PACIFICA TECHNOLOGY

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PT-U79-0357

A STUDY OF CRACK GROWTH RATE IN THE FORT CALHOUN FEEDWATER NOZZLE

TO:

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July 24, 1979

Revised: July 31, 1979

INTRODUCTION

As a result of Nuclear Regulatory Commission (NRC) IE Bulletin 79-13, dated June 1979, Omaha Public Power District (OPPD) is under instruction to examine within 90 days its Fort Calhoun pressurized water reactor (PWR). This is because of findings of significant corrosion assisted fatigue cracking in Westinghouse PWRs. During this shutdown, a detailed volumetric examination of the steam generator main feedwater nozzle and its adjacent piping is to be performed. Pacifica Technology has performed a thermo-structural analysis of the main feedwater nozzle in order to assist OPPD in responding to NRC IE Bulletin 79-13.

The potential for corrosion-assisted fatigue crack growth in or near the safe-end weld of the feedwater nozzle of the Fort Calhoun steam generators has been examined from two points of view, both consistent with the philosophy and practice of the ASME Boiler and Pressure Vessel Code[1], Sections III and XI. The first approach consists of assuming the largest conceivable undetected flaw from pre-service radiography and magnetic particle inspection. This flaw, in accordance with evaluation procedures specified in Appendix A of Section XI, is oriented in the most unfavorable position in the nozzle with respect to crack growth potential, and the extension of the flaw is estimated from the service history stresses and water chemistry during the first six years of operation. This growth is found to be minimal.

Secondly, this flaw, in its extended state, is now subject to an Appendix A evaluation for need of repair, specifically with respect to its potential for reaching a critical crack size as the result of a Level C Service Limit seismic event (g levels defined in Appendix F of FSAR). The assumed large number of cycles for this event provides the most severe test for unstable crack growth potential. The fact that the flaw easily meets Section XI requirements for continued operation without repair is indicative of the quality assurance for this component.

A summary of the results of these analyses follows. Additionally, a discussion of the methods and justification for the analyses is included.

SUMMARY

A worst case, highly conservative analysis of the stresses in the Fort Calhoun steam generator main feedwater nozzle has been performed. Stresses due to 1) internal pressure (p), 2) piping system deadweight (DW), 3) thermal (th) loadings, and 4) an operating basis earthquake (OBE) have been considered. Of these loadings, the piping system deadweight, thermal expansion under maximum operating temperature of 550 F and operating basis earthquake were supplied in the form of the architect engineer's (Gibbs and Hill) computer output. The internal pressure and thermal transient loadings were evaluated by PacTech using the TEXGAP computer code[2]. The following conditions were used:

Internal pressure of 1,000 psi, corresponding to the maximum relief valve setting.

Thermal transient heat up rate of 1200 F/hr (a conservative assumption since the maximum heating rate generally does not exceeded 300 F/hr).

The pressure and transient thermal stresses were calculated using the same TEXGAP model shown in Figure 1. The maximum piping stress resultants are summarized in Table 2. As an additional conservative assumption the maximum values from the analysis of Gibbs and Hill were added together regardless of the actual point on the pipe cross section where they occurred.

The thermal stresses due to the heat up transient were found negligibly small (less than 200 psi in the nozzle safe end) even with the increased heating rate. A cross check on this result using a different approach (direct integration of a heat balance equation) is included in Appendix A.

The maximum stresses were found to act in the axial direction with values of 10,715 psi at the outside surface and 8390 at the inside surface of the pipe. The corresponding maximum values of the membrane and bending components of σ_m = 9560 psi and σ_b = 1165 psi (shown also in Table 1) were

used to evaluate the crack growth potential according to the ASME Code procedures. The calculations verify that:

1. Any undetected pre-service flaws have not grown to an unacceptable level.

2. A postulated quarter thickness flaw would not propagate to cause the pipe to rupture under worst case seismic condition.

The maximum undetected pre-service flaw is assumed to be equal to .025 times the wall thickness. For the sixteen thermal cycles experienced so far, and assuming complete unloading of stresses from all sources during each cycle, this crack is found to grow $.37 \times 10^{-6}$ inches. For the quarter thickness flaw undergoing 50 seismic cycles of complete stress unloading the crack growth is found to be 94.4×10^{-6} inches. Both of these crack growths are so small as to leave the net section stress resultants unaffected, implying zero reduction in the service life capability. Details of these calculations are given in Appendix B.

DISCUSSION

Partial and through-wall cracks in primary and secondary heat removal systems of light-water-cooled nuclear power plants have been a souce of concern to the industry and the regulatory bodies for almost a decade. Originally, this concern was focused on feedwater nozzles and small-diameter stainless steel piping of boiling-water-cooled units (BWR's),with extensive research carried out by the vendor, the General Electric Company [3]; through utility owner groups; the U.S. Nuclear Regulatory Commission [4]; and the utility research arm, the Electric Power Research Institute [5]. The characteristics of this cracking are by now moderately well understood, and can be attributed to at least three interacting factors:

1) the relatively high primary and secondary stresses in these components, due to the combination of pressure and thermal loading, especially during start-up transients (although relatively high, these stresses meet ASME Code requirements without difficulty except for fatigue analysis);

2) the metallurgical effects of welding, ranging from partial sensitization of austenitic stainless steels to residual stresses in dissimilar metal welds; and

3) the deleterious effect of adverse water chemistry, especially the oxygen content, on the conversion of fatigue crack growth from the transgranular (or cleavage) mode, where yield stress plays a dominant role, to the intergranular mode, where the energy required for crack extension is a small fraction of that needed for cleavage.

As the result of research in these three areas, it has been possible to simulate the accelerated crack growth rate in the laboratory [4] for BWR systems. This experimental exercise was instructive especially with regard to items 1) and 3), since a combination of primary and secondary stress range that exceeded the 3 S_m limit of Section III of the ASME Boiler and Pressure

Vessel Code and an oxygen content in the coolant stream of the order of several thousand parts per billion were needed to produce cracks.

On the other hand the PWR secondary side cracking problem is somewhat enigmatic, at this time, for several reasons. First, the stresses due to normal and upset loads seem to be well below those levels that would sustain rapid fatigue crack growth. Second, although some cracking has been observed in the heat-affected zone (HAZ) of the welds connecting piping to transition piece to nozzle, other cracks have been observed in the base metal at distances that are thermally remote from the weld region.

There are characteristics of some PWR systems where cracking was found, that differ significantly from the Fort Calhoun Combustion Engineering (CE) design. We suggest that these differences may be capable of producing the accelerated crack growth rates seen in other PWR designs while substantiating the low propagation rate found from our analysis. The major difference is the welded joint between the carbon steel piping and the high-alloy steel of the steam generator shell and nozzle found in Westinghouse reactors. The affect of differing thermal expansion and thermal conductivity properties on the residual stresses and deformations have only been cursorily studied [7], primarily as the result of the liquid-metal-cooled fast breeder reactor (LMFBR) steam generator program, but the history of premature failures in superheater transition welds of fossil-fired boilers is well documented [8].

The other significant difference between other PWR designs and the Fort Calhoun unit is the elimination of the likelihood of unanticipated cyclic loading, such as waterhammer.

It is premature to speculate on the importance of these various factors in promoting intergranular crack growth without more definitive experiments. Nevertheless, it is likely that a number of mechanisms are needed in combination to produce failure. It may be that either thermal or mechanical loadings, are higher than anticipated in the design specification; dissolved oxygen levels are significantly higher at the nozzle than at the point of

measurement; or the field welding process may introduce adverse residual stresses and metallurgical changes. The possibility of additional thermal cycles caused by the introduction of cold make-up water into the nozzle could greatly accentuate the problem and oxygen may enter in the system at some undetected point.

For the Fort Calhoun Plant unlike Westinghouse Plants, these factors can all be eliminated. The loading and thermal transients experienced by the plant have produced very low stresses. Make up water is chemically treated and added to the recirculating water at the heater, so it is stated that the heater brings the make-up water to 440 F, hence there is no possibility of a cold flow at the nozzle during normal operation. Additionally, oxygen content readings are taken as the feedwater leaves the heater, with only a pipe run to the nozzle, eliminating any possibility of additional oxygen entering after the water chemistry is measured.

The Undetected Flaw

The Fort Calhoun steam generator nozzle, safe end, and connecting piping are presently classified as Class 2 structures in accordance with the 1967 edition of the Code. The justification for this safety classification is their location outside the primary pressure boundary. As Class 2 structures these components are not required to undergo the rigorous volumetric pre-service inspection by ultrasonic methods that is demanded by Section XI for Class 1 Structures. However, two methods of inspection were used on the safe-end weld prior to service: a surface discontinuity detection method, magnetic particle, and a volumetric discontinuity detection method, radiography.

Magnetic particle inspection is a nondestructive method of detecting the presence of cracks, seams, inclusions, segregations, porosity, lack of fusion and similar discontinuities in magnetic materials. The areas to be inspected are covered by finely divided magnetic particles which react to the magnetic leakage field produced by the discontinuity. These magnetic

particles form a pattern on the surface which is an indication of the approximate shape of the surface projection of the discontinuity.

No surface discontinuities were detected at the safe-end weld during the magnetic particle inspection.

Radiographic inspection involves the absorption path of short-wavelength radiation through metal, with the detection of defects due to the variation in absorption from that of sound metal. The shorter propagation path in the defective structure is measured on a film sensitive to the radiation, which shows an image that represents a normal projection of the indication. Radiographic methods are assumed to produce films with a sensitivity of 2 percent relative to a change in weld thickness, or propagation path. For example, a one-inch (2.5 cm) thick weld would have a reference film image such that a variation in propagation path of .02 in is detectable.

The radiographic procedure for a particular structure, such as the safe-end welds in the Fort Calhoun steam generator feedwater nozzles, is calibrated through the use of a ASME Code gage device called a penetrameter--a thin strip of metal equal in density to the weld metal, and less than or equal in thickness to 2 percent of the weld metal thickness. The sharpness of the outline of the penetrameter image against the film background is an indication of the sensitivity of the film.

Pre-service radiography showed no indications of any kind in the safe-end welds. Therefore, it is reasonable to assume that the undetectable flaw is at the upper limit of the penetrameter calibration thickness--namely, 2 percent of the weld thickness. For the Fort Calhoun feedwater nozzle safe-end welds, the depth of the undetected flaw would have an upper limit of .017 in. As a conservative assumption an initial undetected flaw of .025 in. was assumed in the following crack growth analysis which attempts to show that if the operating condition of the Fort Calhoun Plant were similar to those of a Westinghouse plant doulots would develop as to the structural integrity of the main feedwater nozzle.

It should be pointed out that a closed planar flaw oriented parallel to the radiation path would not be detected by radiographic methods, since the projection in a plane perpendicular to the propagation path would be minimal for this configuration. However, the perfectly planar flaw is an analytical concept, designed to simplify the geometric treatment of the crack extension process. In fact, crack extension, especially for intergranular growth of the type expected in oxygenated water, would take place along an irregular path with ample projection in a horizontal plane.

Crack Growth Rate Estimates

The crack growth model will be based upon the expression developed by Paris [7]:

$$\frac{da}{dN} = C\ (\Delta K)^n \qquad (1)$$

where a is the depth of the crack, N is the loading cycle, K is the stress intensity range, and C and n are constants that reflect environmental conditions (temperature, dissolved oxygen levels, etc.) and material structure. For loading that is not completely reversed or removed in a cycle, the Walker [11] adjustment will be used:

$$\frac{da}{dN} = C\ (\Delta K_{eff})^n \qquad (2)$$

where

$$\Delta K_{eff} = K_{max}\ (1-R)^{0.5} \qquad (3)$$

$$R = K_{min}/K_{max}$$

The constants C and n are determined from crack growth experiments of the type described in [9,10], with standard partially-cracked specimens. The data of Hale et al. [9] is especially informative. Two types of specimens of A333 Gr 6 were tested, one with partial cracks in base metal and the other with partial cracks in the heat-affected zone (HAZ). The testing temperature was 550 F (288C) and the dissolved oxygen level was monitored and maintained at 200-400 ppb. Two cyclic frequencies (for loading and unloading the specimen) were used,18 and 75 cycles per hour. Although the lower cyclic frequency clearly indicated an order of magnitude increase in crack growth rate, probably due to intergranular attack at stress, the authors state that "no additional increase in crack growth rate is observed (for low alloy steels) for cycle frequencies less than roughly 10 to 20 cph". This statement is unsubstantiated. (If these laboratory tests were carried out with hold periods, at peak stress intensity, the results would be more believable.) The effect of cyclic frequency holdtime is a relatively new consideration in crack growth studies.

The A333 Gr 6 material has precisely the same chemistry as SA106B. Therefore, an extrapolation of the effect of cycle frequency, in order to account for the longer duration of exposure to the oxygenated water at stress can be attempted from the two frequencies in [2]. Figure 2 shows that the mid-range of crack growth data for an intensity of about 25 ksi$\sqrt{in}$ and a cylic frequency of 75 cph is about a factor of three or four lower than for the same intensity at a frequency of 18 cph. If the startup transient is the event of concern and if the period of time at peak stress is on the order of one to three hours, then the cyclic frequency of the cyclic event is about 1 cph. This period also coincides with the temporary rise in dissolved oxygen content found in the Fort Calhoun water chemistry readings.

Since the intergranular corrosive attack is a diffusion-controlled process with an exponentially-decreasing rate, the extrapolation is carried out on a logarithmic scale. This would imply an acceleration of the crack growth rate by about another factor of four or five under actual conditions. Therefore, for K_{eff} = 25 ksi$\sqrt{in}$, the actual crack growth rate is probably

near 10^{-3} in/cycle, or even slightly higher. For conservatism we choose the crack growth rate to be even higher

$$\frac{da}{dN} = 10^{-2} (\Delta K_{eff})^{3.726} \quad (5)$$

which implies that the Section XI fatigue crack growth rate in a water environment has been shifted upward by a factor of about 20.

If the minimum yield strength is given as 35 ksi, so that the 3 S_m limit for primary and secondary stress is 70 ksi, then simple estimates of crack growth can be made by assuming an initial crack length and a stress state that just satisfies the design limit. For an initial crack length of 0.025 in, the stress intensity range would be on the order of 0.3 (3 S_m), or about 20 ksi $\sqrt{in}$. There is an posibility that this value could be as high as 30 ksi $\sqrt{in}$ or as low as 10 ksi $\sqrt{in}$. Taking the upper limit, we find that

$$\frac{da}{dN} = .003 \text{ in/cycle} \quad (6)$$

so that, in twenty cycles, the crack would grow to a length of about 0.1 in.

The preceeding is a highly speculative indication that nozzles designed to an operating stress level approximately 4 to 5 times higher than the Fort Calhoun Plant and experiencing oxygen levels two orders of magnitude higher could experience low cycle corrosion assisted fatigue crack. It is apparent from the data of both [9] and [10] that for stress intensity factors less than 10 ksi $\sqrt{in}$, the ASME BPV Code design curve is extremely conservative regardless of environment or cycle frequency. Indeed, [9] would imply that the 3 ksi $\sqrt{in}$ level used for operating life crack extension in Appendix B is below the threshold for which no cyclic crack growth is found.

The region where significantly higher crack growth rate has been found is bounded by 15 ksi $\sqrt{in}$ and 50 ksi $\sqrt{in}$ as shown in Figure 6 reference 12, a recent summary study by W. Bamford.

REFERENCES

[1] ASME Section XI, Appendix A, "Rules for Inservice Inspection of Nuclear Power Plant Components, Non-Mandatory Analysis of Flaw Indications", ASME Boiler and Pressure Vessel Code (July 1, 1977 Edition with Addenda).

[2] Becker, E.B. and R.S. Dunham, "Three Dimensional Finite Element Computer Program Development", AFRPL-TR-78-86, February 1979.

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[11] Walker, K., "The Effect of Stress Ratio During Crack Propagation and Fatigue for 2024-T3 and 7075-T6 Aluminum, Effects of Environment and Complex Load History on Fatigue Life, ASTM-STP-462, American Society for Testing and Materials, 1970, pp. 1-14.

[12] Bamford, W.H., "Application of Corrosion Fatigue Crack Growth Rate Data to Integrity Analysis of Nuclear Reactor Vessels", ASME Paper No. 79-PVP-116, March 1979.

Table 1

Stresses (psi) for 1000 psi internal pressure

Case	σ_o	σ_i	σ_m	σ_b
1.	4412	2682	3550	860
2.	4985	3210	4100	890
3.	5730	5180	5460	275
4.	10,715	8390	9560	1165

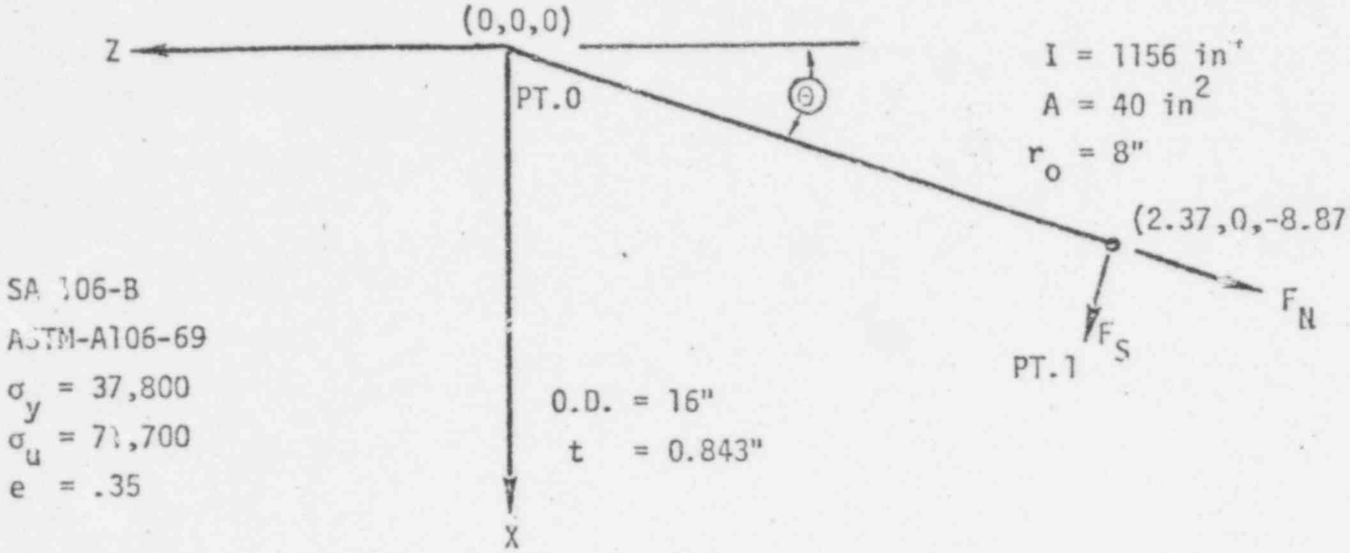
Case Summary:

1. pressure + dead weight
2. pressure + dead weight + O.B.E.
3. thermal stresses
4. pressure + dead weight + O.B.E. + thermal

Note: The stresses listed are calculated axial stresses to which an extremely conservative value equal of pr/2t = 4,750 has been added.

