0.28	0.19	0.47	119.97	408.17	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	20.00	61.80	4.50
	29.48	48.05	77.52	137.90	426.10	
6	1.66	2.27	3.93	20.00	61.80	>10
	11.45	15.65	27.10	137.90	426.10	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	20.00	61.80	>10
	6.76	6.95	13.72	137.90	426.10	
11	0.61	0.28	0.90	20.00	61.80	>10
	4.22	1.96	6.18	137.90	426.10	
12	0.52	0.41	0.93	20.00	61.80	>10
	3.55	2.83	6.39	137.90	426.10	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	66.30 457.12	6.14
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	66.30 457.12	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	66.30 457.12	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-334. Load Combination 352, Post Fire at 90 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 112, 201, 211

Post Fire at 90 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	20.00	61.80	4.50
	29.48	48.05	77.52	137.90	426.10	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	20.00	61.80	>10
	4.22	1.96	6.18	137.90	426.10	
12	0.52	0.41	0.93	20.00	61.80	>10
	3.55	2.83	6.39	137.90	426.10	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-335. Load Combination 353, Post Fire at 120 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 112, 201, 211

Post Fire at 120 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-336. Load Combination 354, Post Fire at 150 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 112, 201, 211

Post Fire at 150 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

**Table 2-337. Load Combination 355, Post Fire at 180 Minutes,
Hypothetical Accident Conditions of Transport – Model AOS-100B**

Load Cases: 112, 201, 211

Post Fire at 180 Minutes, 100°F, Maximum Decay Heat, Maximum Insolation

Internal Design Pressure, 1,930 kPa (280 psia)

Fabrication Stress

Loc	Stress (ksi/MPa)					
	Pm	Pb	Pm+Pb	Sm	Su	MS
---	--	--	-----	--	--	--
1	0.60	0.86	1.46	18.70	59.70	>10
	4.14	5.93	10.07	128.93	411.62	
2	0.04	0.03	0.07	18.70	59.70	>10
	0.28	0.19	0.47	128.93	411.62	
3	0.03	0.02	0.05	18.70	59.70	>10
	0.17	0.16	0.33	128.93	411.62	
4	4.94	8.72	13.66	20.00	61.80	3.52
	34.09	60.09	94.18	137.90	426.10	
5	4.28	6.97	11.24	18.70	59.70	4.31
	29.48	48.05	77.52	128.93	411.62	
6	1.66	2.27	3.93	18.70	59.70	>10
	11.45	15.65	27.10	128.93	411.62	
7	0.29	0.01	0.29	18.70	59.70	>10
	1.97	0.05	2.02	128.93	411.62	
8	0.28	0.00	0.28	18.70	59.70	>10
	1.96	0.00	1.96	128.93	411.62	
9	0.28	0.01	0.30	18.70	59.70	>10
	1.96	0.08	2.04	128.93	411.62	
10	0.98	1.01	1.99	18.70	59.70	>10
	6.76	6.95	13.72	128.93	411.62	
11	0.61	0.28	0.90	18.70	59.70	>10
	4.22	1.96	6.18	128.93	411.62	
12	0.52	0.41	0.93	18.70	59.70	>10
	3.55	2.83	6.39	128.93	411.62	
13	1.04	0.92	1.96	20.00	61.80	>10
	7.17	6.32	13.50	137.90	426.10	

14	0.98 6.76	0.98 6.78	1.96 13.53	20.00 137.90	61.80 426.10	>10
15	3.84 26.44	5.45 37.58	9.29 64.02	20.00 137.90	61.80 426.10	5.66
16	2.32 16.01	3.39 23.40	5.72 39.41	20.00 137.90	61.80 426.10	9.81
17	1.64 11.32	2.46 16.94	4.10 28.26	20.00 137.90	61.80 426.10	>10
18	1.94 13.41	3.00 20.68	4.94 34.09	20.00 137.90	61.80 426.10	>10
19	3.11 21.47	4.80 33.11	7.92 54.57	20.00 137.90	61.80 426.10	6.81
20	2.54 17.53	4.71 32.47	7.25 50.00	20.00 137.90	61.80 426.10	7.52
21	0.22 1.55	0.47 3.21	0.69 4.76	20.00 137.90	61.80 426.10	>10
22	1.97 13.59	2.34 16.13	4.31 29.72	20.00 137.90	61.80 426.10	>10

Min MS: 3.524, Location: 4, Combination: Pm+Pb

2.12.3 LIBRA Finite Element Analysis Program and Verification Problems

2.12.3.1 LIBRA Finite Element Analysis Program

LIBRA is an efficient, general-purpose, finite element method program applicable to static, dynamic, and heat transfer analyses of structural systems. The program contains a comprehensive element library, and more than 20 solution algorithms. In addition, LIBRA has a fully integrated editor for model generation, as well as comprehensive post-processing and plotting capabilities. LIBRA can execute problems of over 250,000 degrees of freedom, on computers configured with 256 MB of available memory and 20 GB of hard disk drive space. The program contains both Gaussian and iterative solvers.

Program Solution Procedures:

- _Linear and non-linear static analyses
- _Analysis of axisymmetric (2D) structures with non-symmetric loads
- _Linear buckling analysis
- _Modal analysis by Lanczos, subspace, and vector iteration methods
- _Dynamic integration using modal coordinates
- _Linear and non-linear direct dynamic integration
- _Modal response solution
- _General sub-sectioning capabilities
- _Steady-state and transient heat transfer analyses

LIBRA Element Library:

- _Straight and curved beam elements
- _Triangular and quad plate and shell elements
- _Doubly curved, 8-node shell element
- _Conic and curved axisymmetric (2D) shell elements
- _Standard and hierarchical 2D and 3D elements
- _Plane stress, plate, and shell composite elements

2.12.3.2 Verification Problems

The following is a LIBRA Finite Element Analysis Program and Verification Problems report, from Structural Mechanics Analysis, Inc.

1.0 Introduction

This report describes the GE Vallecitos Nuclear Center Libra Finite Element Analysis Program verification. The Libra verification consists of three items: the original verification report, Reference 1, the verification program `Libra_Verification.Exe` and associated verification problem files, and this report. A Libra verification can be performed at any time by executing the program `Libra_Verification`. This program executes all of the verification problem files, and tabulates the results in the text file `Verification.txt`. The `Libra_Verification` program and problem files are installed on the Libra Application Directory as part of the Libra installation. The output file, `Verification.txt`, is also located on the Libra Application Directory.

The original verification report, Reference 1, documents a number of the verification problems, including all of the thermal verification problems. The thermal verification problems in Reference 1 were updated in Reference 1a. This report encompasses both References 1 and 1a. All of the verification problems executed by `Libra_Verification` are described in this report, however the theoretical solutions of the original verification problems are given in Reference 1, and are not contained in this report. The theoretical solutions for all verification problems not in Reference 1 are given in this report.

The verification program, `Libra_Verification`, executes 24 problem files. These problems cover a wide spectrum of Libra capabilities, and include all significant types of analyses and elements used at the GE Vallecitos facility. The program compiles the results in two ways. For each verification problem, the program presents a table comparing the Libra solution values with the theoretical values. In addition, since the Libra and theoretical values are not necessarily the same, the program generates a table comparing the current verification results with the expected values. The expected values are not theoretical values, but Libra values from a certified verification.

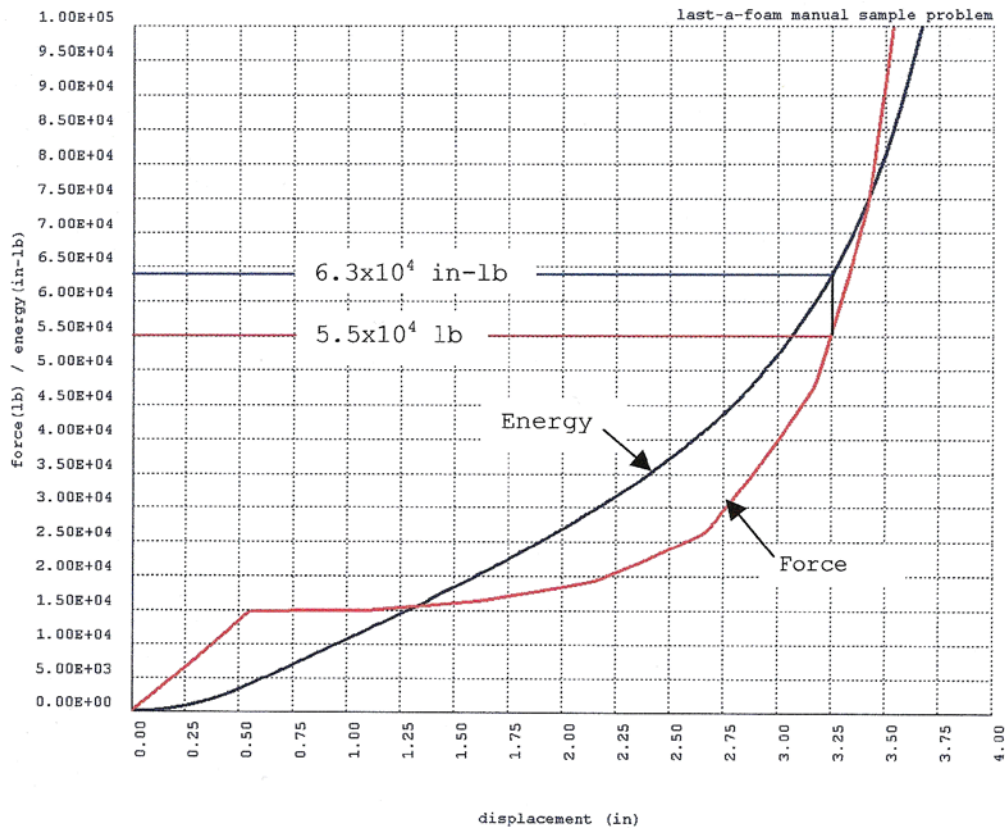
The structure of the Libra program is such that no permanent executable exists. Rather, a new executable is formed whenever the solution or element type changes from the preceding application. To establish the program status, the verification program generates a list of all of Libra subroutines on the file `Verification.txt`. The verification status of any Libra subroutine can then be established comparing it with the listing in `Verification.txt`.

This report is structured around the verification problems. Each problem is presented in a separate section. Each section specifies the problem input data file, and the Libra solution and element types used in the problem. In addition, each section contains a description of the problem, a description of the Libra model, and the theoretical or comparative solution.

Additional Problem

Main23, Element 10. Sample problem in Last-A-Foam Manual, "Rigid Polyurethane Foam for Impact and Thermal Protection," pgs. 2-3. 30 ft drop of 700 lb cylinder onto 5 in thick Last-A-Foam disk. Quarter disk modeled by STIF10 elements. From curve on pg. 3, for 3712 foam,

$$g = \text{impact force} / \text{weight} = 2820 * 78.5 / 700 = 316.2$$



From Libra force and energy curves for 1/4 model,

$$U = 700 \times 30 \times 12 / 4 = 6.3 \times 10^4 \text{ in-lb}$$

$$P = 5.5 \times 10^4 \text{ lb.}$$

$$g = 4 \times 5.5 \times 10^4 / 700 = 314.3$$

$$\text{Difference} = 100 \times (316.2 - 314.3) / 314.3 = 0.6\%$$

Problem 1

Input Data File: VER_PROB.1

Libra Routines: Solution Type12, Elements 32 & 34

Description of Problem

A 0.03 m long carbon resistor is comprised of a 0.001 m radius graphite core, and a micanite thermal conductor with inside radius 0.001m and outside radius .00588 m. 0.4 watt heat through conductor is convected to surrounding air at 310° K. Determine steady-state temperature at outside of graphite core.

$$\begin{aligned}k(\text{graphite}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\k(\text{conductor}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\h(\text{air}) &= 17.0 \text{ W/m}^2/\text{K}^\circ \\Q &= 0.4 \text{ W}\end{aligned}$$

Description of Model

Axisymmetric model of both resistor and conductor. Heat input through resistor elements.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 2

Input Data File: VER_PROB.2

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

A 0.03 m long carbon resistor is comprised of a 0.001 m radius graphite core, and a micanite thermal conductor with inside radius 0.001m and outside radius .00588 m. 0.4 watt heat through conductor is convected to surrounding air at 310° K. Determine steady-state temperature at outside of graphite core.

$$\begin{aligned}k(\text{graphite}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\k(\text{conductor}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\h(\text{air}) &= 17.0 \text{ W/m/K}^\circ \\Q &= 0.4 \text{ W}\end{aligned}$$

Description of Model

Axisymmetric model of conductor only. Heat input by convection at inside of conductor.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 3

Input Data File: VER_PROB.3

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

A 0.03 m long carbon resistor is comprised of a 0.001 m radius graphite core, and a micanite thermal conductor with inside radius 0.001m and outside radius .00588 m. 0.4 watt heat through conductor is convected to surrounding air at 310° K. Determine steady-state temperature at outside of graphite core.

$$\begin{aligned}k(\text{graphite}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\k(\text{conductor}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\h(\text{air}) &= 17.0 \text{ W/m}^2/\text{K}^\circ \\Q &= 0.4 \text{ W}\end{aligned}$$

Description of Model

Axisymmetric model of conductor only. Heat input by thermal loads at inside of conductor.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 4

Input Data File: VER_PROB.4

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

A 0.03 m long carbon resistor is comprised of a thermal conductor with inside radius 0.001m and outside radius .00588 m. 0.4 watt heat through conductor is convected to surrounding air at 310° K. Determine steady-state temperature at inside of conductor.

$$\begin{aligned}k(\text{conductor}) &= 0.1 \text{ W/m}^2/\text{K}^\circ \\h(\text{air}) &= 17.0 \text{ W/m}^2/\text{K}^\circ \\Q &= 0.4 \text{ W}\end{aligned}$$

Description of Model

Axisymmetric model of resistor. Heat applied to elements. Convection elements at surface.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 5

Input Data File: VER_PROB.5

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

Determine transient response of 1/32 in copper wire at 300°F immerse in water at 100°

$$\begin{aligned}h_{\text{water}} &= 15.0 \text{ Btu/hr/ft}^2/\text{°F} \\k_{\text{copper}} &= 216.0 \text{ Btu/hr-in-°F} \\\rho_{\text{copper}} &= 0.091 \text{ lb/in}^3 \\c_{\text{copper}} &= 558.0 \text{ Btu/lbm-°F}\end{aligned}$$

Description of Model

Axisymmetric model of wire, with convection elements at surface.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 6

Input Data File: VER_PROB.6

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

Determine transient response of 1/32 in copper wire at 300°F immerse in air at 100°

$$\begin{aligned}h_{\text{air}} &= 2.0 \text{ Btu/hr/ft}^2/\text{°F} \\k_{\text{copper}} &= 216.0 \text{ Btu/hr-in-°F} \\\rho_{\text{copper}} &= 0.091 \text{ lb/in}^3 \\c_{\text{copper}} &= 558.0 \text{ Btu/lbm-°F}\end{aligned}$$

Description of Model

Axisymmetric model of wire, with convection elements at surface.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 7

Input Data File: VER_PROB.7

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

Concrete wall initially at 100° F has one side exposed to hot gas at 1600° and other side insulated. Find temperature distribution through wall when temperature at insulated side reaches 500°F. Heat transfer coefficient at exposed side is, $h = 5.0 \text{ Btu/hr/ft}^2/\text{°F}$.

Description of Model

Two dimensional model of wall, with a convective element at one surface.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 8

Input Data File: VER_PROB.8

Libra Routines: Solution Type 12, Elements 32 & 34

Description of Problem

Steady-state heat conduction. A furnace has a two layer wall, with $k_1=0.8 \text{ Btu/hr/ft}^2/^{\circ}\text{F}$ and $k_2=0.8 \text{ Btu/hr/ft}^2/^{\circ}\text{F}$. The temperature inside the furnace is 3000°F . The surface conduction at the outside wall is $h = 2.0 \text{ Btu/hr/ft}^2/^{\circ}\text{F}$. Find steady-state temperatures through wall.

Description of Model

Two dimensional model of wall, with a convective element at one surface.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 9

Input Data File: VER_PROB.9

Libra Routines: Solution Type 1, Element 9

Description of Problem

Long cylinder under internal pressure. Determine radial displacement and hoop stress.



Description of Model

Axisymmetric model of cylinder using 8-node quads.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 10

Input Data File: VER_PROB.10

Libra Routines: Solution Type 1, Element 9

Description of Problem

Long, cylindrical tube with axisymmetric, radial pinch at center. Find maximum longitudinal bending stress at pinch.



Description of Model

Axisymmetric model of cylinder using 8-node quads. Half of structure (and load) modeled with symmetric boundary conditions in longitudinal direction.

Theoretical Solution

The theoretical solution is presented in Reference 1.

Problem 11

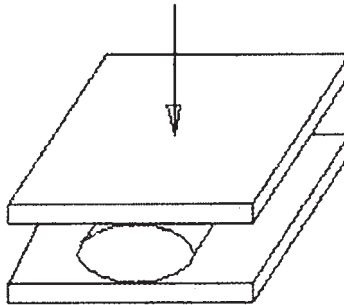
Input Data File: VER_PROB.11

Libra Routines: Solution Type 23, Element 3

Description of Problem

Collapse of a cylindrical ring, 1 in long, 2.485 in outside diameter, 0.185 in wall thickness. Cylinder compressed between two unyielding surfaces.

$$\begin{aligned}E &= 29.5 \times 10^6 \text{ psi} \\E_p &= 1.0 \times 10^6 \text{ psi} \\v &= 0.3 \\ \sigma_y &= 45000 \text{ psi}\end{aligned}$$



Description of Model

3D model composed of triangular shell elements. Half of cylinder modeled with symmetric boundary conditions.

Theoretical Solution

No theoretical solution is available for this problem. FEA solution is checked against test results given in Reference 1.

Problem 12

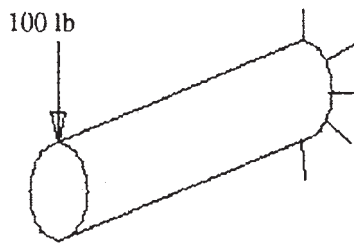
Input Data File: VER_PROB.12

Libra Routines: Solution Type 8, Element 16

Description of Problem

Elastic bending of a 10 in radius, cantilever tube, 1 in wall thickness, 200 in long with a 100 lb concentrated load at free end. Find deflection at load and stress 3 in from fixed end.

$$\begin{aligned}E &= 28.0 \times 10^6 \text{ psi} \\r &= 10.0 \text{ in} \\t &= 1.0 \text{ in} \\L &= 100.0 \text{ in}\end{aligned}$$



Description of Model

Tube bending is analyzed as an axisymmetric structure with nonsymmetric loading. 8-node, solid elements are used to model the tube, and only the first cosine mode used in the analysis. In this analysis, the load at node i for mode n is given by,

$$P_i = \int_0^{360} p_i(\theta) \cdot \cos(n\theta) \cdot r d\theta$$

where $p_i(\theta)$ is the circumferential load at node i . For a concentrated load Q at $\theta = 0$, and Δ_0 the Dirac-delta function at $\theta = 0$,

$$P_i = \int_0^{360} Q \cdot \Delta_0 \cdot \cos(n\theta) \cdot r d\theta = Q$$

Problem 12 – Cont'd

Theoretical Solution

Assuming the deflection shear correction for a cylindrical cross-section is the same as for a rectangle, from Reference 2, pg. 175, and Reference 3, Page 72, Table I, Case 11,

$$\delta = (P \cdot L^3 / 3EI) \cdot (1 + 0.98 \cdot D^2/L^2)$$

$$I = \pi \cdot r^3 \cdot t = 3141.59$$

$$P = 1000 \text{ lb}$$

$$L = 200 \text{ in}$$

$$E = 28.0 \text{ psi}$$

$$r = 10.0 \text{ in}$$

$$\delta = 0.030315 \cdot 1.01 = 0.030618 \text{ in}$$

$$\sigma = M \cdot c / I = 1000 \cdot 197 \cdot 10 / 3141.59 = 627.07 \text{ psi}$$

Problem 13

Input Data File: VER_PROB.13

Libra Routines: Solution Type 1, Element 7

Description of Problem

Elastic deflection of a 5 in radius, 0.025 in wall thickness tube, 50 in long by a distributed radial load of 15.9 lb/in (total load 500 lb). Determine deflection and hoop stress under load.

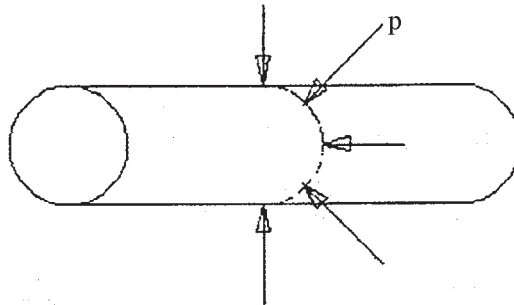
$$E = 28.0 \times 10^6 \text{ psi}$$

$$\nu = 0.3$$

$$r = 5.0$$

$$t = 0.025$$

$$p = 15.916 \text{ lb/in}$$



Description of Model

Tube bending is analyzed as an axisymmetric structure with symmetric loading. 2-node, shell elements are used to model the tube. In this analysis, the load at node i is given by,

$$P_i = \int_0^{360} p_i(\theta) \cdot r d\theta$$

Half of structure (and load) is modeled with symmetric boundary conditions.

Problem 13 – Cont'd

Theoretical Solution

The solution is given in Reference 3, pg.170.

$$\lambda = \sqrt[4]{3(1-\nu^2) / r^2 \cdot t^2} = 3.63538 \text{ in}$$

$$\delta = p \cdot r^2 \cdot \lambda / 2E \cdot t = 0.0010333$$

$$\sigma_H = p \cdot r \cdot \lambda / 2t = 5786.4 \text{ psi}$$

Problem 14

Input Data File: VER_PROB.14

Libra Routines: Solution Type 2, Element 9

Description of Problem

Inelastic deflection of a thick, cylindrical shell under internal pressure. Determine deflection at inside of cylinder for 16 dN/mm² and 18 dN/mm².

$$E = 2.1 \times 10^4 \text{ dN/mm}^2$$

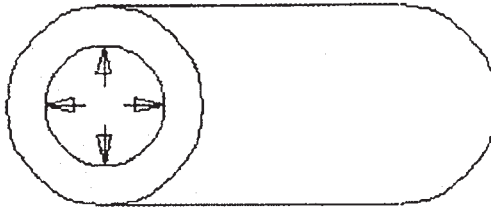
$$\nu = 0.3$$

$$E_p = 0.0$$

$$\sigma_y = 24.0 \text{ dN/mm}^2$$

$$r(\text{inside}) = 100.0 \text{ mm}$$

$$r(\text{outside}) = 200.0 \text{ mm}$$



Description of Model

Cylinder modeled with 8-node plane strain elements. 90° cylinder segment modeled with symmetry boundary conditions at both ends.

Theoretical Solution

A solution for this problem is given in Reference 4, pgs.262-263 in graphic form. From Figure 7.12, pg. 262,

$$\begin{array}{ll} \text{for } p = 16 \text{ dN/mm}^2, & \delta = 0.185 \text{ mm} \\ \text{for } p = 18 \text{ dN/mm}^2, & \delta = 0.265 \text{ mm} \end{array}$$

Problem 15

Input Data File: VER_PROB.15

Libra Routines: Solution Type 9, Element 9

Description of Problem

Elastic response of a spherical cap shell with simple supports under instantaneously applied external pressure. Determine the maximum and minimum deflections, and times of occurrence during period 0 - 0.0007 sec.

$$\begin{aligned}E &= 10.5 \times 10^6 \text{ psi} \\ \nu &= 0.3 \\ \rho &= 2.45 \times 10^{-4} \text{ lb-sec}^2/\text{in}^4 \\ r(\text{inside}) &= 22.27 \text{ in} \\ t &= 0.41 \text{ in} \\ \alpha &= 26.67^\circ \\ p &= 600 \text{ psi}\end{aligned}$$



Description of Model

Spherical cap modeled with 8-node axisymmetric elements.

Theoretical Solution

A solution for this problem is given in Reference 4, pgs. 421-422, in graphic form. From Figure 10.4a, pg. 422,

$$\begin{aligned}\text{@ } t &= 0.00037 \text{ sec,} & \delta &= 0.090 \text{ sec} \\ \text{@ } t &= 0.00055 \text{ sec,} & \delta &= -0.050 \text{ sec}\end{aligned}$$

Problem 16

Input Data File: VER_PROB.16

Libra Routines: Solution Type 4, Element 9

Description of Problem

Find fundamental period of a spherical cap shell simply-supported at base.

$$\begin{aligned}E &= 10.5 \times 10^6 \text{ psi} \\ \nu &= 0.3 \\ \rho &= 2.45 \times 10^{-4} \text{ lb-sec}^2/\text{in}^4 \\ r(\text{inside}) &= 22.27 \text{ in} \\ t &= 0.41 \text{ in} \\ \alpha &= 26.67^\circ\end{aligned}$$



Description of Model

Spherical cap modeled with 8-node axisymmetric elements. Eigen pairs determined by the Lanczos method.

Theoretical Solution

The first period is given in Reference 4, pg. 421,

$$T = 0.55 \times 10^{-3} \text{ sec}$$

Problem 17

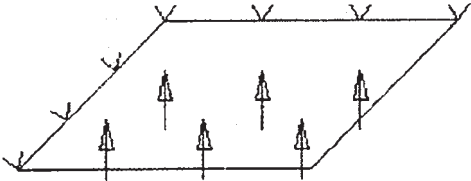
Input Data File: VBR_PROB.17

Libra Routines: Solution Type 2, Element 3

Description of Problem

Inelastic bending of an elastic - perfectly plastic, simply-supported, square plate under uniform lateral pressure. Find load corresponding to a displacement of 0.06 in at center of plate.

$$E = 10.92 \times 10^6 \text{ psi}$$
$$\nu = 0.3$$
$$E_p = 0.0$$
$$\sigma_y = 1600.0 \text{ psi}$$
$$L = 10.0 \text{ in}$$



Description of Model

Plate modeled with triangular shell elements. Solution interpolated from displacements at two load steps.

Theoretical Solution

A solution for this problem is given in Reference 4, pgs. 370-371 in graphic form. From Figure 9.8, pg. 371,

$$D = E \cdot t^3 / 12(1 - \nu^2) = 1000 \text{ psi}$$
$$M_p = \sigma_y \cdot t^2 / 4 = 4.0 \text{ in-lb}$$
$$w = 0.06 \text{ in}$$
$$100 \cdot w \cdot D / M_p \cdot L^2 = 15$$

From Figure 9.8:

$$q \cdot L^2 / M_p = 22.5, \quad q = 0.90 \text{ psi}$$

Problem 18

Input Data File: VER_PROB.18

Libra Routines: Solution Type 2, Element 13

Description of Problem

Inelastic bending of an elastic - perfectly plastic, simply-supported, square plate under uniform lateral pressure. Find load corresponding to a displacement of 0.06 in at center of plate.

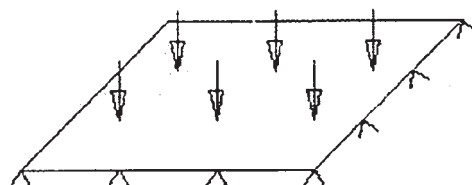
$$E = 10.92 \times 10^6 \text{ psi}$$

$$\nu = 0.3$$

$$E_p = 0.0$$

$$\sigma_y = 1600.0 \text{ psi}$$

$$L = 10.0 \text{ in}$$



Description of Model

Plate modeled with quad shell elements. Solution interpolated from displacements at two load steps.

Theoretical Solution

A solution for this problem is given in Reference 4, pgs. 370-371 in graphic form. From Figure 9.8, pg. 371,

$$D = E \cdot t^3 / 12(1 - \nu^2) = 1000 \text{ psi}$$

$$M_p = \sigma_y \cdot t^2 / 4 = 4.0 \text{ in-lb}$$

$$w = 0.06 \text{ in}$$

$$100 \cdot w \cdot D / M_p \cdot L^2 = 15$$

$$\text{from Figure 9.8: } q \cdot L^2 / M_p = 22.5 \quad q = 0.90 \text{ psi}$$

Problem 19

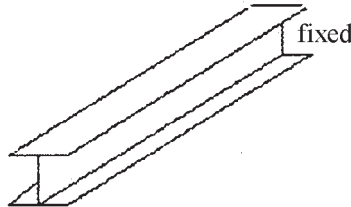
Input Data File: VER_PROB.19

Libra Routines: Solution Type 5, Element 4

Description of Problem

Modal analysis of cantilever steel beam, S-5x10, 20 ft long, 50 lb/ft weight. Determine first three frequencies.

$$\begin{aligned}E &= 28.0 \times 10^6 \text{ psi} \\L &= 240.0 \text{ in} \\I_{zz} &= 12.3 \text{ in}^4 \\I_{yy} &= 1.22 \text{ in}^4 \\J &= 0.114 \text{ in}^4 \\A &= 2.94 \text{ in}^2 \\w &= 50.0 \text{ lb/ft} \\\rho &= 50.0 / (12 \cdot 2.94 \cdot 386.4) = 0.0108 \text{ lb-sec}^2/\text{in}\end{aligned}$$



Description of Model

Beam modeled with 20 STIF4 elements. Z-displacements fixed along entire beam. Eigenpairs determined by Sub-space iteration.

Theoretical Solution

From Reference 5, pg. 313, Figure E18-2,

$$\omega_1 = (1.875)^2 \cdot \sqrt{EI / \rho L^4} = 10.899 \text{ rad/sec}$$

$$\omega_2 = (4.694)^2 \cdot \sqrt{EI / \rho L^4} = 68.020 \text{ rad/sec}$$

$$\omega_3 = (7.855)^2 \cdot \sqrt{EI / \rho L^4} = 191.29 \text{ rad/sec}$$

Problem 20

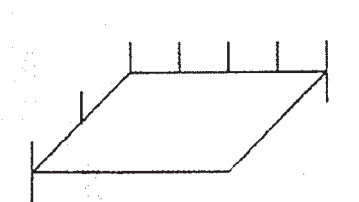
Input Data File: VER_PROB.20

Libra Routines: Solution Type 3, Element 3

Description of Problem

Modal analysis of thin, square plate, two adjacent edges fixed, other two edges free.
Determine first three frequencies.

$$\begin{aligned}E &= 28.0 \times 10^6 \text{ psi} \\ \nu &= 0.3 \\ t &= 0.025 \text{ in} \\ D &= E \cdot t^3 / 12(1-\nu^2) = 40.064 \text{ in-lb} \\ L &= 10.0 \text{ in} \\ \rho &= 0.000725 \text{ lb-sec}^2/\text{in}\end{aligned}$$



Description of Model

Beam modeled with triangular shell elements. Eigen-pairs determined by vector iteration.

Theoretical Solution

From Reference 6, pg. 61-23, Table 61.3,

$$\omega_1 = 6.96 \cdot \sqrt{D/\rho L^4} = 16.45 \text{ hz}$$

$$\omega_2 = 24.1 \cdot \sqrt{D/\rho L^4} = 56.65 \text{ hz}$$

$$\omega_3 = 26.8 \cdot \sqrt{D/\rho L^4} = 63.00 \text{ hz}$$

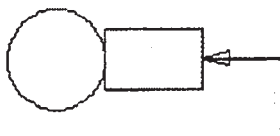
Problem 21

Input Data File: VER_PROB.21

Libra Routines: Solution Type 2, Elements 1 & 8

Description of Problem

Determine contact force between a steel sphere and the bottom flat surface of a steel cylinder due to a displacement at the top of the cylinder. The cylinder radius is 0.0060084 in, and height is 0.006 in. The sphere radius is 0.125 in. The specified displacement is 5.0×10^{-5} in, $E = 28.0 \times 10^6$ psi and $\nu = 0.3$ for both cylinder and sphere.



Description of Model

The cylinder and sphere are modeled separately with STIF8 axisymmetric elements, and are connected with gap spring elements. In this way, the contact area between the cylinder and sphere is determined in the solution. A special node and element generator is used to model the sphere in order to assure proper alignment between the nodes on the cylinder and sphere.

Theoretical Solution

This problem is a form of the Hertz contact problem. A theoretical solution is given in Reference 7, on pg. 376. Solving equation 222 for P,

$$\delta = 1.23 \cdot \sqrt[3]{P^2/E^2 \cdot R}, \quad P = E \cdot \sqrt{R \cdot (\delta/1.23)^3}$$

$$E = 28.0 \times 10^6 \text{ psi}$$

$$R = 0.125 \text{ in,}$$

$$\delta = 5.0 \times 10^{-5} \text{ in,}$$

$$P = 2.5657 \text{ lb.}$$

Problem 22

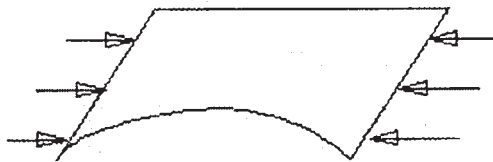
Input Data File: VER_PROB.22

Libra Routines: Solution Type 11, Element 13

Description of Problem

Elastic buckling of thin, square plate under uniform edge compression load, p_0 . Plate simply-supported on three sides, free on fourth side.

$$\begin{aligned}E &= 28 \cdot 10^6 \text{ psi} \\ \nu &= 0.25 \\ L &= 10.0 \text{ in} \\ t &= 0.025 \text{ in} \\ p_0 &= 2.5 \text{ lb/in}\end{aligned}$$



Description of Model

The plate is modeled by quad shell element. The entire plate is modeled with equal and opposite compression load along edges $x=0$, and $x=10$. Edges $x=0$, $x=10$, and $y=0$ are fixed in z -direction, edge $y=10$ is free. The Libra solution gives the problem eigenvalue, λ , and the buckling load is given by, $\sigma_{cr} = \lambda \cdot p_0 / t$.

Theoretical Solution

The theoretical solution for this problem is given in Reference 8, pgs. 360-362. From Equation (j) and Table 9-2 on page 362,

$$\begin{aligned}\sigma_{cr} &= k \cdot \pi^2 \cdot D / b^2 \cdot t \\ k &= 1.440 \text{ (} a/b = 1 \text{)} \\ D &= E \cdot t^3 / (1 - \nu^2) = 3.8382 \text{ lb-in} \\ b &= 10.0 \text{ in} \\ t &= 0.025 \text{ in} \\ \sigma_{cr} &= 221.0 \text{ psi}\end{aligned}$$

Problem 23

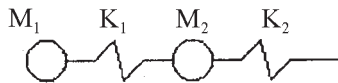
Input Data Files: VER_PROB.23a, VER_PROB.23

Libra Routines: Solution Types 3 &14, Element 1

Description of Problem

RMS response of a two degree of freedom, spring-mass system to a PSD acceleration spectra. Problem given in Reference 9. Determine the 1σ , RMS force at the base.

$$\begin{aligned}m_1 &= 2.0 \text{ lb} \\k_1 &= 50000 \text{ lb/in} \\m_2 &= 1.0 \text{ lb} \\k_2 &= 180000 \text{ lb} \\@ 10 \text{ hz,} & \quad G^2/\text{hz} = 0.020 \\@ 100 \text{ hz,} & \quad G^2/\text{hz} = 0.200 \\@ 300 \text{ hz} & \quad G^2/\text{hz} = 0.200 \\@ 2000 \text{ hz,} & \quad G^2/\text{hz} = 0.005\end{aligned}$$



Description of Model

The Libra model consists of three nodes, and two spring elements in series. The mass is specified for nodes 1 and 2, and node 3 is fixed. The two system modes are determined using MAIN3 with the file VER_PROB.23a. The combined response is determined using MAIN14 with the file VER_PROB.23.

Modal damping values, ξ , used in the combined response solution are determined from the problem data in Reference 9, pgs 53-54, and the approximation for the maximum complex frequency response given in Reference 10, pg. 44, Equation 2-17.

$$\begin{aligned}Q &= 1/2\xi \\Q_1 &= 28.8 \text{ g}, \quad \xi_1 = 0.01736 \\Q_2 &= 43.2 \text{ g}, \quad \xi_2 = 0.01157\end{aligned}$$

Theoretical Solution

From Reference 9, pg. 56b, $P_{\text{rms}} = 109.3 \text{ lb}$

Problem 24

Input Data File: VER_PROB.24

Libra Routines: Solution Type 19, Element 9

Description of Problem

Determine the viscoplastic deflection of a thick, cylindrical shell under internal pressure. Find the radial deflection at inside of cylinder after 1, 2, 3, 5 and 7 days. The shell behavior is that of a Maxwell fluid with $n = 0$, and fluidity parameter $\dot{\gamma} = 0.001/\text{day}$.

$$E = 2.1 \times 10^4 \text{ dN/mm}^2$$

$$\nu = 0.3$$

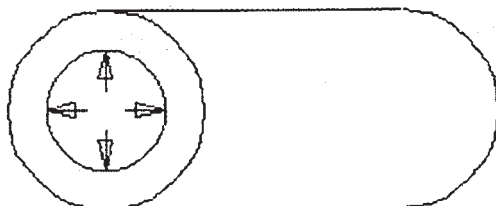
$$E_p = 0.0$$

$$\sigma_y = 24.0 \text{ dN/mm}^2$$

$$p_0 = 14 \text{ dN/mm}^2$$

$$r(\text{inside}) = 100.0 \text{ mm}$$

$$r(\text{outside}) = 200.0 \text{ mm}$$



Description of Model

Cylinder modeled with 8-node plane strain elements. 90° cylinder segment modeled with symmetry boundary conditions at both ends.

Theoretical Solution

A solution for this problem is given in Reference 4, pgs.312-313 in graphic form. From Figure 8.11, pg. 313,

$$@ 1 \text{ day}, \quad \delta = 0.132 \text{ mm}$$

$$@ 2 \text{ days}, \quad \delta = 0.135 \text{ mm}$$

$$@ 3 \text{ days}, \quad \delta = 0.137 \text{ mm}$$

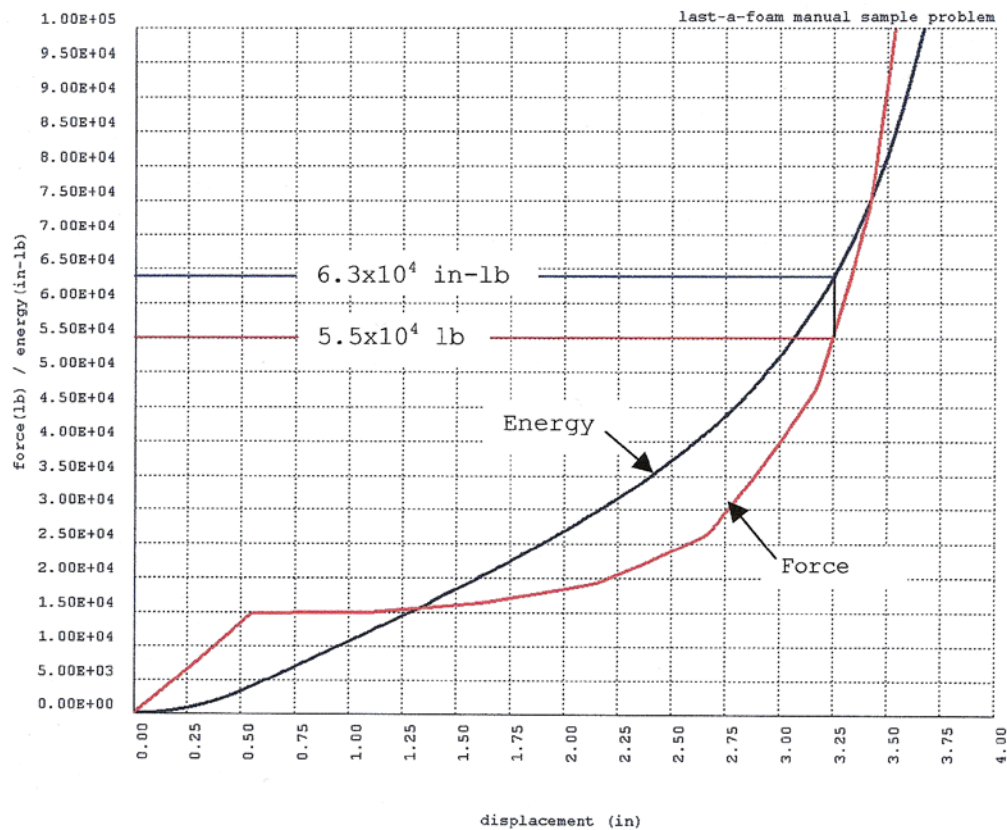
$$@ 5 \text{ days}, \quad \delta = 0.139 \text{ mm}$$

$$@ 7 \text{ days}, \quad \delta = 0.140 \text{ mm}$$

Additional Problem

Main23, Element 10. Sample problem in Last-A-Foam Manual, "Rigid Polyurethane Foam for Impact and Thermal Protection", pgs. 2-3. 30 ft drop of 700 lb cylinder onto 5 in thick Last-A-Foam disk. Quarter disk modeled by STIF10 elements. From curve on pg. 3, for 3712 foam,

$$g = \text{impact force} / \text{weight} = 2820 * 78.5 / 700 = 316.2$$



From Libra force and energy curves for 1/4 model,

$$U = 700 \times 30 \times 12 / 4 = 6.3 \times 10^4 \text{ in-lb}$$

$$P = 5.5 \times 10^4 \text{ lb.}$$

$$g = 4 \times 5.5 \times 10^4 / 700 = 314.3$$

$$\text{Difference} = 100 \times (316.2 - 314.3) / 314.3 = 0.6\%$$

References

1. Libra Verification Problems, GE Nuclear, Vallecitos, 1993.
- 1a. Update of Libra Thermal Verification Problems, GE Nuclear, Vallecitos, June, 2000.
2. S. Timoshenko, Strength of Materials, Part I, 3rd Edition, McGraw-Hill, 1955.
3. R. J. Roark, Formulas for Stress and Strain, 3rd Edition, 1954.
4. D. Owen, E. Hinton, Finite Elements in Plasticity, Pineridge Press, 1980.
5. R. W. Clough, J. Penzien, Dynamics of Structures, McGraw-Hill, 1975.
6. W. Flugge (Editor), Handbook of Engineering Mechanics, McGraw-Hill, 1962.
7. S. Timoshenko, J Goodier, Theory of Elasticity, 2nd Edition, McGraw-Hill, 1951.
8. S. Timoshenko, J. Gere, Theory of Elastic Stability, 2nd Edition, McGraw-Hill, 1961.
9. D. Stienberg, Notes on Random Vibration Analysis for Electronic Equipment, 1979.
10. L. Meirovitch, Elements of Vibration Analysis, McGraw-Hill, 1975.

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2.12.4 Description of LIBRA Files and Post-Processors: AOS Safety Analysis Report

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Description of Libra Files and Post-Processors:
AOS Safety Analysis Report

Prepared for: GE-Hitachi Nuclear Energy
PO No. 431004505
May 3, 2007

Prepared by: Structural Mechanics Analysis, Inc.
P.O. Box 700910
San Jose, CA 95170-0910

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1.0 Introduction

The Alpha-Omega Services (AOS) Safety Analysis Report (SAR) applies to four radioactive materials Type B cask configurations. These four cask configurations are designated by their relative size as AOS-025, AOS-050, AOS-100, and AOS-165. Configuration AOS-025 is approximately 25% the size of configuration AOS-100, configuration AOS-050 approximately 50%, and configuration AOS-165 approximately 165% in comparison to the AOS-100 model. The following provides a description of the Libra post-processors used to perform the structural and thermal analyses to support the preparation of the SAR for the four AOS cask models.

Notwithstanding the scaled nature of the four configurations, the thermal and stress analyses for the four models are not scalable. Rather, an independent set of analyses is required for each model. While the analyses are not scalable, the finite element models used in the analyses are largely scaled, although there are significant differences between models, particularly between model AOS-165 and the others.

Almost all of the thermal and stress analyses in the SAR are based on application of the Structural Mechanical Analysis, Inc. (SMA) Libra finite element program. The Libra program has been used by GE-Hitachi Nuclear Energy Americas, LLC (“GEH”) for a number of years, and was used in the licensing of the Model 2000 Type B transport packaging. SMA has proprietorship of the Libra program, as a result, SMA was able to develop sophisticated post-processing tools integrated with the Libra program, that facilitated the AOS analyses.

The majority of the SAR analyses permit use of axisymmetric, finite element models, since for the majority of load cases the cask, loading, and boundary conditions are axisymmetric. As a result, four axisymmetric models were developed corresponding to the four cask configurations, and these models are the cornerstones of all the finite element analyses in the SAR. For load cases such as drop and transport, where assumptions of axisymmetric loading and boundary conditions are not applicable, 3D finite element models are used. These 3D models are generated from the axisymmetric models by rotation of the model. In this way, there is a well-defined relationship between elements in the axisymmetric and 3D models, and this relationship allows combining stress resultants from the two models.

The two U.S. Nuclear Regulatory Commission (NRC) documents that govern the analyses included in the SAR are Regulatory Guides 7.6 and 7.8. Reg. Guide 7.6 defines the allowable stresses for nuclear shipping casks, while Reg. Guide 7.8 defines the required loading conditions and load combinations. Further, Reg. Guide 7.6 specifies allowable stresses in terms of membrane and bending stresses, or more generally stress resultants. Stress resultants are not a direct output of finite element analyses. For the detailed models used in the AOS analyses, forming stress resultants involves identifying and integrating element stresses across a number selected cask cross-sections. This is an arduous and time consuming task. In addition, NRC Reg. Guide 7.8, which defines the load combinations that must be met, presents additional difficult tasks for analyses based on the finite element method.

1.0 Introduction - Cont'd

Two major post-processing programs were developed to facilitate evaluation of stress resultants and stress combinations required by NRC Reg. Guides 7.6 and 7.8. The first, PmPb, forms the stress resultants required by Reg. Guide 7.6, while the second, CmbLds, forms the load combinations required by Reg. Guide 7.8. The methodology and application of these programs are described in detail in this report. The solution process for all of the four cask configurations involves first finding stresses corresponding to a set of basic load conditions, and then finding the stress combinations. For thermal loading conditions, one or more thermal solutions must be found before solving for stresses. After determining load case stresses, stress resultants are formed by application of the PmPb post-processing program. The PmPb program generates files containing stress resultants for the basic loading conditions. After all of the loading conditions have been run, and corresponding files of stress resultants generated by PmPb, The CmbLds program is executed. The CmbLds program reads the files generated by PmPb, forms the required combinations, and compares the combined stresses to the allowables in Reg. Guide 7.6. This entire process is automated by a Windows Command program, Run_AOS. A section of the Run_AOS batch program is shown in Appendix F.

2.0 PmPb Post Processor Program

The PmPb program forms the stress resultants referenced by Reg. Guide 7.6. The PmPb is a suite of three programs: PmPbData, PmPb, and PmPb3D. Each of these three programs is described below. All three programs use the input file PmPb.in, which lists the elements at each model cross-section where stress resultants are evaluated. A sample PmPb.in file is shown in Appendix A.

The cross-sections on which PmPb operates are shown in Figures 1 and 2. Figure 1 shows the cross-sections for model 165, and Figure 2 shows the cross-section for models 025, 050, and 100. Model 165 has 25 stress cross-sections, while models 025, 050, and 100 have 22 stress cross-sections. The larger number of cross-sections for model 165 is due to the split outer shell. The elements comprising the cross-sections shown in Figures 1 and 2 are defined on the respective input data file PmPb.dat. The 165 cask axisymmetric, and three dimensional finite element models are shown in Figures 3 and 4, respectively.

2.1 AOS Input Load Case designations

AOS Libra input data files all have designations starting with LCnnn, where nnn is a three digit load case number; and ending with suffix mmm, where mmm is a three digit model number. For example, the input file for thermal load case 101, model 025 is, LC101.025. Additional file description is entered following the load case number, with a hyphen preceding the entry. For example LC101-2500-UPDATE.025 is the designation for input file for thermal load case 101, 2500 watts, updated.

AOS load case numbers define the type of loading involved in the load case. Load cases numbered 101-199 are thermal loadings. Load cases 201-299 are pressure or other axisymmetric normal loadings. Load cases 301-399 are accident condition loadings. The load case types are used by the CmbLds program to determine allowable stress for load combinations.

2.2 PmPbData Program

PmPbData program determines the geometry data for the PmPb program, and stores this data on the file PmPb.dat. This geometry function is separated from the PmPb program for efficiency, as it needs to be performed only once for each model. PmPbData must be executed immediately following an execution of the Libra program, as it uses Libra output. The program reads Libra model geometry data from binary file Tape9, and generates the geometric data required to form membrane and moment stress resultants for each stress cross-section. This data is written to the file PmPb.dat, and is utilized by both PmPb and PmPb3D.

2.3 PmPb Program

The PmPb program generates files of membrane and bending stress resultants for axisymmetric loading conditions. The program utilizes the geometry data on the file PmPb.dat, the cross-section elements defined on PmPb.in, and Libra stress data on the binary file Tape8. PmPb generates output files labeled LOAD_CASE.nnn, where nnn is the load case number. For each LCnnn file there is a corresponding LOAD_CASE.nnn file. A typical output file generated by PmPb is shown in Appendix B. Output files list maximum principal stress, and membrane and bending stress for each cross-section. The PmPb program must be executed immediately following execution of a Libra stress run.

2.4 PmPb3D Program

The PmPb3D program generates files containing membrane and moment stress resultants for 3D loading conditions. The program utilizes the geometry data on the file PmPb.dat, cross-section element data on the file PmPb.in, and Libra stress output on the binary file Tape8. All AOS 3D models are generated from axisymmetric models. As a result, each element along a meridian corresponds to a element in the corresponding axisymmetric model. PmPb3D finds the stress resultants for each element along a meridian, and outputs maximum values on the LOAD_CASE file. Stress combinations involving axisymmetric and 3D load cases conservatively combine maximum meridian 3D values with axisymmetric values. The output of PmPb3D is the same as PmPb, and a typical file shown in Appendix B.

2.5 GroupAllow Program

The GroupAllow program finds maximum temperatures at cross-sections where stress resultants are evaluated, and interpolates temperature-dependent, allowable stress data to find the allowable cross-section stress corresponding to these maximum temperatures. This program is executed only for thermal load cases, and is executed after a Libra thermal solution. The GroupAllow program generates files ALLOWABLES.nnn, where nnn is load case number, and the file is subsequently used by the CmbLds program. A typical GroupAllow output file is shown in Appendix C.

3.0 CmbLds Program

As described in Section 2.3, The PmPb program generates stress resultant files LOAD_CASE.nnn, where nnn is the load case number. The CmbLds program forms load combinations using these files, and also determines the allowable stresses against which the combined stresses are compared. A typical CmbLds.in file is shown in Appendix D.

The load case number nnn in the file name LOAD_CASE.nnn defines the type of loading, as described in Section 2.1. LOAD_CASE.nnn files list both membrane and bending stress for each stress cross-section. The ALLOWABES.nnn files, described in Section 2.5, specify allowable stresses for thermal loadings. Based on all this information, the CmbLds program determines the maximum combined stress, the minimum allowable stress, and the minimum margin of safety at all stress cross-sections. The maximum stresses and minimum allowables are output on the file CmbLds.out. A typical output section generated by CmbLds is shown in Appendix E. The table in Appendix E lists the combined stress, allowable stress, and minimum margins of safety for each cross-section. The overall minimum margin of safety is listed at the end of the table.

4.0 AOS Files

The AOS input and output data files, PMPB verification files, and Libra Program files are contained on a single CD. The folders on this disk are listed below, and the following sections describe the contents of these folders.

aos-25	Input data files for AOS cask Model 025
aos-50	Input data files for AOS cask Model 050
aos-100	Input data files for AOS cask Model 100
aos-165	Input data files for AOS cask Model 165
aos-165-2500	Input data files for AOS cask Model 165, 2500 watts
PMPB_Verification	Verification report for post-processors
Source	Post-processors source code
aos-25-out	Output files for AOS cask Model 025
aos-50-out	Output files for AOS cask Model 050
aos-100-out	Output files for AOS cask Model 100
aos-165-out	Output files for AOS cask Model 165
aos-165-2500-out	Output files for AOS cask Model 165, 2500 watts
drop-25	Files for AOS cask Model 025 30' drop analyses
drop-50	Files for AOS cask Model 050 30' drop analyses
drop-100	Files for AOS cask Model 100 30' drop analyses
drop-165	Files for AOS cask Model 165 30' drop analyses

4.1 Input Data Files

The five input data folders, aos-25 ... aos-165-2500, contain all files required to run the Libra stress and thermal analyses for the five cask models. After establishing the Libra program (see Section 4.5), there is a two step process for executing Libra analyses and post-processing programs for a cask model: 1) copy the entire contents of an input data folder onto the Libra.app, or Libra.app sub-folder, directory; 2) execute the batch program RUN_AOS.

All input data is in English units. For thermal problems temperatures are in degrees F, energy in Btu, and length in inches. For structural problems loads are in lb, moduli in lb/in², and length in inches.

Libra executions may take several hours. Output from the Libra runs and post-processors consist of a series of text files labeled Load_Case.nnn, where nnn represents the load case number, and a file labeled Cmb_Loads.out. The Load_Case.nnn files contain the Pm and Pb stress measures at the monitored cask cross-sections for the individual load cases. The Cmb_Loads.out file contains the load combination results, including margins of safety for all combined load cases.

4.2 PMPB Verification Files

The PMPB_Verification folder contains both a report and a verification problem for PMPB and Cmb_Loads post-processors. The verification problem is a simple flat-top cylindrical shell under pressure and thermal loads. The stress resultants as two shell cross-sections are determined analytically, and by the PMPB and Cmb_Loads post processors. The two sets of results are shown to compare well.

A folder containing a set of verification problems for the Libra program, with emphasis on the AOS problem types, is established with installation of the Libra program (see Section 4.5). The Source folder contains the Fortran source codes for the six post processing programs used in the AOS Libra analyses.

4.3 Output Data Files

The AOS-25-out ... AOS-165-2500-out folders contain selected output from the individual Libra load case analyses (see Section 2.1). Each folder contains the LOAD_CASE file (see Section 2.4), The ALLOWABLES file (see Section 2.5), and the Libra output file (TAPE6) for each input data file. The extensions on LOAD_CASE, ALLOWABLES, and TAPE6 files are the same as the input file extension.

4.4 Files for 30' Drop Analyses

The four drop analysis folders, drop-25 ... drop-165, contain input and selected output files for the 30' head-on, side and cg/corner drop analyses. Each folder contains files for a single model, and for the three drop analyses. The output files are plot files for force-energy curves, model displacement, and model stress. The file names have -force,- disp, or -stress to indicate content. File names containing -cold are plots for -40° F thermal conditions, all other files are for 75° F.

The same Libra input data file can be used for all three drop orientations, with non-applicable orientation data commented out by an asterisk in column 1. All of the plot files are BMP format files, and may be viewed by means of the MS Paint program. The displacement and stress files are for displacement fields close to, but not necessarily at maximum values.

The drop-165 folder also contains the Libra input data file slap-down.t5 for slap-down analysis. This file is specifically for AOS model 165 cask, but is easily adapted to other cask models by changing the model structure dimensions and contact stiffness values. Contact stiffness values are taken from the 30' side-drop analyses.

5.0 Libra Installation

Libra installation files are contained in the Libra64 folder. The Libra Program is installed by executing the SETUP program on the Libra64 folder. The SETUP program will request names for Libra Program and Application directories. Libra program files reside on the Program directory, and problems are executed from the Application directory or sub-directories. Default folder names are Libra64 for the program directory, and Libra.app for the application directory. The SETUP program will also prompt for installation of the 64-bit version of Libra. The 64-bit version should be installed only if the host operating system is 64 bits.

On Vista operating systems it may be necessary to set permission for running Script files before executing the Libra SETUP program. The following steps establish permission:

go to Control Panel
click on User Accounts
click on Turn user control on or off
uncheck user account control

After the Libra SETUP program is completed, the Libra program can be executed from the Start menu, or from the Command line in the Libra application folder. The AOS files are organized to run from the Libra Command line. To access the Libra Command line, left click on the Libra Desktop icon. To then execute a Libra input file, at the Command prompt enter,

Libra input_file output_file

If output_file is omitted, the default file name is TAPE6. After a Libra execution, the model can be viewed by entering HPLOT at the command prompt, and stresses viewed by entering STRSPP. Both HPLOT and STRSPP are menu driven.

To execute a set of AOS analyses on the distribution disk, say \aos-25, read the entire contents of \aos-25 onto the application directory (or sub-directory), then enter run_aos at the Command prompt. This executes the batch program run_aos, which executes all of the files and post-processors for AOS Model 025. Output will be contained on a set of files labeled Load_Case.nnn, and on the file Cmb_Loads.out (see Sections 2.3 and 3.0).

Libra installation establishes a folder labeled Verification. This folder contains a number of verification problems for Libra elements and solution procedures. The thermal problems, and several of the structural problems are directly applicable to AOS analyses. In total, the verification problems in this folder encompass all of the Libra elements and solution procedures applied in the AOS analyses. The verification files described in Section 4.2 address the post-processors used in the AOS analyses, and are an adjunct to these Libra verification problems.

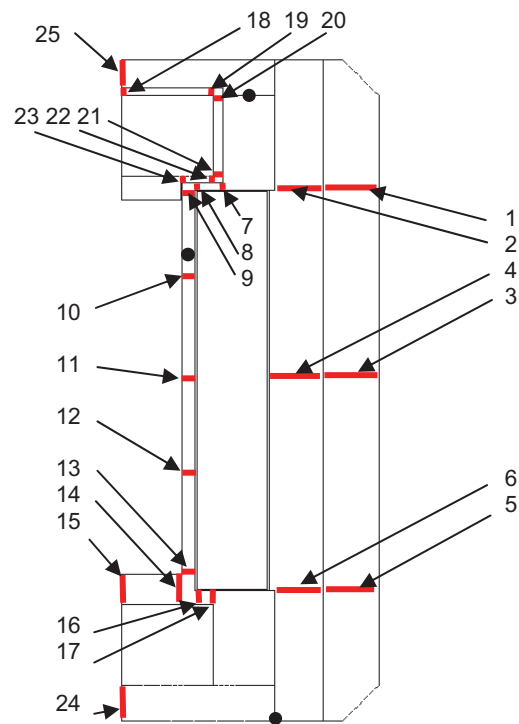


Figure 1. Model 165 PmPb Cross-Sections

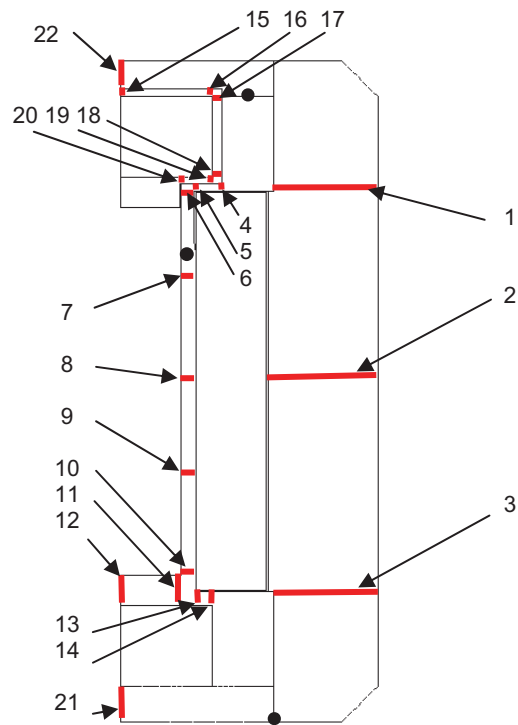


Figure 2. Models 025, 050 and 100 PmPb Cross-Sections

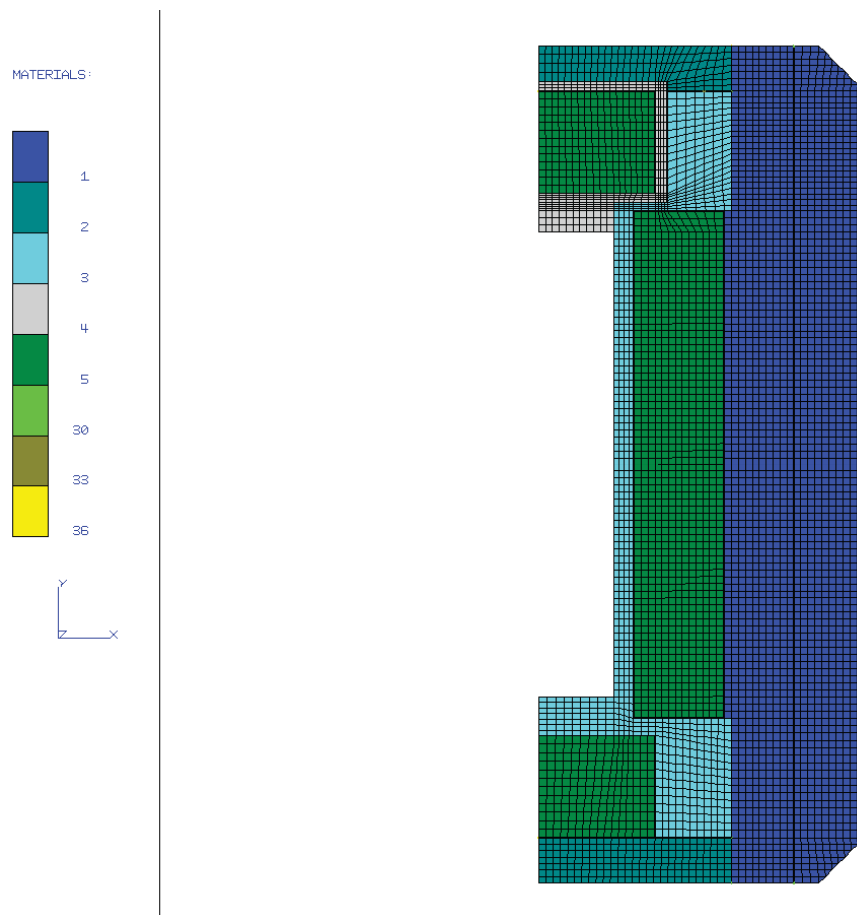


Figure 3. Axisymmetric FEA Model of 165 Cask

MATERIALS:

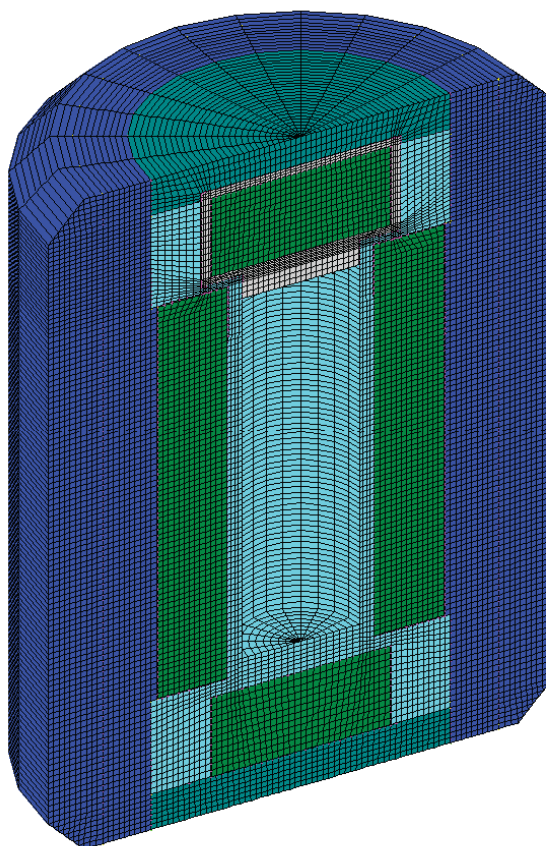
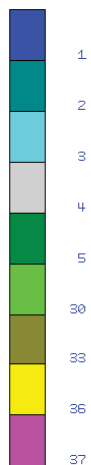


Figure 4. Three Dimensional FEA Model of 165 Cask

Appendix A. Typical PmPb.in File

The following is a typical PmPb.in file listing elements at each stress cross-section. For ease of viewing, cross-section entries are not confined to one line, and blank lines separate entries. In the actual file all section entries are on one line, and there are no blank lines.

1957,1958,1959,1960,1961,1962,1963,1964,1965,2146,2147,2148,2149,2150,
2151,2152,2153,2154,2155

552,904,905,906,907,908,909,910,911,912,1587,1588,1589,1590,1591,1592,
1593,1594,1595,1596

348,349,350,351,352,353,354,355,356,507,508,509,510,511,512,513,514,515,
516

4587,4591,4595,4599

4572,4575,4578,4581

552,4553,4554,4555

4476,4477,4478,4479

4408,4409,4410,4411

4344,4345,4346,4347

4280,4281,4282,4283

4141,4150,4159,4168,4177,4186,4195

4133,4142,4151,4160,4169,4178,4187

4212,4215,4218,4221

4214,4217,4220,4223

5218,5236,5254

5235,5253,5271

5214,5215,5216,5217

5166,5167,5168,5169

5140,5143,5146,5149

5122,5126,5130,5134

3001,3017,3033,3049,3065,3081,3097

3190,3208,3226,3244

Appendix B. PmPb output file, LOAD_CASE.101

The following is the PmPb output file for load case LC101.025. The file lists maximum principal stresses, and calculated membrane and bending stress at each section analyzed. Stresses are listed in both English and metric units.

Load Case_101 - 100F Ambient, Max Decay Heat

Stress (psi/MPa)

Location	Sigma_1	Sigma_2	Sigma_3	Pm	Pb
-----	-----	-----	-----	--	--
1	1.2232E+01 8.4340E-02	-2.5191E+01 -1.7369E-01	-1.8387E+00 -1.2677E-02	3.7423E+01 2.5803E-01	5.8177E+01 4.0111E-01
2	1.6225E+01 1.1187E-01	-3.2962E+01 -2.2727E-01	-6.5255E+00 -4.4992E-02	4.9187E+01 3.3913E-01	1.0016E+02 6.9059E-01
3	1.0870E+01 7.4943E-02	-2.3382E+01 -1.6122E-01	-1.1174E+00 -7.7043E-03	3.4252E+01 2.3616E-01	5.3526E+01 3.6905E-01
4	6.2382E+01 4.3011E-01	-2.3843E+02 -1.6439E+00	-4.1530E+01 -2.8634E-01	3.0081E+02 2.0740E+00	5.9563E+02 4.1067E+00
5	6.1432E+01 4.2356E-01	-2.6905E+02 -1.8550E+00	-1.2242E+02 -8.4406E-01	3.3048E+02 2.2786E+00	5.2038E+02 3.5879E+00
6	6.4534E+00 4.4494E-02	-1.3381E+02 -9.2256E-01	-1.5795E+02 -1.0890E+00	1.4026E+02 9.6705E-01	1.6725E+02 1.1532E+00
7	-1.9752E+00 -1.3619E-02	-4.9672E+01 -3.4248E-01	2.5928E+00 1.7877E-02	4.7697E+01 3.2886E-01	4.3899E+01 3.0267E-01
8	-2.0037E+00 -1.3815E-02	-4.9648E+01 -3.4231E-01	1.9949E-03 1.3755E-05	4.7644E+01 3.2850E-01	4.3457E+01 2.9962E-01
9	-1.9811E+00 -1.3659E-02	-4.9582E+01 -3.4185E-01	-5.2273E-01 -3.6041E-03	4.7600E+01 3.2819E-01	4.1764E+01 2.8795E-01
10	-7.5888E+00 -5.2323E-02	-6.6970E+01 -4.6174E-01	1.0700E+01 7.3772E-02	5.9381E+01 4.0942E-01	1.2009E+02 8.2802E-01
11	-1.6114E+01 -1.1110E-01	-1.0104E+02 -6.9668E-01	-5.3150E+01 -3.6645E-01	8.4930E+01 5.8557E-01	7.0193E+00 4.8396E-02
12	4.9440E+00 3.4087E-02	-1.1870E+02 -8.1839E-01	-1.1938E+02 -8.2311E-01	1.2364E+02 8.5248E-01	7.5796E+00 5.2260E-02

13	-1.3346E+01 -9.2016E-02	-1.7829E+02 -1.2293E+00	-2.9776E+01 -2.0530E-01	1.6495E+02 1.1373E+00	8.7679E+01 6.0452E-01
14	-1.2832E+01 -8.8473E-02	-1.5680E+02 -1.0811E+00	3.6799E+00 2.5372E-02	1.4396E+02 9.9259E-01	9.5911E+01 6.6128E-01
15	3.4752E+02 2.3960E+00	-3.2306E+02 -2.2274E+00	-3.0278E+01 -2.0876E-01	6.7058E+02 4.6235E+00	1.1250E+03 7.7568E+00
16	1.2110E+02 8.3498E-01	-2.3963E+02 -1.6522E+00	-7.8259E+01 -5.3958E-01	3.6074E+02 2.4872E+00	5.8708E+02 4.0478E+00
17	5.3313E+01 3.6758E-01	-1.6483E+02 -1.1365E+00	7.7898E+00 5.3709E-02	2.1815E+02 1.5041E+00	3.7767E+02 2.6039E+00
18	1.3652E+01 9.4130E-02	-8.6978E+01 -5.9969E-01	1.2149E+02 8.3767E-01	1.0063E+02 6.9382E-01	1.5144E+02 1.0442E+00
19	3.7352E+01 2.5754E-01	-1.4759E+02 -1.0176E+00	9.9594E+01 6.8668E-01	1.8495E+02 1.2752E+00	3.1090E+02 2.1436E+00
20	2.5189E+01 1.7367E-01	-1.9576E+02 -1.3497E+00	9.1481E+00 6.3074E-02	2.2095E+02 1.5234E+00	4.1088E+02 2.8329E+00
21	6.6491E+00 4.5844E-02	-2.2294E+00 -1.5371E-02	-1.0467E+00 -7.2168E-03	8.8785E+00 6.1215E-02	6.0550E+00 4.1748E-02
22	2.7655E+00 1.9068E-02	-1.5235E+01 -1.0504E-01	-3.0961E+00 -2.1347E-02	1.8000E+01 1.2411E-01	4.4221E+01 3.0489E-01

Appendix C. GroupAllow Program Output File

The following is the GroupAllow program output file for load case LC101.025. This file lists maximum and average temperatures at each stress section, and the allowable membrane, yield, and ultimate stress at these sections.