Table 2

Joint Forces from ADL PIPE



PT.1	F_x	F_y	F_z	M_x	M_y	M_z
Thermal	4,970	-1,942	19,231	-852,286	17,164	261,166
Seismic	1,416	392	4,942	-54,581	-64,253	26,520
Deadweight	0	104	-2	9,007	-353	-245

$$\theta = \tan^{-1}(2.37/8.87) = 14.96°$$

$$F_N = F_x \sin\theta + F_z \cos\theta$$

$$F_S = F_x \cos\theta - F_z \sin\theta$$

	F_N	F_S	F_y	M_N	M_S	M_y
Thermal	19,862	-163	-1,942	472,327	755,980	17,164
Seismic	5,140	92	392	11,531	-59,577	-64,253
Deadweight	2	0	104	2,088	8,638	-353

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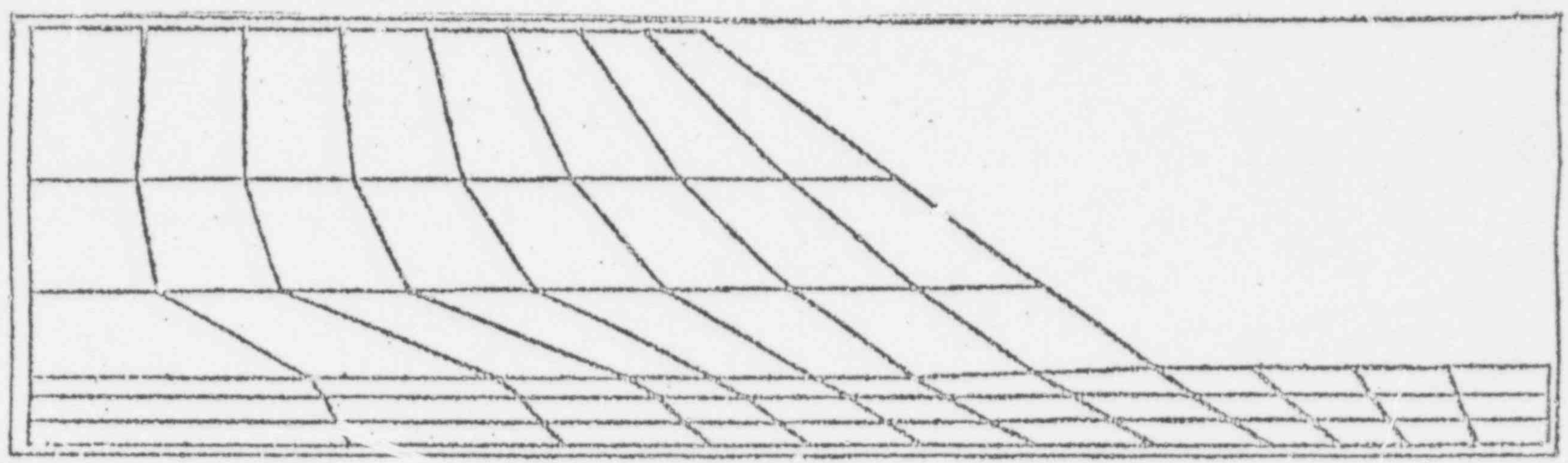
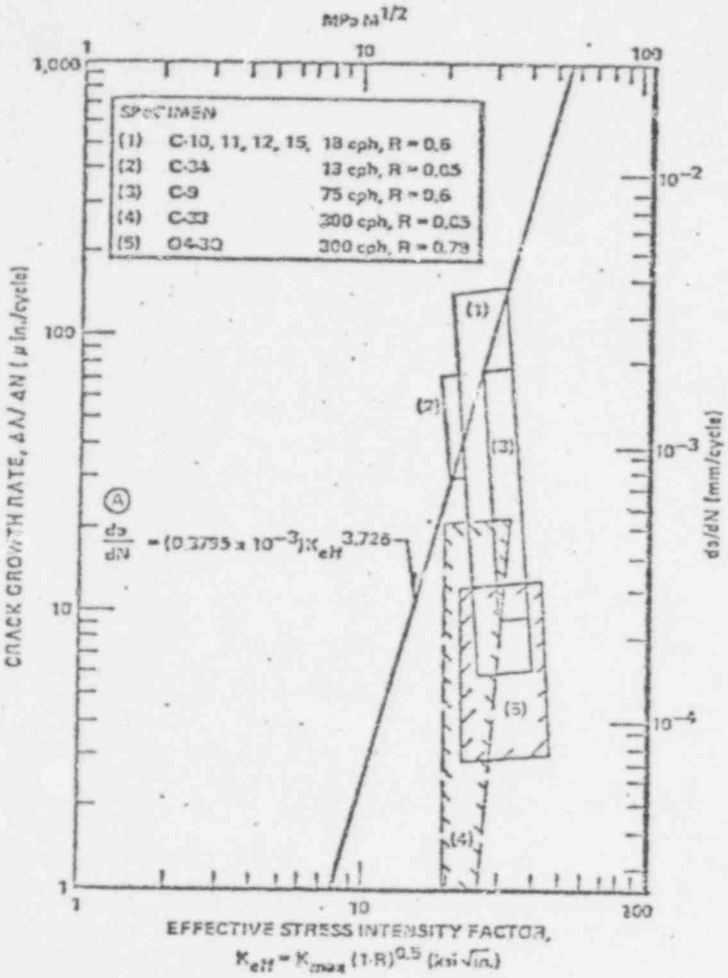


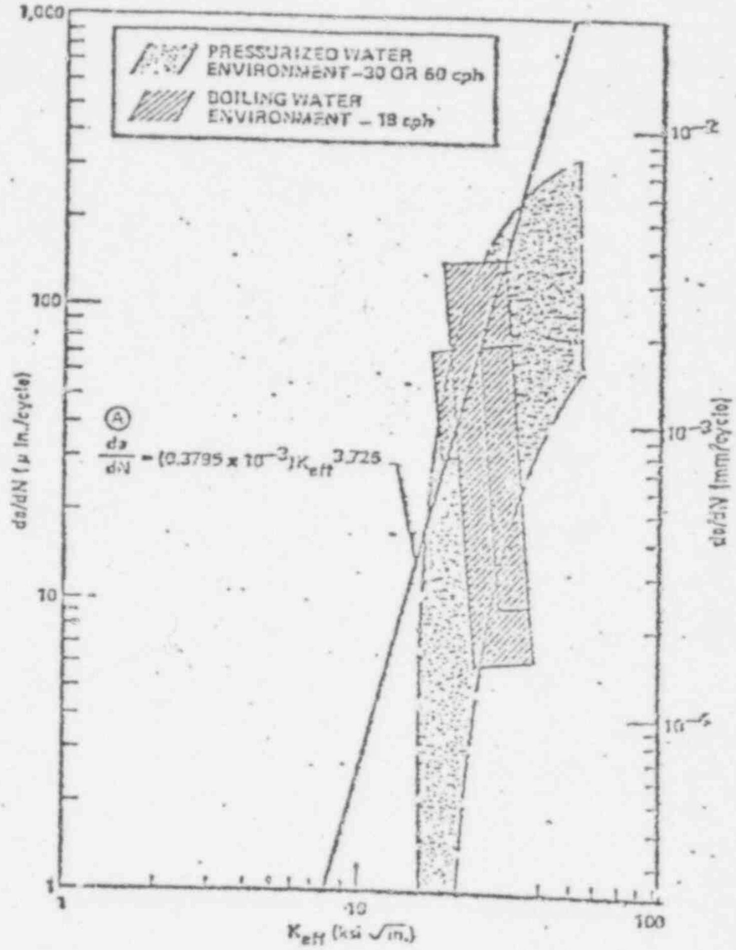
Figure 1

Note: All elements are 8 node, axisymmetric, isoparametric ements with quadratic displacement (temperature) fields.

Figure 2



Fatigue crack growth behavior of low alloy steel 200 ppb/550 F (288 C) water



Comparison of fatigue crack growth behavior of low alloy steel in pressurized water and boiling water reactor environments

APPENDIX A

As a check on the zero thermal stress state predicted by the TEXGAP analysis a heat balance calculation was performed. A measure of the importance of the thermal resistance within a solid body is the ratio of the internal to the external thermal resistance, referred to as the Biot number

$$B = \frac{hL}{K} \qquad \text{(A-1)}$$

where h is the average unit surface conductance, L is a significant dimension obtained by dividing the volume of the body by its surface area, and K is the thermal conductivity of the solid body. It has been found that for cylinders, the assumption of a uniform internal temperature is in error by less than .05 if $B \leq .1$. For the nozzle safe end

$$B = .12$$

and the assumption of a uniform internal temperature is valid if we can show that the cylinder is heating at the same rate as the stream temperature, i.e. 1200 F /hour.

To demonstrate this we define the heat balance equation

$$-\rho cV\frac{dT}{dt} = hA\ (T-T_\infty) \qquad \text{(A-2)}$$

where

$p = .283\ \text{lb/in}^3$

$c = .13\ \text{BTU/lb.-F}$

$V = 40\ \text{in}^3$

$A = 45\ \text{in}^2$

$T_\infty = 120\ \text{F} + 1200t\ \text{F}$

$h = .3\ \text{BTU/in}^2\text{-F -hr}$

t = time in hours

The solution to A-2 is

$$T = (130\, e^{-9.2t} - 10 + 1200t)\ °F \qquad \text{(A-3)}$$

Equation (A-3) indicates that after a transient of less the .1 hour, the heating rate is 1200F /hour. Since the actual heating rate very rarely has exceeded 300F /hour, the assumption of uniform cross-sectional temperature seems valid.

APPENDIX B

The crack growth results reported were calculated according to the proceedures outlined in Appendix A of Section XI of [1]. Two cracks were postulated, a .025 t and a .25 t, where t is the piping/nozzle wall thickness. The .025 t crack represents the maximum allowable undetected preservice crack, while the .25 t crack represents the maximum service life crack growth. The procedure is to first demonstrate that the .025t crack would not have experienced any appreciable growth during the known service life history. The crack growth law

$$\frac{da}{dN} = .3795 \times 10^{-3} (\Delta K_{eff})^{3.726} \qquad \text{(B-1)}$$

where

$$\Delta K_{eff} = K_{max} (1-R)^{0.5} \qquad \text{(B-2)}$$

$$R = K_{min}/K_{max} \qquad \text{(B-3)}$$

shall be used. The service life cyclic history has so far involved 16 thermal cycles during which the temperature never dropped below 120 F. For conservatism we shall assume that all stresses for Case 4 of Table 1 cycle between 0 and their maximum values during a thermal transient. Hence K_{eff} = K_{max} and

$$K_{max} = G_m M_m \sqrt{\pi} \sqrt{a/Q} + G_b M_b \sqrt{\pi} \sqrt{a/Q} \qquad \text{(B-4)}$$

from [1].

$M_m = 1.1$

$M_b = 1.07$

$\therefore \quad Q = 1.2$

$$K_{max} = 3 \text{ ksi } \sqrt{in} \qquad \text{(B-5)}$$

Using this value of K_{max} in (B-1) yields

$$\Delta a = .37 \ \mu \text{ in.} \qquad \text{(B-6)}$$

a crack growth that has no effect on the net section load carrying capability.

The second step is to now demonstrate that the .25t crack will not cause a pipe rupture during a seismic event corresponding to an O.B.E. For a = .25t, (B-4) yields

$$K_{max} = 9.8 \text{ ksi } \sqrt{in} \qquad \text{(B-7)}$$

Reference [1] requires the demonstration that the crack does not grow to 1/2 the critical crack size (defined as 3/4 of the wall thickness). The US NRC Standard Review Plan (Section 3.7.3) requires that 10 maximum stress cycles be assumed for an earthquake event. For additional conservatism we asume 50 cycles for the seismic loading. As can be seen from Table 1, assuming the seismic and pressure loads to cycle would have the stress decreasing a maximum of 50 percent, implying R = .5 and $K_{eff} = (.7)\ K_{max}$. For conservatism, we shall use $K_{eff} = K_{max}$. This yields, for 50 cycles

$$\Delta a = 94.4 \ \mu \text{ in.} \qquad \text{(B-8)}$$

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again a crack growth insignificant to the loading carrying capability of the cross section.

ADL PIPE

GIBBS & HILL, INC.
PIPE STRESS ANALYSIS

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RP DWG 103-2 (IC-67)								
NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
NORMAL OPERATING CONDITION								
B31	7	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.1868E 05	0.0000E 00
ACCEL	0	0	0.9140E 00	0.1560E 00	0.9140E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	0	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
JUNCTION	0	701	0.3802E 01	-0.1953E 01	-0.2585E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	701	0.1000E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
JUNCTION	0	718	-0.1329E 02	-0.2002E 01	-0.3523E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	718	0.1000E 01	0.1000E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	996	-0.1329E 02	-0.1948E 01	-0.5063E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	996	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
SECTION	1	10	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	0	701	0.1600E 02	0.8430E 00	0.9000E 06	0.0000E 00	0.0000E 00	0.0000E 00
RUN	0	1	0.2594E 01	0.0000E 00	-0.9672E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	1	2	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
MATERIAL	1	2	0.1958E 05	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
CHANGE	1	701	0.0000E 00	0.0000E 00	0.2677E 02	0.0000E 00	0.0000E 00	0.1796E 02
RUN	2	3	0.5050E 00	-0.1953E 01	-0.1883E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	3	4	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
CRUN	4	5	0.7030E 00	0.0000E 00	-0.2625E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	5	6	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
CRUN	6	554	0.0000E 00	0.0000E 00	-0.1318E 01	0.0000E 00	0.0000E 00	0.0000E 00

OBE - normal velocity input; SSE - twice ... ; OBE Class C Class D

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GIBBS & HILL, INC.
PIPE STRESS ANALYSIS

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

CRUN	714	701	0.0000E 00	0.0000E 00	-0.2875E 01	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	2	8	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	701	718	0.1600E 02	0.8430E 00	0.2677E 02	0.0000E 00	0.0000E 00	0.1796E 02
CRUN	701	10	0.0000E 00	0.0000E 00	-0.5554E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	10	555	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
RIGID	10	555	0.0000E 00	0.0000E 00	0.9000E 06	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	555	1555	-0.5351E 01	-0.1300E-01	-0.1300E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	1555	12	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
RUN	12	13	-0.6982E 01	-0.1700E-01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
VALVE	13	14	-0.4755E 01	-0.1200E-01	0.0000E 00	0.1600E 02	0.3000E 01	0.2500E 04
ELBOW	14	15	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
CRUN	15	718	0.0000E 00	0.7000E-02	-0.2521E 01	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	3	3	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	718	996	0.1600E 02	0.8430E 00	0.2677E 02	0.0000E 00	0.0000E 00	0.1796E 02
CRUN	718	556	0.0000E 00	0.3000E-02	-0.1146E 01	0.0000E 00	0.0000E 00	0.0000E 00
RUN	556	17	0.0000E 00	0.3700E-01	-0.1303E 02	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	17	996	0.0000E 00	0.0000E 00	-0.1229E 01	0.0000E 00	0.0000E 00	0.0000E 00
END JOB	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00

650 036

GIBBS & HILL, INC.
PIPE STRESS ANALYSIS

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

PIPE SYSTEM GEOMETRY

NUMBER OF NETWORK POINTS = 4 NUMBER OF MEMBERS = 21
NUMBER OF SECTIONS = 3 ORDER OF STIFFNESS MATRIX = 9

NETWORK POINT RESTRAINTS

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
1	0	REST	REST	REST	REST	REST	REST
2	701	REST	FREE	FREE	FREE	FREE	FREE
3	718	REST	REST	FREE	FREE	FREE	FREE
4	996	REST	REST	REST	REST	REST	REST

NETWORK POINT MOVEMENTS (INCHES)

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z

NO MOVEMENTS

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* NOTE *

FOR CURVED MEMBERS, QUANTITIES LISTED UNDER INITIAL CO-ORDS ARE CO-ORDS OF ARC CENTER THE BRACKETED NUMBERS WHICH FOLLOW ARE THE ARC RADIUS (IN), INCLUDED ANGLE (DEG).

* NOTE *

FOR GIBBS AND HILL, CO-ORD DIMENSIONS IN FEET ALL OTHER QUANTITIES, RADIUS, THICKNESS, STRESS, MOMENTS, ETC. ARE DIMENSIONED IN INCHES.

PIPE SYSTEM GEOMETRY

SECTION 1 CONNECTS SEQUENCE POINTS 0 AND 701 AND HAS 10 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	RU	8.00	0.843	0.00	0.00	0.00	2.37	0.00	-8.87	0.900E 12	0.	0.000E 00	0.00
2	EL	8.00	0.843	2.37	-1.99	-8.87	(24.000	45.022)		0.267E 08	0.	0.000E 00	17.96
3	RU	8.00	0.843	2.74	-0.58	-10.23	2.94	-1.36	-10.99	0.267E 08	0.	0.000E 00	17.96
4	EL	8.00	0.843	3.31	0.04	-12.35	(24.000	45.022)		0.267E 08	0.	0.000E 00	17.96
5	CR	8.00	0.843	3.31	-1.95	-12.35	3.57	-1.95	-13.33	0.267E 08	0.	0.000E 00	17.96
6	EL	8.00	0.843	-2.86	-1.95	-15.05	(80.000	14.992)		0.267E 08	0.	0.000E 00	17.96
7	CR	8.00	0.843	3.80	-1.95	-15.05	3.80	-1.95	-15.50	0.267E 08	0.	0.000E 00	17.96
8	RU	8.00	0.843	3.80	-1.95	-15.50	3.80	-1.95	-22.03	0.267E 08	0.	0.000E 00	17.96
9	CR	8.00	0.843	3.80	-1.95	-22.03	3.80	-1.95	-22.97	0.267E 08	0.	0.000E 00	17.96
	SPRING/FLEX				0.00000E 00		0.90000E 06	0.00000E 00		0.00000E 00	0.00000E 00	0.00000E 00	
10	CR	8.00	0.843	3.80	-1.95	-22.97	3.80	-1.95	-25.85	0.267E 08	0.	0.000E 00	17.96

SECTION 2 CONNECTS SEQUENCE POINTS 701 AND 718 AND HAS 8 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	CR	8.00	0.843	3.80	-1.95	-25.85	3.80	-1.95	-26.16	0.267E 08	0.	0.000E 00	17.96
2	EL	8.00	0.843	-2.86	-1.96	-26.16	(80.000	76.344)		0.267E 08	0.	0.000E 00	17.96

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549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

SPRING/FLEX 0.00000E 00 0.00000E 00 0.90000E 06 0.00000E 00 0.00000E 00 0.00000E 00

3	CR	8.00	0.843	-1.29	-1.96	-32.64	-0.77	-1.96	-32.51	0.267E 08	0.	0.000E 00	17.96
4	EL	8.00	0.843	-2.34	-1.96	-26.03	(	80.000	13.655)	0.267E (	0.	0.000E 00	17.96
5	RU	8.00	0.843	-2.34	-1.96	-32.70	-8.53	-1.98	-32.70	0.267E 08	0.	0.000E 00	17.96
6	RU	8.00	3.000	-8.53	-1.98	-32.70	-11.28	-1.98	-32.70	0.267E 08	0.	0.000E 00	17.96

WEIGHT 0.25000E 04

7	EL	8.00	0.843	-11.28	-1.98	-34.70	(	24.000	90.000)	0.267E 08	0.	0.000E 00	17.96
8	CR	8.00	0.843	-13.28	-1.98	-34.70	-13.28	-1.98	-35.22	0.267E 08	0.	0.000E 00	17.96

SECTION 3 CONNECTS SEQUENCE POINTS 718 AND 996 AND HAS 3 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	CR	8.00	0.843	-13.29	-2.00	-35.23	-13.29	-1.99	-36.37	0.267E 08	0.	0.000E 00	17.96
2	RU	8.00	0.843	-13.29	-1.99	-36.37	-13.29	-1.96	-49.40	0.267E 08	0.	0.000E 00	17.96
3	CR	8.00	0.843	-13.29	-1.96	-49.40	-13.29	-1.96	-50.63	0.267E 08	0.	0.000E 00	17.96

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

LOADS
ACCELERATION

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	1	0	BEG	1416.	392.	4942.	-12845.	-356148.	37713.	0.000	0.000	0.000	0.0000	0.0000	0.0000
1	1	1	END	1416.	392.	4942.	-54581.	-64253.	26520.	0.000	-0.000	0.000	-0.0000	-0.0000	0.0000
1	2		BEG	1416.	392.	4942.	-54581.	-64253.	26520.	0.000	-0.000	0.000	-0.0000	-0.0000	0.0000
1	2	2	END	1106.	339.	4633.	-27260.	-22343.	16378.	0.001	-0.001	0.001	-0.0001	-0.0001	0.0000
1	3		BEG	1106.	339.	4633.	-27260.	-22343.	16378.	0.001	-0.001	0.001	-0.0001	-0.0001	0.0000
1	3	3	END	889.	302.	4415.	12209.	-2368.	6257.	0.003	-0.002	0.002	-0.0001	-0.0001	0.0000
1	4		BEG	889.	302.	4415.	12209.	-2368.	6257.	0.003	-0.002	0.002	-0.0001	-0.0001	0.0000
1	4	4	END	579.	249.	4106.	38041.	28218.	-464.	0.005	-0.003	0.004	-0.0000	-0.0000	0.0000
1	5		BEG	579.	249.	4106.	38041.	28218.	-464.	0.005	-0.003	0.004	-0.0000	-0.0000	0.0000
1	5	5	END	380.	215.	3907.	35318.	46428.	-1193.	0.006	-0.003	0.004	-0.0000	-0.0000	0.0000
1	6		BEG	380.	215.	3907.	35318.	46428.	-1193.	0.006	-0.003	0.004	-0.0000	-0.0000	0.0000
1	6	6	END	36.	156.	3563.	31473.	61055.	-1726.	0.007	-0.003	0.004	0.0000	-0.0000	0.0000
1	7		BEG	36.	156.	3563.	31473.	61055.	-1726.	0.007	-0.003	0.004	0.0000	-0.0000	0.0000
1	7	554	END	-49.	141.	3476.	30684.	61021.	-1726.	0.007	-0.003	0.004	0.0000	-0.0000	0.0000
1	8		BEG	-49.	141.	3476.	30684.	61021.	-1726.	0.007	-0.003	0.004	0.0000	-0.0000	0.0000
1	8	8	END	-1337.	-77.	2189.	28179.	6618.	-1726.	0.003	-0.000	0.005	0.0000	0.0000	0.0000
1	9		BEG	-1337.	-77.	2189.	28179.	6618.	-1726.	0.003	-0.000	0.005	0.0000	0.0000	0.0000
1	9		DIS	0.	-663.	0.	0.	0.	0.	0.002	0.000	0.005	0.0000	0.0000	0.0000
1	9	714	END	-1523.	554.	2003.	29240.	-9566.	-1726.	0.002	0.000	0.005	0.0000	0.0000	0.0000
1	10		BEG	-1523.	554.	2003.	29240.	-9566.	-1726.	0.002	0.000	0.005	0.0000	0.0000	0.0000
1	10	701	END	-2089.	457.	1437.	11783.	-71883.	-1726.	-0.000	0.004	0.005	0.0001	0.0000	0.0000
2	1	701	BEG	1795.	457.	1437.	11783.	-71883.	-1726.	0.000	0.004	0.005	0.0001	0.0000	0.0000
2	1	10	END	1733.	447.	1375.	10083.	-65256.	-1726.	-0.000	0.004	0.005	0.0001	0.0000	0.0000
2	2		BEG	1733.	447.	1375.	10083.	-65256.	-1726.	-0.000	0.004	0.005	0.0001	0.0000	0.0000

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
2	2		DIS	0.	0.	-1916.	0.	-0.	0.	0.002	0.011	0.002	0.0000	-0.0000	0.0000
2	2	555	END	-16.	148.	1541.	-15121.	-1299.	13727.	0.002	0.011	0.002	0.0000	-0.0000	0.0000
2	3		BEG	-16.	148.	1541.	-15121.	-1299.	13727.	0.002	0.011	0.002	0.0000	-0.0000	0.0000
2	3	1555	END	-121.	130.	1436.	-14933.	8051.	12860.	0.002	0.011	0.002	0.0000	-0.0000	0.0000
2	4		BEG	-121.	130.	1436.	-14933.	8051.	12860.	0.002	0.011	0.002	0.0000	-0.0000	0.0000
2	4	12	END	-434.	77.	1123.	-14316.	32866.	10990.	0.001	0.012	0.003	0.0000	-0.0000	0.0000
2	5		BEG	-434.	77.	1123.	-14316.	32866.	10990.	0.001	0.012	0.003	0.0000	-0.0000	0.0000
2	5	13	END	-1652.	-130.	-94.	-14223.	-5329.	9191.	0.001	0.005	0.001	0.0000	-0.0000	0.0000
2	6		BEG	-1652.	-130.	-94.	-14223.	-5329.	9191.	0.001	0.005	0.001	0.0000	-0.0000	0.0000
2	6		DIS	2285.	390.	2285.	0.	0.	0.	0.001	0.002	0.000	0.0000	-0.0000	0.0001
2	6	14	END	-4480.	-613.	-2922.	-14253.	6759.	3498.	0.001	0.002	0.000	0.0000	-0.0000	0.0001
2	7		BEG	-4480.	-613.	-2922.	-14253.	6759.	3498.	0.001	0.002	0.000	0.0000	-0.0000	0.0001
2	7	15	END	-5099.	-718.	-3540.	2110.	-34694.	-12182.	0.000	0.000	0.000	0.0000	0.0000	0.0000
2	8		BEG	-5099.	-718.	-3540.	2110.	-34694.	-12182.	0.000	0.000	0.000	0.0000	0.0000	0.0000
2	8	718	END	-5201.	-736.	-3643.	6723.	-66894.	-12272.	-0.000	-0.000	0.000	0.0000	0.0000	0.0000
3	1	718	BEG	1678.	262.	-3643.	6723.	-66894.	-12272.	0.000	0.000	0.000	0.0000	0.0000	0.0000
3	1	556	END	1453.	223.	-3869.	3517.	-45358.	-12215.	-0.000	0.000	0.000	0.0000	0.0000	0.0000
3	2		BEG	1453.	223.	-3869.	3517.	-45358.	-12215.	-0.000	0.000	0.000	0.0000	0.0000	0.0000
3	2	17	END	-1113.	-214.	-6435.	5083.	-18806.	-12140.	0.000	0.000	0.000	-0.0000	0.0000	0.0000
3	3		BEG	-1113.	-214.	-6435.	5083.	-18806.	-12140.	0.000	0.000	0.000	-0.0000	0.0000	0.0000
3	3	996	END	-1355.	-255.	-6678.	8550.	-37014.	-12140.	0.000	-0.000	-0.000	-0.0000	0.0000	-0.0000

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

NETWORK POINT REACTIONS AND DEFLECTIONS

NET PT	SEQ	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	0	-1416.	-392.	-4942.	12845.	356148.	-37713.	0.000	0.000	0.000	0.0000	0.0000	0.0000
2	701	-3884.	0.	-0.	-0.	0.	0.	0.000	0.004	0.005	0.0001	0.0000	0.0000
3	718	-6880.	-998.	-0.	-0.	-0.	0.	0.000	0.000	0.000	0.0000	0.0000	0.0000
4	996	-1355.	-355.	-6678.	8550.	-37014.	-12140.	0.000	-0.000	-0.000	-0.0000	0.0000	-0.0000

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 3 JL 9-3-71

USAS B31.7 STRESS SUMMARY

* NOTE *
NEGATIVE STRESS INDICATES ALLOWABLE
STRESS HAS BEEN EXCEEDED

SEC	MEM	SEQ	POS	TYPE	EQ.	PRESSURE	MOMENT	THERMAL DIS.	WALL GRAD	COMBINED
1	1	0	BEG	RU	9	0.0	2479.4			2479.4
		1	END	RU	9	0.0	611.4			611.4
1	1	0	BEG	RU	10	0.0	2479.4	0.0	0.0	2479.4
					11	0.0	4463.0	0.0	0.0	4463.0
					12					2479.4
					13					0.0
		1	END	RU	10	0.0	611.4	0.0	0.0	611.4
					11	0.0	1100.6	0.0	0.0	1100.6
					12					611.4
					13					0.0
1	2	1	BEG	EL	9	0.0	1793.5			1793.5
		2	END	EL	9	0.0	788.7			788.7
1	2	1	BEG	EL	10	0.0	2391.3	0.0	0.0	2391.3
					11	0.0	2391.3	0.0	0.0	2391.3
					12					2391.3
					13					0.0
		2	END	EL	10	0.0	1051.6	0.0	0.0	1051.6
					11	0.0	1051.6	0.0	0.0	1051.6
					12					1051.6
					13					0.0
1	3	2	BEG	RU	9	0.0	268.9			268.9
		3	END	RU	9	0.0	96.3			96.3
1	3	2	BEG	RU	10	0.0	268.9	0.0	0.0	268.9
					11	0.0	484.0	0.0	0.0	484.0
					12					268.9
					13					0.0
		3	END	RU	10	0.0	96.3	0.0	0.0	96.3
					11	0.0	173.3	0.0	0.0	173.3
					12					96.3
					13					0.0
1	4	3	BEG	EL	9	0.0	282.5			282.5
		4	END	EL	9	0.0	961.2			961.2
1	4	3	BEG	EL	10	0.0	376.7	0.0	0.0	376.7
					11	0.0	376.7	0.0	0.0	376.7

					12					376.7
					13					0.0
		4	END	EL	10	0.0	1281.6	0.0	0.0	1281.6
					11	0.0	1281.6	0.0	0.0	1281.6
					12					1281.6
					13					0.0
1	5	4	BEG	CR	9	0.0	327.7			327.7
		5	END	CR	9	0.0	403.6			403.6
1	5	4	BEG	CR	10	0.0	327.7	0.0	0.0	327.7
					11	0.0	327.7	0.0	0.0	327.7
					12					327.7
					13					0.0
		5	END	CR	10	0.0	403.6	0.0	0.0	403.6
					11	0.0	403.6	0.0	0.0	403.6
					12					403.6
					13					0.0
1	6	5	BEG	EL	9	0.0	530.4			530.4
		6	END	EL	9	0.0	624.6			624.6
1	6	5	BEG	EL	10	0.0	707.2	0.0	0.0	707.2
					11	0.0	707.2	0.0	0.0	707.2
					12					707.2
					13					0.0
		6	END	EL	10	0.0	832.8	0.0	0.0	832.8
					11	0.0	832.8	0.0	0.0	832.8
					12					832.8
					13					0.0
1	7	6	BEG	CR	9	0.0	475.3			475.3
		554	END	CR	9	0.0	472.7			472.7
1	7	6	BEG	CR	10	0.0	475.3	0.0	0.0	475.3
					11	0.0	475.3	0.0	0.0	475.3
					12					475.3
					13					0.0
		554	END	CR	10	0.0	4[illegible].7	0.0	0.0	472.7
					11	0.0	472.7	0.[illegible]	0.0	472.7
					12					472.7
					13					0.0
1	6	554	BEG	CR	9	0.0	472.7			472.7
		8	END	RU	9	0.0	200.6			200.6
1	8	554	BEG	CR	10	0.0	472.7	0.0	0.0	472.7
					11	0.0	472.7	0.0	0.0	472.7
					12					472.7
					13					0.0
		8	END	RU	10	0.0	200.6	0.0	0.0	200.6
					11	0.0	361.1	0.0	0.0	361.1
					12					200.6
					13					0.0
1	9	8	BEG	RU	9	0.0	200.6			200.6
		714	END	CR	9	0.0	213.1			213.1
1	9	8	BEG	RU	10	0.0	200.6	0.0	0.0	200.6
					11	0.0	361.1	0.0	0.0	361.1
										200.6

650 044

					13					0.0
		714	END	CR	10	0.0	213.1	0.0	0.0	213.1
					11	0.0	213.1	0.0	0.0	213.1
					12					213.1
					13					0.0
1	10	714	BEG	CR	9	0.0	213.1			213.1
		701	END	CR	9	0.0	504.1			504.1
1	10	714	BEG	CR	10	0.0	213.1	0.0	0.0	213.1
					11	0.0	213.1	0.0	0.0	213.1
					12					213.1
					13					0.0
		701	END	CR	10	0.0	504.1	0.0	0.0	504.1
					11	0.0	504.1	0.0	0.0	504.1
					12					504.1
					13					0.0
2	1	701	BEG	CR	9	0.0	504.1			504.1
		10	END	CR	9	0.0	457.0			457.0
2	1	701	BEG	CR	10	0.0	504.1	0.0	0.0	504.1
					11	0.0	504.1	0.0	0.0	504.1
					12					504.1
					13					0.0
		10	END	CR	10	0.0	457.0	0.0	0.0	457.0
					11	0.0	457.0	0.0	0.0	457.0
					12					457.0
					13					0.0
2	2	10	BEG	EL	9	0.0	600.4			600.4
		555	END	EL	9	0.0	186.0			186.0
2	2	10	BEG	EL	10	0.0	800.6	0.0	0.0	800.6
					11	0.0	800.6	0.0	0.0	800.6
					12					800.6
					13					0.0
		555	END	EL	10	0.0	248.0	0.0	0.0	248.0
					11	0.0	248.0	0.0	0.0	248.0
					12					248.0
					13					0.0
2	3	555	BEG	CR	9	0.0	141.5			141.5
		***	END	CR	9	0.0	147.2			147.2
2	3	555	BEG	CR	10	0.0	141.5	0.0	0.0	141.5
					11	0.0	141.5	0.0	0.0	141.5
					12					141.5
					13					0.0
		***	END	CR	10	0.0	147.2	0.0	0.0	147.2
					11	0.0	147.2	0.0	0.0	147.2
					12					147.2
					13					0.0
2	4	***	BEG	EL	9	0.0	193.5			193.5
		12	END	EL	9	0.0	340.8			340.8
2	4	***	BEG	EL	10	0.0	258.0	0.0	0.0	258.0
					11	0.0	258.0	0.0	0.0	258.0
					12					258.0
					13					0.0