Allowable Stress for Load Case 101

LOC	Tmax (deg_F)	Tave (deg_F)	Sm (ksi)	Sy (ksi)	Su (ksi)
1	138.91	138.74	20.00	30.00	70.00
2	138.94	138.59	20.00	30.00	70.00
3	138.62	138.37	20.00	30.00	70.00
4	139.15	139.13	20.00	30.00	70.00
5	139.61	139.54	20.00	30.00	70.00
6	139.79	139.72	20.00	30.00	70.00
7	140.04	139.89	20.00	30.00	70.00
8	139.99	139.85	20.00	30.00	70.00
9	139.92	139.77	20.00	30.00	70.00
10	139.78	139.64	20.00	30.00	70.00
11	139.92	139.66	20.00	30.00	70.00
12	140.39	140.09	20.00	30.00	70.00
13	139.33	139.20	20.00	30.00	70.00
14	139.04	138.97	20.00	30.00	70.00
15	139.08	139.03	20.00	30.00	70.00
16	139.19	139.14	20.00	30.00	70.00
17	139.22	139.19	20.00	30.00	70.00
18	139.37	139.34	20.00	30.00	70.00
19	139.50	139.44	20.00	30.00	70.00
20	140.26	140.14	20.00	30.00	70.00
21	138.43	138.36	20.00	30.00	70.00
22	138.82	138.76	20.00	30.00	70.00

Appendix D. Typical CmbLds.in File

The following is a typical PmPb.in file. The first entry is the number of stress cross-sections. The next set of entries is the load case numbers, and this set is terminated with a -1. The second and last set of entries are the load combination numbers, and the combination load cases. Text following entries is descriptive, and not used by the program

```
22
101      ; 100F Ambient, Max Decay Heat
102      ; 100F Ambient, Max Decay Heat, Max Insolation
103      ; -20F Ambient, Zero Decay Heat, Zero Insolation
104      ; -40F Ambient, Zero Decay Heat, Zero Insolation
105      ; -40F Ambient, Max Decay Heat
111      ; Fire @ 30 Min, 1475F Ambient, Max Decay Heat
112      ; Fire @60 Min, 100F, Max Decay Heat,Max Insolation
113      ; Fire @90 Min, 100F, Max Decay heat,Max Insolation
114      ; Fire @120 Min, 100F, Max Decay Heat,Max Insolation
115      ; Fire @150 Min, 100F, Max Decay Heat,Max Insolation
116      ; Fire @180 Min, 100F, Max Decay Heat,Max Insolation
201      ; Maximum Internal Pressure, 30 psi
202      ; Minimum External Pressure, 3.5 psia
203      ; Maximum Increased Pressure, 20 psia
204      ; Additional Increased External Pressure, 290 psi
211      ; Fabrication Stress
215      ; Compression Load
216      ; Rod Drop
221      ; Forward 5g Vibration Inertia Load
222      ; Lateral 5g Vibration Inertia Load
223      ; Vertical 10g Vibration Inertia Load
231      ; 4 ft head-on drop
232      ; 30 ft head-on drop, normal conditions
301      ; 30 ft Head-on drop
302      ; 30 ft Side drop + slap-down
303      ; CG/Corner Drop
304      ; 30 ft Head-on drop, low temp
305      ; 30 ft Side drop + slap-down, low temp
306      ; CG/Corner Drop, low temp
311      ; 3 ft drop onto rod
-1
101, 101,201,211      ; hot environment
102, 104,201,211      ; cold environment
103, 103,201,211      ; increaded ex pres
104, 101,201,202,211  ; min ex pres
105, 105,201,202,211  ; cold environment
106, 101,201,203,211  ; max pres, hot environment
107, 105,201,203,211  ; max pres, cold environment
215, 215,101,201,211  ; compression load
216, 216,101,201,211  ; rod drop
217, 216,104,201,211  ; rod drop cold environment
221, 221,101,201,211  ; fwd vibration
222, 222,101,201,211  ; lateral vibration
```

223, 223,101,201,211	; vertical vibration
231, 231,102,201,211	; 4 ft head-on drop, normal conditions
232, 232,102,201,211	; 30 ft head-on drop, normal conditions
301, 301,102,201,211	; head-on drop
302, 302,102,201,211	; side drop
303, 303,102,201,211	; cg/corner drop
304, 304,105,202,211	; head-on drop, cold environment
305, 305,105,202,211	; side drop, cold environment
306, 306,105,202,211	; cg/corner drop, cold environment
310, 204,101,211	; add ext pres (290 psi)
311, 311,101,201,211	; 3 ft drop onto rod
312, 311,104,201,211	; 3 ftdrop onto rod, cold environment
350, 111,201,211	; fire @ 30 min
351, 112,201,211	; fire @ 60 min
352, 113,201,211	; fire @ 90 min
353, 114,201,211	; fire @ 120 min
354, 115,201,211	; fire @ 150 min
355, 116,201,211	; fire @ 180 min

-1

Appendix E. Typical Output from CmbLds Program

The following is a typical output file from the CmbLds program. The load combination is listed at the top of the table. The file lists maximum membrane and bending stress, and minimum allowables at each section analyzed. Stresses are listed in both English and metric units. Minimum MS and associated values are listed at the end of the table.

Normal Load Combination 101

Load Cases: 101 201 211

100F Ambient, Max Decay Heat

Maximum Internal Pressure - 30 Psia

Fabrication Stress

Stress (ksi/MPa)								

Loc	Pm	Pb	Q	Pm+Pb	Pm+Pb+Q	Sm	Su	MS
---	--	--	-	-----	-----	--	--	--
1	0.75	1.10	0.04	1.85	1.89	20.00	70.00	>10
	5.16	7.60	0.26	12.75	13.01	137.90	482.63	
2	0.14	0.20	0.05	0.34	0.38	20.00	70.00	>10
	0.96	1.35	0.34	2.31	2.65	137.90	482.63	
3	0.08	0.08	0.03	0.16	0.20	20.00	70.00	>10
	0.58	0.54	0.24	1.12	1.36	137.90	482.63	
4	1.16	1.78	0.30	2.94	3.24	20.00	70.00	9.20
	8.00	12.28	2.07	20.28	22.35	137.90	482.63	
5	1.18	1.00	0.33	2.18	2.51	20.00	70.00	>10
	8.17	6.88	2.28	15.05	17.32	137.90	482.63	
6	0.78	1.17	0.14	1.95	2.09	20.00	70.00	>10
	5.40	8.05	0.97	13.44	14.41	137.90	482.63	
7	0.34	0.07	0.05	0.40	0.45	20.00	70.00	>10
	2.34	0.45	0.33	2.79	3.12	137.90	482.63	
8	0.32	0.04	0.05	0.36	0.41	20.00	70.00	>10
	2.21	0.27	0.33	2.48	2.81	137.90	482.63	
9	0.36	0.07	0.05	0.43	0.48	20.00	70.00	>10
	2.48	0.48	0.33	2.97	3.29	137.90	482.63	
10	1.23	0.15	0.06	1.38	1.44	20.00	70.00	>10
	8.49	1.03	0.41	9.52	9.93	137.90	482.63	

11	0.93 6.44	1.23 8.51	0.08 0.59	2.17 14.95	2.25 15.53	20.00 137.90	70.00 482.63	>10
12	1.01 6.95	1.49 10.27	0.12 0.85	2.50 17.23	2.62 18.08	20.00 137.90	70.00 482.63	>10
13	1.19 8.21	1.05 7.23	0.16 1.14	2.24 15.44	2.40 16.58	20.00 137.90	70.00 482.63	>10
14	1.21 8.36	1.54 10.61	0.14 0.99	2.75 18.97	2.89 19.96	20.00 137.90	70.00 482.63	9.91
15	1.70 11.69	1.94 13.38	0.67 4.62	3.64 25.07	4.31 29.70	20.00 137.90	70.00 482.63	7.25
16	1.70 11.72	2.69 18.55	0.36 2.49	4.39 30.27	4.75 32.75	20.00 137.90	70.00 482.63	5.83
17	1.12 7.71	1.79 12.31	0.22 1.50	2.90 20.02	3.12 21.52	20.00 137.90	70.00 482.63	9.33
18	0.87 5.99	1.40 9.65	0.10 0.69	2.27 15.64	2.37 16.33	20.00 137.90	70.00 482.63	>10
19	1.46 10.09	2.17 14.96	0.18 1.28	3.63 25.05	3.82 26.33	20.00 137.90	70.00 482.63	7.26
20	1.82 12.58	2.90 19.99	0.22 1.52	4.72 32.57	4.95 34.09	20.00 137.90	70.00 482.63	5.35
21	0.32 2.24	0.44 3.00	0.01 0.06	0.76 5.24	0.77 5.30	20.00 137.90	70.00 482.63	>10
22	0.46 3.20	0.47 3.23	0.02 0.12	0.93 6.43	0.95 6.55	20.00 137.90	70.00 482.63	>10

Min MS: 5.350, Location: 20, Combination: Pm+Pb

Appendix F. Typical Section of Batch Program to Execute AOS Load Cases

The AOS input data files and post-processor executions are organized and run by a Command batch program. A separate batch program is required for each of the four model configurations. A section of a typical batch program is shown below. Note that the program PmPbData is run before the first execution of PmPb. The GroupAllow program is only run after a Libra thermal analysis. The PmPb (or PmPb3D) program is run after each Libra stress analysis. Calls to the Libra program include the input file name, output file name, and a flag set to 1 to prevent Libra pausing after execution.

```
rem load case 101
call libra lc101-t-update.025  tape6 1
call libra lc101-update.025  tape6 1
groupallow lc101-update.025
pmpbdata
pmpb

rem load case 102
call libra lc102-t-update.025  tape6 1
call libra lc102-update.025  tape6 1
groupallow lc102-update.025
pmpb

rem load case 103
call libra lc103-t-update.025  tape6 1
call libra lc103-update.025  tape6 1
groupallow lc103-update.025
pmpb

rem load case 104
call libra lc104-t-update.025  tape6 1
call libra lc104-update.025  tape6 1
groupallow lc104-update.025
pmpb

rem load case 105
call libra lc105-t-update.025  tape6 1
call libra lc105-update.025  tape6 1
groupallow lc105-update.025
pmpb

rem load case 106
call libra lc106-t-update.025  tape6 1
call libra lc106-update.025  tape6 1
groupallow lc106-update.025
pmpb
```

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2.12.5 Selected Material Properties References

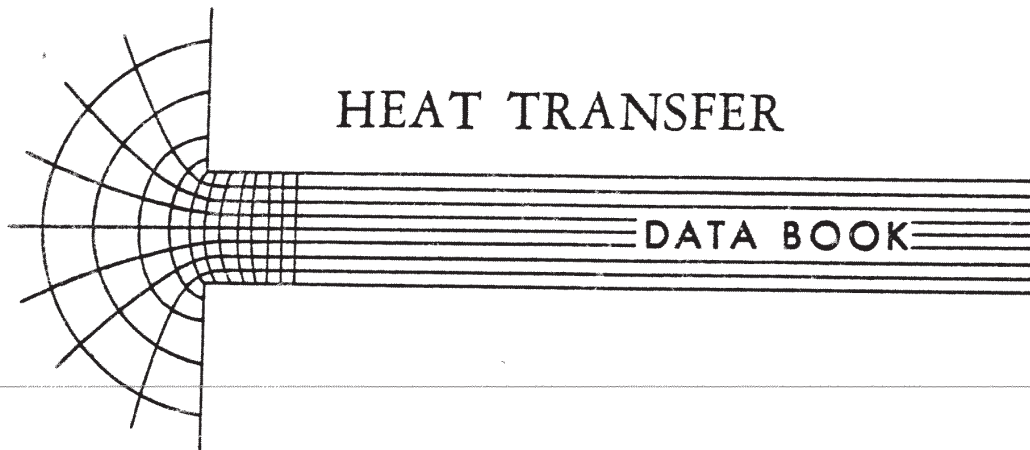
This appendix provides information related to the following materials, that is not included elsewhere in the SAR:

- Contact Resistance
- Decay Heat
- Structural Stability
- Tungsten Alloy
- General Plastics LAST-A-FOAM
- Cask Lid Elastomeric Seal and Port Seal

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Contact Resistance

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EDITORS	TENURE AS EDITOR
R. Hosmer Norris	1943 - 1971
Mrs. Florence F. Buckland	1943 - 1963
Mrs. Nancy D. Fitzroy	1956 -

GENERAL ELECTRIC COMPANY
CORPORATE RESEARCH AND DEVELOPMENT

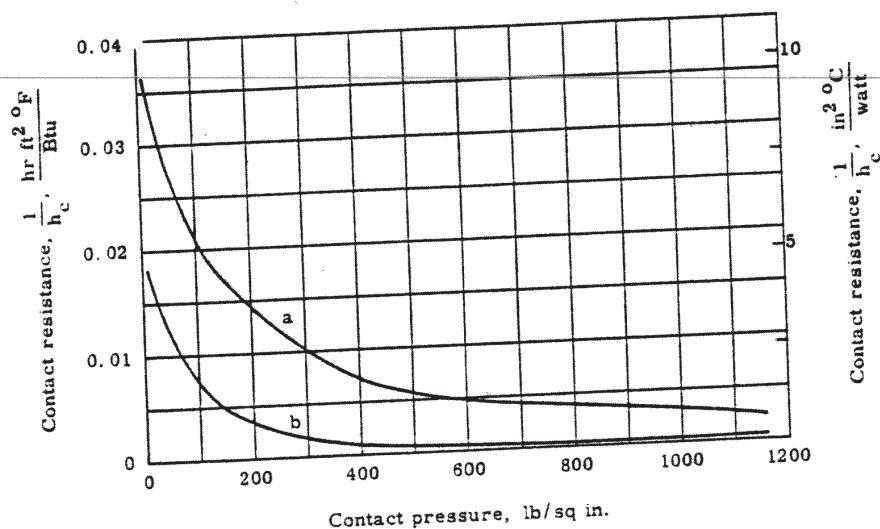
Schenectady, N.Y.

GENERAL  ELELECTRIC

STEEL, BARE SURFACES AT HIGH CONTACT PRESSURES (0 to 1200 psi) - Solid blocks in air at reduced pressure
($p < 0.1$ atm)

For steel with bare surfaces in air, see pages 5-6.
For steel with sandwich material in air, see page 8.
For steel in other gases, see page 9.
For steel with dissimilar metal in air, see page 20; at reduced pressure ($p < 0.1$ atm), see page 21.
For other metals in air, see pages 10-11, 17; at reduced pressure ($p < 0.1$ atm), see pages 12-13, 18-19.
For laminated steels in air, see page 23.

Curve	Material ⁴	Finish	Roughness Rms (μ in.) Block		Fluid in Gap	Temp (°F)	Condition	Ref. No.
			1	2				
a	Stainless Steel 304	Ground	42-60	43-48	Air	75	Clean, 10^{-4} mm Hg abs	45
b	Stainless Steel 304	Ground	15-15	10-10	Air	84	Clean, 10^{-4} mm Hg abs	45



⁴⁻⁵ See page 24

Decay Heat

Decay Heat Load

Model AOS-025 Cask

Decay Heat = 10W

$$10W = 3.4121 * 10 = 34.121 \text{ Btu/hr}$$

Cavity Area

$$\begin{aligned} A &= 2\pi (0.812^2 + (0.612) (7.0 - 2.0)) \\ &= 29.65 \text{ in}^2 \end{aligned}$$

Heat Flux

$$\begin{aligned} q &= 341.21 / 29.65 \\ &= 1.151 \text{ Btu/hr-in}^2 \end{aligned}$$

Model AOS-050 Cask

Decay Heat = 100W

$$100W = 3.4121 * 100 = 341.21 \text{ Btu/hr}$$

Cavity Area

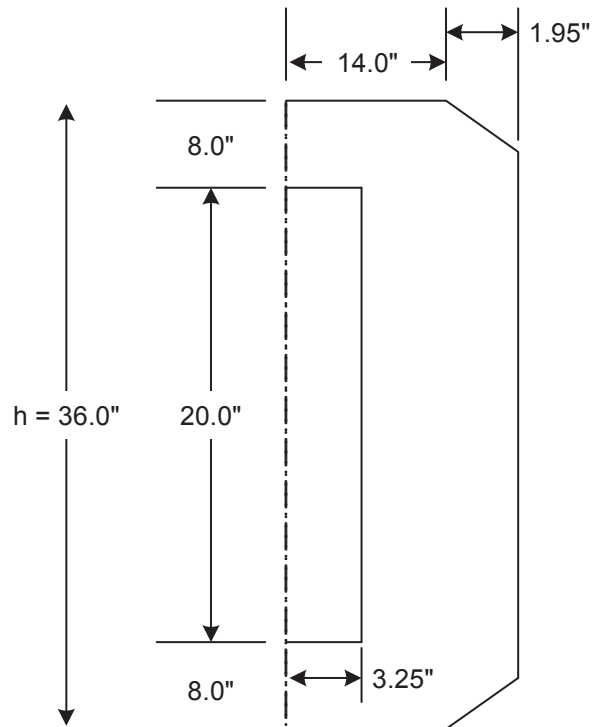
$$\begin{aligned} &2\pi (1.62424^2 + 1.62424 * (14.0 - 4.0)) \\ &= 118.63 \text{ in}^2 \end{aligned}$$

Heat Flux

$$341.21 / 118.63 = 2.876 \text{ Btu/hr-in}^2$$

Model AOS-100 Cask

Outside Cask Body and Cask Height – Model AOS-100



Decay Heat = 400W

$$400\text{W} = 3.4121 \times 400 = 1,365 \text{ Btu/hr}$$

Cavity Surface Area

$$2\pi (3.25^2 + ((3.25) (20))) = 474.77 \text{ in}^2$$

Heat Flux

$$1,365 / 474.77 \text{ in}^2 = 2.88 \text{ Btu/hr-in}^2$$

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Structural Stability

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INTRODUCTION TO Structural Stability Theory

GEORGE GERARD, Sc.D.

*Associate Director of Research and
Research Professor of Aeronautics
College of Engineering, New York University*

McGRAW-HILL BOOK COMPANY, INC. 1962

New York Toronto London

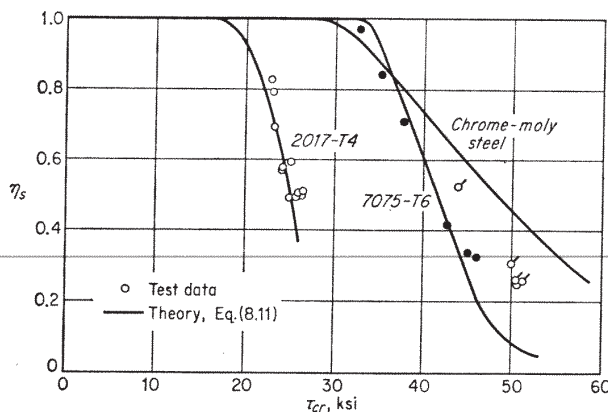


FIG. 8.4. Comparison of test data with plasticity-reduction factor for long cylinders in torsion.

In Fig. 8.3, test data (summarized in Ref. 8.2) on failure of cylinders in torsion of several materials are presented and compared with theory. It can be observed that the upper limit of the test data does conform to the theory. As a result of the postbuckling behavior of cylinders in torsion, there is a considerable mass of test data that lie somewhat below the theory. On the whole, the average of the test data is approximately 15 per cent below theory in the moderate-length-cylinder range.

Before discussing the discrepancy for the torsion case any further, it is convenient to consider the axial compressive buckling of cylinders. Certain additional principles have been evolved in connection with the compressive case that are useful in discussing the small discrepancy between theory and test data in the torsion case (Sec. 8.7).

For torsional loadings, inelastic stability of moderate-length and long cylinders has been considered in Ref. 8.4, and the following plasticity-reduction factor has been derived:

$$\eta_s = \left(\frac{1 - \nu_e^2}{1 - \nu_p^2} \right)^{3/4} \frac{E_s}{E} \quad (8.11)$$

A comparison of Eq. (8.11) with test data summarized in Ref. 8.6 on several materials is presented in Fig. 8.4. Agreement between test data and theory is particularly good for the two aluminum alloys.

8.4. ELASTIC STABILITY UNDER COMPRESSION

For a circular cylinder under axial compression, $N_{xy} = N_y = 0$, $N_x = \sigma t$, and therefore the governing equilibrium relation [Eq. (7.33)]

reduces to

$$D\nabla^2 w + \sigma t \nabla^4 \frac{\partial^2 w}{\partial x^2} + \frac{Et}{R^2} \frac{\partial^4 w}{\partial x^4} = 0 \quad (8.12)$$

A solution of Eq. (8.12) that satisfies the boundary conditions of simple support at the ends of the cylinder is

$$w = w_{mn} \sin \frac{m\pi x}{L} \sin \frac{ny}{R} \quad (8.13)$$

Upon substituting the appropriate derivatives of Eq. (8.13) into (8.12), the following nontrivial solution is obtained:

$$\sigma_{cr} = \frac{\pi^2 k_c E}{12(1 - \nu^2)} \left(\frac{t}{L} \right)^2 \quad (8.14)$$

where

$$k_c = \frac{(m^2 + \beta^2)^2}{m^2} + \frac{12Z^2 m^2}{\pi^4 (m^2 + \beta^2)^2} \quad (8.15)$$

$$\beta = \frac{nL}{\pi R}$$

It can be observed that the wavelength parameter $(m^2 + \beta^2)^2/m^2$ appears in both terms of Eq. (8.15). By minimizing Eq. (8.15) with respect to this parameter, we obtain

$$\frac{(m^2 + \beta^2)^2}{m^2} = \left(\frac{12Z^2}{\pi^4} \right)^{1/2} \quad (8.16)$$

Substituting into Eq. (8.15), we obtain the solution for a moderate-length cylinder under compression:

$$k_c = 0.702Z \quad (8.17)$$

By substituting Eq. (8.17) into (8.14), we obtain the simple result

$$\sigma_{cr} = CE \frac{t}{R} \quad (8.18)$$

where

$$C = [3(1 - \nu^2)]^{-1/2} \cong 0.6$$

We return now to Eq. (8.16) to establish the range of validity of Eqs. (8.17) and (8.18). By solving Eq. (8.16) for β , we obtain

$$\beta = \left[\frac{(12Z^2)^{1/2}}{\pi} m - m^2 \right]^{1/2} \quad (8.19)$$

Since, as a minimum, $m = 1$, it is apparent that for real values of β

$$Z \geq \frac{\pi^2}{12^{1/2}} \geq 2.85 \quad (8.20)$$

Thus, the moderate-length-cylinder solution applies for values of Z greater than 2.85.

Short Cylinders

For short cylinders of Z less than 2.85, the values of $\beta = 0$ and $m = 1$ are to be substituted into Eq. (8.15). Thus, for a simply supported cylinder in the short-cylinder range,

$$k_c = 1 + \frac{12Z^2}{\pi^4} \quad (8.21)$$

In this region, the short cylinder behaves in the same manner as a wide, simply supported column which buckles into one half-wave-

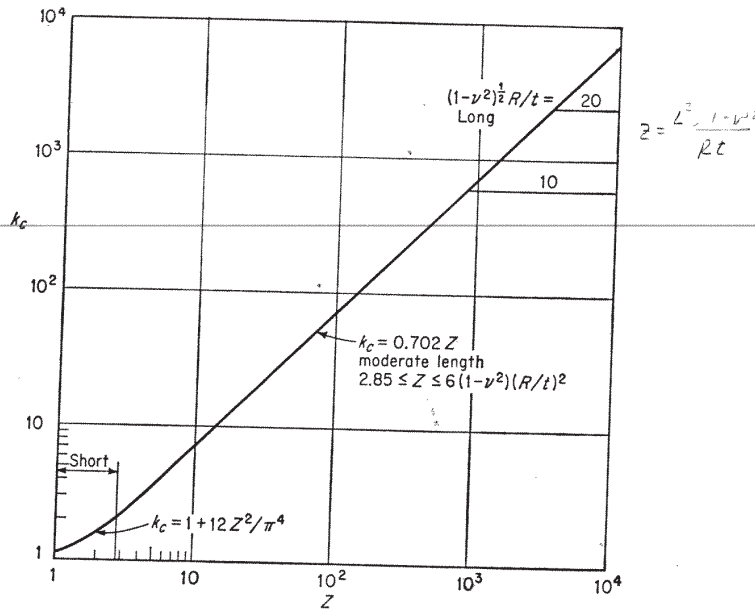


Fig. 8.5. Buckling coefficients for simply supported circular cylinders under axial compression.

length in the loaded axial direction, $m = 1$, and none in the unloaded direction, $n = 0$.

The results given by Eqs. (8.17) and (8.21) are shown in Fig. 8.5. It is to be noted that, at large values of Z , long cylinders buckle as Euler columns with no distortion of the circular cross section. For

cylinders of practical R/t values, however, Euler buckling occurs at values of Z beyond those shown in Fig. 8.5.

8.5. POSTBUCKLING BEHAVIOR UNDER COMPRESSION

By using the large-deflection equations [Eqs. (7.51) and (7.52)], many investigators have studied the postbuckling behavior of compressed cylinders of moderate length. The essential theoretical results of such an analysis by Donnell and Wan (Ref. 8.7) are shown in Fig. 8.6 for both perfect cylinders and those containing small initial imperfections.

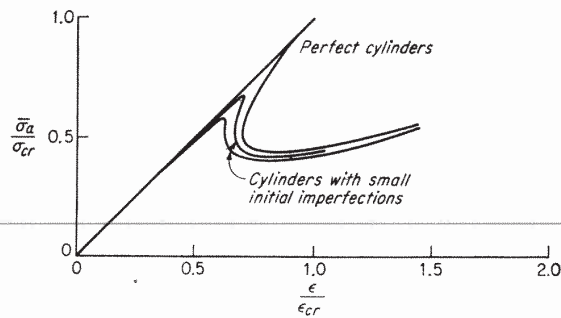


FIG. 8.6. Postbuckling behavior of moderate-length cylinders in axial compression.

It can be seen from Fig. 8.6 that the influence of curvature observed previously in connection with the torsion case is greatly accentuated. For the perfect cylinder under compression, a precipitous decline from the linear buckling stress of Eq. (8.18) occurs after buckling. Of particular importance is the fact that, with continued end shortening, the load-carrying ability is significantly reduced, and it is probably not regained before the onset of plasticity effects.

Cylinders with small initial imperfections exhibit the same type of behavior. Here, too, the postbuckling load-carrying ability apparently does not rise again to the peak load in the region of buckling before the onset of plasticity. As a consequence, we should expect that the failure of moderate-length cylinders in axial compression should be profoundly influenced by the magnitude of the initial imperfections in the cylinder.

This expectation is indeed borne out by the comparison of the linear theory presented in Sec. 8.4 with the large mass of experimental data

on failure of compressed cylinders (Fig. 8.7). It can be observed that none of the test data in the moderate-length region reach the theory and that all are significantly below the theory. Only in the short-cylinder region do the data exceed theory. This is because the test data are for cylinders with clamped ends ($k = 4$ for wide column), whereas the theory is for simply supported ends ($k = 1$ for wide column).

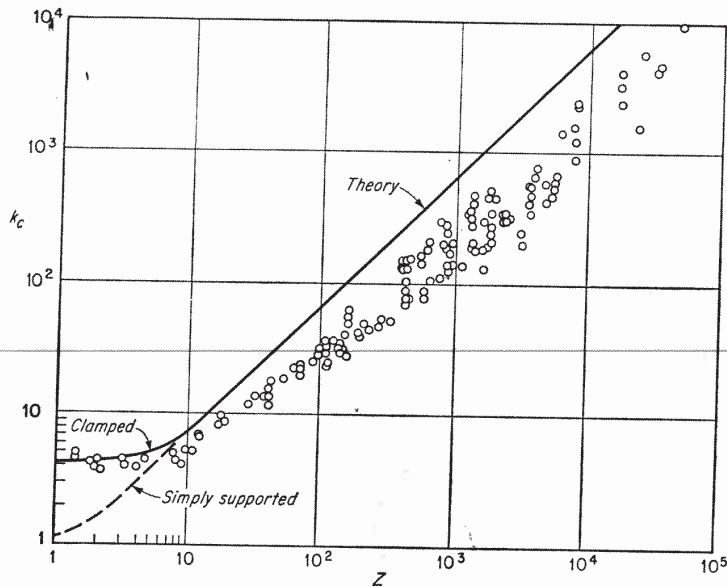


FIG. 8.7. Comparison of linear buckling theory with test data for circular cylinders under axial compression.

At this point, we have reached a rather startling development in that a most significant discrepancy between the results of linear stability theory and experimental data exists. The cause of the discrepancy appears to be associated with the unusual postbuckling behavior of an axially compressed cylinder, and therefore it would seem that we must account for large-deflection effects in this case. Before proceeding to the large-deflection theories that have been developed to resolve this discrepancy, however, we shall first compare the physical behavior of columns, plates, and shells in order to appreciate when large-deflection effects are likely to be of importance.

8.6. BEHAVIOR OF COMPRESSED ELEMENTS

A schematic representation of the postbuckling behavior of axially compressed columns, flat plates, and cylinders is shown in Fig. 8.8 for both theoretically perfect elements and those containing small initial imperfections. It is assumed here that all elements behave elastically.

For the perfect column, the postbuckling behavior is essentially horizontal in the range of end-shortening values considered. The horizontal behavior can be attributed to the fact that, after buckling, no significant transverse-tension membrane stresses are developed to

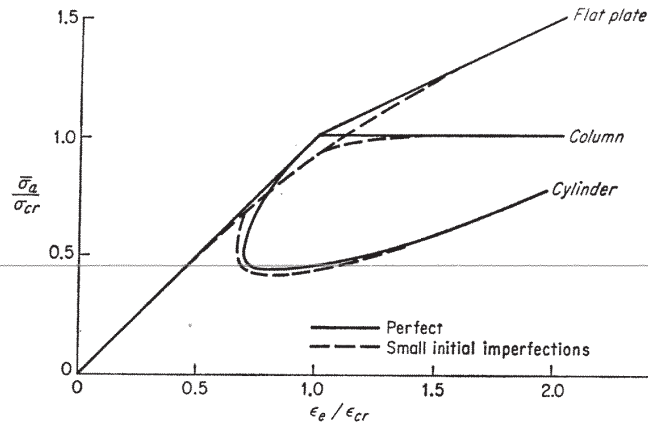


FIG. 8.8. Postbuckling behavior of axially compressed elastic elements.

restrain the lateral motion; therefore, the column is free to deflect laterally under the buckling load.

The flat plate, however, does develop significant transverse-tension membrane stresses after buckling because of the restraint provided by the boundary conditions at the unloaded edges. These membrane stresses act to restrain lateral motion, and thus the flat plate is capable of carrying loads beyond buckling, as indicated in Fig. 8.8.

For the axially compressed cylinder, the effect of the curvature is to translate the postbuckling path considerably downward, with the result that an inward type of buckling is observed to occur. This inward buckling causes superimposed transverse membrane stresses of a compressive nature, so that the buckle form itself is unstable.

As a consequence of the compressive membrane stresses, buckling of an axially compressed cylinder is coincident with failure and occurs

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Tungsten Alloy

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1297 County Line Road, Madison, AL 35756

Date: 8 November 2006

To: Alpha-Omega Services, Inc.
GE Energy

Elevated Temperature Material Characterization

-- Summary of Findings --

Abstract

Summarized herein are the results of specific thermal property tests performed with SD180 as requested by the customer. Elevated temperature tensile testing of this alloy identified a gradual decrease in both offset yield strength and UTS with increasing temperature whereas the elongation at failure rose sharply and then leveled off. Thermal conductivity testing was inconclusive, as thermal testing firms now utilize laser flash diffusivity measurement, which has been shown to provide unreliable results for this material.

Background

ATI Firth Sterling tungsten heavy alloy (WHA) grade SD180 was selected for use in a new large scale design of gamma shield. This alloy has a nominal composition of 95W-3.57Ni-1.43Fe and a nominal density of 18.0 g/cc. The intensity of the gamma flux will result in significant heating of the shield, such that elevated temperature material properties are of significant interest. As a result, this application requires that the shielding material possess a multiplicity of attributes:

- adequate strength and ductility
- good γ radiation attenuation
- sufficient thermal conductivity

The customer specified the tests and the temperatures at which measurements should be made. Temperatures of interest were ambient, 200F, 400F, 600F, and 800F. Further, so as to match the application, testing was to be performed in air. As ATI Firth Sterling is presently equipped only for room temperature material characterization, elevated temperature testing was contracted out to two selected testing firms.

Experimental

Elevated Temperature Tensile Testing

Tensile Testing Metallurgical Lab (Cleveland, OH) was selected to perform the required elevated temperature tests. Tensile testing was conducted using ASTM E8 1" gauge length

specimens pulled at a constant speed of 0.05 in/min. The notch sensitivity of WHA precluded the use of scribe lines or grooves for positioning of a high temperature extensometer. Therefore, crosshead motion was used to generate the displacement measurements in this low compliance, lead screw testing machine. For comparison purposes, a pair of room temperature tensile tests was also performed at ATI Firth Sterling using the same test parameters but with a servohydraulic machine and extensometer. Two specimens were pulled for each test temperature. Averaged results are shown in Table 1.

Table 1. Summary of tensile testing results for SD 180 lot 1808..

Test Temperature	UTS (ksi)	0.2% YS (ksi)	EL (%)
RT (ATIFS)	114.0	93.9	5.0
RT (TTML)	109.7	94.3	3.5
200F (TTML)	112.4	70.8	15.5
400F (TTML)	105.2	60.2	21.8
600F (TTML)	98.2	51.9	21.9
800F (TTML)	95.4	47.8	21.6

The data pairs for each temperature exhibited good agreement, suggesting test results were free from anomalies.

Thermal Property Measurement

Anter Laboratories (Pittsburgh, PA) was selected for measurement of thermal diffusivity and specific heat at the various temperatures of interest. Anter specified that a single disk sample of 0.500" nominal diameter and 0.140" nominal thickness with parallel surfaces and known density be supplied. A SD180 sample from lot 1748 giving a measured ASTM B311 density of 18.11 g/cc was prepared and supplied by ATIFS. Measurements were conducted per ASTM E1461-01. Results are presented in Table 2.

Table 2. Summary of thermal property evaluation of SD 180 lot 1748.

Test Temperature Nom. (F) Actual (C)	Diffusivity (cm ² /sec)	Specific Heat (J/(kg-K))	Conductivity (W/m-K)
RT 25	0.2742	154.7	76.8
200 97	0.2700	159.2	77.8
400 206	0.2624	163.4	77.6
600 316	0.2553	170.3	78.8
800 427	0.2451	173.9	77.2

The thermal conductivity remained relatively constant over the entire test temperature range, whereas specific heat showed a gradual increase and thermal diffusivity a slow decrease. The room temperature density was applied to all conductivity calculations, as the very low CTE of WHA (less than $5.0 \times 10^{-6} \text{ K}^{-1}$) would result in a change of calculated value of only 0.5 W/m-K or less even at the highest test temperature. This was a factor of 4 less than the reported uncertainty of the test procedure.

Discussion of Results

In reviewing the tensile data set generated, the most pronounced effect was that of moving above the ductile to brittle test temperature (DBTT) for WHA, which in most metallurgical conditions is in the vicinity of room temperature. This accounts for the significant increase in alloy ductility, as measured by %EL. Accompanying this increase in ductility was a gradual decrease in both the ultimate and offset yield strengths, which is to be expected in light of induced thermal effects on various dislocation mechanisms that determine deformation response under load. These effects can be seen clearly when the data of Table 1 are plotted and displayed in Figure 1.

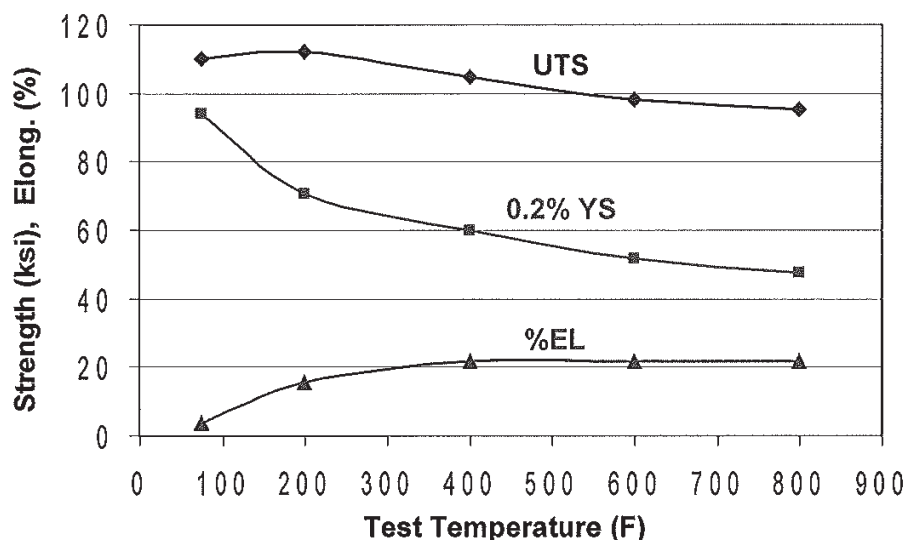


Figure 1. Graphical display of tensile property variation with test temperature.

While the strength of the gamma shield would decrease slightly with heating, the durability of the shield would tend to increase, depending on the magnitude of temperature rise attained.

The data set obtained from thermal property evaluation exhibited consistent trends. However, the resultant calculated values for thermal conductivity, which averaged 78 W/m-K, were well below the accepted industry values for this composition class of WHA. The literature for about two decades has reported values in the range of 110-130 W/m-K. This range is much more in keeping with an alloy having 95 wt.% of a metal that has a conductivity of ~160 W/m-K and is present as a virtually pure phase in the two phase WHA microstructure. The reason for the low measured values is presently unknown. The results obtained appear to underestimate the accepted thermal conductivity by about 35%. Dialogue with Anter revealed no apparent test execution problems. The data set obtained from Anter Laboratories did show that for the temperature range of interest, the thermal conductivity of the WHA, though of systematically low magnitude, did not vary significantly. It was decided that a second independent test be conducted in an effort to understand these results relative to industry accepted values.

Supplemental Testing

In view of the question posed from thermal conductivity testing of the SD180 alloy, a second test sample was prepared for submission to a different laboratory for analysis. While

Anter is nationally recognized for both thermal analysis and the manufacture of thermal analyzers, it was desirable to have a completely independent measurement made. Raul Pomares forwarded the firm of M & P Lab, in that they performed thermal measurements for GE Energy in the past. However, when their thermal analysis contact M. B. Bolduc was contacted, it was learned that they do not perform any thermal conductivity measurements. Harrop likewise, while performing other thermal measurements, does not perform conductivity measurement. Netzsch was therefore chosen as the second source for SD180 thermal conductivity measurement. Netzsch indicated that they also use the laser flash method per ASTM E1461 and calculate the thermal conductivity from measured diffusivity. After about a 6 week lead time, the room temperature test was completed and is shown in Table 3. Netzsch used a density of 18.0 g/cc for the calculation, whereas our measurement yielded 18.06 g/cc.

Table 3. Second conductivity evaluation of grade SD 180.

Test Temperature		Diffusivity (mm ² /sec)	Specific Heat (J/(g-K))	Conductivity (W/m-K)
Nom. (F)	Actual (C)			
RT	25	16.6	0.153	45.9

This new value for thermal conductivity was even further away from the expected value based on composition and density. This measurement underestimated the accepted average conductivity by at least 60%. After obtaining this margin of error, testing was halted, as any elevated temperature values would likewise be of no value.

Conclusions

The selected elevated temperature characterization of SD180 provided a more comprehensive prediction of alloy performance in the target application. The identified property trends were in keeping with fundamental elevated temperature response of metallic materials. Excellent ductility was retained over the entire range of test temperature.

Thermal conductivity measurements however were inconclusive. Two independent tests – both using nationally recognized testing firms that not only routinely perform toll thermal testing but also actually manufacture the equipment – failed to provide results that were even in approximate agreement or close to the accepted values used for decades within the refractory metals industry. These low values should therefore be disregarded, as they cannot be independently repeated. As the entirety of this testing was conducted off site, the reasons for this extreme variation in measurements are presently unknown. Both testing houses guarantee conformance to ASTM E1461. Whatever the case, those skilled in performing laser flash tests have not demonstrated that this technique, now used almost universally for thermal conductivity measurements, is appropriate for tungsten heavy alloy. To the contrary, conductivity measurements obtained to date suggest the flash diffusivity approach is unreliable for this material. The higher industry accepted values of 110-130 W/m-K were no doubt made by techniques that predated laser flash diffusivity and measured conductivity directly using larger size samples. No presently available source for repeating earlier test methods is known.

S. G. Caldwell
Technical Director – Tungsten Alloys

4 September 2008

Troy Hedger / Raul J. Pomares
Alpha-Omega Services, Inc.
9156 Rose Street
Bellflower, CA 90706

Dear Troy / Raul:

I have prepared the following comments in response to your request to address the differences between our previously reported data (under Alpha-Omega Services P.O. #AOS-03590) and the cited specific heat values listed in NUREG/CR-6150.

In briefly revisiting previously submitted project reports, the initial thermal analysis data presented as part of our 7 September 2006 report contained a *Transmittal of Test Results* document from Anter Laboratories, a leading thermal analysis equipment manufacturer and provider of toll thermal analysis services. Testing of our tungsten heavy alloy grade SD180 material used in work defined by the referenced AOS purchase order was conducted by laser flash measurement, as described by ASTM E1461-01 using NIST traceable standards in a NADCAP certified laboratory. This testing house was extremely well qualified to make accurate measurements of specific heat.

Data were obtained at 5 temperatures of interest. The following values were reported by Anter for the 18.1 g/cc density tungsten heavy alloy (nominal composition 95W-3.57Ni-1.43Fe):

Nominal Temperature (F)	Specific Heat (J/[kg-K])
RT	154.7
200	159.2
400	163.4
600	170.3
800	173.9

Then, at a later date, additional thermal analysis of a SD180 sample was performed by Netzsch, who is also both a manufacturer of thermal analysis equipment as well as a toll service provider. As our 11 December 2006 report detailed, Netzsch obtained the following result using the same laser flash ASTM E1461 technique:

Nominal Temperature (F)	Specific Heat (J/[g-K])
RT	0.153

When the reported unit of measure is converted from a gram to kilogram basis, this supplemental testing by a second independent testing house yielded excellent agreement in specific heat – a value of 153 compared to the earlier 154.7 (J/[kg-K]). These values were thus in agreement within ~1.1% - an excellent match for single test data comparison.

In examining Section 15 of NUREG/CR-6150, it is not surprising to find disagreement in specific heat values to those we reported – it is rather to be expected. Tables 15-1 and 15-2 both list data for pure, elemental tungsten (W) – not tungsten heavy alloy. The SD180 alloy additionally contains Fe and Ni, and possesses a lower theoretical alloy density than pure W.

The relevance of previously reported specific heat values for the SD180 used in the aforementioned project over those contained in the cited NUREG document can therefore be summarized as follows:

1. NUREG/CR-6150 does not even relate to the tungsten heavy alloy used in the cask project.
2. NUREG/CR-6150 contains calculated values only, whereas our reported values were from actual material testing conducted by equipment manufacturers to an ASTM standard.
3. The thermodynamic data used for computation of NUREG/CR-6150 data are not given in Section 15. Even for the case of pure W, the calculated density reported in NUREG/CR-6150 Section 15.3 is 19.600 g/cc, which is greater than the tungsten industry accepted value of 19.3 g/cc for W as well as the value of 19.30 g/cc specified in the National Institute of Standards Physical Reference Data listing. It would appear that at least that input datum used in thermal calculations is in slight error even for the case of pure W. Calculated data are only as good as the input data and model.
4. Specific heat values we reported previously accounted for the actual measured density of the SD180 tungsten heavy alloy, as was determined using ASTM B311. As both chemical makeup and density varied from that of pure W, it is only natural that the thermal properties would differ from pure W as well.
5. The values we reported from Anter and Netzsch tests are consistent in trend with data for pure W in Table 15-1 of NUREG/CR-6150. For example, room temperature specific heat for pure W is listed as ~138 J/(kg-K), whereas testing of SD180 gave ~155 J/(kg-K) – an increase of ~12%. The tungsten heavy alloy contained 5 wt.% of transition metals having significantly higher specific heats than W (~460 J/(kg-K) for Ni, ~440 J/(kg-K) for Fe). It is therefore only expected that the room temperature specific heat for the SD180 heavy alloy would be higher than that of pure W.

There is therefore no reason whatsoever to question the specific heats reported by ATI Firth Sterling for SD180 based on NUREG/CR-6150. At best, the cited Section 15 data are not applicable for the reasons described above. Please contact me if further information is needed.

Yours truly,

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Tungsten Heavy Alloy

Engineering Manual

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2. Alloy Selection Criteria

Density

Density is the single most important property that makes a WHA the material of choice for virtually all applications. The selection of a specific composition for a given density application may ultimately be made on the basis of mechanical property requirements in conjunction with sintering considerations, unless a density is mandatory.

As is true with most mechanical designs, the optimum design is the one that adequately addresses all critical parameters and offers the best compromise of the remaining options. As the density of a WHA is increased, the available ductility decreases. Alloy density varies according to tungsten content, as can be seen in the following table of ATI Firth Sterling standard alloys. These alloys conform to the various classes as defined by industry standard MIL-T-21014D (alternately AMS-T-21014 and ASTM B777).

Grade Specification Conformance

Alloy*	Nom. Composition (Wt. %)	MIL-T-21014D Classification	Typical Density (g/cc) (lbs/in ²)		Magnetic Permeability (μ)
SD170	90W-7.14Ni-2.86Fe	Class 1	17.09	0.618	5.0-5.5
Dens21	89.8W-8.92Ni-1.28Fe	Class 1	17.16	0.620	<1.01
SD175	92.5W-5.36Ni-2.14Fe	Class 2	17.62	0.637	4.5-5.0
Dens23	92.5W-6.56Ni-0.94Fe	Class 2	17.67	0.639	<1.01
SD180	95W-3.57Ni-1.43Fe	Class 3	18.12	0.655	4.0-4.5
Dens25	95W-4.37Ni-0.63Fe	Class 3	18.16	0.656	<1.01
SD185	97W-2.14Ni-0.86Fe	Class 4	18.56	0.671	1.6-2.0

Dens21 is manufactured with a tungsten content slightly under the nominal in order to have a sintered density positioned more centrally within the defined interval. In addition to these standard compositions, ATI Firth Sterling can also manufacture custom alloys.

Mechanical Properties

Mechanical properties of modern WHAs far surpass those available from WHAs even a few decades ago. Three factors primarily contribute to this advance: (1) higher purity raw materials, (2) cleaner and more precisely controlled process environments, and (3) the use of modern tungsten-nickel-iron (W-Ni-Fe) compositions rather than the older alloys containing copper.

It is also important to note as a general consideration that the maximum attainable property set for these alloys varies with the size of the blank. This is a direct consequence of the nature of the sintering operation used to make the parts. A number of gradients – thermal, chemical, and gravitational – exist during sintering. As the maximum section thickness of a given part is increased, thermochemical removal of impurities from the center of the pressed part prior to surface pore closure becomes more difficult. Therefore, small parts will always tend to have higher mechanical properties than larger ones.

As seen in the table below, the nominal properties listed meet or exceed the industry standard requirements. All values shown are for material in the as-sintered state, as this is the most commonly supplied condition of the material for commercial applications.

Typical Densalloy™ Properties

Alloy*	Wt.% W (nominal)	UTS (ksi)	0.2% YS (ksi)	EL (%)	Elastic Modulus (x 10 ⁶ psi)	Hardness (HRC)
SD170	90	120	80	10	45	28
Dens21	90	110	75	4	45	28
SD175	92.5	120	80	8	48	28
Dens23	92.5	110	80	3	48	28
SD180	95	120	75	6	50	29
Dens25	95	110	75	3	50	29
SD185	97	110	75	2	52	30

All WHAs are susceptible to hydrogen embrittlement, which lowers the ductility of the alloy. ATI Firth Sterling can provide alloys in a hydrogen outgassed condition, which in some cases can double the tensile elongation. Further property enhancement is possible through additional post-sinter processing.

For structural (load bearing) applications, it is recommended that alloy be used in the most ductile condition feasible for the given part. This promotes "bend before break" behavior needed for critical parts. Part durability is favored by use of lower tungsten content Class 1 and 2 alloys such as SD170 and SD175.

Thermal and Electrical Properties

The properties of WHA are governed by the properties of its principal constituent, tungsten. While properties will vary slightly with tungsten content, binder composition, and microstructure, several example properties will be cited for SD180, as it is near the middle of the commercially defined compositional range.. The thermal conductivity of the alloy is ~80 W/m-°K and a corresponding electrical conductivity of ~13% IACS. The thermal expansion is very low, with a CTE of only ~5.0E-6/°C at 20°C – only about 1/3 that of ferrous alloys. The specific heat of SD180 at room temperature is ~0.037 cal/g-°C. While the melting point of pure tungsten is extremely high, WHAs will begin to form a liquid phase when heated in excess of ~1450°C (2642°F). Therefore, unlike pure W, WHAs are not suitable for high temperature applications.

The change in tensile properties of WHA at elevated temperature is of increasing interest to oilfield engineers. As drilling depths approach 5 miles, there is growing interest in the ability of WHA components to survive the harsh pressure and elevated temperature conditions. The following graph shown below illustrates the systematic change in mechanical properties with temperature for vacuum annealed SD175 typical of what that industry uses. For applications in which the service temperature will exceed ~300°C, slight surface oxidation will occur in air. A protective atmosphere should be considered for prolonged exposure at or above this temperature. It is important to note that at service temperatures exceeding ~500°C – beyond the range of the data shown below – WHA

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Tungsten

Properties, Chemistry, Technology of the
Element, Alloys, and Chemical Compounds

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Significant strengthening is observed up to 2700 K (2427°C). Above this, rapid particle coarsening occurs, and the strengthening effect fades. Additions of rhenium provide ductility at low temperatures by decreasing the DBTT.

W-Re-HfC alloys cannot be produced by powder metallurgical techniques owing to the high oxygen affinity of hafnium. They are produced by arc melting.

Yield strength and ultimate tensile strength of a W-3.6Re-0.26HfC alloy as a function of temperature are shown in Fig. 6.12, in comparison to pure W, W-3.6Re, and W-3.6Re-1ThO₂.

W-Re-HfC alloys are the strongest man-made metallic materials at temperatures above 2000 K [6.25].

6.3. TUNGSTEN COMPOSITES

Tungsten metal exhibits outstanding thermal properties, which makes it attractive for a broad range of applications. However, for certain applications, its electrical and thermal conductivity, sensitivity toward oxidation, and poor workability are unsatisfactory. These limitations have led to the development of two-phase alloys, in which the useful properties of tungsten are combined with those of the additive.

Two important alloy systems belong to this group and are described below:

- The so-called heavy metal alloys, based on W-Ni-Fe and W-Ni-Cu-(Fe). They are used wherever high density, excellent mechanical properties, and good workability are required.
- W-Cu and W-Ag alloys, in which the high electrical and thermal conductivity of copper or silver is combined with the high hardness and wear resistance of tungsten.

6.3.1. Tungsten Heavy Metal Alloys [6.1, 6.2, 6.26, 6.27, 6.29]

The term *tungsten heavy metal* or *heavy metal* is used for a group of two-phase composites, based on W-Ni-Fe and W-Ni-Cu. They are characterized by a high density and a novel (unique) combination of strength and ductility.

Tungsten is the main component of the alloys (typically present in the range of 90 to 98 wt%) and the reason for their high density (between 17 and 18.5 g/cm³). Nickel, iron, and copper serve as a binder matrix, which holds the brittle tungsten grains together and which makes the alloys ductile and easy to machine. A typical microstructure is shown in Fig. 6.13. It consists of spherical tungsten grains (20 to 60 μm in diameter), which are embedded in a tough, metallic matrix. While the grains are nearly pure bcc tungsten, the fcc binder matrix contains about 20 wt% W in solid solution.

Heavy metals are used for applications, where the high specific weight of the material plays an important role. They are used as counterweights, rotating inertia members, X-ray and γ-radiation shields, as rigid tools for machining, as well as for defense purposes (kinetic energy penetrators, fragmentation devices, etc.).

Fabrication [6.26, 6.27]. Heavy metals are produced by conventional P/M techniques. A flow chart of the fabrication process is shown in Fig. 6.14. Elemental powders (W,

Two Phase Composites!

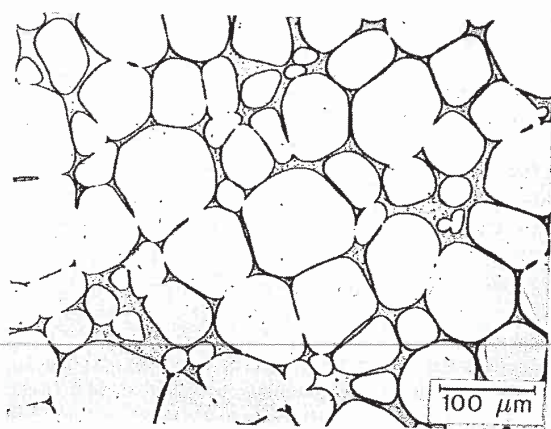


FIGURE 6.13. Optical micrograph of a 95 wt% tungsten heavy metal alloy with 3.2 wt% Ni and 1.8 wt% Cu. By courtesy of Plansee AG, Reutte, Austria.

Fe, Ni, Cu) are blended in mixers or ball mills to the desired ratio, compacted to form a green body, and subsequently liquid-phase sintered. Assuming proper manufacturing conditions, they exhibit full or near-theoretical density in the as-sintered condition.

Powder particle sizes are in the range of 2 to 6 μm . Both die pressing and isostatic pressing (dry- and wet-bag pressing) are in use. No lubricant is commonly added, since the green strength is high enough to handle the compacts. Powder injection molding (PIM) is used for applications where net shaping is desired and large quantities of complex parts are produced [6.28].

Sintering is commonly carried out in molybdenum-wire resistance-heated furnaces under hydrogen or nitrogen mixtures (dissociated ammonia) but can also be performed in vacuum units. The use of wet hydrogen has become industrial practice to suppress hydrogen embrittlement (water vapor porosity) [6.29]. The temperature/time program of the sintering cycle must be adjusted to the composition and size of the sintered parts. A

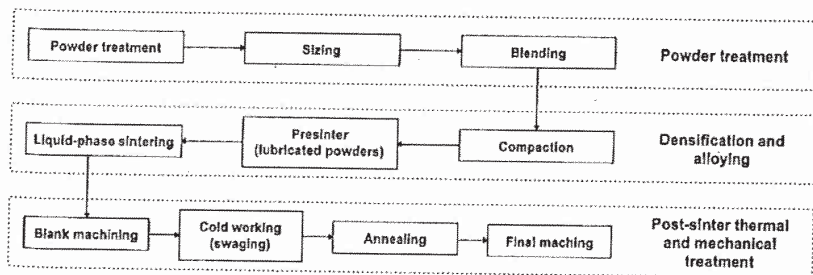


FIGURE 6.14. Flowchart of the fabrication process of tungsten heavy metal penetrators [6.26].

cleaning step in hydrogen at 1000 °C is commonly performed to render the outgassing of volatile compounds. High-purity powder grades must be used for sintering. Otherwise, blistering will occur on liquid-phase sintering, and interface precipitations will occur on cooling.

Isothermal sintering is carried out above the eutectic temperature, typically between 1440 and 1500 °C, but can be as high as 1600 °C. The higher the tungsten content of the alloy, the higher the temperature. Tungsten–nickel–copper alloys are sintered at somewhat lower temperatures than tungsten–nickel–iron alloys. Sintering times are between 30 minutes and two hours. Prolonged sintering under dry hydrogen leads to swelling of the parts and significant embrittlement due to pore coarsening by Ostwald ripening and coalescence. Residual porosities larger than 0.5% drastically reduce the ductility [6.30, 6.31].

On cooling, a significant amount of tungsten remains in solid solution, depending on the binder composition and the cooling rate. The solubility is highest in binary W–Ni alloys (up to 40 wt%; resulting in low ductility), but additions of Fe and Cu depress it to lower values (typically 20 to 25 wt% W), providing a tough and ductile binder matrix.

Shrinkage porosity can form on cooling, in particular in W–Ni–Cu alloys and at high cooling rates; furthermore, impurities (P, S, C) segregate at the tungsten matrix interface. Both effects must be controlled by proper manufacturing conditions, since they significantly lower the ductility.

Optimal mechanical properties require subsequent heat treatment of the alloys. Solution annealing at 900 to 1300 °C and subsequent quenching to avoid impurity segregation and formation of intermetallic phases significantly improves ductility [6.26]. Heavy metals can be cold-worked (swaged, rolled) to increase hardness and strengths at the expense of elongation and toughness. Aging at 500 °C after 25% deformation (cold work) is a compromise to achieve both high ultimate tensile strengths and elongation. Conventional procedure is a double swaging–heat treatment cycle (deformation 25–30%) [6.32]. The structure shows that the original spheroids formed during liquid-phase sintering have been transformed to ellipsoids on deformation (Fig. 6.15). Recently, the advantage of large deformation levels (up to 95%) yielding in a fibrous microstructure (Fig. 6.16) has been demonstrated [6.32]. Heavy metals exhibit a ductile-to-brittle transition temperature. In comparison to pure tungsten it is, however, not a sharp transition but spreads over several hundred degrees [6.1].

Although a considerable amount of densification already occurs during solid-state heating, isothermal liquid-phase sintering is a prerequisite to obtain near-theoretical density and a high degree of microstructural homogeneity. Rapid final densification occurs on formation of the liquid phase under the action of capillary forces. Particle rearrangements, solution/precipitation processes (Ostwald ripening), and coalescence contribute to a higher packing density and a significant grain coarsening during sintering. The original tungsten powder grain size of 3–5 µm is transformed during sintering to rounded tungsten particles (spheroids) of at least 10 times the original grain diameter. Shape accommodation (formation of polyhedras with rounded corners) plays an important role in high tungsten alloys, where only a small quantity of liquid is available for achieving full density.

Depending on the binder composition, heavy metals can be classified into two main groups [6.2, 6.27]:

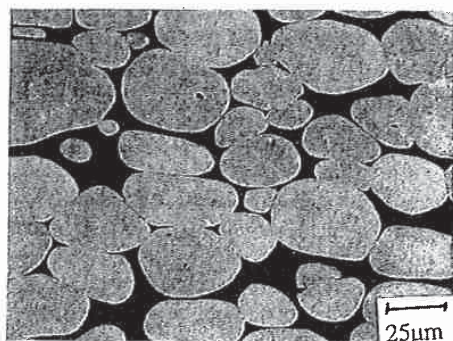


FIGURE 6.15. Microstructure of a W-Ni-Fe-Co alloy after swaging by 30% [6.32]. By courtesy of A. R. Bentley, M. C. Hogwood, and M. Power, Defence Research Agency, Kent, England.

(a) W-Ni-Fe (Ni: 1–7 wt%, Fe: 0.8–3 wt%, Mo: 0–4 wt%)

This group is ferromagnetic. Typical nickel-to-iron ratios range between 1:1 and 4:1. The preferred ratio is 7:3, since this composition avoids the formation of intermetallic phases [6.26]. W-Ni-Fe alloys exhibit excellent strength/ductility combinations and can be cold-worked to a reduction of 60% without intermediate annealing. Molybdenum acts as grain refiner. Higher additions of iron and/or additions of molybdenum cause a significant matrix-strengthening effect and improve high-temperature strength (Gyromet grades) [6.2]. Other additives, such as Co, Ta, and Re, act as grain refiners and increase hardness and strength, but lower the ductility [6.29]. Rhenium additions are of interest in net-shape production, since their high strength in the as-sintered condition (1180 MPa) does not require any post-sintering treatment [6.33].

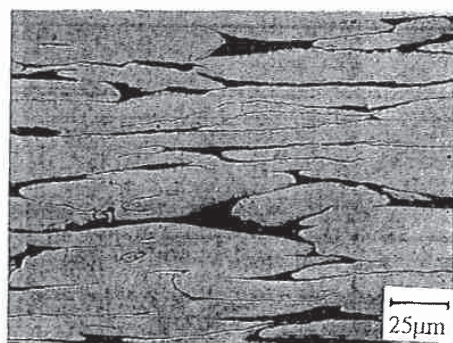


FIGURE 6.16. Microstructure of a W-Ni-Fe-Co alloy after deformation by 80% [6.32]. By courtesy of A. R. Bentley, M. C. Hogwood, and M. Power, Defence Research Agency, Kent, England.

(b) W-Ni-Cu (Ni: 1–7wt%, Cu: 0.5–3 wt%, Fe: 0–7 wt%)

Members of this group are nonmagnetic and exhibit a higher electrical conductivity. The nickel-to-copper ratio ranges from 3:2 to 4:1. W-Ni-Cu alloys exhibit lower strength and ductility than comparable W-Ni-Fe alloys. Due to the low melting point of copper, low heating rates are required to obtain full density.

Properties: [6.1, 6.34, 6.35]. Some properties of tungsten heavy metal alloys are summarized in Table 6.1. Ultimate tensile strengths (660–1350 MPa), yield strengths (565–300 MPa), and fracture elongations (5–30%) can vary widely. In general, mechanical properties are very sensitive to processing conditions, impurities, and microstructure. Problems with controlling porosity, impurities, and microstructural homogeneity are therefore common in heavy alloy fabrication [6.31]. Residual sinter porosity and the formation of interface precipitates are the main reason for inferior material properties.

With increasing tungsten content, the contiguity of the tungsten grains increases (i.e., the W-W interfacial area as a fraction of the total interface area) and both strength and ductility decrease [6.36]. This “microstructural limitation” of the properties is demonstrated in Fig. 6.17 for alloys of different tungsten contents [6.1, 6.31, 6.37]. While the

TABLE 6.1. Properties of Tungsten Heavy Metal Alloys^a

Properties	1	2	3
Density ($\text{g} \cdot \text{cm}^{-3}$)	17.0–18.5	17.0–18.5	17.1–18.6
Young's modulus (GPa)	350–400	320–380	—
Shear modulus (GPa)	—	125–160	—
Poisson's ratio	0.28–0.29	0.28–0.29	—
Hardness			
HV10	270–360	270–470	—
HB30	—	250–450	—
RC	—	—	28–40
Tensile strength (MPa)			
20°C	870–1000	660–1350	880–1320
100°C	—	560–730	—
500°C	340–650	340–610	—
1000°C	220–260	90–260	—
Yield strength (0.2%) (MPa)	600–700	565–1300	750–1240
Fracture elongation (%)	10–30	—	5–30
Compressive strength (MPa)	3500–4500	3500–5500	—
K_{IC} ($\text{MPa} \cdot \text{mm}^{-1/2}$)	800–6300	—	—
Compressibility (% of length)	—	—	45–60
Charpy value (notched)	0.9–2.8	—	—
Specific electrical resistivity ($\mu\Omega \cdot \text{m}$)	0.10–0.18	0.10–0.18	—
Mean linear coefficient of thermal expansion at 20–800°C ($\text{mm}^{-1} \cdot \text{K}^{-1}$)	$5.2-6.5 \times 10^{-6}$	$5.2-6.5 \times 10^{-6}$	—
Half-value thickness			
against ^{60}Co	—	8.5–9.7	—
against ^{137}Cs	—	4.5–5.2	—

^a 1. Pink and R. Eck, “Refractory Metals and their Alloys,” in: *Materials Science and Technology* (R. W. Cahn, P. Haasen, and E. J. Kramer, eds.), Vol. 8, pp. 591–638, VCH, Weinheim, (1996).
 2. Metallwerk Plansee, Densimet Schwermetall Legierungen, Company Brochure, Reutte, Austria (1982).
 3. Ashot Ashkelon, Tungsten-Based Products, Company Brochure.

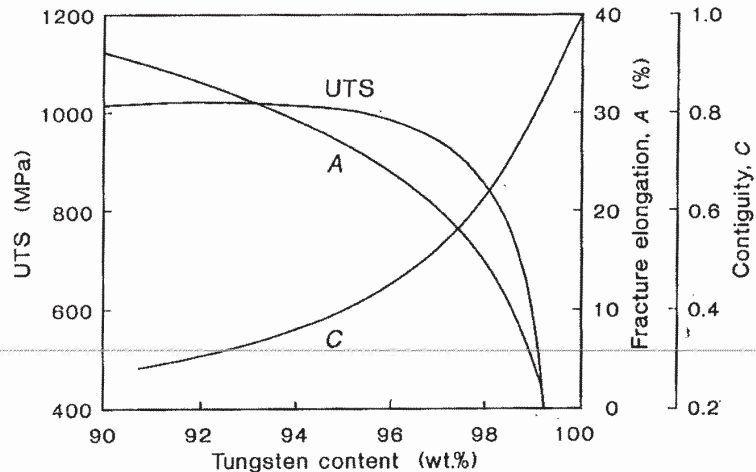


FIGURE 6.17. Optimum values of room-temperature strength and fracture elongation and their correlation with the contiguity factor for tungsten heavy alloys [6.1, 6.31].

trend is most pronounced for the fracture elongation, the tensile strength exhibits a maximum at about 85 vol% W (93 wt%) before it significantly decreases. At 99 wt% W, the elongation is zero and the tensile strength is about 400 MPa [6.38].

Recently, it was demonstrated that large deformation levels yield exceptionally high tensile strength levels (up to 1700 MPa), combined with fracture elongations above 15% [6.32].

Besides the high density and the unique combination of high strength and ductility, there are other attributes which make heavy metals a versatile product:

- the high modulus of elasticity (much higher than steel),
- excellent vibration damping characteristics (for chatter-free heavy machining),
- its good machinability,
- the high absorption ability for X-rays and γ -rays,
- good thermal and electrical conductivity,
- low electrical erosion and welding tendency,
- good corrosion resistance.

Research in tungsten heavy alloys was previously boosted by the ballistic application as anti-armor kinetic energy penetrator. Numerous papers have appeared in the last years and reviews have recently been published [6.29, 6.39, 6.40]. Although the basic requirements are the same for civil as for defense applications (i.e., high density, strength, and elongation), there are two more important factors which must be considered for this specific application: the behavior of the material under high strain rate conditions and their ballistic performance (i.e., their penetration ability). In particular, the latter aspect is of critical importance and, to a certain extent, still a weak point of heavy metals. Their ballistic performance is inferior compared to depleted uranium, which is still used as a

standard penetrator material [6.29]. Nevertheless, recent environmental considerations have put a strong emphasis on substituting depleted uranium by heavy metals because of its radioactivity. Efforts to improve the ballistic performance through proper processing and compositional modifications have failed [6.29, 6.39]. Recent research has therefore focused on alternative matrix alloys, such as tungsten-hafnium, tungsten-uranium composites [6.29], or heavy metal alloys with a spiculating core of WC [6.41].

6.3.2. Tungsten Copper and Tungsten Silver [6.1, 6.2, 6.42].

Tungsten-copper and tungsten-silver composites are widely used in mechanical and electrical engineering. Typical applications include high-, medium-, and low-voltage circuit breakers (W-Cu, W-Ag), resistance welding electrodes, electrode materials for electrical discharge machining, and heat sink materials for microelectronic packaging (W-Cu). More recently, W-Cu composites have been tested as heat flux components in experimental fusion reactors [6.43] and as materials in MHD (magnetohydrodynamics) power generation systems [6.44].

They combine the high hardness, hot strength, and wear resistance of tungsten with the outstanding electrical and thermal conductivity of the two high-conductivity metals. Furthermore tungsten increases the resistance of the materials against spark and arc erosion (burn-off) and lowers the sticking and welding tendency, which are both important criteria for heavy-duty electrical contacts, where switching currents can be up to 100 kA and arc temperatures of a few 10,000 K can occur within a few milliseconds [6.45]. Under arcing conditions, the contacts are cooled through the melting and evaporation of silver or copper ("transpiration" cooling), an effect which was earlier used for rocket nozzle throat liners (for example for underwater-launched ballistic missiles) made of W-Ag [6.2].

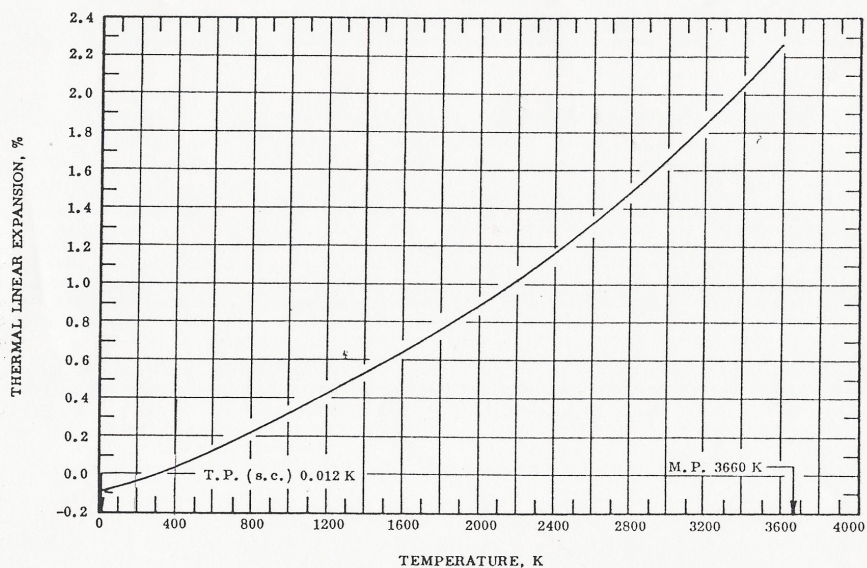
W-Cu and W-Ag composites are not real alloys in the strict meaning of the word, because the mutual solubility of the components is practically zero. Therefore, they are also sometimes called "pseudoalloys."

Production. Powder metallurgy is the only viable way to produce composites of high quality. The method of production depends on the composition ratio. Materials with 10 to 40 wt% copper (20 to 50 wt% silver) are commonly produced by infiltration, while at higher copper or silver contents the powders are blended, pressed, and subsequently solid-state sintered [6.42, 6.46].

Infiltration of porous structures. A porous tungsten skeleton is first produced by pressing either pure tungsten powder or a mixture of tungsten powder and small amounts of the additive element with subsequent sintering in a reducing atmosphere at comparably low temperatures (1200–1800 °C). The porosity of the compact can be varied by the pressing and sintering parameters, as well as by the grain size distribution of the starting tungsten powder. It determines the percentage of infiltrate. For higher copper and silver contents, loose tungsten powder can also be infiltrated.