103-2

				11	8676.6	9598.6	0.0	0.0	18275.2 + 945.6
				12					9598.6
				13					0.0
		556 END	CR	10	8676.6	9163.0	0.0	0.0	17839.6 + 651.8
				11	8676.6	9163.0	0.0	0.0	17839.6 + 651.8
				12					9163.0
				13					0.0
2	10	556 BEG	CR	10	8676.6	9163.0	0.0	0.0	17839.6 + 651.8
				11	8676.6	9163.0	0.0	0.0	17839.6 + 651.8
				12					9163.0
				13					0.0
		17 END	RU	10	9544.2	5198.1	0.0	0.0	14742.4 + 317.6
				11	11453.1	9356.6	0.0	0.0	20809.8 + 571.6
				12					5198.1
				13					0.0
2	11	17 BEG	RU	10	9544.2	5198.1	0.0	0.0	14742.4 + 317.6
				11	11453.1	9356.6	0.0	0.0	20809.8 + 571.6
				12					5198.1
				13					0.0
		996 END	CR	10	8676.6	5011.0	0.0	0.0	13687.6 + 571.6
				11	8676.6	5011.0	0.0	0.0	13687.6 + 571.6
				12					5011.0
				13					0.0

650 046

		12	END	EL	10	0.0	454.4	0.0	0.0	454.4
					11	0.0	454.4	0.0	0.0	454.4
					12					454.4
					13					0.0
2	5	12	BEG	RU	9	0.0	259.4			259.4
		13	END	RU	9	0.0	122.8			122.8
2	5	12	BEG	RU	10	0.0	259.4	0.0	0.0	259.4
					11	0.0	466.9	0.0	0.0	466.9
					12					259.4
					13					0.0
		13	END	RU	10	0.0	122.8	0.0	0.0	122.8
					11	0.0	221.0	0.0	0.0	221.0
					12					122.8
					13					0.0
2	6	13	BEG	RU	9	0.0	52.1			52.1
		14	END	RU	9	0.0	47.4			47.4
2	6	13	BEG	RU	10	0.0	52.1	0.0	0.0	52.1
					11	0.0	93.7	0.0	0.0	93.7
					12					52.1
					13					0.0
		14	END	RU	10	0.0	47.4	0.0	0.0	47.4
					11	0.0	85.3	0.0	0.0	85.3
					12					47.4
					13					0.0
2	7	14	BEG	EL	9	0.0	327.9			327.9
		15	END	EL	9	0.0	747.4			747.4
2	7	14	BEG	EL	10	0.0	437.2	0.0	0.0	437.2
					11	0.0	437.2	0.0	0.0	437.2
					12					437.2
					13					0.0
		15	END	EL	10	0.0	996.6	0.0	0.0	996.6
					11	0.0	996.6	0.0	0.0	996.6
					12					996.6
					13					0.0
2	8	15	BEG	CR	9	0.0	254.8			254.8
		718	END	CR	9	0.0	472.8			472.8
2	8	15	BEG	CR	10	0.0	254.8	0.0	0.0	254.8
					11	0.0	254.8	0.0	0.0	254.8
					12					254.8
					13					0.0
		718	END	CR	10	0.0	472.8	0.0	0.0	472.8
					11	0.0	472.8	0.0	0.0	472.8
					12					472.8
					13					0.0
3	1	718	BEG	CR	9	0.0	472.8			472.8
		556	END	CR	9	0.0	325.9			325.9
3	1	718	BEG	CR	10	0.0	472.8	0.0	0.0	472.8
					11	0.0	472.8	0.0	0.0	472.8
					12					472.8
					13					0.0
		[illegible]	END	CR	10	0.0	325.9	0.0	0.0	325.9

650 047

				11	0.0	325.9	0.0	0.0	325.9
				12					325.9
				13					0.0
3	2 555	BEG	CR	9	0.0	325.9			325.9
	17	END	RU	9	0.0	158.8			158.8
3	2 556	BEG	CR	10	0.0	325.9	0.0	0.0	325.9
				11	0.0	325.9	0.0	0.0	325.9
				12					325.9
				13					0.0
	17	END	RU	10	0.0	158.8	0.0	0.0	158.8
				11	0.0	285.8	0.0	0.0	285.8
				12					158.8
				13					0.0
3	3 17	BEG	RU	9	0.0	158.8			158.8
	996	END	CR	9	0.0	275.9			275.9
3	3 17	BEG	RU	10	0.0	158.8	0.0	0.0	158.8
				11	0.0	285.8	0.0	0.0	285.8
				12					158.8
				13					0.0
	996	END	CR	10	0.0	275.9	0.0	0.0	275.9
				11	0.0	275.9	0.0	0.0	275.9
				12					275.9
				13					0.0

PIPE ERROR MESSAGE NUMBER 1
AT END OF THIS ROUTINE WILL RETURN FOR NEXT SET OF DATA.

650 048

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
BP DWG 103-2 (IC-67)								
NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
NORMAL OPERATING CONDITION								
B31	7	9	0.1100E 04	0.0000E 00	0.0000E 00	0.0000E 00	0.1868E 05	0.0000E 00
DEADWEIGHT	0	0	0.0000E 00	-0.1000E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	0	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
JUNCTION	0	701	0.3802E 01	-0.1953E 01	-0.2585E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	701	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
JUNCTION	0	718	-0.1329E 02	-0.2002E 01	-0.3523E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	718	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	996	-0.1329E 02	-0.1948E 01	-0.5063E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	996	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
SECTION	1	10	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	0	701	0.1600E 02	0.8430E 00	0.9000E 06	0.0000E 00	0.0000E 00	0.0000E 00
RUN	0	1	0.2594E 01	0.0000E 00	-0.9672E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	1	2	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
MATERIAL	1	2	0.1958E 05	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
CHANGE	1	701	0.0000E 00	0.0000E 00	0.2677E 02	0.0000E 00	0.0000E 00	0.1796E 02
RUN	2	3	0.5050E 00	-0.1953E 01	-0.1885E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	3	4	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
CRUN	4	5	0.7030E 00	0.0000E 00	-0.2625E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	5	6	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
CRUN	6	554	0.0000E 00	0.0000E 00	-0.1318E 01	0.0000E 00	0.0000E 00	0.0000E 00
RIGID	6	554	0.0000E 00	0.9000E 06	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	554	8	0.0000E 00	0.0000E 00	-0.6536E 01	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	8	714	0.0000E 00	0.0000E 00	-0.9430E 00	0.0000E 00	0.0000E 00	0.0000E 00

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

CRUN	714	701	0.0000E 00	0.0000E 00	-0.2875E 01	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	2	8	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	701	718	0.1600E 02	0.8430E 00	0.2677E 02	0.0000E 00	0.0000E 00	0.1796E 02
CRUN	701	10	0.0000E 00	0.0000E 00	-0.5554E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	10	555	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
RIGID	10	555	0.0000E 00	0.9000E 06	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	555	1555	-0.5351E 01	-0.1300E-01	-0.1300E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	1555	12	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
RUN	12	13	-0.6982E 01	-0.1700E-01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
VALVE	13	14	-0.4755E 01	-0.1200E-01	0.0000E 00	0.1600E 02	0.3000E 01	0.2500E 04
ELBOW	14	15	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
CRUN	15	718	0.0000E 00	0.7000E-02	-0.2521E 01	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	3	3	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	718	996	0.1600E 02	0.8430E 00	0.2677E 02	0.0000E 00	0.0000E 00	0.1796E 02
CRUN	718	556	0.0000E 00	0.3000E-02	-0.1146E 01	0.0000E 00	0.0000E 00	0.0000E 00
RIGID	718	556	0.0000E 00	0.9000E 06	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	556	17	0.0000E 00	0.3700E-01	-0.1303E 02	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	17	996	0.0000E 00	0.0000E 00	-0.1229E 01	0.0000E 00	0.0000E 00	0.0000E 00
END JOB	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

PIPE SYSTEM GEOMETRY

NUMBER OF NETWORK POINTS = 4 NUMBER OF MEMBERS = 21

NUMBER OF SECTIONS = 3 ORDER OF STIFFNESS MATRIX = 12

NETWORK POINT RESTRAINTS

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
1	0	REST	REST	REST	REST	REST	REST
2	701	FREE	FREE	FREE	FREE	FREE	FREE
3	718	FREE	FREE	FREE	FREE	FREE	FREE
4	996	REST	REST	REST	REST	REST	REST

NETWORK POINT MOVEMENTS (INCHES)

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z

NO MOVEMENTS

680 1051

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

* NOTE *

FOR CURVED MEMBERS, QUANTITIES LISTED UNDER INITIAL CO-ORDS ARE CO-ORDS OF ARC CENTER THE BRACKETED NUMBERS WHICH FOLLOW ARE THE ARC RADIUS (IN), INCLUDED ANGLE (DEG).

* NOTE *

FOR GIBBS AND HILL, CO-ORD DIMENSIONS IN FEET ALL OTHER QUANTITIES, RADIUS, THICKNESS, STRESS, MOMENTS, ETC. ARE DIMENSIONED IN INCHES.

PIPE SYSTEM GEOMETRY

SECTION 1 CONNECTS SEQUENCE POINTS 0 AND 701 AND HAS 10 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	RU	8.00	0.843	0.00	0.00	0.00	2.37	0.00	-8.87	0.900E 12	0.	0.000E 00	0.00
2	EL	8.00	0.843	2.37	-1.99	-8.87	(	24.000	45.022)	0.267E 08	0.	0.000E 00	17.96
3	RU	8.00	0.843	2.74	-0.58	-10.23	2.94	-1.36	-10.99	0.267E 08	0.	0.000E 00	17.96
4	EL	8.00	0.843	3.31	0.04	-12.35	(	24.000	45.022)	0.267E 08	0.	0.000E 00	17.96
5	CR	8.00	0.843	3.31	-1.95	-12.35	3.57	-1.95	-13.33	0.267E 08	0.	0.000E 00	17.96
6	EL	8.00	0.843	-2.86	-1.95	-15.05	(	80.000	14.992)	0.267E 08	0.	0.000E 00	17.96
7	CR	8.00	0.843	3.80	-1.95	-15.05	3.80	-1.95	-15.50	0.267E 08	0.	0.000E 00	17.96
	SPRING/FLEX				0.00000E 00		0.90000E 06		0.00000E 00	0.00000E 00	0.00000E 00	0.00000E 00	
8	RU	8.00	0.843	3.80	-1.95	-15.50	3.80	-1.95	-22.03	0.267E 08	0.	0.000E 00	17.96
9	CR	8.00	0.843	3.80	-1.95	-22.03	3.80	-1.95	-22.97	0.267E 08	0.	0.000E 00	17.96
10	CR	8.00	0.843	3.80	-1.95	-22.97	3.80	-1.95	-25.85	0.267E 08	0.	0.000E 00	17.96

SECTION 2 CONNECTS SEQUENCE POINTS 701 AND 718 AND HAS 8 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	CR	8.00	0.843	3.80	-1.95	-25.85	3.80	-1.95	-26.16	0.267E 08	0.	0.000E 00	17.96
2	EL	8.00	0.843	-2.86	-1.96	-26.16	(	80.000	76.344)	0.267E 08	0.	0.000E 00	17.96

SPRING/FLEX					0.00000E 00		0.90000E 06		0.00000E 00	0.00000E 00	0.00000E 00	0.00000E 00	
3	CR	8.00	0.843	-1.29	-1.96	-32.64	-0.77	-1.96	-32.51	0.267E 08	0.	0.000E 00	17.96
4	EL	8.00	0.843	-2.34	-1.96	-26.03	(80.000	13.655)		0.267E 08	0.	0.000E 00	17.96
5	RU	8.00	0.843	-2.34	-1.96	-32.70	-8.53	-1.98	-32.70	0.267E 08	0.	0.000E 00	17.96
6	RU	8.00	3.000	-8.53	-1.98	-32.70	-11.28	-1.98	-32.70	0.267E 08	0.	0.000E 00	17.96
WEIGHT					0.25000E 04								
7	EL	8.00	0.843	-11.28	-1.98	-34.70	(24.000	90.000)		0.267E 08	0.	0.000E 00	17.96
8	CR	8.00	0.843	-13.28	-1.98	-34.70	-13.28	-1.98	-35.22	0.267E 08	0.	0.000E 00	17.96

SECTION 3 CONNECTS SEQUENCE POINTS 718 AND 996 AND HAS 3 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	CR	8.00	0.843	-13.29	-2.00	-35.23	-13.29	-1.99	-36.37	0.267E 08	0.	0.000E 00	17.96
SPRING/FLEX					0.00000E 00		0.90000E 06		0.00000E 00	0.00000E 00	0.00000E 00	0.00000E 00	
2	RU	8.00	0.843	-13.29	-1.99	-36.37	-13.29	-1.96	-49.40	0.267E 08	0.	0.000E 00	17.96
3	CR	8.00	0.843	-13.29	-1.96	-49.40	-13.29	-1.96	-50.63	0.267E 08	0.	0.000E 00	17.96

650 1053

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

LOADS
DEADWEIGHT

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	1	0	BEG	0.	104.	-2.	9007.	-353.	-245.	0.000	0.000	0.000	0.0000	0.0000	0.0000
1	1	1	END	0.	104.	-2.	-2142.	-360.	-3235.	0.000	0.000	0.000	0.0000	-0.0000	-0.0000
1	2		BEG	0.	104.	-2.	-2142.	-360.	-3235.	0.000	0.000	0.000	0.0000	-0.0000	-0.0000
1	2	2	END	0.	443.	-2.	-6501.	-361.	-4403.	-0.000	-0.000	0.000	-0.0000	0.0000	-0.0000
1	3		BEG	0.	443.	-2.	-6501.	-361.	-4403.	-0.000	-0.000	0.000	-0.0000	0.0000	-0.0000
1	3	3	END	0.	681.	-2.	-11605.	-361.	-5770.	-0.000	-0.000	0.000	-0.0000	0.0000	-0.0000
1	4		BEG	0.	681.	-2.	-11605.	-361.	-5770.	-0.000	-0.000	0.000	-0.0000	0.0000	-0.0000
1	4	4	END	0.	1019.	-2.	-25721.	-362.	-9551.	-0.000	-0.000	0.000	-0.0000	0.0000	-0.0000
1	5		BEG	0.	1019.	-2.	-25721.	-362.	-9551.	-0.000	-0.000	0.000	-0.0000	0.0000	-0.0000
1	5	5	END	0.	1237.	-2.	-38955.	-363.	-13095.	-0.000	-0.001	0.000	-0.0000	0.0000	-0.0000
1	6		BEG	0.	1237.	-2.	-38955.	-363.	-13095.	-0.000	-0.001	0.000	-0.0000	0.0000	-0.0000
1	6	6	END	0.	1613.	-2.	-68486.	-358.	-16808.	-0.000	-0.003	0.000	-0.0001	0.0000	-0.0000
1	7		BEG	0.	1613.	-2.	-68486.	-358.	-16808.	-0.000	-0.003	0.000	-0.0001	0.0000	-0.0000
1	7		DIS	0.	4084.	0.	0.	0.	0.	-0.000	-0.004	0.000	-0.0001	0.0000	-0.0000
1	7	554	END	0.	-2375.	-2.	-77273.	-355.	-16808.	-0.000	-0.004	0.000	-0.0001	0.0000	-0.0000
1	8		BEG	0.	-2375.	-2.	-77273.	-355.	-16808.	-0.000	-0.004	0.000	-0.0001	0.0000	-0.0000
1	8	8	END	0.	-966.	-2.	53798.	-311.	-16808.	-0.000	-0.018	0.000	-0.0001	-0.0000	-0.0001
1	9		BEG	0.	-966.	-2.	53798.	-311.	-16808.	-0.000	-0.018	0.000	-0.0001	-0.0000	-0.0001
1	9	714	END	0.	-763.	-2.	63588.	-305.	-16808.	-0.000	-0.020	0.000	-0.0001	-0.0000	-0.0001
1	10		BEG	0.	-763.	-2.	63588.	-305.	-16808.	-0.000	-0.020	0.000	-0.0001	-0.0000	-0.0001
1	10	701	END	0.	-143.	-2.	79244.	-286.	-16808.	-0.000	-0.023	0.000	-0.0000	-0.0000	-0.0001
2	1	701	BEG	0.	-143.	-2.	79244.	-286.	-16808.	-0.000	-0.023	0.000	-0.0000	-0.0000	-0.0001
2	1	10	END	0.	-76.	-2.	79658.	-284.	-16808.	-0.000	-0.023	0.000	-0.0000	-0.0000	-0.0001
2	2		BEG	0.	-76.	-2.	79658.	-284.	-16808.	-0.000	-0.023	0.000	-0.0000	-0.0000	-0.0001

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
2	2		DIS	0.	4839.	0.	0.	0.	-0.	-0.000	-0.005	0.000	0.0002	-0.0000	-0.0001
2	2	555	END	0.	-3001.	-2.	24584.	-101.	54052.	-0.000	-0.005	0.000	0.0002	0.0000	-0.0001
2	3		BEG	0.	-3001.	-2.	24584.	-101.	54052.	-0.000	-0.005	0.000	0.0002	-0.0000	-0.0001
2	3	1555	END	0.	-2887.	-2.	20142.	-116.	72335.	-0.000	-0.006	0.000	0.0002	-0.0000	-0.0001
2	4		BEG	0.	-2887.	-2.	20142.	-116.	72335.	-0.000	-0.006	0.000	0.0002	-0.0000	-0.0001
2	4	12	END	0.	-2544.	-2.	2187.	-161.	120773.	-0.000	-0.010	0.000	0.0002	-0.0000	-0.0000
2	5		BEG	0.	-2544.	-2.	2187.	-161.	120773.	-0.000	-0.010	0.000	0.0002	-0.0000	-0.0000
2	5	13	END	0.	-1211.	-2.	2187.	8.	-18604.	-0.000	-0.013	0.000	0.0002	-0.0000	0.0000
2	6		BEG	0.	-1211.	-2.	2187.	8.	-18604.	-0.000	-0.013	0.000	0.0002	-0.0000	0.0000
2	6		DIS	0.	-2500.	0.	0.	0.	0.	-0.000	-0.015	0.000	0.0002	-0.0000	0.0000
2	6	14	END	0.	1881.	-2.	2186.	84.	-48854.	-0.000	-0.015	0.000	0.0002	-0.0000	0.0000
2	7		BEG	0.	1881.	-2.	2186.	84.	-48854.	-0.000	-0.015	0.000	0.0002	-0.0000	0.0000
2	7	1[illegible]	END	0.	2558.	-2.	-53322.	152.	2214.	-0.000	-0.00[illegible]	-0.000	0.0001	-0.0000	-0.0000
2	8		BEG	0.	2558.	-2.	-53322.	152.	2214.	-0.000	-0.009	-0.000	0.0001	-0.0000	-0.0000
2	8	718	END	0.	2671.	-2.	-69672.	156.	2214.	-0.000	-0.007	-0.000	0.0001	-0.0000	-0.0000
3	1	718	BEG	0.	2671.	-2.	-69672.	156.	2214.	-0.000	-0.007	-0.000	0.0001	-0.0000	-0.0000
3	1		DIS	0.	4910.	0.	0.	0.	0.	-0.000	-0.005	-0.009	0.0001	-0.0000	-0.0000
3	1	556	END	0.	-1991.	-2.	-108105.	164.	2214.	-0.000	-0.005	-0.000	0.0001	-0.0000	-0.0000
3	2		BEG	0.	-1991.	-2.	-108105.	164.	2214.	-0.000	-0.005	-0.000	0.0001	-0.0000	-0.0000
3	2	17	END	0.	816.	-2.	-16185.	250.	2215.	-0.000	-0.000	0.000	0.0000	-0.0000	-0.0000
3	3		BEG	0.	816.	-2.	-16185.	250.	2215.	-0.000	-0.000	0.000	0.0000	-0.0000	-0.0000
3	3	996	END	0.	1081.	-2.	-30177.	258.	2215.	-0.000	0.000	0.000	0.0000	0.0000	0.0000

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

NETWORK POINT REACTIONS AND DEFLECTIONS

NET PT	SEQ	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	0	-0.	-104.	2.	-9007.	353.	245.	0.000	0.000	0.000	0.0000	0.0000	0.0000
2	701	-0.	0.	-0.	0.	-0.	0.	-0.000	-0.023	0.000	-0.0000	-0.0000	-0.0001
3	718	0.	0.	0.	0.	0.	0.	-0.000	-0.007	-0.000	0.0001	-0.0000	-0.0000
4	996	0.	1081.	-2.	-30177.	258.	2215.	-0.000	0.000	0.000	0.0000	0.0000	0.0000

BP-103-2 (*[illegible]*)

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2 JL 9-3-71

USAS B31.7 STRESS SUMMARY

• NOTE •
NEGATIVE STRESS INDICATES ALLOWABLE
STRESS HAS BEEN EXCEEDED

PRIMARY STRESS INTENSITY RANGE
EQ. (9) ≤ 1.5 Sm
≤ 29,370 psi

SEC	MEM	SEQ	POS	TYPE	EQ.	PRESSURE	MOMENT	THERMAL DIS.	WALL GRAD	COMBINED		PRIMARY STRESS INTENSITY RANGE
1	1	0	BEG	RU	9	5219.4	62.3			5281.8 +	2479.4	
		1	END	RU	9	5219.4	26.9			5246.4 +	611.4	
1	2	1	BEG	EL	9	10438.9	79.1			10518.0 +	1793.5	12,712 *
		2	END	EL	9	10438.9	159.5			10598.4 +	788.7	11,387
1	3	2	BEG	RU	9	5219.4	54.3			5273.8 +	268.9	
		3	END	RU	9	5219.4	89.7			5309.1 +	96.3	
1	4	3	BEG	EL	9	10438.9	263.1			10702.0 +	282.5	10,985
		4	END	EL	9	10438.9	556.8			10995.7 +	961.2	11,957
1	5	4	BEG	CR	9	5219.4	189.8			5409.3 +	327.7	
		5	END	CR	9	5219.4	284.3			5503.8 +	403.6	
1	6	5	BEG	EL	9	10438.9	373.6			10812.5 +	530.4	11,343
		6	END	EL	9	10438.9	641.0			11079.9 +	624.6	11,7[illegible]
1	7	6	BEG	CR	9	5219.4	487.9			5707.3 +	475.3	
		554	END	CR	9	5219.4	547.1			5766.5 +	472.7	
1	8	554	BEG	CR	9	5219.4	547.1			5766.5 +	472.7	
		8	END	RU	9	5219.4	389.9			5609.4 +	200.6	
1	9	8	BEG	RU	9	5219.4	389.9			5609.4 +	200.6	
		714	END	CR	9	5219.4	455.0			5674.5 +	213.1	
	10	714	BEG	CR	9	5219.4	455.0			5674.5 +	213.1	
		701	END	CR	9	5219.4	560.4			5779.9 +	504.1	
2	1	701	BEG	CR	9	5219.4	560.4			5779.9 +	504.1	
		10	END	CR	9	5219.4	563.2			5782.7 +	457.0	
2	2	10	BEG	EL	9	10438.9	740.1			11179.0 +	600.4	11,779
		555	END	EL	9	10438.9	539.8			10978.7 +	186.0	11,165
2	3	555	BEG	CR	9	5219.4	410.8			5630.2 +	141.5	
		***	END	CR	9	5219.4	519.5			5738.9 +	147.2	
2	4	***	BEG	EL	9	10438.9	682.6			11121.5 +	193.5	11,315
		12	END	EL	9	10438.9	1098.0			11537.0 +	240.8	11,578

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2	5	12	BEG	RU	9	5219.4	835.7	6055.1 +	259.4	
		13	END	RU	9	5219.4	129.6	5349.0 +	122.8	
2	6	13	BEG	RU	9	1466.6	54.9	1521.6 +	52.1	
		14	END	RU	9	1466.6	143.5	1610.1 +	[illegible]	
2	7	14	BEG	EL	9	10438.9	992.4	11431.3 +	327.9	11.759
		15	END	EL	9	10438.9	1083.0	11521.9 +	747.4	12.269
2	8	15	BEG	CR	9	5219.4	369.2	5588.6 +	254.8	
		718	END	CR	9	5219.4	482.2	5701.7 +	472.8	
3	1	718	BEG	CR	9	5219.4	482.2	5701.7 +	472.8	
		556	END	CR	9	5219.4	748.1	5967.5 +	325.9	
3	2	556	BEG	CR	9	5219.4	748.1	5967.5 +	325.9	
		17	END	RU	9	5219.4	113.0	5332.4 +	158.8	
3	3	17	BEG	RU	9	5219.4	113.0	5332.4 +	158.8	
		996	END	CR	9	5219.4	209.3	5428.8 +	275.9	

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

NOTE	0	0	0.0	0.0	0.0	0.0	0.0	0.0
BP DWG. 103-2 (IC-67)								
DEADWEIGHT	0	0	0.0	-1.0000	0.0	0.0	0.0	0.0
EXTERNAL	0	0	0.0	0.0	0.0	0.0	0.0	0.0
B31	7	0	0.0	0.0	0.0	0.0	0.0	0.0
ANCHOR	0	0	2.594 0.0	0.0	-9.672 0.0	0.0	0.0	0.0
RE	0	0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
JU	0	701	3.8020	-1.9530	-25.8540	0.0	0.0	0.0
JU	0	718	-13.2860	-2.0020	-35.2290	0.0	0.0	0.0
AN	0	996	-13.2860	-1.9880	-50.6340	0.0	0.0	0.0
RE	0	996	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SE	1	0	0.0	0.0	0.0	0.0	0.0	0.0
PI	0	701	16.0000	0.8430	26.7700	0.0	0.0	17.9600
RU	0	1	2.5940	0.0	-9.6720	0.0	0.0	0.0
FORCE	0	1	49875.0000	60599.0000	229478.0000	0.0	0.0	0.0
EL	1	2	0.0	0.0	0.0	24.0000	0.0	0.0
MA	1	2	19580.0000	0.0	0.0	0.0	0.0	0.0
RU	2	3	0.5050	-1.9490	-1.8850	0.0	0.0	0.0
EL	3	4	0.0	0.0	0.0	24.0000	0.0	0.0
CR	4	5	0.7030	0.0	-2.6250	0.0	0.0	0.0
EL	5	6	0.0	0.0	0.0	80.0000	0.0	0.0
CR	6	554	0.0	0.0	-1.3180	0.0	0.0	0.0
RU	554	8	0.0	0.0	-6.5360	0.0	0.0	0.0
CR	8	714	0.0	0.0	-0.9430	0.0	0.0	0.0
FORCE	8	714	0.0	91399.0000	0.0	0.0	0.0	0.0
CR	714	701	0.0	0.0	-2.8750	0.0	0.0	0.0
FORCE	714	701	72707.0000	0.0	0.0	0.0	0.0	0.0
SE	2	0	0.0	0.0	0.0	0.0	0.0	0.0

650 059

GIBBS AND HILL   PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

PI	701	718	16.0000	0.8430	26.7700	0.0	0.0	17.9600
CR	701	10	0.0	0.0	-4.6560	0.0	0.0	0.0
EL	10	555	0.0	0.0	0.0	80.0000	0.0	0.0
CR	555	1555	-5.3510	-0.0130	-2.1980	0.0	0.0	0.0
EL	1555	12	0.0	0.0	0.0	80.0000	0.0	0.0
RU	12	13	-6.9820	-0.0170	0.0	0.0	0.0	0.0
VA	13	14	-4.7550	-0.0120	0.0	16.0000	3.0000	2500.0000
EL	14	15	0.0	0.0	0.0	24.0000	0.0	0.0
RU	15	718	0.0	0.0070	-2.5210	0.0	0.0	0.0
FORCE	15	718	91209.0000	68011.0000	0.0	0.0	0.0	0.0
SE	3	0	0.0	0.0	0.0	0.0	0.0	0.0
PI	718	996	16.0000	0.8430	26.7700	0.0	0.0	17.9600
CR	718	556	0.0	0.0020	-1.1460	0.0	0.0	0.0
RU	556	17	0.0	0.0370	-13.0300	0.0	0.0	0.0
CR	17	996	0.0	0.0	-1.2290	0.0	0.0	0.0
END	0	0	0.0	0.0	0.0	0.0	0.0	0.0

650 060

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

PIPE SYSTEM GEOMETRY

NUMBER OF NETWORK POINTS = 4
NUMBER OF SECTIONS = 3
NUMBER OF MEMBERS = 21
ORDER OF STIFFNESS MATRIX = 12

NETWORK POINT RESTRAINTS

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
1	0	RST	RST	RST	RST	RST	RST
2	701	FREE	FREE	FREE	FREE	FREE	FREE
3	718	FREE	FREE	FREE	FREE	FREE	FREE
4	996	RST	RST	RST	RST	RST	RST

NETWORK POINT MOVEMENTS (INCHES)

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z

NO MOVEMENTS

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

* NOTE *

FOR CURVED MEMBERS,QUANTITIES LISTED UNDER INITIAL CO-ORDS ARE CO-ORDS OF ARC CENTER THE BRACKETED NUMBERS WHICH FOLLOW ARE THE ARC RADIUS (IN), INCLUDED ANGLE (DEG).

* NOTE *

FOR THIS VERSION, CO-ORD DIMENSIONS IN FEET ALL OTHER QUATITIES, RADIUS, THICKNESS, STRESS MOMENTS, ETC. ARE DIMENSIONED IN INCHES.

PIPE SYSTEM GEOMETRY

SECTION 1 CONNECTS SEQUENCE POINTS 0 AND 701 AND HAS 10 MEMBERS.

MEM	TYPE	FROM	TO	OUTER RAD. IN	WALL THK. IN	INITIAL CO-ORDS X (FEET)	Y (FEET)	Z (FEET)	FINAL CO-ORDS X (FEET)	Y (FEET)	Z (FEET)	MODULUS LB/SQ IN	CHANGE DEG F	EXPAN. IN/IN	WEIGHT LB/IN
1	RU/RU	0	1	8.00	0.843	0.0	0.0	0.0	2.38	0.0	-8.87	0.27E 08	0.0	0.0	17.96
	FORCE/MOMENT					0.50E 05	0.61E 05	0.23E 06	0.0	0.0	0.0				
2	EL/EL	1	2	8.00	0.843	2.38	-2.00	-8.87	(24.000 44.964)			0.27E 08	0.0	0.0	17.96
3	RU/RU	2	3	8.00	0.843	2.75	-0.58	-10.24	2.95	-1.36	-10.99	0.27E 08	0.0	0.0	17.96
4	EL/EL	3	4	8.00	0.843	3.31	0.05	-12.36	(24.000 44.964)			0.27E 08	0.0	0.0	17.96
5	RU/CR	4	5	8.00	0.843	3.31	-1.95	-12.36	3.58	-1.95	-13.33	0.27E 08	0.0	0.0	17.96
6	EL/EL	5	6	8.00	0.843	-2.86	-1.95	-15.06	(80.000 14.992)			0.27E 08	0.0	0.0	17.96
7	RU/CR	6	554	8.00	0.843	3.80	-1.95	-15.06	3.80	-1.95	-15.50	0.27E 08	0.0	0.0	17.96
8	CR/RU	554	8	8.00	0.843	3.80	-1.95	-15.50	3.80	-1.95	-22.04	0.27E 08	0.0	0.0	17.96
9	RU/CR	8	714	8.00	0.843	3.80	-1.95	-22.04	3.80	-1.95	-22.98	0.27E 08	0.0	0.0	17.96
	FORCE/MOMENT					0.0	0.91E 05	0.0	0.0	0.0	0.0				
10	CR/CR	714	701	8.00	0.843	3.80	-1.95	-22.98	3.80	-1.95	-25.85	0.27E 08	0.0	0.0	17.96
	FORCE/MOMENT					0.73E 05	0.0	0.0	0.0	0.0	0.0				

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

SECTION 2 CONNECTS SEQUENCE POINTS 701 AND 718 AND HAS 8 MEMBERS.

MEM	TYPE	FROM	TO	OUTER RAD. IN	WALL THK. IN	INITIAL CO-ORDS X (FEET)	INITIAL CO-ORDS Y (FEET)	INITIAL CO-ORDS Z (FEET)	FINAL CO-ORDS X (FEET)	FINAL CO-ORDS Y (FEET)	FINAL CO-ORDS Z (FEET)	MODULUS LB/SQ IN	CHANGE DEG F	EXPAN. IN/IN	WEIGHT LB/IN
1	CR/CR	701	10	8.00	0.843	3.80	-1.95	-25.85	3.80	-1.95	-26.04	0.27E 08	0.0	0.0	17.96
2	EL/EL	10	555	8.00	0.843	-2.86	-1.97	-26.04	(80.000	67.669)		0.27E 08	0.0	0.0	17.96
3	RU/CR	555	1555	8.00	0.843	-0.33	-1.96	-32.21	-0.33	-1.96	-32.21	0.27E 08	0.0	0.0	17.96
4	EL/EL	1555	12	8.00	0.843	-2.86	-1.97	-26.04	(80.000	22.332)		0.27E 08	0.0	0.0	17.96
5	RU/RU	12	13	8.00	0.843	-2.86	-1.97	-32.71	-8.53	-1.98	-32.71	0.27E 08	0.0	0.0	17.96
6	RU/RU	13	14	8.00	3.000	-8.53	-1.98	-32.71	-11.29	-1.99	-32.71	0.27E 08	0.0	0.0	17.96
	WEIGHT					0.25E 04									
7	EL/EL	14	15	8.00	0.843	-11.29	-1.98	-34.71	(24.000	90.000)		0.27E 08	0.0	0.0	17.96
8	RU/RU	15	718	8.00	0.843	-13.29	-1.99	-34.71	-13.29	-1.99	-35.23	0.27E 08	0.0	0.0	17.96
	FORCE/MOMENT					0.91E 05	0.68E 05	0.0	0.0	0.0	0.0				

SECTION 3 CONNECTS SEQUENCE POINTS 718 AND 996 AND HAS 3 MEMBERS.