Infiltration is accomplished by immersion, dipping, or flooding, either in vacuum, inert gas, or, preferably, in reducing atmosphere at 1150–1250 °C. Oxide layers disturb the infiltration process and must be removed prior to infiltration by reduction with hydrogen. Trace impurities can impair the wetting between tungsten and the melt (for example, silicon) but can also improve it (nickel, cobalt, iron) [6.47]. Densities of 96% up to near-

FIGURE AND TABLE NO. 58R. RECOMMENDED VALUES FOR THERMAL LINEAR EXPANSION OF TUNGSTEN W



RECOMMENDED VALUES
[Temperature, T, K; Linear Expansion, $\Delta L/L_0$, %; α , K^{-1}]

T	$\Delta L/L_0$	$\alpha \times 10^6$
5	-0.086	0.0006
25	-0.086	0.21
50	-0.085	0.88
100	-0.076	2.6
200	-0.040	4.1
293	0.000	4.5
400	0.048	4.5
500	0.093	4.6
600	0.140	4.7
700	0.188	4.8
800	0.237	5.0
900	0.287	5.0
1000	0.339	5.2
1200	0.444	5.3
1400	0.551	5.4
1600	0.661	5.6
1800	0.774	5.8
2000	0.893	6.1
2200	1.020	6.6
2400	1.157	7.1
2600	1.307	7.8
2800	1.469	8.3
3000	1.646	9.2
3200	1.837	10.0
3400	2.042	10.8
3600	2.263	11.6

REMARKS

The tabulated values are considered accurate to within $\pm 3\%$ over the entire temperature range. These values can be represented approximately by the following equations:

$$\Delta L/L_0 = 4.266 \times 10^{-4} (T - 293) + 8.479 \times 10^{-8} (T - 293)^2 - 1.974 \times 10^{-11} (T - 293)^3 \quad (293 < T < 1395)$$

$$\Delta L/L_0 = 0.548 + 5.416 \times 10^{-4} (T - 1395) + 1.952 \times 10^{-8} (T - 1395)^2 + 4.422 \times 10^{-11} (T - 1395)^3 \quad (1395 < T < 2495)$$

$$\Delta L/L_0 = 1.226 + 7.451 \times 10^{-4} (T - 2495) + 1.654 \times 10^{-7} (T - 2495)^2 + 7.568 \times 10^{-12} (T - 2495)^3 \quad (2495 < T < 3600)$$

General Plastics LAST-A-FOAM

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GENERAL PLASTICS
LAST-A-FOAM® FR-3700
FOR
CRASH & FIRE PROTECTION
OF
NUCLEAR MATERIAL
SHIPPING CONTAINERS

GENERAL PLASTICS MANUFACTURING COMPANY
4910 BURLINGTON WAY/ P O BOX 9097 TACOMA, WA 98409
(253) 473-5000, Fax 253-473-5104, Email: engineering@generalplastics.com

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- LONG TERM LIFE PERFORMANCE OF LAST-A-FOAM® FR-3700: Fire and strength results after 20 years.
- LAST-A-FOAM® FR-3700 THERMAL CONDUCTIVITY VS. DENSITY: A one page Chart.
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MATERIAL SAFETY DATA SHEETS

INITIAL ISSUE 4/91, REPRINTED 5/91, 11/91, 9/92, 12/93, 6/95, 2/97, 6/97, 3/98, 2/99, 3/01, 10/03
*(new or revised)

LAST-A-FOAM® FR-3700
DYNAMIC CRUSH STRENGTH (PSI)
and ENERGY ABSORPTION (FT-LB./CU.IN.)
@ 75°F, PARALLEL TO RISE

	CRUSH %															
DENSITY	10		20		30		40		50		60		65		70	
3	100	0	83	1	81	2	78	3	81	3	85	4	96	4	106	5
4	145	1	124	2	124	3	123	4	130	5	143	6	167	7	186	7
5	193	1	170	2	172	4	174	5	188	7	215	8	257	9	288	10
6	244	1	220	3	225	5	231	7	255	9	300	11	365	12	412	14
7	298	1	274	4	282	6	294	8	329	11	397	14	491	16	558	18
8	353	1	331	4	343	7	361	10	411	13	507	17	635	19	725	22
9	411	2	390	5	408	8	434	12	500	16	628	20	797	23	914	27
10	471	2	453	6	477	10	512	14	595	18	761	24	977	28	1124	32
11	627	3	593	8	618	13	660	18	763	24	984	31	1275	36	1468	42
12	736	3	699	9	730	15	785	21	912	28	1186	37	1549	43	1774	50
13	854	4	815	11	851	17	920	25	1075	33	1409	43	1853	50	2112	59
14	979	4	938	12	980	20	1066	29	1252	38	1653	50	2187	58	2482	68
15	1112	5	1070	14	1118	23	1223	33	1442	44	1918	58	2552	67	2884	78
16	1253	5	1209	15	1265	26	1391	37	1647	50	2203	66	2949	76	3320	89
17	1402	6	1357	17	1420	29	1569	41	1865	56	2510	74	3377	86	3788	101
18	1558	6	1513	19	1584	32	1758	46	2097	62	2839	83	3838	97	4290	114
19	1722	7	1677	21	1757	36	1958	51	2344	69	3189	92	4332	108	4826	127
20	1893	8	1849	23	1938	39	2168	56	2604	76	3561	102	4858	119	5397	141
21	2072	9	2029	26	2127	43	2389	62	2879	84	3955	112	5419	132	6002	156
22	2258	9	2217	28	2325	47	2621	68	3168	92	4371	123	6013	145	6641	171
23	2452	10	2413	30	2531	51	2863	74	3471	100	4810	134	6642	158	7316	187
24	2653	11	2616	33	2745	55	3116	80	3788	109	5271	146	7306	172	8027	204
25	2861	12	2828	36	2968	60	3380	86	4119	117	5755	159	8004	187	8773	222
26	3076	13	3047	38	3199	64	3654	93	4465	127	6262	171	8738	203	9555	241
27	3298	14	3274	41	3438	69	3939	100	4825	136	6792	185	9508	219	10374	260
28	3527	15	3509	44	3686	74	4235	107	5199	146	7344	199	10314	235	11229	280
29	3764	16	3751	47	3941	79	4541	114	5588	157	7920	213	11157	253	12120	301
30	4007	17	4001	50	4205	84	4858	122	5991	167	8520	228	12036	271	13049	323

Note: Crushing into shaded area not recommended. Energy Bold, Stress Plain Text.

LAST-A-FOAM® FR-3700
DYNAMIC CRUSH STRENGTH (PSI)
and ENERGY ABSORPTION (FT-LB./CU.IN.)
@ 75°F, PERPENDICULAR TO RISE

	CRUSH %																	
DENSITY	10		20		30		40		50		60		65		70			
3	60	0	55	1	56	1	58	2	64	2	70	3	81	3	91	3		
4	97	0	90	1	93	2	97	3	108	4	124	5	147	5	168	6		
5	140	1	133	2	139	3	144	4	161	5	193	7	235	8	269	9		
6	190	1	182	2	192	4	200	6	225	7	277	9	344	11	396	12		
7	245	1	238	3	253	5	264	7	297	10	376	12	475	14	549	16		
8	306	1	301	4	322	6	335	9	378	12	489	16	628	18	728	21		
9	372	2	369	5	397	8	414	11	468	15	618	19	803	22	933	26		
10	444	2	443	6	479	9	500	13	567	18	761	23	1001	27	1166	32		
11	569	2	562	7	588	12	636	17	748	23	989	30	1319	35	1548	41		
12	681	3	672	8	703	14	762	20	899	27	1194	36	1595	42	1853	49		
13	804	3	793	10	827	17	900	24	1064	32	1418	42	1899	49	2187	58		
14	938	4	923	12	962	20	1051	28	1244	37	1664	50	2233	58	2549	68		
15	1082	5	1064	13	1108	22	1213	32	1439	43	1931	57	2595	67	2941	78		
16	1237	5	1215	15	1263	26	1387	37	1649	49	2220	66	2987	76	3361	90		
17	1402	6	1377	17	1429	29	1574	42	1874	56	2530	74	3410	87	3810	102		
18	1579	7	1549	20	1606	33	1773	47	2114	63	2862	84	3862	98	4289	115		
19	1766	7	1731	22	1793	37	1984	52	2369	70	3215	94	4346	110	4796	129		
20	1964	8	1924	24	1991	41	2207	58	2640	78	3591	104	4860	122	5333	143		
21	2173	9	2127	27	2199	45	2443	64	2926	87	3990	116	5406	135	5900	159		
22	2393	10	2341	30	2418	50	2692	71	3228	95	4411	127	5983	149	6496	175		
23	2624	11	2566	33	2647	54	2953	78	3545	105	4855	140	6592	164	7122	192		
24	2866	12	2801	36	2887	59	3226	85	3878	114	5321	153	7233	179	7778	210		
25	3120	13	3046	39	3138	64	3512	92	4227	124	5811	166	7907	195	8464	229		
26	3384	14	3302	42	3399	70	3811	100	4591	135	6324	180	8613	212	9179	249		
27	3659	15	3569	45	3671	76	4123	108	4972	146	6860	195	9352	229	9925	269		
28	3946	16	3847	49	3953	81	4447	116	5368	157	7420	211	10124	247	10701	291		
29	4243	18	4135	53	4247	88	4784	125	5781	169	8003	227	10929	266	11507	313		
30	4552	19	4434	56	4551	94	5133	134	6209	181	8610	243	11767	286	12343	336		

Note: Crushing into shaded area not recommended. Energy Bold, Stress Plain Text.

3/30/98

Cask Lid Elastomeric Seal and Port Seal

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MATERIAL REPORT

REPORT NUMBER: KK2206

DATE: 06/19/96

TITLE: Evaluation of Parker Compound S1224-70 to ASTM D2000
7GE705 A19 B37 EA14 EO16 E036 F19 G11

PURPOSE: To determine if S1224-70 meets the callout.

CONCLUSION: Compound S1224-70 meets the ASTM D2000 callout.

Recommended temperature limits: -65⁰F to 450⁰F

Recommended For

Dry heat

Some petroleum oils

Moderate water resistance

Fire resistant hydraulic fluids (HFD-R and HFD-S)

Ozone, aging, and weather resistance

Low temperature

Not Recommended For

Ketones

Acids

Silicone oils

Auto and aircraft brake fluid

Parker O-Ring Division
2360 Palumbo Drive
Lexington, Kentucky 40509
(859) 269-2351



Compound Data Sheet
Parker O-Ring Division United States

REPORT DATA

Report Number: KK2206

	ASTM D2000 7GE705 A19 B37 EA14 EO16 E036 F19 G11 Pass / Fail Limits	S1224-70 Slab Results
<u>Basic Physical Properties</u>		
Hardness	70 +/- 5	69
Tensile Strength, psi min	725	1204
Elongation, % min	150	265
<u>ASTM D573 Heat Aging, 70 HRS @ 225°C</u>		
Hardness Change, pts max	+10	+6
Tensile Change, % max	-25	-14
Elongation Change, % max	-30	-26
<u>Compression Set ASTM D395, 22 HRS @ 347°F, plies</u>		
% of Original Deflection, max	30	23
<u>Fluid Immersion, ASTM #1 Oil, 70 HRS @ 150°C</u>		
Hardness Change, pts	0 to -15	-9
Tensile Change, % max	-20	+10
Elongation Change, % max	-20	+3
Volume Change, %	0 to +15	+4
<u>Fluid Immersion, ASTM #3 Oil, 70 HRS @ 302°F</u>		
Hardness Change, pts max	-40	-19
Volume Change, % max	+60	+35
<u>Fluid Immersion ASTM D471 Water 70 HRS. @ 212°F</u>		
Hardness Change, pts. max.	+/-5	0
Volume Change, % max.	+/-5	0
<u>Tear Resistance, ASTM D624, Die B kN/M, min</u>		
	9	14
<u>Low Temperature Brittleness Test ASTM D2137, Method A 3 min. @ -55°C</u>		
	Pass	Pass

Parker O-Ring Division
2360 Palumbo Drive
Lexington, Kentucky 40509
(859) 269-2351

2.12.6 Impact (Free-Drop) Test Report

This appendices includes the following information related to the Free-Drop test report:

- [Test Report: Drop Tests of the Alpha Omega Services Shipping Cask for Radioactive Material](#)
- [Free-Drop Test Activity Record – Pre- and Post-Leak Test](#)

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**2.12.6.1 Test Report: Drop Tests of the Alpha Omega Services
Shipping Cask for Radioactive Material**

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**Test Report:
Drop Tests of the
Alpha Omega Services Shipping Cask
for Radioactive Material**

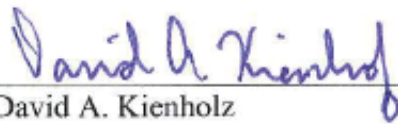
**Report No. 2007533 Rev 1
May 25, 2007**

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This report documents the drop tests of a transport package for shipping radioactive material. The planning and the test itself were conducted by CSA Engineering in cooperation with the Nuclear Energy Division of General Electric and with Alpha Omega Services. CSA's work is conducted under Purchase Order number AOS-3301 from Alpha Omega Services who will be the end user of the transport package.



David A. Kienholz
Vice President/Principal Engineer



Christian A. Smith
Quality Assurance Manager

Revision History

Rev 0 19 April 2007

Initial release.

Rev 1 19 May 2007

Sequence photos for end drop, Figure 29, changed from color to black and white.

Redundancy in data types noted in introduction.

Total deceleration times estimated from video data and results included.

Conclusion added re. total deceleration time from video data.

1. Introduction and Background

This report documents the objectives, methods, results, and conclusions of drop tests of a shipping package for radioactive materials. Among other requirements imposed by the Nuclear Regulatory Commission (10 CFR 71), a shipping cask with its protective impact limiter must survive a 30-foot free fall onto an unyielding surface without loss of structural integrity by the cask. Damage to the impact limiter is allowed but the cask itself must remain capable of performing its primary functions of providing containment, shielding, and subcriticality¹ of the radioactive material.

The cask was the model AOS-165, the largest of a family of casks developed by General Electric Nuclear Energy for Alpha Omega Services. Therefore questions of testing scale models are not considered in this report.

As usual in testing of shipping packages, the test was done without radioactive material. This means that compliance with requirements must be demonstrated indirectly. In this case compliance was shown through dimensional inspections and leak rate tests of the cask before and after each drop.

In addition to verifying that the cask and impact limiter comply with their primary requirements, various instrumentation was used to obtain quantitative data during the test. This data is used both for engineering design and for verifying that the test itself meets its requirements. Measurement methods were chosen to produce some redundancy; data obtained by different methods can serve to verify each other or to fill in for each other in the event of lost data.

2. Test Overview and Objectives

The test objective is to obtain data for demonstrating the adequacy of analytical methods employed for qualifying the shipping package, both at the size tested and scaled-down versions. These analytical methods are used to show that the impact limiters are capable of limiting impact loads on the payload to an acceptable level.

The package was free-dropped three times, once in each of three orientations. The orientations, shown in Figure 1, and the reasons for choosing them are as follows.

¹ Subcriticality is always a requirement for a nuclear shipping container but is not relevant to the present test.

- End drop. The package was dropped with its axis vertical such that it struck on one end. This orientation usually tends to present the largest crushing surface and thus the largest crushing force and greatest payload acceleration.
- Side drop. The package was dropped with its axis horizontal such that the impact limiter sections on both ends struck the ground at nominally the same time. This tends to produce the largest bending and buckling loads in the cask walls.
- Slap-down drop. The package was dropped with its axis at an angle to the vertical as shown such that it lands on one side of one impact limiter section. This tends to present the smallest crush area and thus the largest inward deformation of the impact limiter. It also produces a “slap-down” effect where the cask acquires a significant angular velocity after initial impact, leading to high loads when the second impact limiter strikes the surface (slaps down).

The tests were performed in the order shown above with new impact limiters for each test. Previous tests have used the first two orientations successfully². The slap-down orientation is new and is included in place of previous c.g.-over-corner drops on the basis of analysis which indicates that slap-down is a worst-case.

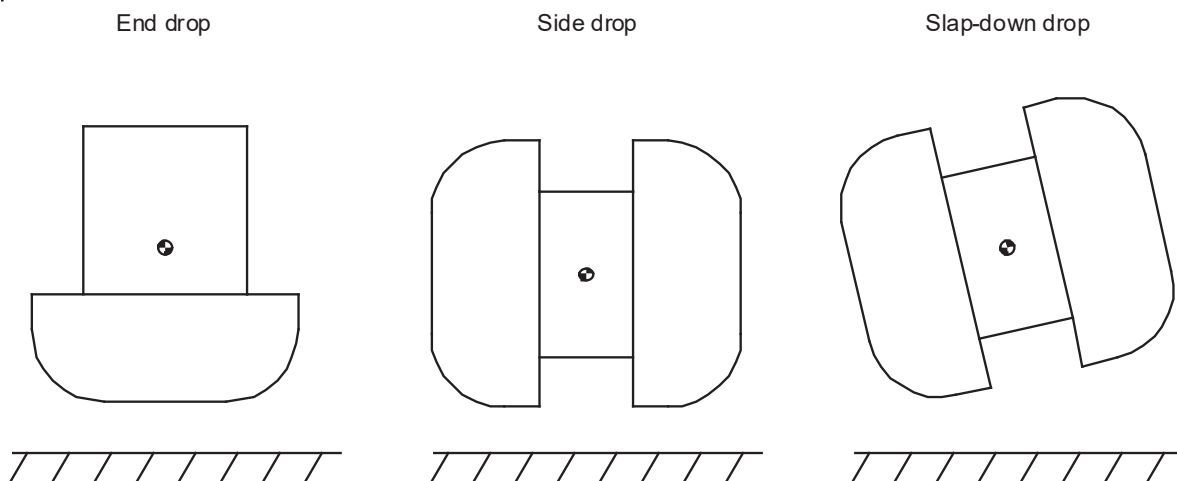


Figure 1 Package orientations for the three drop tests.

Structural integrity of the cask was determined after each of the three drops. Methods for doing so are described in the next section on acceptance criteria. In addition to this pass-fail functional testing, engineering data in the form of cask and impact limiter acceleration time histories at several location/directions were sensed and recorded. Pressure sensitive film was used to

² Kienholz, D.A., and Allen, Bradley, “30-ft. Free Drop Tests of a Quarter-Scale Model 2000 Transport Package,” GE Nuclear Energy division Report NEDO-31581, San Jose, CA, August, 1987.

determine the pressure distribution between the cask and impact limiter. Details of the methods for obtaining these engineering data are presented later in this report.

3. Acceptance Criteria

The primary pass-fail criterion for the test is based on a helium leak rate test performed on the cask before and after the drop tests. The methodology for the leak test is detailed later in subsection 5.9. An acceptable leak rate is less than 2.96×10^{-7} standard cubic centimeters of helium per second at a differential pressure of one atmosphere³. For the package to be judged acceptable, the measured leak rate must be less than this amount both before and after the drop tests.

The secondary criterion relates to external dimensions of the cask. These shall not have changed by any amount that would prevent or endanger the cask's performance of its primary functions of containment and shielding.

4. Cask Description

The test article is a full-scale prototype transport package. It is composed of two main parts: the cask and the impact limiters. The cask (Figure 2) is cylindrical in shape with an outside diameter (excluding trunnion lugs) of 46.20 inches and an axial length of 59.40 inches. Weight of the cask with impact limiters is approximately 38,500 lbs. The cask is composed of stainless steel inner and outer shells with thick tungsten inserts between them for radiation shielding. The central payload cavity is cylindrical in shape with a diameter of 10.72 inches and axial length of 33.63 inches. The cavity is connected to atmosphere by two small ports (shown later in cross section) that are both sealed during normal transport operations.

The cask lid is secured to the cask body by 20 socket head cap screws, size 1-8 x 3.25. There is a double seal between the lid and body with a sealable port running from the volume between the seals to atmosphere. The second (outer) seal and the port allow testing the integrity of the inner seal as described in a later subsection.

The impact limiter is in the form of two "caps" that go over the ends of the cask (Figure 2). Each cap is composed of a stainless steel shell filled with castable impact-absorbing foam. The caps are installed over the ends of the cask and secured to each other by six turnbuckles as shown. Each cap has a recess in its outer end to produce the desired crush area and thus the desired crushing force during an end drop. The lifting rings shown at the top of

³ Mok, G.C., Carlson, R.W., Lu, S.C., and Fischer, L.E., "Guidelines for Conducting Impact Tests on Shipping Packages for Radioactive Material," Lawrence Livermore National Laboratory Report No. UCRL-ID-121673, September 1995, page 19. Also ANSI N14.5.

each impact limiter are for lifting the impact limiter by itself. When assembled, the package is lifted by the side trunnions on the cask.

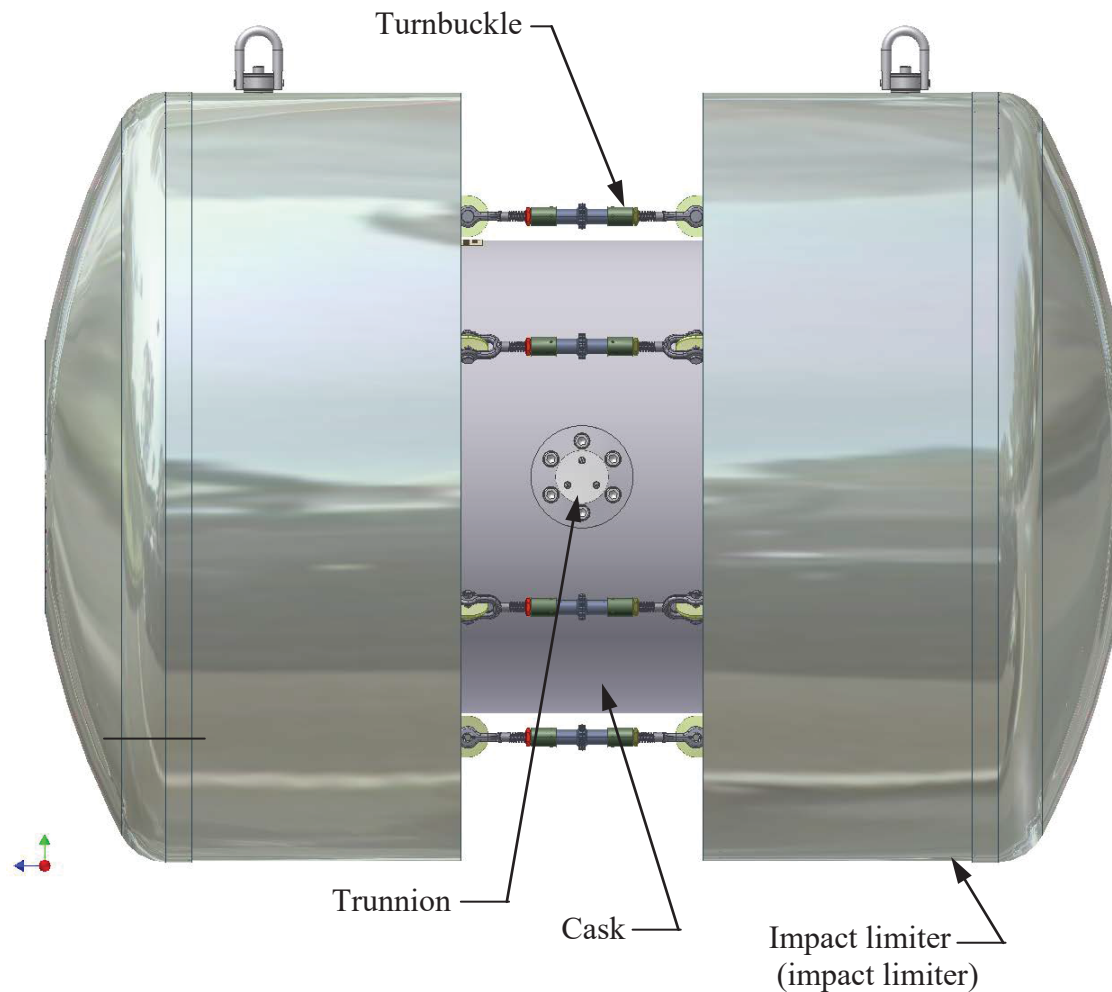


Figure 2 Shipping cask with impact limiters

5. Test Procedure and Equipment

The test procedure and instrumentation generally followed that used successfully in a 1987 test of a quarter-scale transport package⁴. Some enhancements were made in accordance with NRC

⁴ Kienholz, D.A. and Allen, Bradley op cit

guidelines published since the 1987 test⁵ and to take advantage of advances in photographic and instrumentation technology.

5.1 Drop target

The drop target was a large reinforced concrete block embedded in the earth at the General Electric Vallecitos CA site. Figure 3 shows a plan view of the site, including the crane for lifting the test article and the locations for two high-speed cameras. The concrete block is approximately 20' x 15'6" in plan view and six feet thick. It has a steel plate, 120" x 90" x 3", embedded in its horizontal top surface. The target block weighs approximately 290,000 lbs. The concrete has a 28-day cured strength of at least 4500 psi. The site has been used several times before for drop tests. The storage shed on the north side of the drop pad was moved to allow room for the tests. Figure 4 shows an overall view of the site.

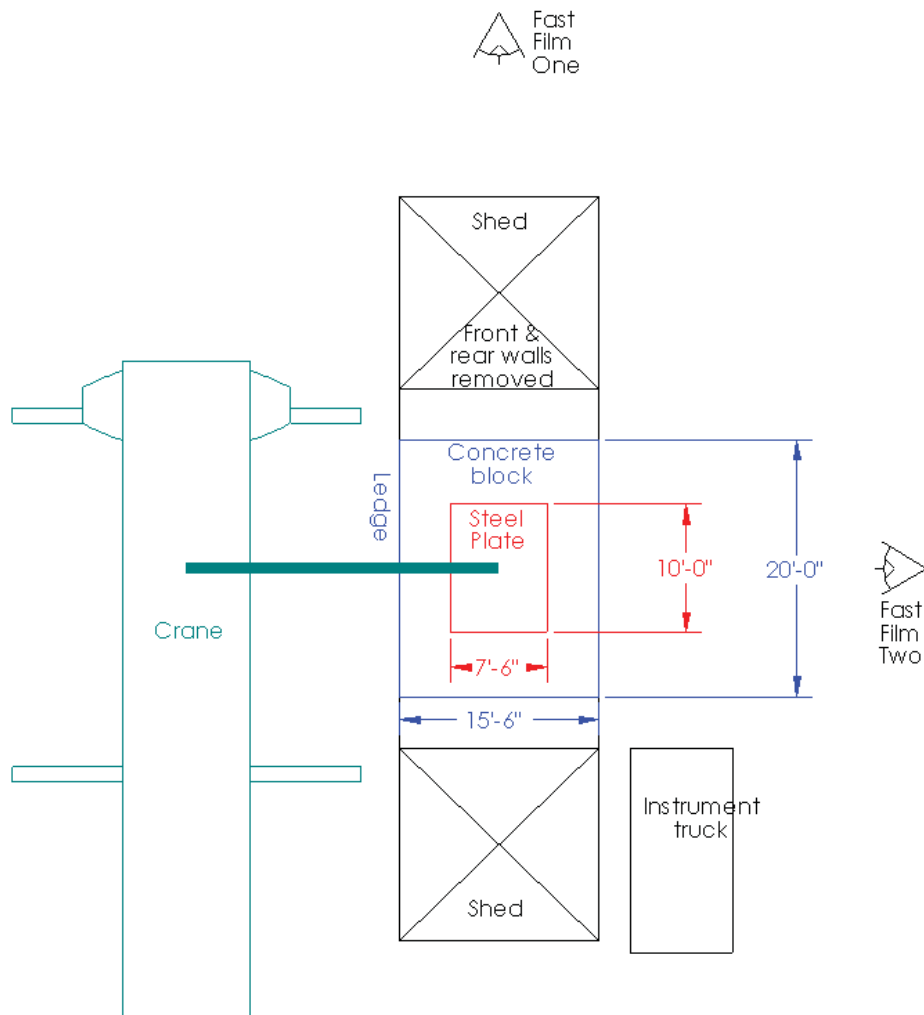


Figure 3 Plan view of drop test site.

⁵ Mok, G.C. et al, op cit



Figure 4 Drop test site with crane and instrument truck in place.

5.2 Pretest and post-test dimensional inspection of cask

Dimensional inspections of the cask before and after each drop were done by East Coast Metrology, Topsfield, MA, under subcontract to GENE. The measurements were made using a laser tracker system capable of rapidly locating many points on the cask in 3-dimensional space. Figure 5 shows an impact limiter being set up for measurements. The laser tracker is the blue device on a tripod on the left

For the impact limiters, scan data was taken at the 0, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300 and 330 degree profiles. In order to compare each impact limiter in its pre- and post- drop condition, an alignment using the bottom perimeter (opposite the domed-end), measured as a circle, was used as a reference. By measuring it as a circle, the center point and vector of the measured circle were established. The portions of this circle that were deformed due to each drop test were not used in this calculation. The vector of this axis was defined to be the primary datum in this alignment. A point was then measured at the 90 degree lifting lug to establish the second axis in the coordinate system. This process provided the only repeatable means to align each impact limiter and subsequently compare the results.



Figure 5 Measuring an impact limiter with the laser tracker.

Once the pre- and post-drop scan data was obtained for each impact limiter, the 90-270 degree profile cross-sections were overlaid in order to calculate the magnitude of deformation for each drop.

For the cask, the 0, 90, 180, and 270 degree profiles were scanned. An alignment using the axis of the cylindrical part of the cask as the controlling datum was used. This axis was then intersected with the “Lid End” of the cask and a point was constructed. Another point was measured at the 90 degree lifting lug to establish the other axis. This alignment was repeated for each measurement of the cask. Results from scans taken before any of the drop tests are shown in Figure 6 and Figure 7. The red areas represent the positive (maximum deviations) and the yellow areas represent the negative (minimum deviations) from the nominal as-designed profile.

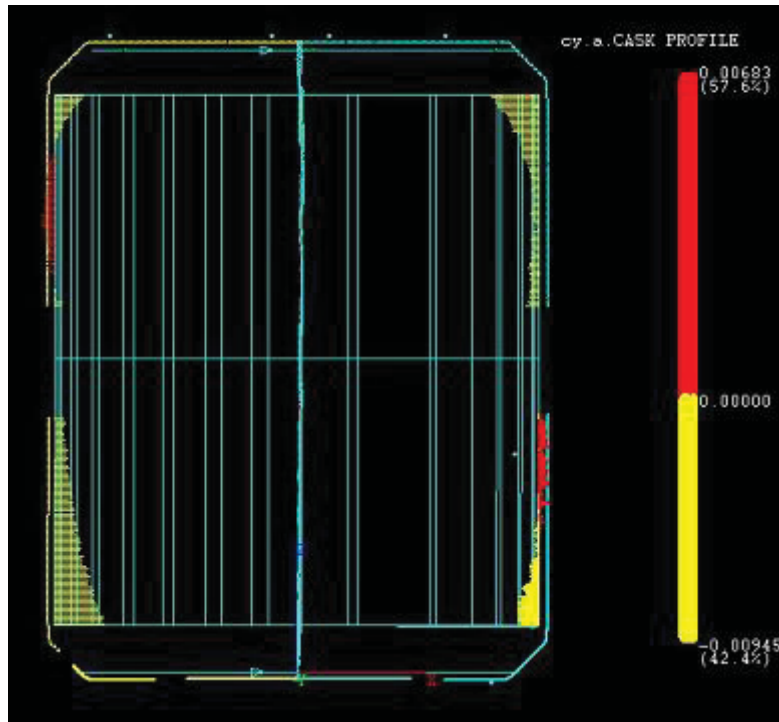


Figure 6 Scan data from cask taken before the first drop, 0-180-degree cross section

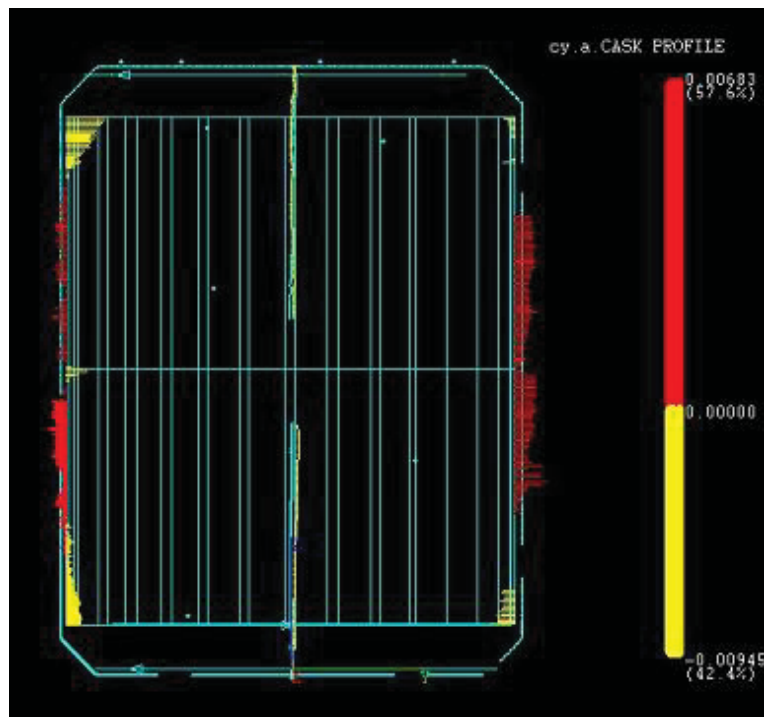


Figure 7 Scan data from cask taken before the first drop, 90-270-degree cross section.

5.3 Lifting and release methods

For each drop, the test article was lifted by a 90-ton mobile crane to a height of at least 30 feet⁶ directly above the steel plate drop target. The crane was provided by Peninsula Crane Service under subcontract to GENE. GENE provided the remaining rigging equipment. Figure 8 illustrates the crane setup for the end drop. Figure 9 shows the crane and quick-release mechanism being tested by dropping a dummy weight.

Two methods were used to measure the drop height. For the first (end) drop, a graduated light chain was hung from above the package.. The chain was marked at one-foot and ten-foot intervals such that the package height above the impact point could be verified just before the drop. The chain was then pulled out of the way prior to the drop. For the second and third drop, a tape measure was secured with tape to the bottom of the package and used to adjust the height to the desired value. The tape measure was then pulled off the test article from the ground.

The use of a hydraulic crane required that the crane boom be “snubbed” with heavy wire ropes from the crane hook down to heavy weights on the ground (Figure 8). The snubbing lines restrained the crane boom when the load was released, preventing damage to the hydraulic system. Since the snubber lines were of fixed length and had to be taut at the time of release, they had some effect on the drop height. Shorter rigging as used on the end drop caused the drop height to be greater than for the side and slap-down drops. However the drop height was over 30 feet for each drop. Exact values are given later.

The package was released using the mechanism shown in the Figure 10, Figure 11, and Figure 12. The heart of the system is the mechanical release mechanism shown in Figure 10. Called a SeaCatch Model TR15Air⁷, it is used in the marine industry for releasing loads while under tension, often underwater. In the photo on the right of Figure 10, the release mechanism is actuated by hand via the lever on the right side. Lifting the lever opens the jaws and allows the lower anchor shackle to fall free. The red rope tied between the shackles in the figures is only for demonstration. In the actual test, the package was hung from the lower shackle, the red rope was not present, and the lower shackle remained attached to the test article as it fell.

Because the package must strike the drop target in a known, repeatable orientation, it is essential that the release mechanism do its job quickly and cleanly, minimizing transient forces and moments imposed on the package during release. This minimizes the angular velocity imparted to the package at release and allows it to fall without rotation such that it strikes the drop target in the same orientation it had prior to release. To this end, the SeaCatch release mechanism was equipped with an integral air cylinder, an accumulator, and a fast solenoid valve for actuation. This method was used in preference to pulling the release lever via a lanyard because the required pull force of over 100 lbs would have disturbed the orientation of the test article just at the critical moment of release.

⁶ 30 feet minimum from the lowest point on the test article to the upper surface of the steel plate of the drop target.

⁷ McMillan Design, Inc., Gig Harbor, WA.

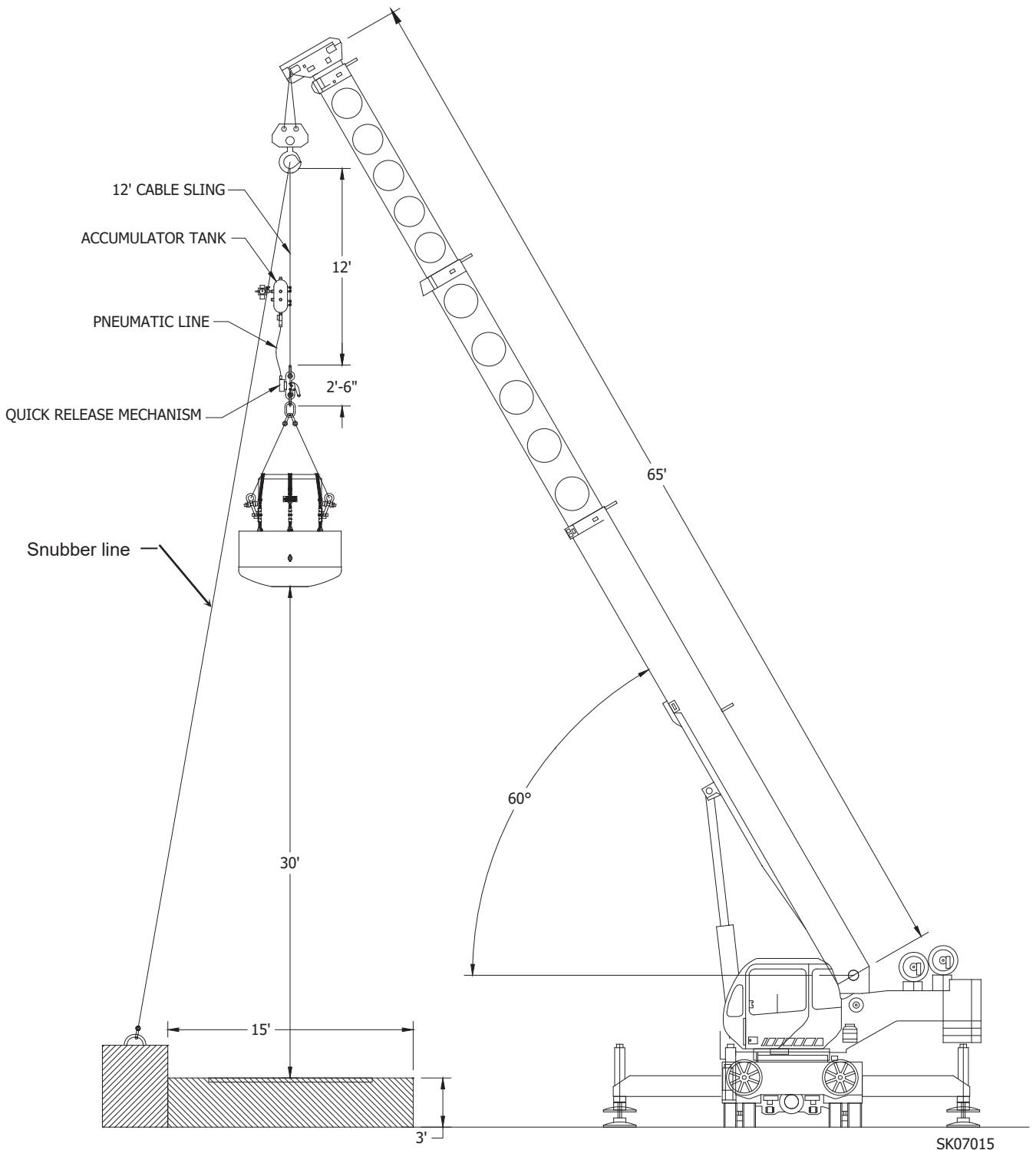


Figure 8 Crane and rigging set up for end drop.



Figure 9 Testing the quick-release mechanism by dropping a dummy weight.



Figure 10 SeaCatch release mechanism before release (left) and after release (right).

A quick release was obtained by using a 3-gallon local air accumulator tank and a fast-acting, two-stage, electrically triggered diaphragm valve mounted close to the release mechanism . Calculated release time is on the order of 0.2 seconds. Figure 11 shows the accumulator tank and valve. Figure 12 shows the accumulator and valve mounted on a short section of heavy wire rope with the SeaCatch hanging from the loop at the lower end of the wire rope. In operation, a compressed air line for charging the accumulator and electrical trigger line were run up the crane boom and over to the accumulator tank.

The SeaCatch is a model TR15AIR and is rated at 50,200 lbs working load with a safety factor of five. It was proof tested to twice the working load by the manufacturer prior to delivery to CSA. Likewise the wire rope, which is rated for 42,000 lbs, was proof tested to 84,000 lbs.



Figure 11 Accumulator tank and fast-acting valve for operating the SeaCatch air piston (left). Entire release system (right).



Figure 12 Cask being assembled with impact limiter for the end drop. The quick-release mechanism is visible at the top of the picture. Pressure-sensing paper has been taped to the part of the cask that goes inside the impact limiter.

5.4 Acceleration sensing

Acceleration time history data was recorded using accelerometers inside the cask and on the impact limiter. A total of nine uniaxial sensors was used, configured as three triaxial groups. One triaxial group was mounted on the flat surface of the impact limiter (Figure 13). The mounting block is fastened to the impact limiter by two ¼-20 cap screws threaded into tapped mounting bosses welded to the impact limiter. A cable breakout bracket for mating the main umbilical cable to individual accelerometer cables is likewise mounted to tapped bosses on the impact limiter as shown.

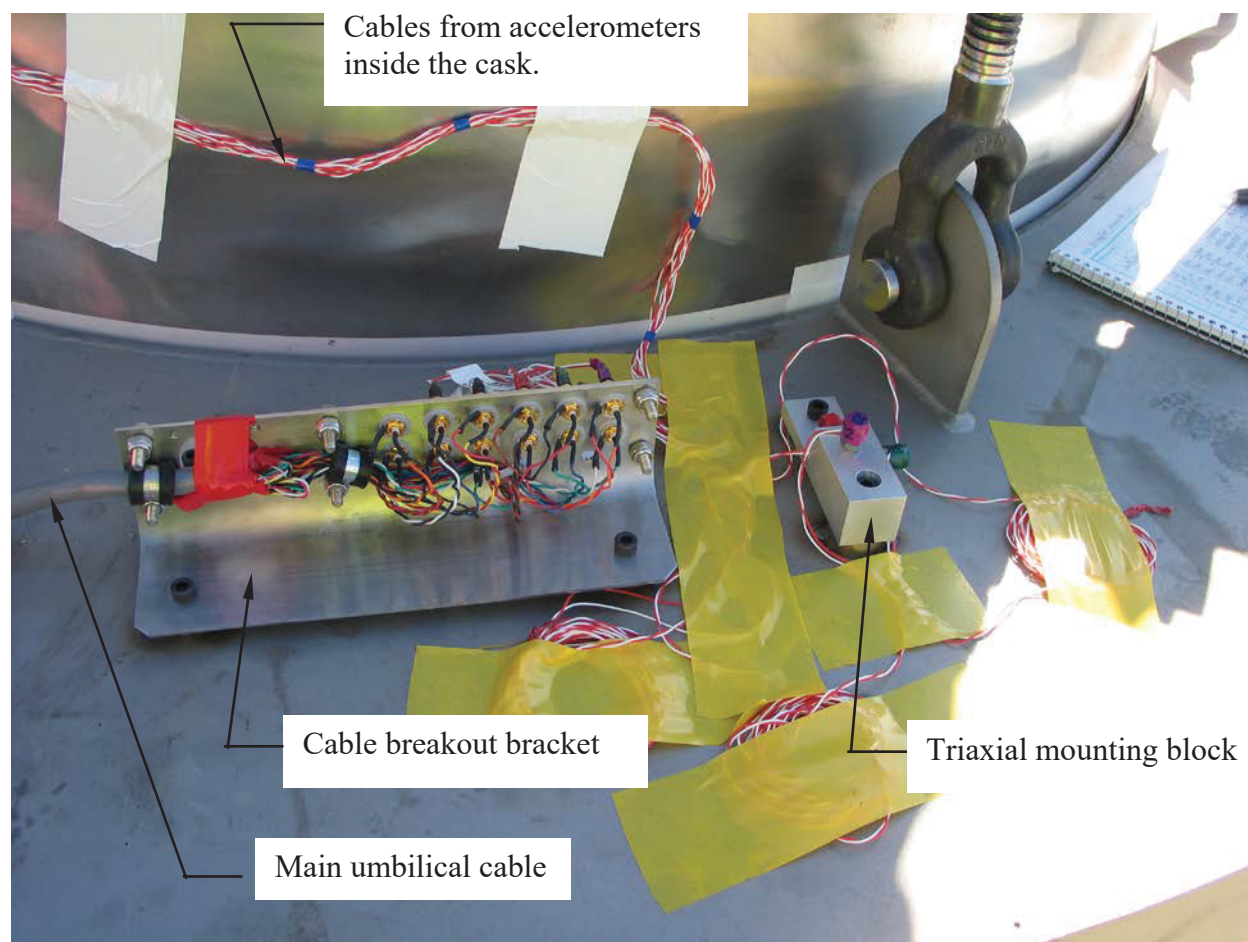


Figure 13 Triaxial accelerometer group mounted on impact limiter. The sheet metal part is a bracket for connecting the 20-conductor umbilical cable to the two-conductor cables of the individual accelerometers.

Two triaxial groups were mounted inside the cask on the wall of the payload cavity (Figure 14). They were mounted on machined aluminum blocks bonded to the cavity wall with Lord 906-16 acrylic structural adhesive. The triaxes were at nominally the same axial location and 180 degrees apart, at the 90-degree and 270-degree lines on the cask. Each triaxial set sensed in

nominally the cask radial, tangential, and axial directions. The cask was oriented for the side drop and slap-down drop such that a plane containing the cask axis and the accelerometer locations was vertical and the accelerometers on the 90-degree line were on the upward-facing side of the cask. In the photos, the radial accelerometers are marked with red tape, the axials with purple tape, and the tangentials with green tape.

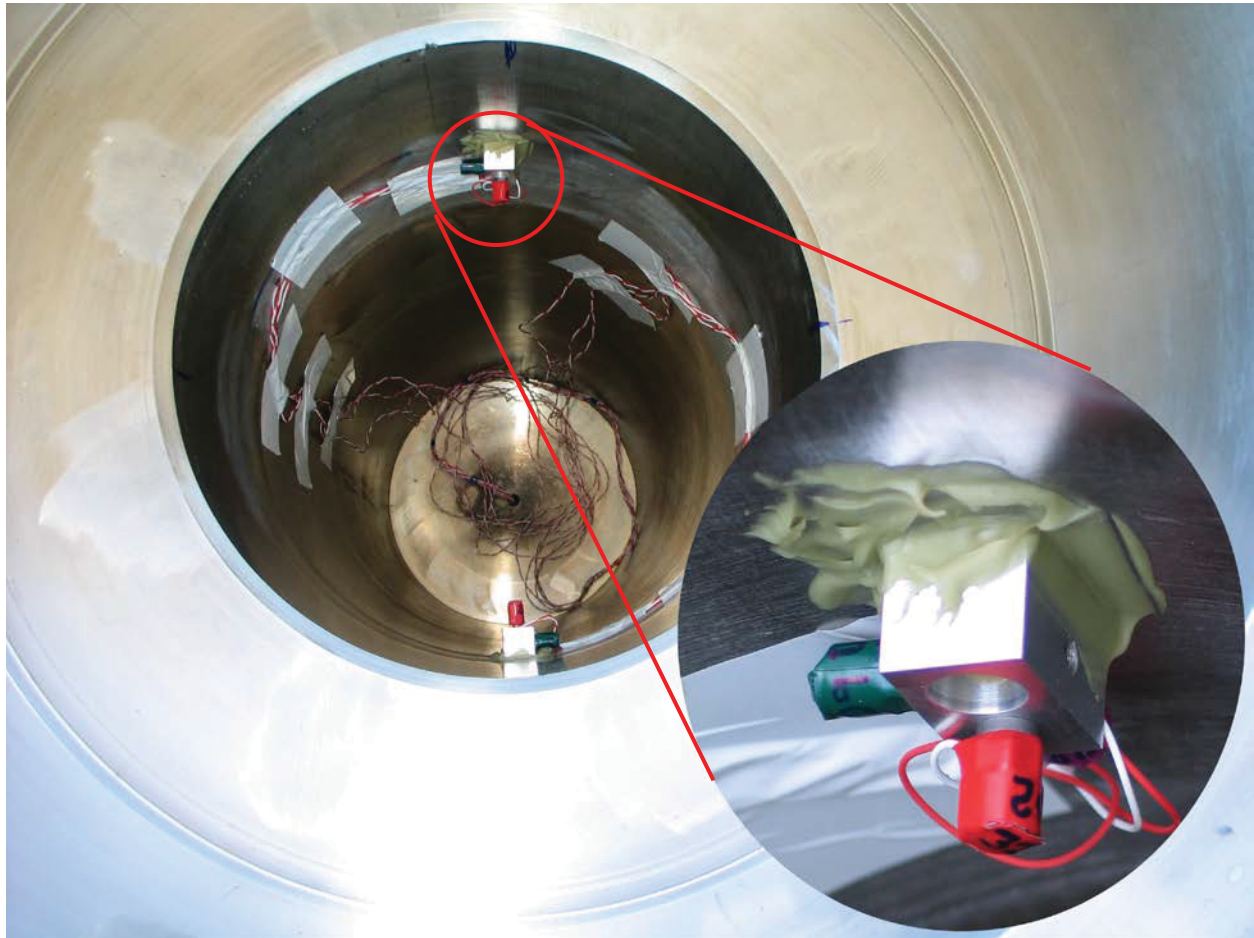


Figure 14 Accelerometers mounted inside the cask. The cables can be seen exiting via the drain port at the bottom of the cask payload cavity.

Cables for the accelerometers inside the cask were routed out through the drain port which exited near the cask bottom along the 90-degree azimuth. For the end drop, only a single impact limiter was used and it was on the lid end of the cask, with the cask being dropped upside-down (Figure 17). For this drop, there was no interference between the accelerometer cables and the impact limiter. For the other two drops, impact limiters were mounted on both ends of the cask and the cables had to come out through the 1/8th-inch radial gap between the cask OD and the impact limiter ID (Figure 16). 1/8-inch-diameter stainless steel rods were welded to the impact limiter ID running in the axial direction on either side of the cable routing to prevent the cables from being crushed between the cask and impact limiter. As described later, this was only partially successful although acceleration data was obtained for the important initial impact on each of the three drops.

All accelerometers were of the piezoelectric, integrated amplifier (ICP) type. The accelerometers mounted on the impact limiter were PCB model 350B23 having a nominal range of $\pm 10,000$ g's (0.5 mV/g sensitivity, 0.5 g resolution, range/resolution = 20,000) and a 1-dB bandwidth of 0.4 to 10,000 Hz. The triaxial accelerometers inside the cask were PCB model 353B13 having a nominal range of ± 1000 g's (5 mV/g sensitivity, 0.05 g resolution, range/resolution = 20,000) and a 1-dB bandwidth of 0.7 to 20,000 Hz. All were powered and AC coupled to the recording system by a Kistler model 5124A power supply/coupler. Figure 15 shows the accelerometers and their power supply / signal coupler. There is no pass-fail criterion based on cask acceleration. However the data obtained will be of use in understanding the package behavior during impact and for estimating loads on the cask.



Figure 15 Accelerometers (1,000 g on lower left, 10,000 g on lower right) and power supply / signal coupler.

Piezoelectric accelerometers were used in preference to bridge-type, DC-coupled accelerometers because the former tend to be better suited to the high acceleration levels found in drop testing. Also, they use simpler electronics integrated directly into the sensor which is of great value in eliminating noise pickup in the signal cabling. Their only disadvantage is that they cannot capture the part of the signal at very low frequency, below about 1 Hz for the present case. This is considered acceptable because the very short-duration impact events have only a very small part of their signal energy in this missing band. Peak accelerations during such short impacts can be measured with AC-coupled accelerometers with negligible loss of accuracy.

The polarity for all accelerometers follows the industry convention: acceleration into the mounting surface of the sensor gives a positive output voltage. Thus the axial accelerometers inside the cask (Figure 14) give a positive voltage when the acceleration is towards the bottom end of the cask (as opposed to the top or lid end), as was the case for the end drop.

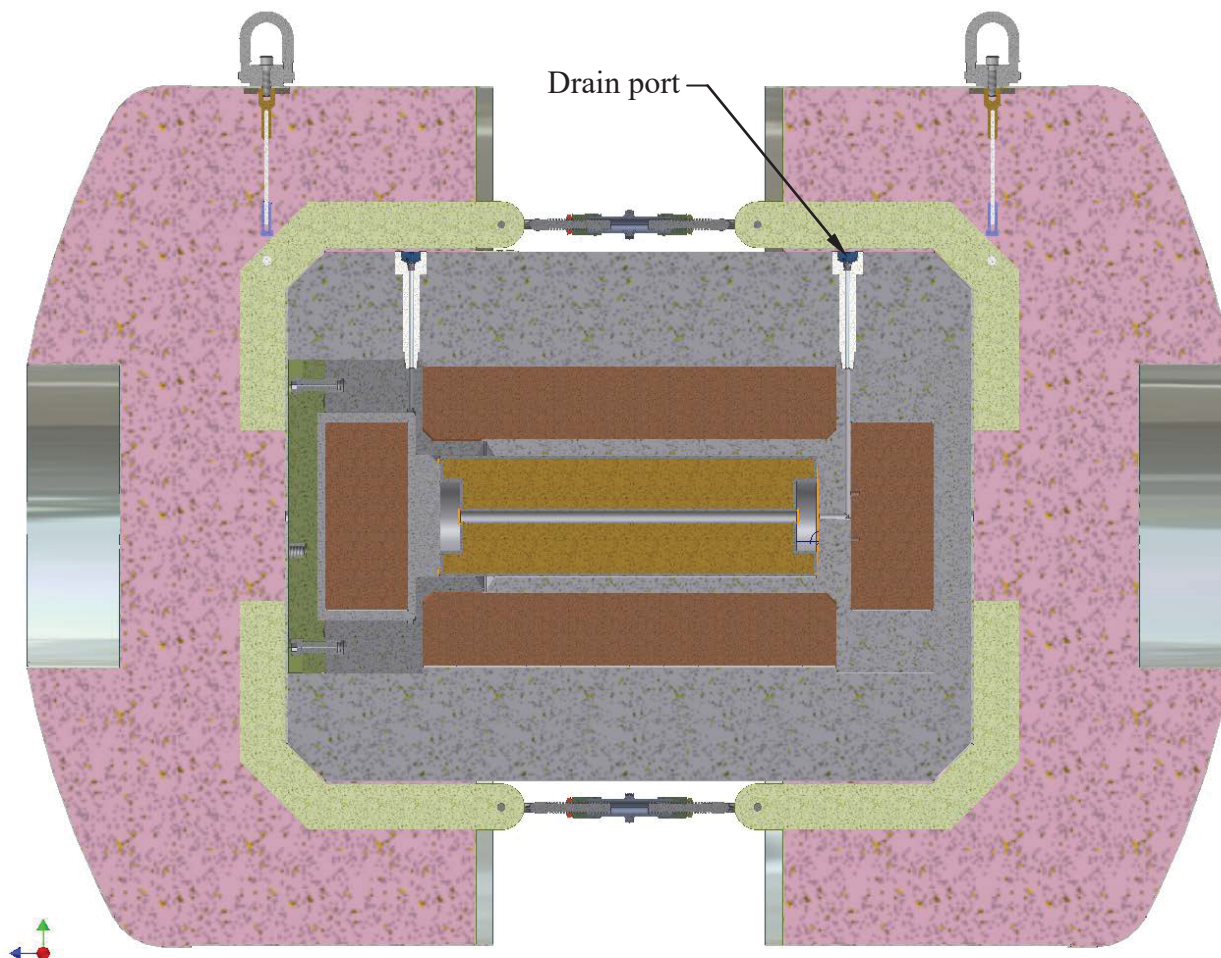


Figure 16 Cross section of cask showing drain port to be used for accelerometer cable routing.

Cables for the accelerometers inside the cask were routed through the water drain port (Figure 16) such that no special feedthroughs or modifications to the cask were needed. During the leak test, the cables were disconnected from the external breakout bracket and pushed back into the drain port so the port can be plugged.

A multi-channel umbilical cord with one shielded, twisted pair for each accelerometer was used to route the signals to a breakout box with BNC connectors on the output side. BNC cables then carried the signals to the Kistler power supply/coupler and from there to the data acquisition system located in the instrumentation truck. The total cable length of approximately 150 feet presented no significant limitation for the relatively low-frequency signals of interest in this test.



Figure 17 Cables from accelerometers inside the cask were routed through the drain port to the breakout bracket. Configuration shown is for the end drop with only one impact limiter used.

5.5 Acceleration signal recording

Acceleration signals during the impact were digitized and recorded directly to disk using a VXI data system from VXI Technology with a 16-channel front end card (model VT1432A). A/D conversion was done at 25,600 samples per second per channel with 16-bit resolution. Anti-aliasing filters were set for a cutoff frequency of 10 kHz.

Real time data acquisition was performed using I-DEAs TEST software to control the VXI front end. Immediately following each drop tests, acceleration time history data was translated to MatLab .mat format. MatLab was used for all display, plotting, filtering, spectrum analysis, and other post-processing work.

It was planned originally to use a digital tape recorder in parallel with the VXI system for redundancy. However problems were encountered with the tape recorder during test preparation so the VXI system was used alone. It performed satisfactorily so no backup was needed.

During the 1987 test, each acceleration signal was recorded to two channels of an FM instrumentation tape recorder. This allowed two different full-scale settings to be used for each signal in order to obtain the best possible signal/noise ratio within the limited (50 dB) dynamic range of the recorder. Modern 16-bit digital recording systems such as the VXI system have rendered this unnecessary since they typically have well over 72 dB of dynamic range.

5.6 Data processing

Data acquired with the VXI system was initially in I-DEAs .ati format. It was converted immediately on-site to MatLab standard double precision (8 bytes per sample) using the I-DEAs IMAT translator. Simple plotting and processing routines were created using basic MatLab commands and the MatLab Signal Processing Toolbox. All raw time history files were permanently archived.

Processing tasks include

- locating, isolating, and plotting the relevant time sections containing the impact
- digital low-pass filtering of acceleration time histories to accentuate the rigid-body component over the resonant flexible-body components
- computing the energy spectral density of the acceleration transient to determine how much is rigid-body response and how much is flexural.

5.7 Contact pressure sensing

Pressure sensitive film was installed between the cask and impact limiters prior to each drop. The film (Fuji Prescale P/N M S R270 M10 1) changes color in response to pressure. The single-sheet type contains embedded microcapsules of a chemical that reacts with another chemical impregnated into the film to produce a red color. Higher pressure breaks more capsules and produces a more intense color. The size and density of the microcapsules can be tailored to make the color change occur over various pressure ranges. The film used is for the pressure range from 10 to 50 MPa (1450 to 7250 psi). Pressure can be inferred by comparing the exposed film to a color chart (Figure 18). However for the present application, the intent is simply to use the pressure paper to indicate areas of contact between the cask and impact limiters.

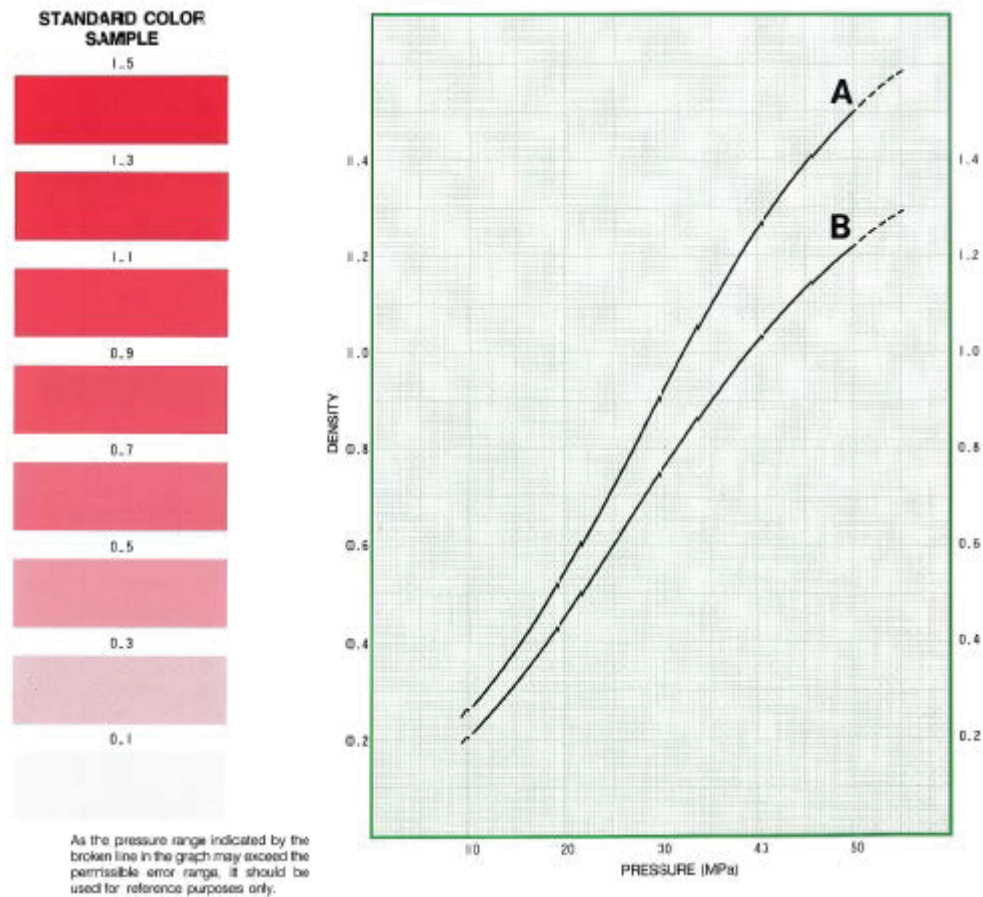


Figure 18 Chart for correlating color to pressure for Fuji medium-range Prescale film.

Fuji publishes two different color charts, one for film exposed to continuous pressure and another for film exposed to momentary pressure. However the two charts are virtually identical to the eye. Also, tests conducted with Prescale film prior to the 1987 drop tests⁸ showed that the color change is virtually instantaneous upon exposure to pressure.

Figure 19 shows the cask with pressure-sensing paper attached being assembled into the impact limiter. The paper can also be seen in Figure 17 protruding out slightly beyond the impact limiter.

⁸ Kienholz, D.A. and Allen, Bradley op cit



Figure 19 Cask with pressure paper attached being lowered into the impact limiter for the end drop.

5.8 High speed photography

High-speed digital video photography was used to record each of the three drops. All cameras were furnished and operated by Speedvision Technologies of San Diego under subcontract to CSA Engineering.. Two high-resolution black-and-white cameras were used with their sight lines at right angles to each other as shown in Figure 3. For the first (end) drop, lower resolution color cameras were located next to each black-and-white camera. Following review of the end drop videos from all four cameras, it was decided that only one color camera would be used for the second and third drops and it would be located at an oblique angle, about midway between the two black-and-white cameras. Figure 20 shows the cameras set up for the end drop.



Figure 20 High-speed cameras set up for end drop

Frame rates for the first drop were 1000 frames/second for the black-and-white cameras and 500 frames/second for color. After review of the videos, it was determined that the higher frame rate offered no real advantage so all cameras were operated at 500 frames/second for the second and third drops.

Following each drop, the raw files from the camera were converted to .avi format. The raw files remain available but examination of the compressed .avi files showed that they had adequate

resolution for most purposes. SpeedVision furnished software for extracting individual frames as jpeg or tiff files. This software was used to produce the frame-by-frame presentation given in later sections for each of the three drops.

A time scale and a length scale were included in the field of view of the each black-and-white camera. The length scales are dark-colored poles mounted vertically with light-colored graduations marked on them at one-inch (yellow marks) and one-foot (white marks) intervals. The poles are placed as close as possible to the vertical drop path and at the same distance from the camera as the drop path in order to minimize parallax and foreshortening error. Time scales, Figure 21, are rotating disks with a light-colored radial line. The background behind the disk has fixed, radial witness lines painted at 30-degree intervals as shown. The disk is rotated by a two-pole induction motor at a constant speed of approximately 3575 RPM or approximately 43 degrees per camera frame at 500 frames per second. The exact rotational speed was determined prior to the test using a digital optical tachometer. Table 1 shows the recent time scale calibration results and those from just before the 1987 test.

Table 1 Calibration results for time scales.

Clock	Speed (RPM)		Percent Change	Degrees per 0.002 seconds
	1987	2005		
#1	3579.00	3579.00	0.00	42.95
#2	3575.40	3572.30	-0.09	42.87

The use of time scales was a hold-over from earlier tests where high-speed film photography was used and frame rates could vary significantly from their nominal value. Modern digital video cameras have very accurate frame rate control (a few parts per million) so the time scales are not strictly necessary and are actually less accurate than the cameras themselves.



Figure 21 Time scale

At the suggestion of SpeedVision, a simple impact trigger signal generator was constructed and used to provide a time reference signal indicating when the test article first impacted the ground. The trigger was simply a sheet of cardboard approximately two feet square with a grid of 2-inch-square holes cut in it and sandwiched between two sheets of heavy-duty aluminum foil (Figure 22). The sandwich was taped to the impact surface at the location where the test article would first strike the surface. When the impact limiter hit the sandwich, it pressed the two sheets of aluminum foil together and closed a circuit. The resulting voltage signal placed a reference time marker on the stream of video frames to indicate first contact. It also cued the cameras to continue recording for another two seconds and then stop. Finally, it produced a step voltage signal that was recorded on one channel of the VXI data system as a time reference for interpreting the acceleration time histories. The impact trigger was used on the second and third drops and found to work very well.

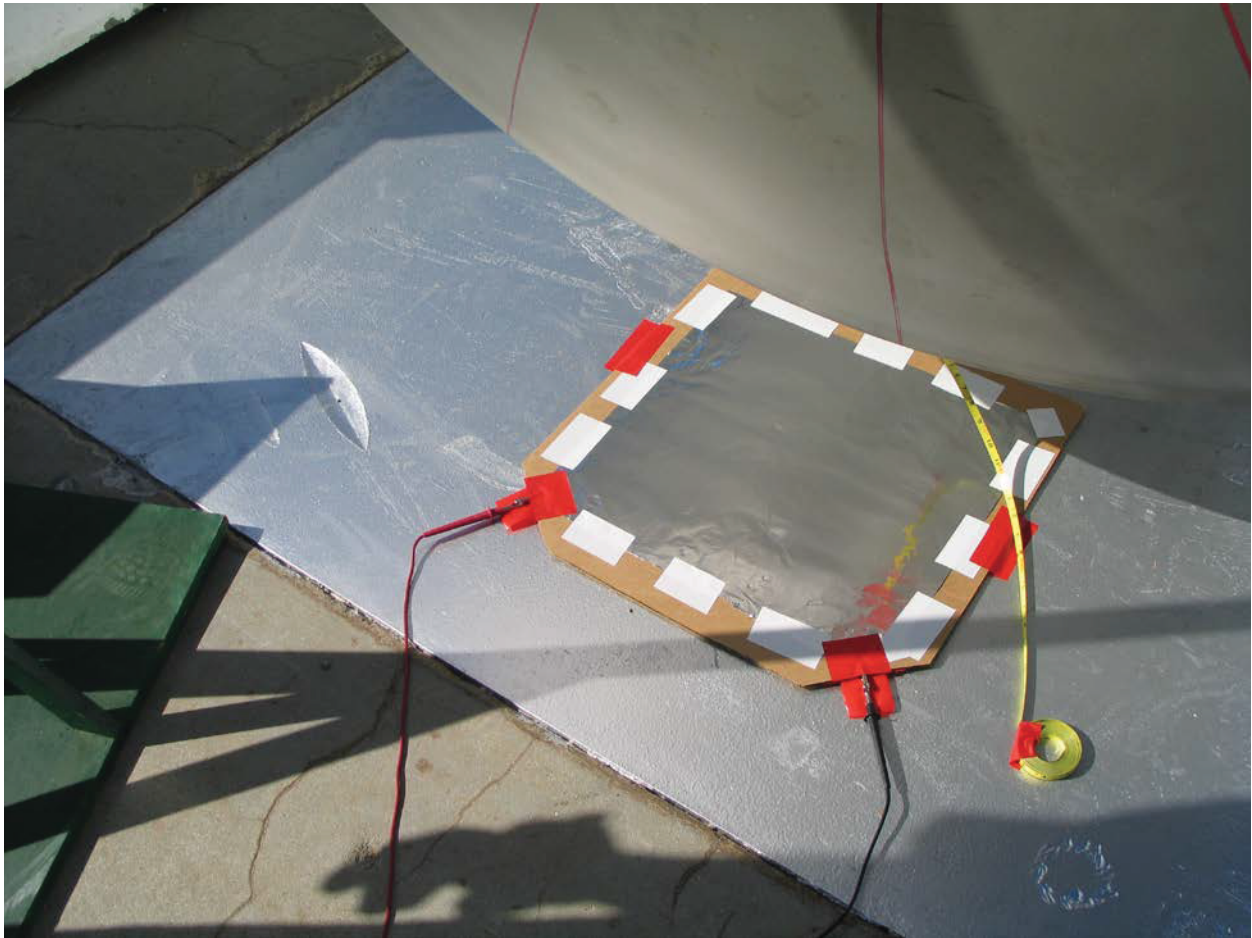


Figure 22 Impact trigger in position for side drop.

5.9 Leak rate tests

Integrity of the cask body and its lid seal was tested before and after each drop test by measuring the leak rate. The lid was bolted in place in the normal operating configuration. A helium pressure bottle was connected to one of the ports leading to the payload cavity and the cavity was purged with helium and then maintained at a pressure of 17.0 psia. The vacuum pump of a helium leak detector was connected to the port leading to the volume between the double seals of the lid. The volume between the seals was pumped down to an absolute pressure of less than 1 Torr and the leak rate of helium was measured by the leak. A leak rate of less than 2.96×10^{-7} standard cubic centimeters of helium per second at this pressure differential was considered leak-tight. Leak detection equipment was furnished and operated by GENE personnel.

During the leak test, the cables from the accelerometers inside the cavity were disconnected from the break-out panel on the outside of the cask and pushed back into the port from which they exited the cask. The port was then plugged such that the cavity could be pressurized. Figure 23 shows the cask undergoing its initial leak test.



Figure 23 Leak testing the cask.

5.10 Test operations

GENE prepared a detailed check list of all the activities to be performed during preparation and execution of the tests. It was maintained by the GENE QA manager assigned to the project and included the designation of the individual responsible for each item. Items were checked off as they were performed.

5.11 Drop heights

Table 2 gives the free-fall distances for each of the drops. These are the measured vertical distances from the drop target to the lowest point on the impact limiter. They were different for the three drops for reasons given earlier related to the crane and rigging.

Table 2 Drop heights

Drop configuration	Drop height (feet and inches)
End	34'-3"
Side	31'-0"
Slap-down	31'-2"

6. Results: End Drop

6.1 Acceleration measurements

This section gives the time history plots of accelerations measured inside the cask and on the impact limiter for the end drop. Only the most important data are shown in this section. A full set of plots has been furnished to GENE. This organization will also be followed for presenting acceleration data from the side drop and the slap-down drop.

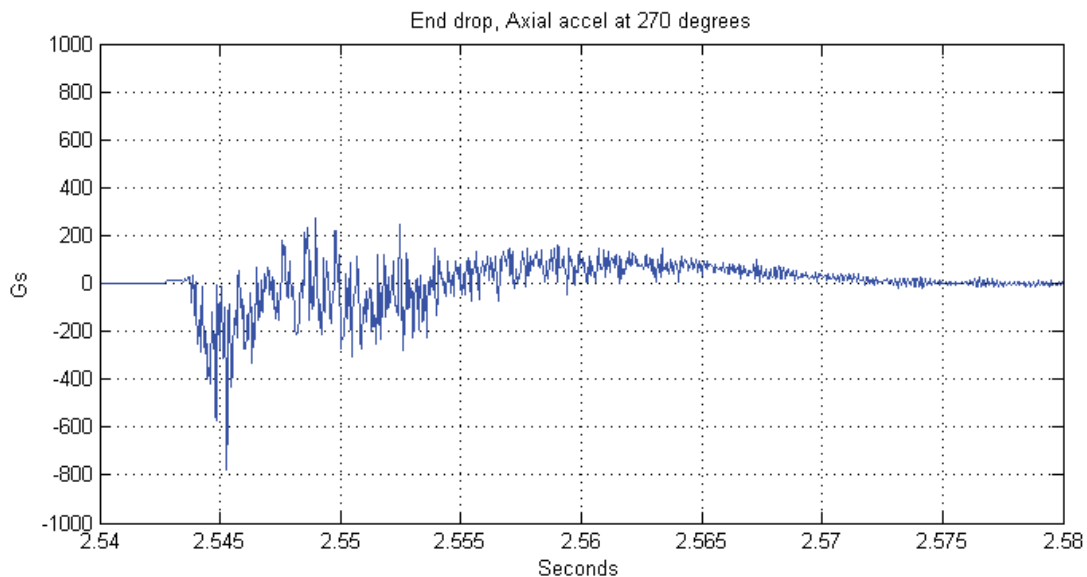
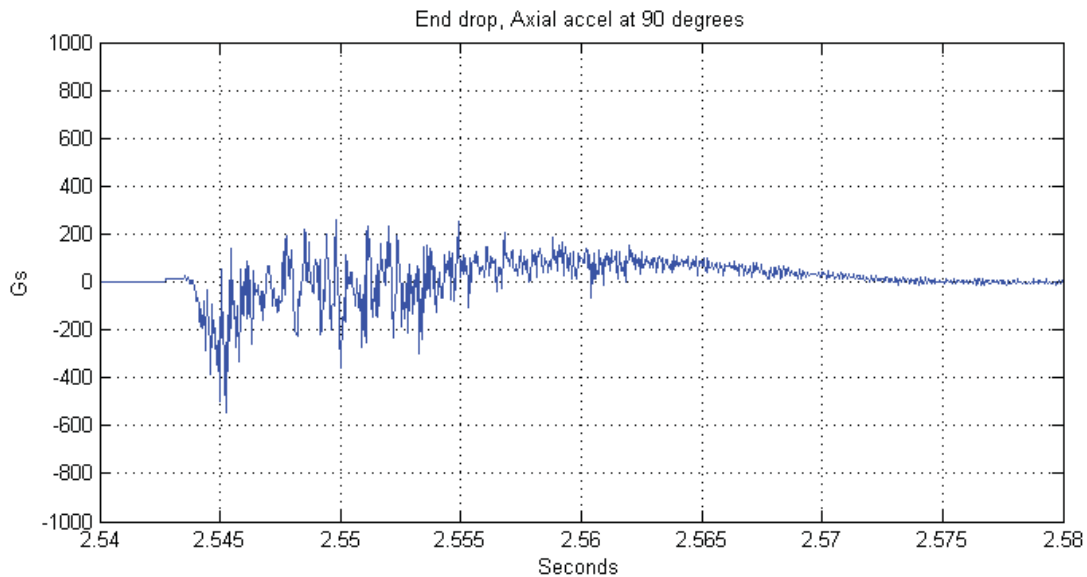


Figure 24 Accelerations measured at impact inside the cask for the end drop.

Figure 24 shows the signals from the two axial accelerometers inside the cask (Figure 14). These two were sensing in the vertical direction for this drop. A positive signal denotes upward acceleration at the accelerometer location.

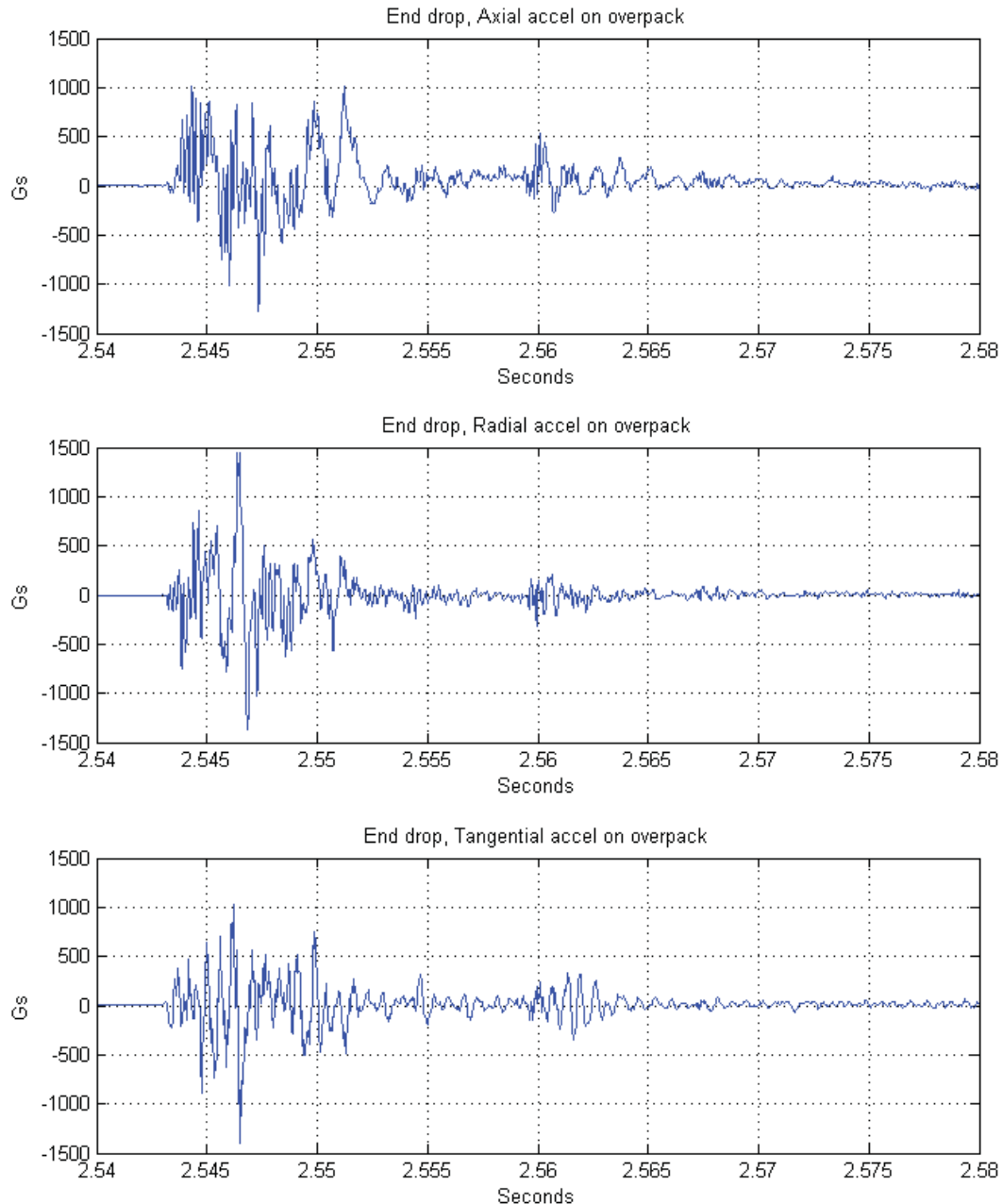


Figure 25 Accelerations measured on the impact limiter during the end drop.

Figure 25 shows data from the accelerometers on the impact limiter (Figure 13). Signals from all accelerometers showed a large amount of “ringing” or resonant response from the cask and impact limiter. This was not surprising considering the sharp blow applied to the package when

it struck the steel plate of the target block. However the ringing makes it difficult to estimate the true deceleration of the cask mass center. To this end, the signals were digitally low-pass filtered to reduce the resonant response and make the rigid-body component of the cask deceleration more evident. The filter was a 4-pole phaseless Butterworth⁹ with a cutoff frequency of 900 Hz. Results are shown in Figure 26, Figure 27, and Figure 28.

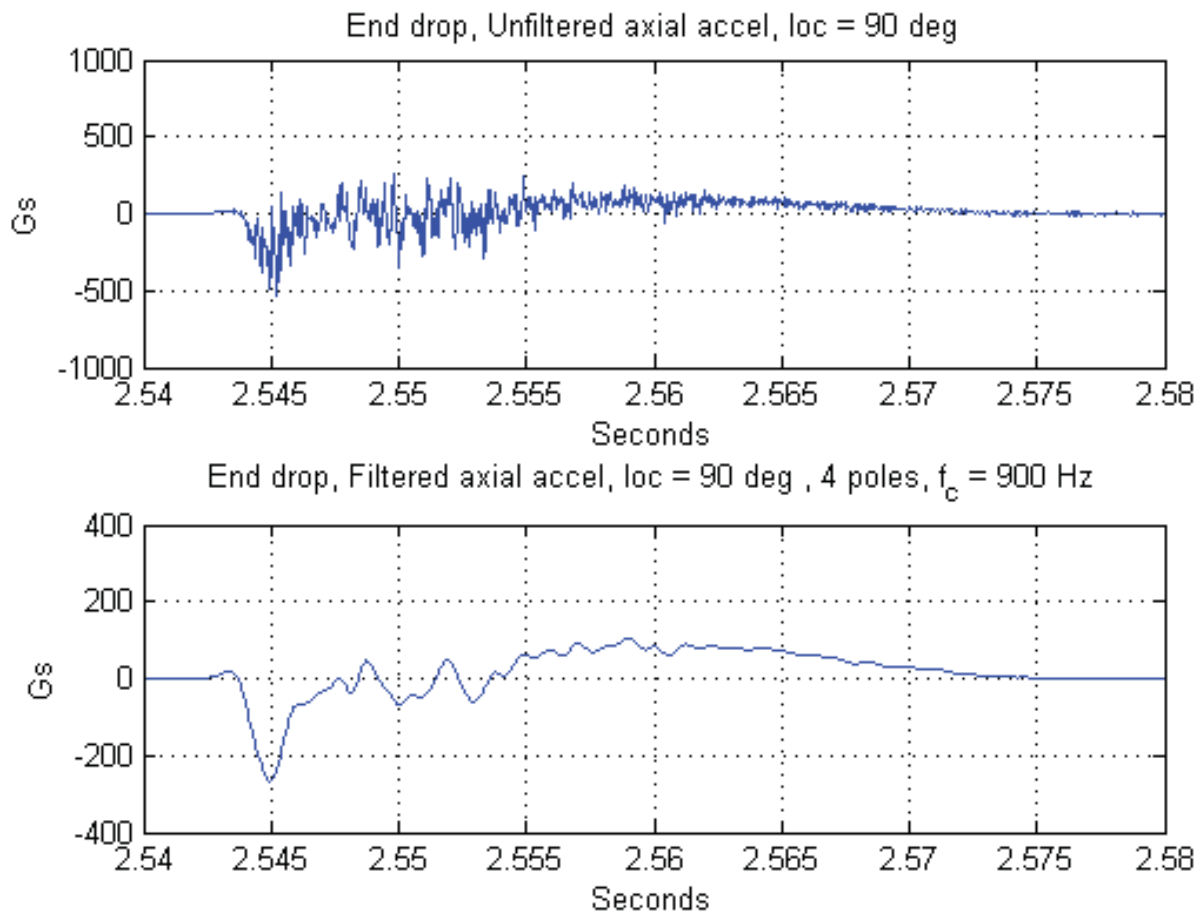


Figure 26 Signal from the axial accelerometer inside the cask on the 90-degree azimuth before (top) and after (bottom) low-pass filtering.

The vertical acceleration signals in Figure 26 and Figure 27 may seem confusing at first. It appears that the big spike in acceleration is in the downward direction. However the signals make sense when one considers the way the cask is constructed. Referring to Figure 16, the brown areas represent voids between the thick stainless steel walls of the cask. These voids are filled with heavy, tungsten “bricks” which are held in place only by steel wool packing. When the cask first strikes the hard surface, there is in fact a small pulse of upward acceleration

⁹ A phaseless filter is created by running the digitized signal twice through the filter, first forward and then backwards. Thus a four-pole phaseless filter gives the same frequency rolloff as an eight-pole conventional filter and does so with no phase distortion.

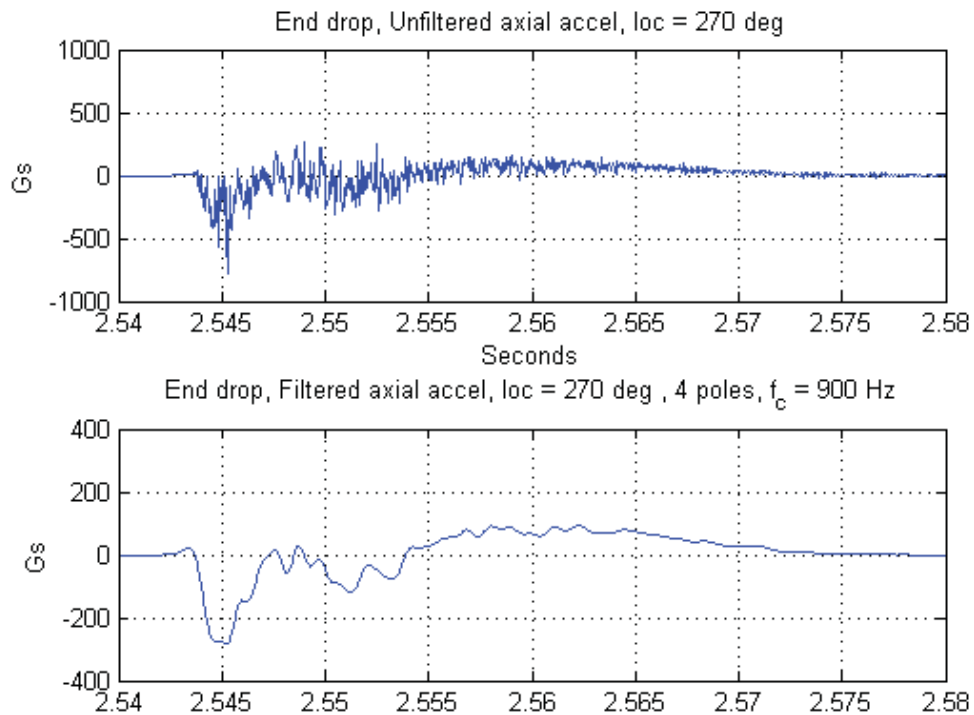


Figure 27 Signal from the axial accelerometer inside the cask on the 270-degree azimuth before (top) and after (bottom) low-pass filtering.

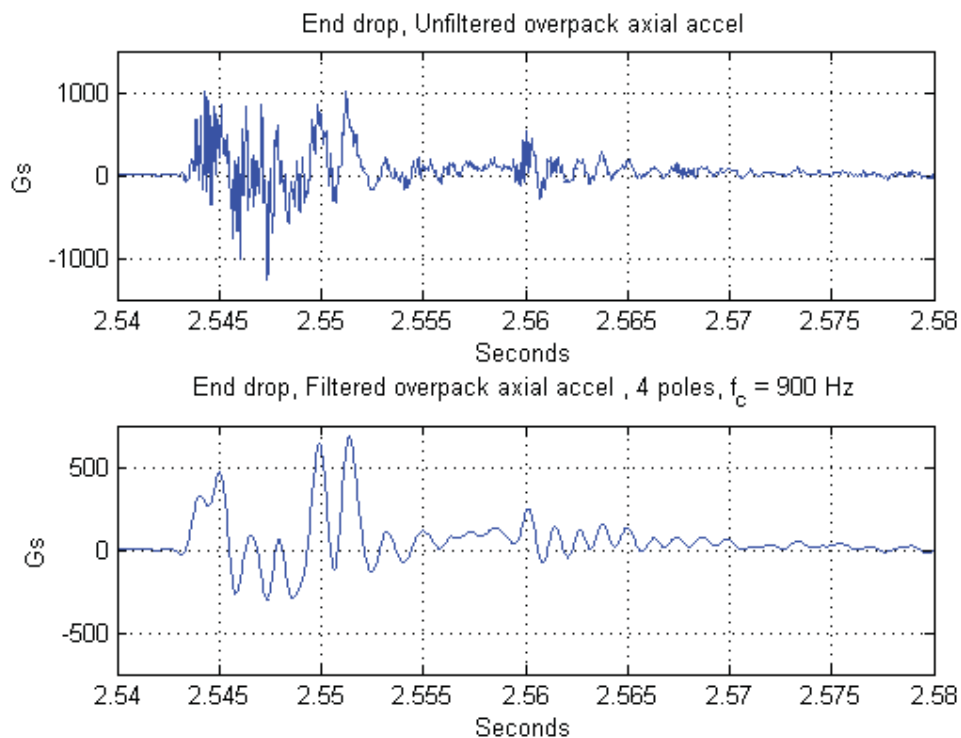


Figure 28 Signal from the axial accelerometer on the impact limiter before (top) and after (bottom) low-pass filtering.

corresponding to the initial deflection of the impact limiter and compression of the steel wool packing. However a millisecond later a secondary collision occurs as the packing goes solid and the tungsten bricks strike the lid end of the cask (recall that the cask is upside down) driving it downwards into the ground. The phenomenon is similar to a car accident where the occupants don't have their seat belts buckled, except that in this case the "occupants" are the heavy tungsten bricks. The secondary collision causes the large negative spike. Following that, a much longer period of upward acceleration occurs, which corresponds to the decay in the initial downward impact velocity. The signal corresponding to this latter positive acceleration is slightly attenuated by the AC coupling of the accelerometers themselves and also by the AC coupling of the signal to the data acquisition system.

The effect of secondary collisions is even more pronounced in the side and slap-down drops presented later, probably because the tungsten bricks are restrained less in the tangential and radial directions than they are in the axial direction.

An important feature of the peak acceleration due to the secondary collision is that it is not heavily dependent on the characteristics of the impact limiter. The spike is caused by several heavy, rigid bodies (the tungsten bricks) striking another (the stainless steel body of the cask) with the accelerometer rigidly mounted to the latter. This factor should be kept in mind in attempting to compare measured peak accelerations to analytical predictions, where the latter assume that all energy absorption is done by the impact limiter.

The effect of the secondary collisions is much less pronounced in the axial acceleration measured on the impact limiter (Figure 28), probably because the surface of the impact limiter mounting the accelerometer is only loosely coupled to the cask body. At this surface, the initial pulse of acceleration is quite large and is in the upward direction as one would expect.

6.2 High-speed video

Figure 29 shows frames from one of the four high speed video cameras. Because the impact trigger was a last-minute addition after this first test, there is no accurate way to time-align the end-drop acceleration time history to the video frames. However based on that alignment for the side and slap-down drops, the initial impact is estimated to occur at $t = 2.542$ seconds in the traces of the last five figures.

Using the video and the length scales, it was determined that the cask bounced to a height of about 43 inches, indicating that about 90% of the kinetic energy was dissipated upon initial impact. After the first bounce, the cask teetered on one corner and then fell over on its side, crushing the umbilical cable from the accelerometers. Fortunately, the important acceleration event was over by this time and had been recorded.

A video editing program¹⁰ was used to estimate the elapsed time from first impact to the point where the vertical velocity of the cask c.g. dropped to zero. It was 0.021 +/-0.004 seconds. Time resolution (time between frames) was 0.001 seconds in the video used for this estimate.

¹⁰ Imaging Studio version 2.4.0, AOS Technologies AG

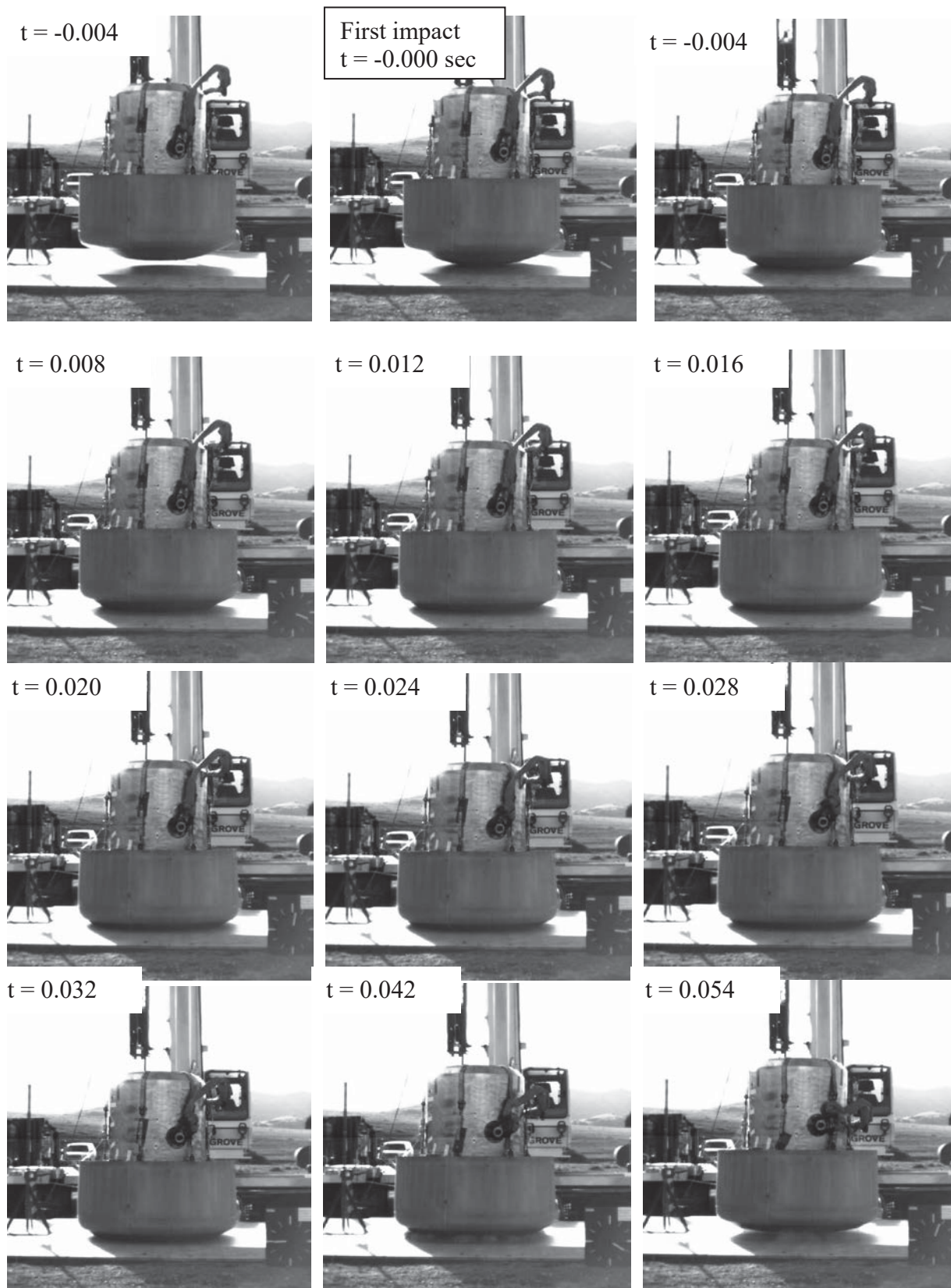


Figure 29 Frames from high-speed video of end drop.

6.3 Pressure sensing film

Figure 30 shows the pressure sensing film from the end drop. The band of film that was taped to the cylindrical surface of the cask (Figure 19) has been cut into four equal pieces which are placed in their respective azimuthal locations in Figure 30. In Figure 30 and in the similar photographs from the side and slap-down drops, the surface of the film which faced away from the cask is towards the camera.

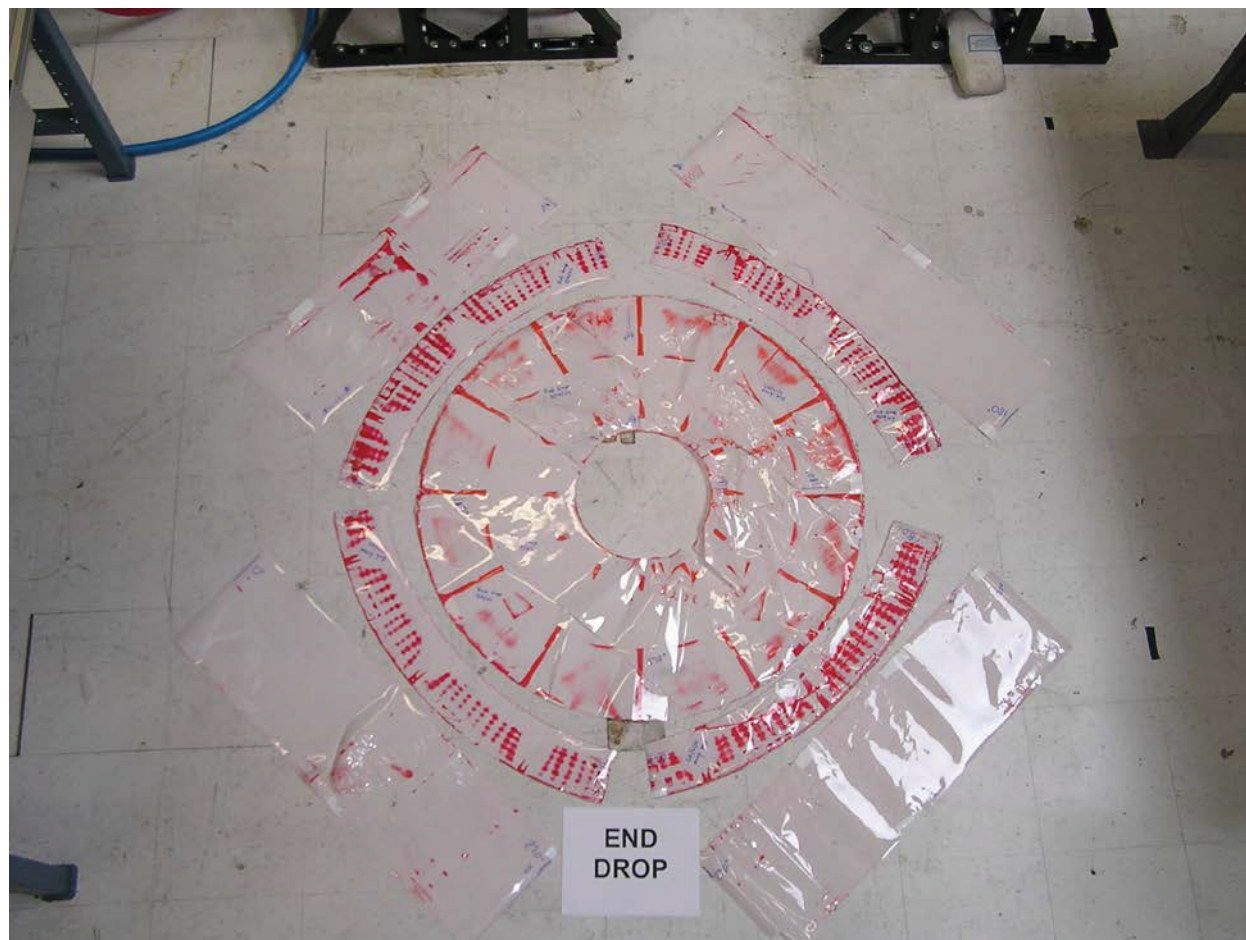


Figure 30 Pressure sensing film removed from the cask after the end drop.

The red areas on the film indicate where contact occurred between the cask and impact limiter. The radial “spoke” impressions made by the 12 strengthening ribs inside the impact limiter are clearly visible on the circular piece of film from the flat end surface of the cask. The picture also shows that significant forces between the cask and impact limiter occurred on the conical surface produced by the chamfer on the end of the cask. The package struck with its axis nearly vertical which accounts for the fact that there was relatively little contact between the cask cylindrical surface and the inside diameter of the impact limiter.

6.4 Deformation measurements

Table 1 shows the measured cask profile deviation from the design nominal before and after the end drop. The conclusion from these measurements was that no significant damage to the cask had occurred.

Table 3 Before and after end-drop measurements of the cask.

Deviation	Cask state at measurement	
	Before end drop	After end drop Before side drop
Maximum	0.0068	0.0046
Minimum	-0.0094	-0.0101

Figure 31 shows an overlay of the profile of the impact limiter before and after the end drop.

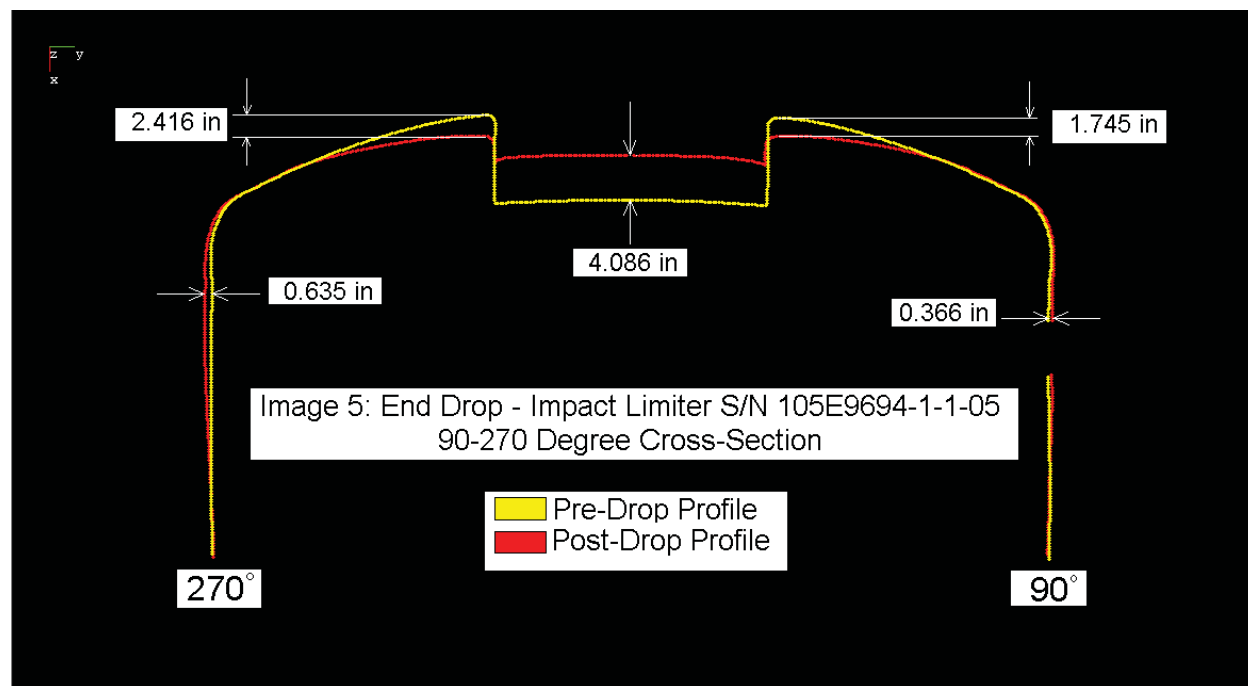


Figure 31 Profiles of the impact limiter before and after the end-drop

Figure 32 shows the impact end of the impact limiter after the end drop. The previously flat surface in the large center relief on the end of the impact limiter has been bulged out over four inches by the force from the cask transmitted through the foam. The weld around the edge of the relief has split over a small part of the circumference.



Figure 32 Cask and impact limiter immediately following the end drop.

6.5 Leak rate test

The cask was leak tested following the end drop and was found to meet specification. It was concluded that no degradation had occurred in the seal integrity of the cask.

7. Results: Side drop

7.1 Acceleration measurements

For the side drop, the two radial accelerometers inside the cask were oriented in the vertical direction but facing in opposite directions. The sensor at 90 degrees azimuth faced downwards so upwards acceleration gave a negative signal. Figure 33 shows the signals from these two sensors during the initial impact.. Initial contact as sensed by the impact trigger was at time = 0.1217 seconds¹¹ in the plot.

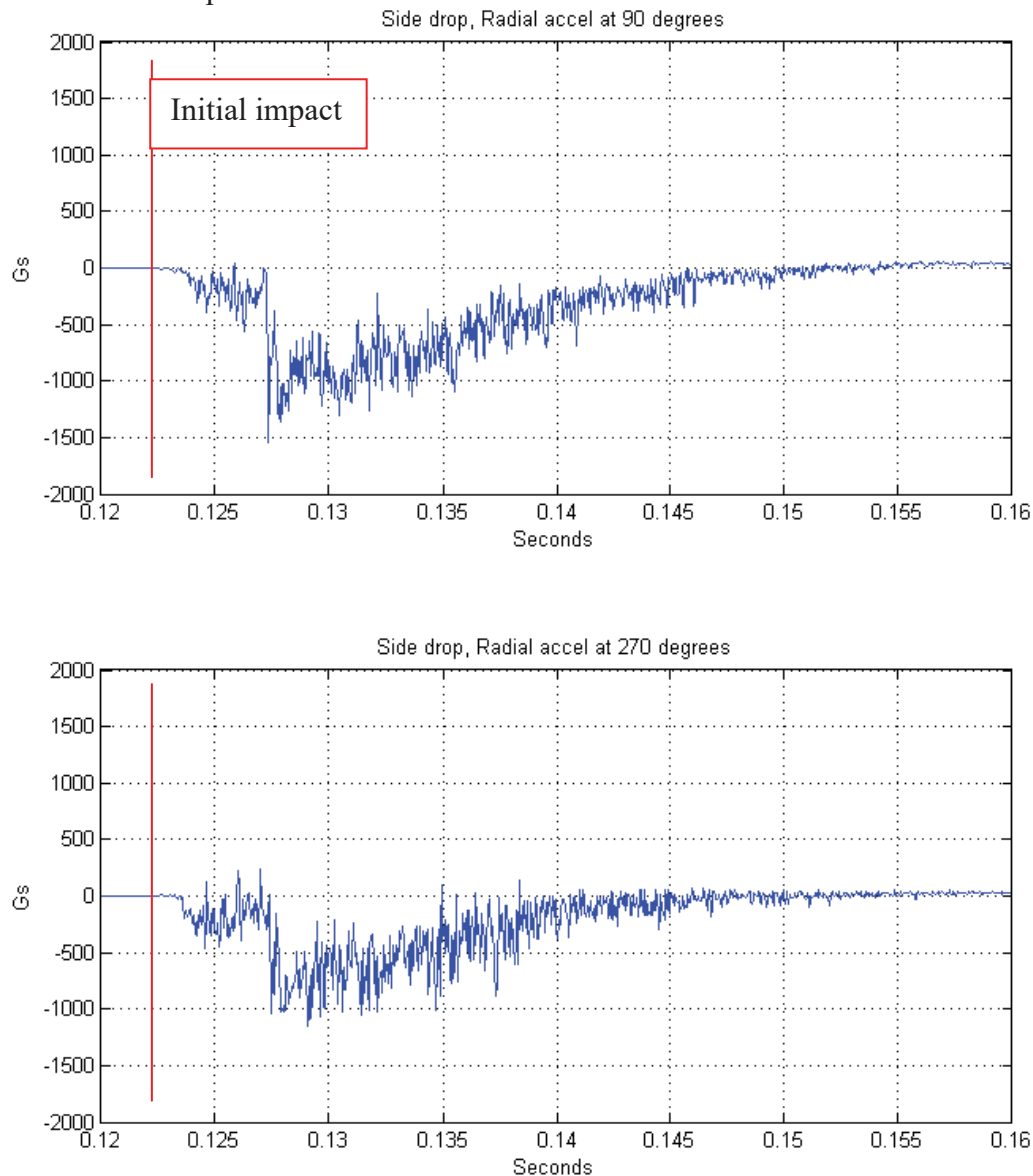


Figure 33 Vertical accelerations measured at impact inside the cask for the side drop.

¹¹ The $t = 0$ origin is arbitrary but is the same for all acceleration signals on a given drop.

Figure 34 shows the triaxial signals from the sensors on the impact limiter. The radial sensor on the impact limiter is essentially vertical and faces downward, like the in-cask accelerometer at 90 degree azimuth, so upwards acceleration gives a negative signal.

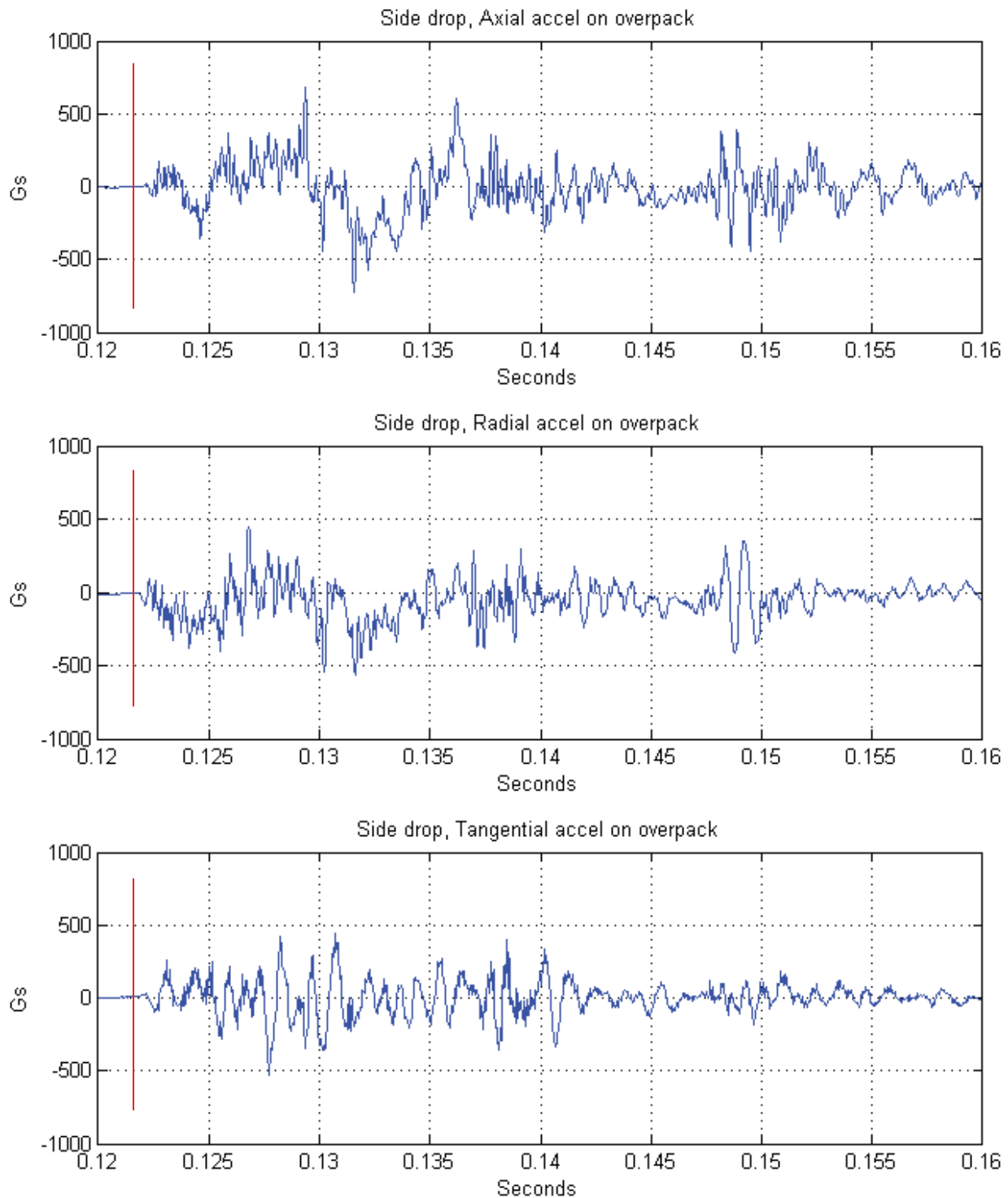


Figure 34 Accelerations measured on the impact limiter during the side drop.

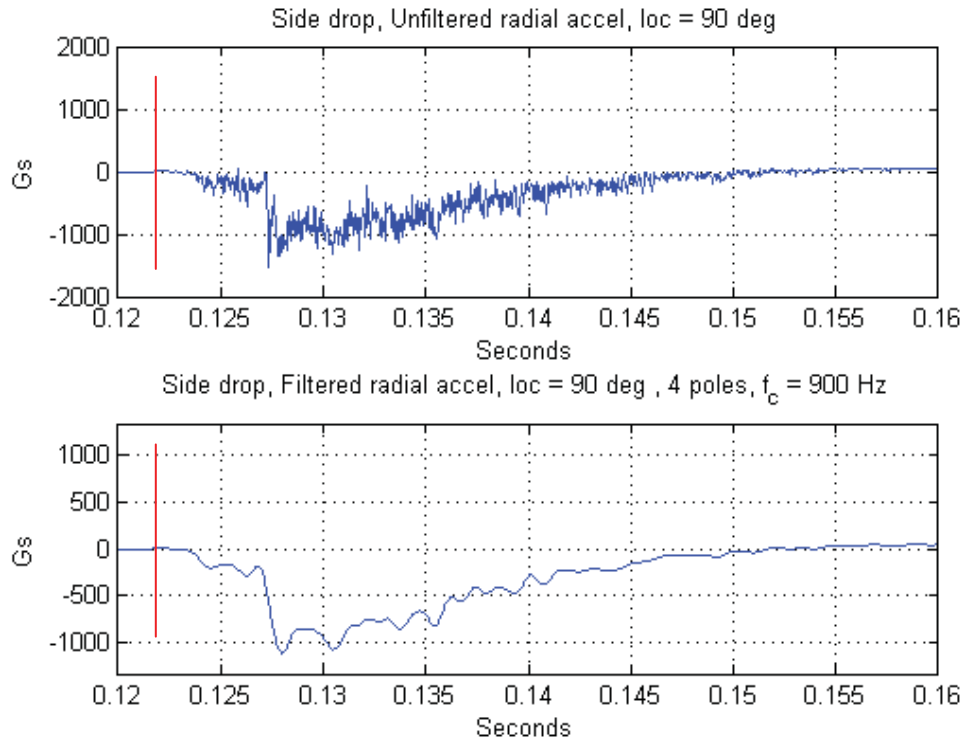


Figure 35 Signal from the radial in-cask accelerometer at 90-degree azimuth for the side drop, unfiltered (top) and low-pass filtered (bottom).

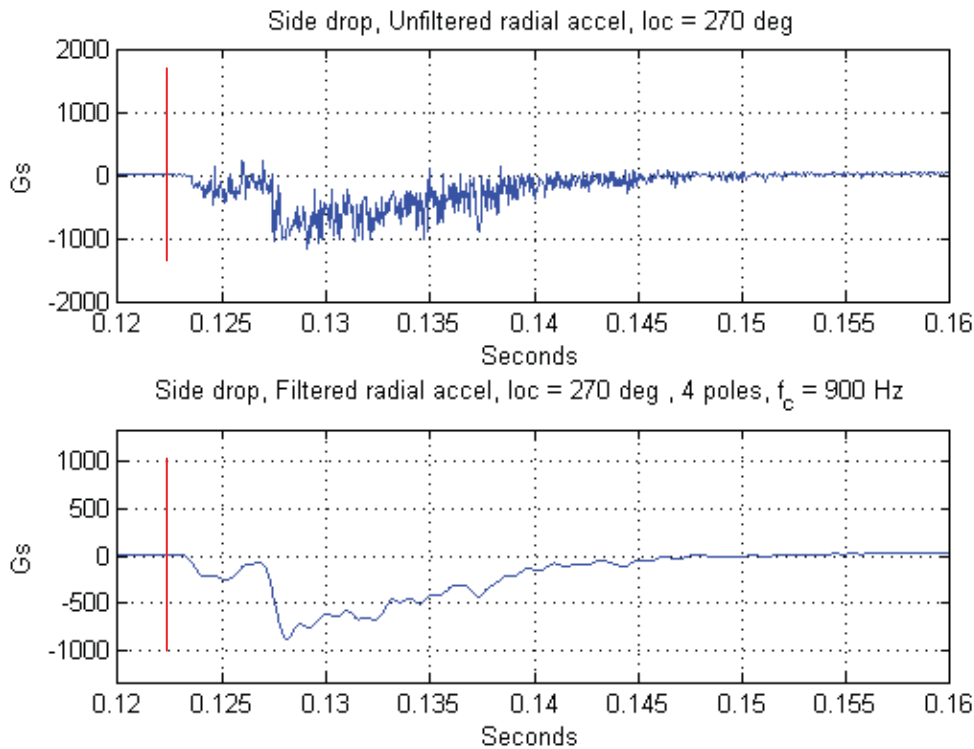


Figure 36 Signal from the radial in-cask accelerometer at 270-degree azimuth for the side drop, unfiltered (top) and low-pass filtered (bottom).

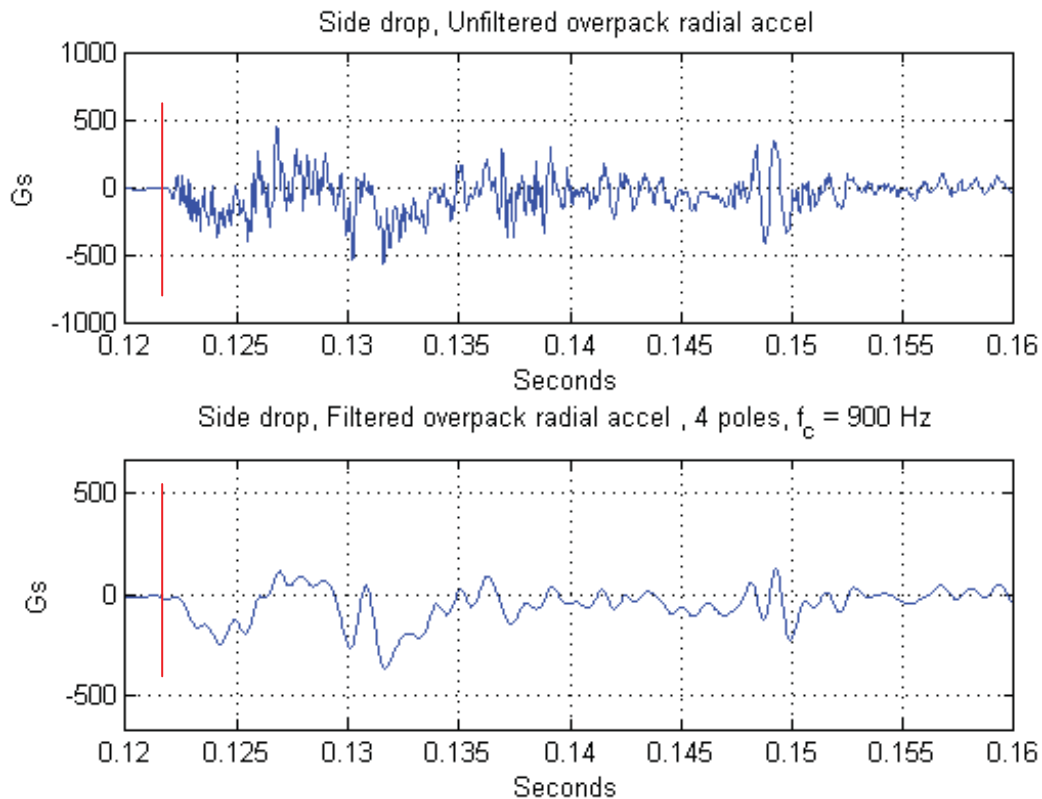


Figure 37 Signal from the radial accelerometer on the impact limiter, unfiltered (top) and low-pass filtered (bottom).

Figure 35, Figure 36, and Figure 37 show unfiltered and filtered signals from the three vertical accelerometers. The most important feature of these signals is that the in-cask accelerometers all over-ranged. They hit their 1000-g limit at time equal to approximately 0.127 seconds when a sudden negative step occurred in the acceleration. Typically with ICP accelerometers, the signal following such an over-range is not valid for a few tenths of a second. Thus, the only thing that can be said with certainty regarding cask acceleration is that it exceeded 1000 g's at the sensor location. This high level was probably caused by the secondary collisions between the heavy tungsten bricks of the shielding layer and the steel body of the cask. It's likely that the steel wool packing did not restrain the tungsten bricks as well in the radial and tangential directions as it did in the axial direction. This would account for the higher peak levels seen in the side drop compared to the end drop.

Referring to Figure 35 and Figure 36, the initial and secondary impacts are clear. The initial impact gives a peak acceleration of about 250 g's and the secondary impact gives over 1000 g's (over-range). However there is one unresolved anomaly in the data. Both radial signals go negative at both initial and secondary impacts. However the two sensors face in opposite directions and thus have signals of opposite polarities relative to upwards. One would expect their signals to be approximately the negatives of each other, at least during the initial smaller impact. At present there is no explanation for this pattern, which also occurred in the slap-down drop.



Figure 38 Cask and impact limiters following the side drop.

Figure 38 shows the cask with impact limiters after the drop. Three of the six heavy steel turnbuckles holding the impact limiters against the cask failed when their clevis pins sheared. This allowed the lower parts of the two impact limiters to move away from each other. This may have caused another secondary impact effect when the impact limiters rotated outwards as far as they could and jammed against the cask outer diameter, thus suddenly stopping the descent of the heavy cask.

7.2 High-speed video

Figure 39 shows frames from one of the three high-speed video cameras. The impact time denoted as $t = 0.000$ seconds in the video frames corresponds to $t = 0.1217$ seconds in the acceleration time histories. The video sequence shows clearly how the lower sides of the two impact limiters pulled away from each other at impact, causing the lower turnbuckles to fail. This may have been due to a wedging action of the chamfered ends of the cask against the conical section of the mating recess in the impact limiters. It might also have been caused by the centroid of the impact force against the lowest surface of each impact limiter being outboard of the cask ends, causing a rotational moment on the impact limiters.

Since there is only about $\frac{1}{4}$ inch of diametral clearance between the cask OD and the impact limiter ID, the outward rotation of the impact limiters would come up against a hard limit, which may have contributed to the secondary impact.

Following the initial impact, the package bounced to a height of about 17 inches, indicating that over 95% of the kinetic energy had been dissipated.

Using the video editing program, the elapsed time was estimated between initial impact and the instant when the cask c.g. reached zero vertical velocity. That time was 0.022 ± 0.004 seconds. The resolution of this measurement (i.e. the time between frames) was 0.002 seconds.

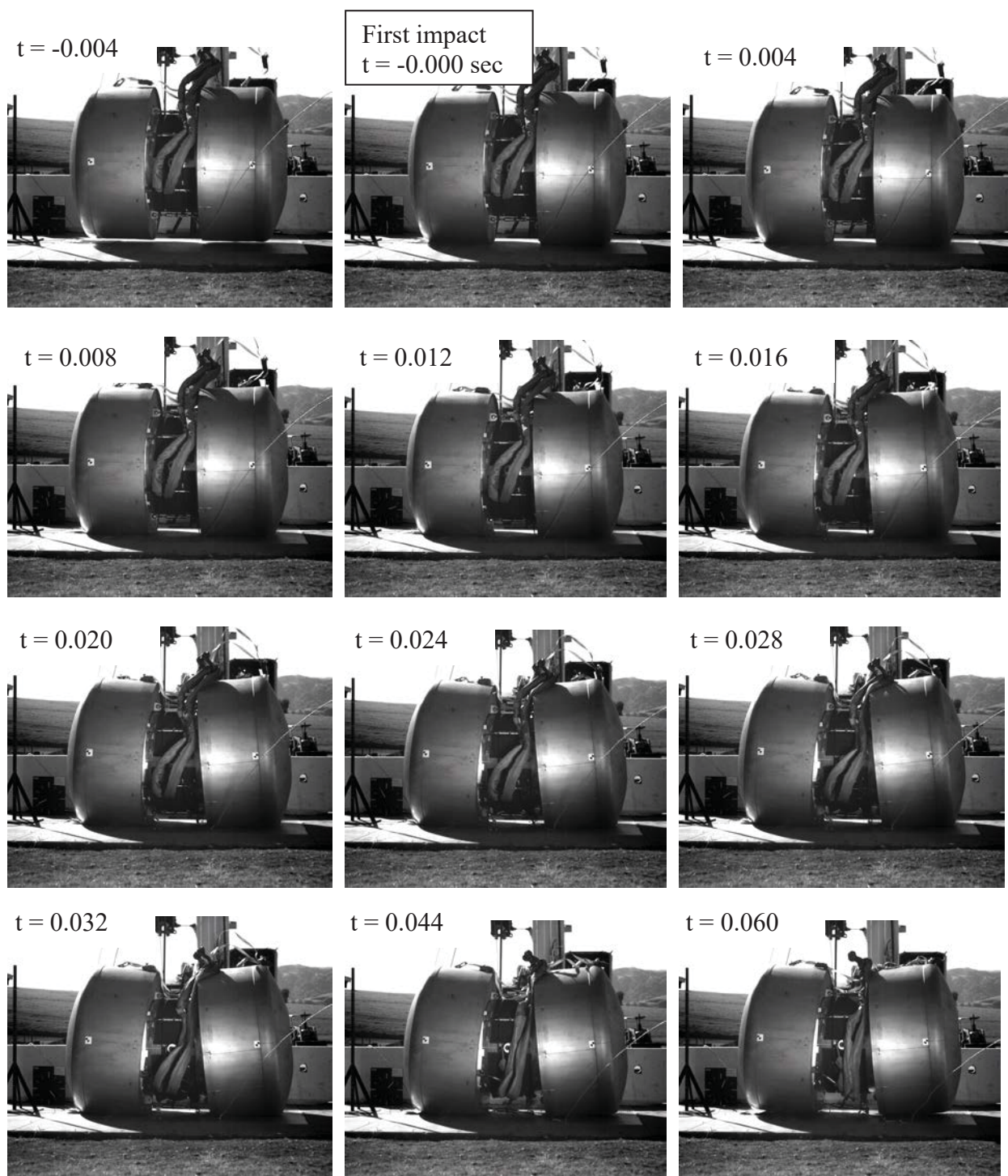


Figure 39 Frames from high-speed video of side drop

7.3 Pressure sensing film

Figure 40 shows the pressure sensing film from the side drop. Most of the impact was taken on the downward-facing part of the cask cylindrical surface (on the right in the photos), and on the



Figure 40 Pressure sensing film removed from the cask after the side drop.

downward facing part of the conical surface, as would be expected. However, there is also a significant amount of red on the paper that was on the uppermost part of the flat, circular end surfaces of the cask (blue arrows in the figure). Pressure against these areas is further evidence of secondary impact after the turnbuckles failed, the impact limiters rotated outwards, and their lower parts moved away from each other.

7.4 Deformation measurements

Table 4 shows the measured cask profile deviation from the design nominal before and after the side drop. The conclusion from these was that no significant damage to the cask had occurred.

Table 4 Measurements of the cask before and after side-drop.

Deviation	Cask state at measurement	
	After end drop Before side drop	After side drop Before slap-down drop
Maximum	0.0046	0.0053
Minimum	-0.0101	-0.0109

Figure 41 shows one of the impact limiters after removal from the cask. One of the welds between the conical and cylindrical sections has split open, revealing the energy absorbing foam within. Figure 42 shows an overlay of the measured impact limiter profiles before and after the side drop.



Figure 41 Damage to impact limiter from side drop.

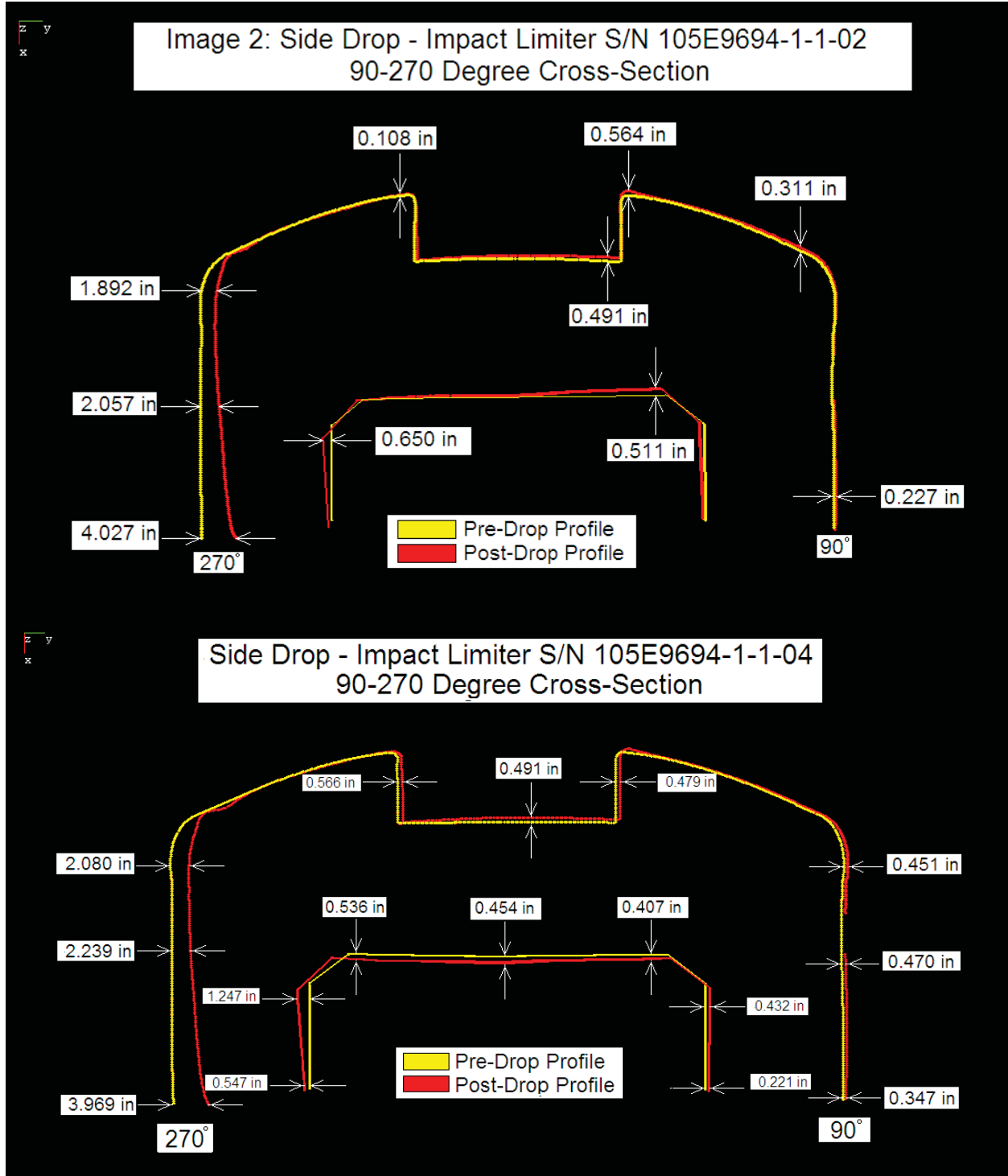


Figure 42 Profiles of the impact limiters before and after the side drop.

7.5 *Leak rate test*

The cask was leak tested following the side drop and was found to meet specification. It was concluded that no degradation had occurred in the seal integrity of the cask.

8. Results: Slap-down drop



Figure 43 Package rigged for the slap-down drop.

Figure 43 shows the package rigged for the slap-down drop. The weight of the package is held by the brown rigging straps which lift at the cask trunnions. The yellow straps on either side were adjusted to hold the package such that its left end was about 10 inches higher than its right end. This had been determined by analysis to be the worst case. The lid end of the cask is on the left in the photo. The impact limiters on the left and right will be referred to as the “lower” and “higher” respectively.

8.1 Acceleration measurements

For the slap-down drop, the two radial accelerometers inside the cask were oriented 7.7 degrees off the vertical direction, facing in opposite directions. The sensor at 90 degrees azimuth faced

downwards so upwards acceleration gave a negative signal from this sensor. Figure 44 shows the signals from these two sensors.. Initial impact was at time = 0.0746 seconds

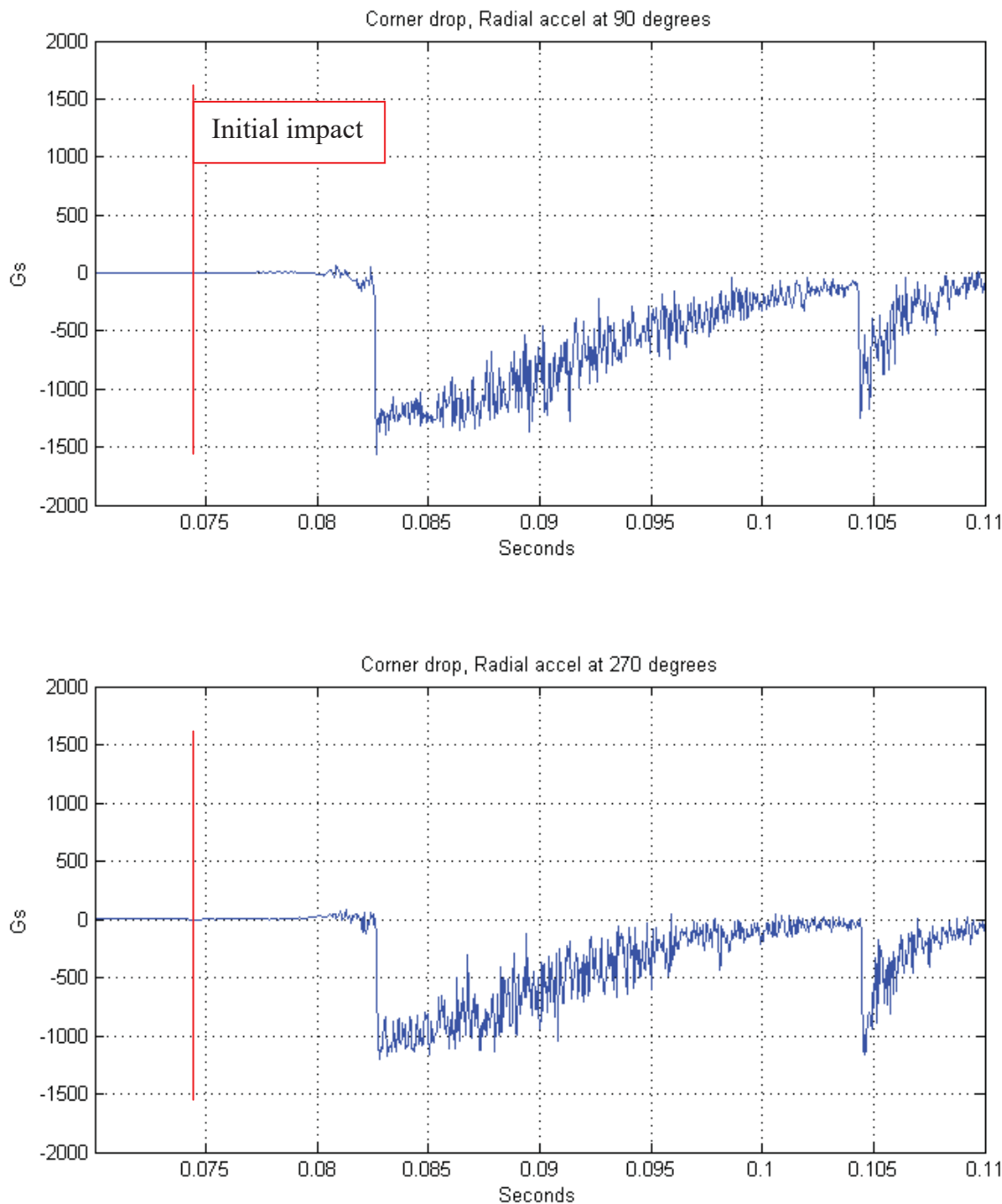


Figure 44 Near-vertical accelerations measured inside the cask for the slap-down drop.

Figure 45 shows the triaxial signals from the sensors on the impact limiter. The radial accelerometer on the impact limiter is again closest to vertical and faces downward. Upwards acceleration gives a negative signal from this sensor.

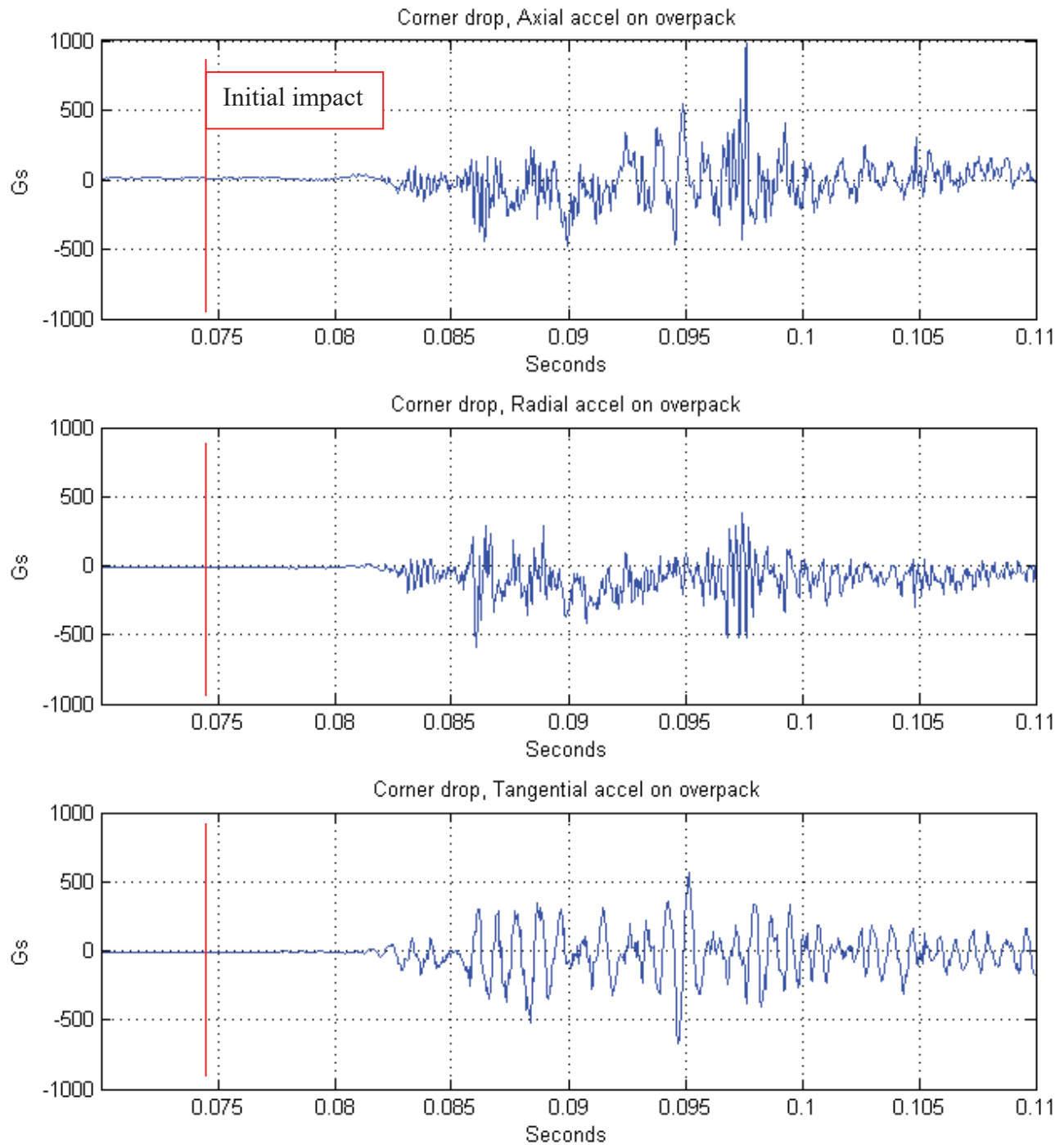


Figure 45 Accelerations measured on the impact limiter during the slap-down drop.

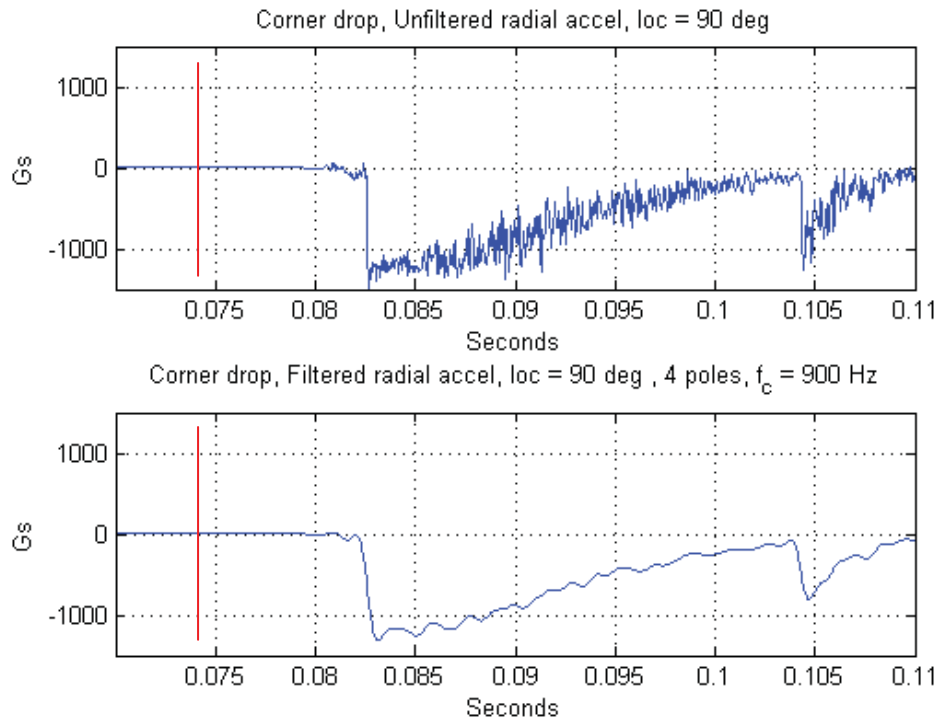


Figure 46 Signal from the radial in-cask accelerometer at 90-degree azimuth for the slap-down drop, unfiltered (top) and low-pass filtered (bottom).