MEM	TYPE	FROM	TO	OUTER RAD. IN	WALL THK. IN	INITIAL CO-ORDS X (FEET)	INITIAL CO-ORDS Y (FEET)	INITIAL CO-ORDS Z (FEET)	FINAL CO-ORDS X (FEET)	FINAL CO-ORDS Y (FEET)	FINAL CO-ORDS Z (FEET)	MODULUS LB/SQ IN	CHANGE DEG F	EXPAN. IN/IN	WEIGHT LB/IN
1	RU/CR	718	556	8.00	0.843	-13.29	-2.00	-35.23	-13.29	-2.00	-36.37	0.27E 08	0.0	0.0	17.96
2	CR/RU	556	17	8.00	0.843	-13.29	-2.00	-36.37	-13.29	-1.96	-49.40	0.27E 08	0.0	0.0	17.96
3	RU/CR	17	996	8.00	0.843	-13.29	-1.96	-49.40	-13.29	-1.96	-50.63	0.27E 08	0.0	0.0	17.96

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

LOADS
DEADWEIGHT
EXTERNAL

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	1	0	BEG	-71821.	-117903.	-192452.	-16364734.	13284374.	-6386993.	0.0	0.0	0.0	0.0	0.0	0.0
1	1	1	DIS	49875.	60599.	229478.	-1.	0.	-1.	1.745	2.637	0.486	0.0353	-0.0239	0.0187
1	1	1	END	21946.	59284.	-37026.	3706098.	-142001.	2991989.	1.745	2.637	0.486	0.0353	-0.0239	0.0187
1	2	2	END	21946.	59622.	-37026.	2472453.	54914.	2576910.	2.300	3.393	0.296	0.0449	-0.0253	0.0236
1	3	3	END	21946.	59860.	-37026.	1585965.	163682.	2226956.	2.755	3.865	-0.070	0.0458	-0.0251	0.0247
1	4	4	END	21946.	60198.	-37026.	342528.	360748.	1809480.	3.358	4.771	-0.292	0.0493	-0.0255	0.0276
1	5	5	END	21946.	60416.	-37026.	-365321.	501955.	1619912.	3.658	5.441	-0.212	0.0492	-0.0254	0.0284
1	6	6	END	21946.	60792.	-37026.	-1619586.	855378.	1455142.	4.179	6.537	-0.144	0.0483	-0.0248	0.0297
1	7	554	END	21946.	60887.	-37026.	-1941377.	971456.	1455142.	4.310	6.793	-0.144	0.0480	-0.0246	0.0301
1	8	9	END	21946.	62296.	-37026.	-6772131.	2692756.	1455142.	6.094	10.227	-0.147	0.0370	-0.0230	0.0349
1	9	714	DIS	-0.	91399.	0.	0.	-0.	-1.	6.315	10.634	-0.148	0.0344	-0.0189	0.0356
1	9	714	END	21946.	-28900.	-37026.	-7478217.	2941100.	1455142.	6.315	10.634	-0.148	0.0344	-0.0189	0.0356
1	10	701	DIS	72707.	0.	0.	0.	-1.	-1.	6.910	11.677	-0.149	0.0266	-0.0152	0.0377
1	10	701	END	-50761.	-28280.	-37026.	-6491863.	3698252.	1455142.	6.910	11.677	-0.149	0.0266	-0.0152	0.0377
2	1	701	BEG	50761.	28280.	37026.	6491864.	-3698250.	-1455141.	6.910	11.677	-0.149	0.0266	-0.0152	0.0377
2	1	10	END	-50761.	-28240.	-37026.	-6428376.	3584213.	1455142.	6.943	11.736	-0.149	0.0261	-0.0150	0.0378
2	2	555	END	-50761.	-26543.	-37026.	-4397400.	1664569.	115196.	7.700	10.837	-0.571	0.0040	-0.0060	0.0424
2	3	1555	END	-50761.	-26543.	-37026.	-4397380.	1664614.	115137.	7.700	10.837	-0.571	0.0040	-0.0060	0.0424
2	4	12	END	-50761.	-25983.	-37026.	-4239398.	2485580.	-682902.	7.730	9.559	-0.716	-0.0017	-0.0031	0.0420
2	5	13	END	-50761.	-24762.	-37026.	-4245530.	5003088.	-2399638.	7.734	6.786	-0.691	-0.0138	0.0051	0.0386
2	6	14	DIS	0.	-2500.	0.	1.	-0.	1.	7.737	5.527	-0.483	-0.0163	0.0076	0.0374
2	6	14	END	-50761.	-21660.	-37026.	-4248618.	6227160.	-3234208.	7.737	5.527	-0.483	-0.0163	0.0076	0.0374
2	7	15	END	-50761.	-20991.	-37026.	-3738703.	5897519.	-3718642.	6.990	4.223	0.018	-0.0262	0.0439	0.0301
2	8	718	DIS	91209.	68011.	0.	1.	-1.	0.	6.710	4.056	0.017	-0.0270	0.0450	0.0291

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
2	8	718	END	-141970.	-88890.	-37026.	-3607178.	5580168.	-3719524.	6.710	4.056	0.017	-0.0270	0.0450	0.0291
3	1	718	BEG	141970.	88890.	37026.	3607174.	-5580165.	3719523.	6.710	4.056	0.017	-0.0270	0.0450	0.0291
3	1	556	END	-141970.	-88643.	-37026.	-2385580.	3627807.	-3722931.	6.066	3.669	0.016	-0.0283	0.0471	0.0270
3	2	17	END	-141970.	-85834.	-37026.	11271451.	*********	-3785965.	0.080	0.049	0.001	-0.0057	0.0093	0.0023
3	3	996	END	-141970.	-85569.	-37026.	12535364.	*********	-3785965.	0.000	-0.000	-0.000	-0.0000	-0.0000	-0.0000

660 065

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

NETWORK POINT REACTIONS AND DEFLECTIONS

NET PT	SEJ	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	0	-71821.	-117903.	-192452.	-16364734.	13284374.	-6386994.	0.0	0.0	0.0	0.0	0.0	0.0
2	701	-0.	-0.	0.	1.	1.	-0.	6.910	11.677	-0.149	0.0266	-0.0152	0.0377
3	718	-0.	-0.	0.	-3.	2.	-1.	6.710	4.056	0.017	-0.0270	0.0450	0.0291
4	996	-141970.	-85569.	-37026.	12535364.	*********	-3785965.	0.000	-0.000	-0.000	-0.0000	-0.0000	-0.0000

990 059

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

USAS B31.7 STRESS SUMMARY

* NOTE *
NEGATIVE STRESS INDICATES ALLOWABLE
HAS BEEN EXCEEDED

SEC	MEM	SEQ	POS	TYPE	EQ.	PRESSURE	MOMENT	THERMAL DIS.	WALL GRAD	COMBINED
1	1	0	BEG	RU	9	0.0	152380.1			152380.1
		1	END	RU	9	0.0	32969.1			32969.1
1	2	1	BEG	EL	9	0.0	96702.8			-96702.8
		2	END	EL	9	0.0	72480.6			-72480.6
1	3	2	BEG	RU	9	0.0	24711.0			24711.0
		3	END	RU	9	0.0	18949.4			18949.4
1	4	3	BEG	EL	9	0.0	55581.2			-55581.2
		4	END	EL	9	0.0	38083.0			-38083.0
1	5	4	BEG	RU	9	0.0	12983.7			12983.7
		5	END	CR	9	0.0	12002.6			12002.6
1	6	5	BEG	EL	9	0.0	15770.5			15770.5
		6	END	EL	9	0.0	21265.5			21265.5
1	7	6	BEG	RU	9	0.0	16184.7			16184.7
		554	END	CR	9	0.0	18081.7			18081.7
1	8	554	BEG	CR	9	0.0	18081.7			18081.7
		8	END	RU	9	0.0	51417.7			-51417.7
1	9	8	BEG	RU	9	0.0	51417.7			-51417.7
		714	END	CR	9	0.0	56501.4			-56501.4
1	10	714	BEG	CR	9	0.0	56501.4			-56501.4
		701	END	CR	9	0.0	52663.5			-52663.5
2	1	701	BEG	CR	9	0.0	52663.5			-52663.5
		10	END	CR	9	0.0	51907.8			-51907.8
2	2	10	BEG	EL	9	0.0	68203.1			-68203.1
		555	END	EL	9	0.0	42756.4			-42756.4
2	3	555	BEG	RU	9	0.0	32540.9			-32540.9
		1555	END	CR	9	0.0	32540.8			-32540.8

650 067

GIBBS AND HILL PIPE STRESS ANALYSIS
549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 2

USAS B31.7 STRESS SUMMARY

* NOTE *
NEGATIVE STRESS INDICATES ALLOWABLE
HAS BEEN EXCEEDED

SEC	MEM	SEQ	POS	TYPE	EQ.	PRESSURE	MOMENT	THERMAL DIS.	WALL GRAD	COMBINED
2	4	1555	BEG	EL	9	0.0	42756.3			-42756.3
		12	END	EL	9	0.0	45103.9			-45103.9
2	5	12	BEG	RU	9	0.0	34327.5			-34327.5
		13	END	RU	9	0.0	48338.8			-48338.8
2	6	13	BEG	RU	9	0.0	20503.1			20503.1
		14	END	RU	9	0.0	24037.8			24037.8
2	7	14	BEG	EL	9	0.0	166227.1			-166227.1
		15	END	EL	9	0.0	160545.5			-160545.5
2	8	15	BEG	RU	9	0.0	54735.2			-54735.2
		718	END	RU	9	0.0	52684.4			-52684.4
3	1	718	BEG	RU	9	0.0	52684.4			-52684.4
		556	END	CR	9	0.0	39571.2			-39571.2
3	2	556	BEG	CR	9	0.0	39571.2			-39571.2
		17	END	RU	9	0.0	152563.9			-152563.9
3	3	17	BEG	RU	9	0.0	152563.9			-152563.9
		996	END	CR	9	0.0	169258.2			-169258.2

DELIMETER ENCOUNTERED. *** PROCESSING TERMINATED.

END OF RUN.

650 070

GIBBS & HILL, INC.
PIPE STRESS ANALYSIS

OMAHA 549S FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
	SYSTEM	1-25	DECK-1	BP-285				
B31	1	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
THERMAL	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	1	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	1	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
JUNCTION	0	19	0.1428E 02	0.1668E 02	0.3259E 01	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	19	0.0000E 00	0.1000E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	25	0.2241E 02	0.1668E 02	0.6030E 01	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	25	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
DISPLACE	0	25	0.0000E 00	0.0000E 00	-0.2630E 00	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	1	18	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	1	19	0.3500E 01	0.3000E 00	0.2570E 02	0.7230E-01	0.5300E 03	0.0000E 00
RUN	1	2	0.2440E 00	0.0000E 00	0.5000E-01	0.0000E 00	0.0000E 00	0.0000E 00
REDUCER	2	3	0.2850E 00	0.0000E 00	0.6000E-01	0.2375E 01	0.2180E 00	0.0000E 00
RUN	3	4	0.4470E 00	0.0000E 00	0.1000E 00	0.0000E 00	0.0000E 00	0.0000E 00
VALVE	4	5	0.8130E 00	0.0000E 00	0.1800E 00	0.2375E 01	0.8000E 00	0.0000E 00
RUN	5	6	0.6500E 00	0.0000E 00	0.1400E 00	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	6	7	0.0000E 00	0.0000E 00	0.0000E 00	0.4500E 01	0.0000E 00	0.0000E 00
CHANGE	6	19	0.3500E 01	0.3000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	7	8	0.0000E 00	0.6453E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	8	9	0.0000E 00	0.0000E 00	0.0000E 00	0.4500E 01	0.0000E 00	0.0000E 00
RUN	9	10	0.0000E 00	0.0000E 00	0.2729E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	10	11	0.0000E 00	0.0000E 00	0.0000E 00	0.4500E 01	0.0000E 00	0.0000E 00
RUN	11	12	0.1416E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	12	13	0.3708E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	13	14	0.0000E 00	0.0000E 00	0.0000E 00	0.1500E 02	0.0000E 00	0.0000E 00
RUN	14	15	0.4354E 01	0.1166E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00

OMAHA 5495 FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

ELBOW	15	16	0.0000E 00	0.0000E 00	0.0000E 00	0.4500E 01	0.0000E 00	0.0000E 00
RUN	16	17	0.0000E 00	0.9067E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	17	18	0.0000E 00	0.0000E 00	0.0000E 00	0.4500E 01	0.0000E 00	0.0000E 00
RUN	18	19	0.2369E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	2	6	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	19	25	0.3500E 01	0.3000E 00	0.2570E 02	0.7230E 01	0.5300E 03	0.0000E 00
RUN	19	20	0.7465E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	20	21	0.6660E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	21	22	0.0000E 00	0.0000E 00	0.0000E 00	0.4500E 01	0.0000E 00	0.0000E 00
RUN	22	23	0.0000E 00	0.0000E 00	0.1979E 01	0.0000E 00	0.0000E 00	0.0000E 00
REDUCER	23	24	0.0000E 00	0.0000E 00	0.2920E 00	0.2375E 01	0.2180E 00	0.0000E 00
RUN	24	25	0.0000E 00	0.0000E 00	0.5000E 00	0.0000E 00	0.0000E 00	0.0000E 00
END JOB	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00

650 072

OMAHA 5495 FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

PIPE SYSTEM GEOMETRY

NUMBER OF NETWORK POINTS = 3 NUMBER OF MEMBERS = 24
NUMBER OF SECTIONS = 2 ORDER OF STIFFNESS MATRIX = 5

NETWORK POINT RESTRAINTS

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
1	1	REST	REST	REST	REST	REST	REST
2	19	FREE	REST	FREE	FREE	FREE	FREE
3	25	REST	REST	REST	REST	REST	REST

NETWORK POINT MOVEMENTS (INCHES)

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
3	25	0.000	0.000	-0.263	0.000	0.000	0.000

660 073

OMAHA 549S FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

• NOTE •

FOR CURVED MEMBERS, QUANTITIES LISTED UNDER INITIAL CO-ORDS ARE CO-ORDS OF ARC CENTER THE BRACKETED NUMBERS WHICH FOLLOW ARE THE ARC RADIUS (IN), INCLUDED ANGLE (DEG).

• NOTE •

FOR GIBBS AND HILL, CO-ORD DIMENSIONS IN FEET ALL OTHER QUANTITIES, RADIUS, THICKNESS, STRESS, MOMENTS, ETC. ARE DIMENSIONED IN INCHES.

PIPE SYSTEM GEOMETRY

SECTION 1 CONNECTS SEQUENCE POINTS 1 AND 19 AND HAS 18 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	RU	1.75	0.300	0.00	0.00	0.00	0.24	0.00	0.05	0.257E 08	530.	0.723E-05	0.00
2	RE	1.18	0.218	0.24	0.00	0.05	0.52	0.00	0.11	0.257E 08	530.	0.723E-05	0.00
3	RU	1.18	0.218	0.52	0.00	0.11	0.97	0.00	0.21	0.257E 08	530.	0.723E-05	0.00
4	RU	1.18	0.800	0.97	0.00	0.21	1.78	0.00	0.39	0.257E 08	530.	0.723E-05	0.00
5	RU	1.18	0.218	1.78	0.00	0.39	2.07	0.00	0.45	0.257E 08	530.	0.723E-05	0.00
6	EL	1.75	0.300	2.07	0.37	0.45	(	4.500	90.000)	0.257E 08	530.	0.723E-05	0.00
7	RU	1.75	0.300	2.43	0.37	0.53	2.43	6.07	0.53	0.257E 08	530.	0.723E-05	0.00
8	EL	1.75	0.300	2.43	6.07	0.90	(	4.500	90.000)	0.257E 08	530.	0.723E-05	0.00
9	RU	1.75	0.300	2.43	6.45	0.90	2.43	6.45	2.88	0.257E 08	530.	0.723E-05	0.00
10	EL	1.75	0.300	2.81	6.45	2.88	(	4.500	90.000)	0.257E 08	530.	0.723E-05	0.00
11	RU	1.75	0.300	2.81	6.45	3.25	3.85	6.45	3.25	0.257E 08	530.	0.723E-05	0.00
12	RU	1.75	0.300	3.85	6.45	3.25	7.39	6.45	3.25	0.257E 08	530.	0.723E-05	0.00
13	EL	1.75	0.300	7.39	7.70	3.25	(	15.000	14.992)	0.257E 08	530.	0.723E-05	0.00
14	RU	1.75	0.300	7.72	6.49	3.25	11.63	7.54	3.25	0.257E 08	530.	0.723E-05	0.00
15	EL	1.75	0.300	11.54	7.90	3.25	(	4.500	75.007)	0.257E 08	530.	0.723E-05	0.00
16	RU	1.75	0.300	11.91	7.90	3.25	11.91	16.31	3.25	0.257E 08	530.	0.723E-05	0.00
17	EL	1.75	0.300	12.29	16.31	3.25	(	4.500	90.000)	0.257E 08	530.	0.723E-05	0.00

18	RU	1.75	0.300	12.29	16.68	3.25	14.28	16.68	3.25	0.257E 08	530.	0.723E-05	0.00

SECTION 2 CONNECTS SEQUENCE POINTS 19 AND 25 AND HAS 6 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	RU	1.75	0.300	14.28	16.68	3.25	21.75	16.68	3.25	0.257E 08	530.	0.723E-05	0.00
2	RU	1.75	0.300	21.75	16.68	3.25	22.04	16.68	3.25	0.257E 08	530.	0.723E-05	0.00
3	EL	1.75	0.300	22.04	16.68	3.63	(	4.500	90.000)	0.257E 08	530.	0.723E-05	0.00
4	RU	1.75	0.300	22.41	16.68	3.63	22.41	16.68	5.23	0.257E 08	530.	0.723E-05	0.00
5	RE	1.18	0.218	22.41	16.68	5.23	22.41	16.68	5.53	0.257E 08	530.	0.723E-05	0.00
6	RU	1.18	0.218	22.41	16.68	5.53	22.41	16.68	6.03	0.257E 08	530.	0.723E-05	0.00