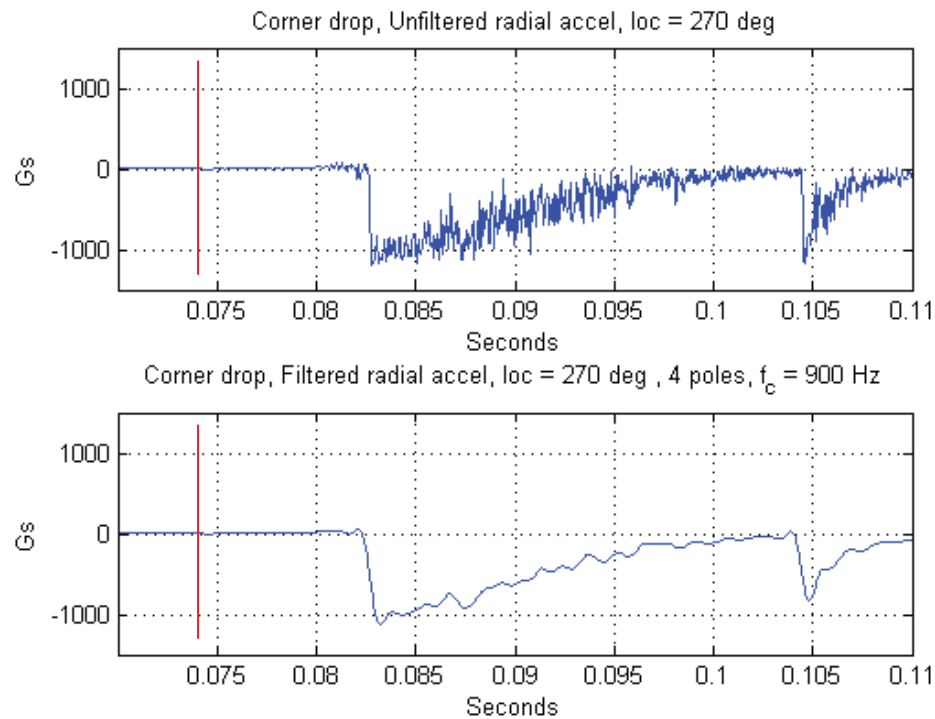


Figure 47 Signal from the radial in-cask accelerometer at 270-degree azimuth for the slap-down drop, unfiltered (top) and low-pass filtered (bottom).

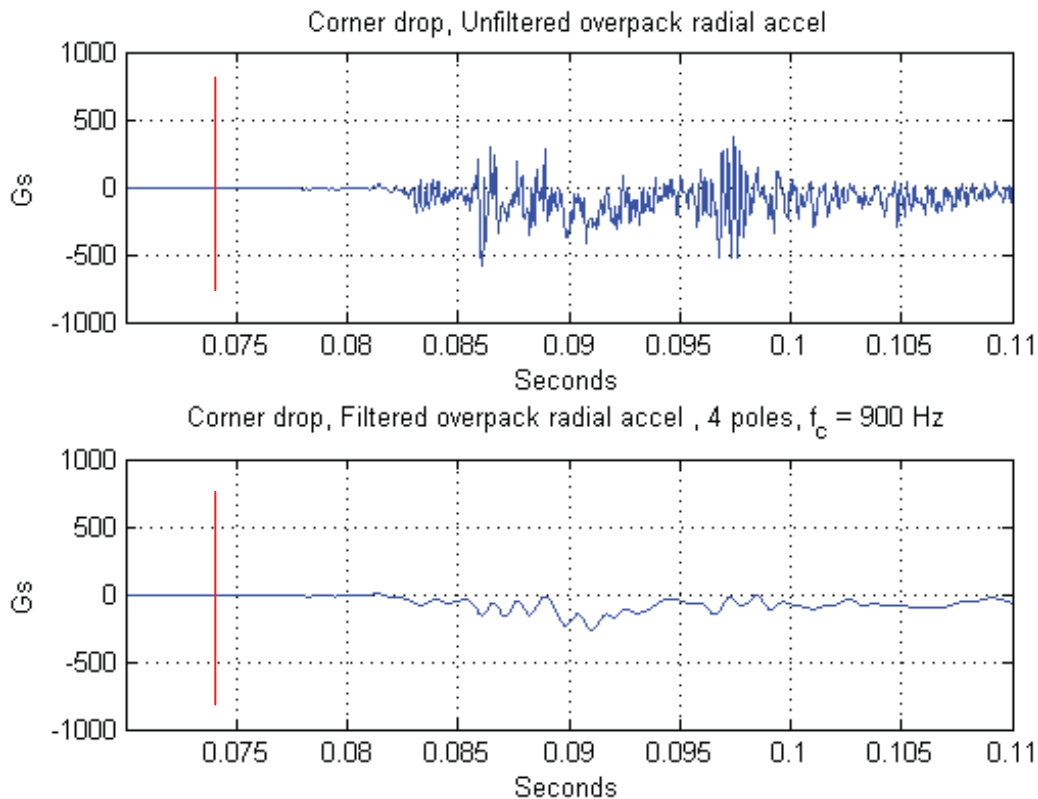


Figure 48 Signal from the radial accelerometer on the impact limiter during the slap-down drop, unfiltered (top) and low-pass filtered (bottom).

Referring to Figure 44, there are two major events, one at 0.0822 seconds and one at 0.1042 seconds. Comparing this time interval to the high-speed video (Figure 49), these two impacts are obviously due to the initial strike of the lower impact limiter (on the left in Figure 49) and the strike of the higher impact limiter (on the right in Figure 49). Like the side drop, the initial impact causes the accelerometers to over-range so the only quantitative conclusion that can be drawn is that the accelerometers saw over 1000 g's. The exact peak level is unknown.

The slap-down drop also produced the same unexplained polarity as the side drop: both in-cask radial accelerometer signals went negative at the major impact events. Taken literally, these signals would indicate that the round cross section of the cask ID was deforming suddenly into an oval, with the 90 and 270-degree azimuthal locations moving away from each other. At present, there is no satisfactory explanation for this phenomenon.

8.2 High-speed video

Figure 49 shows frames from one of the three high-speed video cameras from the slap-down drop. The impact time denoted as $t = 0.000$ seconds in the figure corresponds to $t = 0.0746$ seconds in the acceleration time histories. The turnbuckles holding the impact limiters for this

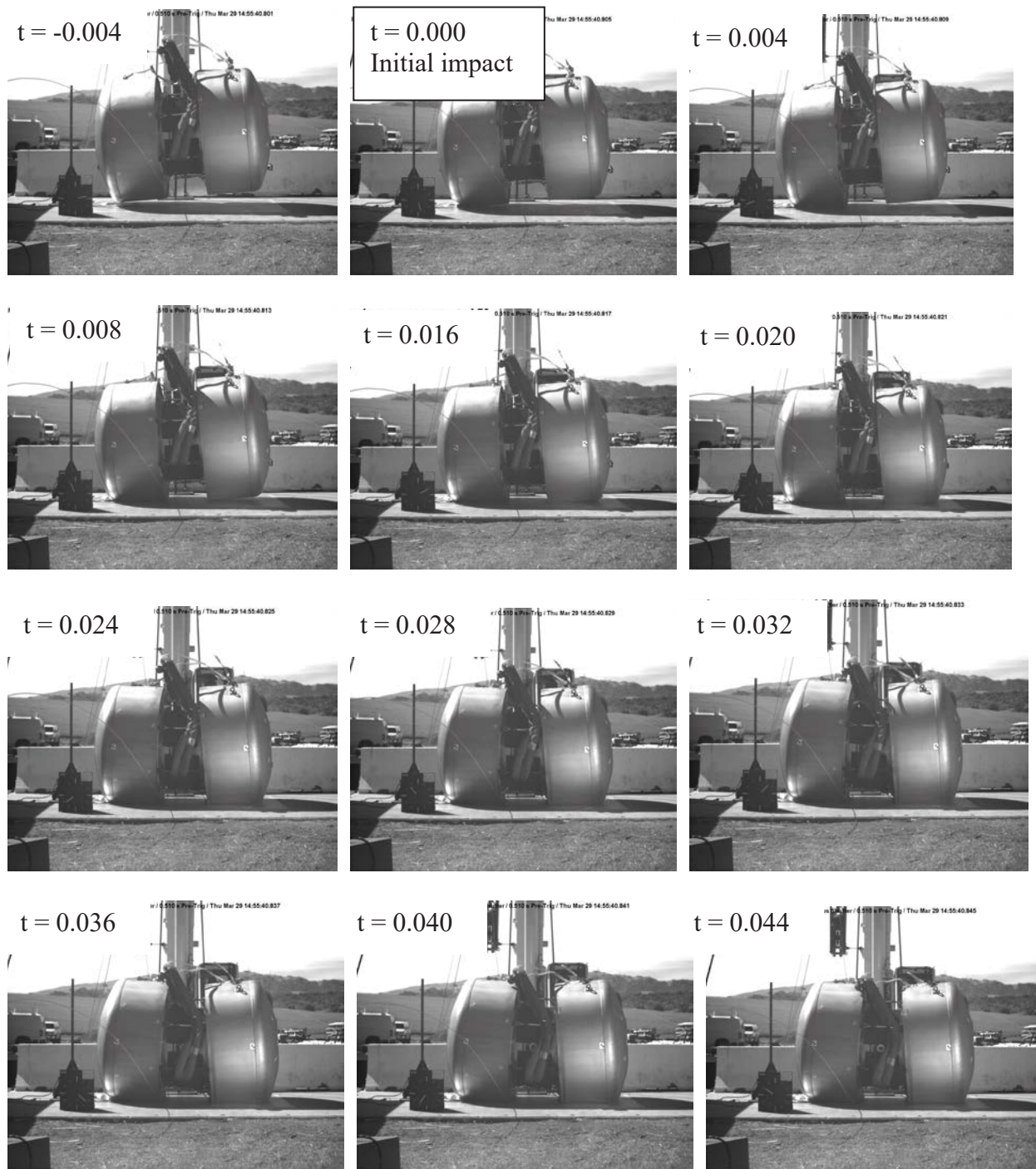


Figure 49 Frames from high-speed video of slap-down drop.

drop used heavier clevis pins which did not break on impact. However the upper turnbuckles buckled which caused them to become shorter so there was still considerable relative rotation between the two impact limiters, as evident in the video frames. Figure 50 shows the uppermost turnbuckle following the drop.

Using the video editing program, the elapsed time was estimated between initial impact and the instant when the cask c.g. reached zero vertical velocity. That time was 0.028 ± 0.004 seconds. Unlike the first two drops, the cask kinetic energy had not been completely dissipated at the zero velocity instant since there was still significant rotational velocity present. The resolution of this measurement (i.e. the time between frames) was 0.002 seconds.

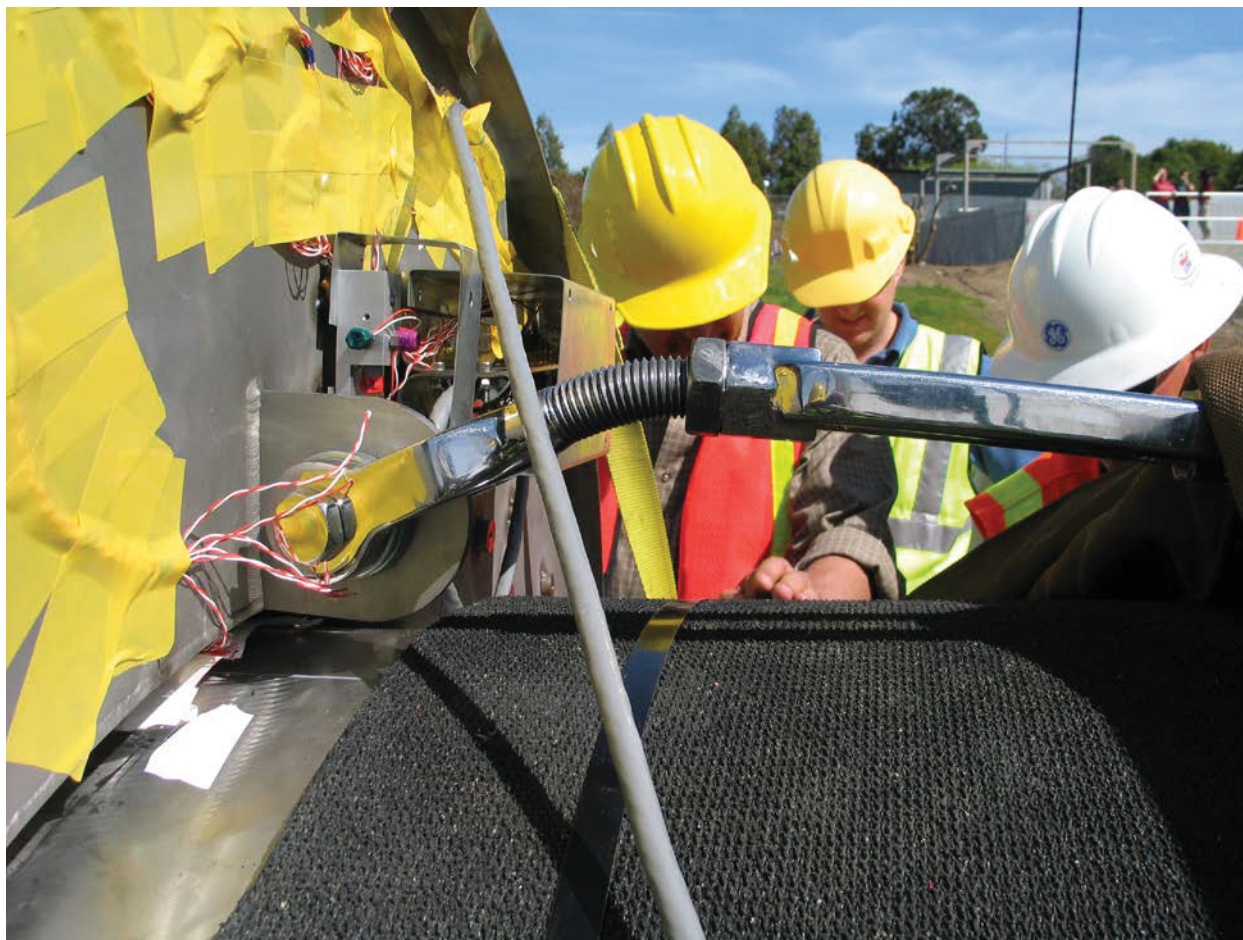


Figure 50 Uppermost turnbuckle after the slap-down drop.

Figure 50 also shows how the wires from the in-cask accelerometers were crushed and cut by being pinched between the impact limiter and the cask. In this case the relative rotation between the impact limiters and the cask was sufficient to pinch the cables, in spite of the 1/8th-inch-diameter protective rods on either side of the cable. Figure 50 shows that the diametral clearance between cask and impact limiter has been increased to well over an inch by deformation of the impact limiter. In an undeformed impact limiter, this clearance is only about 1/4th inch. Fortunately, the cable fault did not occur until about 25 milliseconds after the end of the main acceleration event so the important data was recorded.

Following the impact of the higher impact limiter against the ground, the package rotated counterclockwise (in the view of Figure 49) and its mass center rose approximately 25 inches,

indicating that about 93.3 percent of the kinetic energy was dissipated. Figure 51 shows the highest point in the first bounce.



Figure 51 Highest point in the first bounce during the slap-down drop.

8.3 Pressure sensing film

Figure 52 shows the pressure sensing film removed after the slap-down drop. The pattern of pressure between the cask and impact limiter is quite similar to that from the side drop.



Figure 52 Pressure sensing film removed from the cask and impact limiters after the slap-down drop.

8.4 Deformation measurements

Table 5 shows the measured cask profile deviation from the design nominal before and after the slap-down drop. The conclusion from these was that no significant damage to the cask had occurred.

Table 5 Measurements of cask before and after the slap-down drop.

Deviation	Cask state at measurement	
	After side drop	After slap-down drop
	Before slap-down drop	
Maximum	0.0053	0.0047
Minimum	-0.0109	-0.0105

Figure 53 shows the deformation suffered by the impact limiter that was on the higher end of the cask. Figure 54 shows overlays of the measured impact limiter profiles before and after the slap-down drop. The lower part of the figure shows how much the inner diameter of the impact limiter was deformed when it rotated relative to the cask on impact.



Figure 53 Damage to the impact limiter from the "slap-down" end of the cask.

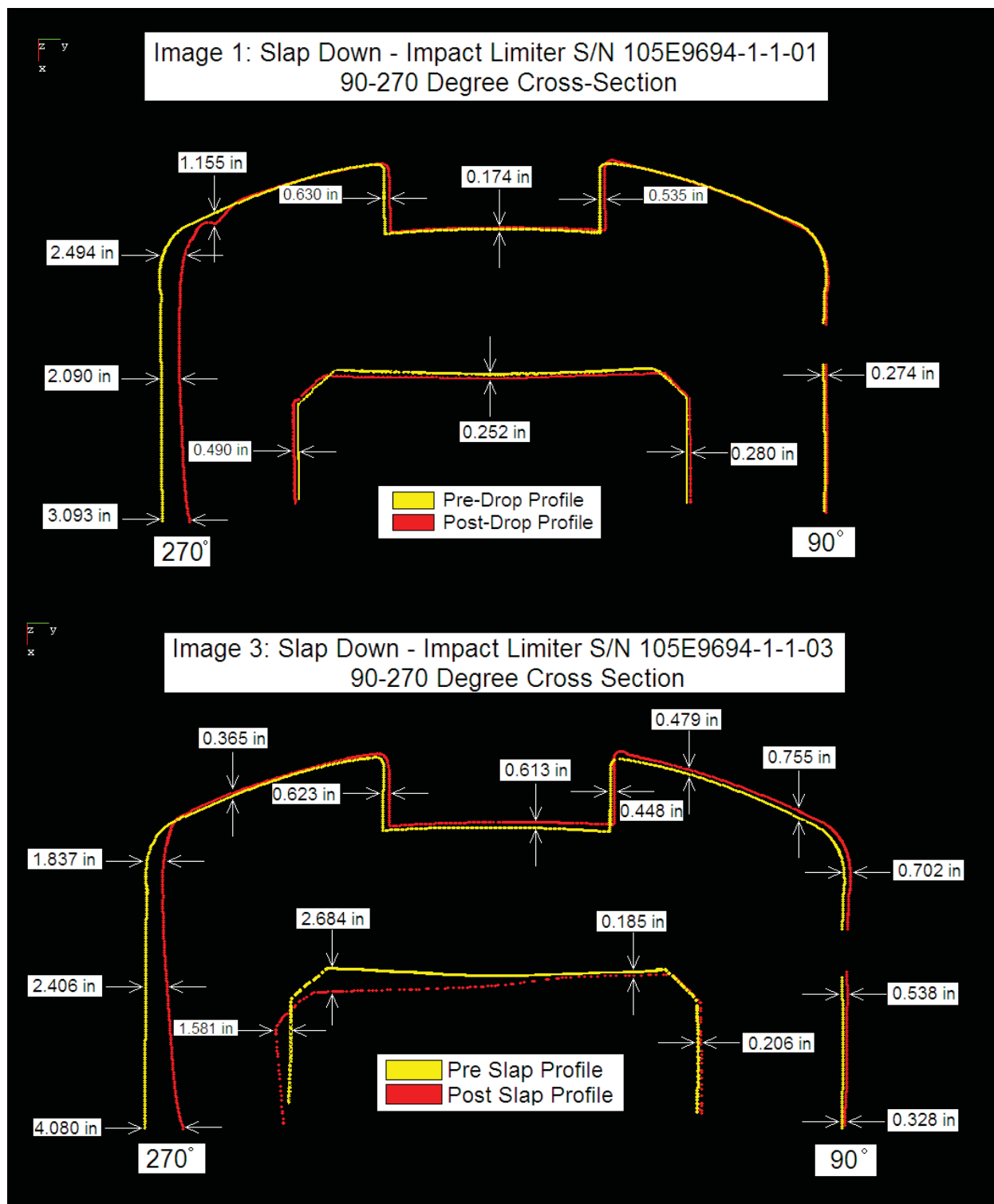


Figure 54 Profiles of the higher (top) and lower (bottom) impact limiters before and after the slap-down drop.

8.5 Leak rate test

The cask was leak tested following the slap-down drop and was found to meet specification. It was concluded that no degradation had occurred in the seal integrity of the cask.

9. Conclusions

The objectives, methods, and results of the drop test have been presented. The primary conclusions are as follows.

1. The cask and impact limiters passed the test. The cask passed its helium leak rate test before the first drop and after each of the three drops. No significant deformation of the cask was measured after any of the drops.
2. Measured peak accelerations are not usable for evaluating the accuracy of analytical predictions of cask and impact limiter behavior. Peak acceleration measured on the cask inner surface appears to be caused by secondary impacts between the internal tungsten shielding blocks and the steel cask body. The response to these impacts is not primarily dependent on impact limiter design.
3. Several measured acceleration time histories contained unexplained features. In particular, they did not exhibit a polarity consistent with the large decrease in downward velocity (i.e. upward acceleration) that had to exist at impact.
4. Two of the three drops caused accelerometers measuring in the vertical or near-vertical direction to exceed their 1000-g range. Therefore the waveform indicated by these accelerometers following the over-range is probably corrupted. The only conclusion that can be drawn from these data is that the peak acceleration exceeded 1000 g's at the sensor location. Acceleration data from the end drop is not over-ranged and should be accurate throughout the transient duration.
5. The high-speed video data allowed a reasonably accurate estimate to be made of the total elapsed time for deceleration of the cask c.g. from its impact velocity to zero. This data may be of use in evaluating the accuracy of the analytical predictions.

2.12.6.2 Free-Drop Test Activity Record – Pre- and Post-Leak Test

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AOS-165 TRANSPORT PACKAGE FREE DROP TEST ACTIVITY RECORD

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Step No. Activity Completed Date

4.4 • Pre-test leak test performed (continue).
 Temp. of CL: 60° C Temp. Corrected Leak Rate: _____
 Thermometer Type: Digital S/N: 1894 Cal. Due: 05/15/2007
 TEST PARAMETERS:
 Tracer Gas: Helium Concentration of Cylinder 2103348 WBA 43.07
 Ambient Temp: 60°F Acceptance Criteria: 2.44x10⁻⁷
 TEST RESULTS: (Seal Joint)
 Pre-Cal. Rate: 2.3x10⁻⁹ Leak Rate: 2.3x10⁻⁹ Post-Cal Rate: 2.4x10⁻⁹
 Test Results: Accept/Reject. Performer: R. Bonar Level: III Cert. No. GE026
 COMMENTS: Tested Gasket only

TEST RESULTS: (Vent Port Plug)
 Pre-Cal. Rate: _____ Leak Rate: _____ Post-Cal Rate: _____
 Test Results: Accept/Reject. Performer: _____ Level: _____ Cert. No. _____
 COMMENTS: N/A Used Ranor, Inc. Test Results.

TEST RESULTS: (Drain Port Plug)
 Pre-Cal. Rate: _____ Leak Rate: _____ Post-Cal Rate: _____
 Test Results: Accept/Reject. Performer: _____ Level: _____ Cert. No. _____
 COMMENTS: N/A Used Ranor, Inc. Test Results

Additional Comments:

Activities Completed:


 Project/Test Engineering


 QA/QC Engineering

AOS-165 TRANSPORT PACKAGE FREE DROP TEST ACTIVITY RECORD

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Step No.	Activity	Completed	Date
D.0	Post-Test - Orientation: <u>END Drop</u> Date: <u>3-19-07</u> Time: <u>8:00 AM</u>		
.1	Videotape cameras stopped.	RJP	3/19/07
.2	Acceleration signal tapes replayed.	RJP	3/19/07
.3	Videotape replayed and package orientation at impact checked.	RJP	3/19/07
.4	Still photos of package taken.	RJP	3/19/07
.5	Impact limiter(s) removed and still photos of the package taken.	RJP	3/19/07
.6	Pressure-sensing film removed, marked, and packed for safe storage.	RJP	3/19/07
.7	Dimensional inspection of the cask and impact limiter(s) taken.	OK	3/19/07
.8	Pre-test leak test performed.	RJP	3/20/07

TEST EQUIPMENT:

MSLD: Mfr: ACATOR Model: 1806 S/N na
Calibrated Leak (CL) S/N: 3437 Leak Rate: 2×10^{-9} Cal. Due: 11/02/2007Temp. of CL: 58°F C/F. Temp. Corrected Leak Rate:Thermometer Type: Digital Thermo SDA S/N: 12947 Cal. Due: 05/15/2007
C163348 HBA 4.3.07 HBA 4.3.07

TEST PARAMETERS:

Tracer Gas: Helium Concentration of Cylinder 99.95% Cylinder ID: 102-227-5-HE-5Ambient Temp: 61.5 C/F. Acceptance Criteria: 1.98×10^{-7}

TEST RESULTS:

Pre-Cal. Rate: 2.3×10^{-9} Leak Rate 9×10^{-9} Post-Cal Rate: 2.3×10^{-9} Test Results: Accept/Reject Performer: R. DOMARCO Level: III Cert. No. C260

COMMENTS:

Activities Completed:

David A. Kienhof
Project/Test EngineeringHansel Anderson
QA/QC Engineering

BCE T AOS QA

.9 COMMENTS:

36 Rev. 3
35 HBA 4.3.07

AOS-165 TRANSPORT PACKAGE FREE DROP TEST ACTIVITY RECORD

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9 16844.4-0

Step No.

Activity

Completed Date

.4.4

- Pre-test leak test performed (continue).

 Temp. of CL: 58.8 °C Temp. Corrected Leak Rate: 1.97×10^{-7}
 Thermometer Type: Digital S/N: 1594 Cal. Due: 05/15/2007
2103348 HGA 43.07

TEST PARAMETERS:

 Tracer Gas: Helium Concentration of Cylinder welding grade % Cylinder ID: 102-227-S-HE-E
 Ambient Temp: 63.3 °C Acceptance Criteria: 1.98×10^{-7}

TEST RESULTS: (Seal Joint)

 Pre-Cal. Rate: 2.4×10^{-9} Leak Rate: 2.6×10^{-9} Post-Cal Rate: 2.10×10^{-9}
 Test Results: Accept/Reject. Performer: R/P Level: III Cert. No. 0260
 COMMENTS:

TEST RESULTS: (Vent Port Plug)

 Pre-Cal. Rate: 2.6×10^{-9} Leak Rate: 2.1×10^{-7} Post-Cal Rate: 2.1×10^{-7}
 Test Results: Accept/Reject. Performer: R/P Level: III Cert. No. 0260
 COMMENTS: Model model 180T

TEST RESULTS: (Drain Port Plug)

 Pre-Cal. Rate: 2.1×10^{-7} Leak Rate: 1.8×10^{-8} 4.4.07 4.4.07 Post-Cal Rate: 2.1×10^{-7}
 Test Results: Accept/Reject. Performer: R/P Level: III Cert. No. 0260
 COMMENTS: Varian model 979

Additional Comments:

Cost side of gasket pressurize to 15 Psi Helium
And held for 5 minute with no leakage.
Pressure gauges S/N 003 and S/N 004 are both due
for calibration the 33rd week of 2007.

Activities Completed:

L. FOMARES
 Project/Test Engineering

Howard Anderson
 QA/QC Engineering

AOS-165 TRANSPORT PACKAGE FREE DROP TEST ACTIVITY RECORD

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Step No.	Activity	Completed	Date
D.0	Post-Test - Orientation: <u>Side Drop</u> Date: <u>3/24/07</u> Time: <u>5:00P</u>		
.1	Videotape cameras stopped.	DAK	3/24/07
.2	Acceleration signal tapes replayed.	DAK	3/24/07
.3	Videotape replayed and package orientation at impact checked.	DAK	3/24/07
.4	Still photos of package taken.	DAK	3/24/07
.5	Impact limiter(s) removed and still photos of the package taken. <i>Remove one panel.</i>	DAK	3/24/07
.6	Pressure-sensing film removed, marked, and packed for safe storage.	DAK	3/24/07
.7	Dimensional inspection of the cask and impact limiter(s) taken.	DAK	3/24/07
.8	Pre-test leak test performed.	DAK	3/24/07

TEST EQUIPMENT:

MSLD: Mfr: varian Model: 979 S/N LL34016
 Calibrated Leak (CL) S/N: 3437 Leak Rate: 2.4×10^{-7} Cal. Due: 11-02-07
 Temp. of CL: 58.6 °C Temp. Corrected Leak Rate: 1.97×10^{-7}
 Thermometer Type: Digital S/N: 1894 Cal. Due: 5-15-07

TEST PARAMETERS:

Tracer Gas: Helium Concentration of Cylinder 99.999% Cylinder ID: 102-227-5-HE-5
 Ambient Temp: 46.4 °C Acceptance Criteria: 1.94×10^{-7}

TEST RESULTS:

Pre-Cal. Rate: 1.97×10^{-7} Leak Rate 2.3×10^{-8} Post-Cal Rate: 1.97×10^{-7}
 Test Results: Accept/Reject. Performer: RP Level: HL Cert. No. 0260

COMMENTS:

Activities Completed:

Project/Test Engineering

QA/QC Engineering

.9 COMMENTS:

AOS-165 TRANSPORT PACKAGE FREE DROP TEST ACTIVITY RECORD

HBA 4/21/07
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 HBA 4-4-07

Step No. Activity Completed Date

4.4

- Pre-test leak test performed (continue).

Temp. of CL: 56.4 °C Temp. Corrected Leak Rate: _____
 Thermometer Type: Digital S/N: 1894 Cal. Due: 5-15-2007

TEST PARAMETERS:

Tracer Gas: Helium Concentration of Cylinder 5.103348 % Cylinder ID: 102-2275-HE-5

Ambient Temp: 41.4 °C Acceptance Criteria: _____

TEST RESULTS: (Seal Joint)

Pre-Cal. Rate: 2.5×10^{-9} Leak Rate: 2.3×10^{-8} Post-Cal Rate: 2.5×10^{-9}

Test Results: Accept/Reject. Performer: RJP Level: III Cert. No. 0260

COMMENTS: _____

TEST RESULTS: (Vent Port Plug)

Pre-Cal. Rate: 2.5×10^{-9} Leak Rate: 2.3×10^{-8} Post-Cal Rate: 1.3×10^{-6}

Test Results: Accept/Reject. Performer: RJP Level: III Cert. No. 0260

COMMENTS: _____

TEST RESULTS: (Drain Port Plug)

Pre-Cal. Rate: 2.5×10^{-9} Leak Rate: 2.3×10^{-8} Post-Cal Rate: 2.5×10^{-6}

Test Results: Accept/Reject. Performer: RJP Level: III Cert. No. 0260

COMMENTS: _____

Additional Comments:

Post pressurize with 15 psi Helium for five (5) minutes with no leakage.

Pressure gauges used S/N 003 and S/N 004 were calibrated week 33 of 2006 and are due for calibration week 33 of 2007.

Activities Completed:

R. POMAREJ
 Project/Test Engineering

Harold Pender
 QA/QC Engineering

AOS-165 TRANSPORT PACKAGE FREE DROP TEST ACTIVITY RECORD

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Step No.	Activity	Completed	Date
D.0	Post-Test - Orientation: <u>Slap down</u> Date: <u>3-29-07</u> Time: <u>4:10 PM</u>		
.1	Videotape cameras stopped.	<u>WBS</u>	<u>3-29-07</u>
.2	Acceleration signal tapes replayed.	<u>ST</u>	<u>3/29/07</u>
.3	Videotape replayed and package orientation at impact checked.	<u>WBS</u>	<u>3-29-07</u>
.4	Still photos of package taken.	<u>RFP</u>	<u>3/29/07</u>
.5	Impact limiter(s) removed and still photos of the package taken.		
.6	Pressure-sensing film removed, marked, and packed for safe storage.		
.7	Dimensional inspection of the cask and impact limiter(s) taken.		
.8	Pre-test leak test performed.		

TEST EQUIPMENT:

MSLD: Mfr: Alctel Model: 180t S/N _____
Calibrated Leak (CL) S/N: 3437 Leak Rate: 2.61×10^{-9} Cal. Due: 11-02-07Temp. of CL: 55° CB Temp. Corrected Leak Rate: 2.56×10^{-9}
Thermometer Type: Digital Therm S/N: 1894 Cal. Due: 5-15-07

TEST PARAMETERS:

Tracer Gas: Helium Concentration of Cylinder 99.999% Cylinder ID: 102-227-5-HE-5
Ambient Temp: 59° CF Acceptance Criteria: 1.97×10^{-7} TEST RESULTS:
Pre-Cal. Rate: 2.61×10^{-9} Leak Rate: 2.61×10^{-9} Post-Cal Rate: 2.4×10^{-9} Test Results: Accept/Reject. Performer: RFP Level: III Cert. No. 0260

COMMENTS:

Activities Completed:

James
Project/Test EngineeringHoward
QA/QC Engineering

.9 COMMENTS:

2.12.7 Dimensional Inspection Report

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RANOR / GE Energy / AOS
AOS-165 Cask Drop Test
Dimensional Summary Report No. 109699-01 (4-23-07)

RANOR Purchase Order No.: 109699

Part Names: AOS-165 Cask Assembly and Impact Limiters
Document References: Drawing Nos. 105E9692 Rev. 2; 105E9694 Rev. 3;
Specification No. 22A9418 Rev. 3
Serial Numbers: AOS-165 105E9693-1 (RANOR S/N 050280-01)
AOS-165 105E9694-1-1-01 (RANOR S/N 060452-01)
AOS-165 105E9694-1-1-02 (RANOR S/N 060452-02)
AOS-165 105E9694-1-1-03 (RANOR S/N 060452-03)
AOS-165 105E9694-1-1-04 (RANOR S/N 060452-04)
AOS-165 105E9694-1-1-05 (RANOR S/N 060452-05)
Inspection Dates: March 16-30, 2007
Attachments: FARO Calibration Certificate No. 4655 (10-19-2006)

Inspection Conditions:

Location: GE Nuclear Energy Vallecitos Nuclear Center Sunol, CA 95486
Material: Stainless Steel
Measurement Units: Inches

East Coast Metrology was contracted by RANOR, Inc. for performance of On-Site Laser Tracker Inspection Services of the AOS-165 Cask Assembly and Impact Limiters fabricated by RANOR. The items were located at GE Nuclear Energy Vallecitos Nuclear Center 6705 Vallecitos Road Sunol, CA 95486.

East Coast Metrology utilized a FARO Laser Tracker Model X System, Serial No. X01000601930 for performing the dimensional inspections. The equipment has been calibrated by the manufacturer - FARO Technologies Kennett Square, PA 19348 on October 18, 2006, calibration due October 18, 2007 (FARO Calibration Certificate Number 4655) using standards traceable to the National Institute of Standards and Technology (NIST).

All dimensional inspection was performed under the direction and observation of GE Nuclear Energy Raul Pomares, Project Manager for the AOS-165 Cask Assembly and components.

The AOS-165 Cask Assembly and accompanying Impact Limiters were inspected by *East Coast Metrology* before and after each drop test to determine the extent of deformation due to each type of drop. Each component was scanned and compared to its corresponding CAD model using a Laser Tracker. See the following for a summary of the inspections and data.

AOS-165 Cask Assembly:

For each set of scan data for the Cask, the 0, 90, 180, and 270 degree profiles were scanned. An alignment using the axis of the cylindrical part of the cask as the controlling datum was used. This axis was then intersected with the “Lid End” of the Cask and a point was constructed. Another point was measured at the 90 degree lifting lug to establish the other axis. This alignment was repeated for each measurement of the Cask.

The table below, *Table 1*, shows the maximum and minimum deviations of the profiles of the Cask when compared to its CAD model for each drop test. The maximum (positive) deviations indicate the profile of the Cask was larger than that of the model. Similarly, the minimum (negative) deviations indicate that the profile of the Cask was smaller than that of the model.

Table 1: Cask Assembly Pre- and Post- Drop Profile Deviations from CAD Model (inches)

Cask Condition	Pre End Drop	Post End Drop	Post Side Drop	Post Slap Down
Maximum Deviation	0.0068	0.0046	0.0053	0.0047
Minimum Deviation	-0.0094	-0.0101	-0.0109	-0.0105

Over the course of all three drop tests, the maximum deviations varied by a total of 0.0022 inches, while the minimum deviations varied by a total of 0.0015 inches. This indicates that the effect of the drop tests had a negligible impact on the profile of the Cask.

Below is a sample of the Cask profile from the Pre- End Drop scan. There are 2 pictures, *Image A* is the 0-180 Cross-Section of the Cask, and *Image B* is the 90-270 Cross-Section. The red areas represent the positive (maximum deviations) and the yellow areas represent the negative (minimum deviations).

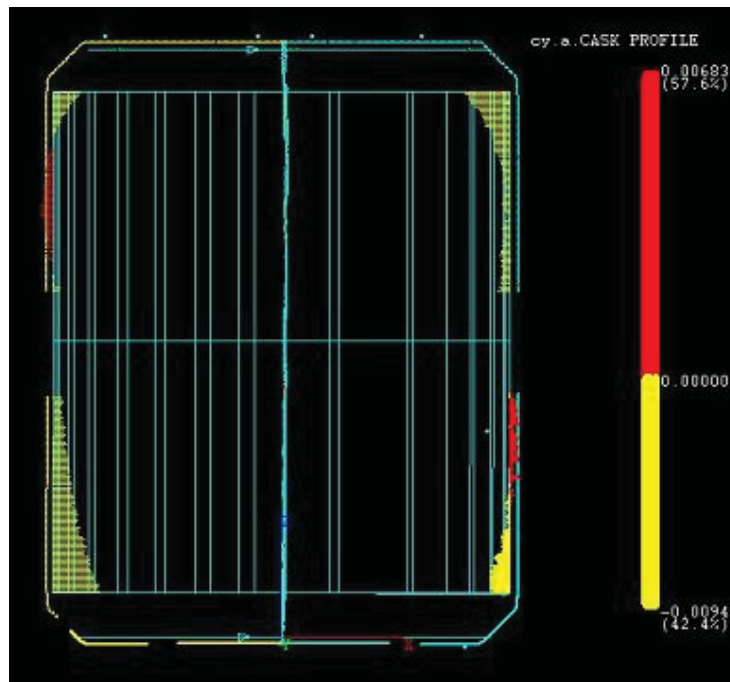


Image A: Cask Assembly Pre-End Drop Scan Data, 0-180 Degree Cross-Section

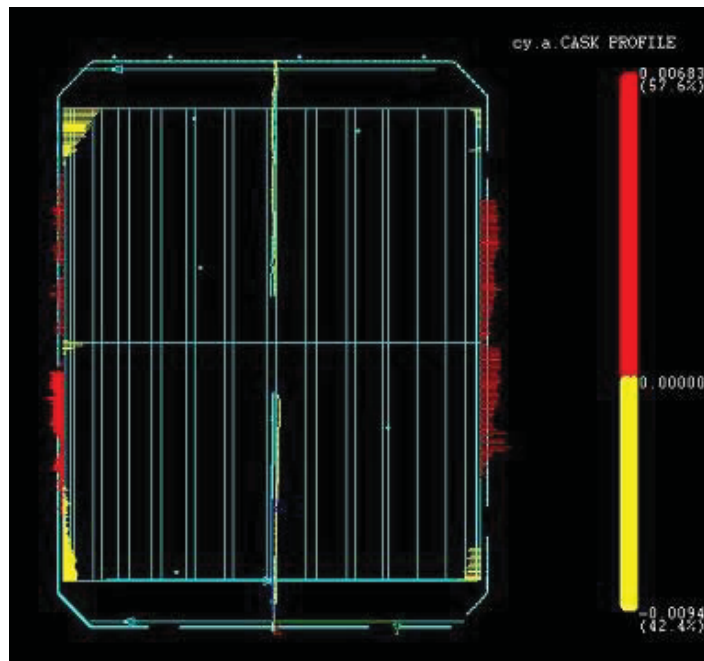


Image B: Cask Assembly Pre-End Drop Scan Data, 90-270 Degree Cross-Section

AOS-165 Cask Impact Limiter Assemblies:

For the Impact Limiters, scan data was taken at the 0, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300 and 330 degree profiles. In order to compare each impact limiter in its pre- and post-drop condition, an alignment using the bottom perimeter (opposite the domed-end), measured as a circle, was used as a reference. By measuring it as a circle, the center point and vector of the measured circle were established. The portions of this circle that were deformed due to each drop test were not used in this calculation. The vector of this axis was defined to be the primary datum in this alignment. A point was then measured at the 90 degree lifting lug to establish the second axis in the coordinate system. This process provided the only repeatable means to align each impact limiter and subsequently compare the results.

Once the pre- and post-drop scan data was collected for each Impact Limiter, the 90-270 degree profile cross-sections were overlaid in order to calculate the magnitude of deformation for each drop. In the images below, each Impact Limiter has been analyzed in this manner and the deformations reported. They are listed below in the same order that the drop tests occurred: End Drop (Impact Limiter 5), Side Drop (Impact Limiters 1 & 3) and Slap Down (Impact Limiters 2 & 4).

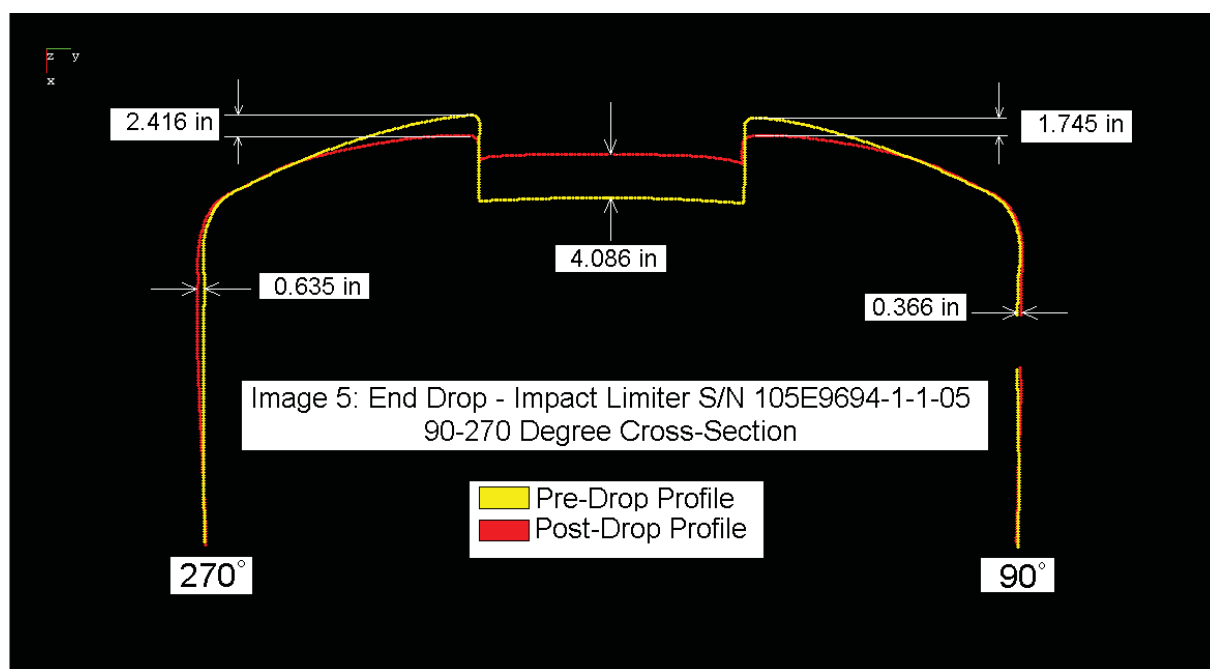


Image 5: Impact Limiter Serial No. 105E9694-1-1-05 - End Drop Cross-Section Overlay

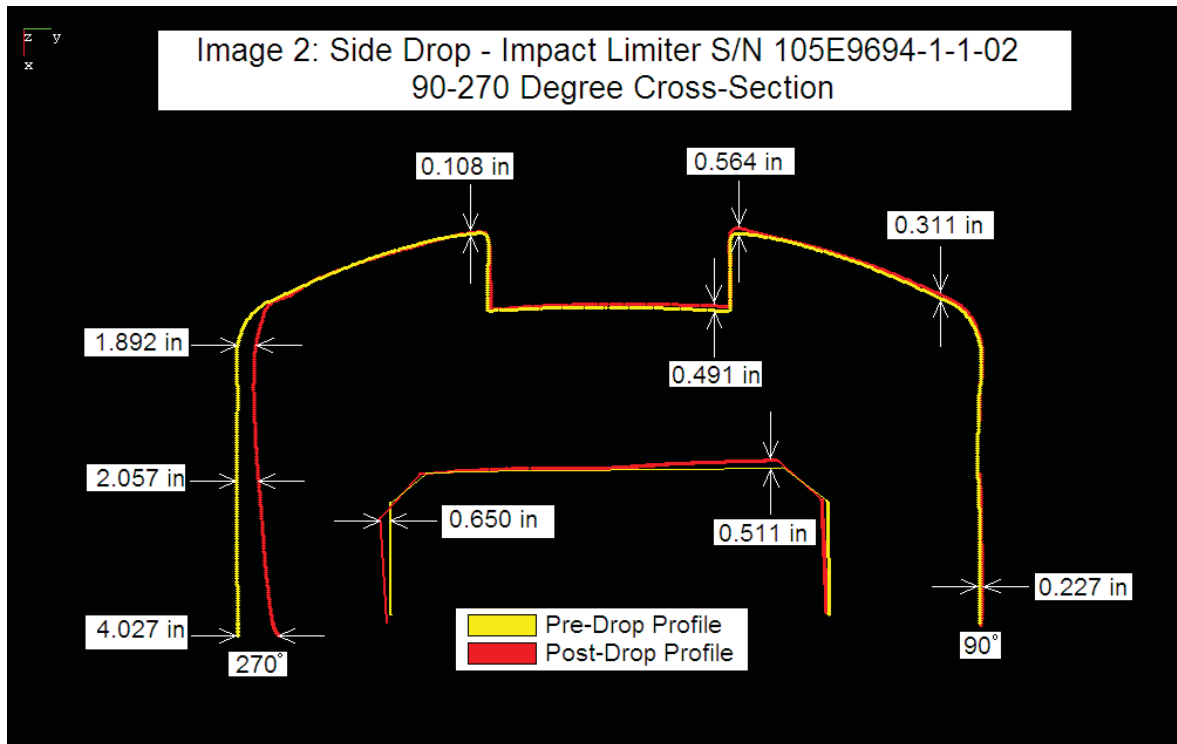


Image 2: Impact Limiter Serial No. 105E9694-1-1-02 - Side Drop Cross-Section Overlay

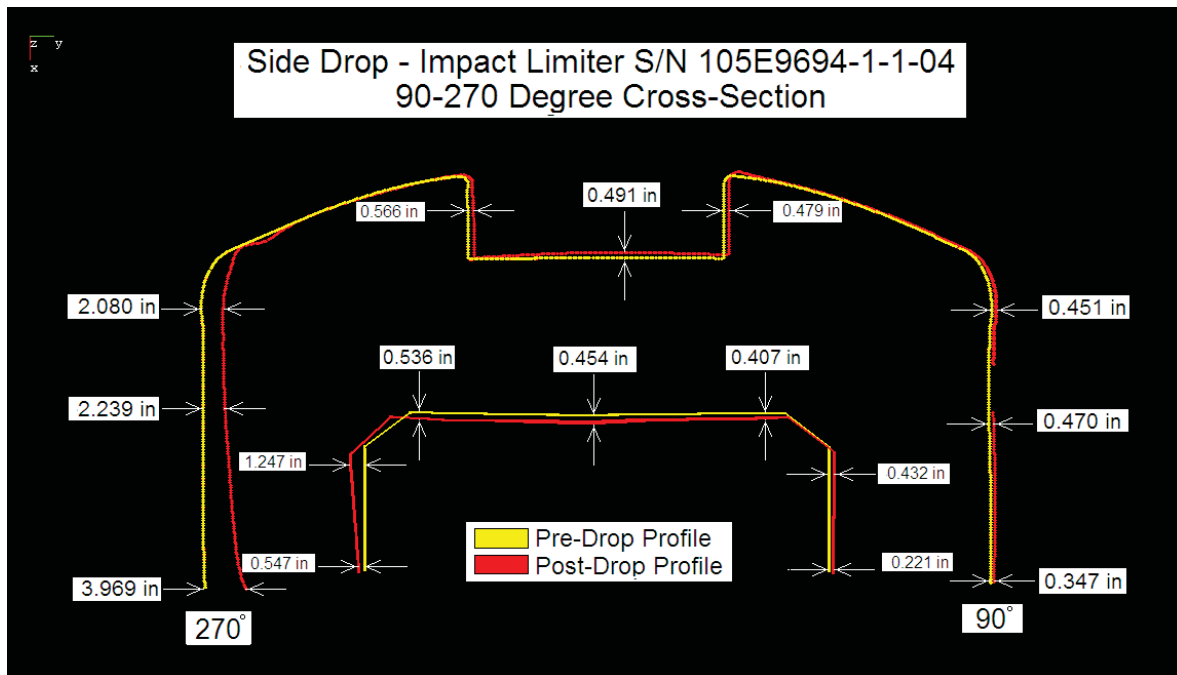


Image 4: Impact Limiter Serial No. 105E9694-1-1-04 - Side Drop Cross-Section Overlay

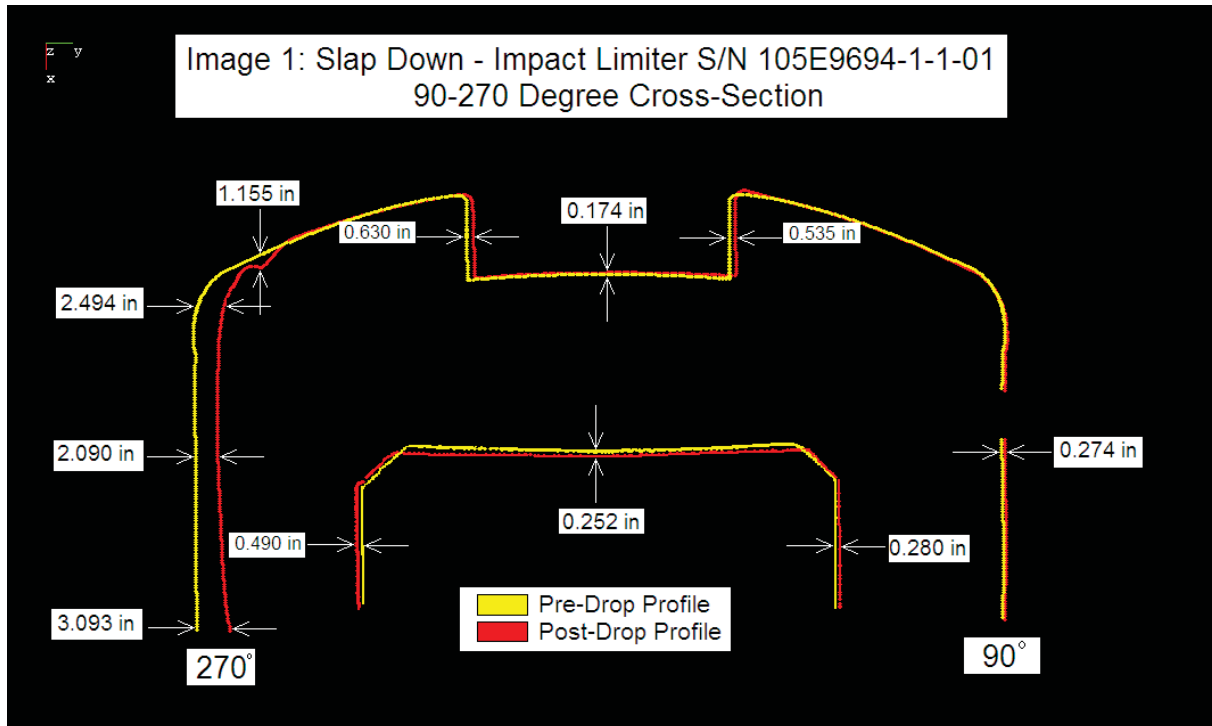


Image 1: Impact Limiter Serial No. 105E9694-1-1-01 - Slap Down Cross-Section Overlay

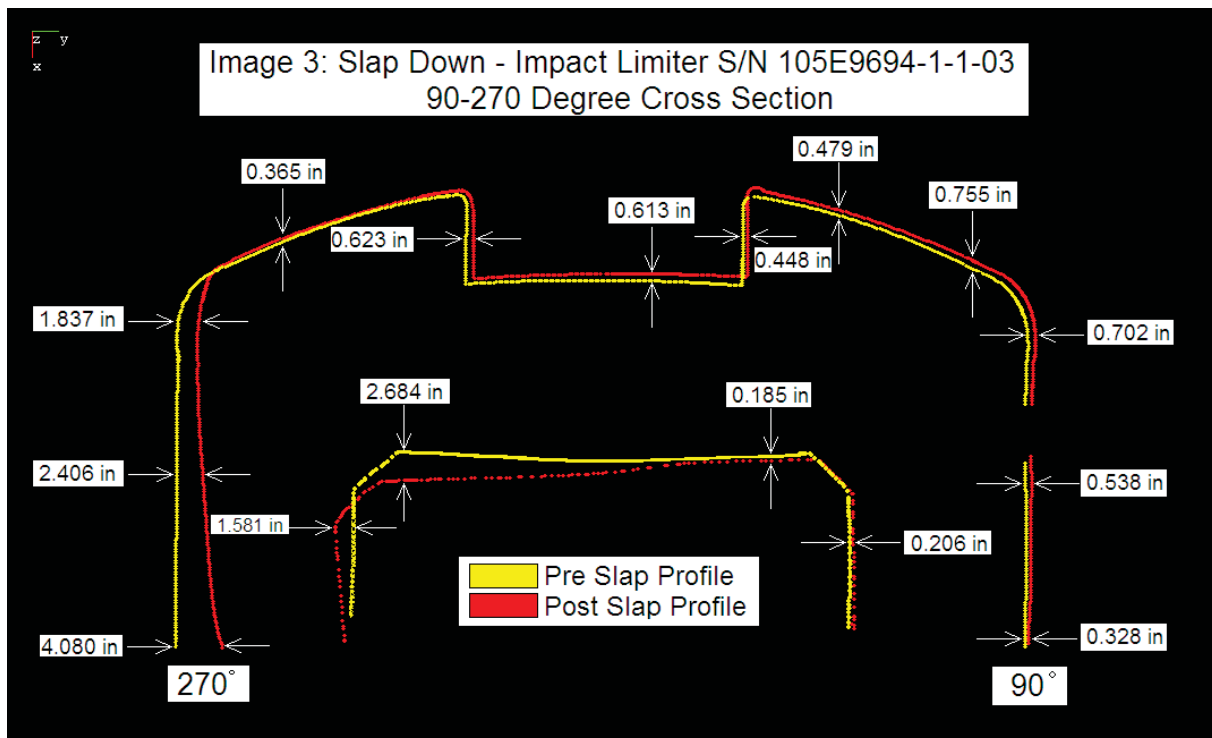


Image 3: Impact Limiter Serial No. 105E9694-1-1-03 - Slap Down Cross-Section Overlay



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Contact Information

As part of this report, *East Coast Metrology* appreciates the request for any additional information, which will help our customers find solutions to their measurement problems.

We proudly consider ourselves as allied partners to our customers, and can assist in the positioning and alignment of features, along with our ability to perform high accuracy measurements.

The key to our success is to be able to provide our customers with complete solutions, and the information that is most valuable to their cause, in a clear and concise manner.

We welcome any questions you may have, and look forward to working together in the near future.

Please feel free to contact us for additional information or concerns that may arise.

David K. Kramer
Project Engineer
East Coast Metrology
461 Boston Street (A4)
Topsfield, Massachusetts 01983
Tel: 503.997.7055
Fax: 603.251.5678
E-mail: dkramer@eastcoastmetrology.com

Attachments:

AOS-165 Cask Assembly Impact limiter, Serial No. 105E9694-1-1-01 Pre- and Post- Slap Down Scan Data (12 pgs)
AOS-165 Cask Assembly Impact limiter, Serial No. 105E9694-1-1-02 Pre- and Post- Side Drop Scan Data (10 pgs)
AOS-165 Cask Assembly Impact limiter, Serial No. 105E9694-1-1-03 Pre- and Post- Slap Down Scan Data (14 pgs)
AOS-165 Cask Assembly Impact limiter, Serial No. 105E9694-1-1-04 Pre- and Post- Side Drop Scan Data (12 pgs)
AOS-165 Cask Assembly Impact limiter, Serial No. 105E9694-1-1-05 Pre- and Post- Head Drop Scan Data (10 pgs)

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2.12.8 Analysis of Content-Cask Lid Impact

Content accelerations due to head-on 30-ft. package drops and content-cask lid gaps are determined by equating impact kinetic energy to strain energy within the impact limiter. The cask and impact limiter are modeled as a generalized single degree of freedom (SDOF) spring-mass system, using an approximation of the impact limiter force-displacement relation determined in the 30-ft. drop analyses. The content is also modeled as a generalized lumped mass, and content impact kinetic energy determined from a central impact formulation. The velocities applied in the central impact calculation are determined from equations of motion for the two generalized masses under gravitational force and initial velocity.

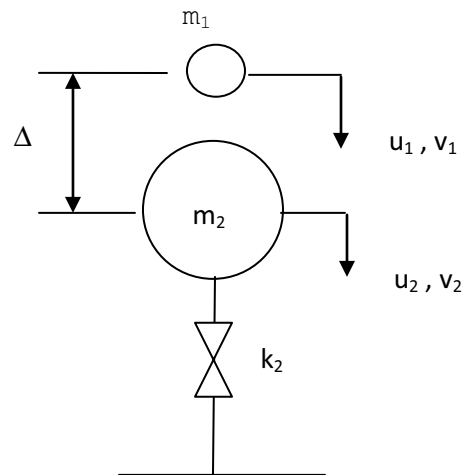


Figure 2-68. Generalized Model of Impact I

a	=	Content acceleration	T	=	Kinetic energy
e	=	Coefficient of restitution	U	=	Strain energy
g	=	Gravitational acceleration	v_0	=	Initial velocity
k	=	Impact limiter spring stiffness	v_1	=	Content velocity
m	=	Effective mass	v_2	=	Cask velocity
m_1	=	Content mass	w_1	=	Content weight
m_2	=	Package mass	w_2	=	Package weight
P	=	Impact force	δ	=	Spring displacement
u_1	=	Content displacement	Δ	=	Gap
u_2	=	Cask displacement	ω	=	Frequency, $\sqrt{k_2 / m_2}$

Content equation of motion for initial velocity v_0 and force g :

$$g = d^2u_1 / dt^2$$

$$u_1 = g * t^2 / 2 + v_0 * t$$

$$v_1 = du_1 / dt = g * t + v_0$$

Cask equation of motion for initial velocity v_0 and force g :

$$g = d^2u_2 / dt^2 + (k_2 / m_2) * u_2$$

$$\omega = \sqrt{(k_2 / m_2)}$$

$$u_2 = (v_0 / \omega) * \sin \omega t + g * t^2 / 2$$

$$v_2 = du_2 / dt = v_0 * \cos \omega t + g * t$$

$$\text{for, } \sin \omega t = \omega t - (\omega t)^3 / 6,$$

$$u_2 = (v_0 / \omega) * [\omega t - (\omega t)^3 / 6] + g * t^2 / 2$$

$$u_2 = v_0 * t - v_0 * \omega^2 t^3 / 6 + g * t^2 / 2$$

Equating cask and content displacements:

$$\Delta = u_1 - u_2$$

$$= v_0 * \omega^2 * t^3 / 6$$

$$t = (6 * \Delta) / (v_0 * \omega^2)^{1/3}$$

Impact kinetic energy:

$$T = 0.5 (1 - e^2) * (v_2 - v_2)^2 * [m_1 * m_2 / (m_1 + m_2)]$$

$$m = [m_1 * m_2 / (m_1 + m_2)]$$

$$e = 0.0$$

$$T = 0.5 * m * (v_1 - v_2)^2$$

$$= 0.5 * m * v_0^2 * (1 - \cos \omega t)^2$$

Equating strain and kinetic energy:

$$T = k * \delta^2 / 2$$

$$\delta = \sqrt{(2 * T / k)}$$

$$P = k * \delta = \sqrt{(2 * T * k)}$$

$$a = P / w_1 = \sqrt{(2 * T * k)} / w_1$$

Applying equations to AOS casks:

Model	W1 (lb)	W2 (lb)	K (lb/in)	Gap (in)	Freq (hz)	Acc (g)
-----	-----	-----	-----	-----	-----	-----
AOS-025	1.500E+01	1.680E+02	1.390E+05	1.000E-01	8.999E+01	8.662E+02
AOS-050	6.000E+01	1.181E+03	1.040E+05	1.000E-01	2.936E+01	1.868E+02
AOS-100	5.000E+02	9.510E+03	2.330E+05	5.000E-01	1.549E+01	1.798E+02

Fortran program for equation evaluation (ContentAcc.for):

```

c
c      a   - content acceleration in g
c      f   - package frequency
c      g   - gap
c      xk  - impact limiter stiffness
c      xm  - effective mass
c      xm1 - content mass
c      xm2 - package mass
c      t   - time to contact
c      T   - 2x kinetic energy
c      v0  - initial velocity
c      w1  - content weight
c      w2  - package weight
c
c      implicit real*8 (a-h,o-z)
c
c  open files & initialize output
c      open(1,file='contentacc.in')
c      open(2,file='contentacc.out')
c      write(2, '(5x,5hModel,5x,6hW1(1b),5x,6hW2(1b),3x,8hK(1b/in),
&              4x,7hGap(in),3x,8hFreq(hz),5x,6hAcc(g))')
c      write(2, '(5x,5h-----,5x,6h-----,5x,6h-----,3x,8h-----,
&              4x,7h-----,3x,8h-----,5x,6h-----)')
c
c      initialize constants
c      v0=527.5
c      exp=0.333333
c      pi2=6.28319
c
c      loop on models
c      do n=1,3
c      read(1,*) model,w1,w2,xk,g
c      xm1=w1/386.4
c      xm2=w2/386.4
c      xm=xm1*xm2/(xm1+xm2)
c      f=dsqrt(xk/xm2)
c      t=(6*g/(v0*f**2))**exp
c      T=xm*v0**2*(1-dcos(f*t))**2
c      a=dsqrt(T*xk)/w1
c      write(2, '(i10,6es11.3)') model,w1,w2,xk,g,f/pi2,a
c      enddo
c
c      end

```

Input data (ContentAcc.in):

```

100,500,9510,2.33e5,0.5
50,60,1181,1.04e5,0.1
25,15,168,1.39e5,0.1

```

2.12.9 Comparison of Libra Static and Dynamic Impact Analysis

Date February 9, 2010

Libra static and dynamic impact analyses are compared to assess applicability of the static method to AOS cask drop analyses. Results of static and dynamic analyses of a 30-ft. head-on drop are compared. A model 165 cask with 20 psf density foam is used in the analyses. Both impact forces and displacements given by the two solutions are shown to be in good agreement.

In the Libra dynamic analysis, the impact velocity corresponding to a 30-ft. drop is applied as an initial condition, and cask response is determined by a direct integration solution. An axisymmetric, 2D model of the foam and cask is used. The FEA model is shown in [Figure 2-69](#), where the foam and cask are distinguished by different colors. The cask is modeled as a solid steel cylinder, with density adjusted to give a total cask and foam weight of 40k. A bi-linear foam constitutive model and von Mises yield criteria is used, with initial modulus of 19.0 ksi, secondary modulus of 5.4 ksi, and an equivalent yield stress of 2.0 ksi. The initial modulus and yield stress are based on foam stress at 10% strain, and the secondary modulus is based on the foam stress at 10% and 65% strains. Both foam to ground and foam to cask interfaces are modeled by gapped, compression-only, spring elements.

Cask time-history displacement determined in the dynamic analysis is shown in [Figure 2-70](#). The maximum displacement is 5.76 in, and occurs at 0.016 sec. Forces in ground impact springs are shown in [Figure 2-71](#) and [Figure 2-72](#). [Figure 2-71](#) shows forces in individual ground contact springs, while [Figure 2-72](#) shows the resultant of all ground contact springs. In [Figure 2-71](#), time lapses before springs compress reflect developing foam-ground contact. From [Figure 2-72](#), the maximum, total impact force is 6020 k. The deformed model at maximum displacement is shown in both [Figure 2-73](#) and [Figure 2-74](#). [Figure 2-73](#) shows only the foam deformation, while [Figure 2-74](#) shows both the foam and cask deformation, with displacement contours super-imposed.

Libra static drop analyses involve determining impact force and foam strain energy due to deformation at ground contact locations. Maximum impact force corresponds to the value of strain energy equal to the potential energy of the 30-ft. drop. A 180°, 3D foam model, shown in [Figure 2-75](#), is used in the analysis. Results of the static analysis are shown in [Figure 2-76](#) and [Figure 2-77](#). [Figure 2-76](#) shows the deformed model at maximum displacement, while [Figure 2-77](#) shows force and energy developed in the analysis. For a 180° model, the required strain energy is half the potential energy of a 40 k structure drop, or 7200 in-k. From [Figure 2-77](#), the corresponding displacement is 5.7 in, and the impact force is 6400 k. [Figure 2-77](#) is based on an accurate foam constitutive model. A static analysis is also performed using the approximate bi-linear foam constitutive model applied in the dynamic analysis. Plots of force and energy for the bi-linear constitutive model are presented in [Figure 2-78](#), and the impact force is 6800 k.

The 5.7 in displacement and 6400 k force determined in the static analysis from [Figure 2-77](#) compare well to the 5.76 in displacement and 6020 k force determined in the dynamic analysis. In addition, the deformation patterns given by the two solutions are also in good agreement. For the same constitutive model, the static method gives 6800 k while the dynamic method gives 6020 k, indicating the static method is conservative.

MATERIALS:



1

2

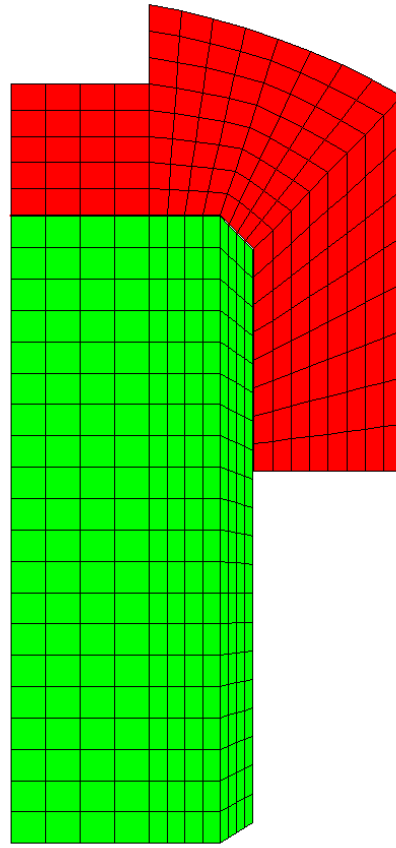


Figure 2-69. Dynamic Analysis FEA Model

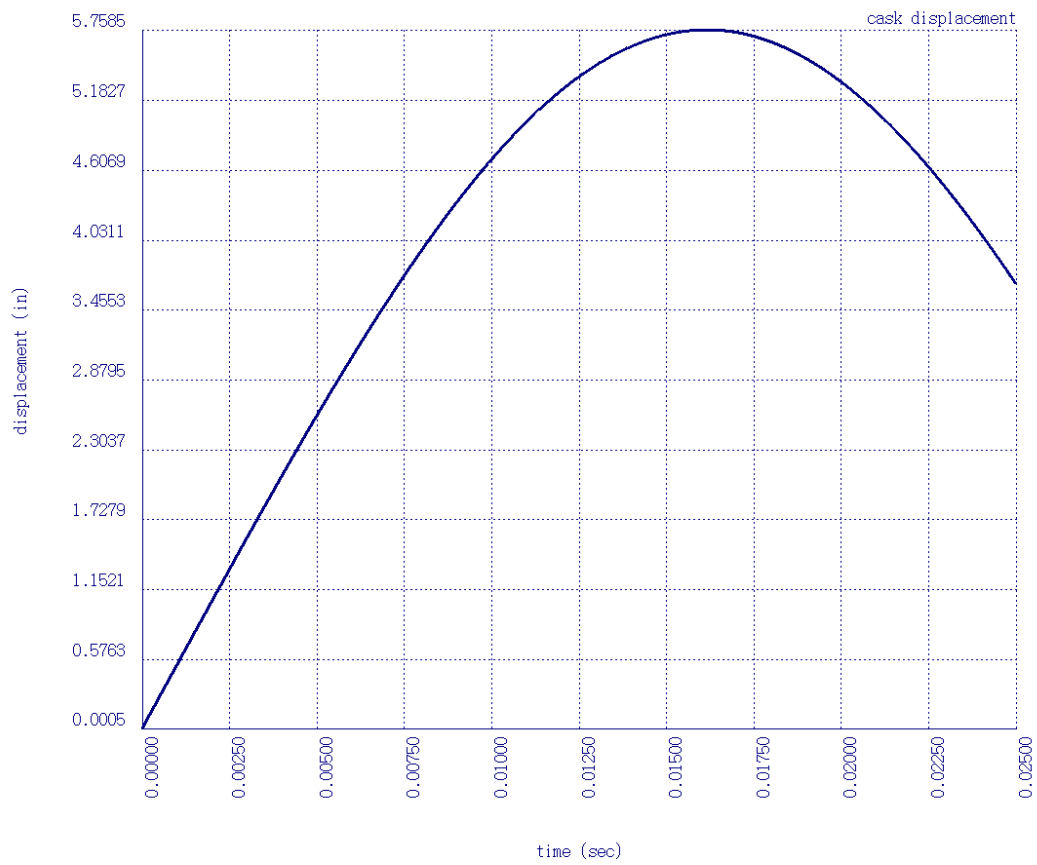


Figure 2-70. Cask Displacement Time-History

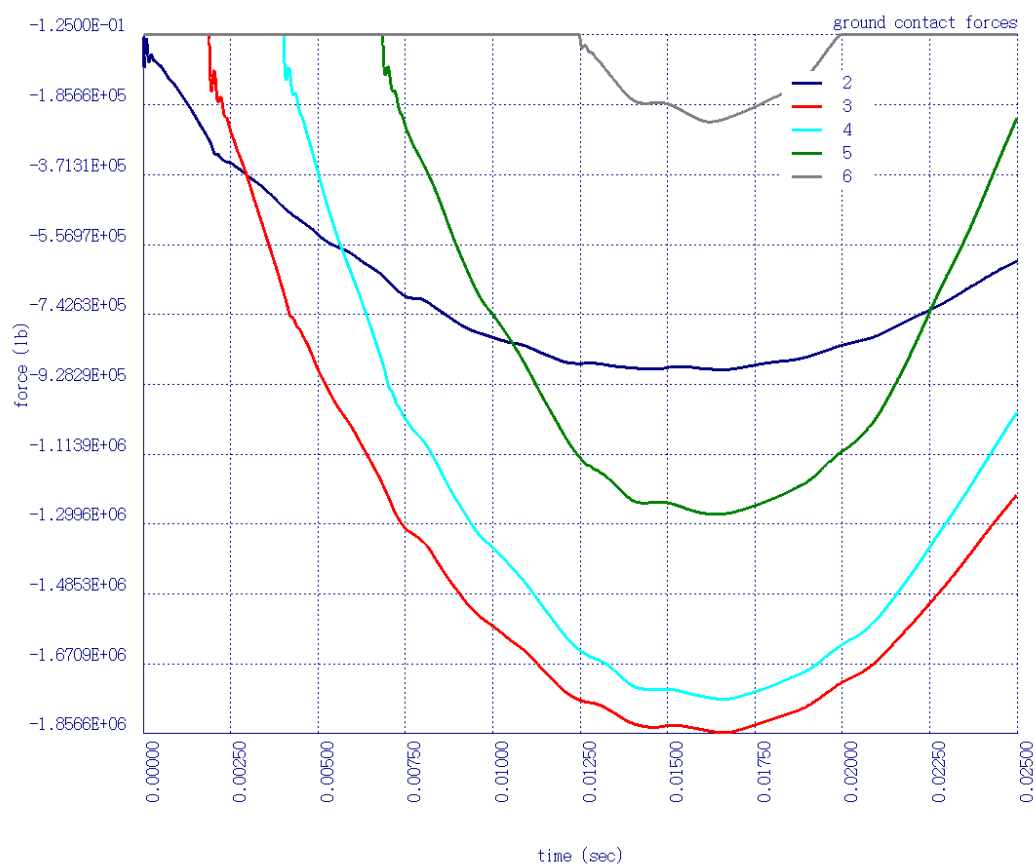


Figure 2-71. Ground Impact Forces in Dynamic Model

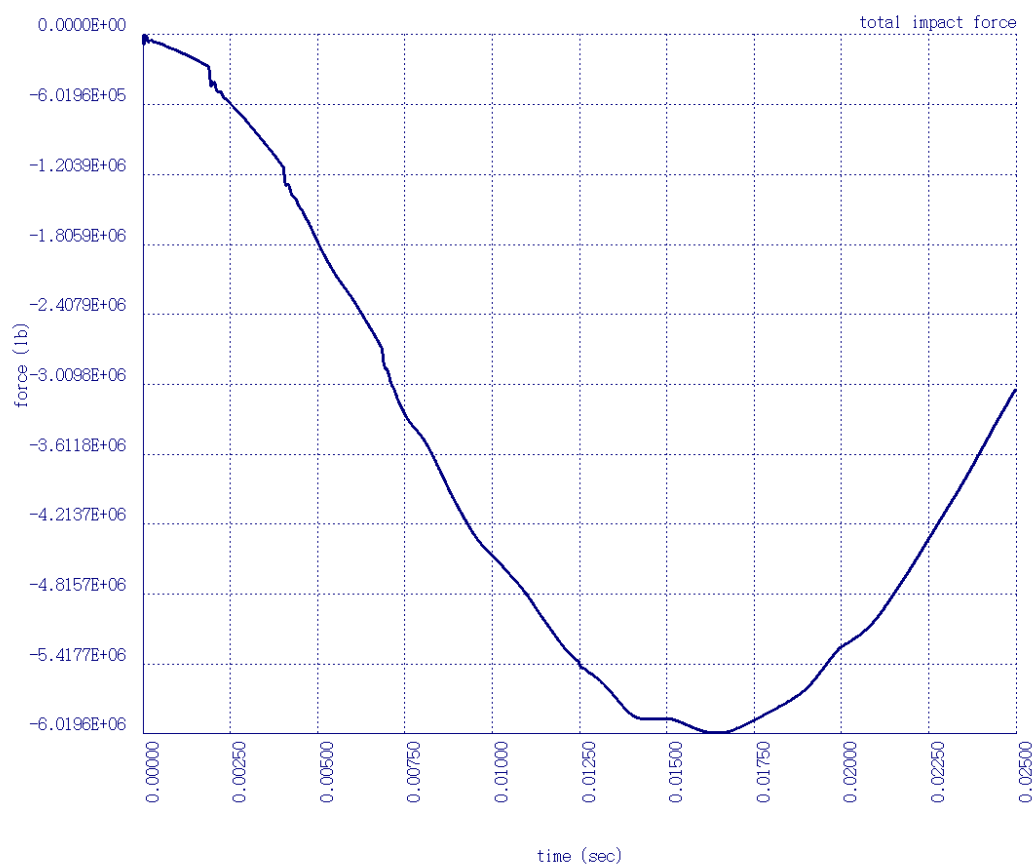


Figure 2-72. Total Ground Impact Force in Dynamic Model

VECTOR: 16
 AMPL: 1.0
 SQUARE: OFF
 SCALE: 0.95

BOUNDARIES:
 X: 0.000
 37.500
 Y: -43.500
 37.700
 Z: 0.000
 0.000

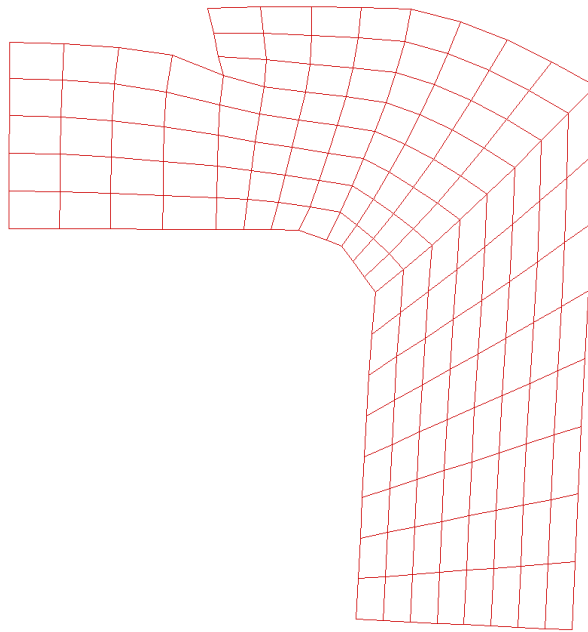


Figure 2-73. Deformed Dynamic Model at Maximum Displacement

VECTOR: 16
 DOF: 2
 MIN: 8.8874E-02
 MAX: 5.7603E+00

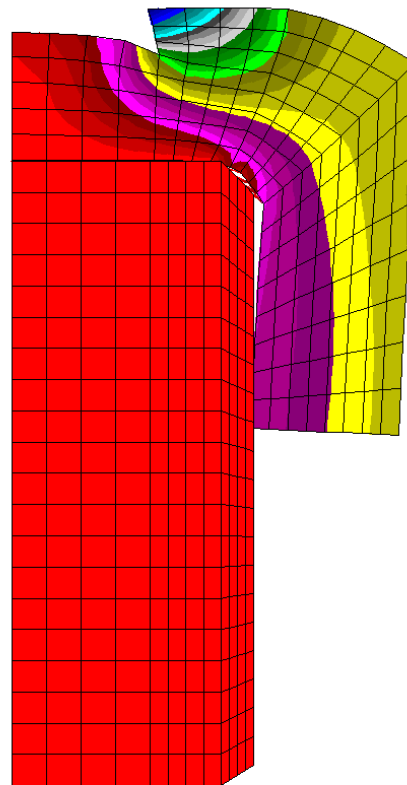
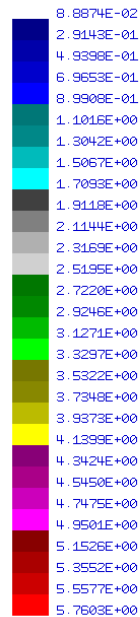


Figure 2-74. Displacement Contours n Deformed Dynamic Model

UEC: 0
 AMPL: 0.000E+00
 SQUARE: OFF
 SCALE: 0.95
 BOUNDARIES:
 X: -37.500
 37.500
 Y: -8.000
 36.700
 Z: 0.000
 37.295

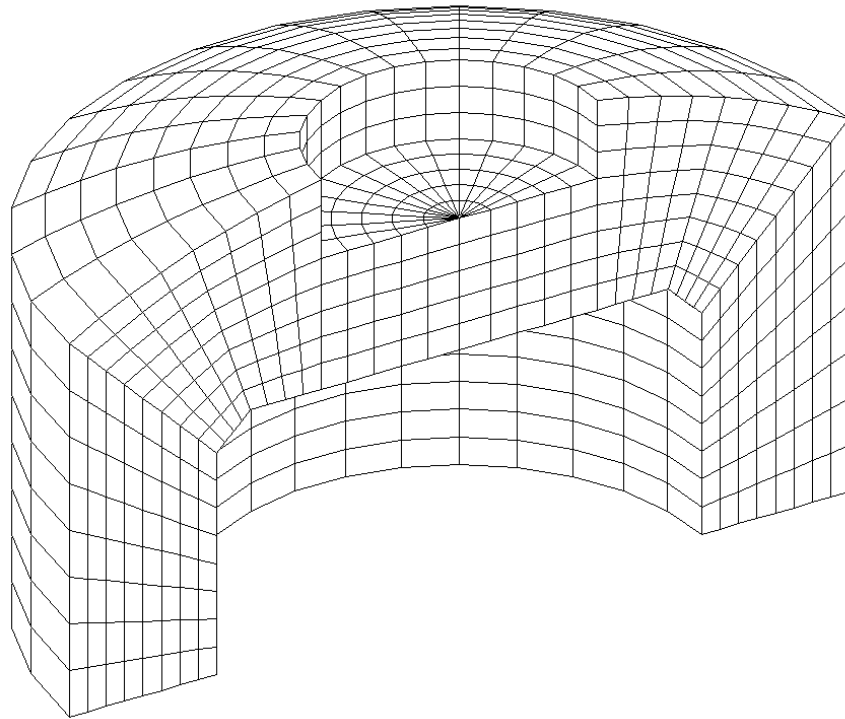


Figure 2-75. Foam Static Analysis FEA Model

UEC: 550
 AMPL: 1.0
 SQUARE: OFF
 SCALE: 0.95
 BOUNDARIES:
 X: -37.500
 37.500
 Y: -8.000
 36.700
 Z: 0.000
 37.295

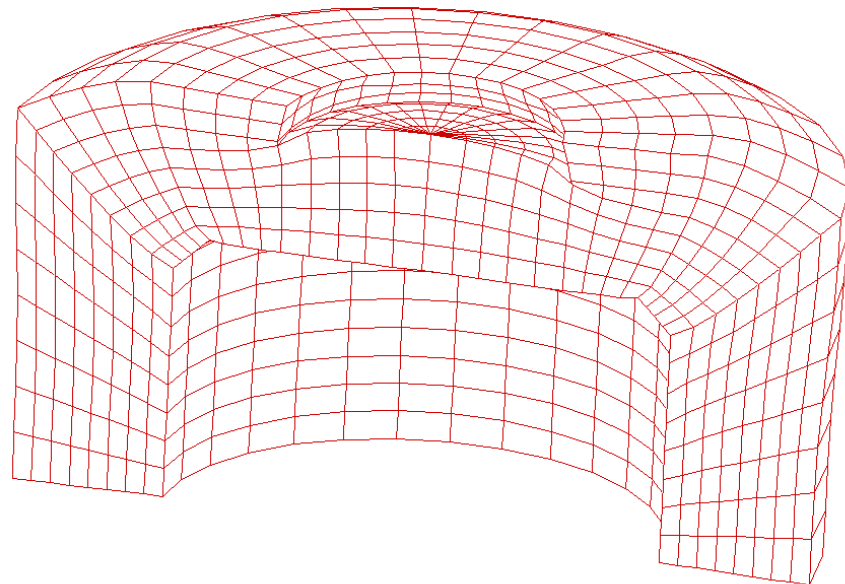


Figure 2-76. Deformed Foam Static Model at Maximum Displacement

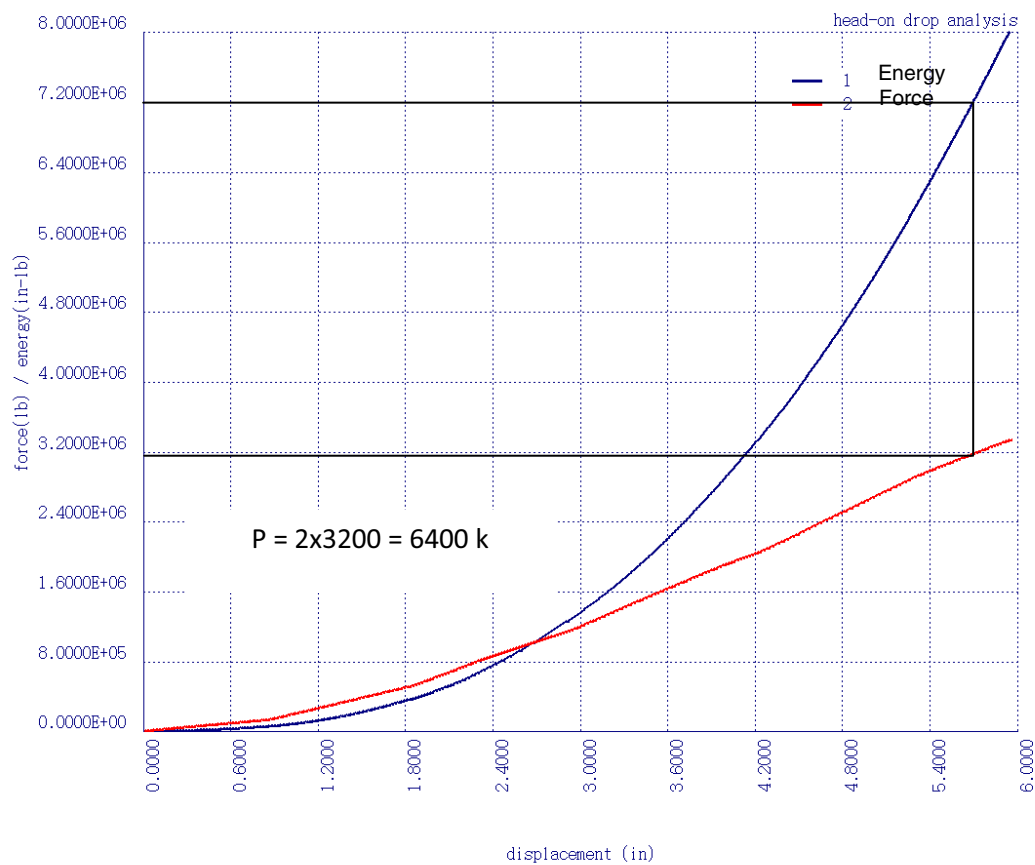


Figure 2-77. Energy and Force Plots for Static Analysis

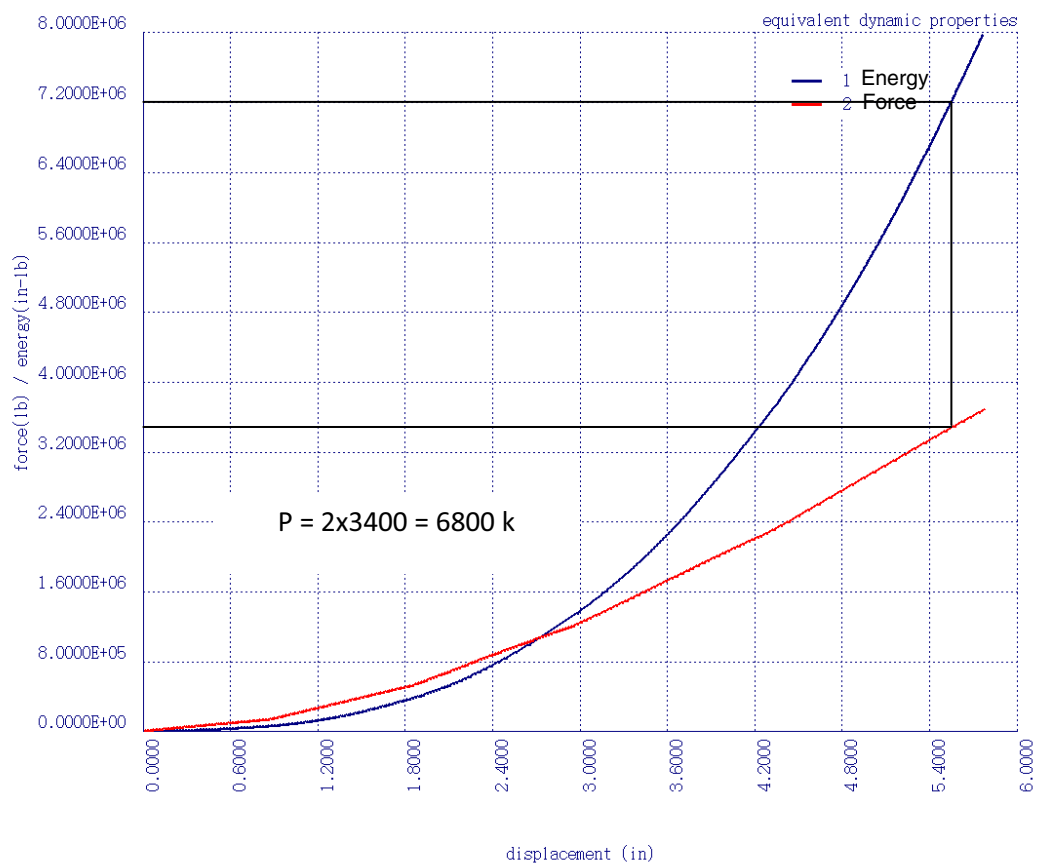


Figure 2-78. Energy and Force Plots for Static Analysis with Bi-Linear Stress-Strain

2.12.9.1 Appendix A – Libra Dynamic Impact Analysis Input File

```
ti      dynamic impact analysis
*
mc      9
*
cnd     1,   23.3,-8,0
,       2,   37.5,-8,0
,       3,   37.5,27.9,0
,       4,   23.3,13.3,0
,       5,   20.1,16.5,0
,       6,   25.6,33.4,0
,       7,   13.3,36.7,0
,       8,   13.3,29.125,0
,       9,   0.0,16.5,0
,      10,   0.0,29.125,0
,      11,   19.4,35.3,0
,      12,   31.7,30.9,0
,      13,   13.3,16.5,0
*
*      foam
*
g10
      9,9,   1,1,   8,1,   0,1
      1,2,3,4
      -1
*
g10
      9,5
      4,3,6,5
      6, 12
      -1
*
g10
      9,5
      5,6,7,13
      6, 11
      -1
*
g10
      5,6
      9,13,8,10
      -1
*
*      pseudo cask
*
g10
      5,21, 1001,1001,   8,2, 0,0
      0,-43.6,0,   13.3,-43.6,0
      13.3,16.4,0,   0,16.4,0
      -1
*
```



```

g10
    5,21, 1201,1201, 8,2, 0,0
    13.3,-43.6,0, 20.1,-43.6,0
    20.1,16.4,0, 13.3,16.4,0
    -1
*
g10
    5,21, 1401,1401, 8,2, 0,0
    20.1,-43.6,0, 23.2,-41.6,0
    23.2,13.2,0, 20.1,16.4,0
    -1
*
* cask contact springs
*
el 2001,1,3, 1101,172, 4,1,1
, 2005,1,3, 1105,163
, 2006,1,3, 1302,154
, 2007,1,3, 1303,145
, 2008,1,3, 1304,136
, 2009,1,3, 1502,109
, 2010,1,3, 1503,100
, 2011,1,3, 1504,91
, 2012,1,3, 1505,73
*
* boundary contact springs
*
nd 3162, 16.3375, 36.7, 0
, 3153, 19.4, 36.7, 0
, 3144, 22.4875, 36.7, 0
, 3126, 25.6, 36.7, 0
, 3117, 28.6875, 36.7, 0
, 3108, 31.7, 36.7, 0
, 3171, 13.3, 37.7, 0
*
el 3001, 1, 4, 162,3162
, 3002, 1, 5, 153,3153
, 3003, 1, 6, 144,3144
, 3004, 1, 7, 126,3126
, 3005, 1, 8, 117,3117
, 3006, 1, 9, 108,3108
, 3007, 1,10, 171,3171
*
* merge nodes
*
me 0.001
*
* boundary cond
*
bc 3108,8,9, 12,0.0
*
* element properties
*
pr 1,101
, 101, 1.9e4,0.3,1.0e-6,3.0e-5,2.0e3,5.4e3

```

```

PR    2,102
,    102, 28.0E6,0.3,1.0E-5,0.00099,1.0e6,1.0e9
pr    3, 1.0e7,1.0e7,1.0e9, 1,0.0000,0, 0,0
pr    4, 1.0e7,1.0e7,1.0e9, 1,0.6375,0, 0,0
pr    5, 1.0e7,1.0e7,1.0e9, 1,1.4000,0, 0,0
pr    6, 1.0e7,1.0e7,1.0e9, 1,2.2875,0, 0,0
pr    7, 1.0e7,1.0e7,1.0e9, 1,3.3000,0, 0,0
pr    8, 1.0e7,1.0e7,1.0e9, 1,4.4875,0, 0,0
pr    9, 1.0e7,1.0e7,1.0e9, 1,5.8000,0, 0,0
pr   10, 1.0e7,1.0e7,1.0e9, 1,0.0000,0, 0,0
*
*    MAIN9 solution data
*
sc 25000,1,0,1, 1.0e-6,1000,0, 0.00001,0,1.4, 1.0
ic 1,1505,2,0,527.5
mo 1,1101,2
mo 4,3001,1
, 4,3002,1
, 4,3003,1
, 4,3004,1
, 4,3005,1
, 4,3006,1
, 4,3007,1
*
end

```

2.12.9.2 Appendix B – Libra Static Impact Analysis Input File

```
ti    static impact analysis
*
mc    23
*option list_input
option lh_check
*
lc    1,1, 0,0,0, 0,1,0, 0,0,1    ; head-on drop
lc    2,2, 0,0,0, 1,0,0, 0,0,1
*
skip
cnd   1,  23.3,-8,0
,     2,  37.5,-8,0
,     3,  37.5,27.9,0
,     4,  23.3,13.3,0
,     5,  20.1,16.5,0
,     6,  25.6,33.4,0
,     7,  13.3,36.7,0
,     8,  13.3,29.125,0
,     9,  3.0,16.5,0
,    10,  3.0,29.125,0
,    11,  19.4,35.3,0
,    12,  31.7,30.9,0
,    13,  13.3,16.5,0
*
*    generate first meridian
*
g10
    9,9,  1,1,  8,1,  0,1
    1,2,3,4
    -1
*
g10
    9,5
    4,3,6,5
    6, 12
    -1
*
g10
    9,5
    5,6,7,13
    6, 11
    -1
*
g10
    5,6
    9,13,8,10
    -1
*
*    merge nodes
*
me    0.05
end
```

```

skip
*
*   generate 3d region
*
g32
    15,180, 1000,0
*
*   center section
*
nd 101001, 0,16.5,0, 6, 0,2.525,0
el 101001,20,1,101001, 172, 1172,101002, 177, 1177,5,1,5,5,1,5,5
el 101011,20,1,101001, 1172, 2172,101002, 1177, 2177,5,1,5,5,1,5,5
el 101021,20,1,101001, 2172, 3172,101002, 2177, 3177,5,1,5,5,1,5,5
el 101031,20,1,101001, 3172, 4172,101002, 3177, 4177,5,1,5,5,1,5,5
el 101041,20,1,101001, 4172, 5172,101002, 4177, 5177,5,1,5,5,1,5,5
el 101051,20,1,101001, 5172, 6172,101002, 5177, 6177,5,1,5,5,1,5,5
el 101061,20,1,101001, 6172, 7172,101002, 6177, 7177,5,1,5,5,1,5,5
el 101071,20,1,101001, 7172, 8172,101002, 7177, 8177,5,1,5,5,1,5,5
el 101081,20,1,101001, 8172, 9172,101002, 8177, 9177,5,1,5,5,1,5,5
el 101091,20,1,101001, 9172,10172,101002, 9177,10177,5,1,5,5,1,5,5
el 101101,20,1,101001,10172,11172,101002,10177,11177,5,1,5,5,1,5,5
el 101111,20,1,101001,11172,12172,101002,11177,12177,5,1,5,5,1,5,5
el 101121,20,1,101001,12172,13172,101002,12177,13177,5,1,5,5,1,5,5
el 101131,20,1,101001,13172,14172,101002,13177,14177,5,1,5,5,1,5,5
el 101141,20,1,101001,14172,15172,101002,14177,15177,5,1,5,5,1,5,5
*
cs 0
*
*   inside foam bc
*
bc 101001,1,1, 2,0
bc 1,16,1000, 13,0
, 10,16,1000, 13,0
, 19,16,1000, 13,0
, 28,16,1000, 13,0
, 37,16,1000, 13,0
, 46,16,1000, 13,0
, 55,16,1000, 13,0
, 64,16,1000, 123,0
, 73,16,1000, 123,0
, 91,16,1000, 123,0
, 100,16,1000, 123,0
, 109,16,1000, 123,0
, 118,16,1000, 123,0
, 136,16,1000, 2,0
, 145,16,1000, 2,0
, 154,16,1000, 2,0
, 163,16,1000, 2,0
, 176,16,1000, 2,0
, 175,16,1000, 2,0
, 174,16,1000, 2,0
, 173,16,1000, 2,0
, 172,16,1000, 2,0
*

```

```

* symmetry bc
*
nd 100001, -50, -8,0
, 100002, 50, -8,0
, 100003, 0, 50,0
*locate_bc 100001,100002,100003, 0.1,3,0, 0
*
me 0.05
*
* properties
*
* 20 lb foam @ 70 deg F
pr 1, 101
, 101, 0.3, .1,1890, .2,1915, .3,1940, .4,2168, 102
, 102, .5,2604, .6,3561, .65,4858, .7,5397
*
* bi-linear foam stress-strain properties
*pr 1, 101
, 101, 0.3, .1,1900, .2,2440, .3,2980, .4,3520, 102
, 102, .5,4060, .6,4600, .65,4870, .7,5140
*
pr 201,202,0.125
, 28.0E6,0.3,1.0E-5,0.000776, 1.0E6,40.0E3
*
* MAIN23 solution data
*
SC 700,0,0.01, 0.002,1,50, 0,1,8.0e6
*
end

```

2.12.9.3 Additional Information (December 1, 2011)

2.12.9.3.1 Contact Elements in Foam-Cask Model

The two input files used to develop the presentation in [Appendix 2.12.9](#) are:

- foam-cask.t5
- head-on-drop.t5

The foam-drop.t5 input file is a dynamic analysis, while the head-on-drop.t5 input file is a static analysis similar to the analyses used in the SAR. In many LIBRA analyses, the input file type is designated as t5. This is a throw-back to when input data was on TAPE 5.

In the dynamic analysis, foam-cask.t5, both the foam-ground and foam-cask contacts are modeled by STIF1 elements. The LIBRA STIF1 elements can model gapped, contact interfaces, as described in the LIBRA help file for STIF1, listed below.

[Figure 2-79](#) is an illustration of the foam-cask.t5 Libra model, and shows the application of STIF1 elements as gapped interfaces. In [Figure 2-79](#) the blue region is the foam, and the green region is the cask. STIF1 gap elements 3001 through 3007 model the interface between the ground and foam, while elements 2001 through 2012 model the interface between the foam and cask. In the dynamic analysis, both foam and cask are assigned an initial velocity corresponding to a 30-ft. free fall, and impact forces are based upon gap closures.

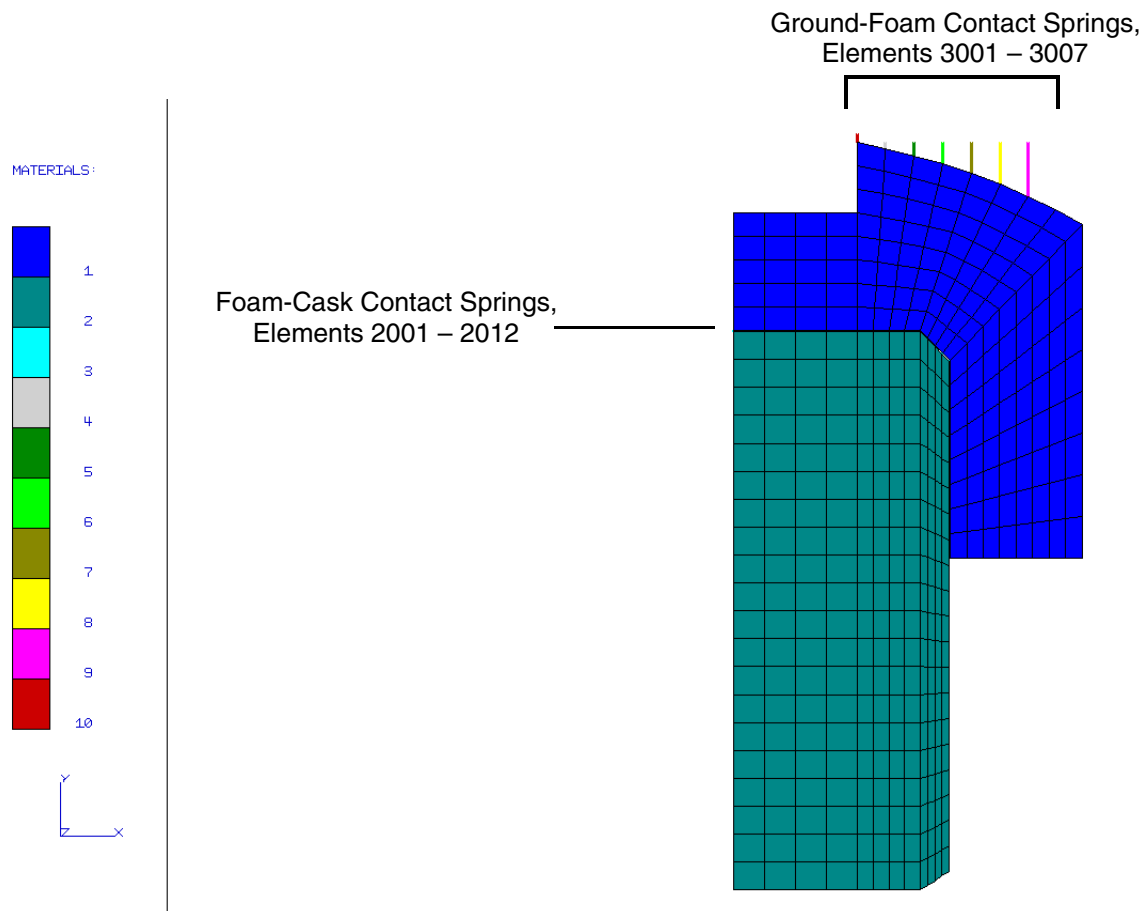


Figure 2-79. foam-cask.t5 LIBRA Model

2.12.9.3.2 Spring/Gap Element (STIF1)

STIF1 is a single degree of freedom spring element. The element is oriented by the two element nodes, or by a specified local coordinate system. The element can be applied in elastic, and elasto-plastic problems. This element can be used in both 2D and 3D problems.

STIF1 can be used to specify compression- or tension-only gaps in MAIN2 and MAIN9 analyses. If used as a gap element, the plasticity flag must be set on the Solution Control record. A single element cannot be modeled as both gapped and elasto-plastic.

If STIF1 is used as a gap element, LIBRA uses the penalty method to model the gap. As a result, it is important to enter a reasonably accurate value for the elastic stiffness; otherwise, the solution can be inaccurate. One method for determining nodal stiffness values is to apply unit loads in linear, static analyses.

2.12.9.3.2.1 STIF1 Element Property Record

Table 2-338. STIF1 Element Property Record

Item	Description	Symbol
	Descriptor (PR)	
	Property set number	NM
1	Elastic stiffness	K
2	Inelastic stiffness	K1
3	Spring yield force	F _y
4	Flag for gap/compression only effects ^{a, b}	IGAP
5	Initial gap value ^c	GAP
6	Local coordinate system for orienting spring ^d	NLCS
7	Dummy entry	(0)
8	Set initial gap to element length ^e	LGAP

a. Set IGAP = 1 for a compression-only gap; set IGAP=2 for a tension-only gap; otherwise, for ordinary spring, set IGAP = 0.

b. Gap elements are considered to be elastic; however, dummy values must be entered for K1 and F_y, to maintain their data position.

c. GAP is entered as a positive value. For element nodal displacements U1 and U2, gaps are closed when the following is true:

$$\text{Compression} \quad (IGAP = 1) \quad U2 - U1 < -GAP$$

$$\text{Tension} \quad (IGAP = 2) \quad U2 - U1 > GAP$$

d. By default, the spring and gap are oriented by the two element nodes. To specify the spring and gap orientation, set NLCS to the number of a local coordinate (LC) system that defines the orientation. The spring is then oriented along the NLCS x-axis, and the gap is measured along the NLCS x-axis, with a positive gap in the +x direction.

e. If LGAP = 1, the initial gap size is set to the element length.

2.12.9.3.2.2 STIF1 Stress Output

Post processing data components for both elastic and inelastic problems are spring load (P) and spring deflection (d).

2.12.10 Effect of Ribs on Stress at Foam-Cask Interface

The effect of ribs inside the foam at the cask-cask lid interface is analyzed by the FEA model shown in Figure 2-80 and Figure 2-81. This model represents a section of foam impact limiter, steel cask, and steel rib, simplified by removing curvature. The section analyzed is a $10 \times 10 \times 10$ in. foam block, positioned on a 5-in. section of the steel cask, and a steel rib embedded inside the foam block. The entire FEA model contains approximately 320,000 DOF, and is shown in Figure 2-80. The embedded rib is shown in the FEA model section in Figure 2-81. The nodal spacing throughout the model is 0.25 in. In the analysis, a uniform, 1-in., Z-displacement is applied to the top of the foam block, and the block is fixed in the Z-direction, at the base of the cask.

Figure 2-82 and Figure 2-83 display a central section of the cask model. Cask Z-displacement is shown in Figure 2-82, and cask Z-directional stress is shown in Figure 2-83. A central model section is selected to remove model edge effects. These two figures show that both displacement and stress perturbations due to the rib are localized to within an inch of the rib location. In accordance with Saint-Venant's Principle, these perturbations do not have a significant effect on cask stress.

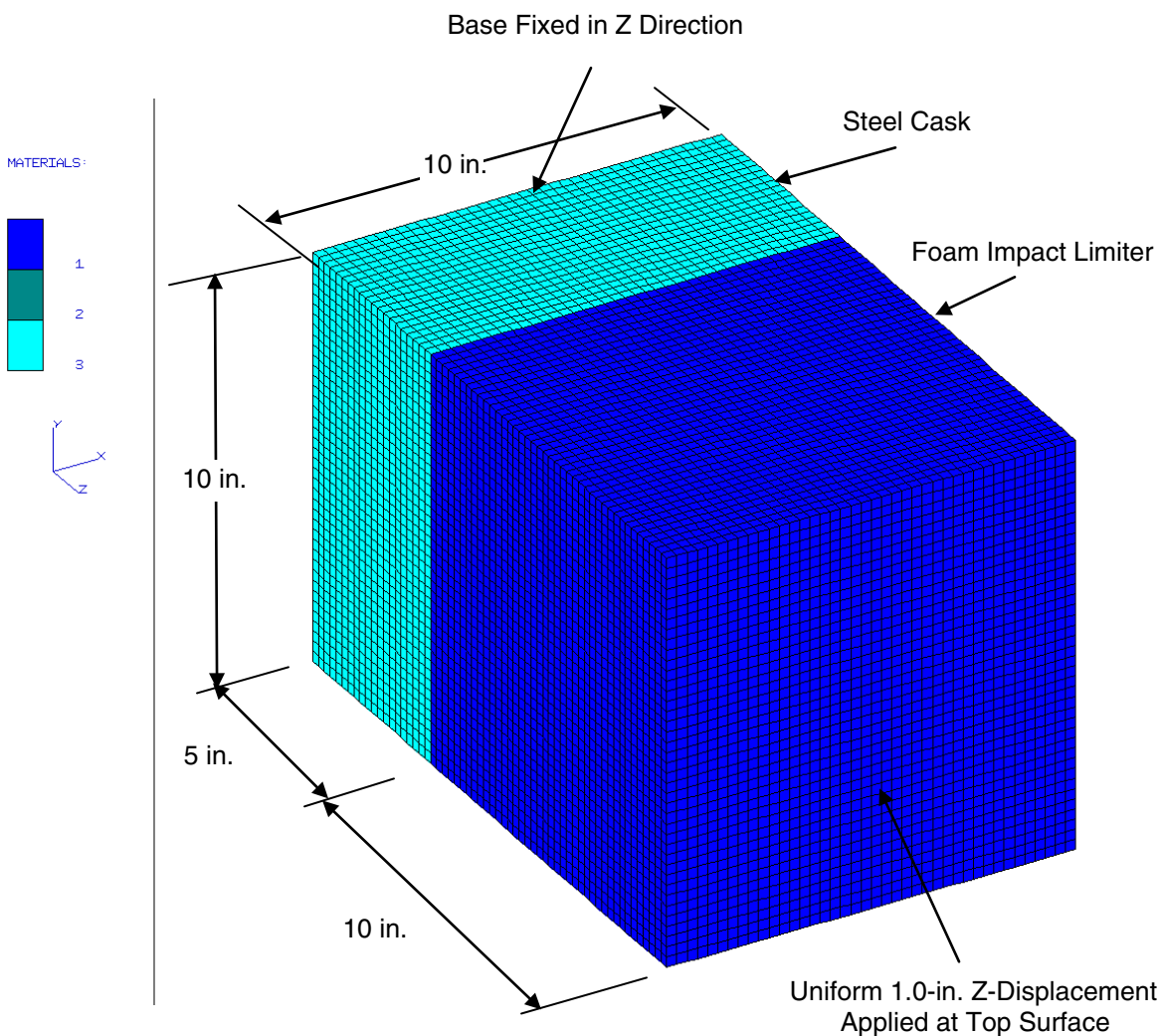


Figure 2-80. FEA Model Used in Rib Study

MATERIALS:



1.

2.

3.

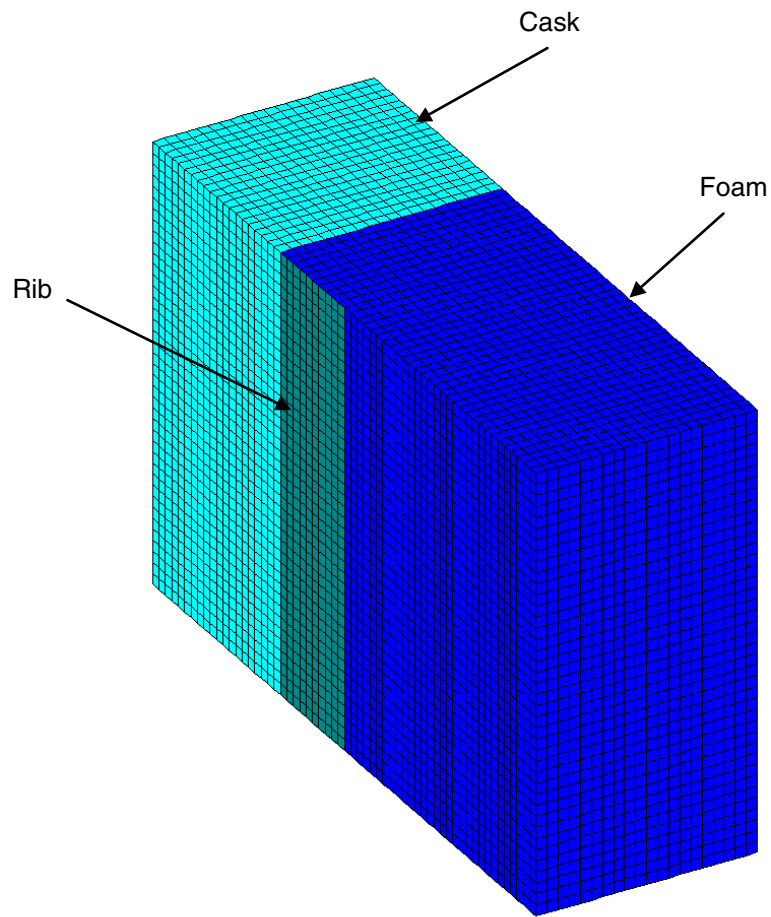


Figure 2-81. FEA Model Section Showing Rib

VECTOR: 1
DOF: 3
MIN: -6.5613E-03
MAX: 0.0000E+00

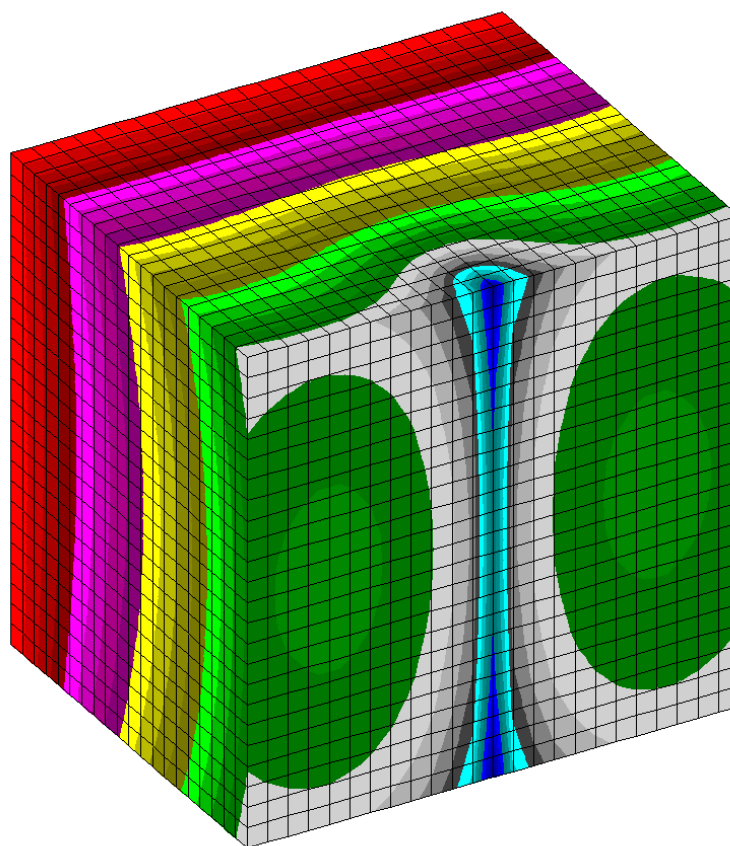
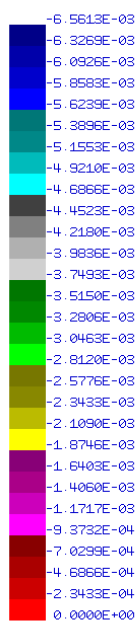


Figure 2-82. Z-Cask Section Z-Displacements

ELEM TYPE: 10
 COMPONENT: 3
 VECTOR: 1

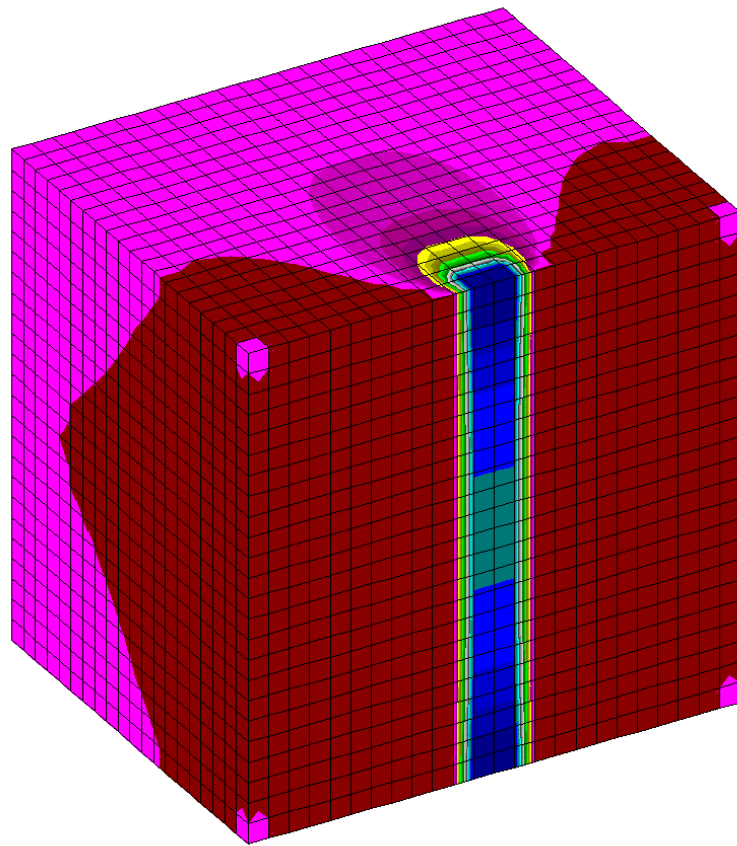
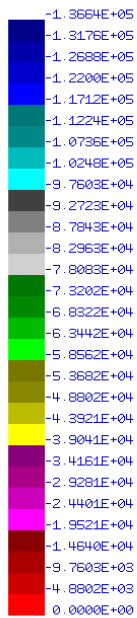


Figure 2-83. Cask Section Z-Stress

2.12.11 Analysis of 30-Ft. Drops with Shipping Cages

Shipping cages and pallets add to the cask impact forces for both Head-On and Cg/Corner 30-ft. Drops. In 30-ft. Side Drops, the shipping cage wire mesh panels impact the cask with negligible force. For Head-On and Cg/Corner Drops, the pallet impacts the cask through the upper impact limiter. As illustrated in [Figure 2-84](#), the pallet impacts the upper impact limiter, while cask impacts the lower impact limiter.

The ground force reacts to both the pallet and cask inertia forces, as illustrated in [Figure 2-84](#). In this analysis, the increase in the ground reaction force due to the pallet impact is evaluated. The upper and lower impact limiters exhibit different stiffness and frequency properties due to the difference in cask and pallet mass. As a result, the pallet inertia force and ground reaction force are not in phase. Dynamic analyses are required to account for the phase difference in the pallet and cask forces, so LIBRA-AGS analyses are performed for the 30-ft drops.

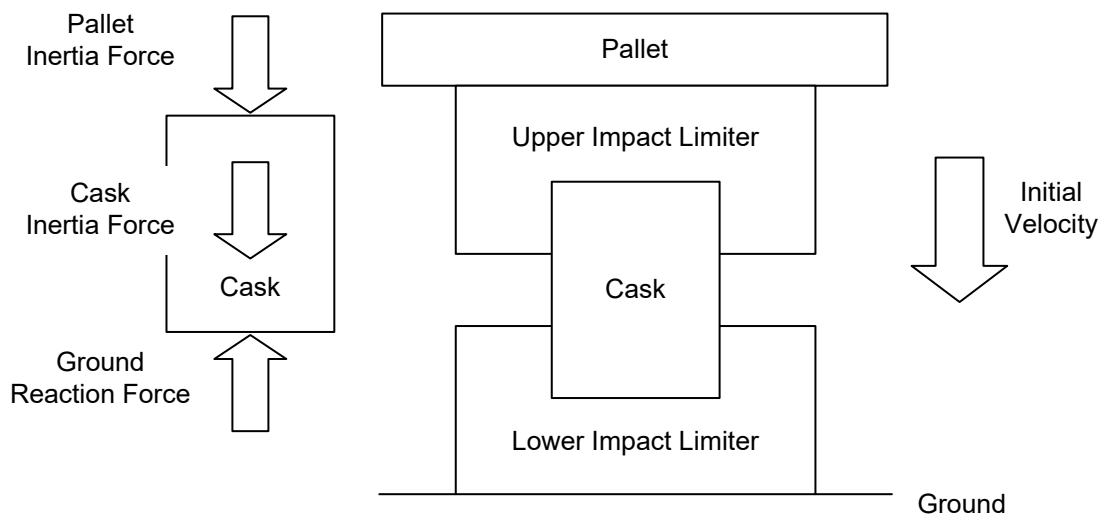


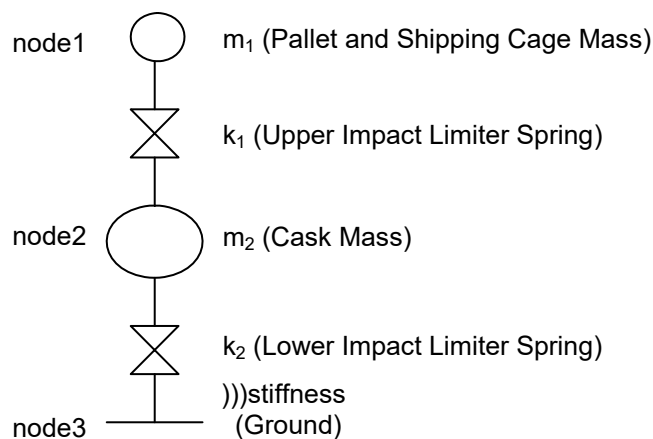
Figure 2-84. Configuration of Cask and Pallet Impact

Note: [Figure 2-84](#) shows the scenario that the analysis evaluates. In this case, it is required that the assembled package be upside down.

2.12.11.1 Description of AGS Analyses

The LIBRA-AGS program is applied to the analyses of 30-ft. cask drops that include shipping cage impacts. The generalized dynamic model illustrated in [Figure 2-85](#) is used for all drop analyses. The model contains two masses representing the pallet and cask, and two piecewise linear springs representing the upper and lower impact limiters. Spring stiffness values are taken from the impact limiter, load-displacement curves for 30-ft. drop analyses. A 30-ft. free-fall velocity is applied to both pallet and cask mass, as initial conditions. For each transport package model and each drop configuration, analyses are performed with, and without, the pallet mass. The effect of the pallet is measured by the difference in the ground impact force with, and without, the pallet mass.

AGS models for the Model AOS-025, AOS-050, and AOS-100 cask configurations differ only in nodal mass and element stiffness values, and AGS models for Head-On and Cg/Corner Drop analyses differ only in spring stiffness. A typical AGS input file is listed in [Figure 2-85](#). The generalized stiffness and mass properties used in the analyses are presented in [Table 2-339](#) and [Table 2-340](#). Additionally, [Table 2-339](#) lists the spring stiffness properties developed from the impact limiter load-displacement analyses. For Head-On Drop analyses, the generalized spring stiffness is modeled as bilinear. For Cg/Corner Drops, the generalized spring stiffness is modeled as trilinear.



```
ti  model 100 + pallet cg/corner drop
sc  10000,5.0e-6, 0.0,0.000, 3,0, 1
nd  1,3.88e-6
,   2,28.5
,   3,1.0
el  1,1, 1,2
,   2,1, 2,3
pr   1, 5.2e4,2.6e5, 8.6e4,6.0e5, 2.4e5,1.0e9
bc  3
iv  1,527.5
,   2,527.5
mo  1,1
,   2,1
,   1,4
,   2,4
end
```

Figure 2-85. AGS Model and Typical Input File

In [Table 2-339](#), the first column lists the transport package model number and drop orientation. The generalized stiffness values are determined from the SAR figures listed in column 2. k_1 , k_2 , and k_3 are piecewise stiffness values. P_1 , P_2 , and P_3 are associated terminal force values. [Figure 2-86](#) and [Figure 2-87](#) are force-displacement plots that illustrate piecewise linear stiffness representations for the Model AOS-100. Piecewise linear stiffness representations for the Model AOS-025 and AOS-050 are similar. [Table 2-340](#) lists the generalized pallet and cask mass values, m_1 and m_2 . Both the pallet and shipping cage mass are included in the m_1 values.

Table 2-339. Generalized Stiffness Properties – All Models

Model and Drop Orientation	Reference Figure	k_1 (lb/in)	P_1 (lb)	k_2 (lb/in)	P_2 (lb)	k_3 (lb/in)	P_3 (lb)
AOS-025, Head-On	Figure 2-54	1.00E+05	6.00E+04	1.71E+05	1.00E+09	–	–
AOS-025 Cg/Corner	Figure 2-56	3.56E+04	4.00E+04	6.40E+04	8.00E+04	1.60E+05	1.00E+09
AOS-050 Head-On	Figure 2-57	8.88E+04	2.00E+05	1.37E+05	1.00E+09	–	–
AOS-050 Cg/Corner	Figure 2-59	2.91E+04	8.00E+04	5.00E+04	1.80E+05	8.22E+04	1.00E+09
AOS-100 Head-On	Figure 2-60	1.70E+05	5.00E+04	3.10E+05	1.00E+09	–	–
AOS-100 Cg/Corner	Figure 2-63	5.20E+04	2.60E+05	8.60E+04	6.00E+05	2.40E+05	1.00E+09

Table 2-340. Generalized Pallet and Cask Mass Properties – All Models

Model	m_1 (lb-sec ² /in)	m_2 (lb-sec ² /in)
AOS-025	0.142	0.505
AOS-050	0.621	3.26
AOS-100	3.88	28.5

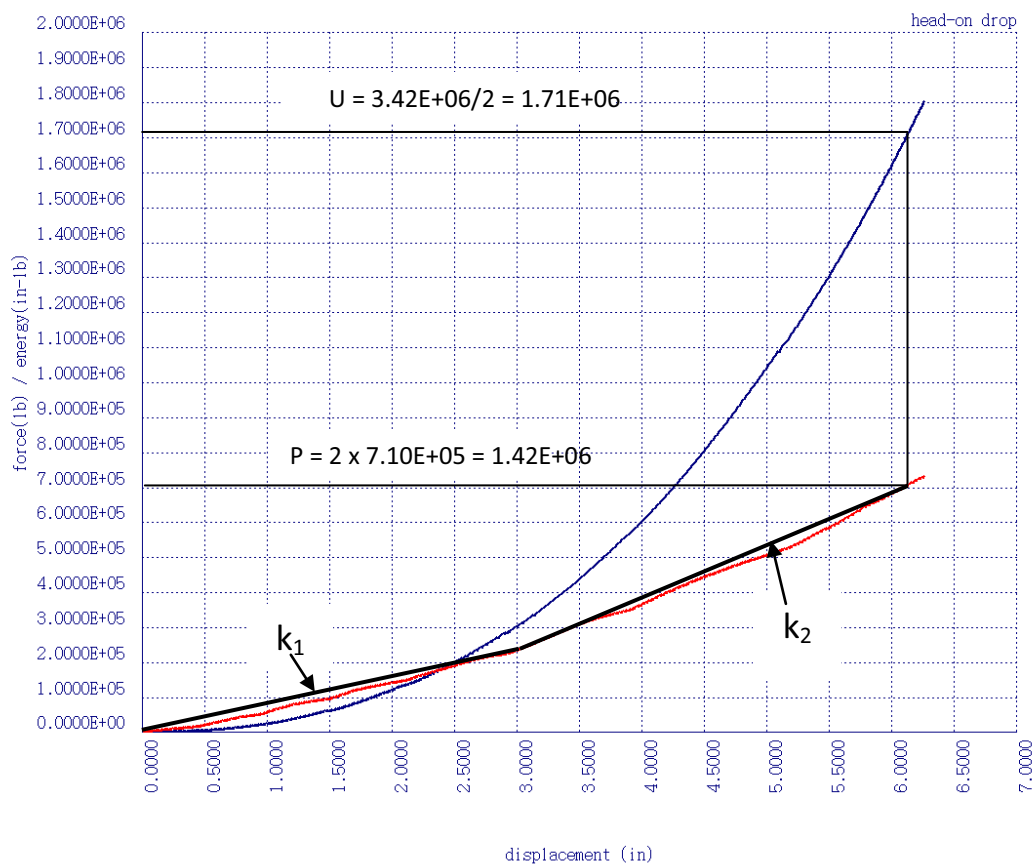


Figure 2-86. Bilinear Representation of Head-On Force-Displacement – Model AOS-100

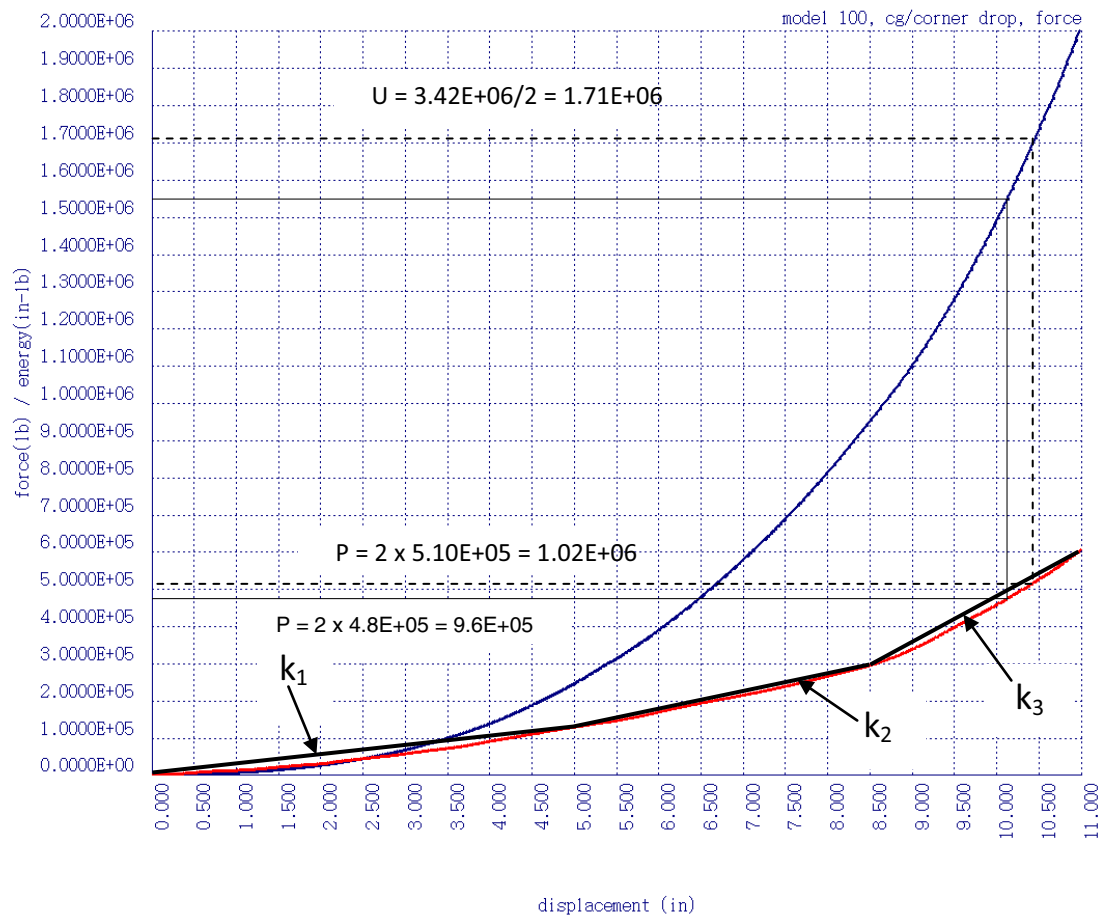


Figure 2-87. Trilinear Representation of Cg/Corner Force-Displacement – Model AOS-100

2.12.11.2 Results of AGS Analyses

Results of analyses for the Model AOS-100 are presented in [Table 2-340](#), and [Figure 2-88](#) and [Figure 2-89](#). [Figure 2-88](#) illustrates time-history plots of pallet mass displacement (1), and cask mass displacement (2). [Figure 2-89](#) illustrates time-history plots of upper impact limiter spring force (3), and lower impact limiter spring force (4).

[Table 2-341](#), [Table 2-342](#), and [Table 2-343](#) present results of analyses for Models AOS-025, AOS-050, and AOS-100, respectively. Each table lists maximum nodal displacements and maximum element forces. Definitions of column data for all three tables are listed after [Table 2-341](#). Each model and drop configuration is analyzed with, and without, the pallet mass. Analyses including pallet mass are designated with “+ Pallet” (for example, “Head-On + Pallet”). Forces and displacements determined in the SAR static impact limiter analysis are included for comparison, in columns labeled F_s and δ_s .

[Table 2-344](#) presents the change in ground impact forces due to the pallets. The F_s column lists the impact forces determined in the impact limiter static drop analyses. The ΔF column lists the increase in dynamic impact force due to the pallet. Values for ΔF are differences in P_2 force for impacts with, and without, the pallet. Using the information presented in [Table 2-341](#), [Table 2-342](#), and [Table 2-343](#), ΔF is the difference between rows 1 and 2 for Head-On Drops, and rows 3 and 4 for Cg/Corner Drops. The F_T column lists the sum of F_s and ΔF . The Ratio column lists the F_T / F_s values, and measures the change in ground impact force due to pallet impact.

Table 2-341. AGS Analysis – Model AOS-025

Drop	δ_1 (in.)	δ_2 (in.)	F_1 (lbs.)	F_2 (lbs.)	δ_s (in.)	F_s (lbs.)	Ratio
Head-On	–	1.09	–	1.46E+05	1.10	1.40E+05	–
Head-On + Pallet	1.35	1.09	0.30E+05	1.44E+05	–	–	1.06
Cg/Corner	–	1.86	–	9.84E+04	1.90	10.0E+04	–
Cg/Corner + Pallet	2.77	1.93	3.80E+04	10.9E+04	–	–	1.11

where:

δ_1	=	Pallet deflection
δ_2	=	Cask deflection
F_1	=	Upper impact limiter spring force
F_2	=	Lower impact limiter spring force
δ_s	=	Foam static analysis displacement
F_s	=	Foam static analysis force
Ratio	=	Ratio of P_2 with pallet to P_2 without pallet

Table 2-342. AGS Analysis – Model AOS-050

Drop	δ_1 (in.)	δ_2 (in.)	F_1 (lbs.)	F_2 (lbs.)	δ_s (in.)	F_s (lbs.)	Ratio
Head-On	–	3.13	–	3.20E+05	3.25	3.40E+05	–
Head-On + Pallet	4.19	3.28	8.55E+04	3.40E+05	–	–	1.06
Cg/Corner	–	5.18	–	2.15E+05	5.30	2.40E+05	–
Cg/Corner + Pallet	7.12	5.36	5.91E+04	2.30E+05	–	–	1.07

Table 2-343. AGS Analysis – Model AOS-100

Drop	δ_1 (in.)	δ_2 (in.)	F_1 (lbs.)	F_2 (lbs.)	δ_s (in.)	F_s (lbs.)	Ratio
Head-On	–	6.17	–	1.50E+06	6.10	1.42E+06	–
Head-On + Pallet	8.03	6.37	3.00E+05	1.56E+06	–	–	1.04
Cg/Corner	–	10.9	–	1.07E+06	10.5	1.02E+06	–
Cg/Corner + Pallet	14.4	11.1	2.09E+05	1.12E+06	–	–	1.05

Table 2-344. Increased Ground Impact Forces – All Models

Model	Drop Orientation	F_s (lbs.)	ΔF (lbs.)	F_T ($F_s + \Delta F$) (lbs.)	Ratio (F_T / F_s)
AOS-025	Head-On	1.44E+05	0.80E+04	1.52E+05	1.06
	Cg/Corner	1.00E+05	1.06E+04	1.11E+05	1.11
AOS-050	Head-On	3.40E+05	2.00E+04	3.60E+05	1.06
	Cg/Corner	2.40E+05	1.50E+04	2.55E+05	1.06
AOS-100	Head-On	1.42E+06	6.00E+04	1.48E+06	1.04
	Cg/Corner	1.02E+06	5.00E+04	1.07E+06	1.05

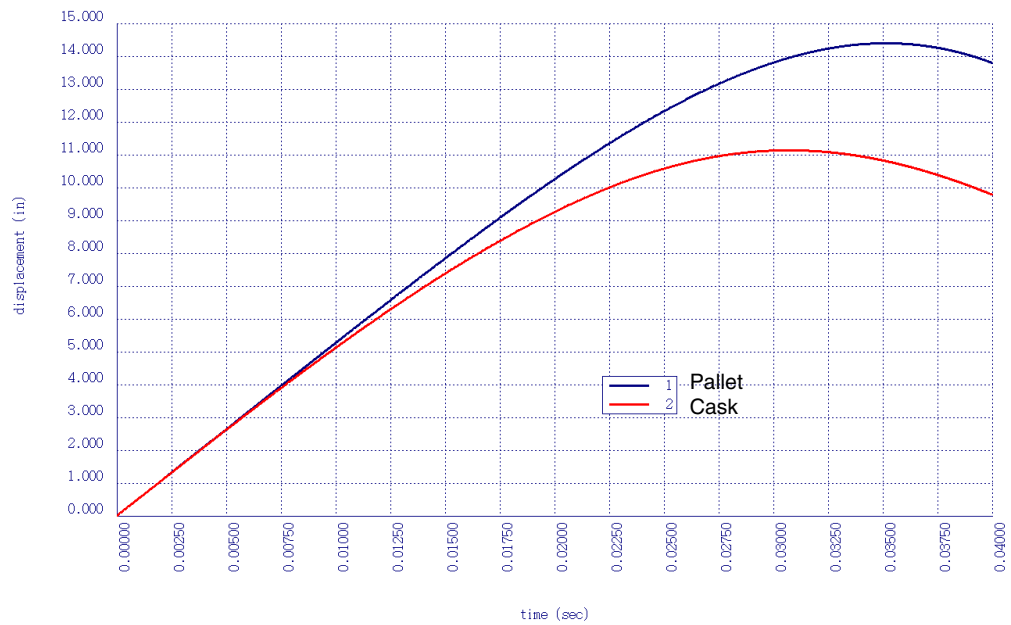


Figure 2-88. Model AOS-100 Cg/Corner Pallet and Cask Displacements

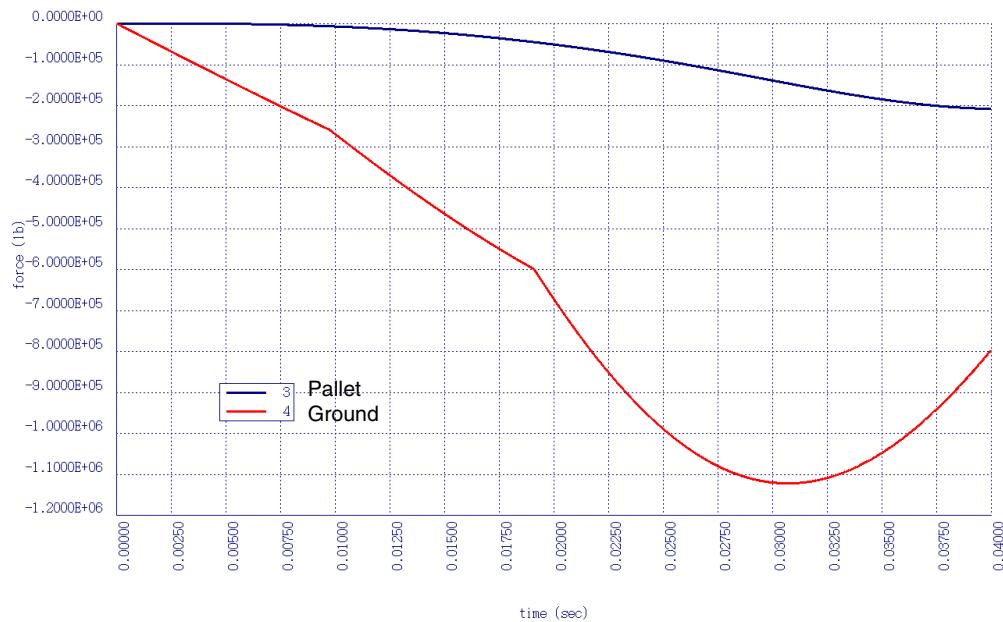


Figure 2-89. Model AOS-100 Cg/Corner Pallet and Ground Impact Forces

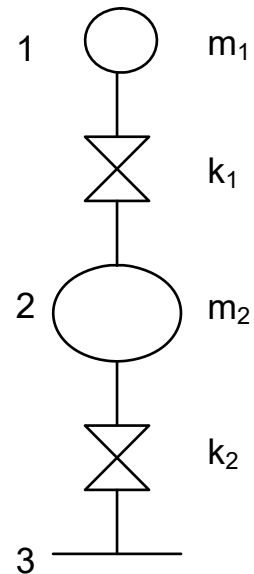
2.12.11.3 AGS Input Data for Cask and Pallet 30-Ft. Drop Analyses

```

ti    cask and pallet drop
*
sc    50000,5.0e-7,  0.0,0.000,  3,0,  0
*
*    model 100
*nd   1,3.88
*nd   2,28.5
*nd   3,1.0
*
*    model 050
nd    1,0.621
nd    2,3.26
nd    3,1.0
*
*    model 025
*nd   1,0.142e
*nd   2,0.505
*nd   3,1.0
*
el    1,1,  1,2
,      2,1,  2,3
*
*    100 head-on
*pr    1,  1.7e5,5.0e5,  3.1e5,1.0e9
*    100 cg/corner

*pr    1,  5.2e4,2.6e5,  8.6e4,6.0e5,  2.4e5,1.0e9
*
*    050 head-on
*pr    1,  8.88e4,2.00e5,  1.37e5,1.00e9
*    050 cg/corner
pr     1,  2.91e4,8.00e4,  5.00e4,1.80e5,  8.22e4,1.00e9
*
*    025 head-on
*pr    1,  1.00e5,6.00e4,  1.70e5,1.00e9
*    025 cg/corner
*pr    1,  3.56e4,4.00e4,  6.40e4,8.00e4,  1.60e5,1.0e9
*
bc     3
*
iv     1,527.5
,       2,527.5
*
mo     1,1
,       2,1
,       1,4
,       2,4
*
end

```



2.12.12 Analysis of Tie-Down Devices

2.12.12.1 Introduction

The Model AOS-050 and AOS-100 cask transport tie-down system is illustrated in [Figure 2-90](#). The system consists of cables (four (4) in the Model AOS-050; eight (8) in the Model AOS-100), a shipping cradle under the lower LAST-A-FOAM FR-3700 series foam, and a tie-down ring over the upper LAST-A-FOAM FR-3700 series foam. The postulated inertia loading is 10g forward, 5g lateral, and 2g vertical. Lateral and vertical inertia forces are illustrated in [Figure 2-90](#), as F and W, respectively. In [Figure 2-90](#), the dimension H is the distance from the cask's center of gravity to lateral support.