660 075

B. P. 350. 785

OMAHA 549S FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

LOADS
THERMAL

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	1	1	BEG	-280.	-313.	-55.	2847.	-2184.	-936.	0.000	0.000	0.000	0.0000	0.0000	0.0000
1	1	2	END	-280.	-313.	-55.	2659.	-2178.	-17.	0.011	-0.000	0.002	0.0001	-0.0000	-0.0000
1	2		BEG	-280.	-313.	-55.	2659.	-2178.	-17.	0.011	-0.000	0.002	0.0001	-0.0000	-0.0000
1	2	3	END	-280.	-313.	-55.	2433.	-2166.	1055.	0.024	-0.000	0.005	0.0006	-0.0004	0.0000
1	3		BEG	-280.	-313.	-55.	2433.	-2166.	1055.	0.024	-0.000	0.005	0.0006	-0.0004	0.0000
1	3	4	END	-280.	-313.	-55.	2056.	-2127.	2738.	0.043	-0.000	0.014	0.0013	-0.0009	0.0006
1	4		BEG	-280.	-313.	-55.	2056.	-2127.	2738.	0.043	-0.000	0.014	0.0013	-0.0009	0.0006
1	4	5	END	-280.	-313.	-55.	1378.	-2062.	5800.	0.078	0.006	0.034	0.0019	-0.0014	0.0017
1	5		BEG	-280.	-313.	-55.	1378.	-2062.	5800.	0.078	0.006	0.034	0.0019	-0.0014	0.0017
1	5	6	END	-280.	-313.	-55.	1148.	-2045.	6867.	0.090	0.012	0.042	0.0023	-0.0017	0.0027
1	6		BEG	-280.	-313.	-55.	1148.	-2045.	6867.	0.090	0.012	0.042	0.0023	-0.0017	0.0027
1	6	7	END	-280.	-313.	-55.	1101.	-2023.	6984.	0.088	0.042	0.065	0.0024	-0.0022	0.0043
1	7		BEG	-280.	-313.	-55.	1101.	-2023.	6984.	0.088	0.042	0.065	0.0024	-0.0022	0.0043
1	7	8	END	-280.	-313.	-55.	4899.	-2023.	-12232.	-0.222	0.304	0.288	0.0045	-0.0040	0.0025
1	8		BEG	-280.	-313.	-55.	4899.	-2023.	-12232.	-0.222	0.304	0.288	0.0045	-0.0040	0.0025
1	8	9	END	-280.	-313.	-55.	3737.	-759.	-13496.	-0.247	0.297	0.327	0.0055	-0.0036	0.0005
1	9		BEG	-280.	-313.	-55.	3737.	-759.	-13496.	-0.247	0.297	0.327	0.0055	-0.0036	0.0005
1	9	10	END	-280.	-313.	-55.	-3715.	5909.	-13496.	-0.331	0.163	0.418	0.0055	-0.0030	-0.0035
1	10		BEG	-280.	-313.	-55.	-3715.	5909.	-13496.	-0.331	0.163	0.418	0.0055	-0.0030	-0.0035
1	10	11	END	-280.	-313.	-55.	-5128.	6922.	-12084.	-0.325	0.117	0.445	0.0053	-0.0016	-0.0054
1	11		BEG	-280.	-313.	-55.	-5128.	6922.	-12084.	-0.325	0.117	0.445	0.0053	-0.0016	-0.0054
1	11	12	END	-280.	-313.	-55.	-5128.	6229.	-8163.	-0.278	0.041	0.460	0.0045	-0.0007	-0.0066
1	12		BEG	-280.	-313.	-55.	-5128.	6229.	-8163.	-0.278	0.041	0.460	0.0045	-0.0007	-0.0066
1	12	13	END	-280.	-313.	-55.	-5128.	3869.	5181.	-0.115	-0.276	0.445	0.0016	0.0013	-0.0073

B.P. 285

OMAHA 5495 FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	13		BEG	-280.	-313.	-55.	-5128.	3869.	5181.	-0.115	-0.276	0.445	0.0016	0.0013	-0.0073
1	13	14	END	-280.	-313.	-55.	-5099.	3654.	6255.	-0.096	-0.302	0.440	0.0014	0.0014	-0.0070
1	14		BEG	-280.	-313.	-55.	-5099.	3654.	6255.	-0.096	-0.302	0.440	0.0014	0.0014	-0.0070
1	14	15	END	-280.	-313.	-55.	-4401.	1045.	17472.	0.141	-0.473	0.341	-0.0014	0.0024	-0.0013
1	15		BEG	-280.	-313.	-55.	-4401.	1045.	17472.	0.141	-0.473	0.341	-0.0014	0.0024	-0.0013
1	15	16	END	-280.	-313.	-55.	-4159.	860.	17298.	0.151	-0.456	0.325	-0.0020	0.0027	0.0019
1	16		BEG	-280.	-313.	-55.	-4159.	860.	17298.	0.151	-0.456	0.325	-0.0020	0.0027	0.0019
1	16	17	END	-280.	-313.	-55.	1437.	860.	-11021.	-0.445	-0.070	-0.001	-0.0034	0.0038	0.0051
1	17		BEG	-280.	-313.	-55.	1437.	860.	-11021.	-0.445	-0.070	-0.001	-0.0034	0.0038	0.0051
1	17	18	END	-280.	-313.	-55.	1687.	610.	-10872.	-0.446	-0.037	-0.034	-0.0032	0.0039	0.0026
1	18		BEG	-280.	-313.	-55.	1687.	610.	-10872.	-0.446	-0.037	-0.034	-0.0032	0.0039	0.0026
1	18	19	END	-280.	-313.	-55.	1687.	-717.	-3363.	-0.355	-0.000	-0.128	-0.0027	0.0039	0.0009
2	1	19	BEG	-280.	-40.	-55.	1687.	-717.	-3363.	-0.355	0.000	-0.128	-0.0027	0.0039	0.0009
2	1	20	END	-280.	-40.	-55.	1687.	-5689.	255.	-0.012	-0.005	-0.385	-0.0007	0.0010	-0.0004
2	2		BEG	-280.	-40.	-55.	1687.	-5689.	255.	-0.012	-0.005	-0.385	-0.0007	0.0010	-0.0004
2	2	21	END	-280.	-40.	-55.	1687.	-5883.	396.	0.001	-0.007	-0.388	-0.0006	0.0008	-0.0004
2	3		BEG	-280.	-40.	-55.	1687.	-5883.	396.	0.001	-0.007	-0.388	-0.0006	0.0008	-0.0004
2	3	22	END	-280.	-40.	-55.	1505.	-4869.	578.	0.018	-0.007	-0.373	-0.0004	-0.0003	-0.0004
2	4		BEG	-280.	-40.	-55.	1505.	-4869.	578.	0.018	-0.007	-0.373	-0.0004	-0.0003	-0.0004
2	4	23	END	-280.	-40.	-55.	728.	535.	578.	0.005	-0.000	-0.299	-0.0002	-0.0007	-0.0003
2	5		BEG	-280.	-40.	-55.	728.	535.	578.	0.005	-0.000	-0.299	-0.0002	-0.0007	-0.0003
2	5	24	END	-280.	-40.	-55.	586.	1519.	578.	0.002	-0.000	-0.285	-0.0001	-0.0006	-0.0002
2	6		BEG	-280.	-40.	-55.	586.	1519.	578.	0.002	-0.000	-0.285	-0.0001	-0.0006	-0.0002
2	6	25	END	-280.	-40.	-55.	344.	3204.	578.	-0.000	-0.000	-0.262	-0.0000	-0.0000	-0.0000

B.P. 285

OMAHA 5495 FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971
NETWORK POINT REACTIONS AND DEFLECTIONS

NET PT	SEQ	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	1	280.	313.	55.	-2847.	2184.	936.	0.000	0.000	0.000	0.0000	0.0000	0.0000
2	19	-0.	-273.	-0.	0.	0.	-0.	-0.355	0.000	-0.128	-0.0027	0.0039	0.0009
3	25	-280.	-40.	-55.	344.	3204.	578.	-0.000	-0.000	-0.262	-0.0000	-0.0000	-0.0000

650 1078

B.P. 285

OMAHA 549S FEEDWATER IN CONTAINMENT RUN BY DZ 10-16-1971

USAS B31.1 STRESS SUMMARY

SEC	MEM	SEQ	POS	TYPE	TORSION	BENDING	COMBINED	PRESSURE
1	1	1	BEG	RU	584.5	1188.2	1666.8	0.0
		2	END	RU	584.5	1010.0	1544.8	0.0
1	2	2	BEG	RU	1779.6	3075.1	4703.7	0.0
		3	END	RE	1777.6	3052.1	4685.6	0.0
1	3	3	BEG	RU	1777.6	3052.1	4685.6	0.0
		4	END	RU	1782.0	4210.4	5516.4	0.0
1	4	4	BEG	RU	1001.6	2366.6	3100.7	0.0
		5	END	RU	999.7	4420.5	4851.7	0.0
1	5	5	BEG	RU	1778.6	7864.4	8631.6	0.0
		6	END	RU	1757.5	9286.6	9929.6	0.0
1	6	6	BEG	EL	577.2	4205.5	4361.1	0.0
		7	END	EL	-454.6	4381.3	4474.6	0.0
1	7	7	BEG	RU	-454.6	3177.5	3305.0	0.0
		8	END	RU	-454.6	5921.6	5991.0	0.0
1	8	8	BEG	EL	-454.6	8164.9	8215.4	0.0
		9	END	EL	-3032.4	2362.9	6509.0	0.0
1	9	9	BEG	RU	-3032.4	1713.7	6302.4	0.0
		10	END	RU	-3032.4	3136.7	6828.0	0.0
1	10	10	BEG	EL	-3032.4	4325.0	7449.1	0.0
		11	END	EL	-1152.1	8629.2	8931.6	0.0
1	11	11	BEG	RU	-1152.1	6258.3	6669.1	0.0
		12	END	RU	-1152.1	4614.6	5158.0	0.0
1	12	12	BEG	RU	-1152.1	4614.6	5158.0	0.0
		13	END	RU	-1152.1	2905.8	3708.6	0.0
1	13	13	BEG	EL	-1152.1	2905.8	3708.6	0.0
		14	END	EL	-894.4	3556.6	3981.1	0.0
1	14	14	BEG	RU	-894.4	3556.6	3981.1	0.0
		15	END	RU	-894.4	7910.7	8110.4	0.0
1	15	15	BEG	EL	-894.4	10907.6	11053.3	0.0
		16	END	EL	193.2	11024.0	11030.7	0.0
1	16	16	BEG	RU	193.2	7995.1	8004.4	0.0
		17	END	RU	193.2	4994.6	5009.5	0.0

690 079

E. P. 285

1	17	17	BEG	EL	193.2	6886.8	68[illegible]7.6	0.0
		18	END	EL	379.1	6747.4	6789.9	0.0
1	18	18	BEG	RU	379.1	4893.6	4952.0	0.0
		19	END	RU	379.1	1545.4	1721.4	0.0
2	1	19	BEG	RU	379.1	1545.4	1721.4	0.0
		20	END	RU	379.1	2559.3	2669.2	0.0
2	2	20	BEG	RU	379.1	2559.3	2669.2	0.0
		21	END	RU	379.1	2649.8	2756.1	0.0
2	3	21	BEG	EL	379.1	3653.7	3731.5	0.0
		22	END	EL	129.8	3158.1	3168.8	0.0
2	4	22	BEG	RU	129.8	2290.4	2305.1	0.0
		23	END	RU	129.8	406.1	482.1	0.0
2	5	23	BEG	RU	395.4	1236.6	1467.9	0.0
		24	END	RE	395.4	2228.5	2364.7	0.0
2	6	24	BEG	RU	395.4	2228.5	2364.7	0.0
		25	END	RU	395.4	4409.4	4479.8	0.0

PIPE ERROR MESSAGE NUMBER 1
AT END OF THIS ROUTINE WILL RETURN FOR NEXT SET OF DATA.

060 030

GIBBS & HILL, INC.
PIPE STRESS ANALYSIS

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
BP DWG 103-2 (IC-67)								
NOTE	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
NORMAL OPERATING CONDITION								
B31	7	10	0.0000E 00	0.9143E 03	0.0000E 00	0.0000E 00	0.1868E 05	0.0000E 00
THERMAL	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	0	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
DISPLACE	0	0	0.2000E 01	0.1313E 01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
JUNCTION	0	701	0.3802E 01	-0.1953E 01	-0.2585E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	701	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
ANCHOR	0	996	-0.1329E 02	-0.1948E 01	-0.5063E 02	0.0000E 00	0.0000E 00	0.0000E 00
RESTRAINT	0	996	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
DISPLACE	0	996	-0.1430E 00	-0.3750E 00	0.4790E 00	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	1	10	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	0	701	0.1600E 02	0.8430E 00	0.9000E 06	0.7048E 01	0.4438E 03	0.0000E 00
RUN	0	1	0.2594E 01	0.0000E 00	-0.9672E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	1	2	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
MATERIAL	1	2	0.1958E 05	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
CHANGE	1	701	0.0000E 00	0.0000E 00	0.2677E 02	0.6896E 01	0.3679E 03	0.0000E 00
RUN	2	3	0.5050E 00	-0.1953E 01	-0.1885E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	3	4	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
CRUN	4	5	0.7030E 00	0.0000E 00	-0.2625E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	5	6	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
CRUN	6	554	0.0000E 00	0.0000E 00	-0.1318E 01	0.0000E 00	0.0000E 00	0.0000E 00
CONSTANT	6	554	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	554	8	0.0000E 00	0.0000E 00	-0.6536E 01	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	8	714	0.0000E 00	0.0000E 00	-0.9430E 00	0.0000E 00	0.0000E 00	0.0000E 00

660 081

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

CRUN	714	701	0.0000E 00	0.0000E 00	-0.2875E 01	0.0000E 00	0.0000E 00	0.0000E 00
SECTION	2	11	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
PIPE	701	996	0.1600E 02	0.8430E 00	0.2677E 02	0.6896E 01	0.3679E 03	0.0000E 00
CRUN	701	10	0.0000E 00	0.0000E 00	-0.5554E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	10	555	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
CONSTANT	10	555	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	555	1555	-0.5351E 01	-0.1300E-01	-0.1300E 01	0.0000E 00	0.0000E 00	0.0000E 00
ELBOW	1555	12	0.0000E 00	0.0000E 00	0.0000E 00	0.8000E 02	0.0000E 00	0.0000E 00
RUN	12	13	-0.6982E 01	-0.1700E-01	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
VALVE	13	14	-0.4755E 01	-0.1200E-01	0.0000E 00	0.1600E 02	0.3000E 01	0.0000E 00
ELBOW	14	15	0.0000E 00	0.0000E 00	0.0000E 00	0.2400E 02	0.0000E 00	0.0000E 00
CRUN	15	718	0.0000E 00	0.7000E-02	-0.2521E 01	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	718	556	0.0000E 00	0.3000E-02	-0.1146E 01	0.0000E 00	0.0000E 00	0.0000E 00
CONSTANT	718	555	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00
RUN	556	17	0.0000E 00	0.3700E-01	-0.1303E 02	0.0000E 00	0.0000E 00	0.0000E 00
CRUN	17	996	0.0000E 00	0.0000E 00	-0.1229E 01	0.0000E 00	0.0000E 00	0.0000E 00
END JOB	0	0	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00	0.0000E 00

650 082

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

PIPE SYSTEM GEOMETRY

NUMBER OF NETWORK POINTS = 3 NUMBER OF MEMBERS = 21
NUMBER OF SECTIONS = 2 ORDER OF STIFFNESS MATRIX = 6

NETWORK POINT RESTRAINTS

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
1	0	REST	REST	REST	REST	REST	REST
2	701	FREE	FREE	FREE	FREE	FREE	FREE
3	996	REST	REST	REST	REST	REST	REST

NETWORK POINT MOVEMENTS (INCHES)

		TRANSLATION			ROTATION		
NETWORK PT.	SEQ	X	Y	Z	X	Y	Z
1	0	2.000	1.313	0.000	0.000	0.000	0.000
3	996	-0.143	-0.375	0.479	0.000	0.000	0.000

660 1083

5493-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

• NOTE •

FOR CURVED MEMBERS, QUANTITIES LISTED UNDER INITIAL CO-ORDS ARE CO-ORDS OF ARC CENTER THE BRACKETED NUMBERS WHICH FOLLOW ARE THE ARC RADIUS (IN), INCLUDED ANGLE (DEG).

• NOTE •

FOR GIBBS AND HILL, CO-ORD DIMENSIONS IN FEET ALL OTHER QUANTITIES, RADIUS, THICKNESS, STRESS, MOMENTS, ETC. ARE DIMENSIONED IN INCHES.

PIPE SYSTEM GEOMETRY

SECTION 1 CONNECTS SEQUENCE POINTS 0 AND 701 AND HAS 10 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	RU	8.00	0.843	0.00	0.00	0.00	2.37	0.00	-8.87	0.900E 12	443.	0.704E-05	0.00
2	EL	8.00	0.843	2.37	-1.99	-8.87	(24.000	45.022)		0.267E 08	367.	0.689E-05	0.00
3	RU	8.00	0.843	2.74	-0.58	-10.23	2.94	-1.36	-10.99	0.267E 08	367.	0.689E-05	0.00
4	EL	8.00	0.843	3.31	0.04	-12.35	(24.000	45.022)		0.267E 08	367.	0.689E-05	0.00
5	CR	8.00	0.843	3.31	-1.95	-12.35	3.57	-1.95	-13.33	0.267E 08	367.	0.689E-05	0.00
6	EL	8.00	0.843	-2.86	-1.95	-15.05	(80.000	14.992)		0.267E 08	367.	0.689E-05	0.00
7	CR	8.00	0.843	3.80	-1.95	-15.05	3.80	-1.95	-15.50	0.267E 08	367.	0.689E-05	0.00
8	RU	8.00	0.843	3.80	-1.95	-15.50	3.80	-1.95	-22.03	0.267E 08	367.	0.689E-05	0.00
9	CR	8.00	0.843	3.80	-1.95	-22.03	3.80	-1.95	-22.97	0.267E 08	367.	0.689E-05	0.00
10	CR	8.00	0.843	3.80	-1.95	-22.97	3.80	-1.95	-25.85	0.267E 08	367.	0.689E-05	0.00

SECTION 2 CONNECTS SEQUENCE POINTS 701 AND 99[illegible] AND HAS 11 MEMBERS.