The Model AOS-025 uses four tie-down straps.

Analyses are performed for 10g forward and 2g vertical inertia loads. Stress due to the 5g lateral load is interpolated from the 10g forward load analysis, because the tie-down configuration is axisymmetric. Stresses due to the three (3) inertia loads are combined where required, and compared to allowable stresses.

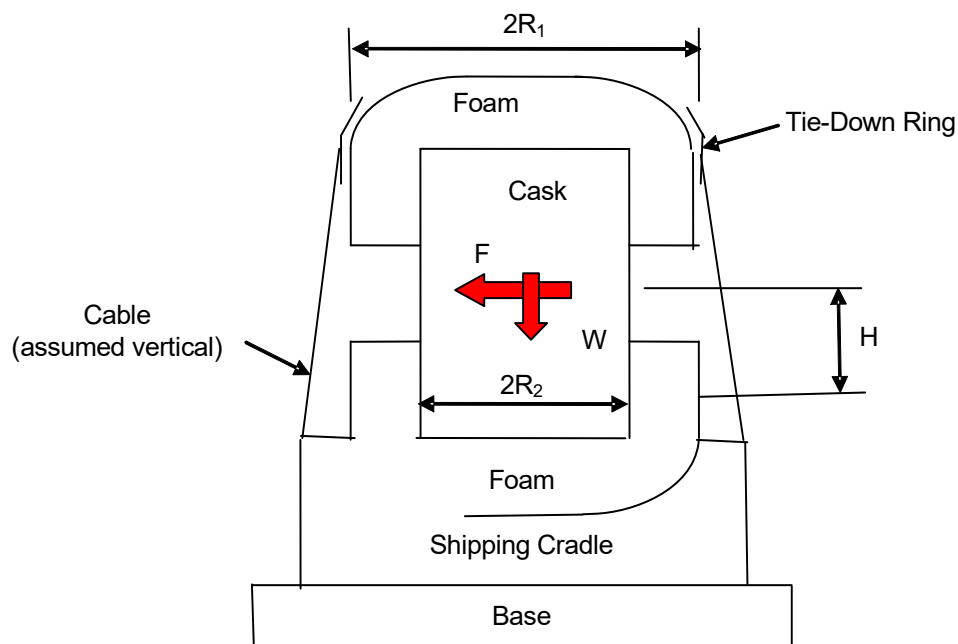


Figure 2-90. Tie-Down Schematic

2.12.12.2 Base Foam Vertical Bearing Force

The inertia force, F , illustrated in Figure 2-90 is assumed to produce the foam bearing traction illustrated in Figure 2-91, at the shipping cradle. The foam bearing traction is assumed sinusoidal in the circumferential direction, and linear in the horizontal direction, as illustrated in Figure 2-91. The bearing traction is provided by:

$$p = (p_0 / 2R_1) * (1 - \cos\theta) * r$$

where:

$$p_0 = \text{Maximum bearing traction}$$

The total bearing force is then:

$$\begin{aligned} P &= p_0 / 2R_1 \int_0^{2\pi} \int_{R_2}^{R_1} (1 - \cos\theta) * r^2 * dr * d\theta \\ &= \pi p_0 (R_1^3 - R_2^3) / 3R_1 \end{aligned}$$

The moment due to the bearing force is:

$$\begin{aligned} M &= p_0 / 2R_1 \int_0^{2\pi} \int_{R_2}^{R_1} (1 - \cos\theta)^2 * r^3 * dr * d\theta \\ &= 3\pi p_0 (R_1^4 - R_2^4) / 8R_1 \end{aligned}$$

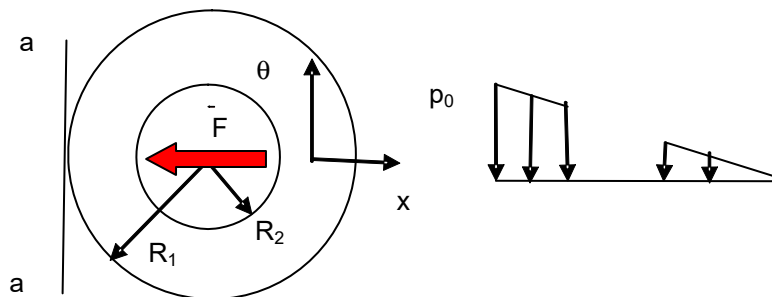


Figure 2-91. Bearing Traction Along Line $\theta = 0 - 180$

The overturning moment about the axis a-a in [Figure 2-91](#) due to the inertia force is $F * H$:

$$F * H = (3\pi p_0 / 8R_1) * (R_1^4 - R_2^4)$$

Solving for maximum bearing traction:

$$p_0 = 8F * H * R_1 / (3\pi (R_1^4 - R_2^4))$$

Vertical foam bearing traction due to W is:

$$p_1 = W / [\pi (R_1^2 - R_2^2)]$$

2.12.12.3 Base Foam Lateral Bearing Force

The foam bearing force at the shipping cradle wall due to inertia force, F , is illustrated in [Figure 2-92](#). The traction distributions are assumed to be sinusoidal in the circumferential direction. For vertical bearing length B , the total wall bearing force is:

$$F = 2B \int_0^{\pi/2} q * R_1 * \cos\theta * d\theta$$

Integrating:

$$F = 2B * R_1 * q$$

$$q = F / 2B * R_1$$

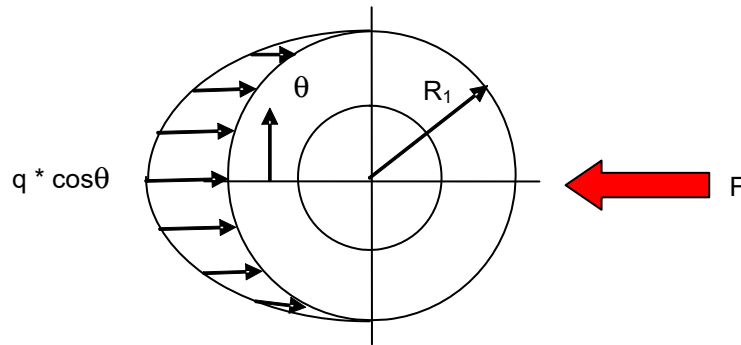


Figure 2-92. Schematic of Lateral Bearing Forces

2.12.12.4 Summary of Stress Equations for Base Foam

B = Lateral shipping cradle wall bearing length

F = Lateral inertia force

H = Lateral inertia force moment arm

R₁ = Outside foam radius

R₂ = Inside foam radius

T = Cable tension force

W = Vertical inertia force

1. Foam vertical traction due to inertial overturning moment:

$$p_0 = 8F * H * R_1 / 3\pi (R_1^4 - R_2^4)$$

2. Foam vertical traction due to vertical inertia:

$$p_1 = W / \pi (R_1^2 - R_2^2)$$

3. Foam horizontal traction due to lateral inertia:

$$q = F / 2B * R_1$$

2.12.12.5 Cable Force

The cable forces react the overturning moment due to the inertia force, F , and height, H , in Figure 2-90. Moment equilibrium is taken about axis a-a in Figure 2-93, with cable forces assumed proportional to the distance from axis a-a.

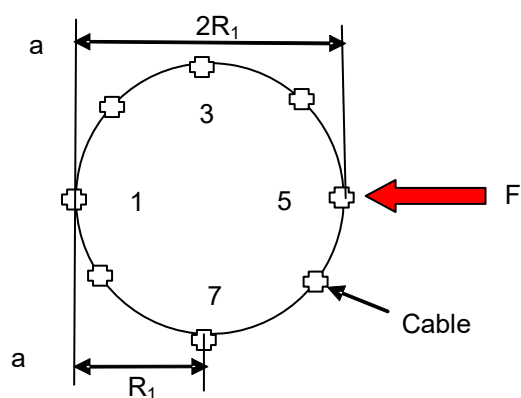


Figure 2-93. Tension Cables – Model AOS-100

Table 2-345. Model AOS-100 Cable Loads

Cable	d	P / T	d * P / T	P (k)
1	0.00000	0.00000	0.00000	0.0000
2	6.73654	0.14645	0.98656	3.0560
3	23.0000	0.50000	11.5000	10.435
4	39.2635	0.85355	33.5134	17.813
5	46.0000	1.00000	46.0000	20.870
6	39.2635	0.85355	33.5134	17.813
7	23.0000	0.50000	11.5000	10.435
8	6.73654	0.14645	0.98656	3.0560
Σ	–	4.00000	138.000	83.478

where:

- d = Distance to axis a-a
- T = Maximum cable tension force
- P = Cable tension force, in kips (k)

From [Figure 2-90](#):

$$M = F * H$$

$$F = 120 \text{ k}$$

$$H = 24 \text{ in.}$$

$$M = 120 * 24 = 2,880 \text{ in-k}$$

From [Table 2-345](#), the maximum and total cable forces are:

$$M = \sum d * P / T$$

$$T = M / 138 = 2,880 / 138 = 20.870 \text{ k}$$

$$\sum P = 4.00 * 20.870 = 83.480 \text{ k}$$

2.12.12.6 Tie-Down Ring Foam Bearing Pressure

The tie-down ring is in equilibrium under the cable forces and foam bearing pressures, as illustrated in [Figure 2-94](#). The bearing pressure due to the cable resultant forces is:

$$p = P / A$$

$$P = 83.478$$

$$A = \pi * (R_1^2 - R_2^2) = 857.7 \text{ in}^2$$

$$p = 0.0973 \text{ lb/in}^2$$

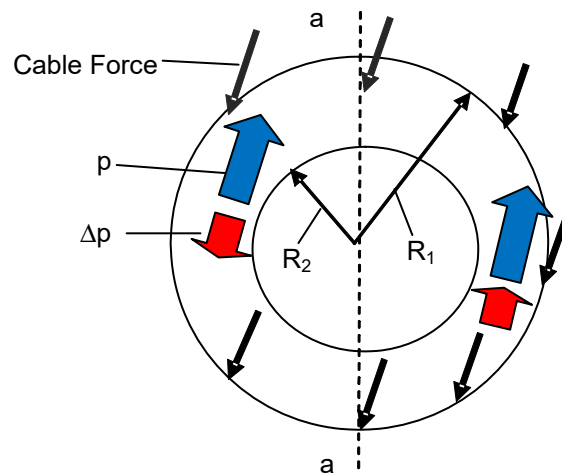


Figure 2-94. Bearing Pressure and Cable Forces

2.12.12.7 Tie-Down Ring Foam Differential Bearing Pressure

The moment about axis a-a in [Figure 2-94](#) due to differential bearing pressure is:

$$\begin{aligned}M' &= 4 * \Delta p \int_0^{\pi/2} \int_{R_2}^{R_1} \cos\theta * r^2 * dr * d\theta \\&= 4 / 3 * (R_1^3 - R_2^3) * \Delta p \\ \Delta p &= M' / [4 / 3 * (R_1^3 - R_2^3)]\end{aligned}$$

From [Table 2-345](#), the moment about axis a-a in [Figure 2-95](#) is:

$$\begin{aligned}M' &= M - (\Sigma P * R_1) \\&= 2,880 - (83.480 * 23.0) \\&= 961.34 \text{ in-k} \\ \Delta p &= 961.34 / 10,761 = 0.0893 \text{ lb/in}^2 \\ p + \Delta p &= 187.0 \text{ lb/in}^2 \\ p - \Delta p &= 8.000 \text{ lb/in}^2\end{aligned}$$

MATERIALS:

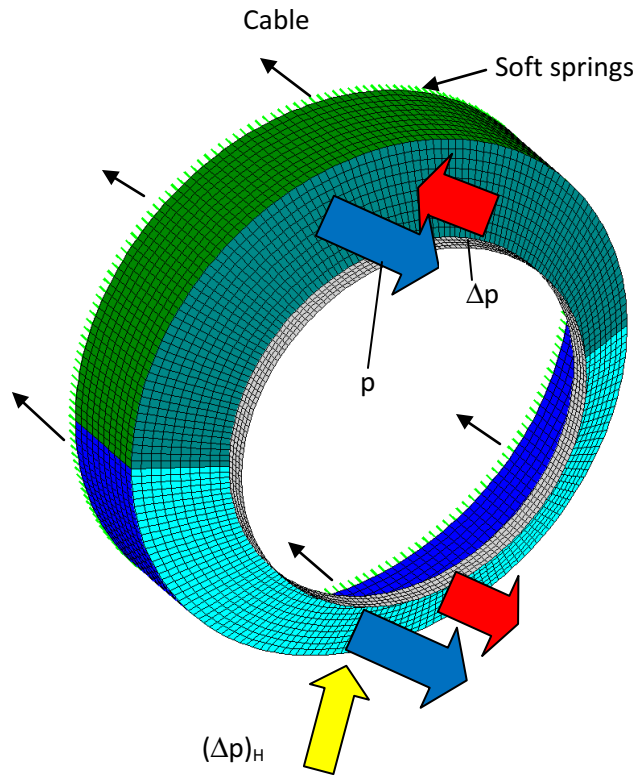
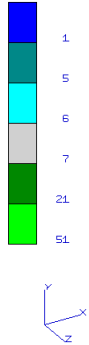


Figure 2-95. FEA Model of Tie-Down Ring

2.12.12.8 Horizontal Component of Differential Pressure

The Δp pressure acting on the conical shell produces a horizontal force resultant:

$$\begin{aligned} P_H &= 4 * \Delta p * \sin \alpha \int_0^{\pi/2} \int_{R_2}^{R_1} \cos \theta * r * dr * d\theta \\ &= 2 * \Delta p * \sin \alpha * (R_1^2 - R_2^2) \end{aligned}$$

where:

$$\alpha = \text{Conical shell base angle}$$

For radius, R_1 , and cylinder height, h :

$$p_H = P_H / 2R_1 * h$$

$$P_H = 2 * 89.3 * \sin 27.2^\circ = 2.23 \times 10^4 \text{ lbs.}$$

$$p_H = 2.23 \times 10^4 / 46.0 * 9.0 = 53.8 \text{ psi}$$

2.12.12.9 Analysis of Tie-Down Ring

The tie-down ring is analyzed for a 10g lateral inertia force by finite elements, using the FEA model illustrated in [Figure 2-95](#). The ring is analyzed as a shell structure, and the FEA model contains 26,400 DOF, with 4,400 nodes and 4,300 quad shell elements. The model is composed of two primary sections – a cylindrical shell and a conical shell. A ring of soft springs is modeled about the base of the cylindrical section to react out-of equilibrium forces.

The loads applied to the model are illustrated in [Figure 2-95](#). These loads are in equilibrium, and consist of the cable loads developed in [Table 2-345](#), and bearing tractions on the conical and cylindrical shells. In [Figure 2-95](#), the resultants of the bearing pressure, p , and differential bearing pressure, Δp , balance the cable force and cable moment resultants. The differential pressure, Δp , acting on the conical shell produces a horizontal force resultant, and this resultant is balanced by the pressure $(\Delta p)_H$ applied to the cylindrical shell.

Results of the tie-down ring stress analysis are presented in [Figure 2-96](#) and [Figure 2-97](#). [Figure 2-96](#) illustrates lateral displacement of the conical shell, and [Figure 2-97](#) illustrates the outer fiber maximum principal stress in the conical shell.

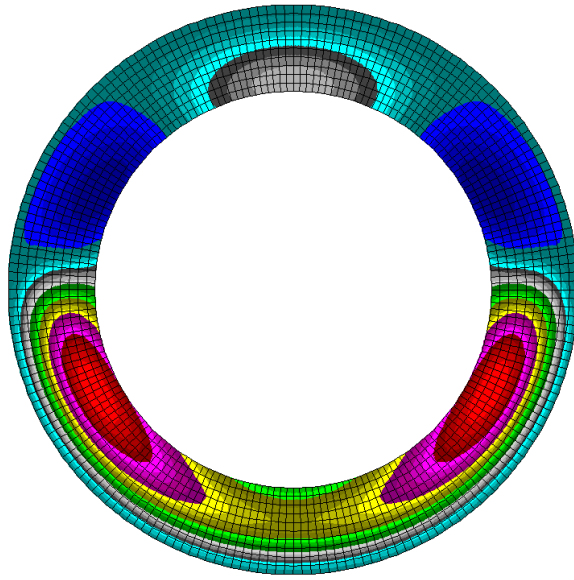
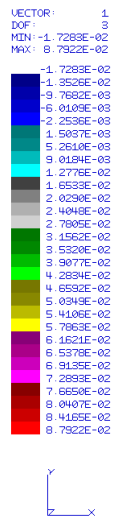


Figure 2-96. Lateral (Z) Displacement in Conical Shell – Model AOS-100

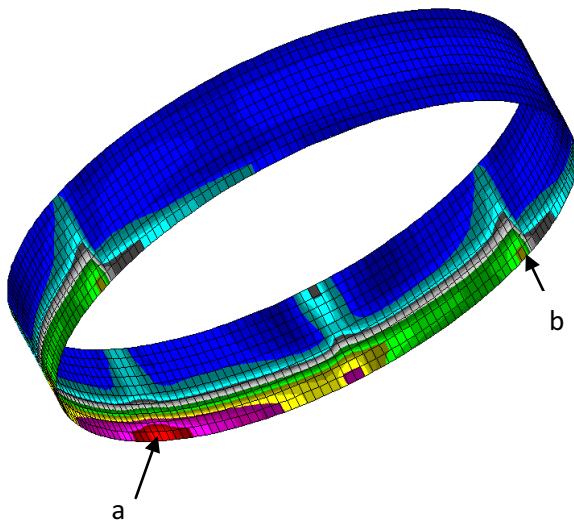
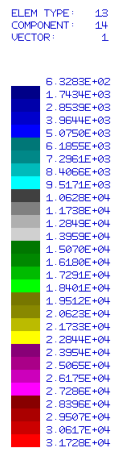


Figure 2-97. Maximum Principal Membrane Stress – Model AOS-100

2.12.12.10 Stress in Foam – Model AOS-100

The foam stress is limited to 10% strain to avoid excessive deformation. From the *Design Guide for Use of LAST-A-FOAM FR-3700 for Crash & Fire Protection of Radioactive Material Shipping Containers* (Reference [\[2.13\]](#)):

$$\begin{aligned}\sigma &= Y_{\text{int}} (\rho)^S \\ Y_{\text{int}} &= 4.3422 \\ \rho &= 12 \\ S &= 1.8809 \\ \sigma &= 4.3422 * 107.1 = 465.1 \text{ psi}\end{aligned}$$

Applying equations in [Appendix 2.12.12.4](#):

$$\begin{aligned}B &= \text{Shipping cradle wall length} && 8.0 \text{ in.} \\ F &= \text{Lateral force} && 120,000.0 \text{ lbs.} \\ H &= \text{Cask center of gravity to shipping cradle} && 24.0 \text{ in.} \\ R_1 &= \text{Outside foam radius} && 23.0 \text{ in.} \\ R_2 &= \text{Inside foam radius} && 14.0 \text{ in.} \\ W &= \text{Vertical force} && 24,000.0 \text{ lbs.}\end{aligned}$$

Base foam vertical bearing stress (psi):

$$p = 8F * H * R_1 / 3\pi (R_1^4 - R_2^4) + W / \pi (R_1^2 - R_2^2) = 234 \text{ psi} (< 465.1)$$

Base foam lateral bearing stress (psi):

$$q = F / 2B * R_1 = 310 \text{ psi} (< 465.1)$$

From [Appendix 2.12.12.7](#), the maximum foam bearing stress at the conical shell:

$$p + \Delta p = 187.0 \text{ psi} (< 465.1)$$

From [Appendix 2.12.12.8](#), the maximum foam bearing stress at the cylindrical shell:

$$p_H = 107.7 \text{ psi} (< 465.1)$$

2.12.12.11 Stress in Tie-Down Ring – Model AOS-100

Figure 2-97 shows the maximum principal membrane stress for bending about the x-axis. The maximum stress occurs at location 'a', and is 31.7 ksi. For bending about the y-axis, the stress at location 'b' corresponds to the stress at location 'a'. The stress at location 'b' is 18.5 ksi for 10g loading. The combined stress due to 10g about the x-axis, and 5g about the y-axis, is then:

$$f = 32.2 + (1 / 2) * 18.5 = 41.5 \text{ ksi}$$

For ASME SA-240/ASTM A240 Type XM-19 steel, yield stress $F_y = 55.0$ ksi, and ultimate strength $F_u = 100.0$ ksi:

$$MS = 55.0 / 41.5 - 1.0 = 0.32$$

2.12.12.12 Stress in Cables – Model AOS-100

P_1 = Maximum cable load (Table 2-345, cable 5) due to 10g forward inertia

P_2 = Maximum cable load due to 5g lateral inertia

P_3 = Cable load due to 1g vertical inertia

P_1 = 20.9 k

P_2 = $(1 / 2) * 20.9 = 10.5$ k

P_3 = $12 / 8 = 1.5$ k

P = $P_1 + P_2 + P_3 = 32.9$ k

From ASTM F1145 - 05(2011), Table 3 (Reference [2.27]), Jaw-Jaw, $P_u = 60$ k:

$$MS = 60 / 32.9 - 1.0 = 0.82$$

2.12.12.13 Forces – Model AOS-050

Note: Refer to [Appendix 2.12.12.7](#) and [Appendix 2.12.12.8](#) for further details.

Maximum cable tension, moment about axis a-a:

$$M = F * H = 2R_1 * (T / 2) + R_1 * 2T = 3R_1 * T$$

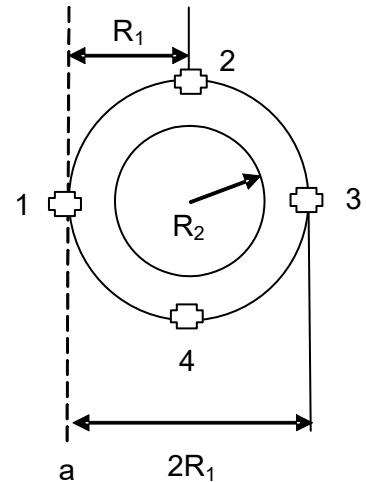
$$T = F * H / 3R_1$$

$$F = 11,810 \text{ lbs.}$$

$$H = 16 \text{ in.}$$

$$R_1 = 12 \text{ in.}$$

$$T = 5,248.9 \text{ lbs.}$$



Total force in cables:

$$P = T + 2 * T / 2 = 2T = 10,500 \text{ lbs.}$$

Conical shell bearing pressure:

$$p = P / A$$

$$P = 10,500$$

$$R_2 = 8.0$$

$$A = \pi * (R_1^2 - R_2^2) = 251.3 \text{ in}^2$$

$$p = 41.8 \text{ lb/in}^2$$

Differential conical shell bearing pressure:

$$\begin{aligned}
 M' &= 4 / 3 * (R_1^3 - R_2^3) * \Delta p \\
 &= M - P * R_1 = 3R_1 * T - 2R_1 * T = R_1 * T \\
 &= 12 * 10,500 = 1.26 \times 10^5 \text{ in-lb} \\
 \Delta p &= M' / [4/3 * (R_1^3 - R_2^3)] \\
 &= 1.26 \times 10^5 / 1.621 \times 10^3 = 77.8 \text{ lb/in}^2 \\
 p + \Delta p &= 119.6 \\
 p - \Delta p &= -36.0
 \end{aligned}$$

Pressure < 0, increase cable loads:

$$\begin{aligned}
 P' &= A * (p - \Delta p) = 251.3 * 36.0 = 9,046.7 \text{ lbs.} \\
 \Delta T &= 9,046.7 / 4 = 2,261.7 \\
 T(1) &= 0.0 + 2,261.7 = 2,261.7 \\
 T(2) &= T(4) = 5,248.9 / 2 + 2,261.7 = 4,886.2 \text{ lbs.} \\
 T(3) &= 5,248.9 + 2,261.7 = 7,510.6 \text{ lbs.} \\
 p + \Delta p &= 119.6 + 36.0 = 155.6 \text{ psi} \\
 p - \Delta p &= -36.0 + 36.0 = 0.0
 \end{aligned}$$

Horizontal component of differential pressure (refer to [Appendix 2.12.12.8](#)):

$$\begin{aligned}
 P_H &= 2 * \Delta p * \sin \alpha * (R_1^2 - R_2^2) \\
 \alpha &= 27.2^\circ \\
 P_H &= 2 * 77.8 * 0.4571 * (12^2 - 8^2) = 5,690.0 \text{ lbs.} \\
 p_H &= P_H / 2R_1 * h = 5,690.0 / 24.0 * 4.5 = 52.6 \text{ psi}
 \end{aligned}$$

2.12.12.14 Stress in Cable – Model AOS-050

Maximum cable load from [Appendix 2.12.12.13](#):

$$T = 7,510.6 \text{ lbs.}$$

From *ASTM F1145 - 05(2011)*, Table 3 (Reference [\[2.27\]](#)), Jaw-Jaw, $P_u = 60 \text{ k}$:

$$MS = 60 / 7.510 - 1 = 7.0$$

2.12.12.15 Stress in Foam – Model AOS-050

Allowable foam stress ($\varepsilon = 0.1$):

$$\sigma = Y_{\text{int}} (\rho)^S$$

$$Y_{\text{int}} = 4.3422$$

$$\rho = 10$$

$$S = 1.8809$$

$$\sigma = 4.3422 * 76.0 = 330.1 \text{ psi}$$

Applying equations in [Appendix 2.12.12.4](#):

$$B = \text{Shipping cradle wall length} \quad 4.0 \text{ in.}$$

$$F = \text{Lateral force} \quad 11,810.0 \text{ lbs.}$$

$$H = \text{Cask center of gravity to shipping cradle} \quad 16.0 \text{ in.}$$

$$R_1 = \text{Outside foam radius} \quad 12.0 \text{ in.}$$

$$R_2 = \text{Inside foam radius} \quad 7.0 \text{ in.}$$

$$W = \text{Vertical force} \quad 2,362.0 \text{ lbs.}$$

Base foam vertical bearing stress (psi):

$$p = 8F * H * R_1 / 3\pi (R_1^4 - R_2^4) + W / \pi (R_1^2 - R_2^2) = 112.9 \text{ psi} (< 330.1)$$

Base foam lateral bearing stress (psi):

$$q = F / 2B * R_1 = 123.0 \text{ psi} (< 330.1)$$

From [Appendix 2.12.12.12](#), the maximum foam bearing stress at the conical shell:

$$p + \Delta p = 155.6 \text{ psi} (< 330.1)$$

$$p_H = 52.6 \text{ psi} (< 330.1)$$

2.12.12.16 Stress in Tie-Down Ring – Model AOS-050

Figure 2-98 illustrates the maximum principal membrane stress for bending about the x-axis. The maximum stress occurs at location 'a', and is 13.5 ksi. For bending about the y-axis, the stress at location 'b' corresponds to the stress at location 'a'. The stress at location 'b' is 5.3 ksi for 10g loading. The combined stress due to 10g about the x-axis, and 5g about the y-axis, is then:

$$f = 13.5 + (1/2) * 5.3 = 16.2 \text{ ksi}$$

For ASME SB-209 Alloy 6061 T6, Yield Strength $F_y = 35.0$ ksi:

$$MS = 35.0 / 16.2 - 1.0 = 1.16$$

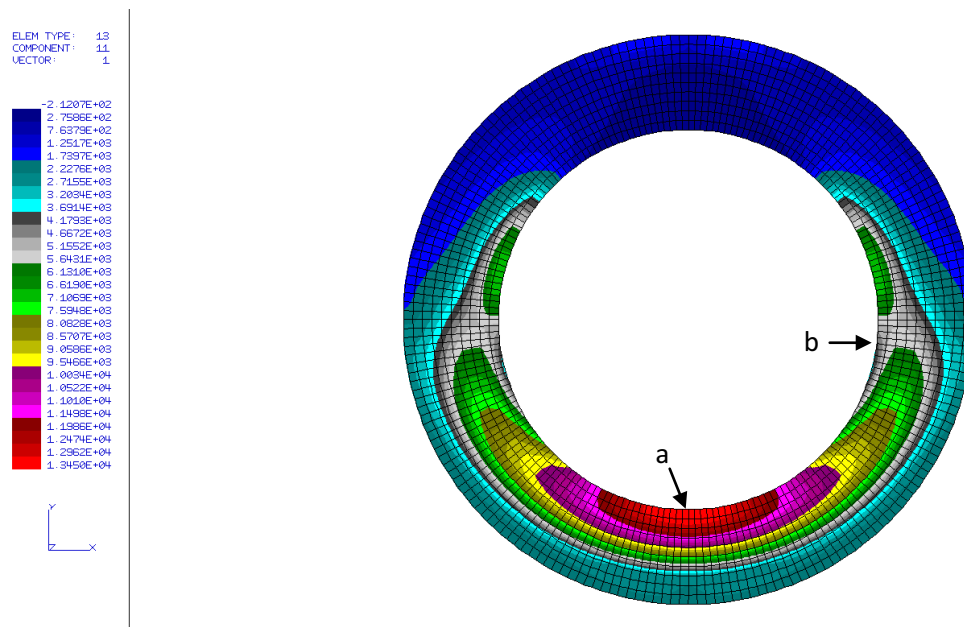


Figure 2-98. Maximum Principal Membrane Stress – Model AOS-050

2.12.12.17 Tie-Down Straps – Model AOS-025

Strap load:

$$\sum M_A = 0$$

$$11.8 * T_1 + 2T_1 / 2 * 5.9 = 1,680 * (16.25 - 2.30) / 2$$

$$T_1 = 1.172 \times 10^4 / 17.7 = 662.0 \text{ lbs.}$$

$$T_2 = T_1 / 2 = 331.0 \text{ lbs.}$$

$$T_3 = W / 4 = 42.0 \text{ lbs.}$$

$$T = T_1 + T_2 + T_3 = 1,035.0 \text{ lbs.}$$

For a 1.0-inch strap, $P_u = 3,000 \text{ lbs.}$:

$$MS = 3,000 / 1,035.0 - 1.0 = 1.90$$

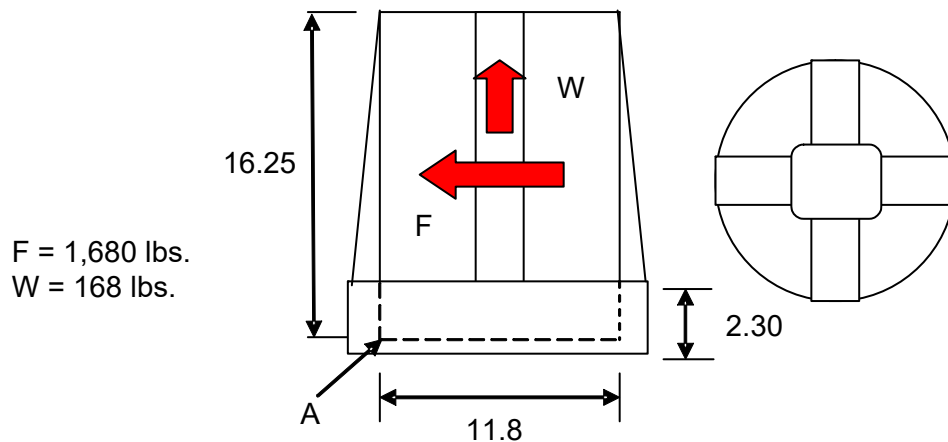


Figure 2-99. Tie-Down Strap Load – Model AOS-025

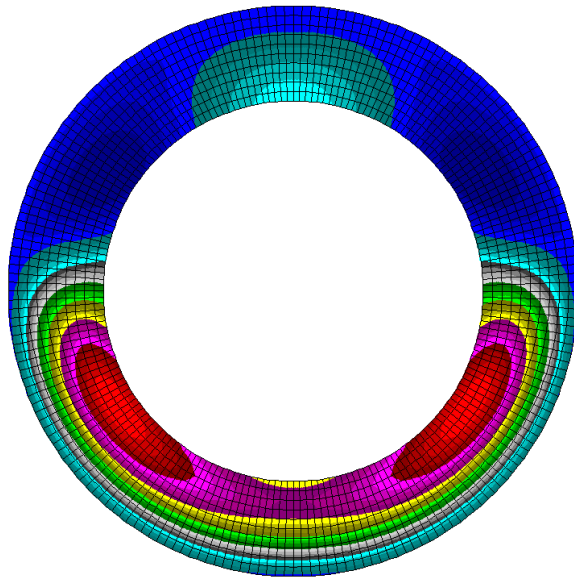
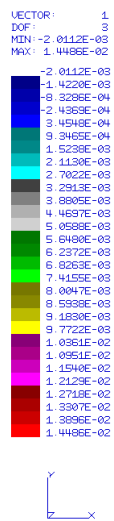


Figure 2-100. Lateral (Z) Displacement in Conical Shell – Model AOS-050

2.12.13 Certificate of Conformance, General Plastics FR-3700 Series Foam – AOS-165A Prototype



4910 Burlington Way, Tacoma, Washington 98409

T (253) 473.5000 F (253) 473.5104 TF (800) 806.6051 www.generalplastics.com

April 25, 2011

Alpha-Omega Services, Inc.
General Electric Nuclear Energy
6705 Vallecitos Road
Sunol, CA 95486

CORRECTED COPY

Attention: Receiving Quality Inspection

Subject: **CERTIFICATE OF CONFORMANCE**

Purchase Order #: **AOS-3835 Rev 2**
SJO Number: **5099-1**
Gentlemen:

This letter certifies that the **AOS-165** Impact Limiter filled with **LAST-A-FOAM® FR-3720** has been manufactured, tested and inspected in accordance with purchase order requirements. These products are classified "Safety Class A." Applicable drawings, specifications and standards called for by the purchase order:

Material Specs, Drawings and Process Standards:

105E9694 Rev. 3
22A9420 Rev. 1

Production control records and test reports covering subject material indicate conformance with applicable requirements and are attached.

Material: General Plastics Mfg. Co.'s
LAST-A-FOAM® FR-3720
Quantity: 5 each **AOS-165 Units 01-05**

Respectfully submitted,

GENERAL PLASTICS MANUFACTURING COMPANY



Gerald Langston
Quality Engineer

GEH-NE Source Inspection

5/17/2011

6-5-2011

ALPHA-OMEGA SERVICES INC. QA

- Enclosures:
- 5 each Production Control Records, Units 01-05.
 - 1 each Formulation Test report, LAST-A-FOAM® FR-3720 Batch # 243-CR04489 (Density, c/s, flame, intumescence, leachable chlorides, thermal conductivity, specific heat, water absorption, chemical composition), 19 pages total.
 - 1 each Batch Test Report, LAST-A-FOAM® FR-3720 Batch # 243-CR04489 (Density, c/s, flame, intumescence, leachable chlorides) 4 pages total.
 - General Plastics Reject Tag #'s 3095, 3099, 3109 & 3110.

2.12.14 Analysis of Shipping Cage Lifting Bars – Models AOS-050A and AOS-100

The optional Lifting Bar on the Model AOS-050A and AOS-100 transport packages are intended to lift only the Shipping Cage and **not** the entire package. As such, *10 CFR 71.45(a)* [\[2.1\]](#) requires that these features must be capable of being rendered inoperable for lifting the package during transport. For this purpose, the lifting holes on the Lifting Bar are covered prior to transport. Furthermore, the Lifting Bars are clearly marked with instructions to **not** lift the entire package.

The Shipping Cage on the Model AOS-025A transport package is easily lifted by hand and therefore is not fitted with a Lifting Bar.

The following analyses for the Model AOS-050A and AOS-100 transport packages demonstrate that the Lifting Bars can safely lift the Shipping Cages. A force of five (5) times the weight of the Shipping Cage is applied to the Lifting Bar and the stress and elastic stability are analyzed.

2.12.14.1 Analysis of Shipping Cage Lifting Bar – Model AOS-050A

The following information is presented:

- Description of the FEA model
- Stress Analysis
- Buckling Analysis

2.12.14.1.1 Description of FEA Model – Model AOS-050A

The FEA model of the Model AOS-050A Shipping Cage and Lifting Bar used in the analyses is illustrated in [Figure 2-101](#) and [Figure 2-102](#). Note that the FEA model used for the Model AOS-050A is not a scaled version of the model for the Model AOS-100. This is because there are significant differences between the two Shipping Cage designs and scaling was not possible.

The Model AOS-050A Shipping Cage consists of a welded aluminum frame and aluminum expanded-metal mesh faces fastened to the frame. The Shipping Cage frame is not reinforced at the corners by gusset plates as in the Model AOS-100 Shipping Cage. The Lifting Bar is a 0.25-in.-thick aluminum T-section beam with a 2-in.-wide base and 2-in. in height. The Lifting Bar is connected to the top of the cage frame with four ¼"-20 UNC bolts.

The FEA model contains 6922 nodes and 12432 elements, comprising 41532 degrees of freedom. The Shipping Cage frame and Lifting Bar are both modeled by STIF3 triangular shell elements. Connections between the lifting bar and frame are modeled by bolt (STIF56) and spring (STIF1) elements. The Lifting Bar is offset from the frame and connects to the frame by bolts and bearing points. The bolts connecting the Lifting Bar to the frame are modeled by STIF56 bolt elements, and bearing points are modeled by STIF1 spring elements. Due to the similarity of the Model AOS-050A and AOS-100 Shipping Cages, the locations of the spring elements modeling the bearing points are based on a gapped analysis performed on the Model AOS-100 Shipping Cage. (Refer to [Paragraph 2.12.14.2.](#))

The expanded metal mesh is loosely attached to the Shipping Cage frame and provides little structural support while dominating structural response due to its flexibility, so it is not included in the analyses. To compensate for omission of the expanded metal mesh, the frame mass density is increased from 0.1 to 0.167 lb/in³. The mass of the expanded metal mesh on the top surface is added to the frame midpoints as four (4) concentrated values.

The weight of the Model AOS-050A Shipping Cage is conservatively taken to be 41.9 lbs. Therefore, an inertial load of 5g results in a force of 209.5 lbs.

The Shipping Cage is assumed to be fixed at a single point at the center of the Lifting Bar, whereas in reality there are two (2) lifting points on the Lifting Bar. Using a single lifting point is a conservative assumption, because lifting by two (2) points away from the center of the Lifting Bar distributes the reaction forces and thereby reduces the stresses and deflection within the Lifting Bar.

In the FEA analysis, the vertical displacement was fixed only at the lifting point illustrated in [Figure 2-101](#). To prevent rigid body motion in the stress analysis, a single node at the base of the Shipping Cage is fixed in the lateral directions. To prevent all possible rigid body modes in the stability analysis, four (4) nodes at the base of the cage and four (4) nodes at the top of the cage are fixed in the lateral directions.

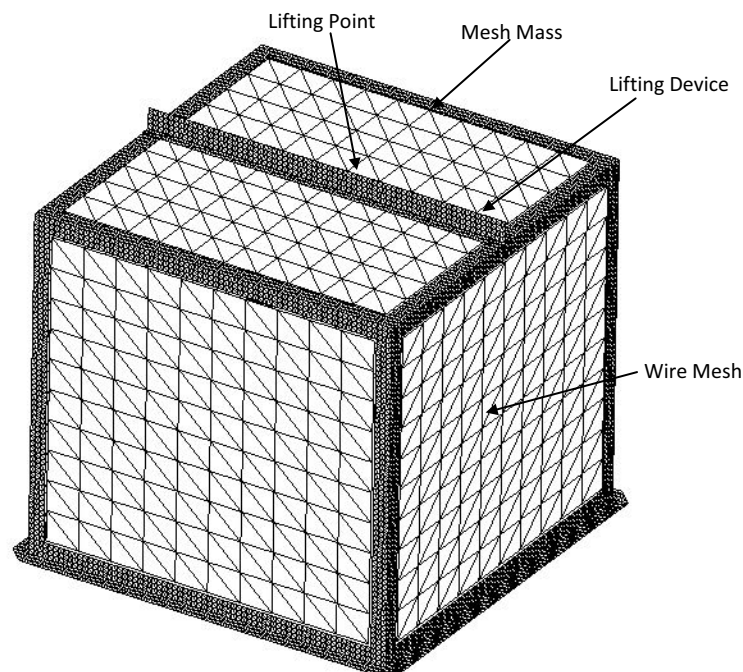


Figure 2-101. Shipping Cage and Lifting Bar – Model AOS-050A

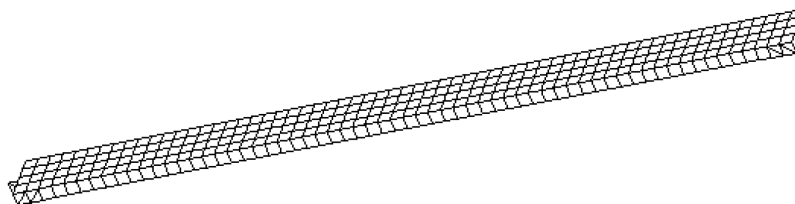


Figure 2-102. Lifting Bar – Model AOS-050A

2.12.14.1.2 Stress Results – Model AOS-050A

A LIBRA stress analysis (MAIN1) and an elastic stability analysis (MAIN11) were performed. The stress analysis results are presented in [Table 2-346](#), [Table 2-347](#), [Figure 2-103](#), and [Figure 2-104](#). [Table 2-346](#) and [Table 2-347](#) are maximum stress values generated by the LIBRA stress post-processor program STRPP.

[Table 2-346](#) indicates that the maximum Equivalent stress in the Shipping Cage frame is 5.4 ksi. [Table 2-347](#) indicates the maximum Equivalent stress in the Lifting Bar is 6.6 ksi.

[Figure 2-103](#) illustrates the deformed geometry amplified by a factor of 25. [Figure 2-104](#) illustrates the stress distribution in both the Shipping Cage and Lifting Bar.

The margins of safety are calculated as follows:

For ASME SB-209 Alloy 6061 T6,
Yield Strength:

$$F_y = 35.0 \text{ ksi}$$

Shipping Cage Frame:

$$MS = F_y / f - 1 = 35.0 / 5.4 - 1 = 5.5$$

Lifting Bar:

$$MS = F_y / f - 1 = 35.0 / 6.6 - 1 = 4.3$$

The stresses within the bolts connecting the Lifting Bar to the Shipping Cage frame are listed in [Table 2-348](#), and the associated contact forces are listed in [Table 2-349](#). From [Table 2-348](#), the maximum bolt equivalent stress indicated is 1,792 psi.

The margin of safety is calculated as follows:

$$\text{Yield strength} = 20 \text{ ksi}$$

$$MS = \sigma_y / \sigma - 1 = 20 / 1.8 - 1 = 10.1$$

Table 2-346. Maximum von Mises Stress in Shipping Cage Frame – Model AOS-050A

	Nx	Ny	Nxy	Mx	My	Mxy
1-6:	-8.0524E+02	4.2206E+02	-1.3235E+02	-1.8634E+01	-1.1487E+01	7.8909E+00
elem:	5071	4377	5137	5860	6359	5849
	S1	S2	T	Se		
7-10:	3.3567E+03	-5.6206E+03	2.5231E+03	5.3565E+03	(top)	
elem:	1377	6073	6073	6073		
11-14:	2.4308E+03	-4.2772E+03	2.0106E+03	4.1551E+03	(mid)	
elem:	2374	5071	5071	5071		
15-18:	4.1532E+03	-5.6220E+03	2.5236E+03	5.3577E+03	(bot)	
elem:	5860	5073	5073	5073		

Table 2-347. Maximum von Mises Stress in Lifting Bar – Model AOS-050A

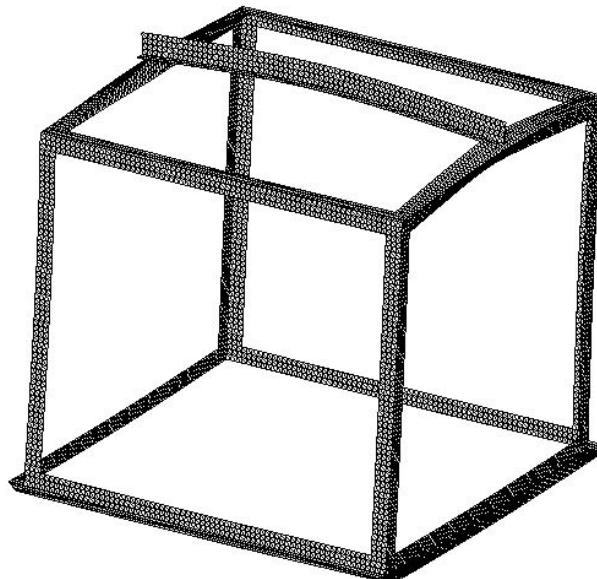
	Nx	Ny	Nxy	Mx	My	Mxy
1-6:	2.5267E+02	1.6698E+03	1.9288E+02	-8.4826E+00	-7.3391E+00	2.7459E+00
elem:	26291	26295	26286	25011	25286	25021
	S1	S2	T	Se		
7-10:	6.7282E+03	-2.8792E+03	3.2548E+03	6.6216E+03	(top)	
elem:	26295	25286	26295	26295		
11-14:	6.7288E+03	-2.3575E+03	3.2550E+03	6.6222E+03	(mid)	
elem:	26295	26274	26295	26295		
15-18:	6.7295E+03	-2.3639E+03	3.2553E+03	6.6227E+03	(bot)	
elem:	26295	26274	26295	26295		

Table 2-348. Bolt Stresses – Model AOS-050A

ELEM	Px	Py	Pz	SIGMA	TAU	EQV_STR
27002	6.500E+01	-2.952E+01	1.426E+01	1.324E+03	6.679E+02	1.758E+03
27001	6.498E+01	2.971E+01	1.697E+01	1.324E+03	6.970E+02	1.792E+03
27012	6.498E+01	-2.958E+01	-1.481E+01	1.324E+03	6.739E+02	1.765E+03
27011	6.499E+01	2.974E+01	-1.643E+01	1.324E+03	6.921E+02	1.786E+03

Table 2-349. Contact Forces – Model AOS-050A

ELEMENT:	27022	P = -1.14484E+01	U = -1.14484E-02
ELEMENT:	27021	P = -1.14510E+01	U = -1.14510E-02
ELEMENT:	27032	P = -1.14498E+01	U = -1.14498E-02
ELEMENT:	27031	P = -1.14466E+01	U = -1.14466E-02

**Figure 2-103. Deformation of Frame and Lifting Bar under Inertia Loading – Model AOS-050A**

ELEM TYPE: 3
 COMPONENT: 10
 VECTOR: 1

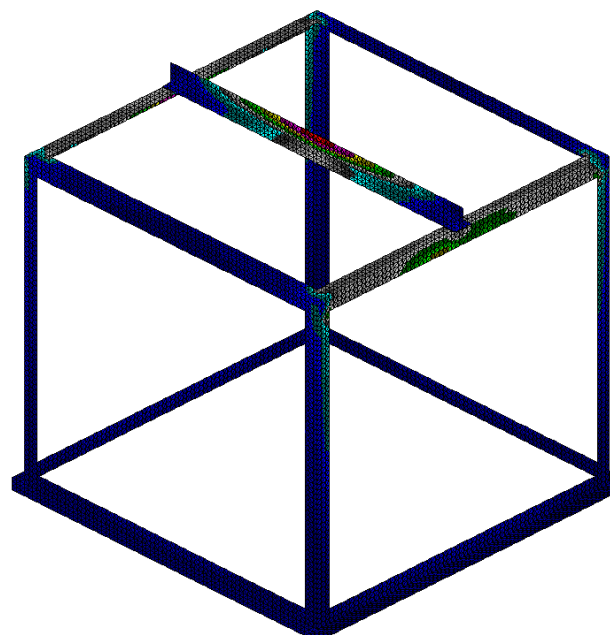
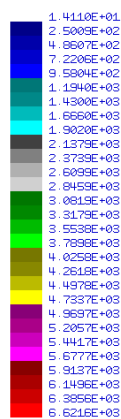


Figure 2-104. Equivalent Stress within Shipping Cage Frame and Lifting Bar – Model AOS-050A

2.12.14.1.3 Buckling Analysis – Model AOS-050A

A LIBRA elastic stability analysis (MAIN11) was performed on the Model AOS-050A Shipping Cage and Lifting Bar, using the FEA model illustrated in [Figure 2-101](#) (expanded metal mesh excluded). A LIBRA elastic stability analysis produces an eigenvalue that corresponds to the load factors at buckling. The solution is iterative and convergence to the lowest buckling mode is listed in [Table 2-350](#). The buckling mode is illustrated in [Figure 2-105](#), with only the Lifting Bar shown for clarity. [Table 2-350](#) indicates that the lowest buckling load is -20.5 times the applied inertia load. The negative eigenvalue in [Table 2-350](#) indicates that the buckling mode corresponds to an inertia load in the upward or +Z direction, and the mode for a downward inertia load would have a load factor greater than 20.5.

The LIBRA Input Files used for the Model AOS-050A Lifting Bar analysis are as follows:

- AOS-050-CAGE-LIFT Principal file
- AOS-050-CAGE-LIFT-A Mesh connections generated by the PRODATA pre-processing data program

Table 2-350. Convergence of Elastic Stability Analysis, Mode 1 – Model AOS-050A

ITERATION	CONVERGENCE	EIGENVALUE
1	1.00000E+00	8.49558E+02
2	1.00598E+01	7.68153E+01
3	9.23549E-02	8.46314E+01
4	8.36717E-01	5.18313E+02
5	4.87923E+00	-8.81600E+01
6	1.12753E+00	-4.14377E+01
7	4.09124E-01	-2.94067E+01
8	1.90801E-01	-2.46949E+01
9	9.47090E-02	-2.25584E+01
10	4.79963E-02	-2.15253E+01
11	2.45209E-02	-2.10101E+01
12	1.25717E-02	-2.07493E+01
13	6.45601E-03	-2.06162E+01
14	3.31806E-03	-2.05480E+01
15	1.70601E-03	-2.05130E+01
16	8.77339E-04	-2.04950E+01
17	4.51232E-04	-2.04858E+01
18	2.32090E-04	-2.04810E+01
19	1.19378E-04	-2.04786E+01
20	6.14044E-05	-2.04773E+01
21	3.15848E-05	-2.04767E+01
22	1.62464E-05	-2.04763E+01
23	8.35679E-06	-2.04761E+01

VEC: 0
AMPL: 0.000E+00
SQUARE OFF
SCALE: 0.95
BOUNDARIES:
X: -1.547
37.540
Y: -1.544
37.544
Z: -0.085
35.105

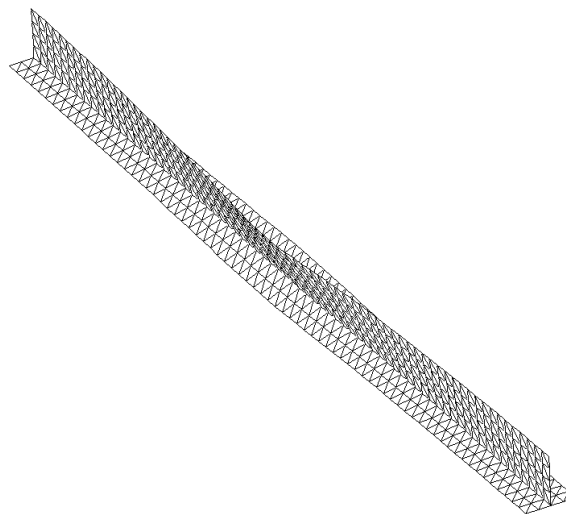


Figure 2-105. Lifting Bar First Buckling Mode – Model AOS-050A

2.12.14.2 Analysis of Shipping Cage Lifting Bar – Model AOS-100

The following information is presented:

- Description of the FEA model
- Stress Analysis
- Buckling Analysis

2.12.14.2.1 Description of FEA Model – Model AOS-100

This analysis is based largely on application of the LIBRA FEA program. The FEA models of the Shipping Cages and Lifting Bars used in the analyses are illustrated in [Figure 2-106](#) and [Figure 2-107](#).

The Model AOS-100 Shipping Cage structure consists of an aluminum frame reinforced at the corners by gusset plates, and stainless steel expanded-metal mesh faces. The Lifting Bar is a 0.375-in.-thick aluminum T-section beam with a 4-in.-wide base and 4 in. in height. The base of the T-section Lifting Bar in the FEA model was reduced to 2-in. wide. This makes the analysis results more conservative.

The Lifting Bar is connected to the top of the Shipping Cage frame with four ½"-13 UNC bolts.

The wire mesh is loosely attached to the Shipping Cage frame and provides little structural support while dominating structural response due to its flexibility, so it is not included in the analyses. To compensate for omission of the expanded metal mesh, a 6g inertia load is applied to the frame and considered to be an effective 5g loading. The weight of the Model AOS-100 Shipping Cage is conservatively taken to be 410 lbs. Therefore, an inertial load of 5g results in a force of 2,050 lbs.

The weight of the Shipping Cage without the expanded-metal mesh was taken to be 342.5 lbs. In the analysis, the applied load is six (6) times this weight or 2,055 lbs.

The cage is assumed to be fixed at a single point at the center of the Lifting Bar, whereas in reality there are two (2) lifting points on the Lifting Bar. Using a single lifting point is a conservative assumption, because lifting by two (2) points away from the center of the Lifting Bar distributes the reaction forces and thereby reduces the stresses and deflection within the Lifting Bar.

In the FEA analysis, the vertical displacement was fixed only at the Lifting Point illustrated in [Figure 2-106](#), and lateral displacements were fixed at four (4) points on the base of the Shipping Cage to prevent rigid body motion.

The bolted connections between the Lifting Bar and the Shipping Cage frame are analyzed using a LIBRA nonlinear analysis (MAIN2). The bolted connections transfer inertia load by a combination of bolt tension and bearing forces. A section of the cage model showing one (1) of the two (2) bolted connections is provided in [Figure 2-108](#). Under inertia load, the Lifting Bar and frame deform (refer to [Figure 2-112](#)). As a result of this deformation, the Lifting Bar bears on the frame. The bearing points and bolt forces are determined by a LIBRA MAIN2 nonlinear analysis, in which possible bearing points are modeled by gap elements. The potential gap elements are located along lines labeled Contact Line 1 and Contact Line 2 in [Figure 2-108](#). The MAIN2 solution process is iterative and in each iteration, the contact elements are assigned opened or closed status depending on the sense of the element force. The solution is considered converged when there is essentially no change in displacements, which indicates no change in element forces.

In the FEA model, there are 12 gapped elements numbered 75001 to 75012, representing potential contact points, and four (4) bolt elements numbered 75101 to 75104, representing the bolts.

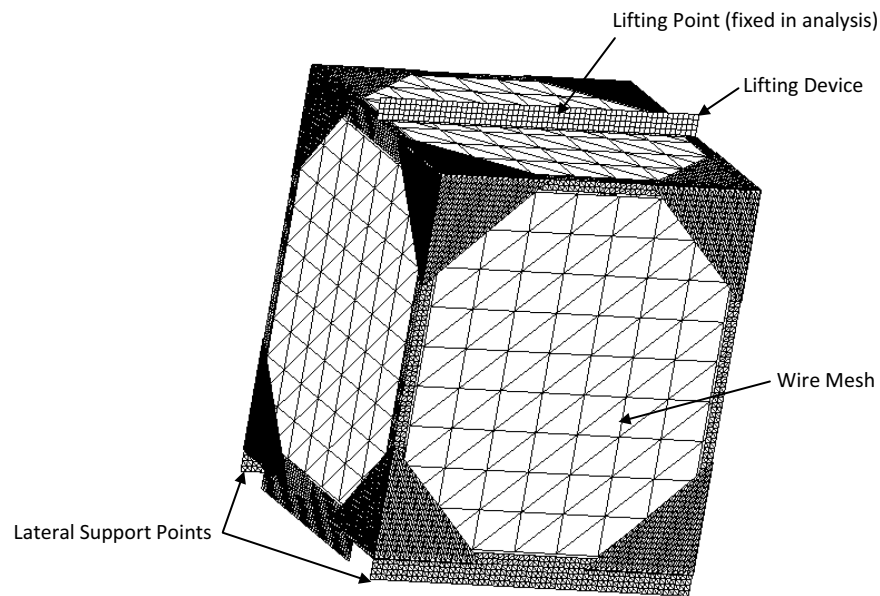


Figure 2-106. Shipping Cage and Lifting Bar – Model AOS-100

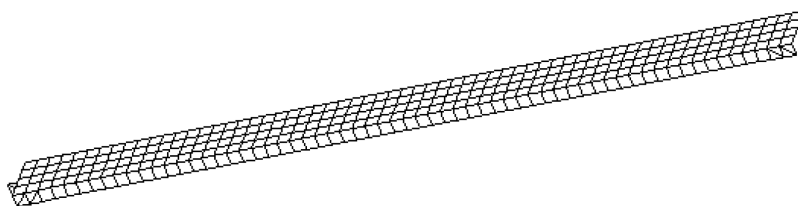


Figure 2-107. Lifting Bar – Model AOS-100

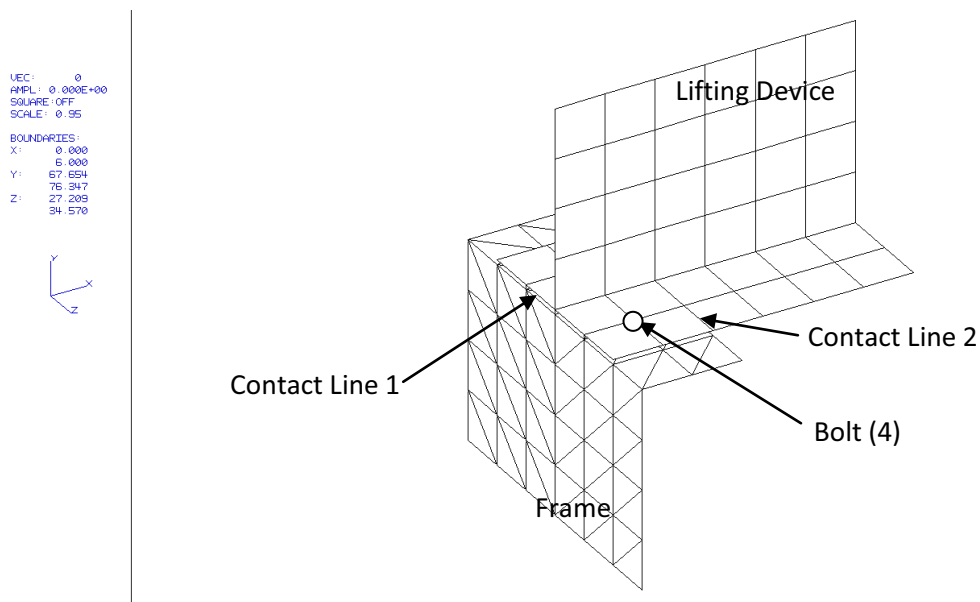


Figure 2-108. Model of Lifting Bar Bolted Connection – Model AOS-100

2.12.14.2.2 Stress Results – Model AOS-100

The Shipping Cage and Lifting Bar stress analysis results are presented in [Table 2-351](#), [Table 2-352](#), [Figure 2-109](#), [Figure 2-110](#), and [Figure 2-111](#). [Table 2-351](#) and [Table 2-352](#) list the maximum stress values generated by the LIBRA stress post-processor program (STRPP). From [Table 2-351](#), the maximum von Mises or Equivalent stress indicated within the Shipping Cage frame is 5.3 ksi. From [Table 2-352](#), the maximum von Mises stress indicated within the Lifting Bar is 14.4 ksi. [Figure 2-109](#) illustrates the vertical displacements. [Figure 2-110](#) and [Figure 2-111](#) illustrate the stress distributions within the Shipping Cage frame and Lifting Bar, respectively. The margins of safety are calculated as follows:

For ASME SB-209 Alloy 6061 T6,
Yield Strength:

$$F_y = 35.0 \text{ ksi}$$

Shipping Cage Frame:

$$MS = F_y / f - 1 = 35.0 / 5.3 - 1 = 5.6$$

Lifting Bar:

$$MS = F_y / f - 1 = 35.0 / 14.4 - 1 = 1.4$$

For the bolting analysis, the resulting contact and bolt element forces and displacements are listed in [Table 2-353](#) and [Table 2-354](#), respectively. Data in these tables is taken directly from the LIBRA stress post-processor program (STRSPP). In [Table 2-353](#), the elements with positive displacements correspond to open gaps and have null forces, and the elements with negative displacements correspond to closed gaps and have compressive forces. Closed gap elements are all located on Contact Line 2 in [Figure 2-108](#), indicating that the inner edge of the Shipping Cage frame bears against the Lifting Bar.

From [Table 2-354](#), the maximum force indicated within the bolt elements is 765 lbs. and the average force indicated is 743 lbs. The average bolt force without prying action is approximately the total inertia force divided by the quantity of bolts. There are four (4) bolts and the total inertia force is 2,055 lbs. Therefore, the average bolt force without prying is approximately 514 lbs. Thus, prying action increases bolt forces by about 50%.

Table 2-351. Maximum von Mises Stress in Shipping Cage Frame – Model AOS-100

	Nx	Ny	Nxy	Mx	My	Mxy
1-6:	-2.5387E+03	3.8960E+02	-3.4725E+02	-5.5458E+01	-3.5749E+01	1.6591E+01
elem:	19048	22361	18859	25815	25815	25809
	S1	S2	T	Se		
7-10:	4.0849E+03	-5.5433E+03	2.5484E+03	5.3341E+03	(top)	
elem:	15812	26048	26048	26048		
11-14:	3.7742E+03	-5.0820E+03	2.3585E+03	4.9097E+03	(mid)	
elem:	15812	19048	26048	19048		
15-18:	4.0846E+03	-5.5433E+03	2.5484E+03	5.3341E+03	(bot)	
elem:	19312	19048	19048	19048		

Table 2-352. Maximum von Mises Stress in Lifting Bar – Model AOS-100

	Nx	Ny	Nxy	Mx	My	Mxy
1-6:	-4.5158E+03	1.4469E+03	-1.3295E+03	-2.6969E+01	-2.1294E+01	-9.9870E+00
elem:	70187	70186	70248	70532	70623	17221
	S1	S2	T	Se		
7-10:	8.6655E+03	-1.2899E+04	7.7629E+03	1.4393E+04	(top)	
elem:	70218	70187	70187	70187		
11-14:	8.6655E+03	-1.2899E+04	7.7629E+03	1.4393E+04	(mid)	
elem:	70218	70187	70248	70248		
15-18:	8.6655E+03	-1.2899E+04	7.7629E+03	1.4393E+04	(bot)	
elem:	70218	70248	70248	70248		

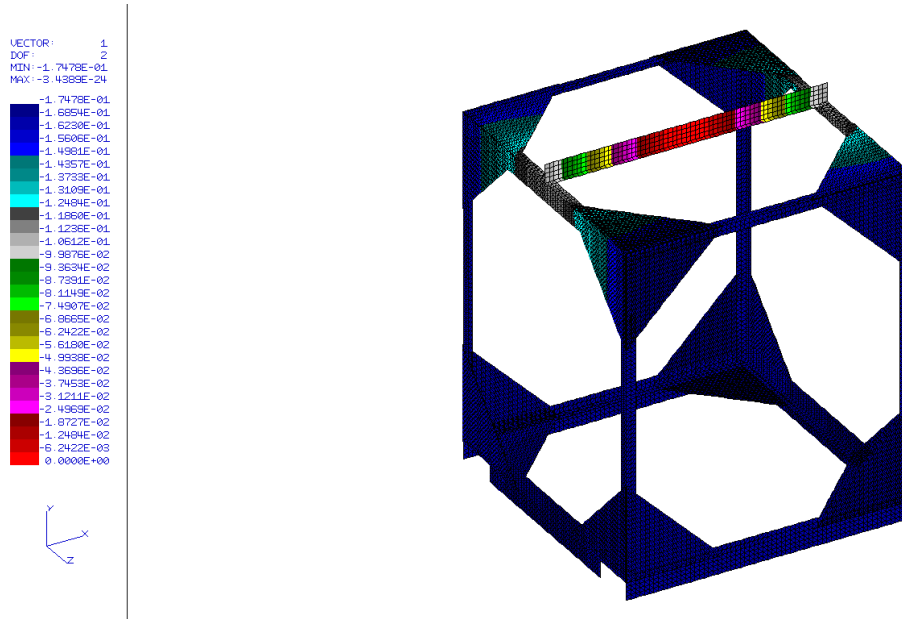


Figure 2-109. Shipping Cage Vertical Displacements – Model AOS-100

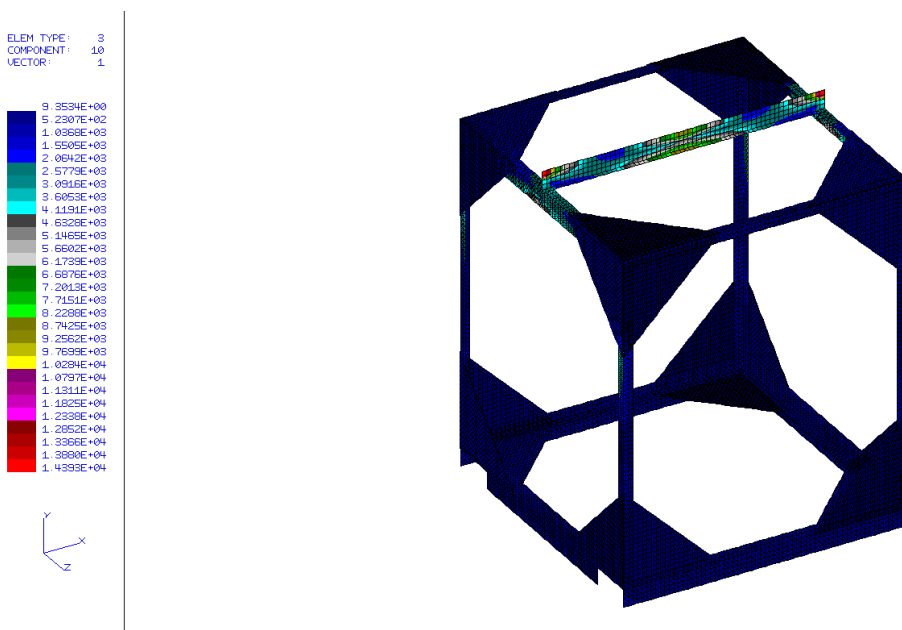


Figure 2-110. Shipping Cage von Mises Equivalent Stress – Model AOS-100

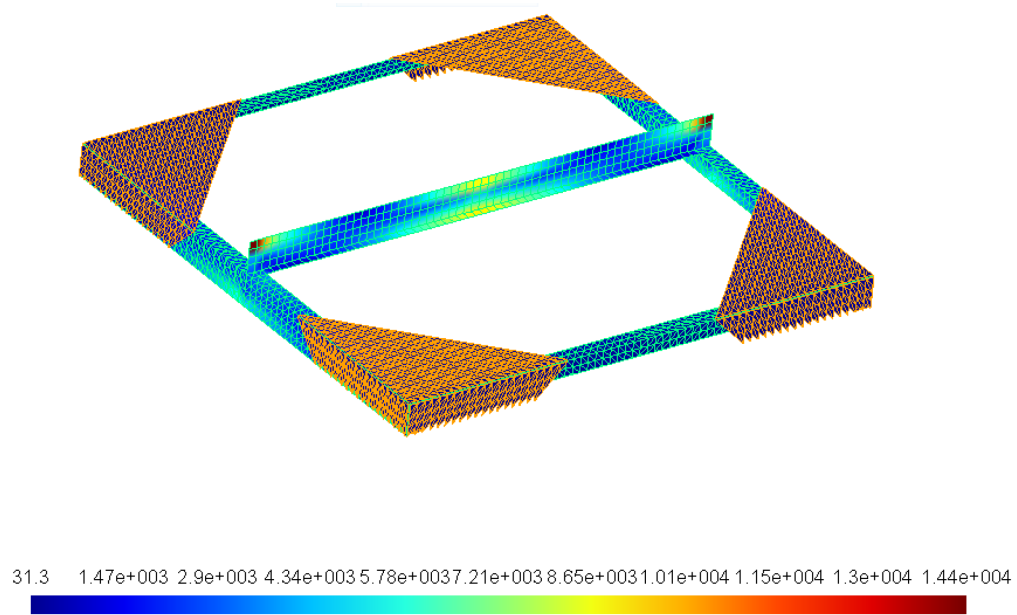


Figure 2-111. Lifting Bar von Mises Equivalent Stress – Model AOS-100

For a maximum force within the bolts of 765 lbs., the bolt stress is calculated as follows.

Bolt diameter = 0.5 in.

Stress area = 0.142 in²

Stress = 765 lbs. / 0.142 in² = 5,387 psi

The margin of safety is calculated as follows:

Yield strength = 20 ksi

MS = $\sigma_y / \sigma - 1 = 20 / 5.4 - 1 = 2.7$

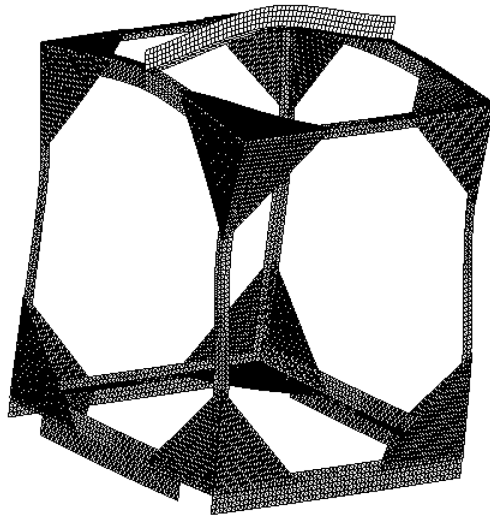


Figure 2-112. Deformation of Frame and Lifting Bar Under Inertia Loading – Model AOS-100

Table 2-353. Displacements and Forces within Contact Elements – Model AOS-100

ELEMENT	FORCE (lb)	DISPLACEMENT (in)
75001	0.00000E+00	3.34722E-03
75002	0.00000E+00	5.01011E-03
75003	0.00000E+00	3.34722E-03
75004	-2.61472E+02	-2.61472E-04
75005	0.00000E+00	1.22887E-04
75006	-2.61472E+02	-2.61472E-04
75007	0.00000E+00	3.51343E-03
75008	0.00000E+00	5.26376E-03
75009	0.00000E+00	3.51343E-03
75010	-2.74541E+02	-2.74541E-04
75011	0.00000E+00	1.43012E-04
75012	-2.74542E+02	-2.74542E-04

Table 2-354. Displacements and Forces within Bolt Elements – Model AOS-100

ELEMENT	FORCE (lb)	DISPLACEMENT (in)
75101	7.20829E+02	7.20829E-04
75102	7.20829E+02	7.20829E-04
75103	7.65040E+02	7.65040E-04
75104	7.65040E+02	7.65040E-04

2.12.14.2.3 Buckling Analysis – Model AOS-100

A LIBRA elastic stability analysis (MAIN11) was performed on the Shipping Cage and Lifting Bar, using the FEA model illustrated in [Figure 2-106](#) (expanded metal mesh excluded). A LIBRA elastic stability analysis produces an eigenvalue that corresponds to the load factor at buckling. The solution is iterative, and convergence is listed in [Table 2-355](#) and [Table 2-356](#) for Buckling Modes 1 and 2, respectively. The first buckling mode's shapes are illustrated in [Figure 2-113](#) and [Figure 2-114](#), with only the Lifting Bar shown for clarity. The second buckling mode is obtained by fixing the Lifting Bar laterally at the load point, thereby preventing the first mode. [Table 2-355](#) indicates that the lowest buckling load is -4.5 times the applied inertia load; however, the negative sign indicates that the mode corresponds to a load in the opposite direction of the applied load. Because the inertia load is not reversible, the second mode is the buckling mode, and from [Table 2-356](#) indicates that the buckling load factor is 6.94.