MEM	TYPE	OUTER RAD. (IN)	WALL THK. (IN)	INITIAL CO-ORDS (FT.) X	Y	Z	FINAL CO-ORDS (FT.) X	Y	Z	MODULUS LB./SQ.IN	TEMP CHANGE DEG. F	THERMAL EXPANSION IN./IN.	WEIGHT PER UNIT LENGTH
1	CR	8.00	0.843	3.80	-1.95	-25.85	3.80	-1.95	-26.16	0.267E 08	367.	0.689E-05	0.00
2	EL	8.00	0.843	-2.86	-1.96	-26.16	(80.000	76.344)		0.267E 08	367.	0.689E-05	0.00
3	CR	8.00	0.843	-1.29	-1.96	-32.64	-0.77	-1.96	-32.51	0.267E 08	367.	0.689E-05	0.00

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

4	EL	8.00	0.843	-2.34	-1.96	-26.03	(	80.000	13.655)	0.267E 08	367.	0.689E-05	0.00
5	RU	8.00	0.843	-2.34	-1.96	-32.70	-8.53	-1.98	-32.70	0.267E 08	367.	0.689E-05	0.00
6	RU	8.00	3.000	-8.53	-1.98	-32.70	-11.28	-1.98	-32.70	0.267E 08	367.	0.689E-05	0.00
7	EL	8.00	0.843	-11.28	-1.98	-34.70	(	24.000	90.000)	0.267E 08	367.	0.689E-05	0.00
8	CR	8.00	0.843	-13.28	-1.98	-34.70	-13.28	-1.98	-35.22	0.267E 08	367.	0.689E-05	0.00
9	CR	8.00	0.843	-13.28	-1.98	-35.22	-13.28	-1.98	-36.37	0.267E 08	367.	0.689E-05	0.00
10	RU	8.00	0.843	-13.28	-1.98	-36.37	-13.28	-1.94	-49.40	0.267E 08	367.	0.689E-05	0.00
11	CR	8.00	0.843	-13.28	-1.94	-49.40	-13.28	-1.94	-50.62	0.267E 08	367.	0.689E-05	0.00

DWG. NO. 103-2

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

LOADS
THERMAL

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	1	0	BEG	4970.	-1942.	19231.	-1059032.	-1061086.	205718.	2.000	1.313	0.000	0.0000	0.0000	0.0000
1	1	1	END	4970.	-1942.	19231.	-852286.	17164.	261166.	2.089	1.312	-0.332	-0.0000	-0.0000	0.0000
1	2		BEG	4970.	-1942.	19231.	-852286.	17164.	261166.	2.089	1.312	-0.332	-0.0000	-0.0000	0.0000
1	2	2	END	4970.	-1942.	19231.	-685125.	183216.	234730.	2.100	1.277	-0.364	-0.0020	-0.0000	-0.0000
1	3		BEG	4970.	-1942.	19231.	-685125.	183216.	234730.	2.100	1.277	-0.364	-0.0020	-0.0000	-0.0000
1	3	3	END	4970.	-1942.	19231.	-487492.	274705.	192887.	2.106	1.234	-0.365	-0.0022	0.0000	0.0000
1	4		BEG	4970.	-1942.	19231.	-487492.	274705.	192887.	2.106	1.234	-0.365	-0.0022	0.0000	0.0000
1	4	4	END	4970.	-1942.	19231.	-320329.	440694.	166443.	2.112	1.169	-0.389	-0.0032	0.0008	-0.0001
1	5		BEG	4970.	-1942.	19231.	-320329.	440694.	166443.	2.112	1.169	-0.389	-0.0032	0.0008	-0.0001
1	5	5	END	4970.	-1942.	19231.	-297561.	559347.	172541.	2.110	1.130	-0.421	-0.0033	0.0009	-0.0000
1	6		BEG	4970.	-1942.	19231.	-297561.	559347.	172541.	2.110	1.130	-0.421	-0.0033	0.0009	-0.0000
1	6	6	END	4970.	-1942.	19231.	-257369.	714590.	177830.	2.091	1.058	-0.477	-0.0036	0.0016	0.0001
1	7		BEG	4970.	-1942.	19231.	-257369.	714590.	177830.	2.091	1.058	-0.477	-0.0036	0.0016	0.0001
1	7	554	END	4970.	-1942.	19231.	-247098.	740880.	177830.	2.082	1.039	-0.490	-0.0036	0.0017	0.0001
1	8		BEG	4970.	-1942.	19231.	-247098.	740880.	177830.	2.082	1.039	-0.490	-0.0036	0.0017	0.0001
1	8	8	END	4970.	-1942.	19231.	-94778.	1130741.	177830.	1.861	0.732	-0.688	-0.0040	0.0041	0.0007
1	9		BEG	4970.	-1942.	19231.	-94778.	1130741.	177830.	1.861	0.732	-0.688	-0.0040	0.0041	0.0007
1	9	714	END	4970.	-1942.	19231.	-72801.	1186990.	177830.	1.813	0.686	-0.716	-0.0041	0.0045	0.0008
1	10		BEG	4970.	-1942.	19231.	-72801.	1186990.	177830.	1.813	0.686	-0.716	-0.0041	0.0045	0.0008
1	10	701	END	4970.	-1942.	19231.	-5800.	1358478.	177830.	1.634	0.542	-0.803	-0.0041	0.0059	0.0011
2	1	701	BEG	4970.	-1942.	19231.	-5800.	1358478.	177830.	1.634	0.542	-0.803	-0.0041	0.0059	0.0011
2	1	10	END	4970.	-1942.	19231.	1494.	1377151.	177830.	1.611	0.527	-0.812	-0.0041	0.0061	0.0011
2	2		BEG	4970.	-1942.	19231.	1494.	1377151.	177830.	1.611	0.527	-0.812	-0.0041	0.0061	0.0011
2	2	555	END	4970.	-1942.	19231.	155323.	568257.	58405.	0.772	0.114	-0.382	-0.0037	0.0118	0.0017

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

SC	ME	SEQ	POS	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
2	3		BEG	4970.	-1942.	19231.	155323.	588257.	58405.	0.772	0.114	-0.382	-0.0037	0.0118	0.0017
2	3	1555	END	4970.	-1942.	19231.	152104.	700173.	70539.	0.805	0.131	-0.451	-0.0037	0.0119	0.0017
2	4		BEG	4970.	-1942.	19231.	152104.	700173.	70539.	0.805	0.131	-0.451	-0.0037	0.0119	0.0017
2	4	12	END	4970.	-1942.	19231.	138346.	1009765.	105358.	0.839	0.186	-0.676	-0.0035	0.0127	0.0018
2	5		BEG	4970.	-1942.	19231.	138346.	1009765.	105358.	0.839	0.186	-0.676	-0.0035	0.0127	0.0018
2	5	13	END	4970.	-1942.	19231.	141821.	-417320.	-39651.	0.652	0.044	0.324	-0.0031	0.0134	0.0019
2	6		BEG	4970.	-1942.	19231.	141821.	-417320.	-39651.	0.652	0.044	0.324	-0.0031	0.0134	0.0019
2	6	14	END	4970.	-1942.	19231.	143425.	-1053113.	-104270.	0.568	-0.018	0.765	-0.0030	0.0131	0.0018
2	7		BEG	4970.	-1942.	19231.	143425.	-1053113.	-104270.	0.568	-0.018	0.765	-0.0030	0.0131	0.0018
2	7	15	END	4970.	-1942.	19231.	189918.	-1395375.	-150849.	0.302	-0.120	0.961	-0.0022	0.0056	0.0011
2	8		BEG	4970.	-1942.	19231.	189918.	-1395375.	-150849.	0.302	-0.120	0.961	-0.0022	0.0056	0.0011
2	8	718	END	4970.	-1942.	19231.	201726.	-1364299.	-150763.	0.267	-0.134	0.945	-0.0022	0.0054	0.0011
2	9		BEG	4970.	-1942.	19231.	201726.	-1364299.	-150763.	0.267	-0.134	0.945	-0.0022	0.0054	0.0011
2	9	556	END	4970.	-1942.	19231.	227741.	-1295942.	-150584.	0.197	-0.164	0.910	-0.0021	0.0048	0.0010
2	10		BEG	4970.	-1942.	19231.	227741.	-1295942.	-150584.	0.197	-0.164	0.910	-0.0021	0.0048	0.0010
2	10	17	END	4970.	-1942.	19231.	522863.	-518725.	-148377.	-0.141	-0.372	0.516	-0.0002	0.0002	0.0000
2	11		BEG	4970.	-1942.	19231.	522863.	-518725.	-148377.	-0.141	-0.372	0.516	-0.0002	0.0002	0.0000
2	11	996	END	4970.	-1942.	19231.	551505.	-445418.	-148377.	-0.143	-0.374	0.479	0.0000	0.0000	-0.0000

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GIBBS & HILL, INC.
PIPE STRESS ANALYSIS

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

NETWORK POINT REACTIONS AND DEFLECTIONS

NET PT	SEQ	FX (LB)	FY (LB)	FZ (LB)	MX (IN-LB)	MY (IN-LB)	MZ (IN-LB)	DX (IN)	DY (IN)	DZ (IN)	RX (RAD)	RY (RAD)	RZ (RAD)
1	0	-4970.	1942.	19231.	1059032.	1061086.	-205718.	2.000	1.313	0.000	0.0000	0.0000	0.0000
2	701	-0.	0.	0.	0.	-0.	0.	1.634	0.542	-0.803	-0.0041	0.0059	0.0011
3	996	4970.	-1942.	19231.	551505.	-445418.	-148377.	-0.143	-0.374	0.479	0.0000	0.0000	-0.0000

1D3-2

549J-OMAHA-FEED WATER IN CONT. BLDG.-DECK 1 JL 9-3-71

USAS B31.7 STRESS SUMMARY

* NOTE *
NEGATIVE STRESS INDICATES ALLOWABLE
STRESS HAS BEEN EXCEEDED

SEC	MEM	SEQ	POS	TYPE	EQ.	PRESSURE	MOMENT	THERMAL DIS.	WALL GRAD	COMBINED	PRIMARY PLUS SECONDARY STRESS INTENSITY RANGE EQ.(10) ≤ 3Sm ≤58,740 psi	PEAK STRESS INTENSITY RANGE EQ.(10) FOR Sa=25,497 THE ALLOWABLE NUMBER OF CYCLES IS 4×10^6
1	1	0	BEG	RU	10	9544.2	10469.3	0.0	0.0	20013.6 + 4958.8	24,972	
					11	11453.1	18844.8	0.0	0.0	30298.0 + 8926.0		39,224
					12					10469.3		
					13					0.0		
		1	END	RU	10	9544.2	6168.5	0.0	0.0	15712.7+ 1222.8		
					11	11453.1	11103.3	0.0	0.0	22556.4+ 2201.2		
					12					6168.5		
					13					0.0		
1	2	1	BEG	EL	10	10678.7	24124.0	0.0	0.0	34802.8+ 4782.6	39,585	
					11	10678.7	24124.0	0.0	0.0	34802.8+ 4762.6		39.555
					12					24124.0		
					13					0.0		
		2	END	EL	10	10678.7	20213.3	0.0	0.0	30892.0+ 2103.2	32,995	
					11	10678.7	20213.3	0.0	0.0	30892.0+ 2103.2		32.995
					12					20213.3		
					13					0.0		
1	3	2	BEG	RU	10	9544.2	5168.5	0.0	0.0	14712.8+ 537.8		
					11	11453.1	9303.3	0.0	0.0	20756.4+ 968.0		
					12					5168.5		
					13					0.0		
		3	END	RU	10	9544.2	4095.0	0.0	0.0	13639.3+ 192.6		
					11	11453.1	7371.0	0.0	0.0	18824.1+ 346.6		
					12					4095.0		
					13					0.0		
1	4	3	BEG	EL	10	10678.7	16014.9	0.0	0.0	26693.7+ 753.4	27,447	
					11	10678.7	16014.9	0.0	0.0	26693.7+ 753.4		27,447
					12					16014.9		
					13					0.0		
		4	END	EL	10	10678.7	15414.1	0.0	0.0	26092.9+ 2563.2	28,656	
					11	10678.7	15414.1	0.0	0.0	26092.9+ 2563.2		28.656
					12					15414.1		
					13					0.0		
1	5	4	BEG	CR	10	8676.6	3941.3	0.0	0.0	12618.0+ 655.4		
					11	8676.6	3941.3	0.0	0.0	12618.0+ 655.4		
					12					3941.3		
					13					0.0		
		5	END	CR	10	8676.6	4543.1	0.0	0.0	13219.7+ 607.2		

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					12					4543.1		
					13					0.0		
1	6	5	BEG	EL	10	9130.6	7959.1	0.0	0.0	17089.7 +	1414.4	
					11	9130.6	7959.1	0.0	0.0	17089.7 +	1414.4	
					12					7959.1		
					13					0.0		
		6	END	EL	10	9130.6	9455.1	0.0	0.0	18585.7 +	1665.6	
					11	9130.6	9455.1	0.0	0.0	18585.7 +	1665.6	
					12					9455.1		
					13					0.0		
1	7	6	BEG	CR	10	8676.6	5397.0	0.0	0.0	14073.6 +	950.6	
					11	8676.6	5397.0	0.0	0.0	14073.6 +	950.6	
					12					5397.0		
					13					0.0		
		554	END	CR	10	8676.6	5541.8	0.0	0.0	14218.4 +	945.4	
					11	8676.6	5541.8	0.0	0.0	14218.4 +	945.4	
					12					5541.8		
					13					0.0		
1	8	554	BEG	CR	10	8676.6	5541.8	0.0	0.0	14218.4 +	945.4	
					11	8676.6	5541.8	0.0	0.0	14218.4 +	945.4	
					12					5541.8		
					13					0.0		
		8	END	RU	10	9544.2	7946.5	0.0	0.0	17490.8 +	401.2	
					11	11453.1	14303.7	0.0	0.0	25756.9 +	722.2	
					12					7946.5		
					13					0.0		
1	9	8	BEG	RU	10	9544.2	7946.5	0.0	0.0	17490.8 +	401.2	
					11	11453.1	14303.7	0.0	0.0	25756.9 +	722.2	
					12					7946.5		
					13					0.0		
		714	END	CR	10	8676.6	8319.3	0.0	0.0	16995.9 +	426.2	
					11	8676.6	8319.3	0.0	0.0	16995.9 +	426.2	
					12					8319.3		
					13					0.0		
1	10	714	BEG	CR	10	8676.6	8319.3	0.0	0.0	16995.9 +	426.2	
					11	8676.6	8319.3	0.0	0.0	16995.9 +	426.2	
					12					8319.3		
					13					0.0		
		701	END	CR	10	8676.6	9479.1	0.0	0.0	18155.8 +	1008.2	
					11	8676.6	9479.1	0.0	0.0	18155.8 +	1008.2	
					12					9479.1		
					13					0.0		
2	1	701	BEG	CR	10	8676.6	9479.1	0.0	0.0	18155.8 +	1008.2	
					11	8676.6	9479.1	0.0	0.0	18155.8 +	1008.2	
					12					9479.1		
					13					0.0		
		10	END	CR	10	8676.6	9607.2	0.0	0.0	18283.8 +	914.0	
					11	8676.6	9607.2	0.0	0.0	18283.8 +	914.0	
					12					9607.2		
					13					0.0		
2	2	10	BEG	EL	10	9130.6	16830.9	0.0	0.0	25961.5 +	1601.2	27.563
					11	9130.6	16830.9	0.0	0.0	25961.5 +	1601.2	27.563
					12					16830.9		

					13					0.0			
		555	END	EL	10	9130.6	7408.4	0.0	0.0	16539.0 +	496.0		
					11	9130.6	7408.4	0.0	0.0	16539.0 +	496.0		
					12					7408.4			
					13					0.0			
2	3	555	BEG	CR	10	8676.6	4228.8	0.0	0.0	12905.4 +	283.0		
					11	8676.6	4228.8	0.0	0.0	12905.4 +	283.0		
					12					4228.8			
					13					0.0			
		***	END	CR	10	8676.6	4981.2	0.0	0.0	13657.8 +	294.4		
					11	8676.6	4981.2	0.0	0.0	13657.8 +	294.4		
					12					4981.2			
					13					0.0			
2	4	***	BEG	EL	10	9130.6	8726.6	0.0	0.0	17857.2 +	516.0		
					11	9130.6	8726.6	0.0	0.0	17857.2 +	516.0		
					12					8726.6			
					13					0.0			
		12	END	EL	10	9130.6	12419.4	0.0	0.0	21550.0 +	908.8	22,459	
					11	9130.6	12419.4	0.0	0.0	21550.0 +	908.8		22,459
					12					12419.4			
					13					0.0			
2	5	12	BEG	RU	10	9544.2	7089.1	0.0	0.0	16633.4 +	516.8		
					11	11453.1	12760.4	0.0	0.0	24213.5 +	933.8		
					12					7089.1			
					13					0.0			
		13	END	RU	10	9544.2	3061.8	0.0	0.0	12606.1 +	245.6		
					11	11453.1	5511.2	0.0	0.0	16964.4 +	442.0		
					12					3061.8			
					13					0.0			
2	6	13	BEG	RU	10	2681.9	1298.6	0.0	0.0	3980.6 +	104.2		
					11	3218.3	2337.6	0.0	0.0	5555.9 +	187.4		
					12					1298.6			
					13					0.0			
		14	END	RU	10	2681.9	3133.9	0.0	0.0	5815.9 +	94.8		
					11	3218.3	5641.1	0.0	0.0	8859.4 +	170.6		
					12					3133.9			
					13					0.0			
2	7	14	BEG	EL	10	10678.7	28896.2	0.0	0.0	39575.0 +	874.4	40,449	
					11	10678.7	28896.2	0.0	0.0	39575.0 +	874.4		40,449
					12					28896.2			
					13					0.0			
		15	END	EL	10	10678.7	38322.1	0.0	0.0	49000.9 +	1993.2	50,994 *	50,994 *
					11	10678.7	38322.1	0.0	0.0	49000.9 +	1993.2		
					12					38322.1			
					13					0.0			
2	8	15	BEG	CR	10	8676.6	9798.9	0.0	0.0	18475.5 +	509.6		
					11	8676.6	9798.9	0.0	0.0	18475.5 +	509.6		
					12					9798.9			
					13					0.0			
		718	END	CR	10	8676.6	9598.6	0.0	0.0	18275.2 +	945.6		
					11	8676.6	9598.6	0.0	0.0	18275.2 +	945.6		
					12					9598.6			
					13					0.0			
2	9	718	BEG	CR	10	8676.6	9598.6	0.0	0.0	18275.2 +	945.6		

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