The LIBRA Input Files used for the Model AOS-100 Lifting Bar buckling analysis are as follows:

- AOS-100-CAGE-LIFT Principal file
- AOS-100-CAGE-LIFT-A Mesh connections generated by the PRODATA pre-processing data program
- AOS-100-CAGE-LIFT-1 Principal file for MAIN2 bolting analysis

Table 2-355. Convergence of Elastic Stability Analysis, Mode 1 – Model AOS-100

ITERATION	CONVERGENCE	EIGENVALUE
1	1.00000E+00	5.82771E+01
2	2.00942E-01	-4.85262E+01
3	4.62168E+00	-8.63197E+00
4	5.25698E-01	-5.65772E+00
5	1.59189E-01	-4.88075E+00
6	5.61581E-02	-4.62123E+00
7	2.13370E-02	-4.52469E+00
8	8.51010E-03	-4.48651E+00
9	3.50804E-03	-4.47082E+00
10	1.47828E-03	-4.46422E+00
11	6.31961E-04	-4.46141E+00
12	2.72663E-04	-4.46019E+00
13	1.18333E-04	-4.45966E+00
14	5.15454E-05	-4.45943E+00
15	2.25056E-05	-4.45933E+00
16	9.84083E-06	-4.45929E+00

Table 2-356. Convergence of Elastic Stability Analysis, Mode 2 – Model AOS-100

ITERATION	CONVERGENCE	EIGENVALUE
1	1.00000E+00	5.82310E+01
2	3.62437E+00	1.25922E+01
3	3.99519E-01	8.99752E+00
4	8.25793E-02	8.31118E+00
5	5.20557E-02	7.89995E+00
6	4.07590E-02	7.59056E+00
7	3.08370E-02	7.36350E+00
8	2.17598E-02	7.20668E+00
9	1.44360E-02	7.10412E+00
10	9.15569E-03	7.03967E+00
11	5.63609E-03	7.00022E+00
12	3.40524E-03	6.97646E+00
13	2.03429E-03	6.96230E+00
14	1.20722E-03	6.95390E+00
15	7.13661E-04	6.94894E+00
16	4.20968E-04	6.94602E+00
17	2.48016E-04	6.94430E+00
18	1.46024E-04	6.94328E+00
19	8.59441E-05	6.94269E+00
20	5.05748E-05	6.94234E+00
21	2.97589E-05	6.94213E+00
22	1.75101E-05	6.94201E+00
23	1.03029E-05	6.94194E+00
24	6.06220E-06	6.94189E+00

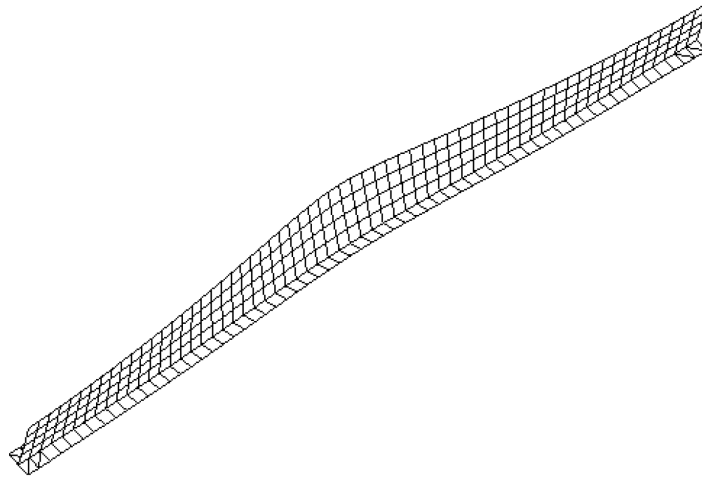


Figure 2-113. Lifting Bar First Buckling Mode – Model AOS-100

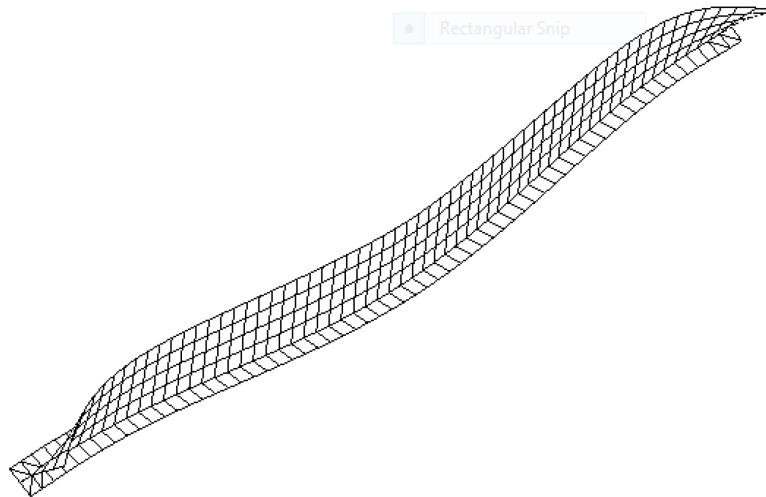


Figure 2-114. Lifting Bar Second Buckling Mode – Model AOS-100

2.12.15 Shielding/Spacer Component Evaluation – Models AOS-050A, AOS-100A, and AOS-100A-S

The axial shielding plates and cavity spacer plates generically refer to shoring components that are added within the Model AOS-050A, AOS-100A, and AOS-100A-S cask cavity for specific isotope shipping configurations, as listed in [Table 2-357](#).

**Table 2-357. Additional Required Shoring Components –
Models AOS-050A, AOS-100A, and AOS-100A-S**

Model	Component	Certification Drawing ^a	Material of Construction	Required for Isotope Shipments of ^b	Description
AOS-050A	Axial Shielding Plates	183C8519	Stainless Steel	Ir-192 Ir-194	Used to offset the cask contents from the cask plug and cask bottom. This dual-purpose shoring component provides both spacing (that is, distance) and supplemental shielding of the cask contents.
AOS-100A AOS-100A-S	Axial Shielding Plates	183C8491	Tungsten Alloy	Co-60-B Co-60-C	Used to offset the cask contents from the cask plug and cask bottom. This dual-purpose shoring component provides both spacing (that is, distance) and supplemental shielding of the cask contents.
	Cavity Spacer Plates	183C8518	Stainless Steel –or– Aluminum ^c	Co-60-C	Used to offset the supplemental axial shielding plates and cask contents from the cask plug and cask bottom, which provides spacing necessary to meet regulatory dose rate limits.

- Refer to [Table 1-5, “AOS Transport Packaging System Certification Drawing List – All Models,”](#) for drawing revision levels.
- As per [Table 1-2, “10 CFR 71.47\(a\) Activity Limits \(All Isotopes Except Ir-192 and Ir-194\) – All Models,”](#) [Table 1-2a, “10 CFR 71.47\(a\) Ir-192 and Ir-194 Activity Limits – All Models,”](#) and [Table 1-2b, “10 CFR 71.47\(b\) Activity Limits – Model AOS-100A and AOS-100A-S.”](#)
- Refer to [Paragraph 2.12.15.6](#) for details.

Figure 2-115 illustrates the Model AOS-100A-S Co-60-C configuration for which the axial shielding plates and cavity spacer plates are both used. Each cavity spacer plate fills the void above or below the upper or lower axial shielding plate, respectively, with only a small gap on the diameter, which prevents the axial shielding plates from shifting during Normal conditions and Hypothetical Accident conditions of transport.

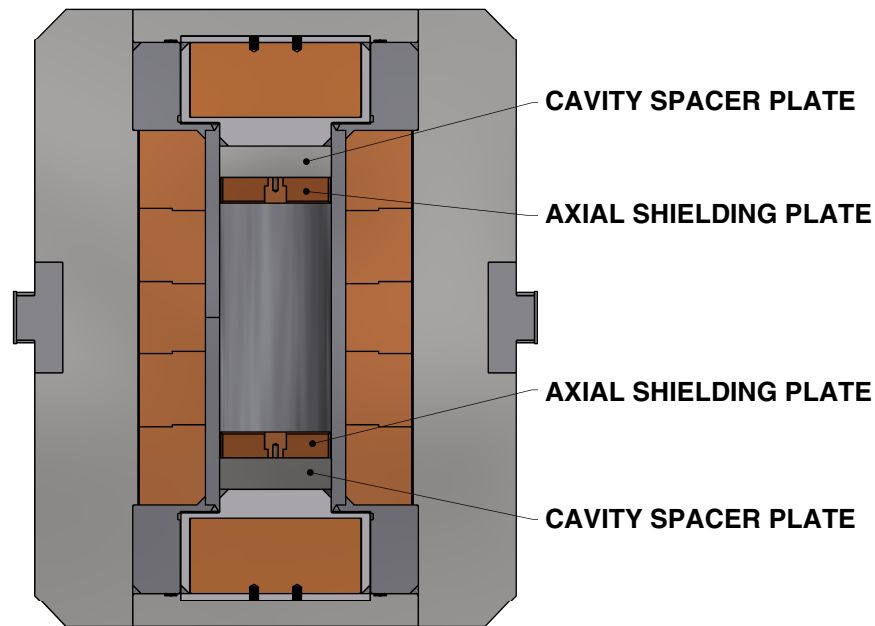


Figure 2-115. Model AOS-100A-S Co-60-C Configuration with Axial Shielding Plates and Cavity Spacer Plates

Note: Model AOS-100A-S is shown. For Model AOS-100A, the lower axial shielding plate is inverted.

2.12.15.1 Fabrication Criteria

Regulatory Guide 7.11 and *NUREG/CR-1815* (References [2.30] and [2.31], respectively), which categorize components based on the cask design's maximum activity level, govern the axial shielding plate's and cavity spacer plate's fabrication. Because AOS casks are used to ship isotopes with activities greater than 3,000 A₂, the axial shielding plates and cavity spacer plates are fabricated as Category I components.

From *NUREG/CR-3854* (Reference [2.24]), the criteria for fabricating metal shipping container components that are to be used for the transport of radioactive materials are based on *ASME Code Section III* –or– *Section VIII* (References [2.26] and [2.29], respectively). The requirements for Category I components are as follows:

- Acceptance criteria for the fabrication of metal shipping container components are located in *ASME Code Section III*, as follows:
 - **Containment components** – *Subsection NB*
 - **Criticality components** – *Subsection NG*
 - **Other safety components** – *Subsection NF*
- Axial shielding plates are relied on for shielding, which falls under the “Other Safety” Component Safety Group. Therefore, the Model AOS-050A axial shielding plates shall be fabricated to *ASME Code Section III, Subsection NF* –or– *Section VIII, Division 1* (References [2.26] and [2.29], respectively). For this evaluation, the stress criteria presented in *Section III, Subsection NF* are used.

2.12.15.2 Component Safety Classification According to Importance to Safety

The axial shielding plates and cavity spacer plates are required to reduce external radiation doses to levels acceptable for transport:

- For Model AOS-050A, the axial shielding plates perform the function of gamma shielding for the transport of Ir-192 and Ir-194
- For Models AOS-100A and AOS-100A-S, the axial shielding plates perform the function of gamma shielding for the transport of Co-60-B and Co-60-C
- For Models AOS-100A and AOS-100A-S, the cavity spacer plates offset the gamma shielding, which provides necessary spacing for the transport of Co-60-C quantities

Note: *Models AOS-025A and AOS-100B do not use axial shielding plates or cavity spacer plates.*

Thus, the axial shielding plates and cavity spacer plates are Category B items, in accordance with *NUREG/CR-6407, Section 5.3.2* (Reference [2.32]).

2.12.15.3 Stress Criteria

ASME Service Level D is used for Hypothetical Accident conditions of transport. The analyses methods and stress criteria allowed by *ASME Code Section III* (Reference [2.26]) are used, as follows:

- Allowable stresses are based on *Subsection NF-3200*
- Hypothetical Accident conditions of transport (Service Level D) design limits are defined in *Appendix F*

Table 2-358 lists the stress criteria.

Table 2-358. Stress Criteria – Models AOS-050A, AOS-100A, and AOS-100A-S

ASME Class 1 Design ^a	Stress Limits ^b
Bearing Loads Service Level D (<i>Appendix F-1332.3</i>)	Except for pinned and bolted joints, bearing stresses need not be evaluated for loads for which Service Level D Limits are specified
Pure Shear Service Level D (<i>Appendix F-1332.4</i>)	$0.42S_u$
Hypothetical Accident Conditions of Transport Service Level D (<i>Appendix F-1332</i>)	$P_m > (1.2S_y \text{ or } 1.5S_m) < 0.7S_u$ $P_m + P_b < 150\%$ of the limit for general primary stress intensity P_m

a. ASME Code Section III (Reference [2.26]).

b. P_m = Primary membrane stress intensity

P_b = Primary bending stress intensity

S_m = Design stress intensity

S_y = Yield strength

S_u = Ultimate strength

2.12.15.4 Axial Shielding Plate Stress Evaluation – Model AOS-050A

The finite element analysis code ANSYS (Reference [2.34]) is used to evaluate the Model AOS-050A axial shielding plate's performance during Hypothetical Accident conditions of transport. Although the analysis evaluates Hypothetical Accident conditions of transport, the analysis applies to device performance during Normal conditions of transport. The following sections provide model, loading condition, boundary condition, and result details.

2.12.15.4.1 Axial Shielding Plate Finite Element Model – Model AOS-050A

As illustrated in Figure 2-116, the finite element model is a full model of the axial shielding plate, which is generated by importing the CAD solid model into the ANSYS Workbench interface. The model's solid portion is constructed using ANSYS solid (SOLID185/186/187) elements. Compression-only contact elements are used to simulate the interaction between the axial shielding plate and cask inner cavity. Specifically, contact between the axial shielding plate and cask inner cavity is modeled using CONTAC174/TARGE170. Weak spring elements (COMBIN14) are automatically inserted during the solution to help stabilize the model. ANSYS assigns low-spring stiffness to the weak spring elements so that their presence will not adversely affect the solution's accuracy.

The axial shielding plate's material properties are obtained from Table 2-11.

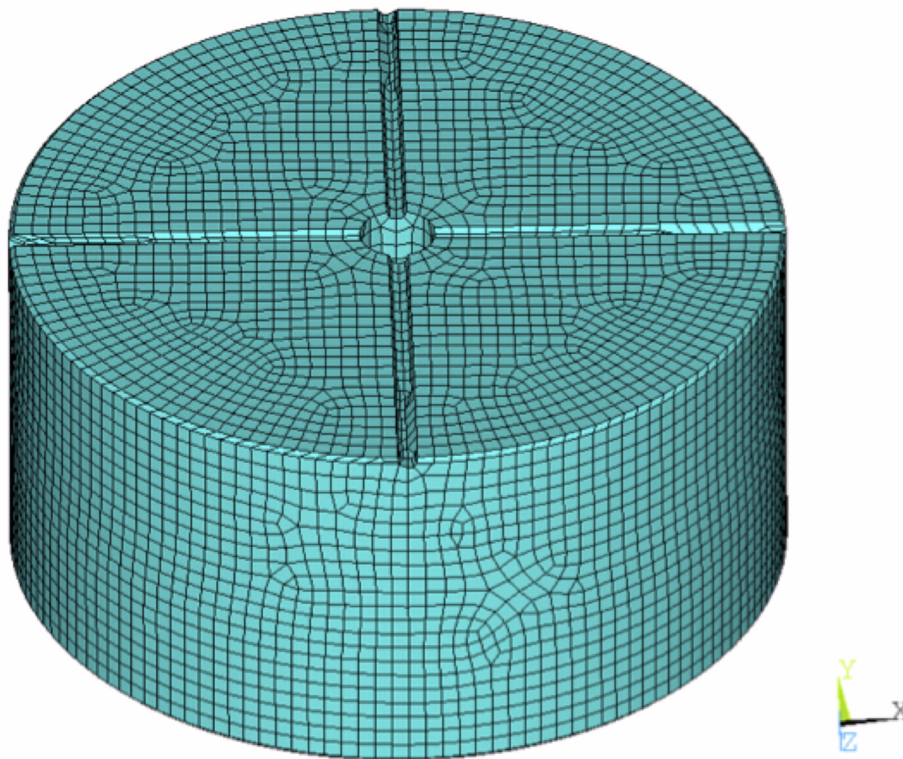


Figure 2-116. Axial Shielding Plate ANSYS Model – Model AOS-050A

2.12.15.4.2 Axial Shielding Plate Loading Conditions – Model AOS-050A

The total content weight of 60 lbs. is obtained from [Table 2-7](#) and accelerations are obtained from [Table 2-50](#). [Table 2-359](#) provides the inertial loads applied to each model in the form of surface pressure. For the side drop, the axial shielding plate's inertial load is equal to the plate's weight multiplied by the corresponding g-load.

Table 2-359. Axial Shielding Plate ANSYS Model Loads – Model AOS-050A

Drop Orientation	Model Component	Load Case	g-Load	Weight (lbs.)	Inertial Load (lbs.)	Area (in ²)	Pressure (psi)
End	Y	304	566.2	60.0	33,972.0	6.956	4,883.8
Side	Normal Pressure	305	598.4	3.2	1,914.9	3.582	534.6
Corner	Normal Pressure	306x	256.0	60.0	15,360.0	3.582	4,288.1
	Y	306y	325.8	60.0	19,548.0	6.956	2,810.2

2.12.15.4.3 Axial Shielding Plate Stress Criteria – Model AOS-050A

The stress criteria for the axial shielding plate is presented in [Section 2.12.15.3](#). Certification drawing 183C8519 (refer to [Table 1-5](#), “AOS Transport Packaging System Certification Drawing List – All Models”) specifies the use of stainless steel for the axial shielding plate's construction. The axial shielding plate's properties are obtained from [Table 2-9](#). The bounding stress intensity of 18,700 psi at a maximum component temperature of 400°F is used for this evaluation. (Refer to [Table 3-3](#), “Maximum Temperature Summary, Normal Conditions of Transport – All Models.”)

2.12.15.4.4 Axial Shielding Plate Analysis Results – Model AOS-050A

The Model AOS-050A axial shielding plate Hypothetical Accident conditions of transport analysis results are presented in Figure 2-117 through Figure 2-119. Table 2-360 summarizes the linearized stress, comparison to the allowable stress, margin of safety (MS), and the total stress intensity as illustrated in Figure 2-117 through Figure 2-119. The analysis results show that axial shielding plate has a significant margin of safety. The minimum margin of safety of +3.2 occurs during the corner drop. Additionally, the axial shielding plate's total stress is less than the material's yield strength. As Table 2-360 shows, the calculated margin of safety is positive, which indicates that the Model AOS-050A axial shielding plate maintains functionality during Normal conditions and Hypothetical Accident conditions of transport.

Table 2-360. Axial Shielding Plate Stress Analysis Results during Hypothetical Accident Conditions of Transport – Model AOS-050A

Drop Orientation	Membrane Stress Intensity (psi)	Allowable (psi)	MS	Membrane + Bending Stress Intensity (psi)	Allowable (psi)	MS	Total Stress Intensity (psi)
End	4,442.0	28,050	5.3	5,000.0	42,075	7.4	9,582.3
Side	812.8	28,050	33.5	993.1	42,075	41.4	1,416.1
Corner	6,688.0	28,050	3.2	8,317.0	42,075	4.1	11,256.1

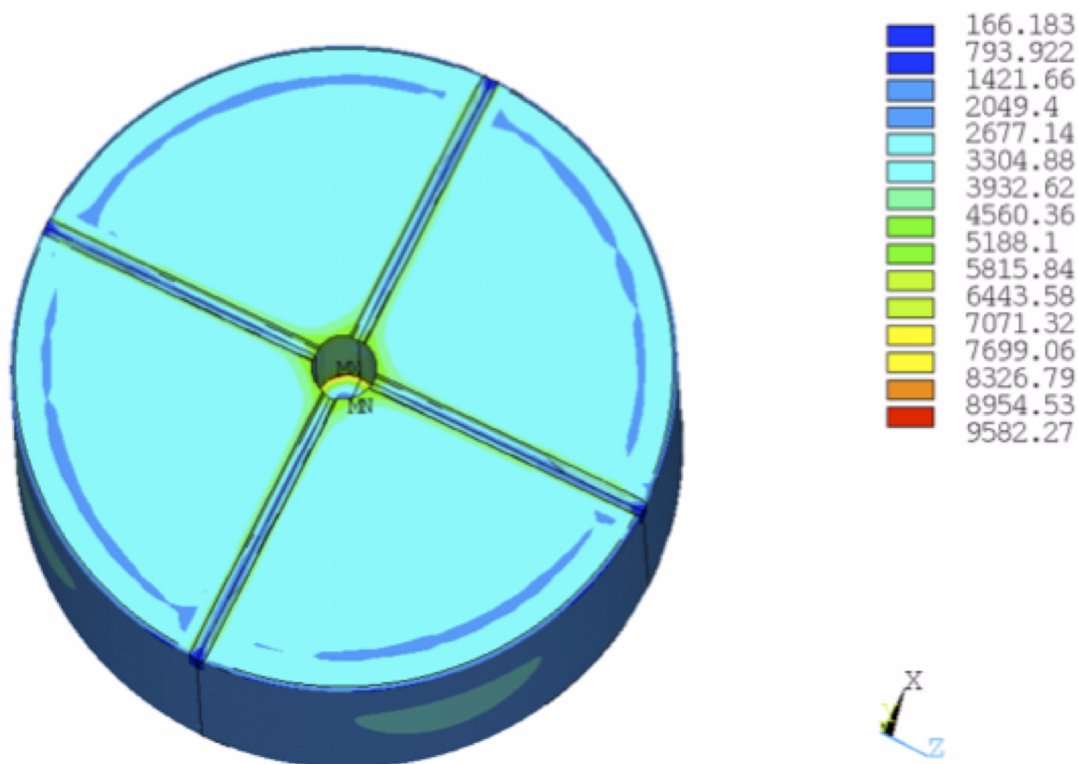


Figure 2-117. Axial Shielding Plate End Drop ANSYS Stress Results – Model AOS-050A

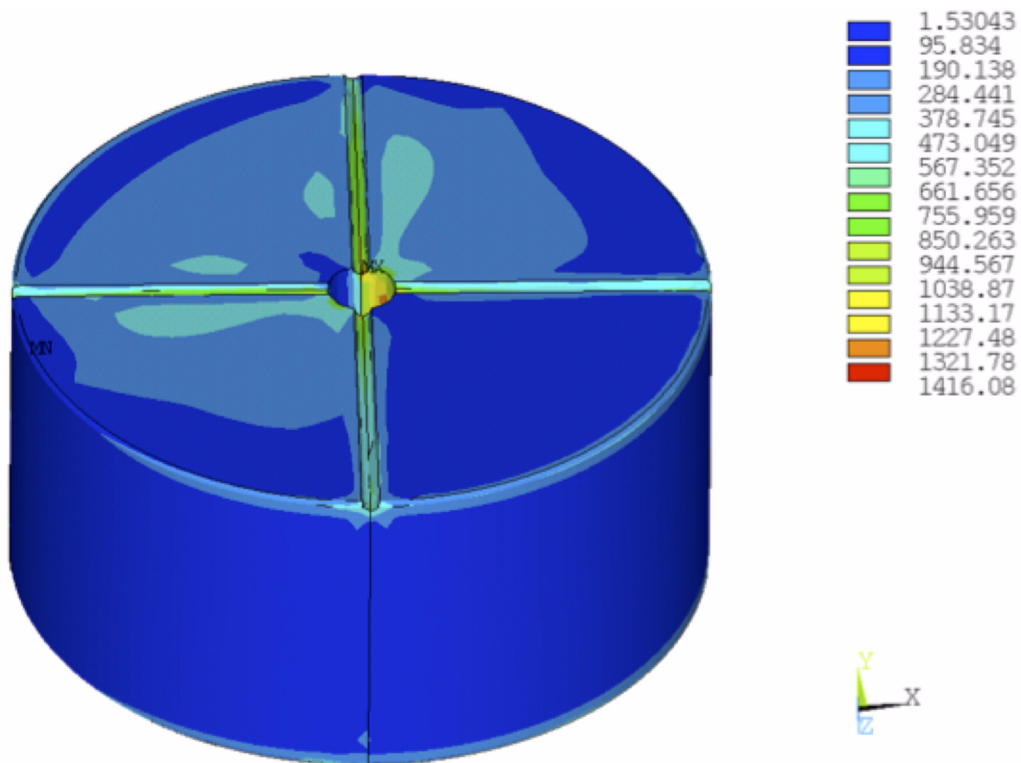


Figure 2-118. Axial Shielding Plate Side Drop ANSYS Stress Results – Model AOS-050A

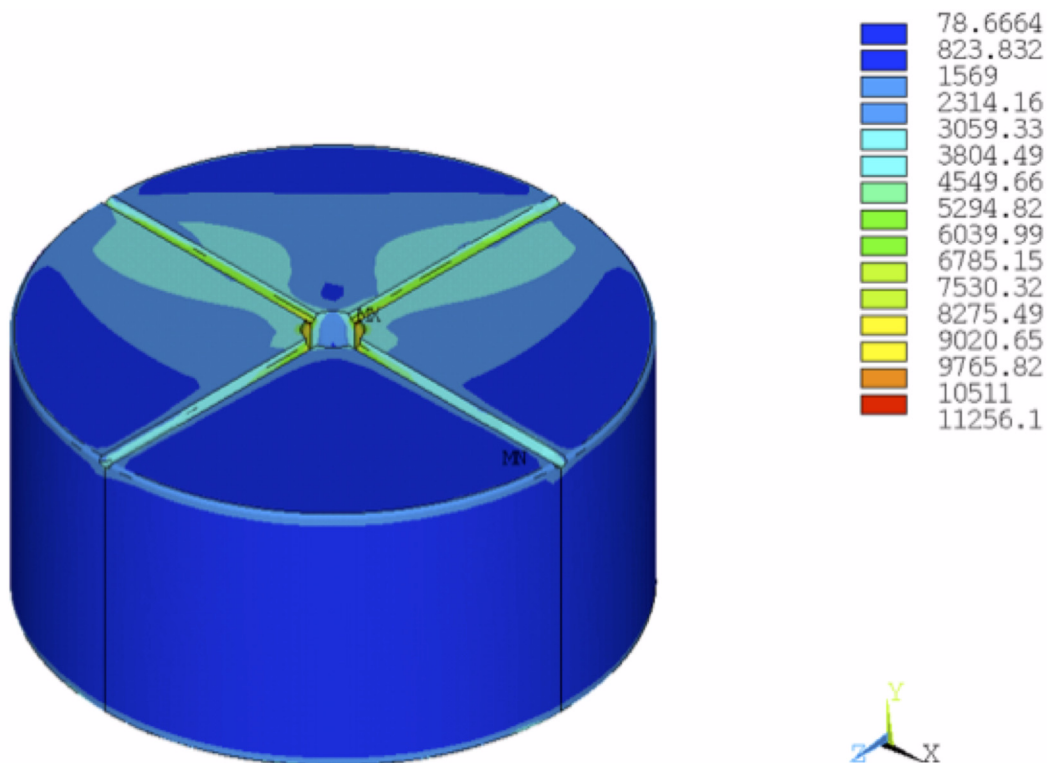


Figure 2-119. Axial Shielding Plate Corner Drop ANSYS Stress Results – Model AOS-050A

2.12.15.5 Axial Shielding Plate Stress Evaluation – Models AOS-100A and AOS-100A-S

The finite element analysis code ANSYS (Reference [\[2.34\]](#)) is used to evaluate the Model AOS-100A/AOS-100A-S axial shielding plate's performance during Hypothetical Accident conditions of transport. Although the analysis evaluates Hypothetical Accident conditions of transport, the analysis applies to device performance during Normal conditions of transport. The following sections provide model, loading condition, boundary condition, and result details.

2.12.15.5.1 Axial Shielding Plate Finite Element Model – Models AOS-100A and AOS-100A-S

As illustrated in [Figure 2-120](#), the finite element model is a full model of the axial shielding plate, which is generated by importing the CAD solid model into the ANSYS Workbench interface. The model's solid portion is constructed using ANSYS solid (SOLID185/186/187) elements. Compression-only contact elements are used to simulate the interaction between the axial shielding plate and cask inner cavity. Specifically, contact between the axial shielding plate and cask inner cavity is modeled using CONTAC174/TARGE170. [Figure 2-121](#) illustrates the contact elements for each drop orientation. Forces are applied on a surface of the model that represents the total applied load for the drop orientation being considered. ANSYS structural surface effect elements (SURF154) are used to apply the load to the model's solid portion. [Figure 2-122](#) illustrates the surface effect elements for each drop orientation. Weak spring elements (COMBIN14) are automatically inserted during the solution to help stabilize the model. ANSYS assigns low-spring stiffness to the weak spring elements so that their presence will not adversely affect the solution's accuracy.

The axial shielding plate's material properties are obtained from [Table 2-11](#).

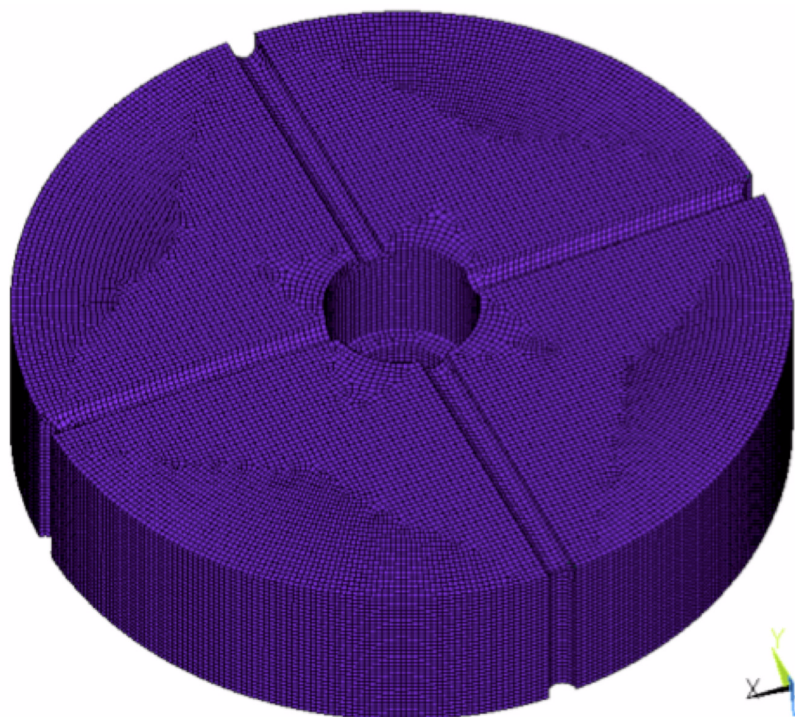
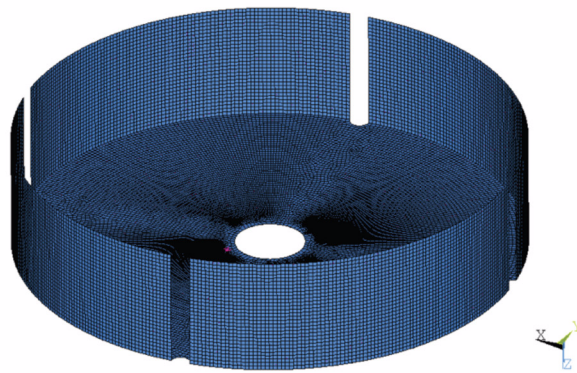
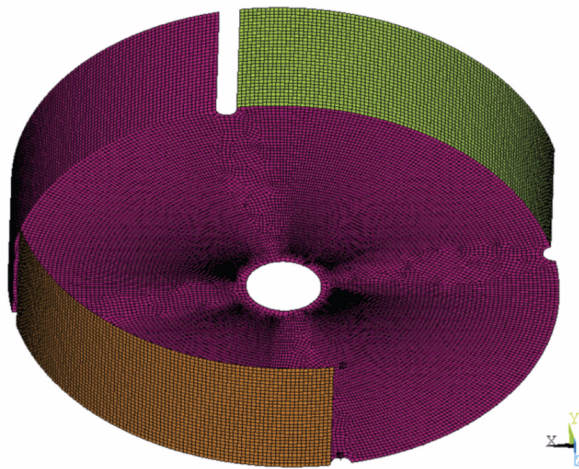


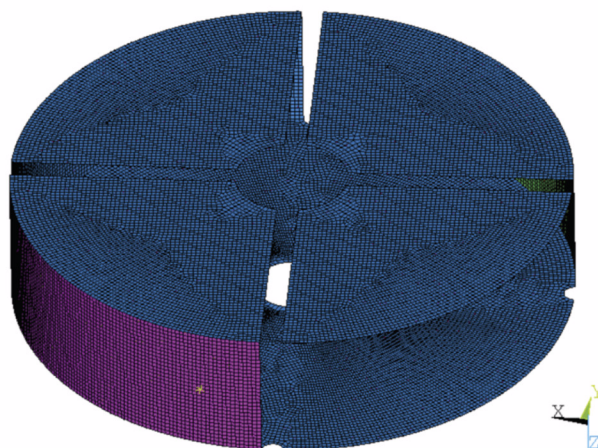
Figure 2-120. Axial Shielding Plate – Models AOS-100A and AOS-100A-S



End Drop – Contact Elements



Corner Drop – Contact Elements



Side Drop – Contact Elements

Figure 2-121. ANSYS Model Contact Elements – Models AOS-100A and AOS-100A-S

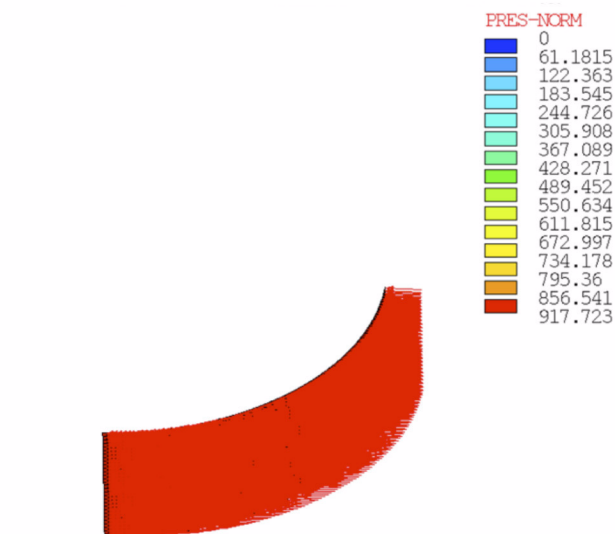
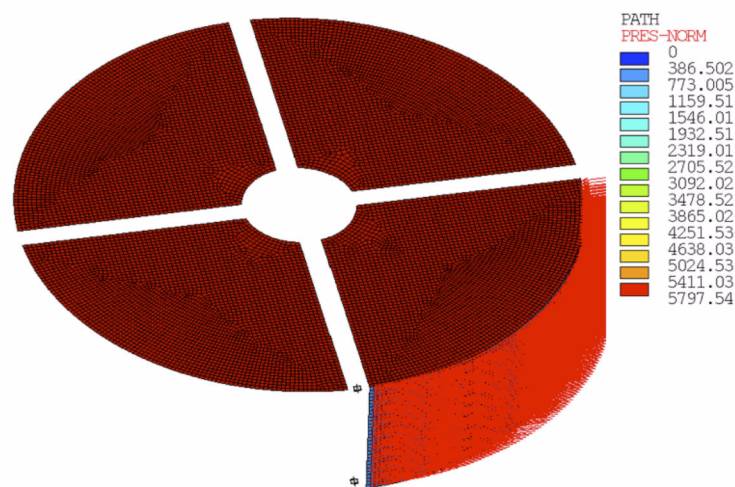
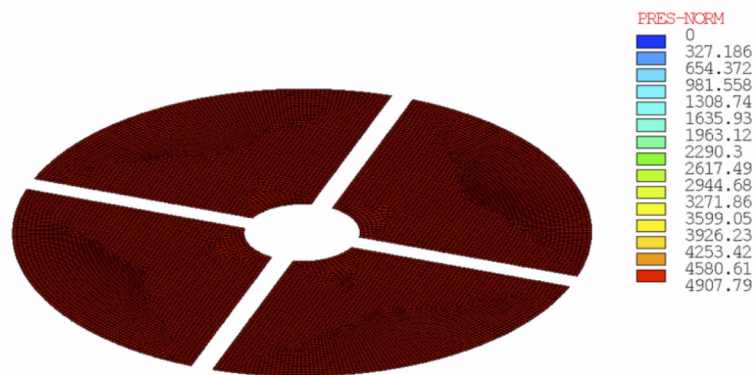


Figure 2-122. ANSYS Surface Effect Elements – Models AOS-100A and AOS-100A-S

2.12.15.5.2 Axial Shielding Plate Loading Conditions – Models AOS-100A and AOS-100A-S

The total content weight of 500 lbs. is obtained from [Table 2-7](#), and accelerations are obtained from [Table 2-52](#). [Table 2-361](#) lists the inertial loads applied to each model in the form of surface pressure. For the side drop, the axial shielding plate's inertial load is equal to the plate's weight multiplied by the corresponding g-load.

Table 2-361. Axial Shielding Plate ANSYS Model Loads – Models AOS-100A and AOS-100A-S

Drop Orientation	Model Component	Load Case	g-Load	Weight (lbs.)	Inertial Load (lbs.)	Area (in ²)	Pressure (psi)
End	Z	304	276.1	500.0	138,050.0	28.128	4,907.8
Side	Resultant	305	307.6	30.13	9,268.0	7.141	1,297.9
	X and Y		307.6	$\cos(45^\circ) \times 30.13$	6,553.5	7.141	917.7
Corner	X and Y	306x	117.1	$\cos(45^\circ) \times 500.0$	41,400.2	7.141	5,797.5
	Z	306y	154.1	500.0	77,048.0	28.128	2,739.2

2.12.15.5.3 Axial Shielding Plate Stress Criteria – Models AOS-100A and AOS-100A-S

The axial shielding plate's stress criteria is presented in [Section 2.12.15.3](#). Certification drawing 183C8491 (refer to [Table 1-5](#), "AOS Transport Packaging System Certification Drawing List – All Models") specifies the use of tungsten alloy for the axial shielding plate's construction. For the tungsten alloy material (refer to [Table 2-11](#)), the S_m value is not defined by the ASME code. However, using the guidance presented in *ASME Code Section II, Part D, Appendix 2, Paragraph 2-110* (Reference [\[2.5\]](#)), tungsten alloy's design stress intensity value is 2/3 of the yield strength. Therefore, the design stress intensity is 50,000 psi. To bound the results, the minimum primary membrane stress allowable is used for this evaluation.

2.12.15.5.4 Axial Shielding Plate Stress Analysis Results – Models AOS-100A and AOS-100A-S

Figure 2-123 through Figure 2-125 present the axial shielding plate analysis stress results for Hypothetical Accident conditions of transport. Table 2-362 summarizes the linearized stress, comparison to the allowable stress, margin of safety, and the total stress intensity as illustrated in Figure 2-123 through Figure 2-125. The analysis results show that axial shielding plate has a significant margin of safety. The minimum margin of safety of +3.5 occurs during the corner drop. Additionally, the axial shielding plate's total stress is less than the material's yield strength. As Table 2-362 shows, the calculated margin of safety is positive, which indicates that the Model AOS-100A/AOS-100A-S axial shielding plate maintains functionality during Normal conditions and Hypothetical Accident conditions of transport.

Table 2-362. Axial Shielding Plate Stress Analysis Results during Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Drop Orientation	Membrane Stress Intensity (psi)	Allowable (psi)	MS	Membrane + Bending Stress Intensity (psi)	Allowable (psi)	MS	Total Stress Intensity (psi)
End	4,519.0	75,000	15.6	4,703.0	112,500	22.9	7,713.2
Side	3,492.0	75,000	20.5	3,958.0	112,500	27.4	6,529.7
Corner	4,544.0	75,000	15.5	25,250.0	112,500	3.5	40,947.5

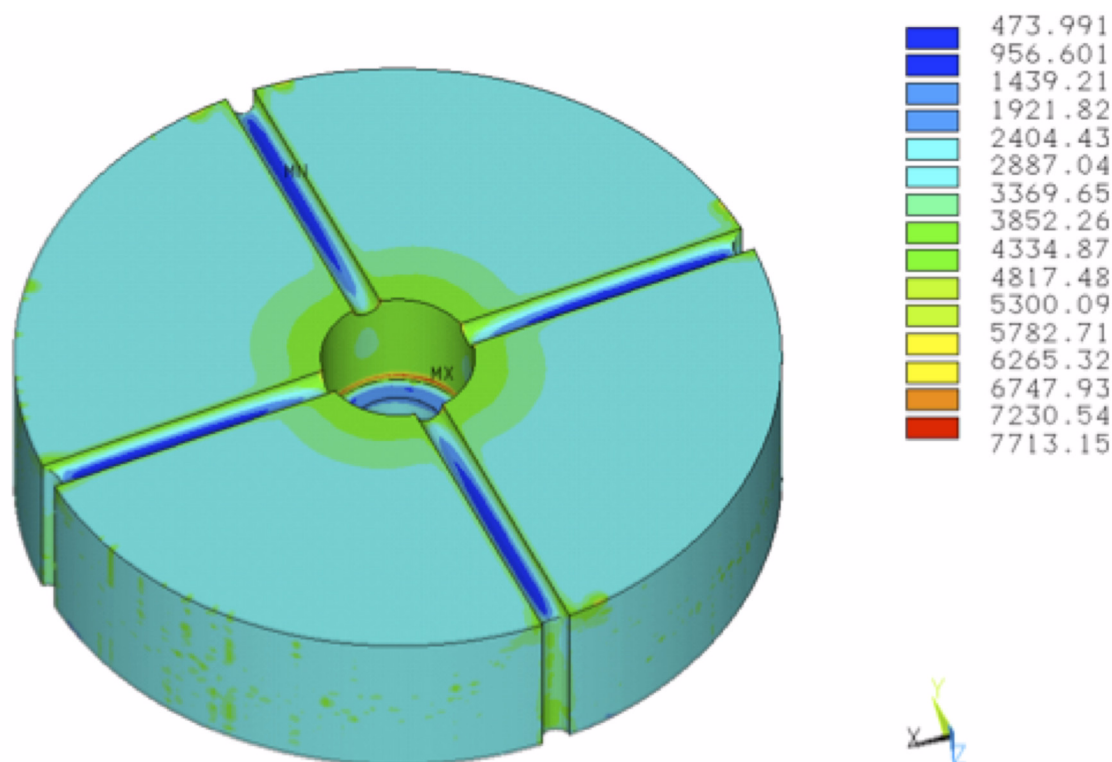


Figure 2-123. Axial Shielding Plate Hypothetical Accident Conditions of Transport End Drop Stress Intensity Results (psi) – Model AOS-100A and AOS-100A-S

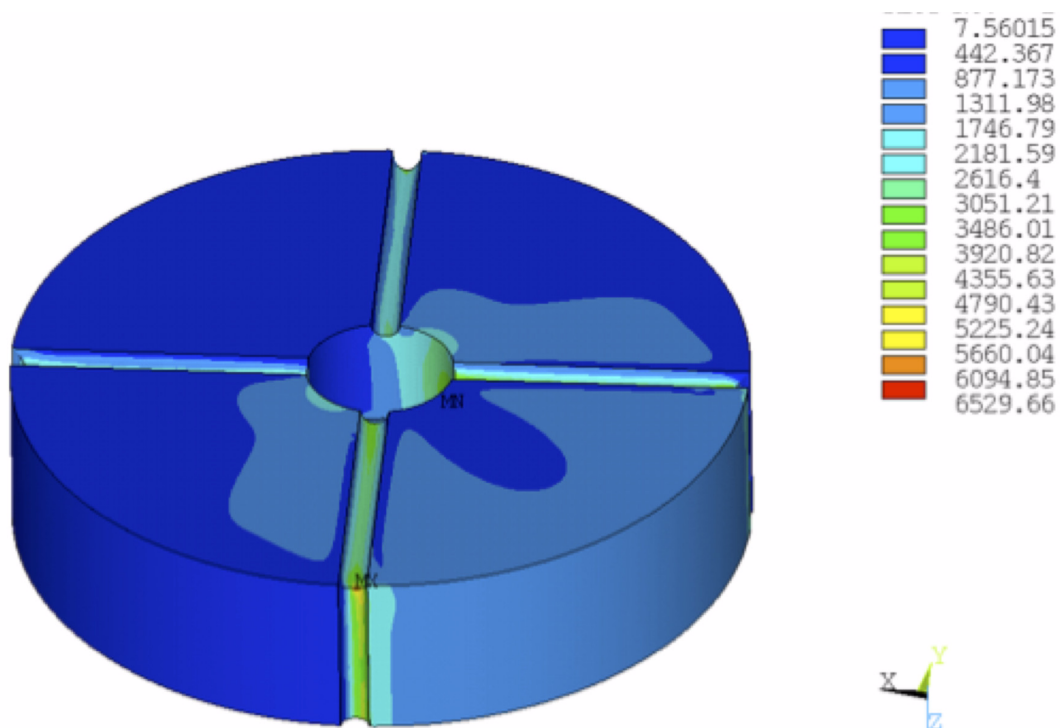


Figure 2-124. Axial Shielding Plate Hypothetical Accident Conditions of Transport Side Drop Stress Intensity Results (psi) – Model AOS-100A and AOS-100A-S

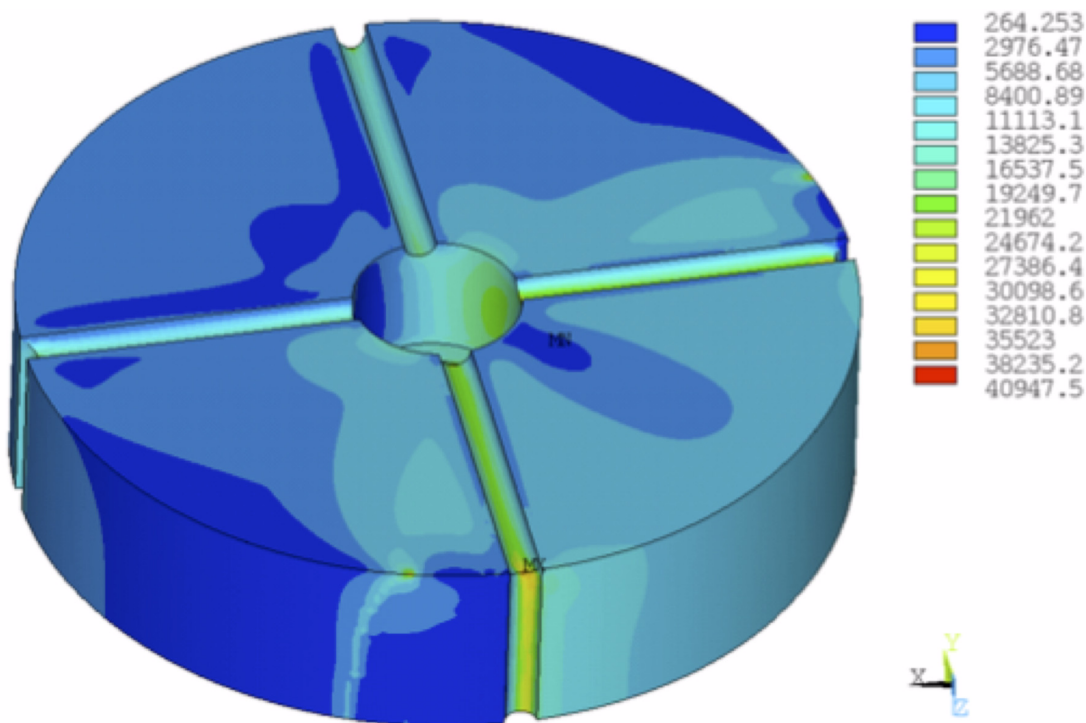


Figure 2-125. Axial Shielding Plate Hypothetical Accident Conditions of Transport Corner Drop Stress Intensity Results (psi) – Model AOS-100A and AOS-100A-S

2.12.15.6 Cavity Spacer Plate Stress Evaluation – Models AOS-100A and AOS-100A-S

The finite element analysis code ANSYS (Reference [2.34]) is used to evaluate the Model AOS-100A/AOS-100A-S axial shielding plate's performance during Hypothetical Accident conditions of transport. Although the analysis evaluates Hypothetical Accident conditions of transport, the analysis applies to device performance during Normal conditions of transport. The following sections provide model, loading condition, boundary condition, and result details.

2.12.15.6.1 Cavity Spacer Plate Finite Element Model – Models AOS-100A and AOS-100A-S

As illustrated in Figure 2-126, the Model AOS-100A/AOS-100A-S cavity spacer plate finite element model was developed using the same methodology presented in Section 2.12.15.5.1. Certification drawing 183C8518 (refer to Table 1-5, "AOS Transport Packaging System Certification Drawing List – All Models") specifies the use of stainless steel or aluminum for the construction of the cavity spacer plate. To bound the cavity spacer plate properties, the mechanical properties of 6061-T4 (*ASME Code Section II, Part D, UNS A96061* (Reference [2.5])) aluminum are used for this evaluation. The material properties used in the ANSYS model are as follows:

Elastic Modulus (E) = 8.7×10^6 psi

Poisson's Ratio = 0.33

Density = 0.098 lb/in³

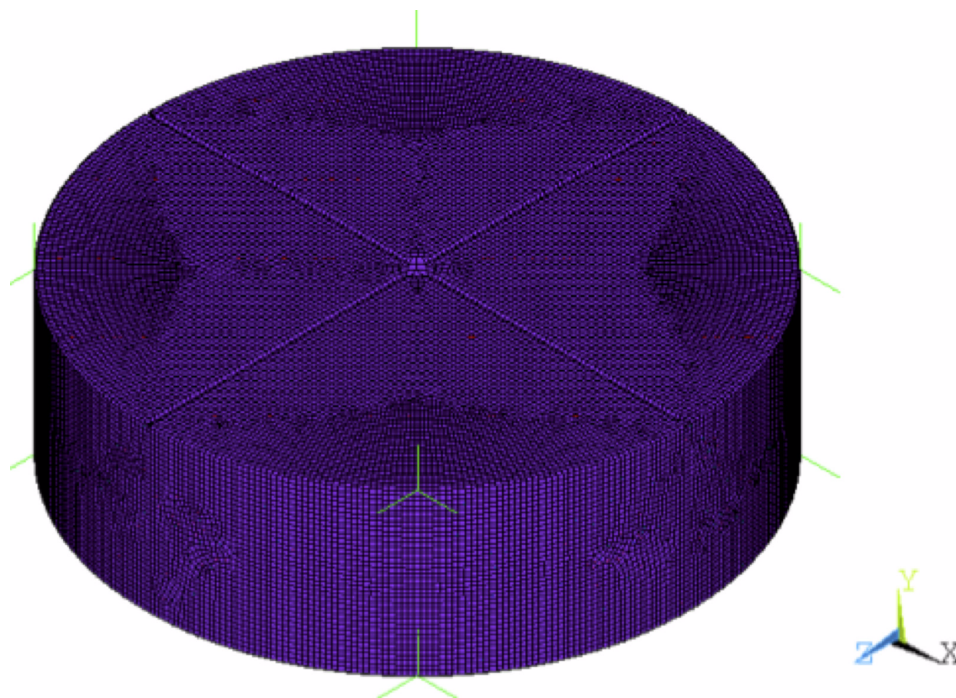


Figure 2-126. Cavity Spacer Plate Stress ANSYS Model –
Models AOS-100A and AOS-100A-S

2.12.15.6.2 Cavity Spacer Plate Loading Conditions – Models AOS-100A and AOS-100A-S

The total content weight of 500 lbs. is obtained from [Table 2-7](#) and accelerations are obtained from [Table 2-52](#). [Table 2-363](#) provides the inertial loads applied to each model in the form of surface pressure. For the side drop, the inertial load of the cavity spacer plate is equal to the plate's weight multiplied by the corresponding g-load. The weight of stainless is used to bound the use of an aluminum cavity spacer plate.

Table 2-363. Cavity Spacer Plate ANSYS Model Loads – Models AOS-100A and AOS-100A-S

Drop Orientation	Model Component	Load Case	g-Load	Weight (lbs.)	Inertial Load (lbs.)	Area (in ²)	Pressure (psi)
End	Z	304	276.1	500.0	138,050.0	26.920	5,128.2
Side	Resultant	305	307.6	15.0	4,614.0	8.210	562.0
	X and Y		307.6	$\text{Cos}(45^\circ) \times 15.0$	3,262.6	8.210	397.4
Corner	X and Y	306x	117.1	$\text{Cos}(45^\circ) \times 500.0$	41,401.1	8.210	5,042.8
	Z	306y	154.1	500.0	77,050.0	26.920	2,862.2

2.12.15.6.3 Cavity Spacer Plate Stress Criteria – Models AOS-100A and AOS-100A-S

The stress criteria for the cavity spacer plate is presented in [Section 2.12.15.3](#). Certification drawing 183C8518 (refer to [Table 1-5](#), “AOS Transport Packaging System Certification Drawing List – All Models”) specifies the use of stainless steel or aluminum for the cavity spacer plate's construction. The yield strength of 11,600 psi is from *ASME Code Section II, Part D, Table Y-1* (Reference [\[2.5\]](#)) at a maximum component temperature of 400°F. (Refer to [Table 3-3](#), “Maximum Temperature Summary, Normal Conditions of Transport – All Models.”) For the Aluminum 6061-T4 material, the S_m value is not listed in the *ASME Code Section III, Division 1* (Reference [\[2.33\]](#)) material tables. However, using the guidance presented in *ASME Code Section II, Part D, Appendix 2* (Reference [\[2.5\]](#)), the design stress intensity value for Aluminum 6061-T4 is 2/3 of the yield strength. Therefore, the design stress intensity is 7,733 psi. To bound the results, the minimum primary membrane stress allowable is used for this evaluation.

2.12.15.6.4 Cavity Spacer Plate Stress Analysis Results – Models AOS-100A and AOS-100A-S

Figure 2-127 through Figure 2-129 present the cavity spacer plate analysis results for Hypothetical Accident conditions of transport. Table 2-364 summarizes the linearized stress, comparison to the allowable stress, margin of safety, and the total stress intensity as illustrated in Figure 2-127 through Figure 2-129. The analysis results show that cavity spacer plate has a significant margin of safety. The minimum margin of safety of +1.1 occurs during the corner drop. As Table 2-364 shows, the calculated margin of safety is positive, which indicates that the Model AOS-100A/AOS-100A-S cavity spacer plate maintains functionality during Normal conditions and Hypothetical Accident conditions of transport. The evaluation also shows that the Model AOS-100A/AOS-100A-S cavity spacer plates can be fabricated from aluminum or a stronger material, such as stainless steel.

Table 2-364. Cavity Spacer Plate Stress Analysis Results during Hypothetical Accident Conditions of Transport – Models AOS-100A and AOS-100A-S

Drop Orientation	Membrane Stress Intensity (psi)	Allowable (psi)	MS	Membrane + Bending Stress Intensity (psi)	Allowable (psi)	MS	Total Stress Intensity (psi)
End	4,402.0	11,600	1.6	5,052.0	17400	2.4	10,450.6
Side	697.3	11,600	15.6	782.1	17400	21.2	1871.5
Corner	3,322.0	11,600	2.5	8,354.0	17400	1.1	42,547.2

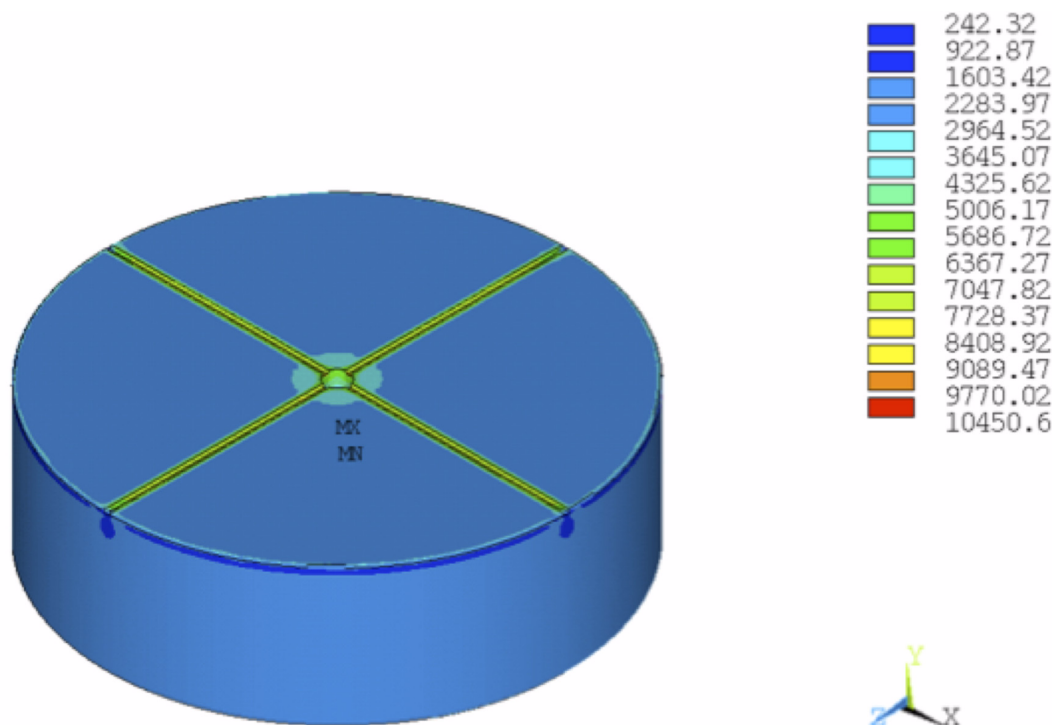


Figure 2-127. Cavity Spacer Plate End Drop ANSYS Stress Results – Models AOS-100A and AOS-100A-S

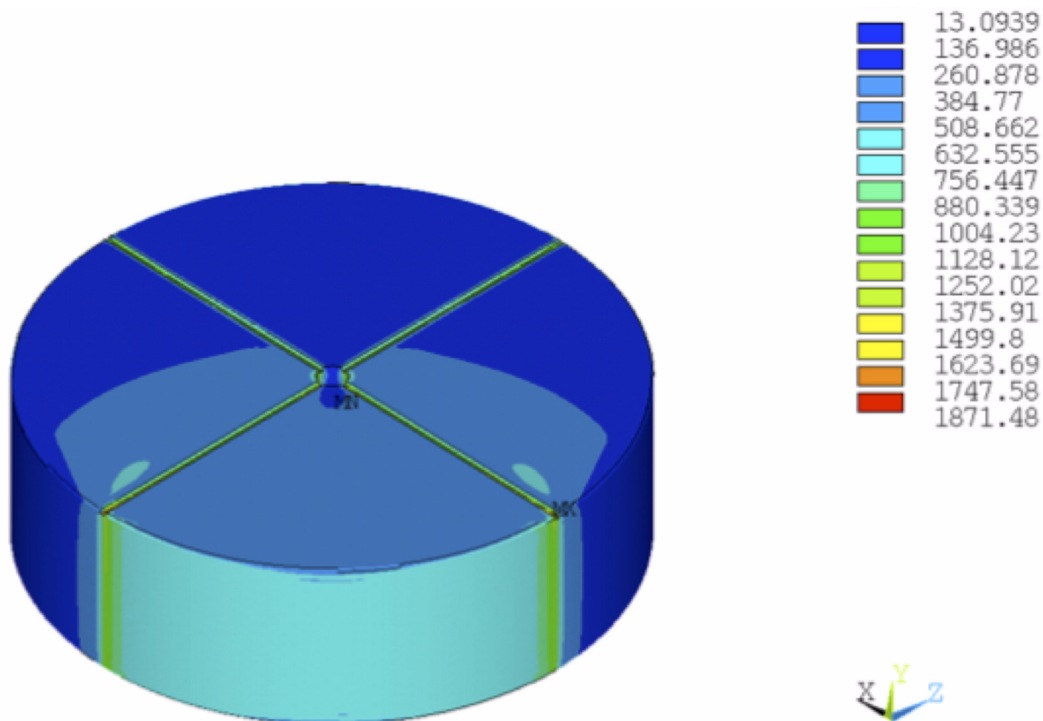


Figure 2-128. Cavity Spacer Plate Side Drop ANSYS Stress Results – Models AOS-100A and AOS-100A-S

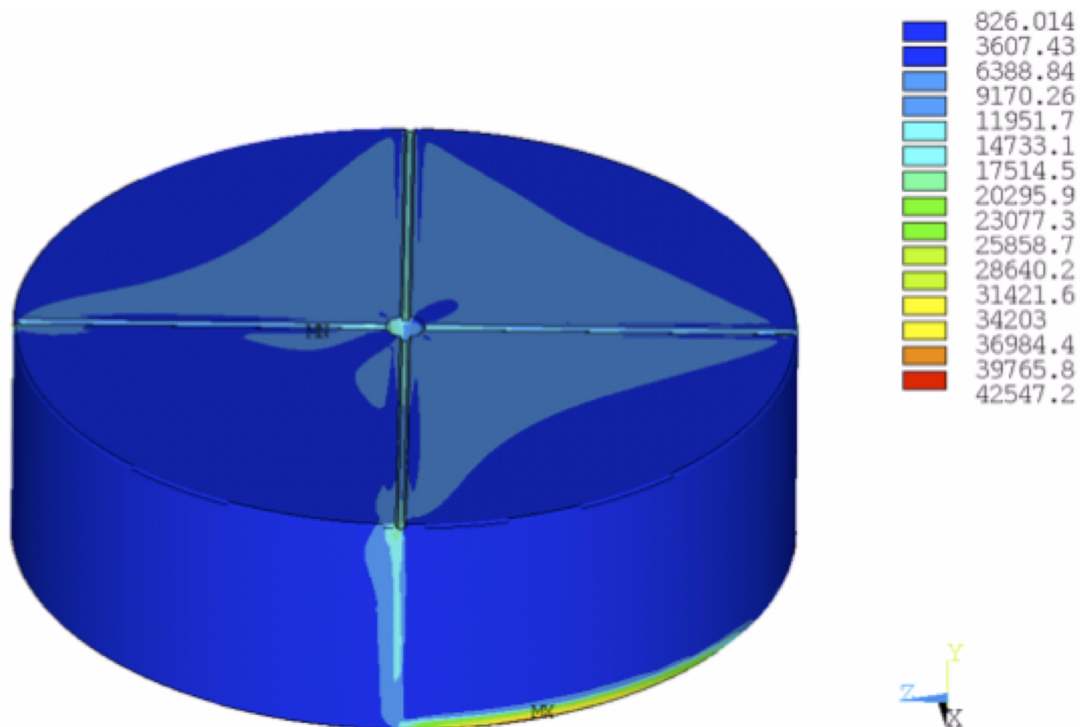


Figure 2-129. Cavity Spacer Plate Corner Drop ANSYS Stress Results – Models AOS-100A and AOS-100A-S

2.13 REFERENCES

- [2.1] U.S. Nuclear Regulatory Commission (NRC), *Title 10, Code of Federal Regulations, Part 71 (10 CFR 71)*, "Packaging and Transportation of Radioactive Material."
- [2.2] *International Atomic Energy Agency (IAEA) Safety Standards Series No. TS-R-1 (IAEA TS-R-1)*, "Regulations for the Safe Transport of Radioactive Material," 1996 Ed. (as amended 2003).
- [2.3] U.S. Nuclear Regulatory Commission (NRC), *Regulatory Guide 7.6*, "Design Criteria for the Structural Analysis of Shipping Cask Containment Vessels," Rev. 1, 1978.
- [2.4] U.S. Nuclear Regulatory Commission (NRC), *Regulatory Guide 7.8*, "Load Combinations for the Structural Analysis of Shipping Casks," Table 10, Rev. 1, 1989.
- [2.5] American Society of Mechanical Engineers, *ASME Boiler and Pressure Vessel Code, Section II, Part D*, 2004 Ed., No Addendum.
- [2.6] Gerard, George, *Introduction to Structural Stability Theory*, McGraw-Hill, New York, 1962, Equation 8-14, p. 142, and pp 143-146.
- [2.7] Kaminski, D. A., Ed., *Heat Transfer Data Book*, General Electric Company, New York, 1981, Section G515/29, p. 5.
- [2.8] American Society of Mechanical Engineers, *ASME Boiler and Pressure Vessel Code, Section II, Part D, Table 3*, p. 406, 2004 Ed., No Addendum.
- [2.9] D. Perry, *Aircraft Structures*, McGraw-Hill, 1950, pp. 398-400.
- [2.10] Metech Welded Mesh, Inc., Online Catalog, accessed June, 2010, <http://www.weldedwiremesh.net/>.
- [2.11] American National Standards Institute, *ANSI N14.5-2014*, "Radioactive Materials – Leakage Tests on Packages for Shipment," June 19, 2014.
- [2.12] MIL-STD-883B(3) NOT 2, "Dissimilar Metals," May, 1993.
- [2.13] General Plastics Manufacturing Company, *Design Guide for Use of LAST-A-FOAM FR-3700 for Crash & Fire Protection of Radioactive Material Shipping Containers*, Tacoma, WA, Issue 005.
- [2.14] ASME, Section III, Division 1, Appendices, Figure I-9.4, "Design Fatigue Curves for High Strength Steel Bolting for Temperatures Not Exceeding 700°F," 2004 Ed., No Addendum.
- [2.15] Caldwell, S.G., Ph.D., *Tungsten Heavy Alloy Engineering Manual*, ATI Firth Sterling, AL, v4.0.
- [2.16] Gibson, Lorna, J. and Michael F. Ashby, *Cellular Solids*, p. 193, Cambridge University Press, New York, NY, 2001.
- [2.17] Torrey Hills Technology, LLC, *High Density Tungsten Technical Data*, accessed September 19, 2010, <http://www.torreyhillstech.com/hddata.html>.
- [2.18] Lassner, Erik and Wolf-Dieter Schubert, *Tungsten – Properties, Chemistry, Technology of the Element, Alloys, and Chemical Compounds*, Kluwer Academic/Plenum Publishers, New York, NY, 1999.

- [2.19] General Plastics Manufacturing Company, *Design Guide for Use of LAST-A-FOAM FR-3700 for Crash & Fire Protection of Radioactive Material Shipping Containers*, Tacoma, WA, March, 1998 (revised October, 2003).
- [2.20] Communication from ATI Firth Sterling to Alpha-Omega Services, Inc., and GE Energy.
- [2.21] Parker O-Ring Division, *Evaluation of Parker Compound S1224-70 to ASTM D2000 7GE705 A19 B37 EA14 EO16 E036 F19 G11 Compound Data Sheet*, Kentucky, June 19, 1996.
- [2.22] Fitzroy, Nancy D., Ed., *Heat Transfer Data Book*, General Electric Company, New York, November, 1970 Edition, Section G502.5, p. 7.
- [2.23] Touloukian, Y. S., *Thermophysical Properties of Matter, Metallic Elements and Alloys*, 1971.
- [2.24] Fischer, L. E. and W. Lai, *NUREG/CR-3854, Fabrication Criteria for Shipping Containers*, Lawrence Livermore Laboratory, Prepared for U.S. Nuclear Regulatory Commission (NRC), Livermore, California, March, 1985.
- [2.25] Monroe, R. E, H. H. Woo, and R. G. Sears, *NUREG/CR-3019, Recommended Welding Criteria For Use in the Fabrication of Shipping Containers for Radioactive Materials*, Lawrence Livermore Laboratory, Prepared for U.S. Nuclear Regulatory Commission (NRC), Livermore, California, March, 1984.
- [2.26] American Society of Mechanical Engineers, *ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsections NB, NF, and NG*, 2004 Ed., No Addendum.
- [2.27] ASTM International, *ASTM F1145 - 05(2011), Standard Specification for Turnbuckles, Swaged, Welded, Forged*, Table 3, West Conshohocken, PA, 2011.
- [2.28] Shigley, Joseph E., *Mechanical Engineering Design*, Chapter 6, "The Design of Screws, Fasteners, and Connections," McGraw Hill, Inc., 3rd Edition, 1977.
- [2.29] American Society of Mechanical Engineers, *ASME Boiler and Pressure Vessel Code, Section VIII, Division 1*, 2004 Ed., No Addendum.
- [2.30] U.S. Nuclear Regulatory Commission (NRC), *Regulatory Guide 7.11, "Fracture Toughness Criteria of Base Material for Ferritic Steel Shipping Cask Containment Vessels with a Maximum Wall Thickness of 4 Inches (0.1 m),"* 1991.
- [2.31] Holman, W.R, and R.T. Langland, *NUREG/CR-1815, Recommendations for Protecting Against Failure by Brittle Fracture in Ferritic Steel Shipping Containers Up to Four Inches Thick*, Lawrence Livermore National Laboratory, Prepared for U.S. Nuclear Regulatory Commission (NRC), June 15, 1981.
- [2.32] McConnell, J. W. Jr., A. L. Ayers, Jr., and M. J. Tyacke, *NUREG/CR-6407, Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety*, Idaho National Engineering Laboratory, Prepared for U.S. Nuclear Regulatory Commission (NRC), Idaho Falls, Idaho, February, 1996.
- [2.33] American Society of Mechanical Engineers, *ASME Boiler and Pressure Vessel Code, Section III, Division 1*, 2004 Ed., No Addendum.
- [2.34] ANSYS, Inc. ANSYS documentation release 15.0, November, 2013.